following application of a field H_x = +23 kOe indicates that the magnetic moments of the sublattices are inclined in this magnetic field away from the C_3 axis towards the γ-quantum propagation direction. At H_x = -23 kOe, the deflection is in the opposite direction. This leads to the conclusion that in easy-axis hematite

$$\mathrm{sign}(\vec{\beta}\cdot\vec{l}) = -1 \qquad (3)$$

Knowing the dependence of the intensity of the Δm = 0 line on the angle θ between the direction of the magnetic field at the nucleus and the direction of γ-quantum propagation ($I_{\Delta m=0} \sim \sin^2\theta$), it is possible to determine from the data of Fig. 2c the value of $|\theta|$ at $|H_x|$ = 23 kOe, and with it also one of the quantitative characteristics of the hematite, namely $(H^2_{eff}/\beta)_{T=198^\circ K}$ = 110 ± 30 kOe. Similar results were obtained also at a sample temperature 243°K (the magnitude of the effect was correspondingly larger).

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OBTAINING A VISIBLE IMAGE OF RADIO EMISSION IN THE MILLIMETER BAND

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Obtaining visible images in millimeter radio waves is an important physical and technical problem. Solution of this problem would make it possible to transmit images of objects using radio waves of this band, and would help to investigate the interaction between millimeter waves and various substances or objects; it would also greatly facilitate studies of the structures of fields of various oscillating systems. Special notice should be taken of the promise offered by this method for the simulation of electromagnetic fields of large-scale reflecting, scattering, or transmitting systems, usually employed in the long-wave band. By obtaining the picture of the distribution, it would be easier to adjust and tune apparatus in quasi-optical systems. Possibilities exist also for the realization of defectoscopy and introscopy in the millimeter band.

Photometry of the obtained photographs would apparently yield the quantitative characteristics of the field distributions.

We obtained visible images of the intensity of the electromagnetic field of radiation with wavelengths λ = 1.7 - 2.5 mm, and photographed these fields. The images were obtained

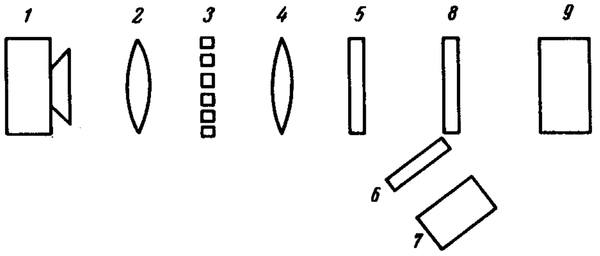

Fig. 1. Setup for the observation of the diffraction pattern on a luminor screen: 1 - generator with horn antenna; 2 - teflon lens, F = 60 mm, dia 50 mm; 3 - diffraction grating with period d = 14 mm; 4 - teflon lens F = 50 mm, dia 50 mm; 6 - luminor screen; 6 - filter, UF-6; 7 - mercury lamp, PRK-4; 8 - filter, ZhS-18; 9 - camera.

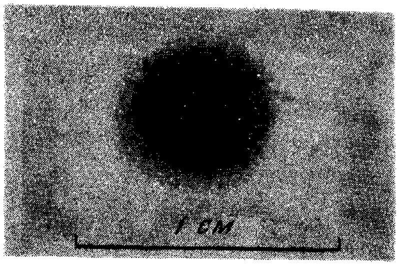

Fig. 2. Photograph of beam cross section

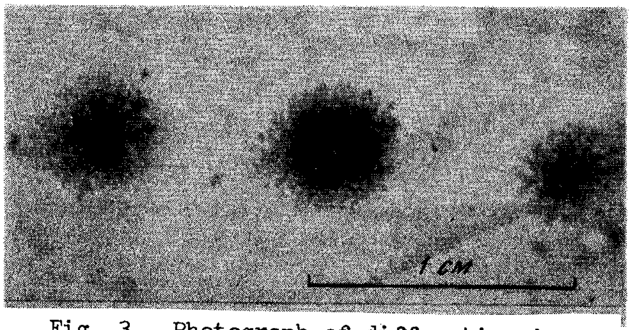

Fig. 3. Photograph of diffraction image ($\lambda = 2.37$ mm; d = 14 mm)

with the aid of a specially prepared luminor based on ZnS and CdS, activated with silver and nickel and possessing thermographic properties (quenching of the luminescence when the luminor is heated). The use of luminors with thermographic properties for the visualization of infrared radiation ($\lambda = 1 - 28\ \mu$) was recently described in the literature [1,2]. In this wavelength range the luminor has an appreciable absorption coefficient. At short millimeter wavelengths, however, the luminor has practically no absorption, so that to heat it during the irradiation it is necessary to place it on an absorbing base with minimum heat capacity and thermal conductivity. Such a base was prepared from mica less than 5 μ thick on which an aluminum layer thinner than 1 μ was sputtered. The base area was about 2 x 3 cm. The time constant of such a luminescent screen is about 1 sec, and the sensitivity is on the order of 100 mW/cm^2.

The luminor excited with ultraviolet acquires a bright green color (luminescence maximum at 0.515 μ). The areas of the luminor exposed to radio emission become heated, causing luminescence quenching.

Figure 1 shows a block diagram of the setup, and Figs. 2 and 3 show photographs of the images obtained by us. The radiation wavelength was 2.37 mm, the power on the order of 100 mW [3], and the screen was at room temperature and atmospheric pressure.

Figure 2 shows the image of a radiation beam formed by means of a teflon lens.

Figure 3 shows the image of radiation passing through a diffraction grating with period 14 mm; the distance between the neighboring maxima on the luminescent screen is 8.5 mm (see Fig. 1). The generator wavelength calculated from the diffraction peak is $\lambda = 2.33$ mm, as against 2.37 mm measured with a wavemeter.

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TEMPERATURE DEPENDENCE OF ELECTRON MEAN FREE PATH IN BISMUTH

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We undertook measurements of the amplitudes of the lines of the radio-frequency size effect [1] in bismuth for the purpose of obtaining data on the temperature-dependent part of the reciprocal of the electron mean free path. We processed plots of the derivative of the imaginary part of the surface impedance of plates of thickness d = 0.6 mm in the frequency range 5 - 14 MHz.

The lines of the size effect from the electronic "ellipsoids" were observed for samples of practically all orientations, provided the magnetic field made an angle less than about 80° with the long semiaxis p_3 of the ellipsoid, and provided the angle between the polarization vector $\vec{E}$ of the high-frequency electric field and the projection of $\vec{p}_3$ on the surface of the sample is sufficiently small. Typical plots, as well as a description of the experimental procedure, are given in [1]. The lengths p_1 and p_2 of the minor semiaxes of the ellipsoids, obtained from these measurements, agree within the limits of errors with the data of [2].

We were unable to see lines from the hole surface even for a sample whose normal $\vec{n}$ was parallel to the bisector axis and with polarization parallel to the C_3 axis, when the electron surfaces produced no size-effect lines and it was therefore possible to increase the sensitivity of the setup. Lines from two electron ellipsoids were obtained with the same sample at a different polarization. It can therefore be stated that the amplitudes of the lines from the electron and hole surfaces differ by a factor of at least 150. Although the parameters of the Fermi surface should affect the line amplitudes, this ratio is apparently governed essentially by the difference in the mean free path.

Assuming that the line amplitude $A^{(i)}$ is given by

$$A^{(i)} \sim \exp(-\xi/\ell^{(i)}), \tag{1}$$

where ξ is the path along the trajectory from one surface of the plate to the other and ℓ is the mean free path, we get

$$\alpha = \ell^{el}/\ell^{h} \simeq 1 + \frac{\ell^{el}}{\xi}\ln(A^{el}/A^{h}). \tag{2}$$

Since $\xi \simeq \pi d/2 \simeq 1$ mm, we get $\alpha \simeq 3.5$ for $\ell^{el} = 0.5$ mm and $\alpha = 2$ for $\ell^{el} = 0.2$ mm. (Incidentally, ℓ^{el} is certainly larger than 0.2 mm, since the lines from the electron ellipsoids were observed, with a large sensitivity margin, for a sample 1.2 mm thick made of the same material).

The ratio of the two corresponding electron and hole mobility tensor components was