Glenn T. Seaborg Center Seminar

Pursuits of Rare Oxidation States in Actinide Chemistry

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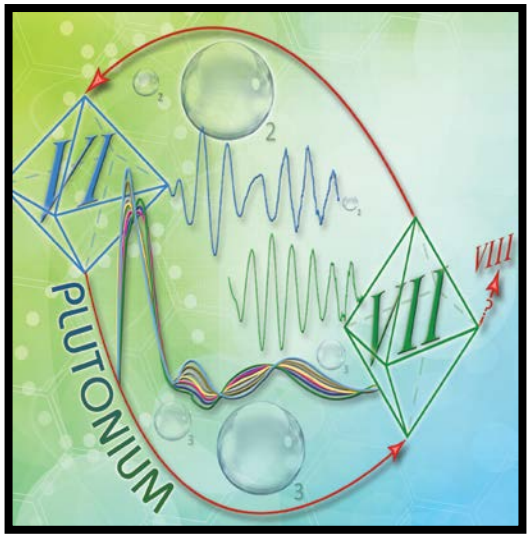
4:00 pm – 5:00 pm
Bldg. 70A, Room 3377

It is not likely that during our lifetimes we will see the periodic table of the elements expand beyond Z=118 to 172 as suggested by Pekka Pyykkö (*Phys. Chem. Chem. Phys.*, 2011, **13**, 161). Rather, the best that we can hope to witness is the discovery of a new vocabulary of oxidation states. In this regard, the recent identification of the first molecule—IrO_4^+—with an element in the oxidation state of IX (Wang et al., *Nature*, 2014, **514**, 475) led Pyykkö to comment that "new well-documented oxidation states are rarer than new elements" (*C&E News*, 27 October 2014, 7), consistent with his vision for 54 elements beyond Z=118. In fact, there have been decades of research on transition metals and f-elements alike to achieve exotic and rare as well as unusually low (negative) and high (positive) states of oxidation. It's simply in our nature to be interested in extremes—whether in the arts or sciences or humanities—we're always pushing at limits. Who doesn't like to witness the extremes of endurance, whether in sport or music, or even chemistry? In this last pursuit, there has been a resurgence of interest, both experimental and theoretical, in neptunium(VII) and plutonium(VII, VIII). These are the subject of this talk. Although not as extreme as Pu(VIII), the solution structures and ground-state electronic properties of Np(VII) and Pu(VII) are, nonetheless, unusual and not fully developed. For example, the results to be presented about the f^1 Pu(VII) ion will be shown to bear upon the issue of the possible existence of Pu(VIII) in strongly alkaline solutions subjected to ozonation. In view of the profound reactivity predicted for Pu(VIII) in fluid media, it will take particularly innovative synthetic chemistry to isolate and characterize a genuine Pu(VIII) species. Until that time, this work provides a definitive comparison of the coordination environments of Np(VII)/Pu(VII) in alkaline solutions.



"Plutonium! Now there's the stuff to put hair on a microbe's chest."
Kurt Vonnegut, Hocus Pocus, 1990, Ch. 27

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