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New Constraints on Sodium Production in Globular Clusters From the ^{23}Na(^{3}He, d)^{24}Mg Reaction[1] CALEB MARSHALL, North Carolina State University, KIANA SETOODEHNIA, European X-ray Free Electron Laser GmbH, Schenefeld, Germany, FEDERICO PORTILLO, RICHARD LONGLAND, North Carolina State University — Globular clusters consist of hundreds of thousands of stars gravitationally bound in a relatively small radius. Over the last few decades, intense observational study has revealed that globular clusters are comprised of multiple stellar populations each with distinct chemical signatures. The star-to-star Na-O anticorrelation is the most pervasive of these so called abundance anomalies, and is theorized to be the result of stellar material undergoing hydrogen burning at $50-100$ MK. Unfortunately, many thermonuclear reaction rates suffer from large uncertainties at these temperatures, thereby limiting our understanding of nucleosynthesis in globular clusters. Among these rates one of the most critical is the sodium destroying reaction ^{23}Na(p, γ)^{24}Mg. Using the Enge Split-pole Spectrograph at Triangle Universities Nuclear Laboratory (TUNL), we have measured the transfer reaction, ^{23}Na(^{3}He, d)^{24}Mg. Several novel analysis techniques have made it possible to extract excitation energies, spin-parities, and spectroscopic factors with realistic uncertainties. These uncertainties have been propagated through to ^{23}Na(p, γ) reaction rate, thereby improving our understanding of sodium destruction in stellar material.

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