MAR12-2011-005442

Abstract for an Invited Paper
for the MAR12 Meeting of
the American Physical Society

Visualizing Helical Metals on Topological Insulators[1]

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During the last few years, it has become apparent that there can be a distinct type of insulator, which can occur because of the topology of electronic wavefunctions in materials comprised of heavier elements. Strong interaction between the spin and the orbital angular momentum of electrons in these compounds alters the sequence in energy of their electronic states. The key consequence of this topological characteristic (and the way to distinguish a topological insulator from an ordinary one) is the presence of metallic electrons with helical spin texture at their surfaces. I will describe experiments that directly visualize these novel quantum states of matter and demonstrate their unusual properties through spectroscopic mapping with the scanning tunneling microscope (STM). These experiments show that the spin texture of these states protects them against backscattering and localization. These states appear to penetrate through barriers that stop other electronic states. I will also describe more ongoing efforts focused on unraveling the physics of topological surface states and their potential for device-like applications.

References:

P. Roushan et al, Nature **460** 1106 (2009).
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[1]Work is supported by NSF, NSF-MRSEC, ONR, and DARPA.