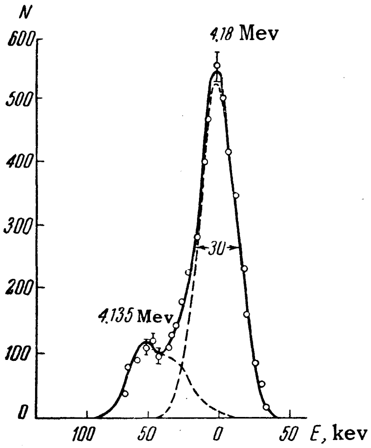

FIG. 2

to the Th^{234} second level. The transition intensity is $(0.25 \pm 0.1)\%$. The level energy is approximately 160 kev. The second to first level energy ratio coincides with the theoretical value obtained using the generalized model of the nucleus. It is most probable that this is the +4 level.

The α_1 group corresponds to a transition of the daughter nucleus to the +2 level. This group of particles is readily separated in the α-particle spectrum by using electric collimation and a narrower analyzer channel (Fig. 2). The intensity of transition to the +2 level is 23%.

This intensity value is in good agreement with the results of Refs. 2 to 5. The decay scheme of U^{238}, plotted in accordance with the results of this work, is shown in Fig. 1.

At the present time further measurements are being made with a view towards a better separation of the α_2 group, so as to increase the accuracy of the results obtained.

[1] Bochagov, Kocharov, and Kirshin **Приборы и техника эксперимента** (Instr. and Meas. Engg.) No. 6, 1957, p. 72.

[2] B. B. Zajac, Phil. Mag. **43**, 264 (1952).

[3] D. C. Dunleavy and G. T. Seaborg, Phys. Rev. **87**, 165 (1952).

[4] G. Albouy and J. Teillac, Compt. rend. **234**, 829 (1952).

[5] Georges Valladac, Dissertation, Paris, 1955.

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ANISOTROPY OF THE EVEN PHOTOMAGNETIC EFFECT

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KIKOIN and Bykovskii[1] have recently observed the presence of a clearly pronounced anisotropy in an investigation of the even photomagnetic effect in semiconductors with cubic lattice. By "even photomagnetic effect," first discovered by I. K. Kikoin,[2] is meant the appearance of a potential difference in a direction perpendicular to the incident light, independent of the direction of the magnetic field.) In this communication we give a purely phenomenological description of the character of this anisotropy.

The problem under consideration is characterized by three vectors: the magnetic field **H**, the outer normal **n** to the illuminated surface of the semiconductor (along which the liberated carriers diffuse), and the resultant electric field **E**. Let the magnetic field be sufficiently small. Then, with accuracy to terms quadratic in **H**, one can write the following general expression

$$E_i = L_{ik} n_k + L_{ikl} n_k H_l + L_{iklm} n_k H_l H_m. \qquad (1)$$

Let the Cartesian coordinate axes coincide with the axes of the cubic crystal. From the symmetry properties of this crystal it follows that

$$L_{ik} = L_1 \delta_{ik}, \quad L_{ikl} = L_2 e_{ikl},$$

where δ_{ik} is the unit tensor of second rank and e_{ikl} is the unit totally-antisymmetrical tensor of third rank.

As is known (see, for example, Ref. 3) the fourth-rank tensor will have only three independent components in a cubic crystal.

$$L_{aabb} = L_{bbaa} \equiv L_3,$$

$$L_{abba} = L_{abab} = L_{baba} \equiv L_4, \quad L_{aaaa} = L_5.$$

As a result the expression for E_i is transformed into

$$E_i = L_1 n_i + L_2 e_{ikl} n_k H_l + L_3 n_i H^2 + 2L_4 H_i n_k H_k + L_5' n_{\underline{i}} H_{\underline{i}}^3,$$

$$L'_5 = L_5 - L_3 - 2L_4 \qquad (2)$$

(there is no summation over the underscored indices).

The first term in (2) corresponds to the Dember effect,[4] the second to the odd photomagnetic effect,[5] and the third determines the variation of the Dember effect with the magnetic field. As to the fourth term, it describes the even photomagnetic effect in that form, in which it takes place in an isotropic semiconductor. If E is measured along a direction l perpendicular to **n**, and if l, **n**, and **H** are in the same plane, then this term signifies a simple dependence on the angle ϑ_0 between **n** and **H**, namely $L_4H^2 \sin 2\vartheta_0$, which was observed in polycrystalline specimens.[2]

The last term in (2) determines the presence of anisotropy in the even photomagnetic effect. L_5' vanishes in a completely isotropic specimen.

If **H** is perpendicular to **n** the isotropic portion of the even photomagnetic effect vanishes and the general expression for $E_l' = \frac{1}{2}[E_l(\mathbf{H}) + E_l(-\mathbf{H})]$ (l perpendicular to **H**) is written as

$$E_l'' = L_5' \sum_i n_i l_i H_i^2. \qquad (3)$$

It follows from (3) that, at a sufficiently small magnetic field and a known orientation of the monocrystalline specimen axes, the change in the even photomagnetic effect makes it possible to determine the anistropic constant L_5'

In the particular case when **n** coincides with the direction of the principal diagonal axis, expression (3) becomes particularly simple

$$E_l'' = \frac{2\sqrt{2}}{9} L_5' H^2 \Big\{\cos^2(\varphi - \varphi_0)\cos\varphi + \cos^2\Big(\varphi + \frac{2}{3}\pi - \varphi_0\Big)\cos\Big(\varphi + \frac{2}{3}\pi\Big) + \cos^2\Big(\varphi + \frac{4}{3}\pi - \varphi_0\Big)\cos\Big(\varphi + \frac{4}{3}\pi\Big)\Big\}. \qquad (4)$$

Here φ_0 is the angle between **H** and l and φ is the angle of rotation of the specimen about **n**. The character of the dependence of E_l'' on φ, as obtained in Ref. 1, is very close to that given by (4)

It must be noted in conclusion that the first to indicate that anistropy in a semiconductor with cubic lattice is possible, in connection with the dependence of the resistance on the magnetic field, was Seitz,[6] who introduced a term analogous to the last term in (2).

The authors are indebted to Academician I. K. Kikoin for valuable discussions.

[1] I. K. Kikoin and Iu. A. Bykovskii, Dokl. Akad. Nauk SSSR **116**, 381 (1957), Soviet Phys. "Doklady" **2**, 447 (1957).

[2] I. K. Kikoin, Dokl. Akad. Nauk SSSR **3**, 418 (1934).

[3] L. D. Landau and E. M. Lifshitz, Механика сплошных сред (Mechanics of Continuous Media) Part II, Ch. 1, 2d Ed., 1953.

[4] H. Dember, Phys. Z. **32**, 554 (1931).

[5] I. K. Kikoin and M. M. Noskov, Phys. Z. Sowjetun. **5**, 586 (1934).

[6] F. Seitz, Phys. Rev. **79**, 372 (1950).

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ON THE DETERMINATION OF THE COVARIANTS IN THE K_{e3} *DECAY*

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If all weak interactions are described by a universal A — V interaction as proposed by Gell-Mann and Feynman[1] and Marshak and Sudarshan[2] then the matrix element for the decay $K \rightarrow e + \nu + \pi$ should be of the form:[3]

$$M \sim GMf(\bar{\psi}_\nu p_K (1 + \gamma_5)\psi_e)$$

(in perturbation theory $f \sim \ln(\Lambda^2/M^2)$ where Λ is the cutoff parameter and M the nucleon mass; however, in general, f may be a function of the π-meson energy). Additional interest is raised thereby in the determination of the decay interaction.

For purposes of analysis the decay of the long-lived K_2^0 meson, $K_2^0 \rightarrow e^\pm + \nu + \pi^\mp$, is the most convenient since the presence of two charged particles permits a complete determination of the kinematics.

In the present note we propose to analyze the decay by a method analogous to the Dalitz analysis for the τ^+ decay,[4] on the assumption that the decay interaction is of the general form discussed by Pais and Treiman:[5]

$$M \sim \bar{\psi}_\nu (f_S + f_S'\gamma_5)\psi_e + \frac{ip_\mu^K}{M}\bar{\psi}_\nu\gamma_\mu (f_V + f_V'\gamma_5)\psi_e + \frac{p_\mu^K p_\nu^\pi}{M^2}\bar{\psi}_\nu\sigma_{\mu\nu}(f_T + f_T'\gamma_5)\psi_e.$$

The Gell-Mann and Feynman scheme corresponds