

Experiment One: Gamma and X-ray Spectroscopy Lab

Intro:

In this experiment we used gamma and x-ray spectroscopy to identify an unknown sample and we produced a decay scheme to aid in the identification of the sample.

Materials:

- ❖ LBNL Isotope Database
- ❖ Gamma Radiation Detector
- ❖ Cesium-137, Cobalt-60, and unknown isotope
- ❖ Oscilloscope

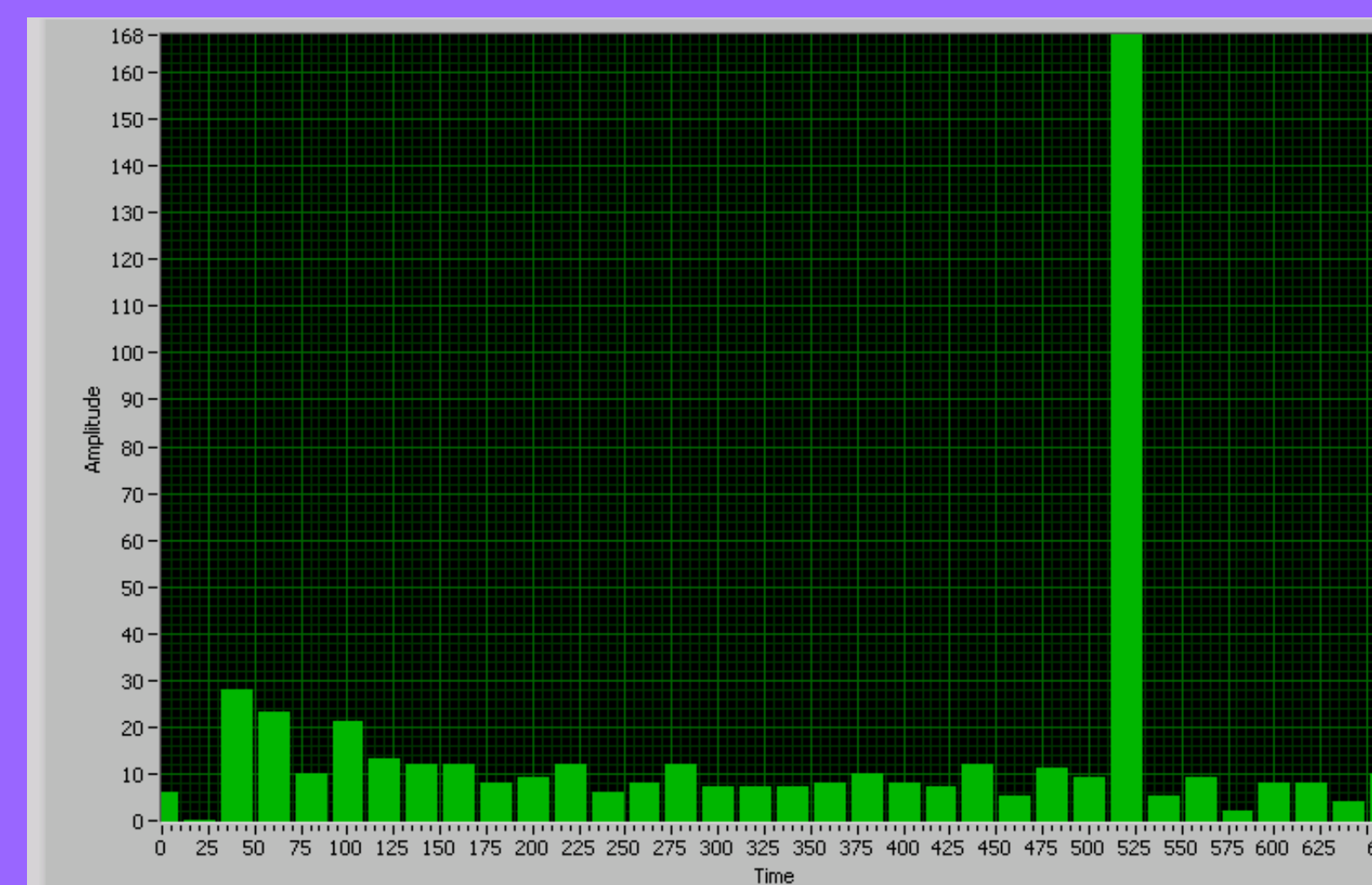
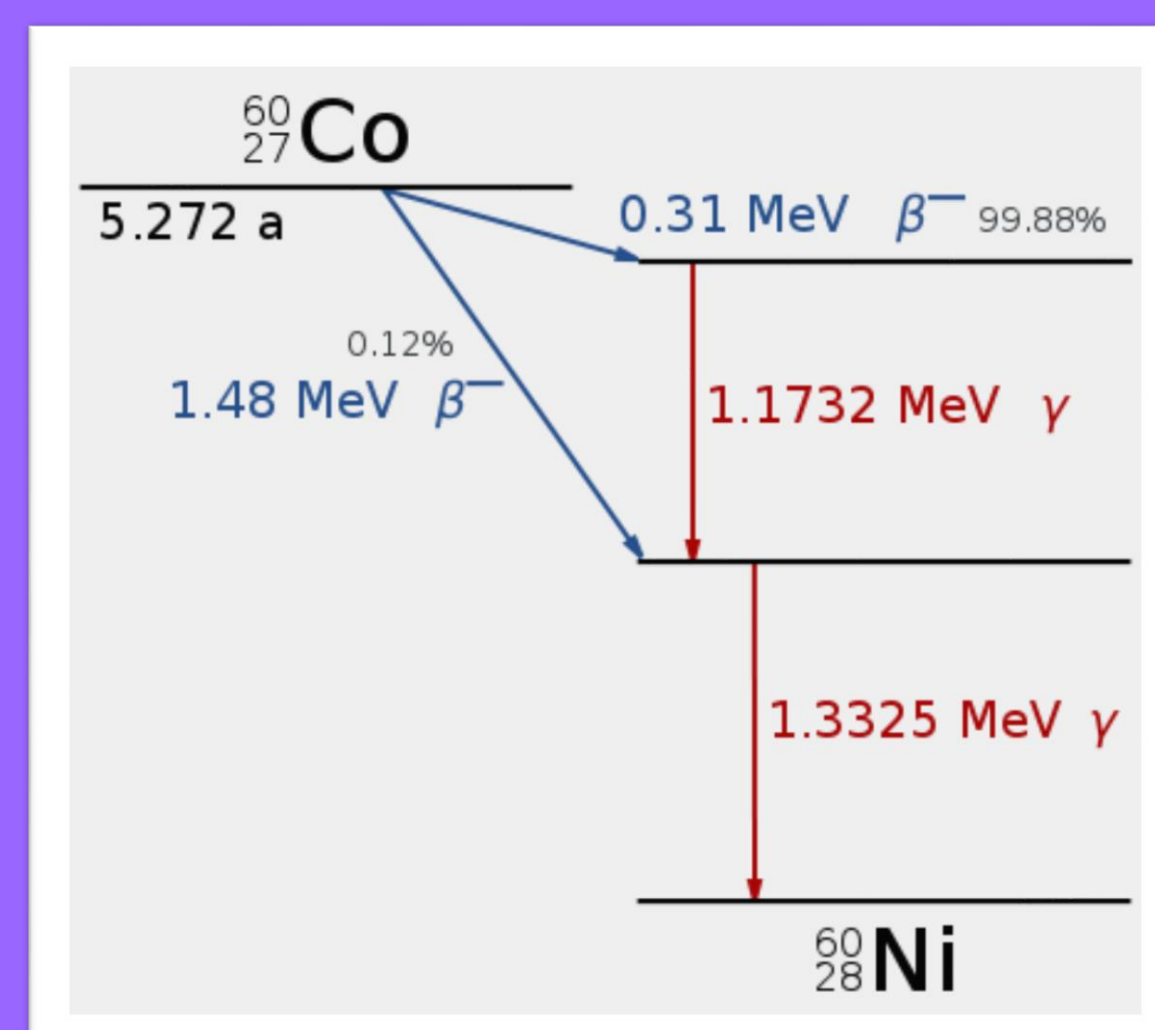
What We Did:

We used the detector to find the energy level of sample isotopes. Then we used this to identify the unknown sample by cross-referencing a database of all known isotopes. We determined it to be Manganese-54.

WWW Table of Radioactive Isotopes

⁵⁴₂₅Mn₂₉

Half life: 312.3 d
 Jp: 3+
 S_n (keV): 8939.0 11
 S_p (keV): 7559.6 10
 Prod. mode: Charged particle reaction
 Fast neutron activation



Experiment Two: Geiger Muller counter

Intro:

Throughout the experiment, a Geiger Muller counter was used to determine the half life of Ag-108

Materials:

- ❖ Geiger Muller counter
- ❖ Cesium-137 & Ag-108
- ❖ Custom made software

What We Did:

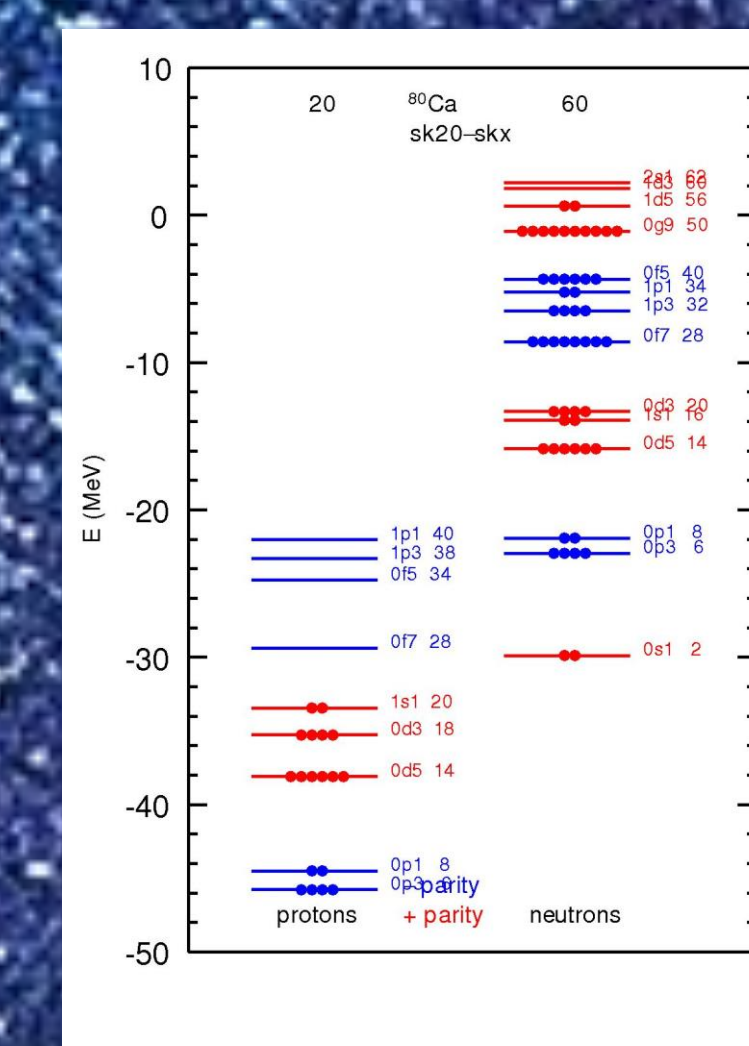
Ce-137 was used to determine the ideal voltage for the GM counter, then was replaced with silver-108. Data was then collected on the number of radioactive atoms present as time passes, to determine the decay rate of the silver. After various trials, the half life was determined to be 148 seconds +/- 6 seconds.



Experiment 3: Nuclear Properties with EDF Theory

Summary:

In this experiment, we used nucleus software that employed the EDF theory to aid in the creation of various diagrams. Utilizing the information that we noticed in the graph, we found the proton and neutron driplines of Calcium as well as the stable isotopes. The proton dripline was Ca-34, and the neutron dripline was Ca-68. One of the stable isotopes was Ca-48.



Takeaways

With the various lectures and experiments in this program, we learned a tremendous amount of information in the fields of astrophysics, particle physics, cosmology, and astronomy. We learned the essential skills of writing proposals, working together, and encountering problems that may not have a known solution. The knowledge gained from this program will aid in our development as scientists.