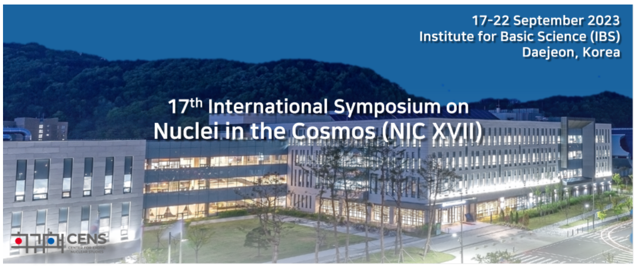

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New constraints on the ^{13}C$(\alpha, n)^{16}$O reaction

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Neutron production for the slow neutron capture process (s-process) is dominated by (α, n) reactions on light nuclei during stellar helium burning. Chief amount these is the ^{13}C$(\alpha, n)^{16}$O reaction, whose low energy cross section is enhanced by the presence of broad resonances and subthreshold states. Experimental measurements have been reported recently at both the LUNA and JUNA underground facilities, reaching to unprecedentedly low energies. These measurements have verified R-matrix extrapolations, constrained by transfer reaction determinations of the dominant subthreshold resonance strength, that the cross section is lower than previous above ground measurements indicated. To further reduce the uncertainty we report measurements of the differential cross section of the ^{13}C$(\alpha, n)^{16}$O reaction, which extend from laboratory α-particle energies of 0.8 to 6.5 MeV in approximately 10 keV energy steps at 18 unique angles between 0 and 160°, resulting in over 700 distinct angular distributions. These measurements are the first accurate differential cross section measurements of this reaction below 1 MeV. We use these differential data to augment the previous state-of-the-art R-matrix fit of the low energy ^{13}C$(\alpha, n)^{16}$O reaction and use Bayesian uncertainty estimation to demonstrate that the differential data decreases the uncertainty by a factor of two, from ≈10\% to ≈5\% over the energy region of astrophysical interest.

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