

THE MATERIALS SCIENCE AND ENGINEERING DEPARTMENT  
FALL COLLOQUIUM SERIES PRESENTS:

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## *Inorganic Materials with a Twist: Breaking Symmetry to Induce Novel Properties*

My group focuses on the synthesis and structural studies of functional inorganic materials. In this seminar, I will focus on two categories of materials we design and synthesize: non-centrosymmetric metal chalcogenides as quantum materials and transition metal phosphates as ferrotoroidics. The first category broadly encompasses superconductors and magnetic materials. In this seminar I will cover layered transition metal chalcogenides intercalated by a variety of species that control the functionality of the quantum material. Our design strategy is to stack metal chalcogenide layers using molecular complexes to break their inversion symmetry and induce a non-centrosymmetric structure. For the second category of materials, I will discuss our efforts to use polarized neutron diffraction to study a class of materials that can simultaneously break space inversion and time reversal symmetries. Such materials are termed ferrotoroidic materials and they comprise the fourth ferroic category along with ferromagnets, ferroelectrics, and ferroelastics. We study how the magnetic point group symmetry of candidate antiferromagnets allows for the long-range and spontaneous order of toroidal moments.

**Efrain E. Rodriguez** received his B.S. from the Massachusetts Institute of Technology and his PhD from the University of California, Santa Barbara. At UCSB Efrain worked with Anthony K. Cheetham, FRS. After his PhD, Efrain went to the National Institute of Standards and Technology (NIST) for his National Research Council post-doctoral fellowship. Today, Efrain is an Associate Professor of Chemistry and Biochemistry at the University of Maryland, College Park. Efrain received the Margaret C. Etter Early Career Award in 2019 from American Crystallographic Association and the CAREER award from the NSF. In 2020, he joined the Board of Directors at the American Institute of Physics and was awarded the Alexander von Humboldt Fellowship for Experienced Researchers. He is also a member of the US National Committee on Crystallography. At the University of Maryland, Efrain has established a program in solid-state chemistry with a multidisciplinary approach for the preparation and study of functional inorganic materials. Efrain and his group study crystallography to establish structure-property relationships in materials, and his group specializes in applying neutron scattering techniques toward such studies..

**Tuesday, November 16 • 4 pm CT • Tech L211**

Registration is required. [RSVP here.](#)

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