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ISOL Systems: Design and Physics Potential

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The RIA facility is being proposed to elucidate a number of key questions in the fields of nuclear structure physics, astrophysics and fundamental interaction physics. Many of these key questions are best addressed with beams of short-lived radioactive isotopes at very low energy or reaccelerated to energy in the range from that typical of explosive astrophysical events up to the Coulomb barrier regime. To fulfill its goal, RIA must have far greater capabilities in this energy regime than existing facilities. This is achieved by using a combination of high power ISOL targets and a new approach combining the advantages of the ISOL and fragmentation techniques to yield beams of a broad array of short-lived isotopes at intensity approaching that available so far only with beams of stable isotopes. The physics questions that will be addressed with these beams will be presented together with a detailed description of the concepts and underlying R&D that enable this breakthrough in performance. This work was supported by the US Department of Energy, Office of Nuclear Physics, under Contract Nos. W-31-109-ENG-38 and DE- FG-06-90ER-41132.