Contribution ID: **193** Type: **Poster**

The Study of 29Si(p,g)30P and Its Relevance to Classical Nova Nucleosynthesis

Tuesday, 26 June 2018 19:00 (1h 30m)

A classical nova is a stellar explosion occurring between the white dwarf and the main sequence companion star of a binary system, and while it is suspected that these explosions are responsible for the galactic production of rare nuclear species, a number of open questions about their dynamics remain unanswered. Some knowledge of the nature of classical novae can be gained using traditional means in the observatory, but by studying presolar grains of nova origin, one can learn more about classical novae in the laboratory as well. These grains, minute traces of ejected material produced in stellar explosions and later incorporated into meteorites, carry isotopic signatures of the processes that created them. A collection of grains with a putative classical nova origin have been identified in recent years. By comparing the isotopic abundances from these grain measurements to the results of computational models of nova explosions, our understanding of these fascinating events can be tested and improved. Discrepancies between grain isotopic ratios and those predicted by simulations complicate the efficacy of this strategy however. It will be shown that poorly constrained reaction rates substantially contribute to these discrepancies, using the effect of 29Si(p,g)30P rate uncertainties on the d(29Si/28Si) ratio as an illustrative case. This motivated the study of several low-energy resonances in the 29Si(p,g)30P reaction undertaken at the Laboratory for Experimental Nuclear Astrophysics (LENA). The experimental and analytical methods and challenges involved in these measurements will be discussed at length, followed by a presentation of results and preliminary understanding of their significance.

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Session Classification: Poster session