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Diagnosis of Interaction-driven Topological Phase via Exact Diagonalization[1] CHEN FANG, Institute of Physics, Chinese Academy of Sciences, HANQING WU, University of California at Northridge, YUANYAO HE, Renmin University, ZI YANG MENG, Institute of Physics, Chinese Academy of Sciences, ZHONGYI LU, Renmin University — We propose a general scheme for diagnosing interaction-driven topological phases in weak interaction regime using exact diagonalization (ED). The scheme comprises the analysis of eigenvalues of the point-group operators for the many-body eigenstates and the correlation functions for physical observables to extract the symmetries of the order parameters and the topological numbers of the underlying ground states at the thermodynamic limit from a relatively small size system afforded by ED. As a concrete example, we investigate the interaction effects on the half-filled spinless fermions on the checkerboard lattice with a quadratic band crossing point. Numerical results support the existence of a spontaneous quantum anomalous Hall phase purely driven by a nearest-neighbor weak repulsive interaction, separated from a nematic Mott insulator phase at strong repulsive interaction by a first-order phase transition.

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