HIGH STATISTICS BETA-DECAY MEASUREMENTS AT TRIUMF-ISAC AND THE TRANSITION FROM THE 8PI SPECTROMETER TO GRIFFIN

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The 8π spectrometer [1] at TRIUMF-ISAC was the world's most powerful array dedicated to γ-ray spectroscopy following β-decay. It was used for a wide variety of studies, including tests of fundamental symmetries, structure of nuclei far from stability, and measurements near stability emphasizing very high statistics to achieve sensitivity to weak, low-energy γ-ray decay branches from levels at high excitation energy. In this latter category, measurements have concentrated on Zr, Cd, and Xe nuclei, and have included the decays of ^{94,98}Y to ^{94,98}Zr, ^{110}In to ^{110}Cd, ^{112}In/^{112}Ag to ^{112}Cd, and ^{122,124,126}Cs to ^{122,124,126}Xe.

For the Zr isotopes, the main motivation for the decay experiments was to provide evidence for shape co-existence. Long suspected to exist in the Zr isotopes, the first firm evidence in ^{94}Zr arose from the observation of the weak γ-ray decay branch from the 2^+ state at 1671 keV to the 0^+ state at 1300 keV that permitted the deformed band to be established [2]. We have continued our studies in ^{98}Zr, where similar in-band transitions permit the delineation of a deformed $K^\pi=0^+$ band. In the Xe isotopes, the main focus is once again on the establishment of excited 0^+ bands. Following the measurement of precise branching ratios in ^{124}Xe that enabled the extraction of Kumar-Cline shape-invariant quantities $\langle Q^2 \rangle$ for the first 3 excited 0^+ states [3], we have observed the in-band transitions in ^{122}Xe that permit the establishment of the $K^\pi=0^+$ bands, and the spin of the levels have been established through the use of γ-γ angular correlations.

As powerful as the 8π spectrometer was for such decay studies, it relied on comparatively small volume (~25%) single-crystal HPGe detectors [1]. Decommissioned at the beginning of 2014, it was replaced with the much more powerful GRIFFIN spectrometer [4] consisting of 16 large-volume clover HPGe detectors. GRIFFIN boosts the γ-γ coincidence efficiency more than 2 orders of magnitude greater than that of the 8π spectrometer, and can also be coupled with the DESCANT neutron detector array [5] enabling detailed studies of β-delayed neutron emitters. The Phase-I implementation of GRIFFIN began operation in Sept. of 2014, and studies to date have concentrated on nuclear structure far from stability and Fermi superallowed β^+ emitters. Phase-II, currently in progress, will see the completion of the array with the installation of BGO anti-Compton shields for both the clover HPGe detectors as well as the ancillary array of 8 $LaBr_3$ detectors for fast-timing measurements.

Highlights of the above nuclear structure studies with the 8π spectrometer, and GRIFFIN, will be presented.

REFERENCES

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