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A Question of Shape: A New Mechanism Governing the Survival of Superheavy Nuclei

A. Rahmatinejad[1], **T.M. Shneidman**[1], **G.G. Adamian**[1], **N.V. Antonenko**[1], **M. Kowal**[2], **P. Jachimowicz**[3]

[1]Joint Institute for Nuclear Research, Dubna, 141980, Russia
[2]National Centre for Nuclear Research, Pasteura 7, 02-093 Warsaw, Poland
[3]Institute of Physics, University of Zielona Góra, Szafrana 4a, 65516 Zielona Góra, Poland

Abstract

We investigate the equilibrium shapes of hot superheavy nuclei at excitation energies relevant to fusion reactions. Finite-temperature calculations for nuclei in the $Z = 118$–120 region reveal that spherical and weakly deformed configurations may evolve into oblate or triaxial shapes at $U \approx 30$–50 MeV [1, 2]. This thermally induced shape inversion originates from the rapid damping of shell corrections in spherical nuclei, where highly degenerate single-particle levels near the Fermi surface become simultaneously accessible. Deformation lifts this degeneracy and allows shell effects to persist to higher excitation energies. The resulting change in the potential-energy landscape modifies the competition between neutron evaporation and fission and may therefore significantly affect calculated survival probabilities. This mechanism is particularly relevant to future synthesis experiments for elements 119 and 120.

References

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