Physical Sciences Seminar

Engineering Giant Artificial Atoms and Waveguide QED

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Models of light-matter interaction with natural atoms typically invoke the dipole approximation, wherein atoms are treated as point-like objects compared with the wavelength of their resonant driving fields. In this talk, we present a demonstration of giant artificial atoms realized with superconducting qubits in a waveguide QED architecture. The superconducting qubits couple to the waveguide at multiple, well-separated locations. In this configuration, the dipole approximation no longer holds, and the giant atom may quantum mechanically self-interfere. This system enables tunable qubit-waveguide couplings with large on-off ratios and a coupling spectrum that can be engineered by design. Multiple, interleaved qubits in this architecture can be switched between protected and emissive configurations, while retaining qubit-qubit interactions mediated by the waveguide. Using this architecture, we generate a Bell state with 94% fidelity, despite both qubits being strongly coupled to the waveguide. Time permitting, we also discuss recent advances in 3D integration of superconducting quantum circuits.

Monday, August 29, 2022 03:00pm - 04:00pm

Heinzel Seminar Room / Office Bldg West (I21.EG.101)

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