duration. Unlike the laser radiation, the spikes of the Stokes radiation had a characteristic steep front. Estimates of the threshold power gave for the backward flux from the confocal resonator into the ruby rod a value $P_{\bar{1}} \sim 20$ W. When account is taken of the losses in the unbleached optical parts, the effective reflection coefficient was 35%, giving a value ~60 W for the incident flux. Actually, the incident power was ~130 W, and consequently approximately half of this flux, pertaining mainly to emission of the higher modes, was reflected sideways by the confocal resonator. This can be attributed to the distortion of the mode structure of the radiation in the ruby rod, to the influence of aberrations of the confocal resonator, and to possible inaccuracy in the adjustment.

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INFLUENCE OF ROTATION OF THE SPONTANEOUS-MAGNETIZATION VECTOR ON THE HALL EFFECT

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We wish to point out in this article a new feature of the behavior of the Hall effect in ferro-ferrimagnets, never before discussed in the literature.

An analysis of the experimental results on the Hall effect in these substances leads to the assumption that the rotation of the spontaneous-magnetization vector I_s by an external field H about the crystallographic axes causes the additional contribution to the anomalous Hall field.

Figure 1 shows a plot of the Hall emf E_H against the magnetization I for an alloy of 45% Ni and 55% Fe and for the ferrite $MnFe_2O_4$. The Hall emf and the magnetization were measured by the method described in [1].

We see that in the initial sections of these curves the Hall emf varies practically linearly with the magnetization. At certain values of I this dependence is violated and the increment of the Hall emf for the same magnetization increment becomes smaller. A plateau appears in the $E_H(I)$ curve in a certain interval of magnetization values. With increasing temperature,

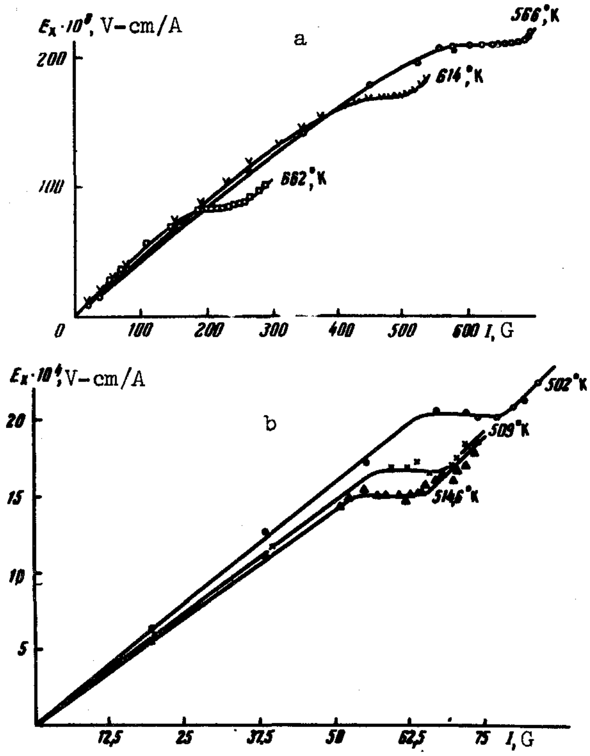

Fig. 1. Dependence of the Hall emf E_H on the magnetization I for an alloy of 45% Ni and 55% Fe (a) and for single-crystal $MnFe_2O_4$(b).

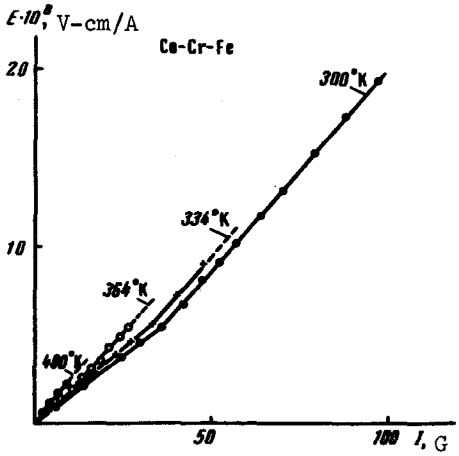

Fig. 2. Dependence of Hall emf E_H on the magnetization I for an alloy of 56% Co, 10% Cr, and 34% Fe.

this plateau occurs at smaller magnetizations and corresponds to a smaller magnetization interval.

A comparison of the curves of Fig. 1 with the I(H) curves of these materials has shown that the plateau occurs in the magnetic field interval corresponding to the region of technical rotation, in which the magnetization increases because of rotation of the vector I_s in the direction of the field H. The increase of the magnetization should correspond to an increase of the Hall emf, as was the case for the initial sections of the curves of Fig. 1. Yet according to the experimental data there is practically no change in the Hall emf in the magnetization region in question. To explain this phenomenon we propose that the rotation of the vectors I_s about the crystal axes produces an additional Hall emf, which cancels out the Hall emf increment expected in the absence of the effect in question. A plateau on the $E_H(I)$ curves is obtained also for nickel [2], but the reason for its appearance has not been noted or discussed in the literature. It is natural to call this phenomenon the "rotational Hall effect." The emf of the "rotational Hall effect" can have either the same sign as the spontaneous Hall field, or be of the opposite sign.

The curves of Fig. 1 illustrate the case of opposite signs, since the emf of the "rotational Hall effect" practically cancels out the expected increment of the Hall emf corresponding to the increment of the magnetization in the technical-rotation region.

Figure 2 shows $E_H(I)$ curves for samples in which the emf of the "rotational Hall effect" and the spontaneous Hall field (i.e., the Hall emf for a fixed position of the vector I_s in the crystal lattice) has the same sign.

The similar behavior of the Hall effect of metallic ferromagnets and ferrites in the rotation region can be of theoretical interest, since these materials have essentially different electric-conductivity mechanisms.

We note there have been recent discussions in the literature [3, 4] of the influence of rotation of the vector I_s in a crystal on the electronic energy spectrum of a ferromagnetic metal. It is possible that analogous phenomena take place also in ferrites.

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ELECTROGYRATION EFFECTS IN QUARTZ CRYSTALS

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Among the nonlinear parametric effects produced in crystals by an external electric field, the linear and quadratic electro-optical effects, which are manifest in changes of the refractive properties of the crystals, are well known. In our investigations we observed an effect wherein the gyrational properties of a crystal are altered by an external electric field[1]. The investigations were carried out with quartz crystals cut perpendicular or parallel to the optical axis. In the former case we determined the value of the specific rotation of the plane of polarization of the radiation of a helium-neon laser (λ = 632.8 nm) under the influence of the field components E_x or E_y. In accordance with the symmetry conditions [1, 2], the specific rotation ρ_3 of the plane of polarization (gyration) can be represented by a series expansion in the even powers of the electric field $E_{x,y}$. In the first approximation we obtain

$$\rho_3 = \rho_3^0 + \beta_{31}E_{x,y}^2 = \frac{\pi}{\lambda n_0}(g_{33} + \beta_{31}^* E_{x,y}^2), \quad \Delta\rho_3 = \frac{\pi}{\lambda n_0}\beta_{31}^* E_{x,y}^2, \tag{1}$$

where ρ_3^0 is the gyration in the absence of a field, connected with the component g_{33} of the axial gyration tensor of second rank, β_{31} and β_{31}^* are the coefficients of quadratic electrogyration or the components of the fourth-rank axial electrogyration tensor without and with allowance, respectively, for the ordinary refractive index n_0 [3], λ is the wavelength in vacuum, and $\Delta\rho_3$ is the gyration increment.

The linear electrogyration was investigated in a polarization system with a ZMR-3 monochromator, using the orientation of the ellipse of polarization produced [5, 6] when linearly polarized light is passed perpendicular to the optical axis through two identical x-cut samples of quartz with thickness d_x = 1 ± 0.01 mm, even when the incident beam is polarized parallel or perpendicular to the principal plane and the ordinary birefringence in the samples is cancelled out. Taking into account the influence of the field E_x, we can represent the angle ρ_1, which determines the orientation of the major axis of the polarization ellipse relative to the plane of polarization of the incident beam, in first approximation, in the form

$$\rho_1 = \rho_1^0 + \gamma_{11}E_x = \frac{1}{n_e^2 - n_0^2}(g_{11} + \gamma_{11}^* E_x), \quad \Delta\rho_1 = \frac{1}{n_e^2 - n_0^2}\gamma_{11}^* E_x, \tag{2}$$

where n_e is the extraordinary refractive index, g_{11} is the component of the second-rank axial tensor of the natural activity, and γ_{11} and γ_{11}^* are the components of the third-rank axial tensor of linear electrogyration without and with allowance for the refractive indices, respectively, and $\Delta\rho_1$ is the increment of the gyration (of the angle ρ_1).

[1] The idea that a linear electrogyrational effect can occur in crystals was first advanced by I.S. Zheludev [1].