not satisfied (ω').

The following values of these parameters, which enter in the formulas of (1), are given in [1] for CH_3CN: $\psi_+ = 0.68 \times 10^{-3}$, $\psi_- = 2.3 \times 10^{-3}$, and $\xi' = 20\xi$. They were obtained by comparing the theoretical relation $\epsilon = (\epsilon_{\parallel} + \epsilon_{\perp})/2 = f(E/p)$, given in [5], with the experimental results of measurement of ϵ in a homogeneous electric field [1]. The calculation shows that, taking into account the foregoing values of the unknown parameters in formulas (1), the $\epsilon_{\perp} = \varphi(H/p)$ plot should reach a maximum ($\epsilon_{\perp\max} = 3.2 \times 10^{-4}$) at $\xi_{\max} = 0.09$ and reverse sign ($\epsilon_{\perp} = 0$) at $\xi_0 = 0.2$. From this we get $\xi_0/\xi_{\max} \simeq 2.2$, and the experimental values $\epsilon_{\perp\max} = 4 \times 10^{-4}$ and $\xi_0/\xi_{\max} = 2.1$ obtained by us agree with the calculated ones within the limits of the measurement errors. It follows therefore that the anomalous magnetic Senftleben effect observed in CH_3CN can be described by a theory that takes into account the presence in the gas of collisions for which the detailed balancing principle is not satisfied.

In conclusion, the authors thank L. L. Gorelik and V. V. Sinitsyn for a discussion and for useful advice.

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BAND INTERACTION AND TRANSITION FROM THE METALLIC TO THE SEMICONDUCTING STATE IN A MAGNETIC FIELD

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1. Investigation of semiconducting Bi-Sb alloys (Sb concentrations $C = 8.6 - 16$ at.%, when an energy gap arises between the extrema of L_1 and T) in fields up to 500 kOe and at liquid-helium temperatures have shown that when the field is oriented along the binary axis, the longitudinal magnetoresistance $\rho_{\parallel}(H)$ passes through a maximum, decreases, and then increases again. The region of the decrease of $\rho_{\parallel}(H)$ corresponds to a table-like section on the transverse-magnetoresistance curve $\rho_{\perp}(H)$ [1,2].

This behavior of $\rho(H)$ was interpreted as a transition of alloys from the semiconducting to the quasimetallic state and from the quasimetallic state again to the semiconducting state, occurring when the L extrema located at one point of the phase space first come together and then move apart with further increase of the magnetic field. (The T extremum moved downward at this orientation of the magnetic field. The character of the shift of the extrema in the magnetic field is shown schematically in Fig. 1a.)

Such a character of the shift of the L extrema in the magnetic field agrees with the results of theoretical calculations by Baraff [3].

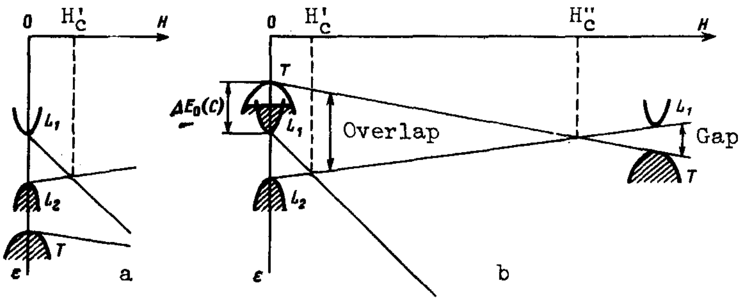

Fig. 1

2. It can be assumed that Bi and Bi-Sb metallic alloys (with Sb concentration less than 8.5 at.%), in which the L and T extrema overlap, should go over inth the semiconducting state (dielectric when T = 0°K) (Fig. 1b) when the magnetic field is oriented along the binary axis in strong fields. When $H < H'_c$, the L_1 and T extrema move downward in the magnetic field. As the result of the fact that L_1 shifts more rapidly than T, the band overlap and the carrier density increase [4,5]. When $H > H'_c$, the character of the shift of the band boundaries changes qualitatively. The T extremum continues to drop (apparently at the same rate), but on the other hand the L_1 extremum begins to rise. According to [3], the interaction between the L_1 and L_2 extrema as they come closer together can be regarded as a reflection. As a result, when $H = H''_c$ the overlap of the L_1 and T bands vanishes, and when $H > H''_c$ an energy gap is produced and the metal turns into a semiconductor (We note that the L_1 and T extrema shift independently of each other, since they are located at different points of phase space.) Obviously, the field H''_c is maximal for bismuth and should decrease in Bi-Sb alloys, owing to the decrease of $\Delta E_0(C)$ of the overlap of the extrema of L_1 and T at H = 0. (If the ratio of the spin and orbital masses does not change appreciably.)

3. To observe this effect, we investigated $\rho_{\parallel}(H)$ and $\rho_{\perp}(H)$ of single-crystal Bi-Sb samples (with Sb concentration, according to chemical analysis, 6.5 and 4.9 at.%) at a magnetic field orientation along the binary axis in fields up to 600 kOe at temperatures 1.5 - 20°K.

In the $Bi_{93.5}Sb_{6.5}$ alloy, the change of the electric resistance ρ on cooling was $\rho_{300}/\rho_{4.2} = 1.6$, while the value for the $Bi_{95.1}Sb_{4.9}$ was 3. 1) According to oscillation measurements, in weak magnetic fields the overlap of the L_1 and T bands in the sample with 4.9 at.% Sb is 11 - 12 meV.

The results of the measurements of the magnetoresistance at T = 4.2°K are shown in Figs. 2 and 3. Figure 2 shows plots of the longitudinal magnetoresistance of the alloys $Bi_{93.5}Sb_{6.5}$ (curve 1) and $Bi_{95.1}Sb_{4.9}$ (curve 2). The upper part of the figure shows the measurement results for one of the samples in constant magnetic fields. The sharp increase of the resistance in weak magnetic fields turns into a decrease, after which, in a sufficiently broad range of fields, the resistance remains approximately constant. A sharp increase of the resistance begins in the $Bi_{93.5}Sb_{6.5}$ sample at a field of 100 kOe. In a field of ~480 kOe, $\rho_{\parallel}(H)$ increases by a factor of 3000. A similar increase of the resistance occurs in

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1) The Bi-Sb alloy single crystals were kindly supplied by G. A. Ivanov.

the $Bi_{95.1}Sb_{4.9}$ sample in fields exceeding 400 kOe. In a 600 kOe field, $\rho_{\parallel}(H)$ increases by ~100 times.

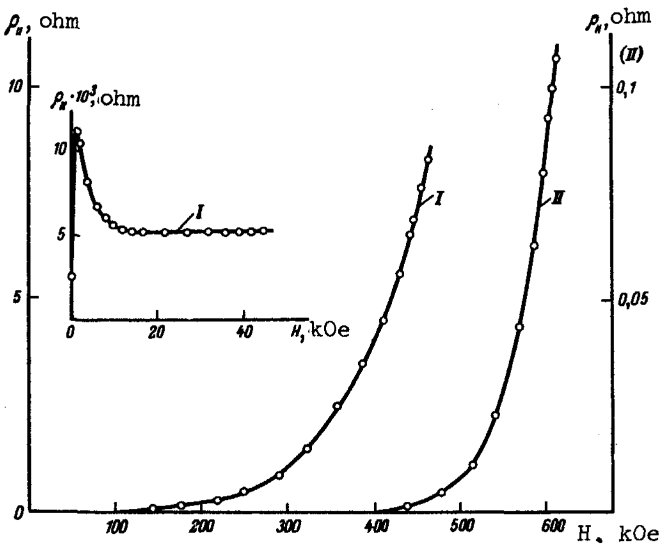

Fig. 2

Figure 3 shows plots of the transverse magnetoresistance for samples of the same concentration. In the $Bi_{93.5}Sb_{6.5}$ sample, a characteristic feature of the $\rho_{\perp}(H)$ curve is the region of the decelerated increase of the resistance in the magnetic field. In stronger fields, the resistance increases sharply.

With increasing temperature, the rise of the magnetoresistance decreases and sets in at stronger fields.

In $Bi_{95.1}Sb_{4.9}$ samples, oscillations are observed on the $\rho_{\perp}(H)$ curve in the region of fields smaller than 400 kOe (the Shubnikov - de Haas effect), and distort strongly the monotonic component of magnetoresistance.

We note that in all cases the resistance in strong magnetic fields increases exponentially

$$\rho \sim \exp\{\alpha(H - H_c'')/kT\} \quad (\text{at } H > H_c'')$$

with close values of the coefficient α. The metallic character of the dependence of the resistance on the temperature at $H < H_c''$ goes over into a semiconducting character at $H > H_c''$.

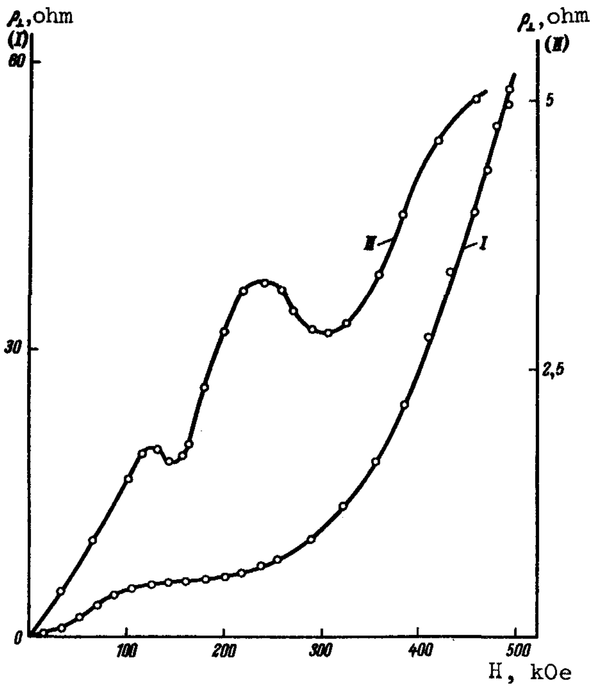

Fig. 3

4. The exponential increase of the magnetoresistance when $H > H_c''$, the appearance of a semiconductor dependence of the electric resistance on the temperature in strong fields, and the dependence of the field H_c'' on the composition of the alloy (the magnitude of the band overlap $\Delta E_0(C)$ at $H = 0$), all indicate that the band overlap in the energy spectrum vanishes at a field H_c and that an energy gap appears when $H > H_c''$. The metallic alloys Bi-Sb then become semiconducting.

A preliminary estimate shows that the fields required to observe an analogous transition in bismuth when the magnetic field is oriented along the binary axis are on the order of 1.5 million Oe.

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OBSERVATION OF INTERFERENCE OF CONVERSION AND OF THE PHOTOEFFECT UPON ABSORPTION OF 26-keV GAMMA QUANTA BY Dy_2O_3

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Yu. Kagan and A. M. Afanas'ev called our attention to the existence of an interesting physical phenomenon, consisting in the possibility of interference between processes of internal conversion and the photoeffect upon interaction of resonant Mossbauer radiation with atoms. Indeed, the final electronic states coincide for these two processes. Then, provided the projection of the nuclear spin remains unchanged during the internal conversion process, the photoeffect and the conversion become physically indistinguishable processes, and interference between the two should take place in the general case.

In the theory developed by Kagan, Afanas'ev, and Voitovetskii [1] it is shown that this interference should in principle be manifest in the energy dependence of both the cross section $\sigma_{\gamma e}$ of the γ - e reaction and the total cross section σ_t of the absorption of resonant gamma quanta. With this, σ_t is given by

$$\sigma_t = \sigma_{ph} + f_a\sigma_0[(1 + \beta_\gamma x)/(1 + x^2)]. \tag{1}$$

Here σ_{ph} is the photoabsorption cross section, f_a the probability of the Mossbauer effect in the absorber, σ_0 the resonance cross section, $x = 2(E_\gamma - E_a)/\Gamma_a$ (E_γ is the gamma-quantum energy, E_a and Γ_a the position and width of the absorption line, respectively), and finally β_γ is a numerical coefficient which determines the relative contribution of the interference term to the total cross section.

The quantity β_γ depends in an essential manner on the multipolarity of the nuclear transition. For almost all transitions except E1, this coefficient is very small. In the case of E1 transitions, however, β_γ is expressed directly in terms of the known quantities and is given by the formula

$$\beta_\gamma = 2\sqrt{(1/3)[(2I + 1)/(2I_0 + 1)]\alpha/(\alpha + 1)(\sigma_{ph}/\sigma_0)}, \tag{2}$$

where I_0 and I are the spins of the ground and excited states of the nucleus and α is the internal-conversion coefficient.

According to the results of [1], an interference term of the same nature is present al-