The 13th Torino Workshop on AGB stars & the 3rd Perugia Workshop on Nuclear Astrophysics



Contribution ID: 41

Type: Oral (remotely)

Experimental kT=28 keV Maxwell-Boltzmann-like neutron spectrum for Maxwellian averaged cross section measurement (R)

Monday, 20 June 2022 11:10 (25 minutes)

To calculate the reaction rate in the neutron capture processes it is common to work with the Maxwellian Average Cross Section (MACS), defined as the reaction rate scaled by the most probable neutron velocity of the Maxwell- Boltzmann distribution. For the s-process mainly, the MACS directly describes the reaction rate inside the stars, for a given temperature and neutron density. Hence, the importance of determining the MACS with the least possible uncertainty. Before any MACS measurement, a characterized neutron beam with a spectrum as similar as possible to the stellar spectrum is mandatory, and this is the main purpose of this work. Mastinu et al. (2009), proposed a method to produce a high-quality Maxwell-Boltzmann neutron spectrum at different thermal temperatures (kT). The method is based on the idea of "shaping the proton beam energy distribution to shape the neutron energy beam to a desired distribution". In the experimental measurement, the ⁷Li(p,n)⁷Be nuclear reaction was employed as neutron source. To obtain a Maxwell-Boltzmann neutron spectrum with 28 keV of thermal temperature, an initial proton energy of 3170 keV and a 51 μ m thickness aluminum (Al) foil, as proton energy shaper, were employed. Using a 600 kHz proton pulsed beam at the Van de Graaff accelerator of the Legnaro National Laboratory of the National Institute of Physics Nuclear (LNL-INFN), in Padua, Italy, the neutron time of flight spectrometry (TOF) was implemented to determine the neutron spectrum. Differential angular neutron energy distributions from 0 to 90 degrees in steps of 10° were measured to obtain the 0°-90° integrated neutron spectra. The expected Maxwell-Boltzmann neutron spectrum has been measured and the obtained results will be presented.

Session

Experimental Nuclear Astrophysics

Primary authors: MUSACCHIO GONZALEZ, Elizabeth (Istituto Nazionale di Fisica Nucleare); Dr MASTINU, Pierfrancesco (LNL-INFN)

Co-authors: Mr MARTIN HERNANDEZ, Guido (CEADEN); Dr CENTOFANTE, Lisa (LNL-INFN); Mr MARAN, Luca (UniPD); Mr RUZZON, Alberto (LNL-INFN); Mr LIDEO, Daniele (UniPD)

Presenter: MUSACCHIO GONZALEZ, Elizabeth (Istituto Nazionale di Fisica Nucleare)

Session Classification: Nuclear Astrophysics