CMP Seminar
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Superconducting quantum nanodevices driven by Meissner currents

If a nanoscale superconducting device is attached to a superconducting electrode and a magnetic field is applied then the Meissner current can flow into the device and can be used as a controlled knob. We will discuss two devices, (1) a qubit and (2) two-wire SQUID. In the qubit, due to the new design, the coupling of Abrikosov vortices to the supercurrent turns out rather strong. Thus we present a study of the qubit relaxation process induced by coupling to superconducting vortices. In the nanowire SQUID, we find that entrance of individual vortices into the loop occurs by means of macroscopic quantum tunneling. An interesting phenomenon observed is the pairing of quantum phase slips [1]. We speculate that such paring reduces the quantum action of the process and this makes such pairs more probable than single unpaired phase slips. The pairing effect is of interest since it was proposed as a rout to topologically protected quantum computation.

[1] A. Belkin, M. Belkin, V. Vakaryuk, S. Khlebnikov, and A. Bezryadin,"Formation of Quantum Phase Slip Pairs in Superconducting Nanowires" *Phys. Rev. X* **5**, 021023/1-9 (2015).

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Prof. Alex Levchenko - Host