Fast-Neutron Yield of Alpha-Neutron Sources Using Varying Targets

Guertler, Joshua (School: Barrington High School)

The neutron has opened a great sum of doors into the world of technological development by providing new forms of clean power and spectroscopy. In order to supply the required neutrons for these devices, neutron sources with an increased efficiency must be developed in order to boost the power and decrease the costs of these revolutionary devices. This experiment does exactly that by assessing which of the commonly used targets in alpha-neutron sources will produce the greatest neutron flux when subjected to an equal amount of alpha particles. The experiment used Lithium-7, Beryllium-9, Boron-11, Carbon-12, and Aluminum-27 targets that were subjected to 5 millicuries of alpha radiation from Polonium-210 to produce an artificial neutron flux that would be measured in counts per minute by a neutron search probe. My hypothesis was that Lithium-7 would produce the highest neutron flux due to how lower atomic mass elements are used more often in neutron sources in pre-existing devices . However, the experiment's results concluded that beryllium was the source that had the highest neutron flux when a constant stream of alpha particles was exposed to it. Beyond lithium, however, the trend that higher mass nuclei created a lower neutron yield appeared to hold true. Upon further research, the researcher discovered that this unexpected occurrence with lithium may be a result of the fact that an alpha particle is not as likely to collide with a lithium nuclei as it is with a beryllium nuclei. Due to this decreased likelihood of a collision, or cross section, possessed by lithium, a higher amount of alpha emissions would have been required to produce the same neutron flux as beryllium produced at the lower alpha emissions level.

Awards Won: