LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN | ARNOLD SOMMERFELD CENTER FOR THEORETICAL PHYSICS

Sommerfeld Theory Colloquium

Dr. Stephan Langer

Pittsburgh University, USA

ASC-PhD-Colloquium:

Transport and real-time dynamics in ultra-cold atomic gases in optical lattices

We investigate the expansion of densities in homogeneous lattice models after a sudden quench using exact numerical methods.This setup has been realized in current experiments using ultra-cold atomic gases in optical lattices and has been shown to give useful insights into the transport properties of the underlying microscopic model. First, we consider one-dimensional trapped Mott insulating ground states and find they expand with a characteristic expansion velocity independent of particle statistics and of the interaction strength. Furthermore, this type of non-equilibrium dynamics and in particular the expansion velocity is sensitive to examples of both, interaction driven quantum phase transition and density driven quantum phase transitions.Second we analyze the expansion of excited states readily available to state of the art experiments in the same framework.For bosons, these results are directly compared to the results from a recent experiment on the expansion of initially localized ultracold bosons in homogeneous one- and two-dimensional optical lattices *[PRL 110, 205301 (2013)]*, with qualitative agreement regarding the extracted velocities. In addition, we study the effect of integrability breaking by replacing the one-dimensional chain by a two-leg ladder. The observed change in dynamics bares similarities with the dynamics in the dimensional crossover from one to two dimensions observed in the experimental study. Finally we cover excited states of two-component Fermi gases and give an overview of similar studies on quantum magnets.

Wednesday, 28 May 2014, 16:15h, Room A348/349, Theresienstr. 37/III

Prof. U. Schollwöck