

Exploring quantum phase transitions in strongly correlated materials using optical spectroscopy

One of the primary areas of interest in contemporary condensed matter physics is the study of strongly correlated materials, which are materials in which there is a strong coupling between charge, spin, lattice and orbital degrees of freedom. Because of the interplay between various competing orders, these systems have highly complex phase diagrams and exhibit interesting phenomena such as colossal magnetoresistance (CMR), high temperature superconductivity and charge/orbital ordering (COO). In this talk, I will present the results of our temperature- and magnetic-field-dependent inelastic light scattering studies of two such correlated materials: (i) In TbMnO_3 , a magnetoelectric multiferroic, we map out the temperature and field phase diagram, and find evidence for field-induced quantum fluctuations of commensurate domains near the field-tuned incommensurate-commensurate phase transition. (ii) In the charge-density-wave (CDW) system, TiSe_2 , we study the collapse of the CDW state as a function of Cu-intercalation and examine the novel emergent phases that result from the competition between CDW and superconducting orders in this complex system.