Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Symmetry protected Spin Quantum Hall phases ZHENG-XIN LIU, Tsinghua university, Beijing, XIAO-GANG WEN, MIT, Perimeter institute — Symmetry protected topological (SPT) states are short-range entangled states with symmetry. Nontrivial SPT states have symmetry protected gapless edge excitations. Topological insulators are examples of nontrivial SPT phases. We study Bosonic SPT phases protected by $SU(2)$ or $SO(3)$ symmetry in 2D. There are infinite number of such phases, which can be described by $SU(2)/SO(3)$ nonlinear-sigma models with a quantized topological θ-term. At open boundary, the θ-term becomes the Wess-Zumino-Witten term and consequently the boundary excitations are decoupled gapless left movers and right movers. Only the left movers (if $\theta > 0$) carry the $SU(2)/SO(3)$ quantum numbers. As a result, the $SU(2)$ SPT phases have a half-integer quantized spin Hall conductance and the $SO(3)$ SPT phases have an even-integer quantized spin Hall conductance. Both the $SU(2)/SO(3)$ SPT phases are symmetric under their $U(1)$ subgroup and can be viewed as $U(1)$ SPT phases with even-integer quantized Hall conductance.

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Date submitted: 07 Nov 2012 Electronic form version 1.4