mates show that the proportionality of the acceleration force and the radiation density is maintained up to $\rho \ll \rho_{max}$; at this value the order of magnitude of ρ_{max} is λ/r_0 times greater than ρ_{cr}, where λ is the characteristic wavelength of the radiation and r_0 is the classical radius of the particle. For example, in the second radiation belt electrons with energy 10^5—10^6 eV move in a gas with a density of 10^3 particles/cm^3 and the critical density of radio radiation at a wavelength $\lambda \sim 1/\omega_{He} \sim 0.1$—1 km is 10^{-20}—10^{-23} erg/cm^3. Although no data are available for these wavelengths we can, for the purposes of estimates, make extrapolations from the data for 10—20 m. We then find that even the radio radiation from the sun is capable of accelerating the fast electrons in the radiation belt. Under the most favorable conditions the radio radiation from the galaxy can accelerate electrons (lose energy) for tens of days.[1)]

Finally, we wish to point out that for heavy ions (mass $m \gg m_e$ and charge Ze) the accelerating force

$$\frac{dE}{dz} = \frac{Z^2e^2\omega_{0e}^3}{2m_e v_z^4}\int u^3du \,\frac{|\varepsilon_z|}{\varepsilon^2 h}\,(\overline{N}_- - \overline{N}_+) \tag{4}$$

is proportional only to the square of the charge of the particle (the dependence on m_i disappears when $\overline{N}_- \gg \overline{N}_+$); in other words, the acceleration of heavy ions is favored. The acceleration mechanism being considered here is statistical, as is that proposed by Fermi, and can be described by a diffusion equation in energy space. Explosions of supernovae, which appear as a source of cosmic rays in the galaxy,[7] are accompanied by intense radiation fluxes. A comparative estimate of the acceleration time for the Fermi mechanism and for the radiation mechanism described here shows that the radiation effect can predominate in the early stages of expansion and can be regarded as an injection mechanism for Fermi acceleration. The effect of radiation on fast particles in a medium should evidently be considered in a number of other astrophysical problems (theory of comet tails etc.).

1)The larger angle can increase the particle lifetime in the radiation belt.

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NUMBER OF NEUTRONS EMITTED BY U^{236} *IN REGIONS OF SYMMETRIC FISSION*

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THE sum of the kinetic energies of fission fragments and of their excitation energies calculated by the semi-empirical formula of Cameron[1] changes little with the fragment mass ratio near symmetric fission. Until very recently it was thought that the total kinetic energy of fragments is maximum for symmetric fission and decreases slowly with increasing mass ratio. Recent works[2,3] indicate convincingly that this assumption is false in the case of U^{233}, U^{235} and Pu^{239} fission by thermal neutrons. The kinetic energy reaches a maximum of ~ 180 MeV for a 1.25 mass ratio and decreases to ~ 40 MeV for symmetric fission. This situation forces us to review our previous notions concerning the balance of energy during fission. Although it could turn out that the semi-empirical formula gives incorrect results for a nucleus which is far off β-stability, it seemed more probable that the total excitation energy of the fragments changes sharply near symmetric fission, thereby neutralizing the change in the kinetic energy.

In this connection, measurement of the number of neutrons emitted in fission at different mass ratios has become particularly interesting. Similar research on U^{233}[4] and U^{235}[5] was already carried out before. In [5] there was even observed a slight increase in the number of neutrons in the mass ratio range 1.10 — 1.20, but the accuracy of both researches in regions of interest to us was clearly insufficient.

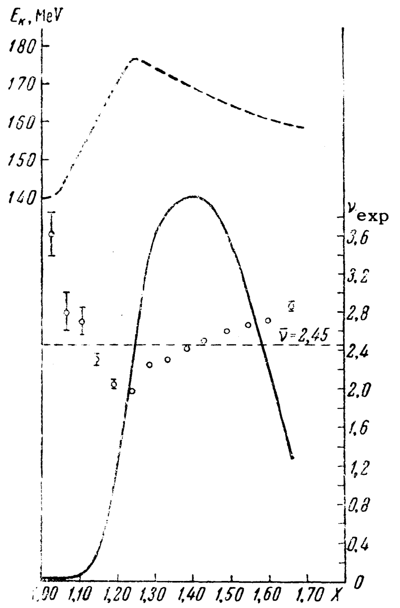
In the present work we attempted to obtain more reliable data on this problem.

We investigated fission of U^{235} by thermal neutrons. The detector of the fragments consisted of a double grid ionization chamber, with which the mass distribution of the fragments was obtained. The ratio of emitted fragments at the maximum of the distribution to those emitted at symmetric fission was ~ 210. The apparatus analyzed all the pulses in the ionization chamber with amplitudes in excess of the level corresponding to 25 MeV. Fission neutrons were recorded with a 4π detector with an efficiency that depended only slightly on the neutron energy.

About 25 fissions per second were recorded under operating conditions. About 4×10^5 fission neutrons were recorded during the measurements, while the background in the detector was somewhat smaller than the effect itself.

The results of the measurements are given in the figure. The abscissas represent the fragment mass ratio of the fragments $X = M_h/M_l$. The measured numbers of neutrons $\nu(X)$ with their statistical errors are shown by dots, the solid curve shows the experimental distribution of the fragments, and the dotted line is the total kinetic energy according to the data of [2,3].

We can see from the figure that there is a clear cut correlation between the kinetic energy and the number of neutrons $\nu(X)$. The minimum number of neutrons is emitted for a mass ratio of 1.20 — 1.25, which coincides practically with the position of the maximum kinetic energy. In regions of larger ratios the magnitude of $\nu(X)$ increases slowly, and our data agree well with our previous measurements [5].



Of greatest interest is the fact that on approaching symmetric fission a fast increase occurs in the magnitude of $\nu(X)$ so that 3.6 ± 0.2 neutrons per fission are recorded at mass ratios from 1.00 to 1.04 (first channel of analyzer).

The experiment thus discloses a significant difference in the number of neutrons emitted in symmetric fission and in fission at mass ratios corresponding to maximum kinetic energy. The experimental value of this difference is $\nu_{max} - \nu_{min} = 1.6 \pm 0.2$ neutrons.

As already noted, the insufficient resolution of the mass analyzer made the dip in the experimental fragment yield curve approximately equal to 210, whereas the true value is 600 [6]. The decrease in the dip was obviously due to fissions with other mass ratios falling into the region of unity mass ratio. It can be seen from the figure that the region outside symmetric fission is characterized by a small value of $\nu(X)$. Therefore the real value of ν in the region of symmetric fission should have a larger experimental value. Approximate calculations indicate that our results are consistent with the assumption that about 6 neutrons are emitted in symmetric fission.

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