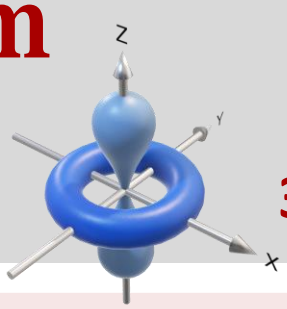
Department of Physics Colloquium

March 21, 2022 **3:00 PM**



Probing topological and geometric defects in functional materials

Prof. Edwin Fohtung

Department of Materials Science and Engineering
Rensselaer Polytechnic Institute

The intersection of condensed matter physics and topology provides an exciting opportunity and playground to study novel ground states and quasiparticles with properties beyond that of simple electrons. In functional materials such as ferroelectrics, ferroelastic, and ferromagnetic, such defects (excitations) have topological properties that can be leveraged to design and engineer superior characteristics compared to the conventionally used charge, spin, and lattice degrees of freedom. On the other hand, geometric defects such as dislocations (line defects) are generated by mechanical deformation, which creates dislocation densities that are much higher than the thermal equilibrium (*i.e.* they are non-equilibrium defects). While other geometric defects such as vacancies (point defects) are usually thermally generated.

In ferroelectric $BaTiO_3$ nanocrystals, mechanical deformation (strain) can stabilize topological defects such as vortices at the intersections of morphotropic-phase-boundary-like phase mixture and thus generate large electric-field-dependent strains with the enhancement of the electromechanical response. We shall discuss how synchrotron-based Bragg coherent diffractive imaging can be used to capture and spatially resolve, in three dimensions, the evolution of topological defects. We shall discuss how ferroic materials that display novel spin-charge coupling ties driven by topology at surfaces/interfaces have enormous potential for low power, spin-based, charge-based, and quantum-coherent technology

This colloquium will be held in-person, at SERC 116 unless announced otherwise.