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Quantum electrodynamics with an artificial atom in a superconducting circuit

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Atoms and photons interact in free space in one of nature's most fundamental processes. The interaction strength between the two systems is determined by fundamental constants, with one of its limiting factors being the volume spanned by the propagating photons. A waveguide is an engineered medium that confines the electromagnetic field and in proximity to atoms allows light-matter interactions with stronger couplings compared to free space. Superconducting quantum circuits enable the study of quantum electrodynamics with a transmission line on a chip replacing the waveguide and a superconducting qubit playing the role of an artificial atom. By proper engineering of these circuits, a wide range of possibilities opens up: from atom-photon interactions in unexplored quantum optical regimes to wide-band, on-demand single-photon generation. In this talk, recent experimental progress coupling qubits to open transmission lines will be discussed. In the first part, results from an on-demand single photon source engineered using a tunable boundary condition in a semi-infinite transmission line will be presented, while in the second part, a strongly driven qubit ultrastrongly coupled to a transmission line realizing the driven, dissipative spin-boson model will be discussed.

Biography

Pol Forn-Díaz has completed his PhD from the Delft University of Technology and Postdoctorate from the California Institute of Technology and the Institute for Quantum Computing at the University of Waterloo. He leads the experimental team of QUANTIC group at the Barcelona Supercomputing Center. He has published more than 15 papers in reputed journals and is an Advisor and Partner of Entanglement Partners SL.

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