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Bayesian Uncertainty Quantification of Alpha Elastic Scattering to Constrain the α Optical Model

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Accurate predictions of α -induced reactions on medium mass nuclei are critically reliant on the alpha optical model potential (α OMP). At the energies relevant to explosive nucleosynthesis, the behavior of the α OMP is poorly constrained by existing data, leading to orders of magnitude variation in thermonuclear reaction rates undermining the predictive accuracy of stellar models. To improve this situation, targeted experiments are needed not only to measure astrophysically relevant reactions, but to improve α OMP phenomenology in general. In this talk I will present results from a recent $^{86}\text{Sr}(\alpha, \alpha)$ experiment performed at the Triangle Universities Nuclear Laboratory. Employing a first of its kind Bayesian analysis, we carried out an extensive investigation of the constraints that can be placed on the α OMP from a single elastic scattering experiment. Our results demonstrate that despite ambiguities in potential parameters and non-unique energy dependencies, the low-energy cross-section can be predicted with a precision of 50%.

Author: MARSHALL, Caleb (University of North Carolina at Chapel Hill, Triangle Universities Nuclear Laboratory)

Co-authors: LANSING, Taliah (The College of Wooster); Dr SETOODEHNIA, Kiana (Duke University/Triangle Universities Nuclear Laboratory); GRIBBLE, David (UNC Chapel Hill/TUNL); Dr LONGLAND, Richard (North Carolina State University/Triangle Universities Nuclear Laboratory); PSALTIS, Thanassis (TUNL)

Presenter: MARSHALL, Caleb (University of North Carolina at Chapel Hill, Triangle Universities Nuclear Laboratory)

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