Constraining the $^{19}\text{Ne}(p,\gamma)^{20}\text{Na}$ Reaction Rate Using Direct Measurements at DRAGON

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Determining proton radiative capture reaction rates in explosive stellar environments is of critical importance for our understanding of the chemical evolution of the Milky Way. One particularly significant rate is that of the $^{19}$Ne$(p, \gamma)^{20}$Na reaction. This reaction is expected to strongly influence the final ejected abundance of $^{19}$F in oxygen-neon (ONe) novae[1], as well as providing a key step in the breakout sequence from the hot-CNO cycles into the rp process in Type I X-ray bursts[2]. In these stellar environments, the $^{19}$Ne$(p, \gamma)^{20}$Na reaction is thought to be dominated by a single, narrow resonance, 457 keV above the proton emission threshold in $^{20}$Na[3]. The exact nature of this resonance has been a matter of significant scientific debate for over 30 years and, as such, has resulted in large uncertainties in the $^{19}$Ne$(p, \gamma)^{20}$Na reaction rate. In order for us to fully understand the latest observational data obtained from ONe novae and X-ray bursts by modern telescopes, it is essential that the uncertainty of this reaction rate is reduced. A direct measurement of the $^{19}$Ne$(p, \gamma)^{20}$Na reaction has been recently performed at TRIUMF National Laboratory, Canada, using the DRAGON recoil separator. Results of the strength of the 457 keV resonance from this study, as well as its contribution towards the $^{19}$Ne$(p, \gamma)^{20}$Na reaction rate at ONe novae and X-ray burst temperatures, will be presented; and its implications for nucleosynthesis in such explosive stellar environments will be discussed.

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