NTT Research to Work with Caltech, Cornell, Michigan, MIT, NASA, Stanford, Swinburne, and 1QBit

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NTT Research PHI Lab Focused on Quantum Neural Network-Based Computing Announces Eight Joint Research Agreements

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PALO ALTO, Calif.–(BUSINESS WIRE)–NTT Research, Inc., a division of NTT (TYO:9432), today announced that its Physics and Informatics (PHI) Lab has reached joint research agreements with six universities, one government agency, and one private company. The PHI Lab, which is focused on a new computing paradigm created in the interdisciplinary field between quantum physics, neuroscience, and optical technology, has struck five-year agreements with California Institute of Technology (Caltech), Cornell University, University of Michigan, Massachusetts Institute of Technology (MIT), NASA Ames Research Center in Silicon Valley, Stanford University, Swinburne University of Technology, and quantum computing software company 1QBit. NTT Research PHI Lab Director Yoshihisa Yamamoto believes this collaborative framework will advance its goal of rethinking "computation" within the principles of quantum physics and brain science.

"Having launched only four months ago, we are excited to have reached agreements with eight of the world's top research organizations with interests and expertise in the three fields crucial to our mission: quantum-to-classical crossover physics, neural networks, and optical parametric oscillators," said NTT Research PHI Lab Director Yamamoto. "Over the next five years, we believe our collaboration will uncover novel principles and technologies that advance information processing beyond the current state of the art."

Each of the agreements identifies research subjects, project milestones between 2019 and 2024, and one or more principal investigators (PIs) at the collaborating organization who are responsible for the direction and content of their research. The 14 PIs and co-PIs together with Ph.D. students, post-doctoral fellows, and researchers who make up the collaborating teams will conduct research and joint experiments with scientists at NTT Research's PHI Lab in Palo Alto.

"These agreements reflect our belief that a new computing model requires teamwork, in the broadest and best sense of that word," said Kazuhiro Gomi, President and CEO, NTT Research. "They also represent our respect for the talent and expertise of our primary investigator collaborators and the promise of their research teams."

Summaries of the eight agreements follow:

Caltech – Primary goal: to develop a scalable architecture for efficient quantum simulation of many-body systems using optical parametric oscillator (OPO) networks. PI: Alireza Marandi, Assistant Professor of Electrical Engineering and Applied Physics.

Cornell – Primary goal: to develop a quantum neural network (QNN) based on error detection and error correction feedback. PI: Peter McMahon, Assistant Professor of Applied and Engineering Physics.

Michigan – Primary goal: to perform theoretical studies of topological states in nonlinear optics and synthetic topological matter. PI: Franco Nori, Affiliated Faculty, Department of Physics.

MIT – Primary goal: to develop the photonic accelerators for deep learning and the superconducting coherent Ising machines (CIMs) for optimization. PIs: Dirk Englund, Associate Professor of Electrical Engineering and Computer Science; and Will Oliver, Associate Professor of Electrical Engineering and Computer Science and Professor of the Practice of Physics.

NASA Ames Research Center– Primary goal: to perform benchmark studies of CIMs vs. modern heuristics on various optimization problems. PI: Eleanor Rieffel, Lead, Quantum Artificial Intelligence Laboratory.

Stanford – Primary goal: to develop novel optical and superconducting devices for studying the quantum-to-classical crossover physics and critical phenomena in the quantum neural network. PI: Hideo Mabuchi, Professor of Applied Physics; and co-PIs: Martin Fejer, Professor of Applied Physics; Benjamin Lev, Associate Professor of Applied Physics and of Physics; Surya Ganguli, Associate Professor of Applied Physics; and Amir Safavi-Naeini, Assistant Professor of Applied Physics.

Swinburne – Primary goal: to develop and implement the theoretical models for CIMs. PIs: Peter Drummond, Distinguished Professor and Science Director, Centre for Quantum and Optical Science (CQOS); and Margaret Reid, Professor of Physics, School of Science, CQOS, and Department of Physics and Astronomy.

1QBit – Primary goal: to perform research in design and analysis of a stack of algorithms that bridge commercially viable applications to the forms of computation natively done by CIMs, with a multitude of applications in operations research and artificial intelligence. PI: Pooya Ronagh, Head of Hardware Innovation Lab.

In addition to its PHI Lab, NTT Research has two other divisions: the Cryptography and Information Security (CIS) Lab, and the Medical and Health Informatics (MEI) Lab. On November 14, NTT Research President and CEO Kazuhiro Gomi will be speaking on "Fundamental High-Impact Research," as part of the three-day NTT R&D Forum in Tokyo. The three NTT Research Lab directors will also be providing research updates at this event.

About NTT Research

NTT Research opened its Palo Alto offices in July 2019 as a new Silicon Valley startup to conduct basic research and advance technologies that promote positive change for humankind. Currently, three labs are housed at NTT Research: the Physics and Informatics (PHI) Lab, the Cryptography and Information Security (CIS) Lab, and the Medical and Health Informatics (MEI) Lab. The organization aims to upgrade reality in three areas: 1) quantum information, neuro-science and photonics; 2) cryptographic and information security; and 3) medical and health informatics. NTT Research is part of NTT, a global technology and business solutions provider with an annual R&D budget of $3.6 billion.