FR PHYSIK

UNIVERSITÄT DES SAARLANDES

Naturwissen-schaftlich-Technische Fakultät

PHYSIKALISCHES KOLLOQUIUM

Prof. Peter Schlagheck

University of Liège, Belgium

"Quantum chaos and quantum interference with ultracold bosonic atoms"

Thursday, January 16th, 2020, 4:15 p.m.
Building C6 4, Lecture Hall II

Ultracold bosonic atoms in optical lattices are among the most versatile experimental platforms for performing quantum simulations of interacting many-body physics. They are particularly suited in order to explore dynamical manifestations of many-body quantum chaos, i.e. the quantum properties of many-body systems whose classical counterparts exhibits chaotic dynamics. Key experimental studies in this context mainly focused on thermalization and localization phenomena through time evolution processes following a quench. While those phenomena admit to a large extent a classical understanding in terms of the dynamics of the underlying classical bosonic field theory, quantum tunneling and interference effects beyond this classical correspondence can nevertheless play a significant role.
In my talk, I will specifically focus on the manifestation of many-body quantum interference in the time evolution of ultracold bosonic atoms. I shall argue that the phenomenon of coherent backscattering in Fock space can give rise to an appreciable deviation from quantum ergodicity in finite optical lattices that feature microscopically small populations [1]. I will furthermore show that mesoscopically populated Bose-Einstein condensates in such lattices exhibit significant enhancements of their return probability to their initial state as compared to a classical prediction. Those enhancements arise due to quantum interference effects that are induced by discrete symmetries as well as by dynamical localization phenomena [2].

[1] T. Engl et al., Phys. Rev. Lett. 112, 140403 (2014).
[2] P. Schlagheck et al., Phys. Rev. Lett. 123, 215302 (2019).

Gregor Jung (64848) and Giovanna Morigi (57472) take care of the guest.

Interested people are cordially invited

Coffee at 4:00 p.m. in front of the Lecture Hall