Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

An edge index for topological insulators[1] EMIL PRODAN, Yeshiva University — Topological insulators display dissipationless currents flowing at the edges of the samples. These currents are associated to chiral edge modes, whose existence is intrinsically linked to the topology of the electronic states of the bulk. The edge modes can be easily investigated when the edges are smooth and have a periodicity, but as soon as the periodicity is absent, the problem becomes untraceable by purely theoretical means. In my talk I will exemplify the use of non-commutative calculus to explore the properties, especially the stability of the edge modes. For example, using such techniques one can give a fairly elementary proof that the edge modes in Chern insulators survive even for a rough (random) edge. Similarly, for the Spin-Hall effect, one can define an observable and its associated current whose conductance remains quantized during various deformations of the Hamiltonian system. It turns out that in all cases, the edge conductance is given by the index of a Fredholm operator, which provides a new topological invariant linked directly to the edge rather than the bulk.

[1]This research was supported by an award from Research Corporation for Science Advancement

Emil Prodan
Yeshiva University

Date submitted: 21 Nov 2008 Electronic form version 1.4