PRODUCTION OF NUCLEI ON THE PROTON DRIPLINE

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INTRODUCTION

Exotic radioactive beams are of interest in a multitude of fields in physics such as Nuclear Astrophysics. In order to study the properties of these beams they must be created in a laboratory. Using the K500 cyclotron and the Momentum Achromat Recoil Spectrometer (MARS) at Texas A&M we can produce and separate particular exotic beams of interest [1].

METHOD

We use the parameters LISE++ predicted to determine how to tune MARS for the experiment. A beam from the K500 cyclotron travels into MARS which impinges upon a target. The products then are separated by magnetic rigidity, and the primary beam is blocked by a graphite faraday cup in the coffin which reads the beam current. The products are further filtered by the velocity filter which separates isotopes by their charge to mass ratio. The products are detected by our ΔE vs. E Si telescope which is read as an electronic signal and recorded by our DAQ setup. Particles can then be identified based on their vertical position and energy loss in the Si telescope [3].

RESULTS

From this experiment we found that the Ni target has a higher production rate for 35,36Ca than what LISE++ predicted at this energy. The amount of 40Ca available was ~60 enA which allows us to calculate production rates from each reaction. The 40Ca+Ni reaction produced was ~82 35Ca per hour and ~1295 36Ca per hour. The Al and Be targets not only underperform in comparison to the LISE++ predictions, but produces less 35,36Ca than the Ni target. The 40Ca+Al reaction made ~40 35Ca, ~933 36Ca per hour, and the 40Ca+Be reaction made ~10 35Ca, ~328 36Ca per hour.

FUTURE RESEARCH

We wish to further explore what isotopes on or near the proton dripline Texas A&M is able to produce for various future experiments. The creation of a 35Ca beam allows for the study of its β-delayed proton/2-proton emission which can give interesting information such as a measurement of the half-life of 35Ca, and decay modes of daughter nuclei from the decay [4].

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REFERENCES