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Using the 23Na(3He,d)24Mg Reaction to Reexamine Sodium Production in Globular Clusters[1] CALEB MARSHALL, North Carolina State University, TUNL, KIANA SETOODEHNIA, European X-ray Free Electron Laser, FEDERICO PORTILLO, RICHARD LONGLAND, North Carolina State University, TUNL — Globular clusters are gravitationally bound, compact collections of hundreds of thousands of stars. Our current theories of stellar evolution, however, cannot account for the observed anticorrelation between sodium and oxygen in cluster stars. While the astrophysical site of these so called abundance anomalies is still unknown, this chemical signature indicates the processing of stellar material by hydrogen burning at temperatures of 50−100 MK. Unfortunately, many key thermonuclear reaction rates suffer from large uncertainties at these temperatures, including the critical sodium destroying reaction $^{23}\mathrm{Na}(p,\gamma)^{24}\mathrm{Mg}$. Using the Split-pole Spectrograph at Triangle Universities Nuclear Laboratory, we have measured the $^{23}\mathrm{Na}(^{3}\mathrm{He},d)^{24}\mathrm{Mg}$ transfer reaction. Excited states in the astrophysical region of interest were observed and their energies deduced. Making use of novel analysis techniques, we were able to put constrains on level spins and extract spectroscopic factors with statistically rigorous uncertainties. These results indicate that the $^{23}\mathrm{Na}(p,\gamma)$ reaction rate is significantly stronger than previously reported, increasing the destruction rate of sodium in stellar material.

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