Features of acoustic properties of $ErFeO_3$ in second-order phase transitions

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Ultrasound spectroscopy of solitary single-crystal samples was used for a comparative study of three spontaneous and magnetic-field induced second-order phase transitions in erbium orthoferrite ($T = T_N, T_2, T_1$). The basic differences between the dynamics of these phase transitions are established. The effect of a number of factors on the character of the acoustic anomalies in the phase-transition region is analyzed. It is shown that magnetoelastic interaction is neither the principal nor sole factor forming the gap in the magnon spectra. H–T diagrams are plotted for the low-temperature phase transition.

Erbium orthoferrite belongs to a large class of rare-earth rhombic antiferromagnets containing two magnetic subsystems with substantially different properties—the rare-earth and iron subsystems. It has been established (see, e.g., Refs. 1 and 2) that the observed variety of the orthoferrite properties is substantially governed by the individual singularities of the magnetism of the rare-earth ion (R) in the crystal and by its interaction with the iron subsystem. At $T > 5$ K the rare-earth ions in orthoferrites are paramagnetic, but the R–Fe interaction leads to their polarization (magnetization). As the temperature is lowered, the polarization contribution to the anisotropy energy increases in proportion to T^{-1}. This can reverse the signs of the effective anisotropic constants and lead thereby to orientational phase transitions (OPT). The R–R interaction comes into play only at low temperature ($T < 5$ K) and can lead to antiferromagnetic ordering of the R-subsystem.

The dynamics of OPT in rare-earth orthoferrites is complicated and is determined by the interaction of various types of excitation. On the whole, the spectrum of an orthoferrite has four modes, two describing vibrations of the R subsystem and two those of the Fe subsystem. Either the R or the Fe mode can be the soft one near the OPT (see, e.g., Ref. 3).

The iron subsystem in $ErFeO_3$ becomes ordered at $T \approx 640$ K to form a weakly canted antiferromagnetic structure of Fe^{3+} spins (Γ_4). As the temperature is lowered, the structure undergoes three spontaneous second-order OPT: at $T_1 \approx 97$ K (Γ_4–Γ_{24}), at $T_2 \approx 87$ K (Γ_{24}–Γ_2), and at $T_N \approx 4.1$ K (Γ_2–Γ_{12}), when the iron antiferromagnetism vector **G** is rotated from the **a** axis ($T > T_1$) through the canted phase in the **ac** plane $T_1 > T > T_2$ to the **c** axis ($T_2 > T > T_N$), and then in the **bc** plane from the **c** axis to the **b** axis by an angle 49° ($T < T_N$). The antiferromagnetic ordering of the Er^{3+} spins is affected at $T = T_N$. Thus, a distinguishing feature of the second-order low-temperature phase transition (PT) at $T = T_N$ is its combined nature—the OPT in the iron subsystem is accompanied by an ordering PT in the erbium subsystem.[4] The arrangement of the magnetic moments in $ErFeO_3$ is shown as a function of temperature in Fig. 1.

Note that according to Ref. 3 the dynamics of the above phase transitions in erbium orthoferrite is substantially related to the erbium subsystem not only in low-temperature PT region $T = T_N$ (Ref. 5) but also, in contrast to other orthoferrites with relatively high OPT temperatures, in the OPT region at $T = T_1, T_2$. That is to say, even at a temperature on the order of 100 K it is suggested that there exists a low-lying Er mode that softens in the region of the OPT Γ_2–Γ_{24}–Γ_4 and prevents complete softening of the frequency of the quasiferromagnetic Fe mode. The latter is softened only at the lower spin reorientation boundary at $T = T_2$. The experimentally observed energy gaps f_0 for soft magnetic-resonance modes amount to ≈ 25 GHz in the vicinity of the PT $T \sim T_N$, T_2 and ≈ 80 GHz at $T \sim T_1$ (Refs. 6 and 7).

According to the theory (see, e.g., Ref. 8), the main factor shaping the energy gap in a magnon spectrum at an OPT point is the magnetic interaction. The experimentally observed gaps, however, are not of the same order as the corresponding theoretical estimates of the magnetoelastic gap. This stimulates interest in the study of the dynamics of acoustic-mode behavior in the OPT region. The aim of the present study was a comparative experimental ultrasonic investigation of $ErFeO_3$ in the vicinity of the PT at $T = T_N$, T_1, T_2, and in a magnetic field as well.

EXPERIMENT

A pulsed ultrasonic (US) spectrometer was used for the measurements. Sound oscillations were excited by resonant lithium-niobate resonant piezoconverters. Their frequency, $f = 25$–30 MHz is substantially lower than energy gap f_0 in which there is no resonant absorption for the softening magnetic-resonance mode. The relative velocities are measured point by point by a phase-sensitive method. The sound damping was measured in a continuous regime with an automatic plotter. The temperature was determined from the measured helium vapor pressure or measured with a copper resistance thermometer placed near the sample. A magnetic field up to 40 kOe was produced by a superconducting solenoid.

The measurements were made on two $ErFeO_3$ single crystals. The first was a rounded-edge disk $d = 1.9$ mm thick and 4 mm in diameter, the normal **n** to which was parallel to the crystal axis **c**. The second was a cylinder of thickness $d = 6$ mm, diameter 4 mm, and normal $\mathbf{n} \| \mathbf{c}$. The accuracy of

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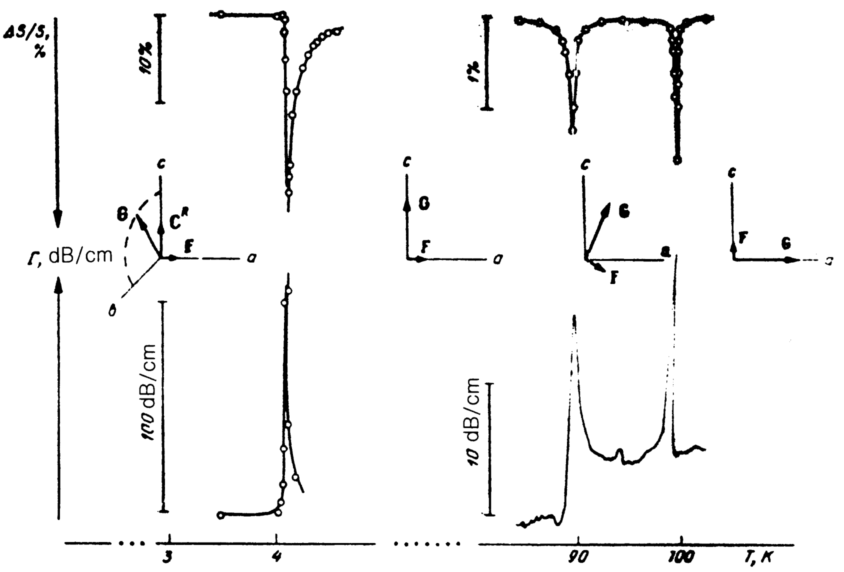

FIG. 1. Temperature dependences of the absorption coefficient and of the relative changes of the velocity of active transverse sound modes in the vicinity of a second-order PT in $ErFeO_3$. Schematic arrangement of the Fe antiferromagnetism, Fe ferromagnetism, and Er antiferromagnetism vectors (**G**, **F**, and $\mathbf{C}^R$) vectors relative to the crystallographic axes **a**, **b**, and **c** in the temperature scale.

the alignment of the axes with the normal to the sample plane was $\approx 0.5°$, of the magnetic field with the **c** axis $\approx 0.5°$, and with the axes **a** and **b** in the plane of the sample $\approx 3°$.

EXPERIMENTAL RESULTS

1. Spontaneous PT

Figure 1 shows the temperature dependences of the absorption coefficients Γ and of the relative changes of the velocity S of active acoustic modes in the vicinity of each of the PT. These dependences demonstrate substantial differences in their manifestations.

At $T \sim T_N$, from symmetry considerations, the active mode, i.e., the one interacting with the magnons, is the transverse a acoustic mode with the wave vector $\mathbf{q} \| \mathbf{c}$ and polarization $\boldsymbol{\varepsilon} \| \mathbf{b}$. This mode is seen to exhibit gigantic resonant and strongly asymmetric critical anomalies of the sound velocity and damping, having no analogs in either magnitude or form among the heretofore known OPT or PT orderings (see also Refs. 6 and 9).

At $T \sim T_1$ and $T \sim T_2$ the active transverse mode ($\mathbf{q} \| \mathbf{c}$, $\boldsymbol{\varepsilon} \| \mathbf{a}$) exhibits anomalies that are weaker by at least an order of magnitude than at $T \sim T_N$. These anomalies have a resonant character, the line-wing slopes in the symmetric (Γ_2, Γ_4) and canted (Γ_{24}) phases differ, in accord with the theory, by approximately a factor of two, the maximum relative change of the velocity reaches $\approx 1.5\%$, and the damping change reaches ≈ 15 dB/cm. Control experiments on sample No. 2 led to similar results. Attention is called to the following reliably established fact: the width of the singularity in the T_2 vicinity is noticeably larger than for $T = T_1$.

2. Induced PT

$T = T_N$

In accord with the symmetry (see Fig. 1), the character of this PT should not be altered by application of a magnetic field $\mathbf{H} \| \mathbf{a}$, and the configuration Γ_2–Γ_{12} is preserved (see also Refs. 10 and 11). Indeed, as seen from Fig. 2, the character of the $\Gamma(T)$ and $S(T)$ dependences of an active transverse mode preserves at $\mathbf{H} \| \mathbf{a}$ the main features in a spontaneous transition. The experimentally observed broadening of both anomalies can be partially attributed to the difficulty of exactly setting the orientation $\mathbf{H} \| \mathbf{a}$. We emphasize that the difference between the $\Gamma(T)$ and $S(T)$ line widths, which is well noted in Fig. 2, is reliably observed for $\mathbf{H} \| \mathbf{a}$. When the ultrasound signal increases vigorously, the velocity in some range ΔT still remains unchanged. Figure 3a shows the dependences of the amplitude A of the sound signal passing through the sample ($\mathbf{q} \| \mathbf{c}$, $\boldsymbol{\varepsilon} \| \mathbf{b}$) on the magnetic field $\mathbf{H} \| \mathbf{a}$ at various temperatures. It can be seen that just as in the case of a spontaneous transition the absorption has a clearly pronounced strong anomaly of the resonant type. As T is lowered, the amplitude and width of the anomaly decrease insignificantly. The H–T phase diagram is plotted in Fig. 4 on the basis of the position of the anomaly in the magnetic field.

Superposition of a magnetic field $\mathbf{H} \| \mathbf{c}$ leads to an overall lowering of the system's magnetic symmetry. The PT acquires the configuration Γ_{24}–Γ_{124}. Figure 2 shows for comparison the changes of the shapes of the singularities of the lines $\Gamma(T)$ and $S(T)$ in the same field $H = 3.7$ kOe but at $\mathbf{H} \| \mathbf{c}$. The anomalies are evidently substantially broadened and become more symmetrical, with a special leveling of the abrupt slope of the left-hand low-temperature wings of the lines. Figure 3b shows plots of ultrasound absorption ($\mathbf{q} \| \mathbf{c}$, $\boldsymbol{\varepsilon} \| \mathbf{b}$) vs the magnetic field $\mathbf{H} \| \mathbf{c}$ for various temperatures. The corresponding relative changes of the velocity (the ratio of the change of the velocity with a magnetic field to that with $H = 0$ at the same temperature) are shown in Fig. 3c. These data show that:

—the abrupt increase of the sound absorption coefficient in the PT region has a resonant character and is observed in the entire investigated temperature range (4.2–1.8 K). The sound-absorption peak decreases substantially and its width relative to the field increases when the temperature is lowered. A splitting of the peak is reliably observed, at any rate for $T \leqslant 3.9$ K (for higher T the signal at the minimum vanishes, and the statement above becomes moot).[1] Both the absorption peak and its intermediate minimum shift with temperature along the magnetic field, so that an H–T phase diagram can be plotted (Fig. 4);

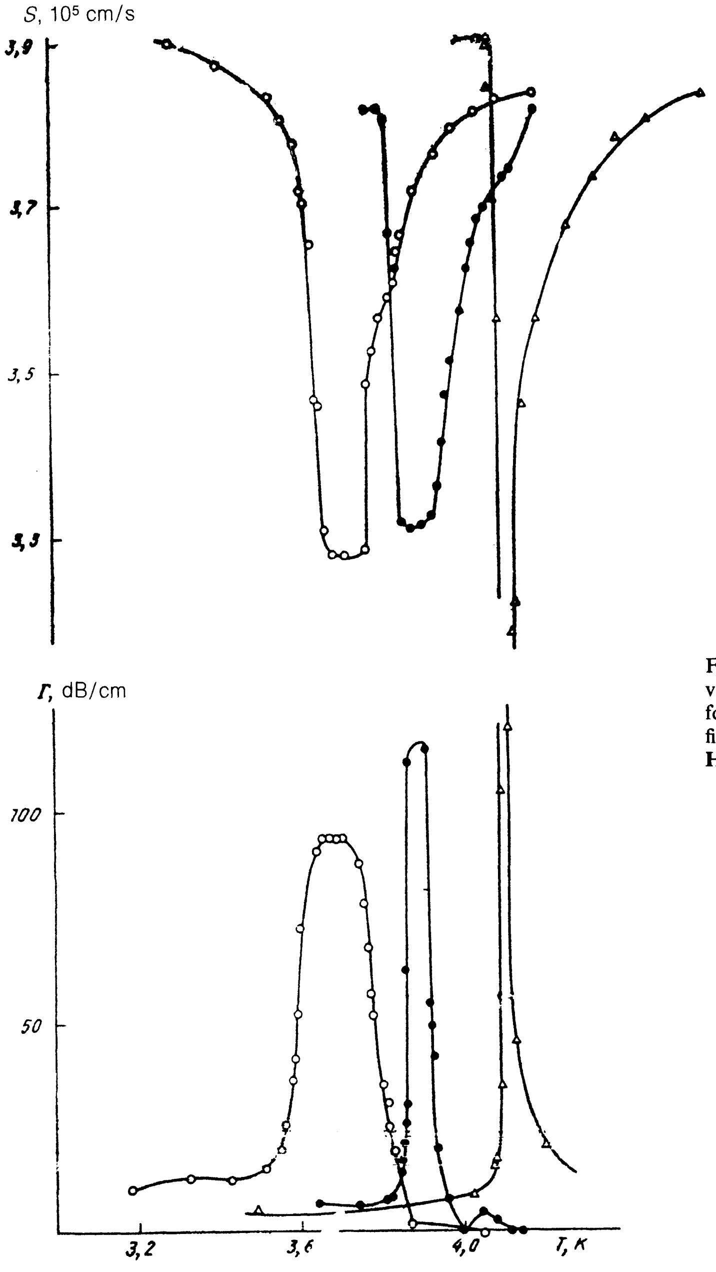

FIG. 2. Temperature dependences of the absorption coefficient and of the velocity of the active transverse ultrasound wave ($f=35$ MHz, $\mathbf{q}\|\mathbf{c}$, $\boldsymbol{\varepsilon}\|\mathbf{b}$) for a low-temperature phase transition $T_N \approx 4.1$ K without a magnetic field and in a field $H=3.7$ kOe with different polarizations: O—$\mathbf{H}\|\mathbf{c}$; ●—$\mathbf{H}\|\mathbf{a}$, Δ—$\mathbf{H}=0$.

—at a given temperature and at $T<T_N$, the active acoustic-mode velocity has a pronounced maximum at the PT point relative to the magnetic field. The relative velocity change in the PT region decreases and becomes smeared out when the temperature is lowered. At a temperature $T \gtrsim T_N = 4.1$ K, but in the temperature region where the active acoustic mode is still softened in a spontaneous PT as a result of the strong asymmetry of the PT, the relative velocity change $\Delta S/S_{H=0,T=\text{const}}$ with change of the magnetic field has the form of a one-sided branch (Fig. 3c, $T=4.1$; 4.2 K). To restore the velocity to the maximum outside the PT region, i.e., $S_{\max} \approx 3.9 \cdot 10^5$ cm/s, a 4–6 kOe magnetic field must be applied. The ensuing maximum relative velocity changes (20% for $T=4.1$ K and $\gtrsim 9\%$ for $T=4.2$ K) agree well quantitatively with the absolute values of the sound-velocity changes shown in Fig. 2.

The sound absorption measured by inactive longitudinal acoustic modes ($\mathbf{q}\|\boldsymbol{\varepsilon}\|\mathbf{c}$) (Fig. 3d) and by an inactive transverse acoustic mode ($\mathbf{q}\|\mathbf{c}$, $\boldsymbol{\varepsilon}\|\mathbf{a}$) in the region of a low-temperature PT at $\mathbf{H}\|\mathbf{c}$ show that in this geometry the anomalies in the PT region are substantially lower (by $\gtrsim$ two orders than for the active mode, while the anomalies of the sound velocity have not been fixed within the limits of the measurement accuracy and correspondingly to not exceed fractions of a percent $T=T_1, T_2$.

At $T=T_1, T_2$ the OPT are unusually sensitive to the presence of an external magnetic field. Turning on an arbitrarily weak magnetic field $\mathbf{H}\|\mathbf{a}$ practically annihilate the OPT at $T=T_1 \approx 100$ K and suppresses substantially the OPT at $T=T_2$, which was actually observed up to $H \lesssim 6$ kOe (see Fig. 5, inset for $T=T_2$). The influence of a field $\mathbf{H}\|\mathbf{c}$ is the opposite. In this geometry the OPT is eliminated

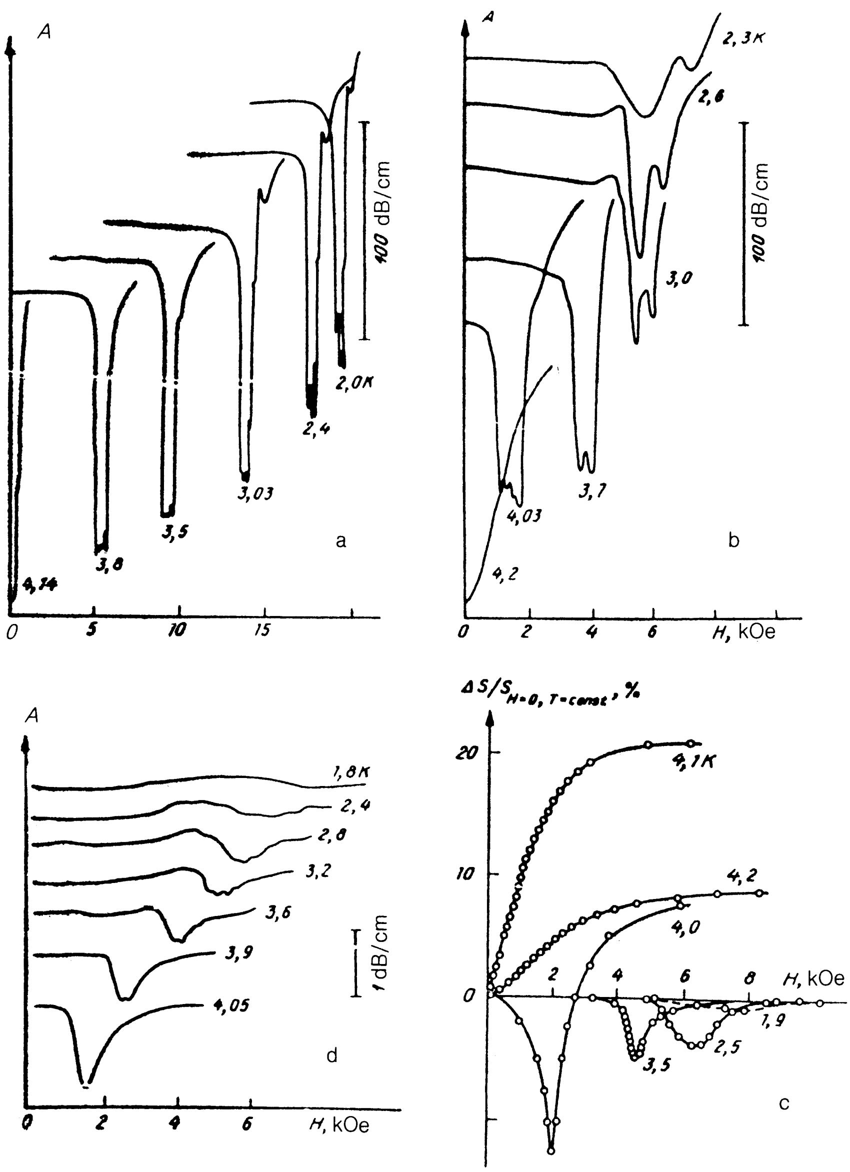

FIG. 3. Low-temperature phase transition in $ErFeO_3$: isotherms of field dependences of the amplitude of an active transverse acoustic mode (**q**||**c**, **ε**||**B**) passing through the sample, at $f = 25$ MHz and **H**||**a** (a) and **H**||**c** (b); c—isotherms of field dependences of the relative changes of the velocity of the active transverse acoustic mode (**q**||**c**, **ε**||**b**) for **H**||**c**, $f = 25$ MHz; d—isotherms of field dependences of the longitudinal acoustic mode **q**||**c**||**H**, $f = 30$ MHz.

almost completely at $T = T_2 \approx 90$ K and the field suppresses substantially the transition at $T = T_1$, which is actually observed only up to $H \lesssim 3$ kOe (Fig. 5, $T = T_1$ and the corresponding inset).

The data obtained are insufficient for a complete phase H–T diagram because, first, the field interval in which the OPT are observable is narrow and, second, because there is practically no shift of the signal with respect to T when H is varied. This last circumstance does not agree with the known data on the H–T diagram and is probably connected with the dependence of the latter on the field disorientation in the **ac** plane, observed, for example, in $YbFeO_3$ (Ref. 12), and with the actual inaccuracy of aligning **H** along the **a** or **c** axis.

Note that in the experiment there was practically no hysteresis in any of the three phase transitions. In our opinion, there were likewise not nonlinear effects in the experiments. The measurements were made at the minimum applied acoustic power, a factor particularly important in the vicinity of $T = T_N$. The singularity observed here is unusually acute along the low-field edge and is correspondingly usually sensitive to the smallest superheating of the sample.

DISCUSSION OF RESULTS

The three OPT that occur in $ErFeO_3$ are manifested in substantially different manners, so that their comparative analysis permits the following conclusions to be formulated.

1. The influence of sample inhomogeneities on the extent of the Γ and S anomalies in the vicinity of an OPT was experimentally confirmed.

In fact, the spontaneous transitions Γ_2–Γ_{24}–Γ_4, typical of practically all the orthoferrites, are OPT. The behavior of various acoustic modes in the OPT region can be theoretically predicted.[8] It was calculated specifically for $ErFeO_3$ in

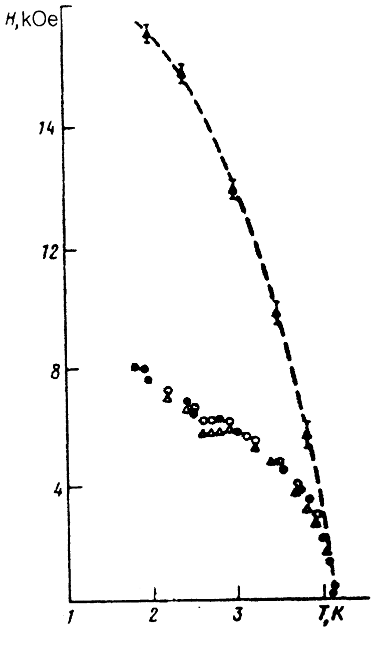

FIG. 4. HT phase diagram of $ErFeO_3$ in the region of a low-temperature PT: ▲—**H**‖**a**, **q**‖**c**, **ε**‖**b**, min $A(H)$; ●—**H**‖**c**, **q**‖**c**, **ε**‖**b**, min $\Delta S/S_{H=0, T=\text{const}}$; △—**H**‖**c**, **q**‖**c**, **ε**‖**b**, min $A(H)$; ○—**H**‖**q**‖**ε**‖**c**, min $A(H)$.

Refs. 13–15. It was shown that the interaction of an active acoustic mode with a soft magnon mode should lead to resonant singularities of the $S(T)$ dependence with a difference by approximately a factor of 2 between the line-wing slopes in the symmetric and canted phases, and with almost vanishing of the velocity of the quasiacoustic wave at the OPT point as the wave vector $\mathbf{q}\to 0$. The singularities previously observed in orthoferrites,[12,13,16–18] while having qualitatively the expected form, are nevertheless of negligible magnitude. For example, assume that the relative changes of the velocity of the active acoustic mode in $ErFeO_3$ at $T = T_1$, T_2 did not exceed 10^{-2} (Refs. 13, 16, and 17). The causes of the substantial limitation of the velocity anomalies of the active acoustic mode can be inhomogeneities (structural, temperature-dependent) of the employed single-crystal samples, the influence of the domain walls, the weakening of the coupling between the magnetic and elastic subsystem on account of dipole interaction, and actual use of nonzero values of the wave vector **q** of the sound wave.

The magnetoacoustic singularities we observed at $T = T_1$ and T_2, larger by almost two orders than the earlier ones, cannot be accounted for by the value of **q**, which is approximately the same as used in Refs. 13, 16, and 17, or by the dipole interaction, which is significant only for the Γ_2–$\Gamma_{24}(T = T_2)$ transition.[14] The domains will be discussed below. The $ErFeO_3$ single crystals used by us were of higher grade, as attested to by the higher measured value of T_N and by the sound velocity higher than ever recorded before. Thus, at nitrogen temperature and at **q**‖**c** the longitudinal and transverse sound velocities $S_\parallel$ and $S_\perp$ amount to

$$S_\parallel = 6{,}05\cdot 10^5 \text{ cm/s},\quad S_{\perp,\,\varepsilon\parallel b} = 3{,}98\cdot 10^5 \text{ cm/s},$$

$$S_{\perp,\,\varepsilon\parallel a} = 3{,}42\cdot 10^5 \text{ cm/s}$$

as against[13]

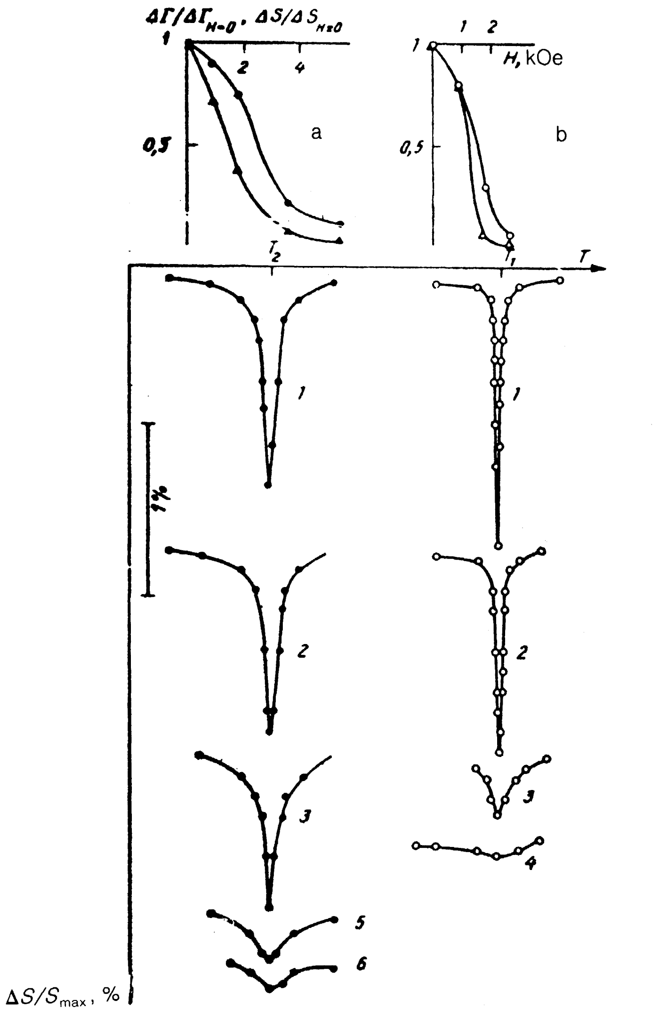

FIG. 5. Temperature dependences of the relative changes of the velocity of an active transverse sound mode (**q**‖**c**, **ε**‖**a**) in the OPT region at $T = T_1$, **H**‖**c** and $T = T_2$, **H**‖**a** for different values of the magnetic field 1—$H = 0$; 2—0.9; 3—1.8; 4—2.8; 5—3.7; 6—5.5 kOe. The dependences for the absorption curves are analogous. Insets—decrease of the resonant signal of the amplitude (△,▲) and velocity (○,●) of the active ultrasound mode in the vicinity of the OPT at $T = T_2$ (a) and $T = T_1$ (b).

$$S_\parallel = 5{,}85\cdot 10^5 \text{ cm/s},\quad S_{\perp,\,\varepsilon\parallel b} = 3{,}83\cdot 10^5 \text{ cm/s},$$

$$S_{\perp,\,\varepsilon\parallel a} = 3{,}33\cdot 10^5 \text{ cm/s}$$

or in Ref. 17

$$S_\parallel = 5{,}9\cdot 10^5 \text{ cm/s}.$$

Thus, in our opinion, it is precisely the high perfection of the single crystals which leads to an overall growth of the power of the singularities for the OPT Γ_2–Γ_{24}–Γ_4 in our experiment.

2. The experiment shows that the influence of the domain walls on the leveling of the anomalies of the $\Gamma(T)$ and $S(T)$ dependence is insignificant.

In fact, to eliminate the domain, to change the sample into a single-domain state, and by the same token expect, according to the theory, enhancement of the $S(T)$ singularities, it is customary to use a strong magnetic field (see, e.g., Ref. 12). As described above, however (see also Ref. 16), introduction of both **H**||**c** and **H**||**a** does not increase, but suppresses strongly the singularities at $T = T_1$ and T_2. Recall that for $YbFeO_3$ (Ref. 12) they observed precisely a substantial enhancement of the magnetic singularities in the region of the $\Gamma_2-\Gamma_{24}-\Gamma_4$ transition in a magnetic field. However, as shown convincingly by the authors, this enhancement can likewise not be regarded as confirming the influence of the domain structure on the weakness of the Γ and S anomalies.

3. The experiment can be regarded as a confirmation of a definite influence of the dipole interaction on anomalies of the relative velocity changes in OPT. In fact, according to Ref. 14, the weakening of the coupling between the magnetic and elastic subsystems on account of the dipole interaction takes place only at $T = T_2$ ($\Gamma_2-\Gamma_{24}$). It is precisely this anomaly which is smaller and substantially wider than the anomaly observed at $T = T_1$ (see Fig. 1). This statement calls nevertheless for some caution because no such behavior was observed, for example, in ytterbium[12] or thulium[17] orthoferrites.

4. It can be concluded from the experimental results that magnetoelastic interaction is indeed one of the factors forming the energy gap in the magnon spectrum.

In fact (see also Refs. 10 and 11), an analysis of the amplitude dependence of the anomaly of sound absorption in the region of the $\Gamma_{12}-\Gamma_2$ PT at **H**||**a** (Fig. 3a), i.e., in a geometry in which the magnetic field does not influence the character of the PT, shows that a gradual insignificant decrease of the acoustic-anomaly amplitude correlates convincingly with an equally smooth decrease of the measured gap in the spectrum of the soft magnetic mode.[19] Furthermore, for the almost anomalous $\Gamma_2-\Gamma_{24}$ (T_2) and $\Gamma_{24}-\Gamma_4$ (T_1) OPT, a larger gap in the magnon spectrum[7] at $T = T_1$ corresponds to a stronger and narrower resonant singularity on the $\Gamma(T)$ and $S(T)$ dependences (see Fig. 1). An analysis of the results reported in Ref. 12 also shows a correspondence between the amplitudes of the $\Delta S/S$ singularities and the sizes of the gaps in the magnon spectrum at $T = T_1$ and $T = T_2$ for ytterbium orthoferrite.

5. Magnetoelastic interaction is not the only and decisive factor in the formation of the energy gap in the magnon spectrum.

In fact, experiments with the same samples, under the same conditions, and at one and the same value of the sound-wave **q** show, firstly, that when the gaps for $T = T_N$ and $T = T_2$ are equal the acoustic singularities differ by at least an order of magnitude. Secondly, that when the gap for $T = T_1$ is several times larger than for $T = T_N$ (notwithstanding the logical assumption that the elastic interaction is the only factor governing the gap formation) is stronger by more than an order than at $T = T_1$. The statement above is of course limited by the complexity of the PT at $T = T_N$.

6. Note that the explanation proposed in Ref. 15 for the singularities in the onset of the three described OPT in $ErFeO_3$ is apparently not complete or final. According to Ref. 15, the anomalies of S at $T = T_N$ and $T = T_1$ should be comparable and should differ in experiment for purely methodological reasons: a) The temperature interval of the OPT at $T = T_N$ is $\Delta T \approx 1$ K, whereas for $T = T_1$ it is estimated at $\Delta T \sim 10^{-3}-10^{-4}$ K, which naturally prevents observation of the total change of $\Delta S/S$ if T is not sufficiently stabilized in experiment. b) For both $T = T_N$ and $T = T_1$ the dipole interaction does not influence the limitation of the velocity anomaly of the active transverse sound wave, and S should tend to zero in both cases. The damping factor of the quasi-elastic branch, however, is essentially determined by the damping parameter of the R-subsystem, which decreases substantially when T is lowered.[20] The authors of Ref. 15 assume therefore that the damping by the OPT in the region of T_1 (and T_2) increases against the background of an overall large damping connected with the damping inthe R-subsystem. This, in turn, simply prevents the observation of ultrasonic echo signals, so that it is naturally impossible to measure the total change of the sound velocity.

The above arguments, unfortunately, contradict the experimental observations. Firstly, phonon absorption of sound in the vicinity of $T = T_1$ or T_2 is insignificant (or at any rate weaker than in the vicinity of T_N), and allows 40–50 echo pulses to be seen on the oscilloscope screen, whereas when the temperature passes through the OPT points not more than two echo signals remain on the oscilloscope screen. There is no loss of information on account of the vanishing of the echo signal, in contrast to the case of $T = T_N$. Secondly, measurements of both $\Gamma(T)$ and $S(T)$ [as a check, additional measurements of $S(T)$ were made and continuously plotted automatically] seem to favor a larger working interval of ΔT at $T = T_1$ provided, of course, that the effect is not exceedingly sensitive to the accuracy of the experimental geometry.

It seems that the larger difference between the observed gaps for soft magnon modes in the regions of the considered OPT likewise attests to deeper differences between the phase transitions at $T = T_1$ and $T = T_N$.

Lastly, the steepest temperature change occurs in the low-temperature edges of the anomalies of $\Gamma(T)$ and $S(T)$ for $T = T_N$, when the value of Γ changes in the interval $\Delta T \lesssim 10^{-2}$ K by more than 100 dB/cm while $\Delta S/S$ changes by more than 20%. It is quite possible to attribute this to the behavior of the anisotropy constant K_{cb} (the contribution to the gap of Fe-subsystem spin waves from the anisotropy in the **cb** plane,[15] but a proof of this statement calls for numerical estimates.

It can be assumed, on the whole, that the singularities of the low-temperature PT in $ErFeO_3$ are governed in fact by that structure of the effective anisotropy constants which really causes the complexity of this phase transition.

The described experimental material serves as a base for further research and a detail analysis of the nature of the anomalous critical dynamics of PT in erbium orthoferrite.

[1)] A similar splitting of the peak on the plot of the magnetostriction against H for an $ErFeO_3$ crystal at **H**||**c** was observed in Ref. 4 and attributed to superposition of contributions to the magnetostriction from the Er^{3+} and Fe^{3+} ions at **H**||**c**.

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