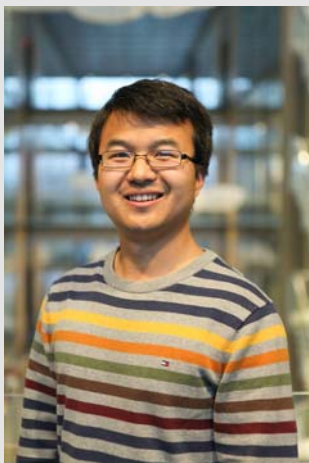


# MAE Faculty Candidate Seminar

FRIDAY,  
NOVEMBER 1  
10:00 AM  
206 FURNAS



**Dr. Shiming Lei**  
Postdoc  
Princeton University

## HIGH-QUALITY MAGNETIC QUANTUM MATERIALS TOWARDS SPINTRONIC APPLICATIONS

### ABSTRACT

Quantum materials are believed to be key for many next-generation technologies, such as sensing, computing, modeling or communication, with higher accuracy and efficiency. Particularly, the magnetic quantum materials are promising for spintronic applications due to the interplay of magnetic order with electronic properties. To study the intrinsic material properties and evaluate the performance of novel devices fabricated from these materials, a high material quality is necessary. Otherwise the desired properties might be obscured. In my presentation, I will talk about two distinct magnetic quantum materials and their electronic, magnetic, and structural properties, which are enabled by high crystal quality. The first part of my talk will focus on magnetic van der Waals (vdW) materials. Despite the rapid advances in recent years, so far magnetic vdW materials are mainly insulating or semiconducting, and none of them possesses a high electronic mobility. The realization of high mobility in a magnetic vdW material, however, is known to be critical for the realization of novel magnetic twistrionic devices. Here I will introduce an antiferromagnetic vdW material with a record-high electronic mobility, which is comparable to that of black phosphorus, and is only surpassed by graphite. Furthermore, I show that this material can be mechanically exfoliated to monolayers. The combined properties of antiferromagnetism, high mobility and easy exfoliation establish it as a distinct member in the growing pool of 2D materials. In the second part of my talk, I am going to introduce a potential magnetic topological semimetal. I will show how stoichiometry control affects the crystal structure and introduces charge density waves, which couples with the electronic structure and leads to the formation of novel topological phases.

### BIO SKETCH

Dr. Shiming Lei is currently a postdoc with Prof. Leslie Schoop in the Chemistry department at Princeton University. He obtained his PhD degree in the Materials Science and Engineering department at the Pennsylvania State University in December, 2017. His PhD work is mainly on the exploration of microstructure-property relationship on a class of materials that have no inversion-symmetry, including ferroelectric materials, multiferroics and magnetic non-centrosymmetric metals. By using transmission electron microscopy, atomic force microscopy, and nonlinear optical imaging, his research works uncover multi-scale material microstructural evolution, from atomic to mesoscale, under various external stimuli, such as electric field, magnetic field, and uni-axial tensile stress. As a postdoc at Princeton University, he expands his interest to high-quality material synthesis and magneto-transport characterizations. His research is mainly focusing on two types of magnetic quantum materials, including magnetic topological semimetals and magnetic 2D van der Waals crystals.



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