Q 41 Quantengase II

Zeit: Dienstag 15:00–16:00 Raum: HU Kinosaal

Q 41.1 Di 15:00 HU Kinosaal

Transport of Bose-Einstein condensates through disorderd potentials — •Tobias Paul[1], Peter Schlagheck[1], Patricio Leboeuf[2], and Nicolas Pavloff[2] — [1]Institut für theoretische Physik, Universität Regensburg, Germany — [2]Laboratoire de Physique Théorique et Modèles Statistiques, Université Paris Sud, France

Recent atom-chip experiments have revealed that the surface roughness in the chip wires induces significant disorder in the magnetic potential, which may lead to the fragmentation of the condensate [1,2]. This raises the question how disorder influences the transport of Bose-Einstein condensates through mesoscopic waveguides. We investigate this problem by a time-dependent wave packet propagation approach as well as by calculating stationary scattering states in presence of a disordered potential. The scaling of the transmission with the atom-atom interaction strength as well as with the spatial length of the disorderd region is discussed. Furthermore we investigate how a weak disorder in the waveguide affects the resonant transport of a Bose-Einstein condensate through a symmetric double barrier potential [3].

[1] J.Fortágh et al., Phys. Rev. A **66**, 041604(R) (2003)
[2] T.Schumm et al., physics/0407094 (2004)
[3] T. Paul, K. Richter and P. Schlagheck, cond-mat/0407488 (2004)

Q 41.2 Di 15:15 HU Kinosaal

Dynamik des Mott-Isolator-Übergangs — •T. Gericke, A. Widera, S. Fölling, F. Gerbier, O. Mandel und I. Bloch — Johannes Gutenberg-Universität Mainz

Ultrakalte Atome in optischen Gittern haben einen neuen Zugang zu interessanten Fragestellungen der Vielteilchenphysik eröffnet. So wurde es möglich, den Mott-Isolator (MI) Phasenübergang in einem dreidimensionalen optischen Gitter zu realisieren [1].

Ausgehend von ^{87}Rb Atomen in einem Bose-Einstein-Kondensat, erreicht man das Mott-Isolator-Regime durch Erhöhen der Intensität des optischen Potentials. Bei diesem Phasenübergang geht die makroskopische Phasenkohärenz des Systems verloren. Ausgehend von einem MI-Zustand, ist man in der Lage durch eine Verminderung der Gitterintensität, diese Phasenkohärenz zurück zu gewinnen.

Wir untersuchen die Wiederherstellung der Phasenkohärenz in Abhängigkeit von Form und Zeitskalen der Intensitätsrampen des Gitterpotentials. Hieraus lassen sich Rückschlüsse auf die zu Grunde liegenden Dynamik des Quantenphasenüberganges ziehen [2]. Die Messungen können mit neuen theoretischen Rechnungen verglichen werden.

[1] M. Greiner, O. Mandel, T. Esslinger, T.W. Hänsch und I.Bloch, Nature, **415**(6867): p. 39, (2002)
[2] S.R. Clark und D.Jaksch, Phys. Rev. A **70**, 043612 (2004)

Q 41.3 Di 15:30 HU Kinosaal

Time evolution of a freely falling BEC — •Gerrit Nandi, Reinhold Walser, and Wolfgang P. Schleich — Abteilung für Quantenphysik, Universität Ulm, Germany

A freely falling Bose-Einstein condensate (BEC) provides a novel experimental configuration for fundamentally new studies of the nature of the BEC order parameter. Such microgravity experiments can be realized in drop towers or space. We study freely falling degenerate bosons or fermions, confined in a time-dependent harmonic trap, with two internal states in the co-rotating frame of the earth. It is possible to eliminate all non-inertial forces via a transformation to a non-rotating freely-falling frame [1-3]. In this context, we investigate a superfluid vortex in a macroscopic superposition with a non-rotating ground state, prepared in two distinguishable internal states of a BEC. This configuration acts as a quantum gyroscope [4] and can be used for high-precision measurements.

[1] J. F. Dobson, Phys. Rev. Lett. **73**, 2244 (1994).
[2] I. Bialynicki-Birula, and Z. Bialynicka-Birula, Phys. Rev. A **65**, 063606 (2002).
[3] G. Nandi, R. Walser, and W. P. Schleich, in preparation.
[4] S. Stringari, Phys. Rev. Lett. **86**, 4725 (2001).

Q 41.4 Di 15:45 HU Kinosaal

Production of a single 2-D condensate from an array of BECs in an optical lattice — •Sabine Stock, Baptiste Battelier, Zoran Hadzibabic, and Jean Dalibard — Laboratoire Kastler Brossel, ENS, 24 rue Lhomond, 75005 Paris, France

I will discuss our studies of an array of two-dimensional ^{87}Rb Bose-Einstein condensates, created in a one-dimensional optical lattice with a lattice period of several micrometers. This configuration allows us to load up to 10^4 atoms into each potential well and to completely isolate the BECs from each other. The potential wells can also be made steep enough, so that every well contains a 2-dimensional cloud. When studying matter wave interference in this system, we observed high-contrast interference between 30 condensates with uncorrelated phases[1]. These observations are quantitatively explained with a simple theoretical model which generalizes the analysis of the interference of two independent condensates.

It is also possible to separate a single two-dimensional condensate from this configuration by applying a magnetic field gradient to the lattice. I will present first results achieved by this setup.

[1] Z. Hadzibabic et al, PRL 93, 180403 (2004).