Why muons are important in the chemical sciences: theory and experiment

Speaker : Prof. Donald Fleming (The University of British Columbia, Canada)
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Abstract

Isotopic mass effects have been important in the sciences since the discovery of deuterium (D) by Harold Urey in 1935. Not long after, Rutherford discovered tritium (T), the heaviest isotope of the H-atom at that time. However, at this most sensitive end of the isotopic mass scale, D is only twice as heavy as H and though T is three times heavier it is dangerously radioactive, so has seen only limited use in experiments. It is only via muon science then that we can expand the H-atom isotopic mass scale, first to its lightest isotope, Muonium (Mu $= \mu^+ e^-$), with a mass of only 0.114 amu; and more recently to its heaviest isotope, Muonic-He (H$\mu = (\alpha\mu^-) + e^-$), with a mass of 4.11 amu, encompassing a remarkable factor of 36 in H-atom isotopic mass. Several recent examples demonstrating the importance of muons in particularly the chemical sciences will be presented and discussed, in chemical reactivity and bonding and, currently, in the reactivity of Mu on gold nanoparticles.