Abstract Submitted
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Elasticity, Plasticity and Supersolidity in Solid Helium[1] JOHN BEAMISH, University of Alberta, ARIEL HAZIOT, ANDREW FEFFERMAN, XAVIER ROJAS, SEBASTIEN BALIBAR, Laboratoire de Physique Statistique de l'ENS — The frequency of a torsional oscillator containing solid helium depends on the helium's elastic properties, as well as its inertia. Mobile dislocations reduce the helium's shear modulus, but they are pinned at low temperatures. The resulting increase in shear stiffness raises the TO frequency and can mimic mass decoupling in a supersolid. The size of this elastic effect depends on the geometry of the oscillator and on the magnitude of the modulus changes. We recently showed that the elastic effect can be large enough to explain the apparent mass decoupling in some oscillators whose torsion rods have a central hole to admit the helium, suggesting that the apparent supersolidity is an artifact due to elastic changes. We have observed extremely large modulus changes in high quality single crystals. We were able to identify the dislocations responsible for the elastic changes and to show that they were arranged in a network with very large pinning lengths. The large modulus changes reflect the dislocations' extremely high mobility at low temperatures, which produces a "giant plasticity" in this quantum crystal.

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