Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Isotropic Landau levels of relativistic and non-relativistic fermions in 3D flat space YI LI, CONGJUN WU, University of California, San Diego — The usual Landau level quantization, as demonstrated in the 2D quantum Hall effect, is crucially based on the planar structure. In this talk, we explore its 3D counterpart possessing the full 3D rotational symmetry as well as the time reversal symmetry. We construct the Landau level Hamiltonians in 3 and higher dimensional flat space for both relativistic and non-relativistic fermions. The 3D cases with integer fillings are Z_2 topological insulators. The non-relativistic version describes spin-1/2 fermions coupling to the Aharonov-Casher SU(2) gauge field. This system exhibits flat Landau levels in which the orbital angular momentum and the spin are coupled with a fixed helicity. Each filled Landau level contributes one 2D helical Dirac Fermi surface at an open boundary, which demonstrates the Z_2 topological nature. A natural generalization to Dirac fermions is found as a square root problem of the above non-relativistic version, which can also be viewed as the Dirac equation defined on the phase space. All these Landau level problems can be generalized to arbitrary high dimensions systematically.

[1] Yi Li and Congjun Wu, arXiv:1103.5422.
[2] Yi Li, Ken Intriligator, Yue Yu and Congjun Wu, arXiv:1108.5650.

Yi Li
University of California, San Diego

Date submitted: 09 Nov 2011 Electronic form version 1.4