PANic! in the Accelerator

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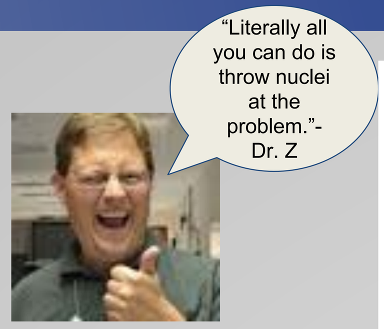
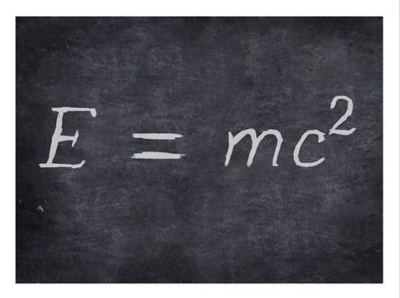
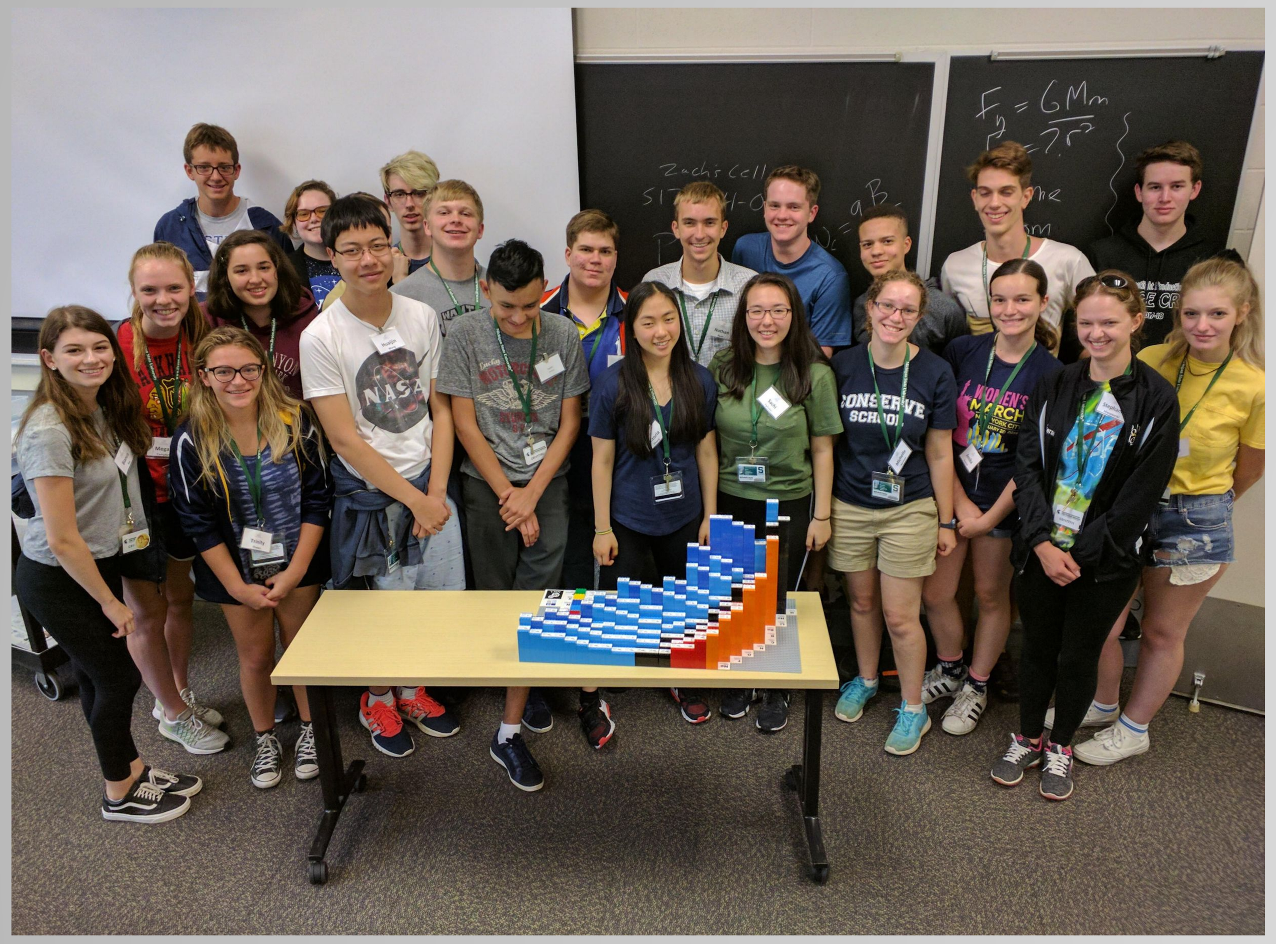
Day One: Playing with Toys!



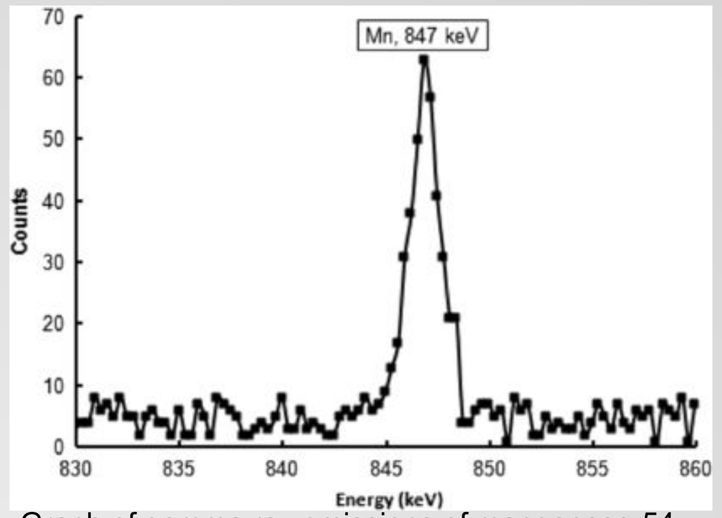


The first day of camp Dr. Constan and Dr. Lyons provided two lectures covering interactions of the nucleus. Dr. Constan presented radioactive decay, and the basic functions of an accelerator using magnetic marbles. He allowed us to make a small scale "accelerator" and smash marbles into each other in attempt to make isotopes. Dr. Lyons gave a lecture about the binding energy of the nucleus and taught us how to calculate that energy using Einstein's equation of mass energy equivalence. Dr. Lyons then allowed us to put together a Lego chart of the binding energy of different nuclei.



Day Two: Gamma Spectroscopy!

On the second day of camp Dr. Cortesi gave us a lecture about radiation detectors commonly found inside colliders. That afternoon, we were given the ability to participate in a lab, using radiation detectors to identify an unknown substance. The point of the lab was to identify and unknown substance by counting gamma ray energy emission using gamma spectroscopy. By measuring two known samples, we were able to calibrate the energy readings and identify the emissions of our sample. This allowed us to identify the sample by cross-referencing the existing databases of gamma energies specific to each radioisotope.



Graph of gamma ray emissions of manganese-54

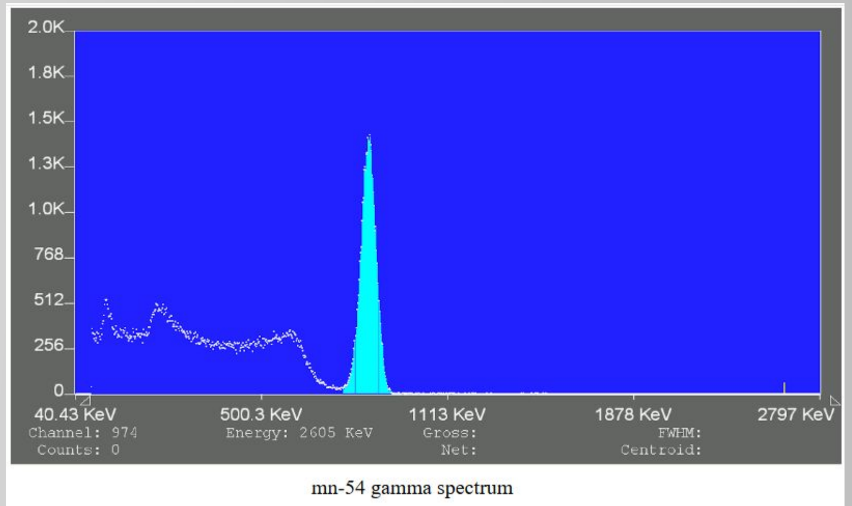
WWW Table of Radioactive Isotopes

Gamma energy search

Eg between 826 and 836 keV; $T_{1/2}$(parent) ≥ 0.5 y; $T_{1/2}$(parent) ≤ 5 y;

Eg (keV)	Ig (%)	Decay mode	Half life	Parent
832.00 *10*	0.0000146 *24*	a	1.9116 y *16*	^{228}Th
834.848 *3*	99.976 *1*	e+b+	312.3 d *4*	^{54}Mn

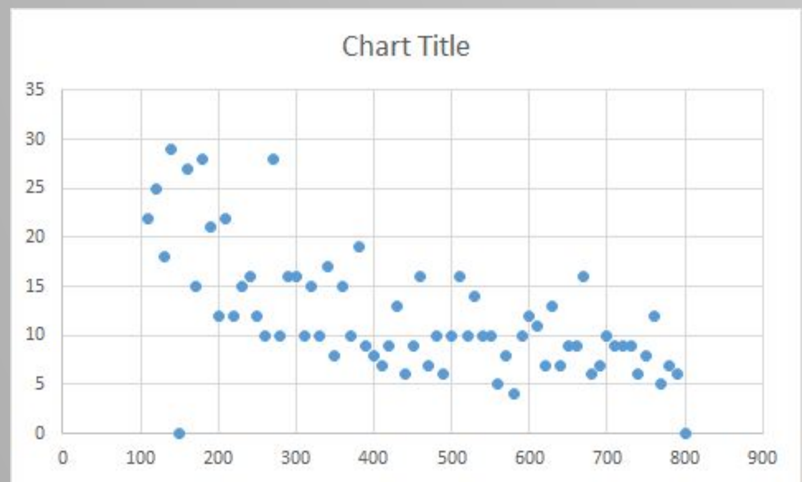
Main page | Radiation search | Nuclide search



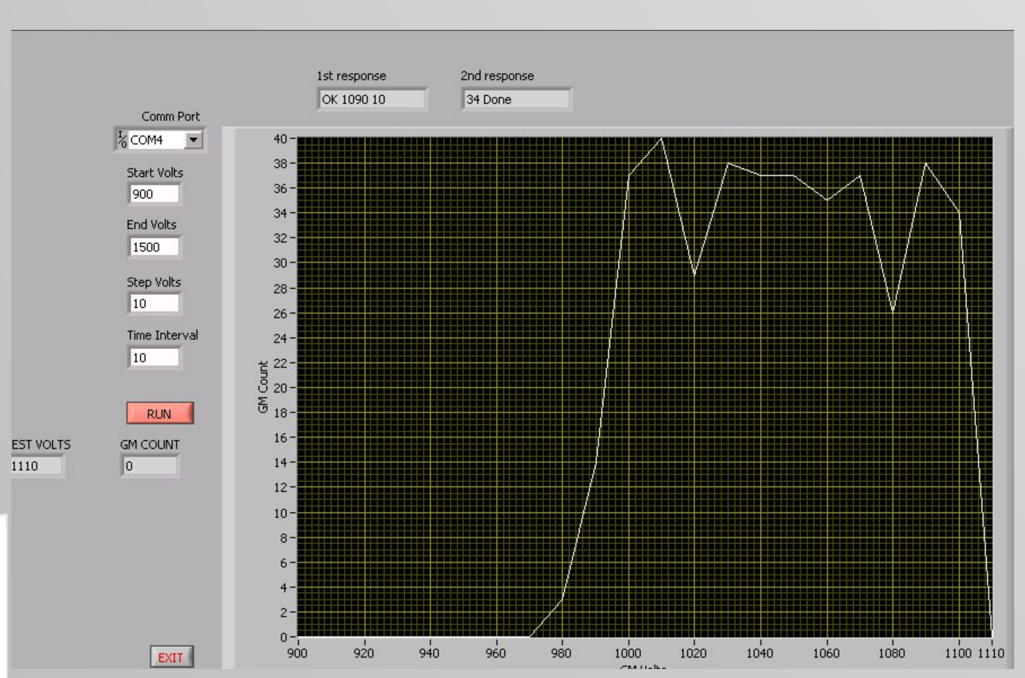
Graph for the unknown substance showing the counts of gamma ray emissions of specific energies.

Day Three: Half-Lives!

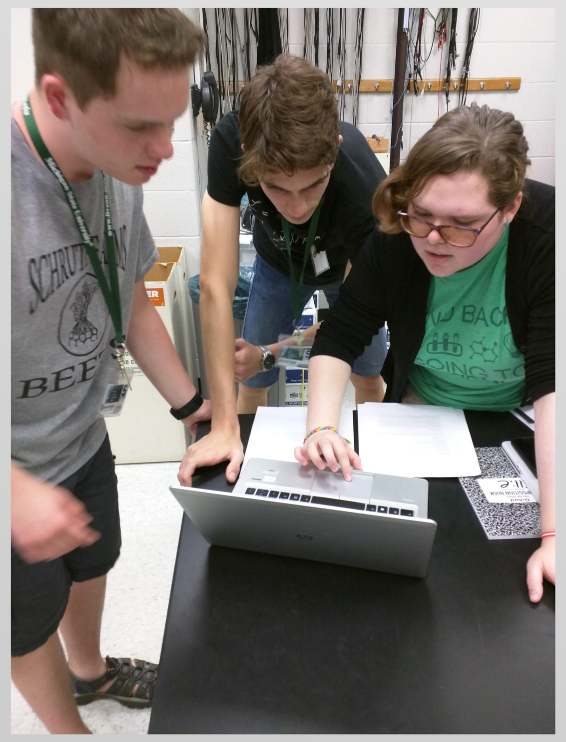
The third day of camp kicked off with a lecture by Dr. Roberts on nuclear astrophysics. He discussed the composition and fusion occurring within stars of varying masses along with remaining questions in his field of study. In the afternoon we examined a silver coin that had been bombarded with neutrons in an attempt to prove that silver isotopes 108 and 110 could decay into cadmium. By graphing a decay rate on a linear graph, using the slope of the line the half-life can be extrapolated. Using the equation λ = ln(2)/t(½) and N= N(0) * e^(-**λ**T) the half life can be be mathematically calculated. We calculated the half-life of silver 110 to be 2.68 minutes, only a 12% error when compared to the actual half-life.

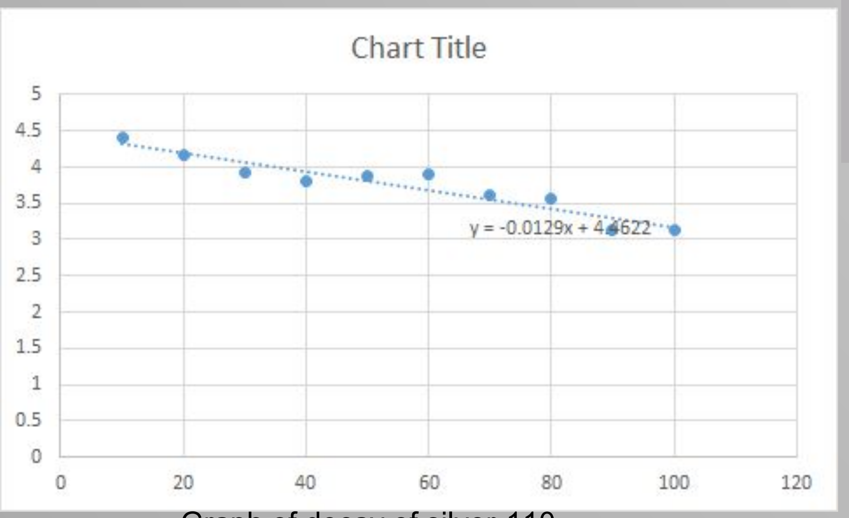


Graph of decay of silver-108



Graph for calibrating voltage for the Geiger counter

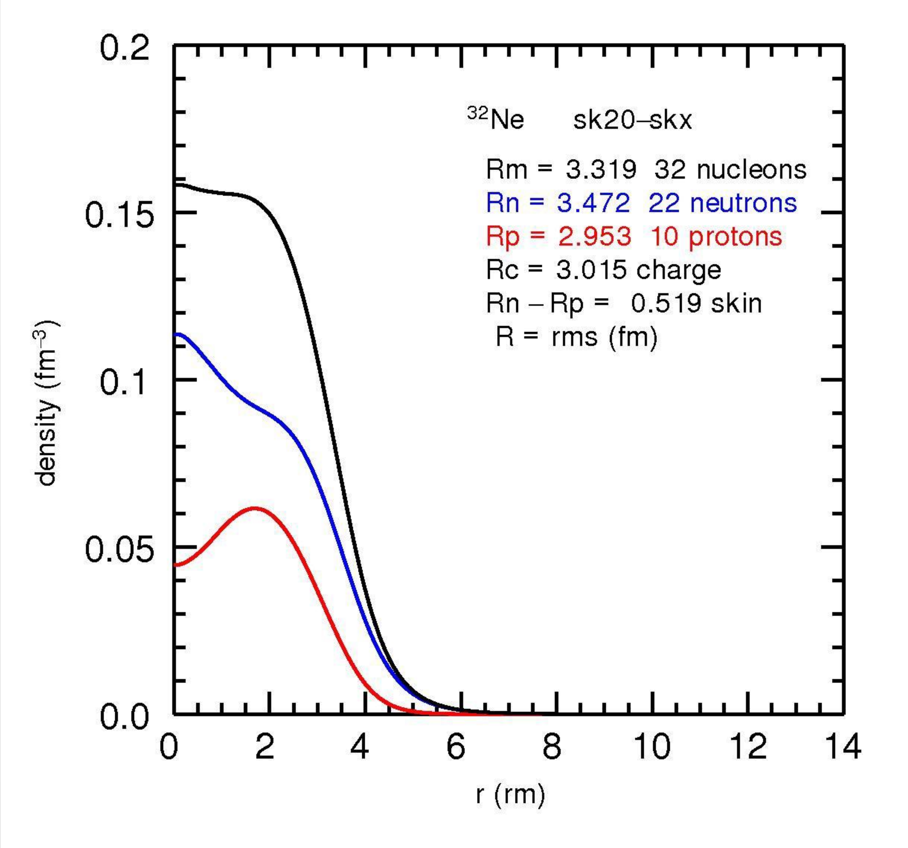




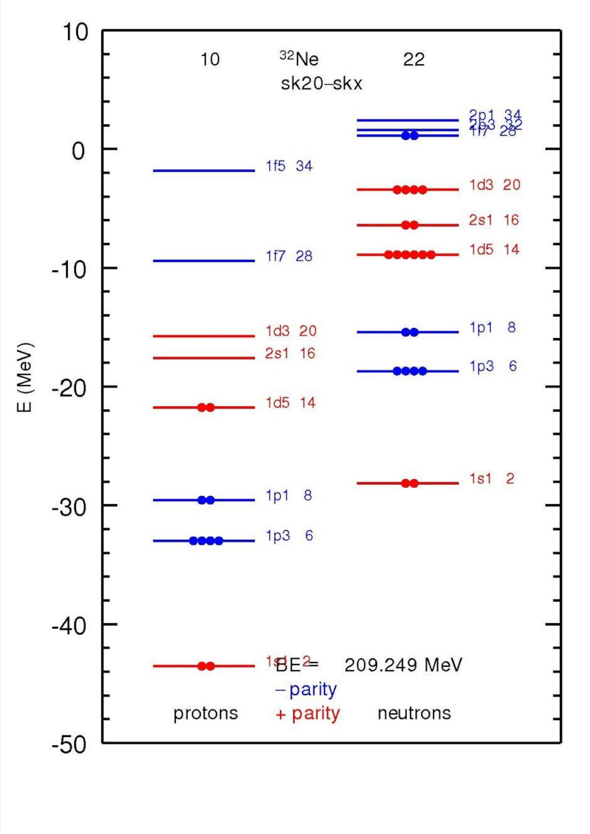
Graph of decay of silver-110

Day Four: Nuclear Properties and Astronomy

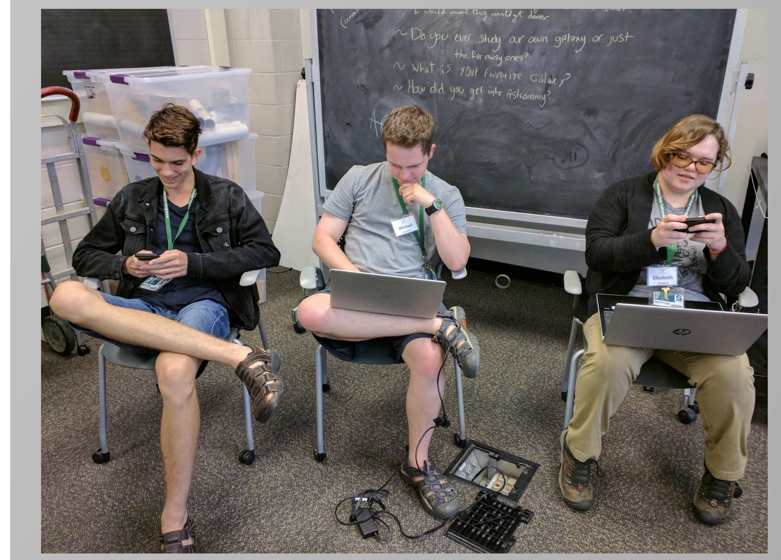
On day four, we listened to a riveting lecture by Professor O'Shea about the field of theoretical astrophysics. That afternoon, we participated in a number of theory simulations about nuclear density, shell model, and stability. These were presented to us by Dr. Brown, who explained to us the program and how to read the results. We ran a number of simulations regarding drip lines and instability, and learned what the arrangement of nuclear shells means for whether an isotope can exist.



Graph representing the density distribution of a nucleus



A visualization of the energy levels of nucleons in a nucleus



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).