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Numerical detection of symmetry enriched topological phases with space group symmetry[1] LING WANG, ANDREW ESSIN, California Institute of Technology, MICHAEL HERMELE, University of Colorado at Boulder, OLEXEI MOTRUNICH, California Institute of Technology — Topologically ordered phases of matter, in particular so-called symmetry enriched topological (SET) phases, can exhibit quantum number fractionalization in the presence of global symmetry. In Z_2 topologically ordered states in two dimensions, fundamental translations T_x and T_y acting on anyons can either commute or anticommute. This property, crystal momentum fractionalization, can be seen in a periodicity of the excited-state spectrum in the Brillouin zone. We present a numerical method to detect the presence of this form of symmetry enrichment given a projected entangled pair state (PEPS); we study the minima of spectrum of correlation lengths of the transfer matrix for a cylinder. As a benchmark, we demonstrate our method using a modified toric code model with perturbation. An enhanced periodicity in momentum clearly reveals the nontrivial anticommutation relation $\{T_x, T_y\} = 0$ for the corresponding quasiparticles in the system.

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