Contribution ID: **25** Type: **Oral presentation**

Statistical properties of 85Rb nucleus relevant to the astrophysical p-process

Monday 27 May 2024 12:20 (20 minutes)

There are 35 proton-rich stable isotopes, known as p-nuclei. Their existence is attributed to the p-process, primarily consisting of a network of photodisintegration reactions on s- and r-process seed nuclei. The abundances of p-nuclei can be obtained based on simulations of this network, with most of the isotopes involved being radioactive. For this reason, direct measurements of these reactions are challenging, thus reaction rates are often obtained via theoretical models. Constraining theoretical models is crucial to obtain experimentally constrained cross-section values for unstable elements. 85Rb has been identified as a branching point for the p-process network. The reaction flow can proceed through two competing reactions, namely 85Rb(γ,p)84Kr or 85Rb(γ,n)84Rb photodisintegrations. Depending on which is the dominant channel, that affects the production of the 78Kr p-nucleus. Therefore, knowledge of the cross-sections for both channels is crucial to obtaining more accurate abundances for 78Kr. Typically it is preferred to study these reactions in the time-reverse direction. 84Rb is a radioactive isotope with T1/2= 32.8 days. Thus, direct neutron capture measurements on this isotope are currently unfeasible. Hauser-Feshbach theory allows for theoretical cross-section calculations when the Nuclear Level Density (NLD) and gamma-ray strength function (gSF) of the compound nucleus are given as inputs. Here we use the 84Kr(p,γ)85Rb reaction to populate the 85Rb compound nucleus, extract NLD and gSF information, and use it to constrain the 85Rb(γ,n)84Rb reaction cross section.
The 84Kr(p,γ)85Rb proton capture reaction was measured with the SuN detector at NSCL at MSU. A stable 84Kr beam was impinged onto a hydrogen gas target in the energy range of 2.7 MeV/u to 3.7 MeV/u. In the present work, a systematic investigation was performed to obtain the NLD and gSF for the 85Rb compound nucleus. The RAINIER code was implemented to simulate the statistical de-excitation of the 85Rb compound nucleus using various combinations of NLD and gSF parameters. The resulting simulated spectra were compared to the experimental data to identify suitable combinations of NLD and gSF. These combinations were used as input in the TALYS 1.96/2.0 code to yield the experimentally constrained cross-section for the 85Rb(γ,n)84Rb reaction. These results can be used to evaluate the competition between the (γ,p) and (γ,n) reactions at the 85Rb branching point and constrain the production of 78Kr within the p process.

Author: BOSMPOTINIS, KONSTANTINOS (Michigan State University)

Co-authors: Dr DOMBOS, Alex (University of Notre Dame); Dr PALMISANO, Alicia (Oak Ridge National Laboratory); Dr RICHARD, Andrea (Ohio University); Dr SIMON, Anna (University of Notre Dame); Dr SIMON, Anna (University of Notre Dame); Ms TSANTIRI, Artemis (Michigan State University/ FRIB); Prof. SPYROU, Artemisia (Michigan State University/ FRIB); Ms HARRIS, Caley (Michigan State University/ FRIB); Dr GOOD, Erin (Pacific Northwest National Laboratory); Ms BERG, Hannah C (Michigan State University/ FRIB); Dr PEREIRA, Jorge (Michigan State University/ FRIB); Dr SMITH, Mallory (Michigan State University/ FRIB); Dr GOMEZ, O. (University of Notre Dame); Dr GASTIS, Panagiotis (Los Alamos National Laboratory); Prof. DEYOUNG, Paul (Hope College); Dr MOHR, Peter (ATOMKI); Prof. ZEGERS, Remco (Michigan State University/ FRIB); Prof. LIDDICK, Sean (Michigan State University/ FRIB); Dr LYONS, Stephanie (Pacific Northwest National Laboratory)

Presenter: BOSMPOTINIS, KONSTANTINOS (Michigan State University)