

Limiting behaviors in superconductors with a restricted sample geometry

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Superconductors with a designed restricted geometry, which have been shown to exhibit limiting behaviors not found in the bulk, may provide insight into how macroscopic quantum phase coherence can be engineered, which may in turn be relevant for achieving very high temperature superconductivity. The Little-Parks effect observed in doubly connected superconductors, the quantum oscillations of the superconducting transition temperature with the applied flux, is well known. Its limiting behavior, referred to originally by de Gennes as the destructive regime, is found in ultrasmall doubly connected samples in which the global superconducting phase coherence is lost near the half-flux quanta because of the competition between the kinetic and the condensation energies of the system. I will present measurements on doubly connected quasi 1D cylinders and ultrasmall loops of Al, the observation of the destructive regime in both types of samples, as well as the restoration of the lost global phase coherence by manipulating sample geometries. I will also describe briefly our recent experimental efforts in the study of atomically

thin, single-crystalline flakes of NbSe₂ (prepared by mechanical exfoliation) as well as nanostructures fabricated on these flakes.

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