Dislocation Mobility in a Quantum Crystal: the Case of Solid ^{4}He

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Abstract

We investigate the structure and mobility of dislocations in *hcp* ^{4}He crystals. In addition to fully characterizing the five elastic constants of this system, we obtain direct insight into dislocation core structures on the basal plane, which demonstrates a tendency toward dissociation into partial dislocations. Moreover, our results suggest that intrinsic lattice resistance is an essential factor in the mobility of these dislocations. This insight sheds new light on the possible correlation between dislocation mobility and the observed macroscopic behavior of crystalline ^{4}He.