

720th ASRC Seminar

Date: 13:30~15:00 Tue., May 22

Location: 302 Meeting Room, ASRC Bldg.

Speaker: Dr. Guillaume Scamps
(Tsukuba University)

Title: What is the origin of mass-asymmetric fission of actinides ?

Abstract:

Nuclear fission of heavy (actinide) nuclei results predominantly in asymmetric mass-splits. Without quantum shells, which can give extra binding energy to these mass-asymmetric shapes, the nuclei would fission symmetrically. The strongest shell effects are in spherical nuclei, so naturally, the spherical "doubly-magic" ^{132}Sn nucleus, was expected to play a major role. However, systematic studies of fission have shown that the heavy fragments are distributed around $Z=52$ to 56 , indicating that ^{132}Sn is not the only driver. We show that the final mass asymmetry of the fragments is determined by the extra stability of octupole (pear-shaped) deformations which have been recently found experimentally around ^{144}Ba ($Z=56$). Using a modern quantum many-body model of superfluid fission dynamics, we found that heavy fission fragments are produced predominantly with 52 - 56 protons, associated with significant octupole deformation acquired on the way to fission. These findings may explain surprising recent observations of asymmetric fission of lighter than lead nuclei, and improve predictions of fission properties of exotic nuclei which impact the abundance of elements produced in the astrophysical r-process.

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