UNIVERSITÄT BONN

Bethe Colloquium

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Unconventional dynamics of ultracold bosons in optical lattices

Atomic gases cooled to Nanokelvin temperatures are a new exciting tool to study a broad range of quantum phenomena. In particular, an outstanding degree of control over the fundamental parameters, such as interaction strength, spin composition, or dimensionality has been achieved. This has facilitated access to strongly correlated quantum many body physics in exceptionally clean samples. For example, artificial periodic structures for the atomic gas can be created using laser light to mimic condensed matter systems. Further, the outstanding tunability of cold gases allows to rapidly change the system parameters or to induce a coupling to an environment and to observe the subsequent quantum evolution. This ability poses new challenges for the understanding of quantum dynamics in correlated many-body systems. I will report on recent progress on investigating bosonic gases in optical lattices coupled to dissipative light fields described by Markovian Master equations. In particular, we point out different dynamical regimes: The first one is an algebraic decay of correlations which is followed by a stretched exponential decay. We analyze the origin of this unconventional dynamics. The algebraic behavior is related to the continuum spectrum of the bosonic gas and we develop a classical diffusion equation description for the dynamics. In contrast, the stretched exponential dynamics can be traced back to the existence of rare states with increasingly long time scales.

Lecture Hall 1 - Physikalisches Institut - Nussallee 12 - 53115 Bonn

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