Contribution ID: **94** Type: **Parallel**

Sensitivity Study for the $^{12}C(\alpha,\gamma)^{16}O$ Astrophysical Reaction Rate

Wednesday, May 30, 2018 3:20 PM (20 minutes)

The $^{12}C(\alpha,\gamma)^{16}O$ reaction has a key role in nuclear astrophysics. A multilevel R-matrix analysis was used to make extrapolations of the astrophysical S factor for this reaction to the stellar energy of 300 keV. The statistical precision of the S-factor extrapolation was determined by performing multiple fits to randomized (according to the experimental errors) existing E1 and E2 ground state data. The impact of a future proposed experiment at Jefferson Laboratory (JLab) was assessed within this framework. The proposed JLab experiment will make use of a high-intensity low-energy bremsstrahlung beam that impinges on an oxygen-rich single-fluid bubble chamber in order to measure the total cross section for the $^{16}O(\gamma,\alpha)^{12}C$ reaction. The importance of low energy data as well as high precision data was investigated. The results of this study will be presented.

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Funding source

U.S. National Science Foundation, grant 1506459 and U.S. Department of Energy, Office of Nuclear Physics, contract No. DE-AC02-06CH11357.

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Session Classification: Particle and Nuclear Astrophysics

Track Classification: PNA