

(α, n) measurements at University of Notre Dame and AZURE2 R -matrix analyses

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Improved (α, n) cross section measurements are needed for a range of applications such as nuclear astrophysics, neutrino physics, geophysics, nuclear energy, and weapons research. While they are sometimes focused on different energy regions, all benefit from improved measurements over a wide energy range. The connection is further strengthened through the use of R -matrix analysis for the evaluation of the data in all cases. The shared desire for an improved characterization of the cross sections makes it clear that a comprehensive R -matrix analysis will be the most consistent method, as opposed to piecemeal ones, that sample only a fraction of the data and energy range.

At the University of Notre Dame we have pursued an improvement (α, n) cross section evaluation both by making new experimental measurements and R -matrix analyses. In this talk I will give an overview of several (α, n) experimental projects that are planned or underway, with a focus on the $^{13}\text{C}(\alpha, n)^{16}\text{O}$ reaction. These new measurements focus on thin target, high energy resolution, differential measurements of partial cross sections using neutron and secondary γ -ray spectroscopy, the type of data most directly implemented into an R -matrix analysis. On the R -matrix side, I'll discuss efforts to construct an analysis of the ^{17}O system using the code AZURE2, and new methods of performing Bayesian uncertainty analysis to determine probability distributions for observables and to calculate covariance matrices for fit parameters.

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