Contribution ID : 36 Type : Invited oral

Chester supersolid in dipolar interlayer exciton condensates

Thursday, 26 September 2024 11:00 (30)

We have predicted in an electron-hole bilayer semiconductor system using a variational approach, a transition from an exciton superfluid to an incompressible “Chester supersolid”, which has occupancy of one on each lattice site [1].

By solving the full Gross-Pitaevskii equation for this 2D system, we carry out a complete investigation of the time-dependent dynamic exciton supersolid. Here, the interaction between the excitons is purely repulsive and dipolar-like, in marked contrast with ultracold dipolar gases, where the stability is driven by an additional effective attractive interaction[2]. We extend the Gross-Pitaevskii formalism to include the strong two-particle correlations[3], and to exclude the self-interaction energy which is absent for one-particle occupancy per supersolid site[4].

We present solutions of the Gross-Pitaevskii equation for a range of accessible experimental parameters which are the electron-hole layer separation and the exciton density.

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Session Classification : Session

Track Classification : Condensed matter physics