



Guest Editorial

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Outer Limits: Pushing the Extremities

Four new elements are highlighted in this issue (see Wire, page 16), presumably completing the bottom row of the existing Periodic Table, the centerpiece of chemistry. Part of the excitement about these discoveries is how well understood chemical (and nuclear) properties at the fringes of Nature are. The exploration of extremities is a current theme in science in general: witness the recent somewhat surprising discovery of the alleged planet X at the solar system periphery, the explorations of the edges of the known universe, and the finding of primitive microbes at depths of kilometers beneath deep sea beds where life would seem unviable. Probes of the limits of knowledge, even though they are becoming more and more difficult and technologically challenging, seem destined to provide continued surprises and excitement. In the case of the Periodic Table, to which elements have been added on an average of every two-and-a-half years over the past three centuries, fairly consistent periodicity has lent confidence to cementing each element onto its anticipated place on the Table's grid. But with higher and higher coulomb forces by the nucleus on an atom's electrons, relativistic effects that complicate predictions of chemical properties are becoming extraordinarily influential, increasing at least as Z^2 and possibly as fast as Z^4 . Existing predictions are no longer the source of extrapolation we have become accustomed to. Theoretical quantum-relativistic calculations forecast various projections of behavior that look as if the elements were not yet fastened in place, but rather as if someone bumped into the Table, jarring the regular order at the extremities, where yet-unsynthesized superheavy elements should be placed. Observing the actual chemistry of the new superheavy elements is clearly needed. But the increasing difficulty in producing these species and the daunting challenge of working with very transient objects should not be discouraging. We are not talking about "unobtainium". As tough as they are, searches for planet X, for astrophysical phenomena at the edge of the universe, and for life where none should be are all part of our scientific quest to understand the understandable and to peek at what lies ahead.

Paul J. Karol

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Chair of the IUPAC/IUPAP Joint Working Party (JWP)

on the priority of claims to the discovery of new elements

Cover image: On 30 December 2015, IUPAC announced the verification of the discoveries of Elements with Atomic Numbers 113, 115, 117 and 118; the 7th period of the periodic table of elements is complete. Cover design by Purple Zante, Inc.