Z. Hasan: *Topological Insulators and Superconductors*

Topological Insulators are a new phase of electronic matter which realizes a non-quantum-Hall-like topological state in the bulk matter and unlike the quantum Hall liquids can be turned into superconductors at the bulk and/or at the interface. I will first review the basic concepts defining topological matter and experimental probes that reveal topological order. I will present experimental results that demonstrate the fundamental properties of topological insulators such as spin-momentum locking, non-trivial Berry's phases, mirror Chern number, absence of backscattering, protection by time-reversal and other discrete symmetries and their persistence up to the room temperature (at the level of M.Z. Hasan and C.L. Kane, Rev. of Mod. Phys., 82, 3045 (2010)). I will then present recent results demonstrating broken symmetry phases such as superconductivity and magnetism in artificial hetero interfaces as well as outline the emerging experimental research frontiers of the field of topological insulators as a whole. Time permitting, I will also present experimental results on a new class of topological insulators beyond the Kane-Mele Z2 theory.