DREXEL UNIVERSITY
Materials Science and Engineering
College of Engineering

Department of Materials Science and Engineering

PhD Defense

Date & Time: 5th June 2025, 12:00 pm
Where: Disque 109, Disque Hall

Tuning functionality in topological kagome magnets

Name: Prajwal M. Laxmeesha
Advisor: Prof. Steven J. May

MS Teams: https://tinyurl.com/bdf7m36f

Abstract:

Quantum materials hold great promise to meet the growing demand for computer processing power and storage by coupling the spin degree-of-freedom and charge transport properties of electrons for use in spintronic devices. Of these, kagome magnets – magnetic metals with a trihexagonal sublattice – offers a unique platform to explore electron correlation and band topology within the same materials. To leverage upon these characteristics and realize next-generation integrated non-volatile memory and storage, it is crucial to synthesize high-quality heterostructures and control the functional properties of the materials that make them up.

In this presentation, I will showcase the progress I've made in thin film synthesis of multiple kagome materials-based heterostructures *via* molecular beam epitaxy (MBE) on insulating oxide substrates, with a special focus on antiferromagnetic FeSn which exhibits strong exchange bias when coupled with an adjacent ferromagnet. Furthermore, I will discuss doping strategies that allow for the tuning of electronic and magnetic properties such as alloying and interfacial charge transfer, specifically in ferromagnetic Fe_3Sn_2 and $(Fe_3Sn_2)_m/(CoSn)_n$ superlattices. Through the use of synchrotron-based X-ray magnetic circular dichroism (XMCD) and polarized neutron reflectometry (PNR), I will demonstrate the means to directly probe elemental contribution to magnetism in these materials, disentangling both spin and orbital moments. These advanced characterization techniques provide exceptional insight into magnetic behavior globally across complex heterostructures and at localized interfaces, enabling a thorough understanding of the underlying phenomena.