

Physicists discover new isotope actinium-204

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The gas-filled recoil separator Spectrometer for Heavy Atoms and Nuclear Structure-2 (SHANS2). Credit: IMP

A research team at the Institute of Modern Physics (IMP) of the Chinese Academy of Sciences (CAS), together with their collaborators, have recently synthesized a new isotope, actinium-204, which is the lightest actinium isotope so far discovered and the fourth actinium isotope

beyond the proton-drip line. The study has been published in *Physics Letters B*.

Scientists performed the experiments at the Heavy Ion Research Facility in Lanzhou (HIRFL) and the China Accelerator Facility for superheavy Elements (CAFE2). The new isotope actinium-204 was produced in the fusion-evaporation reaction and identified via the recoil- α correlation at the gas-filled recoiled separators. This is the 35th nuclide synthesized at IMP.

Scientists then determined its α -particle energy and half-life to be 7948 keV and 7.4 ms, respectively. Both of them are consistent with the theoretical prediction.

For many isotopes, the odd-even staggering of half-life is strictly synchronized with that of α -particle energy. However, scientists found that this rule is not appropriate to actinium-204 as well as some other isotopes with less than 119 [neutrons](#). This [phenomenon](#) reveals the blocking effect to α -decay process caused by the unpaired neutron in actinium-204. In other words, the unpaired neutron reduces the probability of forming an α cluster near the surface of the actinium-204 nucleus.

This study provided experimental data about mass and α -decay of the new isotope actinium-204, and contributed to the understanding of the role of unpaired nucleon in α -decay process.

More information: M.H. Huang et al, α decay of the new isotope 204Ac, *Physics Letters B* (2022). [DOI: 10.1016/j.physletb.2022.137484](https://doi.org/10.1016/j.physletb.2022.137484)

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