The PANhandlers

A Week at Physics of Atomic Nuclei

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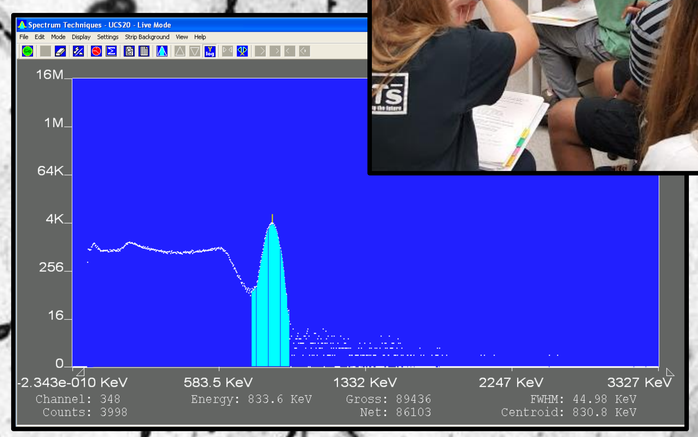
Experiment One:
Gamma and X-Ray Spectroscopy

Objective:
To produce a decay scheme for an unknown radiation source and identify it, while learning how to use professional lab equipment.

Procedure:
We explored how to use the software by calibrating the equipment with known nuclei sources, then designed an experimental procedure and wrote a proposal. We determined the energy of the gamma rays from the unknown source using the centroids on our graph. Then we used the LBNL Radiation Search to identify the isotope.

Conclusion:
We inferred that our unidentified isotope was Mn-54. This was confirmed the next day.

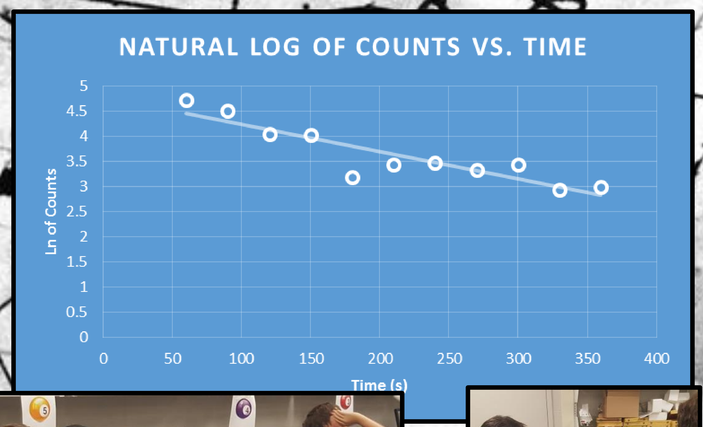


Experiment Two:
The Geiger Müller Counter

Objective:
To learn how to calibrate and use a Geiger Müller Counter in order to measure the half-life of Ag-108,110.

Procedure:
We calibrated the voltage of the Geiger Müller Counter by using a known sample of radioactive material. Then we measured the gamma radiation of the sample of the Ag-108,110. After collecting the data we estimated the half-life using linear regression and calculated the uncertainty.

Conclusion:
We calculated the half-life of Ag-108,110 to be 175.23 s ± 57.1 s.

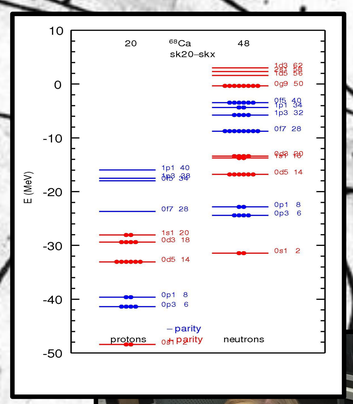


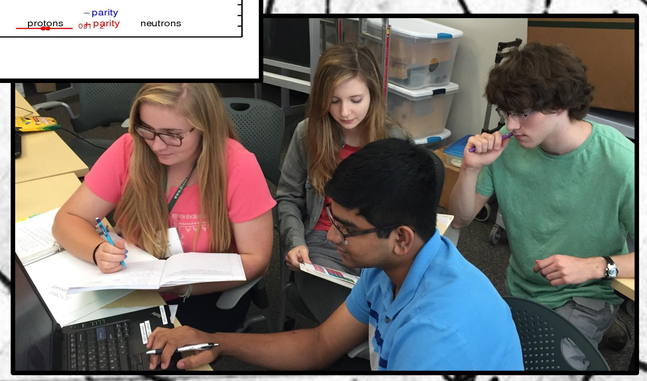
Experiment Three:
Nuclear Properties with EDF Theory

Objective:
To determine the proton and neutron dripline for Calcium using quantum mechanics and EDF Theory software.

Procedure:
We learned the basics of quantum mechanics and then produced calculations and visuals based on Energy Density Function Theory. We interpreted these visuals to predict the cutoff for the proton and neutron driplines as well as the most stable Calcium isotope.

Conclusion:
We concluded that the proton dripline was Ca-34. The neutron dripline was Ca-68. We estimated the most stable isotope was Ca-42.





This material is based upon work supported by the National Science Foundation under Grant No. PHY-1430152 (JINA Center for the Evolution of the Elements).

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