

CQD Kolloquium – Poster Session

Transport in a Many-Body Wannier-Stark Setup

J. Parra-Murillo, Javier Madroñero* and Sandro Wimberger

Complex Dynamics in Quantum Systems, Institut für Theoretische Physik, Universität Heidelberg
Department, Technische Universität München, James-Frank-Str. 1, 85748 Garching, Germany



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 various topics in Wannier-Stark systems and the influence of different parameters on transport or interaction. These methods are:

- algebraic renormalization
- Floquet-Lanczos algorithm
- full diagonalization and matrix renormalization
- variational approaches
- time-dependent perturbation theory
- exact effective models
- compare results with exact results (DMRG)

(J. Parra-Murillo, arXiv:1508.01001)

On the band coupling: avoided crossings

• Single particle's Wannier-Stark spectrum

- the tilt F is the control parameter
- single particle avoided crossing at this $F_c = \frac{1}{2} \sqrt{4t^2 - \Delta^2}$
- typical exchange of character of F_c (interacting case: $\sqrt{1 + \Delta^2}$ hidden)

Manifold



On the dynamics: EF's diffusion!

Through E_c ...

- many-body avoided crossing is visible at deep Lattices (low energy)
- negative diffusion: $D(F) = -D_0 \ln(1 + \frac{F}{F_c})$



Mittwoch, 18.05.2016 17:00 / 17:30 Uhr
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