Depinning and flow of the vortex lattice in $NbSe_2$: anisotropic vortex displacement and motion history.

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Abstract

The depinning of the vortex lattice is studied by magnetic decoration experiments on $NbSe_2$ at low (20-70 Gauss) fields, either by zero field cooling the sample and increasing the field, or by high field (1 kG) cooling and removing the field. After the depinning the lattice order transverse to the direction of motion is preserved. Along the direction of motion, however, the lattice order is destroyed as can be seen from the large variation in bond length between neighbouring vortices in the direction of motion (moving vortex smectic). When the vortex lattice is stopped, the anisotropy in bond length variation is partially preserved in the static structure. We calculate for such lattices an angular dependence of vortex displacement correlator $< [u_\varphi(\mathbf{r}) - u_\varphi(\mathbf{0})]]^2 >^{1/2}$ and find that it grows fastest in the flow direction. The latter result suggests an interesting possibility to reveal motion history by analyzing decoration images of a static lattice.