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Impact of triaxial degree of freedom in superheavy region

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Currently, one of the most important and difficult areas of research in nuclear structure is the production of superheavy elements. All superheavy elements discovered so far are not stable against the two dominant decay modes, namely alpha decay and spontaneous fission. The decay modes and other essential properties of these nuclei have not been fully investigated experimentally due to their short life time. For example, the half-life of the latest synthesized element ^{294}Og is 0.58 ms \cite{brewer2018search}, and also shorter half-life than that around 60 ns reported for ^{252}Rf isotope \cite{khuyagbaatar2025stepping} . In order to overcome this challenge, and help the experimentalist to refine the next reactions, microscopic approaches are used to produce accurate information about them. The goal of this work is to investigate the impact of triaxial shape degrees of freedom on the dominant decay modes in some even-even isotopic chain of superheavy nuclei with $Z = 114 - 120$ and atomic mass A is ranging from 300 to 326.
The study was performed within a Hartree-Fock-plus-Bardeen-Cooper-Schrieffer (HF+BCS) approach using the SLy4 Skyrme parametrization. Seniority force was employed in the BCS framework to approximate the pairing interaction. The neutron and proton pairing strengths were fitted to reproduce the Madland pairing gaps. Some important ground state properties that have been investigated in both axial symmetric and triaxial calculations include binding energy, potential energy surface as a function of electric quadrupole deformation β_{20}, and triaxial electric quadrupole deformation β_{22}, alpha decay and spontaneous fission half lives. It was found that the ground state shapes of some isotopes with a non-rigid axially symmetric potential well appeared triaxial in the case of taking into account triaxiality. Furthermore, the fission barriers were reduced significantly for all considered isotopes in triaxial calculation, resulting the shorter half lives than the axial calculation. Finally, the impact of triaxiality on the dominant decay modes of superheavy nuclei was determined.

Authors: FAZLI, Fazle Rabi (UTM); Dr HOCK, Koh Meng (Senior Lecturer at UTM)

Presenter: FAZLI, Fazle Rabi (UTM)

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