Josephson photonics: quantum optics meets quantum electronics

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Real quantum systems never live in isolation but are embedded in surrounding media. An impressive example is cavity quantum electrodynamics which deals with the interaction of light quanta or the electromagnetic vacuum with atoms in optical cavities. Its more recent realization is circuit-QED, where `artificial atoms' in microwave cavities are implemented with superconducting circuits.

Another example is charge transfer in solid state physics, where in the field of quantum electronics fascinating progress has been achieved as well in the last decades with accurate control down to the level of individual charge carriers.

Activities to combine these previously basically distinct fields, quantum optics and quantum electronics, have appeared only very recently both in experiments and theory. This opens a new playground to study a wealth of phenomena close and far from thermal equilibrium including the crossover from incoherent (Coulomb blockade) To coherent (Josephson regime) charge transfer, strong charge-photon coupling, nonlinear resonances, squeezing and entanglement. In this talk I will discuss recent developments, specific examples, and future perspectives.