Relativistic Effects in Superheavy Elements

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Relativistic effects scale approximately with Z^2 (Z = nuclear charge), hence very large relativistic effects are expected for the trans-actinides, the elements beyond nuclear charge 103, the so-called superheavy elements. The heaviest element discovered so far is the superheavy element 112 with a half-life of only about 400 ms for the isotope 277. For chemical studies at an atom-at-a-time scale half-lives within at least the second range are required. Currently, this limits chemical applications to the elements up to nuclear charge 106. On the other hand, the synthesis of more neutron-rich elements near the double-magic number of protons and neutrons, the island of stability with $Z = 114$ and $N = 184$, may produce elements with half-lives for any radioactive decay lying well above the second range. A major drawback in the synthesis is the small production cross section which drops rapidly with increasing nuclear charge. Thus, for the prediction of periodic trends and the chemical behaviour for elements including the 7th period of the periodic table and beyond, the use of theoretical methods are currently the only way to gain useful chemical information. This talk gives an overview on properties for the elements with nuclear charge 111 to 119. It is shown that relativistic effects significantly influence chemical properties of these elements.