crystal and the angle was chosen such as to produce a second-harmonic wave. The harmonic was separated from the fundamental radiation by means of filters and was photographed in the focal plane of a quartz lens with f = 150 mm. Figure 2 shows photographs of both harmonics and the traces of the laser beams in the focal plane of the indicated lens. For KDP, $\theta_0 = 57^\circ 8'$ and $\Delta_1 = 3^\circ 21'$.

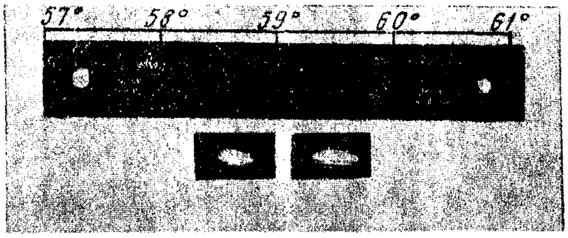

Fig. 2

Figure 2 shows clearly the difference in the angular distributions of the harmonic in the direction of the synchronism and of the harmonic connected with the interaction of the beams. This is due to the fact that a unique focusing of the harmonic is observed near the synchronism direction. As seen from Fig. 1, the (φ_1, φ_2) curve has a vertical tangent at the point θ_0. Therefore, at a finite aperture $\Delta\varphi$ of the laser beam, the angular dimensions of the harmonic will be quantities of second order of smallness relative to $\Delta\varphi$, and the radiation of the second wave has angular dimensions of the order of $\Delta\varphi$. For the same reason, the lateral maxima connected with the finite length of the crystal are seen clearly only in the synchronism direction.

Similar results were obtained with beams of two lasers, since the generation condition does not require coherence of the beams.

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ANOMALOUS MAGNETIC SENFTLEBEN EFFECT

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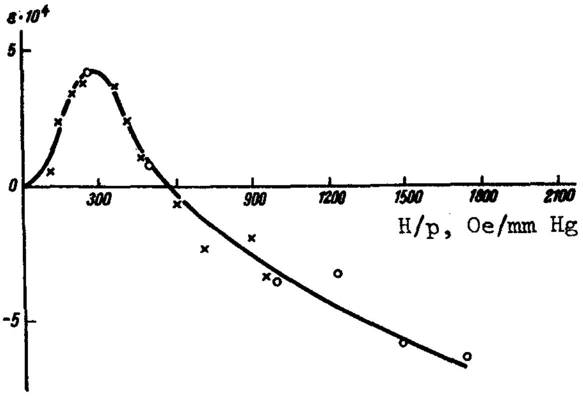
It was recently noted [1] that, unlike the observed effect in polar gases (the electric Senftleben effect) [2,3], the relative change of the thermal conductivity coefficient ($\epsilon = \Delta\kappa/\kappa_0$) of the strongly polar gas CH_3CN (dipole moment d = 3.96 Debye) in an electric field has a strongly pronounced nonmonotonic character (the anomalous electric Senftleben effect): the quantity ϵ, which depends on the field E and on the pressure p via the ratio E/p, has a maximum ($\epsilon_{max} = 5 \times 10^{-4}$) at E/p = 180 V/cm-mm Hg, and reverses sign ($\epsilon = 0$) at E/p = 350 V/cm-mm Hg. According to the theory presented in [4,5], the increase of the thermal conductivity coefficient is directly connected with the presence in the gas of collisions for which the detailed balancing principle is not satisfied, and therefore the anomalous effect is of considerable interest for further research. The precession of the nonspherical molecules, which is due to the interaction of the dipole moment with the electric field, causes the cross section of collisions of this type to decrease, leading to an increase in the coefficient of thermal conductivity, whereas the cross section of the collisions for which the detailed-balancing principle is satisfied increases, causing a decrease in the thermal-conductivity coefficient. The observed change in the thermal-conductivity coefficient is the sum of these two changes.



Experimental plot of $\epsilon = (H/p)$ for CH_3CN: × - p = 0.14 mm Hg, o - p = 0.29 mm Hg.

The authors of [4] predicted a possible increase of the coefficient of thermal conductivity of similar gases in a magnetic field. In the present paper we describe preliminary results of experiments in which we observed an anomalous magnetic Senftleben effect using the thermal conductivity of the gas CH_3CN as an example.

The experiments were performed with a setup similar to that used in [6], in the pressure range $p = 0.03 - 1$ mm Hg, and in fields H up to 300 Oe. The measured quantity was $\epsilon_\perp$, the value of ϵ under conditions when the field is perpendicular to the temperature gradient. The absolute values of $\epsilon_\perp$ were obtained as a result of calibration experiments using the known magnetic Senftleben effect in nitrogen [6], and employing the procedure described in [1].

The figure shows an experimental plot of $\epsilon_\perp = \varphi(H/p)$, obtained in CH_3CN at two pressures, $p = 0.14$ and 0.29 mm Hg. It is seen from the figure that, within the limits of the measurement errors ($\Delta\epsilon/\epsilon \lesssim 30\%$), $\epsilon_\perp$ depends on the field and on the pressure via the ratio H/p. $\epsilon_\perp$ is positive at small H/p, and when the ratio increases it goes through a maximum ($\epsilon_{\perp\max} = 4 \times 10^{-4}$) at H/p = 270 Oe/mm Hg. At H/p = 560 Oe/mm Hg, $\epsilon_\perp$ reverses sign. Thus, the $\epsilon_\perp = \varphi(H/p)$ relation observed in the gas CH_3CN is similar to the relation $\epsilon = (\epsilon_\parallel + \epsilon_\perp)/2 = f(F/p)$ obtained earlier in [1] for this gas in an electric field.

According to [4], the change of the thermal-conductivity coefficient is described by the following expressions:

$$\epsilon_\perp = \psi_+ c_1 - \psi_- c_2,$$
$$c_1 = \frac{\xi'^2}{1+\xi'^2}, \quad c_2 = \frac{\xi^2}{1+\xi^2} + \frac{8\xi^2}{1+4\xi^2}, \quad \xi' = k'\frac{\gamma H}{p}, \quad \xi = k\frac{\gamma H}{p}, \tag{1}$$

where ψ_+ and ψ_- (> 0) determine respectively the limiting values (at $\xi \to \infty$) of the positive and negative changes of the thermal-conductivity coefficient, $\gamma = g_{rot}\mu_{nuc}$, where g_{rot} is the rotational g-factor and μ_{nuc} is the nuclear magneton. ξ and ξ' are dimensionless parameters equal to the ratios of the molecule precession frequency ($\Omega \sim \gamma H$) to the collision frequencies (ω, $\omega' \sim p$), for which the detailed balancing principle is satisfied (ω) or is 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].