

The synthesis of heavy elements in stellar explosions

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Since its birth roughly 60 years ago, the field of Nuclear Astrophysics strives to provide a comprehensive description of element synthesis in the Universe. While some of the astrophysical processes responsible for stellar nucleosynthesis are well understood, others remained elusive for decades. Specifically, the production of elements heavier than iron has been one of the major open questions in the field. An important breakthrough happened in 2017 when gravitational-wave and electromagnetic observatories around the world, and in space, detected for the first time the merging of two neutron stars, and identified it as a main source of heavy element production in the Universe. The puzzle, however, is far from solved. Interpreting the observations requires the understanding of the nuclear processes that drive these events. This talk will focus on the critical nuclear properties needed to explain the neutron-star merger observations. I will discuss recent experiments performed at the National Superconducting Cyclotron Laboratory at MSU, as well as new initiatives, and plans for the future at the Facility for Rare Isotope Beams.