

PSI Colloquium

WHGA/001 – Auditorium PSI-West

Friday, April 12, 2024, 11:15h



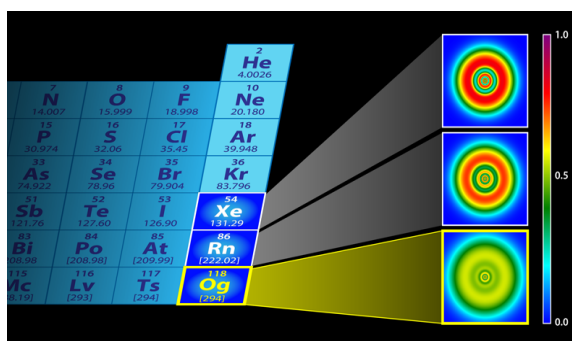
Prof. Dr. Peter Schwerdtfeger

Centre for Theoretical Chemistry and Physics, The New Zealand Institute for Advanced Study,
Massey University Auckland, Auckland, New Zealand

From Meyer and Mendeleev to Oganessian and Dirac: Is there an end in sight for the Periodic Table?

ABSTRACT

The first periodic table of elements was proposed by Dmitri Ivanovich Mendeleev in 1869. It was based on arranging the elements in ascending order of atomic weights and grouping for similarities in chemical properties. Mendeleev predicted the existence and properties of new elements and pointed to accepted atomic weights that were flawed. At this time, it was not known how far one can increase the atomic weight to the critical point where heavy elements become unstable and undergo radioactive decay or when electronic levels dive into the Dirac sea. A century later it was speculated that the periodic table would end with heavy atomic nuclei containing no more than 100 protons because of the immense Coulomb repulsion between the protons. In 1948, however, Goeppert-Mayer pointed out that the nuclear shell model can significantly increase the stability of the atomic nuclei, and Meldner demonstrated in 1967 that the next proton-neutron-shell closure (island of nuclear stability) will take place at a nuclear charge of $Z = 114$ and a neutron number of $N = 184$. Over the past two decades, we gained detailed insight into the nuclear stability problem by producing new superheavy elements up to a nuclear charge of $Z = 118$ (oganesson). The periodic table is most fundamental to chemistry, but key questions remain unanswered: where does the periodic table end from a theoretical and practical point of view? Can we still do chemistry with exotic and highly unstable elements? How can one predict the chemical and physical behaviour of these superheavy elements as the electronic spectrum becomes dense? What is quantum theory doing in the super-critical Coulomb field region when electronic states dive? Do superheavy elements exist in nature, and are these produced in supernova explosions or neutron star mergers?



COFFEE BEFORE THE COLLOQUIUM AT 11:00h

CONTACT

Patrick Steinegger

Tel. +41 56 310 44 89,
patrick.steinegger@psi.ch

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