Quantized pumping and topological Bose insulators

Ehud Altman
(Weizmann Institute)

Tue Jul 12 16:00 2011
(Hörsaal II)

Abstract

Spinless bosons in a one dimensional chain at integer filling can form two gapped phases, the Mott and Haldane insulators, which do not break any obvious symmetry. I will argue that the distinction between the two phases is protected by lattice inversion symmetry. Breaking this symmetry gaps out the transition and leaves the critical point as an isolated gapless point in the two-parameter space of the original tuning parameter and the symmetry breaking perturbation. I will show that encircling this point adiabatically entails pumping of exactly one boson across the Bose insulator. When multiple chains are coupled, the two insulating phases are no longer sharply distinct, but the pumping property survives and allows to associate a topological flux with gapless regions in the phase diagram. This leads to strict constraints on the topology of the phase diagram of systems of quasi-one dimensional interacting bosons. Finally I will use the pumping property to elucidate the topological invariant underlying the Haldane phase and to discuss possible extensions to interacting topological phases in higher dimensions.