

Correlation Lengths at the Vortex Lattice Melting Transition

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Abstract

We carry out Monte Carlo simulations of the anisotropic 3D XY model with uniform frustration as a model for vortex line fluctuations in high T_c superconductors in an applied magnetic field. Considering both vortex and phase correlation functions within the vortex line liquid, we compute how the correlation length parallel to the applied field grows as one cools towards the first order melting transition. Results for different values of applied field and system anisotropy, when appropriately scaled, are shown to collapse near T_m onto a universal curve allowing us to make a realistic prediction for the size of the parallel correlation length in real high T_c materials.