Superconducting fluctuations in Josephson junctions

Gil Refael

Condensed Matter Physics
Caltech 114-36
Pasadena CA 91125

At low temperatures, phase fluctuations give rise to fascinating behavior in small-scale superconducting links. The first example I will discuss is the idealized system of a Josephson point-contact connecting two infinite superconducting planes. Despite the quasi long-range order in the planes, the point-contact is resistive at all finite temperatures due to phase slips. This resistance is nearly activated with the energy barrier set by the stiffness in the planes. Following that I'll discuss the opposite limit of a thin long wire, partially normal and partially superconducting, that connects two finite leads. Phase fluctuations in the form of phase-slip dipoles decouple the normal and superconducting electronic fluids in the wire at low energies. This leads to the possibility of a Chakravarty-Schmid transition, tuned by the total resistance of the wire's normal-part.