SFB/TRR 21 - Seminar

4. Juni 2012, Stuttgart

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Interacting bosons in 1D lattices: statics and dynamics of topological insulating phases

We accurately study the ground-state phase diagram of the one-dimensional extended Bose Hubbard model with on-site and nearest-neighbor interactions, at integer filling. Besides conventional superfluid, Mott insulating and density-wave phases, the presence of extended interactions is able to stabilize a peculiar gapped phase, also named Haldane phase, which displays long-range string ordering. In the second part of the talk we discuss some dynamical properties involving the topological phase. By opening a gap between the Mott insulator and the Haldane phase, we can encircle the quantum phase transition point adiabatically and show that this enables dissipationless transport of exactly one boson across the ring, as originally predicted by Thouless. Finally we address the effects of a quenched dynamics involving the Haldane phase. Our results have been obtained by means of the density matrix renormalization group technique.

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