Voltage noise and dynamic vortex phases in driven two dimensional superconducting thin films

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Abstract

We will present molecular dynamics simulations of current driven vortices in a two dimensional superconducting thin film with pinning defects. We model the vortex-vortex interaction with a logarithmic potential as a model for two-dimensional vortices in thin films. We study the voltage noise as a function of current both in the longitudinal direction (parallel to the current) and the transverse direction (perpendicular to the current, i.e. "Hall noise"), as well as vortex structure factor and voltage power spectrum. We find that the Hall noise is very large in the plastic flow regime. In the dynamic transition to a moving vortex system with elastic channels (a moving smectic), the Hall noise is reduced by many orders of magnitude due to vortex "localization" in the transverse direction. Such a sharp transition in the Hall noise could be a good experimental signature of the onset of the moving smectic regime. We will also present results for the vortex diffusion and average quadratic displacements in both transverse and longitudinal directions for different currents.