probability of capture by ≈ 17 percent, and the angular correlation coefficient by a factor of about 2.4; the polarization of the neutrons is changed only slightly as compared with the results of the ordinary theory. At present calculations are being carried out on the capture of mesons by nuclei according to the Feynman — Gell-Mann theory. It can be expected that in this case also the correction introduced by the anomalous magnetic moment will be large.

[1] E. C. G. Sudarshan and R. E. Marshak, Phys. Rev. **109**, 1860 (1958).

[2] R. P. Feynman and M. Gell-Mann, Phys. Rev. **109**, 193 (1958).

[3] M. Gell-Mann, Test of the Nature of the Vector Interaction in β Decay (preprint).

[4] J. Bernstein and R. Lewis, The Vector Interaction in β Decay (preprint).

[5] Weinberg, Marshak, Okubo, Sudarshan, and Teutsch, Phys. Rev. Letters **1**, 25 (1958).

[6] Boehm, Soergel, and Stech, Phys. Rev. Letters **1**, 77 (1958).

[7] F. Eisler, R. Plano, et al., Leptonic Decay Modes of the Hyperons (preprint).

Translated by W. H. Furry
329

ON THE SPECTRUM OF THE ELECTRON-PHOTON COMPONENT OF EXTENSIVE AIR SHOWERS

I. A. IVANOVSKAIA and I. V. RAKOBOLSKAIA

P. N. Lebedev Physics Institute, Academy of Sciences, U.S.S.R.

Submitted to JETP editor June 27, 1958

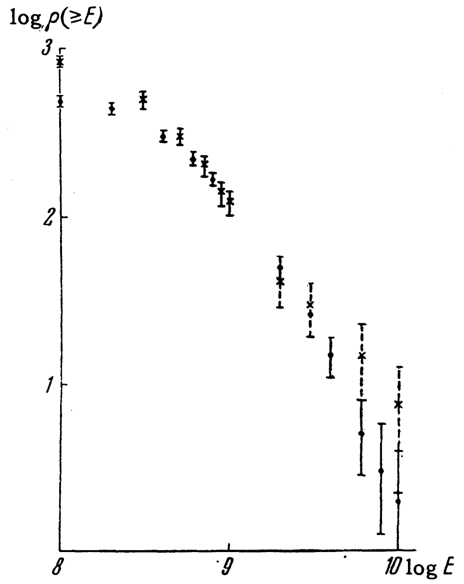
J. Exptl. Theoret. Phys. (U.S.S.R.) **35**, 1583-1584 (December, 1958)

An experiment was carried out in 1958 in Moscow in an attempt to explain the discrepancies observed in our earlier experiments.[1,2]

In these experiments we studied the electron-photon component of extensive atmospheric showers (EAS), and in particular the fraction of high-energy electrons and photons near the shower axis. A cloud chamber with lead plates was used for that purpose.[3] The energy of electrons and photons was determined from the number of particles in the cascade showers produced by them in the lead plates.

The energy spectra obtained for the region $< 10^9$ ev in references 1 and 2 were different. In addition, the fraction of high-energy electrons and photons $\rho\,(\geq 10^9)/\rho\,(>0)$ at 0 to 3 m from the shower axis amounted to $(1.85 \mp 0.25)\,\%$ according to reference 1 and to $\geq 10\%$ according to reference 2. Several reasons for the discrepancy were indicated:[1] (a) difference in shower sizes, (b) different transition effects in the roof above the apparatus, and (c) large errors in the axis location by means of the hodoscope in reference 1.

An additional experiment was carried out at sea level to study the problem, using the same cloud chamber. The selection method[4] made it possible to record EAS, the axes of which fell in 70% of the cases at a distance 0 to 3 m from the chamber. The mean shower size was $\sim 3 \times 10^4$ particles. Such showers were studied in reference 1 with best statistics. A total of 385 showers were recorded during 400 hours of operation.



Integral energy spectra of the electron-photon component. The ordinate represents $\log \rho(\geq E)$, where $\rho(\geq E)$ is proportional to the density of electrons and photons per 1 m² in one shower. The abscissa represents log E, where E is the energy in ev, ×) data of reference 1 in the range 0 to 3 m, •) data of the present experiment for all distances (70% of the showers in the range 0 to 3 m). The spectra are normalized at $E = 10^9$ ev.

As the result of the measurements we obtained the integral energy spectrum of the electron-photon component shown in the figure. The spectrum obtained in reference 1 for distances 0 to 3 m is included for a comparison. It can be seen that the spectra are different below 10^9 ev.

The fraction of high-energy electrons and photons was defined, as in the earlier experiments, as the ratio of the density of electrons and photons with $E \geq 10^9$ measured in the cloud chamber, to the density of electrons with $E > 0$ obtained by means of the hodoscope. It was found that $\rho\ (\geq 10^9)/\rho\ (> 0) = (12 \mp 3)\%$ at distances 0 to 3 m from the shower axis.

It seems to us, after a careful study of the data of references 1 and 2, and of the newly-obtained results, that the reasons for the discrepancy between the results of the present work and those of reference 1 are the following:

(1) At distances 0 to 3 m, the axes of the showers recorded in the later experiment and in reference 1 were differently distributed with respect to the distance from the cloud chamber. This fact can play a substantial role, since the main contribution to the fraction of high-energy electrons and photons at these distances is due to showers the axis of which fell less than one meter from the chamber.

(2) In reference 1, showers were recorded at < 1 m from the chamber, which could cause a large fluctuation of the fraction of high-energy particles since the distribution of the latter is different from Poissonian.

(3) In view of the small number of counters in the hodoscope,[1] the distance from the cloud chamber was not measured accurately enough, and a certain amount of showers from larger distances could have been ascribed to the 0 to 3 m region.

A detailed analysis of the above hypotheses will be presented later.

The hypothesis that the fraction of high-energy electrons and photons depends strongly on the shower size has not been confirmed. Calculations show that the transition effect in the roof above the apparatus was almost equal in both experiments and, consequently, cannot explain the discrepancy of the results.

From the comparison, we can conclude that the discrepancy between the theory and the experiment with respect to the fraction of high-energy electrons and photons in EAS is apparently smaller than that reported in reference 1.

In conclusion, the authors wish to thank G. T. Zatsepin, S. I. Nikol'skii, and O. I. Dovzehnko for a discussion of the results.

[1] Ivanovskaia, Kulikov, Rokobol'skaia, and Sarycheva, J. Exptl. Theoret. Phys. (U.S.S.R.) **33**, 358 (1957), Soviet Phys. JETP **6**, 276 (1958).

[2] Danilova, Dovzhenko, Nikol'skii, and Rakobol'skaia, J. Exptl. Theoret. Phys. (U.S.S.R.) **34**, 541 (1958), Soviet Phys. JETP **7**, 374 (1958).

[3] I. A. Ivanovskaia and A. G. Novikov, J. Tech. Phys. (U.S.S.R.) **26**, 209 (1956), Soviet Phys. "Tech. Phys." **1**, 206 (1956).

[4] Dovzhenko, Nikol'skii, and Rakobol'skaia, J. Exptl. Theoret. Phys. (U.S.S.R.) **36**, 17 (1959), Soviet Phys. JETP **9** (in press).

Translated by H. Kasha
330