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Symmetry-Protected Topological Entanglement IMAN MARVIAN, University of Southern California — We propose an order parameter for the Symmetry-Protected Topological (SPT) phases which are protected under an Abelian on-site symmetry. This order parameter, called the SPT entanglement, is defined as the entanglement between A and B, two distant regions of the system, given that the total charge (associated with the symmetry) in a third region C is measured and known, where C is a connected region surrounded by A and B and the boundaries of the system. In the case of 1-dimensional systems we prove that at the limit where A and B are large and far from each other compared to the correlation length, the SPT entanglement remains constant throughout a SPT phase, and furthermore, it is zero for the trivial phase while it is nonzero for all the non- trivial phases. Moreover, we show that the SPT entanglement is invariant under the low-depth local quantum circuits which respect the symmetry, suggesting that the SPT entanglement remains constant throughout a SPT phase in the higher dimensions as well. Finally, based on the concept of SPT-Ent, we propose a new interpretation of string order parameters and also an algorithm for extracting the relevant information about the SPT phase from them.

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