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Constraint of the $^{13}C(\alpha,n)$ Cross Section Toward Astrophysical Energies for the Main s-Process[1] REBECCA TOOMEY, Rutgers University, MICHAEL T. FEBBRARO, STEVEN D. PAIN, WILLIAM A. PETERS, Oak Ridge National Laboratory, JOLIE A. CIZEWSKI, Rutgers University, CHARLES C. HAVENER, MARK E. BANNISTER, KELLY A. CHIPPS, Oak Ridge National Laboratory, DAVID G. WALTER, CHAD C. UMMEL, HARRISON SIMS, Rutgers University — The slow neutron capture process (s-process) typically occurs in relatively low neutron flux environments, such as AGB stars, and is a key mechanism in heavy-element synthesis. The dominant source of neutrons for the main s-process is the $^{13}C(\alpha,n)$ reaction, which proceeds at stellar temperatures (~ 0.1GK, 200 keV), via reactions well below the Coulomb barrier. Direct measurements of the reaction rate in the Gamow window ($\sim 140 - 230$ keV) is difficult, complicated by the low yields and high beam currents required. Current measurements have constrained the cross section down to approximately 320 keV - still well above stellar conditions- with significant statistical uncertainties. These uncertainties, and the influence of a near-threshold $1/2^+$ state at 6.4 MeV, means that extrapolation of the data into the Gamow window is unreliable. These measurements typically use high-efficiency moderated neutron counter detectors, meaning energy information of the incident neutrons is lost. A quasi-spectroscopic approach has been used to measure the $^{13}C(\alpha,n)$ reaction rate at energies between 300-350 keV with the aim of reducing uncertainties in current measurements.

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