Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Anisotropic Quantum Spin Hall Effect, Spin-Orbital Textures and Mott Transition TIANHAN LIU, LPTHE Jussieu, CPHT Ecole Polytechnique, BENOIT DOUCOT, LPTHE Jussieu, KARYN LE HUR, CPHT Ecole Polytechnique — We investigate the interplay between topological effects and Mott physics in 2D on a graphene-like lattice, via a tight-binding model containing an anisotropic spin-orbit coupling on the next-nearest-neighbour links and the Hubbard interaction. We thoroughly analyze the resulting phases, namely an anisotropic quantum Spin Hall phase until moderate interactions, a Neel and Spiral phase at large interactions in the Mott regime, as well as the formation of a spin-orbital texture in the bulk at the Mott transition. At weak interactions, the system is described through a Z_2 topological invariant and we describe how the anisotropic spin-orbit coupling already produces an exotic spin texture at the edges. The physics at the Mott transition is described in terms of a U(1) slave rotor theory. Taking into account gauge fluctuations around the mean-field saddle point solution, we show how the spin texture now proliferates into the bulk above the Mott critical point. The latter emerges from the response of the spinons under the insertion of monopoles and this becomes more pronounced as the spin-orbit coupling becomes prevalent. We discuss implications of our predictions for thin films of the iridate compound Na_2IrO_3 and also graphene-like systems.

Tianhan Liu
LPTHE Jussieu, CPHT Ecole Polytechnique

Date submitted: 15 Nov 2013 Electronic form version 1.4