

Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Simultaneous Measurement of Non-Classical Rotational Inertia and Shear Modulus of Solid ^4He

WONSUK CHOI, JAEHO SHIN, Center for Supersolid & Quantum Matter Research and Department of Physics, KAIST, Daejeon 305-701, R. O. K., HYOUNG CHAN KIM, National Fusion Research Institute(NFRI), Daejeon 305-333, R. O. K., KEIYA SHIRAHAMA, Department of Physics, Keio University, Yokohama, Japan, EUNSEONG KIM, Center for Supersolid & Quantum Matter Research and Department of Physics, KAIST, Daejeon 305-701, R. O. K. — A failure to rotate or oscillate is the essential nature of low temperature superfluid helium, and more technically known as non-classical rotational inertia (NCRI). It is counter-intuitive, but NCRI is also found in solid helium-4 below ~ 200 mK [1,2]. Recently, shear modulus showed unusual increase with striking resemblance to those of NCRI [3]. Extended measurements show the NCRI occurs only in a stiffened Bose solid, but it is not understood how they are related. Here we report the first simultaneous measurement of shear modulus and NCRI in solid helium to elucidate the fundamental connection between them. Both emerge at remarkably similar temperatures, whereas no quantitative agreement between the increase of the shear modulus and the magnitude of NCRI is found. The increase of shear modulus seems to be the necessary condition for the onset of NCRI.

[1] E. Kim and M. H. W. Chan *Nature* **427**, 225-227 (2004)

[2] E. Kim and M. H. W. Chan *Science* **305**, 1942 (2004)

[3] J. Day and J. Beamish *Nature* **450**, 853-856 (2007)

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Date submitted: 18 Nov 2011

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