SFB/TRR 21 - Colloquium

20. December 2013, Stuttgart


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## Quench dynamics in strongly correlated Bose-Hubbard chains

Ultracold atoms are an ideal setting to study non-equilibrium quantum many-body dynamics in a very controlled way. I will present a series of experiments in the context of strongly correlated atomic bosons in one-dimensional geometry. Specifically, we study the dynamics of one-dimensional chains after a sudden quench of the system's Hamiltonian, for which we independently control J, the (coherent) tunneling rate, U, the strength of the interaction, and E, a tilt along the longitudinal direction of the chains. For a quench to U≈E we couple to nearest neighbors collectively and observe characteristic oscillations in the number of double occupancies that we analyze in the many-body context [1]. For U/2≈E, U/3≈E etc. we observe collective long-range tunneling to next-nearest neighbors and beyond. In particular, for U/3≈E we observe dynamics due to the higher-order super-exchange interaction scaling as J^3/U^2 [2]. For J≈U<<E we observe interaction-induced quantum phase revivals, and for J≈U≈E we find evidence for the transition to the quantum chaotic regime [3].


[1] Many-body quantum quench in an atomic one-dimensional Ising chain, F. Meinert et al., Phys. Rev. Lett. 111, 053003 (2013)

[2] Observation of many-body long-range tunneling after a quantum quench, F. Meinert et al., submitted, preprint at arXiv:1312.2758 (2013).

[3] Interaction-induced quantum phase revivals and evidence for the transition to the quantum chaotic regime in 1D atomic Bloch oscillations, F. Meinert et al., submitted, preprint at arXiv:1309.4045 (2013).


**20. December 2013, 14:00 Uhr**

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