Contribution ID: **23** Type: **not specified**

Experimental studies of explosive heavy element nucleosynthesis

Tuesday, 4 September 2018 14:25 (25 minutes)

About 50% of the chemical elements heavier than iron are synthesized in stellar explosions, in supernovas or in neutron star mergers. After tremendous experimental and theoretical efforts and significant progress in astrophysical modeling, the origin of neither the r nor the p isotopes is fully understood. One thing is certain: improved nuclear physics knowledge is needed to describe better the synthesis of these isotopes.

In recent years a large number of low energy alpha induced reactions relevant for the understanding the synthesis of the p isotopes have been studied at Atomki and worldwide. The measured cross sections are compared to theoretical calculations with the aim of improving the reliability of the calculated reaction rates used in the reaction networks.

In the so-called astrophysical r-process exotic isotopes, close to the drip line are formed via rapid neutron capture reactions. When the neutrons flux ceases these isotopes decay toward the valley of stability, therefore, to reproduce the observed abundance pattern, the properties of the β-decays have to be known. Last year the BRIKEN neutron detector has been built at the BigRIPS separator at RIKEN Nishina Center to study the decay properties of the most neutron-rich nuclei produced through the fragmentation of high intensity 238U primary beam.

In this talk, the cross section measurements performed at Atomki will be presented as well as the first results achieved using the BRIKEN neutron counter.

Selected session

Nuclear Astrophysics

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Session Classification: Nuclear Astrophysics