MP 5: Klassische Feldtheorie und Statistische Mechanik

Time: Tuesday 17:15–18:15 Location: SPA SR125

MP 5.1 Tue 17:15 SPA SR125

Thermal fluctuations and correlations in the Bose-Hubbard model — •Patrick Navez[1], Konstantin Queisser[2], Konstantin Krutitstky[1], and Ralf Schützhold[1] — [1]Universtät Duisburg-Essen, Lotharstrasse 1, 47057 Duisburg, Germany — [2]The University of British Columbia, 6224 Agricultural Road, Vancouver, BC V6T 1Z1, Canada

For the example of the Bose-Hubbard model in the (formal) limit of large coordination numbers Z, we calculate properties of the thermal state via an expansion into powers of $1/Z$. This method provides the thermal energy, the on-site reduced density matrix containing the thermal fluctuations as well as the thermal correlations between two lattice sites. Furthermore, it yields the thermal eigen-frequencies of the system and gives the phase boundary between the Mott and the superfluid state at finite temperature. Employing the hierarchy of correlations [1,2,3], these results provide the correct thermal initial state for a quantum quench of the Bose-Hubbard model.

Ref: [1] *Emergence of coherence in the Mott-superfluid quench of the Bose-Hubbard model*, P. Navez, R. Schützhold, Phys. Rev. A, **82** 063603 (2010); [2] *Quasi-particle approach for general lattice Hamiltonians*, P. Navez, F. Queisser, R. Schützhold, `arXiv:1303.4112`; [3] *Equilibration versus (pre) thermalization in the Bose and Fermi Hubbard models*, F. Queisser, K. Krutitsky, P. Navez, R. Schützhold, `arXiv:1311.2212`.

MP 5.2 Tue 17:35 SPA SR125

Isospinning hopfions and baby Skyrmions — •Yakov Shnir — BLTP JINR, Dubna, Russia — Institute of Physics, Carl von Ossietzky University Oldenburg, Germany

The problem of constructing internally rotating solitons of fixed angular frequency ω in the Faddeev-Skyrme model and in the planar baby Skyrme model is reformulated as a variational problem for an energy-like functional, called pseudoenergy, which depends parametrically on ω. This problem is solved numerically using a gradient descent method, without imposing any spatial symmetries on the solitons, and the dependence of the solitons' energy on ω, and on their conserved total isospin J, studied. We investigated patterns of the critical behavior of the solitons, and two different types of the soliton instability are discussed. A simple elastic rod model of time-dependent hopfions is developed which, despite having only one free parameter, accounts well for most of the numerical results.

MP 5.3 Tue 17:55 SPA SR125

Plane waves as tractor beams — Péter Forgács[1,2], •Árpád Lukács[1], and Tomasz Romanczukiewicz[3] — [1]Wigner RCP RMKI, Budapest, Hungary — [2]LMPT, Université de Tours, France — [3]Jagiellonian University, Krakow, Poland

It is shown that in a large class of systems plane waves act as *tractor beams*: i.e., an incident plane wave can exert a *pulling* force on the scatterer. The underlying physical mechanism for the pulling force is due to the sufficiently strong scattering of the incoming wave into another mode carrying more momentum, in which case *excess momentum* is created *behind* the scatterer. This *tractor beam* or *negative radiation pressure* (NRP) effect is found to be generic in systems with multiple scattering channels. In a birefringent medium electromagnetic plane waves incident on a thin plate exert NRP of the same order of magnitude as optical radiation pressure, while in artificial dielectrics (metamaterials) the magnitude of NRP can be even macroscopic. In two dimensions we study various scattering situations on vortices, and NRP is shown to occur by the scattering of heavy baryons into light leptons off cosmic strings, thereby reducing the friction acting on cosmic strings moving in a surrounding plasma of particles (the dominant energy loss mechanism for cosmic strings in the friction era). It is shown, that the famous enhancement of the small angle cross section for cosmic strings is another manifestation of this phenomenon, and that this enhancement also occurs for neutron scattering off vortices in the XY model.