Thesis Presentation

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Path Integral Monte Carlo Absorption Studies of Superfluid Helium-4 in Mesoporous Silicates

When quantum fluids are placed into low-dimensional environments approaching the one-dimensional limit, they exhibit novel behaviors differing from that of a bulk three-dimensional quantum fluid. Helium-4 absorbed into mesoporous silica provides a physical example of such a low-dimensional system that is realizable in the laboratory. To better understand the absorption behavior and arrangement of helium atoms inside silica-like materials, large scale path integral Monte Carlo simulations utilizing realistic helium-helium and helium-silica interactions were conducted at low temperature for a variety of chemical potentials. The results indicate that the helium atoms group into isolated 1-D chains at lower pressures, revealing these types of systems as an exciting candidate for the experimental realization of a truly one-dimensional quantum fluid.

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