Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Topological Invariants for Disordered Systems: Analysis and Computation JUNTAO SONG, EMIL PRODAN, Yeshiva University — Non-Commutative Geometry enables one to formulate topological invariants for aperiodic systems, in particular, for Disordered Topological Insulator from different symmetry classes with or without magnetic fields. Examples of such invariants, to be discussed in this talk, are the non-commutative Chern numbers, non-commutative winding numbers, electric polarization of systems from certain symmetry classes and the magneto-electric response of strong topological insulators. We show that these non-commutative formulas provide the basis for some of the most efficient and accurate algorithms for computing topological invariants in the presence of strong disorder. Using explicit calculations, we demonstrated that, in many instances, we obtain quantization of the invariants with machine precision, even when the Fermi level is in dense localized spectrum (i.e. not in spectral gap). Phase diagrams computed with these algorithms will be presented, for models from various symmetry classes. Acknowledgement: This research was supported from U.S. NSF grants DMS-1066045, DMR-1056168 and DMS-1160962 and NSFC grant 11204065 and RFDPHEC grant. A2013205168.

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Date submitted: 15 Nov 2013 Electronic form version 1.4