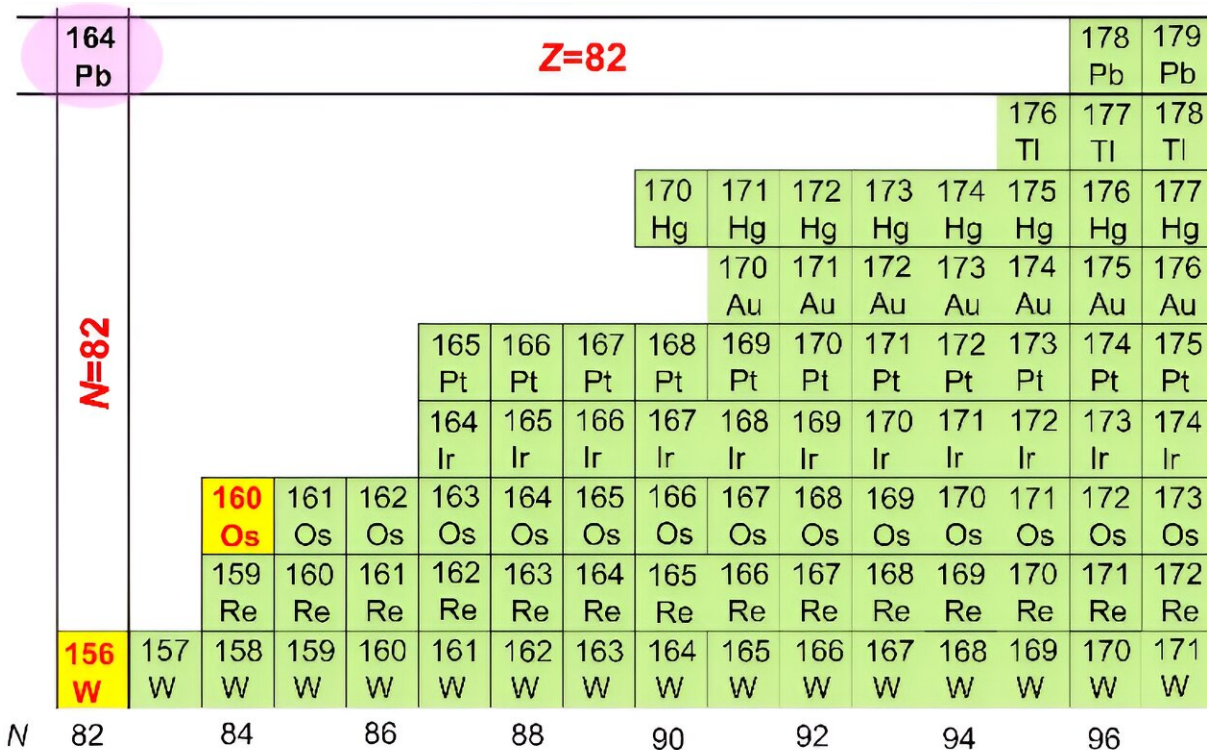


Researchers synthesize two new isotopes, osmium-160 and tungsten-156

February 19 2024, by Liu Jia



Position of the new isotopes, osmium-160 and tungsten-156, on the chart of nuclides. Credit: YANG Huabin

Researchers at the Institute of Modern Physics (IMP) of the Chinese Academy of Sciences (CAS) and their collaborators have synthesized two new isotopes—osmium-160 and tungsten-156—which sheds new

light on nuclear structures and hints that lead-164 could be a doubly magic nucleus with increased stability.

[The study](#) was published in *Physical Review Letters* and highlighted as an Editors' Suggestion.

"Magic numbers" of protons and [neutrons](#) can make an [atomic nucleus](#) particularly stable. The traditional magic numbers include 8, 20, 28, 50, 82 and 126. In previous studies, researchers discovered the vanishing of traditional magic numbers and the emergence of new magic numbers on the neutron-rich side of the chart of nuclides.

Will other traditional magic numbers disappear in the extremely neutron-deficient nuclear region? Further exploration is needed to enrich and develop nuclear theories, and to deepen our understanding of nuclear forces.

In this study, researchers carried out the experiment at the gas-filled recoil separator, Spectrometer for Heavy Atoms and Nuclear Structure (SHANS), at the Heavy Ion Research Facility in Lanzhou (HIRFL), China.

Using the fusion evaporation reaction, researchers synthesized osmium-160 and tungsten-156 for the first time. They measured the α -particle energy and the half-life of osmium-160, which is an α -emitting isotope. In addition, they determined that the daughter nucleus, tungsten-156, is a β^+ emitter with a half-life of 291 ms.

With the newly measured α -decay data, researchers derived α -decay reduced width for osmium-160 and compared it with those of other nuclei with 84 neutrons but fewer protons, and they found a surprising trend: The higher the [proton](#) number, the lower the decay rate.

"This trend is interpreted as evidence for the strengthening of 82-neutron shell closure towards the proton drip line, which is supported by the increase of the neutron-shell gaps predicted in [theoretical models](#)," said Dr. Yang Huabin from IMP, the first author of the paper.

Moreover, researchers suggested that the enhanced stability of 82-neutron shell closure can be attributed to the increasing closeness to the doubly magic nucleus lead-164, which might be a stable nucleus with 82 protons and 82 neutrons. Although lead-164 is predicted beyond the proton-drip line, the enhanced shell effect has the potential to make it a bound or quasi-bound nucleus.

More information: H. B. Yang et al, Discovery of New Isotopes Os160 and W156 : Revealing Enhanced Stability of the N=82 Shell Closure on the Neutron-Deficient Side, *Physical Review Letters* (2024).
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