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Ultracold Ytterbium Atoms in Dynamically Tunable Optical Lattices

mardi 23 février 2016 11:10 (30 minutes)

Dynamical controllability of the system parameters in ultracold atomic gases has made it possible to observe diverse kind of quantum dynamics. In this talk, we present the optical-lattice realization of a Lieb lattice [1], which plays an important role in quantum magnetism. Making full use of the tunability of the lattice potential, we load a Bose condensate of ^{174}Yb into the excited dispersionless band of the Lieb lattice. By exploiting a technique to measure the sublattice occupancies of atoms in the lattice, we observe the characteristic freezing of tunneling to adjacent lattice sites.
We also show the first demonstration of Thouless'topological pumping [2] of fermionic ^{171}Yb atoms with an optical superlattice [3]. Here, the long-period lattice moving with respect to the short-period lattice realizes the Rice-Mele model with dynamically tunable parameters. Depending on the trajectory in the 2D parameter space, atoms show quantized transport which reflects the Chern number of the energy band.

[1] S. Taie, *et al.*, Sci. Adv. **1**, e1500854 (2015).
[2] D. J. Thouless, PRB **27**, 6083 (1983).
[3] S. Nakajima, *et al.*, Nature Phys., published online (2016); see also M. Lohse *et al.*, *ibid* (2015).

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