Q 50 Quantengase III

Zeit: Dienstag 18:00–19:00 Raum: HU Kinosaal

Q 50.1 Di 18:00 HU Kinosaal

Density wave packets of ultracold bosonic atoms in an optical lattice using adaptive t-DMRG — •Corinna Kollath[1,2], Ulrich Schollwöck[1], Jan von Delft[2], and Wilhelm Zwerger[3] — [1]Institut für theoretische Physik, RWTH Aachen — [2]Sektion Physik, LMU München — [3]Institute for Theoretical Physics, Universität Innsbruck

We investigate the propagation of density wave packets in a Bose-Hubbard model using the adaptive time-dependent density-matrix renormalization group method (adaptive t-DMRG). This is a theoretical model for the propagation of a density perturbation in ultra-cold bosons subjected to an optical lattice. We discuss the decay of the amplitude, the dependence of the velocity, in particular the sound velocity, on the background density, the interaction strength and the height of the perturbation in a quasiexact calculation. packet. By comparing the sound velocity to theoretical predictions we determine the limits of the hydrodynamical approach and of the continuum limit in describing the physics generated by the Bose-Hubbard model.

Q 50.2 Di 18:15 HU Kinosaal

Creation of effective magnetic fields in atomic gases using electromagnetically induced transparency — •Gediminas Juzeliūnas[1], Patrik Öhberg[2], Julius Ruseckas[1], and Alexander Klein[3] — [1]Vilnius University Research Institute of Theoretical Physics and Astronomy, Goštauto 12, 2600 Vilnius, Lithuania — [2]Department of Physics, University of Strathclyde, Glasgow G4 0NG, Scotland — [3]Fachbereich Physik, TU Kaiserslautern

In this work we investigate the influence of the control and probe beams of light on the mechanical properties of atomic Bose-Einstein condensates and degenerate Fermi gases. The theory is based on the explicit analysis of the quantum dynamics of cold atoms coupled to the laser beams. In particular we consider that the contol and probe fields contain orbital angular momenta and induce an electromagnetically induced transparency. This allows us to introduce an effective magnetic field which acts on the electrically neutral atoms [1]. In the case of fermions we have a typical, often regarded as an academic, textbook scenario with free electrons moving in a constant magnetic field. This opens up a possibility to study phenomena well known from solid state and condensed matter physics, with all the benefits given by the trapped atoms where a range of experimental parameters such as atom-atom interactions, particle numbers, the shape of the trapping potential etc. can easily be manipulated. In addition, using light as the effective magnetic field is going to be favourable since it is rather difficult to control real magnetic fields.

[1] G. Juzeliunas and P. Ohberg, Phys. Rev. Lett. 93, 033602 (2004).

Q 50.3 Di 18:30 HU Kinosaal

Non-perturbative quantum field theory of far-from-equilibrium dynamics of atomic Bose gases — •Thomas Gasenzer, Jürgen Berges, Michael Schmidt, and Marcos Seco — Institut für Theoretische Physik, Universität Heidelberg, Philosophenweg 16, 69120 Heidelberg, Germany

We develop a non-perturbative dynamical quantum field theory for Bose-Einstein condensates which goes beyond the Hartree-Fock-Bogoliubov approximation. The theory is based on action functional techniques, specifically on a 1/N expansion of the Two-Particle-Irreducible Effective Action. It has recently been shown that such approximation methods which correspond to a resummation of graphs to all orders in the coupling constant allow to describe the long-time dynamics including thermalization of strongly interacting many-body systems. We derive the dynamic equations for the mean field and the 2-point correlation functions and examine their long-time validity for systems far from equilibrium by comparing their solution with results from exact calculations.

Q 50.4 Di 18:45 HU Kinosaal

RF-Spektroskopie eines ^{6}Li-Quantengases im BEC-BCS-Crossover-Regime — •Alexander Altmeyer[1], Stefan Riedl[1], Reece Geursen[1], Markus Bartenstein[1], Selim Jochim[1], Johannes Hecker Denschlag[1], Cheng Chin[1] und Rudolf Grimm[1,2] — [1]Institut für Experimentalphysik, Universität Innsbruck, Technikerstraße 25, 6020 Innsbruck, Österreich — [2]Institut für Quantenoptik und Quanteninformation, Österreichische Akademie der Wissenschaften, 6020 Innsbruck, Österreich

Wir untersuchen ein ultrakaltes Gas von ^{6}Li-Atomen im BEC-BCS-Crossover-Regime. Eine Feshbach-Resonanz ermöglicht hierbei den Übergang zwischen einem BEC von $^6Li_2$-Molekülen [1] und einem stark wechselwirkenden fermionischen Gas von ^{6}Li-Atomen. Dabei untersuchen wir die Eigenschaften der entstehenden Paare mit Hilfe von RF-Spektroskopie [2]. Wir konnten die Existenz einer Anregungslücke im Bereich des stark wechselwirkenden Fermi-Gases oberhalb der Resonanz zeigen und damit ein weiteres Indiz für das Vorliegen von Superfluidität liefern. Außerdem erlauben jüngste Messungen mit RF-Übergängen die präzise Ermittlung der Position der Feshbach-Resonanz auf 834,1 (1,5) G [3]. Die genaue Positionierung der Feshbach-Resonanz ermöglicht die Untersuchungen der Streueigenschaften ultrakalter ^{6}Li-Gase in bisher unerreichter Qualität.

[1] S. Jochim et al., Science 302, 2103 (2003); 10.1126/science.1093280
[2] C. Chin et al., Science 305, 1128 (2004); 10.1126/science.1100818
[3] M. Bartenstein et al. cond-mat/0408673