Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Helical topological exciton condensates PAOLO MICHETTI, Institute of Theoretical Physics, Technische Universität Dresden, Germany, JAN C. BUDICH, Department of Physics, Stockholm University, Sweden, BJÖRN TRAUZETTEL, Institute for Theoretical Physics and Astrophysics, University of Würzburg, Germany — We investigate a bilayer system of critical HgTe quantum wells each featuring a spin-degenerate pair of massless Dirac fermions. In the presence of an electrostatic inter-layer Coulomb coupling, we determine the exciton condensate order parameter of the system self-consistently. Calculating the bulk topological Z2 invariant of the resulting mean field Hamiltonian, we discover a novel time reversal symmetric topological exciton condensate state coined the helical topological exciton condensate. We argue that this phase can exist for experimentally relevant parameters. Interestingly, due to its multi-band nature, the present bilayer model exhibits a nontrivial interplay between spontaneous symmetry breaking and topology: Depending on which symmetry the condensate order parameter spontaneously picks in combined orbital and spin space, stable minima in the free energy corresponding to both trivial and nontrivial gapped states can be found.

Paolo Michetti
Institute of Theoretical Physics, Technische Universitaet Dresden, Germany

Date submitted: 13 Nov 2013 Electronic form version 1.4