

Abstract Submitted  
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**An Ordered State of Dislocations in Solid Helium** HANS JOCHEN

LAUTER, Oak Ridge National Laboratory, ECKHARD KROTSCHKE, University at Buffalo-SUNY, EFIM KATS, Landau Institute for Theoretical Physics, KENNETH HERWIG, ANDREY PODLESNYAK, DIALLO SOULEYMANE, Oak Ridge National Laboratory, GLYDE HENRY, University of Delaware, ANDREII SAVICI, Oak Ridge National Laboratory — An ordered state of dislocations, see e.g. [1], is disclosed from neutron inelastic scattering data taken from solid helium at 40mK and a pressure of about 30bar. A characteristic feature is the phonon gap at the origin of about 0.15 meV, which reveals the non-equilibrium state of stressed helium created by rapid cooling with the blocked-capillary method. Energy gain scattering starts to appear at a temperature of 0.5 K that underlines the non-equilibrium state of stressed helium and the non-applicability of the detailed balance. The increasing thermal occupation of phonon-states observed as increasing intensity in energy gain scattering builds to a phase transition close to 1.4K. The creation of a helium single crystal with hcp-structure in thermal equilibrium [2] is observed at this temperature. This phase transition is in agreement with the vanishing quasi two-dimensional superfluid helium in solid helium confined in aerogel around 1.3K [3]. The event of the “supersolid” transition around 100mK is not observed in the two neutron scattering experiments.

[1] G. Söyler, et. al., Phys. Rev. Lett. **103**, 175301 (2009)

[2] E. Blackburn, et. al., PRAMANA **71**, 673 (2008)

[3] H.Lauter, et. al., Phys. Rev. Lett. **107**, 265301 (2011)

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