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Detecting symmetry protected topological states by generalized correlation YIZHUANG YOU, ALEX RASMUSSEN, ZHEN BI, CENKE XU, University of California, Santa Barbara — The symmetry protected topological (SPT) states has attracted much research attention recently. They classify a large family of disordered gapped quantum states that have non-trivial topological twist in their wave functions. Examples include topological insulators and the Haldane spin-1 chain. To better understand the physical properties of the SPT states, we focus on their many-body wave functions. We propose a simply way to distinguish the SPT state from the trivial state by studying the behavior of a generalized static bulk correlation function. We show that for 2D SPT states, the generalized correlation function will exhibit a long-range or quasi-long-range behavior, distinct from the short-range behavior for trivial states. This quasi-long-range behavior in the bulk is closely related to the symmetry protected gapless edge modes on the boundary of SPT state. The effective theory for the gapless edge can be described by the conformal field theory (CFT), whose central charge may be extracted from the scaling behavior of the entanglement entropy, which can be given by the wave function overlap on a double torus. We demonstrate our proposal with lattice models for both the fermion and the boson SPT states.

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