The order of runs in these experiments was not arranged to give an accurate value of η, but we can give $\eta=0.40$ as a preliminary value from which we calculate $\tau_0=2.6\times10^{-6}$ sec. with $f=1/10$ or $=2.4\times10^{-6}$ sec. with $f=0.5$. The result is insensitive to the choice of f.

We wish to acknowledge helpful discussions with Dr. C. G. Montgomery and to state that the Carnegie Institution of Washington contributed to the support of the experiments.

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The Bartol Research Foundation of the Franklin Institute,
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Ferromagnetism of Semi-Conductors

A theory of ferromagnetism of semi-conductors has been proposed on the basis of Wilson's model of semi-conductors[1] and Slater's model of ferromagnetic substances[2] in which ferromagnetism appears in crystals having very large exchange integrals.

The outline of our theory is as follows: We assume that in semi-conductors there are two near energy bands, and at absolute zero temperature the lower band in which a very large exchange integral exists between two electrons is entirely filled up, while the higher band in which the exchange integral is small is entirely empty.

In a suitable temperature range several electrons are excited to the higher band, and thereby make positive holes in the lower band. Then ferromagnetism can appear.

The number of positive holes $2n$ at T°K is

$$2n=2\varphi_1(T)\nu\exp(-\Delta B/2kT),$$

where $\varphi_1(T)$ is a function related with the shape of the lower (magnetic) band, ν is the total number of ferromagnetic atoms in the crystal, and ΔB is the width of the forbidden region.

Then the magnetic moment M_s of one mole of the crystal is given by the following formulae:

$$M_s=M_\infty\exp(-\Delta B/2kT)\tanh(\alpha+M_s\theta/M_\infty T),$$
$$M_\infty=2\mu L\varphi_1(T),$$
$$\alpha=\mu H/kT,$$
$$\theta=J\varphi_1(T)/k,$$

where L is the number of atoms of one mole, k the Boltzmann's constant, J the exchange integral in the free atom, H the magnetic field, μ the Bohr magneton and T the temperature on absolute scale.

If we assume $\varphi_1(T)$ is a constant b, and the magnetic field is weak, we can calculate M_s numerically as the function of absolute temperature for the different values of γ, where $\gamma=\frac{1}{2}\Delta B/Jb$.

Ferromagnetism can not appear in every temperature when $\gamma>1/e$.

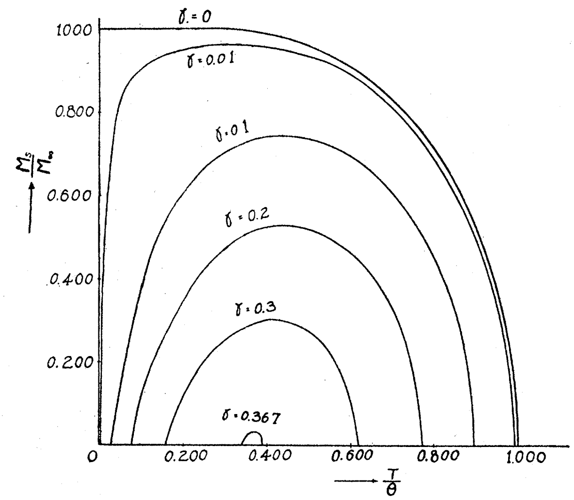

FIG. 1. Ferromagnetism of semi-conductors.

The results are different from those calculated by the ordinary Weiss-Heisenberg theory.

Our results are illustrated in Fig. 1. It is specially interesting to note that at very low temperature ferromagnetism vanishes.

This result will be useful for the interpretation of experimental facts on magnetite,[3] pyrrhotite[4] and chromium sulphide.[5] Further experiment which is necessary for the verification of our theory is now in progress.

The detailed account of the above theory will be published at a later date.

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Mesotron as the Name of the New Particle

After reading Professor Bohr's address at the British Association last September in which he tentatively suggested the name "yucon" for the newly discovered particle, I wrote to him incidently mentioning the fact than Anderson and Neddermeyer had suggested the name "mesotron" (intermediate particle) as the most appropriate name. I have just received Bohr's reply to this letter in which he says:

"I take pleasure in telling you that every one at a small conference on cosmic-ray problems, including Auger, Blackett, Fermi, Heisenberg, and Rossi, which we have just held in Copenhagen, was in complete agreement with Anderson's proposal of the name 'mesotron' for the penetrating cosmic-ray particles."

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December 7, 1938.