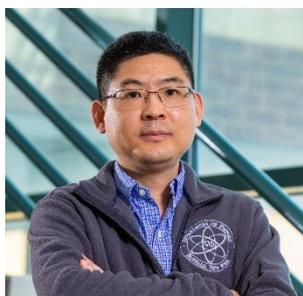


Covalent 2D magnets and heterostructures

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The recent realization of atomically thin van der Waals (vdW) magnets by exfoliation down to the monolayer limit has rekindled interest in 2D magnetism. However, most existing research has focused on exfoliated vdW systems, limiting chemical diversity and tunability. In this talk, I will introduce a class of lesser-explored materials known as covalent 2D magnets. These magnets emerge from the self-intercalation of native 3d transition metal cations between layers of transition metal dichalcogenides, forming atomically thin, covalently bonded layered magnets denoted by the chemical formula $M_{1+\delta}X_2$. The degree of self-intercalation provides a unique mechanism to control exchange coupling, magnetic order, and spin texture. I will begin by discussing the synthesis of these materials, focusing on Cr_2Te_3 , as well as 2D magnet/semiconductor heterostructures. Subsequently, I will uncover a novel mechanism underlying the unconventional anomalous Hall effect (AHE) observed in such systems, driven by the nodal structures in the electronic bands modulated by the noncolinear spin texture. Finally, I will discuss how we leverage such a mechanism to realize reversal switching of AHE by solid-state ionic gating.

Bio



Hao Zeng is the Moti Lal Rustgi Professor of Physics in the Department of Physics at University at Buffalo (UB), the State University of New York. He received his B.S. degree in Physics from Nanjing University, China, in 1993, and his Ph.D. in Physics from the University of Nebraska-Lincoln in 2001. From 2001 to 2004, he was a postdoctoral fellow at the IBM Thomas J. Watson Research Center. He joined UB as an Assistant Professor and was promoted to full Professor in 2014. Dr. Zeng is a fellow of the American Physical Society and a recipient of the Fulbright Scholarship and US NSF CAREER Award. He is the Editor-in-Chief of Journal of Magnetism and Magnetic Materials. He has published 160 papers, which have been cited 25,000 times. His current research interests include nanoscale magnetism and spintronics, bio-applications of magnetic nanoparticles, and unconventional chalcogenide semiconductors.