Contribution ID: **4** Type: **not specified**

Predicting neutron-induced reactions on short-lived nuclei

Tuesday 26 August 2025 11:45 (45 minutes)

The present talk will critically review the enormous theoretical challenges in nuclear physics faced by astrophysical applications and more specifically by neutron-induced reactions for nucleosynthesis applications. These include, in particular, the theoretical determination of radiative neutron capture and neutron-induced fission cross sections of exotic short-lived neutron-rich nuclei. To do so, the various nuclear ingredients, namely nuclear masses, level densities, photon strength functions, as well as fission properties, need to be estimated on the basis of accurate and reliable models.
New progress based on mean-field models (and beyond) will be described, namely
- Masses obtained from the BSkG3 Skyrme-HFB calculations using a 3D coordinate-space representation, allowing for axial, triaxial and octupole deformations;
- Fission probabilities based on the same BSkG3 Skyrme-HFB calculations taking into account both triaxial and octupole deformations simultanously to estimate the fission path;
- Nuclear level densities obtained (i) within the combinatorial approach on the basis of the triaxial BSkG3 ground state and fission isomers, and (ii) within the conceptually new approach based on the boson expansion of QRPA excitations;
- Photon strength functions for both E1 and M1 de-excitation modes within the QRPA approach
All these new predictions are compared with available experimental data as well as predictions from other competing models. They are used to estimate radiative neutron capture and fission probabilities.

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Session Classification: Tuesday II