Structure and Phase Transition of the Josephson-Vortex System in High-T_c Superconductors

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Abstract

When an external magnetic field is applied parallel to the *ab* plane of a high-T_c superconductor, Josephson vortices centering in the blocking layers are induced. The instability of the triangular flux lattice comes from the anisotropy of inter-vortex repulsions, the commensuration between inter-vortex forces and the layer structure, and the thermal fluctuations. There are many aspects to be explored in this situation, compared with the much more studied case of the external magnetic field applied along the *c* axis.

We shall report our Monte Carlo simulation results on the Josephson-vortex system [1]. For sufficiently large anisotropy, which is proportional to the external field in our model, we observed a second-order phase transition between phases of finite resistivity and of zero *ab*-plane resistivity. Our data for the temperature dependence of the helicity modulus and the specific heat suggest the phase transition belonging to the universality class of the 3D XY model. At low temperatures, we obtain Josephson-vortex lattice for small anisotropy, and chains waving in the *c* direction for large anisotropy, respectively.

[1] X. Hu and M. Tachiki, Phys. Rev. Lett. **80** , 4044, 1998.