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Investigating the Structure of ^{46}Ca through the β^- Decay of ^{46}K Utilizing the New GRIFFIN Spectrometer

Tuesday 16 June 2015 16:00 (15 minutes)

Due to its very low natural abundance of 0.004%, the structure of the magic nucleus ^{46}Ca has not been studied in great detail compared to its even-even Ca neighbors. The calcium region is currently a new frontier for modern shell model calculations based on NN and 3N forces [1,2], so detailed experimental data from these nuclei is necessary for a comprehensive understanding of the region. Excited states in ^{46}Ca have been identified previously by various reaction mechanisms, most notably from (p, p') and (p, t) reactions [3]. The low-lying structure has been investigated by two previous beta-decay experiments, with large discrepancies present between the reported decay schemes [4,5]. A recent beta-decay of ^{46}K performed at TRIUMF's ISAC yield station obtained a new $T_{1/2}$ value of 96.303(79) s and identified 33 new gamma rays attributed to ^{46}Ca [6]. However, since the ISAC yield station is not equipped with gamma-gamma coincidence capabilities the observed gamma rays were not placed into the decay scheme of ^{46}Ca.

In this experiment, using an early-implementation of the new GRIFFIN spectrometer located at TRIUMF-ISAC, a 9μA 500 MeV proton beam was impinged onto a uranium carbide target to induce spallation and fission reactions. Radioactive species were surface ionized and a high-resolution mass separator was used to select singly-charged A = 46 ions only. The beam consisting almost entirely of ^{46}K was implanted onto a Mylar tape at the center of the GRIFFIN array. The ^{46}K source then populated the excited states of ^{46}Ca through β^- decay. The resulting gamma-rays were detected with the new GRIFFIN spectrometer, consisting of 15 HPGe clover detectors. The array also included SCEPTAR, an array of ten plastic scintillators mounted down-stream for β particle detection, and PACES, an array of Si(Li) detectors used for the detection of conversion-electrons. The high-statistics data set obtained from this experiment makes it possible to extend the current level scheme, including the assignment of new transitions and levels. The spin and parity of excited states in ^{46}Ca will be determined through a gamma-ray angular correlation analysis. Preliminary results from this experiment will be discussed.

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