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Amplitude Dependence of the Shear Modulus Anomaly in Solid Helium[1] JAMES DAY, ALEXANDER SYSHCHENKO, JOHN BEAMISH, University of Alberta — The shear modulus of solid ^{4}He increases substantially in the temperature range below 200 mK where torsional oscillator measurements showed mass decoupling apparently associated with supersolidity. The amount of helium which decoupled depended on the oscillator amplitude, which was interpreted in terms of a supersolid critical velocity of order 10 microns/second. We observed a similar amplitude dependence in our shear modulus anomaly - the stiffening at low temperatures decreased above a critical drive level. By varying the measurement frequency (from 20 to 2000 Hz) and by changing the sample's dimensions, we conclude that the amplitude dependence we see is a function of the stress or displacement in the solid helium rather than the velocity. This contrasts with recent torsional oscillator measurements in which the amplitude dependence scaled with sample velocity. However, the amplitude dependence in our modulus measurements begins at stresses comparable to those in torsional oscillators and at low temperatures it shows hysteretic behavior similar to that seen in torsional oscillators.

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