

Binding energy estimates for even-even actinide nuclei

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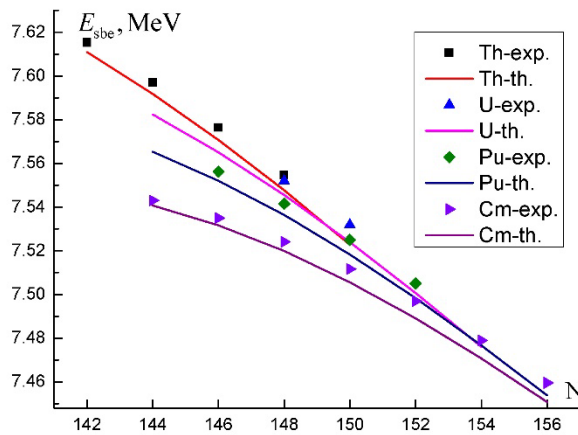
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Systematic studies of neutron-rich actinide and transactinide nuclei are essential for exploring the limits of nuclear stability and the formation of the heaviest elements. Based on experimental results and theoretical predictions, multinucleon transfer (MNT) reactions offer a feasible approach to reach these neutron-rich regions [1], [2], which are largely inaccessible using standard fusion evaporation methods. However, the simultaneous production of many reaction products in MNT reactions makes the unambiguous identification of individual isotopes experimentally challenging. Decay spectroscopy alone is often insufficient for reliable isotope assignment. Direct mass measurements using mass spectrometry methods therefore play a crucial complementary role.

In this context, reliable predictions of nuclear binding energies are essential to support the mass spectrometry identification methods. For this purpose, both approximations and theoretical calculations of nuclear binding energies can be employed. In this work, we present results for even-even

nuclei obtained within the self-consistent nuclear mean-field framework using the Hartree-Fock-Bogoliubov (HFB) method with density functional theory (DFT), as implemented in the HFODD code~[3]. The figure shows specific binding energies as a function of neutron number for isotopes of Th, U, Pu, and Cm, comparing experimental and calculated values. Even the discrepancy between these quantities can be used to provide a more accurate estimate of the yet unmeasured binding energy for a nucleus of interest.



References

1. S. Heinz, H. M. Devaraja, Eur. Phys. J. A **58**, 114(2022).
2. H. M. Devaraja [et al.], Phys. Lett. B **862**, 139353 (2025).
3. J. Dobaczewski, P. Baczyk, P. Becker, J. Phys. G: Nucl. Part. Phys. **48**, 102001 (2021).