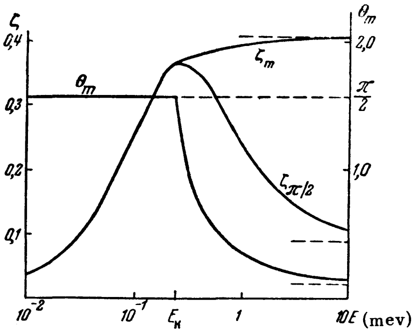
We have taken into account only dipole transitions and have dropped terms not important to Eq. (1).

Substitution of expression (3) into (1) gives for the unpolarized bundle of $\gamma$-quanta

$$\zeta = \frac{{}^1/_3\,(\mu_p - \mu_n)\sin\theta\,\sqrt{M}\,(\sqrt{\varepsilon_1} + \sqrt{\varepsilon_0})\,E/(\varepsilon_0 + E)(\varepsilon_1 + E)}{ME\,(\varepsilon_1 + E)^{-2}\sin^2\theta + {}^1/_6\,(\mu_p - \mu_n)^2\,(\sqrt{\varepsilon_1} + \sqrt{\varepsilon_0})^2/(\varepsilon_0 + E)}\,\mathbf{n}, \quad (4)$$




$\theta_m$ is the angular departure corresponding to maximum polarization of $\zeta_m$ of photoneutrons, $\zeta_{\pi/2}$ is the polarization of neutrons departing at an angle of $\pi/2$ ( for $E < E_k$, $\theta_m = \pi/2$ and $\zeta_m = \zeta_{\pi/2}$).

$[\varkappa \cdot \mathbf{p}]$.

where n is the unit vector in the direction $\varkappa \times \mathbf{p}$. In the vicinity of the threshold the maximum value of $|\zeta|$ is obtained for the angle $\theta = \pi/2$. However if the energy of the photoneutron $E$ is higher than $E_k = 0.24$ mev**, then the maximum value of polarization is

$$\zeta_m = (E/6)^{1/6}\,(\varepsilon_0 + E)^{-1/2} \approx 6^{-1/2}\,(1 - \varepsilon_0/2E) \quad (5)$$

corresponding to the emission angle $\theta = \theta_m$, where

$$\sin\theta_m \quad (6)$$

$$= (\mu_p - \mu_n)(\sqrt{\varepsilon_1} + \sqrt{\varepsilon_0})(\varepsilon_1 + E)/\sqrt{6ME\,(\varepsilon_0 + E)}$$

$$\approx 0{,}11\,(1 + \varepsilon_1/E).$$

In the case of a polarized photon bundle, the vector n in Eq. (4) should be replaced by the sum

$$\mathbf{n}\,(1 + \xi_x\cos 2\varphi + \xi_y\sin 2\varphi)$$

$$+ [\mathbf{n}\varkappa]\,(\xi_x\sin 2\varphi - \xi_y\cos 2\varphi + \xi_z\sqrt{\varepsilon_0/E}),$$

and the first term in the denominator of Eq. (4) should be multiplied by $1 + \xi_x\cos 2\varphi + \xi_y\sin 2\varphi$, where $\varphi$ is the azimuthal angle of neutron emission.

*We assume $\hbar = c = 1$.

**$E_k$ is the root of the equation

$$6ME\,(\varepsilon_0 + E) = (\mu_p - \mu_n)^2\,(\sqrt{\varepsilon_1} + \sqrt{\varepsilon_0})^2\,(\varepsilon_1 + E)^2;$$
$$\varepsilon_1 = 2{,}23 \text{ mev}, \; \varepsilon_0 = 0.064 \text{ mev};$$

for numerical evaluations we take $\epsilon_1 = 2.23$ mev, $\epsilon_0 = 0.064$ mev.


[1] A. I. Akhiezer and I. Ia. Pomeranchuk, *Certain questions of Nuclear Theory*, Moscow, 1950.

[2] F. W. Lipps and H. A. Tolhoek, Physica 20, 85 (1954).


Translated by G. L. Gerstein
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## New Type of Disintegration of a Heavy Meson?


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In the summer of 1955, I. I. Gurevich and coworkers exposed an emulsion stack in the stratosphere. The stack consisted of 45 layers of type P emulsion. Thickness of an undeveloped layer was 400 $\mu$, and diameter was 100 mm. The exposure was made at a height of 25 to 27 km, and the stack was at this height for two hours. Subsequently this emulsion stack was turned over to us by I. I. Gurevich. The result of microscopic scanning of the developed emulsions has been three cases, which are described below.

First Case (found by scanner N. G. Petruzashvilyi). The incident particle of unknown mass, having a path in emulsion of 2000 $\mu$, stops and decays into a $\pi^+$-meson which leaves a track of length 365 $\mu$. In its turn, the $\pi^+$-meson decays into a $\mu^+$-meson with track length 630 $\mu$, and finally decays into a positron. The whole chain of decays lies in the plane of a single emulsion layer.

Second Case (found by scanner K. A. Abashidze). The incident particle of unknown mass, emitted from a star which has 4 black and 3 relativistic tracks, travels for 5600 $\mu$ and decays into a $\pi^-$-meson with range 353 $\mu$, forms a $\sigma$-star consisting of three protons. The decay of the unknown mass particle and the $\sigma$-star are in a single emulsion layer.

Third Case (found by scanner L. N. Gabunia). The incident particle of unknown mass, having a range in emulsion of 6500 $\mu$, stops and decays into a $\pi^+$-meson, which has a range 354 $\mu$. The $\pi^+$-meson in its turn, decays into a $\mu^+$-meson, which after 570 $\mu$ decays by the emission of a positron. The entire chain of decays lies in a single emulsion layer.

If we had only a single case to deal with, it would undoubtedly be interpreted as the decay of a $\tau'$-meson, according to the scheme

$$\tau'^{\pm} \rightarrow \pi^{\pm} + 2\pi^0.$$

However, as can be seen from the description of these cases, the common characteristic for all is the occurrence of a $\pi$-meson track of length 357 $\mu$ ± 2%. Since these $\pi$-mesons are monochromatic, the decay of the ± particle of unknown mass is with high probability a two particle process.

A two particle decay of an incident meson into a $\pi$-meson of 3.4 mev energy (corresponding to 357 $\mu$), is so far unknown.

The gradient of emulsion grains along the tracks of the unknown initial particles and also the nature of their multiple scattering does not allow us to differentiate between the possibilities of a fork caused by the decay of a neutral meson, or a two prong star, or a sudden change of direction of the initial particle in a single scattering event.

Since the exact measurement of initial particle mass by one of the indirect methods was made difficult by the inconvenient placement of the tracks relative to the emulsion, we are at present limited to an examination of various possible decay modes using particles of known mass.

Variation I. The decay scheme of the unknown particle is

$$?^{\pm} \rightarrow \pi^{\pm} + \pi^0 + Q.$$

Then its mass is

$$m_?^{\pm} = 560\ m_e,\quad Q = 6.8 \text{ mev.}$$

Variation II. The decay scheme is

$$?^{\pm} \rightarrow \pi^{\pm} + \theta^0 + Q.$$

Then

$$m_?^{\pm} = 1260\ m_e,\quad Q = 4{,}4 \text{ mev.}$$

Variation III. The decay scheme is:

$$?^{\pm} \rightarrow \pi^{\pm} + \nu + Q.$$

Then

$$m_?^{\pm} = 350\ m_e,\quad Q = 33{,}4 \text{ mev.}$$

Variation IV. A K±-meson of mass 970 $m_e$ decays with the scheme

$$K^{\pm} \rightarrow \pi^{\pm} + ?^0 + Q.$$

Then

$$m_?^0 = 680\ m_e,\quad Q = 4.8 \text{ mev.}$$

It is interesting to note that three of the suggested variations give new masses for the initial incident particle, while the fourth gives a new value of mass for the neutral secondary meson. Attention should be directed to the fact that in one of the cases a negative initial particle stopped in the emulsion and was not captured by a nucleus, but decayed into a $\pi^-$-meson which in turn formed a $\sigma$-star.

Indirect measurement of the incident particle mass continues.

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## Connection between α-Decay and Nuclear Deformation

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IN this communication a connection between the deformation of the nuclear surface[1] and the relative intensities of α-groups in complex α-spectra of radioactive nuclei will be established; the results calculated apply to the α-spectrum of RdAc.[2] Among those factors which influence the intensity of α-groups should be listed the exponential factor