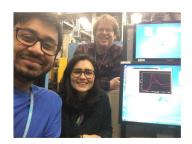


The La Pierre Group studies how collective magnetic, physical, and chemical properties arise from electron (de)localization phenomena in f-element systems. Our studies include the development of solid-state and solution methodologies for the synthesis of novel lanthanide and actinide (Th - Am) materials and complexes. These synthetic efforts are paired with synchrotron and neutron spectroscopies and physical property studies to break down the challenge of understanding the electronic structure of f-element systems. These materials and complexes present unique valence electronic structures due the near degeneracies engendered in these systems and strong electron correlation. Our efforts to-date have focused on the synthesis and analysis of molecular and solid-state systems governed by one of three phenomena: multi-configurational electronic structures (ground state degeneracy including hybridization with ligand/band states), mixed-valence metal ions (i.e. mixed f/d occupancy and mixed-oxidation states), and magnetic exchange. Understanding and controlling the manifestation of these phenomena in molecular systems is crucial for understanding the interplay of these phenomena underpinning topological insulators such as SmB6 and PuB6 and superconductors such as CeCoIn₅ and PuCoGa₅. In turn, the group has employed this expanded fundamental understanding of f-element electronic structure and redox chemistry to construct components of quantum information technologies (e.g. quantum bits (qubits), single-molecule magnets).

The research program is currently supported by the NSF-Chemical Synthesis Program, DOE – Heavy Element Chemistry Program, DOE – Quantum Information Science Program, the Arnold and Mabel Beckman Foundation, and the Alfred P. Sloan Foundation. The members of the group routinely travel (2-3 times a year) to the National High Magnetic Field Laboratory (Tallahassee, FL), Stanford Synchrotron Research Laboratory (Palo Alto, CA), and the Advanced Photon Source (Chicago. IL). There are new opportunities for research internships/collaborations at Pacific Northwest National Laboratory, Oak Ridge National Laboratory, and Savannah River National Laboratory. The research group currently consists of six graduate students, two postdocs, and two undergraduate students. Recent Ph.D. graduates have started postdoctoral positions at Los Alamos National Laboratory (2 graduates), Lawrence Berkeley National Laboratory/University of California, Berkeley, and the University of Chicago. See the group website for details and more photos.









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