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## *Matrix product operator symmetries in topological phases of matter*

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Abstract:

Symmetry has played an essential role in the development of modern physics, from the theories of special and general relativity, to quantum mechanics, field theory and the standard model. Topological invariance is a very strong symmetry that underpins a profound understanding of emergent phenomena in condensed matter systems, such as the quantum Hall effect, that are remarkably robust to perturbation and impurity. In this thesis, we develop a theoretical framework that accommodates both global and topological symmetries of tensor network states and facilitates the extraction of universal physical data to classify the emergent phases of matter. For critical spin chains in one dimension, we decompose their emergent conformal field theories into topological sectors. For two dimensional topological phases enriched by global symmetry, we calculate the action of the global symmetry on the topological sectors. Finally, in three dimensions, we construct and study novel topological spin models.