Seminar

Dominic Meiser
(University of Arizona)

Characterization of the coherence of ultra-cold atoms with nonlinear matter-wave optics methods

Rapid progress in the cooling and trapping of atoms over the last two decades has enabled experimentalists to reach the ultra-cold regime. In this regime the wave nature of the atoms becomes apparent and quantum statistical effects are important. Recent examples include Bose-Einstein condensation, super-fluid Fermi systems, coherently coupled atom-molecule systems, ultra-cold atoms in optical lattices, etc. Coherence properties are important both for understanding the fundamental properties of these systems as well as for their potential applications such as in matter-wave interferometers. Coherence of quantum fields has been studied in quantum optics for a long time and many powerful experimental and theoretical techniques have been developed. In this talk I show how several of these methods can be adapted to the problem of characterization of the coherence of ultra-cold atomic systems. Specifically, I consider the XFROG method that has first been developed for the phase reconstruction of ultra-short laser pulses and I show how it can be adapted to the phase reconstruction for matter waves. Secondly, exploiting the formal analogies between the coherent formation of molecules and optical second harmonic generation, I show how the formation of molecules can be used to measure second order correlations of atomic systems. I apply this method to the problem of detecting the super-fluid order parameter in a fermionic system.

Wann? Donnerstag 27.07.2006, 13:00 Uhr

Wo? Universität Stuttgart, Raum 4.331