Abstract Submitted
for the APR07 Meeting of
The American Physical Society

Application of Symmetry Theories to the Design of Fragment Separators for Exotic Isotope Accelerators JAMES MALONEY, Northern Illinois University — Exotic isotope accelerators are posed to provide us with unique abilities to investigate and test current theories regarding nuclei structure, weak-force interaction symmetry, and cosmologic evolution. Crucial to this powerful experimental tool is the design of its fragment separator. Designs for such a fragment separator can be developed through use of symmetry theories and simulation software. The goals and requirements of such designs include mechanical specifications; minimizing the effects of beam aberrations, fringe fields, and stochastic effects of the systems elements; allowing large acceptance; and providing a high-intensity beam of pure ions to be transported to experiments through the accelerator. Beam aberrations create substantial problems in any design, particularly beyond the first- and second-order terms. Symmetry theories help understanding the cause of these aberrations and provide clues to correct the design. This thesis explores a variety of designs that have been tested and compared to develop a proposed system layout that will best meet the needs and goals of the next-generation exotic isotope accelerator.

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Date submitted: 05 Jan 2007 Electronic form version 1.4