Stony Brook University
The Graduate School

Doctoral Defense Announcement

Abstract

Entanglement in Low Dimensional Theories

By

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In the ground state of gapped systems, the entanglement entropy of a subsystem A scales with the length of the boundary of A. This observation suggest that the entanglement properties of the subsystem can be described in terms of degrees of freedom living in the boundary of A. We will discuss the the connection between entanglement properties and effective boundary descriptions in spin systems in one and two dimensions.

In one dimension we present analytic results for the spin S=1, Affleck-Kennedy-Lieb-Tasaki (AKLT) ground state entanglement, characterized by negativity and entanglement spectrum. We also discuss a generalization of the AKLT model, based on the quantum group $U_q(sl(2))$ for general integer spin S. In two dimensions, we study two spin systems whose ground state can be written in terms of tensor product states of bond dimension two, the AKLT model in the hexagonal lattice and the Ising projected entangled pair state (Ising PEPS) in the square lattice. We show how the reduced density matrix of a partition is associated with a thermal state of a one dimensional model along the boundary of that partition. We also present arguments supporting this correspondence for arbitrary gapped systems. Finally we discuss the behavior of this boundary theories when the original two dimensional model is tuned through a quantum phase transition.

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