Synthesis and Characterization of Topological Insulator Materials

Exploration of a new class of “Dirac” materials that feature metallic surface states protected by time-reversal symmetry in a manner similar to graphene is of fundamental interest and relevance to future applications in spintronics and quantum computation. UMD-MRSEC researchers have progressed to achieving synthesis of high-quality crystals of Bi$_2$Se$_3$ with the highest electron mobility values and lowest carrier concentrations known to date.

Low temperature transport and optical transmission experiments have revealed a surprisingly strong scattering rate for surface conduction in this system, providing important information on the nature of the topological protection touted as the next frontier in exotic states of matter.