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R-Process Experiments with Unstable Isotope Beams

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The measurement of elemental abundances in ultra-metal poor stars over the last decade, and the recent observation of a neutron-star merger event, are crucial steps towards solving one of the outstanding questions in nuclear astrophysics: the synthesis of the heaviest elements during the rapid neutron-capture process (r-process). However, and in spite of steady progress in the experimental and theoretical fronts, the lack of reliable nuclear data for most isotopes involved in the r-process still represents a significant hurdle to make precise comparisons of astrophysical theories with astronomical observations. Improving nuclear data for the r-process is one of the main motivations for the development of a new generation of radioactive ion beam laboratories specifically designed to be able to reach very unstable isotopes. I will review current efforts on r-process experiments with radioactive ion beams, discussing examples of measurements of nuclear masses and decay properties of neutron-rich isotopes at the National Superconducting Cyclotron Laboratory (NSCL) in the US, and the Radioactive Ion Beam Factory (RIBF) of RIKEN in Japan, which our group is involved with. I will also present an outlook of the exciting new experimental opportunities that will be offered by the Facility for Rare Isotope Beams (FRIB) under development at Michigan State University.

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