Peter Armitage,
JHU, Baltimore, USA

Low frequency electrodynamics of topological materials

Topological insulators (TIs) are a recently discovered state of matter characterized by an “inverted” band structure driven by strong spin-orbit coupling. One of their most touted properties is the existence of robust "topologically protected" surface states. The optical response of topological insulators turns out to be one of their most distinguishing and interesting aspects as these materials can be seen not as surface conductors, but as bulk magnetoelectrics. I will review our work on the optical response of topological insulators thin films of Bi_2Se_3 and in particular emphasize our most recent work where we find evidence for Faraday and Kerr rotation angles quantized in units of the fine structure constant. This quantized rotation angle can be seen as evidence for a novel magneto-electric of the TI’s surface states and modified Maxwell’s equations. This quantized rotation is a 3D analog of the quantized resistances seen in quantum Hall systems. The unique optical properties of these materials opens of new areas for photonics applications in the IR regime.