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Production of the γ-ray emitters ^{22}Na and ^{26}Al in classical novae[1]

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A classical nova is a thermonuclear explosion occurring on the surface of a white dwarf star that is accreting hydrogen-rich material from a companion star in a binary system. Novae are expected to eject the γ-ray astronomy targets ^{22}Na and ^{26}Al in observable quantities. If ^{22}Na were observed it could provide an unprecedented isotopic constraint for nova models. The observed Galactic ^{26}Al/^{60}Fe ratio is already used as a benchmark for models of nucleosyntheis in massive stars and their supernovae, but a substantial contribution of ^{26}Al from novae could skew such comparisons. The expected production of ^{22}Na and ^{26}Al in novae is sensitive to modeling details and uncertainties in the thermonuclear rates of the ^{22}Na$(p,\gamma)^{23}$Mg and ^{25}Al$(p,\gamma)^{26}$Si reactions, respectively. We recently measured the strengths of the relevant ^{22}Na$(p,\gamma)^{23}$Mg resonances to be higher than previous measurements by factors of two or more using the tandem Van de Graaff accelerator at the Center for Experimental Nuclear Physics and Astrophysics (CENPA) and ^{22}Na targets prepared at TRIUMF-ISAC. We also evaluated the ^{25}Al$(p,\gamma)^{26}$Si rate at CENPA based on available experimental data, reducing the uncertainty by large factors. An imminent CENPA-led experiment is expected to further solidify the ^{25}Al$(p,\gamma)^{26}$Si rate.

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