DY 17 Superfluidity and Bose-Einstein-Condensation

Time: Monday 17:15–18:00 Room: SCH 251

DY 17.1 Mon 17:15 SCH 251

Bose-Einstein Condensate in Trapped Systems from a Canonical Point of View — •Konstantin Glaum[1], Hagen Kleinert[1], and Axel Pelster[2] — [1]Fachbereich Physik, Freie Universität Berlin, Arnimallee 14, 14195 Berlin, Germany — [2]Fachbereich Physik, Universität Duisburg-Essen, Universitätsstraße 5, 45117 Essen, Germany

We develop a perturbative path integral approach for calculating a recursion relation for the partition function of a fixed number N of weakly interacting bosons in different trap configurations. After performing a chain resummation of the perturbative result, we discuss how a two-particle δ-interaction influences the behaviour of the thermodynamic quantities near the quasi-critical point. Furthermore, we show that the heat capacity and the number of particles in the ground state, which defines the quasi-condensate, approach their thermodynamic limits uniformly for all temperatures.

DY 17.2 Mon 17:30 SCH 251

Emergence of superfluidity in the dynamics of a Bose-Einstein condensate in a parabolic lattice — •Joachim Brand[1] and Andrey Kolovsky[1,2] — [1]Max-Planck-Institut für Physik komplexer Systeme, D-01187 Dresden, Germany — [2]Kirensky Institute of Physics, 660036 Krasnoyarsk, Russia

The dynamics of a Bose-Einstein condensate is studied in a combined periodic plus harmonic external potential. The emergence and breakdown of superfluid transport in this system is analysed from a nonlinear-dynamics point of view. Unexpected regimes of stable collective dipole and Bloch oscillations are identified and explained in terms of quantum mechanical and classical pendulum models[1]. The theoretical analysis is supported by full numerical solutions of the discrete and continuous nonlinear Schrödinger equation.

[1] J. Brand and A. R. Kolovsky. E-print cond-mat/0412549

DY 17.3 Mon 17:45 SCH 251

Parametric Bose-Hubbard Hamiltonians and Structural Analysis of Eigenstates in the Chaotic Regime — •Moritz Hiller[1,2], Tsampikos Kottos[1,3], and Theo Geisel[1,2] — [1]Max-Planck-Institut für Dynamik und Selbstorganisation, Bunsenstraße 10, D-37073 Göttingen, Germany — [2]Fakultät für Physik, Universität Göttingen, Friedrich-Hund-Platz 1, D-37077 Göttingen, Germany — [3]Department of Physics, Wesleyan University, Middletown, CT-06459, USA

We consider a family of chaotic Bose-Hubbard Hamiltonians (BHH) parameterized by the coupling strength k between neighboring sites. As k increases, the eigenstates undergo changes which are reflected in the structure of the Local Density of States. We analyze these changes both numerically and analytically, using perturbative and semiclassical methods. The outcome of our studies is relevant to a vast number of experimental realizations of Bose-Hubbard Hamiltonians, like condensate systems in optical lattices and atom lasers.