TT 102: Cold Atomic Gases - Poster Session

Time: Thursday 15:00–19:00 Location: P2

TT 102.1 Thu 15:00 P2

Second order self-energy of fermions with dipolar interaction — Jan Krieg[1], •Philipp Lange[1,2], and Peter Kopietz[1,2] — [1]Institut für Theoretische Physik, Universität Frankfurt, Frankfurt am Main, Germany — [2]Department of Physics, University of Florida, Gainesville, Florida, USA

We calculate the self-energy, the quasiparticle residue and the effective mass of a two- and three-dimensional system of dipolar fermions, which are aligned by an external field, up to second order perturbation theory. The influence of the anisotropy of the dipolar interaction on these quantities is investigated as a function of the interaction strength and, for two-dimensional systems, the tilting angle between the external field and the normal of the plane of dipoles.

TT 102.2 Thu 15:00 P2

Quantum quench dynamics in the Bose-Bose resonance model — •Florian Dorfner and Fabian Heidrich-Meisner — Ludwig-Maximilian-University Munich

We study quantum quenches between the three phases of the Bose-Bose resonance model, a one-dimensional model of bosonic atoms and diatomic molecules interacting via resonant Feshbach-type interactions. The three phases are: (i) Mott insulator (MI), (ii) molecular condensate (MC) and (iii) atomic and molecular condensate (AC+MC) [1]. We are interested in the temporal evolution of optimal modes that are the eigenstates of the one-site reduced density matrix. We also investigate the distribution of weights by computing the associated von-Neumann entropy. The optimal mode spectra and weights are calculated using exact diagonalization. We find that for quenches from the AC+MC to the MC phase the optimal mode weights and spectra stay almost constant in time. For this quench, the number of particles of the two species is studied and found to be oscillating in time. This is understood by decomposing the starting state into the eigenstates of the quenched system showing that there is significant overlap with only two eigenstates. In other cases the optimal mode spectra and weights change more significantly.

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[1] S. Ejima, M. J. Bhaseen, M. Hohenadler, F. H. L. Essler, H. Fehske and B. D. Simons, PRL 106, 015303 (2011)

TT 102.3 Thu 15:00 P2

Relaxation and thermalization dynamics in the one-dimensional Bose-Hubbard-Model — •Stefan Sorg, Lode Pollet, and Fabian Heidrich-Meisner — Ludwig-Maximilians-Universität München

Motivated by experiments recently carried out with ultracold atomic gases [1], we study the relaxation and thermalization dynamics of several observables in the one-dimensional Bose-Hubbard-Model with integer filling after a global interaction quantum quench. Using exact diagonalization, we analyze the distribution of the diagonal matrix elements of several observables and the energy distribution of quench initial states in the framework of the eigenstate thermalization hypothesis, discussing its applicability in different regimes of U/J.

We acknowledge financial support through DFG FOR 801 and 1807.

[1] Ronzheimer et al., Phys. Rev. Lett. **110**, 205301 (2013)

TT 102.4 Thu 15:00 P2

Numerical calculation of spectral functions of the Bose-Hubbard model using B-DMFT — •Jaromir Panas[1,3], Anna Kauch[2], Jan Kunes[2], Dieter Vollhardt[3], and Krzysztof Byczuk[1] — [1]Institute of Theoretical Physics, Faculty of Physics, University of Warsaw, ul. Hoza 69, 00-681 Warszawa, Poland — [2]Institute of Physics, Academy of Sciences of the Czech Republic, Na Slovance 2, 18221 Praha, Czech Republic — [3]Theoretical Physics III, Center for Electronic Correlations and Magnetism, University of Augsburg, 86135 Augsburg, Germany

Spectral functions of the Bose-Hubbard model are computed within the bosonic dynamical mean field theory (B-DMFT) [1] using a continuous-time quantum Monte Carlo (CT-QMC) solver together with maximum entropy method for analytic continuation. Results are obtained for different interaction strengths and chemical potentials and are compared with approximate results from a strong coupling solution of the B-DMFT equations [2].

[1] K. Byczuk and D. Vollhardt, Phys. Rev. B 77, 235106 (2008)
[2] A. Kauch, K. Byczuk, D. Vollhardt, Phys. Rev. B 85, 205115 (2012)

TT 102.5 Thu 15:00 P2

Ferromagnetism in a two-component Bose-Hubbard model with synthetic spin-orbit coupling — Jize Zhao[1,2], •Shijie Hu[3], Jun Chang[4], Ping Zhang[1,2], and Xiaoqun Wang[5] — [1]LCP, Institute of Applied Physics and Computational Mathematics, Beijing 100088, China — [2]Beijing Computational Science Research Center, Beijing 100084, China — [3]Max-Plank Institute fuer Physik Komplexer Systeme, Dresden 01187, Germany — [4]Institute of Theoretical Physics and Kavli Institute for Theoretical Physics, CAS, Beijing 10080, China — [5]Department of Physics, Renmin University of China, Beijing 100872, China

We study the effect of the synthetic spin-orbit coupling in a two-component Bose-Hubbard model in one dimension by employing the density-matrix renormalization group method. A ferromagnetic long range order emerges in both Mott insulator and superfluid phases resulting from the spontaneous breaking of the Z_2 symmetry, when the spin-orbit coupling term becomes comparable to the hopping kinetic energy and the inter-component interaction is smaller than the intra-one. In the symmetry-broken phase, the system behaves effectively as a one-component model. The novel effects are expected to be detectable with the present realization of the synthetic spin-orbit coupling in experiments.

TT 102.6 Thu 15:00 P2

Dimensional crossover of topological insulators and cold-atom realization of gapless Mott insulators — •Peter P. Orth[1], Mathias Scheurer[1], and Stephan Rachel[2] — [1]Institute for Theory of Condensed Matter, Karlsruhe Institute of Technology (KIT), , 76131 Karlsruhe, Germany — [2]Institute for Theoretical Physics, TU Dresden, 01062 Dresden, Germany

We propose a realistic cold-atom setup which allows for a dimensional crossover from a two-dimensional quantum spin Hall insulating phase to a three-dimensional strong topological insulator phase by simply tuning the hopping between the layers. We further employ cluster slave-rotor mean-field theory to study the effect of additional Hubbard onsite interactions that give rise to various spin liquid-like phases such as gapless and semi-metallic Mott insulating states.