SYMM 2: Focus Session: Neutron capture reactions in the cosmos and the lab (joint session HK/SYMM)

Time: Tuesday 14:00–15:30 Location: HS 1 Physik

Invited Talk SYMM 2.1 Tue 14:00 HS 1 Physik
Neutron-induced reactions and open questions in the s-process — •Alberto Mengoni — INFN, Bologna and CERN, Geneva

Despite the enormous progress made in the investigation of the nucleosynthesis of the s-process, there are several open issues that need additional investigations, both experimentally as well as with the help of theoretical modeling. Among these, one of the most critical is the determination of the neutron capture rate for unstable branching points in the s-process path. While difficult to be measured (because of their radioactivity), the neutron capture cross section of branching points nuclei are useful for the determination of the astrophysical conditions in which the s-process is taking place (neutron densities, temperature).

Considerable progress has been made recently in the possibility to measure neutron capture cross section of unstable nuclei. Examples are recent measurements performed at experimental facilities such as n_TOF at CERN, LANSCE at Los Alamos and LiLIT at SARAF. Further developments of these activities will be presented.

Additional aspects of the nuclear physics developments, including those related to the determination of the stellar neutron capture rates and their theoretical modeling, as well as their corresponding beta-decay rates in plasma conditions will be reviewed.

Invited Talk SYMM 2.2 Tue 14:25 HS 1 Physik
n-capture experiments in inverse kinematics — •Rene Reifarth — LANL, Los Alamos, USA

Virtually all of the isotopes heavier than iron would not exist without neutron-induced reactions. Despite there importance in many different astrophysical scenarios, there are almost no direct measurements for isotopes with half-lives shorter than a few years. A radically new approach is necessary to overcome this constraint.

Ion storage rings offer unprecedented possibilities to investigate radioactive isotopes of astrophysical importance in inverse kinematics. During the last years, a series of pioneering experiments proofed the feasibility of this concept for the fusion of charged paricles at the Experimental Storage Ring (ESR) at GSI. In the future, a combination of a free-neutron target and an ion storage ring can bring the half-life limit for direct neutron-induced reactions down to fractions of a minute.

I will review different astrophysical scenarios, status of current experiments as well as prospects of this new experimental endeavor.

Invited Talk SYMM 2.3 Tue 14:50 HS 1 Physik
Single atom counting of live interstellar radionuclides in natural archives — •Johannes Lachner — Helmholtz-Zentrum Dresden-Rossendorf

Recent nearby supernovae and other cosmic explosions produce also long-lived radionuclides that penetrate into the solar system and are collected in terrestrial and lunar archives. Accelerator Mass Spectrometry (AMS) is used to identify minute amounts of these live radionuclides in environmental samples. Such signatures provide insight into the location and frequency of recent nearby Supernova activity and r-process events.

However, only in a few cases the proper combination of environmental archive and long-lived radionuclide allows to identify a clear fingerprint of such a rare input. Measurements of Supernova-produced ^{60}Fe ($T_{1/2}$=2.6 Myr) in deep-sea sediments and FeMn crusts as well as in lunar soil point to multiple Supernovae occurring in our solar vicinity within the past 10 Myr. Besides ^{60}Fe, recently also the pure r-process nuclide ^{244}Pu ($T_{1/2}$=81 Myr) was detected in deep-sea archives demonstrating that r-process indeed occurred within the past few 100 Myr.

In this presentation, I will also discuss present technical constraints in the detection of such radionuclides by AMS and ongoing work increasing the capabilities for the analysis of additional interstellar radionuclides, e.g. ^{182}Hf and ^{247}Cm.

Common discussion: 15'