Gammel,[1] to the energy domain below 1 Mev, using the theoretical energy dependence of the p -phases for potential scattering. In this case the maximum contribution of the p -phase to the scattering cross section does not exceed 3%.

A phase-shift analysis of the measured results was carried out, assuming pure s -scattering, for 176.7 and 118 kev protons. The following values of the phases were obtained (two solutions):

$$E_p = 176.7 \text{ kev}$$

$$\text{I}\begin{cases}\delta_0^1 = 6° \pm 5° \\ \delta_0^0 = -15° \pm 7°\end{cases} \qquad \text{II}\begin{cases}\delta_0^1 = -5° \pm 1° \\ \delta_0^0 = 17° \pm 12°\end{cases}$$

$$E_p = 118 \text{ kev}$$

$$\text{I}\begin{cases}\delta_0^1 = 3° \pm 3° \\ \delta_0^0 = -8° \pm 8°\end{cases} \qquad \text{II}\begin{cases}\delta_0^1 = -2° \pm 2° \\ \delta_0^0 = 7° \pm 8°\end{cases}$$

A characteristic feature of these solutions is that the singlet and triplet phases are opposite in sign. The second of these agrees with the values of the phases obtained by extrapolating the data of Frank and Gammel to the domain of small energies and with the deductions of reference 2 on the existence, in this energy domain, of a resonance level with the momentum I = 0.

Curves for the scattering cross section calculated according to reference 1 are also drawn in the figures (continuous curve). The triplet S -phase, extrapolated to the domain of small energies, was taken to be the potential scattering phase, while the singlet S -phase was calculated using the level parameters deduced in reference 1. The p -phase was neglected. The same figure shows also curves (dotted) calculated on the assumption of pure potential scattering in both spin states. The interaction radius was taken to be $a = 3 \times 10^{-13}$ cm. Experimental values for the scattering cross section, as seen from the figure, are in good agreement with the assumption of resonance scattering in the $^1S_0$ state and not in agreement with the assumption of pure potential scattering in both spin states.

Thus, the results of the present work indicate that the scattering in the domain of low energies is described by the phases of reference 1. The scattering cannot be considered as pure potential, one of the s-phases must be positive. According to references 1 and 2 the singlet phase must be positive.

The authors express their thanks to Professors I. M. Frank and F. L. Shapiro for suggesting the problem and discussing the results of the work.

*Deceased.

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Translated by Kenneth Smith
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## *CERENKOV RADIATION OF A MAGNETIC DIPOLE IN AN ANISOTROPIC MEDIUM*

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Submitted to JETP editor February 27, 1959

J. Exptl. Theoret. Phys. (U.S.S.R.) 36, 1939-1940 (June, 1959)

THE Cerenkov radiation of a point magnetic dipole in an isotropic medium has been considered by a number of authors.[1-5] In the present note we consider the Cerenkov radiation of a point magnetic dipole in anisotropic and gyrotropic media.

Let a transparent medium be characterized by the dielectric permativity tensor and the magnetic susceptibility tensor

$$\varepsilon_{ik} = \begin{pmatrix} \varepsilon_1, & -i\varepsilon_2, & 0 \\ i\varepsilon_2, & \varepsilon_1, & 0 \\ 0, & 0, & \varepsilon_3 \end{pmatrix} \qquad \mu_{ik} = \begin{pmatrix} \mu_1, & -i\mu_2, & 0 \\ i\mu_2, & \mu_1, & 0 \\ 0, & 0, & \mu_3 \end{pmatrix}.$$

If the dipole moves along the optical axis (with velocity v) and the magnetic moment $\mu_0$ points in the direction of motion the energy losses due to Cerenkov radiation are given by the expression

$$-\frac{d\mathcal{E}}{dz} = \frac{\mu_0^2}{v^4}\int\limits_{\text{I}} \frac{\omega^3 d\omega}{\varepsilon_1^2 a^2 g^2 \beta^4}\{[a\varepsilon_1 n_1^2\beta^2 - \varepsilon_1\varepsilon_3\beta^2 - a(\varepsilon_1 - \varepsilon_3)]^2 g$$
$$- [\varepsilon_2 a - \varepsilon_1 b][2\beta^2\varepsilon_1 abn_1^2 - \beta^2\varepsilon_2(\varepsilon_1 b + \varepsilon_3 a) - 2\varepsilon_1 ab$$
$$+ 2\varepsilon_3 ab]\}(\beta^2 n_1^2 - 1)[n_1^2 - n_2^2]^{-2}$$
$$+ \frac{\mu_0^2}{v^4}\int\limits_{\text{II}} \frac{\omega^3 d\omega}{\varepsilon_1^2 a^2 b^2 \beta^4}\{[a\varepsilon_1 n_2^2\beta^2 - \varepsilon_1\varepsilon_3\beta^2 - a(\varepsilon_1 - \varepsilon_3)]^2 g$$
$$- [\varepsilon_2 a - \varepsilon_1 b][2\beta^2\varepsilon_1 abn_2^2 - \beta^2\varepsilon_2(\varepsilon_1 b + \varepsilon_3 a) - 2\varepsilon_1 ab$$
$$+ 2\varepsilon_3 ab]\}(\beta^2 n_2^2 - 1)[n_2^2 - n_1^2]^{-2},$$

where

$$n^2_{1,2} = \{(ag - a^2)\varepsilon_1 + ag(\varepsilon_1 - \varepsilon_3) + b^2\varepsilon_1 + (\varepsilon_1^2 a - \varepsilon_2^2 a + \varepsilon_1\varepsilon_3 g)\beta^2 \pm [(\varepsilon_1^2 a - \varepsilon_2^2 a - \varepsilon_1\varepsilon_3 g)^2\beta^4 - 2a\varepsilon_1(\varepsilon_3 g - \varepsilon_1 a)^2\beta^2 + 2a^2\varepsilon_2^2(\varepsilon_1 a + \varepsilon_3 g)\beta^2 + 2b^2\varepsilon_1(a\varepsilon_1^2 - a\varepsilon_2^2 + g\varepsilon_1\varepsilon_3)\beta^2 - 8abg\varepsilon_1\varepsilon_2\varepsilon_3\beta^2 + (g\varepsilon_3 - \varepsilon_1 a)^2 a^2 + b^2\varepsilon_1(b^2\varepsilon_1 - 2a^2\varepsilon_1 + 2ag\varepsilon_3)]^{1/2}\} / 2\varepsilon_1 ag\beta^2,$$

$$a = \mu_1/(\mu_1^2 - \mu_2^2), \quad b = \mu_2/(\mu_2^2 - \mu_1^2), \; g = 1/\mu_3.$$

The regions of integration are determined by the following inequalities (cf. reference 3):

$$\text{I: } \beta^2 n_m^2 > \beta^2 n_1^2 > 1, \quad \text{II: } \beta^2 n_m^2 > \beta^2 n_2^2 > 1.$$

In the case of a non-gyrotropic uniaxial crystal ($\epsilon_2 = b = 0$) we have

$$-d\mathcal{E}/dz = \mu_0^2 v^{-4} \int\limits_{\mu_3(\varepsilon_1\mu_1\beta^2 - 1)/\mu_1 > 1} \omega^3 d\omega \cdot \mu_3^2(\varepsilon_1\mu_1\beta^2 - 1)/\mu_1.$$

From the above it is apparent that the radiation intensity for an anisotropic dielectric ($\mu_1 = \mu_3 = 1$) differs from an isotropic dielectric only in that $\epsilon \rightarrow \epsilon_1$. In this case, in general $\epsilon_3$ does not appear in the final expression. The formula for the isotropic case coincides with the well known expression obtained by Frank[1] (cf. also reference 4). It should be noted that the results which have been obtained apply for Cerenkov radiation of a small closed current loop. In this case by $\mu_0$ we are to understand the magnetic moment associated with the current loop.

The author is indebted to N. M. Polievktov-Nikoladze for his interest in this work.

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Translated by H. Lashinsky
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## *RELATION BETWEEN THE GRAVITATIONAL CONSTANT, THE CHARGE TO MASS RATIO OF THE ELECTRON, AND THE FINE STRUCTURE CONSTANT*

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Submitted to JETP editor March 2, 1959

J. Exptl. Theoret. Phys. (U.S.S.R.) **36**, 1940 (June, 1959)

THE following numerical relation exists between the gravitational constant $G = 6.673 \times 10^{-8}$ g$^{-1}$ cm$^3$ sec$^{-2}$, the electron mass m, the electron charge e, and the fine structure constant $\alpha = e^2/\hbar c = (137.0377 \pm 0.0016)^{-1}$

$$\frac{1}{G}\left(\frac{e}{m}\right)^2 = \left(\frac{4\pi}{3}\right)^{\hbar c/2e^2}.$$

This relation is extremely sensitive to the value of the fine structure constant; nevertheless, the numerical relation holds to an accuracy of 1%.

It may be assumed that this simple relation is no accident.

Translated by A. M. Bincer
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## *SATURATION IN A HYPERON SYSTEM*

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Submitted to JETP editor March 5, 1959

J. Exptl. Theoret. Phys. (U.S.S.R.) **36**, 1941-1942 (June, 1959)

THE phenomenon of saturation is a characteristic property of a system of nucleons. At the present time it is believed that saturation is due to certain attributes of two-body nucleon forces — namely the repulsion at short distances and the exchange character of some of the forces. The main features of contemporary phenomenological nucleon-nucleon potential are deduced from meson theory. Thus repulsion at short distances is related to the existence of the function $\delta(\mathbf{r})$ in the second-order interaction potential of pseudoscalar meson theory. The energy of a system of nucleons depends strongly on the radius of the repulsive core and on the admixture of exchange forces. A decrease in the radius of the repulsive core and in the amount of exchange forces leads to a considerable increase in the binding energy of a system of nucleons.[1]

According to present-day ideas about hyperons