Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Wilson-loop Classification of Inversion-Symmetric Topological Insulators and the $\mathbf{Z}_2$ Crystalline Topological Insulator A. ALEXANDRADINATA, Department of Physics, Princeton University, XI DAI, Beijing National Laboratory for Condensed Matter Physics and Institute of Physics, Chinese Academy of Sciences, B. ANDREI BERNEVIG, Department of Physics, Princeton University — In the context of translationally-invariant insulators, Wilson loops describe the adiabatic evolution of the ground state around a closed circuit in the Brillouin zone. We propose that the Wilson-loop eigenspectrum provides a complete characterization of (a) the inversion-symmetric topological insulator, and (b) the $\mathbf{Z}_2$ crystalline topological insulator: time-reversal symmetric insulators with either C_4 or C_6 rotational symmetry, but with no spin-orbit coupling. For the 1D inversion-symmetric insulator, we formulate a $\mathbf{Z}$ Wilson-loop index, which is identifiable with the number of protected boundary modes in the entanglement spectrum. For the 2D inversion-symmetric insulator, we identify a $\mathbf{Z}$ relative-winding number, which is the inversion-analog of the first Chern class (for charge-conserving insulators). For the $\mathbf{Z}_2$ crystalline topological insulator, we show how the $\mathbf{Z}_2$ invariant can be extracted from the Wilson-loop eigenspectrum; this aids the identification of materials that realize this phase.

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Date submitted: 11 Nov 2012 Electronic form version 1.4