Contribution ID: **82** Type: **Keynote**

# Nuclear reactions relevant to nuclear astrophysics, status and perspectives.

*Thursday, 11 July 2024 11:05 (50 minutes)*

Though the origin of most of the nuclides lighter than iron is now quite well understood, the synthesis of the heavy elements (i.e. heavier than iron) remains puzzling in many respects. The major mechanisms called for to explain the production of the heavy nuclei are the slow neutron-capture process (or s-process), occurring during the hydrostatic stellar burning phases, the rapid neutron-capture process (or r-process) believed to develop during the explosion of a star as a supernova or the coalescence of two binary neutron stars. In addition, the origin of the neutron-deficient nuclides observed in the solar system is attributed to the so-called p-process taking place in supernovae. Recently, the intermediate neutron-capture process (or i-process) has been called for to explain the surface enrichment of specific metal-poor stars. The stellar production of heavy elements requires a detailed knowledge not only of the astrophysical sites and physical conditions in which the processes take place, but also of accurate and reliable nuclear data.
The present talk will critically review the different astrophysical models as well as the enormous theoretical challenges in nuclear physics. These include, in particular, nuclear models needed to estimate reaction rates, namely nuclear masses, level densities, photon strength functions, as well as fission properties. New progress based on mean-field models will be described and their impact on nucleosynthesis processes illustrated.

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**Session Classification:** Astrophysics, Fission

**Track Classification:** Nuclear applications