and decorated at the same temperature, again showed a "domain" structure with very distinct domain boundaries (Fig. 2). The "domain" structure with very distinct domain boundaries (Fig. 2). The "domain" structure of the TGS surface is retained for a rather long time after the crystals are heated in the interval 50 - 90°C.

The disclosure of a "domain" structure in TGS crystals above the Curie point is a new and very important experimental fact showing that a definite defect structure of TGS crystals, which correlates in the ferroelectric state with the domain structure, is preserved also in the paraelectric state. This proves also that the selective nucleation of silver on domains charged to the same polarity is produced not under the influence of the electric field of the domains as a whole, but exclusively of the local active centers, which constitute accumulations of point defects that are polar and are oriented in the electric field of the domains. The orientation of the active centers above the Curie point is a highly unbalanced state. Further heating of the TGS crystals to 100°C for one hour leads to a uniform nucleation of the silver, due to disorientation of the active centers relative to the polar axis of the crystals. The uniform distribution of the active centers remains also after cooling the crystals to room temperature, whereas etching reveals the new domain structure immediately after going through the Curie point, i.e., the defect and domain structures do not coincide in annealed TGS crystals. Such a state is metastable, since the "aging" of the crystals leads both to a change (coarsening) of the domain structure and to an increase in the new distribution of the active centers. The domain and defect structures in the ferroelectric state interact with each other tending to become equal. The interaction has a mutual character: the electric polarization of the domains causes a corresponding orientation of the active centers, and the distribution of the active centers, which depends on the prior history of the samples, governs and determines the appearance of the particular domain structure. The observed defect structure, which consists of accumulations of point defects, apparently constitutes the "memory" of the TGS crystal domains, and presumedly of ferroelectric crystals in general.

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EFFECT OF EXTERNAL ELECTRIC FIELD ON THE ELECTRON RESONANCE SPECTRUM IN A MAGNETICALLY ORDERED PIEZOELECTRIC CRYSTAL

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The presence of the magnetoelectric effect in magnetically ordered crystals [1] gives grounds for assuming that a change in the electron-resonance spectrum can occur in these crystals when an external electric field is superimposed.

We investigated the influence of an electric field on the electron resonance in $Ga_{0.85}Fe_{1.15}O_3$ (T_c = 308°K) and observed a clear-cut effect consisting in a change of the

form and position of the electron-resonance line when the intensity of the external electric field is varied. The crystals $Ga_xFe_{2-x}O_3$ ($0.7 < x < 1.4$) have a rhombic symmetry and their space group is C_{2v}^9 [2]. They are ferromagnetic and piezoelectric, and have the largest magnetoelectric field among all other investigated crystals [4].

The crystals were grown by crystallization from a solution of Ga_2O_3 and Fe_2O_3 in a melt of Bi_2O_3 and B_2O_3. The asmples used for the measurements were in the form of parallelepipeds 1 - 1.5 mm long and of 0.06 - 0.09 mm^2 cross section area. The electrodes were deposited by fusing a silver paste on the end faces of the crystal in such a way that the external constant electric field was directed along the [001] axis. The measurements were made with an RE-1304 superheterodyne electron-resonance spectrometer operating in the 8 mm band.

Figure 1 shows the first derivative of the electron-resonance absorption lines in $Ga_{0.85}Fe_{1.15}O_3$ at 298°K. As seen from plots I and II, the electron-resonance lines for each orientation have in the absence of an electric field a complicated form. It is not excluded that this is actually a superposition of at least two lines. Plots II and IV show the lines in the presence of an external electric field. In this case only single lines of a rather regular form are observed.

We shall agree to define the line width ΔH as the distance between the outer extrema of the derivative (points 1 and 3 of Fig. 1-II), and define the position H_0 as the point where the derivative goes through zero (points 2 and 2'). Figure 2 shows plots of H_0 and ΔH against the electric field when $H \parallel E \parallel [001]$.

Figure 3 shows the values of H_0 for the orientations $H \parallel [100]$ and $E \parallel [001]$ as functions of E for different temperatures.

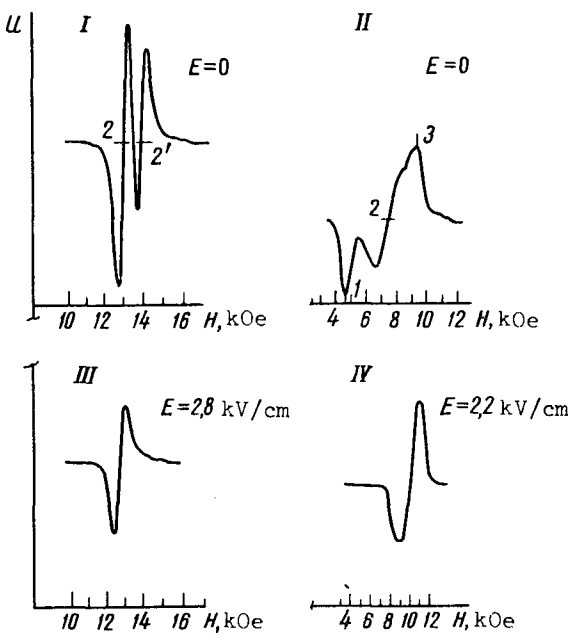

Fig. 1. Electron resonance line shape. I and III - orientations $H \parallel [100]$ and $E \parallel [001]$; II and IV - orientation $H \parallel E \parallel [001]$

The ranges of the applied electric fields were determined by the thermal conductivity of the sample. We measured the conductivity of the sample σ as a function of E. The foregoing results correspond to values of E such that the electric conductivity changes by not more than 1.5 - 2 times. Our data yield a small value of σ ($\sim 10^{-5}$ - 10^{-4} $(ohm\text{-}cm)^{-1}$) and we assume that the change of the electric conductivity in the observed effects is negligible.

We can point to the following peculiarities in the foregoing results:

1. The complicated for and the large width of the electron-resonance line in the single crystal in the absence of an external electric field.

2. Complete vanishing of the complicated structure when sufficiently strong electric fields are applied.

3. Practically complete lack of influence of the electric field on the resonance spectrum in the paramagnetic region (Fig. 3).

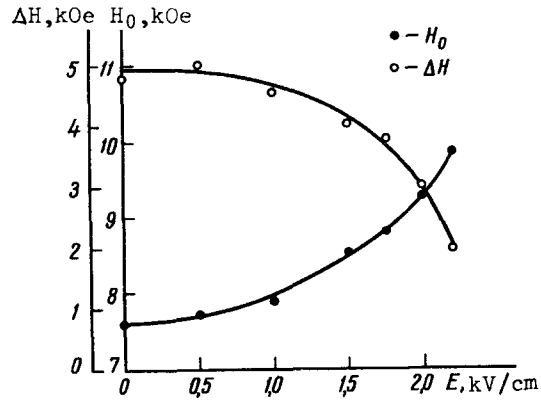

Fig. 2. Position (H_0) and width (ΔH) of the line vs. the intensity of the external electric field (E) at orientation H ∥ E ∥ [001].

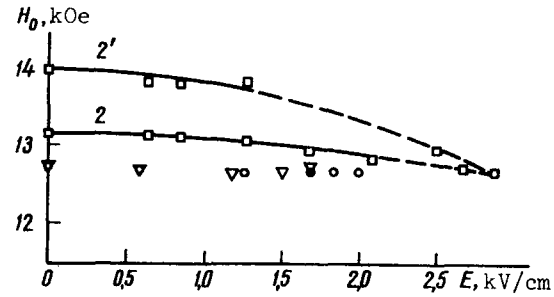

Fig. 3. Dependence of maxima of the line (0-derivative) on the field intensity E at different temperatures for the orientation H ∥ [100], E ∥ [001]. □) T = 298°K, ○) T = 315°K, ▽) T = 323°K. Plots 2 and 2' correspond to points 2 and 2' of Fig. 1-I.

To explain the observed phenomena we can consider the following model. Owing to the magnetoelectric interaction, a certain electric polarization is also produced in a magnetically ordered piezoelectric. Then the precession of the magnetic moment is accompanied by a corresponding precession of the electric polarization. The joint motion of the two moments can lead to a change in the ferromagnetic-resonance line shape, or even to a splitting of the line into two (or more lines if electric domains are present). This effect should depend on the orientation of the sample, since χ_{me} (magnetoelectric susceptibility) is a tensor. When a sufficiently strong external electric field is applied, the motion of the electric moment freezes, and the usual ferromagnetic-resonance line is then observed. In the paramagnetic phase the effect should be much weaker owing to the small value of the magnetization in the external field.

Besides the described measurements we investigated also samples of spherical form and at frequencies in the 3 cm band. The results were similar.

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NATURE OF GRAVITATIONAL FIELD

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Measurements of the oblateness of the sun (Dicke, Goldenberg [1]) lead to the esti-