Gamma-Rays from Uranium Activated by Neutrons

A search has been made for gamma-rays emitted during the bombardment of uranium by neutrons. Uranium nitrate enclosed in a lead envelope 3 cm×12 cm and 0.85 mm thick was waxed to the inside wall of a cloud chamber filled with air and alcohol vapor in a magnetic field of 1500 gauss and bombarded with neutrons produced by 350 kilovolt deuterons on a heavy ice target. Out of 532 photographs 118 beta-ray tracks with energies in excess of 2.2 Mev were measured. The majority of the tracks originated in the walls of the chamber (or perhaps in the heavy material outside) and are attributed to recoils from gamma-rays and not to betas coming directly out of the uranium.

The experiment was repeated with the same amount of lead in the chamber but without the uranium. There were 238 photographs made and 23 recoils were measured whose energies exceeded 2.2 Mev. In Fig. 1 is plotted an integral curve for each of the runs. The upper curve shows the results with uranium in the cloud chamber. The lower curve represents the results without the uranium reduced to the same number of photographs as the upper curve and to approximately the same neutron intensity. (An estimate of the relative neutron intensities in the two experiments was made by comparing the number of recoil protons observed in an equal number of pictures. The ratio of the number of recoil protons without uranium to the number with uranium in the chamber was 1.5.)

Part of the difference in the number of low energy gamma-rays in the two cases might be attributed to radiative neutron capture in the uranium, but it seems quite clear that certainly the gamma-rays above 4 or 5 Mev are associated with the fission process, and probably are emitted by the excited products of the ruptured uranium nucleus. If in the products of the uranium disintegration, as in other excited nuclei, the gamma-ray energy is distributed over several quanta, one can conclude that these nuclei are in a very highly excited state after the fission in view of the high energy gamma-rays observed.

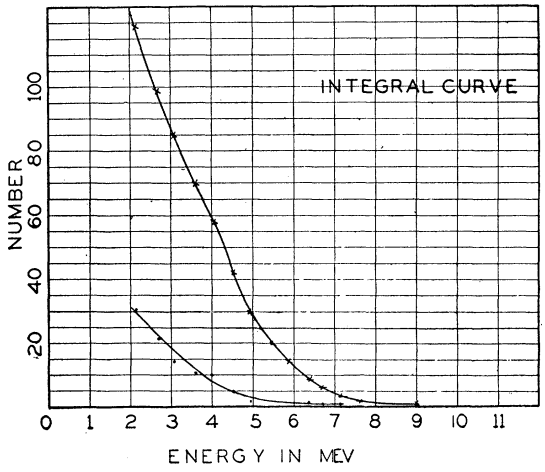

FIG. 1.

Because very few tracks came out of the lead envelope the present experiment might indicate that there are very few high energy beta-rays emitted during the actual fission. A few practically straight beta-ray tracks were observed in the cloud chamber, but it is possible that they were due to cosmic-ray shower particles, and consequently these were not included in the data in Fig. 1.

The data shown in Fig. 1 are not to be interpreted as representing a true distribution of the gamma-ray energies because only direct views of the tracks were photographed in the cloud chamber whose sensitive region was approximately 3 cm deep; and all tracks which could be measured, regardless of their lengths, were included in the data.

We wish to acknowledge the financial aid of the Duke University Research Council, and the helpful discussion of members of the Physics Department in this work.

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March 15, 1939.

Influence of Frequency on the Electro-Optical Effect in Colloids

Colloidal clay was separated into various particle sizes by centrifuging by the technique of Hauser and Reed.[1] A 1-percent suspension of particle size approximately 1500A was subjected to alternating electric fields from 30 to 12,000 cycles. The electro-optical effect on light moving perpendicular to the electric field between crossed Polaroids oriented at 45° to the field was observed. The transmitted light was measured by a photo tube and recording meter as the frequency was changed continuously. The r.m.s. field was held constant at 25 volts/cm and the temperature was 30°C.

As Mueller[2] reports, there is an enormous "Kerr" effect. (See Fig. 1.) Furthermore the continuous record shows one frequency where there is no light response to the voltage applied, although there is response at higher

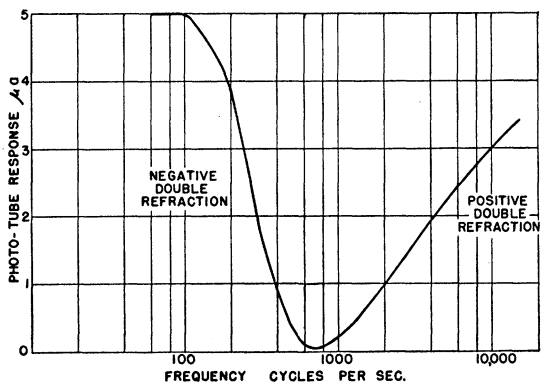

FIG. 1. Electric double refraction of colloidal clay.