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Weak rp-process nucleosynthesis in low-metallicity novae explosions

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Classical novae are stellar thermonuclear explosions that occur when a white dwarf accretes material from a companion star. In the early Galactic history, and still today in metal-poor environments, these explosions likely proceeded differently due to the accretion of sub-solar metallicity material. It has been suggested that such low-metallicity novae produced distinct abundance patterns compared to their more recent counterparts [1]. In particular, nuclear processes in low-metallicity novae extend up to the Cu-Zn region, resembling a weak rp-process, whereas classical novae typically terminate around Ca. In this talk, we investigate nucleosynthesis in this scenario and assess the impact of nuclear physics uncertainties on the final abundance pattern. Using a Monte Carlo approach [2,3], we varied all relevant reaction rates within their uncertainties to identify key nuclear processes influencing the production of intermediate-mass nuclei [4]. Our results highlight specific reactions whose uncertainties significantly affect nucleosynthesis under low-metallicity-nova conditions [5]. These reactions require experimental measurements at both stable and radioactive beam facilities to improve their rate precision. To begin addressing these uncertainties, we discuss recent indirect (^{3}He,d) transfer measurements conducted at the Triangle Universities Nuclear Laboratory (TUNL) using the Enge split-pole spectrograph. These measurements provide crucial constraints on (p,γ) reaction rates, improving our understanding of nucleosynthesis in low-metallicity novae.

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