CHEMISTRY COLLOQUIUM

Guest Speakers:

Professor George Christou

University of Florida

Department of Chemistry

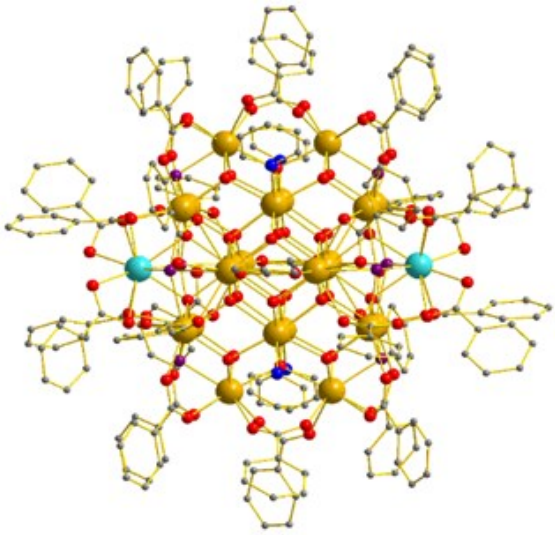
Wednesday, October 3, 12:00pm

Hutchison Hall Room 140

Lander Auditorium

University of Rochester

Department of Chemistry



TITLE: "The Power of Molecular Chemistry in Nanoscale Materials Research"

Abstract:: Molecular chemistry can bring many powerful advantages to the study of nanoscale materials of various kinds, and this area of 'molecular nanoscience' is therefore a rapidly growing field. The advantages include truly monodisperse (single-size) products and a shell of organic ligation that imparts solubility and crystallinity, allowing structural characterization to atomic resolution by X-ray crystallography. The ligands can also usually be modified as desired, allowing tuning of redox properties and atom/isotope labelling (e.g. ^{2}H, ^{19}F, etc.) for various studies in solution and the solid state, such as NMR spectroscopy. This molecular approach has proven absolutely crucial in previous work in the molecular nanomagnetism arena, where the study of single-molecule magnets (SMMs) such as $[Mn_{12}O_{12}(O_2CR)_{16}(H_2O)_4]$, molecules that function as nanoscale magnets, has been greatly assisted, leading to discovery of new quantum phenomena important to 21st century technologies that could not be reliably detected from the study of traditional nanoparticles. The Mn_{12} SMM has recently also proved a source of new cluster-based electrocatalysts of water oxidation to O_2 with unusually low over-potential.

We have now extended the above molecular approach to the bottom-up synthesis of nanoscale pieces of important metal oxides, aiming for M/O/carboxylate clusters whose M/O core has the same structure as the bulk materials. They thus represent ligand-stabilized nanoscale fragments of the bulk materials, what we have termed "molecular nanoparticles". To date, we have been concentrating on CeO_2, whose importance as a catalyst spans a wide range from industry to medicine, and the $AMnO_3$ manganites (A = lanthanide or main group metal) with the perovskite structure, which include many ferromagnets, ferroelectrics and multiferroics important to various new applications.

The structures and properties of a selection of the above materials will be described.

Host: Professor Ellen Matson, email: ellen.matson@rochester.edu