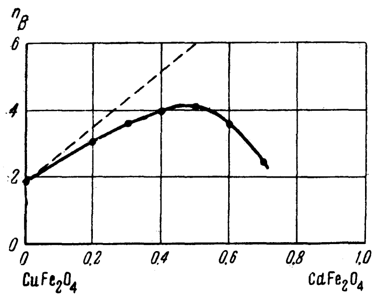

FIG. 1

retical values find an explanation in modern theory. In particular, Gorter[1] obtained similar moment curves for a number of other systems of mixed ferrites $MeFe_2O_4$-$ZnFe_2O_4$ and provided an explanation of them from the standpoint of Néel's theory; his explanation is also completely applicable to our system of ferrites.

It is known that the magnetic moment of copper ferrite, $CuFe_2O_4$, depends on the rate of cooling of the specimen. Néel explained this on the basis that the concentration of copper ions on A sites is a function of the temperature of the specimen. Rapid cooling to room temperature leads to retention of the ion distribution that existed at the quench temperature. This produces a higher percent non-inversion of the ferrite and increases its magnetic moment. The cooling conditions for our $CuFe_2O_4$ specimen apparently were not conducive to attainment of a stable equilibrium in the arrangement of ions in the lattice, since the magnetic moment of the specimen was abnormally large, being equal to 1.92 Bohr magnetons. To confirm this, we subjected our specimen to an annealing for 100 hours at $t = 370°C$. As a result of this annealing its magnetic moment decreased to 1.28 ± 0.02 Bohr magnetons which agrees well with Gorter's data.[1]

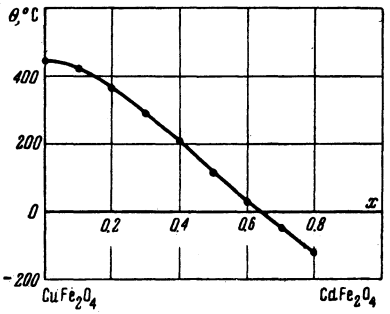

FIG. 2

The curve in Fig. 2 shows the Curie temperature Θ as a function of composition. A similar behavior of the Curie-temperature curve of this ferrite system was obtained earlier by Smolenskiĭ.[2,3] However, for our specimen of composition $CuFe_2O_4$, $\Theta = 450 \pm 3°C$, in agreement with the standard value of Θ for this composition, whereas according to Smolenskiĭ $\Theta \sim 425°C$. Accordingly our curve is higher in the neighborhood of the origin.

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[1] E. W. Gorter, Usp. Fiz. Nauk **57**, 279 (1955) [translated from Phil. Res. Rep. **9**, 295, 321, 403 (1954)].

[2] G. A. Smolenskiĭ, Dokl. Akad. Nauk SSSR **78**, 921 (1951).

[3] G. A. Smolenskiĭ, Izv. Akad. Nauk SSSR, Ser. Fiz. **16**, 728 (1952).

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POLARIZATION OF PROTONS IN SCATTERING BY C^{12}

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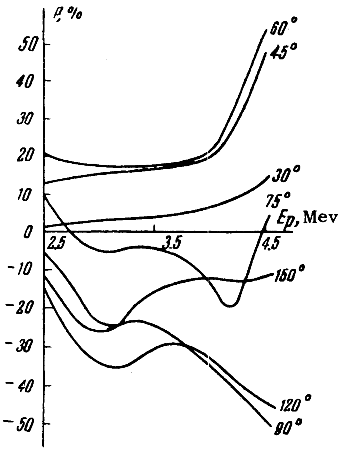
ANALYSIS of data on the elastic scattering of protons makes it possible to obtain sometimes sufficiently complete information on the position and characteristics of the levels of atomic nuclei. One such case is the scattering by C^{12}, at which the lower levels of N^{13} are excited.

Reich et al.[1] investigated elastic scattering of protons by C^{12} in the interval from 1.5 — 5.5 Mev and carried out a sufficiently complete phase analysis, whereby the following levels of N^{13} were identified: $1.698\,(1/2^-)$; $1.748\,(5/2^+)$; $4.808\,(5/2^+)$, and $5.37\,(3/2^+)$.

Measurement of the proton polarization due to scattering can supplement considerably our information on the levels of a given nucleus. Using the phase analysis given in reference 1, we have calculated the dependence of the polarization and of the cross section on the energy in p-C^{12} scattering in the energy interval 2.5 — 4.5 Mev at scattering angles 0 — 180° c.m.s. The principal results are shown in a diagram: The curves represent the energy dependence of the polarization at several scattering angles. The values of the polarization (particularly in the interval from 30 — 90°) are quite sensitive to the values of the D phases: for example, a 5° change in the $D_{3/2}$ phase at 4.5 Mev changes the value of the polarization in the forward angles by a factor of 2 or 3, while the cross



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.

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

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SCATTERING OF PROTONS ON TRITONS AT SMALL ENERGIES

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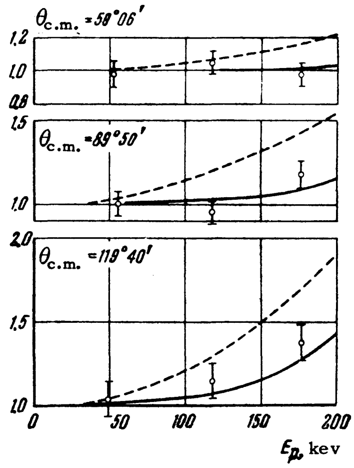
THE existence of a level in He^4 with excitation energy about 20 Mev is indicated by a series of experiments. Thus, a phase-shift analysis[1] of p-T scattering at $E_p = 1$ to 3.5 Mev indicates a resonance behavior of the phase in the $^1S_0$ state. The large magnitude of the cross section for the $He^3(n, p)T$ 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