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Theory for supersolid 4He: Vacancy condensation facilitated by a low-energy bound state

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Although both vacancies and interstitials have relatively high activation energies in the normal solid, we propose that a lower energy bound state of a vacancy and an interstitial may facilitate vacancy condensation to give supersolidity in 4He. We use a phenomenological two-band boson lattice model to demonstrate this new mechanism and discuss the possible relevance to the recently observed superfluidlike, nonclassical rotational inertial experiments of Kim and Chan in solid 4He. Some of our results may also be applicable to trapped bosons in optical lattices.