obtained.

The second situation for b), when the level densities of the two systems do not differ appreciably, can be analyzed in the following manner. Let $\omega_1(\epsilon)$ and $\omega_2(\epsilon)$ be the distribution functions for the distance between levels in each of the two systems. $[\omega_i = d_i^{-1} f(\epsilon/d_i)]$. The probability of finding a level of the second system at a distance ϵ from a level of the first system is given by the expression

$$\varphi_i(\varepsilon) = \frac{1}{d_i}\int_\varepsilon^\infty w_i(\eta)\, d\eta.$$

It is easy to show that the distribution function for the distance between levels for the entire system (levels are not distinguished) will be

$$W(\varepsilon) = Dd^2\Psi(\varepsilon)/d\varepsilon^2, \qquad (2)$$

where

$$\Psi(\varepsilon) = \psi_1(\varepsilon)\psi_2(\varepsilon),$$

$$\psi_i(\varepsilon) = \int_\varepsilon^\infty \varphi_i(\eta)\, d\eta = \frac{1}{d_i}\int_\varepsilon^\infty (\eta-\varepsilon)\, w_i(\eta)\, d\eta, \qquad (3)$$

D is the average distance between levels of the entire system $[\psi_i(0) = 1]$.

If we assume that the repulsion of levels for each system must make $\omega_{1,2}(0)$ go to zero, it follows from Eq. (2):

$$W(0) = \frac{2D}{d_1 d_2} = \frac{1}{D}\frac{2\alpha}{(1+\alpha)^2}, \qquad (4)$$

where $\alpha = d_1/d_2$ the ratio of the level distances of the two systems.

The presently available statistical material is not sufficient to allow detailed analysis along the above lines.

In conclusion we thank S. T. Beliaiev and V. M, Galitskii for fruitful discussions about two systems of related levels.

* The work of Levin and Hughes[4] was sent to the USSR before its publication, for which we thank the authors.

** Unpublished data from Brookhaven National Laboratory. We thank V. V. Vladimirskii for communicating these results, obtained from Prof. D.H. Hughes.

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The Polarization of Neutrons from the $D(\gamma, n)$ Reaction

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THE derivation of equations which give the cross section for photodisintegration of the deuteron for $E_\gamma \lesssim 10$ mev can be found in any textbook of nuclear physics (for example, Ref. 1), but there is no mention in the literature that the products of this process are polarized. As is shown below, this effect is caused by an interference of electric and magnetic transitions.

The polarization of the neutrons $\zeta = \langle \sigma_n \rangle$ from the $D(\gamma, n)$ reaction is

$$\zeta = \mathrm{Sp}\,(\sigma_n Q_\lambda Q_{\lambda'}^+) \times (\delta_{\lambda\lambda'} + \xi\Omega_{\lambda\lambda'})/\mathrm{Sp}\,(Q_\lambda Q_{\lambda'}^+)(\delta_{\lambda\lambda'} + \xi\Omega_{\lambda\lambda'}), \qquad (1)$$

where Ω has the components

$$\Omega_x = \begin{pmatrix}1 & 0\\ 0 & -1\end{pmatrix},\quad \Omega_y = \begin{pmatrix}0 & 1\\ 1 & 0\end{pmatrix},\quad \Omega_z = \begin{pmatrix}0 & -i\\ i & 0\end{pmatrix}, \qquad (2)$$

ξ_x, ξ_y, ξ_z are parameters characterizing the polarization of the incident bundle of photons (Ref. 2), and Q_λ is the matrix element for the photodisintegration of the deuteron by a γ-quantum of momentum $k = \omega\varkappa\ (|\varkappa| = 1)$* and polarization vector $e_\lambda (\lambda = 1,2)$

In the approximation of central $n-p$ forces with zero interaction radius and using the usual notation

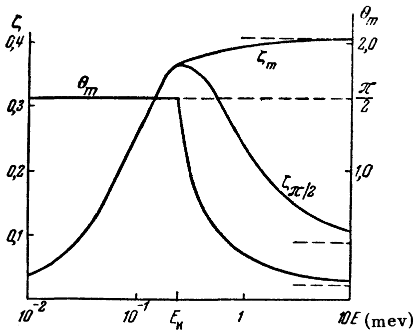
$$Q_\lambda \sim \delta_{S1}\delta_{mm_0}\frac{(\mathbf{p}\cdot\mathbf{e}_\lambda)}{\alpha_1^2 + p^2} \qquad (3)$$

$$+ \delta_{S0}\delta_{m0}\, i\,(\mu_p - \mu_n)\,(\chi_0, ([\varkappa\cdot\mathbf{e}_\lambda], \sigma_p - \sigma_n)\,\chi_1^{m_0})\,\frac{\alpha_1 - \alpha_0}{4M(\alpha_0 + ip)}.$$

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 γ-quanta

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



θ_m is the angular departure corresponding to maximum polarization of ζ_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

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

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

$$\sin\theta_m \qquad (6)$$

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

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

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 φ 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.

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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 μ , 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 μ , stops and decays into a π^+ -meson which leaves a track of length 365 μ . In its turn, the π^+ -meson decays