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**Fermionic and Bosonic transport in homogeneous optical lattices**

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Out-of-equilibrium dynamics of interacting quantum systems present one of the hardest problems in many-body theory, harder than predicting static properties such as e.g. the nature of their ground states. At the same time, transport properties are among the defining characteristics of many important phases in condensed-matter physics, the most prominent example being the electrical conductivity, which, for example, allows one to distinguish normal conductors from insulators or superconductors. Ultracold atoms in optical lattices offer the possibility to study transport and out-of-equilibrium phenomena in a clean and well-controlled environment and can therefore act as a quantum simulator for condensed-matter systems. In this talk I will discuss our experimental studies on the expansion of initially confined quantum gases of either fermionic [1] or bosonic [2] atoms in the lowest band of a homogeneous optical lattice in various dimensions. For non-interacting atoms, we always observe ballistic transport, independent of the dimension. In two dimensions, already small interactions dramatically reduce the observed expansion velocity and give rise to almost bimodal density distributions containing a diffusive core. These dynamics are independent of the sign of the interaction, revealing a novel dynamic symmetry of the Hubbard model [1]. In the bosonic case, dimensionality has a crucial influence, since, in contrast to higher dimensions, one-dimensional bosonic systems expand ballistically also in the strongly interacting hard-core limit. Individually controlling the lattice depths along two directions has allowed us to observe a gradual crossover from ballistic to diffusive expansions in the hard-core limit [2].

[1] U. Schneider et al., Nature Physics 8, 213 (2012)
[2] J.P. Ronzheimer et al., ArXiv:1301.5329