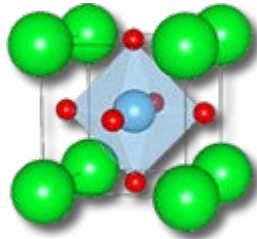


SrTiO₃: The Hydrogen Atom of Solid State Physics



This special topics course will cover a number of modern areas in condensed matter physics, materials science, nanoscience and engineering, viewed through the prism of a single material system, SrTiO₃. In this sense it will be both exceptionally broad and deep. Each topic will describe a fundamental set of concepts, using examples that will include SrTiO₃ but also other material systems or toy models as well. Students may work through exercises that help to create a comprehensive mosaic of information and concepts related to research in the field of complex oxides and oxide interfaces.

Topics to be covered

- Crystal Structure
- Structural phases and phase transitions
- Electronic band structure and DFT
- Defects
- Fermi Surface
- Phonons
- Magnetism
- X-Ray Diffraction
- Superconductivity
- Spin-Orbit Coupling
- Optical Properties
- Nonlinear optics, electro-optics, magneto-optics
- Quantum Transport
- Ferroelectricity, magnetism, multiferroics
- Superconductivity
- Oxide thin film growth: PLD, MBE,...
- Characterization: STEM, RHEED, XPS, XMCD, ARPES
- Symmetries and group theoretical methods
- Topological order
- Heterostructures (semiconductor and oxide)
- Modern magnetic materials and their properties
- Spin-dependent transport