Extended Bose-Hubbard model with dipolar excitons

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Résumé

The Bose-Hubbard (BH) model quantifies the quantum matter phases accessible to strongly correlated
bosons confined in lattice potentials. In its elementary form the BH Hamiltonian is restricted to on-site
interactions and quantifies the transition from superfluid to Mott insulating phases. Extending the BH model
to additional degrees of freedom naturally provides a route to broaden the range of accessible quantum matter
states. In this presentation we introduce a new platform to experimentally emulate the Bose-Hubbard model
extended by nearest neighbour interactions. In particular, we emphasise dipolar excitons of GaAs bilayers,
confined in electrostatic lattice potentials. They realise first a Mott insulating phase at unitary lattice filling,
and a second quantum insulator at half lattice filling that exhibits the signatures of a checkerboard solid (1).

(1) C. Lagoin et al., Nature 609, 485 (2022)

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