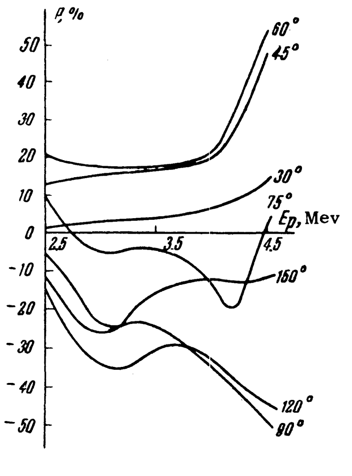

sections change by merely 5 or 10%. Thus, a study of the polarization makes possible a much more accurate phase analysis and thereby establishes more definitely the parameters of the levels of N^{13}. From the foregoing data it is evident that the polarization becomes considerable in this energy interval. Carbon can therefore be used to obtain and to analyze polarized proton beams with energies 2 — 5 Mev, which in many cases is more convenient than the use of He^4.

[1] Reich, Phillips, and Russell, Phys. Rev. **104**, 193 (1956).

Translated by J. G. Adashko
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SCATTERING OF PROTONS ON TRITONS AT SMALL ENERGIES

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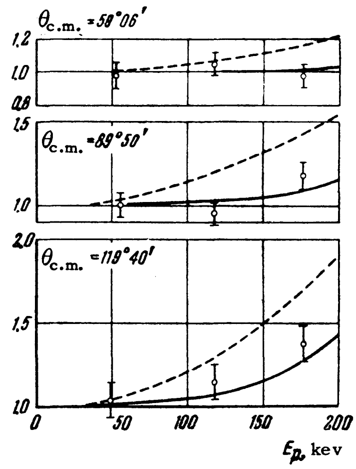
Submitted to JETP editor February 27, 1959

J. Exptl. Theoret. Phys. (U.S.S.R.) **36**, 1937-1939 (June, 1959)

THE existence of a level in He^4 with excitation energy about 20 Mev is indicated by a series of experiments. Thus, a phase-shift analysis[1] of p-T scattering at $E_p = 1$ to 3.5 Mev indicates a resonance behavior of the phase in the $^1S_0$ state. The large magnitude of the cross section for the $He^3(n, p)T$ reaction, and its deviation[2] from the $1/v$ law in the domain $E_n < 25$ kev can also be explained by a resonance level in He^4 with characteristics 0^+. However, this level is not revealed in the study of reactions in which He^4 appears as the final nucleus.[3] On the other hand, a phase-shift analysis of p-T scattering[1] cannot be considered as undoubted proof of the existence of the level in He^4, in so far as the analysis is carried out neglecting the reaction $T(p, n)He^3$ and making use of simplifying assumptions on the phase. In this situation, considerable interest attaches to the measurement of the cross-section for p-T scattering at energies below the threshold for the reaction $T(p, n)He^3$, where p-scattering plays a smaller role also. Since measurements in this domain are not sufficiently reliable or extensive, we have started to measure the p-T scattering cross section at low energies.

The features of the method employed have been noted previously.[4] The target chamber was filled with a mixture of hydrogen and deuterium, to measure the incident beam with respect to the outgoing α-particles from the reaction $T(d, n)\alpha$. The cross section for the elastic scattering of tritons by hydrogen was measured at bombarding energies below 530 kev for three angles.



The results are shown in the figure (ordinate: ratio of the measured cross section to the cross section for scattering by a Coulomb field). Within experimental error, they can be described by pure s-scattering. The contributions to the scattering from higher angular momenta are seen to be insignificant from a calculation of potential scattering for p-waves. For an interaction radius $a = 3 \times 10^{-13}$, calculations indicate that the contributions of the p-phase to the scattering cross section in the energy interval under consideration does not exceed 1% (for $E_p = 200$ kev and $\theta = 120°$). Analogous results can also be obtained if we extrapolate the p-phases, obtained by Frank and

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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[2] Bergman, Isakov, Popov, and Shapiro, J. Exptl. Theoret. Phys. (U.S.S.R.) **33**, 9 (1957), Soviet Phys. JETP **6**, 6 (1958). тр. Московской конференции по ядерным реакциям, 1957 (Trans. Moscow Conference on Nuclear Reactions, 1957), in press.

[3] J. Benveniste and B. Cork, Phys. Rev. **89**, 422 (1953); R. M. Eisberg, Phys. Rev. **102**, 1104 (1956); J. C. Allred, Phys. Rev. **84**, 694 (1951).

[4] Yu. G. Balashko and I. Ya. Barit, J. Exptl. Theoret. Phys. (U.S.S.R.) **34**, 1034 (1958); Soviet Phys. JETP **7**, 715 (1958).

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 μ_0 points in the direction of motion the energy losses due to Cerenkov radiation are given by the expression

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