

# Quantum phase transitions and order parameters of a topological insulator

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## Abstract

Using quantum entanglement, quantum coherence, and the reduced density matrix, we study the quantum phase transitions and propose order parameters for the phases of a topological insulator, specifically a spinless Su-Schrieffer-Heeger (SSH) model, and consider the effect of short-range interactions. All the derived order parameters and their possible corresponding quantum phases are verified by the entanglement entropy and electronic configuration analysis results. The order parameter appropriate to the topological regions is further proved by calculating the Berry phase under twisted boundary conditions. It is found that the topological nontrivial phase is robust to the introduction of repulsive intersite interactions and can appear in the topological trivial parameter region when appropriate interactions are added.

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