

Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Superfluid Mass Decoupling in Two-dimensional ^4He : a Double-frequency TO Study JAEWON CHOI, OLEKSIY ZADOROZHKO¹, EUNSEONG KIM, Korea Adv Inst of Sci Tech — Helium film adsorbed on graphite substrates has been investigated as a realization of quasi-two-dimensional system. Interplay of interactions between helium atoms and substrate offer a rich phase diagram. Especially, Crowell and Reppy reported an anomalous superfluid signal in the second layer of ^4He films adsorbed on Grafoam from their torsional oscillator (TO) experiment. This signal, reproduced successfully by recent measurements, suggests the possibility of supersolid phase in which both crystalline and superfluid orders coexist. However, an ab initio Monte Carlo calculation did not agree with supersolid interpretation: no commensurate solid phase in the corresponding range of atomic density (or coverage). In this study, we investigated superfluid mass decoupling in the second layer of ^4He film adsorbed on Grafoil at two different resonant frequency. A double-frequency TO was employed to study the frequency dependence of the TO responses to identify whether the response can be attributed to the appearance of superfluid or not. Both period shift and dissipation were measured in the atomic coverages ranging from 17 to 20 atoms/nm² where the superfluid responses were reported. A diaphragm-type capacitive strain gauge was also mounted above the sample cell for in-situ pressure measurement.

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Date submitted: 11 Nov 2016

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