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HELICAL METALS ON THE SURFACES OF TOPOLOGICAL INSULATORS

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ABSTRACT:

Topological insulators are a new class of insulators in which a bulk gap for electronic excitations is generated by strong spin-orbit coupling. These novel materials are distinguished from ordinary insulators by the presence of gapless metallic boundary states, akin to the chiral edge modes in quantum Hall systems, but with helical spin textures. I will describe experiments that visualize these novel quantum states of matter and demonstrate their unusual properties through spectroscopic mapping with the scanning tunneling microscope. Specifically experiments demonstrate that spin texture of these states protect them against backscattering.[1] They also demonstrate that unlike conventional surface states , which are localized crystalline defects, these state can penetrate through crystalline barriers. [2] I will describe these experiment and more ongoing efforts focused on unraveling the physics of topological surface states.

[1] Roushan et al. Nature 460 1106 (2009).
[2] Seo et al. Nature, 466 434 (2010).