Considering a Topological Insulator as a Viscous Electronic Fluid

THEODORE REBER, JONATHON RAMEAU, JOHN SCHNEELOCH, RUIDAN ZHONG, GENDA GU, PETER JOHNSON, Brookhaven National Lab — Certain topological insulators’ protected surface states may be better treated as hydrodynamic fluids than as collections of quasiparticles. We will present data showing that Bi$_{0.5}$Sb$_{1.5}$Se$_{1.6}$Te$_{1.4}$ natively exists in the hydrodynamic regime at room temperature. A calculation of the viscosity finds that Bi$_{0.5}$Sb$_{1.5}$Se$_{1.6}$Te$_{1.4}$ is surprisingly comparable to that of standard fluids such as water and helium, when normalized to the entropy of each system. This finite viscosity implies an unexpected method for current dissipation via turbulence.

Theodore Reber
Brookhaven National Lab

Date submitted: 05 Nov 2015