GAMMA RAYS EMITTED FROM CADMIUM UNDER SLOW NEUTRON BOMBARDMENT

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An examination of the spectrum emitted by the atoms of an element has told us much about the nature of the atom itself. Now it is hoped that an examination of the electromagnetic radiation from the nuclei of atoms will give us an insight into the structure of the nucleus. The two cases are similar in nature but the experimental procedures differ greatly due to the fact that the radiation from the nucleus has a wave length of only about one one-thousandth that of the radiation from the atom. These radiations coming from the nucleus are called gamma rays and are usually described in terms of their energy value rather than in terms of their wave length. One way of exciting the nucleus to emit gamma rays is by bombardment with neutrons.

The neutron source used in the present experiment was prepared as follows: Radon gas formed by one-half gram of radium was collected and compressed into a small capsule containing beryllium. Thus the beryllium was subjected to a bombardment of high energy alpha particles from the radon and neutrons were formed according to the following reaction:

$$ {}^{9}_{4}\mathrm{Be}+{}^{4}_{2}\mathrm{He} \quad {}^{12}_{6}\mathrm{C}+{}^{1}_{0}\mathrm{N} $$

The neutron source was placed at the center of a heavy lead cylinder. Around the cylinder were placed several large cakes of paraffin. Sheets of cadmium were distributed throughout the paraffin. The lead served to absorb the gamma rays from the radioactive substance in the capsule. The neutrons were not appreciably absorbed by the lead but were greatly slowed down in the paraffin. Some of the slow neutrons would be absorbed by the cadmium. Upon capture of a neutron the cadmium nucleus would emit a gamma ray. The energy of the gamma rays were measured by means of a Wilson cloud chamber.

The cloud chamber was placed near the cadmium. Gamma rays from the cadmium were occasionally absorbed by a thin strip of lead placed inside the chamber. The absorbed gamma ray would either knock off an electron from one of the lead atoms or form a positron-negatron pair. These electrons were curved in a strong magnetic field perpendicular to the face of the chamber. Stereoscopic photographs of the electron tracks were taken. The photographs were then projected and the curvature of the tracks measured. From this the energy of the electrons could be calculated and hence the energy of the gamma rays were known.

The highest energy gamma ray photon observed was around six million volts. The remaining photons ranged from this value down to two million volts, the lowest value included in the data. The distribution between these values was rather continuous in accordance with the Bohr theory. More numerous data are needed however, before this conclusion can be certified.

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