Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Orbitronics: The Intrinsic Orbital Hall Effect in p-doped Silicon
TAYLOR HUGHES, Stanford University, ANDREI BERNEVIG, SHOU-CHENG ZHANG — The spin Hall effect depends crucially on the intrinsic spin-orbit coupling of the energy bands in semiconductors. However materials with small spin-orbit coupling such as silicon will only exhibit a much reduced spin Hall effect. We show that the electric field in p-doped silicon will induce a dissipationless orbital current in a fashion reminiscent of the spin Hall effect. The effect is robust against disorder because the vertex correction due to impurity scattering vanishes due to symmetry. This orbital Hall effect can lead to the accumulation of local orbital angular momentum at the edge of the sample, and can be detected by the Kerr effect.

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Date submitted: 28 Nov 2005 Electronic form version 1.4