

Nonequilibrium dislocation dynamics and instability of driven vortex lattices in two dimensions

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Abstract

We consider dislocations in a vortex lattice that is driven in a two-dimensional superconductor with random impurities. The structure and dynamics of dislocations is studied in this genuine nonequilibrium situation on the basis of a coarse-grained equation of motion for the displacement field. The presence of dislocations leads to a characteristic anisotropic distortion of the vortex density that is controlled by a Kardar-Parisi-Zhang nonlinearity in the coarse-grained equation of motion. This nonlinearity also implies a screening of the interaction between dislocations and thereby an instability of the vortex lattice to the proliferation of free dislocations.