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Spin-charge Interconversion in Topological Quantum Materials[1]

NITIN SAMARTH, Pennsylvania State University

The study of spin-to-charge interconversion in topological quantum materials is of fundamental interest because of the fascinating interplay between spin-orbit coupling, spin texture, and underlying symmetries. The observation of high efficiency spin-to-charge interconversion in topological insulators at room temperature has in particular motivated the recent emergence of "topological spintronics" as a basis for non-volatile memory and energy efficient spin-based logic. We first provide an overview of this field and then discuss recent measurements of spin-to-charge interconversion in the archetypal Dirac semimetal Cd_3As_2, detected by both spin torque ferromagnetic resonance and spin pumping. We observe behavior consistent with previously reported spin-to-charge interconversion mechanisms in heavy metals, topological insulators, and Weyl semimetals. We also find that the efficiency of these phenomena is comparable to that due to the spin Hall effect in heavy metals. Finally, we compare our results with first principles calculations and discuss the origins of the observed effects. Work carried out with Wilson Yanez, Yongxi Ou, Run Xiao, Jacob Held, Jahyun Koo, Timothy Pillsbury, Anthony Richardella, Andre Mkhoyan, and Binghai Yan.

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