LETTERS TO THE EDITOR

The order of runs in these experiments was not arranged to give an accurate value of $\eta$, but we can give $\eta = 0.40$ as a preliminary value from which we calculate $\tau = 2.6 \times 10^{-4}$ sec. with $f = 1/10$ or $= 2.4 \times 10^{-4}$ 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.

THOMAS H. JOHNSON
MARTIN A. POMERantz

The Bartol Research Foundation of the Franklin Institute, Philadelphia, Pennsylvania.

December 8, 1938.


Ferromagnetism of Semi-Conductors

A theory of ferromagnetism of semi-conductors has been proposed on the basis of Wilson’s model of semi-conductors and Slater’s model of ferromagnetic substances 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 $T^\circ K$ is

$$2n = 2\varphi(T) \exp\left(-\Delta B/2kT\right),$$

where $\varphi(T)$ is a function related with the shape of the lower (magnetic) band, $v$ is the total number of ferromagnetic atoms in the crystal, and $\Delta B$ 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:

$$M_s = M_e \exp\left(-\Delta B/2kT\right) \tanh\left(\alpha + M_e \theta/M_e T\right),$$

$$\theta = J\varphi(T)/k,$$

where $\varphi(T)$ is a function of $T$, and the magnetic field, $\mu$ the Bohr magneton and $T$ the temperature.

If we assume $\varphi(T)$ is a constant $\theta$, and the magnetic field is weak, we can calculate $M_s$ numerically as the function of absolute temperature for the different values of $\gamma$, where $\gamma = \Delta B/\theta$.

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

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, pyrrhotite and chromium sulphide. 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.

SVÔKEI MIYAHARA

The Research Institute for Iron, Steel and Other Metals, Tohoku Imperial University, Sendai, Japan, November 25, 1938.


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.”

ROBERT A. MILLIKAN

California Institute of Technology,
Pasadena, California,
December 7, 1938.