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Possible glass anomalies in the shear modulus and dielectric function of solid helium JUNG-JUNG SU, MATTHIAS J. GRAF, ALEXANDER V. BALATSKY, Los Alamos National Laboratory — The shear modulus of solid ^{4}He exhibits an anomalous change at low temperature that is qualitatively similar to a frequency change in torsional oscillator experiments. We propose that in solid ^{4}He the stiffening of the shear modulus with decreasing temperature can be described with a generalized susceptibility including a glassy backaction by assuming a distribution of temperature-dependent relaxation times $\tau(T)$. The glass susceptibility captures the freezing out of glassy degrees of freedom below a characteristic crossover temperature T_X, when the dynamic response of the solid satisfies $\omega\tau(T_X) \sim 1$, thus leading to a viscous response. We predict that the maximum change of the amplitude of the shear modulus and the height of the dissipation peak are independent of the applied frequency ω. Recent measurements of the dielectric function $\epsilon(\omega)$ by the UFL group show a similar amplitude increase. We propose that changes in $\epsilon(\omega)$ are due to the glassy dynamics of low-lying excitations and are related to the shear modulus through acousto-optical coupling. We predict a dissipation peak in the imaginary part of the dielectric function, where the change in the real part is largest.

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