intensity of the f_1 and f_2 oscillations increases noticeably. A similar effect (albeit less intense) can be observed when f_M coincides with any of the other combination frequencies. Figure 2b shows the amplitude dependence of this effect. When the modulating signal with frequency $f_M = f_b$ is large enough, an increase by two or three orders of magnitude can be obtained at f_1 and f_2. It should be noted here that the experimentally observed increase in the peaks at the frequencies f_1 and f_2 was accompanied, as expected, by an increase in the intensities of the remaining combination and higher-harmonic frequencies of the spectrum.

The observed effect can be regarded as a three-plasma interaction that leads to the decay of the wave with $f_M \sim f_b$ into two other waves into two others with frequencies f_1 and f_2 corresponding to the most intense oscillations present in the spectrum [4].

It must be noted that these phenomena are observed only in the first half of the tube, where the intensity of the oscillations increases exponentially with increasing distance from the gun (Fig. 3). In that part of the tube where the oscillation intensity approaches the maximum value (z > 130 mm), the initial modulation of the beam at the frequency f_b leads not to an increase but to a decrease of the oscillations of frequency f_1. This effect is similar apparently to the suppression of microwave oscillations which was observed by the authors of [5] when an electron beam was modulated by a monochromatic signal.

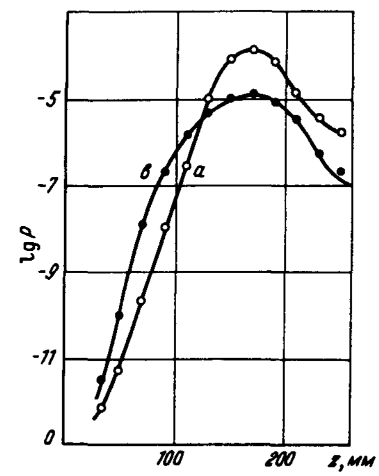

Fig. 3. Oscillation intensity distribution along tube at frequency f_1 without beam modulation (a) and with beam modulated by a monochromatic signal of frequency f_b (P_M = 3 μW).

In conclusion, I consider it my pleasant duty to thank S. M. Levitskii and V. N. Oraevskii for many valuable hints and suggestions.

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DEPENDENCE OF EPR SIGNAL WIDTH ON EXTERNAL CONSTANT ELECTRIC FIELD

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Two of the present authors have shown earlier [1] that the width of the EPR signal of paramagnetic impurities in crystals without an inversion center can depend strongly on an external constant electric field. It has turned out that the electric field influences the spectrum and wave functions of the dynamic system, and consequently also the spin-phonon interaction that determines the line shape.

An experimental investigation of the influence of a constant electric field on the width of the EPR signal was made on ruby samples with chromium-ion concentration close to 0.05%. The EPR signals were observed with a superheterodyne EPR spectrometer operating in the 3-cm band at room temperature, and were registered on the automatic-recorder chart in the form of derivatives of the absorption signals. A voltage whose value could be varied from 0 to 18 kV was applied to thin electrodes deposited on the the surface of a ruby sample 13 mm thick. The maximum electric field intensity in our experiments reached 1400 kV/cm. The electric field E was directed in all experiments along the optical axis of the crystal. As is well known, at such an orientation of the field the ruby EPR-spectrum signals experience a pseudo-Stark splitting due to the presence of non-equivalent inversion-coupled ions in the unit cell of the crystal. In our experiments we measured the width ΔH of the components of the split EPR signal at the maximum-slope points (this quantity will henceforth be referred to as the "half-width"), corresponding to the $1/2 \leftrightarrow 3/2$ transition, as a function of E. An important quantity was the angle θ between the magnetic field H and the optic axis of the crystal. It has turned out that when θ is close to 40° one of the components of the split signal (the one

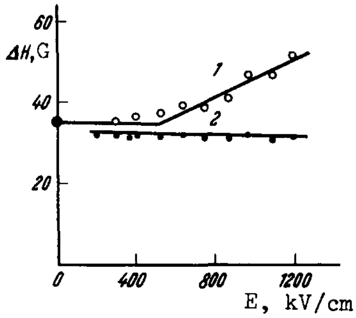

Fig. 1. Half-width ΔH of EPR signal vs. external field E. Curves 1 and 2 pertain to two non-equivalent positions of the Cr^{3+} ions in the ruby unit cell. Transition $1/2 \leftrightarrow 3/2$, $\theta = 38°$, $E \parallel C$. Klystron frequency f = 9270 MHz.

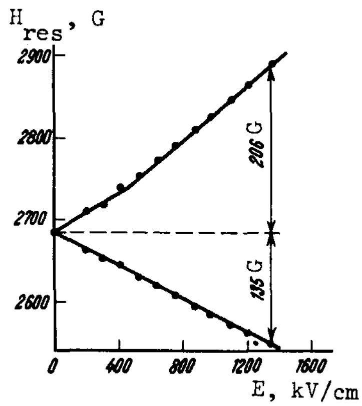

Fig. 2. Dependence of the position (H_{res}) of the components of the EPR signal split in an external electric field on the value of E for Cr^{3+} ions in ruby. Transition $1/2 \leftrightarrow 3/2$, $\theta = 38°$, $E \parallel C$. Klystron frequency f = 9270 MHz.

in the larger magnetic fields) broadens noticeably with increasing field E, starting with $E \approx 500$ kV/cm, whereas the second component of the signal changes little with the field E. When $\theta = 0$ both components of the signal reatain (within the limits of experimental error) a width equal to that of the unsplit EPR signal observed when E = 0. Figure 1 shows one of the plots obtained by us for the EPR signal width vs. E, measured at $\theta = 38°$.

In analogy with [1], calculation for the case under consideration leads to a linear dependence of the half-width of the EPR signals on E. For two non-equivalent positions of the ions, the linear addition differs in sign. The experimentally observed different slopes of the two curves (Fig. 1) are connected with the fact that the line shape is investigated experimentally as a function of the external magnetic field, and not of the klystron frequency. It is easy to show that the magnetic fields which determine the half-width ΔH can be determined from the equation

$$|\omega_{21}(\Delta H) - \omega_{21}(H_M)| = |1/\tau_{21}|, \qquad (1)$$

where $1/\tau_{21}$ is the half-width in the case when the line shape is determined as a function of the klystron frequency; ω_{21} is the frequency of the transition in question and is in general a complicated function of H; H_M is the magnetic field corresponding to the maximum of the EPR absorption signal. The experiment was performed in the magnetic-field region where ω_{21} is a nonlinear function of H. In this case, as follows for example from [3], H_M is a linear function of E and has different slopes for the two non-equivalent ion positions, in agreement with experiment (Fig. 2). This leads, as can be seen from (1) to different slopes of the ΔH vs. E plot for the two non-equivalent ion positions. Thus, the theory explains qualitatively all the features of the experimental results.

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OSCILLATIONS OF BERYLLIUM RESISTANCE IN STRONG MAGNETIC FIELDS

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We have already shown in [1] that in fields 45 - 50 kOe there appear in bismuth open trajectories along the hexagonal axis. The directions of the magnetic field and of the current in the sample are in this case mutually perpendicular and lie in the hexagonal plane. The $\rho(H)$ dependence for such a crystal orientation deviated noticeably from quadratic at $H \geq 50$ kOe, being closer to linear. Such a behavior was attributed by us to magnetic breakdown. In the case of magnetic breakdown, however, one should expect an oscillating dependence of the resistance on the magnetic field, owing to the passage of the Landau levels through the Fermi boundary. A preliminary analysis based on data obtained by observing the de Haas - van Alphen effect in Be [2] has shown that the period of such oscillations may turn out to be relatively small, requiring for their observation a noticeable increase in the homogeneous magnetic field and the use of a measurement technique different from that used in [1].

In the present study we used a superconducting solenoid with a permendur concentrator, producing a magnetic field up to 80 kOe in a 2-mm gap. The single-crystal Be sample ($I \perp$ [0001], $\rho_{300^\circ K}/\rho_{4/2^\circ K} = 120$) was mounted on a rigid shaft which was rotated through 360° by