

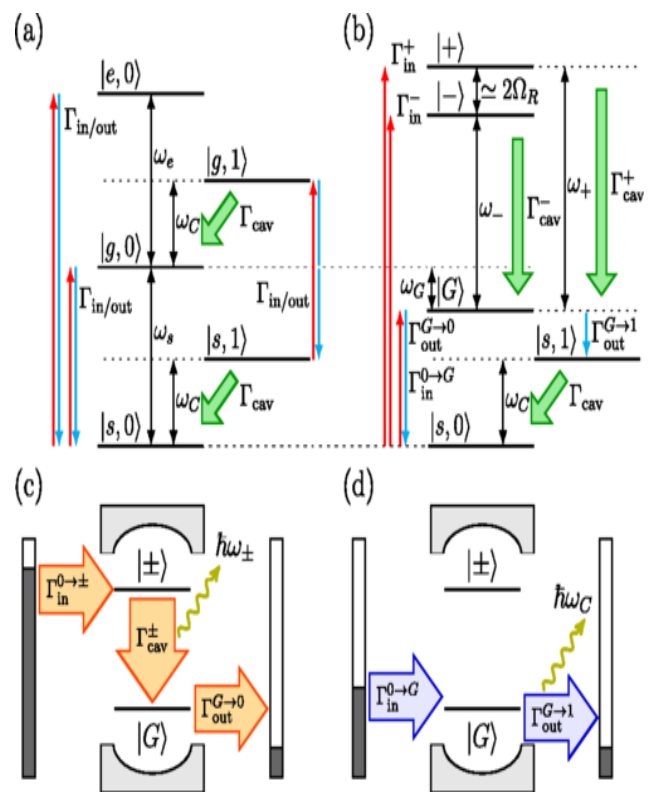
## Ground State Electroluminescence

### Objective

To study ground state electroluminescence

### Summary of Research Activities

- ◆ Electroluminescence, the emission of light in the presence of an electric current, provides information on the allowed electronic transitions of a given system. It is commonly used to investigate the physics of strongly coupled light-matter systems, whose eigenfrequencies are split by the strong coupling with the photonic field of a cavity.
- ◆ We showed that, together with the usual electroluminescence, systems in the ultrastrong light-matter coupling regime emit a uniquely quantum radiation when a flow of current is driven through them.
- ◆ While standard electroluminescence relies on the population of excited states followed by spontaneous emission, the process we describe herein extracts bound photons from the dressed ground state and it has peculiar features that unequivocally distinguish it from usual electro-luminescence.
- ◆ Our aim is to present a novel QED effect, a priori relevant for many of the systems in which the ultrastrong coupling regime has been observed. We thus consider a generic model exhibiting GSE: a two-level electronic system ultra-strongly coupled to a single mode of a photonic resonator.



(a) Energy diagram for the uncoupled system. Photons can leave the cavity at a rate  $\Gamma_{cav}$  and electrons can populate or leave the system at rates  $\Gamma_{in/out}$ . (b) Diagram levels for the strongly coupled regime at resonance. (c) Schematic showing standard electroluminescent emission. (d) Schematic showing the dominant ground state electroluminescence process.

### Publications

M. Cirio, S.D. Liberato, N. Lambert, F. Nori, *Ground State Electroluminescence*, Phys. Rev. Lett. **116**, 113601 (2016).