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Dissipation due to vortices in a bilayer thin film superconductor
WEI ZHANG, H.A. FERTIG, Department of Physics, Indiana University — Vortex dynamics in a bilayer thin film superconductor are studied through a Josephson-coupled two layer XY model. A duality transformation and renormalization group analysis show that there are three phases for this system: free vortex phase, logarithmically confined vortex-antivortex pair phase, and a linearly confined phase. The phases may be distinquished by measuring the resistance to counterflow current in a bilayer superconductor. For a geometry in which current is injected and removed from the two layers at the same edge by an ideal (dissipationless) lead, we argue that the three phases yield distinct behaviors: metallic conductivity in the free vortex phase, a power law I-V in the logarithmically confined phase, and true dissipationless superconductivity in the linearly confined phase. Numerical simulations of a resistively shunted junction model reveal size dependences for the conductance of this system that support these expectations.

Wei Zhang
Department of Physics, Indiana University

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