Room Temperature Topological Insulator Spintronic Devices: Write and Read Function Design and Implementation

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Room temperature non-volatile spintronic devices possess unique advantages as key building blocks for future computing, memory and analog electronic systems. Recent developments show that topological insulators hold significant promise as an alternative materials platform for such spintronic devices. Hybrid structures that interface topological surface states with magnetism show promising spintronic device-related phenomena such as extremely efficient charge-to-spin conversion at room temperature. In this talk, I will first review the roadblocks remaining for developing topological spintronics into a viable technology. Then I will report our recent effort to design and implement write and read functions of spintronic devices based on topological insulators and their hybrid structures: 1) the demonstration of room temperature spin pumping for write function implementation [1]; 2) an observation of a novel magnetoresistance effect for direct read function implementation [2]; 3) a manufacturing-friendly approach to prepare topological insulator materials and gated devices [3]; Finally I will discuss our observation and the importance of the interface between the topological insulator and ferromagnetic material.

[1] M. Jamali et al., Nano Letters 10, 7126 (2015)
[2] Y. Lv et al., to be submitted (2016)
[3] Mahendra DC et al., to be submitted (2016)

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Wang received his PhD degree in 1995 from Institute of Physics, Chinese Academy of Sciences, where he performed research on nanomagnetism. He established and managed the Magnetic Media and Materials program at Data Storage Institute, Singapore, as the founding program manager, from 1998 to 2002. He joined the faculty of the Electrical and Computer Engineering department at the University of Minnesota in 2002. He has authored and co-authored more than 220 publications in peer-reviewed top journals and conference proceedings and holds 39 patents. His current research programs focus on searching, fabricating and fundamentally understanding novel nanoscale magnetic and spintronic materials and devices.