Quantum Vortex Physics in hcp solid ^{4}He

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The nature of solid ^{4}He has been questioned by recent reports by Xiao Mi and Reppy[1] as well as by Chan's group[2] that careful experiments reveal the absence of the supersolid behavior in the solid He in Vycor glass. We discuss that these observations can be explained by the characteristic length scales of the supersolidity below T_c as well as in the vortex fluid state below the onset temperature T_o of hcp He in comparison to the Vycor pore size. Furthermore we present new evidences supporting supersolid state below T_c as well as the vortex fluid state below T_o in terms of physics of quantized vortices. Some of the essential points of our discussion has been already published and summarized in [3]. The characteristic length scales were obtained by the absolute size evaluation of the supersolid mass both in the supersolid state and in the vortex fluid state. Further detailed discussion based on the physics of quantized vortices which explaines many of the observations will be given. Authors acknowledge supports from Gen Tatara(Riken), Masato Murakami(SIT), and encouragement by P.W. Anderson.

1.Xiao Mi and John D. Reppy, "Anomalous Behavior of Solid 4He in Porous Vycor Glass", PRL 108, 225305 (2012). 2. Duk Y. Kim and Moses H. W. Chan, "Absence of Supersolidity in Solid Helium in Porous Vycor Glass", PRL 109, 155301 (2012). 3. Kubota, M. (2012). "Quantized Vortex State in hcp Solid ^{4}He". J Low Temp Phys, 169, 228-247.

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