Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Unconventional Quantum Hall Effect and Tunable Spin Hall Effect in monolayer MoS_2 XIAO LI, Department of Physics, The University of Texas at Austin, FAN ZHANG, Department of Physics and Astronomy, University of Pennsylvania, QIAN NIU, Department of Physics, The University of Texas at Austin — We analyze the Landau level (LL) structure in a monolayer MoS_2 and find a field-dependent unconventional quantum Hall plateau sequence $\nu = \cdots -2M-6$, $-2M-4$, $-2M-2$, $-2M-1$, $\cdots$, -5, -3, -1, 0, 2, 4 $\cdots$. Due to orbital asymmetry, the low-energy Dirac fermions become heavily massive and the LL energies grow linearly with B, rather than with $\sqrt{B}$. Spin-orbital couplings break spin and valley degenerate LL's into two distinct groups, and LL crossing effects appear in the valence bands only. In a p-n junction, spin-resolved fractionally quantized conductance appears in two-terminal measurements with a controllable spin-polarized current that can be probed at the interface. We also show that the zero-field spin Hall conductivity has some interesting tunability. For more information, please refer to arXiv: 1207.1205.

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Date submitted: 09 Nov 2012 Electronic form version 1.4