Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Casimir Interaction Between Topological Insulator Thin Films and Graphene Sheets[1] WANG-KONG TSE, A.H. MACDONALD, University of Texas at Austin — The Casimir effect is a peculiar manifestation of quantum vacuum fluctuations of the electromagnetic field, resulting in an attractive force between closely-spaced conductors. Because of the advent of new materials like graphene and topological insulators, it is of fundamental and potentially also of practical interest to investigate the Casimir effect between conductors described by two-dimensional Dirac models. In this work we study the Casimir effect between topological insulator thin films and graphene planes in the presence of a time-reversal breaking perturbation, most practically an external magnetic field, that gives rise to a half-quantized quantum Hall effect. We evaluate the Casimir energies and forces from the reflection properties of the double layer system. We demonstrate the essential role that is normally played by the Dirac system's dissipative longitudinal conductivity which is neglected in topological field theory descriptions of the Casimir effect. We also show that repulsive Casimir forces are possible in the presence of a magnetic field.

[1]This work is supported by the Welch Foundation under 790 Grant No. F1473 and NSI-SWAN.

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Date submitted: 13 Dec 2011 Electronic form version 1.4