

Department of Physics

Condensed Matter Physics

Clarendon Laboratory, Parks Road, Oxford OX1 3PU



CONDENSED MATTER SEMINAR

Thursday 22 February at 2.15pm

“Controlling coherent-state superpositions using superconducting circuits”

Dr Brian Vlastakis

Department of Physics, Oxford University

Quantum computation requires a large yet controllable Hilbert space. While many implementations use discrete quantum variables such as the energy states of a two-level system to encode quantum information, continuous variables could allow access to a larger computational space while minimizing the amount of required hardware. With a toolset of conditional qubit-photon logic, quantum information can be encoded into the amplitude and phase of coherent state superpositions in a resonator, also known as Schrödinger cat states.

In this talk, I will present my previous work towards this goal with superconducting circuits. Using a transmon qubit off-resonantly coupled to a three-dimensional microwave resonator, we achieve interaction strengths much greater than decoherence rates and higher-order nonlinearities and create superposition states of over one-hundred photons. Furthermore, we combine this experiment with fast, high-fidelity qubit state readout to perform composite qubit-cavity state tomography and detect entanglement between a physical qubit and a cat-state encoded qubit. In addition, I will discuss current work using this architecture which include logical-qubit operations and quantum error correction.

Host: Dr Peter Leek

Audrey Wood Seminar Room, Clarendon Laboratory