where T is the period. The value μ_n determines the coefficient of refraction n of electromagnetic waves in a ferromagnetic metal, while μ_k determines their coefficient of absorption[3] k:

$$n=(\sigma T\mu_n)^{\frac{1}{2}} \text{ and } k=(\sigma T\mu_k)^{\frac{1}{2}}.$$

In practice μ_k is usually calculated from the resistance of ferromagnetic wires to an alternating current and μ_n

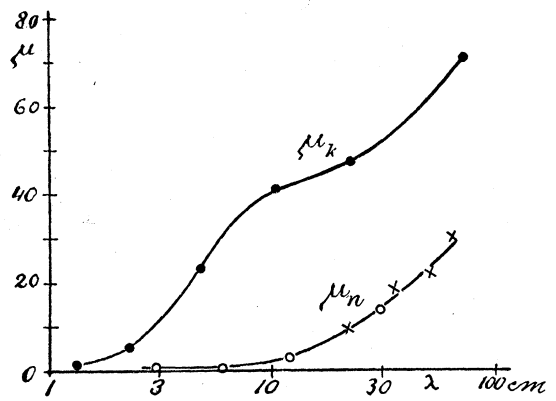

FIG. 1.

from their self-induction. The values μ_k, defined by me, were calculated from the resistance determined from the coefficient of absorption of waves in parallel wires. In another paper[4] I determined the magnetic permeability by a method which consisted in comparing the coefficient of reflection of the waves from a coarse Hertzian grating of magnetic wires, with the coefficient of reflection from a grating of non-magnetic wires of the same diameter and resistance.

This method allows one to calculate the value of μ_n and to compare it with μ_k obtained by the method of absorption of the waves in wires.[5] The results observed by me for λ between 1 and 73 cm for a wire 0.0245 mm in diameter, are shown by circles in Fig. 1. The values of μ_n obtained by Hoag and Jones are shown by crosses. They relate to a wire 3.18 mm in diameter. The concordance of the results of Hoag and Jones with my values is better than expected. We see from the above, that the values obtained by them for μ_n were bound to be smaller than my values for μ_k. We see also, that the permeability of iron really decreases, approaches 1 at $\lambda=1$ cm, and approaches the value corresponding to thermal and optical frequencies.

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[3] W. Arkadiew, Phys. Zeits. **14**, 928 (1913).

[4] W. Arkadiew, Ann. d. Physik **45**, 133 (1914).

[5] W. Arkadiew, Ann. d. Physik **81**, 661 (1926); Table IV, Fig. 3; Festschrift d. Mosk. Magn. Laborat. p. 53 (1931); Ann. d. Physik **11**, 406 (1931), Fig. 3.

An Attempt to Observe a Helium Isotope

Langer[1] has recently demonstrated that Be^9 is radioactive and has suggested the possibility that He^5 might be one of the products of the disintegration and that, if so, He^5 should be found in old beryllium mineral.

Professor Gruner placed at our disposal a large crystal of beryl from the pre-Cambrian dykes of the Black Hills in South Dakota (estimated age greater than 3×10^8 years). The gases were driven out by heating the crushed crystal and were passed through a charcoal trap immersed in liquid air. A mass-spectrograph analysis of the gas not absorbed showed He^4. If He^5 was present its concentration was less than one part in 40,000 relative to He^4.

As a check on the apparatus, ordinary hydrogen was examined for the $(H^2H^1)^+$ molecular ion. An analysis of the data, taken at different pressures to correct for $(H_3^1)^+$, showed H^2 present in a concentration of the order of 1 part in 30,000 relative to H^1.

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[1] R. M. Langer and R. W. Raitt, Phys. Rev. **43**, 585 (1933).

Collisions of Neutrons with Protons

With the hope of learning more about the nature of the neutron I have been studying the collisions between neutrons and protons using a Wilson cloud chamber. This work is being held up to permit the completion of some measurements on nitrogen disintegration tracks. As the progress of the two problems is very slow because of the weakness of my neutron source I have thought it advisable to make this preliminary report on the neutron-proton collisions.

Although the neutron itself leaves no track in a cloud chamber the essential facts of the collision are known if one measures the direction in which the proton is projected relative to the initial direction of motion of the neutron. I have therefore arranged a source of neutrons in a small volume surrounded by a cylinder of paraffin of diameter 12.5 mm, the whole being placed at the center of the cloud chamber. The tracks formed by the protons projected from the paraffin are photographed. Since the neutrons proceed in a radial direction the angle between the directions of motion of the neutron and of the proton may be measured.

About 150 such tracks have been measured. Corrections are applied for the volume of the paraffin effective in the