Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Gauge-discontinuity contributions to the Chern-Simons orbital magnetoelectric coupling JIANPENG LIU, Kavli Institute for Theoretical Physics, University of California, Santa Barbara, DAVID VANDERBILT, Department of Physics and Astronomy, Rutgers University — We propose a new method for calculating the Chern-Simons orbital magnetoelectric coupling, conventionally parametrized in terms of a phase angle θ. We propose to relax the periodicity condition in one direction (k_z) so that a gauge discontinuity is introduced on a 2D **k** plane normal to k_z. The total θ response then has contributions from both the integral of the Chern-Simons 3-form over the 3D bulk BZ and the gauge discontinuity expressed as a 2D integral over the **k** plane. Sometimes the boundary plane may be further divided into subregions by 1D "vortex loops" which make a third kind of contribution to the total θ, expressed as a combination of Berry phases around the vortex loops. The total θ thus consists of three terms which can be expressed as integrals over 3D, 2D and 1D manifolds. When time-reversal symmetry is present and the gauge in the bulk BZ is chosen to respect this symmetry, both the 3D and 2D integrals vanish; the entire contribution then comes from the vortex-loop integral, which is either 0 or π corresponding to the Z_2 classification of 3D time-reversal invariant insulators. We demonstrate our method by applying it to the Fu-Kane-Mele model with an applied staggered Zeeman field.

Jianpeng Liu
Kavli Institute for Theoretical Physics, University of California, Santa Barbara

Date submitted: 04 Nov 2015 Electronic form version 1.4