Contribution ID: **102**   Type: **Oral**

Study of key resonances in the 30P(p,g)31S reaction in classical novae

Tuesday, 26 June 2018 14:45 (15 minutes)

Classical novae outbursts are the third most energetic explosions in the Universe after gamma-ray bursts and supernovae. During this explosive burning, nucleosynthesis takes place and the newly synthesized material is ejected into the interstellar medium. In order to understand these objects, the study of presolar grains and gamma-ray emitters are of speci1c interest since they can give direct insights into the nucleosynthesis processes and isotopic abundances.

The 30P(p,g)31S reaction is one of the few remaining reactions which rate uncertainty has a strong impact on classical novae model predictions. Sensitivity studies have shown that it has the largest impact on the predicted elemental abundance ratios of Si/H, O/S, S/Al, O/P and P/Al, which can be used to constrain physical properties of classical novae. The 30Si/28Si isotopic ratio, which is an important signature that helps to identify presolar meteoritic grains of a likely nova origin, depends also strongly on the 30P(p,g)31S reaction rate.

To reduce the nuclear uncertainties associated to this reaction we performed an experiment at ALTO facility of Orsay using the 31P(3He,t)31S reaction to populate 31S excited states of astrophysical interest and detect in coincidence the protons coming from the decay of the populated states in order to extract the proton branching ratios.

After a presentation of the astrophysical context of this work, the current situation of the 30P(p,g)31S reaction rate will be discussed. Then the experiment set up of this work and the analysis of the single and coincidence events will be presented.

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Session Classification: Stellar contribution: WDs, Novae SNeIa, & X-ray burst