

Joint Quantum Institute Seminar  
January 28, 2008 at 12:30  
Physics 1201

## **Circuit QED: Quantum Optics and Quantum Computing on a Superconducting Chip**

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When is an electrical signal a photon? I will describe a system we call circuit quantum electrodynamics, which is a way to do new experiments in quantum optics with a superconducting integrated circuit. In circuit QED, microwave photons are guided and confined by superconducting transmission lines and cavities, and can then be coherently coupled to a Cooper-pair box, which is a kind of two-level “artificial atom” or qubit made with Josephson junctions. This system leads to much stronger coupling of the “light” and “matter” than are possible with traditional atomic systems. We can access the usual strong coupling limit of cavity QED, as well as a new “strong dispersive” regime where the qubit and photon interact without exchanging energy. I will discuss experiments where we are able to perform quantum non-demolition measurements of both the qubit and the photon, to generate single 5 GHz photons on demand, and to communicate quantum information between widely separated qubits using photons as an intermediary.

Host UMD: Luis Orozco