Gamma-ray Spectroscopy of Proton-rich Nuclei in the $f_{7/2}$ Shell via Two-step Fragmentation Reactions

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Recent studies of energy differences between isobaric analogue states in the $f_{7/2}$ shell have been shown to be very sensitive to subtle nuclear structure phenomena, such as particle alignments[1], the "*J=2 anomoly*" [2], radial shape changes [1] and single-particle effects such as the electromagnetic spin-orbit interaction [3]. To date, the nuclei studied in this region have generally been produced in fusion-evaporation reactions. As more exotic species are sought however, the cross-sections for proton-rich nuclei become prohibitively small. To this end a experiment was carried out at the NSCL facility to investigate the effectiveness of high-luminosity two-step fragmentation reactions for gamma-ray spectroscopy in this region. The A1900 and S800 separators were utilised for particle identification and the SeGA array for gamma-ray detection. Using measurements of Coulomb energy differences in isobaric analogue states, isospin symmetry will be investigated as the proton drip-line is approached.

This *test* experiment demonstrates the technique to be highly effective at producing and cleanly identifying a wide variety of isotopes in a single experiment. Preliminary results will be presented for several $T_z = -^3/_2$ nuclei, with reference to the physics outline above.

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