Dipolar Molecules in Optical Lattices

Tue, 2013-04-02 12:24 - Mattia Giardini [1] **Date:** 2012-03-13
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Reference:
URL: http://link.aps.org/doi/10.1103/PhysRevLett.108.115301 [2]
DOI: 10.1103/PhysRevLett.108.115301
PACS: 67.85.Hj, 37.10.Jk

We study the extended Bose-Hubbard model describing an ultracold gas of dipolar molecules in an optical lattice, taking into account all on-site and nearest-neighbor interactions, including occupation-dependent tunneling and pair tunneling terms. Using exact diagonalization and the multiscale entanglement renormalization ansatz, we show that these terms can destroy insulating phases and lead to novel quantum phases. These considerable changes of the phase diagram have to be taken into account in upcoming experiments with dipolar molecules.

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