META 2024 Toyama - Japan

The 14th International Conference on Metamaterials, Photonic Crystals and Plasmonics

Program Booklet

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The 14th International Conference on Metamaterials, Photonic Crystals and Plasmonics

Edited by

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Kotaro Kajikawa | Tokyo Institute of Technology, Japan
Said Zouhdi | Paris-Saclay University, France

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Osaka University is a national research university in Osaka, Japan. The university traces its roots back to Edo-era institutions Tekijuku (1838) and Kaitokudo (1724), and was officially established in 1931 as the sixth of the Imperial Universities in Japan, with two faculties: science and medicine. Following the post-war educational reform, it merged with three pre-war higher schools, reorganizing as a comprehensive university with five faculties: science, medicine, letters, law and economics, and engineering. After the merger with Osaka University of Foreign Studies in 2007, it became the largest national university in Japan by undergraduate enrollment.

Tokyo Institute of Technology Tokyo Tech is the top national university for science and technology in Japan with a history spanning more than 140 years. Of the approximately 10,500 students at the Ookayama, Suzukakedai, and Tamachi Campuses, half are in their bachelor's degree program while the other half are in master's and doctoral degree programs. International students number 1,800. There are 1,100 faculty and 600 administrative and technical staff members.

Université Paris-Saclay is a research university based in Paris, France. Université Paris-Saclay offers a comprehensive and varied range of Undergraduate, Master's and PhD degrees, renowned internationally thanks to the University's reputation for research excellence and the commitment of its academic staff. The University's constituent faculties, institutes and component institutions all contribute to the curricula with cutting-edge specialised courses in Science and Engineering, Life Sciences and Health, and Social Sciences and Humanities.
Université Paris-Saclayis ranked 1st in France and 13th in the world according to the Academic Ranking of World Universities (ARWU).

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Nanophotonics (De Gruyter) covers recent international research results, specific developments in the field and novel applications. It publishes all article in a Gold Open Access model and belongs to the top journals in the field. Nanophotonics focuses on the interaction of photons with nano-structures, such as carbon nano-tubes, nano metal particles, nano crystals, semiconductor nano dots, photonic crystals, tissue and DNA.

PLENARY SPEAKERS

Harry Atwater

California Institute of Technology, USA

is the Otis Booth Leadership Chair of the Division of Engineering and Applied Science, and the Howard Hughes Professor of Applied Physics and Materials Science at the California Institute of Technology. Atwater's scientific effort focuses on nanophotonic light-matter interactions. His work spans fundamental nanophotonic phenomena and applications, including active wavefront shaping of light using metasurfaces, optical propulsion of lightsails, quantum and 2D nanophotonics as well as solar energy conversion, on earth and in space.

Atwater was an early pioneer in nanophotonics and plasmonics and gave a name to the field of plasmonics in 2001. He is Chair of the LightSail Committee for the Breakthrough Starshot program. Currently Atwater is also the Director for the Liquid Sunlight Alliance (LiSA), a Department of Energy Hub program for solar fuels, and was also the founding Editor in Chief of the journal ACS Photonics. Atwater is a Member of the US National Academy of Engineering, a Fellow of APS, MRS, SPIE and Optica, a Web of Science Highly Cited Researcher from 2014-2023, and is recipient of numerous awards, including the 2021 von Hippel Award of the Materials Research Society.

Hui Cao

Yale University, USA

Shaping light propagation in complex media

Hui Cao is the John C. Malone Professor of Applied Physics, a Professor of Physics, and a Professor of Electrical Engineering at Yale University. She received her Ph.D. degree in Applied Physics from Stanford University in 1997. Prior to joining the Yale faculty in 2008, she was on the faculty of Northwestern University for ten years. Her technical interests and activities are in the areas of mesoscopic physics, complex photonic materials and devices, nanophotonics, and biophotonics. Cao is a Fellow of IEEE, AAAS, APS and OSA, and an elected member of the National Academy of Sciences, and the American Academy of Arts and Sciences.

Shaping light propagation in complex media
By breaking the diffusion limit, we deliver optical energy into a target region of arbitrary size and shape anywhere inside a strong-scattering system. We further demonstrate an order of magnitude enhancement of remitted signals that carry information from deep inside a diffusive medium.

Franco Nori

Riken (Japan) and University of Michigan, USA

Topological dissipation in a time-multiplexed photonic resonator network and topological temporally mode-locked lasers

Franco Nori is a Chief Scientist at RIKEN, with a concurrent position at the University of Michigan. He received his PhD from the University of Illinois, and afterwards became a postdoc at the Institute for Theoretical Physics, University of California, Santa Barbara. His research group has done pioneering interdisciplinary studies at the interface between nanoscience, photonics, quantum optics, dissipative quantum open systems, quantum information processing, superconducting quantum circuitry, opto-mechanics, and condensed matter physics. He has been listed by the Web of Science as a "Highly Cited Researcher" (less than 0.1% are selected) in Physics for the past seven consecutive years: from 2017 to 2023. He is an Elected Fellow of the American Physics Society (APS), Institute of Physics (IoP), American Association for the Advancement of Science (AAAS), and Optical Society of America (OSA) [this last one "for fundamental contributions to quantum information science and optics, including circuit quantum electrodynamics, and the interface between quantum optics and quantum circuits"]. He received the 2014 Prize for Research in Physics, from the Matsuo Foundation, Japan; and the 2013 Prize for Science, by the Minister of Education, Culture, Sports, Science and Technology, Japan. Also, an "Excellence in Research Award" and an "Excellence in Education Award" from the University of Michigan. He is an Elected Member of the Academia Europaea, the Latin American Academy of Sciences, and a Foreign Member of the Swedish Royal Society of Arts and Sciences, in Gothenburg, Sweden. He won the 2023 W.E. Lamb Medal, and the 2024 Charles H. Townes Medal (from the OSA), both for research on Quantum Optics, Quantum Electronics and Quantum Information.

Topological dissipation in a time-multiplexed photonic resonator network and topological temporally mode-locked lasers

This talk provides an overview of recent results on topological dissipation in a time-multiplexed photonic resonator network, and topological temporally mode-locked lasers. A very brief summary will also be made of recent work on non-Abelian effects in dissipative photonic topological lattices.

Takashige Omatsu

Chiba University, Japan

Materials manipulation with structured light fields

Takashige Omatsu received his BS and PhD degrees in applied physics from the University of Tokyo in 1983 and 1992, and he has been a professor at Chiba University since 2007. He is currently working as a director of Molecular Chirality Research Center, Chiba University. He has been investigating the generation of structured light on a nano/ micron scale and pioneering nano/micro fabrications using structured light. He has already published 200+ journal papers, 250+ international conference papers, and 14 patents (including 2 US-patents), and he has performed 150+ invited presentations. Prof. Omatsu is working as the founding editor-in-chief of Optics Continuum (Optica), and he is also serving as a chair of the CLEO Pacific Rim Steering Committee. He was elected Optica, SPIE and JSAP fellow. Also, he was awarded Prize for Science and Technology, MEXT in 2016.

Materials manipulation with structured light fields

Structured light fields, such as optical vortex, has been currently growing up to a particle-like optical field (optical skyrmion). We review state-of-the-art structured materials fabrication and new materials manipulation with structured light fields.

Daria Smirnova

Australian National University, Australia

Localized states trapped by topological defects in photonic and hybrid metasurfaces

Daria Smirnova received her Ph.D. in Physics in 2016 from the Australian National University (ANU), followed by work experience in the USA, Russia, Japan, and Australia. Since 2019, she has consecutively held two prestigious fellowships supported by the Australian Research Council: the Discovery Early Career Researcher Award and, currently, the Future Fellowship at the ANU. In 2020, Daria was honoured as one of Australia's leading young researchers in The Australian's Special Report. Her research interests span over nonlinear physics, multipolar electrodynamics, nanophotonics, and topological photonics. The quality and impact of her works have been recognized through awards from international organizations, including the International Union of Pure and Applied Physics (IUPAP), MIT Technology Review, Elsevier, L'Oreal-UNESCO, the journal Nanophotonics, and the Australian and New Zealand Optical Society.

Localized states trapped by topological defects in photonic and hybrid metasurfaces
This talk will report novel phonon-polariton states trapped by topological defects in a silicon metasurface integrating hexagonal boron nitride (hBN). Spatially localized polaritonic modes originate from the coupling of electromagnetic fields with phonon vibrations in hBN.

KEYNOTE SPEAKERS

Gerrit Ernst Wilhem Bauer

University of the Chinese Academy of Science (China) & Tohoku University (Japan)

Gated Spin Communities

Gerrit Ernst Wilhem Bauer (*1956) was raised in the Gronau/Westfalen, Germany. He studied chemical engineering at Twente University in the Netherlands (M.Sc. 1980), experimental physics at the Hahn-Meitner Institute in Berlin (Ph.D. 1984) and theoretical physics as a JSPS Postdoctoral Fellow at the University of Tokyo. He spent 6 years at the corporate Philips Research Laboratories in Eindhoven (NL). He became professor in Theoretical Physics at Delft University of Technology in 1992, at the Tohoku University in Japan in 2011, and at the UCAS in China in 2022. He is presently Chair Professor at the Kavli Institute for Theoretical Science in Beijing as well as Professor and PI at the Advanced Institute of Material Science of Tohoku University on a shared basis. He is a Fellow of the American Physical Society and The Japan Society of Applied Physics. He received a.o. the Humboldt Research Award 2023. His published oeuvre in (mainly) theoretical condensed matter physics can be found under his Researcher ID F-8273-2010.

Gated Spin Communities
Conducting contacts modulate and control the magnetodipolar interaction that causes chirality of the magnetization and energy transport by spin waves at interfaces and in thin films. Metallic normal, ferromagnetic, and superconducting gates thereby generate new functionalities in magnonic circuits and devices.

Davide Bigoni

University of Trento (Italy)

Metamaterials with architected instabilities

Davide Bigoni has been holding a full professor position at the University of Trento (Italy) since 2001, where he is leading a very active group in the field of Solid ad Structural Mechanics. He was elected in 2009 Euromech Fellow (of the European Mechanics Society), received in 2012 the Ceramic Technology Transfer Day Award (of the ACIMAC and ISTEC-CNR), and in 2014 he was awarded the Doctor Honoris Causa degree at the Ovidius University of Constanta. He has received the Panetti and Ferrari Award for Applied Mechanics (from the Accademia delle Scienze di Torino), in 2018 he was Guest Lecturer for the Midwest Mechanics Seminars, in 2019 he was nominated Fellow of the Istituto Lombardo, Accademia di Scienze e Lettere, he was awarded a 60th Anniversary Issue of the Journal of the Mechanics and Physics of Solids. His research has been featured on 8 covers of International Journals. He has coordinated and has been involved in 3 European grants between academia and industry. He has been awarded 2 ERC advanced grants from the European Research Council, the first in 2013 and the second in 2021. He is co-editor of the Journal of Mechanics of Materials and Structures, is associate Editor of Mechanics Research Communications and member of the editorial boards of: Archives of Mechanics, International Journal of Solids and Structures, Journal of Elasticity, Journal of the Mechanical Behavior of Materials, Acta Mechanica Sinica, and International Journal of Applied Mechanics. He is reviewer for more than 150 international journals. He was vice chair of the panel PE8 for the European Research Council Starting Grants.

Metamaterials with architected instabilities
Homogenization is used for periodic elastic grids subject to axial prestress, to obtain equivalent elastic materials. The latter can be tailored to exhibit material instabilities driven by the microstructure of the grid and its level of prestress. Instabilities include shear band fromation and Hopf bifurcation, thus leading to odd elasticity.

Costantino De Angelis

Brescia University (Italy)

Analog computing with nonlinear flat optics

Costantino De Angelis received his PhD from the University of the Padova (1993) where he served as Assistant Professor of Electromagnetic Fields and Photonics. In 1998 he joined Brescia University where he is Full Professor of Electromagnetic Fields and Photonics since 2004. He is the head of the NORA group at the University of Brescia (https://nora.unibs.it/home) and his current research interest include nonlinear optics, nanophotonics, and optical metamaterials. He is a Fellow of OPTICA (the Optical Society of America).

Analog computing with nonlinear flat optics
Digital signal processing has revolutionized many fields of science and engineering, but it still shows critical limits; a long-sought solution is optical analog computing. We demonstrate here that nonlinear phenomena combined with engineered nonlocality in flat optics can be leveraged to synthesize Volterra kernels able to outperform linear devices.

Ortwin Hess

Trinity College Dublin (Ireland)

Nanoplasmonics as Enabler of Ultrafast Quantum Nanophotonics at Ambient Temperatures

Ortwin Hess currently holds the Chair Professorship of Quantum Nanophotonics and an SFI Research Professorship in the School of Physics and the CRANN Institute of Trinity College Dublin, The University of Dublin, Ireland. He is Editor-in-Chief of the gold open-access journal APL Quantum. Ortwin is a Fellow of the Institute of Physics (FInstP), a Fellow of Optica (formerly OSA) and a Professorial Fellow of Trinity College Dublin. Previously, Ortwin held the Leverhulme Chair in Metamaterials in the Blackett Laboratory at Imperial College London, UK. From 2003 to 2010 he was a full professor at the University of Surrey (Guildford, UK) and visiting professor at Stanford University, USA, and at the Ludwig-Maximilians University of Munich, Germany. Ortwin obtained the Dr.-rer-nat. (PhD) degree from the Technical University of Berlin, Germany in 1993 and the Habilitation (Dr.-habil.) at the University of Stuttgart, Germany in 1997. Ortwin's research interests bridge quantum nanophotonics with semiconductor and metamaterials physics, laser science and bio-medical photonics. He discovered the 'trapped-rainbow' principle, had the idea of stopped-light lasing and made defining contributions to the fields of spatio-temporal dynamics of semiconductor lasers, ultraslow light in metamaterials, complex quantum dot photonics and photonic crystals and strong coupling in nanoplasmonics. Ortwin pioneered active nanoplasmonics and optical metamaterials with quantum gain for which he has been awarded the Royal Society Rumford Medal.

Nanoplasmonics as Enabler of Ultrafast Quantum Nanophotonics at Ambient Temperatures
We discuss how nanoplasmonic-cavity strong coupling and ultrafast plasmonic near-field evolution can be exploited to achieve high-speed nanophotonic quantum operations at ambient temperatures, including dynamic multi-partite entanglement, and introduce a novel strategy for preparation and 'immortalization' of selected plasmon-exciton polariton states by means of quantum coherent perfect absorption

Malcolm Kadowala

University of Glasgow (UK)

Chiral Nanophotonics: Enabling Ultrasensitive Detection in Biophysical Measurements

Malcolm Kadowala is the Gardiner Chair of Chemistry at the University of Glasgow. He has pioneered the use of chiral plasmonic metamaterials for the study of biomaterials. His seminal paper on the demonstration of the application of chiral near fields for biomaterial characterisation (Nature Nano) has been cited >1100 times (Google Scholar). He was awarded a JSPS visiting Professorship at the Institute of Molecular Sciences, Japan in 2015, was a visiting Professor at the Dept of Physics, Osaka Metropolitan University, in 2018, and was awarded a Leverhulme research fellowship (2019-2021).

Chiral Nanophotonics: Enabling Ultrasensitive Detection in Biophysical Measurements
This talk will explore how the emerging field of chiral nanophotonics can overcome this barrier. By harnessing the unique properties of nanostructures, we can significantly enhance the interaction between light and chiral molecules. This allows for highly sensitive CD measurements, potentially reaching the single-molecule level.

Christoph Lienau

University of Oldenburg (Germany)

Two-dimensional electronic spectroscopy of many-body correlations in quantum materials

Christoph Lienau is a professor for experimental physics at the University of Oldenburg with an in interest in ultrafast dynamics of nanoscale systems. He studied physics in Göttingen and received a Ph.D. in Physical Chemistry in 1992. He then started postdoctoral work with Ahmed H. Zewail at Caltech as a Fellow of the German Science Foundation. In 1995 he accepted a position as senior member of the scientific staff at the newly founded Max Born Institute in Berlin in the department of Thomas Elsässer. Here, he founded a research activity in “Ultrafast nano-optics”. In 2006, he received a full professorship at the Institute of Physics in Oldenburg. He has published more than 250 articles in refereed journals and has given more than 150 invited and plenary talks at international conferences. Christoph served as head of the Semiconductor Physics Division of the German Physical Society and as Dean of the School of Mathematics and Natural Sciences in Oldenburg. He is a Fellow of the Optical Society of America and a Visiting Fellow of Chinese Academy of Sciences.

Two-dimensional electronic spectroscopy of many-body correlations in quantum materials
Two-dimensional electronic spectroscopy with few-femtosecond resolution is an emerging tool for probing quasi-particle interactions in quantum materials. The talk will discuss its use for exploring the quantum dynamics of strongly-coupled J-aggregate exciton/surface-plasmon hybrids, ultrafast intervalley couplings in atomically-thin semiconductors and for tailoring the nonlinearities of such semiconductors in plasmonic cavities.

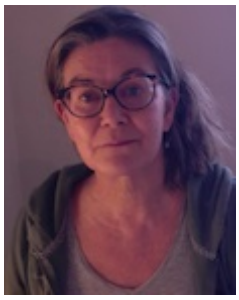
Stefan Maier

Monash University (Australia) & Imperial College London (UK)

Silicon carbide as a platform for mid-IR metasurfaces

Stefan Maier is the Head of the School of Physics and Astronomy at Monash University and the Lee-Lucas Chair in Experimental Physics at Imperial College London. His main research interests lie in metasurfaces and nanophotonics for energy conversion, sensing, and optoelectronics. He is a Fellow of the Australian Institute of Physics, the Institute of Physics (UK) and Optica. He also currently serves as editor-in-chief for Nanophotonics. Stefan obtained his PhD in Applied Physics at Caltech, and held academic positions at the University of Bath and LMU Munich. He has been on the ICI Highly Cited list since 2017.

Silicon carbide as a platform for mid-IR metasurfaces
Silicon carbide enables strongly confined surface phonon-polaritons in the mid-infrared. We demonstrate the use of this materials platform for phonon-polariton metasurfaces supporting vortex and quasi bound-states-in-the-continuum resonances. Additionally we present results of active metasurfaces operating in the visible regime based on conductive polymers.



Agnès Maurel

Institute Langevin (France)

Acoustic grating with space-time modulation

Agnès Maurel is a research director at CNRS and conducts her research at the Langevin Institute in Paris. She studied physics at the École Normale Supérieure de Lyon and obtained her PhD in Paris, after which she completed postdoctoral fellowships at Stanford University and the Universidad de Chile. She studies wave propagation in complex media in the fields of acoustics, electromagnetism, elasticity, and water surface waves. She has been an associate editor for Wave Motion and the Journal of the Acoustical Society of America, and she is currently an associate editor for the Journal of Theoretical, Computational and Applied Mechanics. In recent years, her research has focused on the modeling of microstructured materials, including metamaterials and metasurfaces.

Acoustic grating with space-time modulation
We present a theoretical and numerical analysis of the diffraction of acoustic waves by space-time modulated gratings with rigid-type modulations. We report results exemplifying the non-reciprocal behavior of the grating, in relation with spatial and temporal harmonics.

Nam-Gyu Park

Sungkyunkwan University (Korea)

In the Quest for the Viable Perovskite Solar Cells

Nam-Gyu Park is a Distinguished Professor at the School of Chemical Engineering and Director of the SKKU Institute of Energy Science and Technology (SIEST), Sungkyunkwan University (SKKU). He received his B.S. degree in chemical education, and M.S. and Ph.D. degrees in chemistry from Seoul National University in 1988, 1992, and 1995, respectively. He worked as a postdoctoral researcher at ICMCB-CNRS, France, from 1996 to 1997 and at National Renewable Energy Laboratory, USA, from 1997 to 1999. He was director of the solar cell research center at the Korea Institute of Science and Technology (KIST) from 2005 to 2009 and senior researcher at the Electronics and Telecommunications Research Institute (ETRI) from 2000 to 2005 before joining SKKU as a full professor in 2009. He is a fellow of the Korean Academy of Science and Technology (KAST) since 2017. He has been working on photovoltaics since 1997. He was the first to report a long-term stable perovskite solar cell in 2012. This opened a new research area, so-called perovskite photovoltaics. He was selected as Citation Laureate (top 0.01% scientist); a New Class of Nobel Prize-Worthy Scientist on September 20, 2017, and included in highly cited researchers (HCR, top 1% scientists) from 2017 to 2023 by Clarivate Analytics. He received awards including the Scientist Award of the Month (2008), KIST Award of the Year (2009), Dupont Science and Technology Award (2010), SKKU fellowship (three times in 2013, 2018, and 2021), PVSEC Hamakawa Award (2015), Dukmyung KAST Engineering Award (2016), ACS-KCS Excellence Award (2018), Ho-Am Prize (Samsung, 2018) and Rank Prize (UK, 2022). Prof. Park has currently more than 390 refereed publications and more than 70 patents. He received an H-index of 116 from Google Scholar (105 from Web of Science and 108 from Scopus). He is the Senior Editor of ACS Energy Letters and serves on the Editorial Advisory Board for Chem. Rev., ChemSusChem, and Solar RRL.

In the Quest for the Viable Perovskite Solar Cells
Research endeavors focus on enhancing stability and exploring tandem structures for electricity generation in both terrestrial and space applications. The perovskite solar cell stands poised as the most promising energy solution, with its potential impact on sustainable energy surpassing current expectations once stability and lead immobilization challenges are effectively addressed.

Vladimir M. Shalaev

Purdue University, USA

Extreme Space-Time Optics & Quantum Meta-Photonics

Vladimir M. Shalaev, Scientific Director for Nanophotonics at Birck Nanotechnology Center and Distinguished Professor of Electrical and Computer Engineering at Purdue University, specializes in nanophotonics, plasmonics, and optical metamaterials. Vladimir M. Shalaev has received several awards for his research in the field of nanophotonics and metamaterials, including the Max Born Award of the Optical Society of America for his pioneering contributions to the field of optical metamaterials, the Willis E. Lamb Award for Laser Science and Quantum Optics, IEEE Photonics Society William Streifer Scientific Achievement Award, Rolf Landauer medal of the ETOPIM (Electrical, Transport and Optical Properties of Inhomogeneous Media) International Association, the UNESCO Medal for the development of nanosciences and nanotechnologies, OSA and SPIE Goodman Book Writing Award. He is a Fellow of the IEEE, APS, SPIE, MRS and OSA. Prof. Shalaev has authored three books, thirty invited book chapters and over 500 research publications.

Extreme Space-Time Optics & Quantum Meta-Photonics
We discuss all-optical modulation with single photons using electron avalanche, resulting in record-high nonlinearities. Then we show that transparent conducting oxides (TCOs) operating in the near-zero index regime can provide strong single-cycle modulation, enabling novel photonic time crystals. Finally, we discuss scalable quantum photonics with single-photon emitters in silicon nitride.

Kaoru Tamada

Kyushu University (Japan)

High Spatiotemporal Resolution Live Cell Imaging on a Plasmonic Metasurface

Kaoru Tamada is a Senior Vice President and Distinguished Professor in Kyushu University, Japan. After 7 years industrial experience, she moved to University of Wisconsin-Madison. After the experiences in RIKEN, AIST, MPIP and NUS, she became associate professor at Tokyo Tech in 2005. She moved to Research Institute of Electrical Communication (RIEC), Tohoku University, as a full professor in 2007 and Institute for Materials Chemistry and Engineering (IMCE), Kyushu University, in 2011. Her research interests include 2D self-assembly of organic molecules, metal and semiconductor nanocrystals, and their device applications. She obtained several awards for her achievement in nanoscience. She is a member of Science Council of Japan, Project Officer of JST SICORP e-ASIA program and Vice President of the Japan Society of Applied Physics. She is the associate editor of ACS Applied Nano Material sand advisory board member of several international journals.

High Spatiotemporal Resolution Live Cell Imaging on a Plasmonic Metasurface
Self-assembled monolayers composed of metal nanoparticles can be regarded as metasurfaces with high refractive index and extinction coefficient due to collective excitation of coupled localized surface plasmon resonance. This plasmonic metasurface confines light to the nanointerface and enhances fluorescence, thus enabling high-speed interfacial imaging with high axial and lateral resolution.

Mona Tréguer-Delapierre

University of Bordeaux (France)

Controlling nanomaterial properties using organization

Mona Tréguer-Delapierre is a Professor of Chemistry at the University of Bordeaux leading research in nanoparticle synthesis and assembly at the Institute of Chemistry of Condensed Matter of Bordeaux (ICMCB). She received her PhD from the University of Orsay (Paris-Saclay) and was a postdoctoral fellow at the University of Notre Dame (USA). She is the recipient of awards from the Chancellerie des Universités de Paris and H&M Zimmer of the University of Cincinnati. Her current research interests focus on how nanoparticles can be manipulated in 2D or 3D to engineer nanostructured materials with unusual optical effects.

Controlling nanomaterial properties using organization
We demonstrated a new concept for making nanostructures with unusual optical properties by organizing metal nanoparticles. In research and industry, molecules from drugs and polymers are made by combining high-yield chemical reactions in series. We have extended this approach to the nanoscale: we make metamolecules by combining high-yield colloidal reactions.

Din Ping Tsai

City University of Hong Kong (Hong Kong)

Intelligent Meta-lens for Imaging Underwater, Aerial and Land

Din Ping Tsai is currently Chair Professor of the Department of Electrical Engineering, City University of Hong Kong. He is an elected Fellow of AAAS, APAM, APS, AAIA, COS, EMA, IAE, IEEE, JSAP, NAI, OSA, SPIE, and TPS, respectively. He is the author and co-author of 372 SCI papers, 65 book chapters and conference papers, and 39 technical reports and articles. He was granted 69 patents for 45 innovations. He was invited as an invited speaker for international conferences or symposiums more than 340 times (30 Plenary Talks, 62 Keynote Talks). He received more than 40 prestigious recognitions and awards, including "Global Highly Cited Researchers," Web of Science Group (Clarivate Analytics) in 2020 and 2019, respectively; China's Top 10 Optical Breakthroughs in 2020 and 2018, respectively; "Mozi Award" from International Society for Optics and Photonics (SPIE) (2018); etc.

Intelligent Meta-lens for Imaging Underwater, Aerial and Land
We have developed a series of intelligent meta-lens systems for underwater, land, and aerial imaging and sensing. We reported the design, fabrication, characterization, and applications of the monocular, binocular, and multilocular meta-lens.

Anatoly V. Zayats

King's College London (UK)

Optical spin topologies in plasmonics and metamaterials

Anatoly V. Zayats is a Chair in Experimental Physics and the head of the Photonics & Nanotechnology at the Department of Physics, King's College London, where he also leads Nano-optics and Near-field Spectroscopy Laboratory (www.nano-optics.org.uk). He is a Co-Director of the London Centre for Nanotechnology and the London Institute of Advanced Light Technologies. His current research interests are in the areas of nanophotonics, plasmonics, metamaterials, optical spin-orbit coupling, plasmonically-derived hot carriers, scanning probe microscopy, nonlinear and ultrafast optics and spectroscopy, and optical properties of surfaces, thin films, semiconductors and low-dimensional structures. He is a founding co-editor-in-chief of Advanced Photonics journal. He is a Fellow of the Institute of Physics, the Optical Society of America, SPIE, the Royal Society of Chemistry and elected Member of Academia Europaea.

Optical spin topologies in plasmonics and metamaterials
We will discuss spin-orbit coupling in interaction of complex vector beams with plasmonic metamaterials. Spin-orbit coupling and topology of evanescent waves and vector beams propagating in free space and metamaterials in different dispersion regimes will be considered.

Jinfeng Zhao

Tongji University (China)

Elastic spin angular momentum in metamaterials and classical structures

Jinfeng Zhao received M.S. degree in solid mechanics from Tongji University and Ph.D. degree in physics from University Pierre and Marie Curie. He is currently working in Tongji University. Prof. Zhao has coauthored 60 journal articles, including Phys. Rev. Lett., Nat. Commun and J. Mech. Phys. Solids. He owns 20 Chinese patents. He has been selected as excellent young scholar by Shanghai Society of Theoretical and Applied Mechanics (2021). He has made over 10 invited and oral presentations in academic conferences. His research interests lie in chiral elasticity, metamaterials, phononic crystals and ultrasonic non-destructive evaluation. He has made significant experimental contribution to reveal the elastic spin angular momentum (SAM) in both classical structures and topological metamaterials. He has observed broadband super-diffraction wave focusing both inside and outside graded devices. He builds up graded Helmholtz resonators with IXPP films that lead to dual function, i.e. noise reduction and energy harvesting.

Elastic spin angular momentum in metamaterials and classical structures
Topological phenomena of bosonic-like waves have attracted wide interests during the last few years. Spin angular momentum (SAM) provides new insights from the local point of view. Here, we experimentally investigate SAM in metamaterials and classical structures. Multi-dimensional wave routing is achieved due to the SAM-wavenumber locking mechanism.

TUTORIALS

Prof. Franco Nori

Riken (Japan) and University of Michigan (USA)

Wednesday 17th July
14:00 - 15:00 — Main Hall

Topological Origin of Surface Maxwell Waves and Surface Acoustic Modes

Franco Nori is a Chief Scientist at RIKEN, with a concurrent position at the University of Michigan. He received his PhD from the University of Illinois, and afterwards became a postdoc at the Institute for Theoretical Physics, University of California, Santa Barbara. His research group has done pioneering interdisciplinary studies at the interface between nanoscience, photonics, quantum optics, dissipative quantum open systems, quantum information processing, superconducting quantum circuitry, opto-mechanics, and condensed matter physics. He has been listed by the Web of Science as a "Highly Cited Researcher" (less than 0.1% are selected) in Physics for the past seven consecutive years: from 2017 to 2023. He is an Elected Fellow of the American Physics Society (APS), Institute of Physics (IoP), American Association for the Advancement of Science (AAAS), and Optical Society of America (OSA) [this last one "for fundamental contributions to quantum information science and optics, including circuit quantum electrodynamics, and the interface between quantum optics and quantum circuits"]. He received the 2014 Prize for Research in Physics, from the Matsuo Foundation, Japan; and the 2013 Prize for Science, by the Minister of Education, Culture, Sports, Science and Technology, Japan. Also, an "Excellence in Research Award" and an "Excellence in Education Award" from the University of Michigan. He is an Elected Member of the Academia Europaea, the Latin American Academy of Sciences, and a Foreign Member of the Swedish Royal Society of Arts and Sciences, in Gothenburg, Sweden. He won the 2023 W.E. Lamb Medal, and the 2024 Charles H. Townes Medal (from the OSA), both for research on Quantum Optics, Quantum Electronics and Quantum Information.

Topological Origin of Surface Maxwell Waves and Surface Acoustic Modes
Interfaces between optical media (including dielectrics, metals, negative-index materials) can support surface electromagnetic waves, which now play crucial roles in plasmonics, metamaterials, and nanophotonics. We have shown [K. Y. Bliokh et al., Nat. Commun. 10, 580 (2019)] that surface Maxwell waves at interfaces between homogeneous isotropic media described by real permittivities and permeabilities have a topological origin explained by the bulk-boundary correspondence. This is explained by the nontrivial topology of the non-Hermitian photon helicity operator in the Weyl-like representation of Maxwell equations. The corresponding topological invariant, which determines the number of surface modes, describes the winding of the complex helicity spectrum across the interface. Our theory provides a new twist and insights for several areas of wave physics: Maxwell electromagnetism, topological quantum states, non-Hermitian wave physics, and metamaterials. We have also analyzed [K. Y. Bliokh et al., Phys. Rev. Lett. (2019)] another type of classical waves: longitudinal acoustic waves corresponding to spinless phonons. We show that surface acoustic waves, which appear at interfaces between media with opposite-sign densities, can be explained by similar topological features and the bulk-boundary correspondence. However, in contrast to photons, the topological properties of sound waves originate from the non-Hermitian four-momentum operator in the Klein-Gordon representation of acoustic fields.

Dr. Rachel Won

Nature Photonics, UK

Thursday 18th July
14:00 - 15:00 — Main Hall

Writing and Submitting Your Papers

Rachel Won is an International Editor of Nature Photonics. She joined the journal in June 2006 as one of four Founding Editors. Before that, Rachel worked for Aston University's Business Partnership Unit in Birmingham, UK, as a Medici Fellow commercializing research output of the university, particularly that of photonics research. She obtained her PhD in microwave photonics and nonlinear optics as a member of Aston's Photonics Research Group. She worked for Philips Optical Storage in Singapore as an Optics Engineer after completing her Master's degree study in Nanyang Technological University of Singapore doing research in optical fibre sensing. She holds a Bachelor's degree from the National University of Malaysia. She is a Fellow of OPTICA and the International Society of Optics and Photonics (SPIE).

Writing and Submitting Your Papers
This talk covers the detailed information and guidelines on scientific paper preparation and submission, including tips for writing an effective cover letter, an informative abstract, a comprehensive introduction and an attractive paper, and editorial and peer-review processes. You will also get to know how to choose a journal for submission, what editors seek, how your papers are reviewed and how to make an appeal.

INDUSTRIAL WORKSHOPS

SYNOPSYS®

16th & 17th July, 16:40 - 17:40 — Room 3

From Design to Manufacture - Complete Inverse Design Flow for MetaOptics

Chenglin Xu, Bryan Stone, JiSoo Park

Synopsys offers solutions to metalens design and manufacturing challenges, including tools for hybrid refractive metalens systems that consider manufacturing tolerances. This workshop is presented in two parts:

1. July 16: Introduction to MetaOptic Designer;
2. July 18: Demo of hybrid metalens system design and virtual fab simulation.

The workshop is free and open to all META conference attendees.

GUIDELINES FOR PRESENTERS I **IN-PERSON**

Oral Presentations

Each session room is equipped with a stationary computer connected to a LCD projector. Presenters must load their presentation files in advance onto the session computer. Technician personnel will be available to assist you.

Scheduled time slots for oral presentations are 15 mn for regular, 20 mn for invited presentations, 30 mn for keynote talks and 35 mn for plenary talks, including questions and discussions. Presenters are required to report to their session room and to their session Chair at least 15 minutes prior to the start of their session.

The session chair must be present in the session room at least 15 minutes before the start of the session and must strictly observe the starting time and time limit of each paper.

Poster Presentations

Presenters are requested to stand by their posters during their session. One poster board, A0 size (118.9 x 84.1 cm), in portrait orientation, will be available for each poster. Pins or thumbtacks are provided to mount your posters on the board. All presenters are required to mount their papers 30mn before the session and remove them at the end of their sessions. Posters must prepared using the standard AES poster template (available on the conference website).

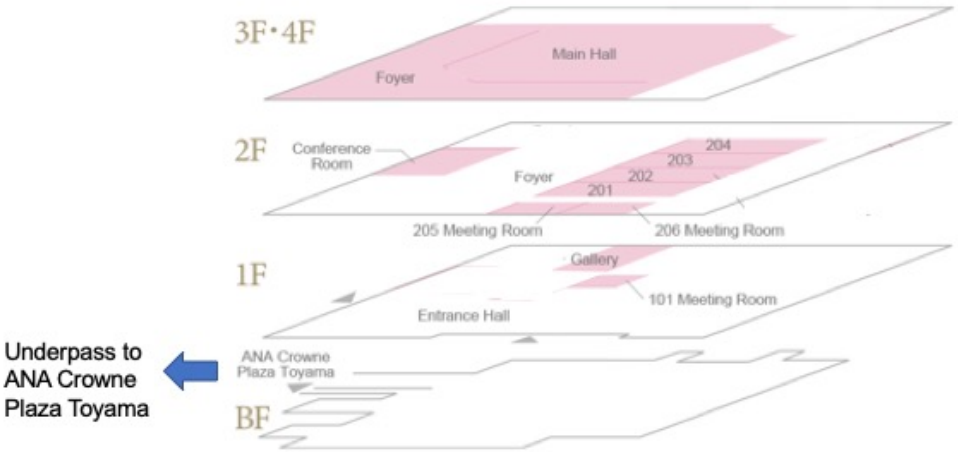
USEFUL INFORMATION

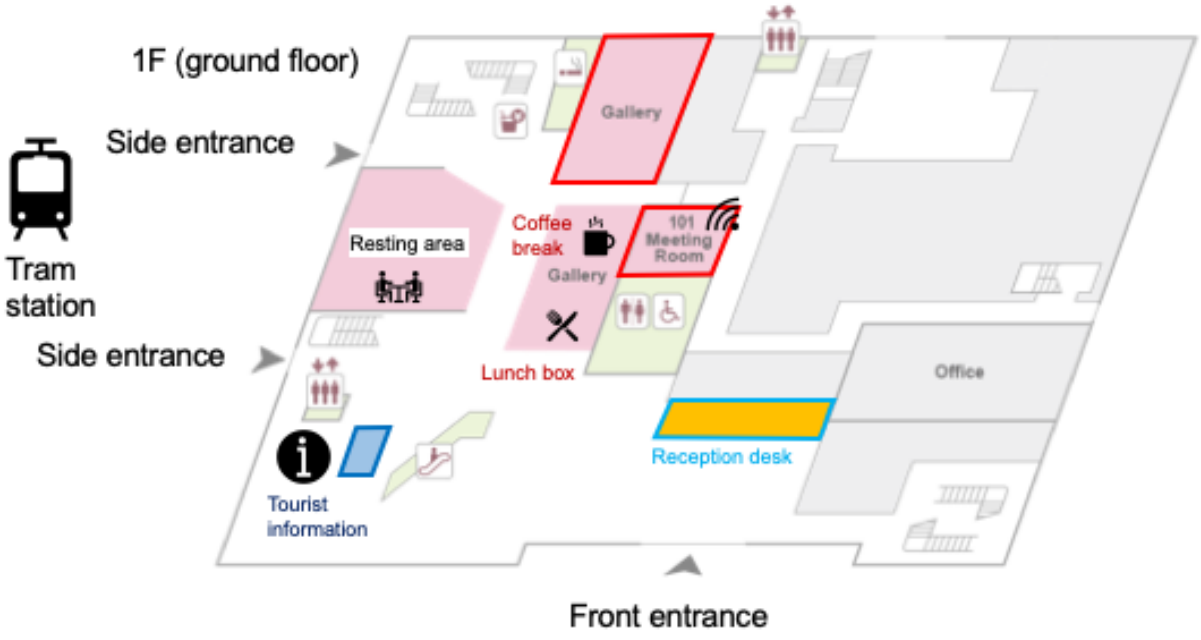
Venue

META 2024 will be held at
Toyama International Conference Center
1-2 Ote-machi, Toyama, Japan

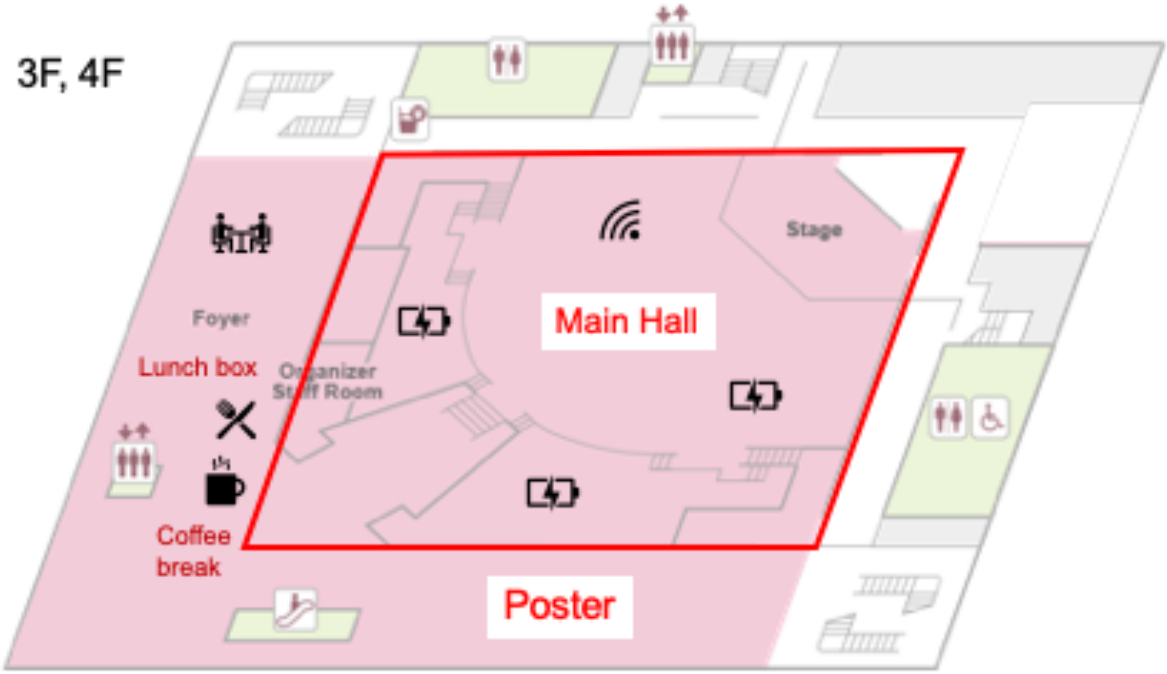
https://www.ticc.co.jp/english/

Floor Map of TICC




1F (ground floor)
Side entrance
Tram station
Side entrance
Gallery
Resting area
Coffee break
101 Meeting Room
Gallery
Lunch box
Office
Reception desk
Tourist information
Front entrance


2F
Lunch box
204
Conference Room
Exhibition
203
Open Ceiling
Multi-Purpose Room
Foyer
202
201
Open Ceiling
Coffee break
205 Meeting Room
206 Meeting Room



Getting to Venue

Toyama City is the largest city and capital of Toyama Prefecture in the Hokuriku Region of northern Chubu. The city is a former castle town and is historically a center of medicine. Due to its position on the Hokuriku Shinkansen (high speed “bullet train” rail line), Toyama is a popular stop for tourists on the way to other attractions in the area such as the Tateyama Kurobe Alpine Route.

Travel Information

Toyama is easily reachable from both within and outside Japan, positioned at an approximate equal distance from the country’s three major cities: Tokyo, Osaka, and Nagoya. It takes just 2 hours and 8 minutes from Tokyo via the Hokuriku Shinkansen (“bullet train"). Additionally, Toyama Airport offers connections from Tokyo and Sapporo, as well as direct flights from Shanghai, Taipei, Dalian, and Seoul.

For travelers arriving in Tokyo, there are two primary international airports: Haneda Airport and Narita Airport. Regardless of your arrival airport, you can take a train or bus to Tokyo Station and then catch the Hokuriku Shinkansen to Toyama Station, which typically takes about 2 hours and 30 minutes.

If you land at Haneda Airport, there’s another option available: transferring to a domestic flight bound for Toyama Airport, with three ANA flights available daily. Upon arrival at Toyama Airport, a convenient shuttle bus service can transport you to the city center in just 30 minutes.

- Getting to Toyama (Link to the Official Toyama City Travel Guide “Toyama Net”)
- Getting to Toyama (Link to the Official Toyama Travel Guide “Visit Toyama”)

TECHNICAL PROGRAM

Monday 15th July, 2024

Registration

Reception Desk

15:00 - 18:00

Tuesday 16th July, 2024

Registration

Reception Desk

08:00 - 17:30

Opening Address

Main Hall

08:45 - 09:00

09:00 - 10:10 — Main Hall

Session 1A1

Plenary Session I

Chaired by: Anatoly Zayats

09:00 : Plenary talk
Localized states trapped by topological defects in photonic and hybrid metasurfaces
Daria Smirnova
Australian National University (Australia)

This talk will report novel phonon-polariton states trapped by topological defects in a silicon metasurface integrating hexagonal boron nitride (hBN). Spatially localized polaritonic modes originate from the coupling of electromagnetic fields with phonon vibrations in hBN.

09:35 : Plenary talk
Materials manipulation with structured light fields
Takashige Omatsu
Chiba University (Japan)

Structured light fields, such as optical vortex, has been currently growing up to a particle-like optical field (optical skyrmion). We review state-of-the-art structured materials fabrication and new materials manipulation with structured light fields.

Coffee Break

Session 1P1
Poster Session I
10:10 - 10:50

P1: Orthogonal chemical toolbox for antifouling biointerface on gold nanoparticle arrays serving in plasmonic biosensing applications
D. Cattozzo Mor[1], A. B. Plšek[1], V. T. Vu[1], G. Aktug[1], Z. Hubička[1], C.-J. Huang[2], Jackub Dostalek[1]
[1] *Czech Academy of Sciences (Czech Republic),* [2] *National Central University (Taiwan)*

In plasmonic biosensing applications, gold nanostructures are typically attached to oxide surfaces. We present an orthogonal chemical toolbox to promote gold-glass adhesion and to selectively modify arrays of gold nanoparticles by antifouling and biofunctional moieties, based on a set of dedicated silatrane and thiol molecules bearing carboxy- and sulfo-betaine headgroups.

P2: Strong nonlinear optical activities in the asymmetric 2D material with inversion-symmetry breaking
Song Zhu, Ruihuan Duan, Zheng Liu, Qi Jie Wang
Nanyang Technological University (Singapore)

Here, we demonstrate strong second-order and third-order susceptibilities of 64 pm/V and 6.2$imes$10-19 m2/V2, respectively, in the even-layer PdPSe. It also simultaneously exhibited strong SHG anisotropy with an anisotropic ratio of $\sim$45, which is the largest reported among all 2D materials to date, to the best of our knowledge.

P3: Demonstration of hybrid photonic crystal nanocavity using atomically thin van der Waals flakes
Chee Fai Fong[1], Daiki Yamashita[2], Nan Fang[1], Shun Fujii[3], Yih-Ren Chang[1], Takashi Taniguchi[4], Kenji Watanabe[4], Yuichiro Kato[1]
[1]*RIKEN (Japan),* [2]*AIST (Japan),* [3]*Keio University (Japan),* [4]*NIMS (Japan)*

We demonstrate the formation of hybrid nanocavities by partially covering silicon photonic crystal (PhC) waveguides with suitably-sized 2D material flakes, obtaining cavity quality (Q) factors as high as 4.0x105.

P4: Water-Air Acoustic Communication Based on Broadband Impedance Matching
Han Jia, Yuzhen Yang, Jun Yang
Chinese Academy of Sciences (China)

Efficient acoustic communication across the water-air interface has always been expected in ocean explorations. However, the existing researches are mainly concentrated on the narrow-band transmission based on resonance. Here, we combined the air-based and water-based metafluids to realize an exponential gradient impedance matching layer for broadband water-air sound transmission.

P5: Finite-difference frequency-domain calculations of chiral material composites
Takamichi Terao
Gifu University (Japan)

The finite-difference frequency-domain method to investigate electromagnetic wave propagation in chiral material composites was presented. Eigenmode analysis of random chiral material multilayers were demonstrated. These approaches will be useful for the analysis of chiral metamaterials and their composites.

P6: Tunable filter based on the Brewster effect in metafilms: From all-pass filter to narrowband perfect absorber
Tomohiro Hoshino, Yasuhiro Tamayama
Nagaoka University of Technology (Japan)

We show that the ratio of the non-radiative loss to the radiative loss of a broadband reflectionless single-layer metamaterial designed so that the Brewster effect occurs can be controlled by varying the arrangement of the constituent meta-atoms without changing the structure of the meta-atoms.

P7: Noble Metal - Chalcopyrite Hybrid Nanostructures for Enhanced Plasmonic Photocatalysis
Bjoern Reinhard
Boston University (USA)

Chalcopyrite (CuFeS2) nanocrystals, which support quasistatic resonances in the visible, and noble metal nanoparticles are combined into one nanostructure to provide a bi-resonant hybrid material. The interplay of metal and CuFeS2 resonances on the photoreactivity of the hybrid material is characterized for different nanoarchitectures and reactions.

P8: Transient dissipative structures in surface plasmon polaritons propagation
S. Derevyanko[1], M. Spector[2]
[1]*Ben Gurion University of the Negev (Israel),* [2]*Schwartz/Reisman Science Education Center (Israel)*

We suggest an easily configurable dynamical method of creating a transient periodic plasmonic lattice in a metal film by temperature induced variation of the dielectric permittivity. We demonstrate a range of effects from dissipative plasmonic crystal to induced electromagnetic transparency.

P9: Refined Quantum Hydrodynamic Model for Deep Nanoscale Plasmonics with Noble Metal and Dielectrics
Xue-Wen Chen

Huazhong University of Science and Technology (China)

Quantum hydrodynamic model has become a versatile and efficient tool for plasmonics at the deep nanoscale, but the current model is in principle only applicable to simple metals, not for noble-metal structures. We present a refined quantum hydrodynamic model to effectively account for various effects from noble metals.

P10: Spin angular momentum of enhanced electric fields around a plasmonic nanostructures excited by circularly polarized light

Naoki Ichiji, Takuya Ishida, Ikki Morichika, Tetsu Tatsuma, Satoshi Ashihara
University of Tokyo (Japan)

We evaluated the spin angular momentum (SAM) in the electromagnetic field around plasmonic nanostructures excited by circularly polarized light. We revealed that the enhanced electromagnetic field can possess unidirectional SAM and their direction can be reversed depending on the resonance mode.

P11: From Air to Water: Expanding Inverse-Design Applications in Ultrasonic OAM

Chuanxin Zhang, Xue Jiang, Dean Ta
Fudan University (China)

This study presents an inverse-design methodology for optimizing Orbital Angular Momentum (OAM) beams, enhancing ultrasonic motor performance. Utilizing an airborne 16x16 phased array and holographic lenses, we achieved significant improvements in beam uniformity and signal-to-noise ratio, demonstrating superior particle control in a constructed twisted ultrasonic motor.

P12: Analyzing Absorption Mechanisms of Plasmonic and Dielectric Surface Lattice Resonance Embedded in Absorptive Medium

Joshua T. Y. Tse, Shunsuke Murai, Katsuhisa Tanaka
Kyoto University (Japan)

In this work, we present an analytical model based on the temporal coupled-mode theory that describes different absorption pathways of surface lattice resonance with absorptive nanoparticle array and index-matching layer. Each component of absorption is further analyzed to reveal general guidelines on optimizing nanoparticle arrays for photoluminescence enhancement.

P13: Optical imaging based on metasurfaces

Shuming Wang
Nanjing University (China)

The optical imaging has been demonstrated based on various metasurface devices, such as broadband achromatic metalens, ultracompact spectral light field imaging (SLIM) camera, and pixel-level metasurface-based Bayer-type colour router, etc.

P14: Optimized Near-infrared Absorption of Reflective Aluminum Gratings: Theoretical and Experimental Investigation

Roy Avrahamy[1], Dror Cohen[1], Benny Milgrom[2], Ben Amir[1], Daniel Belker[1], Asi Solodar[1], Erez Golan[1], Oren Sadot[1], Amiel Avraham Ishaaya[1]
[1] *Ben-Gurion University of the Negev (Israel),* [2] *Jerusalem College of Technology (Israel)*

We inversely design reflective Aluminum gratings for narrow-/wide-linewidth TE/TM/unpolarized perfect absorption around 1.06μm. Expanding the widely studied P-polarization plasmonic case, we highlight the achievability of perfect S-polarization absorption in the simplest 1D geometry without extra materials. Optical and thermal measurements of the absorption of a large-area fabricated design match simulations

P15: Frequency-selective valley edge waveguiding in topological phononic-crystal plates

Jin-Chen Hsu, Chun-Hao Wei, Che-Ting Huang
National Yunlin University of Science and Technology (Taiwan)

We designed four elastic valley Hall materials composed of pillared phononic-crystal plates with two different topological modulations. By constructing distinct phase domain walls, the valley edge states emerge at different frequencies in the complete band gap. Accordingly, we can demonstrate robust zigzag waveguiding and frequency-selective channeling for elastic Lamb waves.

P16: Design of composite mufflers based on dissipative and reactive units

Yuzhen Yang, Han Jia, Quanquan Shi, Jun Yang

Chinese Academy of Sciences (China)

We have proposed and validated a design of a composite muffler. This design combines both dissipative and reactive units with different operating mechanisms to take advantage of the benefits offered by each structure. The result achieved a high transmission loss across a wide frequency range in a ventilation duct system.

P17: The Multi-angle Beam Bender with Transformation Materials
Wen-Xiu Dong, Yun-Yun Lai, Jin Hu
Beijing Institute of Technology (China)

In contrast to the usual bender that can only bending fixed angle of the beam path no matter what the incidence angle is, a new bender that can guiding the beam path to wide range bending angles is proposed, which can adjust the path directions according to the incidence angles.

P18: A universal impedance-matching strategy towards ultrathin broadband perfect absorbers enabling efficient hot electron photodetection
Cheng Zhang, Xiaofeng Li
Soochow University (China)

We derive conditions for achieving impedance matching in ultrathin films with negligible/comparable thickness to the incident wavelength. We design and experimentally demonstrate broadband perfect absorbers operating across various spectral bands, with average absorption exceeding 90 %. Integration with p-type silicon enables hot carrier photodetection, promising applications in telecommunication and near-infrared imaging.

P19: Quasi-BIC Mode Lasing in a Quadrumer Plasmonic Lattice
Rebecca Heilmann[1], Grazia Salerno[2], Javier Cuerda[2], Tommi K Hakala[3], Päivi Törmä[2]
[1] *Aalto University (The Netherlands),* [2] *Aalto University (Finland),* [3] *University of Eastern Finland (Finland)*

Multiparticle unit cells of nanoparticle arrays are a promising concept for realizing quasi-BIC modes whose darkness in the far-field is topologically protected against imperfections. By combining theory with polarization-resolved measurements of the emission, we show that the lasing emission from a plasmonic quadrumer array has a topological charge.

P20: Deep subwavelength titanium nitride grating structures for mid-infrared vibrational absorption sensing
Leonid Beliaev, Evgeniy Shkondin, Andrei Lavrinenko, Osamu Takayama
DTU-Technical University of Denmark (Denmark)

The mid-infrared vibrational spectroscopy has been used for the detection of various molecules due to the characteristic infrared absorption features of chemical bondings. We realize high-aspect ratio plasmonic titanium nitride gratings where infrared absorption by vanillin molecules is significantly enhanced due to stronger electric fields within the deep subwavelength structures.

P21: Hybrid Plasmonic Waveguide NFT for HAMR Heads
Will Lee[1], Andres Neira[2], Beverley McConnell[2], Robert Bowman[1]
[1] *Queens University Belfast (United Kingdom),* [2] *Seagate Technology (United Kingdom)*

In this study, a novel hybrid plasmonic waveguide as near field transducer is proposed, consisting of high refractive index nanorod separated from metal by low primitivity region. The design aims to enhance mode confinement at the metal-dielectric interface by combining the benefit of both the nanorod and the plasmonic waveguide.

P22: Topology optimization for liquid crystal-based holograms
Peter Ropač[1], Yu-Tung Hsiao[2], Brecht Berteloot[2], Miha Ravnik[1], Jeroen Beeckman[2]
[1] *University of Ljubljana (Slovenia),* [2] *Ghent University (Belgium)*

We demonstrate a topology optimization-based algorithm to design thin liquid crystal phase-only 2D computer-generated holograms. Our method considers the material properties of liquid crystal, such as elastic energy, by using gradient limiter mapping functions. With our method and photopatterning, we can produce high-fidelity and high-contrast liquid crystal-based computer-generated holograms.

P23: Plasmonic Copper Nanorings for Building Energy Management
Xavier Baami Gonzalez[1], Jimmy Duc Tran[2], Duncan Sutherland[1]
[1] *iNANO - Aarhus University (Denmark),* [2] *Technical University of Denmark (Denmark)*

Copper nanorings of a diverse range of sizes (200-800 nm) have been successfully fabricated showing plasmonic behavior. They represent an alternative for future applications such as energy-saving glasses coatings and films to block infrared radiation.

P24: Highly Efficient Stimulated Raman Conversion in SF6-filled Photonic Crystal Fiber
Roy Avrahamy, Daniel Belker, Aviran Halstuch, Amiel Avraham Ishaaya
Ben-Gurion University of the Negev (Israel)

We report a highly efficient stimulated Raman conversion of a nanosecond pulsed Ytterbium-doped laser from 1065nm to the first Stokes at 1161nm using a hollow-core photonic crystal fiber pressurized with SF6. Non-trivially, optimization of the input pump angle of linear polarization facilitates a 100 % conversion efficiency increase over previous reports.

P25: A Direct Approach towards Nanoscale Mapping of Plasmonic Heat Generation in Nanostructures
Serene Pauly, Amit Kumar
Queen's University (United Kingdom)

This work focuses on direct visualisation and optimisation of nanoscale plasmonic heating in metallic nanostructures. Through integration of scanning thermal microscopy with laser-enabled plasmonic excitation, our methodology allows for precise measurement and analysis of localised heating effects. Additionally, the study examines wavelength, and morphological effects on influencing the thermal response.

P26: Bio-inspired metalens array for directional detection in 3D light imaging and ranging
Clément Majorel[1], Amir Loucif[1], Emil Marinov[1], Renato Juliano Martins[1], Adelin Patoux[1], Virginie Brandli[1], Patrice Genevet[2]
[1] *CRHEA-CNRS (France),* [2] *Colorado School of Mines (USA)*

We present a bio-inspired metalens array designed to perform directional detection in a 3D light detection and ranging (LiDAR) experiment. Thanks to the high compactness of metasurfaces, our component can be easily integrated in front of any sensing device.

P27: Spontaneous emergence of eyes in reinforcement learning agents
Zongfu Yu, Boyuan Liu, Ming Zhou, Yurui Qu, Zhicheng Wu, Qingyi Zhou, Zongfu Yu
University of Wisconsin Madison (USA)

We show that an artificial agent powered by reinforcement learning can spontaneously develop visual functions in the form of optical lens without any supervision.

P28: Dissipative Triatomic Metamaterial for Broadband Asymmetric Elastic-wave Transmission
Sagr Alamri[1], Bing Li[2]
[1] *King Khalid University (Saudi Arabia),* [2] *Northwestern Polytechnical University (China)*

An innovative design is proposed for a dissipative triatomic elastic metamaterial to obtain asymmetric wave transmission to realize asymmetric wave transmission in two low-frequency bands. These frequency bands can be analytically and experimentally predicted to realize two paths of wave propagation and wave attenuation along two different directions of transmission.

P29: Integrating functional inorganic nanomaterials for spatiotemporal modulation of full-polarized light emission
Jiawei Lv, Jeong Hyun Han, Ki Tae Nam
Seoul National University (Korea)

Here we present a solid-state full-polarized controlling device by integrating the spatiotemporal modulation of the LED device, the precise control and efficient polarization emission through nanomaterial assembly, and the programmable patterning/positioning using 3D printing. We achieved an extremely high degree of polarization for both linearly and circularly polarized emission.

P30: Satisfaction of circular polarized Laguerre-Gaussian mode generation requirements by mid-infrared thermal emission metasurface
Kazuma Sekiya, Yoshiaki Nishijima
Yokohama National University (Japan)

We studied the design methodology for generating circularly polarized Laguerre-Gaussian beams using a metal-insulator-metal structured mid-infrared metasurface. As a result, it suggested that a two-layered meta-

molecule with optimized three-dimensional chiral structure could control circular dichroism and geometric phase, indicating the potential realization of compact devices emitting ultra-narrowband mid-infrared radiation.

10:50 - 12:40 — Main Hall

Session 1A2

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Satoshi Ishii

10:50 : Keynote talk
Nanoplasmonics as Enabler of Ultrafast Quantum Nanophotonics at Ambient Temperatures
Ortwin Hess
Trinity College Dublin (Ireland)

We discuss how nanoplasmonic-cavity strong coupling and ultrafast plasmonic near-field evolution can be exploited to achieve high-speed nanophotonic quantum operations at ambient temperatures, including dynamic multi-partite entanglement, and introduce a novel strategy for preparation and 'immortalization' of selected plasmon-exciton polariton states by means of quantum coherent perfect absorption.

11:20 : Invited talk
Fano line shapes generated by excitonic nanoparticles
Shinji Hayashi
Kobe University (Japan)

Based on the Mie theory and its electrostatics approximation, we analyze analytically and numerically optical responses and resonant behaviors of internal fields in spherical excitonic nanoparticles and show that Fano line shapes can easily be generated in the scattering spectra and spectra of internal fields.

11:40 : Invited talk
Ultrafast electron dynamics at Fe(001)-Au(001) heterostructures
M. Heckschen, Y. Beyazit, E. Shomali, F. Kuhne, J. Jayabalan, P. Zhou, D. Diesing, M. E. Gruner, R. Pentcheva, B. Sothmann, Uwe Bovensiepen
University of Duisburg-Essen (Germany)

Understanding hot electron transport requires distinguishing diffusive or ballistic regimes. We determine the energy-dependent electron propagation time through Fe(001)-Au(001) heterostructures using femtosecond time-resolved photoelectron spectroscopy, electronic structure theory, and transport simulations. The electron velocity increases with growing Au layer thickness since the propagation aligns with the interface normal direction.

12:00 : Invited talk
Sb2S3 phase change material for optical switching: the Brewster angle effect
Gonzalo Santos[1], Diego Pérez-Francés[1], Josef Resl[2], María Losurdo[3], Yael Gutiérrez[1], Fernando Moreno[1]
[1] *University of Cantabria (Spain),* [2] *Johanes Keppler University (Austria),* [3] *CNR ICMATE (Italy)*

Phase change materials in optical switching devices provides with tunable optical responses, ultrafast switching speeds, and low power consumption. In this contribution we will present a novel optical amplitude switch incorporating PCM antimony trisulfide (Sb2S3) based on the Brewster angle phenomenon.

12:20 : Invited talk
Modeling Photomolecular Effect Using Feibelman Parameters and Generalized Boundary Conditions for Maxwell Equations
Gang Chen
MIT (USA)

Here, we re-derive a set of generalized boundary conditions for Maxwell equations using Feibelman parame-

ters to describe the photomolecular effect: photons directly cleaving off water molecular clusters in the visible spectrum where bulk water has negligible absorption. We show that this approach can reasonably explain our experimental data.

10:50 - 12:40 — Room 201

Session 1A3

Symposium I: Hybrid Nanomaterials and Metastructures for Photonics, Sensing and Energy

Organized by: Jérôme Plain, Alexander Govorov, Davy Gérard and Pedro Hernandez Martinez

Chaired by: Jérôme Plain

10:50 : Invited talk
Periodic Arrays of Single-Crystal Gold and Silver Nanoplates
Svetlana Neretina, Z. R. Lawson, W. J. Tuff
University of Notre Dame (USA)

In this presentation, we demonstrate the implementation of both plasmon-mediated and chemical reduction methods for generating large area arrays of single-crystal gold and silver hexagonal nanoplates, nanotriangles, and helical spirals on substrates.

11:10 : Invited talk
Hybrid Metamaterial Plasmonic Tweezers for Trapping and Manipulating Dielectric Particles and Biomolecules
Viet Giang Truong[1], Domna G. Kotsifaki[2], German Suslin[1], Theodoros D, Bouloumis[1], Mirco Dindo[1], Paola Laurino[1], Síle Nic Chormaic[1]
[1] *Okinawa Institute of Science and Technology Graduate University (Japan),* [2] *Duke Kunshan University (China)*

Precise manipulation and discrimination of particles on a scale smaller than the diffraction limit is a topic of enduring interest. This study provides an alternative approach for trapping and identifying dielectric and bioparticles using metamaterial plasmonic tweezers, while paving the way for label-free characterization of biomolecules at single-entity levels.

11:30 : Keynote talk
Chiral Nanophotonics: Enabling Ultrasensitive Detection in Biophysical Measurements
Malcolm Kadodwala
University of Glasgow (United Kingdom)

This talk will explore how the emerging field of chiral nanophotonics can overcome this barrier. By harnessing the unique properties of nanostructures, we can significantly enhance the interaction between light and chiral molecules. This allows for highly sensitive CD measurements, potentially reaching the single-molecule level.

12:00 : Invited talk
Waveguiding and metasurface platforms for sensing
Stefan Maier
Monasu University (Australia)

Nanogap waveguides are demonstrated as a promising platform for the routing of Stokes emission in a context of surface-enhanced Raman scattering, or more generally for the decoupling of localised emission. Coupling of waveguides to metalenses provides additional opportunities for the creation of compact sensing devices.

12:20 : Invited talk
Assymmetric electric fields induced on symmetric structure that yield chiral structured materials
Hiromi Okamoto, Hyo-Yong Ahn, Tetsuya Narushima
Institute for Molecular Science (Japan)

Interference between an incident circularly polarized optical field and a scattered field by a plasmonic cuboid particle created a spiral-shaped optical field structure, which was replicated on a polymer relief through photopolymerization.

10:50 - 12:30 — Room 202

Session 1A4

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Gerrit Bauer

10:50 : Invited talk

Gyromagnetic Double-zero-index Metamaterials Enable Ultrarobust Generation of Optical Spatiotemporal Vortices

Xiaohan Cui[1], **Ruo-Yang Zhang**[1], **Yuan-Song Zeng**[2], **Geng-Bo Wu**[2], **C. T. Chan**[1]

[1] *Hong Kong University of Science and Technology (Hong Kong),* [2] *City University of Hong Kong (Hong Kong)*

We expand the scope of conventional double-zero-index media by introducing non-reciprocity and experimentally realizing gyromagnetic double-zero-index metamaterials (GDZIMs). A homogeneous GDZIM slab displays an ultra-robust reflection phase vortex, unaffected by slab thickness adjustments. This discovery reveals a novel mechanism for generating robust optical spatiotemporal vortices by breaking time-reversal symmetry.

11:10 : Invited talk

Making sense of the electron transport CISS effect properties and the spinterface model

Amos Sharoni[1], **Reut Bornovski**[1], **Seif Alwan**[2], **Yontant Dubi**[2]

[1] *Bar Ilan University (Israel),* [2] *Ben Gurion University of the Negev (Israel)*

Transport CISS effect is observed in metal-chiral-ferromagnet junctions, where current changes dramatically with magnetization of FM. Understanding different experimental findings and their origin is difficult. We show our spinterface model well explains effects such as magnitude of CISS signal and temperature dependence. We present recent experimental results supporting the model.

11:30 : Invited talk

Nonreciprocal Optical Responses and Diode Effect in Superconductors: Quantum Geometry, Topological Superconductivity, and Exotic Pairing

Hiroto Tanaka[1], **Akito Daido**[1], **Hikaru Watanabe**[2], **Naratip Nunchot**[1], **Kyohei Nakamura**[1], **Shun Asano**[1], **Youichi Yanase**[1]

[1] *Kyoto University (Japan),* [2] *University of Tokyo (Japan)*

We present the theoretical framework of nonreciprocal transport and optical responses in superconductors. The optical second-harmonic generation, bulk photocurrent, superconducting diode effect, and nonreciprocal Meissner effect are discussed. Observation of exotic Cooper pairing and topological superconductivity is proposed.

11:50 : Invited talk

Chiral and non-chiral magnetic texturing in antiferromagnetic Cr2O3

Oleksandr Pylypovskyi

Helmholtz-Zentrum Dresden-Rossendorf (Germany)

The spontaneous appearance of magnetic textures in the easy-axis antiferromagnets can be related to the grain boundaries and crystal interfaces. Here, we discuss the properties of domain walls in thin films and the surface-symmetry-driven Dzyaloshinskii-Moriya interaction using Cr2O3 as the case study.

12:10 : Invited talk

Dynamical control of topological solitons in ferroelectrics and dynamical multiferroicity via twisted light
Lingyuan Gao, Sergei Prokhorenko, Yousra Nahas, Laurent Bellaiche
University of Arkansas (USA)

Via the use of first-principle-based atomistic simulations, it is demonstrated that twisted light can induce emergent electrodynamic phenomena in ferroelectric systems. These include: (1) dynamical evolution of topology in ferroelectric skyrmions, (2) effective gyration of dipolar vortex arrays, and (3) orbital magnetic moments of ions and composed magnetic topological textures.

10:50 - 12:30 — Room 203

Session 1A5

Symposium III: Advanced passive and active metasurfaces and zero-index materials

Organized by: Howard Lee, Pin Chieh Wu and Qinghua Song

Chaired by: Howard Lee

10:50 : Invited talk
Reconfigurable Acoustic Metasurfaces for Controlling Disordered Sound Fields
Guancong Ma
Hong Kong Baptist University (Hong Kong)

Disordered sound fields are ubiquitous in our daily life - the sound in a room undergoes multiple scattering form such a sound field. Here, we show that reconfigurable acoustic metasurfaces can control the disordered sound for various advanced functionalities, including the generation of quiet zones, and the elimination of cross-talks.

11:10 : Invited talk
Enhanced Photogating Gain in Scalable MoS2 Plasmonic Photodetectors via Resonant Metasurfaces
Yu-Jung Lu
Academia Sinica (Taiwan)

Here, we introduce a novel demonstration of utilizing scalable nitride-based resonant plasmonic metasurfaces, with a work function of 4.7 eV, to dramatically augment the light-matter interaction in wafer-scale monolayer single-crystal MoS2 photodetectors. Our pioneering approach has achieved excellent responsivity and impressive detectivity via the plasmon-enhanced photogating effect.

11:30 : Invited talk
Monocular metasurface camera for single-shot multi-dimensional imaging
Yuanmu Yang
Tsinghua University (China)

I will present our group's recent effort to replace conventional camera lenses with metalenses. We aim to build compact camera systems that can capture multi-dimensional light field information of a target scene in a single shot under ambient illumination conditions.

11:50 : Invited talk
Active and Nonlinear Metasurfaces with the Generation and Relaxation of Plasmonically Induced Hot Carriers
Wenshan Cai
Georgia Institute of Technology (USA)

The generation, transport, and relaxation of hot electrons in plasmonic metasurfaces provide a novel route to active and nonlinear optical effects with ultrafast responses. Here, we present the exploitation of hot carrier dynamics for diverse applications in all-optical modulation, nonlinear optical signal generation, and photoinduced optical chirality.

12:10 : Invited talk
Electrochemically Active Metasurface and Multispectral Light and Heat Management
Po-Chun Hsu
University of Chicago (USA)

Electrochemistry is a powerful tool with gigantic refractive index changes. This talk includes three subjects: (i) Conjugated polymers for near-perfect dynamic thermal meta-emitter. (ii) Reversible metal electrodeposition for multispectral solar and mid-infrared control and dynamic beam steering. (iii) Spectrally selective hierarchical fabric for practical radiative cooling for the human body.

10:50 - 12:35 — Room 204

Session 1A6

Symposium V: Architectured Elastic and Acoustic Metamaterials and Phononic Crystals

Organized by: Marco Miniaci, Jensen Li, Vicente Romero-García, Vincent Pagneux and Noé Jiménez

Chaired by: Noé Jiménez

10:50 : Invited talk
Modeling wave propagation and boundary effects in acoustic metamaterials by a relaxed micromorphic continuum
Angela Madeo[1], Jendrik Voss[1], Svenja Hermann[1], Gianluca Rizzi[1], Felix Erel-Demore[1], Leonardo A. Perez Ramirez[1], Plastiras Demetriou[1], Patrizio Neff[2]
[1] *TU Dortmund University (Germany),* [2] *University of Duisburg-Essen (Germany)*

The relaxed micromorphic model (RMM) is employed to investigate the elastic wave propagation of mechanical metamaterials. This model adeptly captures band gaps, restricting wave propagation at specific frequencies. Addressing finite-size blocks, we enrich the RMM framework to incorporate essential boundary effects, exemplifying this through the concept of boundary forces.

11:10 : Invited talk
Design strategies for amplitude and phase acoustic holograms in biomedical ultrasound
Noé Jiménez, Diana Andrés, Alba Eroles-Simó, Alicia Carrión, Francisco Camarena
Universitat Politècnica de València / CSIC (Spain)

We present several topologies for phase-and-amplitude acoustic holograms based on metamaterial and phononic crystals. These approaches go beyond traditional phase holograms and produce sharper acoustic images for non-invasive and localized preclinical and clinical therapeutical applications like neuromodulation, drug delivery or surgery, or biomedical ultrasound imaging. Several application examples are provided.

11:30 : Invited talk
Topological Shear Band Engineering in Mechanical Metamaterials
Jingyi Zhang[1], Jingran Liu[1], Anton Souslov[2], María Teresa Pérez Prado[1], Javier Segurado[1], Maciej Haranczyk[1], Johan Christensen[1]
[1] *IMDEA Materials (Spain),* [2] *Cavendish Laboratory (United Kingdom)*

In this contribution we focus on mechanical metamaterials and discuss how the lattice topology can influence stress localizations when uniaxial compression is applied. We discuss a theoretical model that faithfully can predict the shape and orientation of stress localizations, which appear in good agreement with experimental measurements.

11:50 : Dispersion relationship of weakly scattered media
Mario Lazaro[1], Vicent Romero-García[1], Luis García-Raffi[1], Richard Craster[2]
[1] *Universitat Politècnica de València (Spain),* [2] *Imperial College London (United Kingdom)*

In this paper periodic media with an arbitrary number of scatterers in the unit cell are considered. Our goal is to know analytically the propagation conditions outside the forbidden bands. By applying perturbative techniques

we are able to find analytical solutions and the mathematical conditions under which our technique converges

12:05 : Keynote talk
Acoustic grating with space-time modulation
Agnes Maurel[1], **Kim Pham**[2]
[1] *Université PSL (France),* [2] *ENSTA Paris (France)*

We present a theoretical and numerical analysis of the diffraction of acoustic waves by space-time modulated gratings with rigid-type modulations. We report results exemplifying the non-reciprocal behavior of the grating, in relation with spatial and temporal harmonics.

10:50 - 12:30 — Conference Room

Session 1A7

SP10. Advanced Computational Electromagnetics for the Analysis and Design of Nanophotonic Devices

Organized by: Maha Ben Rhouma

Chaired by: Andrea Locatelli

10:50 : Invited talk
On the different models of Graphene conductivity and its effects on Casimir forces and on radiative heat transfer in nanostructured systems
Mauro Antezza
University of Montpellier (France)

We discuss different available models of graphene conductivity, and graphene effects two main fluctuational electrodynamics effects in nanostructured systems.

11:10 : Invited talk
Quasinormal mode expansion theory for mesoscale plasmonic nanoresonators with an analytical treatment of nonclassical electromagnetic boundary condition
Haitao Liu[1], **Can Tao**[1], **Ying Zhong**[2]
[1] *Nankai University (China),* [2] *Tianjin University (China)*

We propose a quasinormal mode (QNM) expansion theory for mesoscale plasmonic nanoresonators with nanometric feature sizes. Our theory can analytically unveil the impact of nonclassical quantum effects described by the nonclassical electromagnetic boundary condition (NEBC) on the optical response and thus provides an efficient tool for various design tasks.

11:30 : Invited talk
Effective Medium Theory for Photonic Parallel Universes
Yun Lai
Nanjing University (China)

Conventional wisdom tells us that a physical space corresponds to only one optical medium, e.g. an optical space cannot behave like vacuum and glass simultaneously. Surprisingly, this fundamental limitation can be broken in photonics. Here, I demonstrate multiple effective media associated with one physical space, effectively creating photonic parallel universes.

11:50 : Invited talk
Space-time photonic metasurfaces
Stefano Vezzoli, Anthony Harwood, Riccardo Sapienza
Imperial College London (United Kingdom)

Metamaterials control light by acting on its momentum, yet they are static devices and bounded by energy conservation. Here we discuss spatial and temporal diffraction in a film of Indium Tin Oxide, as a first step towards a space-time metasurface for photonic applications.

12:10 : Invited talk
Topological transition from bound states in the continuum of plasmonic lattices
Grazia Salerno, Rebecca Heilmann, Kristian Arjas, Kerttu Aronen, Jani-Petri Martikainen, Päivi Törmä
Aalto University (Finland)

We study lasing of plasmonic BIC modes with topological charge 0, ± 1 and -2. We evidence a loss-driven topological phase transition in the lasing mode, as the scale of the unit cell is varied. Our work shed light on the interplay between non-Hermitian systems and the topology of polarization singularities.

10:50 - 12:30 — Room 205

Session 1A8

SP8. Strong light-matter interactions in plasmonic/dielectric metasurfaces

Organized by: Shunsuke Murai and Shaojun Wang

Chaired by: Shaojun Wang and Keisuke Watanabe

10:50 : Invited talk
Embedding plasmonic gratings for enhanced polarized photodetection and imaging in the near-infrared
Tong Yu, Cheng Zhang, Ying Luo, Xiaofeng Li
Soochow University (China)

We proposed and experimentally demonstrated embedded plasmonic gratings, boosting hot electron generation and extraction efficiency. We achieved a 1.7 mA/W responsivity at λ=1455 nm, three times higher than non-embedded setups. We integrated the photodetector into a near-IR light imaging system, showcasing impressive polarized imaging capabilities.

11:10 : Invited talk
Strong coupling between surface plasmons and magnetic polaritons in a borophene-based hybrid system
Ye Ming Qing
Nanjing University of Posts and Telecommunications (China)

Borophene-based hybrid plasmonic structure enables strong coupling between surface plasmons and magnetic polaritons. This interaction leads to unique energy transfer, dual-band light trapping, and mode splitting characteristics, described by a coupled oscillator model. This innovative work offers a platform for light-matter studies and plasmonic device development.

11:30 : Invited talk
Condensation and Transport of Organic Exciton-Polaritons from Bound States in the Continuum
Matthijs Berghuis[1], Jose Luis Pura[2], Gabriel Castellanos Gonzales[1], Mohammad Ramezani[1], Diego Romero Abujetas[3], Shunsuke Murai[4], Erik van Heist[1], José Sanchez Gil[5], Jaime Gómez Rivas[1]
[1] Eindhoven University of Technology (The Netherlands), [2] Universidad de Valladolid (Spain), [3] Fribourg University (Switzerland), [4] Kyoto University (Japan), [5] Consejo Superior de Investigaciones Científicas (Spain)

We show the formation of a polariton condensate from molecules strongly coupled to a bound state in the continuum in a metasurface of Si nanoparticles. We find that the condensation threshold depends on the excitation spot size, due to ballistic transport of the polaritons in the plane of the metasurface.

11:50 : Invited talk
Engineering Light-Matter Interactions at the Nanoscale for Functional Devices
Zhaogang Dong
*A*STAR (Singapore)*

In this talk, we will present our recent work on engineering light-matter interactions at the nanoscale for functional devices, such as highly saturated red color pixels, color-sensitive miniaturized detectors, imaging of bound-states-in-the-continuum (BIC) mode, quasi-BIC resonance for enhancing cathodoluminescence, tunable color pixels, Si UV plasmonics, and tunable perovskite emission wavelength.

12:10 : Invited talk

Plasmonics and metamaterials for controlling optical properties and device applications through strong light-matter interactions

Koichi Okamoto
Osaka Metropolitan University (Japan)

In this study, we examine recent advancements in plasmonics and metamaterials, spotlighting progress in light manipulation across the UV to IR spectrum and highlighting applications in high-efficiency photonic devices, sensing, imaging, and quantum technologies. Additionally, we focus on innovative fabrication techniques that expand the frontiers of nano-optical engineering.

10:50 - 12:30 — Room 206

Session 1A9

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Wakana Kubo

10:50 : Invited talk

Full-space Janus Metasurface for Direction-duplex Quad-channel Electromagnetic Wave Manipulation

Weixu Yang, Shufang Dong, Ke Chen, Yijun Feng
Nanjing University (China)

This article presents a full-space Janus metasurface that enables asymmetric transmission-reflection-integrated electromagnetic wave functionalities for the right-handed circularly-polarized incidence propagating along opposite directions. As a proof of concept, direction-duplex quad-channel holographic images are demonstrated in microwave region using the fabricated metasurface.

11:10 : Invited talk

Metamaterials based Pixelated Thermal Signature Control

Zhuo Li[1], Xiu Liu[1], Yibai Zhong[1], Lin Wang[2], Tak Sing Wong[2], Han Wang[3], Jing Kong[4], Xu Zhang[1], Sheng Shen[1]
[1] *Carnegie Mellon Unversity (USA),* [2] *Pennsylvania State University (USA),* [3] *University of Hong Kong (Hong Kong),* [4] *Massachusetts Institute of Technology (USA)*

We will present two examples about metamaterials based pixelated thermal signature control. Inspired by leafhopper-generated brochosomes, we designed binary metastructures functioning as pixel twins to achieve pixelated thermal signature control at the microscale. We also experimentally demonstrated dynamic, pixelated modulation of coherent emission based on an electrically programmable plasmonic metasurface.

11:30 : Invited talk

A polarization-tunable coloration with wide dynamic range using highly lossy material-based metal/dielectric/meta subwavelength grating

Yuusuke Takashima, Kentaro Nagamatsu, Masanobu Haraguchi, Yoshiki Naoi
Tokushima University (Japan)

A polarization-tunable coloration with wide dynamic range was demonstrated using the highly lossy metal-based metal/dielectric/metal-subwavelength grating structure. By using the spectrally broadened resonant reflections and phase retardations in the designed structure, we achieved the multi colors generation across entire visible region by simply rotating the polarization of light.

11:50 : Invited talk

In situ modification of the Quantum Hall effect with cavity vacuum fields

Josefine Enkner[1], Lorenzo Graziotto[1], Felice Appugliese[1], Dalin Borici[2], Mattias Beck[1], Christian Reichl[1], Werner Wegscheider[1], Giacomo Scalari[1], Cristiano Ciuti[2], Jerome Faist[1]
[1] *ETH Zurich (Switzerland),* [2] *Université Paris Cité (France)*

Cavity vacuum fields can break the topological protection of edge states in the integer Quantum Hall effect. With the ability to in situ tune the light-matter coupling of this system, we observe a reduction of the g-factor and a hardening of the gap of fractional states while increasing the coupling.

12:10 : Invited talk
Nonlinear optics in low-index bulk media: past, present, and future
Wallace Jaffray[1], **Sven Stengel**[1], **Alexandra Boltasseva**[2], **Vladimir Shalaev**[2], **Andrea Di Falco**[3], **Marcello Ferrera**[1]
[1] *Heriot-Watt University (United Kingdom),* [2] *Purdue University (USA),* [3] *University of St Andrews (United Kingdom)*

Transparent conducting oxides have evolved from an industrial platform to a new playground for photonic scientists. Within this context, I will provide a quick overview of past results while also giving relevance to our most recent achievements and future perspectives around nonlinear integrated photonics and light acceleration in time-varying media

10:50 - 12:05 — Room 101

Session 1A10

GEN1: Advances and Emerging Applications of Nanophotonics

Chaired by: Takuo Tanaka

10:50 : Research on the enhancement of photocatalytic activity of bismuth-based materials by plasma effect
Derek Hao
RMIT University (Australia)

The study investigates the enhancement of photocatalytic activity in bismuth oxide material through plasma effect. The research explores the preparation of C/Bi/Bi2O3 composite photocatalyst. The reduced particle size and plasma effect of bismuth increase the photocatalytic efficiency, offering promising applications in environmental remediation and energy conversion.

11:05 : TDBC microstructures made by local photo-bleaching in J-aggregate thin organic layers for photonics applications
Komlan Gadedjisso-Tossou[1], **Antoine Bard**[2], **Kevin Chevrier**[2], **Clémentine Symonds**[2], **Jean-Michel Benoit**[2], **Joel Bellessa**[2], **Alban Gassenq**[2]
[1] *Université de Lomé (Togo),* [2] *ILM - University Lyon 1 (France)*

We have study the local photobleaching in TDBC layers for grating and strong coupling applications. With this method, the refractive index can be both locally and spectrally modulated. In this work, fundamental properties and fabricated micro-devices have been investigated highlighting the high potential of this interesting materials for photonics applications.

11:20 : Titanium nitride (TiN) nano and microstructures as novel highly efficient SERS platform
Jan Krajczewski[1], **Aleksandra Michałowska**[1], **Nozka Libor**[2]
[1] *University of Warsaw (Poland),* [2] *Palacky University in Olomouc (Czech Republic)*

In this work, we report on a high-efficiency SERS platform based on Titanium Nitride (TiN) nano and microstructures. TiN films were deposited by magnetron sputtering. The structural, and optical properties were carefully studied. SERS measurements confirmed the high SERS activity of TiN samples with good stability and repeatability.

11:35 : Harmonic enhancement via a time-varying Fabry-Perot resonator
Theodosios Karamanos[1], **Stamatios Amanatiadis**[2], **Nikolaos Kantartzis**[2], **Fabrice Lemoult**[1]
[1] *ESPCI Paris (France),* [2] *Aristotle University of Thessaloniki (Greece)*

Time-varying surfaces are a promising emerging means for the generation of higher frequencies in future THz communication systems. In this work, we present a novel time-varying Fabry-Perot setup to enhance

generated higher-order harmonics. The design is aided by a rigorous semi-analytic technique that aims to empower optimization efforts.

11:50 : Chiral spin-preserving reflection in helicoid-based plasmonic metamaterials
Eunji Im[1], Hyeohn Kim[2], Ji-hyeok Huh[1], Ki Tae Nam[2], Seungwoo Lee[1]
[1] *Korea University (Korea),* [2] *Seoul National University (Korea)*

We figured out that induced magnetic dipole of chiral meta-atom is critical to CD like a chiral molecule. And we suggest the simple method to enhancing magnetic dipole by MIM (Metal-Insulator-Metal) motif with chiral geometry.

10:50 - 12:20 — Gallery

Session 1A11

GEN2: Metasurface and Subwavelength Gratings for Optical Field Manipulation

Chaired by: Kotaro Kajikawa

10:50 : An active Fabry-Pérot interferometer operated at terahertz frequencies based on pitch-variable subwavelength gratings
Ying Huang, Yangxun Liu, Taiyu Okatani, Naoki Inomata, Yoshiaki Kanamori
Tohoku University (Japan)

We constructed, for the first time, an active Fabry-Pérot interferometer (FPI) operated in the terahertz range by properly integrating a pitch-variable subwavelength-grating (PV-SWG) into an FP cavity. The period of PV-SWG can be varied to change the effective refractive index and shift the optical resonant frequency of the FPI.

11:05 : Understanding The Reflective Footprint of Ghost and Leaky Hyperbolic Polaritons in Crystal Quartz
Mark Cunningham, Adam Lafferty, Mario Gonzalez Jimenez, Rair Macêdo
University of Glasgow (United Kingdom)

We demonstrate the impact of anisotropy orientation on hyperbolic polaritons in quartz using attenuated total reflection. We reveal new insights into leaky and ghost hyperbolic polaritons, including their directionaldependency and cross-polarization conversion. This highlights their potential to transform direction dependent optical device development for next-generation sensing and communication technologies.

11:20 : 300-GHz-band transmission-type beamforming metasurface for an outdoor-to-indoor signal coverage extension for future wireless networks
Adam Pander, Hibiki Kagami, Daisuke Kitayama, Hiroyuki Takahashi
NTT Corporation (Japan)

300-GHz-band transmission-type metasurface beamformers were designed, fabricated, and evaluated. Beamforming angles in the range of 18° to 38° with a transmission loss of about 4 dB were achieved. Flexibility, good transparency, and broadband operation of the fabricated self-standing devices make them perfect candidates for future outdoor-to-indoor signal coverage extension applications.

11:35 : Enhanced chirality with Mie resonance-based multi-cylinder chiral metasurfaces
Seung Hyeon Hong, Seokhyeon Hong, Youngsoo Kim, Bo Kyung Kim, Juhan Lee, Soon-Hong Kwon
Chung-Ang University (Korea)

Our proposed single-layer metasurface structure, integrating three dielectric cylinders based on a Mie resonator with a strong electric dipole mode. This design achieves a circular dichroism enhancement of 0.67 and an optical activity enhancement of 1.16X106 [degree/mm], confirmed through simulation to validate its tailored chiral optical effects.

11:50 : Designing a metasurface color router via photonic inverse design
Jeongwoo Son[1], Rishad Arfin[2], Mohamed H. Bakr[2], Jens Niegemann[3]

[1]*Ansys Korea (Korea),* [2]*McMaster University (Canada),* [3]*Ansys Canada Ltd. (Canada)*

Metasurface color routers have emerged as a promising solution to address the inefficiencies associated with traditional color filters. Here, we present a metasurface color router, designed using an adjoint-based inverse design approach, with optical efficiencies of 57 %, 74 %, and 54 % for red, green, and blue channels, respectively.

12:05 : Mid-infrared achromatic metalens with large field-of-view based on standard i-line stepper
Yen-Chun Chen[1], Wei-Lun Hsu[1], Qiu-Chun Zeng[1], Chen-Yi Yu[1], Yu-Hsin Lin[1], Che-Chin Chen[2], Chih-Ming Wang[1]
[1]*National Central University (Taiwan),* [2]*Taiwan Instrument Research Institute (Taiwan)*

We proposed an achromatic metalens with a 90° large field of view and a diameter of 5.75 mm for a wavelength range of 8 to 12 um. This metalens is fabricated by an i-line stepper, which has mass-production advantages and is low-cost. Additionally, it captures great-quality images.

Lunch

12:30 - 14:00

14:00 - 15:50 — Main Hall

Session 1A12

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Eugene Kamenetskii

14:00 : Keynote talk
Optical spin topologies in plasmonics and metamaterials
Anatoly Zayats
King's College London (United Kingdom)

We will discuss spin-orbit coupling in interaction of complex vector beams with plasmonic metamaterials. Spin-orbit coupling and topology of evanescent waves and vector beams propagating in free space and metamaterials in different dispersion regimes will be considered.

14:30 : Invited talk
Chiral structures fabrication with structured light possessing orbital angular momentum
Takashige Omatsu
Chiba University (Japan)

We demonstrate the fabrication of chiral structured materials with structured light possessing orbital angular momentum (OAM), that is an optical vortex. Such chiral structures pave the way towards a myriad of innovative technologies: for instance, an optical vortex induced self-written helical fiber acts as a mode-convertor for OAM modes.

14:50 : Invited talk
Non-Hermitian Aharonov-Bohm effect under imaginary magnetic fields
Tomoki Ozawa
Tohoku University (Japan)

We discuss the Aharonov-Bohm effect under imaginary magnetic fields. We find that the Aharonov-Bohm effect appears as amplification and/or decay of the norm of the wavefunction, reflecting the enclosed imaginary flux inside the trajectory we consider. We consider both real and parameter space versions of this non-Hermitian Aharonov-Bohm effect.

15:10 : Invited talk
Chiral Atoms and Helical Electrons
Hiroshi Yamamoto
Institute for Molecular Science (Japan)

An internal mechanism of Chirality-Induced Spin Selectivity (CISS) is discussed based on a symmetry consideration in which electron's helicity is connected to molecular chirality and spin accumulation with a language of electronic multipoles.

15:30 : Invited talk
Photonic vortex lattice based on dielectric polarization textures
Ramaz Khomeriki[1], Vakhtang Jandieri[1], Koki Watanabe[2], Daniel Erni[3], Douglas H. Werner[4], Marin Alexe[5], Jamal Berakdar[1]
[1] *Martin-Luther University (Germany),* [2] *Fukuoka Institute of Technology (Japan),* [3] *Center for Nanointegration Duisburg-Essen (Germany),* [4] *The Pennsylvania State University (USA),* [5] *University of Warwick (United Kingdom)*

Polar vortex lattice in strained ferroelectrics is shown to couple simultaneously to electric and magnetic field components leading to the formation of a photonic vortex lattice with particular dispersion. We discuss the spectral and mode properties of the formed photonic textures and discuss possible utilization in optoelectronics.

14:00 - 16:10 — Room 201

Session 1A13

Symposium I: Hybrid Nanomaterials and Metastructures for Photonics, Sensing and Energy

Organized by: Jérôme Plain, Alexander Govorov, Davy Gérard and Pedro Hernandez Martinez

Chaired by: Jérôme Plain

14:00 : Invited talk
Control of light emission of quantum emitters coupled to silicon nanoantenna
Jean-Marie Poumirol[1], Martin Montagnac[1], Yoann Brûlé[2], Ana Estrada-Real[3], Ioannis Paradisanos[4], Aurellien Cuche[1], Sebastien Weber[1], Jonas Müller[1], Guilhem Larrieu[1], Vincent Larrey[5], Peter Wiecha[1], Frank Fournel[5], Olivier Boisron[6], Bruno Masenelli[7], Gerard Colas des Francs[2], Bernhard Urbaszek[3], Gonzague Agez[1], Vincent Paillard[1]
[1] *Université de Toulouse (France),* [2] *Université de Bourgogne (France),* [3] *Technische Universität Darmstadt (Germany),* [4] *Foundation of Research and Technology Hellas (Greece),* [5] *Université Grenoble-Alpes (France),* [6] *Université de Lyon (France),* [7] *Université de Lyon, Université Lyon 1, CNRS UMR 5510, ILM, Villeurbanne, France. (FR)*

Mie resonators based on silicon nanostructures allow tuning of light-matter-interaction. Optically active materials such as transition-metal dichalcogenide monolayers or europium ions can be placed in the near-field region of such Mie resonators allowing control of both the excitation and the emission processes trough antenna design and cylindrical vector beams.

14:20 : Invited talk
Ultrafast Optical Response of Plasmonic Doped-VO2 Metasurfaces
Benedict Morris[1], Zahra Shayegan[2], Robin Reig[1], Baptiste San-Nicolas[1], Sébastien Frenkel[1], Joëlle Margot[2], Mohamed Chaker[2], Bruno Palpant[1]
[1] *Université Paris-Saclay (France),* [2] *Institut National de la Recherche Scientifique (Canada)*

Pure or tungsten-doped vanadium dioxide thin films are elaborated by pulsed laser deposition. Gold nanoparticle arrays are then deposited by e-beam lithography. The metasurface ultrafast optical response is determined. The influence of the localized plasmon resonance is analyzed in terms of photothermal conversion and near-field enhancement.

14:40 : Invited talk
Innovative Deposition and Oxidation-Coupled Technique for Low-Temperature Fabrication of VO2, Thin Films and their Application to Photonic Devices
Mohamed Chaker
INRS-EMT (Canada)

Vanadium dioxide is a smart material that exhibits a metal-to-insulator transition at a temperature of 68 °C. This property makes it of strong interest for many applications, including advanced photonic devices. An innovative deposition method is presented to achieve VO2 thin films at low temperature on large area scale.

15:00 : Invited talk
Development of new chiroptically active quantum nanostructures
Yurii Gun'ko
Trinity College Dublin (Ireland)

This work is to develop new types of nanoparticulate materials possessing optical activity and chirality, study their properties, investigate their nature and explore their applications. Here report a range of new chiral nanomaterials including chiral semiconducting nanoparticles as well as chiral 2D nanostructures for potential enantioselective chemo-sensing applications.

15:20 : Keynote talk
Controlling nanomaterial properties using organization
Mona Tréguer-Delapierre
University of Bordeaux (France)

We demonstrated a new concept for making nanostructures with unusual optical properties by organizing metal nanoparticles. In research and industry, molecules from drugs and polymers are made by combining high-yield chemical reactions in series. We have extended this approach to the nanoscale: we make meta-molecules by combining high-yield colloidal reactions.

15:50 : Invited talk
Publishing in Nature journals
Rachel Won
Nature Photonics (United Kingdom)

In this talk, Rachel will tell you all you need to know about publishing your work in Nature journals, including an introduction to existing and new Nature journals, recent trends in publishing, options you have during your submission, and the editorial and peer review processes.

14:00 - 16:10 — Room 202

Session 1A14

SP10. Advanced Computational Electromagnetics for the Analysis and Design of Nanophotonic Devices

Organized by: Maha Ben Rhouma

Chaired by: Chia Wei (Wade) Hsu

14:00 : Invited talk
Design for quality: multifunctional flat optics using metasurfaces
Hanyu Zheng, Fan Yang, Hung-I Lin, Yunxi Dong, Hualiang Zhang, Juejun Hu, Tian Gu
Massachusetts Institute of Technology (USA)

In this talk, I will discuss the prospects and hurdles of utilizing multifunctional metasurfaces across multiple applications. Leveraging advanced materials and designs, we develop ultra-compact meta-optics with unprecedented performance and new imaging and sensing architectures. The judiciously engineered metasurfaces show significantly lower the size, weight, power and cost (SWaP-C) .

14:20 : Invited talk
Singularity and topology in structured near fields
Shubo Wang[1], Tong Fu[1], Shiqi Jia[1], Jie Peng[1], Ruo-Yang Zhang[2]
[1] *City University of Hong Kong (Hong Kong),* [2] *The Hong Kong University of Science and Technology (Hong Kong)*

Under external excitations, simple metal structures can generate strong near fields with rich subwavelength vector properties. These near fields can exhibit complex structures of polarization with interesting topological and singularity properties fundamentally connected to the real-space topology of the metal structures.

14:40 : Keynote talk
Analog computing with nonlinear flat optics
Costantino De Angelis, Domenico de Ceglia
University of Brescia (Italy)

Digital signal processing has revolutionized many fields of science and engineering, but it still shows critical limits, a long-sought solution is optical analog computing. We demonstrate here that nonlinear phenomena combined with engineered nonlocality in flat optics can be leveraged to synthesize Volterra kernels able to outperform linear devices.

15:10 : Invited talk
Electron-tunneling-induced thermoelectric effects
Mauricio Gómez Viloria, Riccardo Messina, Philippe Ben-Abdallah
Université Paris-Saclay (France)

We introduce direct (Seebeck) and inverse (Peltier) thermolectric effect induced by electron tunneling between closely separated conducting films: a transverse temperature gradient applied along one film induces a bias voltage in the second, whereas an electric current passing through one film can allow to extract or deliver a thermal power.

15:30 : Invited talk
Low Dimensional Thermal Radiation
Sebastian Volz
The University of Tokyo (Japan)

Heat carried by Surface Phonon-Polaritons is investigated in thin films with contributions in the range of the one of heat conduction and of the Planck emission.

15:50 : Invited talk
End-to-end Nanophotonic Inverse Design for Computational Imaging
Zin Lin
Virginia Tech (USA)

We introduce end-to-end inverse design in which a nanophotonics frontend is optimized in conjunction with a computational-imaging backend to minimize reconstruction errors. We present several nanophotonics designs for snapshot multi-dimensional imaging.

14:00 - 16:00 — Room 203

Session 1A15

Symposium III: Advanced passive and active metasurfaces and zero-index materials

Organized by: Howard Lee, Pin Chieh Wu and Qinghua Song

Chaired by: Pin Chieh Wu

14:00 : Invited talk
Dirac Mass Gap Induced by Optical Gain and Loss

Yidong Chong[1], **Letian Yu**[1], **Haoran Xue**[2], **Yun Yong Terh**[1], **Ruixiang Guo**[1], **Eng Aik Chan**[1], **Cesare Soci**[1], **Baile Zhang**[1]
[1] *Nanyang Technological University (Singapore),* [2] *Chinese University of Hong Kong (Hong Kong)*

We introduce a non-Hermitian lattice model whose quasiparticle excitations are governed by the Dirac equation. Unusually, this non-Hermitian system has bands with real energies and orthogonal eigenstates. The physical implications of the gain/loss induced Dirac mass gap are explored using a synthetic lattice in a coupled fiber loop experiment.

14:20 : Invited talk
Third-harmonic generation in near-zero index heterogeneous nanostructures
Matteo Silvestri[1], **A. Sahoo**[1], **Luca Assogna**[1], **Paola Benassi**[1], **Carino Ferrante**[2], **Alessandro Ciattoni**[2], **Andrea Marini**[1], **Andrea Marini**[1]
[1] *University of L'Aquila (Italy),* [2] *CNR - SPIN (Italy)*

We theoretically model third-harmonic generation produced by collision-driven nonlinear electron dynamics in near-zero index heterogeneous nanostructures. We focus on a sodium-aluminum bilayer and model the harmonic generation process to explore its potential for the development of compact extreme ultraviolet radiation sources and for integrated spectroscopy schemes.

14:40 : Invited talk
Manipulation of Electron Beams by Laguerre-Gaussian Modes
Yung-Chiang Lan[1], **Ming-Chieh Lin**[2]
[1] *National Cheng Kung University (Taiwan),* [2] *Hanyang University (Korea)*

Manipulation of electron beam by Laguerre-Gaussian (LG) modes is investigated using finite-difference time-domain particle-in-cell (FDTD-PIC) simulations. The collective and individual behaviors of macro-electrons are examined. Dependence of electron beam size and current on electric field amplitude and gradient of LG modes are also explored.

15:00 : Invited talk
Methods for characterization of wafer scale SERS substrates
Matthew Singer[1], **Ryan Priore**[2], **Longfei Ye**[2]
[1] *Thorlabs Inc. (USA),* [2] *Thorlabs Spectral Works (USA)*

In this work, we demonstrate a textured SiO2 substrate with Au plasmonic layer that can be fabricated on a standard 4 wafer. The resulting SERS substrate is characterized at the wafer scale using automated tools, paving the way for mass produced and consistent SERS chips.

15:20 : Invited talk
Si Metasurfaces for DUV Plasmonics and Biomolecular Spectroscopy
Bo Ray Lee[1], **Mao Feng Jiang**[1], **Pei Ying Ho**[1], **Kuan-Heng Chen**[1], **Jia Hua Lee**[1], **Min-Hsiung Shih**[2], **Der-Hsien Lien**[1], **Tzu-En Lin**[1], **Ray-Hua Horng**[1], **Ming Lun Tseng**[1]
[1] *National Yang Ming Chiao Tung University (Taiwan),* [2] *Academia Sinica (Taiwan)*

We demonstrate plasmonic metasurfaces made of Si for DUV spectroscopy. Due to the photon-doping effect arising from the interband transition in the DUV, Si nanostructures show significant plasmonic resonance. The metasurface shows field enhancement at 266nm due to Fano-type resonance. Applications for enhancing fluorescence and Raman scattering will be discussed.

15:40 : Invited talk
Compact depth sensing and facial recognition from integration of metasurface and photonic-crystal surface-emitting laser
Yao-Wei Huang
National Yang Ming Chiao Tung University (Taiwan)

Our depth sensing and facial recognition technology leverages the innovative integration of metasurfaces and photonic-crystal surface-emitting lasers with structured light and monocular depth-sensing. Compared to existing approaches, our method projects a higher density of infrared dots across a wider field of view, offering substantial benefits for future spatial computing systems.

14:00 - 15:55 — Room 204

Session 1A16

Symposium V: Architectured Elastic and Acoustic Metamaterials and Phononic Crystals

Organized by: Marco Miniaci, Jensen Li, Vicente Romero-García, Vincent Pagneux and Noé Jiménez

Chaired by: Noé Jiménez

14:00 : Invited talk
Broadband and low frequency acoustic absorber with frozen sound
Anis Maddi[1], Come Olivier[2], Gaelle Poignand[1], Guillaume Penelet[1], Vincent Pagneux[1], Yves Aurégan[1]
[1] *LAUM (France),* [2] *Centre de Transfert de Technologies du Mans (France)*

We present the design of an ultra-broadband, low-frequency and non-reciprocal absorber based on thermoacoustic effects using liquid nitrogen. It is shown that the system can achieve an absorption of up to 95 % in the very low frequency range (10 Hz), with a broadband absorption above 80 % over 6.3 octaves.

14:20 : Invited talk
PT-latent symmetries
Malte Röntgen[1], Xuelong Chen[2], Wenlong Gao[2], Vincent Pagneux[3], Vassos Achilleos[1], Vassos Achilleos[1]
[1] *LAUM (France),* [2] *EIT Institute for Advanced Study (China),* [3] *France (France)*

In this work, we combine PT-symmetry with hidden symmetries, introducing the concept of latent PT - symmetry. We show how such systems can be designed, and experimentally confirm our theory. Moreover, we provide the means on how to keep the PT-unbroken phase of the system arbitrarily large.

14:40 : Invited talk
Physically Interpretable Data-Driven Modeling and Control of Wave Dynamics
Tristan Shah, Feruza Amirkulova, Stas Tiomkin
San Jose State University (USA)

We present a novel machine learning method, based on deep neural networks, for efficiently learning the dynamics of an acoustic wave equation from samples. Our model is fully interpretable and maps physical constraints and intrinsic properties of the real acoustic environment into its latent representation of information.

15:00 : Invited talk
Any Dispersion You Want - Demystifying Roton, Maxon, Saddle Point, and Higher-order van Hove Singularities via Nonlocal Phononic Crystals
S. Paul, F. Chen, K. J. Deshmukh, B. Deng, A. Kazemi, X. Zhu, H. C. Fu, Pai Wang, Pai Wang
University of Utah (USA)

We first show precise inverse design of band structures via beyond-nearest-neighbor (BNN) interactions in discrete nonlocal phononic crystals of both 1D and 2D cases. Next, we focus on localized modes with vanishing group velocity and explain related concepts such as rotons, van Hove singularities, and bound states in continuum (BIC).

15:20 : Invited talk
Negative refraction in a single-phase flexural metamaterial with hyperbolic dispersion
Kim Pham[1], Agnès Maurel[2], Jean-Jacques Marigo[2]
[1] *Institut Polytechnique de Paris (France),* [2] *CNRS (France)*

This study examines the band structure of a single-phase elastic metamaterial based on flexural resonances, employing two-scale asymptotic homogenization and Bloch–Floquet analysis. It reveals two frequency-dependent mass densities governing symmetric/antisymmetric flexural resonances, leading to low-frequency band-gaps and negative refraction in hyperbolic regions of the dispersion diagram.

15:40 : Braiding of Bloch eigenmodes in a non-Abelian topological phase with quaternion charge
Xiaoming Wang, Guancong Ma

Hong Kong Baptist University (China)

In this work, we show that non-Abelian quaternion charges can be realized by braiding its Bloch eigenmodes. An acoustic system with built-in synthetic dimensions is proposed for the realization of the non-Abelian topological phase and for the observation of the non-Abelian braiding of its eigenmodes.

14:00 - 16:00 — Conference Room

Session 1A17

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Junichi Takahra

14:00 : Invited talk

Dynamically switchable phase contrast imaging with metaoptics

Shaban Sulejman, Lincoln Clark, Haiwei Wang, Lukas Wesemann, Ann Roberts
University of Melbourne (Australia)

Metasurfaces can all-optically manipulate images in the object or image plane leading to an orders-of-magnitude reduction in size compared to Fourier plane approaches. Here approaches to dynamically modifying the response of a device, essential for multifunctional imaging, using polarization and phase change materials is discussed.

14:20 : Invited talk

Coherent Array of Superconducting Qubits as a Sensitive Microwave Antenna

Patrick Navez[1], Alexander Balanov[2], Sergey Savel'ev[2], Alexandre Zagoskin[2]
[1] *Universite de Montpellier (France),* [2] *Loughborough University (United Kingdom)*

We show that artificial quantum coherent structures comprised of superconducting qubits, in particular, an array of qubits in a resonator, can serve as sensitive antennas of microwave radiation, and that the signal-to-noise ratio under certain condition can exceed the Standard Quantum Limit and approach the Heisenberg limit of sensitivity.

14:40 : Invited talk

Graphene-based 2D Plasmonic Metamaterials for Terahertz Detectors

Taiichi Otsuji[1], K. Tamura[1], Chao Tang[1], A. Satou[1], H. Fukidome[1], Y. Takida[2], H. Minamide[2], M. Ryzhii[3], V. Mitin[4], M. S. Shur[1], V. Ryzhii[1]
[1] *Tohoku University (Japan),* [2] *RIKEN (Japan),* [3] *University at Buffalo (USA),* [4] *Rensselaer Polytechnic Institute (USA)*

This paper reviews recent advances in the research and development of graphene-based 2D plasmonic metamaterials for terahertz detectors and reports on achieving responsivities.

15:00 : Invited talk

Observation of off-Γ BIC in photonic crystals in both k- and real spaces

Yuto Moritake, Taiki Yoda, Masaya Notomi
Tokyo Institute of Technology (Japan)

Bound states in the continuum (BICs), which are localized states above the light, is actively studied due to their high Q-factor and topological nature. In this presentation, we introduce observation of photonic BIC with off-Γ wavenumbers not only in k- but also real spaces using light propagation imaging.

15:20 : Invited talk

Recent progresses on quantum-enhanced nonlinear imaging

Thomas Dickinson[1], Ivi Afxenti[2], Giedre Astrauskaite[2], Lennart Hirsch[2], Samuel Nerenberg[2], Ottavia Jedrkiewicz[3], Alessandra Gatti[3], Daniele Faccio[2], Caroline Mullenbroich[2], Matteo Clerici[4], Matteo Clerici[4], Lucia Caspani[1]

[1] *University of Strathclyde (United Kingdom),* [2] *University of Glasgow (United Kingdom),* [3] *Istituto di Fotonica e Nanotecnologie del CNR (Italy),* [4] *Universita dell'Insubria (Italy)*

We investigated the quantum nature of non-linear processes driven by non-classical light. We studied second-harmonic generation pumped by parametric down-conversion (PDC), and we observed a quantum effect for high-flux PDC, beyond the photon pairs regime.

15:40 : Invited talk
Topological phase-supporting materials for nanophotonic sensing
Gustavo Cruz, Sayan Roy, Arnab Banerjee, Peter Bermel
Purdue University (USA)

Dimensionality affects topological phases in materials such as bismuth selenide telluride (BST), and applications to nanophotonic sensing. Understanding how to adjust the phase transition point of these materials allows us to put our sensor near the phase transition line, to substantially heighten its sensitivity to the local environment.

14:00 - 16:00 — Room 205

Session 1A18

SP8. Strong light-matter interactions in plasmonic/dielectric metasurfaces

Organized by: Shunsuke Murai and Shaojun Wang

Chaired by: Zhaogang Dong and Koichi Okamoto

14:00 : Invited talk
Light-matter strongly coupled states in optical microcavities using highly oriented organic molecular crystals
Kenichi Yamashita
Kyoto Institute of Technology (Japan)

Organic microcavities offer promising avenues for achieving room temperature polariton states. This study delves into the ultrafast dynamics of polariton states and optical spin-orbit coupling within an optical microcavity utilizing highly oriented molecular crystals.

14:20 : Invited talk
NanoOptoCraft: plasmonic MEMS, nanoscale patterning, and optical low-loss film
Kenzo Yamaguchi
Tokushima University (Japan)

The NEMS drives versatile plasmomechanical devices by utilizing MEMS techniques for precise spatial control. Adiabatic plasmon wires enable manipulation of nanoscale gaps. Alternatively, narrow gaps can be realized through single-deposition techniques using stencil lithography. As a common approach, the development of low-loss single-crystalline metal films promises advancements in nanooptical devices.

14:40 : Invited talk
Probing plasmonic light-matter interactions with Kelvin probe force microscope
Satoshi Ishii[1], **Min-Wen Yu**[2], **Kuo-Ping Chen**[2]
[1] *NIMS (Japan),* [2] *National Tsing Hua University (Taiwan)*

Using a Kelvin probe force microscope with external light sources, we image surface potential shifts in the nanoscale induced by the exciton-polariton coupling of MoS2 monolayers and the plasmoelectric effect in zirconium nitride nanodisks.

15:00 : Invited talk
Optical Interplay between Triplet-Triplet Annihilation Upconversion Systems and Plasmons: Towards Upconverted Emission Enhancement
Kosuke Sugawa, Shota Jin, Jotaro Honda

Nihon University (Japan)

We have elucidated the effect of localized surface plasmon (LSP) resonance on a complicated triplet-triplet annihilation upconversion (TTA-UC) systems and endeavored to develop high-performance plasmonic TTA-UC systems. While the enhancement mechanism resembled conventional metal-enhanced fluorescence, some quenching mechanisms via LSP resonance unique to the TTA-UC were demonstrated.

15:20 : Invited talk
Integrated lithium niobate photonics: from communications to metrology
Yang Li
Tsinghua University (China)

By leveraging tunable repetition rate of integrated lithium niobate (LN) electro-optic frequency combs, we achieved distance measurement system. Based on integrated LN phase modulators, we achieved optical phased array. To achieve mass production of integrated LN devices with high fidelity and low cost, we developed wet etching-based fabrication process.

15:40 : Invited talk
Silicon BIC metasurfaces for strong interactions with molecular vibrations
Keisuke Watanabe, Hemam Rachna Devi, David Hernandez-Pinilla, Masanobu Iwanaga, Tadaaki Nagao
National Institute for Materials Science (Japan)

We report strong interactions between quasi-bound states in the continuum formed in silicon-on-calcium-fluoride wafers and molecular vibrations. Owing to the small losses and strong optical confinement, we demonstrate silicon-based surface-enhanced infrared absorption with a large enhancement factor and sensitivity at the monolayer level.

14:00 - 16:00 — Room 206

Session 1A19

SP12. Quantum Metasurfaces

Organized by: Diego Dalvit, Maria Chekhova and Igal Brener

Chaired by: Maria Chekhova

14:00 : Invited talk
Recent progress on photon pair generation in semiconductor metasurfaces
Tomas Santiago-Cruz[1], Jiho Noh[1], Vitaliy Sultanov[2], Sylvain D. Gennaro[1], Chloe F. Doiron[1], Hyunseung Jung[1], Maria V. Chekhova[2], Igal Brener[1]
[1] *Sandia National Laboratories (USA),* [2] *Max Planck Institute for the Science of Light (Germany)*

In this talk, I will discuss the generation of photon pairs driven by quasi bound states in the continuum resonances in metasurfaces made of gallium arsenide of two different crystallographic orientations, and how these resonances can shape the polarisation state of the emitted photons.

14:20 : Invited talk
Space-Time Quantum Metasurfaces
Diego A. R. Dalvit
Los Alamos National Lab. (USA)

Here, we introduce the concept of space-time quantum metasurfaces for arbitrary control of the spectral, spatial, and spin properties of nonclassical light using a compact photonic platform. We show that space-time quantum metasurfaces allow on-demand tailoring of entanglement among all degrees of freedom of a single photon. We also show that spatiotemporal modulation induces asymmetry at the fundamental level of quantum fluctuations, resulting in the generation of steered and vortex photon pairs out of vacuum.

14:40 : Invited talk
Stable-to-unstable transition in quantum friction

Daigo Oue[1], **John Pendry**[2], **Mario Silveirinha**[1]
[1] *University of Lisbon (Portugal),* [2] *Imperial College London (United Kingdom)*

We utilise a fully quantum-mechanical theory without perturbative approximations to investigate non-contact friction between two metallic bodies in relative motion, employing modified fluctuation-dissipation relations.

15:00 : Invited talk
Dual-Band Control of Bound States in the Continuum with Pairwise Positioning of Singularities in Metasurfaces
Chloe Doiron
Sandia National Laboratories (USA)

Applications of metasurfaces in classical and quantum optics are driving the need for polarization control of nearly-degenerate, high quality-factor (Q) modes. To address this need, we developed and experimentally demonstrated a design paradigm for controlling the Q-factors, mode splittings, and polarization responses of pairs of high-Q modes in dielectric metasurfaces.

15:20 : Invited talk
On-Chip Metaphotonics Empowered Single-Photon Emission
Yinhui Kan, Xujing Liu, Sergey I. Bozhevolnyi
University of Southern Denmark (Denmark)

We present a new avenue by introducing array of subwavelength nanostructures to on-chip couple with quantum emitters (QEs), which can efficiently outcouple the QEs-excited nonradiative surface plasmon polaritons to photon emission encoded with desired properties, i.e., directionality, specific spin and orbital angular momenta.

15:40 : Invited talk
Quantum light-matter interfaces with arrays of trapped atoms
Efi Shahmoon
Weizmann Institute of Science (Israel)

We develop a general framework for the design of efficient atom-array quantum interfaces. Our approach relies on the mapping of realistic, collective atomic systems to a generic 1D model of a quantum interface, characterized by a reflectivity parameter. This gives a universal relation between a simple measurable quantity – the reflectivity – and various desired quantum tasks, from quantum memories to entanglement generation.

14:00 - 16:00 — Room 101

Session 1A20

SP22. 2D Materials and Nanophotonics

Organized by: Masanobu Iwanaga and Der-Hsien Lien

Chaired by: Masanobu Iwanaga

14:00 : Invited talk
Excitons in 2D TMDCs for metaoptics and photodetector applications
Zeng Wang, Jinghua Teng
*A*STAR (Singapore)*

Our research explores excitons in two-dimensional TMDCs for metaoptics and photodetectors, highlighting advancements in exciton-enabled metaoptics, tunable exciton-trion conversion, and ambipolar photoconductivity control. This demonstrates the promise of TMDCs in optoelectronics, offering enhanced performance for next-generation imaging and sensing technologies.

14:20 : Invited talk
Plasmonic photodetectors with superior optoelectronic performance demonstrated in MIR, NIR, visible and UV regions

Yu-Te Chu, Shyam Narayan Singh Yadav, Ching-Han Mao, Yu-Ping Kuang, Chang Hua Liu, Shangjr Gwo, Yu-Jung Lu, Pin-Chieh Wu, Ta-Jen Yen
National Tsing Hua University (Taiwan)

Incorporating plasmonic nanostructures with semiconductor compounds offers a new route to significantly improving the performance of photodetectors. Herein, we developed six hybrid structures comprised of 2D semiconductors, perovskite QDs and GaN with different design of plasmonic nanostructures to demonstrate ultrasensitive photodetection in MIR, NIR, visible and UV regions, respectively.

14:40 : Invited talk
Abundant optical properties of hexagonal boron nitride
Kenji Watanabe, Takashi Taniguchi
National Institute for Materials Science (NIMS) (Japan)

We will review the new aspects of hexagonal boron nitride (h-BN), especially the peculiar and outstanding optical characteristics originating from the anisotropic two-dimentional crystal structure.

15:00 : Invited talk
Resonant exciton transfer in mixed-dimensional heterostructures for overcoming dimensional restrictions in optical processes
Nan Fang[1], Yih-Ren Chang[1], Daiki Yamashita[1], Shun Fujii[1], Mina Maruyama[2], Yanlin Gao[2], Chee Fai Fong[1], Keigo Otsuka[1], Kosuke Nagashio[3], Susumu Okada[2], Yuichiro K. Kato[1]
[1] *RIKEN (Japan),* [2] *University of Tsukuba (Japan),* [3] *The University of Tokyo (Japan)*

We report on exciton transfer in carbon-nanotube/tungsten-diselenide heterostructures, where the excitons within the two-dimensional semiconductor are funneled into carbon nanotubes through diffusion. When band alignment is resonant, we observe substantially more efficient excitation via tungsten diselenide compared to direct excitation of the nanotube.

15:20 : Invited talk
Plasmonic Strong Coupling and Tamm Plasmon Polaritons Photodetectors Enabled by 2D materials Hot Electrons
Kuo-Ping Chen
National Tsing Hua University (Taiwan)

Two-dimensional materials are being studied for their unique optical characteristics and miniaturization capabilities. We proposed that by combining Tamm plasmon polariton (TPP) resonance and a 2D materials at the point of strong field confinement, a wavelength- and angle-selective photodetector that significantly enhances photocurrent response.

15:40 : Invited talk
Unlocking the technology of wafer-scale layered atomic crystal growth on dielectric substrates for electronic and photonic applications
Xu Yang[1], Yoshiki Sakuma[2], Markus Pristovsek[1], Hiroshi Amano[1]
[1] *Nagoya University (Japan),* [2] *National Institute for Materials Science (Japan)*

This study reports on wafer-scale high-quality two-dimensional atomic crystals of hBN and MoS2 on technologically relevant dielectric substrates. Chemical vapor deposition and annealing resulted in highly ordered hBN and MoS2 crystal layers with a quality that is comparable to or even better than the state-of-the-art.

14:00 - 16:05 — Gallery

Session 1A21

SP4. DNA nanotechnologies for photonics and sensing

Organized by: Guillermo Acuna and Denis Garoli

Chaired by: Guillermo Acuna and Denis Garoli

14:00 : Invited talk
Optical Modelling of DNA-Made Janus Nanoheaters
Pablo Albella
University of Cantabria (Spain)

Nanostructures manufactured using DNA-based nanotechnology, especially DNA-origami, possess a DNA core that influences their thermoplasmonic performance. In this work, we identify key parameters that optimize its thermoplasmonic response by comparing them with their solid counterparts. We also explore the impact that random rotations have on their thermal performance.

14:20 : Invited talk
Universal click-chemistry approach for the DNA functionalization of nanoparticles for the development of new optical nanoantennas
Nicole Siegel[1], Hiroaki Hasebe[2], German Chiarelli[1], Denis Garoli[3], Hiroshi Sugimoto[2], Minoru Fujii[2], Guillermo Acuna[1], Karol Kołątaj[1]
[1] *University of Fribourg (Switzerland),* [2] *Kobe University (Japan),* [3] *Universita di Modena e Reggio Emilia (Italy)*

In this work, we present a new method to conjugate various nanoparticles with DNA by employing freezing-assisted SPAAC reaction, with a special focus on Si and SiO2 NPs. Further, the developed method has been used for the fabrication of Si dimers using DNA origami structures.

14:40 : Invited talk
Optically active substrates through DNA-based lithography
Veikko Linko
University of Tartu (Estonia)

We show that by combining DNA origami with common top-down lithography methods, we can create versatile substrates that show superior properties in surface-enhanced Raman spectroscopy (SERS) applications.

15:00 : Invited talk
Broadband Circularly Polarized Thermal Emission enabled by Chiral Plasmonic Metamaterial
René Iseli[1], Abraham De Jesus Aguilar Uribe[1], Bilel Abdennadher[1], Anne Nguyen[2], Viola Vogler-Neuling[1], Frank Scheffold[1], Jean-Jacques Greffet[2], Ullrich Steiner[1], Matthias Saba[1]
[1] *University of Fribourg (Switzerland),* [2] *Institut d'Optique Graduate School (France)*

Using Nanoscribe IP-Dip technology on conductive substrates we create a metallic chiral woodpilefor circular polarized thermal emission. The heated sample emits broadband circular polarized mid-infrared radiation. Predicted on the basis of the local Kirchhoff law andtheoretical studies considering fundamental evanescent Floquet states we show first experimental results.

15:20 : DNA-assembled nanogaps for continuous single-molecule biosensing
Livio Oliveira de Miranda[1], Abtin Saateh[2], Annelies Dillen[3], Mathias Dolci[1], Claudia Scarpellini[3], Khulan Sergelen[4], Hatice Altug[2], Jeroen Lammertyn[3], Peter Zijlstra[1]
[1] *Eindhoven University of Technology (The Netherlands),* [2] *Ecole Polytechnique Federal de Lausanne (Switzerland),* [3] *KU Leuven (Belgium),* [4] *Biomed X Institute (Germany)*

We present a single-molecule plasmon sensor suitable for continuously monitoring analyte concentrations over time. We analyze the far-field optical properties of the sensor by single-particle spectroscopy. A reversible sandwich assay enables the monitoring of DNA markers a temporal resolution of minutes and a sub-picomolar limit-of-detection.

15:35 : DNA origami-based plasmonic nanoantennas for single-molecule SERS
Yuya Kanehira, Amr Mostafa, Anushree Dutta, Sergio Kogikoski, Ilko Bald
University of Potsdam (Germany)

DNA origami nanoforks are used to assemble versatile plasmonic nanoantennas optimized for single-molecule surface-enhanced Raman scattering (SERS). Here, we demonstrate the role of molecular orientation within the SERS hot spot on single-molecule spectra as well as a detailed analysis of single protein SERS spectra.

15:50 : Anapole modes enabling linear and nonlinear chiral sensing in hybrid metasurfaces
Guillermo Serrera, Javier Gonzalez-Colsa, Pablo Albella
University of Cantabria (Spain)

In this work, we present how anapole modes can be exploited in hybrid metasurfaces to significantly enhance

circular dichroism (CD) up to 5 times. Our results demonstrate that this metasurface offers efficient generation of background-free nonlinear CD signals, up to a 10-fold enhancement, that complements linear CD measurements.

Coffee Break

Session 1P2
Poster Session II
16:00 - 16:40

P1: Robustness of Active Phase-Change Metasurfaces against High-Power Sources
George Braid[1], Carlota Ruiz de Galarreta[2], Joe Pady[1], Andrew Comley[3], Jacopo Bertolotti[1], C. David Wright[1]
[1] *University of Exeter (United Kingdom),* [2] *IO-CSIC (Spain),* [3] *Atomic Weapons Establishment (United Kingdom)*

Chalcogenide phase-change materials can enable active control of metasurfaces, but the effects ofhigh-power sources on such devices is not yet well-studied. Here, we develop a model for the optical response ofmetasurfaces subjected to high-power lasers and apply it to previous designs for a beam steerer and a lens.

P2: Fabrication of visible metalenses by thermal oxidation of silicon nanopillars
Taiyu Okatani, Rei Ando, Naoki Inomata, Yoshiaki Kanamori
Tohoku University (Japan)

We propose a fabrication method of visible metalens composed of SiO2 formed by thermal oxidation of Si nanopillars. A prototype transmissive metalens was fabricated by performing electron beam lithography, deep reactive ion etching, and wet thermal oxidation on a 2 μm thick monocrystalline Si layer on a quartz glass substrate.

P3: Electrical tuning of exceptional points in microwave plasmonic structures
Hoon Yeub Jeong
Korea University (Korea)

We propose and experimentally demonstrate electrically addressable EP in a plasmonic structure. We employ a localized spoof plasmon structure that supports circulating plasmonic modes in compact single-resonator geometry. Plasmonic modes are perturbed by an angled metal line, and the interaction between the plasmonic modes is electrically controlled using a varactor.

P4: Observation of Projective Embedded Topology and Trijunction-Induced Topological State in Acoustic Lattices
Hau Tian Teo[1], Yang Long[1], Kailin Song[1], Haoran Xue[2], Baile Zhang[1]
[1] *Nanyang Technological University (Singapore),* [2] *The Chinese University of Hong Kong (Hong Kong)*

Contrary to dimension increment for weak topology, we demonstrate dimension reduction in insulators with projective crystal symmetry to construct embedded topology. Based on the one-dimensional strong topology at interfaces between two-dimensional trivial insulators, we realize a trijunction-induced topological state on tight-binding and acoustic platforms, thus enriching band topology in subdimensions.

P5: Dielectric metasurfaces for nonlinear asymmetric imaging
Davide Rocco, Andrea Locatelli, Luca Carletti, Maria Antonietta Vincenti, Costantino De Angelis
University of Brescia (Italy)

We report nonlinear asymmetric generation of light from a dielectric metasurface via second-harmonic generation. In this platform, conversion efficiency is dramatically different when the metasurface is pumped from air and substrate. We exploit these findings to demonstrate that we can generate different images at second-harmonic depending on the illumination direction.

P6: Versatile Flexible Plasmonic Chip for Non-Invasive Dual Modal Glucose Detection
Andreea Campu, Simion Astilean, Monica Focsan
Babes-Bolyai University (Romania)

Glucose is a key metabolite and primary nutrient in the metabolism, thus, its monitoring is imperative for the prevention, early diagnosis, and treatment of diabetes. Great efforts are invested in the development of highly efficient non-invasive sensors able to detect glucose from body fluids such as sweat or tears.

P7: Dielectric metasurface for wave-vector variant and circular polarization dependent transmission
Helene Wetter[1], Wenlong Gao[2], Falk Rehberg[1], Jan Wingenbach[1], Stefan Schumacher[1], Thomas Zentgraf[1]
[1] *Paderborn University (Germany),* [2] *EIT Institute for Advanced Study (China)*

We study a silicon metasurface consisting of sinusoidal sidewall waveguides where near-field coupling of local resonances causes negative coupling. This gives rise to fully circularly polarized radiational eigenstates that form a line in momentum space. The corresponding metasurface provides wave-vector variant and spin-selective transmission.

P8: Crystallization of Induce Optical Vortex by Bessel Beams
Sahil Sahoo, Yuri Gorodetski
Ariel University (Israel)

We demonstrate the gradual development of optical vortices and their crystallization inside the array, which results in the formation of an optical vortex lattice. To demonstrate this phenomenon, an array of Bessel beams is applied to the plasmonic metasurface.

P9: Color arrestor pixels for high-fidelity, high-sensitivity imaging sensors
Mingwan Cho[1], Joonkyo Jung[1], Myungjoon Kim[1], Jeong Yub Lee[2], Seokhwan Min[1], Jongwoo Hong[1], Shinho Lee[3], Minsung Heo[3], Jong Uk Kim[3], In-Sung Joe[3], Jonghwa Shin[1]
[1] *KAIST (Korea),* [2] *Samsung Advanced Institute of Technology (Korea),* [3] *Samsung Electronics (Korea)*

We introduce color arrestor pixels (CAPs), a breakthrough in CMOS sensor technology, offering unparalleled color accuracy and miniaturization. By mimicking human eye response with advanced metasurfaces, CAPs outperform traditional sensors, achieving high efficiency and angular tolerance with a small footprint. This innovation heralds a new era in high-fidelity imaging.

P10: Deep Neural Networks for Prediction of Structure Parameters and Far-field Radiation Patterns of Nano-antenna
Yi-Chiang Chang, Yung-Chiang Lan
National Cheng Kung University (Taiwan)

The inverse neural network (INN) and forward neural network (FNN) are established for bi-directional prediction of structure parameters and far-field radiation patterns of nano-antennas. The INN with pre-trained VGG16 model has better predictive performance. The FNN can capture the main features of predicted radiation patterns.

P11: Embryonic stem cell sensing with terahertz plasmonic exceptional points
Yang Guo, L. Y. Hu, C. Luo, W. Y. Chang, C. Z. Gu
Chinese Academy of Sciences (China)

By inducing a phase transition of parity-time symmetry, we have theoretically proposed and practically demonstrated a terahertz metasurface capable of supporting a plasmonic EP. This terahertz EP-based metasurface serves as a sensor for detecting residual embryonic stem cells (ESCs) among differentiated cells, offering significant value in medical diagnosis.

P12: Broadband sound attenuation under grazing flow via metamaterial-based acoustic liner
Sibo Huang[1], Yong Li[2], Jie Zhu[2], Din Ping Tsai[1]
[1] *City University of Hong Kong (Hong Kong),* [2] *Tongji University (China)*

This work presents a metamaterial-based acoustic liner consisting of a front perforated plate, an air interlayer, and an array of neck-embedded Helmholtz resonators. The presented liner experimentally achieves efficient sound attenuation within 800-3000 Hz in the presence of grazing flows with speeds from 10 m/s to 60 m/s.

P13: Deep-Ultraviolet High-Quality-Factor Metasurfaces
Bo Ray Lee, Shang Jie Shen, Ting An Hsu, Mao Feng Jiang, Pei Ying Ho, Kuan-Heng Chen, Jia Hua Lee, Tzu-En Lin, Yao-Wei Huang, Ray-Hua Horng, Ming Lun Tseng
National Yang Ming Chiao Tung University (Taiwan)

We demonstrate high-quality-factor dielectric metasurfaces working in the deep-ultraviolet (DUV) range. The

metasurfaces were designed by incorporating several device schemes to enable strong light confinement for high Q resonances. The applications of the reported metasurfaces will be discussed.

P14: Scanning Reflectance Anisotropy Microscopy: mapping of strained amorphous semiconductors and chiral metasurfaces
Fabian Haake, Henning Galinski, Ralph Spolenak
ETH Zurich (Switzerland)

We present a broadband scanning reflectance anisotropy microscope as a platform for measuring ellipsometric properties, particularly sensitive to anisotropies such as strain. Leveraging its inherent phase sensitivity, we can distinguish enantiomorphic states of chiral nano resonators. We show non-destructive mechanical characterization of amorphous semiconductors and chiral metasurfaces

P15: Fabricating High-Performance Metasurfaces via Direct Printing with Polymer Infused Titanium Dioxide Nanoparticles
Dong Kyo Oh, Joohoon Kim, Hyunjung Kang, Yujin Park, Junsuk Rho
Pohang University of Science and Technology (POSTECH) (Korea)

Investigating high-refractive-index materials for visible metasurfaces, we propose a direct printing method using polymer with titanium dioxide (TiO2) nanoparticles. This enables precise control of refractive index (up to 1.9), optimized metasurface design, and high-performance fabrication on flexible substrates. This approach offers promise for efficient, multifunctional metasurface applications.

P16: Palladium Nanorods Overlayer Induced Electrostatic Contribution to Silicon Rib Waveguide Sensitivity
Anastasia Novikova, A. Katiyi, A. Karabchevsky
Ben-Gurion University of the Negev (Israel)

The methods for identifying fast-evaporating substances must be fast, easy to use, and sensitive. We modified the surface of the waveguides with gold nanorods coated with palladium to adsorb the hexane and N-Methylaniline molecules to the waveguide surface. We achieved an increased sensitivity 100 times higher than the numerical simulation.

P17: Resonant enhancement of optoacoustic response in van der Waals materials
Anton Samusev[1], Alex Carr[2], Claudia Ruppert[1], Giulia Magnabosco[3], Nicolas Vogel[3], Tetiana Linnik[1], Andrew Rushforth[2], Alexey Scherbakov[1], Manfred Bayer[1], Andrey Akimov[2]
[1] Technische Universität Dortmund (Germany), [2] University of Nottingham (United Kingdom), [3] Friedrich-Alexander-Universität Erlangen-Nurnberg (Germany)

Acoustic nanocavities with high (above 10 GHz) resonance frequencies can be exploited in sensing and quantum devices. We demonstrate that for a sub-100-nm-thick van der Waals layer, the combination of exciton and Fabry-Pérot resonances, both tuned to the optical probe frequency, grants enhanced photoelastic response demanded in possible single-phonon applications.

P18: The reduced loss of guided exciton-polariton modes in WS2 multilayers by hBN- encapsulation
Ho Seung Lee, Junghyun Sung, Dong-Jin Shin, Su-Hyun Gong
Korea University (Korea)

Guided exciton-polariton modes, innately form in bare TMDC layers due to self-hybridization between excitons and photons, exhibit a limited propagation distance owing to the substantial exciton absorption within the material. We overcome this limitation and increased propagation distance by utilizing hBN layers to provide flat substrates and protect surface.

P19: Centimeter-scale cylindrical metalens
Kyungtae Kim, Junsuk Rho
POSTECH (Korea)

Metalens is a two-dimensional wave manipulator that enables modulating properties of the light with remarkable versatility. In this work, we investigate centimeter-scale cylindrical metalens which operates at awavelength of 1064 nm with a focal length of 20 mm

P20: Analysis of aliasing in phase gradient metasurfaces: Breaking efficiency limits of high-NA ultraviolet metasurface

Kyungtae Kim, Junsuk Rho
POSTECH (Korea)

Designing metasurfaces via phase sampling has been extensively investigated, as it enables manipulation of light intuitively. However, it causes unwanted aliasing which reduces the focusing efficiency. Here, we investigate aliasing patterns in metasurfaces and how to effectively address them, especially in case of large deflection angles and UV regime.

P21: On the quantization of non-Hermitian nanophotonic systems
Luke Hands, Angela Demetriadou, Ben Yuen
University of Birmingham (United Kingdom)

We present a new method that gives an exact and complete description for the quantum emitters coupled to non-Hermitian photonic devices, via the pseudomode transformation. Using this method, we obtain the non-Markovian quantum dynamics for a quantum emitters coupled with a silicon spherical particle.

P22: Polarization-Insensitive Ultra-Broadband Terahertz Metamaterials for 6G Applications
Bhagwat Singh Chouhan, Partha Pratim Barman, Bhumidhar Barman, Gagan Kumar
Indian Institute of Techmology (India)

Our study presents a novel metamaterial design that enables ultra-wideband terahertz transmission while being insensitive to polarization. This is achieved by stacking a cross-shaped resonator on top of a square ring resonator separated by an optimized polyimide spacer. Our results indicate that stacking the resonators provides wideband terahertz transmission.

P23: Smart Electromagnetic Manipulation Based on Programmable Metasurfaces with Space Sensing
Yuanke Liu
Southeast University (China)

We introduce a programmable metasurface with smart control system that can detect multiple parameters of environment such as the orientation, distance and shape of an external target. Based on the detected information, electromagnetic manipulation is realized in a non-contact and self-adaptive way.

P24: Magnetoelectric effect in magnetic toroidal metal HoAgGe
Akimitsu Kirikoshi, Satoru Hayami
Hokkaido University (Japan)

We theoretically study the magnetic states in HoAgGe. The two distinct ordered phases accompany the magnetic toroidal moment with a finite magnetic ordering wave vector. We construct a tight-binding model and discuss the differences in magnetoelectric effects under these phases based on the microscopic electronic degrees of freedom.

P25: Optoelectronic metasurface based on photodiodes
Ya Lun Sun
Southeast University (China)

We present an optoelectronic metasurface that can realize direct and efficient optical-microwave interactions in free space. This metasurface is realized by integrating microwave resonant meta-structure with photoresponsive materials. We construct an optoelectronic metasurface based on photodiodes, in which the phase of output microwave can be tuned by input laser intensity.

P26: Diverse reconfigurability in far- and mid-infrared few-layer metasurfaces capable of polarization manipulation: case of phase-change materials
Andriy Serebryannikov[1], Akhlesh Lakhtakia[2]
[1] *Adam Mickiewicz University in Poznan (Poland),* [2] *Pennsylvania State University (USA)*

Numerical studies on few-layer metasurfaces have clarified how functionality and its possible switching depend on the way in which tunable components are incorporated. Two thermally tunable materials, VO2 and InSb, were used in the metasurfaces with and without resonant components that are capable of polarization manipulation and asymmetric transmission.

P27: Water sensors using soft films with metamaterials
Chia-Yi Huang, Harry Miyosi Silalahi
Tunghai University (Taiwan)

This study involves the creation of a metamaterial sandwiched between two soft films. When exposed to water, the soft films cause cracks in the metamaterial due to swelling. These cracks disrupt the electromagnetic resonance, leading to an increase in the transmittance of the metamaterial at its resonance frequency.

P28: Magnetically Controllable Multimode Interference in Topological Photonic Crystals
Weiyuan Tang[1], Mudi Wang[2], Shaojie Ma[1], C.T. Chan[2], Shuang Zhang[1]
[1] *The University of Hong Kong (Hong Kong),* [2] *The Hong Kong University of Science and Technology (Hong Kong)*

We demonstrate magnetically controllable multimode interference based on gyromagnetic topological photonic insulators that support two unidirectional edge modes with different dispersions. Herein, we successfully achieve tunable power splitting in experiments by controlling multimode interference with the magnetic field intensity or the frequency of wave.

P29: Ultrathin Water-Immersion Metalens in the Visible
Pei Ying Ho, Yu Chia Chung, Jia Hua Lee, Bo Ray Lee, Yao Wei Huang, Ray Hua Horng, Ming Lun Tseng
National Yang Ming Chiao Tung University (Taiwan)

Immersion metalenses are important to numerous applications. We report an ultrathin water-immersion metalens for the visible range. The metalens consist of GaP meta-atoms of various shapes that enable Huygens' resonance for wavefront control. This work provides a striking platform to realize nanophotonic components for bioimaging, sensing, and many other applications.

16:40 - 18:00 — Main Hall

Session 1A22

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Qing-Dong Jiang

16:40 : Invited talk
Hall Quantized Hall Effect
Shun-Qing Shen
The University of Hong Kong (Hong Kong)

A single gapless Dirac cone of fermions gives rise to one half quantum Hall conductance while.a gapped Dirac cone of fermions has zero or one quantum Hall conductance. The effect can be realised in a semi-magnetic topological insulator.

17:00 : Invited talk
Nonlinear topological magnon spin Hall effect
Peng Yan
UESTC (China)

Nonlinear scattering of magnons and skyrmions in antiferromagnets leads to a spin Hall effect that emerges from real-space topology.

17:20 : Invited talk
Optical forces of optical modes with helicity and angular momentum
Gabriel Molina-Terriza
UPV-EHU/CSIC (Spain)

I will show our latest results in the control of the scattering and optical forces using modes of light with well-defined angular momentum and helicity. Traditionally, the roles of helicity and angular momentum are mixed. I will present the differential features of angular momentum and helicity of optical beams.

17:40 : Invited talk
Orbital angular momentum of magnons in confined magnetodielectrics
Eugene Kamenetskii
Ben Gurion University of the Negev (Israel)

Can magnon excitations have both spin and orbital angular momentum? Whereas the spin of magnon is equal to unit, the OAM is unknown. For MS magnons in a ferrite disk, an OAM is half integer. A vacuum vicinity zone of a disk is associated with symmetry breaking and magnetoelectric characteristics.

16:40 - 19:20 — Room 201

Session 1A23

Symposium I: Hybrid Nanomaterials and Metastructures for Photonics, Sensing and Energy

Organized by: Jérôme Plain, Alexander Govorov, Davy Gérard and Pedro Hernandez Martinez

Chaired by: Pedro Hernandez Martinez

16:40 : Invited talk
Scaling up Precision: Engineering Gold Nanoparticles for Optimal Performance in Advanced Production Platforms
Kyoungweon Park[1], Eva Yazmin Santiago Santos Santos[2], Alexander Govorov[2], Richard A. Vaia[1]
[1] *Air Force Research Laboratory (USA),* [2] *Ohio University (USA)*

We demonstrated cost-effective strategies to synthesize scalable Gold NanoSpheres, NanoRods, and NanoWires. Tailoring their properties optimally for specific applications was explored. Implementing these approaches unlocks the complete potential of gold nanoparticles and assemblies, paving the way for practical applications in diverse domains.

17:00 : Invited talk
DNA Origami Self-Assembled High-Index Dielectric Optical Antennas for Single-Molecule Fluorescence Manipulation
M. Sanz Paz[1], N. Siegel[1], K. Kołątaj[1], F. Zhu[1], H. Hasebe[2], J. Gonzalez-Colsa[3], G. Serrera[3], H. Sugimoto[2], M. Fujii[2], P. Albella[3], Guillermo Acuna[1]
[1] *University of Fribourg (Switzerland),* [2] *Kobe University (Japan),* [3] *University of Cantabria (Spain)*

We self-assemble optical antennas based on silicon nanoparticles using the DNA origami technique. We exploit these structures to manipulate the fluorescence properties of single fluorophores placed in their proximity. We focus on effects on the fluorescence lifetime, intensity and directivity.

17:20 : Invited talk
Nonradiative Cooling
Wakana Kubo
Tokyo University of Agriculture and Technology (Japan)

We report a nonradiative cooling technology that can reduce the temperature of space surrounded by an opaque container. When a metamaterial-loaded thermoelectric device is placed in an opaque and sealed container, the metamaterial absorber absorbs the thermal radiation inside the container, resulting in a temperature reduction inside the container.

17:40 : Invited talk
Proving non-thermal plasmon catalysis mechanisms through the overtone vibrational quantum states of reactants
Zee Hwan Kim
Seoul National University (Korea)

Employing SERS spectroscopy, we show that the plasmons activate the reactants to vibrational overtone states possessing $>$ 0.5 eV of energy. We use the light intensity and wavelength dependences of the overtone

population to quantify the non-thermal contribution to the activation and to validate the indirect hot electron transfer mechanism.

18:00 : Invited talk
Optoelectronic Physical Reservoir Computing with Digital Delayed Feedback featuring in situ Optimization
Fyodor Morozko, Shadad Watad, Amir Naser, Antonio C. Lesina, Andrey Novitsky, Alina Karabchevsky
Ben-Gurion University of the Negev (Israel)

We've developed a physical reservoir achieving outperforming pattern recognition and time-series prediction. Incorporating FPGA provides adequate delay time within the reservoir's operational bandwidth, compatible with generic electronic hardware. This capability allows for achieving a normalized mean squared error (NMSE) below 0.6 in the NARMA10 time series recovery task.

18:20 : Invited talk
Ultrafast Processes and Energy Dissipation in Hybrid Nanomaterials
Gary Wiederrecht
Argonne National Laboratory (USA)

Optically induced ultrafast processes are characterized to better understand energy flow and dissipation in nanostructured materials. The potential impacts on hybrid nanomaterials of interest for optoelectronics, energy conversion and sensing are described. Efforts to enhance the range of materials that can be explored by ultrafast spectroscopy are also described.

18:40 : Invited talk
Enhancing Infrared-to-Visible Photon Upconversion with Metasurfaces
Mengfei Wu[1], Dileep Kottilil[1], Yuxiang Zhang[2], Kangning Yu[3], Sourav Adhikary[1], Jinal Tapar[1], Emmanuel Lassalle[1], Daniil Shilkin[1], Febiana Tjiptoharsono[1], Ramon Paniagua-Dominguez[1], Xiaogang Liu[2], Arseniy Kuznetsov[1]
*[1]A*STAR (Singapore), [2]National University of Singapore (Singapore), [3]Department of Chemistry, National University of Singapore (Singapore)*

Upconversion of infrared light into visible light has wide potential applications, but current efficiency is too low to be practical. Here, we present a variety of dielectric and plasmonic metasurfaces that enhance upconversion efficiency. We show that enhancement of several orders of magnitude may be achieved at low excitation flux.

19:00 : Invited talk
Rapid modulation of left- and right-handed optical vortices for precise measurements of helical dichroism
Shun Hashiyada, Y. Y. Tanaka
Hokkaido University (Japan)

We propose and experimentally demonstrate rapid modulation of the directions of handedness of optical vortices carrying orbital angular momentum (OAM) at around 50 kHz. This modulation is achieved through the rapid modulation of those of circularly polarized lights carrying spin angular momentum (SAM), coupled with the SAM-OAM conversion techniques.

16:40 - 19:00 — Room 202

Session 1A24

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Hiromi Okamoto and Kotaro Kajikawa

16:40 : Invited talk

Structural Properties of Nanoporous Gold Metamaterial for Optical Applications

Xinyan Wu[1], Fatemeh Ebrahimi[1], Maurice Pfeiffer[1], Nadiia Mameka[2], Manfred Eich[1], Alexander Petrov[1]
[1] *Hamburg Unversity of Technology (Germany),* [2] *Helmholtz-Zentrum Hereon (Germany)*

Nanoporous gold (npAu), known for its adjustable large surface-to-volume ratio and broadband light absorption, exhibits potential for advanced optical applications. Our study investigates the npAu structural properties and its impact on absorption, electron collision frequency and photoemission efficiency. Optimizing npAu feature sizes enhanced performance in photocatalysis processes is demonstrated.

17:00 : Invited talk

Hot-electron induced chemistry using chiral and non-chiral plasmonic nanostructures

Shashank Gahlaut, Christina Beresowski, Sergio Kogikoski Jr., Ilko Bald
University of Potsdam (Germany)

We investigate the influence of nanoparticle structure and excitation condition on the rate of plasmon-induced chemical reactions using surface-enhanced Raman scattering (SERS). In particular, we focus on the size of Au and Ag nanoparticles, as well as chiral Au nanocubes using excitation with circularly polarized light.

17:20 : Invited talk

Development of Nonclassical Light Sources for Time-Resolved THz detection

D. Adamou[1], L. Hirsh[1], T. Shields[1], S. Yoon[1], A. C. Dada[1], J. M. R. Weaver[1], D. Faccio[1], L. Caspani[2], M. Peccianti[3], Matteo Clerici[4]
[1] *University of Glasgow (United Kingdom),* [2] *University of Strathclyde (United Kingdom),* [3] *Loughborough University (United Kingdom),* [4] *Universita degli Studi dell'Insubria (Italy)*

THz time-domain spectroscopy is a widespread technology. It is pump-and-probe-based and delivers a large dynamic range, currently limited by the probe shot noise. Therefore, quantum metrology tools, such as squeezed states, can enhance its sensitivity. We shall present our first attempts in this direction, including discrete and continuous variable approaches.

17:40 : Invited talk

Ultrabroadband polarization-independent directional thermal emission

Ziwei Fan, Taeseung Hwang, Sam Lin, Yixin Chen, Zi Jing Wong
Texas A&M University (USA)

By leveraging non-imaging optical principles, a pixelated micro-emitter is experimentally demonstrated for ultrabroadband, polarization-independent directional control of thermal radiation. This design enables high emissivity contrasts at different view angles. By exploiting the tunable angular range of the pixelated micro-emitter, we create an infrared display with directionally encoded information.

18:00 : Invited talk

Förster resonance energy transfer in absorbing environment

Lyudvig Petrosyan[1], Mikhail Noginov[2], Tigran Shahbazyan[1]
[1] *Jackson State University (USA),* [2] *Norfolk State University (USA)*

We present an analytical model for Förster resonance energy transfer between donors and acceptors in the presence of a metal surface. We find that energy transfer to the metal results in a reduction of the Förster radius, leading to a suppression of concentration quenching for high molecule concentrations.

18:20 : Invited talk

Continuous mechanical machining of asymmetric nanogratings with tailored period and shape by azimuthal rotation-controlled nanoinscribing

Jong G. Ok
Seoul National University of Science and Technology (Korea)

We demonstrate the high-throughput mechanical patterning of period- and shape-tunable asymmetric nanogratings via azimuthal rotation-controlled nanoinscribing (ARC-DNI) which utilizes continuous inscription of a nanograting tool edge on viscoelastic polymers. ARC-DNI enables scalable fabrication of diverse asymmetric nanogratings with trapezoidal, triangular, and parallelogrammatic profiles for various photonic and diffractive optical elements.

18:40 : Invited talk

High-performance Ultraviolet Metasurfaces based on Wide bandgap Dielectrics

Cheng Zhang
Huazhong University of Science and Technology (China)

I will present our recent work on employing wide bandgap dielectrics to implement an array of high-performance metasurface optics in the ultraviolet, including down to the deep-ultraviolet region.

16:40 - 17:40 — Room 203

Session 1A25

Industrial Workshop I

16:40 : Industrial WorkShop: From Design to Manufacture - Complete Inverse Design Flow for Meta-Optics
Chenglin Xu[1], **Bryan Stone**[1], **JiSoo Park**[2]
[1] *Synopsys, Inc. (USA),* [2] *3Synopsys, Inc. (Korea)*

Synopsys offers solutions to metalens design and manufacturing challenges, including tools for hybrid refractive metalens systems that consider manufacturing tolerances. This workshop is presented in two parts: 1. July 16: Introduction to MetaOptic Designer; 2. July 18: Demo of hybrid metalens system design and virtual fab simulation.

17:40 - 18:50 — Room 203

Session 1A26

Symposium III: Advanced passive and active metasurfaces and zero-index materials

Organized by: Howard Lee, Pin Chieh Wu and Qinghua Song

Chaired by: Wenshan Cai

17:40 : Invited talk
Gap plasmon structures constructed by oligonucleotides and integrated with fluorophores
Wan-Ping Chan, Yu-Long Lin, Shiuan-Yeh Chen
National Cheng Kung University (Taiwan)

Structures supporting gap plasmon modes have been widely utilized in metasurfaces. Here, we show that the gap plasmon structures constructed by oligonucleotides (short DNA strands) and their interaction with embedded fluorophores. This configuration may extend the capability of active metasurfaces.

18:00 : Invited talk
Near-field manipulation of angular momentum of light
Haoran Ren
Monash University (Australia)

Nanophotonics opens the possibility of realising subwavelength optical vortices through coupling optical beams into subwavelength surface polaritons. I will highlight our recent work on hybrid nanophotonic circuits and nano-lasers used for angular-momentum-selective on-chip applications, as well as on dispersion control and multiplication of low-loss polaritonic vortices at mid-infrared frequencies.

18:20 : Active Multitasking Metasurfaces: Simultaneous and Independent Steering of Frequency-Shifted Beams
Prachi Thureja, Jared Sisler, Michael D. Kelzenberg, Ruzan Sokhoyan, Harry A. Atwater
California Institute of Technology (USA)

We experimentally steer frequency-shifted light using an electrically tunable ITO-based metasurface operating at near-infrared wavelengths. By independently addressing metasurface elements, we superimpose MHz driving frequencies with nonresonant spatial phase offsets. This configuration creates a chip-scale platform for simultaneous and independent control of the frequency and wave vector of light.

18:35 : Grayscale Electron Beam Lithography Direct Patterned Antimony Sulfide
Wei Wang[1], Uwe Hubner[2], Tao Chen[2], Anne Gärtner[3], Joseph Köbel[4], Tanveer Ahmed Shaik[2], Astrid Bingel[3], Volker Deckert[2]
[1] *Friedrich-Schiller-Universität (Germany),* [2] *Leibniz Institute of Photonic Technology (Germany),* [3] *Fraunhofer Institute for Applied Optics and Precision Engineering (Germany),* [4] *Friedrich Schiller University Jena (Germany)*

We present a combination of grayscale electron beam lithography (g-EBL) and direct forming methodology to fabricate free-form antimony sulfide structures. 4-level Fresnel Zone Plates (FZP) and metalenses were produced and characterized. The method can be used for the fabrication of 3D micro-optical elements in a single step manner.

16:40 - 19:20 — Room 204

Session 1A27

Symposium V: Architectured Elastic and Acoustic Metamaterials and Phononic Crystals

Organized by: Marco Miniaci, Jensen Li, Vicente Romero-García, Vincent Pagneux and Noé Jiménez

Chaired by: Noé Jiménez

16:40 : Invited talk
Enhanced Understanding through Experimental Study: Disorderly Arrangement of Vertical GaN Nanowires in Polymer Materials
F. Soldevila[1], A. Huynh[1], E. Charron[1], B. Bonello[1], B. Perrin[1], A. Chevillard[2], N. Gogneau[2], M. Tchernycheva[2], Olga Boyko[3]
[1] *Institut des Nanosciences de Paris (INSP) (France),* [2] *Université Paris-Saclay (France),* [3] *University Pierre et Marie Curie (France)*

Our study focuses on the elastic properties of gallium nitride (GaN) nanowires within a polymer matrix, vital for force sensor and artificial skin development. Utilizing picosecond acoustics, we investigate surface wave propagation, offering insight into the composite material's elasticity and resonant properties, crucial for advancing nanotechnology applications.

17:00 : Invited talk
Control of FRET in radio frequencies with metasurfaces, in other words, dipole-dipole interactions in the near field of a metasurface
Kseniia Lezhennikova[1], Kaizad Rustomji[1], Boris Kuhlmey[2], Tryfon Antonakakis[3], Pierre Jomin[1], Stanislav Glybovski[4], Martijn De Sterke[2], Jérôme Wenger[1], Redha Abdeddaim[1], Stefan Enoch[1]
[1] *Aix-Marseille Université (France),* [2] *University of Sydney (Australia),* [3] *Multiwave Technologies AG (Switzerland),* [4] *ITMO University (Russia)*

Energy transfer by Förster resonance (FRET) and the local density of states (LDOS) are both dependent on the electromagnetic environment. An analogy between direct measurements with a microwave antenna has been developed both theoretically and experimentally. A review of the work we have done on this subject will be presented.

17:20 : Invited talk
Non-resonant extraordinary acoustic transmission
Oliver B. Wright[1], Eun Bok[2]
[1] *Osaka University (Japan),* [2] *Yonsei University (Korea)*

Acoustic metamaterials, which are engineered structures composed of sub-wavelength resonators, are designed to control sound propagation in ways not found in natural materials. Here we discuss the curious case of enhanced transmission through bare holes without resonance using the language of metamaterials.

17:40 : Invited talk

Static Loading Challenges of Three-Dimensional Ultrawide Phononic Crystals and Elastic Metamaterials

Cetin Yilmaz
Bogazici University (Turkey)

Three-dimensional ultrawide phononic crystals and elastic metamaterials can ideally be applied for vibration isolation, elastic wave shielding and seismic protection. However, most designs in the literature are additively manufactured from polymers in small sizes. Challenges regarding production of these ultrawide designs in large sizes will be explained considering static loading.

18:00 : Invited talk

Thermal rectification in graphite Tesla valve based on phonon hydrodynamics

Masahiro Nomura
The University of Tokyo (Japan)

We demonstrate a phonon hydrodynamics approach to realize the rectification of heat conduction in isotopically enriched graphite crystals. We design a Tesla valve at the micrometer scale within a 90-nm-thick sample and experimentally observe a discernible 14 % difference between the thermal conductivity in the opposite directions at 40 K.

18:20 : Invited talk

Exploring Tunable Poisson's Ratio in Origami Metamaterials

Diego Misseroni
University of Trento (Italy)

We present a triclinic metamaterial system of minimal symmetry derived from a Trimorph origami pattern. We investigate the Trimorph pattern through mathematical analyses, numerical simulations, and experimental validation. We developed a manufacturing technique and a testing device, named the Saint-Venant setup, to quantify its reversible auxeticity.

18:40 : Invited talk

Twofold topological transition induced by third-nearest-neighbor hoppings in anartificial elastic polyacetylene

Rafael Méndez-Sanchez[1], Yonatan Betancur-Ocampo[1], Bryan Manjarrez-Montañez[1], Angel Martínez-Arguello[2]
[1] *Universidad Nacional Autonoma de Mexico (Mexico),* [2] *Benemerita Universidad Autonoma de Puebla (Mexico)*

An artificial elastic molecule, which emulates the electronic properties of the cis-polyacetylene with third-nearest-neighbor hoppings is introduced. The tight-binding band structure shows a transition between two topological phases with different winding numbers. The low frequency excitations obey the modified Dirac equation. The finite element numerical simulations agree with the theory.

19:00 : Invited talk

Superlattice nanowires: a versatile platform for phonon engineering

Aswathi K. Sivan[1], Begoña Abad[1], Omer Arif[2], Johannes Trautvetter[1], Tommaso Albrigi[3], Alicia Ruiz Caridad[1], Chaitanya Arya[1], Diego de Matteis[1], Francesca Rossi[4], Valentina Zannier[2], Lucia Sorba[2], Riccardo Rurali[3], Ilaria Zardo[1]
[1] *University of Basel (Switzerland),* [2] *NEST, Instituto Nanoscienze-CNR and Scuola Normale Superiore (Italy),* [3] *Institut de Ciencia de Materials de Barcelona (ICMAB-CSIC) (Spain),* [4] *IMEM—CNR (Italy)*

Phonons are fundamental particles responsible for heat and sound transport in materials. The ability to control and manipulate phonons is essential for effective thermal management. In this study, we aim to showcase the remarkable adaptability of NWs as a platform for effective phonon engineering.

16:40 - 18:35 — Conference Room

Session 1A28

SP10. Advanced Computational Electromagnetics for the Analysis and Design of Nanophotonic Devices

Organized by: Maha Ben Rhouma

Chaired by: Owen Miller

16:40 : Invited talk
Existence of Friedrich-Wintgen bound states in the continuum in periodically perturbed slabs
Amgad Abdrabou[1], Wangtao Lu[2], Ya Yan Lu[3]
[1] *Purdue University (USA),* [2] *Zhejiang University (China),* [3] *City University of Hong Kong (Hong Kong)*

Bound states in the continuum (BICs) have been used to improve and enhance many photonic devices, but their existence has only been justified in some special or simple cases. In this paper, we present a general existence theory for Friedrich-Wintgen BICs in a wide class of periodically perturbed slabs.

17:00 : Invited talk
Hardware-Accelerated FDTD Simulation
Zongfu Yu, Tyler Hughes, Shanhui Fan
Flexcompute Inc (USA)

We will discuss how electromagnetic simulation compute requirements motivate new approaches to computing hardware. Then, we will demonstrate how our technology leverages these understandings to enable the simulation and design of novel photonic devices at speeds and scales not possible with conventional approaches.

17:20 : Adaptive Meshing Using A Posteriori Error Estimation
Albin J. Svärdsby, Philippe Tassin
Chalmers University (Sweden)

We present our work on adaptive meshing of electromagnetic simulations based on a posteriori error estimation. We present our implementation and demonstrate that our adaptive meshing technique can lead to faster convergence with lower memory footprint, especially for simulations of complex three-dimensional nanophotonic structures.

17:35 : Invited talk
Second harmonic generation of optical beams with orbital angular momentum on dielectric films and metasurfaces
Laure Coudrat[1], Domenico De Ceglia[2], Rana Tanos[3], Jean-Michel Gérard[3], Costantino De Angelis[2], Aloyse Degiron[1], Giuseppe Leo[1]
[1] *Université Paris Cité (France),* [2] *University of Brescia (Italy),* [3] *Université Grenoble Alpes (France)*

We report on the generation of second-harmonic vortices with either a uniform film or an optical metasurface, fabricated in a hybrid AlGaAs-on-sapphire platform. In the former case we demonstrate spin-to-orbital angular momentum transfer, while in the latter we generate orbital angular momentum with arbitrary topological charge via a nonlinear meta-hologram.

17:55 : Invited talk
Calculation of surface state spectra for topological photonic and acoustic crystals
Y. X. Sha, Yi Yang
The University of Hong Kong (China)

We present efficient algorithms for calculating the surface state spectra of photonic and acoustic crystals, which are beneficial in studying topological materials in classical systems.

18:15 : Invited talk
Thermal radiation at the nanoscale, electroluminescence, single and dual radiative heat engines
J. Legendre, T. Châtelet, M. Thomas, O. Merchiers, P-Olivier Chapuis

CNRS-INSA Lyon (France)

At the crossroad of nanophotonics and energy harvesting, a novel class of heat engines in the near field is being developed. Building on the experimental confirmation of near-field thermophotovoltaics and on the physics of light-emitting diodes, dual radiative heat engines, e.g. thermophotonic ones, are attractive for heat-to-electricity conversion and refrigeration.

16:40 - 18:30 — Room 205

Session 1A29

SP8. Strong light-matter interactions in plasmonic/dielectric metasurfaces

Organized by: Shunsuke Murai and Shaojun Wang

Chaired by: Guangyuan Li and Kosuke Sugawa

16:40 : Invited talk

Robust quasi-BIC modes in a four cuboid cluster metasurface

Jose Algorri[1], V. Dmitriev[2], H. E. Hernandez-Figueroa[3], L. Rodríguez-Cobo[4], F. Dell'Olio[5], A. Cusano[6], J. M. López-Higuera[1], D. C. Zografopoulos[7]

[1] *Universidad de Cantabria (Spain),* [2] *Federal University of Para (Brazil),* [3] *University of Campinas-UNICAMP (Brazil),* [4] *Instituto de Salud Carlos III (Spain),* [5] *Polytecnic University of Bari (Italy),* [6] *University of Sannio (Italy),* [7] *Consiglio Nazionale delle Ricerche (Italy)*

A metasurface with a unit cell composed of a cluster of four hollowed cuboids to work at the VIS spectrum is proposed. By shifting the hole asymmetrically, a qBIC resonant mode that is very robust to perturbations of the cuboid structure is produced thanks to its particular electric field profile.

17:00 : Invited talk

Optical properties of chiral plasmonic nanostructures coupled with nanocavity

Tomoya Oshikiri

Tohoku University (Japan)

We fabricated the two-dimensionally chiral Au nano-windmills (Au-NWs) by electron beam exposure and lift-off process on the Fabry-Pérot nanocavity of TiO2 on Au-film. The chiroptical responses on Au-NWs with different geometric structures coupled with nanocavity in far and near fields are discussed.

17:20 : All-optical phase rotation in strongly coupled light-matter systems

Fedor Benimetskiy[1], Paul Walker[1], Sylvain Ravets[2], Maurice Skolnick[1], Jacqueline Bloch[2], Dmitry Krizhanovskii[1]

[1] *University of Sheffield (United Kingdom),* [2] *Université Paris-Saclay (France)*

We demonstrate cross-phase modulation of up to 17.5 mrad per polariton using laser beams attenuated to the average intensity of single photons, the highest amount achieved without using atom-like emitters. This advance opens new possibilities for quantum information processing and nonlinear quantum optics using strongly coupled light-matter systems.

17:35 : Weyl points and chiral states in correspondence of Bound States in Continuum connected by Fermi arc

Vito Mocella, Fabrizio Sgrignuoli, Bryan Guilcapi Alulema, Silvia Romano, Gianluigi Zito, Bruno Miranda, Aida Seifalinezhad, Ivo Rendina

CNR-ISASI (Italy)

We establish a correlation between Bound States in the Continuum (BIC), Fermi arcs, Weyl points, and singularities in far-field in a theoretical model. Experiments prove that without chirality, in materials or in nanostructures, around the BIC condition the far-field exhibits chiral behavior, confirming the existence of a Weyl point.

17:50 : Invited talk

Significant loss suppression in metasurfaces via resonances coupling
Guangyuan Li, Xiaoqing Luo, Xueqian Zhao
Chinese Academy of Sciences (China)

We proposed and experimentally demonstrated significant loss suppression in plasmonic or all-dielectric metasurfaces via cooperative near-/far-field coupling or analogue of electromagnetically induced transparency, respectively. Both mechanisms are based on collective-collective resonances coupling, resulting to record high measured quality factors. We expect this work will advance the performance of related applications.

18:10 : Invited talk
Continuous wave-pumped second-harmonic generation and application from GaSe-assisted microfiber
Biqiang Jiang, Zhen Hao, Yuxin Ma, Xuetao Gan, Jianlin Zhao
Northwestern Polytechnical University (China)

We demonstrate the realization of low-power, continuous wave-pumped second-order nonlinear optical processes with high efficiency from GaSe-assisted microfiber, and its application in the characterization of ultrashort optical pulses, with a broad measurable applicability for pico- and femto-second pulses.

16:40 - 18:40 — Room 206

Session 1A30

SP12. Quantum Metasurfaces

Organized by: Diego Dalvit, Maria Chekhova and Igal Brener

Chaired by: Diego Dalvit

16:40 : Invited talk
Applications of Spacetime Quantum Metasurfaces to Simulating Hawking Radiation
Patrick Brown[1], Wilton J. M. Kort-Kamp[2], Gerald Cleaver[1], Diego Dalvit[2]
[1] *Baylor University (USA),* [2] *Los Alamos National Laboratory (USA)*

In this talk I will discuss how, due to their unique quantum properties, STQMs could provide a novel and unique platform for the simulation of Hawking radiation and other quantum effects predicted in curved spacetimes.

17:00 : Invited talk
Controlling quantum states and quantum noise with nonlinear photonics
Nicholas Rivera
Harvard University (USA)

We present recent theoretical and experimental results on using engineered nonlinear interactions to generate elusive quantum states of light and control quantum noise of electromagnetic fields.

17:20 : Invited talk
Analog of Quantum Bit Empowered by A Novel Electromagnetic Metasurface
Long Chen, J. W. You, Z. Gu, Q. Ma, Tie Jun Cui
Southeast University (China)

Current metamaterial research mainly focuses on the classical bit as the fundamental unit of information. To overcome the limitations of classical information capacity, we recently have proposed a new electromagnetic metasurface to implement analog quantum bit. This presentation would summarize our recent works in the field of analog quantum metasurfaces.

17:40 : Invited talk
Tailored generation of biphoton polarization Bell state from an InGaP metasurface
Jinyong Ma[1], Tongmiao Fan[1], Tuomas Haggren[1], Jihua Zhang[1], Saniya Shinde[1], Frank Setzpfandt[2], Hark Hoe Tan[1], Chennupati Jagadish[1], Dragomir N. Neshev[1], Andrey A. Sukhorukov[1]
[1] *The Australian National University (Australia),* [2] *Friedrich Schiller University Jena (Germany)*

We develop, for the first time, an ultrathin source of two-photon polarization Bell states based on an InGaP nonlinear metasurface. The metasurface facilitates a local optical resonance with a tailored angular dispersion, enabling the all-optical tuning of polarization entanglement.

18:00 : Invited talk
Spontaneous Parametric Downconversion Facilitated by Intrinsic Nonlinear Response of Plasmonic Metal Nanoparticles
Andrei Piryatinski[1], Syed Shah[1], Michael Clark[2], Joseph Zyss[3], Maxim Sukharev[2]
[1] *Los Alamos National Laboratory (USA),* [2] *Arizona State University (USA),* [3] *Université Paris-Saclay (France)*

Our theoretical study explores using L-shaped gold metal nanoparticles with intrinsic plasmonic second-order nonlinearity for spontaneous parametric downconversion. Through quantum optical modeling parameterized by FDTD simulations, it demonstrates the MNPs' potential as probabilistic quantum photon sources suitable for applications as building units of quantum metasurface.

18:20 : Invited talk
Lattice Resonances in Periodic Arrays with Multiparticle Unit Cells
Alejandro Manjavacas
IO-CSIC (Spain)

We explore novel functionalities provided by the lattice resonances supported by periodic arrays of nanostructures with multiparticle unit cells.

16:40 - 17:55 — Room 101

Session 1A31

SP22. 2D Materials and Nanophotonics

Organized by: Masanobu Iwanaga and Der-Hsien Lien

Chaired by: Masanobu Iwanaga

16:40 : Hundred- to thousand-fold enhanced luminescence and the quantum nature manifested in continuous 2D materials coupled with metasurfaces
Masanobu Iwanaga, Xu Yang, Vasilios Karanikolas, Takashi Kuroda, Yoshiki Sakuma
National Institute for Materials Science (NIMS) (Japan)

Atomic-layer 2D materials are attracting huge research interest. Transition metal dichalcogenide (TMDC) monolayers exhibit efficient luminescence. By coupling a continuous TMDC monolayer with all-dielectric metasurfaces or plasmo-photonic metasurfaces, significant luminescence enhancement was achieved. Furthermore, the quantum nature of the enhanced luminescence was visualized in confocal microscopy.

16:55 : Absorption Enhancement of Exciton of WS2, by Silicon Metasurface Based on Degenerate Critical Coupling
Dingwei Chen, Junichi Takahara
Osaka University (Japan)

We study an absorption enhancement of two-dimensional transition-metal dichalcogenides coupled to a Silicon metasurface by degenerate critical coupling. Here, we demonstrate in numerical simulations that the absorption of A mode of exciton in WS2 can be increased 15.5 times by degenerated Mie modes.

17:10 : Membrane Nanophotonic Platform for Enhanced Light-Matter Interaction of Transition Metal Dichalcogenide Monolayer
Ya-Lun Ho[1], Chee Fai Fong[2], Yen-Ju Wu[1], Kuniaki Konishi[3], Jui-Han Fu[3], Yuichiro Kato[2], Vincent Tung[3], Chun-Wei Chen[4]
[1] *National Institute for Materials Science (NIMS) (Japan),* [2] *RIKEN (Japan),* [3] *The University of Tokyo (Japan),* [4] *National Taiwan University (Japan)*

Strong coupling between the membrane metasurface and TMDC monolayer via the quasi-BIC mode is de-

monstrated, presenting enhanced photoluminescence emission. The significance of membrane metasurface design for achieving highly confined quasi-BIC modes, distinct from conventional photonic guided modes, is clarified, offering new possibilities for 2D material-based nanophotonic and quantum devices.

17:25 : Revealing the Local Band Structures of Sharp WS2/MoS2 Heterojunction and Graded WxMo1-xS2 Alloy by Near-Field Optical Imaging
Po-Wen Tang[1], **He-Chun Chou**[1], **Shiue-Yuan Shiau**[2], **Xin-Quan Zhang**[3], **Yi-Hsien Lee**[3], **Chi Chen**[1]
[1]*Academia Sinica (Taiwan),* [2]*National Center for Theoretical Sciences (Taiwan),* [3]*National Tsing-Hua University (Taiwan)*

We demonstrate the state-of-the-art scanning near-field optical microscopy (SNOM) imaging of 2D materials. We identified the exciton quenching behavior at sharp WS2 and MoS2 lateral heterojunctions with a 68 nm NF-photoluminescence resolution. Furthermore, the bandgap evolution and interlayer coupling in the WxMo1-xS2 alloy were visualized using the NF-transmission method.

17:40 : Nanoengineered Transition Metal Dichalcogenides Platform for Quantum Photonics: Generation and interference of single photons
A. Paralikis, C. Piccinini, P. Metuh, J. F. Neto, P. Wyborski, A. A. Madigawa, L. Vannucci, N. Gregersen, Battulga Munkhbat
Technical University of Denmark (Denmark)

Our recent progress in nanoengineered transition metal dichalcogenides (TMDs) enables high-quality single-photon sources (SPSs). I will present a method for fabricating highly polarized, pure single-photon emitters. Additionally, I discuss the importance of employing advanced optical excitation in improving single photon characteristics and discuss on-chip SPS developments with the TMD platform.

17:55 - 18:55 — Room 101

Session 1A32

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Takaaki Yano

17:55 : Invited talk
Scalable Chiral Photonic Architectures via Soft Nanoimprinting lithography
Jose Mendoza-Carreño, Xiaoyu Qi, Isabel Alonso, Miquel Garriga, Luis Alberto Pérez, Agustín Mihi
ICMAB-CSIC (Spain)

Template-assisted self-assembly is a scalable nanofabrication technique in which elastomeric pre-patterned stamps are used to induce long range order from a colloidal dispersion used as ink. Metal colloids or perovskite nanocrystals are used to fabricate high quality and large area 2D photonic crystals supporting narrow lattice resonances and chiroptical properties.

18:15 : Invited talk
Dynamic plasmonics based on conducting polymers
Shangzhi Chen[1], **Magnus Jonsson**[2]
[1]*Linkoping University (Sweden),* [2]*Linkoping University, Sweden (Sweden)*

Conducting polymer nanoantennas with redox tunability form an emerging approach towards dynamic plasmonics. In this talk, the progress and future prospects of active plasmonics based on conducting polymers will be briefly reviewed.

18:35 : Invited talk
Ge-Sb-Te material for applications in photonics
Mikhail Rybin
ITMO University (Russia)

Phase change materials including Ge-Sb-Te (GST) are under extensive studies for applications in photonics. Here is a brief review of recent works reported by our team in this topic: modification of radiation properties, fabrication of GST samples by lithography and other techniques, and study of single GST particle resonators.

16:40 - 19:00 — Gallery

Session 1A33

SP21. Non-Hermitian Photonics: Topological, Disordered and Quantum systems

Organized by: Konstantinos Makris and Li Ge

Chaired by: Konstantinos Makris

16:40 : Invited talk
Bunching states and memory loss in noisy non-unitary dynamics of bosons
Ken Mochizuki[1], **Ryusuke Hamazaki**[2]
[1] *University of Tokyo (Japan),* [2] *RIKEN (Japan)*

We explore noisy non-unitary dynamics of bosons exposed to random measurements and postselections. We find that noisy dynamics typically exhibit bunching states with no memory of initial states, where all bosons occupy one time-dependent mode. We also show a universal power law of relaxation times to the fluctuating bunching state.

17:00 : Invited talk
Topological enhancement of non-normality in non-Hermitian systems
Masatoshi Sato
Kyoto University (Japan)

The non-Hermitian skin effects are representative phenomena intrinsic to non-Hermitian systems. In this talk, I argue that topological enhancement of non-normality under the OBC accurately quantifies the non-Hermitian skin effects. The topological enhancement of non-normality governs the perturbation sensitivity of the non-Hermitian systems and the anomalous time-evolution dynamics.

17:20 : Invited talk
Resonance energy transfer near PT-symmetric and non-Hermitian multilayer systems
Fiodar Marozka[1], **Aliakasndr Arlouski**[2], **Alina Karabchevsky**[1], **Andrey Novitsky**[2]
[1] *Ben Gurion University (Israel),* [2] *Belarusian State University (Belarus)*

Non-Hermiticity provides a fascinating route for the control over nanophotonic phenomena. Here we study the resonant energy transfer (RET) between acceptor and donor molecules for optically thick PT-symmetric layers. We relate spectral and RET features, show stochastic-like behavior of exceptional point positions, and give insights into machine-learning optimization of RET.

17:40 : Invited talk
Non-Bloch band theory of photonic crystals
Kazuki Yokomizo[1], **Taiki Yoda**[2], **Yuto Ashida**[1], **Shuichi Murakami**[2]
[1] *The University of Tokyo (Japan),* [2] *Tokyo Institute of Technology (Japan)*

We study the non-Hermitian skin effect of photonic crystals by establishing the non-Bloch band theory, which allows us to calculate the continuum bands of the localized eigenmodes. We reveal the qualitative and quantitative properties of the skin modes in photonic crystals.

18:00 : Invited talk
Classifying topology in photonic crystal slabs despite their radiative environment
Stephan Wong[1], **Terry A. Loring**[2], **Alexander Cerjan**[1]
[1] *Sandia National Laboratories (USA),* [2] *University of New Mexico (USA)*

The spectral localizer is used to probe the topology in full-wave simulated photonic systems. Using a topological photonic crystal slab, we show the genuine topological protection where the radiative loss is taken into

account.

18:20 : Invited talk

Non-hermitian coupled modes controlled by the slot chirality in a parity-time symmetric waveguide pair

Alice De Corte[1], **Bjorn Maes**[1], **Henri Benisty**[2], **Mondher Besbes**[2]
[1] *University of Mons (Belgium),* [2] *Université Paris Saclay (France)*

Chiral materials inserted in the gap of PT-symmetric coupled dielectric waveguides induce a coupling of their non-Hermitian modes. The interplay of chirality-induced polarization-related anticrossing and exceptional points unveils a rich physics, featuring enhancement mechanisms such as slot geometries and providing unusual dispersion around exceptional points.

18:40 : Invited talk

Dual symmetry classification of non-Hermitian systems and point-gap topology

Zhiyu Jiang, Geonhwi Hwang, Hideaki Obuse
Hokkaido University (Japan)

Since there is no distinct difference in mathematical definitions for Hamiltonians and time-evolution operators in non-Hermitian systems, we show that the systems can be always classified by two ways. We demonstrate this for point-gap topology of quantum walks. We also explain the bulk-edge correspondence for point-gap topology in junction systems.

Wednesday 17th July, 2024

08:30 - 10:15 — Main Hall

Session 2A1

Plenary Session II

Chaired by: Ortwin Hess

08:30 : Plenary talk
Active Metasurfaces in Space and Time
Harry Atwater
California Institute of Technology (USA)

In this talk, I will discuss metasurfaces with high quality factor, local, resonant elements capable of two-dimensional phase gradient generation, in both passive and active metasurface designs. I will also describe active metasurfaces with both spatial and temporal phase gradients, and an active metasurface as a lens-less imaging system, and compare the characteristics to conventional lens-coupled image sensors.

09:05 : Plenary talk
Shaping light propagation in complex media
Hui Cao
Yale University (USA)

By breaking the diffusion limit, we deliver optical energy into a target region of arbitrary size and shape anywhere inside a strong-scattering system. We further demonstrate an order of magnitude enhancement of remitted signals that carry information from deep inside a diffusive medium.

09:40 : Plenary talk
Topological dissipation in a time-multiplexed photonic resonator network and topological temporally mode-locked lasers
Franco Nori
RIKEN (Japan)

This talk provides an overview of recent results on topological dissipation in a time-multiplexed photonic resonator network, and topological temporally mode-locked lasers. A very brief summary will also be made of recent work on non-Abelian effects in dissipative photonic topological lattices.

Coffee Break

Session 2P1
Poster Session III
10:15 - 10:50

P1: MEMS-based double filter configuration for air gap sensing in tunable Fabry-Pérot filter
Pratyasha Sahani, S. Nabana, T. Okatani, N. Inomata, Y. Kanamori
Tohoku University (Japan)

We fabricate a device that configures the tunable air gap Fabry-Pérot filter with a static gradient thickness filter to estimate air gap dimension in tunable filter. The chip-level microelectromechanical integration of gradient thickness filter can serve the purpose of device miniaturization while performing air gap sensing in visible wavelength range.

P2: Metasurface-Driven Hyperspectral Video Camera and Real-Time Spectral Analysis applications
Arturo Burguete Lopez, Qizhou Wang, Maksim Makarenko, Andrea Fratalocchi

King Abdullah University of Science and Technology (Saudi Arabia)

We present a hardware-accelerated hyperspectral video camera that employs a metasurface for real-time spectral analysis. The metasurface implements artificial intelligence algorithms, enabling video-rate assessment of object properties inaccessible to traditional cameras. We show experimental results on the system's performance on spectrally enhanced segmentation and fruit ripeness level sensing.

P3: An Effective Medium Description for Cylinder- and Coated-cylinder- Multifunctional Metamaterials

Anna Tasolamprou[1], Charalampros Mavidis[2], Maria Kafesaki[2]
[1] *University of Athens (Greece),* [2] *Foundation for Research and Technology Hellas (Greece)*

We present an effective medium approach for the study of metamaterials made of cylindrical scatterers/meta-atoms based on the Coherent Potential Approximation. We demonstrate the power of this approach and a rich metamaterial behaviour, including frequency regions of engineerable negative permittivity, negative permeability, negative refractive index and hyperbolic response.

P4: End-to-End Framework for Designing Broadband Achromatic Metalens in High-quality Long-infrared Imaging

Qizhou Wang[1], Daniele Veraldi[1], Arturo Burguete-Lopez[1], Maksim Makarenko[2], Andrea Fratalocchi[1]
[1] *King Abdullah University of Science and Technology (Saudi Arabia),* [2] *Saudi Aramco (Saudi Arabia)*

This paper introduces an end-to-end design framework for constructing a broadband achromatic metalens, corrected across 5 equispaced frequencies within the long-wavelength infrared (LWIR) spectrum (8 μm to 12 μm). We combined nanophotonic hardware with computer-vision reconstruction networks, realizing a mean absolute error (MAE) of 0.035 over test dataset.

P5: Light-accelerated NiFe oxyhydroxides-alloy photoanode metasurfaces for efficient and stable solar water-splitting

Fei Xiang, Ning Li, Arturo Burguete-Lopez, Zhao He, Maxim Elizarov, Andrea Fratalocchi
King Abdullah University of Science and Technology (Saudi Arabia)

We report a light-accelerated NiFe oxyhydroxides-alloy metamaterial as a catalytic-protective layer on Si photoanodes for efficient and durable solar water splitting. This technique enables a record applied bias photon-to-current efficiency (ABPE) efficiency of 4.24 $\%$ in homojunction-free photoanodes. It extends the device's lifetime to beyond 250 hours.

P6: Bismuth-based color generation devices : from traditional optical cavities to gap-surface plasmon metastructures

Fernando Chacon-Sanchez, Carlota Ruiz de Galarreta, Rosalia Serna
Instituto de Optica IO-CSIC (Spain)

We report the successful use of bismuth nanostructures for generating vivid structural colors through two distinct routes: traditional Fabry-Perot cavities and gap-surface plasmon metasurfaces. By exhaustively comparing computational and experimental results from each approach, we assess their suitability for both micro- and macro-coloring sustainable devices and its tunability potential.

P7: Investigating the charge carrier dynamics in an array of Split-H ladder (SHL) of Au on amorphous SiO2

Nikita Vashistha[1], R. Sharma[2], T. N. Narayanan[2], R. S. Singh[3], Mahesh Kumar Sharma[4]
[1] *Friedrich Schiller University Jena (Germany),* [2] *Tata Institute of Fundamental Research (India),* [3] *CSIR-National Physical Laboratory (India),* [4] *(India)*

This work investigated carrier dynamics in SHL-array on gold deposited on an amorphous SiO2 substrate. Each 140nmx220nm unit cell has a slit width of 260nm. The sample shows multiple resonance bands extending from visible to the NIR region and long-lived excited carriers due to structuring-induced changes in electron-phonon interaction.

P8: Small Microlens based on metasurface characterization using Quadriwave Lateral Shearing Interferometry

Martin Lepers[1], Alain Ostrovsky[1], Jerôme Vaillant[2], Samira Khadir[3], Jean-Yves Duboz[3]
[1] *STMicroelectronics (France),* [2] *CEA-Leti (France),* [3] *CRHEA (France)*

We have used Quadriwave Lateral Shearing Interferometry (QLSI) to precisely characterize the phase induced by metasurfaces on the incident light. The resulting wavefront analysis can be used to evaluate fabrication

quality and its impact on metasurface performance. We propose a method to correlate wavefront variations with process errors.

P9: Portable Hydrogen Sensing Enabled by Overlaid Holographic Metasurfaces andLiquid Crystal Integration
Dohyun Kang, Younghwan Yang, Junsuk Rho
POSTECH (Korea)

A commercially viable, portable hydrogen meta-sensor is introduced, integrating gas-responsive liquid crystal cells with two-by-two metasurface arrays. This innovation can identify hydrogen gas concentrations at four levels. Fabricated through cost-effective nanoimprinting methods, the metasurfaces make this gas meta-sensor promising for on-the-go sensing in diverse industrial applications.

P10: Dynamics and delocalized emissions of surface plasmon polaritons in one-dimensional plasmonic crystals
Izzah Machfuudzoh, Sotatsu Yanagimoto, Naoki Yamamoto, Takumi Sannomiya
Tokyo Institute of Technology (Japan)

Surface plasmon polaritons (SPPs) are vital in nanophotonics, yet local optical properties of SPP-based nanostructures remain underexplored due to their sub-wavelength field localization and propagating nature. Employing cathodoluminescence techniques, we investigate their interaction with plasmonic crystals, revealing distinctive dispersion patterns, further elucidated by SPP scattering dynamics through optical spot analysis.

P11: Unified Metasurfaces for Dynamic Beam Steering
Hsiu-Ping Su, Po-Sheng Huang, Pin Chieh Wu
National Cheng Kung University (Taiwan)

Research has demonstrated active control of beam deflection, yet it relies on multiple deflectors or complex integration with intricate circuitry. In this work, we introduce a metasurface to adjust the deflection angle by simply altering the position of incident light. This breakthrough holds promise for applications in LiDAR and AR/VR.

P12: Polarization- and direction-multiplexed vector holography based on asymmetric transmission of bi-layer metasurfaces and its application
Joonkyo Jung, Hyeonhee Kim, Jonghwa Shin
KAIST (Korea)

We investigate the potential of bi-layer metasurfaces for achieving full control of asymmetric transmission in optical systems. We demonstrate that the polarization- and direction-multiplexed vector holography can be achieved using bi-layer metasurfaces. With this approach, we also suggest a novel optical encryption algorithm.

P13: Plasmonic-enhanced Fabry-Perot cavity for photocatalysis application
Ning Lyu[1], Anjalie Edirisooriya[2], Zelio Fusco[2], Fiona Beck[2], Christin David[1]
[1] *Friedrich-Schiller-Universitat Jena (Germany),* [2] *Australian National University (Australia)*

In photocatalysis, selectivity in reaction pathways has a significant challenge. We concentrate on coupling nanoparticle on cavities to catalyzed N-demethylation reaction. This design, root in strong coupling, enables an active-control over light-driven photocatalysis through tailored configurations. Through the adjustment of cavity length, we have achieved a 7-fold enhancement in yield.

P14: Metamaterial Range Extended And Field localized Parity-Time Symmetrical Wireless Power Transfer System
Abdulrahman Mohammed Alsaadi, Inki Kim
Sungkyunkwan University (Korea)

Conventional wireless power systems are limited in range, efficiency, and robustness. Our system provides, extended-range power transfer using the physics of parity-time symmetry and metamaterials, increasing transfer efficiency stability against distance fluctuations with the ability to localize the power from a larger transmitter to a smaller size receiver.

P15: High Diffraction Efficiency Top-hat Beam Shaper Metasurface for Fluorescence Observation
Tomoki Shimatani[1], Li Jie[2], Ryota Yamada[1], Satoshi Ikezawa[3], Kentaro Iwami[1]

[1] *Tokyo University of Agriculture and Technology (Japan),* [2] *R&D Technology Center, Tamron Co., Ltd. (Japan),* [3] *Waseda University (Japan)*

We developed a Gaussian-to-top-hat metasurface beam shaper for spherical incident waves. Using dielectric pillar meta-atoms made of a-Si, a uniform intensity distribution of $\pm 9.31\,\%$RMS and absolute diffraction efficiency of $72.1\,\%$ were obtained. Fluorescent imaging was demonstrated using the fabricated metasurface.

P16: Artificial neural networks-based on-demand inverse design for 3D chiral metamaterials

Jehyeon Shin, Jeonghoon Park, Jaebum Noh, Junsuk Rho
POSTECH (Korea)

The bandgap properties of chiral metamaterials can be used to inhibit wave modes in physical beams. We use the inverse neural network to get chiral structures that have bandgap requirements by adjusting the range of maximal stress. This approach allows for building metamaterials while adjusting physical characteristics as intended.

P17: Microlaser with topologically protected light distribution based on a 3D Soft-Matter-Based Photonic Crystal

Eva Oton[1], Marcin Muszyński[2], Przemysław Morawiak[1], Piotr Kapuściński[2], Przemysław Oliwa[2], Maria Popławska[2], Jacek Szczytko[2], Wiktor Piecek[1]
[1] *Military University of Technology (Poland),* [2] *University of Warsaw (Poland)*

We report a newly observed, topological lasing from a 3D soft photonic crystal. Directional lasing with circular polarization and emitted from a custom-made microcavity was observed in the reciprocal space.

P18: 3D Soft Photonic Crystal Photoswitch between Cubic Lattices

Eva Oton[1], Martin Cigl[2], Przemyslaw Morawiak[1], Sergei Mironov[2], Alexej Bubnov[2], Wiktor Piecek[1]
[1] *Military University of Technology (Poland),* [2] *Czech Academy of Sciences (Czech Republic)*

An all-optical switchable 3D soft photonic crystal was demonstrated. Two photomodulated systems were prepared: a photoswitch changing from cubic lattice BCC to SC, and shutter from BCC to isotropic medium. Both can switch between states by swapping the illumination source and without loss of monocrystallinity of the soft photonic crystals.

P19: Polarization-selective metalens for varifocal imaging system

Hyeonsu Heo, Gyeongtae Kim, Hongyoon Kim, Dongmin Jeon, Junsuk Rho
POSTECH (Korea)

Achieving compact varifocal imaging system is significant topic for various practical applications. We introduce a multifocal metalens enabling focal length adjustment through incident polarization variation, targeting AR/VR applications. We analyze multifocal design platform with various lens parameters and explore alternative methods for increasing the focal points.

P20: High-Index Atomic Layer-Nanoparticle Embedded-Resin Hybrid Metasurfaces for High-Performance Visible Metaphotonics

Dohyun Kang, Minseok Choi, Hyunjung Kang, Junsuk Rho
POSTECH (Korea)

High-index atomic layer-nanoparticle embedded-resin hybrid metasurfaces are introduced as cost-effective and high-throughput method for high-performance visible metasurfaces. With theoretical $93.7\,\%$ conversion efficiency at 450 nm, featuring 3 nm titanium dioxide layer, 600 nm height, and 6.6 aspect ratio, these hybrids are poised for commercial adoption, potentially replacing traditional optical components.

P21: Flat optics light harvesting in large-area TMDs films for photoconversion and photochemical applications

Giulio Ferrando, Matteo Gardella, Giorgio Zambito, Francesco Bisio, Matteo Barelli, Maria Caterina Giordano, Francesco Buatier De Mongeot
University of Genoa (Italy)

Two-dimensional Transition Metal Dichalcogenide semiconductors (2D-TMDs) show potential for optoelectronics and photon-to-energy conversion. Moreover, by combining different TMDs layers into van der Waals heterostructures, their optoelectronic response can be engineered further. This work introduces large-area flat optics light harvesting and growth methods to maximize their potential.

P22: Lattice resonances in multipartite periodic arrays with electric and magnetic response
Juan R. Deop-Ruano[1], Juan J. Alvarez-Serrano[1], Luis Cerdan[2], Vincenzo Aglieri[3], Andrea Toma[3], Alejandro Manjavacas[1]
[1] *Instituto de Optica (IO-CSIC) (Spain),* [2] *Instituto de Quimica Fisica (IQF-CSIC) (Spain),* [3] *Istituto Italiano di Tecnologia (Italy)*

Arrays with multipartite unit cells can be engineered to support lattice resonances with exceptional properties. Here, we show the excitation of out-of-plane lattice resonances at normal incidence in a bipartite array of metallic nanostructures. Furthermore, we analyze a metallo-dielectric array exhibiting a lattice resonance with perfect absorption.

P23: Large Field-of-View Near-Infrared Imaging based on Telecentric Metaoptics
Wei-Lun Hsu[1], Qiu-Chun Zeng[1], Chen-Yi Yu[1], Yen-Chun Chen[1], Yi-Fan Chen[1], Che-Chin Chen[2], Chih-Ming Wang[1]
[1] *National Central University (Taiwan),* [2] *Taiwan Instrument Research Institute (Taiwan)*

In this work, we demonstrate a telecentric-based metalens operating at a wavelength of 940 nm, providing a high-quality focal spot at viewing angles from 0° to 60°. Due to the maximum aspect ratio of the meta-atom being only 4, this metalens is relatively easy to be fabricated.

P24: Exploring Wave Phenomena in Quasicrystal-Based Photonic Structures
Mikhail Rybin
ITMO University (Russia)

Quasicrystal-based photonic structures offer unique design flexibility due to their aperiodic nature, allowing for novel wave phenomena. This article reviews our recent reports on such structures, focusing on intrinsic light localization, photonic bandgap formation, and selective absorption of electromagnetic radiation, showcasing the potential of quasicrystals in photonics.

P25: Super-resolution elasticity imaging with nanobells
Rafael Fuentes Dominguez[1], Marina Paris Ogayar[2], Kerry Setchfield[1], Richard Smith[1], Daniel Jaque[2], Matt Clark[3]
[1] *University of Nottingham (United Kingdom),* [2] *Autonomous University of Madrid (Spain),* [3] *University of Nottingham (University of Nottingham)*

We present a new scheme of super-resolution imaging that can reconstruct the size, shape, position and orientation of metallic nanostructures with a precision of 5 nm, using a pump-probe method technique. This also opens a way to extract the elasticity or stiffness of the surrounding environment at the nanoscale.

P26: Nanopatterning of Nitride Nanostructures for Optoelectronic Applications
Sudarshana Patra, Uttam Manna, Mahua Biswas
Illinois State University (USA)

In this work, we show the fabrication process of the aluminum nitride (AlN) nanostructure pattern, an attractive material for optoelectronic device research, such as for photodetectors and light-emitting diodes (LEDs) by utilizing a low-temperature, substrate independent and selective deposition method called sequential Infiltration synthesis (SIS).

P27: 3D Inkjet Printing for the Manufacture of Micron-to-Millimeter-Scale Metamaterial Structures
Oliver Nelson Dummett, Lyudmila Turyanska, Richard Hague, Christopher Tuck
University of Nottingham (United Kingdom)

We demonstrate additive manufacturing of complex 3D geometries using inkjet deposition of silver nanoparticles and other materials. We produce 3D lattice structures as well as unsupported overhangs, which can be encapsulated in various materials to enhance the dielectric contrast and create floating elements with a view to create metamaterials.

P28: Subwavelength-Scale Variability Impact on Hypersonic 1-D Phononic and Photonic Crystals
Omid Reza Ranjbar-Naeini[1], Gloria Conte[1], Jouni Ahopelto[2], Clivia Marfa Sotomayor Torres[1]
[1] *Nanophononics Group (Portugal),* [2] *VTT Technical Research Centre of Finland Ltd. (Finland)*

Slight variations in the critical dimensions of fabricated nano-opto-electro-mechanical systems (NOEMS) impact their performance by affecting the band gaps and dispersion relation. We study the effect of variability, using COMSOL simulations, on 1-dimensional hypersonic phononic and photonic crystals at telecom wave-

length designed to operate at a mechanical frequency of 2GHz.

P29: Flexible Metasurface as an Efficient Resonator for 7T MRI
Santosh Maurya, Eiska Tegareh, Rita Schmidt
Weizmann Institute of Science (Israel)

We proposed a flexible and cost-effective metasurface design based on maze-like geometry of concentric split ring resonators (SRRs) for ultra-high field 7T human MRI. This design not only lowered the resonant frequency but also increased the RF field efficiency by x1.5-2 folds. This have been demonstrated both numerically and experimentally.

P30: Generation of orbital angular momentum by optical non-Hermitian skin effect in mirror-time symmetric media
Issei Takeda[1], Taiki Yoda[1], Yuto Moritake[1], Kenta Takata[2], Masaya Notomi[1]
[1] *Tokyo Institute of Technology (Japan),* [2] *NTT Nanophotonics Center (Japan)*

In this study, we investigate propagation states of two-dimensional optical non-Hermitian skin effect in closed mirror-time (MT)-symmetric media and have found that skin modes rotating around the edges of the system can be realized and orbital angular momentum is generated, especially in rectangular cavities with MT-symmetric medium.

P31: Technology of auxetic-structured substrate for skin attachable conformal sensor
Jae-Hwan Lee[1], Tae-Gyong Kim[1], Jun-Sang Lee[2], Seung-Kyun Kang[1]
[1] *Seoul National University (Korea),* [2] *Purdue University (Korea)*

This study introduces a novel method to design a substrate with customizable Poisson's ratio using hybrid re-entrant structures and finite element analysis for evaluation and analysis of the strain-dependent Poisson's ratio of substrates. The substrate matches skin's Poisson's ratio across different strains, enabling tailored sensor substrates for various skin areas.

P32: Plasmonic anisotropy of metallic nanoparticles induced by uniaxially-stretched graphene substrates
Chihiro Yamano, Shin-nosuke Ozeki, Ryo Kato, Takuo Tanaka, Taka-Aki Yano
Tokushima University (Japan)

Precise control of localized surface plasmon resonance (LSPR) wavelengths has been highly demanded for the practical use of metallic nanostructures in various nanophotonic devices. In this study, we demonstrated anisotropic control of the LSPR wavelengths of gold nanoparticles on a graphene substrate, achieved by uniaxially stretching the graphene.

10:50 - 12:40 — Main Hall

Session 2A2

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Koichi Okamoto

10:50 : Keynote talk
Extreme Space-Time Optics & Quantum Meta-Photonics
Vladimir M. Shalaev
Purdue University (USA)

We discuss all-optical modulation with single photons using electron avalanche, resulting in record-high nonlinearities. Then we show that transparent conducting oxides (TCOs) operating in the near-zero index regime can provide strong single-cycle modulation, enabling novel photonic time crystals. Finally, we discuss scalable quantum photonics with single-photon emitters in silicon nitride.

11:20 : Invited talk
Organic epsilon-near-zero and hyperbolic dispersion optical films
Jeong Weon Wu
Ewha Womans University (Korea)

Organic thin films presenting a lamellar structure exhibit hyperbolic dispersion with epsilon-near-zero. Polymethine character is associated with ENZ behavior of molecular film.Directive emission and photoluminescence lifetime are controlled by organic ENZ film. Optical Kerr nonlinearity of a polymethine thin film are strongly enhanced in the ENZ spectralregion.

11:40 : Invited talk
Highly damped plasmonic and ferromagnetic metamaterials for wireless opto-magnetic actuation and detection
Aritz Lafuente[1], Arnon Fluksman[2], Alejandro G. Roca[1], Ofra Benny[2], Josep Nogues[1], Mar Alvarez[3], Borja Sepulveda[3]
[1] *Catalan Institute of Nanoscience and Nanotechnology (Spain),* [2] *The Hebrew University of Jerusalem (Israel),* [3] *IMB-CNM, CSIC (Spain)*

Highly damped plasmonic and ferromagnetic metamaterials exhibit highly efficient broadband light absorption, minimal scattering and strong magnetic actuation capabilities. Here we show how this combination can be applied to develop: (i) wirelessly soft opto-magnetic actuators and detectors and (ii) locally amplified nanotherapies enabling tumor eradication at ultra-low drug concentrations.

12:00 : Invited talk
Deep ultraviolet meta-emitter boosted by bound states in the continuum
Omar A. M. Abdelraouf, Aravind P. Anthur, Xiao Renshaw Wang, Qi Jie Wang, Hong Liu
*A*STAR (Singapore)*

We demonstrated a crystalline silicon (c-Si) metasurface simultaneously exciting bound states in the continuum (BICs) resonance at the near-infrared wavelength and a plasmonic resonance at the DUV regime to enhance third harmonic generation (THG). We achieved a THG power of 14.5 nW under a peak power density of 15 GW/cm2.

12:20 : Invited talk
Tailoring THz radiation pattern through intrapulse and interpulse difference-frequency generation at the nanoscale: modeling and perspectives
Unai Arregui Leon[1], Luca Carletti[2], Davide Rocco[2], Costantino De Angelis[2], Giuseppe Della Valle[1]
[1] *Politecnico di Milano (Italy),* [2] *University of Brescia (Italy)*

All-dielectric nanoantennas and metasurfaces unlock the possibility to engineer the directionality of electromagnetic fields owing to the interference between multipolar resonances. We exploit this concept in the framework of NIR-to-THz conversion from flat-optics elements and analyze the role of pump's degrees-of-freedom in the intrapulse and interpulse schemes for difference-frequency generation.

10:50 - 12:40 — Room 201

Session 2A3

SP11. Chiro-optical and chiral-acoustic phenomena

Organized by: Alessandro Belardini and Oliver Wright

Chaired by: Daniel Torrent Marti

10:50 : Invited talk
Towards chiral phononic modes in silicon
Clivia M. Sotomayor Torres[1], O. Florez[2]
[1] *International Iberian Nanotechnology Laboratory (Portugal),* [2] *Catalan Institute of Nanoscience and Nanotechnology (Spain)*

We present simulations of phononic crystals supporting interface modes in the GHz range, which are treated as waveguides. Under certain conditions chiral phononic modes are predicted. The sensitivity to critical dimensions variability is discussed.

11:10 : Invited talk
Tunable spiraling metamaterial as a platform for controlling sound waves, electromagnetic waves, and enhancing optomechanical coupling
Osama Bilal
University of Connecticut (USA)

In this work, we present a dynamic platform for designing phononic and photonic materials utilizing a periodic tessellation of Archimedean spirals. Such tessellations are capable of opening band gaps for both sound and electromagnetic waves and enhancing opto-mechanical coupling.

11:30 : Invited talk
Fourier-based band structure computation for quasicrystalline media
Marc Martí-Sabaté[1], Matheus I. N. Rosa[2], Sebastien Guenneau[1], Daniel Torrent[3]
[1] *Imperial College London (United Kingdom),* [2] *ETH Zurich (Switzerland),* [3] *Universitat Jaume I (Spain)*

This presentation introduces a novel method for computing the band structure of nonperiodic crystals using Fourier-based techniques and plane wave expansion. It discusses applications to Moiré lattices, cut-and-project quasicrystals, and incommensurable modulated crystals. The method is broadly applicable to wave systems like photonic, acoustic, and phononic quasicrystals.

11:50 : Invited talk
Acoustic Spin and Phonon Spin
Jie Ren
Tongji University (China)

Spin angular momentum is an inherent property of classical waves. It was believed that only circularly polarized transverse waves carry spin, while longitudinal waves lack spin structures. However, recent progress has challenged this understanding. Here, I'll share recent progress on acoustic and phonon spin, along with spin related chiral phenomena.

12:10 : Keynote talk
Elastic spin angular momentum in metamaterials and classical structures
Jinfeng Zhao, Yao Huang, Yuxuan Zhang, Yongdong Pan
Tongji University (China)

Topological phenomena of bosonic-like waves have attracted wide interests during the last few years. Spin angular momentum (SAM) provides new insights from the local point of view. Here, we experimentally investigate SAM in metamaterials and classical structures. Multi-dimensional wave routing is achieved due to the SAM-wavenumber locking mechanism.

10:50 - 12:40 — Room 202

Session 2A4

Symposium III: Advanced passive and active metasurfaces and zero-index materials

Organized by: Howard Lee, Pin Chieh Wu and Qinghua Song

Chaired by: Howard Lee

10:50 : Invited talk
Subradiant plasmonic cavities make bright polariton states dark
J. E. Yim[1], Z. T. Brawley[1], Matthew T. Sheldon[2]
[1] *Texas A&M University (USA),* [2] *University of California (USA)*

We demonstrate that nanostructured plasmonic metasurfaces, which create dark subradiant cavities, can strongly couple with molecular vibrations to produce both detectable bright molecular states and typically undetectable dark polariton states, a reverse of the usual findings in similar experiments using bright cavities.

11:10 : Invited talk
Nanoscale Extended Chirality Density Enhanced by Plasmonic Nanoresonator
Hanwei Wang, Yulei Shen, Gayatri Chandran, Yang Zhao
University of Illinois Urbana Champaign (USA)

Chirality is essential in physical, chemical, and biological processes, playing a critical role in disease formation and drug synthesis. While metasurfaces enhance chirality detection, they often introduce significant background. This talk will address these challenges and introduce new design principles to improve the signal-to-noise ratio for more effective chirality detection.

11:30 : Keynote talk
Silicon carbide as a platform for mid-IR metasurfaces
Stefan Maier
Monasu University (Australia)

Silicon carbide enables strongly confined surface phonon-polaritons in the mid-infrared. We demonstrate the use of this materials platform for phonon-polariton metasurfaces supporting vortex and quasi bound-states-in-the-continuum resonances. Additionally we present results of active metasurfaces operating in the visible regime based on conductive polymers.

12:00 : Invited talk
Three-dimensional co-axial double cylinder metasurface for high-sensitive gas molecular sensing
Takuo Tanaka
Tokushima University (Japan)

An ultra-sensitive infrared spectroscopic gas detection technique enhanced by a three-dimensional (3D) metasurface is proposed. A 3D co-axial double-cylinder structure is introduced as the unit structure of the metasurface. Owing to its strong resonant absorption, unwanted background in IR spectroscopy are suppressed, and the signal-to-background ratios has been improved.

12:20 : Invited talk
Controlling Far-Field Radiation with Photoluminescent and Incandescent Metasurfaces
Anne Nguyen, Elise Bailly, Jean-Paul Hugonin, Jean-Jacques Greffet, Benjamin Vest
Institut d'Optique (France)

Intrinsically incoherent thermal or luminescent emitters can be coupled to metasurfaces to establish some coherence in emission and therefore to enable structuration of the emitted field. We present here light-emitting metasurfaces designed using a Kirchhoff's law approach demonstrating a controlled of the polarization state and angular radiation pattern.

10:50 - 12:45 — Room 203

Session 2A5

Symposium V: Architectured Elastic and Acoustic Metamaterials and Phononic Crystals

Organized by: Marco Miniaci, Jensen Li, Vicente Romero-García, Vincent Pagneux and Noé Jiménez

Chaired by: Vicente Romero-García

10:50 : Invited talk
Acoustic and Optic drills by dynamic high-order Bessel beam mixing
Kestutis Staliūnas[1], Gabrielius Kontenis[2], Noe Jimenéz[3]
[1] *ICREA (Spain),* [2] *Vilnius University (Lithuania),* [3] *Universitat Politècnica de València (Spain)*

We demonstrate experimentally dynamical acoustic and optical “drill” beams, presenting nonstationary intensity distributions that resemble the spinning mechanical drill. The drills appear as the spatiotemporal interference of two Bessel-vortex beams of different topological charges and different carrier frequencies. We explore material processing with such drills.

11:10 : Fast Quasiadiabatic Driving with 2D Optimization in Elastic Waveguides
Dong Liu, Yiran Hao, Jensen Li
Hong Kong University of Science and Technology (China)

We design a compact polarization rotator for elastic waveguides. To achieve maximum compactness, we employ a fast quasiadiabatic driving algorithm, optimizing the integration of adiabaticity parameter and making a uniform distribution of it. In both simulations and experiments, our designed device efficiently transfers power flow from one waveguide to another.

11:25 : Invited talk
Non-adiabatic phononic control of polariton Bose-Einstein condensates
Alexander Kuznetsov, Klaus Biermann, Paulo Ventura Santos
Paul-Drude-Institut fur Festkörperelektronik (Germany)

Phononic resonators based on high-frequency surface acoustic waves are employed for the non-adiabatic modulation of Bose-Einstein condensates (BECs) of microcavity polariton. The long temporal coherence of the BECs and the efficient modulation by the SAW enables us to reach a novel regime of temporal coherence controlled by the phononic amplitude.

11:45 : Invited talk
Mechanical tuning of topological waveguiding in auxetic metamaterial
Federico Bosia[1], Giorgio Carta[2], Maryam Morvaridi[1], Vinicius Fonseca Dal Poggetto[3], Antonio Gliozzi[1], Charles Croenne[3], Marco Miniaci[3], Nicola Pugno[4], Michele Brun[2]
[1] *Politecnico di Torino (Italy),* [2] *University of Cagliari (Italy),* [3] *Université Lille (France),* [4] *University of Trento (Italy)*

We control topologically protected states applying uniaxial prestrain in an auxetic metasurface, realized in a thin slab applying oriented cuts in a hexagonal lattice, where degeneracy is removed and topological band gaps opened by reducing the cut lengths. Scatter-free propagation can then be manipulated with the application of prestrain.

12:05 : Invited talk
Ultrasonic Hologram for Bi-directional Diffusion by Phase Controlling the Scattering Coefficients
Eric Ballestero[1], Josep Rodríguez-Sendra[2], Jean-Philippe Groby[1], Noé Jiménez[2], Vicent Romero Garcia[2]
[1] *Université du Mans (France),* [2] *Universitat Politècnica de València (Spain)*

We report an ultrasonic hologram based on Quadratic Residue sequences encoded with resonant building blocks behaving as an ideal Lambertian scatterer from both sides, with spatial autocorrelation coefficients d=0.7 each one, therefore diffusing waves in both transmission and reflection.

12:25 : Invited talk
X-ray Transient Gratings: Access to Nanoscale Acoustics, Magnonics, and More
Keith A. Nelson
MIT (USA)

Transient grating (TG) measurements exploit interference between crossed excitation pulses to define a spatial period, and corresponding wavevector, for thermoelastic and other time-dependent dynamics that are measured. The TG method has been extended to extreme UV and hard x-ray spectral ranges, accessing nanometer periods for acoustic waves, thermal transport, magnons, and other high-wavevector responses. Recent results will be reviewed. Nondestructive excitation of nonlinear acoustic/shock waves will also be discussed.

10:50 - 12:30 — Room 204

Session 2A6

Symposium I: Hybrid Nanomaterials and Metastructures for Photonics, Sensing and Energy

Organized by: Jérôme Plain, Alexander Govorov, Davy Gérard and Pedro Hernandez Martinez

Chaired by: Davy Gérard

10:50 : Invited talk

Quasi-2D Colloidal Quantum Wells for High Optical Gain and High LED Efficiency

Farzan Shabani, Furkan Isik, Savaş Delikanli, Hilmi Volkan Demir
Bilkent University (Turkey)

Colloidal quantum wells (CQWs) are shown to possess exceptionally high performance as the gain medium and active layer in the LEDs. The CQWs exhibit a record-breaking gain coefficient of 140,000 cm-1 with a lasing threshold of 8 μJ cm-2 and an ultra-high external quantum efficiency of 18.1 $\%$ for CQWs-LEDs.

11:10 : Invited talk

Recent challenges in hybrid plasmonic nano-emitters

Minyu Chen[1], Sylvie Marguet[2], Ali Issa[1], Safi Jradi[1], christophe Couteau[1], Celine Fiorini[2], Ludovic Douillard[2], Olivier Soppera[3], Jerome Plain[1], Tao Xu[4], Bin Wei[4], Renaud Bachelot[1]
[1] *University of Technology of Troyes (France),* [2] *Université Paris Saclay (France),* [3] *Université de Haute Alsace (France),* [4] *Shanghai University (China)*

The development of hybrid plasmonic nanosources of light require the control of the spatial distribution of the active medium in the vicinity of metallic nanoparticles. An approach used to take up this challenge is based on plasmonic photopolymerization. In particular, the spatial symmetry can be controlled at the nanoscale.

11:30 : Invited talk

Tracing temporal plasmonics with direct field sampling

Holger Lange[1], Kai-Fu Wong[1], Andreas Knorr[2], Francesca Calegari[1], Matthias Kling[3]
[1] *The Hamburg Centre for Ultrafast Imaging (Germany),* [2] *TU Berlin (Germany),* [3] *Stanford PULSE Institute (USA)*

We present a direct sampling approach for localized surface plasmons in the petahertz domain, permitting to trace few-femtosecond transient fields in the visible spectral region. The experiment can be accompanied by single-digit femtosecond optical pump-probe spectroscopy to correlate plasmon damping and electron dynamics in the time domain.

11:50 : Invited talk

Determining the orientation of gold nanorods by means of polarimetric spectroscopy

P. Christian Simo, Annika Mildner, Dieter P. Kern, Monika Fleischer
University of Tuebingen (Germany)

We present a technique to acquire the azimuthal orientation of gold nanorods of various aspect ratios within just four measurements. Dark-field spectroscopy enables the extraction of the eigenmode line shape and phase shift information, which can be used in tandem with an analytical dipole model to determine the azimuthal orientations.

12:10 : Invited talk

Enhanced color down-shifting of colloidal quantum dots for high-resolution full-color displays

Son Tung Ha[1], Hadi Kareem Shamkhi Alnaeemah[1], Ramon Paniagua-Dominguez[1], Hilmi Volkan Demir[2], Arseniy Kuznetsov[1]
[1] *A*STAR (Singapore),* [2] *Nanyang Technological University (Singapore)*

High volumetric optical cavity is essential for high performance light-emitting devices where absolute absorption is necessary. In this talk, I will present several design concepts of dielectric resonant nanostructures to enhance the fluorescent down-shifting proccess of colloidal quantum dots for applications in high-resolution full-color displays.

10:50 - 12:30 — Conference Room

Session 2A7

SP10. Advanced Computational Electromagnetics for the Analysis and Design of Nanophotonic Devices

Organized by: Maha Ben Rhouma

Chaired by: Costantino De Angelis

10:50 : Invited talk
Quantum Effects in Plasmonic/Nonlinear Meta-Surfaces: Development and Applications of Maxwell-TDDFT Method
Takashi Takeuchi[1], **Mitsuharu Uemoto**[2], **Kazuhiro Yabana**[3]
[1] *RIKEN (Japan),* [2] *Kobe University (Japan),* [3] *University of Tsukuba (Japan)*

We develop a computational method coupling time-dependent density functional theory for electron dynamics and Maxwell equations for light propagation. We apply the method for various nonlinear and/or nonlocal optical phenomena where quantum electronic motion is significant, including plasmonic and semiconductor meta-surfaces.

11:10 : Invited talk
Computing free-electrons Kerr nonlinearities in semiconductor plasmonic systems
Cristian Ciraci, Huatian Hu
Istituto Italiano di Tecnologia (Italy)

We present a time-domain numerical approach based on finite-elements to solve hydrodynamic equations for free-electrons and demonstrate giant free-electron Kerr nonlinearities supported by the longitudinal bulk plasmon mode in heavily doped semiconductors.

11:30 : Invited talk
Is photonic band topology rare or common?
Thomas Christensen
Technical University of Denmark (Denmark)

Overall, rather common. Although intensely researched for more than a decade, it remains unclear whether photonic crystal band topology is a rare or common feature. I will present our answers, obtained from statistical analysis of high-throughput symmetry-based calculations in two-dimensional photonic crystals, and spanning stable, fragile, and high-order band topology.

11:50 : Invited talk
THz Plasmonic Detectors Based on Field-Effect Transistors with Metallic Diffraction Grating Metasurfaces
Akira Satou, T. Otsuji
Tohoku University (Japan)

We review our recent experimental and numerical studies on terahertz (THz) plasmonic detectors based on field-effect transistors with metallic diffraction grating metasurface structures for fast, ultra-sensitive, and room-temperature-operating THz detection.

12:10 : Invited talk
Advancing Nano- and Quantum Photonics with Machine Learning
B. Wilson, Y. Chen, V. Shalaev, A. Kildishev, Alexandra Boltasseva
Purdue University (USA)

We report on advancing machine-learning techniques for improving nanophotonics experiments and device designs with applications in thermophotovoltaics, reflective optics, and lightsail technology as well as for on-chip quantum photonic components and super-resolution imaging.

10:50 - 12:30 — Room 205

Session 2A8

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Michael Tobar

10:50 : Invited talk
Three-dimensional topological spin textures in chiral magnets
Jiadong Zang
University of New Hampshire (USA)

In this talk, I will discuss our recent attempts of generalizing topological spin textures in two-dimensions to those in three-dimensions.

11:10 : Invited talk
Photoacoustic spectroscopy and polarimetry spectroscopy for the chiro-optical characterization of nanostructures
Alessandro Belardini, Emilija Petronijevic, Claudia Skubisz, Concita Sibilia
Sapienza Universita di Roma (Italy)

Chiro-optical characterization at nanoscale can be performed by using different techniques. The most used ones are the spectral extinction measurements in transmission, or in reflection where samples on opaque substrate were used. In addition to these techniques, there are other less conventional ones such as photoacoustic spectroscopy and spectral polarimetry.

11:30 : Invited talk
Screw dislocations in chiral magnets
Maria Azhar[1], **S. C. Shaju**[1], **V. P. Kravchuk**[2], **M. Garst**[3], **K. Everschor-Sitte**[1]
[1] *University of Duisburg-Essen (Germany),* [2] *Leibniz-Institut fur Festkörper- und Werkstoffforschung (Germany),* [3] *Karlsruhe Institute of Technology (Germany)*

We report the micromagnetic structure of screw dislocation line defects, within the 1-dimensional periodic spiral magnetic order in cubic chiral magnets. Using analytical and numerical techniques we show that the far field of these dislocations has the universal form found in general for lamellar order, with a non-trivial core structure.

11:50 : Invited talk
Pseudomagnetic fields in photonic crystals with synthetic strain: Observation of Landau levels and chiral edge states
René Barczyk[1], **L. Kuipers**[2], **Ewold Verhagen**[1]
[1] *AMOLF (The Netherlands),* [2] *Delft University of Technology (The Netherlands)*

We experimentally demonstrate pseudomagnetic fields in photonic crystals with engineered synthetic strain, and investigate the resulting photonic Landau-levels and novel guided chiral edge states. This offers a design paradigm for optical confinement, radiation, and light-matter interaction.

12:10 : Invited talk
Control of high harmonic generation and photo current in graphene by tuning laser polarization and combing two laser fields
Masahiro Sato, Minoru Kanega
Chiba University (Japan)

We theoretically study laser-driven high harmonic generation (HHG) and zeroth-order harmonics (photo-induced DC current) in graphene. It is shown that the HHG spectrum and photo current can be controlled by changing the laser polarization and the laser-field trajectory with two laser mixture.

10:50 - 12:30 — Room 206

Session 2A9

SP23. Nano-optical imaging and spectroscopy

Organized by: Takumi Sannomiya

Chaired by: Takumi Sannomiya

10:50 : Invited talk
Light-matter interaction probed by cathodoluminescence spectroscopy
Fatemeh Chahshouri, Masoud Taleb, Maximilian Black, Nahid Talebi
Kiel University (Germany)

We show how electron beams can be used to study nanooptical excitations of van der Waals materials and group III nitride heterostructures. In addition, we present methods for coherently controlling the shape of free-electron wavepackets using nanooptical excitations.

11:10 : Invited talk
A plasmonic resonator array enhancing luminescence from a phosphor thin film studied by cathodoluminescence
Hikaru Saito, Yuichiro Kimura, Kentaro Matsuzaki, Kosuke Watanabe, Miki Inada, Takumi Sannomiya
Kyushu University (Japan)

Cathodoluminescence saturation imaging is proposed as a new approach to discriminate coherent and incoherent emissions in phosphor-resonator systems. This method was applied to an integrated system of a Zn2SiO4 phosphor film and a plasmonic resonator array, successfully visualized plasmon-enhanced luminescence at the nanoscale.

11:30 : Invited talk
New insights into optical property characterization of 2D semiconductor materials through time-correlated photon/electron spectroscopies
Florian Castioni[1], Yves Auad[1], Nadezda Varkentina[1], Alissa Freilinger[1], Steffi Woo[1], Noémie Bonnet[1], Jean-Denis Blazit[1], Xiaoyan Li[1], Marcel Tencé[1], Kenji Watanabe[2], Takashi Taniguchi[2], Odile Stéphan[1], Mathieu Kociak[1], Luiz Tizei[1]
[1] *Université Paris-Saclay (France),* [2] *National Institute for Materials Science (Japan)*

This contribution investigates the possibilities presented by the latest advancements in STEM techniques, specifically focusing on electron-photon time-correlations. Utilizing techniques such as CLE and EEGS, the objective is to gain deeper insights into the optical characteristics of model systems like TMD 2D semiconductors at the nanometer scale.

11:50 : Invited talk
Femtosecond time-resolved microscopy for spatio-temporal characterization of structured surface plasmon polariton wave packets
Atsushi Kubo
University of Tsukuba (Japan)

Recent studies of structured light (SL) have generated various optical fields with internal structures of energy flow density and angular momentum. The surface-wave correspondence of SL, structured surface plasmon polaritons (SPPs), can also be formed. We investigate the generation and visualization of structured SPPs using femtosecond time-resolved microscopy methods.

12:10 : Invited talk
Single-molecule photonics with scanning tunneling microscopy: nanospectroscopy and beyond
Hiroshi Imada
RIKEN (Japan)

The study introduces a novel single-molecule nanospectroscopy technique combining scanning tunneling microscopy and near-field optics, enabling precise investigation of molecular excited states and energy conversions at the submolecular level. This approach overcomes previous limitations in optical spectroscopy,

offering new insights into organic material functions.

10:50 - 11:45 — Room 101

Session 2A10

SP8. Strong light-matter interactions in plasmonic/dielectric metasurfaces

Organized by: Shunsuke Murai and Shaojun Wang

Chaired by: Shunsuke Murai and Biqiang Jiang

10:50 : Invited talk
Multi-wavelength single-mode plasmonic nanolasing in an H-shape cavity
Fajun Xiao
Northwestern Polytechnical University (China)

A multi-wavelength plasmonic nanolaser has been demonstrated by inserting InGaAs/GaAs nanowires into an n H-shape cavity. The nanolaser shows a low threshold at room temperature benefited from the enhanced energy transfer between excitons and standing plasmon waves. Our design may open up exciting prospects for ultra-compact photonic integrated circuits and biochemical sensing.

11:10 : Long-range super-Planckian heat transfer between nano-emitters in a resonant cavity
Kiryl Asheichyk[1], Philippe Ben-Abdallah[2], Matthias Kruger[3], Riccardo Messina[2]
[1] *Belarusian State University (Belarus),* [2] *Université Paris-Saclay (France),* [3] *Georg-August-Universität (Germany)*

We study radiative heat transfer between two nano-emitters placed inside different types of closed cavities by means of a fluctuational-electrodynamics approach. We highlight a very sharp dependence of this transfer on cavity width and connect this to the matching between the material-induced resonance and the resonant modes of the cavity.

11:25 : Invited talk
Infrared photodetectors based on 2D heterostructures modulated by photogating
Jiong Yang, Chao Zhang, Bining Sheng, Xiaofeng Li
Soochow University (China)

Photodetectors based on 2D heterostructures can overcome bandgap limitations of individual 2D semiconductors and operate at long wavelengths. However, ultra-low interlayer absorptions result in weak photoresponsivity. Taking advantage of the photogating effect, infrared photodetectors based on 2D heterostructures are demonstrated to reach a photoresponsivity of 0.55 A/W at 1550 nm.

10:50 - 11:50 — Gallery

Session 2A11

SP21. Non-Hermitian Photonics: Topological, Disordered and Quantum systems

Organized by: Konstantinos Makris and Li Ge

Chaired by: Konstantinos Makris and Li Ge

10:50 : Invited talk
Topological control of OAM in photonic lattices
Zhigang Chen
Nankai University (China)

In this talk, I will present a few examples of our recent demonstrations on topological control and manipulation of OAM modes in photonic graphene-like structures, including topological singularity mapping that leads to stair-wise generation of OAM beams and topological protection of OAM transport.

11:10 : Invited talk
Sub-symmetry protected topological states
Ziteng Wang[1], Xiangdong Wang[1], Zhichan Hu[1], Domenico Bongiovanni[1], Dario Jukić[2], Liqin Tang[1], Daohong Song[1], Roberto Morandotti[3], Zhigang Chen[1], Hrvoje Buljan[2]
[1] *Nankai University (China),* [2] *University of Zagreb Faculty of Science (Croatia),* [3] *INRS-EMT (Canada)*

A hallmark of symmetry-protected topological phases are topological boundary states immune to perturbations respecting the protecting symmetry. We find that the boundary states are protected by so-called sub-symmetry. By precisely controlling symmetry-breaking in photonic lattices, we demonstrate such sub-symmetry protection of topological states.

11:30 : Invited talk
Non-Hermitian Many-body Landau-Zener Systems: Quantum Dynamics and Correlations
Avadh Saxena, Rajesh K. Malla, Julia Cen, Wilton J. M. Kort-Kamp
Los Alamos National Laboratory (USA)

We provide a framework to solve a diverse class of linearly driven non-Hermitian quantum systems. The anti-Hermitian couplings between the diabatic levels introduce non-Hermiticity. We find a conservation law which is unique to this class of models. The conservation law is related to a pair-production mechanism: dissociation of diatomic molecules.

11:50 - 12:30 — Gallery

Session 2A12

SP2. Machine learning for metamaterials and metasurfaces

Organized by: Willie Padilla

Chaired by: Willie Padilla

11:50 : Invited talk
Physics-informed inverse design of programmable metasurfaces
Yucheng Xu[1], Jiq-Qi Yang[1], Sheng Wang[1], Jingbo Wu[1], Caihong Zhang[1], De-Chuan Zhan[1], Willie Padilla[2], Biaobin Jin[1], Kebin Fan[1]
[1] *Nanjing University (China),* [2] *Duke University (USA)*

In this work, we proposed an efficient inverse design algorithm for a liquid-crystal based programmable metasurface through adding a physics layer, which is developed based on a modified coupled mode theory, into a residual neural work. We experimentally demonstrated an inversely designed programmable metasurface for beam steering application.

12:10 : Invited talk
Effective machine-learning approaches with reduced dimensionality for design and knowledge discovery in large-scale nanophotonic structures
Mahmoodreza Marzban, Mohammadreza Zandehshahvar, Mohammad R. Tavakol, Mohammad H. Javai, Ali Adibi
Georgia Tech (USA)

This talk is focused on reducing the complexity of machine-learning (ML) approaches for the design and knowledge discovery in large-scale nanophotonic structures based on combining manifold-learning approaches (for minimizing the dimensionality of the response and design spaces) with a novel appraoch for reducing the design parameters using spatial bases.

Lunch

12:30 - 14:00

14:00 - 15:00 — Main Hall

Session 2A13

Conference Tutorial I

14:00 : Tutorial
Topological Origin of Surface Maxwell Waves and Surface Acoustic Modes
Franco Nori
Riken (Japan)

Interfaces between optical media (including dielectrics, metals, negative-index materials) can support surface electromagnetic waves, which now play crucial roles in plasmonics, metamaterials, and nano-photonics. We have shown that surface Maxwell waves at interfaces between homogeneous isotropic media described by real permittivities and permeabilities have a topological origin explained by the bulk-boundary correspondence. We have also analyzed another type of classical waves: longitudinal acoustic waves corresponding to spinless phonons. We show that surface acoustic waves, which appear at interfaces between media with opposite-sign densities, can be explained by similar topological features and the bulk-boundary correspondence. However, in contrast to photons, the topological properties of sound waves originate from the non-Hermitian four-momentum operator in the Klein-Gordon representation of acoustic fields.

15:00 - 16:00 — Main Hall

Session 2A14

SP1. Bottom-up approaches, new fabrication routes and ENSEMBLE3

Organized by: Dorota Pawlak and Virginie Ponsinet

Chaired by: Dorota Pawlak and Virginie Ponsinet

15:00 : Invited talk
Beyond Singularities: New Frontiers in Centrosymmetric Gain-Enhanced MetalNanoparticles and Their Applications
Karen Caicedo[1], Milena Mora[1], Nicole Recalde[1], Maria Antonia Iatí[2], Rosalba Saija[3], Onofrio M. Maragò[2], Ashod Aradian[4], Melissa Infusino[1], Alessandro Veltri[1]
[1] *Universidad San Francisco de Quito (Ecuador),* [2] *CNR-IPCF (Italy),* [3] *Universita degli Studi di Messina (Italy),* [4] *Université de Bordeaux (France)*

In the dynamic field of nanophotonics, our research group explores the potential of centrosymmetric gain-enhanced metal nanoparticles. This presentation will highlight our most relevant theoretical predictions and practical applications, showcasing the versatility and impact of these nanoparticles in advancing nanophotonic technology.

15:20 : Invited talk
Femtosecond pulse shaping with semiconductor Huygens' metasurfaces
Katsuya Tanaka[1], D. Arslan[2], M. Weissflog[1], N. Geib[1], K. Gerold[2], A. Szeghalmi[2], M. Ziegler[3], F. Eilenberger[1], T. Pertsch[1], I. Staude[1]
[1] *Friedrich Schiller University Jena (Germany),* [2] *Fraunhofer Institute for Applied Optics and Precision Engi-*

neering IOF (Germany), [3] *Leibniz Institute of Photonic Technologies (Germany)*

Manipulating ultrashort laser pulses unlocks versatile applications in laser processing, quantum state encoding, ultrafast bio-chemical reactions, and optical communication. Our study demonstrates femtosecond-scale pulse shaping with silicon Huygens' metasurfaces, enabling control over pulse dynamics. Our experimental results align closely with simulations, underscoring precise pulse manipulation capabilities.

15:40 : Invited talk
Bottom-up fabricated metasurfaces with correlated disorder for the light management in solar cells
Prerak Dhawan[1], **Maria Gaudig**[2], **Peter Piechulla**[2], **Alexander Sprafke**[2], **Ralf Wehrspohn**[2], **Carsten Rockstuhl**[1]
[1] *Karlsruhe Institute of Technology (Germany),* [2] *Martin Luther University Halle-Wittenberg (Germany)*

The bottom-up fabrication of metasurfaces with correlated disorder on large surfaces permits excellent control over light propagation characteristics and unlocks applications in the context of light management in solar cells. This contribution comprehensively describes the design, fabrication, and characterization of such devices with increasing complexity.

14:00 - 16:10 — Room 201

Session 2A15

Symposium V: Architectured Elastic and Acoustic Metamaterials and Phononic Crystals

Organized by: Marco Miniaci, Jensen Li, Vicente Romero-García, Vincent Pagneux and Noé Jiménez

Chaired by: Vicente Romero-García

14:00 : Keynote talk
Metamaterials with architected instabilities
Davide Bigoni
University of Trento (Italy)

Homogenization is used for periodic elastic grids subject to axial prestress, to obtain equivalent elastic materials. The latter can be tailored to exhibit material instabilities driven by the microstructure of the grid and its level of prestress. Instabilities include shear band fromation and Hopf bifurcation, thus leading to odd elasticity.

14:30 : Invited talk
Harnessing topology and nonlinearity for advanced elastic wave control
Georgios Theocharis
LAUM-CNRS (France)

In this talk we will investigate structures for advanced control of elastic waves using concepts and tools from topological materials and nonlinear dynamics. This line of research has practical applications in the design of robust elastic wave devices and reconfiguration of flexible elastic materials.

14:50 : Invited talk
On the role of phase in nonreciprocal vibration transmission in passive and active phononic lattices
Ali Kogani, Jiuda Wu, Behrooz Yousefzadeh
Concordia University (Canada)

We highlight the contribution of phase to nonreciprocal vibration transmission in nonlinear (passive) and spatiotemporally modulated (active) phononic lattices of finite length. We showcase nonreciprocal response regimes characterized by equal energies transmitted in opposite directions. A nonreciprocal phase shift is the only contributor to breaking of reciprocity in this scenario.

15:10 : Invited talk
Advancements in Vibration Energy Harvesting through Metamaterials: Insights from the MetaVEH

Project
Andrea Colombi[1], **B. Zhao**[2], **R. Ardito**[3], **J. M. De Ponti**[3], **R. V. Craster**[4]
[1] *Zurich University of Applied Sciences (Switzerland),* [2] *ETH Zurich (Switzerland),* [3] *Politecnico di Milano (Italy),* [4] *Imperial College London (United Kingdom)*

MetaVEH project, funded by the EU, pioneers in metamaterials for efficient vibration energy harvesting, enhancing frequency bandwidth and energy conversion. Achievements promise sustainable, battery-free solutions for autonomous devices, marking significant strides in self-powered electronics and sustainable energy solutions.

15:30 : Invited talk
Experimental study of sonic velocity modulations and time interfaces in a controllable piezoelectric phononic crystal
Charles Croënne[1], **Sarah Tessier Brothelande**[1], **Florian Allein**[2], **Jérôme O. Vasseur**[3], **Bertrand Dubus**[1]
[1] *IEMN/CNRS (France),* [2] *IEMN/Junia (France),* [3] *IEMN/University of Lille (France)*

This communication concerns the experimental study of elastic wave propagation in a piezoelectric phononic crystal with controllable electrical conditions. The two control laws under study are (a) non-stop shifting conditions in the so-called sonic regime of modulation, and (b) global abrupt changes of conditions, i.e. time interfaces.

15:50 : Invited talk
Topological states in periodic and disordered elastic metabeams
Runcheng Cai[1], **Yabin Jin**[1], **Yan Pennec**[2], **Laurent Carpentier**[2], **Xiaoying Zhuang**[1], **Bahram Djafari Rouhani**[2]
[1] *Tongji University (China),* [2] *IEMN (France)*

We study theoretically topological interface states in periodic and disordered pillared elastic metabeams. Using band inversion symmetry, we obtain interface states and through their coupling achieve a robust Fano mechanical resonance. Then, we show multiple topological interface states in hyperuniform disordered pillared metabeams. Finally, we consider topological Anderson insulators.

14:00 - 15:50 — Room 202

Session 2A16

SP10. Advanced Computational Electromagnetics for the Analysis and Design of Nanophotonic Devices

Organized by: Maha Ben Rhouma

Chaired by: Cristian Ciraci

14:00 : Invited talk
Modelling and design of complex light matter interactions on the nanoscale
Lora Ramunno
University of Ottawa (Canada)

Computational electrodynamics is ubiquitous in nanophtonics modelling. I will describe our in-house electrodynamics software that goes beyond usual FDTD, in order to model complex light matter interactions on the nanoscale (including nonlinear and time-dependent materials) as well as our approach to the inverse design of complex light-matter interactions.

14:20 : Invited talk
Physics-based design of dielectric particle accelerators
Andrea Locatelli[1], **Roberta Palmeri**[2], **Nunzio Salerno**[3], **Giorgio Mauro**[4], **Giuseppe Torrisi**[4], **Gino Sorbello**[3], **Davide Rocco**[1]
[1] *University of Brescia (Italy),* [2] *University Mediterranea of Reggio Calabria (Italy),* [3] *University of Catania (Italy),* [4] *National Institute for Nuclear Physics (Italy)*

We illustrate a methodology for designing sub-relativistic dielectric accelerators. We focus on slot waveguides where an optimal taper can ensure particle-wave synchronicity and maximum energy gain. The optimization is carried out through a physics-based approach, which is validated by comparison with a downhill simplex method searching algorithm.

14:40 : Keynote talk
Intelligent Meta-lens for Imaging Underwater, Aerial and Land
X. Liu[1], M. K. Chen[1], T. Tanaka[2], Din Ping Tsai[1]
[1] *City University of Hong Kong (Hong Kong),* [2] *RIKEN (Japan)*

We have developed a series of intelligent meta-lens systems for underwater, land, and aerial imaging and sensing. We reported the design, fabrication, characterization, and applications of the monocular, binocular, and multilocular meta-lens.

15:10 : Invited talk
Quantifying Symmetry of Metasurfaces and Eigenmodes for Optimisation Design
Matthew Parry, Andrey Sukhorukov, Dragomir Neshev
Australian National University (Australia)

We demonstrate a novel technique to numerically quantify the symmetry of metasurface eigenmodes. We show its application to the optimization of a metasurface laser for multiple objectives such as enhancing pump absorption by four times relative to a Fabry-Perot cavity as well as controlling the mode dispersion.

15:30 : Invited talk
Design and simulation of a metalens-based eye-tracking system
Han-Hsiang (Michael) Cheng[1], Dan-Nha Huynh[2], Thibault Leportier[3], Jens Niegemann[3], Vlad Smagley[4], Erin Elliot[4], Allen Cheng[5]
[1] *Ansys Japan K.K. (Japan),* [2] *Ansys Germany GmbH (Germany),* [3] *Ansys Canada Ltd. (Canada),* [4] *Ansys Inc. (USA),* [5] *Ansys Taiwan (Taiwan)*

We present a computational workflow that integrates metalens design into the classical optical design process. Our approach encompasses the design of phase profiles, meta-atoms, and a full system-level simulation within a ray-tracing environment. As a practical application, design a metalens-based eye-tracking system, seamlessly embedded within a VR device.

14:00 - 16:00 — Room 203

Session 2A17

Symposium I: Hybrid Nanomaterials and Metastructures for Photonics, Sensing and Energy

Organized by: Jérôme Plain, Alexander Govorov, Davy Gérard and Pedro Hernandez Martinez

Chaired by: Pedro Hernandez Martinez

14:00 : Invited talk
Fluorescence-based chiral sensing enhanced by silicon nanophotonics
Tom Sistermans[1], Ershad Mohammadi[2], T. V. Raziman[2], Alberto Curto[1]
[1] *Ghent University (Belgium),* [2] *Eindhoven Hendrik Casimir Institute (The Netherlands)*

Chirality is omnipresent in biochemistry, where molecules with opposite handedness can have markedly different effects. Detecting molecular chirality is however plagued by low sensitivity, limiting it to high concentrations and volumes. We present nanophotonic structures and a polarization-modulation microscope to push the limits of chiral sensing using fluorescence.

14:20 : Invited talk
Infrared Nanophotonics in Naturally-Hyperbolic Calcite Metamaterials
Chase Ellis[1], Eric Seabron[2], Eric Jackson[1], Michael Meeker[1], Andrew Lang[1], Brandon Durant[1], Xitlali

Juarez[1], **daniel ratchford**[1], **Rhonda Stroud**[3], **Joseph Tichler**[4]
[1] *US Naval Research Laboratory (USA),* [2] *Howard University (USA),* [3] *Arizona State University (USA),* [4] *University of Oklahoma (USA)*

Within this work, we investigate how mid-infrared can excite sub-diffractional, volume-confined hyperbolic modes within nanostructured surfaces of (100)-cut calcite crystals. We find that controlling the relative orientation of these nanostructures and the crystal anisotropy provides unique tuning of the spectral and energy propagation characteristics of these modes.

14:40 : Invited talk
Mapping phonon polaritons with visible light
Joseph Tischler[1], **Kiernan Arledge**[1], **Chase Ellis**[2], **Nazli Rasouli Sarabi**[1], **Vincent Whiteside**[1], **Chul Soo Kim**[2], **Mijin Kim**[2], **Daniel Ratchford**[2], **Binbin Weng**[1]
[1] *University of Oklahoma (USA),* [2] *U.S. Naval Research Laboratory (USA)*

Low-loss phonon polariton (PhP) modes are promising for mid-IR applications. Here, PhP eigenmodes in nanostructures of InP and 4H-SiC are spatially mapped using confocal Raman microscopy. We find that the polarizability selection rules surprisingly couple PhPs to bulk phonons, potentially providing a new approach to tune PhPs through phonon interactions.

15:00 : Invited talk
Nano antenna-assisted quantum dots emission into high-index planar waveguide
X. Yu, J.-C. Weeber, L. Markey, J. Arocas, A. Bouhelier, A. Leray, Gérard Colas des Francs
Université de Bourgogne (France)

We established directional quantum dot (QD) emission coupling to a planar TiO2 waveguide assisted by a Yagi-Uda antenna. Antenna on waveguide is first designed by scaling radio frequency dimensions to nano-optics, taking into account the hybrid plasmonic/photonic platform. The optical characterization shows clear directional coupling originating from antenna effect.

15:20 : Invited talk
Bound States in the Continuum: Advancements in Photonics from Enhanced Upconversion to Ultra-Sensitive Sensors
Silvia Romano[1], **Bruno Miranda**[1], **Aida Seifalinezhad**[1], **Adam Schwartzberg**[2], **Ivo Rendina**[1], **Vito Mocella**[1], **Gianluigi Zito**[1]
[1] *National Research Council of Italy (Italy),* [2] *Lawrence Berkeley National Laboratory (USA)*

Bound states in the continuum (BICs) are unique electromagnetic modes within the radiation continuum, distinguished by their non-coupling nature. BICs exhibit infinitely high Q-factors, offering advantages in photonics and optical engineering. Here, we present recent experimental results regarding several applications on supercritical coupling for giant upconversion enahncement and ultrasensitive sensing.

15:40 : Invited talk
Bioanalytics using plasmonic nanostructures
F. Seier, L. Dubbert, M. Al-Maoush, A. Hoxha, A. Heewig, M. Urban, A. Csaki, Wolfgang Fritzsche
Leibniz IPHT (Germany)

The effect of localized surface plasmon resonance (LSPR) on chemically synthesized gold nanoparticles is utilized to setup a biosensing platform with the potential for sensitive and specific detection of biomolecules of interest such as biomarkers.

14:00 - 16:00 — Room 204

Session 2A18

Symposium III: Advanced passive and active metasurfaces and zero-index materials

Organized by: Howard Lee, Pin Chieh Wu and Qinghua Song

Chaired by: Pin Chieh Wu

14:00 : Invited talk
Electrochemically-tunable oxide materials for metasurfaces and large-area, additive patterning
Vivian Ferry
University of Minnesota (USA)

This talk will discuss two strategies for new, tunable metasurfaces. The first part of the talk will discuss the use of electrolyte gating to control the optical properties of materials, focusing on La1-xSrxCoO3-d as an exemplary case. The second part will discuss large-area fabrication methods for multilayer, flexible devices.

14:20 : Invited talk
Nonlinear all-dielectric metasurfaces driven by multipolar resonances and quasi-bound states in the continuum
Hui-Hsin Hsiao
National Taiwan University (Taiwan)

The interaction of multipolar resonances in all-dielectric metasurfaces provides a unique platform for confining strong near-field enhancement inside nanocavities as well as tailoring far-field scattering properties. Here, we investigated third-harmonic generation of all-dielectric metasurfaces driven by the generalized Kerker condition and quasi-bound states in the continuum, respectively.

14:40 : Invited talk
Metamaterial assisted super-resolution microscopy
Zhaowei Liu
University of California (USA)

Metamaterial assisted illumination nanoscopy (MAIN) has recently been proved to be a promising approach for linear super-resolution microscopy with unprecedented resolution capability. In this talk, I will summarize some of our recent progresses in the field and showing biological imaging examples with resolution down to 20nm scales.

15:00 : Invited talk
Multiparameter Sensing of On-Chip Infrared Photodetectors Enabled by Metasurfaces
Mingjin Dai, Qi Jie Wang
Nanyang Technological University (Singapore)

On-chip multiparameter infrared photodetectors are highly desirable for the next-generation ultra-compact optical and optoelectronic systems1,2. Here, we proposed the on-chip infrared photodetectors to realize multiparameter detection such as intensity, polarization, chirality, and orbital angular momentum enabled by using the metasurface integrated with two-dimensional materials3-5.

15:20 : Invited talk
Dispersion engineering of mid-IR polaritons in van der Waals crystals
Sergey Menabde, Min Seok Jang
Korea Advanced Institute of Science and Technology (Korea)

In this talk, I discuss several experimental approaches that can be used to manipulate the dispersion of mid-IR polaritons and significantly reduce their damping at the same time: monocrystalline gold, ultra-high-index and low-loss topological insulators, and harmonically corrugated gold substrate.

15:40 : Invited talk
Photoluminescent gratings and metasurfaces
Pierre Berini
University of Ottawa (Canada)

Carbonaceous residue is transformed into carbon quantum emitters on Ag gratings by hot carriers excited via surface plasmon decay thereon. Yellow photoluminescence emerges in situ as the carbon dots form in an O2 depleted environment. The formation of photoluminescent carbon dots by plasmons opens a novel pathway to photoluminescent metasurfaces.

14:00 - 15:55 — Conference Room

Session 2A19

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Yuto Moritake

14:00 : Invited talk
Amorphous dielectric materials with complete photonic band-gaps in 3D
Abraham de Jesus Aguilar Uribe[1], **Marian Florescu**[2], **Frank Scheffold**[1]
[1] *University Of Fribourg (Switzerland),* [2] *University of Surrey (United Kingdom)*

Recently, we proposed a comprehensive framework that unifies the description of light transmission through three-dimensional amorphous dielectric materials where we address the role of light localization and photonic bandgaps. Here, we present experimental results on light transmission and reflection in amorphous dielectric networks, providing empirical support for the theoretical framework.

14:20 : Invited talk
Fundamental studies for new device applications in two-dimensional plasmonic crystals through analytical demonstrations in the submillimeter-wave band
Go Itami, Osamu Sakai
The University of Shiga Prefecture (Japan)

Plasmonics is attracting renewed attention as the demand for optical integrated circuits increases. In particular, localization and near-field enhancement of light by surface plasmon and plasmonic band design are important for device applications. A control method of plasmonic skin depth and band structures using periodic structures are introduced.

14:40 : Invited talk
Chiral emission from perovskite metasurfaces and metacavities
Young Chul Jun
Ulsan National Institute of Science and Technology (Korea)

In this talk, we discuss two recent experiments on chiral emission from resonant optical nanostructures. First, maximally chiral emission from perovskite metasurfaces is demonstrated using chiral quasi-bound states in the continuum. Second, chiral electroluminescence is achieved at room temperature with a substantial degree of circular polarization using thin-film-based chiral metacavities.

15:00 : Invited talk
Efficient nonlinearities in metasurfaces enabled by bound states in the continuum
Hayk Harutyunyan
Emory University (USA)

We present a novel approach to designing high-quality bound states in the continuum in dielectric metasurfaces using magnetic dipole resonances coupled to a mirror. This simplifies fabrication and enhances practical applications, demonstrated by a record-breaking third harmonic generation efficiency and superior modulation characteristics with a switching time of 100 fs.

15:20 : Advanced Heterostructures of Semiconductor Nanocrystals for Nanophotonics
Hilmi Volkan Demir
Bilkent University (Turkey)

Semiconductor nanocrystals, have attracted great interest in quality lighting and displays. Such colloidal semiconductors enable enriched color conversion essential to superior lighting and displays. We will introduce emerging field of semiconductor nanocrystal optoelectronics and showcase examples of advanced heterostructures of semiconductor nanocrystals along with their photonic structures and device architectures.

15:35 : Invited talk

Lasing of gain-doped plasmonic nanoshells: Threshold, emission linewidth and giant pull-out effects

Ashod Aradian[1], **Andres Cathey**[2], **Karen Caicedo**[3], **Milena Mora**[3], **Melissa Infusino**[3], **Alessandro Veltri**[3]
[1] *Université de Bordeaux (France),* [2] *Max Planck Institute for Plasma Physics (Germany),* [3] *Universidad San Francisco de Quito (Ecuador)*

We present a model describing the lasing / spasing properties of a nanoshell made of a plasmonic metal, whose core is filled with a gain medium. We calculate the nonlinear lasing state above the threshold, demonstrating that the emission spectrum and linewidth are dictated by unusually strong frequency pull-out effects.

14:00 - 16:00 — Room 205

Session 2A20

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Qing-Dong Jiang

14:00 : Invited talk

Polarization in inhomogeneous crystals and its relationship to quadrupole moments

Nobuhiro Arai[1], **Yang Gao**[2], **Di Xiao**[3], **Shuichi Murakami**[1]
[1] *Tokyo Institute of Technology (Japan),* [2] *University of Science and Technology of China (China),* [3] *University of Washington (USA)*

We revisit the problem of defining electric quadrupole moments as bulk quantities. We calculate the polarization for inhomogeneous crystals, from which we derive the formula for the electric quadrupole moment. In particular cases such as crystals under uniform electric or magnetic fields, our result agrees with previous works.

14:20 : Invited talk

Ultracompact, controllable circular polarization laser based on chiral metamaterials

Ioannis Katsantonis[1], **Anna Tasolamprou**[1], **Thomas Koschny**[2], **Maria Kafesaki**[1]
[1] *FORTH (Greece),* [2] *Iowa State University (USA)*

We demonstrate (theoretically) an ultracompact lasing structure formed by combining a bi-isotropic chiral metamaterial with a gain medium. The structure provides dynamically controllable polarization emission, ranging from left-handed circularly polarized (CP) to right-handed CP. The dynamic polarization control is achieved by changing the polarization of a linearly polarized pump wave.

14:40 : Invited talk

Thermal Hall effect from chiral magnon-magnon many-body scattering

Dimos Chatzichrysafis, Alexander Mook
Johannes Gutenberg University Mainz (Germany)

We present a theory of thermal Hall transport caused by magnon-magnon skew scattering. In field-polarized chiral magnets, the Dzyaloshinskii-Moriya interaction causes three-magnon scattering, which interferes with four-magnon scattering to break the microscopic detailed balance. The resulting skew scattering produces a thermal Hall conductivity even without a magnon Berry curvature.

15:00 : Invited talk

Giant electromagnetic nonreciprocity in magnetic epsilon-near-zero metamaterials

Jun Qin, Yucong Yang, Shuang Xia, Lei Bi
University of electronic Science and Technology of China (China)

Magnetic epsilon-near-zero (ENZ) metamaterials present unique advantages of improving the electromagnetic nonreciprocity. Here, we report our recent progress on nonreciprocal electromagnetic wave manipulations via magnetic ENZ metamaterials, demonstrating strong nonreciprocal thermal absorption using InAs ENZ films, and significantly enhanced Cotton-Mouton effect in magnetic zero-index metamaterials based on Y3Fe5O12 photonic crystals.

15:20 : Invited talk

Vorticity of Spin / Orbital Berry Curvature and Topological Charges in pseudo-nodal semimetals

Peter Christian Schmitz, Dongwook Go, Yuriy Mokrousov
Forschungszentrum Julich (Germany)

We investigate the relationship between crossings in Spin-Orbital-texture and the Berry-curvature-flux, in terms of divergence and vorticity, on avoided-crossing-manifolds in the 3D-BZ of selected vdW-materials and TI/NI-superlattices. We identify hidden currents with topological charge and chirality in symmetry-subspaces, such as the inversion (anti)-symmetric states on adjacent sides of the interfaces.

15:40 : Invited talk

Designing lattices and interface modes in valley topological photonics

Gaëtan Lévêque, Yan Pennec, Abdu Subahan Mohammed, Guillaume Durcournau, Pascal Szriftgiser, Alberto Amo
Université de Lille (France)

Valley topological photonics allows designing devices whose performances strongly depend on the geometry of both unit cells and interfaces. We compare classical honeycomb crystals and a lattice consisting of three non-equivalent subsets of holes, whose richness brings insights in the relation between the interface geometry and the topological light conduction.

14:00 - 15:40 — Room 206

Session 2A21

SP11. Chiro-optical and chiral-acoustic phenomena

Organized by: Alessandro Belardini and Oliver Wright

Chaired by: Daniel Torrent Marti

14:00 : Invited talk

Chiral Plasmonic Structures as Acoustoplasmonic Transducers

Beatriz Castillo López de Larrinzar[1], Chushuang Xiang[2], Edson R. Cardozo de Oliveira[2], N. Daniel Lanzillotti-Kimura[2], Antonio Garcia-Martin[1]
[1] *CSIC (Spain),* [2] *Université Paris-Saclay (France)*

The study demonstrates that absorption and scattering cross sections can be qualitatively different for two circular polarizations. Thus, the dominating cross section, absorption/scattering, changes with the polarization of the beam. This allows coherent phonon generation and detection by separating absorption and scattering for the same wavelength using the appropriate helicity.

14:20 : Invited talk

Chiral phonon-originated nonreciprocal phenomena in magnets

Yoichi Nii
Tohoku University (Japan)

Surface acoustic wave (SAW) devices serve a versatile platform in both classical and quantum technologies, gaining increasing prominence in modern research. This work unveils a novel facet of SAW phenomena - the manifestation of nonreciprocal responses arising from the coupling between phonon and spin angular

momentum.

14:40 : Invited talk
Photonic and phononic characterization of twisted acoustoplasmonic nanostructures
Beatriz Castillo López de Larrinzar[1], Jorge M. García Martínez[1], Chushuang Xiang[2], E. R. Cardozo de Oliveira[2], N. Daniel Lanzillotti Kimura[2], Antonio García Martín[3]
[1] *Instituto de Micro y Nanotecnología (IMN-CSIC) (Spain),* [2] *Université Paris-Saclay (France),* [3] *IMN-CSIC (Spain)*

The excitation of modes in structures depends on the spatial profile of the acoustic eigenmodes and the optics of the system. In this work we present a system that is composed of a twisted metallic propeller-like structure, that give rise to the excitation of new optical and acoustic modes.

15:00 : Invited talk
How can planar become chiral? Maximum-chiral optics with flat metasurfaces
Maxim Gorkunov[1], Alexander Antonov[1], Yuri Kivshar[2]
[1] *Kurchatov Research Center (Russia),* [2] *Australian National University (Australia)*

Dielectric metasurfaces are game-changing platform for chiral optics. Designs relying on mirror symmetry breaking by variable height or elevation of meta-atoms are technologically inconvenient. We consider optical chirality of flat metasurfaces including extrinsic-chiral single-layered and intrinsic-chiral multilayered ones, and especially focus on the effects of mirror symmetry breaking by substrates.

15:20 : Invited talk
Circularly-Polarized Light for Probing and Controlling Spins and Magnetization in Atomically-Thin Materials
Marcos Guimaraes
University of Groningen (The Netherlands)

Two-dimensional materials provide an exciting platform for studying spin-dependent (chiral) light-matter interaction. In this talk I will show how (chiral) light can be used to control the spin accumulation and magnetization in two-dimensional magnets and semiconductors.

14:00 - 14:55 — Room 101

Session 2A22

SP23. Nano-optical imaging and spectroscopy

Organized by: Takumi Sannomiya

Chaired by: Takumi Sannomiya

14:00 : Invited talk
Photon-STM study of exciton creation and annihilation processes in a single molecule
Miyabi Imai-Imada
RIKEN (Japan)

We report atomic-scale investigation of the electron dynamic processes that drive exciton creation and annihilation, including luminescence and photocurrent generation, in a single molecule.

14:20 : Invited talk
Optical chiral fields and plasmon modes in gold nanostructures studied by apertured near-field spectroscopic imaging
Kohei Imura
Waseda University (Japan)

We have developed various types of near-field imaging methods to elucidate optical properties of nanomaterials. Plasmonic materials have gained much attention due to the enhancement of plasmonic and chiral fields. To gain deep insights into the localized fields, various near-field imaging methods are applied to plasmonic

nanostructures.

14:40 : Theory for single molecule imaging with photo-induced force microscopy: A comparative study of phthalocyanine molecules
Mamoru Tamura[1], **Hidemasa Yamane**[2], **Hajime Ishihara**[1]
[1] *Osaka University (Japan),* [2] *Research Institute of Industrial Science and Technology (Japan)*

Using our developed theoretical framework for photo-induced force microscopy (PiFM), we successfully visualized single molecule images of phthalocyanine molecules. The obtained PiFM images reflected the characteristics of Zinc and H2 phthalocyanines. This not only affirms the capability of our theoretical framework but also contributes to the advancement of material science.

14:55 - 15:55 — Room 101

Session 2A23

GEN4: Micro/Nano Fabrication and Characterization Techniques

Chaired by: Kentaro Iwami

14:55 : Single- and multi-layer diffractive lens fabrication on fiber endoscope probes for advanced imaging technologies
Fei He[1], **Rafael Fuentes-Dominguez**[1], **Richard Cousins**[1], **Christopher J. Mellor**[1], **Jennifer K. Barton**[2], **George S. D. Gordon**[1]
[1] *University of Nottingham (United Kingdom),* [2] *University of Arizona (USA)*

We present a novel method to fabricate single- and multi-layer diffractive lenses on optical fibres, which is achieved via transfer bonding pre-fabricated patterns onto fiber facets. As proof-of-principle, we bond Fresnel zone plates, diffractive axicons and double-layer Fresnel zone plates onto optical fiber facets shaping output light with versatile depth-of-fields.

15:10 : Zeiss Crossbeam FIB-SEM for nanophotonic materials research and nanofabrication
Olena Vertsanova[1], **Benjamin Tordoff**[1], **Feng Lin Ng**[2]
[1] *Carl Zeiss Microscopy GmbH (Germany),* [2] *Carl Zeiss Pte. Ltd. (Singapore)*

Zeiss Crossbeam FIB-SEM solutions for nanofabrication and nanomaterials research for photonics applications are presented. The benefits of Zeiss Gemini optic for high-quality imaging and the long-term current stability of the Ion-sculptor focused ion beam (FIB) column for a very long-running nanostructuring process are demonstrated.

15:25 : Reliability and remaining useful life of flexible silver nanowire-based transparent electrodes
Mikita Marus[1], **Nikolay Lyapunov**[1], **Abel Wong**[1], **Tak-Lam Chan**[1], **Haibo Hu**[2]
[1] *CAiRS (Hong Kong),* [2] *Hong Kong Polytechnic University (Hong Kong)*

Silver nanowires attract great interest for optoelectronics applications, including highly efficient flexible transparent electrodes. However, knowledge of their reliability remains scarce and lacks systematization. Here, we present a comprehensive reliability study of silver nanowire transparent electrodes and compare them with state-of-the-art indium tin oxide electrodes.

15:40 : Fabrication of form birefringent 3D metastructures for visible wavelength range using 3D laser printing technique
Darius Gailevičius[1], **Domas Paipulas**[1], **Saulius Juodkazis**[2], **Vygantas Mizeikis**[3]
[1] *Vilnius University (Lithuania),* [2] *Swinburne University of Technology (Australia),* [3] *Shizuoka University (Japan)*

We report on the realization of form birefringent phase retarders based on anisotropic 3D photonic crystal architecture using 3D laser printing technique and Q-plate structures capable of operation at visible wavelengths.

14:00 - 16:00 — Gallery

Session 2A24

SP2. Machine learning for metamaterials and metasurfaces

Organized by: Willie Padilla

Chaired by: Willie Padilla

14:00 : Invited talk
Wide Field-of-View and Broadband Metalens Imaging via Deep Learning
Yunxi Dong[1], Bowen Zheng[1], Fan Yang[2], Hong Tang[1], Huan Zhao[1], Yi Huang[1], Tian Gu[2], Juejun Hu[2], Hualiang Zhang[1]
[1] *University of Massachusetts Lowell (USA),* [2] *Massachusetts Institute of Technology (USA)*

We propose a deep learning (DL) strategy for reconstructing images captured with wide field-of-view (WFOV) metalenses. The DL employs a generative adversarial network (GAN) to correct chromatic aberration and image distortion in metalens imaging. Our image collection setup, combined with GAN model, significantly improves computational fidelity and metalens imaging performance.

14:20 : Invited talk
Free-Form Inverse Design Driven by Machine Learning
Timo Gahlmann, Philippe Tassin
Chalmers University (Sweden)

We present an overview of our work on free-form inverse design of nanophotonic devices. We have developed a CGAN network that can provide lithographic masks for a meta-atom with desired transmission and reflection properties. We show examples of metasurfaces with refractive properties and even with meta-atoms with interdependent properties.

14:40 : Invited talk
Do we need machine learning to predict wave scattering in metasurface-programmable unknown complex media?
Philipp del Hougne
Université de Rennes (France)

I discuss recent results on physics-compliant modeling of metasurface-programmable complex media, the estimation of these models' parameters (and associated ambiguities), and the relation of this area to optimal blind focusing on perturbation-inducing targets inside complex media. Physics-compliant models present 10X advantages over deep learning because of their naturally built-in constraints.

15:00 : Invited talk
Design of Radiative Cooling Metamaterials by Generic Algorithm and Neural Network
Kotaro Kajikawa
Tokyo Institute of Technology (Japan)

Radiative cooling (RC) materials, cooling objects without electricity, are an essential research target for a sustainable society. The RC materials are required to have high transmittance in the visible and high emissivity in near-infrared regions. We study a genetic algorithm and neural network to design RC materials.

15:20 : Invited talk
Deep learning-enabled metasurface design and autonomous meta-devices
Chao Qian
Zhejiang University (China)

Recent breakthroughs in deep learning have ushered in an essential tool for optics and photonics, recurring in various applications of material design, system optimization, and automation control. In this talk, we will share the recent advances in how to streamline metasurface design and develop self-driving meta-devices.

15:40 : Invited talk
Data-driven Inverse Design and Characterization of Metasurface

Li Gao
Nanjing University of Posts and Telecommunications (China)

Deep neural network can capture the highly nonlinear, complex relationship between nanostructure geometry and its optical properties, and proves accurate inverse design of near-field enhancement, far-field spectrum and phase changes etc, which can be helpful for exploring subtle, complex multifunctional nanophotonics for sensing and energy conversion applications.

Coffee Break

Session 2P2
Poster Session IV
16:00 - 16:40

P1: Non-Hermitian quasicrystals
Ananya Ghatak[1], I. Komis[1], Z. H. Musslimani[2], K. G. Makris[1]
[1] *FORTH (Greece),* [2] *Florida State University (USA)*

In the framework of non-Hermitian photonics, we investigate the wavepacket diffraction dynamics in non-Hermitian one-dimensional quasiperiodic and two-dimensional quasicrystal waveguide lattices. In particular, the effect of spatial symmetries and localization on the spectral sensitivity is examined in terms of pseudospectra.

P2: Optical spin sorting in a plasmonic crystal waveguide
Kotaro Kihara[1], Midori Ikeuchi[1], Izzah Machfuudzoh[2], Takumi Sannomiya[2], H. Saito[1]
[1] *Kyushu University (Japan),* [2] *Tokyo Institute of Technology (Japan)*

We designed a unique plasmonic crystal waveguide composed of metallic nanodisk arrays on a metal film (MIM structure) that can convert circularly polarized light into a unidirectionally guided plasmon mode. The plasmon propagation direction can be switched depending on the orientation of circular polarization.

P3: Orbital angular momentum multiplexed metasurface for multi-wavelength holography
Seong-Won Moon, Jaehyuck Jang, Junsuk Rho
POSTECH (Korea)

This study introduces a wavelength-multiplexed orbital angular momentum holographic device capable of encoding and reconstructing multiple holographic images using light of specific wavelengths and topological charges. The device, demonstrating significant storage potential, successfully encoded and reconstructed nine distinct images under defined conditions.

P4: Super-resolution imaging of sulfur vacancies in 2D molybdenum disulfide using expansion microscopy and dSTORM
Pin-Jen Wang[1], Ting-Jui Ben Chang[1], Hui-Jen Lin[1], Shun-Min Yang[1], Mor Pal Vikram[1], Kai-Chun Huang[1], Tsung-Hsin Liu[1], Chih-Yang Huang[1], T. Tony Yang[1], Ann-Shyn Chiang[1], Yeu-Kuang Hwu[2], Chun-Wei Chen[1], Li-Chyong Chen[1], Han-Chun Wu[3], Shi-Wei Chu[1]
[1] *National Taiwan University (Taiwan),* [2] *Academia Sinica (Taiwan),* [3] *Beijing Institute of Technology (China)*

Defect inspection in 2D transition metal dichalcogenides has been limited to electron microscopy which has low field-of-view and low imaging speeds. Here we propose to use expansion microscopy (ExM) to embed the defect distribution onto a swellable hydrogel and combine with localization microscopy to achieve sub-10-nm resolution with optical microscopy.

P5: Photocurrent Enhancement induced by Fabry-Pérot quasi-Bound States in the Continuum in Silicon Nanodisk Hexagonal Array beyond 1400 nm in Wavelength
Keisuke Moriasa, Hiroaki Hasebe, Hiroshi Sugimoto, Minoru Fujii
Kobe University (Japan)

A nanodisk array of polycrystalline silicon with the toroidal dipole resonances in the sub-bandgap region is produced on a metal mirror via a spacer. The structure possesses the Fabry-Pérot bound states in the continuum, and strongly enhances the photocurrent in the eye-safe wavelength.

P6: Mie-assisted photonic memories based on the phase change of silicon nanoparticles
Jhih-Jia Chen[1], Te-Hsin Yen[1], Kentaro Nishida[1], Junichi Takahara[2], Mihail Petrov[3], Shi-Wei Chu[1]
[1]*National Taiwan University (Taiwan),* [2]*Osaka University (Japan),* [3]*ITMO University (Russia)*

Photonic memories based on phase change materials have recently attracted much attention, but mostly require rare materials. Here, we demonstrate that silicon nanostructures exhibit laser-induced phase change, through a confocal micro-spectroscopy setup, leading to clearly bistable states with 80 $\%$ scattering modulation The results are promising for silicon-based all-photonic memories.

P7: Jones matrix holography with liquid crystal-integrated active metasurface
Hyeyoung Yoon, Hyounghan Kwon, Inki Kim
Sungkyunkwan University (Korea)

This research integrates a liquid crystal cell with a holographic metasurface for dynamic polarization control, utilizing the Gerchberg-Saxton algorithm and Jones matrix. Devices based on this technology can operate in arbitrary polarization, thereby enhancing the flexibility of optical systems.

P8: High-Q and Small Size Cavity with Mie Scattering Mirror
Bokyung Kim, Seokhyeon Hong, Youngsoo Kim, Seung Hyeon Hong, Juhan Lee, Soon-Hong Kwon
Chung-Ang University (Korea)

We propose a new Mie scattering based two-dimensional resonator. Using strong backscattering based on Kerker condition, resonators have a physical size on the order of a wavelength and can achieve quality factor(Q) values up to 120,000.

P9: Effect of Thermal Annealing on Surface Plasmon Properties of Gold and Silver Nanodisk Structures for Live Cell Imaging
Kota Yamasaki, Ryohei Hatsuoka, Tetsuya Matsuyama, Kenji Wada, Koichi Okamoto
Osaka Metropolitan University (Japan)

We investigate the effect of thermal annealing on Localized Surface Plasmon Resonance (LSPR) properties of gold and silver nanodisk structures. We found that gold structures showed blue-shifts and narrowing of peaks, while silver structures exhibited peak blue-shifts and reduction in intensity. These changes were analyzed using an electromagnetic field analysis.

P10: Analyzing qubit arrays via a multiresolution approach
Mandana Bidarvand, Artur Sowa
University of Saskatchewan (Canada)

Utilizing a multiresolution approach, we analyze the properties of infinite qubit arrays. Our method merges the classical Borel isomorphism and the Haar basis, connecting the qubit system's Hilbert space to $L_2(0,1]$. This furnishes a geometric representation of fundamental operators and reveals an unexpected integration of classical calculus in this structure.

P11: Ultrafast Photonic PCR with All-Solution Processed Perfect Absorber
Seho Lee, Abdulrahman Alsaadi, Inki Kim
Sungkyunkwan University (Korea)

We developed a low-cost all-solution processed metaplasmonic PCR chip using a metal-insulator-meal configuration with gold nanoparticles and MXene Ti3C2Tx. This chip featuring ultra-high absorption and low-power consumption, overcomes cost challenges associated with traditional methods. Utilizing a solution processing approach, we achieved 30 cycles of the PCR process within 8 minutes.

P12: Enhancement of Circular Dichroism by Engineered Absorption in Chiral Dielectric Metasurface
Anna Fitriana, Katsuya Tanaka, Lukas Raam Jaeger, Martin Hafermann, Thomas Pertsch, Carsten Ronning, Isabelle Staude
Friedrich Schiller University Jena (Germany)

We demonstrate that ion-beam irradiation of chiral dielectric metasurfaces can enhance optical chirality by carefully tailoring the material absorption. We approach the critical coupling regime associated with maximum circular dichroism by irradiating chiral silicon dimers with energetic Ne+ ions. This provides potential of tweaking metasurface properties post fabrication using ion-beams.

P13: Dirac bound states in the continuum in honeycomb photonic crystal slabs

Yi-Chi Kao, Sheng-Wei Kao, Ruey-Lin Chern
National Taiwan University (Taiwan)

We propose a design of photonic crystal slabs for investigating the bound states in the continuum (BICs), which are identified as the Dirac BICs. By changing the geometric parameters of the unit cell without breaking the C6v symmetry, a pair of Friedrich-Wintgen BICs appear near the Dirac point.

P14: High NA multifocal array metalens

Hyemi Park, Yongjae Jo, Inki Kim
Sungkyunkwan University (Korea)

We introduce a novel metalens capable of generating a 10x10 multifocus array with high NA, unlike conventional low-NA microlens arrays. This method enhances imaging speed and quality, promising advancements in various imaging applications with superior resolution and efficiency.

P15: Hybrid full-space metalens for ultraviolet light

Beata Idesova, Filip Ligmajer, Ondřej Červinka, Tomas Sikola
Brno University of Technology (Czech Republic)

Conventional optical elements used nowadays are bulky and heavy, while metasurfaces offer a promising solution allowing for miniaturization and multifunctionality. In this work, we use hybrid nanostructures made of hafnium dioxide and aluminium to fabricate a metalens operating both in reflection and transmission simultaneously for a wavelength of 325 nm.

P16: Acoustic diffusers by phase-control acoustic metamaterials for reflected and transmitted waves

Jia-Hong Sun, Yu-Wei Chen, Ching-Yun Chang
Chang Gung University (Taiwan)

This paper studied acoustic metamaterials that can control the phase of sound waves. Two types of microstructures were used to control proper phase delay for reflected and transmitted acoustic waves, respectively. By arranging the microstructures properly, thin-plane acoustic diffusers were designed, and specimens were fabricated to be tested in experiments.

P17: Fabrication of delay lines using spoof-surface-plasmon-polariton waveguides coupled with split-ring resonators for microwave integrated circuits

Minh Nguyen, Nobuaki Kikuchi, Toshiyuki Kodama, Taiyu Okatani, Naoki Inomata, Yoshiaki Kanamori
Tohoku University (Japan)

We proposed and fabricated three delay lines based on spoof-surface-plasmon-polariton (sSPP) waveguides and split-ring resonators (SRR) with different gap sizes varied at sub-micrometer which results in a phase difference up to 50 degrees and the notch-band central frequency shift of 0.085 GHz for application in phase shifters and modulators.

P18: Exciton-polaritons in van der Waals heterostructures coupled to optical bound state in the continuum

Dong-Jin Shin, HyunHee Cho, Woo Hun Choi, Ho Seung Lee, Su-Hyun Gong
Korea University (Korea)

We realized the subwavelength-thick exciton-polariton platform exclusively consists of van der Waals two-dimensional (2D) materials. By leveraging their exceptional optical properties and van der Waals nature, we achieve successful integration between bound state in the continuum (BIC) modes and excitonic resonances of atomically thin 2D semiconductors.

P19: Numerical investigation of dielectric metasurfaces for refractive index-based sensing applications

Roxana Tomescu, Cristian Kusko, Veronica Anastasoaie, Dana Cristea
IMT Bucharest (Romania)

This paper presents a numerical investigation of dielectric metasurfaces tailored for sensing applications. The structures will be used in the development of biosensors that detect changes in the environment's refractive index. The proposed metasurface is a transmission mode array of amorphous silicon disks patterned on a fused silica substrate.

P20: Tuneable Optical Edge Detection using Phase-Change Metasurfaces

Stuart Kendall[1], **Carlota Ruiz de Galarreta**[1], **Joe Shields**[1], **Guoce Yang**[2], **Mengyun Wang**[2], **June Sang Lee**[2], **Nikolaos Farmakidis**[2], **Andy Moskalenko**[2], **Kairan Huang**[2], **Lou Deguzman**[3], **Andrea Alù**[4], **Jacopo Bertolotti**[1], **Harish Bhaskaran**[2], **C. David Wright**[1]
[1] *University of Exeter (United Kingdom),* [2] *University of Oxford (United Kingdom),* [3] *University of North Carolina (USA),* [4] *City University of New York (USA)*

Local and non-local phase-change optical metasurface designs for reconfigurable edge-detection/bright-field imaging are explored. Reconfigurability is achieved via switching phase-change material between crystal and amorphous states. Applications include fast pre-processing for image analysis, optical microscopy and more.

P21: Hot electron induced photoreduction of Fullerene C60 using coupled plasmonic - Fabry-Perot systems

Anjalie Edirisooriya[1], **Ning Lyu**[2], **Zelio Fusco**[1], **Fiona Beck**[1]
[1] *Australian National University (Australia),* [2] *Friedrich-Schiller-Universität Jena (Germany)*

This study demonstrates efficient fullerene reduction using hot electrons in a Plasmonic-Fabry-Perot system, emphasizing their pivotal role. Investigating nanoparticle size, hot electron dynamics, and photoreduction efficiency in plasmon-driven processes, it unveils avenues for controlling chemical reduction and optimizing plasmonic catalysts, impacting applications such as photocatalysis

P22: Electric Field driven Trion Drift in Suspended 2D Transition Metal Dichalcogenides

Woo Hun Choi, Seong Won Lee, Su-Hyun Gong
Korea University (Korea)

Trions, quasiparticles composed of an exciton bound to an excessive charge, in transition metal dichalcogenide (TMD) are potential candidate of information carriers that can be controlled using external electric fields. In this work, we demonstrate drift of trions in a suspended TMD monolayer by using a simple electromechanical device.

P23: Ultrafast Switching of Magnetization using Chiral Optical Phonons

Carl Davies[1], **F.G.N. Fennema**[1], **Arata Tsukamoto**[2], **Ilya Razdolski**[3], **Alexey V. Kimel**[1], **Andrei Kirilyuk**[1]
[1] *Radboud University (The Netherlands),* [2] *Nihon University (Japan),* [3] *University of Bialystok (Poland)*

Using chiral optical phonons that are driven at resonance within a paramagnetic substrate, we demonstrate that magnetization can be non-locally switched in a magnetic overlayer. This application of the ultrafast Barnett effect offers a novel and potentially universal pathway for the ultrafast switching of magnetization.

P24: TiO2 Nanoantenna Stickers for Fabricating Large-Area Twisted Metamaterials with Tunable Chiroptical Effects

Jiayang He, Shunsuke Murai, Tienyang Lo, Katsuhisa Tanaka
Kyoto University (Japan)

Twisted metamaterials, created by stacking and twisting two achiral nanostructured layers exhibit chirality. We propose a simple method employing nanoantenna stickers to fabricate such metamaterials, achieving precise control of giant circular dichroism via twist angle adjustment with the largest effect at 22.5°, holding promise for chiral optics and sensing development.

P25: Advancements in polarization-sensitive metasurfaces

Ondřej Červinka[1], **Martin Hrtoň**[1], **Jakub Lelek**[2], **Filip Ligmajer**[1], **stěpan Vénos**[2], **Libor ulehla**[2], **Tomas Sikola**[1]
[1] *Brno University of Technology (Czech Republic),* [2] *Meopta - Optika (Czech Republic)*

We present two metasurfaces capable of full-Stokes polarization analysis in the visible spectrum. One includes a highly sensitive Shack-Hartmann detector for wavefront sensing, while the other incorporates a holographic approach for enhanced human readability and interpretability. Both metasurfaces include polarization-multiplexing for increased efficiency.

P26: Enhancing photodetection and photoluminescence in low dimensional materials with photonic crystals

Muhammad Atif Yaqub, Harsh Gupta, Tatiana Contino, Muhammad Waseem Ashraf, Michele Tamagnone
Italian Institute of Technology (Italy)

We integrate photonic crystals into 2D and vdW materials (in particular GaTe and InSe) aiming to enhance

their optical properties such as photoconductivity and photoluminescence. These materials were selected owing to their direct bandgaps. We optimized the design of photonic crystal to maximize the absorption and photoluminescence characteristics.

P27: Optical cavity based on reflective metasurfaces
Muhammad Waseem Ashraf, Muhammad Atif Yaqub, Tatiana Contino, Michele Tamagnone
Italian Institute of Technology (Italy)

We present new designs for open optical cavities based on reflecting metasurfaces. Our metasurfaces are a new hybrid of traditional unit cells and supercells. We consider several types of cavities to enhance the Purcell factor of an emitter, including one type that requires only one metasurface to establish a mode.

P28: Au film-porous anodic aluminum oxide-Al hybrid nanomaterial-based optical biosensor for detection of the VEGFA protein.
Uldis Malinovskis, Amanda Reke, Raimonds Poplausks, Aleksandrs Dutovs, Oskars Putans, Irina Oliseveca, Donats Erts, Indrikis Muiznieks, Juris Prikulis
University of Latvia (Latvia)

We tested the suitability of Au film-porous anodic aluminum oxide (PAAO)-Al plasmonic nanomaterials as sensor substrate for optical detection of vascular endothelial growth factor A (VEGFA). These substrates are suitable for refractometric detection of elevated concentrations of VEGFA protein using simple optical microscopy setup.

P29: Lensless localized surface plasmon resonance sensor using porous anodic alumina based nanostructured metal-insulator-metal multilayers
Aleksandrs Dutovs, Amanda Reķe, Uldis Maļinovskis, Raimonds Popļausks, Donāts Erts, Juris Prikulis
University of Latvia (Latvia)

We demonstrate a proof-of-concept localized surface plasmon resonance (LSPR) sensor device using high-density gold nanoparticle (AuNP) arrays on porous anodic aluminum oxide (PAAO) substrates. Refractometric sensitivity of approximately 100 % relative intensity change per refractive index unit (RIU) was achieved in measurements of optical scattering in an off-resonance wavelength band.

P30: Innovative Approach: Inverse Design of 2D Slanted Gratings through the Fusion of Polynomial Modal Method, Neural Networks and Slime mold algorithm and/or Harris Hawkes optimizer, with Application in Augmented Reality
Kofi Edee, G. Granet
Universite Clermont Auvergne (France)

We presents design a slanted gratings by integrating the Polynomial Modal Method (PMM), Neural Networks (NN), and metaheuristic algorithms, with a specific applications in Augmented Reality. The solution of Maxwell's equations is achieved within a slanted coordinates. A logistic regression model using a NN is employed during the optimization.

P31: Post-synthesis band gap halide anion exchange tuning in CsPbBr3 nanocrystals and issues of light-induced phase segregation
Petr Liska, Tomas Musalek, Matous Kratochvíl, Tomas samořil, Petr Dvořak, Miroslav Kolíbal, Tomas Sikola
Brno University of Technology (Czech Republic)

This study investigates post-synthesis band gap tuning of CsPbBr3 nanocrystals through halide anion exchange (HAE) with CsI. While effective HAE occurs, phase segregation leads to Br-rich core and I-rich shell formations, impacting optical properties. Comprehending these phenomena enhances the development of precise optoelectronic engineering strategies tailored for semiconductor nanocrystals.

P32: All-Optical Excitation and Control of Ultrafast Lattice Dynamics in WSSe
Sergio Rey, Martin Cross, Malte Welsch, Frederik Schroeder, Binbin Zhou, Nicolas Stenger, Peter Jepsen, Edmund Kelleher
DTU (Denmark)

A coherent acoustic phonon in the alloy WSSe is revealed using double-pump-probe spectroscopy. The proposed mechanism involves a cascaded process of exciton formation, phonon recycling, thermoelastic defor-

mation and a potential piezoelectric enhancement of the coherent oscillation. The coherent phonon response is optically controlled using a tailored pump pulse sequence.

16:40 - 17:50 — Main Hall

Session 2A25

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Akira Satou

16:40 : Keynote talk
High Spatiotemporal Resolution Live Cell Imaging on a Plasmonic Metasurface
Kaoru Tamada
Kyushu University (Japan)

Self-assembled monolayers composed of metal nanoparticles can be regarded as metasurfaces with high refractive index and extinction coefficient due to collective excitation of coupled localized surface plasmon resonance. This plasmonic metasurface confines light to the nanointerface and enhances fluorescence, thus enabling high-speed interfacial imaging with high axial and lateral resolution.

17:10 : Invited talk
Ultra-large Area Coherent Lasing Action through Hermitian/non-HermitianControl in Photonic Crystals
Susumu Noda
Kyoto University (Japan)

Realizing large-scale high-power and high-beam-quality semiconductor lasers, which rival (or even replace) bulky gas and solid-state lasers, is one of the ultimate goals of photonics and laser physics. Conventional high-power semiconductor lasers, however, inevitably suffer from poor beam quality owing to the onset of oscillation in many modes, and moreover, the oscillation is destabilized by disruptive thermal effects under continuous-wave (CW) operation. Here, we surmount these challenges by scaling photonic-crystal surface-emitting lasers (PCSELs) up to as large as 3mm in diameter while controlling Hermitian and non-Hermitian couplings inside a double-lattice photonic crystal and maintaining these couplings even under CW conditions.

17:30 : Invited talk
Laser production of nanofibers
Felix Quintero[1], Joaquin Penide[2], Raul Barciela[1], Monica Fernandez-Arias[1], Antonio Riveiro[1], Jesus del Val[3], Rafael Comesana[1], Fernando Lusquiños[1], Juan Pou[1]
[1] *University of Vigo (Spain),* [2] *Medical & Engineering Technologies, GMIT (Ireland),* [3] *Defense University Center (Spain)*

Nanofibers are novel materials with very special properties, different from their bulk counterparts, due to the very reduced size and consequent microstructural differences. In this presentation two novel laser-assisted technologies, specific developed for the production of nanofibers, will be introduced: Laser Spinning and COFIBLAS.

16:40 - 19:25 — Room 201

Session 2A26

Symposium I: Hybrid Nanomaterials and Metastructures for Photonics, Sensing and Energy

Organized by: Jérôme Plain, Alexander Govorov, Davy Gérard and Pedro Hernandez Martinez

Chaired by: Jérôme Plain

16:40 : Invited talk
Up- and Down-conversion Engineering with Surface Lattice Resonances
Shunsuke Murai
Kyoto University (Japan)

We combined a luminescent layer or substrate with metallic or dielectric nanoantennae to harness the photoluminescence into a specific direction predefined by the antenna design. A notable ($>$ 10 times) enhancement in radiation intensity is demonstrated. We also fabricated nanoantenna sticker where the nanoantenna was embedded in a flexible polymer.

17:00 : Invited talk
Polymerization of diazonium salts on gold nanoparticles: hot electron and heating effects
Liudmila Trotsiuk[1], Aurelie Broussier[1], Anne-Laure Baudrion[1], Sylvie Marguet[2], Yun Luo[3], Claire Mangeney[3], Nordin Felidj[3], Pierre-Michel Adam[1], Renaud Bachelot[1]
[1] Université de Technologie de Troyes (France), [2] Université Paris Saclay (France), [3] Université Paris Cité (France)

In this work, we explored the polymerization of diazonium molecules on the surface of gold nanoparticles under CW- and pulsed laser irradiation. Two different polymerization mechanisms of diazonium salts can be induced by gold nanoparticles under irradiation through local heating and hot electron injection resulting in different polymer patterns.

17:20 : Invited talk
Controlling properties of collective plasmonic–diffractive excitations via dispersion engineering
Jussi Kelavuori, Ali Panahpour, Mikko Huttunen
Tampere University (Finland)

We show how strong dispersion can be used to control losses in diffractive–plasmonic resonances. Bragg-reflector waveguides are proposed as highly dispersive media for plasmonic metamaterials, allowing orders of magnitude reduction in array sizes, while still achieving ultra-high quality factors.

17:40 : Invited talk
Nonlinear optical sensing in arrays of plasmonic nanoparticles
Augustin Verneuil[1], A. Zilli[2], C. Vézy[1], J. Béal[1], M. Finazzi[2], M. Celebrano[2], Anne-Laure Baudrion[1]
[1] Université de Technologie de Troyes (France), [2] Politecnico di Milano (Italy)

Second harmonic generation from plasmonic materials, originating mostly from the surface, is a promising platform for sensing applications. In this work, we investigate the performance of a sensor based on periodic and aperiodic metagratings of V-shaped nanoantennas, exploring both the intensity and angular variations of their nonlinear emission.

18:00 : Invited talk
Infrared photoresponse in twisted bilayer graphene at a near-magic angle
Dmitry Mylnikov[1], Ilya Mazurenko[1], Alexey Shupletsov[2], Aparna Parappurath[3], Saisab Bhowmik[3], Denis Bandurin[4], Arindam Ghosh[3], Alexander Chernov[1]
[1] MIPT (Russia), [2] P.N. Lebedev Physical Institute RAS (Russia), [3] Indian Institute of Science (India), [4] National University of Singapore (Singapore)

We have performed the transport and IR-photoresponse measurements in the twisted bilayer graphene. The structure demonstrates enhanced photothermoelectric response. We demonstrate the gate-tunable biased photovoltage that strongly correlates with the peculiarities in transport measurements. The obtained results can be further used for tunable mid-infrared optoelectronics.

18:20 : Invited talk
Synthesis of tailored functional nanoparticles by polymerization induced by surface plasmons
Olivier Soppera
Université de Haute-Alsace (France)

Polymerization induced by surface plasmon resonance was used to couple functional polymer on metal nanostructures. This approach is a method for investigating nanophotochemistry and opens the door towards new functional nanoobjects for applications in sensors or nanophotonics.

18:40 : Fabrication of vanadium dioxide micro- and nanostructures by laser-induced hydrothermal synthesis
Christophe Pin[1], Hideki Fujiwara[2], Keiji Sasaki[1]
[1] *Hokkaido University (Japan),* [2] *Hokkai-Gakuen University (Japan)*

Bottom-up synthesis of vanadium dioxide (VO2) micro- and nanostructures is achieved by focusing an infrared laser beam on a gold film or on gold plasmonic nanoantennas immersed in a precursor solution. Site-selective VO2 synthesis is demonstrated by controlling the excitation of localized surface plasmon resonances.

18:55 : Circularly polarized photoluminescence from light-emitting metasurfaces
Vivian Ferry
University of Minnesota (USA)

This talk will discuss recent results on semiconductor nanocrystal-based metasurfaces designed for circularly polarized photoluminescence. We will discuss two complementary fabrication routes, direct write electron beam lithography and large-area printing, and the design guidelines for incorporating chiral nanocrystals, chiral semiconductor patterns, and chiral plasmonic patterns to manipulate the optical response.

19:10 : Guided Domino Lithography: Enabling Uniform Fabrication of Single-Digit-Nanometer Plasmonic Nanoantenna Arrays
Dong Kyo Oh, Jihae Lee, Huichang Yun, Junsuk Rho
Pohang University of Science and Technology (POSTECH) (Korea)

Guided Domino Lithography (GDL) presents a novel solution for uniform fabrication of single-digit-nanometer plasmonic nanoantenna arrays. GDL leverages collapsing behavior of unstable photoresist nanostructures to achieve ultra-sharp bowtie masks. Experimental comparison with conventional lithography demonstrates superior yield and uniformity. GDL promises practical manufacturing for diverse quantum nanophotonic devices.

16:40 - 18:40 — Room 202

Session 2A27

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Eugene Kamenetskii

16:40 : Invited talk
Control of Circularly Polarized Light Using Electron Beam
Takumi Sannomiya
Tokyo Institute of Technology (Japan)

This study explores novel approaches to control circular polarization using electron beam excitation. Scanning transmission electron microscopy based cathodoluminescence technique reveals possibilities of circularly polarization light control by electron beam. The demonstrations include manipulating polarization in symmetric structures such as spherical nanoantennas and circular holes in a metal film.

17:00 : Invited talk
Deep-learning-based end-to-end metalens imaging

Joonhyuk Seo[1], **Jaegang Jo**[1], **Joohoon Kim**[2], **Joonho Kang**[1], **Chanik Kang**[1], **Seongwon Moon**[2], **Eunji Lee**[2], **Jehyeong Hong**[1], **Junsuk Rho**[2], **Haejun Chung**[1]
[1] *Hanyang University (Korea),* [2] *POSTECH (Korea)*

Metalens imaging suffers from a trade-off between broadband focusing efficiency and operating bandwidth of metalenses. We demonstrate a deep-learning-based end-to-end image restoration framework to overcome the physical limitations of metalenses. The proposed framework achieves full-color imaging for mass-produced 10-mm-diameter metalens and provides high image qualities comparable with ground truth images.

17:20 : Invited talk
Chirality-induced polarized phenomena in chiral inorganic materials
Yoshihiko Togawa
Osaka Metropolitan University (Japan)

A role of chirality in materials is discussed with an emphasis on the emergence of macroscopic polarization of spin angular momenta and angular momenta in chiral inorganic materials.

17:40 : Invited talk
Cavity materials: Virtual Photons, Real Effects
Qing-Dong Jiang
Shanghai Jiao Tong University (China)

Recently, the convergence of quantum optics and materials has spawned a compelling new direction called cavity quantum materials. Both experiments and theory demonstrate that quantum fluctuations in vacuum cavities can significantly tailor quantum material properties. In my presentation, I'll unveil several topological effects in materials driven by vacuum cavities.

18:00 : Invited talk
Exploring chiral nanogap structures using inverse topology design
Atsushi Taguchi
Hokkaido University (Japan)

Chiral nanostructures hold promises for controlling chiral light-matter interactions at the nanoscale, yet the structure design poses challenges due to intricate near-field responses involving helically structured light. We present the inverse design of chiral nanostructures, demonstrating excellent chiroptical functionalities with structural complexities that are unattainable by designing with human intuition.

18:20 : Invited talk
Emergent One-Dimensional Helical State on the Surface Opposite to a Step Edge in Higher-Order Topological Insulators
Akihiko Sekine, Manabu Ohtomo, Kenichi Kawaguchi, Mari Ohfuchi
Fujitsu Limited (Japan)

We show theoretically that a one-dimensional conducting state with a helical spin structure, which also has a linear dispersion near the zero energy, emerges at a step edge and on the surface opposite to the step edge in three-dimensional higher-order topological insulators such as few-layer Td-WTe2.

16:40 - 17:40 — Room 203

Session 2A28

Industrial Workshop II

16:40 : Industrial WorkShop: From Design to Manufacture - Complete Inverse Design Flow for Meta-Optics
Chenglin Xu[1], **Bryan Stone**[1], **JiSoo Park**[2]
[1] *Synopsys, Inc. (USA),* [2] *3Synopsys, Inc. (Korea)*

Synopsys offers solutions to metalens design and manufacturing challenges, including tools for hybrid refractive metalens systems that consider manufacturing tolerances. This workshop is presented in two parts: 1.

July 16: Introduction to MetaOptic Designer; 2. July 18: Demo of hybrid metalens system design and virtual fab simulation.

17:40 - 19:10 — Room 203

Session 2A29

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Takuo Tanaka

17:40 : Invited talk
Strong Coupling with Different Photonic Modes within Single GaN Microstructure
Yong-Hoon Cho
KAIST (Korea)

We observed whispering gallery polariton condensation in a GaN hexagonal microrod at room temperature. Optical properties of the whispering gallery and Fabry-Perot modes generated in a hexagonal GaN microrod are compared. We also fabricated triangular GaN structures and adjusted the dominant mode between the whispering gallery and superscar modes.

18:00 : Invited talk
Tunable Second Harmonic Generation from Lithium Niobate Metasurfaces
Mengxin Ren, Lun Qu, Lu Bai, Zhengqing He, Wei Wu, Jingjun Xu
Nankai University (China)

Metasurfaces have demonstrated themselves as a promising platform for enhanced second harmonic generation to achieve ultracompact nonlinear light-sources. Lithium niobate thin film on insulators (LNOI) has emerged recently as a promising platform to manufacture metasurfaces. In this talk, we will present our recent works on tunable SHG from LN metasurfaces.

18:20 : Invited talk
EM-Flow: A Conditional Reversible Flow-Based Deep Learning Model for Intelligent Electromagnetic Sensing by Reprogrammable Metamaterial
Hongrui Zhang[1], Yanjin Chen[1], Mingyi Li[1], Hengxin Ruan[2], Lianlin Li[1]
[1] *Peking University (China),* [2] *Peng Cheng Laboratory (China)*

We present EM-Flow, a novel deep learning approach for electromagnetic sensing based on reprogrammable metamaterials, which employs a conditional flow-model-based reversible network architecture. It provides uncertainty quantification while adhering to physical constraints, particularly demonstrating exceptional performance in 3D imaging by introducing point-clouds for mesh-free modeling, thus significantly alleviating computational burdens.

18:40 : Mass Production of Metalenses for Near-Infrared Imaging
Seong-Won Moon, Joohoon Kim, Junsuk Rho
POSTECH (Korea)

This work presents scalable method for manufacturing near-infrared metalenses. we demonstrate a 1 cm diameter, 0.53 numerical aperture polarization-independent metalens composed of hydrogenated amorphous silicon. The proposed metalenses exhibit high-resolution imaging capabilities, making significant progress in metalens production and optical technology.

18:55 : A three-dimensional transformable metamaterial for programmable elastic waves control
Zhou Hu[1], Rui Zhu[1], Zhibo Wei[2], Yan Chen[2]
[1] *Beijing Institute Of Technology (China),* [2] *Tianjin University (China)*

We propose a three-dimensional mechanical metamaterial which can transform its effective elasticity tensor and covers all seven types of extremal metamaterials. By engineering the zero modes in the proposed me-

tamaterial, both the static and dynamic states of the 3D-printed prototype can be reconfigured. Moreover, reprogrammable wave functionalities are also demonstrated.

16:40 - 18:55 — Room 204

Session 2A30

Symposium V: Architectured Elastic and Acoustic Metamaterials and Phononic Crystals

Organized by: Marco Miniaci, Jensen Li, Vicente Romero-García, Vincent Pagneux and Noé Jiménez

Chaired by: Vicente Romero-García

16:40 : Invited talk
Diffusive Acoustic Metasurfaces for Single-element Photoacoustic Imaging
Alejandro Cebrecos, Irene Pi-Martín, Roby Weeteling, Juan José García-Garrigós, Noé Jiménez
CSIC - UPV (Spain)

We present a novel strategy to generate high-resolution photoacoustic images based on spatiotemporal encoding by combining a single-element detector and a reflecting cavity with attached acoustic metasurfaces designed to maximize sound diffusion in reflection. Numerical results demonstrate the potential of this concept to develop low-cost photoacoustic imaging systems.

17:00 : Theoretical Bound of Symmetric Metasurfaces
Chan Wook Park, Yoon Young Kim
Seoul National University (Korea)

Symmetry may restrict the transmission and phase coverage of local scatterers of the metasurfaces. We investigate the theoretical limit of transmission coverage of the symmetric metasurface. We conduct numerical simulations of controlling acoustic wavefronts to validate our theoretical results.

17:15 : Invited talk
AI-empowered acoustic metamaterials and their applications
Bin Liang
Nanjing University (China)

In this talk, I will discuss some of our recent advances obtained by coalescing artificial Intelligence and acoustic artificial structures with extraordinary acoustic properties. Furthermore, I will also mention the applications of acoustic metamaterials in several important scenarios such as architectural acoustics and acoustic communication.

17:35 : Invited talk
Efficient electromechanical coupling to an optomechanical nanobeam
Tapani Makkonen[1], Oili Ylivaara[2], Sara Pourjamal[2], Jouni Ahopelto[2]
[1] *VTT Technical Research Centre of Finland Ltd (The Netherlands),* [2] *VTT Technical Research Centre of Finland Ltd (Finland)*

We have developed a new approach for efficient electromechanical coupling into an optomechanical nanobeam. We exploit small bulk acoustic wave transducers integrated directly to the nanobeam. The transducers operate at GHz frequencies and at room temperature. Simulations suggest that in optimized structures, the conversion efficiency can approach 90 $\%$.

17:55 : Invited talk
Tunable Topological Properties in Phononic Crystals via Photoresponsive Polymers
Antonio Gliozzi[1], Federico Bosia[1], Bryn Davies[2], Gregory Chaplain[3], Marco Miniaci[4], Emiliano Descrovi[1], Richard Craster[2]
[1] *Politecnico di Torino (Italy),* [2] *Imperial College London (United Kingdom),* [3] *University of Exeter (United Kingdom),* [4] *Université Lille (France)*

This study explores the tunability of phononic crystals' topological properties, using photoresponsive azopolymers based on the Su-Schrieffer-Heeger model. It demonstrates dynamic adjustment of edge mode frequencies in a one-dimensional SSH chain and the ability to induce topological phase changes in a two-dimensional SSH lattice through illumination.

18:15 : Invited talk
Viscous phononic supercrystal
Arkadii Krokhin[1], **Martin Ibarias**[2], **Jose Sanchez-Dehesa**[2]
[1] *University of North Texas (USA),* [2] *Universitat Politècnica de València (Spain)*

An effective medium theory and experimental study are proposed for a supercrystal of metallic rods in viscous background. Supercrystal (SC) is a combination of two phononic crystals with different periods imbedded in a viscous fluid. The decay coefficient of sound is calculated analytically at low frequencies when both lattices homogenize.

18:35 : Invited talk
Non-Hermitian Metasurfaces for Extraordinary Elastic-wave Manipulations of Higher-order Diffractions
Bing Li, Jiali Cheng, Bochen Ren
Northwestern Polytechnical University (China)

Beyond the traditional paradigm of Hermitian physics, the concept of non-Hermiticity has recently inspired a surge of nontrivial principles and applications. In this work, we propose several active and passive non-Hermitian metasurfaces that enable unprecedented elastic-wave manipulations, including skin-like effects, asymmetric wave propagation, and perfect absorption.

16:40 - 19:00 — Conference Room

Session 2A31

SP10. Advanced Computational Electromagnetics for the Analysis and Design of Nanophotonic Devices

Organized by: Maha Ben Rhouma

Chaired by: Ali Adibi

16:40 : Invited talk
Limits and opportunities for nonlinear nanophotonics
Alejandro Rodriguez
Princeton University (USA)

In this talk, we review recent advances and applications of large-scale optimization techniques to nonlinear processes, including limitations on the ability of structuring to control spontaneous emission, second harmonic generation, and Raman scattering in resonant media.

17:00 : Invited talk
Efficient modelling and tailoring of nonlinear wavefront and enhanced third harmonic generation in dielectric metasurfaces
Viktor Myroshnychenko
Paderborn University (Germany)

We present an effective geometry optimization approach for tailoring phase and amplitude of the third-harmonic wavefront with a high emission efficiency using dielectric metasurfaces. We demonstrate optimal metasurface designs operating as a third harmonic beam deflector and possessing a strong third harmonic generation originating from a multi-mode Fano mechanism.

17:20 : Invited talk
Modeling and Implementation of Asymmetric Angular Transmittance

Mahmoud A. A. Abouelatta, Karim Achouri
EPFL (Switzerland)

We demonstrate theoretically and experimentally how asymmetric angular transmittance may be achieved using a meta-grating. We develop two approaches for predicting the response of this system based on generalized sheet transitions conditions and effective polarizabilities. This concept may find applications in the design of compact spatial analog processing systems.

17:40 : Invited talk
Anamorphic meta-lenslet array for laser guide star wavefront sensing
Josephine Munro, Sarah Dean, Neuton Li, Israel J. Vaughn, Andrew Kruse, Tony Travouillon, Dragomir Neshev, Robert Sharp, Andrey Sukhorukov
Australian National University (Australia)

Laser guide star wavefront sensing will be a major challenge for next generation extremely large telescopes, as Shack-Hartmann wavefront sensors will suffer from laser guide star elongation. We present the design of a meta-lenslet array which efficiently uses detector space by anamorphically rescaling the image space uniquely for each subaperture.

18:00 : Invited talk
One-way excitation of normal incident light for a plasmonic grating coupler with trapezoidal dielectric gratings
Jun Shibayama, Hinami Nakasaka, Kazuma Takeya
Hosei University (Japan)

We investigate the coupling problem of a plasmonic grating coupler with trapezoidal dielectric gratings. The coupler is analyzed using the frequency-dependent finite-difference time-domain method. It is shown that the normal incident light is coupled to the grating and the coupled light propagates in one direction.

18:20 : Invited talk
Fast Multi-channel Full-wave Solver and Inverse Design with Augmented Partial Factorization
Chia Wei Hsu
University of Southern California (USA)

I will describe a numerical approach called augmented partial factorization (APF) that bypasses the computation of unnecessary quantities to enable single-shot full-wave computation of the complete response of multi-channel optical systems and efficient inverse design. APF can reduce the computing time by orders of magnitude compared to existing frequency-domain methods.

18:40 : Invited talk
Modeling the Acousto-Plasmonic Coupling: Raman Energy Density Framework
Nicolas Large[1], José Luis Montaño-Priede[1], A. Mlayah[2]
[1] *University of Texas at San Antonio (USA),* [2] *CNRS - Université de Toulouse (France)*

We present a theoretical study of the interactions between confined acoustic phonons and localized surface plasmons in metallic nanoparticles. We introduce a new physical quantity, the Raman energy density, which is a local quantity that serves as a tool for the study of Raman scattering mediated by plasmons in nanoparticles.

16:40 - 19:10 — Room 205

Session 2A32

SP11. Chiro-optical and chiral-acoustic phenomena

Organized by: Alessandro Belardini and Oliver Wright

Chaired by: Alessandro Belardini

16:40 : Invited talk
Far-field and near-field chirality in plasmonic metamolecules

T. Aoudjit, F. Lamaze, J. Béal, A. Hmima, W. d'Orsonnens, T. Maurer, J. Plain, J. Proust, Davy Gerard
Université de Technologie de Troyes (France)

We study metamolecules consisting of coupled metallic nanoparticles. We show that the local field dissymmetry under left- and right-handed circular polarization can be directly imaged using a photopolymer. Then, we show experimentally that both the far- and near-field chirality can be controlled by fabricating the metamolecules onto a stretchable substrate.

17:00 : Invited talk
1D and 2D Topological solitons in nanoelectromechanical resonator arrays
Hiroshi Yamaguchi, Daiki Hatanaka, Motoki Asano, Samer Houri
NTT Basic Research Laboratories (Japan)

We theoretically and numerically demonstrate 1D and 2D coupled parametric resonator arrays generating a topological soliton in its rotating-frame phase space. The soliton can be implemented by using electromechanical resonators in both 1D and 2D systems providing a fully controlled on-chip test bed for the study of a topological soliton.

17:20 : Invited talk
Valley pseudospin polarized transports of ultrahigh frequency phonons in topological ring-waveguide coupled systems
Daiki Hatanaka[1], Hiroaki Takeshita[2], Motoki Kataoka[2], Hajime Okamoto[1], Kenji Tsuruta[2], Hiroshi Yamaguchi[1]
[1] *NTT Basic Reseach Laboratories (Japan),* [2] *Okayama University (Japan)*

We investigate propagation characteristics of microwave phonon waves in valley topological ring and waveguide coupled systems. The coupled system sustains valley polarization of phonons so that we successfully excite resonant vibrations in wavelength-scale micro-rings without significant backscattering. The results indicate capability of the topological technology to finely manipulate phonons.

17:40 : Invited talk
Non-reciprocal coupling between chiral phonons and magnons in ferromagnetic-semiconductor hybrid structures
Alberto Hernandez-Mínguez[1], Ferran Macia[2], Joan Manel Hernandez[2], Jens Herfort[1], Paulo Ventura Santos[1]
[1] *Paul-Drude-Institut fur Festkörperelektronik (Germany),* [2] *Universitat de Barcelona (Spain)*

We demonstrate a high degree of non-reciprocity for surface acoustic waves (SAWs) at GHz frequencies propagating in an epitaxial ferromagnetic layer. The non-reciprocal behavior depends on the relative chirality between the SAW strain field (phonons) and spin waves (magnons) in the ferromagnetic film.

18:00 : Ultrafast topological phase switching of non-Hermitian photonic metasurfaces
Sangha Lee, Donghak Oh, Junho Park, Soojeong Baek, Fabian Rotermund, Bumki Min
Korea Advanced Institute of Science and Technology (Korea)

In this work, we report ultrafast switching of topological phases in a time-varying system both numerically and experimentally, using FDTD simulations and optical-pump terahertz-probe (OPTP) spectroscopy.

18:15 : Invited talk
Diffraction of OAM beams assisted by Bloch Surface Waves
Niccolò Marcucci[1], Zongyuan Tang[2], Tianlong Guo[3], Matthieu Roussey[3], Yanjun Liu[4], Emiliano Descrovi[2]
[1] *CNR-IFAC (Italy),* [2] *Politecnico di Torino (Italy),* [3] *University of Eastern Finland (Finland),* [4] *SusTech (China)*

Beams carrying Orbital Angular Momentum are produced from multilayered structures upon excitation of surface modes. Such structures are axially-symmetric and exhibit a high Local Density of States to facilitate radiation coupling from localized, possibly individual emitters located on the surface, such as q-dots or defected 2D materials.

18:35 : Acoustic Fullerene Metamaterials
Danwei Liao[1], Jingyi Zhang[2], Shuochen Wang[1], Zhiwang Zhang[1], Alberto Cortijo[3], Maria A. H. Vozmediano[3], Francisco Guinea[4], Ying Cheng[1], Xiaojun Liu[1], Johan Christensen[2]
[1] *Nanjing University (China),* [2] *IMDEA Materials (Spain),* [3] *CSIC (Spain),* [4] *IMDEA Nanociencia (Spain)*

In this contribution we focus on various acoustic analogies of carbon allotropes and discuss their topological origins and characteristics. Through theoretical insight, numerical studies, and experimental verifications we

demonstrate acoustic examples with their various nontrivial confinements.

18:50 : Invited talk
Directional manipulation of guided light by anisotropic chirality
Yuqiong Cheng, Kayode Adedotun Oyesina, Bo Xue, Dangyuan Lei, Alex.M.H. Wong, Shubo Wang
City University of Hong Kong (Hong Kong)

We theoretically and experimentally construct a complete near-field directionality space by the synergy of chirality and anisotropy. An anisotropic chiral particle can serve as a directional dipole dice, achieving all types of directional dipoles via different faces of the particle and realizing face-multiplexed and high-dimensional routing of guided light.

16:40 - 18:35 — Room 206

Session 2A33

Symposium III: Advanced passive and active metasurfaces and zero-index materials

Organized by: Howard Lee, Pin Chieh Wu and Qinghua Song

Chaired by: Matthew T. Sheldon

16:40 : Invited talk
Spherulite based Metasurfaces
Jingbo Sun, Y. Liu, L. Zhou, Y. Shen, J. Zhou
Tsinghua University (China)

Spherulites are crystals with cylindrical crystalline structures and thus exhibit anisotropic optical properties with cylindrical symmetry. Here we proposed several way of generating and modulating cylindrical vector optical vortex beams by using spherulites. This strategy provides promising opportunities for the spherulite applications in structured light fields.

17:00 : Invited talk
Introducing Circular Dichroism with Chiral Bound State in the Continuum
Cheng-An Mao, Wen-Hui (Sophia) Cheng
National Cheng Kung University (Taiwan)

A structure of all-dielectric metasurface with the concept of chiral BIC is introduced and studied. By break both in-plane and out-of-plane symmetry, intrinsic chiral metasurfaces with strong circular dichroism of around 0.9 at normal incidence can be realized.

17:20 : Invited talk
Real-Time Multidimensional Imaging with an Encoding Metasurface
Lidan Zhang, Chen Zhou, Hyunju Ahn, Shengyuan Chang, Md Tarek Rahman, Tunan Xia, Zhiwen Liu, Xingjie Ni
The Pennsylvania State University (USA)

We present a metasurface capable of encoding light information across multiple dimensions – polarization, frequency, and time, and consequently, the complete properties of the light field can be captured by a single snapshot. A deep learning-based recovery algorithm is employed to facilitate real-time retrieval of multidimensional images.

17:40 : Invited talk
Nonlinear Mid-infrared Metasurfaces for Harmonic Generation and Deep-Subwavelength Nanomachining
Maxim Shcherbakov
University of California, Irvine (USA)

We perform shot-controlled fifth harmonic generation measurements from a SiC meta-membrane with re-

sonances in the mid-infrared. Back focal plane imaging reveals more than two orders of magnitude FHG enhancement of from the meta-membrane, compared to the unstructured SiC film of the same thickness, along with an unusual Kerr-induced spectral behavior.

18:00 : Impedance-matched zero-index metamaterials: from waveguide to antenna
Yang Li
Tsinghua University (China)

Photonic-crystal-based zero-index metamaterials feature a uniform spatial phase distribution. Coupling between zero-index modes and plane wave induces in-plane and out-of-plane radiations. We close these radiation channels by forming zero-index modes with BICs, leading low propagation-loss zero-index waveguides. Alternatively, we also leverage out-of-plane radiations to achieve high-directivity small-aperture antennas.

18:15 : Invited talk
Building Uncooled Infrared Camera based on One Atom Thick Graphene
Debashis Chanda
University of Central Florida (USA)

The talk will outline a novel strategy for uncooled, tunable, multispectral infrared detection. One atom thick graphene offers an alternative mechanism bypassing material bandgap restriction. The performance of preliminary demonstration compares favorably even with present cryogenically cooled detection schemes paving the path for commercial development of many applications.

16:40 - 18:45 — Room 101

Session 2A34

SP1. Bottom-up approaches, new fabrication routes and ENSEMBLE3

Organized by: Dorota Pawlak and Virginie Ponsinet

Chaired by: Dorota Pawlak and Virginie Ponsinet

16:40 : Invited talk
Creating Meta-Atoms Based on Gold Nanoparticle Assemblies on Polymer Microspheres
Hiroshi Yabu
Tohoku University (Japan)

Fabrication of polymer microspheres densely accumulated with noble metal nanoparticles on their surface, and their applications as sensors and in metamaterials will be shown.

17:00 : Invited talk
Aggregation of Core/Shell Quantum Rods in Composite Polymer Film for Polarization Conversion
Yutaka Okazaki, Shusaku Kubota, Kan Hachiya, Takashi Sagawa
Kyoto University (Japan)

In this presentation, we introduce an approach for achieving both isotropy in the absorption process (low PLP-Abs value) and anisotropy in the emission process (high PLP-Lum value) by controlling aggregation formation of luminogens in uniaxially stretched luminogen/polymer composite films.

17:20 : Invited talk
Development of Colloidal Silicon Nanoparticles and Composites for Photonic Applications
Hiroshi Sugimoto, Minoru Fujii
Kobe University (Japan)

Recently, we developed Mie resonant crystalline Si nanospheres in the size range of 100-300 nm dispersible in solution. Colloidal dispersions of Si nanospheres enable the formation of functional composites with different materials for photonic applications utilizing enhanced light matter interactions.

17:40 : Invited talk

Full-wafer fabrication of all-inorganic metalenses, waveguides and diffractive optics via direct nanoimprint lithography
Dae Eon Jung[1], **Vicent Einck**[2], **Alex Dawicki**[1], **Lucas Verrastro**[1], **Amir Arbabi**[1], **James Watkins**[1]
[1] *University of Massachusetts (USA),* [2] *Myrias Optics, Inc (USA)*

We fabricate all-inorganic, high refractive index optics including metalenses via nanoimprint lithography with TiO2 nanoparticle dispersion inks and report full-wafer fabrication of visible wavelength metalenses with absolute efficiencies greater than 80 %. Atomic layer deposition is used post-imprint to tune refractive index from 1.9 to 2.25 using 20 cycles.

18:00 : High-Density Carbon Nanotube Forest Metamaterials for Advanced Photonic Applications
Hiroshi Furuta, Hinako Kimura, Hokuto Sakoda, Riko Matsuzaki, Saiful Islam, Kazuya Kobiro
Kochi University of Technology (Japan)

Carbon nanotube (CNT) forest metamaterials grown on nano-spherical substrates show flat reflectance in the visible range, showing potential for solar absorption and photonic computing applications through controlled electromagnetic resonance and isotropic optical characteristics.

18:15 : Effective properties of self-assembled plasmonic clusters with spatial dispersion
Ranjeet Dwivedi[1], **Ashod Aradian**[1], **Kevin Vynck**[2], **Alexandre Baron**[1]
[1] *University of Bordeaux - CNRS (France),* [2] *University of Lyon 1 - CNRS (France)*

We study dense, spherical clusters made of hundreds of randomly packed plasmonic nanoparticles. We find that, using a spatial dispersion formalism, these clusters can be described as much simpler equivalent, homogeneous spheres, revealing the presence of artificial magnetism, but also of a longitudinal mode localized at the cluster borders.

18:30 : Optical properties and luminescence control of Ag/TiO2 stacked metasurfaces using out-of-plane quadrupole resonance
TienYang Lo, S. Murai, K. Tanaka
Kyoto University (Japan)

In this study, we experimentally and numerically elucidated the optical properties of a bilayer metasurface system exhibiting out-of-plane quadrupole resonance characteristics and demonstrated the potential for bilayer metasurfaces system in directional light source application.

16:40 - 19:10 — Gallery

Session 2A35

SP5. Bio-Inspired Nanophotonics

Organized by: Debashis Chanda, Hyuck Choo and Radwanul Hasan Siddique

Chaired by: Debashis Chanda

16:40 : Invited talk
Cross-reactive plasmonic arrays as artificial tastebud sensors
Justin R. Sperling[1], **Chad Sipperley**[2], **Rudi Schick**[2], **William J. Peveler**[1], **Alasdair W. Clark**[1]
[1] *University of Glasgow (UK),* [2] *Spraying Systems Co. (USA)*

We present a cross-reactive nanoplasmonic sensor system capable of identifying and classifying almost any complex liquid mixture. Analogous to biological tastebuds, our commercially available plasmonic sensor shows promise in a variety of industrial applications as a simple, rapid quality control measure.

17:00 : Invited talk
Self-Assembled Structural Color Colorimetric Sensor for Smart Phone based Bio-Chemical Sensing
Pablo Cencillo, Mahdi Soudi, Debashis Chanda
University of Central Florida (USA)

We present a self-assembly platform for low-cost, scalable nanoplasmonic colorimetric sensors, overcoming

limitations of traditional fabrication methods. This versatile platform enables real-time detection of chemicals, biomarkers, and environmental conditions, integrating seamlessly with smartphones for portable, power-free diagnostic and sensing applications.

17:20 : Invited talk
Towards a machine learning approach for print parameter prediction in three-dimensional multiphoton laser lithography
Sven Enns, Nicolas Lang, Julian Hering-Stratemeier, Georg von Freymann
RPTU Kaiserslautern-Landau (Germany)

Reducing deviations between design and 3D micro-printed samples without several test prints is difficult since important material properties depend on the process parameters. We present first results towards a detailed prediction of 3D printed structures based on a modeling approach combined with machine learning to adjust the corresponding process parameters.

17:40 : Invited talk
High-performance optical diffuser inspired by Morpho butterfly's optical properties
Akira Saito, Kazuma Yamashita, Kana Taniguchi, Shuta Sakamoto, Takuma Hattori, Yuji Kuwahara
Osaka University (Japan)

A novel type of diffraction-based optical diffuser was developed inspired by Morpho butterfly's optical properties. This diffuser can give simultaneously high transmittance, wide angular spread, low color dispersion, diffused-shape controllability, and anti-fouling. Such multi-functional property has been impossible by conventional diffusers that are based on scattering or refraction.

18:00 : Invited talk
Controlling light and heat with Conducting Polymers and Cellulose
Magnus Jonsson
Linkoping University (Sweden)

We study novel ways to control light and heat using redox-tuneable conducting polymers and other organic materials like cellulose. Applications include dynamically tunable metasurfaces, reflective displays, radiative cooling, and adaptive camouflage. I will present our recent work on those topics.

18:20 : Invited talk
Structural colors: toward AI-enabled design and solution-based fabrication
Weijie Feng, Anwesha Saha, Taigao Ma, Haozhu Wang, L. Jay Guo
University of Michigan (USA)

Structural colors based on layered structures can be mass-produced and have been applied in industrial applications. Such structures can now be designed by machine learning algorithms. Environmental-friendly chrome-like coating can be designed this way and made by PVD process. Solution process was explored as low-cost alternative to make layered structures.

18:40 : Investigating disorder in synthetic and biological 3D photonic structures with volume imaging
Viola Bauernfeind[1], Kenza Djeghdi[1], Ullrich Steiner[1], Bodo D. Wilts[2]
[1] *University of Fribourg (Switzerland),* [2] *Paris-Lodron University Salzburg (Austria)*

Disorder in photonic structures often alters their optical signal. Complex photonic structures with varying extents of disorder have been found in many animals. In vitro, such structures are often achieved via self-assembly processes. Using volume imaging, we work towards a quantitative understanding of disorder in three-dimensional photonic structures.

18:55 : Symmetry Breaking in Bio-Inspired 2D Aluminum Networks probed by Electron Energy Loss Spectroscopy
Jelena Wohlwend[1], Marcello Pozzi[1], Georg Haberfehlner[2], Ralph Spolenak[1], Henning Galinski[1]
[1] *ETH Zurich (Switzerland),* [2] *TU Graz (Austria)*

Natural networks such as lichen show intriguing properties for light absorption. Inspired by such natural networks, using energy electron loss spectroscopy, we analyze the plasmonic modes of different 2D aluminum networks. We resolve a multitude of different plasmonic modes and show the influence of size, connectivity, and symmetry.

Thursday 18th July, 2024

08:30 - 10:05 — Main Hall

Session 3A1

SP9. Metamaterial Technology and Its Application Prospects

Organized by: Tatjana Gric and Edik Rafailov

Chaired by: Tatjana Gric and Edik Rafailov

08:30 : Invited talk
Binocular Meta-lens for Computer Vision
Xiaoyuan Liu[1], Mu Ku Chen[1], Takuo Tanaka[2], Din Ping Tsai[1]
[1] *City University of Hong Kong (Hong Kong),* [2] *RIKEN Center for Advanced Photonics (Japan)*

Meta-lenses, utilizing artificial nanoantenna arrays, offer ultra-thin, aberration-free optics, enhanced by deep learning for improved imaging and sensing. We've developed intelligent binocular meta-lens systems for computer vision applications like particle image velocimetry (PIV), underwater vision, and assisted driving, achieving compactness and high accuracy in multimodal perception.

08:50 : Invited talk
Conducting polymer-cellulose devices for tunable infrared and THz optics
Chaoyang Kuang, Shangzhi Chen, Magnus Jonsson
Linköping University, Sweden (Sweden)

Conducting polymers possess excellent reversible tunability for optical and electrical properties, enabling their various applications ranging from organic (opto)electronics to nanophotonics. In this talk, I will present our latest studies on conducting polymer devices for terahertz and infrared photonic applications.

09:10 : Invited talk
Boosting the tunability of Mid-infrared Metasurfaces based on graphene field-effect transistors
Fei Han[1], The Linh Pham[1], Kacper Pilarczyk[1], Nguyen Thanh Tung[2], Dinh Hai Le[3], Guy A. E. Vandenbosch[1], Joris van de Vondel[1], Niels Verellen[4], Xuezhi Zheng[1], Ewald Janssens[1]
[1] *KU Leuven (Belgium),* [2] *Vietnam Academy of Science and Technology (Vietnam),* [3] *University of New South Wales (Australia),* [4] *IMEC (Belgium)*

In this study, we propose a fabrication-efficient way to enhance the tuning range of mid-infrared resonances based on graphene field-effect transistors. A tuning range in the mid-infrared of 700 nm is more than two times larger than the range presented in previous studies on similar devices with multiple resonances.

09:30 : Invited talk
Energy- and Time-resolved NIR to Visible Upconversion Luminescence from SingleNaYF4:Yb3+,Tm3+ Nanoparticles on Self-assembled Chiral Metasurfaces
A. Ahmed[1], K.Y. Chiok[1], S. May[2], A. Baride[2], R. B. Anderson[1], S. Zhou[1], S. Smith[1]
[1] *South Dakota School of Mines and Technology (USA),* [2] *University of South Dakota (USA)*

We use time- and energy-resolved single particle spectroscopic imaging to assess the plasmonic enhancement of NIR-to-visible upconversion luminescence (UCL) from single β-NaYF4:Yb3+:Tm3+ upconverting nanoparticles (UCNPs) supported on self-assembled chiral metasurfaces1. By examining the effects at the single particle level, we assess the plasmon-enhanced radiative decay and polarization of upconversion luminescence on metasurfaces self-assembled from tetrahedral Au nanoparticles.

09:50 : Optical induced temperature change for ionic thermoelectric applications
Dan Zhao, M. N. Liao, Magnus Jonsson
Linköping University (Sweden)

The low energy density part of solar radiation that cannot be directly utilized by photovoltaics composes

80 % of the total solar energy. Those energy was converted into heat by transparent meta-surface and black absorber to drive the operation of ionic thermoelectric devices.

08:30 - 10:00 — Room 201

Session 3A2

SP18. Plasmonics: Fundamentals and Applications

Organized by: Hong Wei

Chaired by: Hong Wei

08:30 : Invited talk
Subnanometer Resolved Single-Molecule Optical Spectroscopy
Zhen-Chao Dong
University of Science and Technology of China (China)

Recent progresses on two STM-based optical phenomena will be presented. One is single-molecule Raman spectromicroscopy down to single-bond resolution, allowing to track bond breaking and forming of surface reactions, the other is single-molecule electro-phosphorescence with the discovery of a new optomagnetic channel to activate the emission from triplet-to-singlet transition.

08:50 : Invited talk
Tip-enhanced cavity-spectroscopy for quantum light-matter interactions at the nanoscale
Kyoung-Duck Park
POSTECH (Korea)

In this talk, we provide a novel concept of tip-enhanced cavity-spectroscopy (TECS) overcoming the limitations of previous approaches to induce, probe, and dynamically control ultrastrong light-matter interactions. We will then talk about exciton funneling and exciton-to-trion conversion properties in 2D semiconductors at the nanoscale.

09:10 : Keynote talk
Two-dimensional electronic spectroscopy of many-body correlations in quantum materials
Christoph Lienau
Universität Oldenburg (Germany)

Two-dimensional electronic spectroscopy with few-femtosecond resolution is an emerging tool for probing quasi-particle interactions in quantum materials. The talk will discuss its use for exploring the quantum dynamics of strongly-coupled J-aggregate exciton/surface-plasmon hybrids, ultrafast intervalley couplings in atomically-thin semiconductors and for tailoring the nonlinearities of such semiconductors in plasmonic cavities.

09:40 : Invited talk
White-nanolight-source through plasmon nanofocusing for nanoimaging, nanosensing, and nano-optical switching
Takayuki Umakoshi, Prabhat Verma
Osaka University (Japan)

Plasmon nanofocusing is an alternate technique that confines the light field at the apex of a metalized nano-tip, enabling background-free detection. This non-resonant method confines all wavelengths simultaneously, producing a white nanolight at the apex for multi-color optical investigations and applications such as nano-imaging, nanosensing, and nano-optical switching.

08:30 - 09:50 — Room 202

Session 3A3

SP17. Perovskite Photovoltaics: Light-Matter Interaction

Organized by: Hui-Seon Kim and Kazuteru Nonomura

Chaired by: Hui-Seon Kim and Kazuteru Nonomura

08:30 : Invited talk
Nano-photonics as a route to enhance the open circuit voltage from perovskite and organic photovoltaic cells
Jordi Martorell
ICFO-The Institute of Photonic Sciences (Spain)

A nanophotonic structuration of perovskite and organic solar cell architectures is considered for enhancing the open-circuit voltage (Voc). Numerical and experimental results to limit Boltzmann losses and set the path to push the efficiency from planar geometry single junction cells from 33 % to levels exceeding 41 % will be presented.

08:50 : Invited talk
Crystal Growth and Composition Engineering for Reproducible Fabrication of High-Performance Perovskite Solar Cells
Jin-Wook Lee
Sungkyunkwan University (Korea)

Reproducible fabrication of PSCs is a critical consideration for market viability and practical commercialization. In this work, I will discuss the critical functions of atmospheric humidity to regulate the crystallization and stabilization of formamidinium lead triiodide (FAPbI3) perovskites.

09:10 : Invited talk
Vacuum-Processed Additive: A Novel Approach for Controlling Growth of Perovskite Crystals in All Vacuum Processed Perovskite Solar Cells
K. Lee, Kyungkon Kim
Ewha Womans University (Korea)

We present a novel method for controlling the growth of perovskite crystals in a vacuum thermal evaporation process by utilizing a vacuum-processable additive, propylene urea (PU). Co-evaporating of perovskite precursors and PU retards the direct reaction between the perovskite precursors. This facilitates larger domain size and reduced defect density.

09:30 : Invited talk
Improving efficiency and stability of hybrid perovskite devices
Yeng Ming Lam, Haixia Rao, Tze Chian Sum, Senyun Ye
Nanyang Technological University (Singapore)

Organic-inorganic hybrid perovskites have emerged in recent years as one of the most promising materials for solution-processed electronics and optoelectronics. We showed that through a full precursor technology option, it is possible to access a wider cation library for these capping layers.

08:30 - 09:50 — Room 203

Session 3A4

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Akira Baba

08:30 : Invited talk
Silicon Nitride Platform for Quantum Photonics and Quantum Phononics
Khaled Mnaymneh
National Research Council Canada (Canada)

We present our work for producing high quality silicon nitride films for integrated quantum optics and quantum phononics. Our main findings are related to refractive index and its dependence on the film stress and surface roughness. Furthermore, photon and phonon dispersion relations, particle group velocities and the nonlinear index depends very much on the material quality. Here we show how we can use fabrication steps and tools to ensure the reliable realization of next-generation devices targeting applications in quantum technologies.

08:50 : Invited talk
Thermochromic thermal radiator based on angle selective thermal radiation applicable under direct solar irradiance
Makoto Shimizu, Ryu Onozaki, Rihab Benlyas, Zhen Liu, Hiroo Yugami
Tohoku University (Japan)

In this study, a thermochromic thermal radiator is proposed that can dissipate heat at high temperature but insulate heat at low temperature. In addition, thanks to the angular selective thermal radiation property at high temperature, it is applicable under solar irradiance due to its angular selective emission (absorption) property.

09:10 : Invited talk
Finite Difference Driven and Eigenmode Modelling of Polaritonic Systems
Michele Tamagnone, Harsh Gupta, Tatiana Contino, Muhammad Atif Yaqub, Muhammad Waseem Ashraf
Istituto Italiano di Tecnologia (Italy)

We present a new numerical finite difference numerical package capable of handling periodic driven or eigenvalue linear problems in an arbitrary number of dimensions and with user-defined physical laws (e.g. Maxwell's or Schrodinger's equations). We then illustrate the applications to experimental nanophotonic devices and highly confined polaritons in 2D materials.

09:30 : Invited talk
'Meta'-Optical Fibers
Andrew Palmer, Yucheng Jin, Stuart Love, Yujin Zha, Beyonce Hu, Ho Wai Howard Lee
University of California, Irvine (USA)

In this talk, I will present our recent development of 'Meta'-optical fiber, an advanced optical fiber integrated with emerging nanophotonic concepts such as optical metasurfaces, plasmonic nanowires, and zero-index photonics.

08:30 - 10:00 — Room 204

Session 3A5

Symposium V: Architectured Elastic and Acoustic Metamaterials and Phononic Crystals

Organized by: Marco Miniaci, Jensen Li, Vicente Romero-García, Vincent Pagneux and Noé Jiménez

Chaired by: Vincent Pagneux

08:30 : 3D printed polarizer for shear elastic waves
Taeyul Choi[1], Yuqi Jinin[1], Teng Yang[1], Arup Neog[2], Arkadii Krokhin[1]
[1] *University of North Texas (USA),* [2] *University of Electronic Science and Technology of China (China)*

Anisotropy of 3D printing process is explored for design of a polarization rotator of shear waves. Due to strong anisotropy of elastic modulus of 3D printed sample the polarization of shear wave rotates following the gradual change in the direction of infilled lines. The fabricated 90° rotator demonstrates high performance.

08:45 : Coherent excitation of torsional mechanical modes in coupled nanoantennas
Jorge M. Garcia[1], Beatriz Castillo Lopez de Larrinar[1], Chushuang Xiang[2], N. Daniel Lanzillotti-Kimura[2], Antonio Garcia-Martin[1]
[1] *CSIC (Spain),* [2] *Université Paris-Saclay (France)*

We study a two coupled nanoantennas system, where torsional mechanical modes are excited using light with null angular momentum. Twisting of the phononic mode is provided by the peculiar symmetry of the mechanical eigenmode due to the interaction of the bars via either the substrate or a central connector.

09:00 : Single-pixel imaging based on time-modulated gratings and compressive sensing
Pawel Packo[1], Daniel Torrent[2]
[1] *AGH University of Krakow (Poland),* [2] *Universitat Jaume I (Spain)*

In this work, a single-pixel imaging system, made of a homogeneous slab of material with time-dependent transmission properties, is employed for image reconstruction. We use the compressive sensing theory to optimize the recovery process and limit the number of coding sequences of the grating.

09:15 : Tunable magnetic lattices as a platform for controlling sound waves
Osama Bilal
University of Connecticut (USA)

In this work, we realize metamaterials with programmable dynamical characteristics by combining analytical, numerical, and experimental analyses, to utilize tunable nonlinear magnetic lattices for sound wave manipulation.

09:30 : Using Ping-Pong balls to reduce ambient noise
Yan Pennec, Eric Cochin, Gaëtan Lévêque, Bahram Djafari-Rouhani
IEMN - University of Lille (France)

We study an acoustic metasurface using interconnected ping-pong balls as Helmholtz resonators (HR) for broad low-frequency spectral responses. We demonstrate how inter-unit coupling alters low-frequency acoustic insulation and introduce additional attenuation modes. Both numerical and experimental methods are employed for analysis.

09:45 : Acoustic Realization of Multiple Topological Corner Modes in a Coupling-inverted Phononic Crystal
Dongyi Wang, Guancong Ma
Hong Kong Baptist University (Hong Kong)

Here, an unprecedented higher-order topological phase safeguarded by a larger-than-unity multipole chiral number (MCN) is experimentally realized with coupling inversion, i.e., long-range couplings stronger than the nearest-neighbour ones, in acoustic crystal. Sixteen topological corner modes are observed in the mid-gap (4 at each corner), protected by an MCN=4 phase.

08:30 - 09:45 — Conference Room

Session 3A6

SP10. Advanced Computational Electromagnetics for the Analysis and Design of Nanophotonic Devices

Organized by: Maha Ben Rhouma

Chaired by: Riccardo Messina

08:30 : Invited talk
Machine-Learning Assisted Multi-User Frequency Selective Beam Steering with a Reconfigurable Intelligent Surface
Alexander Wolff, Lukas Mueller, Steffen Klingel, Janis Krieger, Lars Franke, Ralf Stemler, Marco Rahm
RPTU Kaiserslautern-Landau (Germany)

We used a Machine Learning approach to design, optimize and experimentally implement a Reconfigurable Intelligent Surface (RIS) that allows simultaneous, dynamic beam steering of microwave signals at 27 GHz and 31 GHz to two users that locally move at two different locations.

08:50 : Invited talk
High-Accuracy DDA
Owen Miller
Yale University (USA)

The discrete dipole approximation (DDA) is a simple but typically low-accuracy simulation technique. We describe two straightforward modifications that reduce the error from first order to fourth order in resolution. We demonstrate fast, accurate simulation in the regime DDA typically struggles: high-complexity, three-dimensional structures with large refractive indices.

09:10 : Invited talk
Duality Gaps in Photonic Inverse Design
Sean Molesky
Polytechnique Montreal (Canada)

Lagrange duality and semi-definite programming relaxations have been recently employed to bound a variety of photonic design objectives. Here, I will describe why these techniques work so well, and provide limits on how much the associated bounds may differ from an optimal device.

09:30 : Plasmonic semiconductor waveguides with tunable nonlinear optical response
Gonzalo Alvarez-Perez, Huatian Hu, Cristian Ciraci
Istituto Italiano di Tecnologia (Italy)

We design tunable nonlinear plasmonic waveguides made of heavily doped semiconductors to boost third harmonic generation. Employing a hydrodynamic nonlocal description, we calculate the power transfer and nonlinear efficiency. Our work has applications in advancing the realization of all-semiconductor photonic integrated circuits and all-optical neural networks.

08:30 - 10:10 — Room 205

Session 3A7

SP11. Chiro-optical and chiral-acoustic phenomena

Organized by: Alessandro Belardini and Oliver Wright

Chaired by: Alessandro Belardini

08:30 : Invited talk
Intrinsic Three-dimensional Spin Angular Momentum of Gigahertz Evanescent Acoustic Phonons
Yi He[1], Hoon Sohn[2], Osamu Matsuda[3], Zhongqing Su[1]
[1] *The Hong Kong Polytechnic University (Hong Kong),* [2] *Korea Advanced Institute of Science and Technology (Korea),* [3] *Hokkaido University (Japan)*

The present work is dedicated to gaining insight into the SAM of GHz evanescent acoustic phonons (EAP) in the lattice of monocrystalline materials, in which the temporally averaged Poynting vector of EAP is zero along specific directions. Theoretical modelling on lattice dynamics reveals that the EAP carries intrinsic three-dimensional (3-D) SAM – a trait that the bulk acoustic phonons do not manifest.

08:50 : Invited talk
Angular momentum addition of flexural wave using transformation approach
Pengfei Zhao[1], Xiaofan Wang[2], Liyou Luo[1], Jensen Li[1], Huanyang Chen[2]
[1] *The Hong Kong University of Science and Technology (China),* [2] *Xiamen University (China)*

We propose to add flexural wave angular momentum on the plate with tailor-made thickness profile using transformation approach. The experimental result illustrates that two vortexes with same topological charge

l located at different positions in space appear like a new single vortex with topological charge 2l in the near field.

09:10 : Invited talk
Topological boundary modes in a hexagonal flexural wave machine
Motonobu Tomoda, Hayato Takeda, Ryoya Minami, Osamu Matsuda, Oliver B. Wright
Hokkaido University (Japan)

We construct a two-dimensional mechanical wave machine based on a hexagonal lattice to investigate low-frequency flexural plate waves whose propagation mimics a topological quantum valley Hall system. Imaging experiments, backed up by simulations, reveal the presence of boundary modes along a topological interface.

09:30 : Invited talk
Some three-dimensional acoustic flat bands
Baile Zhang
Nanyang Technological University (Singapore)

Flat bands are momentum-independent energy levels, whose history can be traced back to the Landau levels introduced in 1930. Here we discuss the construction of 3D flat Landau levels in an acoustic crystal. We also discuss the construction of highly degenerate 3D flat bands with acoustic waves.

09:50 : Invited talk
Jet formation induced by sub-nanosecond optical vortex optical pulses
Keisaku Yamane[1], Ryota Tamemoto[1], Kotaro Sato[1], Yasunori Toda[1], Takashige Omatsu[2], Ryuji Morita[1]
[1] *Hokkaido University (Japan),* [2] *Chiba University (Japan)*

The jet formation was induced by a 120-ps optical vortex pulse irradiation with a topological charge of 1. The generated jet was monitored by a snapshot imaging system and its speed was evaluated to be 40 m/s.

08:30 - 10:10 — Room 206

Session 3A8

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Xiangrong Wang

08:30 : Invited talk
Symmetry Breaking in Colloidal Metal Nanostructures by Circularly Polarized Light Directed Galvanic Replacement Reaction
Monika Ghalawat[1], Daniel Feferman[1], Artur Movsesyan[2], Wanting He[3], Zhiming Wang[4], Dongling Ma[3], Alexander Govorov[2], Gil Markovich[1]
[1] *Tel Aviv University (Israel),* [2] *Ohio University (USA),* [3] *Institut National de la Recherche Scientifique (Canada),* [4] *University of Electronic Science and Technology of China (China)*

Colloidal gold@silver nanocuboids were illuminated with circularly polarized light during partial galvanic replacement reaction of the silver shell with gold ions. This resulted in a small symmetry breaking manifested through appearance of circular dichroism, in spite of the random rotational averaging of the nanocuboids with respect to the illumination direction.

08:50 : Invited talk
Si metasurface on a magneto-optical thin film for enhancing nonreciprocal polarization rotation
Yasutomo Ota[1], Siyuan Gao[1], Tatsuya Kitai[1], Kota Taniguchi[1], Takeru Yambe[1], Satoshi Iwamoto[2]
[1] *Keio University (Japan),* [2] *The University of Tokyo (Japan)*

Magneto-optical interactions in transparent materials are generally weak, making the devices bulky. Here, we discuss the design of a Si metasurface placed on a magneto-optical thin film. A 45° nonreciprocal polari-

zation rotation at 1.5 μm was achieved by loading a 140-nm-thick Si metasurface on a 513-nm-thick Bi:YIG membrane.

09:10 : Invited talk
Surface Lattice Resonance for Enhanced Magnetoplasmonic Activity
Terunori Kaihara, Pablo Rodriguez-Suarez, Paolo Vavassori
CIC nanoGUNE BRTA (Spain)

We investigate the magneto-optical effect enhancement in magnetoplasmonic metacrystals. Utilizing surface lattice resonance in periodic arrangements and noble/ferromagnetic metal hybridization, we achieve a $\sim$4-fold enhancement over film counterparts without the need for correction by the fill factor. This underscores the importance of far-field coupling via surface lattice modes.

09:30 : Invited talk
Correlation-enhanced interaction of a Bose-Einstein condensate with parametric magnon pairs and virtual magnons
Oleksandr (Alexander) Serha (Serga)
University of Kaiserslautern-Landau (Germany)

Nonlinear interactions in a magnetic medium excited by parametric pumping lead to Bose-Einstein condensation of spin-wave quanta-magnons. Using Brillouin light scattering spectroscopy, we have discovered a correlation-enhanced four-wave interaction process of the magnon condensate with fully correlated parametric magnon pairs, which results in off-resonant spin-wave excitations-virtual magnons.

09:50 : Invited talk
Antiferromagnetic skyrmion lattice of the 4-sublattice tetrahedral order
Tomoki Hirosawa[1], Maria Azhar[2], Alexander Mook[3]
[1]*Aoyama Gakuin University (Japan),* [2]*University of Duisburg-Essen (Germany),* [3]*Johannes Gutenberg University Mainz (Germany)*

The 4-sublattice tetrahedral order is the smallest topological spin texture with spatially uniform topological charge density. In this work, we study a minimal spin lattice model of the tetrahedral phase. We investigate the magnetic phase diagram when the Dzyaloshinskii-Moriya interaction is present.

08:30 - 10:05 — Room 101

Session 3A9

Symposium III: Advanced passive and active metasurfaces and zero-index materials

Organized by: Howard Lee, Pin Chieh Wu and Qinghua Song

Chaired by: Howard Lee

08:30 : Invited talk
Local high quality factor metasurfaces for extremely low threshold,nonlinear image filtering and efficient programmable wave shaping
Mark Lawrence, Lin Lin, Bo Zhao, Samuel Ameyaw
Washington University in St Louis (USA)

The latest frontiers of efficient nonlinear and dynamic light shaping are at odds with the traditional metasurface paradigm as the demand for dramatically amplified light-matter coupling typically constrains dielectric meta-atoms to be much bigger than the wavelength. Here, we present a solution to this problem

08:50 : Invited talk
Absorption-Based Nanophotonic Quantum Sensing on Resonant Metasurfaces
Laura Kim
University of California Los Angeles (USA)

Optically addressable nitrogen-vacancy (NV) centers in diamond have emerged as one of the leading quantum sensing platforms but suffer from suboptimal readout due to the inefficient spin-photon interface. I will discuss spin-coupled resonant metasurfaces that offer opportunities for near-unity readout fidelity within a nanoscopic sensing volume for wide-field sensing applications.

09:10 : Invited talk
Experimental demonstration of ENZ-enhanced optical nonlinearity in ultrathin TiN epilayers
F.-T. Tseng[1], I-H. Ho[1], S. Gwo[2], Hyeyoung Ahn[1]
[1] *National Yang Ming Chiao Tung University (Taiwan),* [2] *National Tsing Hua University (Taiwan)*

Epsilon-near-zero (ENZ) effect for metals can be observed in the visible range, but only for ultrathin layers with nanoscale thickness. We report the first experimental realization of ENZ-enhanced ultrafast optical nonlinearity from refractory TiN ultrathin epilayers grown by MBE via the thickness and incidence-angle dependent z-scan and transient absorption measurements.

09:30 : Full-Stokes metasurface polarimetry based on multidimensional polarization conversion
Chenglong Zheng, Huaping Zang, Peinan Ni
Zhengzhou University (China)

We demonstrate a multi-focus metalens for terahertz polarization detection that requires only a single measurement to obtain complete polarization parameters and reconstruct the polarization state of the incident field. The proposed metasurface polarimetry may find applications in the fields of real-time terahertz detection and integrated optics.

09:45 : Invited talk
Dynamic optical MEMS metasurfaces
Fei Ding
University of Southern Denmark (Denmark)

We have demonstrated a micro-electro-mechanical (MEMS) mirror-integrated dynamic optical metasurface platform for dynamic wavefront control with high modulation efficiencies and fast speed by electrically controlling the air gap between the plasmonic metasurface and MEMS mirror.

08:30 - 10:05 — Gallery

Session 3A10

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Maria Vanessa Oguchi

08:30 : Invited talk
Origin of high transmission via sharp bends of photonic-crystal waveguides with and without inversion symmetry
W. Dai, T. Yoda, Y. Moritake, Masaya Notomi
Tokyo Institute of Technology (Japan)

We investigate transmission properties via sharp bends of various triangular- and square-lattice photonic-crystal waveguides including valley-photonic waveguides, and have found that high transmission appears for some type of bands and interface configurations, irrespective of the inversion symmetry. This phenomenon is governed by bright circularly-polarized singular points around the bending interface.

08:50 : Invited talk
Attosecond Electron Microscopy
Joel Kuttruff, David Nabben, Levin Stolz, Andrey Ryabov, Peter Baum
Universität Konstanz (Germany)

We introduce attosecond transmission electron microscopy as a method to probe the electromagnetic near-

fields of nanostructures in space and time.

09:10 : Invited talk
In-Operando Optical Spectroscopy of Field-Effect-Gated Transparent Conductive Oxides
Michele Magnozzi[1], Maria Sygletou[1], Stefano Colace[1], Riccardo Magrin Maffei[2], Stefania Benedetti[3], Alessandro di Bona[3], Aleksandr Petrov[4], Piero Torelli[4], Emilio Bellingeri[5], Maurizio Canepa[1], Francesco Bisio[5]
[1] *Universita di Genova (Italy),* [2] *Universita di Modena e Reggio Emilia (Italy),* [3] *CNR-NANO (Italy),* [4] *CNR-IOM (Italy),* [5] *CNR-SPIN (Italy)*

Transparent conductive oxides (TCOs) are often exploited as active optical materials in field-effect configuration. Voltage-driven charge accumulation/ depletion in TCOs allows to tune their optical response. We report an in-operando investigation of TCOs under field effect, exploiting spectroscopic ellipsometry and optical modelling to reconstruct the charge-density profile within the materials.

09:30 : Negative index metamaterial using colloidal lithography for large-area and high productivity
Youngsun Jeon, H. Cho, Junsuk Rho
POSTECH (Korea)

Metamaterials are subwavelength structures designed to exhibit extraordinary phenomena such as negative refraction. A multilayer fishnet metamaterial fabricated using colloidal lithography offers large-area production. The material demonstrates negative refraction at 1550nm, promising sub-diffraction imaging, nanolithography and real-time biological imaging.

09:45 : Invited talk
Controlling the radiation space and wavelength with MIM metasurface in mid infrared wavelength
Yoshiaki Nishijima, Tsuyoshi Kawaida, Megumi Tanaka, Kazuma Sekiya
Yokohama National University (Japan)

We have realized the thermal radiation control of MIM metasurface using the concept of metalens. The reflection phase was obtained FDTD simulation and fabricated the metasurface by electron beam lithography. The focal spot of thermal radiation can be seen with desired focal point.

Coffee Break

Session 3P1
Poster Session V
10:00 - 10:40

P1: Inch-scale metalenses for imaging eyepieces with expanded field of view
David Woolf, Nicholas Kochan, Michael Rayno, Evan Simmons, Mohamed Mohamed, Joel Hensley
Physical Sciences, Inc. (USA)

Physical Sciences, Inc. designed, fabricated, and characterized an eyepiece optical system containing both refractive optics and metalenses to significantly reduce the size and weight of a 60° field of view eyepiece designed for visible wavelengths relative to an all-refractive system.

P2: Impact of Numerical Simulation Boundary-Decomposition Errors on Optical Performance of Meta-diffusors
Louis-Henri Fernandez-Mouron[1], Loumi Tremas[2], Mathys Legrand[2], Pascal Urard[2], Habib Mohamad[2], Lucie Dilhan[2], Enrico Giuseppe Carnemolla[3], Matteo Fissore[4], James Downing[4], Valérie Serradeil[2], Bruce Rae[4], Denis Rideau[2]
[1] *StMicroelectronics (France),* [2] *STMicroelectronics (France),* [3] *STMicroelectronics (United Arab Emirates),* [4] *STMicroelectronics (United Kingdom)*

Performing accurate optical FDTD simulations of large meta-diffusors (∼mm) with subwavelength meshing is challenging. A common technique [1-2] involves subdividing the domain and stitching the simulation results, but the resulting error has been rarely studied. We propose a novel approach to emulate this stitching simulation strategy error on meta-diffusors.

P3: Inverse Design of microwave absorber based on adjoint topological optimization
Hyeonjin Park, Jonghwa Shin
Korea Advanced Institute of Science and Technology (Korea)

Optimization of metal-backed multi-layered slab structure were considered for X-band absorption. The permittivity of each slab was assumed to possess a single Lorentzian resonance. The permittivity value was optimized with a topological adjoint algorithm and achieved an ultra-thin microwave close to the theoretical limit near 89 %

P4: Non-Hermitian topological systems using nonreciprocal electroacoustic elements
Anis Maddi, Guillaume Penelet, Vincent Pagneux, Vassos Achilleos
Université du Mans (France)

In this work, we explore the use of active acoustic elements for the design of non-Hermitian topological systems. We experimentally observe the emergence of the non-Hermitian skin effect in a nonreciprocal acoustic network. Additionally, we discuss the transition from PBC to OBC and the associated boundary sensitivity.

P5: Topologically dark metamaterials for optical biosensing
Gleb Tselikov[1], Georgy Ermolaev[1], Aleksey Arsenin[1], Andrei Kabashin[2], Valentyn Volkov[1]
[1] *Emerging Technologies Research Center (United Arab Emirates),* [2] *Aix Marseille University (France)*

Our research focuses on utilizing topologically dark metamaterials to achieve exceptionally high spectral and phase sensitivity in detecting biological binding events. The proposed approach can provide a plenty of sensing modalities in wearable electronic devices like multifunctional smart contact lenses. Moreover, it was used to probe two dimensional materials.

P6: Linearly Polarization-Sensitive Monolayer MoS2 Plasmonic Phototransistors
Chen-Yu Wang[1], Shane Yeh[1], Jui-Han Fu[2], Cheng-Han Lin[1], Tzu-Yu Peng[1], Jia-Wern Chen[3], Feng-Yang Tsai[1], Vincent Tung[2], Yu-Jung Lu[1]
[1] *National Taiwan University (Taiwan),* [2] *The University of Tokyo (Japan),* [3] *Academia Sinica (Taiwan)*

We demonstrate highly polarization-sensitive plasmonic phototransistors using a monolayer MoS2 on an HfN-gated structure and integrated with plasmonic Au nanorod arrays. Through finite-difference time-domain (FDTD) calculations, we achieved a strong linear polarization selectivity of up to 90 % under illumination at 660 nm.

P7: MAPLE simulation for multilayer-layers solar cell based in ZnS- CZTSSe
Hala El-Khozondar[1], A. N. Sahmoud[2], R. J. El-Khozondar[2], Y. F. Nassar[1]
[1] *Islamic University of Gaza (Palestine),* [2] *Al-Aqsa University (Palestine)*

The model is implemented using Maple to assess open-circuit voltage, short-circuit current density, conversion efficiency, and fill factor for a ZnO(window)/CdS(buffe)/ CZTSSe(absorber) solar cell. The varying thicknesses of Buffer layer (wn) is considered in the calculations. The outcomes reveal that wn leads to a significant enhancement in all performance indicators.

P8: Lithium-plasmon-based low-powered dynamic color display
Jie Liang, Yan Jin, Jia Zhu, Lin Zhou
Nanjing University (China)

In modern electronics, displays and power supplies stand as pivotal yet independent pillars. This report introduces a novel dual-function lithium-plasmon dynamic display, seamlessly blending dynamic color features with energy recycling to achieve both low energy consumption and high resolution.

P9: Self-referenced integrated plasmo-photonic sensor for temperature compensated refractive index sensing measurements
Stelios Simos[1], Lamprini Damakoudi[1], Evangelia Chatzianagnostou[1], Konstantinos Fotiadis[1], Dimosthenis Spasopoulos[1], Evangelia Chatzianagnostou[1], Dimitris Bellas[2], Omkar Bhalerao[3], Stephan Suckow[4], Max Lemme[5], Nikos Pleros[1]
[1] *Aristotle University of Thessaloniki (Greece),* [2] *University of Ioannina (Greece),* [3] *RWTH Aachen University (Greece),* [4] *AMO GmbH (Germany),* [5] *RWTH Aachen University (Germany)*

In this work we propose a self-referenced plasmo-photonic refractive index sensor configuration, integrated on a polymer platform, to compensate for the effect of temperature.

P10: Integrated Plasmo-Photonic Bimodal Interferometer for Temperature Sensing
Lamprini Damakoudi[1], Stelios Simos[1], Konstantinos Fotiadis[1], Dimosthenis Spasopoulos[1], Evangelia Chatzianagnostou[1], Omkar Bhalerao[2], Stephan Suckow[3], Max Lemme[2], Eleftherios Lidorikis[4], Nikos Pleros[1], Konstantinos Vyrsokinos[1]
[1]*Aristotle University of Thessaloniki (Greece),* [2]*RWTH Aachen University (Germany),* [3]*AMO GmbH (Germany),* [4]*University of Ioannina (Greece)*

This work reports on an integrated plasmo-photonic bimodal interferometer with 1.233 nm/ ℃ sensitivity.

P11: Control of Electric and Magnetic Dipole Emission by Purcell effect of Mie resonant Silicon nanosphere
Hiroki Kasai, Hiroshi Sugimoto, Minoru Fujii
Kobe University (Japan)

The enhancement of magnetic dipole transition is a key factor for controlling light emission of rare-earth ions and facilitating spin-forbidden optical transition. In this study, we employ spherical silicon nanoparticles with magnetic-type Mie resonances for enhancing the magnetic dipole emission of Eu3+ ions.

P12: Self-Assembled Plasmonic Nanoparticles for Photocatalysis
Asta Tamuleviciene, Klaudijus Midveris, Tomas Klinavicius, Muhammad Haris, Mindaugas Juodenas, Domantas Peckus, Sigitas Tamulevicius, Tomas Tamulevicius
Kaunas University of Technology (Lithuania)

Chemically synthesized gold nanoparticles were self-assembled on a template and transferred onto TiO2 layer. The photoelectrochemical performance and spectral response of high-Q surface lattice resonance demonstrating electrode was compared with the counterpart containing random particles originated by dewetting of thin film and having broader localized surface plasmon resonance.

P13: Unified model for multiple scattering problems in one-dimensional elastic waveguides
Mario Lazaro[1], Vicente Romero-García[1], Luis M. García-Raffi[1], Richard V. Craster[2]
[1]*Universitat Politècnica de València (Spain),* [2]*Imperial College London (United Kingdom)*

In this paper, a new model for the wave response of waveguides with an arbitrary number of scatterers is proposed. We consider two types of scatterers: resonator-type and inclusion-type, these latter as small properties perturbations (material and cross section). A resulting unified mathematical model results for both type of scatterers.

P14: Characterization of metasurface-based optical vortices using quadriwave lateral shearing interferometry
Yanel Tahmi[1], Samira Khadir[2], Matthieu Ansquer[1], Patrice Genevet[3], Benoit Wattellier[1]
[1]*PHASICS (France),* [2]*Université Côte d'Azur (France),* [3]*Colorado School of Mines (USA)*

For more than 30 years, optical vortices (OVs) have been an active research topic with numerous applications. The emergence of metasurfaces has opened up new avenues for the generation of OVs. We propose a study of OVs generated with metasurfaces using a wavefront sensor based on quadriwave lateral shearing interferometer.

P15: Time-varying nonlinear effects in Q-boosted metasurfaces
Anna Chernyak[1], Alexander Musorin[1], Andrea Tognazzi[2], Paolo Franceschini[2], Costantino De Angelis[2], Andrey Fedyanin[1]
[1]*Lomonosov Moscow State University (Russia),* [2]*National Research Council (Italy)*

Metasurfaces provide control of light properties, including nonlinear effects enhancement, with potential applications through active manipulation of radiation parameters via external permittivity perturbations. The metasurface we propose is feasible for fabrication and demonstrates an increase in quality factor following photo-excitation from optical pump pulses and dynamically enhanced 3rd harmonic generation.

P16: Electromagnetic response of liquid crystal based tunable high refractive index dielectric rings metasurfaces
Pratiksha Sakhare, Jayasri Dontabhaktuni
Mahindra University (India)

In current work, we present detailed numerical investigation of high refractive index circular and square rings. We calculate scattering response, near-field, far-field radiation profiles of rings in infrared regime. We observe

tunability, formation of certain modes as a function of thickness, liquid-crystal orientations with applications towards optically active metadevices, sensors.

P17: Dynamics of Thermal Asymmetry: Interfacial Thermal Conductance in Plasmonic Janus Nanostructures

Javier Gonzalez-Colsa[1], Fernando Bresme[2], Pablo Albella[1]
[1] *University of Cantabria (Spain),* [2] *Imperial College London (United Kingdom)*

Plasmonic Janus nanoparticles have shown as promising agents in biomedicine due to their controllable photothermal response. Here, we study how interfacial thermal conductance affects their thermal relaxation. The main result is a directional heat dissipation under nanosecond pulsed light, something that supports their potential in photothermal therapies and temperature-controlled devices.

P18: The role of elastic interfaces in a reduced relaxed micromorphic formulation of finite-size mechanical metamaterials

Leonardo Andres Perez Ramirez, Jendrik Voss, Gianluca Rizzi, Svenja Hermann, Plastiras Demetriou, Angela Madeo
TU Dortmund (Germany)

The surfaces and interfaces found in finite-size metamaterials are likely to trigger boundary effects. Introducing elastic interfaces in the micromorphic formulation of the problem captures this boundary-driven response in the simplified framework of generalized continuum mechanics. Finite-size specimens, identical almost everywhere except at their boundaries, may show different responses.

P19: Monolayer semiconductor superlattices for enhanced absorption with controlled interlayer interaction

Sara Elrafei[1], Tom Sistermans[2], Lennart Heijnen[1], Rasmus Hjelmgart Godiksen[1], Alberto Curto[2]
[1] *Eindhoven University of Technology (The Netherlands),* [2] *Ghent University (Belgium)*

Strongly absorbing materials are needed for nanoscale optoelectronics and strong light-matter coupling applications. Here, we demonstrate that monolayer WS2 superlattices provide higher absorption than natural monolayers and bilayers while preserving the exciton emission. The use of a molecular spacer allows us to control the interlayer coupling at sub-nanometric distances.

P20: Investigating Nonlinear Optical Switching via Nanosecond Z-scan: Coupling Saturable Absorption in Gold with Reverse Saturable Absorption in Strontium Titanate

Nikita Vashistha[1], Hitheshwar Prasad[2], N. Sri Ram Gopal[2], Rajiv K. Singh[3], Sandeep Singh[3], S. P. Singh[3], Mahesh Kumar[4]
[1] *Friedrich Schiller University Jena (Germany),* [2] *University of Hyderabad (India),* [3] *CSIR-National Physical Laboratory (India),* [4] *(India)*

This study demonstrates visible region nonlinear optical switching by coupling reverse saturable absorption(RSA) in STO with saturable absorption(SA) in a Gold film. SA in Gold comes from SPR bleaching, while RSA in STO from 2PA. Using a nanosecond pulsed laser(532nm), we achieved optical switching at irradiances from 2.12 to 3.0GW/cm².

P21: Manipulation of 2-Dimensional layers of plasmonic nanoparticles using a SAW device

Chandresh Sindal, Julien Reboud, Narayana M. S. Sirimuthu, Alasdair W. Clark, Jonathan M. Cooper
University of Glasgow (United Kingdom)

We present the acoustic manipulation of 2D structures of metallic nanoparticles and their use for localized surface plasmon resonance (LSPR) sensing, creating a unique LSPR scanning system. The movable nanoparticle monolayers were patterned using standing surface acoustic wave (SSAW) tweezers. We validated their functionality for refractive index sensing.

P22: Resonances Governed by Lattice Induced Multipole Coupling in Metasurfaces with Inversion Symmetry

Izzatjon Allayarov, Andrey B. Evlyukhin, Antonio Cala Lesina
Leibniz University Hannover (Germany)

We discuss multiresonant features of symmetric metasurfaces and the physical mechanism behind them, i.e., the lattice induced coupling between high-order Mie-type multipoles. Our analytical and numerical results provide important possibilities in the design of simple metasurfaces for structural color generation, optical

sensing, and nonlinear processes.

P23: Free-form inverse design of dynamically tunable metamaterial absorber for Mid-Infrared applications
Ram Prakash S, Aastha Jain, Rajesh Kumar, Anirban Mitra
Indian Institute of Technology Roorkee (India)

We present a free-from inverse design of a dynamically tunable metamaterial absorber using a phase change material. The proposed inverse design is based on a neural-adjoint optimization method using a Wasserstein generative adversarial neural network (WGAN) to predict tunable metamaterial design for the desired absorption spectrum in the mid-infrared region.

P24: Fluorescence enhancement of novel azulene-tetrazoles using metasurface structures
Veronica Anastasoaie[1], Iuliana Mihalache[1], Roxana Tomescu[1], Adrian Dinescu[1], Eleonora-Mihaela Ungureanu[2], Oana Brincoveanu[1], Dana Cristea[1]
[1] *IMT-Bucharest (Romania),* [2] *National University of Science and Technology POLITEHNICA Bucharest (Romania)*

This study aims to enhance the fluorescence of novel azulene-tetrazole derivatives using a platform based on plasmonic metasurfaces with the aim of developing new biosensors. We focus on two important azulene-tetrazole derivatives. We investigate the effect on fluorescence of gold, silver or aluminum nanostructures on silicon or glass substrates.

P25: Nanophotonic chirality transfer to dielectric Mie resonators
Ershad Mohammadi[1], TV Raziman[1], Alberto G. Curto[2]
[1] *Eindhoven University of Technology (The Netherlands),* [2] *Ghent University and IMEC (Belgium)*

Nanophotonics can boost the weak circular dichroism of chiral molecules. One mechanism relies on creating fields with high optical chirality at the molecular position using resonators. Here, we elucidate how the reverse interaction between molecules and the resonator, called chirality transfer, can produce stronger circular dichroism in dielectric Mie resonators.

P26: All-In-One Etching and Measurements of Silicon Metalens for Near-Infrared Focusing
Bingrui Lu[1], Søren Engelberth Hansen[2], Michael Juhl[2], Søren Stobbe[2]
[1] *Technical University of Denmark (Germany),* [2] *Technical University of Denmark (Denmark)*

A metalens containing silicon pillars arranged in hexagonal unit cells for near-infrared wavelengths is fabricated through a high-precision all-in-one etch to avoid wet chemistry processes during fabrication. Measurements demonstrate the focusing property of the metalens. It can be placed on photonic circuits or components to form a 2.5D integrated system.

P27: Consensus ADMM for Photonic Design
Hyeonhee Kim[1], Myungjoon Kim[1], Zeyu Kuang[2], Owen D. Miller[2], Jonghwa Shin[1]
[1] *KAIST (Korea),* [2] *Yale University (USA)*

We propose a novel photonic design approach by formulating the problem as quadratically constrained quadratic programming and applying a consensus-based alternating direction method of multipliers. We demonstrate that for a metalens design, our algorithm outperforms conventional inverse design methods, achieving superior outcomes in terms of solution quality and optimization speed.

P28: Tunable Transition Metal Dichalcogenide Based Metasurfaces in Liquid Crystal Medium
Koviloor Anu, Jayasri Dontabhaktuni
Mahindra University (India)

In this work, we demonstrate versatility and tunability of transition metal dichalcogenide based metasurfaces in air and liquid-crystal medium. We explore the tunability in electromagnetic response, near-field, far-field radiation profiles, sensitivity, strong coupling between excitons and polaritons in WS2 based metasurfaces as a function of liquid-crystal orientations in visible region.

P29: Metal-Insulator Transition in Vanadium Dioxide Inspected by Analytical Electron Microscopy
Jan Krpensky[1], Michal Horak[2], Jakub Planer[2], Peter Kepic[2], Jiri Kabat[2], Andrea Konecna[2], Vlastimil Krapek[2]
[1] *CIC nanoGUNE (Spain),* [2] *Brno University of Technology (Czech Republic)*

Vanadium dioxide is an emerging plasmonic material with metal-insulator transition, relevant for active plasmonics and switchable optical metasurfaces. We study the metal-insulator transition with analytical electron microscopy, locally correlating signatures of the transition in chemical, crystallographic, and optical properties.

P30: Quantification of chirality based on electric toroidal monopole: Application to a twisted methane molecule

Akane Inda[1], R. Oiwa[2], S. Hayami[1], H. M. Yamamoto[3], H. Kusunose[4]
[1]*Hokkaido University (Japan),* [2]*RIKEN (Japan),* [3]*Institute for Molecular Science (Japan),* [4]*Meiji University (Japan)*

We propose a way to quantitatively evaluate chirality in terms of the electric toroidal monopole, a time-reversal-even pseudo(parity-odd) scalar at the quantum-mechanical level. Applying the method to a twisted chiral methane molecule, we analyze the important model parameter for chirality beyond the symmetry analysis.

P31: Infrared Surface Lattice Resonances using Plasmonic Transition Metal Nitrides

Hsing-Yu Kuo[1], Tzu-Yu Peng[1], Jia-Wern Chen[2], Yu-Jung Lu[2]
[1]*National Taiwan University (Taiwan),* [2]*Academia Sinica (Taiwan)*

We report high Q surface lattice resonances using plasmonic transition metal nitride nanoparticle arrays, which possess a high-quality factor (Q-factor) that is sensitive to the surrounding environment of the nanoparticle structure. We intend to utilize this plasmonic nanostructures for future design of high temperature enable optical sensing systems.

P32: Realization of Wilson fermions in topolectrical circuits

Huanhuan Yang, Lingling Song, Yunshan Cao, Peng Yan
University of Electronic Science and Technology of China (China)

We realize the Wilson fermions (WFs) in momentum space with electrical circuits and find the structure of WFs manifest as topological spin textures analogous to the half skyrmion, half-skyrmion pair, and Néel skyrmion structures, depending on their mass. We further confirm their topological features in lattice space.

P33: Conductivity responsive effective permittivity control in GaAs tunable metamaterials

Minyeul Lee[1], Sungyoung Yoon[2], Jonghwa Shin[1]
[1]*KAIST (Korea),* [2]*Samsung Electronics (Korea)*

In this study, we propose a novel metamaterial configuration utilizing semiconductor conductivity to achieve notable tunability in relative permittivity. Theoretical analysis and simulations confirm the efficacy of this approach. Experimental measurement employing GaAs, including capacitance analysis under LED illumination, reveals this metamaterial's tunability.

P34: Plasmon-enhanced fluorescence immunosensor using polymer-coated silver nanoparticles

Nahoko Okimi[1], Setsuko Yano[2], Yoshie Komatsu[2], Toshifumi Nanjyo[2], Mitsuhiro Uesugi[2], Ryo Kato[1], Takuo Tanaka[1], Fumihisa Kitawaki[2], Taka-aki Yano[1]
[1]*Tokushima University (Japan),* [2]*PHC Corporation (Japan)*

We developed a one-pot method for synthesizing polymer-coated silver nanoparticles, which are suitable for plasmon-enhanced fluorescence immunosensing. The coating with the polymer layer is sufficiently thin to plasmonically enhance fluorescence, yet thick enough to effectively suppress fluorescence quenching. This enables the highly sensitive detection of blood biomarkers at picomolar(pM) concentrations.

P35: Applications of a ray-based metalens design tool on freeform metasurfaces

Yijun Ding[1], Bryan Stone[1], Motoyuki Otake[2]
[1]*Synopsys Inc. (USA),* [2]*Synopsys Inc. (Japan)*

We discuss applications of a ray-based design tool for metalenses. The application examples include (1) reflective metalens on a curved surface for near-eye displays, (2) meta-Alvarez lens, and (3) a metalens for projecting illumination to various angles from an actuated fiber tip in a scanning fiber endoscope.

P36: Spontaneous disentanglement and thermalisation

Eyal Buks
Technion (Israel)

The problem of quantum measurement can be partially resolved by incorporating a process of spontaneous disentanglement into quantum dynamics. We propose a modified master equation, which contains a nonlinear

term giving rise to both spontaneous disentanglement and thermalisation. The added term enables limit cycle steady states.

10:40 - 12:30 — Main Hall

Session 3A11

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Eugene Kamenetskii

10:40 : Invited talk
Chirality in optical manipulation via electronically resonant light-matter interactions
Hajime Ishihara
Osaka University (Japan)

Particles ranging in size from the atomic scale to the micro scale can be mechanically manipulated by optical forces. This presentation delves into the effects of light-matter chiral interaction that appear in the optical force phenomena, which are discussed based on the electronically resonant linear and nonlinear optical response.

11:00 : Invited talk
Twisted Cavity Resonators of Anyon Rotational Symmetry with Bulk Modes of Non-Zero Helicity
Jeremy Bourhill, Emma Paterson, Maxim Goryachev, Michael Tobar
The University of Western Australia (Australia)

We present a new type of cavity resonator with bulk resonant modes with non-zero electromagnetic helicity and hence strong angular momentum. By constructing a stabilized oscillator from the resonator, we show that the modes couple to ultra-light dark matter axions by adding amplitude-modulated sidebands through the axion-photon chiral anomaly.

11:20 : Invited talk
Planar resonant metasurfaces with 3D intrinsic chirality
Zi-Lan Deng, Meng-Xia Hu, Xin Li, Qian-Mei Deng, Feng-Jun Li, Xiangping Li
Jinan University (China)

This talk presents our recent studies on the chiral resonant metasurfaces with planar structures embedded in an asymmetric environment. 3D intrinsic chirality could be achieved with simultaneous tunable quality factor and emission circular dichroism, enabling new possibilities for circularly polarized light sources, chiral molecule detection, and chiral nonlinear optics.

11:40 : Keynote talk
Gated Spin Communities
Tao Yu[1], Gerrit Bauer[2]
[1] *Huazhong University of Science and Technology (China),* [2] *Kavli Institute for Theoretical Sciences (China)*

Conducting contacts modulate and control the magnetodipolar interaction that causes chirality of the magnetization and energy transport by spin waves at interfaces and in thin films. Metallic normal, ferromagnetic, and superconducting gates thereby generate new functionalities in magnonic circuits and devices.

12:10 : Invited talk
Algebra of Optical Phase Dislocations
Yuri Gorodetski
Ariel University (Israel)

We demonstrate that by combining a physical lattice dislocation with the Berry phase dislocationin one structure the manipulation with the topological charge of the emerging vortex beams can becontrolled in an intriguing way. As a result, the plasmonic field in the near-field can be modified andselectively excited.

10:40 - 12:20 — Room 201

Session 3A12

SP18. Plasmonics: Fundamentals and Applications

Organized by: Hong Wei

Chaired by: Xiulai Xu

10:40 : Invited talk
Plasmon-based chiroptical sensing
S. Liu, Rong-Yao Wang
Beijing Institute of Technology (China)

In this talk, we report a chiral plasmonic nanosensor capable of transforming molecularly enantioselective recognition into asymmetrically amplified plasmonic circular dichroism (CD) readouts. This chiral nanosensor enables the enantiospecific recognition and determination of enantiomeric excess of amino acid molecules.

11:00 : Invited talk
Chiroptics of hybrid nanostructures : Strong coupling effect and interference effect
Wei Zhang
Institute of Applied Physics and Computational Mathematics (China)

We study chiroptical properties of hybrid nanostructures, paying attention to the strong coupling effect and interference effect. Strong plasmon-exciton coupling leads to double Rabi splitting in the circular dichroism spectroscopy. Mode hybridization leads to chirality transfer between bright modes and dark modes and chirality selective Rabi splitting/Fano effect.

11:20 : Invited talk
Chiral Response of plasmonic metasurface
Jinwei Shi
Beijing Normal University (China)

By breaking the interlayer symmetry, we demonstrated a bilayer metasurface that can achieve circular dichroism close to 1. A triple-layer metasurface is then designed to obtain multiple chiral bands with near unity circular dichroism. Finally, we experimentally achieved an chiral exceptional point in the optical communication band.

11:40 : Invited talk
Dynamic plasmonics with structured alkali metals
Jie Liang, Yan Jin, Jia Zhu, Lin Zhou
Nanjing University (China)

Dynamic plasmonics has long been regarded as one of the most crucial branches for nanophotonics and integrated optics, which is urgent for active subwavelength optical devices. This report will present the recent advancements on alkali metals based dynamic plasmonics, from the fundamental optical properties to the potential applications.

12:00 : Invited talk
On-chip electrical detection of plasmon in the top-down fabricated plasmonic waveguides on SOI substrate
Xiangqian Li[1], Weikang Liu[1], Huijie Wang[1], Li Chen[2], Zhiqiang Guan[1], Hongxing Xu[1]
[1] *Wuhan University (China),* [2] *University of California (USA)*

On-chip plasmon detection is highly demanding in the plasmonic-integrated circuits. We demonstrated an on-chip plasmonic detector by placing an externally biased silicon strip at the end of the top-down fabricated gold plasmonic waveguides. The polarization and wavelength-dependent photocurrent confirm plasmonic detection under optimized near-field coupling geometry.

10:40 - 12:30 — Room 202

Session 3A13

SP17. Perovskite Photovoltaics: Light-Matter Interaction

Organized by: Hui-Seon Kim and Kazuteru Nonomura

Chaired by: Hui-Seon Kim and Kazuteru Nonomura

10:40 : Keynote talk
In the Quest for the Viable Perovskite Solar Cells
Nam-Gyu Park
Sungkyunkwan University (Korea)

Research endeavors focus on enhancing stability and exploring tandem structures for electricity generation in both terrestrial and space applications. The perovskite solar cell stands poised as the most promising energy solution, with its potential impact on sustainable energy surpassing current expectations once stability and lead immobilization challenges are effectively addressed.

11:10 : Invited talk
Interface study for Sn-Pb mixed perovskite solar cells
Dong Hoe Kim
Korea University (Korea)

Most studies of Sn-Pb perovskite have focused mainly on itself. In this presentation, I introduce our diverse works on the interfaces between Sn-Pb perovskite and charge transport layers to improve the electrical and physical properties on the device.

11:30 : Invited talk
Performance-limiting processes in lead-free Cs2AgBiBr6 double perovskite solar cells
Wolfgang Tress
Zurich University of Applied Sciences (Switzerland)

Cs2AgBiBr6 double perovskite solar cells are one of the sister devices of the lead-based perovskites. However, their photophysics is highly distinct posing various open questions. Some of those are addressed by photo and electro-luminescence spectroscopy and sensitive spectral response measurements, all performed on working devices and temperature-dependent.

11:50 : Invited talk
Subcell Characterization Platforms for Emerging Tandems
Jin Young Kim
Seoul National University (Korea)

We report comprehensive electrical characterization methods based on either 2-terminal or 3-terminal platform that can accurately and easily analyze the subcells of monolithic emerging tandems. In addition to the current-voltage and external quantum efficiency measurements, advanced characterization for subcells such as impedance spectroscopy and thermal admittance spectroscopy will be demonstrated.

12:10 : Invited talk
Halide Interfacial Layers for Perovskite Solar Cells
Jun Hong Noh
Korea University (Korea)

Halide perovskite solar cells have a thin-film device architecture including interfaces between hetero-materials such as oxides, halides, and organic materials. Here, the wide-band gap halide interfacial layers will be discussed to ensure compatibility with the light absorbing halide perovskite layer for achieving high photovoltaic performance.

10:40 - 12:20 — Room 203

Session 3A14

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Mana Toma

10:40 : Invited talk
Rayleigh surface waves of extremal elastic materials
Yu Wei, Yi Chen, Wen Cheng, Xiaoning Liu, Gengkai Hu
Beijing Institute of Technology (China)

We theoretically investigate the propagation of Rayleigh waves in extremal materials based on continuum theory and verify our findings with designed metamaterials. Dispersion relations and polarizations of Rayleigh waves in extremal materials are derived, and the impact of higher order gradient effects is also investigated using strain gradient theory.

11:00 : Invited talk
Broadband Nonlinear Optical Waveguides Based On Conformal Transformation Optics
Chunyu Huang, Yu Luo, Yule Zhao, Xiaofei Ma, Zhiwei Yan, Ziyi Liu, Chong Sheng, Shining Zhu, Hui Liu
Nanjing University (China)

Integrated nonlinear optical devices are important in modern optical communications. However, a universal method for designing such devices on chip still lacking. We proposed a general strategy based on transformation optics to design curved accelerating waveguides with spatially gradient curvatures able to achieve broadband nonlinear frequency conversion on chip.

11:20 : Invited talk
Silicon-Nitride photonics for high-throughput biosensing applications
Niels Verellen
IMEC (Belgium)

Silicon nitride nanophotonics offers a platform that is ideally suited for visible-light bio applications. Allowing to integrate complex optical functionality on a small footprint, including on-chip routing and manipulation of free-space radiation. We will review our recent applications of the platform in high-throughput molecular sensing, cytometry, optogenetics, and microscopy.

11:40 : Invited talk
Topological transformations of vortex rings in paraxial laser beams
Zhamila Kulchukova, Anton Desyatnikov
Nazarbayev University (Kazakhstan)

Vortex rings are generated by the interference of Gaussian beams and a plane wave. We describe non-trivial topological events controlled by relative amplitude and phase: birth and death of isolated vortex rings as well as reconnections of two or more vortex rings, including transformations which change the number of rings.

12:00 : Invited talk
Manipulating the Exotic Quasi-Particles of van der Waals Correlated Antiferromagnet
Han Htoon
Los Alamos National Laboratory (USA)

We report influences of material composition and lateral dimension on spin-correlated exciton and magnons of van der Waal correlated antiferromagnets MPX3 (M = Mn, Fe, Ni, X = S, Se)

10:40 - 12:35 — Room 204

Session 3A15

SP7. Meta-optics for multi-dimensional manipulation of light

Organized by: Zi-Lan Deng and Kun Huang

Chaired by: Zi-Lan Deng

10:40 : Invited talk
Versatile Metaphotonic Singularities: Multidimensional, Optomechanical, and Topological Aspects
Tianyue Li, Shuming Wang, Shining Zhu
Nanjing University (China)

This presentation highlights metaphotonic singularities in nanophotonics, emphasizing their multi-dimensional nature and optomechanics applications. Using spin-dependent metasurfaces and Jones matrix innovations, we show dynamic control and transformation of singular light beams, advancing nano-device development and on-chip optical manipulation in metaphotonic physics.

11:00 : Invited talk
Topological momentum gap in PT-symmetric photonic crystals
Ming-Wei Li, Jian-Wei Liu, Wenjie Chen, Jian-Wen Dong
Sun Yat-Sen University (China)

We study the topological feature of the momentum bandgap (PT-broken regime) with a simple 1D binary photonic crystal. Our theory shows that its momentum band (PT-exact regime) can exhibit nontrivial band topology, guaranteeing the existence of a robust temporal boundary state localized in time but extended in space.

11:20 : Invited talk
Tunable metaoptics using phase change and van der Waals materials
Kandammathe Valiyaveedu Sreekanth, Arash Nemati, Zeng Wang, Meng Zhao, Yuanda Liu, Jichao Fu, Jinghua Teng
*A*STAR (Singapore)*

We introduce our recent works on chalcogenide phase change materials for tunable Tamm plasmonic response for bio-sensing, color coding, wide-angle perfect absorption and light beam switching, as well as van der Waals materials for electrically tuning of flat lens focusing, refractive index and near infrared plasmonic resonance.

11:40 : Janus Bound States in the Continuum with Asymmetric Topological Charges and Intrinsic Chirality
Meng Kang[1], **Meng Xiao**[2], **C. T. Chan**[1]
[1] *The Hong Kong University of Science and Technology (Hong Kong),* [2] *Wuhan University (China)*

We propose Janus bound states in the continuum (BICs), a new topological defect with asymmetric topological charges for upward and downward radiation. Janus BICs enable the realization of chiral BICs and offer a novel approach to control momentum-space phase singularities and enhance direction- and spin-dependent asymmetric light-matter interactions.

11:55 : Invited talk
Metalens for Accelerated Optoelectronic Edge Detection under Ambient Illumination
Shuai Wang
Harbin Engineering University (China)

Analog optical edge detection systems usually rely on coherent laser sources for illumination, which significantly restricts their use in imaging tasks with ambient illumination. Here, we demonstrated a metalens-assisted imaging system that can allow optoelectronic edge detection under ambient illumination. It holds great potential for image processing under ambient illumination.

12:15 : Invited talk
Evanescent Wave Manipulation Based on Non-Hermitian Physics
Huanan Li

Nankai University (China)

We present the concept of parity-time (PT) symmetry and spectral singularities as applied to evanescent waves, along with the first experimental verification of PT symmetry for evanescent waves using an acoustic platform. Our study sheds light on the opportunity to manipulate evanescent waves through non-Hermitian physics.

10:40 - 12:30 — Conference Room

Session 3A16

SP19. Recent Developments in Optical Nanoantennas for Enhanced Light Matter Interaction

Organized by: Hiroshi Sugimoto

Chaired by: Hiroshi Sugimoto

10:40 : Invited talk
Beam Engineering for Enhanced Light-Matter Interactions in Optical Nanostructures
Uttam Manna, Mahua Biswas
Illinois State University (USA)

In this talk, I will review our recent works on enhanced light-matter interactions in various optical nanostructures under illumination with cylindrical vector beams that demonstrate the excitation of optical anapoles in high-index dielectric nanoparticles, selective induction of optical magnetism in dielectric core-metal nanoparticle nanostructures, etc.

11:00 : Invited talk
Controlled radiation modes of second harmonic generation from plasmonic nanoantennas
Yoshito Tanaka
Hokkaido University (Japan)

We have theoretically and experimentally investigated the control of the radiation mode of second harmonic generation from plasmonic nanonantennas by near-field coupling of surface SH polarization induced by the fundamental field into the plasmonic eigenmodes at the SH wavelength.

11:20 : Invited talk
Probing the quantum tunneling in plasmonic gaps with magnetic plasmon resonances
Haisheng Luo[1], Ruizhao Yao[1], Helene Giesler[2], Sebastian Schlucker[2], Sheng Lan[1], Guangcan Li[1]
[1] *South China Normal University (China),* [2] *University Duisburg-Essen (Germany)*

The quantum tunneling (QT) effects in metal plasmonic gaps were revisited in a nanoparticle-dimer-on-mirror (NDoM) structure exhibiting concurrent electric and magnetic plasmon resonances. The distinct response of the magnetic resonance to the gap conductivity enable a reliable and robust strategy to deterministically probe QT events in thin metal gaps.

11:40 : Invited talk
Multiplexed single-molecule plasmon sensing by spectral decomposition
Vincenzo Lamberti, Sjoerd Nooteboom, Tim Schellekens, Peter Zijlstra
Eindhoven University of Technology (The Netherlands)

Narrowband light-matter interactions mediated by plasmonic nanoantennae strongly modify a nearby emitter's emission spectrum. Such reshaping shrouds the original emission spectrum of the dye and hampers multicolor applications. Here, I will describe our recent efforts to elucidate single-molecule spectral reshaping and use it for continuous and multicolor single-molecule plasmon sensing.

12:00 : Optical Heating Triggered by Multipolar Mie Resonance of Silicon Nanoparticles
Mojtaba Karimi Habil, Kana Kondo, Hiroshi Sugimoto, Minoru Fujii
Kobe University (Japan)

We experimentally demonstrate temperature raising over 300 K of crystalline spherical silicon nanoparticles (Si NPs) when the low-power laser light is coupled to the multipole Mie resonances. The experimental results are supported by numerical simulations. These hot Si NPs may have potential applications in biosensing and photothermal therapy.

12:15 : Plasmonic lightning-rod effect
Vlastimil Krapek, Rostislav Repa, Michael Foltyn, Tomas Sikola, Michal Horak
Brno University of Technology (Czech Republic)

We study the role of the local curvature of plasmonic antennas on the local electromagnetic field enhancement and disentangle it from other effects contributing to the field enhancement. Our findings are supported by electromagnetic simulations and electron energy loss spectroscopy. We provide a phenomenological model for the field enhancement.

10:40 - 12:15 — Room 205

Session 3A17

SP11. Chiro-optical and chiral-acoustic phenomena

Organized by: Alessandro Belardini and Oliver Wright

Chaired by: Daniel Torrent Marti

10:40 : Invited talk
Control of Circular Polarization Using Nonlinear Optical Effect in Dielectric Membrane Nanostructures
Kuniaki Konishi
The University of Tokyo (Japan)

Circular polarization is crucial for exploring chiro-optical effects. However, in the vacuum ultraviolet region, generating and controlling circular polarization proves difficult. We discovered that the nonlinear optical effect of nanostructures fabricated on free-standing films with a sub-micron thickness enables the generation and control of circular polarization in such short-wavelength regions.

11:00 : Invited talk
Three-dimensional Design of Acoustic/Elastic Waveguides based on Higher Order Topological Modes
Kenji Tsuruta, Yusuke Hata, MD Anzan Uz Zaman
Okayama University (Japan)

We designed three-dimensional acoustic/elastic waveguides based on higher-order topological modes in stacked layer phononic crystals. A hierarchical property of phononic bandgaps was utilized for designing two-dimensional edge modes and one-dimensional hinge modes. The elastic-wave propagation normal to the layers is demonstrated numerically and experimentally in a layered Kagome lattice.

11:20 : Invited talk
Peculiar wave transports in elastic valley-chiral phononic crystal plates
Weitao Yuan[1], Jinfeng Zhao[2]
[1] *Southwest Jiaotong University (China),* [2] *Tongji University (China)*

We report on the peculiar behavior of waves in elastic valley-chiral phononic crystal plates, including the multi-branch topological edge states (TES) in one single devices, the transversely symmetric and antisymmetric feature of TES, the abnormal refractions, and etc. These wave behaviors provide efficient path to precisely control the wave transports.

11:40 : Robust chiral optical force for small chiral molecules, inspired by a sea creature
Robert P. Cameron, Duncan McArthur, Alison M. Yao
University of Strathclyde (United Kingdom)

We draw inspiration from nature to identify a robust chiral optical force for small chiral molecules that can be several orders of magnitude stronger than other chiral optical forces proposed to date. Potential applications

range from chiral molecular matter-wave interferometry to the resolution of enantiomers.

11:55 : Invited talk
Acoustic Metasurface in a Nano-Opto-Electro-Mechanical Device for High Optomechanical Coupling Rate
Abdellatif Gueddida, Yan Pennec, Laurent Carpentier, Gaëtan Lévêque, Bahram Djafari-Rouhani
IEMN - University of Lille (France)

We theoretically investigate a phoXonic nanobeam for optomechanical coupling. Our focus lies to explore high-frequency (10 GHz) phonons trapped inside tapered or topologic high-Q cavities. To reach this objective, we propose the design of a metasurface to focus the acoustic wave into the nanobeam.

10:40 - 12:40 — Room 206

Session 3A18

SP9. Metamaterial Technology and Its Application Prospects

Organized by: Tatjana Gric and Edik Rafailov

Chaired by: Tatjana Gric and Edik Rafailov

10:40 : Invited talk
Automated Design Flow for Hybrid Metalens System with Manufacturing Awareness
Maryvonne Chalony[1], Yijun Ding[2], Larry Melvin[2], Bernd Kuechler[3], Bryan Stone[2], Evan Heller[2], Mayank Bahl[2], Rob Scarmozzino[2], Rob Scarmozzino[2], Chenglin Xu[2]
[1] *Synopsys, Inc (France),* [2] *Synopsys, Inc (USA),* [3] *Synopsys, Inc (Germany)*

A fully automated design flow has been developed for hybrid metalens systems by combining macro-scale ray tracing and nano-scale electromagnetic solver. Optimum design can be automatically obtained to match desired targets. Furthermore, by taking manufacturing limitations and constrains into account, a first print correct design can be achieved.

11:00 : Invited talk
The fabrication and application of 3D metamaterials
Changzhi Gu, Yang Guo
Chinese Academy of Sciences (China)

We developed a nanofabrication method of 3D metamaterials based on ion beam irradiation, which can constructed 3D nanostructures and devices. The optical characteristics of 3D plasmonic nanograters was studied, and the unusual and well-scalable Fano resonances were observed, which holding great potential applications in multi-resonance differential sensing and optical communication.

11:20 : Invited talk
Low-power Laser Coloration by Oxidation and Deformation of Self-assembled AL-PS Metamaterial
Maxim Elizarov, Ning Li, Fei Xiang, Andrea Fratalocchi
KAUST (Saudi Arabia)

We introduce a technique for wide-gamut structural coloration of a pre-processed metamaterial in 33k DPI resolution by continuous-wave laser irradiation with an average power of 10 mW. The basis of the metamaterial is self-assembled AL-PS nanosphere arrays, in which controllable material oxidation and deformation allow optical response tuning.

11:40 : Invited talk
Towards Plexcitonics: Direct Plasmonic Nanostructures Lithography on 2D Transition Metal Dichalcogenides
Ermes Peci[1], Lorenzo Ramò[1], Michele Magnozzi[1], Emma Spotorno[1], Valentina Venturino[1], Maria Sygletou[1], Maria Caterina Giordano[1], Giorgio Zambito[1], Francesca Telesio[1], Maurizio Canepa[1], Francesco Bisio[2]
[1] *Universita di Genova (Italy),* [2] *CNR-SPIN (Italy)*

Thermal scanning-probe lithography allows a direct-write fabrication route to create plasmonic nanostructures on top of exfoliated transition metal dichalcogenide (TMDC) crystals. This plasmonic-excitonic hybrid structure can be exploited to investigate heat diffusion at the nanoscale.

12:00 : Invited talk
Laser-based 3D printing of structures to control electromagnetic radiation: Bridging 2D, 2.5D, and 3D
Gordon Zyla[1], Odysseas Tsilipakos[2], Dimitrios Zografopoulos[3], Savvas Papamakarios[1], Maria Farsari[1]
[1] IESL/FORTH (Greece), [2] National Hellenic Research Foundation (Greece), [3] Consiglio Nazionale delle Ricerche (Italy)

We introduce laser-based 3D printing through multi-photon lithography as an effective approach for fabricating 2D, 2.5D, and 3D structures with high resolution. Furthermore, we demonstrate these structures' capabilities to control electromagnetic radiation, offering interesting applications from the visible to the THz regimes.

12:20 : Invited talk
Engineering spin-orbit coupling of light in weak and strong light-matter coupling regimes for topological photonics
Jacek Szczytko, M. Muszyński, P. Oliwa, P. Kapuściński, P. Kokhanchik, M. Kędziora, K. Łempicka-Mirek, E. Oton, R. Mazur, P. Morawiak, W. Piecek, P. Kula, D. Bobylev, D. Solnyshkov, G. Malpuech, W. Bardyszewski, B. Piętka
University of Warsaw (Poland)

We have developed a method to control the spin-orbit coupling of light by embedding emitters within liquid-crystal microcavities. We explore light-matter interactions in both weak and strong coupling regimes, which extend beyond traditional optical properties. This approach has enabled us to achieve tunable lasing, including dual and circularly polarized lasing.

10:40 - 12:35 — Room 101

Session 3A19

SP16. Recent Advances in Metamaterials and their Applications

Organized by: Weiren Zhu, Zhenfei Li and Fajun Xiao

Chaired by: Fajun Xiao and Haogang Cai

10:40 : Invited talk
Combinatorial Optimization of Electromagnetic Devices using metamaterial Function Units
Guoyan Dong
Chinese Academy of Sciences (China)

Periodic or aperiodic spatial arrangements of metamaterial resonant elements can not only enhance and extend the resonant characteristics through mutual coupling resonance effects but also design and optimize the performance of devices according to specific application requirements. These designs have significant applications in light modulation and performance enhancement.

11:00 : Invited talk
Phase Change Materials-based Metasurface Discs
Shuo Du[1], P. X. Liang[1], S. Hu[2], C. S. Li[3], C. Z. Gu[3], X. C. Chen[1]
[1] BOE Technology Group Co. (China), [2] Henan University of Technology (China), [3] Chinese Academy of Sciences (China)

Based on the phase-change materials, we propose a storage technology capable of writing and erasing the functions of metasurfaces. By constructing phase storage units using phase-change materials, the phase of pixels can be written and erased with a laser.

11:20 : Invited talk
Plasmonic nanoparticle clusters with tiny gaps fabricated with self-assembly superlattices

Shao-Ding Liu, Lan-Qi Lian, Qiang Zhang
Taiyuan University of Technology (China)

Plasmonic nanoparticle clusters are reliably fabricated with a modified electron-beam lithography method using self-assembly superlattices, where the interparticle separations is less than 5 nm, the non-radiative losses can be suppressed, and the fabrication processes are simplified compared with conventional top-down approaches.

11:40 : Meta-lens Digital Image Correlation
Yu Ji[1], Zhou Zhao[1], Mu Ku Chen[2], Sheng Xian Shi[1], Din-Ping Tsai[2]
[1] *Shanghai Jiao Tong University (China),* [2] *City University of Hong Kong (China)*

An approach for digital image correlation (DIC) measurement using a single camera is reported in this work, utilizing the polarization-independent GaN binocular meta-lens to measure the displacement of the flat-plate. Finally, the depth and displacement of the cylinder are measured through binocular imaging, validating the feasibility of the proposed approach.

11:55 : Invited talk
Optomechanical metasurfaces based on kirigami technology
Nanzhong Deng, Ashish Pandey, Gregory Roberts, Haogang Cai
New York University (USA)

As inspired by the Japanese art of paper cutting, kirigami technology has been used to create mechanical and optical metamaterials. Based on our recent nano-kirigami actuators whose tilting angle can be predefined by the geometry, we demonstrated deformable mirrors, dynamic tunable optical metasurfaces and photonics crystals with broad applications.

12:15 : Invited talk
The Design, Control and Optimization of Cavity-based Metamaterials for Miniature Spectrometer Application
Ruonan Ji, Qingquan Liu, Shaowei Wang
Shanghai Institute of Technical Physics (China)

Spectrometers are vital for diverse applications but face limitations like size and cost. This paper focuses on developing compact, integrated miniature spectrometers using dielectric cavity-based metamaterials, enhancing portability and performance through innovative spectrometric metamaterials and advanced reconstruction algorithm. This research contributes to the ongoing progress in miniaturized optical sensing systems.

10:40 - 12:20 — Gallery

Session 3A20

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Shunsuke Murai

10:40 : Invited talk
Superoscillatory tweezer arrays for subwavelength trapping and manipulation of cold atoms
Vincent Mancois[1], Kelvin Lim[1], Haijun Wu[2], Nikolay Zheludev[3], Yijie Shen[1], David Wilkowski[1]
[1] *Nanyang Technological University (Singapore),* [2] *Harbin University of Science and Technology (China),* [3] *University of Southampton (United Kingdom)*

Spatial control of atoms with subwavelength accuracy is a crucial tool for quantum computing and quantum simulations. Using superoscillatory structured light we plan on extending the recent work on single atom subwavelength trapping to few atoms superoscillatory tweezer arrays, where trap sizes and interdistances is dynamically tuned below diffraction limit.

11:00 : Invited talk

Epsilon-Near-Zero Regime in the Infrared for Ultrafast Switching
Carl Davies, Andrei Kirilyuk
Radboud University (The Netherlands)

Using narrow-band infrared pulses tailored to entirely fit the epsilon-near-zero regime, we experimentally find that the magnetization in iron-garnet films and the polarization in ferroelectric barium titanate can be permanently reversed. This offers a novel strategy for the ultrafast switching of spontaneous magnetization and polarization.

11:20 : Invited talk
Ultrasensitive Portable Surface-Enhanced Raman Spectroscopy for Clinical Applications
Dehui Wan
National Tsing Hua University (Taiwan)

This talk presents a facile, scalable fabrication strategy for developing an ultrasensitive SERS-based detection platform that serves as a rapid, label-free diagnosis device. Highly dense Au nanoparticle arrays with narrow gap distances is formed directly through physical vapor deposition on hydrophobic cellulose fibers to achieve excellent portable SERS performance

11:40 : Invited talk
Chiral coherent control of electronic population transfer with femtosecond pulses: towards all-optical and highly enantioselective photochemistry
Andrés Ordóñez[1], Patricia Vindel-Zandbergen[2], David Ayuso[1]
[1] *Imperial College London (United Kingdom),* [2] *New York University (USA)*

We provide a route to achieve highly enantioselective photochemistry via interference between two quantum pathways leading to an electronic excitation. Our simulations reveal differences of up to 19 % in the excited state populations of R and S carvone, a major improvement over what is possible with circularly polarized light ($\sim$0.01 %)

12:00 : Invited talk
Recent progress on chip-based Brillouin interactions
Moritz Merklein
The University of Sydney (Australia)

On-chip stimulated Brillouin scattering (SBS) is a powerful nonlinear effect for optical signal processing due to its narrow linewidth and tunability via an optical pump. Here, I present our recent discovery of surface acoustic wave SBS and our progress of integrating Brillouin active waveguides with electro-optic interfaces.

Lunch

12:30 - 14:00

14:00 - 15:00 — Main Hall

Session 3A21

Conference Tutorial II

14:00 : Tutorial
Writing and Submitting Your Papers
Rachel Won
Nature Photonics (UK)

This talk covers the detailed information and guidelines on scientific paper preparation and submission, including tips for writing an effective cover letter, an informative abstract, a comprehensive introduction and an attractive paper, and editorial and peer-review processes. You will also get to know how to choose a journal for submission, what editors seek, how your papers are reviewed and how to make an appeal.

15:00 - 16:00 — Main Hall

Session 3A22

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Hajime Ishihara

15:00 : Invited talk
Electromagnetic enhancement induced by subradiant plasmon resonance demonstrated by single plasmonic systems
Tamitake Itoh[1], **Yuko S. Yamamoto**[2]
[1] *National Institute of Advanced Industrial Science and Technology (AIST) (Japan),* [2] *Japan Advanced Institute of Science and Technology (JAIST) (Japan)*

Plasmon resonance has been used for exploring surface enhanced Raman scattering (SERS) of nanoparticle dimers. We investigated the relationships between SERS, electromagnetic enhancement factor, and plasmon resonance Rayleigh scattering spectra. The numerical calculation analysis revealed that the SERS is caused by dipole-quadrupole coupled resonance, which is subradiant, in asymmetric dimers.

15:20 : Invited talk
Van Der Waals Polaritonic Crystals and Their Nanostructures
Huanjun Chen, Zebo Zheng, Wuchao Huang, Shaozhi Deng
Sun Yat-sen University (China)

Recent studies have unveiled the capability of van der Waals (vdW) two-dimensional atomic crystals and their nanostructures to sustain diverse polaritonic modes across the mid-infrared to THz spectral range. In this presentation, we will share our latest research progress in the exploration of polaritons within nanostructures of vdW crystals.

15:40 : Invited talk
Scaling Challenges in Watts Level PCSELs
Weidong Zhou, Chhabindra Gautam, Mingsen Pan
University of Texas at Arlington (USA)

We report high power semiconductor PCSEL performance trade-offs and challenges in power scaling, modal competition, and charge injection control. We also report the impact of charge injection control, the design towards high speed high power lasers, and coherent coupled PCSEL arrays. Perspectives on the future directions will also be discussed.

14:00 - 16:00 — Room 201

Session 3A23

SP18. Plasmonics: Fundamentals and Applications

Organized by: Hong Wei

Chaired by: Zhen-Chao Dong

14:00 : Invited talk
Nanocavity-dependent photon output from WSe2 single quantum emitter with broken valley symmetry
Xiulai Xu
Peking University (China)

We show experimental evidence of valley symmetry breaking for quantum emitters in WSe2 monolayer by interacting with chiral plasmonic nanocavities. And a cavity-dependent circularly polarized single-photon output

is also demonstrated.

14:20 : Invited talk
Photoluminescence modulation of 2D semiconductors by individual plasmonic metal nanocrystals
Lei Shao
Sun Yat-sen University (China)

Integrating plasmonic nanostructure with 2D semiconductor materials has great potential in developing compact, high-performance photonic devices and nanoscale optoelectronic devices. In this presentation, we will introduce our recent work of employing individual plasmonic noble metal nanocrystals to integrated with 2D WS2 and modulate the photoluminescence properties of the latter.

14:40 : Invited talk
Strong Coupling between Surface Plasmons and Excitons
Hong Wei
Institute of Physics, Chinese Academy of Sciences (China)

The strong coupling between surface plasmons and excitons leads to the formation of plasmon-exciton polariton states in nanoscale systems at room temperature. In this presentation, I will talk about our research on the strong coupling of single plasmonic nanogap structures and nanowires with monolayer transition metal dichalcogenides.

15:00 : Invited talk
Nanometer-Scale Spatial and Spectral Mapping of Exciton Polaritons in Structured Plasmonic Cavities
David Masiello
University of Washington (USA)

Exciton polaritons (EPs) are ubiquitous light-matter excitations under intense investigation as testbeds of fundamental physics and as components for all-optical computing. In this talk, I will present a new approach to measure EPs in periodic nanophotonic cavities at their natural energy, momentum, and length scales via electron energy gain spectroscopy.

15:20 : Invited talk
Statistical quantitative SERS beyond the single-molecule level and its physical foundations
Zhipeng Li[1], Longkun Yang[1], Hao Zhang[1], Hongxing Xu[2]
[1] *Capital Normal University (China),* [2] *Wuhan University (China)*

We proposed a new physical principle for ultra-sensitive quantitative SERS detection. Based on Poisson statistical distribution, the relationship between probability and average molecular number is established. Quantitative SERS of 1 fM beyond the single-molecule level is realized.

15:40 : Invited talk
Integrated microlasers on a Bloch surface wave platform
Yang-Chun Lee, Ya-Lun Ho, Bo-Wei Lin, M.-H. Chen, Di Xing, Hirofumi Daiguji, Jean-Jacques Delaunay
The University of Tokyo (Japan)

We report the stimulated emission of a quasi-Bloch surface wave mode guided in a ring made of a gain material. The ring is patterned by UV lithography on a 1D photonic crystal using a dye-doped resist. The reported microlasers exhibit narrow line widths of approximately 0.02 nm.

14:00 - 16:00 — Room 202

Session 3A24

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Oleksandr Serha

14:00 : Invited talk
Generation of Ultra-compact Optical Vortex Through Photonic Spin-orbit Interactions in Nanostructures and Its Super-resolution Imaging
Benfeng Bai
Tsinghua University (China)

With photonic spin-orbit interactions, efficient generation of ultra-compact optical vortices (OVs) in meta-devices are reported, which have a minimum radius of 1 μm and a signal-to-noise ratio larger than 6 dB. A spin-selective and phase-resolved scanning near-field optical microscopy (SSPR-SNOM) is established to probe and visualize the OV generation process.

14:20 : Invited talk
CP2 triple-Q state in the SU(3) Kondo lattice model
Yutaka Akagi
The University of Tokyo (Japan)

This research details the CP2 triple-Q state in the SU(3) ferromagnetic Kondo lattice model, highlighting its ground state phase diversity and topological magnetism at varying itinerant fermion filling and Kondo coupling strength.

14:40 : Invited talk
Thermally induced dynamics of magnetic skyrmions and their device functions
Masahito Mochizuki[1], Xichao Zhang[1], Junnosuke Matsuki[2]
[1] *Waseda University (Japan),* [2] *University of Tokyo (Japan)*

Thermally induced dynamics of magnetic topology in magnets has turned out to host rich physical phenomena and device functions, which are subject to intensive studies in recent spintronics research. We discuss several intriguing phenomena related with thermal dynamics of magnetic skyrmions, i.e., thermoelectric effects and active-matter-like behaviors.

15:00 : Invited talk
Topological magneto-optical effect induced by skyrmion lattice formation
Yoshihiro Okamura, Y. D. Kato, M. Hirschberger, Y. Tokura, Y. Takahashi
University of Tokyo (Japan)

We show the magneto-optical Kerr effect (MOKE) induced by the skyrmion formation, i.e., topological MOKE, in Gd2PdSi3. The magneto-optical rotation is significantly enhanced in the skyrmion phase, which demonstrates the topological MOKE ranging up to the sub-eV region. This finding exemplifies the light-skyrmion interaction arising from the emergent gauge field.

15:20 : Invited talk
Classifying Topology in Open Photonic Systems
Alexander Cerjan
Sandia National Laboratories (USA)

We develop a mathematical framework for determining the topology and associated measure of protection for photonic structures embedded in free space. This framework is both applicable to 2D systems with radiative environments along their edges, as well as 2.5D slab systems that radiate into free space from their surfaces.

15:40 : Invited talk
Spin wave amplification through superradiance
Xiangrong Wang, K. Y. Jing, X. Gong
The Hong Kong University of Science and Technology (Hong Kong)

Superradiance is a phenomenon of multiple facets that occurs in classical and quantum physics under the extreme conditions. A notion of supermirror made of energy-source powered media with inverted spectra is proposed. Supermirrors resemble the Hawking radiance or the Dicke superradiance. The principle is demonstrated for spin waves.

14:00 - 15:40 — Room 203

Session 3A25

SP17. Perovskite Photovoltaics: Light-Matter Interaction

Organized by: Hui-Seon Kim and Kazuteru Nonomura

Chaired by: Hui-Seon Kim and Kazuteru Nonomura

14:00 : Invited talk

Surface Chemistry for Efficient Sn- and Pb-based Perovskite Photovoltaics

Atsushi Wakamiya, Minh Anh Truong, Noboru Ohashi, Tomoya Nakamura, Chien-Yu Chen, Richard Murdey

Kyoto University (Japan)

Perovskite solar cells are emerging as a game-changer in photovoltaics, offering a path to highly efficient solar energy conversion.1-3 Surface modification of perovskite layer is crucial to improve device performance and durability. We will present recent progress on the development of charge collecting materials and surface modification with dipole strategy.

14:20 : Invited talk

Orientation control of perovskites using asymmetric amines

Yuko Takeoka, Hirona Kobayashi, Daizo Hishida, Masahiro Yoshizawa-Fujita, Masahiro Rikukawa

Sophia University (Japan)

q-2D organic-inorganic perovskites are expected as solar cell materials due to their high stability. Because the orientation q-2D perovskites affets carrier transport properties, the orientation is important. In this study, we focused on the orientation control of q-2D perovskites prepared from asymmetric diamines and evaluated their solar cell performance .

14:40 : Invited talk

Tailoring Charge Transport in Mixed-Valence Coordination Polymers for Emerging Molecular Devices

Marina Freitag

Newcastle University (United Kingdom)

Coordination polymers offer exceptional tunability and sustainability as charge transport materials for emerging technologies, including photovoltaics, batteries, and sensors. This comprehensive study elucidates their structure-function relationships, charge transport mechanisms, and applications, showcasing their potential to outperform conventional charge extracting materials. Tailoring mixed-valence copper polymers yielded high efficiencies and stability.

15:00 : Invited talk

Functions of Porous Carbon in Multi-Porous-Layered-Electrode Perovskite Solar Cells (MPLE-PSCs)

Seigo Ito

University of Hyogo (Japan)

Information of carbon materials (carbon black and graphite) for fully-printed carbon-based perovskite solar cells has been disclosed. TEM images and conductivity variation with the mixing ratio are shown. And, the hole extraction ability has been discussed with the results of J-V curves by inversed-structured multi-porous-layered-electrode perovskite solar cells (MPLE-PSCs).

15:20 : Invited talk

New Class of Semiconducting Organic-Inorganic Metal Halides for Photovoltaic Devices

Hyunjung Shin

Sungkyunkwan University (Korea)

Organic-inorganic metal halides are now emerging as new class of semiconductors. It shows Perovskite crystal structure and as a main light absorber in photovoltaic cells, known as Perovskite Solar Cell (PSC). The notable examples are MAPbI3 and FAPbI3. The PSC now shows a remarkable power conversion efficiency (PCE) of 26.1 %.

14:00 - 15:00 — Room 204

Session 3A26

SP7. Meta-optics for multi-dimensional manipulation of light

Organized by: Zi-Lan Deng and Kun Huang

Chaired by: Zi-Lan Deng

14:00 : Invited talk
Unidirectional unpolarized photoluminescence emission via vortex excitation
Jincheng Ni
University of Science and Technology of China (China)

Directional light emission at subwavelength scale is key for quantum information processing and optical imaging. Here, we present unidirectional emission of unpolarized luminescence in a spatially symmetric nanopillar lattice assisted by photonic orbital angular momenta (OAM), providing a tunable and large directional emission method for nanoscale optical control .

14:20 : Invited talk
Machine-learning aided optimization for metasurfaces
Wei Ma
Zhejiang University (China)

We present an algorithm-driven strategy to automatically design metasurfaces for multi-dimensional light manipulation. Our metasurface design pipeline comprises iterative optimization steps, integrating gradient-based optimization or heuristic algorithms enhanced by machine learning models. This approach has been experimentally validated using multi-channel holograms, focusing lenses, and guided light control.

14:40 : Invited talk
Multidimensional manipulation of Light: From metasurfaces to liquid crystals
T. Huang, Y. Xie, Z. Zhou, D. Zhang, Zile Li, G. Zheng
Wuhan University (China)

Metasurfaces exhibit exceptional abilities to manipulate the amplitude, phase, polarization, and spectral properties of light fields. These mechanisms for light field control can be extended to other material systems like liquid crystals, facilitating the creation of novel functionalities and devices.

14:00 - 15:35 — Conference Room

Session 3A27

SP19. Recent Developments in Optical Nanoantennas for Enhanced Light Matter Interaction

Organized by: Hiroshi Sugimoto

Chaired by: Hiroshi Sugimoto

14:00 : Invited talk
Solving Maxwell Equations from a Single Polarimetry Measurement
Jorge Olmos-Trigo
Universidad de La Laguna (Spain)

In this talk, we demonstrate that measuring the Stokes parameters at a single scattering angle is sufficient to solve Maxwell's equations for a set of objects widely used in Nanophotonics. Our method for solving Maxwell's equations endows the Stokes parameters an even more fundamental role in the electromagnetic scattering theory.

14:20 : Invited talk
Optical Metafluid Made from Silicon Nano-spheres
Minoru Fujii, Hiroshi Sugimoto
Kobe University (Japan)

A silicon nanoparticle exhibits optical magnetism, and can satisfy the electromagnetic duality symmetry condition at the 1st Kerker condition. We demonstrate that the colloidal suspension also has the optical magnetism and acts as a metafluid that preserves the handedness of circularly polarized light.

14:40 : Invited talk
Spin-valley nanophotonics with atomically thin semiconductors
Alberto G. Curto
Ghent University (Belgium)

Atomically thin semiconductors such as WS2 can sustain spin-valley polarization and emit circularly polarized light. Using few-layer WS2, we investigate the electrodynamic nature of valley-polarized emission using back focal plane imaging. We also demonstrate a Drexhage experiment to enhance and control valley-polarized emission.

15:00 : Invited talk
Mie resonances in silicon nanospheres probed by pump-probe cathodoluminescence spectroscopy
Saskia Fiedler[1], **Evelijn Akerboom**[1], **Patrick Spaeth**[1], **Hiroshi Sugimoto**[2], **Minoru Fujii**[2], **Albert Polman**[1]
[1] *AMOLF (The Netherlands),* [2] *Kobe University (Japan)*

We study optical Mie resonances in individual Si nanospheres (NPs) using cathodoluminescence (CL) spectroscopy, complemented with theoretical CL calculations. We couple light into the SEM-CL system to locally heat NPs and observe spectral shifts of Mie modes. Delaying the synchronized laser and electron pulses enables in-situ pump-probe CL for nanothermometry.

15:20 : Enhancement and Directional Control of Light Emission from Monolayer MoS2 by Silicon Nanosphere Antennas
Keisuke Ozawa[1], **Daisuke Shima**[1], **Søren Raza**[2], **Keisuke Imaeda**[3], **Kosei Ueno**[3], **Hiroshi Sugimoto**[1], **Minoru Fujii**[1]
[1] *Kobe University (Japan),* [2] *Technical University of Denmark (Denmark),* [3] *Hokkaido University (Japan)*

High-index dielectric nanostructures work as optical antennas to control the light emission from quantum emitters, including the intensity enhancement and the directional control by Mie resonances. In this work, we demonstrate the enhancement and modification of the light emission from monolayer molybdenum disulfide by a crystalline silicon nanosphere.

14:00 - 16:05 — Room 205

Session 3A28

SP3. Parity-Time and quasi-normal modes in Photonics, Plasmonics, Acoustics

Organized by: Anatole Lupu and Henri Benisty

Chaired by: Henri Benisty

14:00 : Invited talk
Photonics of topological transitions Disk - Ring - Split Ring
M. E. Bochkarev, N. S. Solodovchenko, K. A. Bronnikov, K. B. Samusev, Mikhail Limonov
ITMO University (Russia)

The chain of topological transitions disk - ring - split ring with a gradual change in structural parameters has been studied. We demonstrate that transitions between structures of different topologies are accompanied by impressive photonic effects.

14:20 : Invited talk

Response strength of general non-Hermitian systems at exceptional points
Jan Wiersig
Otto von Guericke University Magdeburg (Germany)

Non-Hermitian systems with exceptional points exhibit a strongly enhanced response to perturbations and excitations. We present the theory of the spectral response strength for the general case where the dimension of the Hilbert space can be larger than the order of the exceptional point.

14:40 : Invited talk
Frequency combs in dissipative Kerr cavities with non-Hermitian periodic potentials
S. B. Ivars[1], M. Botey[1], K. Staliunas[2], Ramon Herrero[1]
[1] *Universitat Politècnica de Catalunya (Spain),* [2] *Institucio Catalana de Recerca i Estudis Avancats (ICREA) (Spain)*

We demonstrate stabilization of solitonic solutions and associated frequency combs in Kerr cavities with non-Hermitian periodic modulations. These potentials hybridize the two mechanisms of soliton formation, yielding new families of stable solitons and molecules and making them accessible. This scenario diversifies frequency combs, allowing real-time reshaping and broadening applications.

15:00 : Invited talk
Nonperturbative effects in the eigenvalue sensitivity of non-Hermitian systems
Henning Schomerus
Lancaster University (United Kingdom)

Systems with an effectively non-Hermitian Hamiltonian display an enhanced sensitivity that arises from the nonorthogonality of their eigenstates. I derive an exact nonperturbative expression for this sensitivity that applies to arbitrary eigenvalue configurations. This reveals that states can have a sizable effect even if they are spectrally well separated.

15:20 : Exceptional points in a single dielectric nanoparticle
Adria Canos Valero[1], Vjaceslavs Bobrovs[2], Thomas Weiss[1], Alexander S. Shalin[3], Yuri Kivshar[4]
[1] *University of Graz (Austria),* [2] *Riga Technical University (Latvia),* [3] *Moscow Institute of Physics and Technology (Russia),* [4] *Australian National University (Australia)*

Exceptional points are singularities of open systems, where eigenvalues and eigenvectors coalesce. They are being intensively studied in photonics, owing to their strong sensitivity to perturbations. However, most works are restricted to wavelength-scale structures. Here, we present rigorous criteria for the design of exceptional points in a single dielectric nanoparticle.

15:35 : Quasi-normal modes and transmission channels in non-Hermitian disordered media
Valentin Freilikher
Bar Ilan University (Israel)

A review of quasi-normal modes (QNMs) studies in disordered open systems is presented. The existence of transmission resonances and hidden QNMs in weakly scattering media is demonstrated. The connection between QNMs and diffusive transmission channels is investigated. Algorithms of coherent control of wave transport in randomly scattering media are outlined.

15:50 : Anomalous acoustic tunneling effect with non-Hermitian Willis coupling
Danwei Liao, Xinhua Wen, Xinghong Zhu, Jensen Li
The Hong Kong University (China)

We extend anomalous tunneling phenomenon observed in reciprocal electromagnetic metamaterials to acoustic metamaterials via bianisotropy and Willis coupling, covering nonreciprocal regime. Digitally virtualized atoms are employed to generate the required non-Hermitian Willis coupling, which leads to decaying fields for both acoustic pressure and velocity within metamaterial.

14:00 - 16:00 — Room 206

Session 3A29

SP9. Metamaterial Technology and Its Application Prospects

Organized by: Tatjana Gric and Edik Rafailov

Chaired by: Tatjana Gric and Edik Rafailov

14:00 : Invited talk
All-Garnet Magnetooptical Microcavity
Taichi Goto
Tohoku University (Japan)

Magnetooptical device using magnetic domains have attract many interests because of its quick response and large diffraction angle. To develop these devices, we grew all-garnet magnetooptical microcavity using rf ion-beam sputtering, showing nano-scale magnetic domain and a large Faraday rotation angle.

14:20 : Invited talk
Tailoring gold plasmonic metasurfaces for efficient harmonic generation
Shroddha Mukhopadhyay[1], Crina Maria Cojocaru[1], Maria Antonietta Vincenti[2], Kent Hallman[3], Agustin Mihi[4], Michael Scalora[5], Jose Trull[1]
[1] *Universitat Politècnica de Catalunya (Spain),* [2] *University of Brescia (Italy),* [3] *PeopleTec, Inc. (USA),* [4] *Institute of Materials Science of Barcelona ICMAB - CSIC (Spain),* [5] *Aviation and Missile Center (USA)*

We report a combined experimental-theoretical investigation on more than three orders of magnitude enhancement in the second and third harmonic generation from plasmonic metasurfaces in the visible and UV ranges. Our experimental results are validated by our unique microscopic, hydrodynamic model for linear and nonlinear interactions in metal surfaces.

14:40 : Invited talk
Synthesis and plasmonic properties of Fe3O4-Au-Pd hybrid nanoparticles
Yukie Yokota, Mao Takeda
Sophia University (Japan)

In this study, we focused on iron oxide to magnetically resolve noble metal nanoparticle arrays or to construct noble metal nanoparticle 3D structures. By adding Au and Pd to iron oxide nanoparticles, we developed a method for synthesizing iron oxide-gold-palladium nanoparticles (Fe3O4-Au-Pd nanoparticles) that can be recovered with a magnet.

15:00 : Invited talk
From synthesis to assembly: a Silicon based metasurface fabrication
Juan Xin, Julien Proust, Jerome Plain
Université de Technologie de Troyes (France)

In this study, we present an assembly technique based on the use of the capillarity force and allowing the obtaining of metasurfaces from silicon nanoparticles. Particularly, we will present the use of such technique to obtained complicated pattern thus paving the way to the fabrication of engineering metasurfaces.

15:20 : Invited talk
Slime mold algorithm for topology optimization of photonics structure
Kofi Edee, G. Granet, P. Bonnet
Universite Clermont Auvergne (France)

We introduce an innovative approach to photonics structure design, incorporating the slime mold algorithm (SMA) [1], a gradient-free metaheuristic optimization method, in tandem with the topology optimization (TO) method, and utilizing a spectral modal method. Through the integration of TO with SMA, (TO-SMA) we achieve successfully metagrating designs [2].

15:40 : Invited talk
Microscale concave interfaces: a new reflective colorimetric platform
Jacob Rada[1], Chi Zhou[2], Qiaoqiang Gan[1]
[1] *King Abdullah University of Science and Technology (Saudi Arabia),* [2] *The State University of New York*

(USA)

This talk will discuss the novel use of microscale concave interfaces (MCI) for generating structural colors through total internal reflection interference. Highlighting both theoretical understanding and experimental research, it promises significant applications in information display, traffic safety, and photonics.

14:00 - 15:20 — Room 101

Session 3A30

SP16. Recent Advances in Metamaterials and their Applications

Organized by: Weiren Zhu, Zhenfei Li and Fajun Xiao

Chaired by: Yahong Liu and Ruonan Ji

14:00 : Invited talk

Versatile and Flexible Membrane Metasurfaces for Optimal Optoelectronic Device Efficiency

Shaojun Wang

Soochow University (China)

We present a novel technique for transferring a polymer membrane incorporating monocrystalline silicon nanoparticle arrays (NPAs) onto diverse support substrates. Leveraging the collective resonances of the c-Si NPAs, this device exhibits efficient capabilities for beaming the fluorescence of μ-LED color-converters and enhancing light outcoupling in scintillators for low-dose X-ray imaging.

14:20 : Invited talk

Chiral meta-coder for target camouflage and identification

Zhenfei Li[1], **Weiren Zhu**[2]

[1] *Northwestern Polytechnical University (China),* [2] *Shanghai Jiao Tong University (China)*

We present an innovative method for achieving spin switchable electromagnetic camouflage and target identification functionalities using an irregular chiral meta-coder. This meta-coder is designed by combining chiral meta-atoms with an irregular phase encoding method. It could potentially open up new avenues for applications in the field of information security.

14:40 : Invited talk

Multiband and broadband acoustic topological metamaterial

Changlin Ding, Y. Sun, X. P. Zhao

Northwestern Polytechnical University (China)

We firstly present a dual-band acoustic high-ordered topological metamaterial (AHOTM) composed of meta-atoms and meta-molecules with edge states and corner states in two frequency regions. And then the dual-band negative refraction, valley-locked topological transport and local enhancement are investigated. At last, we realize broadband AHOTM with topological edge states.

15:00 : Invited talk

Overlapped Bandgap and Ultrabroadband Transmission in a Valley Photonic Insulator Based on Dendritic Structure

Yahong Liu, Meize Li, Peng Li, Liyun Tao, Lianlian Du

Northwestern Polytechnical University (China)

Exploring multi-dimensional manipulation waves will greatly promote the development of physical systems. In topological insulators[1-2], overlapped bandgap with nontrivial topology has never been reported. Besides, it is urgent to improve the bandwidth of topological transmission[3-4]. In this work, overlapped bandgap and ultrabroadband transmission are realized in dendritic valley photonic insulator.

14:00 - 15:50 — Gallery

Session 3A31

SP24. Meta and plasmonic materials for advanced biosensing and bioimaging

Organized by: Mana Toma

Chaired by: Mana Toma

14:00 : Invited talk
High-speed near-field optical microscopy: super-resolution plasmonic imaging for biological studies
Takayuki Umakoshi
Osaka University (Japan)

We developed high-speed near-field optical microscopy by combining near-field optical microscopy and high-speed atomic force microscopy, holding a great promise for biological studies owing to the real-time label-free imaging capability. In this talk, details of the constructed setup and its applications are discussed.

14:20 : Invited talk
Polymeric Grating Prism-based Dual-mode Miniature Surface Plasmon Resonance Sensor
Akira Baba[1], Wisansaya Jaikeandee[1], Chutiparn Lertvachirapaiboon[2], Kazunari Shinbo[1], Keizo Kato[1], Sanong Ekgasit[3]
[1] *Niigata University (Japan),* [2] *NANOTEC (Thailand),* [3] *Chulalongkorn University (Thailand)*

In this study, we demonstrate the fabrication of a dual-mode miniature surface plasmon resonance (SPR) sensor using a polymeric grating prism made from a UV-curable adhesive, specifically Norland Optical Adhesive 61 (NOA 61), employing a confined sessile drop technique.

14:40 : Invited talk
Plasmonic biosensor platforms for digital single molecule assay readout
Katharina Schmidt[1], Naoto Asai[1], Gizem Aktug[2], Dario Cattozzo Mor[2], Prasanth Asokan[2], Stefan Fossati[2], Yevhenii Morozov[3], Andreas Weinhaeusel[3], Tomas Riedel[2], Andres de los Santos Pereira[2], Jakub Dostalek[2]
[1] *Danube Private University (Austria),* [2] *Czech Academy of Sciences (Czech Republic),* [3] *AIT-Austrian Institute of Technology (Austria)*

Optical biosensors with digital readout format for ultrasensitive biomarker analysis will be presented. It is based on counting of individual affinity-captured biomolecules by using the combination of optical plasmonic enhancement and enzymatic as well as non-enzymatic amplification without the need of compartmenting the analyzed sample.

15:00 : Invited talk
Plasmonic Immunosensor Platform Composed of a Capture Interface Formed by Photochemical Reaction
Keiko Tawa
Kwansei Gakuin University (Japan)

Plasmonic chips were prepared by coating periodic patterns with metal films. By exposing the surface modified with photoreactive O-MBA to the light, the intermediate was photochemically reacted with maleimide-labeled molecules on the pattern within the exposure spots. Multi-arrayed spots can induce high-throughput detection with reaction promotion and enhanced fluorescence.

15:20 : Spectrometer-free colorimetric plasmonic biosensor for detection of food allergens
Daiki Hirabayashi, Kotaro Kajikawa, Mana Toma
Tokyo Institute of Technology (Japan)

The direct detection of a food allergen, ovomucoid from egg white, is demonstrated by a colorimetric plasmonic biosensor. Plasmonic colors of our metal nanodome arrays allow us to realize biosensing with portable equipment such as smartphones.

15:35 : Understanding on Light-matter Interaction in Chiral Plasmonics

Jeong Hyun Han, Ryeong Myeong Kim, Ki Tae Nam
Seoul National University (Korea)

Plasmonic materials enhance chiral sensing in a noninvasive, ultra-sensitive manner. We take note of principles of chiral light-matter interactions in chiral plasmonics driven by optical chirality and chiral perturbation. We demonstrate two strategies based on them: collective resonances in periodic chiral plasmonic nanoparticles and nanostructure optimization via machine learning.

Coffee Break

Session 3P2
Poster Session VI
16:00 - 16:40

P1: A universal infrared absorption analysis system using deep learning
Eito Nakagawa, Hiroto Sasaki, Yoshiaki Nishijima
Yokohama National University (Japan)

We focused on reducing the experimental cost of obtaining mid-infrared absorption spectra using machine learning techniques. The large amount of spectral data from HITRAN and quantum scientific calculations can be a useful method effective prediction to the experimental spectra.

P2: Utilizing Flexible Polymer Linkers in a Continuous Monitoring Plasmonic Biosensor for Detecting Low Molecular Weight Analytes
Gizem Aktug[1], N. Asai[2], V. Van-Truc[3], C.-J. Huang[3], C. Monteiro da Santa[4], S. Park[4], K. Sergelen[4], Jackub Dostalek[1]
[1] *Czech Academy of Sciences (Czech Republic),* [2] *Danube Private University (Austria),* [3] *National Central University (Taiwan),* [4] *BioMed X Institute (Germany)*

This research aims to develop a plasmonic sensor capable of continuously monitoring low molecular weight analytes by exploiting reversible interactions with flexible polymer linkers, coupled with a plasmonically enhanced fluorescence (PEF) energy transfer readout.

P3: High-bandwidth slow-light silicon modulators
Xingjun Wang, Changhao Han
Peking University (China)

We realize a modulator with an EO bandwidth of 110 GHz in a length of about 100μm, and enables transmission beyond 224 Gbps PAM-4 per lane.

P4: Inverse Design for wavelength and polarization multiplexing in optical metasurfaces
Bo Xiong, Wei Ma
Zhejiang University (China)

By introducing the engineered noise to the precise solution of Jones matrix elements, we break the fundamental limit of polarization multiplexing capacity of metasurfaces. We experimentally demonstrate up to 11 independent holographic images using a single metasurface illuminated by different polarizations.

P5: Inverse Design of Broadband Acoustic Lens using Gradient-Based Optimization
Feruza Amirkulova, Samer Gerges, Jovana Samaniego
San Jose State University (USA)

We design broadband acoustic lenses through gradient-based optimization. The root mean square of absolute pressure amplitudes at the focal point is maximized, considering a range of frequencies and incident angles amidst the nonuniform configuration of scatterers. We demonstrate how the analytical form of gradients enriches the modeling and solution accuracy.

P6: Optimizing Metasurface Design for Interference Lithography: Achieving Two-Dimensional Bravais Lattices with Arbitrary Motifs
Myungjoon Kim, Nayoung Kim, Jonghwa Shin
KAIST (Korea)

Periodic metasurface masks are utilized in interference lithography. In this study, we demonstrate that through the inverse design of metasurfaces, it is possible to achieve all two-dimensional Bravais lattices with any desired motifs by manipulating the amplitude, phase, and polarization of individual diffraction beams.

P7: Lifetime analysis of nitrogen-vacancy centers in nanodiamond particles using cathodoluminescence microscopy

Sotatsu Yanagimoto[1], **Naoki Yamamoto**[1], **Akiba Keiichirou**[2], **Takumi Sannomiya**[1]
[1] *Tokyo Institute of Technology (Japan),* [2] *National Institutes for Quantum Science and Technology (Japan)*

We measured the lifetimes of nanodiamond particles with nitrogen-vacancy centers using cathodoluminescence microscopy combined with Hanbury Brown-Twiss interferometry. The experimental results showed the lifetime distribution due to the size effect of the particles. The lifetime can be further modified by coupling with surface plasmons.

P8: Broadband large-scale photonics inverse design enabled by experimental machine learning

Maksim Makarenko[1], **Sergey Rodionov**[2], **Qizhou Wang**[2], **Fedor Getman**[2], **Andrea Fratalocchi**[2]
[1] *Aramco (Saudi Arabia),* [2] *King Abdullah University of Science and Technology (Saudi Arabia)*

In this work we propose a new methodology to inverse design for the development of high-efficient wavefront engineering structures using direct experimental fabrications without a need of first-principle simulations. We train the model to accurately predict flat-optics transmission responses, resulting in a ten-fold error's reduction compared to traditional approaches.

P9: Highly-Sensitive Broadband Gap-Plasmon-Enhanced NbN Superconducting Single Photon Detectors

Feng-Yang Tsai[1], **Jing-Wei Yang**[2], **Jia-Wern Chen**[2], **Li-Min Wang**[1], **Yu-Jung Lu**[2]
[1] *National Taiwan University (Taiwan),* [2] *Academia Sinica (Taiwan)*

We report a broadband gap-plasmon-enhanced superconducting single-photon-detector using NbN superconducting microstrip integrated with silver nanocubes to form gap plasmon resonances from 440 nm to 640 nm. The nonlinear photoresponse is attributed to the gap-plasmon-induced heating that breaks the superconducting state to normal, an impressive detection efficiency of 98 $\%$ was achieved.

P10: Physics-Driven Vector-Quantized Autoencoder for Space-Time-Coding Matrix

Xiao Qing Chen, Lei Zhang
Southeast University (China)

We have designed and trained a physics-driven vector-quantized (PD-VQ) autoencoder model that takes the target harmonic scattering pattern as an input, and this PD-VQ autoencoder model quickly outputs the optimal discrete space-time coding (STC) matrix, which can help the STC digital metasurface to perform agile multi-frequency harmonic beamforming in real-time.

P11: Revisable Tuning of Tamm Plasmon Polaritons

Ming-Jyun Ye[1], **Kuo-Ping Chen**[2]
[1] *National Yang Ming Chiao Tung University (Taiwan),* [2] *National Tsing Hua University (Taiwan)*

Phase-change materials (PCMs) provide a specific combination of properties. Sb2S3 is consider one of the promising candidates, especially its intrinsic HRI, low loss and wide bandgap properties, in near infrared (NIR). Here, the Sb2S3 transformation from amorphous to crystal state embedded between the distribute Bragg reflector (DBR) and metal layer.

P12: Photoluminescence and electroluminescence control of 2D semiconductors coupled to nanophotonic structures

Antti Moilanen[1], **Takashi Taniguchi**[2], **Kenji Watanabe**[2], **Lukas Novotny**[1]
[1] *ETH Zurich (Switzerland),* [2] *National Institute for Materials Science (Japan)*

We present control of photoluminescence and electroluminescence properties of two-dimensional (2D) semiconducting materials, monolayers of transition metal dichalcogenides (TMDs), by incorporating them into plasmonic and photonic cavities as well as waveguides. As another way to control the emission properties, we exploit electrostatic doping of the TMDs by using gate electrodes.

P13: Realizing an acoustic T-shaped superscatterer with inverse design

Di Wang, Jie Zhu, Zhongming Gu

Tongji University (China)

We present an inverse design approach aimed at realizing efficient and straightforward structures capable of achieving superscattering of ultrasound in water. Through a combination of numerical simulations and experimental investigations, we demonstrate the effectiveness of the proposed super scatterer in significantly enhancing ultrasound backscattering when compared to a rigid cylinder.

P14: Robustness evaluation of merged topological bound states in the continuum
Jiamin Guo, Zhongming Gu, Jie Zhu
Tongji University (China)

We propose a theoretical model for realizing merged topological bound states in the continuum (TBICs), focusing on the investigations of system robustness through tight-binding calculations and numerical simulations. Our findings demonstrate that the topologically protected merged bound states exhibit remarkable robustness against various types of defects and perturbations.

P15: Real-time terahertz modulation with gold-MoS2 metasurface
Jianhong Zhang, Fangfang Ren, Jiandong Ye, Xiaoli Ji, Hai Lu
Nanjing University (China)

The authors introduce a method for precise control of terahertz (THz) radiation using a gold split-ring metasurface and MoS2 layers. Through optical pumping, a high-quality THz signal transmission with 81 $\%$ modulation depth can be achieved at 0.61 THz, promising advancements in sensing, switching, and filtering for THz applications.

P16: Resonant exceptional points in terahertz metasurfaces
Lei Wang, Caihong Zhang, Jingbo Wu, Kebin Fan, Biaobing Jin, Jian Chen, Peiheng Wu
Nanjing University (China)

In this study, we comprehensively investigate the resonant exceptional point (EP) in terahertz metasurfaces, which directly realize the singularity of complex frequency requiring one measurement only. Our approach not only provides a novel perspective to understanding EP in non-Hermitian terahertz metasurfaces but also offers alternative methods for terahertz high-Sensitivity sensing.

P17: Particle Image Velocimetry Utilizing Binocular Polarization-independent Meta-lens
Y. He[1], Z. Zhao[1], Y. Ji[1], T. Tanaka[2], M. K. Chen[3], S. Shi[1], D. P. Tsai[3]
[1]*Shanghai Jiao Tong University (China),* [2]*Tokushima University (Japan),* [3]*City University of Hong Kong (China)*

Experimental fluid dynamics is mainly studied using PIV, but traditional methods need complex optical system. Binocular meta-lens PIV, utilizing polarization-independent GaN meta-lenses and CMOS sensors, offers a compact solution for obtaining three-dimensional velocity fields. Measurement error of 1.3 $\%$ on vortex ring shows promise for space-constrained applications.

P18: Fundamental limits to metalens critical dimensions
Nicolas Kossowski[1], Emil Marinov[1], Clément Majorel[1], Samira Khadir[1], Patrice Genevet[2]
[1]*CRHEA-CNRS (France),* [2]*Colorado School of Mines (USA)*

Array of micro-metalenses have been proposed to be integrated with pixels matrices of imaging systems to improve the modulation transfer function of imaging systems. Here, we investigate the theoretical limits of the metasurface approach for such applications and identify suitable operating domains.

P19: Large-area, two-dimensional single-crystal gold for low-loss nanoplasmonics
Chenxinyu Pan[1], Yuanbiao Tong[1], Anatoly V. Zayats[2], Limin Tong[1], Pan Wang[1]
[1]*Zhejiang University (China),* [2]*King's College London (United Kingdom)*

Two-dimensional gold with a single-crystal structure is highly desired for upcoming technologies. In this work, we demonstrate the fabrication of large-area ($>$104 μm2), two-dimensional single-crystal gold using a chemical etching approach with an atomic-level precision, and its use for the realization of ultrathin plasmonic structures with low loss

P20: Coupling theory of quasinormal mode for an efficient and intuitive modeling of optical-nanoresonator arrays with a large scale or varying arrangement
Haitao Liu[1], Can Tao[1], Qiyong Tao[1], Zhe Qi[1], Ying Zhong[2]

[1] *Nankai University (China),* [2] *Tianjin University (China)*

Optical-nanoresonator arrays with a large scale or varying arrangement have important applications such as metasurfaces or optical-force manipulations, but their electromagnetic modeling using traditional full-wave numerical methods requires huge computational amount with poor physical intuitiveness. Here we report a coupling theory of quasinormal mode (QNM) to address such challenges.

P21: Photonic Modes in Gyrotropic-Hyperbolic Heterostructures

Daniele Battesimo Provenzano, Giuseppe Carlo la Rocca
Scuola Normale Superiore (Italy)

This study analyzes electromagnetic surface waves at the interface of a one-dimensional semi-infinite photonic crystal, comprised of gyroelectric and hyperbolic layers. Investigating both single and multilayered interfaces, it elucidates the impact of gyrotropy and media parameters on surface mode behavior, revealing non-reciprocal dispersion and modes with negative group velocity.

P22: Artificial intelligence optical hardware empowers real-time ultra-sensitive detection of dopamine at 10-11 mol/L

Ning Li, Qizhou Wang, Zhao He, Arturo Burguete-Lopez, Fei Xiang, Andrea Fratalocchi
KAUST (Saudi Arabia)

We discuss integrated platform for ultrasensitive detection comprising artificial intelligence hardware embedded in a monochrome camera. By utilizing the interference media, it reports detection ranges from 10-11 mol/L to 10-4 mol/L, which improves one to two orders of magnitude of the current state-of-the-art sensitivity requiring electrochemical workstations or mass spectrometers.

P23: Optimally designed ultra-thin underwater metamaterial absorber

Nan Gao[1]**, Sichao Qu**[2]**, Alain Tinel**[3]**, Bruno Morvan**[3]**, Vicente Romero-García**[1]**, Jean-Phillippe Groby**[4]**, Ping Sheng**[5]
[1] *Universitat Politècnica de València (Spain),* [2] *The University of Hong Kong (Hong Kong),* [3] *Normandie University (France),* [4] *Le Mans Université (France),* [5] *The Hong Kong University of Science and Technology (Hong Kong)*

In this talk, I present an ultra-thin broadband acoustic metamaterial absorber for underwater acoustics. It comprises an optimal combination of Fabry-Perot resonators (FP) made of a low longitudinal sound speed tungsten-polyurethane composite that matches the water impedance.

P24: Self-Aligned Nanoring Doublet as a Single Particle Nanocavity for Strong Coupling

Kyungwha Chung[1]**, Luke Lee**[2]
[1] *Sungkyunkwan University (Korea),* [2] *Harvard University (USA)*

Au self-aligned nanoring doublets (SANDs) are introduced as a single-nanoparticle cavity at room temperature for strong coupling with randomly distributed chlorophyll-a molecules, without highly concentrated J-aggregates, mirrors, or any sophisticated effort to create dimers.

P25: High Transmittance 3D Metasurface Holograms Made of SiN for Multicolor Projection with Time-division-multiplexing Method

Tamaki Onozawa, Junpei Beppu, Masakazu Yamaguchi, Kentaro Iwami
Tokyo University of Agriculture and Technology (Japan)

We developed large-area 3D metasurface holograms observed with the naked eyes for multicolor projection in the time-division-multiplexing method. Using dielectric SiN pillar meta-atoms, a high transmittance of 81 % was achieved. We also demonstrated an automatic optical system for the multicolor projection.

P26: Evaporative Analysis of Lithium-Ion Battery Electrolytes Using Surface-Enhanced Raman Spectroscopy in a Controlled Microenvironment

Maziar Moussavi, Nadzeya Khinevich, Asta Tamulevičienė, Tomas Tamulevičius, Mindaugas Juodėnas, Sigitas Tamulevičius
Kaunas University of Technology (Lithuania)

This research aims to develop a novel optical sensor integrated into a battery system for early detection of lithium-ion electrolyte leakage failures. The sensor utilizes surface enhanced Raman scattering measurements and features a graphene-protected substrate comprising a 2D array of silver nanoparticles with a tailored lattice resonance.

P27: Generation of multi-channel overlapping perfect vortex beam on chip
X. R. Zhao[1], Q. H. Wang[2], X. Z. Pei[1], C. Xu[1], Q. Kan[2], Yiyang Xie[1]
[1] *Beijing University of Technology (China),* [2] *Chinese Academy of Sciences (China)*

This article endeavors to integrate a metasurface with a VCSEL to achieve a perfectly compact and miniaturized perfect vortex beams (PVB) integrated VCSEL chip. This concept is also applied to broaden the functionalities of PVB, including on-chip overlapping PVB and on-chip multi-channel overlapping PVB.

P28: Design of inorganic photoelectrodes based on photonic crystals with incorporated Mo6 clusters.
Clement Lebastard[1], Adele Renaud[2], Stephane Cordier[2], Tetsuo Uchikoshi[1], Tohru Suzuki[1], Fabien Grasset[1]
[1] *NIMS (Japan),* [2] *Université de Rennes (France)*

This work describes the elaboration of photoelectrodes based on an inverse opal structure made of semiconductor oxides and hexamolybdenum clusters as light harvesters. Nanostructure fabrication is possible thanks to electrophoretic deposition method, a low-cost and scalable process.

P29: Vanadium dioxide for compensation of angle-dependent shifts in structural color filters
Katarína Rovenska[1], Filip Ligmajer[1], Peter Kepic[1], Beata Idesova[1], Jan Chochol[2], Jiří Liska[1], Tomas Sikola[1]
[1] *Brno University of Technology (Czech Republic),* [2] *Onsemi (Czech Republic)*

Structural color filters propose an advanced alternative to conventional color filters. However, their optical response shifts with angle variations of the incident light. We address this problem by introducing a conformal tunable VO2 layer onto bare aluminum structural color filters. This approach is adaptable and suits any existing structural filters.

P30: Design of a 3D Reconfigurable Intelligence Surface
Sung-Sil Cho, Biswarup Rana, Ic-Pyo Hong
Kongju National University (Korea)

In this work, a novel type of reconfigurable intelligent surface (RIS) has been proposed. We have designated these RIS types as '3D RIS.' One advantage that these types of RIS have over traditional RIS is their ability to steer the beam in full space.

P31: Developing Spatiotemporal Modulated Graphene-Based Waveguide to Integrate the whole Terahertz Transceiver Front-End in one Device
Mahsa Valizadeh[1], Leila Yousefi[2], MirFaez Miri[1]
[1] *University of Tehran (Iran),* [2] *University of Sussex (United Kingdom)*

Here, attractive features of spatiotemporally modulated graphene-based waveguides are utilized to integrate all functionalities of a THz transceiver front-end in one device. We have implemented the leaky wave antenna, isolator, and mixer all in one device using spatiotemporal modulated structures.

P32: Photonic topological states with auxiliary orbital degree of freedom in Kekulé modulation surface-wave metamaterials
Liyun Tao[1], Yahong Liu[1], Xin Zhou[2], Lianlian Du[1], Meize Li[1], Kun Song[1], Zhenfei Li[1], Xiaopeng Zhao[1]
[1] *Northwestern Polytechnical University (China),* [2] *Xi'an Mingde Institute of Technology (China)*

We design and demonstrate topological metamaterials with an arbitrary auxiliary orbital DOF by applying continuous generalized Kekulé modulations in honeycomb surface-wave metamaterials. Three kinds of photonic platforms are constructed . The perfect electrical conductor boundaries in finite structures, the interface of the two topological metamaterials and a band-notch line-defect waveguide.

P33: Exceptional point sensing in planar terahertz metasurface
Bo Wang[1], Leyong Hu[2], Junjie Li[2]
[1] *Chinese Academy of Sciences (China),* [2] *Beijing National Laboratory for Condensed Matter Physics, Institute of Physics, Chinese Academy of Sciences (China)*

We experimentally demonstrate a plasmonic metasurface supporting exceptional points at terahertz frequencies, based on wisely tailored coupling between bright and dark modes. As an application, we use the metasurface EP sensor to trace residual embryonic stem cells in differentiated cells with a detection limit of less than 1 $\%$.

16:40 - 18:40 — Main Hall

Session 3A32

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Osamu Takayama

16:40 : Invited talk
Integrated quantum photonic sources
Xifeng Ren
University of Science and Technology of China (China)

I will introduce our recent works about quantum photonic sources based on nanophotonic structures, such as 2D materials, metalens array, microcavity, nanowaveguide, etc.

17:00 : Invited talk
Intracavity metasurfaces in fiber lasers for linear and nonlinear applications
Lili Gui[1], Chuanshuo Wang[1], Hao Chen[1], Chao Meng[2], Xianglong Mei[1], Hailun Xie[1], Zhijin Chen[1], Fengbin Lin[1], Fei Ding[2], Sergey I. Bozhevolnyi[2], Kun Xu[1]
[1] *Beijing University of Posts and Telecommunications (China),* [2] *University of Southern Denmark (Denmark)*

Intracavity metasurfaces are explored for spatially or temporally modulating light wave inside fiber lasers. First we harness static and dynamic metasurfaces for building orbital-angular-momentum (OAM) laser sources. Secondly, resonant metasurfaces are used for Q-switched or mode-locked fiber lasers. They open new perspectives in structured optics, ultrafast optics and neuromorphic photonics.

17:20 : Invited talk
High Q-factor coupled Fabry-Perot plasmonic nanoresonator
Baptiste Fix
ONERA (France)

Multi Fabry-Perot (FP) nanoresonators have been widely described as independent cavities. However, we evidence the coupling of FP nano-cavities leading to perfectly absorbing high quality factor plasmonic resonators through an analytical model and experimental demonstration on several architecture. Applications for nonlinear optics and infrared photodetection will be presented.

17:40 : Invited talk
Multipolar description of the scattering of dense clusters of metallic nanoparticles
Maeva Lafitte[1], Ranjeet Dwivedi[2], Philippe Barois[1], Alexandre Baron[1], Olivier Mondain-Monval[1], Virginie Ponsinet[1]
[1] *CNRS-Université de Bordeaux (France),* [2] *Ensemble 3 (Poland)*

Optical metasurfaces are two-dimensional assemblies of optical nanoresonators and could constitute next generation ultrathin optical components. We propose an emulsion-based scalable fabrication approach both for the fabrication of colloidal resonators, presenting a strong interaction with light with simultaneous magnetic and electric resonance modes, and for their deposition in homogeneous films.

18:00 : Invited talk
Advanced Terahertz-Wave Phase and Polarization Control Devices Powered by Metasurfaces
Yuehong Xu, Hiroaki Minamide
RIKEN (Japan)

This work introduces several advanced terahertz-wave phase and polarization control devices powered by metasurfaces, integrating dynamic and geometric phase control. This spin-decoupled phase control method offers robust and flexible solutions for beam steering and polarization multiplexing.

18:20 : Invited talk
Tailoring the optical properties of 3D photonic crystals coated with Aluminum Zinc Oxide in the telecommunication wavelength

Dimitra Ladika[1], **Anna Theodosi**[1], **Odysseas Tsilipakos**[2], **Argyro Klini**[1], **Panagiotis Loukakos**[1], **Maria Kafesaki**[1], **Maria Farsari**[1], **David Gray**[1]
[1] *Foundation for Research and Technology Hellas (Greece),* [2] *National Hellenic Research Foundation (Greece)*

Introducing a novel approach to customize the optical properties of a transparent conductive oxide that exhibits epsilon-near-zero (ENZ) behavior, in three dimensions. The combination of 3D photonic crystals with the ENZ material yields a promising 3D device with static optical properties suitable for telecommunication applications.

16:40 - 17:20 — Room 201

Session 3A33

SP18. Plasmonics: Fundamentals and Applications

Organized by: Hong Wei

Chaired by: Yan Pennec

16:40 : Invited talk
Plasmonic-assisted 2D hybrid broadband photodetectors
Ilya Goykhman
The Hebrew University (Israel)

The rich portfolio of 2D materials and favorable heterogeneous integration with silicon technology set up new horizons for integrated photonics and optoelectronics. In this talk, I will present advanced plasmonic-assisted 2D hybrid broadband photodetectors and discuss the key aspects of material properties, device physics, nanofabrication, and system performance.

17:00 : Invited talk
Multifunctional Dynamic MEMS-based Optical Metasurfaces
Chao Meng, P. C. V. Thrane, Y. D. Deng, F. Ding, S. I. Bozhevonyi
University of Denmark (Denmark)

Recent advances in piezoelectric MEMS enabled multifunctional optical metasurfaces (OMSs) for dynamic phase and polarization control are presented. Moreover, theoretical investigations on the MEMS-OMS configuration show that control over scattering phase singularities in the parameter space determined by the MEMS-OMS separations and meta-atom sizes with the OMS, underpins these developments.

16:40 - 18:35 — Room 202

Session 3A34

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Xiangrong Wang

16:40 : Invited talk
Peltier effect of phonons driven by electromagnetic waves
Hiroaki Ishizuka[1], **Masahiro Sato**[2]
[1] *Tokyo Institute of Technology (Japan),* [2] *Chiba University (Japan)*

We show that a phenomenon analogous to the Peltier effect occurs by phonon photocurrent in a material

subject to a linearly polarized light. We derive a general formula for the nonlinear Peltier coefficient. An order-of-magnitude estimate using this theory predicts an experimentally observable energy current using available THz-infrared light sources.

17:00 : Invited talk
Spatiotemporal Light Structuring
Michael Almeida de Oliveira, Antonio Ambrosio
Istituto Italiano di Tecnologia (Italy)

We show to coherently control both the spatial and temporal characteristics of laser beams by using a Fourier space-time shaper based on an axicon grating to disperse the frequencies of a pulsed beam into colinear rings which are then individually tailored with an azimuthal phase via a digital modulator.

17:20 : Invited talk
Chiral optical forces in integrated photonic waveguides for sorting enantiomers
Iago Diez[1], Josep Martínez-Romeu[1], Sebastian Golat[2], Francisco Rodríguez-Fortuño[2], Alejandro Martínez[1]
[1] *Universitat Politecnica de Valencia (Spain),* [2] *King's College London, (United Kingdom)*

Optical forces with opposite signs for enantiomeric versions of a molecule or nanoparticle can enable their separation, essential in chemistry and pharmaceutics. We analyze such forces in integrated dielectric waveguides with simulations, demonstrating separation within seconds for high and low chirality nanoparticles.

17:40 : Invited talk
Manifestation of crystal chirality in quasiparticles
Takehito Yokoyama
Tokyo Institute of Technology (Japan)

I will talk about how crystal chirality is manifested in quasiparticles: Bogoliubov quasiparticles in superconductors and magnons in ferromagnets in the presence of chiral crystal structures.

18:00 : Effects of Strong Capacitive Coupling Between Meta-Atoms in Three-Dimensional rf SQUID Superconducting Metamaterials
Jingnan Cai, Yilin Li, Steven Anlage
University of Maryland (USA)

We model and measure a nonlinear three-dimensional superconducting metamaterial with qualitatively new properties enabled by strong capacitive coupling between the meta-atoms. The new form of coupling creates a multitude of resonant modes. The model is verified with rf current images produced by laser scanning microscopy of the operating metamaterial.

18:15 : Invited talk
Exploring magneto-optical and nonlinear processes using a polarimeter optical spectrum analyzer
Eyal Buks
Technion (Israel)

Two recently-discovered effects are explored. The first is an unequally spaced optical comb that occurs in a fiber loop operated at low temperatures. The second effect under study is single sideband modulation that is observed in an optical modulator based on a ferrimagnet. Both effects are explored using polarization measurements.

16:40 - 18:25 — Room 203

Session 3A35

GEN1: Advances and Emerging Applications of Nanophotonics

Chaired by: Maria Vanessa Oguchi

16:40 : Identify Defect and Strain of Monolayer WSe2 through Exciton Anisotropy
Shu-Hsien Chen, Sih-Wei Chang, Hsuen-Li Chen

National Taiwan University (Taiwan)

Identify the quality through variations of anisotropic exciton resonances. The optical power requirement through exciton anisotropy is 1010 times smaller than Raman measurements while obtaining an optical signal with a standard deviation of 10 times smaller. Therefore, we believe that exciton anisotropy is much more sensitive to characterize TMDCs films.

16:55 : Investigating the Optical Properties of Thin Films Coated with MWCNTs

Md Saiful Islam[1], **Furuta Hiroshi**[2]
[1]*Kochi University of Technology (Japan),* [2]*Kochi University Of Technology (Japan)*

The study aimed to investigate the relationship between the density and alignment of randomly aligned multi-walled carbon nanotube (MWCNT) coatings and their optical properties in the visible region. The results showed that 0.0002 gm of MWCNT exhibited low reflectance and high absorption, making it suitable for optical applications.

17:10 : Second optical harmonic generation in high-Q dielectric metasurfaces integrated with transition metal dichalcogenide films

Alena Nazarenko, Anna Chernyak, Alexander Musorin, Alexander Shorokhov, Andrey Fedyanin
Lomonosov Moscow State University (Russia)

Atomically thin transition metal dichalcogenides are a promising class of novel materials, that provide new approaches in photonics, for instance, in nonlinear optics. Coupling two-dimensional semiconductors with dielectric resonant metasurfaces provides an opportunity to achieve higher efficiencies of nonlinear optical processes.

17:25 : Templated Self-Assembled Plasmonic Metasurfaces. From Lasing and Sensing to Photocatalysis

Tomas Tamulevičius[1], **Klaudijus Midveris**[1], **Gvidas Klyvis**[1], **Tomas Klinavičius**[1], **Muhammad Haris**[1], **Nadzeya Khinevich**[1], **Asta Tamulevičienė**[1], **Mindaugas Juodėnas**[1], **Domantas Peckus**[1], **Joel Henzie**[2], **Sigitas Tamulevičius**[1]
[1]*Kaunas University of Technology (Lithuania),* [2]*National Institute for Materials Science (Japan)*

Chemically synthesized plasmonic nanoparticle colloid templated self-assembly onto soft lithography replicated elastomer templates is a well-established method for originating 1 cm2 scale metasurfaces. Regular noble metal nanoparticle arrays couple the scattered localized plasmon light into high-Q surface lattice resonances serving in nanolasing, Raman enhancing, and photocatalysis.

17:40 : Super Resolution Imaging of Resonance Mode Inside Silicon Nitride Nanowire Based on Photothermal Nonlinearity

Yu-An Chen, Te-Hsin Yen, Kentaro Nishida, Chih-Wei Chang, Shi-Wei Chu
National Taiwan University (Taiwan)

As Si3N4-based photonic integrated circuits emerge as a promising platform, it's important to diagnose their spatial configuration with resolution beyond diffraction limit. Here, we demonstrate a resolution enhancement of hundred-nanometer-diameter Si3N4 nanowires based on photothermal nonlinearity and higher order saturated excitation subtraction and detect the resonance mode inside it..

17:55 : Cd(Zn)O nanostructures for SEIRA sensing in de Mid-IR

Pablo Ibañez-Romero[1], **Eduardo Martinez Castellano**[1], **Javier Yeste**[2], **Fernando Gonzalez-Posada**[3], **Thierry Taliercio**[3], **Vicente Muñoz-Sanjosé**[2], **Miguel Montes Bajo**[1], **Adrian Hierro**[1]
[1]*Universidad Politécnica de Madrid (Spain),* [2]*Universitat de València (Spain),* [3]*Université de Montpellier (France)*

Surface Enhanced Infrared Absorption (SEIRA) allows the resonant coupling between a plasmonic mode and a narrow resonance of an analyte. We demonstrate two different approaches for sensing PMMA and vanillin, using Cd(Zn)O nanostructures reporting enhancement factors of up to 220 %.

18:10 : Cost-Efficient Deterministic Engineering of Quantum Light Emission in Two-Dimensional Semiconductors

Snezana Lazic, Sanja Djurdjić Mijin, Ismael de Pedro Embid
Universidad Autónoma de Madrid (Spain)

Various techniques, including strain engineering and surface treatments, have been tested for spatially de-

terministic generation of quantum light emitters in 2D layered semiconductors. Here, we develop a more cost-efficient and simpler method by placing mechanically exfoliated GaSe flakes onto a substrate carrying dispersed radiative microparticles with a distinctive bipyramidal shape.

16:40 - 17:35 — Room 204

Session 3A36

Symposium V: Architectured Elastic and Acoustic Metamaterials and Phononic Crystals

Organized by: Marco Miniaci, Jensen Li, Vicente Romero-García, Vincent Pagneux and Noé Jiménez

Chaired by: Vincent Pagneux

16:40 : Invited talk
Explorations with nonlinearity and coupled orbitals in mechanical and magneto-mechanical topological crystalline insulators
G. Liu, I. Grinberg, V. Workman, J. Noh, W. A. Benalcazar, M. Lin, Y. Ma, C. W. Peterson, J. Zhao, A. Mangu, C. Harris, T. L. Hughes, G. Bahl
University of Illinois at Urbana-Champaign (USA)

Mechanical and magneto-mechanical structures be engineered to generate a variety of nonlinear couplings and can even emulate orbital physics. In this talk I will discuss our team's experimental work to leverage such couplings for topological pumping, non-linearity induced spontaneous transitions, and new orbital-based topological states.

17:00 : Invited talk
Optomechanical measurement of liquids in unconventional regimes (Part I)
Ivan Favero
Université Paris Cité, CNRS (France)

We discuss our recent achievements using nano-optomechanical devices and concepts to measure liquid dynamics with increased temporal resolution and sensitivity. This has enabled access to previously unexplored temporal and spatial scales in the liquid state, leading to the observation of unconventional regimes. This is an example of the application of optomechanical technologies to probe complex matter.

17:20 : Optomechanical measurement of liquids in unconventional regimes (Part II)
Ivan Favero
Université Paris Cité, CNRS (France)

We discuss our recent achievements using nano-optomechanical devices and concepts to measure liquid dynamics with increased temporal resolution and sensitivity. This has enabled access to previously unexplored temporal and spatial scales in the liquid state, leading to the observation of unconventional regimes. This is an example of the application of optomechanical technologies to probe complex matter.

17:35 - 18:35 — Room 204

Session 3A37

GEN3: Crystal Structures of Nanomaterials

Chaired by: Satoshi Iwamoto

17:35 : Optical vortex generation using GaN nanopillars and metal nanostructures
Ryuji Kuruma[1], Masato Takiguchi[2], Peter Heidt[3], Yuto Moritake[1], Taiki Yoda[1], Adam Mock[4], Masaya

Notomi[5]
[1] *Tokyo Institute of Technology (Japan),* [2] *NTT Corporation (Japan),* [3] *NTT Corporation (USA),* [4] *Michigan University (Japan),* [5] *Tokyo Institute of Technology, Nanophotonics Center, NTT Corporation, NTT Basic Research Laboratories (Japan)*

This study explores generation of Orbital Angular Momenta (OAMs) in sub-wavelength nanowires. We reveal that a hexagonal GaN hollow nanowire exhibits distinctive OAM when Au nanopillars are closely placed, which is due to non-Hermitian perturbation breaking the mirror symmetry. We show a variety of structures optimizing the OAM.

17:50 : Coupled thermal and mechanical phenomena induced by the fluctuations of the electromagnetic field
Juan R. Deop-Ruano, Alejandro Manjavacas
Instituto de Optica (IO-CSIC) (Spain)

Radiative heat transfer and Casimir interactions arise from the fluctuations of the electromagnetic field. Here, we analyze the simultaneous transfer of momentum and energy in different nanoscopic systems. In doing so, we find that the motion of the nanostructures allows us to modulate the heat transfer, and vice versa.

18:05 : Large-area self-organized plasmonic gold nanowire matrix for advanced photochemical applications
Giulio Ferrando[1], **Matteo Gardella**[1], **Long Duy Pham**[2], **Hieu Si Nguyen**[2], **Chi Le Ha**[2], **The Hung Mai**[2], **Giorgio Zambito**[1], **Matteo Barelli**[1], **Maria Caterina Giordano**[1], **Francesco Buatier De Mongeot**[1]
[1] *University of Genoa (Italy),* [2] *Vietnam Academy of Science and Technology (Vietnam)*

Renewable energy and waste water treatment require advanced nanoscale platforms. Localized Surface Plasmon Resonances (LSPR) show promise. Here is proposed a self-organized method creates glass nanorippled templates for gold nanowire growth, enhancing photocatalysis and electrode performance. Plasmonic NWs extend absorption, offering potential for scalable solar energy conversion and large-area photonics.

18:20 : Structured Light Generation Using Spherulite in Linear and Nonlinear Realm
Yuanfeng Liu[1], **Le Zhou**[1], **Youcheng Xu**[1], **Yongzheng Wen**[1], **Natalia M. Litchinitser**[2], **Yang Shen**[1], **Jingbo Sun**[1], **Ji Zhou**[1]
[1] *Tsinghua University (China),* [2] *Duke University (USA)*

Structured light exhibits spatially varying phase or polarization, implying intriguing physical properties for advanced optical applications. Here, we introduce naturally-crystalized spherulites as the structured light generator. The cylindrical anisotropy of the spherulite can be engineered through molecular design, offering a flexible toolbox for structured light generation.

16:40 - 18:30 — Conference Room

Session 3A38

SP25. Recent Trends in Metaoptical and Plasmonic Systems

Organized by: Kentaro Iwami and Junichi Takahara

Chaired by: Kentaro Iwami and Junichi Takahara

16:40 : Invited talk
Enhancing the photo sensitivity of photo detector using nanophotonics approach
Soh Uenoyama
Hamamatsu Photonics K.K. (Japan)

Silicon photomultiplier has been used in various applications due to its excellent photon counting ability. We demonstrated the enhancement of the sensitivity by focusing incident photon on the photo-sensitive area of pixel using metalens array. Additionally, we report on various nanophotonic approaches for enhancing the performance of the photodetector.

17:00 : Invited talk
Enhancement of photothermal nonlinear scattering from Mie-resonant silicon nanostructures
Kentaro Nishida, Shi-Wei Chu
National Taiwan University (Taiwan)

Signal nonlinearity is an essential factor in all-optical switching and super-resolution imaging applications. In our research, we demonstrated strong photothermal nonlinear scattering from silicon Mie nanoresonator via utilizing several different approaches: quasi-perfect absorbing metasurface, displacement excitation by focused laser beam and optical bistability.

17:20 : Invited talk
High-sensitivity image sensors based on dispersion-engineered metalenses
Masashi Miyata
NTT Device Technology Laboratories (Japan)

This talk will review our recent work on dispersion-engineered metalenses for color splitting on sensor pixels, which provide a path toward the development of high-sensitivity color image sensors while maintaining consistency with CMOS sensor technology.

17:40 : All-optical spectral control by perfect absorber based on quadrupole resonance and photothermal effect
Seiya Shinkai, Junichi Takahara
Osaka University (Japan)

We study all-optical spectral control of silicon metasurface by photothermal effect. We fabricated a perfect absorber based on metasurface which supports two degenerated quadrupole modes. In this study, we demonstrate 8nm red-shift and the modulation of transmission spectra induced 3 % increase by 90K temperature rise.

17:55 : Development of wide-angle metalenses capable of simultaneously capturing near and far-view images
Atsushi Hasegawa[1], Ryota Yamada[1], Keisuke Ozawa[2], Yuki Abe[2], Mineki Taoka[2], Takeshi Yamagishi[2], Kentaro Iwami[1]
[1] *Tokyo University of Agriculture and Technology (Japan),* [2] *Samsung R&D Institute (Japan)*

We developed wide-angle metalenses capable of simultaneously capturing near and far view images. From the imaging evaluation at object distances of 5.3 mm and 15.7 mm, near and far view metalenses had angular field of views of 86.7° and 103.7°, respectively. We successfully captured simultaneous images using the fabricated metasurface.

18:10 : Invited talk
Reconstructive Spectrometer Using Plasmonic Photodetector
Yuuki Kaneda[1], Eslam Abubakr[1], A. Abadi[1], Shun Yasunaga[2], Masaaki Oshita[1], Tetsuo Kan[1]
[1] *The University of Electro-Communications (Japan),* [2] *The University of Tokyo (Japan)*

When a metallic structure is formed on a semiconductor, the hot electrons in the metal excited by surface plasmon resonance are extracted as an electric current. By configuring the structure that generates SPR as a continuous one-dimensional diffraction grating, it is possible to perform reconstructive spectroscopy.

16:40 - 18:00 — Room 205

Session 3A39

SP3. Parity-Time and quasi-normal modes in Photonics, Plasmonics, Acoustics

Organized by: Anatole Lupu and Henri Benisty

Chaired by: Henri Benisty

16:40 : Invited talk

Scattering Singularities of Complex Non-Hermitian Systems Probed with Continuously Variable Metasurfaces
Jared Erb, Thomas Antonsen, Steven Anlage
University of Maryland (USA)

We utilize continuously tunable metasurfaces to establish coherent perfect absorption and exceptional point scattering singularities in generic microwave resonant systems in 1, 2, and 3-dimensions. We demonstrate CPA through 100 % absorption of incident radiation, and examine the topological properties of multiple Exceptional Points in two- and three-dimensional parameter spaces.

17:00 : Invited talk
Non-Hermitian Systems with a Real Spectrum and Selective Skin Effect
Li Ge
CUNY (USA)

We show a simple approach to constructing non-Hermitian Hamiltonians with a real spectrum, using the product of a Hermitian Hamiltonian H0 and a positive semi-definite matrix A. When A is diagonal, we reveal a selective non-Hermitian skin effect where only the zero mode is a skin mode.

17:20 : Invited talk
Pseudospectra and non-normality in non-Hermitian photonics
Konstantinos Makris
IESL-University of Crete (Greece)

In the context of non-Hermitian photonics we present recent results regarding sensitivity of non-normal optical waveguide lattices. We investigate dissipative optical lattices with gain/loss and asymmetric couplings and study their response in terms of their pseudospectra. The effect of disorder and optical nonlinearity will be also discussed.

17:40 : Invited talk
Non-Hermitian mode-cleaning in linear and nonlinear optical waveguides
Mohammad Nayeem Akhter, Ramon Herrero, Kestutis Staliunas, Muriel Botey
Universitat Politècnica de Catalunya (Spain)

We present a novel all-optical mode-cleaning mechanism in waveguides triggered by an antisymmetric non-Hermitian potential. Unidirectional coupling among transverse modes enables light management, yielding ideally single-mode spatially coherent output. Analytical predictions based on a 1D linear and nonlinear mode coupling expansion are numerically validated.

16:40 - 18:40 — Room 206

Session 3A40

SP9. Metamaterial Technology and Its Application Prospects

Organized by: Tatjana Gric and Edik Rafailov

Chaired by: Tatjana Gric and Edik Rafailov

16:40 : Invited talk
Hyperband Multi-functional Metasurface based on Double-walled Carbon Nanotubes
Jin Zhang, Peng Liu, Zhipei Sun
Aalto University (Finland)

Mastering the cross wavelength modulation of spatial light over the entire electromagnetic spectrum remains a challenging task. We experimentally demonstrate an avenue towards hyperband multifunctionality in a single metasurface based on double-walled carbon nanotubes. The proposed metasurface integrates three typical functionalities including microwave selectivity, terahertz diffusion, and optical transparency.

17:00 : Invited talk

Plasmonic Nanoplatforms - A New Generation of Efficient Heat Generators for Thermoplasmonic Detection

Andreea Campu, Simion Astilean, Monica Focsan
Babes-Bolyai University (Romania)

The thermoplasmonic detection is a newly emerging application of the rapidly growing and promising field of thermoplasmonics. Despite the exploitation of the heat generated by gold nanoparticles in biomedical applications (e.g. photothermal therapy), the understanding of the influence of nanoscale photothermal processes is still subject to debate.

17:20 : Invited talk

Periodically nanostructured anisotropic coatings for spatial filtering and polarization control

Julianija Nikitina, Matas Plukys, Darius Gailevičius, Kestutis Staliunas, Lina Grineviciute
FTMC (Lithuania)

An overview of technologies to form conformal coatings on patterned surfaces will be presented. The proposed 2D structure is a promising component for intracavity spatial filtering and 0 AOI polarizer. A reduction of M2 and brightness increase twice was recorded for the microchip laser when the fabricated structure was used.

17:40 : Plasmonic Enhancement of the Performance of Integrated Phase-Change Memory and Computing Devices

Junchao Song[1], Nikolaos Farmakidis[2], Ivonne Bente[3], Emanuele Gemo[4], June Sang Lee[2], Xuan Li[2], Samarth Aggarwal[2], Wen Zhou[5], Nathan Youngblood[6], Johannes Feldmann[2], Wolfram Pernice[3], Harish Bhaskaran[2], David Wright[1]
[1] *University of Exeter (United Kingdom),* [2] *University of Oxford (United Kingdom),* [3] *University of Munster (Germany),* [4] *Politecnico di Torino (Italy),* [5] *Xi'an Jiaotong University (China),* [6] *University of Pittsburgh (USA)*

Integrated phase-change photonic memory devices are of much current interest due to their ability to provide a platform for fast, low-energy in-memory and neuromorphic computing. Here we explore the use of plasmonic enhancement of such devices to increase programming speed, reducing energy consumption and enable direct electrical access.

17:55 : Picosecond dynamics of electromagnetically-induced transparency in infrared metamaterials

The Linh Pham[1], Kacper Pilarczyk[1], Nils Deßmann[2], Fei Han[1], Joris Van de Vondel[1], Niels Verellen[3], Thanh Tung Nguyen[4], Ewald Janssens[1]
[1] *KU Leuven (Belgium),* [2] *Radboud University (The Netherlands),* [3] *IMEC (Belgium),* [4] *Vietnam Academy of Science and Technology (Vietnam)*

We studied the ultrafast dynamics of near-field coupling of dark and bright resonators in electromagnetic-induced transparency (EIT) metamaterials. Given the picosecond pump fluence of 8 J/m2, the optical response of the system changes and exhibits more than 100 % of transmission modulation depth, opening a new approach for ultrafast optical devices.

18:10 : Optical to Terahertz Frequency Conversion using near Zero-index Nonlinear Hybrid Waveguides

Chong Sheng, X. F. Ma, N. Y. Wang, R. Z. Cao, C. Sheng, S. N. Zhu, H. Liu
Nanjing University (China)

Terahertz communications has emerged as an excellent candidate for the next generation of wireless communication networks. Despite of significant advances, one still looks for a high-efficiency terahertz source using nonlinear optics. Here, we propose near zero-index nonlinear hybrid waveguides to realize a high generation efficiency of terahertz waves.

18:25 : Low-frequency sound insulation and ventilation with spiral metastructure

Shanjun Liang, Wenjian Kuang
The Hong Kong Polytechnic University (Hong Kong)

We report a new design of acoustic metamaterial for broadband insulation and natural ventilation. The unit cell consists of an Archimedean spiral channel and a straight pipe alongside, allowing fresh air flow and mode cancellation. It shows over 15dB transmission loss over a broad bandwidth of around 1000 Hz.

16:40 - 17:10 — Room 101

Session 3A41

SP16. Recent Advances in Metamaterials and their Applications

Organized by: Weiren Zhu, Zhenfei Li and Fajun Xiao

Chaired by: Zhenfei Li and Jin Zhang

16:40 : Reflective Moiré Metasurfaces: A Paradigm of Innovation and Challenge
Shuo Liu, Lei Zhang, Xiaoqing Chen
Southeast University (China)

Reflective moiré metasurface offers a cost-effective solution for dynamic beamforming in RIS applications and importantly, paves new ways for synthesizing far-field scattering using tightly stacked ultrathin metallic patterns of varying plane symmetries. This innovation is expected to have widespread impact across the fields of electromagnetics, antenna development, and wireless communication.

16:55 : Metasurface-enabled light-to-microwave hybrid wireless communications
Xin Ge Zhang, Ya Lun Sun, Wei Xiang Jiang
Southeast University (China)

We will introduce an optically-controlled programmable metasurface for remote microwave control and hybrid light/microwave signal processing. A hybrid wireless communication system that allows dual-channel data transmissions in a light-to-microwave link is demonstrated, and the experimental results show that two different videos can be transmitted and received simultaneously and independently.

17:20 - 18:20 — Room 101

Session 3A42

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Hiromi Okamoto

17:20 : Invited talk
Ceramic metasurfaces for biophotonics applications in the visible range
Mohammad Biabanifard, Tomasz Plaskocinski, Jianling Xiao, Andrea Di Falco
University of St Andrews (United Kingdom)

We introduce ZrO2 as a reliable material platform for photonic metasurfaces for on-chip optical trapping and imaging applications in the visible range. We demonstrate devices for optical trapping with a high numerical aperture at a wavelength as low as 488 nm, validating the use of the platform for biophotonics applications.

17:40 : Invited talk
Magnetic control of electrically uncharged magneto-optical particles
Manuel Marques[1], Shulamit Edelstein[2], Pedro A. Serena[2], Beatriz Castillo Lopez de Larrinzar[3], Antonio Garcia Martin[3]
[1] *Universidad Autonoma de Madrid (Spain),* [2] *ICMM-CSIC (Spain),* [3] *IMN-CNM CSIC (Spain)*

In this work we present a method to perform magnetic control of electrically uncharged particles based on magneto-optical materials illuminated by a spinning monochromatic light field. We analyze the behavior of these particles under different isotropic optical configurations, and we calculate the value of the induced magnetic charge.

18:00 : Invited talk

Plasmon-enhanced nanospectroscopy for molecular sensing and control

Taka-aki Yano
Tokushima University (Japan)

We present plasmon-enhanced nanospectroscopy using a sharp metallic tip which enables us to demonstrate not only nanoscale sensing but also nanoscale control of molecular reactions.

16:40 - 18:25 — Gallery

Session 3A43

GEN2: Metasurfaces and Emerging Materials

Chaired by: Makoto Shimizu

16:40 : Robust nano-antenna metrology for metasurface design

Cecile Le Gall, Bastien Rouze, Cindy Bellanger, Jerome Primot, Julien Jaeck
Onera (France)

Meta-optics allow the realization of new optical functions that are increasingly complex to realize and characterize locally. We propose an interferometric method to measure both amplitude and phase of an array of meta-elements constituting a metasurface. Tested for MIM (Metal-Isolating-Metal) metasurfaces, this technique can be applied to all metasurfaces.

16:55 : Meta-lenses for second harmonic generation imaging on the tip of hair-thin optical fiber for advanced endoscopic imaging

Rafael Fuentes Dominguez, Diekolopemi Afuwape, Fei He, Richard Cousins, George Gordon
University of Nottingham (United Kingdom)

We present a method for second harmonic generation (SHG) imaging compatible with hair-thin optical fibres with the use of two meta-lenses for 900 and 450 nm wavelength. These are fabricated using conventional e-beam lithography, polymer encapsulated, and transferred one-by-one to the tip of single-mode optical fibres.

17:10 : Optimized design strategy of polychromatic metasurfaces considering their fundamental dispersion limits

Adelin Patoux[1], Nicolas Kossowski[1], Clément Majorel[1], Samira Khadir[1], Patrice Genevet[2]
[1] *Université Cote d'Azur (France),* [2] *Colorado School of Mines (USA)*

In this work we describe a simple way of quantifying the dispersion limits of a dataset, which can be used to optimize the design of polychromatic metasurfaces. As an example, the design, fabrication and characterization of a highly effective achromatic metalens was performed using this approach.

17:25 : Electro-Optical Switching in Nonlinear Metasurfaces

Matthew Feinstein, Alexander Andronikides, Euclides Almeida
Queens College of City University of New York (USA)

We demonstrate a nonlinear metasurface that combines electrical and optical switching in a single device. Broadband mid-infrared to visible light conversion is attained in a metasurface that couples mid-infrared radiation to electrically tunable hybrid graphene-gold plasmons. All-optical switching measurements suggest that the device can be operated at Terahertz rates.

17:40 : Toroidal dipole bound states in the continuum in dielectric metasurfaces

Sheng-Wei Kao, Yi-Chi Kao, Ruey-Lin Chern
National Taiwan University (Taiwan)

We propose a design of dielectric metasurfaces for investigating the bound states in the continuum (BICs), which are recognized as toroidal dipoles (TDs) characterized by the electric or magnetic fields bent into a torus. Several electric or magnetic TDs are gathered in the unit cell to form multiple TD BICs.

17:55 : Unidirectional mode excitation due to magnetochiral effects

Hiroyuki Kurosawa[1], **Keisuke Itoh**[2], **Tetsuya Ueda**[1]
[1] *Kyoto Institute of Technology (Japan),* [2] *Industorial Technology Institute, Miyagi Prefectural Government (Japan)*

A numerical study shows that a single metamolecule with magnetism and chirality exhibits unidirectional mode excitation in a waveguide at microwave frequencies. The directionality has a linear response to the magnetization and the chirality, indicating that the anisotropy of the mode excitation originates from the magnetochiral effects.

18:10 : Giant Optical Anisotropy in Van der Waals Materials: Perspectives and Challenges
Valentyn Volkov[1], **Georgy Ermolaev**[1], **Dmitry Grudinin**[1], **Kirill Voronin**[2], **Andrey Vyshnevyy**[1], **Arslan Mazitov**[3], **Gleb Tselikov**[1], **Ivan Kruglov**[1], **Davit Ghazaryan**[4], **Luis Martin-Moreno**[5], **Alexey Arsenin**[1], **Konstantin Novoselov**[6]
[1] *XPANCEO Emerging Technologies Research Center (United Arab Emirates),* [2] *Donostia International Physics Center (DIPC) (Spain),* [3] *École Polytechnique Fédérale de Lausanne (Switzerland),* [4] *Yerevan State University (Armenia),* [5] *CSIC-Universidad de Zaragoza (Spain),* [6] *National University of Singapore (Singapore)*

Van der Waals (vdW) materials are at the core of modern optoelectronics and nanophotonics. However, relatively little research attention is devoted to their giant optical anisotropy. Here, we demonstrate that the use of giant anisotropy leads to the next-generation integrated circuits and optical elements.

Conference Dinner

20:00 - 22:00

Friday 19th July, 2024

08:30 - 10:30 — Main Hall

Session 4A1

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Yoshiaki Nishijima

08:30 : Invited talk
Manipulating Chemical Reactions with Light
Z. Fusco[1], A. Edirisooriya[1], N. Lyu[1], C. David[2], Fiona Beck[1]
[1] *Australian National University (Australia),* [2] *Friedrich Schiller University of Jena (Germany)*

Light-matter coupling mediated by plasmonic resonances could allow the manipulation of chemical reactions. Resonant energy transfer between plasmonic modes and molecular energy levels can activate molecular bonds, inducing bond breaking or triggering transformation which can enhance or suppress a particular chemical reaction pathway, and ultimately determine the final product distribution.

08:50 : Invited talk
Soft Metamaterials for Innovative Medical Devices
Jianfeng Zang, Hanchuan Tang, Ye Tian, Zhangqi Pan
Huazhong University of Science and Technology (China)

Soft metamaterials can generate mechanical deformation when subjected to external stimuli like optics, acoustics, mechanics, electric field, magnetic field, etc., resulting in new properties or functions. This talk will summarize our recent works on soft acoustics metamaterials, and their medical applications including bioinspired cochlear, implantable sensors.

09:10 : Invited talk
Design of Thin Film Metamaterial Absorber for IoT Application
Tatsunosuke Matsui, Tomoki Narita, Sho Yoshikawa
Mie University (Japan)

We show numerical designs of the thin film metamaterial absorber. We designed a subwavelength-thick ground plane-less and reflection-less metamaterial absorber that shows frequency-selective narrow-band near-perfect absorption, and also designed polymer thin film metamaterial absorber that can be fabricated by printing technology, both work at 2.4 GHz for IoT application.

09:30 : Invited talk
Low-noise metamirrors for the visible spectral range
Johannes Dickmann[1], Thomas Siefke[2], Jana Hartmann[1], Nico Wagner[1], Mika Gaedtke[1], Andreas Waag[1], Stefanie Kroker[1]
[1] *TU Braunschweig (Germany),* [2] *FSU Jena (Germany)*

Explore recent developments in metamirrors, utilizing sub-wavelength micro- and nanostructures. These mirrors offer advantages such as high reflectivity and focusing in a single, thin layer. This talk reviews low-noise meta mirrors for precision applications, tracking progress from infrared to visible spectra, providing insights into the ongoing advancements in this field.

09:50 : Invited talk
Resonances in doubly anisotropic, high-index nanoplatelets
Bingying You, Tom Sistermans, Alberto Curto
Ghent University (Belgium)

Optical anisotropy plays a crucial role in manipulating light. Its strength is, however, limited to low values

in conventional materials. Transition metal dichalcogenides possess both high refractive index and high birefringence. Here, we investigate optical resonances in nanoplatelets with geometrical and refractive index anisotropies to control light scattering and emission.

10:10 : Invited talk
Multipole coupling for control light propagation and trapping in dielectric and hybrid metasurfaces
Andrey Evlyukhin, I. Allayarov, A. Cala Lesina, B. N. Chichkov
Leibniz University Hannover (Germany)

A general concept of multipole coupling is discussed to explain the control of resonant light propagation and trapping in dielectric and hybrid metasurfaces. Several examples with important application perspectives are presented.

09:10 - 10:30 — Room 201

Session 4A2

SP27. Recent advances in non-Hermitian metamaterials

Organized by: Xue-Feng Zhu

Chaired by: Xue-Feng Zhu and Yu-Gui Peng

09:10 : Invited talk
Arbitrary Chern Vectors in Non-Reciprocal 3D Acoustic Crystals
Yan Meng[1], Linyun Yang[2], Xiang Xi[2], Yihao Yang[3], Gui-Geng Liu[4], Baile Zhang[4], Zhen Gao[2]
[1] *Dongguan University of Technology (China),* [2] *Southern University of Science and Technology (China),* [3] *Zhejiang University (China),* [4] *Nanyang Technological University (Singapore)*

In this talk, we extend the 3D Chern insulator phase into acoustic crystals, introducing a strategy for constructing arbitrary Chern vectors. This approach facilitates surface-state torus knots or links on the surface of a single crystal with non-reciprocal coupling, offering a comprehensive understanding of bulk-boundary correspondence in topological Chern vectors.

09:30 : Invited talk
Observation of Discrete-Light Temporal Refraction by a Quantized Moving Gauge Potential Barrier
Chengzhi Qin[1], Bing Wang[1], Stefano Longhi[2], Peixiang Lu[1]
[1] *Huazhong University of Science and Technology (China),* [2] *Politecnico di Milano (Italy)*

We observe discrete-light temporal refraction by a moving gauge-potential barrier, which obeys a different Snell's law compared to traditional refraction at a static boundary. To eliminate beam splitting we find the barrier can only move at a quantized speed of integer and fractional values, which exhibit reflectionless and reflective refractions.

09:50 : Invited talk
Heat circulation metadevices
Ran Ju[1], Pei-Chao Cao[1], Dong Wang[1], Minghong Qi[1], Liujun Xu[2], Shuihua Yang[3], Cheng-Wei Qiu[3], Hongsheng Chen[1], Ying Li[1]
[1] *Zhejiang University (China),* [2] *Graduate School of China Academy of Engineering Physics (China),* [3] *National University of Singapore (Singapore)*

Having developed a comprehensive thermal scattering theory that describes the nonreciprocal transmission properties of temperature field effectively, this work creates a metadevice that supports both dynamic and steady-state nonreciprocal heat transfer. It uncovers the unique multiple-scattering effect at steady state, as well as the resonance enhanced nonreciprocity of thermal fields.

10:10 : Invited talk
Acoustic orbital-related topological states and phase transitions
Feng Gao, Yu-Gui Peng, Xuefeng Zhu

Huazhong University of Science and Technology (China)

In this talk, we concentrate on the topological states and phase transitions induced by orbital-interactions. The introduction of acoustic orbitals enables counterintuitive orbital-dependent topological edge states and versatile corner states, opening avenues for exploring orbital-related topological physics and sound-wave interaction.

08:50 - 10:30 — Room 202

Session 4A3

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Oleksandr Pylypovskyi

08:50 : Invited talk

Exploring Strategies for Enhancing the Sensitivity of Chiroptical Spectroscopy with Aluminum Nanoplasmonics

Bjoern Reinhard

Boston University (USA)

A scalable nanofabrication strategy for the generation of chiral or achiral aluminum nanoantennas that support plasmon resonances in the UV is evaluated, and design criteria for UV-resonant surfaces that enhance the sensitivity of molecular circular dichroism (CD) spectroscopy are discussed.

09:10 : Invited talk

A Scalar Product for Computing Fundamental Quantities in Matter

Ivan Fernandez-Corbaton, Maxim Vavilin

Karlsruhe Institute of Technology (Germany)

We introduce a systematic way to obtain expressions for computing the amount of fundamental quantities such as helicity and angular momentum contained in static matter, given its charge and magnetization densities. In an exemplary application, we compute the helicity and angular momentum squared stored in a magnetic Hopfion.

09:30 : Invited talk

Off-resonance Spin-locked Metasurfaces based on Quasi-Bound States in the Continuum and Nonreciprocal Chiral Splitters

Zuojia Wang[1], Haochen Yang[1], Yujie Zhang[2], Guang Chen[3], Liqiao Jing[1]

[1]*Zhejiang University (China),* [2]*Shandong University (China),* [3]*Hangzhou City University (China)*

We demonstrate off-resonance spin-locked metasurfaces inspired by quasi-bound states in the continuum, to achieve hybridized analog computing in two domains. High-quality resonance is excited in a broadband spin-locked scattering spectrum, providing frequency fliting in meta-splitters and meta-deflectors. We also discuss how nonreciprocal chiral splitting can be controlled in gyromagnetic metasufaces

09:50 : Invited talk

Detecting the symmetry breaking of the quantum vacuum in a QED system

Tiefu Li

Tsinghua University (China)

In ultrastrong coupling regime, a qubit-resonator system has an entangled quantum vacuum with a nonzero average photon number. We experimentally observe the vacuum by the induced symmetry breaking of a dispersively coupled probe qubit. This result opens a way to experimentally explore the novel quantum-vacuum effects.

10:10 : Invited talk

Toroidal-assisted Metasurface for High-performance Nanophotonics

Pin Chieh Wu
National Cheng Kung University (Taiwan)

We propose using toroidal-assisted responses to enhance the transmission efficiency of plasmonic metasurfaces. The Fano coupling between toroidal dipoles and quadrupoles enables a cross-polarization converter with 22.9 % efficiency, and a hybrid meta-atom can achieve over 50 % efficiency in the near-infrared region.

08:30 - 10:30 — Room 203

Session 4A4

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Kentaro Iwami

08:30 : Invited talk

The interplay of gain and loss in room-temperature planar polaritonic systems

Anton Samusev
Technische Universität Dortmund (Germany)

Strong exciton-photon coupling in systems based on halide perovskites and 2D semiconductors at room temperature is demanded in tunable and nonlinear on-chip photonics. Here, we demonstrate a weak-to-strong coupling transition accompanied by the onset of polariton motional narrowing, polariton lasing enhanced by exceptional points, and an ultrafast high-contrast polariton modulator.

08:50 : Invited talk

Field homogenization recipe for brain MRI

Kyounsub Yoon, Sunkyu Yu, Namkyoo Park
Seoul National University (Korea)

We present the systematic design of cylindrical metasurfaces that provide the designer wavefront for the ultra-high field brain MRI. We achieve substantially improved B1+ whole brain homogeneity, implying the solution for the issue which has persisted in the past 20 years.

09:10 : Invited talk

Artificial Neural Networks and Quantum Information Processing using Integrated Photonics

Imtiaz Alamgir[1], Luigi Di Lauro[1], Stefania Sciara[1], Abdul Rahim Aadhi[1], Celine Mazoukh[1], Hao Yu[1], Bennet Fischer[1], Nicolas Perron[1], Nicola Montaut[1], Mario Chemnitz[1], Brent E. Little[2], Sai T. Chu[3], David J. Moss[4], Zhiming Wang[5], Roberto Morandotti[1]
[1]INRS-EMT (Canada), [2]QXP Technology (China), [3]City University of Hong Kong (China), [4]Swinburne University of Technology (Australia), [5]University of Electronic Science and Technology of China (China)

Integrated photonics advances emerging artificial intelligence and quantum information processing technologies. This work employs on-chip, reconfigurable devices for highly efficient, intelligent, and secure classical and quantum signal processing. We demonstrate simultaneous operations with high speed, low power consumption, and small footprints, paving the way for next generation telecommunication solutions.

09:30 : Invited talk

A Compact Silicon Photonic Crystal Spectrometer with Unprecedented Resolution

Takasumi Tanabe, Junnosuke Kokubu, Ryo Sugano, Jinwei Zhang
Keio University (Japan)

We introduce a compact, cost-effective silicon photonic crystal spectrometer with unparalleled resolution (0.01 nm for single, $<$0.03 nm for multiple wavelengths), leveraging a chirped waveguide for enhanced precision.

09:50 : Invited talk

Dynamic Thermoplasmonic Control of Colloids, Molecules and Liquids
Martin Fränzl, Desmond Quinn, Diptabrata Paul, Frank Cichos
Leipzig University (Germany)

Optically pumped plasmonic nanostructures allow a dynamic release of heat for an unprecedented control of objects like colloids and macromolecules in microfluidic environments. We report on experiments that assemble photonic and molecular structures with the help of local hydrodynamic flow and pressure fields that are the result of thermoplasmonic heating.

10:10 : Invited talk
Optoelectronic control of quantum optical phenomena with graphene
Mikkel Have Eriksen, Joel Cox
University of Southern Denmark (Denmark)

We explore strategies to harness the polariton-assisted nonlinear response and optoelectronic tunability of graphene to actively control quantum light emission and manipulate the quantum states of atomic systems.

08:30 - 10:30 — Room 204

Session 4A5

SP13. Integrated metasurfaces/metamaterials on photonic platform

Organized by: Songyan Hou and Hao Hu

Chaired by: Songyan Hou and Hao Hu

08:30 : Invited talk
Observation of momentum-gap topology of light
Yihao Yang
Zhejiang University (China)

Topological phases have prevailed across diverse disciplines. Hitherto, the understanding of these phases has centered on frequency bandstructures, showcasing topological boundary states at spatial interfaces. Here, we report the experimental observation of momentum-gap topology of light, manifesting as topological boundary states at temporal interfaces between systems with distinct momentum-gap topology.

08:50 : Invited talk
Time Edge States Protected by Chiral Symmetry
Hao Hu
Nanjing University of Aeronautics and Astronautics (China)

This talk will introduce a novel type of edge states that are localized in the time domain. As protected by the chiral symmetry, the time edge states are proven to be robust against the external perturbations.

09:10 : Invited talk
Approaching unity quantum coupling of free electrons and photons using nanophotonic structures
Yuval Adiv
Technion (Israel)

Using a dispersion-engineered nanophotonic structure we achieve a unity quantum coupling strength between free electrons and 2D photons. This record coupling strength enables the first observation of 2D Cherenkov radiation and provides insights into the quantum nature of free-electron radiation.

09:30 : Invited talk
Thin film lithium niobate double notch filter
Songyan Hou
Xidian University (China)

We propose a tunable double notch filter on thin-film lithium niobate using dual micro-ring architecture. This

unique integrated filter is essential for complex photonic integrated circuits, along with multiple channels and various frequency spacing.

09:50 : Invited talk
Extending the bandwidth of nonlinear optics
Yu Luo, Chunyu Huang, Hui Liu
Nanjing University of Aeronautics and Astronautics (China)

In this talk, I will first present a universal strategy based on transformation optics to design broadband nonlinear optical devices on chip, and then show stacked perfect-electric-conductor and epsilon-near-zero metamaterial consisting of nonlinear varactors can be used for strong second harmonic generation over a wide range of illumination angles.

10:10 : Invited talk
The Proposal of the Substrate-inverted Multi-Material Technology (SuMMIT) for Scalable Heterogeneously-Integrated Photonics
Jia Xu Brian Sia
Nanyang Technological University (Singapore)

Current silicon photonic heterogeneous integration has displayed challenges with contemporary foundry-compatible, wafer-scale silicon photonics. Through the integration of industrial foundry-level silicon photonics and hybrid Cu bonding technologies, the SuMMIT platform is proposed, where heterogeneous photonic integration can be realized in a scalable fashion.

08:30 - 10:30 — Conference Room

Session 4A6

SP26. Spatiotemporal Metamaterials and Metasurfaces

Organized by: Pai-Yen Chen, Chung-Tse Michael Wu and Mohamed D. Farhat

Chaired by: Pai-Yen Chen

08:30 : Invited talk
Down-conversion of terahertz wave frequencies by mode coupling at temporal boundaries in semiconductor waveguides
Keisuke Takano[1], Satoko Uchiyama[1], Shintaro Nagase[1], Yuka Tsuchimoto[1], Toshihiro Nakanishi[2], Yosuke Nakata[3], Joel Pérez-Urquizo[4], Julien Madéo[4], Keshav Dani[4], Fumiaki Miyamaru[1]
[1]*Shinshu University (Japan),* [2]*Kyoto University (Japan),* [3]*Osaka University (Japan),* [4]*Okinawa Institute of Science and Technology Graduate University (Japan)*

Photoexcitation can induce a temporal boundary that alters dispersion relations of electromagnetic waves in semiconductor waveguides, leading to frequency conversion. In this study, we demonstrate frequency down-conversion of terahertz waves via coupling between transverse-magnetic and transverse-electromagnetic modes at a photoexcited temporal boundary in a waveguide made of semi-insulating GaAs.

08:50 : Invited talk
Waveform-Selective Metasurfaces Varying in Time and Space at the Same Frequencies in Accordance with Pulse Width
Hiroki Wakatsuchi, Ashif Aminulloh Fathnan
Nagoya Institute of Technology (Japan)

In this Invited talk, we report recently developed circuit-based metasurfaces that show distinct behavior while operating at the same frequencies in accordance with the pulse width of incoming waves. We also demonstrate how such waveform-selective metasurfaces can be exploited for specific applications in antenna design, wireless communications, and electromagnetic compatibility.

09:10 : Invited talk

Acoustic Fiber via Rotational Motion
Mohamed Farhat, Ying Wu
KAUST (Saudi Arabia)

We will discuss our recent work on acoustic wave propagation in spinning fluid (air or water) that may lead to fiber applications. We reveal that spin can alter the refractive index and therefore can support waveguide modes. The propagation is asymmetric: allowing right-hand propagation and prohibiting left-hand propagation.

09:30 : Invited talk
Near-infrared metasurface with simultaneous control of dielectric and magnetic properties in the 100-THz band
Harumi Asada, Kumiko Ryu, Takehito Suzuki
Tokyo University of Agriculture and Technology (Japan)

This report presents a metasurface that controls the dielectric and magnetic properties for the directivity control of near-infrared thermal radiation. We fabricate the metasurface with three-layered square Au, SiO2, and Au patches on a supporting Si substrate. Measurements verify that the metasurface has a resonance at approximately 120 THz.

09:50 : Invited talk
A Physical Unclonable Function Based on Time-Modulated Systems with Exceptional Points of Degeneracy
Pai-Yen Chen
University of Illinois (USA)

I will outline my recent findings on hardware security primitives built based upon time-variant electronic system with exceptional points at which high entropy occurs. I will show that the proposed encryption notion can provide excellent performance metrics in terms of randomness, uniqueness, and robustness against modeling attacks.

10:10 : Invited talk
Enhanced optical effects based on the bound states in the continuum
Haitao Jiang, Zhiwei Guo, Yong Sun
Tongji University (China)

We reveal that the bound states in the continuum in meta-grating or metasurface structures can strongly enhance the optical effects including giant Goos-Hänchen shift, optical chirality and nonlinear optical effects. Our work provides a direct avenue towards the realization of ultra-sensitive sensors, high-efficiency chiral optical and nonlinear optical devices.

08:30 - 09:50 — Room 205

Session 4A7

SP15. Quantum metamaterials for artificial intelligence

Organized by: Alexandre Zagoskin and Sergey Saveliev

Chaired by: Alexandre Zagoskin

08:30 : Invited talk
Point defect-based material solutions for quantum sensing and quantum reservoir computing
Viktor Ivady
Eötvös Lorand University (Hungary)

Point defects with controllable electron and nuclear spin states provide a versatile toolbox for developing quantum applications in the fields of sensing, information processing, and computation. My talk outlines the physics of point defect quantum bits and discusses recent advances in light of sensing and quantum reservoir computing.

08:50 : Invited talk
An infinite array of boson sites - a rigorous approach
Artur Sowa[1], **Jonas Fransson**[2]
[1] *University of Saskatchewan (Canada),* [2] *Uppsala University (Sweden)*

We demonstrate how to analyze an infinite array of boson sites with the use of the Dirichlet series. The results apply to the Bose-Hubbard model, which is of relevance to various types of physics, including anisotropic magnetism. Our approach leads to the construction of coherent states in the Fock space.

09:10 : Invited talk
Bloch transistor for quantum electronics
Ilya Antonov[1], **Rais Shaikhaidarov**[1], **Kyung Ho Kim**[1], **Dmitry Golubev**[2], **Vladimir Antonov**[1], **Oleg Astafiev**[1]
[1] *Royal Holloway University of London (United Kingdom),* [2] *QS Quantum Simulations GmbH (United Kingdom)*

We report Bloch transistor for the emerging platform of quantum electronics. The fully quantum device facilitates precise control of electronic current in quantum circuits. The transistor maintains the source-drain current at quantized values, I=2efn, through four controls: the gate or bias voltage and the frequency or amplitude of the microwave.

09:30 : Invited talk
Simultaneous AC bias and gate drive to control a SINIS turnstile
M. Marín-Suárez[1], **Yu. A. Pashkin**[2], **J. T. Peltonen**[1], **J. P. Pekola**[1]
[1] *Aalto University (Finland),* [2] *Lancaster University (United Kingdom)*

We experimentally demonstrate a driving protocol in which, in addition to the conventional AC gate drive, we also apply an AC bias drive. This improves the single-electron current accuracy by one order of magnitude and allows accurate single-electron current generation even at zero DC bias.

09:50 - 10:35 — Room 205

Session 4A8

Metamaterials and Metasurfaces

Chaired by: Yuri Pashkin

09:50 : A Broadband Metamaterial-Based Electromagnetic Absorber with the Capability of being Fabricated by 3-D Printers
Mohammad Javadi[1], **Leila Yousefi**[2]
[1] *University of Tehran (Iran),* [2] *University of Sussex (United Kingdom)*

A broadband metamaterial-based electromagnetic absorber is proposed which can be fabricated by 3-D printing . The proposed structure provides an absorption of more than 90 % in the whole frequency band of 8-12 GHz, for incident angles of 0 to 30 degrees, and for both TE and TM polarizations.

10:05 : Selective excitation of diverse subwavelength resonances in metasurfaces comprising volumetric resonators: a brief discussion
Andriy E. Serebryannikov
Adam Mickiewicz University (Poland)

The approaches to selective excitation of subwavelength resonances in metasurfaces comprising volumetric resonators made of dielectric and phase-change materials are briefly reviewed. The applicability of particular approaches depend on the spectral and spatial features of the incident electromagnetic wave.

10:20 : Bias-free optical metamaterial with nonreciprocal magnetoelectric response
Shadi Safaei Jazi[1], **Ihar Faniayeu**[2], **Rafael Cichelero**[2], **Dimitrios C. Tzarouchis**[3], **Mohammad Mahdi Asgari**[4], **Alexandre Dmitriev**[2], **Shanhui Fan**[5], **Viktar Asadchy**[4]
[1] *Aalto University (The Netherlands),* [2] *University of Gothenburg (Sweden),* [3] *Meta Materials Europe (Greece),* [4] *Aalto University (Finland),* [5] *Stanford University (USA)*

We propose the first nonreciprocal magnetoelectric metamaterials with resonant responses at visible and mid-infrared frequencies and without the requirement of external magnetic bias. The designed metamaterial consists of randomly oriented nanocylinder meta-atoms comprising a ferromagnet in a single-domain magnetic state and a high-permittivity dielectric operating near the magnetic Mie-type resonance.

08:30 - 10:50 — Room 206

Session 4A9

SP20. Topology, Geometry, and Quantumness of Textured Light

Organized by: Jamal Berakdar and Andrei Afanasev

Chaired by: Jamal Berakdar

08:30 : Invited talk
Nonclassical states of light after high-harmonic generation in semiconductors:A Bloch-based perspective
Javier Rivera-Dean[1], Philipp Stammer[1], Andrew Maxwell[2], Th. Lamprou[3], Andrés Ordóñez[1], Emilio Pisanty[4], Paraskevas Tzallas[3], Maciej Lewenstein[1], Marcelo Ciappina[5]
[1] ICFO (Spain), [2] Aarhus University (Denmark), [3] Foundation for Research and Technology-Hellas-IESL (Greece), [4] King's College London (UK), [5] Guangdong Technion-Israel Institute of Technology (China)

We investigate high-harmonic generation in semiconductors from a quantum optical perspective and demonstrate the generation of non-classical light states. We analyze the dependence of their features on the solid characteristics and the driving field strength. Our study provides insights for generating non-classical light sources using bulk matter.

08:50 : Invited talk
Lie Group Theory and Topology of Structured Light
Shinichi Saito
Hitachi (Japan)

We have developed a Lie Group theory for the SU(N) symmetry of structured light, and experimentally demonstrated their controls over a full Poincaré sphere. We show trajectories of Stokes parameters exhibit non-trivial topological features like a torus, a Möbius strip, and a bosonic Dirac cone.

09:10 : Invited talk
Selective Photoexcitation of Finite Momentum Excitons in 2D Materials by Using Structured Lights
Shun-Jen Cheng[1], Guan-Hao Peng[1], Ping-Yuan Lo[1], Wei-Hua Li[1], Oscar J. G. Sanchez[1], Jhen-Dong Lin[1], Kristan Bryan Simbulan[2], Ting-Hua Lu[2], Yann-Wen Lan[2]
[1] National Yang Ming Chiao Tung University (Taiwan), [2] National Taiwan Normal University (Taiwan)

In this work, we will review our recent experiment-theory-joint studies and the developed theory of the light-exciton interactions between excitons in 2D materials and structured lights, including scalar twisted lights carrying orbital angular momenta and vector vortex beams.

09:30 : Invited talk
Propagation-Independent Polarization Features Near Phase Singularities of Electromagnetic Fields
Andrei Afanasev
The George Washington University (USA)

We considered polarization properties of optical vortex beams beyond the paraxial approximation, which requires inclusion of the longitudinal component of the electric field. The vortex beams expand under propagation due to diffraction, the polarization features near phase singularities remain constant. Polarization near phase singularity is illustrated with Young's double-slit setup.

09:50 : Invited talk
Optical skyrmions

Jörg Götte, Zhujun Ye, Amy McWilliam, Fiona Speirits, Claire Cisowski, Sonja Franke-Arnold, Stephen Barnett
University of Glasgow (United Kingdom)

We show how optical skyrmions and their associated skyrmion field provide the natural framework to analyse the topology and geometry of fully structured light.

10:10 : Invited talk
Generation and application of structured attosecond light pulses with controlled topology
Carlos Hernández-García
Universidad de Salamanca (Spain)

Structured attosecond light pulses with designed light properties can be currently generated in the extreme ultraviolet thanks to high harmonic generation. We demonstrate how the topological properties of the structured harmonic beams can be properly controlled, and how they can be used to reveal ultrafast electronic dynamics within matter

10:30 : Invited talk
Interaction of structured light with a trapped ion
Anton A. Peshkov[1], R. Lange[1], Y. M. Bidasyuk[1], R. P. Schmidt[1], E. Jordan[1], M. Kromrey[1], K. K. Mehta[2], T. E. Mehlstäubler[1], N. Huntemann[1], E. Peik[1], A. Surzhykov[1]
[1] *Physikalisch-Technische Bundesanstalt (Germany),* [2] *Cornell University (USA)*

We study the nondipole excitation of trapped ions by structured light. Particular attention is paid to finding the optimal light polarization and external magnetic field orientation to obtain simultaneously the maximum Rabi frequency and the minimum light shift. The theoretical predictions are compared with experimental data.

08:30 - 10:30 — Room 101

Session 4A10

SP14. Meta-optics for imaging, microscopy and information processing

Organized by: Benfeng Bai, Guixin Li and Baohua Jia

Chaired by: Benfeng Bai

08:30 : Invited talk
Metasurface-enabled Wavefront Engineering for Advanced Imaging Technologies: 3D Sensing and Biomedical Imaging
Inki Kim
Sungkyunkwan University (Korea)

In this talk, I will introduce metasurface-enabled advanced imaging techniques: (1) Electrically tunable varifocal metalens and point cloud generating metasurface for 3D depth imaging, (2) Dual-mode metalens for switchable bright-field and edge-enhanced imaging (3) Multifunctional metalens for photoacoustic microscopy

08:50 : Invited talk
Monocular polarimetric metalens for ultracompact snapshot stereo-imaging
Shuming Wang
Nanjing University (China)

We propose a non-interfering, all-Stokes imaging polarimeter based on a single-layer metasurface to demonstrate the stereo-imaging in an ultracompact size.

09:10 : Invited talk
Towards thinner imaging systems with Huygens' spaceplates
Francisco J. Diaz-Fernandez[1], Luis M. Manez-Espina[1], Ana Diaz-Rubio[1], Viktar Asadchy[2]
[1] *Universitat Politècnica de València (Spain),* [2] *Aalto University (Finland)*

Spaceplates are designed to replace free-space gaps in optical systems. We show that by leveraging Huygens'-type condition in a photonic crystal slab supporting two resonance modes it is possible to strongly enhance spaceplates characteristics and make it transparent across a wide frequency range, laying the foundation for multicolor spaceplate systems.

09:30 : Invited talk
Varifocal Meta-lenses for Bio-imaging and 6G Communication
Mu Ku Chen[1], Jing Cheng Zhang[1], Xiaoyuan Liu[1], Yin Zhou[1], Jialuo Cheng[1], Takuo Tanaka[2], Din Ping Tsai[1]
[1] *City University of Hong Kong (Hong Kong),* [2] *RIKEN Center for Advanced Photonics (Japan)*

Meta-device is a new type of flat optical device composed of artificial nanostructures that can manipulate the incident electromagnetic wave. We developed varifocal meta-lenses to manipulate the focusing spot for bioimaging and 6G communication from 1D to 3D.

09:50 : Invited talk
Subnanometer-matter,s Farfield Optical Fingerprints and Metrology Applications
Xue-Wen Chen
Huazhong University of Science and Technology (China)

We report that subnanometer-dielectric surface undulations feature deterministic and pronounced speckles in the farfield via interference scattering microscopy. We show they could serve as the optical fingerprints of the dielectric substrate surface. Consequently, we demonstrate their applications for marker-free position identification and displacement sensing with sub-nanometer precisions.

10:10 : Invited talk
Photothermal inspection of optoelectronic chips
Xiangping Li
Jinan University (China)

In this paper, we report the microscopic excitation and imaging of dielectric Mie resonators. The interaction of tightly focused vector beams with dielectric nanoparticles leads to exotic phenomena including multipolar excitation by displacement resonances, directional scattering, as well as superresolution imaging.

08:30 - 10:30 — Gallery

Session 4A11

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Atsushi Kubo

08:30 : Invited talk
Control of non-hermitian degeneracy using intersubband polaritonic metasurfaces
Hyeongju Chung[1], Beomjoon Kim[1], Gerhard Boehm[2], Mikhail A. Belkin[2], Jongwon Lee[1]
[1] *Ulsan National Institute of Science and Technology (UNIST) (Korea),* [2] *Technical University of Munich (Germany)*

We suggest the control of non-Hermitian degeneracies in the mid-infrared spectrum using two electrically tunable plasmonic split-ring resonators. These resonators interface with intersubband transitions within multiple-quantum-wells and can be independently manipulated via two bias voltages. At a wavelength of 8.97 μm, we achieve the convergence of eigen polarization states.

08:50 : Invited talk
Tuning Nanoscale Photocurrent Direction and Terahertz Polarization State via Incident Light Polarization in Optoelectronic Metasurfaces
Hou-Tong Chen, Jacob Pettine, Yunseok Choi, Chun-Chieh Chang

Los Alamos National Laboratory (USA)

Nanoscale vectorial photocurrents were observed in symmetry-broken optoelectronic metasurfaces. Nanoantennas with three-fold rotation symmetry enable the continuous rotation of the photocurrent direction and the linear polarization of the emitted terahertz radiation by 360°, and the switching of terahertz vector beams between radial and azimuthal directions, via the incident light polarization.

09:10 : Invited talk

Active layer morphology of organic and perovskite photovoltaics – a study based on grazing-incidence X-ray and neutron scattering

HXinhui Lu

The Chinese University of Hong Kong (Hong Kong)

Here, we will present our recent studies on the process-structure-device correlation of organic and perovskite solar cells. In these studies, grazing incidence scattering techniques using X-rays and neutrons were employed for various purposes, such as grazing incidence wide-angle/small-angle X-ray scattering (GIWAXS/GISAXS), GI-transmission small-angle X-ray scattering (GTSAXS), and GI-neutron scattering (GISANS).

09:30 : Invited talk

Mid-infrared topological edge modes in the symmetric and asymmetric photonic crystal slabs fabricated in SOI wafers

Afshan Begum, Yuanzhao Yao, Takashi Kuroda, Yoshihiko Takeda, Naoki Ikeda, Takaaki Mano, Kazuaki Sakoda

National Institute for Materials Science (Japan)

We present the design, fabrication, and detection of topological bandgaps and edge modes of photonic crystal slabs fabricated in the top Si layer of SOI wafers. We show their polarization properties in addition to their dispersion relation based on high-resolution angle-resolved reflection measurements.

09:50 : Invited talk

An electrically tunable polarization-selective photonic crystal based on a microcavity filled with a self-assembled uniformly lying helical liquid crystal

Marcin Muszyński[1], Przemysław Oliwa[1], Pavel Kokhanchik[2], Piotr Kapuściński[1], Eva Oton[3], Rafał Mazur[3], Przemysław Morawiak[3], Wiktor Piecek[3], Przemysław Kula[3], Witold Bardyszewski[1], Barbara Piętka[1], Daniil Bobylev[2], Dmitry Solnyshkov[2], Guillaume Malpuech[2], Jacek Szczytko[1]

[1] *University of Warsaw (Poland),* [2] *Université Clermont Auvergne (France),* [3] *Military University of Technology (Poland)*

We study a microcavity-based photonic crystal formed by self-assembled uniformly lying helices of the embedded cholesteric liquid crystal. Applying an external voltage breaks the system's mirror symmetry inducing optical activity due to the inter-band interaction. This suggests a dynamically tunable way of controlling light polarization at the nanoscale.

10:10 : Invited talk

Recent advances in metasurface fluorescence biosensors for diverse targets

Masanobu Iwanaga

National Institute for Materials Science (NIMS) (Japan)

Metasurfaces have been activated as resonant-wavelength shift and fluorescence biosensors. Here, we address recent advances in metasurface fluorescence (FL) biosensors that can detect diverse targets from antigen/antibody to DNA even at one molecule per test. The metasurface FL biosensors have been realized in both all-dielectric and plasmonic types.

Coffee Break

Session 4P1
Poster Session VII
10:30 - 11:00

P1: Realization of Geometry-Dependent Skin Effect in a Reciprocal Two-Dimensional
Mengying Hu, Kun Ding
Fudan University (China)

We theoretically and experimentally demonstrate the non-Hermitian skin effect in a 2D spectral and Lorentz reciprocal mechanical system in which the only non-Hermiticity is the gain and loss.

P2: First-principles prediction of nonlinear optical response in silicon nanostructures
Gosuke Matsuura[1], Shunsuke Yamada[2], Mitsuharu Uemoto[1]
[1] *Kobe University (Japan),* [2] *National Institutes for Quantum Science and Technology (Japan)*

We use multiscale method combining electromagnetics and quantum mechanical simulations to make first-principles predictions of harmonic generation by semiconductor nanostructures. The enhancement of harmonic generation in silicon nanocylinder array is investigated, and its dependency on geometric parameters is analyzed, e.g. the optimum radius representing resonant condition R=25nm is found.

P3: Enhancing bandwidth in GHz metamaterials through superposed Lorentzian Resonances
Yun Hyeong, Hyeonjin Park, Jonghwa Shin
Korea Advanced Institute of Science and Technology (Korea)

In this study, we propose a GHz-metamaterial with an extended μ bandwidth. Initially, we theoretically investigate the trade-off relationship between magnetic permeability and bandwidth. Based on these results, we introduce a magnetic metamaterial comprising superposed Lorentzian resonances at adjacent frequencies.

P4: Stability of optical properties of a metasurface based on Huygens elements
Ekaterina Maslova, Matvey Sogrin, Mikhail Rybin
ITMO University (Russia)

We investigate the stability of the optical properties of a metasurface formed by Huygens elements. The structural elements consist of silicon nanodisks separated by a glass layer. We investigate the influence of the dielectric permittivity of nanodisks and structural disorder on the deflection and focusing abilities of the metasurface

P5: Robust gesture recognition based on millimeter-wave programmable metasurface
Mingyi Li, Hongrui Zhang, Shengguo Hu, Jiawen Xu, Lianlin Li
Peking University (China)

This paper proposes a novel approach to achieve robust gesture recognition by employing 26GHz millimeter-wave programmable metasurface. By leveraging beamforming for wavefront manipulation and deep learning for gesture classification, the proposed system aims to enhance accuracy and reliability for gesture recognition.

P6: Flexible metamaterial absorber on custom-engineered polymer nanocomposites as substrates
Kumaran Rengaswamy[1], Siva Bhagavathi L. G.[2], Rahul Manohar O.[1], Anjali Murugan[1], Vijayashri V.[2], Chitti Venkata Krishnamurthy[1], Subramanian Venkatachalam[1]
[1] *Indian Institute of Technology Madras (India),* [2] *Meenakshi College for Women (India)*

A thin, flexible metamaterial-based transmission-type absorber is designed and fabricated on a custom-engineered substrate prepared using silver nanoparticles decorated MWCNT embedded in an epoxy resin polymer. This absorber gives a maximum absorption of 97 % at 11.6 GHz with a bandwidth of 0.75 GHz. Fabrication, simulation, and experimental details are presented.

P7: Fast-speed Ultrasonic Imaging Using a Single Sensor by Combining Disordered Metasurface and Artificial Intelligence
Wei Wang, Jie Hu, Jingjing Liu, Bin Liang, Jianchun Cheng
Nanjing University (China)

We propose a mechanism that can realize real-time and single-sensor ultrasonic imaging with ultra-low-cost using a disordered metasurface combined with a neural network. A single fixed sensor and a handcrafted metasurface with costs of much less than one dollar are proved sufficient to yield a high imaging quality.

P8: The Bandgap Characteristics of Wave Dispersion in Monocoupled Metamaterial
Abhigna Bhatt, Arnab Banerjee
Indian Institute of Technology Delhi (India)

Previously, wider bandgap and band merging in metamaterial with simultaneous negative mass and stiffness were noted [1,2]. This article identifies double attenuation peaks in such metamaterial, attributed to resonance coupling of longitudinal and transverse resonators, ensuring significant spatial attenuation throughout the band.

P9: Biomedical applications of laser reirradiated metallic nanoparticle
Ana María Vilas[1], Mohamed Boutinguiza[1], M. Fernández-Arias[1], Daniel Rodríguez[2], Oscar Barro[1], Felipe Arias-Gonzalez[1], Pablo Pou-Alvarez[1], Ramon Soto[1], Juan Pou[1]
[1] *University of Vigo (Spain),* [2] *UPC-Barcelona TECH (Spain)*

Laser ablation allows controlling the main features of metallic nanoparticles by tuning the processing parameters. In addition, reirradiation of nanoparticles reduces its size and allows obtaining bimetallic nanoparticles without any additional reagent or contaminant that can be harmful to the healthy tissues. Applications such as antibacterial agent will be presented.

P10: Development of Vapor Cells Based on Tri-functional Metasurface for Microfabricated Atomic Clock
Ryosei Ito[1], Ponrapee Prutphong[1], Katsuma Aoki[1], Satoshi Ikezawa[2], Motoaki Hara[3], Kentaro Iwami[1]
[1] *Tokyo University of Agriculture and Technology (Japan),* [2] *Waseda University (Japan),* [3] *National Institute of Information and Communication Technology (Japan)*

We report on a microfabricated vapor cell based on tri-functional metasurfaces that combine lens, prism, and quarter-wave plate. The fabricated metasurface showed a high deflection efficiency of 65.4 $\%$, a degree of circular polarization (DoCP) of -0.78, and a focal length of 511 μm.

P11: Metal-dielectric gratings with broad geometric range for angle interrogation of surface plasmons
Shafeek Abdul Samad, Nityanand Kumawat, Priyamvada Venugopalan, Sunil Kumar
New York University Abu Dhabi (United Arab Emirates)

We report the comprehensive analysis of metal-dielectric gratings with broad opto-geometric parameter range, for the angular interrogation of surface plasmonic excitation. The multi-parameter optimization of sinusoidal and rectangular grating structures yields the design coordinates for sharp resonance features in the angular reflection response of surface plasmons.

P12: Reconfigurable Tunable Integrated Optical Filter based on Nested Coupled Dual Ring Resonator
Pragya Mishra, Tushar Gaur, Talabattula Srinivas
Indian Institute of Science (India)

We present a novel reconfigurable device Nested Ring Coupled Dual Ring Resonators (NCDRR) for high-speed communication, which allows tuning of notch and comb spectra by adjusting coupling coefficients. We've explored the versatile lineshapes of the Nested Ring Resonator (NRR), making our device suitable for various high-speed communication applications.

P13: Utilizing a microcone array to control the distance between a microsphere and a SERS substrate for photonic nanojet-mediated SERS
Chen-Ting Hung, Yan-Ru Liu, Yih-Fan Chen
National Yang Ming Chiao Tung University (Taiwan)

A photonic nanojet (PNJ) is a narrow and intense electromagnetic beam on the shadow side of a microsphere when illuminated by light. We fabricated a microcone array to control the distance between microspheres and surface-enhanced Raman spectroscopy (SERS) substrates, effectively utilizing the PNJ effect to enhance signals by 15 times.

P14: Vibrational Strong Coupling for Cavity catalysis of an Enantioselective Reaction
Jaibir Singh, Pallavi Garg, Ramasamy Vijaya Anand, Jino George
IISER Mohali (India)

Vibrational strong coupling is applied, and Fabry-Perot cavity mode is coupled to the reactant vibration in an asymmetric aldol reaction. Increase in product formation is observed by NMR, but negligible changes in enantioselectivity are observed by chiral HPLC. Control experiments suggest the minimum involvement of enantioselectivity in the rate-determining step.

P15: Modulable Chiral Plasmonic Activates via Stimulus Triggered Shape-Morphing

Yisheng He[1], **Chunhong Ye**[2]
[1] *Shanghai Tech University (China),* [2] *ShanghaiTech University (China)*

A unique approach to fabricate chiral plasmonic materials based on helically arranged AuNSs was presented by utilizing polymeric micro-origami. The shape-morphing of the micro-origami from 2D sheets to 3D tubules induced the pre-assembled AuNS chains into 3D helices, which exhibited tunable circular dichroism signals over frequency, magnitude and handedness.

P16: Extremely Narrow, Sharp-Peaked Resonances at the Edge of the Continuum

Ignas Lukosiunas[1], **Lina Grineviciute**[2], **Julianija Nikitina**[2], **Darius Gailevicius**[1], **Kestutis Staliunas**[3]
[1] *Vilnius University (Lithuania),* [2] *Center for Physical Sciences and Technology (Lithuania),* [3] *ICREA (Spain)*

We report a critical narrowing and sharpening of resonances of a potential well when their eigenfrequencies approach the edge of the continuum. The situation was realized for the electromagnetic wave propagating across the dielectric thin films with a periodically modulated interfaces.

P17: Dynamic medium based on tunable transmissive metasurfaces

Zhedong Wang, Chao Qian, Hongsheng Chen
Zhejiang University (China)

Here, we introduce dynamic dielectrics medium driven by transmissive tunable metasurfaces. Through the variations of structure or incorporating varactor diode, the metasurfaces exhibits the equivalent electromagnetic features similar to true medium based on the effective medium theory. We validate the viability of arbitrary permittivity medium.

P18: Emission properties of plasmonic nanoshell lasers: Symmetric vs. antisymmetric lasing modes and gain-medium detuning effects

Karen Caicedo[1], **Melissa Infusino**[1], **Ashod Aradian**[2], **Alessandro Veltri**[1]
[1] *Universidad San Francisco de Quito (Ecuador),* [2] *University of Bordeaux & CNRS (France)*

This research explores the lasing dynamics of gain-doped metallic nanoshells, focusing on frequency pull-out effects and emission linewidth in relation to plasmonic resonances. By analyzing symmetric versus antisymmetric plasmonic modes and the impact of detuning the gain medium with respect to plasmonic resonances, we provide insights into optimizing nanoshell lasers.

P19: Observation of D-class topology in an acoustic metamaterial

Shi-Qiao Wu[1], **Wenting Cheng**[2], **Xiao-Yu Liu**[1], **Bing-Quan Wu**[1], **Emil Prodan**[3], **Camelia Prodan**[4], **Jian-Hua Jiang**[1]
[1] *Soochow University (China),* [2] *University of Michigan (USA),* [3] *Yeshiva University (USA),* [4] *Fordham University (USA)*

Topological D-class phases (TDPs) are archetypes of the ten-fold classification of topological phases with particle-hole symmetry. Here, with a novel design scheme, we realize 2D TDPs in an acoustic crystal by synthesizing both the particle-hole and fermion-like time reversal symmetries for a wide range of frequencies.

P20: Chirality switchable molecular traps based on plasmonic metastructures with intertwined Fibonacci spirals

Chung-Kai Tseng, Tang-Chun Liu, Diksha Thakur, Chao-Yi Tai
National Central University (Taiwan)

High density molecular traps are realized by metastructures with intertwined Fibonacci spirals. Depending on the chirality of incident light, traps are switchable following either clockwise or counterclockwise spirals. The associated trapping potential is larger than 10kBT with incident intensity I=15 mW/μm2 showing capability to stably trap molecules at room temperatures.

P21: Hyperspectral Imaging for Flat Optics enabled by Dielectric Metasurfaces

Marie Braasch[1], **Thomas Pertsch**[1], **Phillip Manley**[2], **Sven Burger**[2], **Berthold Wegner**[3], **Paul Heimel**[3], **Tzenka Miteva**[3]
[1] *Friedrich Schiller University (Germany),* [2] *JCMwave GmbH (Germany),* [3] *Sony Europe BV (Germany)*

Optical spectroscopy has become a widely used tool for various areas in technology. Most commercial spectrometers are bulky and exploit diffractive optics. Here we present a miniaturized design that can be utilized for hyperspectral imaging. Based on dielectric metasurfaces and Fabry-Perot resonances it facilitates optics which are compatible with photodetectors.

P22: Directional sources realized by toroidal dipoles
Junho Jung[1], **Yuqiong Cheng**[1], **Shubo Wang**[2]
[1] *City University of Hong Kong (Hong Kong),* [2] *City University of Hong Kong, City University of Hong Kong Shenzhen Research Institute (Hong Kong)*

We demonstrate that toroidal dipole can be applied to realize three new types of directional sources: pseudo-circular dipole, pseudo-Huygens dipole, and pseudo-Janus dipole. These directional sources exhibit near-field directional behavior analogous to conventional directional sources, while they provide more degrees of freedom to tune the directionality.

P23: The critical size of hybrid metal-dielectric nanoslits guide mode resonance optical filters by the spatial Fourier transform analysis
Rong He[1], **Cheng Chen**[1], **Yuxiang Zheng**[1], **Liangyao Chen**[1], **Junpeng Guo**[2]
[1] *Fudan University (China),* [2] *University of Alabama in Huntsville (USA)*

In this work, we analyze the performance of hybrid metal-dielectric nanoslits guide mode resonance optical filters using finite-difference time-domain simulations and spatial Fourier transform analysis. We propose the empirical values of the critical sizes in both lateral dimensions for maintaining the filter performance.

P24: Lithium niobate nanostructures: fabrication and nonlinear wavefront control
Yunan Liu, Leyong Hu, Bo Wang, Junjie Li
Chinese Academy of Sciences (China)

We have innovated a unique dry etching method for producing lithium niobate nanostructures with side-wall angles exceeding 85 degrees. Utilizing this technique, we have successfully created a second harmonic metalens boasting a remarkable numerical aperture of up to 0.7.

P25: Titanium nitride as a an alternative metamaterial fabricated via gas nitridation
Liya Tony, I. Packia Selvam, Sankara Narayanan Potty
Calicut University (India)

The correlated opto-electrical properties of transition metal nitrides, wide band gap semiconductor proposed it as alternative photonic material. Stoichiometric tunablity of titanium nitride is the mandatory criteria for converting it as photonic material. Here we are fabricating TiN through ammonia gas nitridation of titanium metal film with enhanced material properties.

11:00 - 11:40 — Main Hall

Session 4A12

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Takaaki Yano

11:00 : Invited talk
Engineered composites and plethora of on-demand functionalities and applications
D. A. Pawlak[1], **P. Piotrowski**[1], **M. Tomczyk**[1], **K. Sadecka**[1], **K. Bandopadhay**[1], **N. Aghad**[1], **K. Markus**[1], **A. Abbas**[1], **S. Saha**[1], **A. Materna**[1], **A. Bellardini**[2], **C. Sibilia**[2]
[1] *ENSEMBLE3 Centre of Excellence (Poland),* [2] *Sapienza University of Rome (Italy)*

New composite materials and their properties will be shown including various potential applications. The studied materials belong to two types of composites: (i) eutectic composites where two or more crystalline phases can be combined to enable particular functionality, (ii) glass composites where various nanoparticles can be embedded in glass matrices.

11:20 : Invited talk
Advanced high contrast grating designs for biosensing applications
Leonid Y. Beliaev[1], **Giovanni Finco**[2], **Sungyeoung Kim**[1], **Larissa Vertchenko**[3], **Bjørn F. S. Nielsen**[1],

Mads V. Evensen[1], **Ada-Ioana Bunea**[1], **Radu Malreanu**[1], **Lars René Lindvold**[1], **Osamu Takayama**[1], **Peter E. Andersen**[1], **Andrei V. Lavrinenko**[1]
[1] *DTU-Technical University of Denmark (Denmark),* [2] *ETH Zurich (Switzerland),* [3] *Sparrow Quantum Ltd (Denmark)*

We propose two novel designs of high contrast gratings (HCGs) composed of silicon grating bars: pedestal and half-buried HCG designs, and demonstrate that these designs exhibit improved bulk refractive index sensitivity and limit of detection (LoD) for myoglobin, in a concentration range relevant for clinical diagnostic applications.

11:00 - 11:40 — Room 201

Session 4A13

SP27. Recent advances in non-Hermitian metamaterials

Organized by: Yu-Gui Peng

Chaired by: Xue-Feng Zhu

11:00 : Invited talk
Non-Hermitian skin effects in anisotropic metamaterials
Y. Tian, Xiujuan Zhang
Nanjing University (China)

We demonstrate the occurrence of non-Hermitian skin effect (NHSE) in anisotropic metamaterials. Our experiments reveal selective excitation of skin modes based on the wave vector, where the localization of these modes is precisely controlled by an effective gauge potential stemming from the anisotropy of the non-Hermitian density tensor.

11:20 : Invited talk
The Manipulation of Topological Modes and Anderson Localized Modes via non-Hermicity
Xulong Wang, Wei Wang, Guancong Ma
Hong Kong Baptist University (Hong Kong)

In this work, we utilize active resonant platforms to demonstrate the manipulation of topological modes (TMs), and Anderson localized modes (ALMs) through non-Hermicity. Localized topological modes can be reconfigured into diverse shapes via non-Hermitian interactions. Complex Anderson modes can be formed in a one-dimensional non-Hermitian disordered ring.

11:00 - 11:40 — Room 202

Session 4A14

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Oleksandr Pylypovskyi

11:00 : Invited talk
Valley-Hall Topological Waveguides for Integrated Quantum Photonics
N. J. Martin[1], **M. J. Mehrabad**[2], **L. Hallacy**[1], **D. Hallett**[1], **X. Chen**[1], **R. Dost**[1], **E. Nussbaum**[3], **R. Dost**[1], **A. Foster**[1], **E. Clarke**[1], **P. K. Patil**[1], **S. Hughes**[3], **M. Hafezi**[2], **A. M. Fox**[1], **M. S. Skolnick**[1], **L. R. Wilson**[1]
[1] *University of Sheffield (UK),* [2] *NIST/University of Maryland (USA),* [3] *Queen's University (Canada)*

This study investigates chiral interactions and mode manipulation in quantum photonic circuits using topological photonic crystals and quantum dots. It features four pivotal advancements: tunable photon emission, efficient mode tapering, chiral multiport routing, and a comparative analysis of waveguides, with important implications for the design of efficient integrated quantum devices.

11:20 : Invited talk
Brillouin Light Scattering Study of Nonreciprocal Spin Dynamics in Artificial Chiral Magnets
M. Xu, A. J. M. Deenen, H. Guo, D. Grundler
EPFL (Switzerland)

Chiral magnets are materials which possess unique helical arrangements of magnetic moments, which give rise to nonreciprocal transport and fascinating physics phenomena. Here, we report the creation and exploration of artificial chiral magnets, which exhibit significant nonreciprocal magnon transport at GHz frequencies at room temperature.

11:00 - 12:35 — Room 203

Session 4A15

SP6. Light-matter interaction on a chip

Organized by: Alina Karabchevsky

Chaired by: Alina Karabchevsky

11:00 : Invited talk
Simulation of spatial rogue waves in a solid-state laser with transverse mode-locking
Roza Navitskaya[1], Ihar Stashkevitch[1], Stanislav Derevyanko[2], Alina Karabchevsky[2]
[1] *Belarusian State University (Belarus),* [2] *Ben Gurion University of the Negev (Israel)*

We investigate theoretically the generation of spatial and spatio-temporal rogue waves in a multimode Q-switched Nd:YAG laser as a result of spontaneous transverse mode-locking. The statistics and temporal dynamics of rogue waves are defined by the frequency separation between the modes and spatial anisotropy of the mode configuration

11:20 : Invited talk
Novel Plasma Treatments for AlZnO Local Modulation and its Application on Fabrication of Planar Infrared Metasurfaces
Kai Sun, Tom Howe, Cornelis H. de Groot, Otto Muskens
University of Southampton (United Kingdom)

Al:ZnO (AZO) is very popular as a plasmonic infrared material. Here, we demonstrate a novel technique using O2/H2 plasma to modulate AZO optical responses and can be used to form AZO metasurfaces. Through s-NOM nearfield scanning, we demonstrate local optical property modulation in the AZO metasurface with sub-10 nm roughness.

11:40 : Invited talk
Inverse design for arbitrary optical materials and integrated nanophotonics
Abhishek Nanda[1], Johannes Gedeon[1], Emadeldeen Hassan[2], Michael Kues[1], Antonio Cala Lesina[1]
[1] *Leibniz University Hannover (Germany),* [2] *Umeå University (Sweden)*

We focus on time-domain topology optimization techniques for the inverse design of materials with arbitrary optical dispersion and anisotropy. This method enables 3D free-form nanostructures with broadband performance. We also present the frequency-domain inverse design of integrated beam splitters with desired phase at the output ports for quantum information processing.

12:00 : Invited talk
Photonics based non-invasive wearable devices for health monitoring.
Edik Rafailov

Aston University (United Kingdom)

Continuous monitoring of human health and activity using wearable devices will be a key technology in the sensor network society for years to come. Recent advances in the development of the miniaturised optoelectronics components have opened a new perspective for the implementation of non-invasive wearable sensors for health monitoring.

12:20 : Real time optical and mechanical environmental sensing based on nano-optomechanical disk resonators

Elena Sentre-Arribas[1], Alicia Aparicio-Millan[1], Aristide Lemaître[2], Ivan Favero[3], Javier Tamayo[1], Montserrat Calleja[1], Eduardo Gil-Santos[1]

[1] *IMN-CNM (CSIC) (Spain),* [2] *Université Paris-Saclay (France),* [3] *Université Paris-Cité (France)*

In this work, we use nano-optomechanical disk resonators for environmental monitoring. We show that simultaneously tracking both optical and mechanical modes enables to discriminate between temperature and humidity effects. We demonstrate that actively tracking the optical mode allows to directly obtain reliable mechanical signals, avoiding previous calibration and extra post-processing.

11:00 - 11:40 — Room 204

Session 4A16

SP13. Integrated metasurfaces/metamaterials on photonic platform

Organized by: Songyan Hou and Hao Hu

Chaired by: Songyan Hou and Hao Hu

11:00 : Invited talk

Self-focusing beam in hyperbolic media

Yueqian Zhang[1], Chongwu Wang[1], Qian Wang[2], Qi Jie Wang[1], Yu Luo[3]

[1] *Nanyang Technological University (Singapore),* [2] *Institute of Materials Research and Engineering (A*STAR) (Singapore),* [3] *Nanjing University of Aeronautics and Astronautics (China)*

Special beams, exemplified by the Airy beam since 2007, exhibit intriguing properties. However, their behavior in hyperbolic media remains poorly explored. We propose a method to convert half Bessel beams in isotropic media into self-focusing special beams in hyperbolic media, expanding avenues for advanced beam manipulation.

11:20 : Invited talk

Spoof Plasmonic Skyrmions and Sensing Application

Liangliang Liu

Nanjing University of Aeronautics and Astronautics (China)

We developed an ultracompact and topologically robust sensor based on spoof plasmonic skyrmions (SPSs) for characterizing dielectric materials in a wideband. The SPSs sensor features highly sensitive and extremely accurate sensing performance against continuous shape deformations, providing a versatile platform for the design of ultracompact and topologically robust plasmonic sensors.

11:00 - 11:40 — Conference Room

Session 4A17

SP26. Spatiotemporal Metamaterials and Metasurfaces

Organized by: Pai-Yen Chen, Chung-Tse Michael Wu and Mohamed D. Farhat

Chaired by: Chung-Tse Michael Wu

11:00 : Invited talk
Application of Deutsch-Jozsa Algorithm via an Inverse-Designed Polyimide Metamaterial
A. Blackwell, R. Yahiaoui, Y- H. Chen, P- Y. Chen, T. A. Searles, Zizwe A. Chase
University of Illinois Chicago (USA)

Using inverse design, a quantum algorithm emulator, made of a polyimide gradient-index and silicon, is optimized to enhance the interaction of incident light with the metamaterial showing improvements in the amplitude and FWHM of the outgoing wave in the terahertz region for the implementation of the Deutsch-Josza algorithm.

11:20 : Invited talk
Direction-of-arrival (DOA) estimation with a programmable space-time-modulated metamaterial receiver
Shaghayegh Vosoughitabar[1], Chung-Tse Michael Wu[2]
[1] *Rutgers University (USA),* [2] *National Taiwan University (Taiwan)*

A space-time-modulated metamaterial antenna is leveraged as a receiver to estimate the direction-of-arrival (DOA) of an incoming signal. This approach uses the power levels of first-order harmonics, generated due to the periodic time-modulation of the metamaterial unit-cells' phase constants, allowing for precise DOA estimation of waves impinging on the antenna.

11:00 - 12:00 — Room 205

Session 4A18

GEN2: Metasurfaces and Emerging Materials

Chaired by: Wakana Kubo

11:00 : Reciprocal Lens: Imaging Based on Lateral Ray Shifting via Non-Local Metasurfaces
Jing Guang Chen, Wenzhe Liu, Lei Shi, Jian Zi, C. T. Chan
Fudan University (China)

We report an imaging mechanism via lateral ray shifting from non-local metasurfaces without spatially-varying features and a geometric center, producing upright real images. Experimentally, a C6v-symmetric periodic metasurface at 28.5 GHz demonstrates this reciprocal lens behavior following u+v=f . Stacking multiple layers additively increases the focal length f.

11:15 : Controlling Diffraction Efficiency Redistribution via Incomplete Phase Metagrating
Qiyao Liu[1], Zhengtong Liu[2], Xuezhi Ma[1], Jie Deng[1], Chen Zhang[2], Zhenmin Chen[2], Arash Nemati[1], Sui Kit Ng[1], Sergey Gorelik[1], Siew Lang Teo[1], Rong Ji[1], Meng Zhao[1], Leonard Verano Gonzaga[1], Hong Liu[1], Fuyong Yue[2], Shaohua Yu[2], Yu Luo[3], Qian Wang[1]
[1] *A*STAR (Singapore),* [2] *Peng Cheng Laboratory (China),* [3] *Nanyang Technological University (Singapore)*

Our study introduces an unconventional metagrating that surpasses the traditional 2π phase constraint within the supercell of a metasurface, enabling precise control over high-order diffraction with adjustable efficiency redistribution. This work shines light on the design of multifunctional diffraction ultrathin optical components, such as metalens and holograms.

11:30 : Holograms and wide-angle optics with hybrid supercell metasurfaces
Tatiana Contino, Harsh Gupta, Andrea Toma, Michele Tamagnone

Istituto Italiano di Tecnologia (Italy)

In this work, we experimentally demonstrate new types of hybrid supercell metasurfaces which exploit different types of supercells and unit cells in the same design, creating a smooth transition between them. We use this new method to control phase and amplitude of light at the same time designing speckle-free holograms.

11:45 : Tailoring acoustic complex media for optimal wave mode conversion
Hongkuan Zhang, Guancong Ma
Hong Kong Baptist University (Hong Kong)

Complex media exhibit characteristics of disorder and chaos, yet their numerous degrees of freedom prove advantageous for wave control. Here, we achieve perfect waveguide mode conversion by tailoring acoustic complex media, enabling multiple modes conversion while preserving almost full energy transmission. This research present possibilities for advanced acoustic devices.

11:00 - 12:15 — Room 206

Session 4A19

GEN1: Advances and Emerging Applications of Nanophotonics

Chaired by: Takumi Sannomiya

11:00 : Tamm Assisted Metasurfaces for classical and quantum photonics applications
Edmund Harbord, Huili Hou, Talal Alshammari, Mengxun Bai, David Dlaka, Angela Stephens, Jon Pugh, Ruth Oulton, Martin Cryan
University of Bristol (United Kingdom)

Tamm optical states are formed at the interface between a distributed Bragg reflector and a thin ($\sim$10 nm) layer of metal. We combine these with metasurfaces to form readily manufacturable devices for controlling light at the nanoscale with applications in lasers, single photon sources, and photodetectors.

11:15 : Plasmonic hydrogen sensor at the ppm level based on the plasmon-triggered switching
Pascal Giraud[1], Hugo Bruhier[1], Isabel Verrier[1], Salma Rajab Pacha[2], Christelle Varenne[2], Jérôme Brunet[2], Amadou Ndiaye[2], Yves Jourlin[1]
[1] *Université Jean Monnet Saint-Etienne (France),* [2] *Université Clermont Auvergne (France)*

Plasmonic sensors have garnered significant interest due to their ability to exhibit high sensitivities. In this work, we present the proof of concept for a plasmonic hydrogen sensor with a low detection limit at the ppm level (1.91 ppm).

11:30 : Near Unity Index Meta-surface for Effective Reduction of CO2 to Methanol
Joel Yi Yang Loh
University of Manchester (United Kingdom)

A ZnO/Cu metamaterial surface has an effective refractive index similar to air demonstrates 97 $\%$ absorption from 350 to 650 nm. With index $<$1, the plasmonic electric field expands to the entire visible spectrum, which enhances adsorption of CO2 gas with angular invariance. FTIR reveals additional intermediates, suggesting new reaction pathways.

11:45 : Ultrathin bismuth and antimony films as alternative materials towards versatile and sustainable metastructures
Fernando Chacon-Sanchez, Carlota Ruiz de Galarreta, Rosalia Serna
Instituto de Optica IO-CSIC (Spain)

Semimetals are versatile, unconventional materials with great potential for their application on metasurfaces. We will study the tailoring potential of their dielectric function via ultra-thin film morphology control and apply this tailoring for structural coloration, combining them with industrial materials like silicon or steel to achieve vivid, sustainable structural colors.

12:00 : Optical response of Smooth and rough Mono and bilayers of plasmonic materials
Jorge Alberto Polito Lucas, Ana Lilia Gonzalez
Benemérita Universidad Autónoma de Puebla (Mexico)

Rough thin films were modeled using DDA and patterns composed by hemispheres and hemi ellipsoids. The reflected, transmitted and absorbed light of these rough films are compared with that of a real roughness pattern obtained by AFM. Smooth and rough mono- and bilayers of plasmonic materials and nitrides are presented

11:00 - 12:20 — Room 101

Session 4A20

SP14. Meta-optics for imaging, microscopy and information processing

Organized by: Benfeng Bai, Guixin Li and Baohua Jia

Chaired by: Benfeng Bai

11:00 : Invited talk
Optical information processing on thin film lithium niobate
Mengjie Yu
University of Southern California (USA)

In this talk, I will review our recent developments of generation and measurement of ultrafast optical waveforms, optical modulation for free space communication and optical neutral network on thin-film LN nonlinear platform.

11:20 : Computer-generated holography and its applications to metasurfaces
Kexuan Liu, Yunhui Gao, Jiachen Wu, Zehao He, Liangcai Cao
Tsinghua University (China)

Optical metasurfaces offer unprecedented light manipulation capabilities for various applications including holography. In this talk, we introduce the general inverse problem approach for computer-generated holography and discuss its potential applications with the emerging field of optical metasurfaces.

11:35 : Manipulation of Electromagnetic field based on Plasmonic-ENZ Nonlinear Metasurface
Junhong Deng, Guixin Li
Southern University of Science and Technology (China)

In epsilon-near-zero (ENZ) materials, second-harmonic generation (SHG) is significantly enhanced but the oblique incidence is required to address nonlinearity. We show that Au meta-atoms on an indium-tin-oxide (ITO) layer provide an approximately 104-fold experimentally measured SHG enhancement at normal incidence at the fundamental wavelength near the ENZ condition of ITO.

11:50 : Super-Resolution Exciton Imaging of Nanodefects in 2D Semiconductors
Jia-Tai Huang, Benfeng Bai
Tsinghua University (China)

The nanodefects of Two-dimensional (2D) semiconductors rise during growth and transfer inevitably and may significantly alter the optoelectronic properties of composed devices. We provide a near-field nanophotoluminescence method that can investigate their impact on local excitonic properties of 2D semiconductors with a very high spatial resolution of 10 nm.

12:05 : Metasurface array for single-shot spectroscopic ellipsometry
Shun Wen, Xinyuan Xue, Yuanmu Yang
Tsinghua University (China)

We demonstrated a compact metasurface array-based spectroscopic ellipsometry system that allows single-shot spectropolarimetric detection and accurate determination of thin film properties without any mechanical

movement.

11:00 - 12:20 — Gallery

Session 4A21

Symposium II: New trends in nanophotonics and advanced materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Hajime Ishihara

11:00 : Invited talk
Enhanced Optical Interactions in Nonlinear Topological Photonic Nanostructures
Nicolae C. Panoiu
University College London (UK)

I will present an analysis of the band topology of 2D PhCs and demonstrate that nonlinear optical processes can be implemented via one-way edge modes. I will also illustrate how bound states in the continuum of certain PhC slabs can be used to achieve an orders-of-magnitude enhancement of the SHG.

11:20 : Invited talk
Optical spin waves
V. Karakhanyan, R. Salut, M. A. Suarez, N. Martin, T. Grosjean
University of Franche-Comté - CNRS (France)

The precession of the magnetic moments in magnetic materials, forming spin waves, has many applications in magnetism and spintronics. We show that an optical analog of spin waves (OSW) can be generated in arrays of plasmonic nanohelices.

11:40 : Invited talk
An ultra-low loss alumina waveguide platform for nonlinear photonics in the visible and UV
E. McKay[1], **N. G. Pruiti**[1], **M. Clerici**[2], **M. Sorel**[1]
[1] *University of Glasgow (UK),* [2] *Università degli Studi dell'Insubria (Italy)*

We demonstrate ultra-low loss alumina waveguides for visible and UV photonics with sub-dB/cm loss at 450 nm through optimization of film deposition and lithography. Using this technology, we demonstrate the first octave spanning supercontinuum generation in dispersion engineered alumina waveguides spanning a range from the UV to near-IR.

12:00 : Invited talk
Non-equilibrium light-matter interactions in photonic temporal crystals
Bumki Min
KAIST (Korea)

Using classical light-matter interaction theory and Floquet analysis, we demonstrate a significant increase in spontaneous emission decay rates at momentum gap frequencies in photonic temporal crystals. These crystals also facilitate the excitation of atoms from ground to excited states with photon emission.

The End of the Conference

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