TCSUH Bi-Weekly Seminar

Probing Strained-induced Quantum Behavior in Two-dimensional Magnets

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In Person – Room 102, Houston Science Center, 12:00 p.m. – 1:00 p.m.

Sandwiches will be provided on a first-come, first-served basis.

ABSTRACT: Two-dimensional (2D) van der Waals (vdW) magnets exhibit exotic behaviors that raise fundamental physics questions while promising to revolutionize device concepts in the electronics industry. These materials display delicate linkages between quantum degrees of freedom (DOF) such as spin (S), orbital state (O), atomic lattice position (L), and electron charge (C). Connections among these DOFs allow 2D magnets to be described as moderate to strongly correlated electron systems (SCES). This suggests that magnetic ordering and switching can be tuned by via orbital, lattice and charge channels. Our work at the University of Houston is focused on explaining the fundamental couplings of charge, phonon and magnon behavior in low-dimensional vdW magnets. We are exploring chromium-based tri- and mixed-halides as they form the vanguard of an expanding group of 2D magnets. Strain serves as a highly controllable tuning parameter in these materials CrX_3 (X = Cl, I, Br) and CrSBr. Exploiting these systems will require a detailed understanding of the delicate connection between strain fields and magnetic ordering, charge states and spin waves (magnons). By employing advanced static and ultrafast scattering probes, we have observed new quantum states and new atomic dynamics as a function of static and dynamic strain fields in Cr-based, low-D magnets. X-ray scattering experiments reveal novel electronic density of states in the well-sought-after near infrared (NIR) region. Ultrafast electron scattering indicates that the Cr-systems can support the generation of acoustic phonon modes that are close in energy to reported magnon modes. This talk will elaborate on these experiments and discuss how they point to new potential devices in electronics and quantum information hardware.

BIO: Dr. Byron 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.

Persons with disabilities who require special accommodations to attend this lecture should call (713) 743-8212.