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Radiative Capture Reactions in Explosive Stellar Phenomena

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Recent multi-messenger observations of explosive astronomical events are generating exciting new challenges for nuclear physics and force a rethinking of old paradigms. In particular, advanced, space-based telescopes have provided unprecedented insight into the production of chemical elements across the Galaxy, while the detection of massive neutron stars have ruled out a variety of hypotheses regarding the nature of nuclear matter. Unfortunately, despite the wealth of observational data available, many broad and open questions relating to stellar nucleosynthesis throughout the cosmos still remain, owing to large uncertainties in the underlying nuclear physics processes that drive explosive stellar scenarios.

In this regard, exceptional advances in experimental nuclear physics, over the past few years, offer an exciting means to address this issue. Specifically, the latest generation of radioactive beam facilities can now act as terrestrial laboratories for the direct reproduction of astrophysical reactions, while state-of-the-art detection systems offer the possibility to study key unstable nuclei, that govern the pathway of nucleosynthesis in explosive astronomical events. In this talk, direct and indirect methods for studying astrophysical reactions will be discussed, with a specific emphasis on innovative techniques and advanced detection systems.

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