Title of the Talk: Competing itinerant and local spin interactions in kagome metal FeGe

Abstract:

Two-dimensional kagome metals consisting of corner-sharing triangles offer a unique platform for studying strong electron correlations and band topology due to its geometrically frustrated lattice structure. The similar energy scales between spin, lattice, and electronic degrees of freedom in these systems give rise to competing quantum phases such as charge density wave (CDW), magnetic order, and superconductivity. For example, kagome metal FeGe first exhibits A-type collinear antiferromagnetic (AFM) order at TN $\approx$ 400 K, then establishes a CDW phase coupled with AFM ordered moment below TCDW $\approx$ 100 K, and finally forms a c-axis double cone AFM structure around TCanting $\approx$ 60 K. Here we use neutron scattering to demonstrate the presence of gapless incommensurate spin excitations associated with the double cone AFM structure at temperatures well above TCanting and TCDW that merge into gapped commensurate spin waves from the A-type AFM order. While commensurate spin waves can be well described by a local moment Heisenberg Hamiltonian, the temperature dependence of the incommensurate spin excitations suggest the formation of a spin density wave order that couples with the CDW order. By comparing these results with density functional theory calculations, we conclude that the incommensurate magnetic structure arises from the nested Fermi surfaces of itinerant electrons, likely due to flat electronic bands near the Fermi level around TN and associated electron correlation effects.