Quantum Photonics with Single-Electron Devices

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Isotopically enriched silicon has been termed a “semiconductor vacuum” due to its ability to support very long quantum coherence times. I will describe recent efforts by my group to couple a single electron trapped in a Si/SiGe double quantum dot to the photonic field of a superconducting coplanar waveguide resonator. A high degree of control over a single electron wavefunction is achieved using a recently developed overlapping aluminum gate electrode architecture. Measurements of the microwave transmission through the superconducting resonator allow sensitive measurements of the charge state occupation of the Si/SiGe double quantum dot.