

NCRI and shear modulus of solid helium at low temperatures

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Supersolidity, the appearance of viscousless flow in solids, was first indicated in 4He torsional oscillator (TO) experiments. Despite many efforts to uncover the mechanism of supersolidity since the first observation of non-classical rotational inertia (NCRI), the microscopic origin and physical interpretation of the observed phenomena has been under considerable debate. Recently, shear modulus measurements of solid helium showed unusual increase with striking resemblance to those of TO anomaly. The similarities invigorate alternative non-superfluid explanations for the TO response. In this talk, we will present simultaneous measurement of shear modulus and NCRI in solid helium to examine the fundamental connection between two phenomena. TO response is found to be independent of the stiffening or softening of elastic modulus. In addition, the rotational response of NCRI is also contradicting with that of shear modulus; the NCRI shows strong suppression but the shear modulus remains unchanged. These results indicate that microscopic origin of TO anomaly is different from shear modulus change.

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