The result obtained has the same appearance as that of motion in a magnetic field,[1] but the numerical coefficients are somewhat different for the quantum correction.

In conclusion, I should like to express my gratitude to Professor M. S. Rabinovich for much valuable advice.

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Translated by W. Ramsay
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ENERGY SPECTRUM OF FRAGMENTS FROM THE PHOTOFISSION OF U^{238}

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A systematic study of the variation of the nature of fission with excitation is possible by comparison of the energy spectra of any one isotope for different excitation energies. This should show a preference for excitation of the nucleus by gamma quanta, since the number of nucleons in the nucleus is not changed by this method. Some data for such a comparison can be gained at present from the behavior of U^{238}, for which the spectrum of spontaneous fission fragments[1,2] and the spectrum of fragments from photofission for a maximum gamma-ray energy of 16.7 Mev[3] have been investigated. The purpose of the present work was to obtain the energy spectrum of fragments from the photofission of U^{238} at a maximum betatron gamma-ray energy of 12.5 Mev.

The measurement of the kinetic energy of the photofission fragments was made in an apparatus consisting of a differential pulse ionization chamber, an amplifying channel, and a photo-recording pulsed oscillograph. The chamber had two parts — working and compensating — with a common collecting electrode and high voltage electrodes of opposite sign. The working part of the chamber was an ordinary pulse chamber with a grid. The compensating part of the chamber gave better compensation in the absence of a grid electrode within it. A layer of U_3O_8, which had been a target for a beam of gamma-rays and had a surface density of 0.4 mg/cm^2, was placed on the negative electrode. No collimation of the direction of the fragments was made.

The angular distribution of fragments in photofission is anisotropic with a maximum in the direction perpendicular to the gamma-ray beam. When the orientation of the chamber axis was parallel to the beam axis an additional distortion of the fragment spectrum could have arisen at the expense of absorption, since a significant part of the fragments could have flown out at very small angles to the plane of the preparation. Therefore in practice the chamber axis was set up at an angle of 15° to the beam axis.

The energy spectrum of fragments from the photofission of U^{238} for a maximum betatron bremsstrahlung energy of 12.5 Mev is shown in Fig. 1. The energy distribution of fragments from the slow neutron fission of U^{235} was obtained with the same apparatus and with the same preparation. This distribution is also shown in Fig. 1.

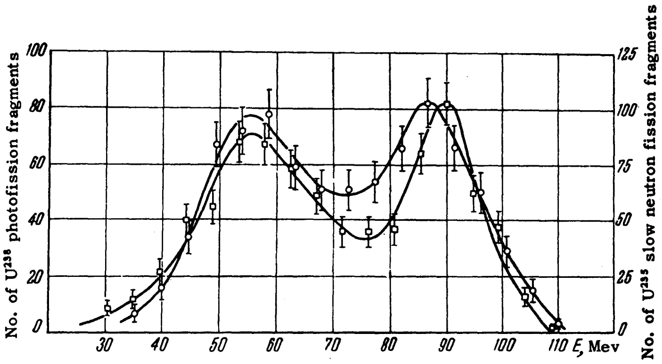

FIG. 1. Fragment energy spectra: ◎ — photofission of U^{238} at a maximum gamma-ray energy of 12.5 Mev, □ — slow neutron fission of U^{235}.

The spectrum of the photofission fragments has the most probable energies of (55.1 ± 1) and (86.9 ± 1) Mev for the groups of heavy and light fragments, respectively. To take the absorption in the preparation layer into account, these values must each be increased by approximately 5 Mev.

In Fig. 2 the U^{238} photofission spectrum is compared with the spontaneous fission spectrum obtained in reference 2. The comparison was made by means of the energy spectra of fragments from

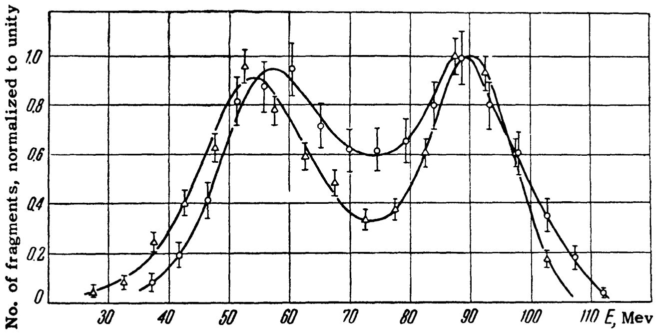

FIG. 2. Comparison of energy spectra of fragments from: ⊙ – photofission and Δ – spontaneous fission of U^{238}.

the slow neutron fission of U^{235}, determined, by the way, both in the present work and in reference 2.

Owing to the different thicknesses of the preparations (the surface density of the preparation in reference 2 amounted to 0.15 mg/cm^2), the neutron fission spectra differ somewhat among themselves. The main difference consists in the most probable energies of the spectrum in the present work being 2 Mev less, on the average, than those of the spectrum found in reference 2. Moreover, the increase of the thickness of the preparation is connected with an additional distortion of the spectrum, which consists in each peak obtaining some spread and becoming more asymmetrical at the expense of the appearance of a "tail" in the low-energy region. It is evident that if the neutron fission spectrum undergoes a distortion, then the photofission spectrum will undergo a similar distortion. However, the two neutron fission spectra do not differ from each other in form within the limits of error. Therefore the corrections to the distortions of the spectrum form caused by the large preparation thickness were not introduced into the photofission spectrum. In the comparison of the photofission and spontaneous fission spectra they were shifted with respect to one another so as to guarantee the best superposition of the U^{235} neutron fission spectra obtained in both cases. Thus the influence of the difference in the surface densities of the preparations was eliminated.

Comparison of the spectra shows that they differ mainly in the ratio of the notch height to the height of the light fragment peak. For the photofission spectrum this quantity is 0.60, and for the spontaneous fission spectrum it is 0.33.

This difference may depend both on the large excitation of the nucleus in photofission and on the superposition of fluctuations of the compensated gamma background. These fluctuations are due to a differential effect between the gamma pulses in the two parts of the chamber. The average magnitude of the pulse fluctuations on a pulse amplitude scale graduated in fragment energy units is about 4 Mev. The fluctuation pulses were superposed on the fragment pulses, producing a small broadening of the energy spectrum peaks. However, an estimate showed that the increase of the half-widths of the photofission spectrum peaks from this cause consisted of not more than 1 Mev, which can lead to an increase of the ratio of the notch height to the peak height of approximately 0.05. Hence, the main increase in the ratio of the notch height to the peak height by 0.22 should be carried at the expense of an increase in the number of symmetric fissions due to the high excitation of the fissioning nucleus in photofission.

Notwithstanding the considerable excitation energy, there is no essential increase observed of the most probable fragment energies and of the total kinetic energy in photofission compared with spontaneous fission. One can note also a certain pulling together of the photofission spectrum peaks compared with those of the spontaneous fission spectrum.

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Translated by Malcolm A. McLeod
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THE BETA SPECTRA OF F^{20} *AND* F^{17}

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THE beta spectrum of F^{20} has been investigated with the aid of a beta-ray spectrometer with a magnetic lens. A beam of 4-Mev deuterons, accelerated in the cyclotron of the Research Institute for Nuclear Physics, Moscow State University, was led into the chamber of the beta-ray spectrometer. The arrangement of the experiment was described by us earlier.[1] LiF of about 0.4 mg/cm^2 served as a target. The beta spectrum obtained by us is a superposition of the beta spectrum of F^{20} (pro-