28th UCD School of Chemistry Wheeler Lecture

Professor Polly L. Arnold OBE FRS

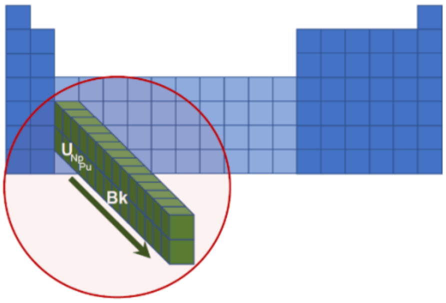
University of California Berkeley

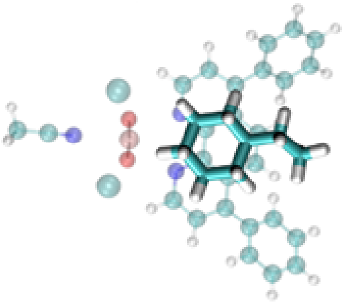
Organometallic Actinide Chemistry in High Oxidation States
Theatre D, O'Brien Centre for Science - Hub, 16:00
Reception to follow, 4th Floor O'Brien Centre for Science East, 17:00

The UCD School of Chemistry is delighted to welcome Professor Polly Arnold OBE FRS to deliver the 28th Wheeler Lecture on October 9th 2025. Director of the chemical sciences division at Lawrence Berkeley National Laboratory, Professor Arnold is a renowned expert in heavy-element chemistry where her group elegantly advance our understanding of the f-block of the periodic table. We welcome you to join us for her much-anticipated lecture on *Organometallic Actinide Chemistry in High Oxidation States*.

Organometallic Actinide Chemistry in High Oxidation States

The f-block comprises two rows of elements. The first are the lanthanides, or ‘rare-earths’ which are essential to many energy technologies and catalysis. The second row are the actinides, present in varied amounts in civil nuclear waste, and a legacy that we have an essential duty to safeguard. To safely manipulate, separate, and recycle these elements, we need a better understanding of the subtleties of their electronic structure and reactivity. This is still poorly-understood due to their large size, and the radioactivity of the actinides, which complicate both computational predictions and experimental manipulation.





We will show some of our work to make unusual new molecules of these metals that makes it easier to manipulate the bonding electrons, study the subtle bonding differences, and demonstrate new reactivity patterns that were previously unanticipated for these metals.

We will show how we work at sub-microgram scales in order to isolate new compounds of the extremely rare berkelium (Bk) isotope,* and safely strip away its electrons, revealing a surprise in the extent of involvement of the 5f orbitals in the reactivity.

In the earlier actinides, we are finding that restricting access to air and water enables us to understand and now control the activation and functionalization of the oxo groups of the ubiquitous uranyl ion, ligands which are normally considered inert. We will show some reactions that lead to oxo functionalization and rearrangement, and the cleavage of inert hydrocarbon C-H bonds with just visible light photoexcitation.

These results contribute to our understanding of these metals that are so important for providing energy justice and a better environment for the future.

References:

Berkelium–carbon bonding in a tetravalent berkelocene. *Science* 2025, 387, 974-978. doi:10.1126/science.adr3346.

Ligand-Directed Actinide Oxo-Bond Manipulation in Actinyl Thiacalix[4]arene Complexes. *Angew. Chem., Int. Ed.* 2025, e202422974. 10.1002/anie.202422974.

The effect of ancillary ligands on hydrocarbon C–H bond functionalization by uranyl photocatalysts. *Chem. Sci.* 2024, 15, 6965-6978. 10.1039/D4SC01310G

* unfortunately the t-shirt cannon is currently unavailable.