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Science of rare isotopes: connecting nuclei with the universe.¹

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Understanding nuclei is a quantum many-body problem of incredible richness and diversity and studies of nuclei address some of the great challenges that are common throughout modern science. Nuclear physicists strive to build a unified and comprehensive microscopic framework in which bulk nuclear properties, nuclear excitations, and nuclear reactions can all be described. A new and exciting focus in this endeavor lies in the description of short-lived nuclei. The extreme isospin of these nuclei, relative to those near stability, and their weak binding bring new phenomena to the fore which isolates and amplifies important features of nuclear many-body open quantum systems. The fields of nuclear physics and astrophysics provide the link between our understanding of the fundamental constituents of nature and explaining the matter of which we and stars are made. Studies of rare isotopes elucidate fundamental questions in this area. In this talk, experimental and theoretical advances in rare isotope research will be reviewed in the context of the main scientific questions. Particular attention will be given to the worldwide radioactive beams initiatives and to the progress in theoretical studies of nuclei due to the advent of terascale computing platforms.

Reference: Rare-Isotope Science Assessment Committee Report, The National Academies Press
<http://books.nap.edu/openbook.php?isbn=0309104084>

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