2018 Fall Chem 501 Seminar

Dr. George Christou
Drago and Distinguished
Chemistry Professor, University of Florida

UF | Department *of* Chemistry
University *of* Florida

Thursday – October 18, 2018
Refreshments 3:25pm, Buehler 513
Lecture at 3:45pm, Buehler 555

https://www.chem.ufl.edu/faculty-and-research/research-areas/name/george-christou/

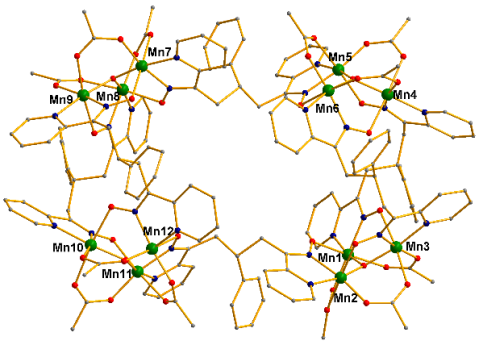
Hosted by: Dr. Ben Xue

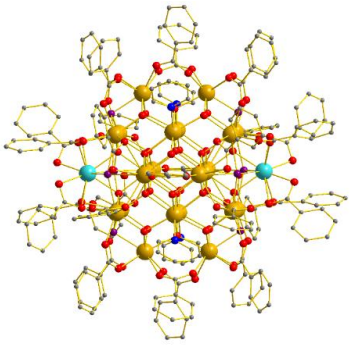
"The Power of Molecular Chemistry in Nanoscale Materials Research"

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 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 usually also 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.

In the molecular nanomagnetism arena, the above advantages have been absolutely crucial in the study of single-molecule magnets (SMMs), individual molecules that function as nanoscale magnets. They have greatly assisted the synthesis and structural characterization of numerous SMMs, and they have led to discovery of new quantum physics phenomena important to new 21st century technologies. These include quantum tunneling of the magnetization vector, and quantum superposition/entanglement states, phenomena that could not be reliably detected from the study of traditional nanoparticles. Our giant (~4 nm) SMMs have also bridged the gap between the 'top-down' world of traditional magnetic nanoparticles and the 'bottom-up' world of molecular nanomagnets. In more recent work we have also been developing controlled ways to form supramolecular oligomers of 2 or more weakly-linked SMMs to study the quantum properties more deeply, and for the first time in solution.

More recently still, we have extended our molecular approach to other interesting materials and have been targeting molecular clusters that can be considered 'molecular nanoparticles' of certain metal oxides, such as cerium(IV) dioxide, and mixed-metal oxides with the perovskite structure. As part of this work, we have been developing routes to coordination cages with a second metal type inside, analogous to the perovskite repeating unit in $AMnO_3$ (A = lanthanide or main group metal) perovskites, as well as developing new 3d metal-oxo catalysts for water oxidation. The syntheses, structures, and properties of a selection of these materials will be described.





Professor Christou received his BS and PhD degrees from the University of Exeter in southwest England. He joined faculty at Indiana University in 1983, rising through the ranks to be Blough Professor. In 2001, he moved to the University of Florida as Drago Professor of Chemistry. His main research interests are bioinorganic chemistry and magnetic applications of multinuclear metal complexes. Professor Christou is one of the "Highly Cited Researchers" worldwide by Thompson Reuters. Among many honors and awards, he recently named the ACS Southern Chemist.