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**Optimization of a Neutron Detector to Measure (a,n) Reaction Cross-Section**[1] JESUS PERELLO, Florida International University, FERNANDO MONTES, TONY AHN, National Superconducting Cylcotron Laboratory, ZACHARY MEISEL, Michigan State University — Nucleosynthesis, the origin of elements, is one of the greatest mysteries in physics. A recent particular nucleosynthesis process of interest is the charge-particle process (cpp). In the cpp, elements form by nuclear fusion reactions during supernovae. At the moment, this fusion process is not well understood and has been proposed to be studied. This process of nuclear fusion, (a,n), will be studied by colliding beam elements produced and accelerated at the National Superconducting Cyclotron Laboratory (NSCL) to a helium-filled cell target. The elements will fuse with a (helium nuclei) and emit a neutron during the reaction. The neutrons will be detected for a count of fused-elements, thus providing us the probability of such reactions. By knowing the probability, we can then calculate how much of a certain element will be created in the cpp, which tells us its abundance. The neutrons will be detected using the Neutron Emission Ratio Observer (NERO). Currently, NERO's efficiency varies for neutrons at the expected energy range (0-12MeV). To study (a,n), NERO's efficiency must be near-constant at these energies. Monte-Carlo N-Particle Transport Code (MCNP6), a software package that simulates nuclear processes, was used to optimize NERO configuration for the experiment.

[1]McNair Society, SROP MSU

Jesus Perello
Florida International University

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