Variational description of the exchange-driven liquid-to-solid quantum phase transition in ^{4}He

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We present a detailed study of a simple but accurate and exchange-symmetric wavefunction that was proposed for the ground state of solid helium [1]. It is shown that a direct variational optimization of this two-parameter wavefunction properly predicts the location of the melting transition of ^{4}He. Transition is also predicted to be of the first order. This allows us to study the phase transition variationally and the extend to which the Bose statistics of solid helium-4 influences both the solidification and the properties of the solid.

1. C. Cazorla, G.E. Astrakharchik, J. Casulleras, J. Boronat, "Bose–Einstein quantum statistics and the ground state of solid ^{4}He" New J. Phys. 11, 013047 (2009).

Section: QS - Quantum solids

Keywords: quantum phase transition, quantum solid