Exploring α-Induced Reactions and Their Astrophysical Significance*

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Since helium is the second most abundant element in the universe, α-induced reactions on both stable and radioactive isotopes play a pivotal role in nuclear astrophysics. For instance, several α-induced reactions are key to understanding the nucleosynthesis of the lightest elements during the rapid neutron-capture process (r-process) occurring in neutrino-driven winds following core-collapse supernovae. Additionally, α-induced reactions are critical for understanding explosive astrophysical environments such as X-ray bursts.

Direct measurements of these reactions at astrophysically relevant energies are experimentally challenging. This is due to their low cross sections and the difficulties associated with working with low-intensity radioactive beams. As a result, many reaction rates crucial for astrophysical modeling remain poorly constrained or entirely unknown. However, recent developments in radioactive ion beam facilities and experimental techniques are enabling new approaches to overcome these challenges. In this presentation, I will review recent progress in the direct measurement of α-induced reactions.

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