

**Department of Electrical and Computer Engineering
Materials Engineering Program
Texas Center for Superconductivity at Univ. of Houston
Center for Integrated Bio and Nano Systems
10:30 a.m., April 22, 2022
Room: CBB 122**

Determining Electronic Energy Scales in 2D van der Waals Magnets

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Abstract:

Two-dimensional, van der Waals (vdW) magnets are of great interest to condensed matter physicists because they promise to serve as building units of future, spin-based electronics. Such spintronic devices are predicted to be as transformative for the future as microelectronic devices were in the past. The van der Waals chromium trihalides (CrX_3 : $X = \text{Cl}, \text{Br}, \text{I}$) 2D magnets exhibit field-tunable, two-dimensional magnetic orders that vary with the halogen species and the number of layers. Their magnetic ground states with proximity in energies are sensitive to the degree of ligand–metal (p–d) hybridization and relevant modulations in the Cr d-orbital interactions. We will discuss how soft X-ray absorption (XAS) and resonant inelastic X-ray scattering (RIXS) spectroscopy, at Cr L-edge along with the atomic multiplet simulations, can determine key energy scales in these materials. XAS and RIXS directly measure the Cr electronic density of states; quantifying electronic interactions is thought to be critical for predicting the CrX_3 magnetic ground states. This information is important because it provides insight into how to utilize the magneto-optical properties of these materials in devices. We will also discuss our strain studies of CrX_3 . Mechanical deformation of the crystals have a profound effect on their physical properties. Even small modifications of the bond geometry can greatly alter the size and sign of magnetic exchange interactions and thus the magnetic ground state. This talk will discuss our efforts, along with collaborators, to understand the effect of strain-tuning on the electronic states of a very new vdW antiferromagnetic semiconductor CrSBr .



Short Bio:

B. Freelon is an assistant professor in the physics department at the University of Houston. Prior to UH, he was briefly at the University of Louisville. He received the PhD, in condensed matter physics, from the University of Minnesota. Next, he did postdoctoral work at Lawrence Berkeley National Laboratory. He has held scientific staff positions at UC Berkeley, Argonne National Laboratory and the Massachusetts Institute of Technology.