

Quasi-2D superfluid helium in solid helium in aerogel

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Two sharp phonon-roton curves provide evidence for the presence of superfluid helium within solid helium confined into aerogel at high pressures up to 54bar and low temperatures down to 50mK. The roton-gap parameters of these modes are clearly distinct from those of the bulk rotons. Microscopic many body calculations lead to the conclusion that the excitations correspond to rotons propagating in liquid double layers within the solid helium and at the solid helium substrate interface. Annealing at 1.3K leads to crystallization of the superfluid double layers inside the solid helium, whereas the roton excitation corresponding to a mode that lives at the liquid-solid interface stays unaffected. The crystallization process is revealed by the Bragg-peaks of solid helium.