

CQD Kolloquium – Poster Session

Transport in a Many-Body Wannier-Stark Setup

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Ultra-cold atoms in optical lattices

Ultra-cold atoms in optical lattices are systems showing rich and complex behaviour

- Bose-Einstein condensates are easily created and loaded into optical lattices
- physical parameters can be controlled almost at will and many different Hamiltonians realized
- quantum effects can be studied in detail



We focus on ultra-cold bosons in deep optical lattices, which allow to realize the Wannier-Stark Hamiltonian for interacting particles

(Phys. Rev. Lett. 102, 045701 (2009))

Methods of investigation

We use different theoretical methods to investigate single- and many-body transport problems and the influence of different parameters, the number of interactions. These methods are:

- algebraic renormalization
- T-matrix-Lowell algorithm
- Hubbard-Stratonovich and auxiliary field methods
- variational approaches
- time-dependent perturbation theory
- exact effective models
- compare results with exact results (DMRG)

(J. Phys.: Condens. Matter 24, 155601 (2012))

On the band coupling: avoided crossings

• Single particle's Wannier-Stark spectrum

- the SR F is the control parameter
- single particle avoided crossing at this $F_c = \frac{1}{2}(\epsilon_1 + \epsilon_2) - \epsilon_0$
- typical exchange of character of F_c (interacting case: $\gamma = 1$) holds

Manifold



On the dynamics: EF's diffusion!

Through E_c ...

- many-body avoided crossing is visible at deep Lattices (low values of interaction strength, $F_c = \frac{1}{2}(\epsilon_1 + \epsilon_2) - \epsilon_0$)



Mittwoch, 07.06.2017 17:00 / 17:30 Uhr
Kirchhoff-Institut, INF 227