Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Spin Aharonov-Bohm effect and topological spin transistor JOSEPH MACIEJKO, Stanford University, EUN-AH KIM, Cornell University, XIAO-LIANG QI, Stanford University — Ever since its discovery, the electron spin has only been measured or manipulated through the application of an electromagnetic force acting on the associated magnetic moment. In this work, we propose a spin Aharonov-Bohm effect in which the electron spin is controlled by a magnetic flux while no electromagnetic field is acting on the electron. Such a nonlocal spin manipulation is realized in an Aharonov-Bohm ring made from the recently discovered quantum spin Hall insulator, by taking advantage of the defining property of the quantum spin Hall edge states: the one-to-one correspondence between spin polarization and direction of propagation. The proposed setup can be used to realize a new spintronics device, the topological spin transistor, in which the spin rotation is completely controlled by a magnetic flux of $hc/2e$, independently of the details of the sample.

Joseph Maciejko
Stanford University

Date submitted: 16 Nov 2009 Electronic form version 1.4