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Topological insulators for next generation electronics and photonics

Dongxia Qu
Lawrence Livermore National Laboratory, USA

Recently, a new type of quantum states of matter- topological insulators has been discovered as a Dirac system with strong spin-orbit coupling. In these insulators, the bulk is gapped just like in normal insulators, but the surfaces possess spin-polarized electronic states protected by time-reversal symmetry. The experimental exploration of this new class of materials is leading to an explosion of applications such as energy-efficient electronics, thermoelectric devices, and spin-plasmonics. In this talk, author will first review the basics of topological insulators, and then present our investigations into growth and transport measurements of topological surface states toward utilizing these exotic states in practical applications. In bulk topological insulators, it was resolved the surface conduction from dominant bulk contributions through Shubnikov-de Haas oscillations and the weak-field Hall anomaly. It was discovered that the mobility of the surface hole band in topological insulator $Bi_{0.91}Sb_{0.09}$ is the highest in so far reported 3D topological insulators. The author will also report our recent progress in thermopower measurements of surface states, in which we uncovered additional thermopower resonances signaling the fractional filling states possibly caused by electron correlation. In conclusion, how this new class of materials can be used for the development of future electronics and photonics applications will be discussed.

Biography

Dongxia Qu is currently a postdoctoral fellow in the Condensed Matter and Materials Division at Lawrence Livermore National Laboratory. She obtained her PhD from Princeton University in 2011. Her recent research has focused on the fundamental investigations of topological insulators and their applications in ultrafast electronics, thermoelectrics, and photonic devices. Her research interests also include Terahertz spectroscopy, plasmonics, and semiconductor lasers. She was a recipient of National Science Foundation (NSF) Graduate Fellowship and Princeton Graduate Fellowship and her research work was reported by Science and Physicsworld.

qu2@llnl.gov