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Understanding supersolids MIKLOS GULACSI, ANDRE STOFFEL, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany —
We model the newly discovered supersolid phase of ^{4}He by a hard-core bosonic quantum lattice model in 3 dimension including nearest and next-nearest neighbor interactions. As hard-core Boson exhibit the same algebra as spin-1/2 operators there exists a one-to-one correspondence to the anisotropic Heisenberg model in an external field. To solve this Heisenberg model we used the Tyablikov Green's function technique and in order to obtain a closed set of equations we used a cumulant decoupling scheme. The obtained Green's functions have been used to study the properties of the system. Here, we are particularly interested in the normal-solid (NS) and supersolid (SS) phases as well as the corresponding phase transition. It was long proposed that vacancies and defects may play a crucial role in the formation of the supersolid phase. Hence we studied the incommensurability which is a measure of the net fraction of vacancies. For the NS phase we re-obtained the well-known thermal activation theory. However, the incommensurability in the SS displays a rather different behavior, which also suggests that the NS to SS transition is a commensurate-incommensurate transition.

Miklos Gulacsi
Australina National University, Canberra, Australia

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