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Direct Measurements of Key Nuclear Reactions for Astrophysics Using DRAGON

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Most elements observed in the galaxy are produced through nuclear reactions inside stars, including explosive stellar phenomena, such as classical novae, supernovae, and neutron star mergers. To understand galactic elemental abundances, it is essential to determine the rates of these reactions. Additionally, simulations of these astrophysical environments have shown that many predicted properties are highly sensitive to nuclear reaction rate uncertainties.

The ideal method for determining these reaction rates is through direct measurements. Such experiments are conducted using the DRAGON recoil mass spectrometer at TRIUMF. In this talk, I will present results from a recent DRAGON experiment to determine the yield curve of the ^{7}Li(α,γ)^{11}B reaction close to $E_{CM} \sim 2.8$ MeV. Determining the rate of this reaction is important for understanding the abnormally large decay rate of the β^{-}-delayed proton decay of ^{11}B and the production of ^{7}Li and ^{11}B in core-collapse supernovae. Additionally, I will present a new development where DRAGON was coupled with the DEMAND array of neutron detectors to directly study (α,n) reactions. These reactions are particularly important for the weak r-process in core-collapse supernovae and the s-process in AGB and massive stars. This measurement represents the first of its kind, introducing a novel approach for directly determining (α,n) reaction rates.

Keyword-1

Nuclear Reactions

Keyword-2

Nuclear Astrophysics

Keyword-3

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