

MAR05-2004-001226

Abstract for an Invited Paper  
for the MAR05 Meeting of  
the American Physical Society

**Dissipationless quantum spin current and the intrinsic spin Hall effect**

SHOU-CHENG ZHANG, Stanford University

A recent theory predicts that dissipationless spin currents can be induced purely by an electric field in conventional semiconductors. The dissipationless spin current is derived from a novel topological structure in momentum space, is independent of the sample disorder and leads to the intrinsic spin Hall effect. In hole doped semiconductors, with or without inversion symmetry breaking, there are no vertex corrections due to impurities scattering, and there are no extrinsic contributions to the spin Hall effect in the clean limit. I shall analyze two recent experiments on the spin Hall effect, and show that they are both consistent with the intrinsic nature of the effect. S. Murakami, N. Nagaosa and Shou-Cheng Zhang, "Dissipationless quantum spin current at room temperature", *Science*, **301**, 1348 (2003). J. Sinova et. al., *Phys. Rev. Lett.* **92**, 126603 (2004). Y. Kato et. al., *Science*, 11 Nov 2004 (10.1126/science.1105514). J. Wunderlich et.al., cond-mat/0410295. B. Andrei Bernevig and Shou-Cheng Zhang, cond-mat/0411457.