

Current voltage curves in the regime of strong pinning

V. B. Geshkenbein

Institute for Theoretical Physics, ETH Zürich, 8093 Zürich

We determine the current-voltage characteristic of type II superconductors in the presence of strong pinning centers. The small pin-density limit generically provides us with a nearly linear characteristic shifted by the critical force density which approaches the flux-flow regime only at large drives. This reminds the Coulomb's Law of dry friction: Kinetic friction is independent of the sliding velocity. Furthermore, we find that the dynamical response of the vortex solid to pinning is crucially altered near the Labusch point, where strong pinning crosses over to the weak collective pinning behavior. Whereas strong pins induce a hysteretic and hence discontinuous response at small velocities generating a jump in the current-voltage characteristic, the latter evolves smoothly past the critical current in the regime near the Labusch point.