Entanglement Spectrum Classification of Disordered Class AII Symplectic Systems

MATTHEW GILBERT, TAYLOR HUGHES, University of Illinois at Urbana-Champaign, ANDREI BERNEVIG, Princeton University — Of the available classes of random matrices which have been shown to contain topologically non-trivial properties, one of the most intriguing is class AII, which is characterized by a system that possesses time-reversal symmetry. This class of random matrices has been the subject of significant attention as it encompasses $\mathbb{Z}_2$ topological systems of which the quantum spin Hall (QSH) state is a member. We calculate the entanglement spectrum for disordered class AII symplectic systems in two-dimensions as a function of disorder strength, chemical potential, and bulk inversion asymmetry. We show that there is a one to one correspondence between the full system Hamiltonian and that of the entanglement spectrum not only in terms of level statistics but also in terms of the scaling of the inverse participation ratios. We also use the properties of the entanglement spectrum to illustrate the nature of the symplectic metal phase which appears when inversion symmetry is broken.

1 MJG is supported by the AFOSR under grant FA9550-10-1-0459

Matthew Gilbert
University of Illinois at Urbana-Champaign

Date submitted: 11 Nov 2011

Electronic form version 1.4