The Hall constant in high fields is constant and equal to 9.4×10^{-4}. This agrees with the results of E. S. Borovik.[5] (We should point out that in this paper the value given for R was incorrectly an order of magnitude greater).

The data of Lüthi and Olsen[7] are represented by the triangles in Fig. 2. Köhler's rule has been used to reduce the effective fields to our scale. Clearly, there is disagreement for large fields and we are inclined to regard Olsen's results as in error. The source of error could be the incorrect neglect of the Hall field on the results for the resistance change. It can be seen from Fig. 2 (curve 2) that the Hall field is nearly 10 times greater than the field in the current direction. We found an upward trend to the curve, as in Lüthi and Olsen's work, when the potential leads for the measurement of resistance were not mounted on the same current line. The effect we found was weaker and started in larger fields (21,000 oe). The source of the error found for such a disposition of potential leads has been elucidated by Alekseevskiĭ, Brandt, and Kostina.[10]

The results obtained for indium — the absence of anisotropy in the Hall coefficient and the small anisotropy of magnetoresistance — enable us to state that indium belongs to the group of metals with closed Fermi surfaces.[11] The form of the dependence of resistance and E_y/E_x on field shows that indium is a metal with unequal numbers of holes and electrons.[8]

From the relations obtained for the Hall effect and magnetoresistance in high fields, ignoring Olsen's results, we may suppose that aluminum also belongs to the same type of metals, but measurements on a single crystal would be necessary to make sure of this.

As has been shown by Lifshitz, Azbel', and Kaganov,[11] the difference between the concentrations of electrons and holes can be derived rigorously from the Hall constant in high fields by the formula $R = 1/nec$ (where n is the concentration difference). We have derived this from the data given above. For indium $n = 4.2 \times 10^{22}$ and for aluminum $n = 6.7 \times 10^{22}$. These values are in agreement with earlier determinations.[8]

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POSSIBLE MODE OF OSCILLATION FOR A CHARGE IN CROSSED FIELDS

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We consider the motion of a charge in mutually perpendicular uniform electric and magnetic fields. It is assumed that a damping force $m\gamma(v)\mathbf{v}$ acts on the charge. The z axis is taken in the direction of the magnetic field, the y axis is in the direction of the electric field, and we assume that $v_z \equiv 0$. We convert from the variables v_x and v_y to the new variables a and ψ, using the relations

$$v_x = v_x^0 + a\cos\psi, \quad v_y = v_y^0 - a\sin\psi,$$

$$v_x^0 = \frac{cE/H}{1+\gamma^2(v_0)/\omega_H^2}, \quad v_y^0 = \frac{\gamma(v_0)/\omega_H}{1+\gamma^2(v_0)/\omega_H^2}\frac{cE}{H}. \qquad (1)$$

It is apparent that $\mathbf{v}^0(v_x^0, v_y^0)$ is the drift velocity while a and ψ are the amplitude and phase of the Larmor rotation of the charge. If the damping is linear (γ independent of v) the Larmor rotation disappears in the course of time and only the drift motion remains.

The situation is changed, however, if the damping is nonlinear. Here we have the analog of a self-oscillating system of the Thomson type, with the Larmor rotation of the charge acting as the "tank circuit." The amplitude of this rotation does not vanish in the course of time, but approaches a constant stable value, given by the relation

$$\frac{1}{\pi}\int_0^{\pi}(a+v_0\cos\psi)\,\gamma\left(\sqrt{v_0^2+a^2+2v_0 a\cos\psi}\right)d\psi=0. \qquad (2)$$

The drift motion remains and is determined by the relations in Eq. (1).

Equation (2) has a root $0 < a < v_0$ if the condition

$$\frac{1}{\gamma(v_0)}\left(\frac{d\gamma}{dv_0}\right)_{v_0} < -\frac{2}{v_0}, \qquad (3)$$

which is the oscillation excitation condition, is satisfied.

The theorem proposed applies if the parameter γ/ω_H is small, and can be verified by averaging[1] the equations for a and ψ. It will be apparent from the expression for $\gamma(v)$ given in reference 2 that a charge in a plasma can oscillate. In this case the excitation condition (3) is given approximately by $cE/H > v_T$. Here v_T is the thermal velocity of the charges which surround the charge and damp its motion.

In conclusion we wish to thank Ya. P. Terletskiĭ for discussion of the present work.

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DIRECT ELECTRON-POSITRON PAIR PRODUCTION BY ELECTRONS

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In this note we follow the terminology used in the paper by Tumanyan et al.,[1] in which 25 cases of production of visible tridents were analyzed in the experimental part. Up to this time 29 additional visible tridents have been registered as a result of a study of the photon component of two high energy ($\gtrsim 10^{13}$ ev) nuclear interactions* and a study of three isolated electron-photon showers.

The energies of the electron-positron pairs created by the photon component were determined from measurements of relative multiple scattering. In the isolated electron-photon showers the energy of the primary electron-positron pairs was also determined from the characteristics of the longitudinal development of the electromagnetic cascade.[2]

In a total length of electron track of 107.5 radiation length units 54 visible tridents were observed, which should be referred to an average electron energy of 20 Bev. The true number of tridents obtained with the help of the results of a Monte Carlo calculation[1] turned out to be 19.6. Our results on the determination of the mean free path λ, together with the results of other authors, are shown in the figure (taken from the paper by Weill et al.[3] which contains references to the literature for the appropriate sources; our data are represented by the star and the crosshatched cell). The curves show the theoretical dependence of λ on the electron