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Isospin Symmetry Studies Using Direct Reactions on Fragmentation Beams

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The neutron-proton exchange (isospin) symmetry results in striking symmetries in nuclear behavior between isobaric analogue states (IAS). The very small differences in excitation energy between the IAS can be interpreted in terms of Coulomb, and other isospin-non-conserving, effects. The analysis of these energy differences has been shown to be a sensitive probe of nuclear structure effects and provides stringent tests of model calculations (e.g.[1-5]). New experimental techniques have been applied in the last few years to access excited states in isobaric multiplets of larger isospin through spectroscopic studies of proton-rich nuclei heading towards the proton drip-line.

Knockout reactions have recently been shown to provide a successful and versatile technique for accessing states on interest in proton-rich nuclei for isospin-related studies. The direct nature of the 1-nucleon and 2-nucleon knockout mechanism yields selective population specific analogue states within a multiplet, allowing studies of isospin-symmetry breaking - see e.g. [6]. In this talk, the latest results using knockout reactions on radioactive beams at NSCL will be presented, including an analysis of mirrored knockout reactions and population of high-spin states through knockout from a high-spin isomer [7]. Theoretical analysis of both the reaction cross sections and isospin-symmetry breaking effects across the multiplets in the f7/2 shell will be presented.

In the shape-coexistence region around A~70, the strongly competing nuclear shapes have been predicted to yield the potential for the breakdown of isospin symmetry across a multiplet (e.g. [8]). To test these ideas, the study of the full A=70 isobaric triplet has been the subject of a number of experimental studies, to examine the extent to which isospin symmetry is retained. The recent identification of excited states in 70Kr [9] now completes this triplet. These data and their interpretation will be presented.

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