Contribution ID: **93** Type: **Oral**

Measurement of β-delayed protons from decay of 31Cl covering the Gamow window of 30P(p,γ)31S at typical nova temperatures

Thursday, 22 June 2017 15:50 (20 minutes)

The thermonuclear runaway in classical novae proceeds through radiative proton capture re- actions (p,γ) involving proton rich sd-shell nuclei close to the dripline. Many of the capture reactions at typical peak nova temperatures of 0.2-0.4 GK are dominated by resonant capture. Therefore, the key parameters in understanding the astrophysical reaction rates are the energies, decay widths and spins of these resonances. One of the bottleneck reactions in the ONe nova nucleosynthesis is the radiative proton capture 30P(p,γ)31S.
In absence of intense 30P radioactive beams, the experimental efforts for finding and studying the resonances in 31S have concentrated on using a variety of indirect methods. One indirect method with high selectivity is the allowed β-decay of the 3/2+ ground state of 31Cl which populates excited states in 31S, corresponding to l = 0 resonances (Jπ = 1/2+,3/2+) and l = 2 resonances (J π = 5/2+). An observation, or non-observation, of β -delayed protons or γ -rays from the levels with uncertain or contradicting spin assignments [1] will help constraining the possible astrophysically important states. The previous efforts on measuring β-delayed protons from the states of astrophysical interest in 31S (Ex ~ 100–500 keV) have not been successful for the fact that these studies suffered from the intense β-background in the setups utilizing Silicon detectors [2,3]. Recently, high statistics measurement of β -delayed γ -rays from decay of 31 Cl identified a new candidate for a resonance in the middle of the Gamow window [4]. Since the new level is seen populated in β-decay, it opens possibility for determining the proton branching ratio, which is one of the pieces of information needed for the experimental determination of the experimental value of the resonance strength.
We have done a measurement of β-delayed protons from 31Cl with the newly built and commissioned AstroBox2 detector, based on Micro Pattern Gas Amplifier Detector (MPGAD) technology [5]. An intense and pure beam of 31Cl was produced with the MARS separator at the Texas A&M University, and implanted and stopped inside the gas volume of the AstroBox2 for the decay study. In this experiment we suppressed the β-background down to 100 keV, allowing background free study of β-delayed proton emitting states in 31S throughout the whole Gamow window of the 30P(p,γ)31S reaction. In this contribution we describe our setup and present the results of the experiment.
[1] C. Ouellet and B. Singh, Nucl. Data Sheets 114, 209 (2013);
[2] A. Kankainen et al., Eur. Phys. J. A 27, 67 (2006);
[3] A. Saastamoinen et al., AIP Conf. Proc. 1409, 71 (2011);
[4] M.B. Bennett et al., Phys. Rev. Lett. 116, 102502 (2016);
[5] A. Saastamoinen et al. Nucl. Instrum. and Meth. in Phys. Res. B 376 (2016) 357.

Primary author: Dr SAASTAMOINEN, Antti (Cyclotron Insitute, Texas A&M University)

Presenter: Dr SAASTAMOINEN, Antti (Cyclotron Insitute, Texas A&M University)

Session Classification: Indirect methods 1

Track Classification: Explosive scenarios in astrophysics: observations, theory, and experiments