

Supersolid Behavior and Inertial Anomalies in Solid ^4He Formed in Nanoporous Media

Keiya Shirahama

Department of Physics, Keio University, Yokohama 223-8522, Japan

”Non-classical rotational inertia (NCRI)” observed in solid ^4He formed in a porous Vycor glass [1] has been remaining as a puzzle in theoretical interpretations for possible supersolidity in solid ^4He . To elucidate the mechanism of NCRI, we have made torsional oscillator studies for solid ^4He in a nanoporous Gelsil glass, which has much narrower pores (2.5 nm) than Vycor has. Most of the supersolid properties found in bulk solid are also observed in the confined solid. Moreover, we observe an additional decrease in rotational inertia accompanied with a dissipation peak around 1 K. This ”high - T inertial anomaly” has a slight, systematic dependence on pressure but no dependence on oscillation velocity, unlike the NCRI seen below 0.15 K. We attribute the high - T anomaly to a relaxation of microscopic excitations in amorphous solid ^4He . Similar inertial anomaly is observed in thin solid ^4He films adsorbed on the same porous glass sample. The onset temperature decreases to 0 K as the superfluid critical coverage approaches, suggesting that the inertial anomaly in solid films is related to a quantum phase transition between a gapped solid and a genuine superfluid [2].

[1] E. Kim and M. H. W. Chan, *Nature* **427**, 225 (2004).

[2] P. A. Crowell, F. W. Van Keuls, and J. D. Reppy, *Phys. Rev. Lett.* **75**, 1106 (1995); *Phys. Rev. B* **55**, 12620 (1997).

INVITED PAPER