Chez Pierre

Presents ...

Monday, October 31, 2011
12:00pm
MIT Room 4-331

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"Atomic physics approach to coherent quantum phase-slips in superconducting wires"

Superconducting order in an infinite one-dimensional wire is destroyed at zero temperature by quantum fluctuations, inducing 2π slips of the phase across the wire [1]. However, for a finite length wire, coherent quantum phase slips would manifest themselves simply as energy level shifts in the spectrum of the circuit incorporating this wire [2].
Furthermore, due to Aharonov-Casher interference between phase slips occurring at different locations along the wire, the shift depends periodically on the configuration of offset charges residing between these locations. Being inherently fluctuating, offset charges turn shifts into linewidths. We experimentally observed this effect on a long Josephson junction chain acting as the "slippery" wire [3]. Quantum phase-slip frequencies as low as few 100 kHz, were resolved from the flux-dependent dephasing of a superconducting fluxonium [4] qubit.

[1] B. Halperin et al., arXiv:1005.3347 (2009).
[2] A. Hriscu et al., arXiv:0912.3699 (2009).
[3] V. Manucharyan et al., arXiv:1012.1928 (2010).
[4] V. Manucharyan et al., arXiv:0906.0831 (2009).