CMP Seminar
Michigan State University

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Quasiparticle dynamics and decoherence in superconducting qubits

Superconducting quantum circuits have attracted growing interest in recent years as a promising candidate for fault-tolerant quantum information processing, powered by dramatic improvements in their coherence times. In this talk I will describe recent experiments unraveling the dominant decoherence mechanisms in state-of-art superconducting qubits: quasiparticle tunneling and surface dielectric dissipation. No intrinsic limit to the perfection of Josephson junctions as a quantum circuit element appears in sight.

Moreover, we find vortices can surprisingly improve coherence of superconducting qubits by suppressing non-equilibrium quasiparticles. I will present measurements of quasiparticle dynamics (recombination, trapping, generation and diffusion) in superconducting aluminum at 20 mK using the qubit as a sensitive probe. We directly demonstrate the power-law decay characteristics of the canonical quasiparticle recombination process, and show quantized changes of quasiparticle trapping rate due to individual vortices.

Monday, February 2, 2015
4:10 p.m.
BPS 1400
Prof. Norman Birge - Host