Abstract Submitted
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Plasticity and dislocation-induced anomalous softening of solid helium under DC shea IRENE BEYERLEIN, CAIZHI ZHOU, Los Alamos National Laboratory, JUNG-JUNG SU, Stanford University, MATTHIAS GRAF, CHARLES REICHHARDT, ALEXANDER BALATSKY, Los Alamos National Laboratory — The classical motion of gliding dislocation lines in slip planes of crystalline solid helium leads to plastic deformation even at temperatures far below the melting temperature and strongly affects elastic properties. In this work we propose that the gliding of dislocations and plasticity may be the origin of many observed elastic anomalies in solid He-4, which have been argued to be connected to supersolidity. We present and propose a dislocation motion model that describes the stress-strain τ–ε curves and work-hardening rate $\tau/\mathrm{d}\varepsilon$ of a DC shear experiment to be performed at constant strain rate in solid helium. The calculated $\tau/\mathrm{d}\varepsilon$ exhibits strong softening with increasing temperature owing to the motion of dislocations, which mimics anomalous softening of the elastic shear modulus μ. In the same low-temperature region the classical motion of dislocations causes dissipation with a prominent peak [1] [1] C. Zhou et al., Philos. Mag. Lett. 92 (2012) 608

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