Nuclear Structure of ^{98}Kr

Aaron W. Kindred, Rebekah G. Preshong
Mustafa M. Rajabali

Interests

The isobaric decay chain at N=60 ^{98}Rb, ^{98}Sr, ^{98}Y, ^{98}Zr (Figure 1) reveals that the disk shaped nuclear structure (oblate) is no longer preferred. Instead, a football shaped (prolate) structure is populated (Figure 2). Through gamma ray spectroscopy of the beta-decay from ^{98}Kr (Eq. 1), a deeper understanding of this oblate to prolate transition can be reached. Also, a detailed level scheme for ^{98}Kr will be constructed.

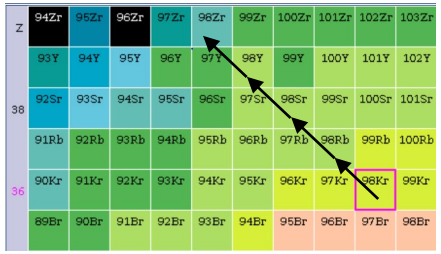

Figure 1: Isobaric decay chain starting from ^{98}Kr.

$$n \longrightarrow p + e^- + \bar{\nu} \quad (1)$$

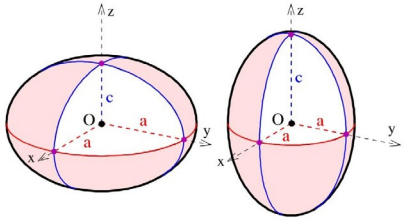

Figure 2: Oblate (left) Prolate (right).

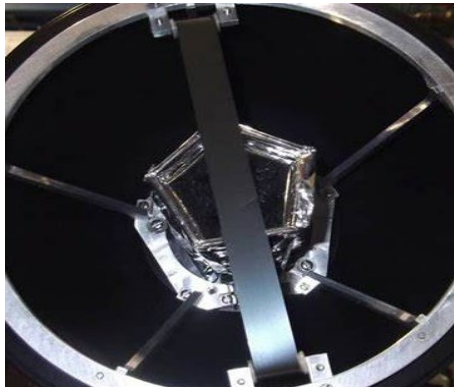

Figure 3: Moving tape collector inside GRIFFIN along with 5 of 11 SCEPTAR scintillators.

Figure 4: GRIFFIN array with moving tape collector on left.

Experimental Summary

The data for this experiment was gathered from the GRIFFIN array alongside 11 SCEPTAR scintillators at the TRIUMF lab. A moving tape collector running through the GRIFFIN array pictured above is used to implant the beam produced by the cyclotron. GRIFFIN is an array of 16 high purity germanium detectors used for the accurate measurement of gamma ray energy. (Figure 4) SCEPTAR are plastic beta particle scintillators useful for cutting down background noise (Figure 3). The raw data from the lab was sorted using data analysis tool GRSISort (Figure 5). The GRIFFIN array was then calibrated using known sources of radiation. A linear relationship between charge displaced in the detectors and expected energy was established and utilized in the spectroscopy of ^{98}Kr. Utilizing the beta detection data and a TBGSubtraction spectrum – a method of further background noise reduction and gamma coincidence location – background radiation was eliminated from the list of possible gamma rays from the decay.

Results/Future Work

Through careful analysis of the mentioned spectra, five peaks were determined to be from unknown origin, as they are not listed in the literature values provided [1]. Below is an example of the TBGSubtraction used to locate coincidences and subtract background noise (Figure 6). The suspect peaks can be found at 123, 247.4, 426.4, 496.3, 963.6 keV. Extra analyses of these spectra will be needed to confirm the origin of these as well as any other gamma rays that may be found, and ultimately construct a level scheme.

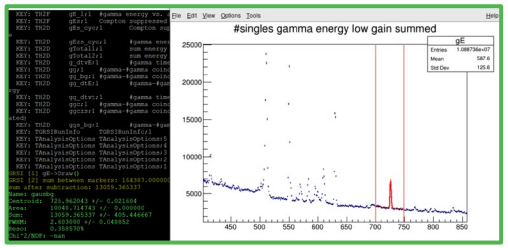

Figure 5: Fitting peaks via Gaussian curve with the GRSISort analysis tool.

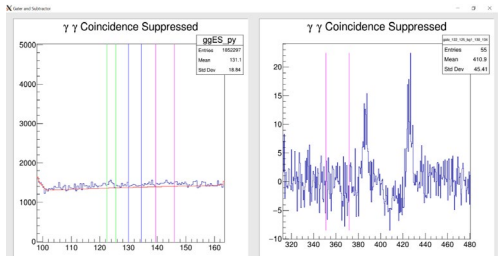

Figure 6: TBGSubtraction gated on 123 keV peak with 426.4 keV peak found in coincidence.

References: [1] nndc.bnl.gov
[2] M. M. Rajabali. *Decay spectroscopy of 96,97,98,99Kr isotopes.*

Funded by the Department of Energy under grant DE-SC0016988.