Quantum phase transitions in 1D systems

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Abstract

Phase transitions can occur in quantum systems even at a temperature of absolute zero. Unlike in thermodynamics, those quantum phase transitions are not driven by thermal fluctuations but by quantum fluctuations and connect two ground states of the system. A well known example in a deep lattice potential is the Mott-Hubbard quantum phase transition from a weekly interacting superfluid to a Mott insulating phase. However, for a strongly-interacting quantum system confined to one-dimensional geometry a novel type of quantum phase transition may be induced by adding an arbitrarily weak optical lattice potential commensurate with the atomic granularity [1]. We observe this so called commensurate-incommensurate quantum phase transition for a one-dimensional quantum gas of bosonic cesium atoms with tunable interactions, connecting the phases of a Tonks-Girardeau gas and a Mott-insulator.

Keywords: Bose-Hubbard, sine-Gordon, Mott-insulator, Tonks-Girardeau gas, 1D,

References

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