heating (20° in 3 hours), there are no anomalies.

The inverse phenomenon is observed when the sample is cooled, namely the sample expands upon cooling. The first report of such an anomalous behavior of chromium is contained in [4]. This behavior of chromium may be connected with the unique "superheating" of the sample. Then the increase of the internal energy, resulting from the delay of the transition, is offset by a decrease of the exchange energy via spontaneous compression. This conclusion agrees with a pressure study [5] that has shown that pressure decreases the energy gap, and hence the antiferromagnetic interaction.

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THRESHOLD PHENOMENA IN A PARAMETRICALLY EXCITED SPIN SYSTEM OF FERRITES

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It was shown in [1, 2] that it is possible to observe in a parametrically excited spin system secondary threshold phenomena due to the excitation of new groups of spin waves. The most important processes are those for which the energy and momentum conservation laws are written in the form

$$\omega_{k_0} = \omega_k + \omega_{k_0 - k}, \tag{1}$$

$$2\omega_{k_0} = \omega_{k_0 + \kappa} + \omega_{k_0 - \kappa}, \tag{2}$$

where $\vec{k}_0$ is the wave vector of the primary excited spin wave in the parametric excitation of spin waves (PESW). The first of these processes, predicted theoretically by one of the authors [1], was confirmed experimentally by Lemaire et al. [3]. In accord with [1], this effect was observed in a relatively narrow region of magnetizing fields H_0, defined by the inequality

$$0 \leq H_0 - \frac{1}{3} 4\pi M \leq -2\pi M - \frac{1}{3}\left[(2\pi M)^2 + \left(\frac{\omega_{k_0}}{\gamma}\right)^2\right]^{1/2} + \frac{2}{3}\left[(4\pi M)^2 + \left(\frac{\omega_{k_0}}{\gamma}\right)^2\right]^{1/2}. \tag{3}$$

It turned out that the critical instability field (1) for yttrium ferrite exceeds the usual PESW threshold by 20 dB.

It was of interest to observe experimentally an instability of type (2), the excitation threshold of which may turn out to be low because of the compensation of the losses of the corresponding group of waves by an external alternating magnetic field. To this end, we investigated the behavior of a number of ferrite crystals beyond the PESW threshold. The measurements were made on spherical samples of 1.2 mm diameter at a frequency 9200 MHz and a temperature 300°K. The exciting pulse length was 3 μsec. The samples were magnetized usually along <111>. The investigation resulted in observation of a group of

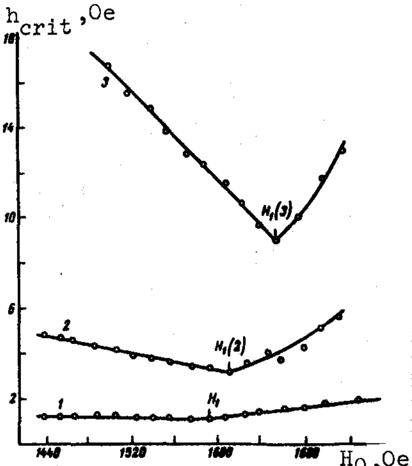

Fig. 1

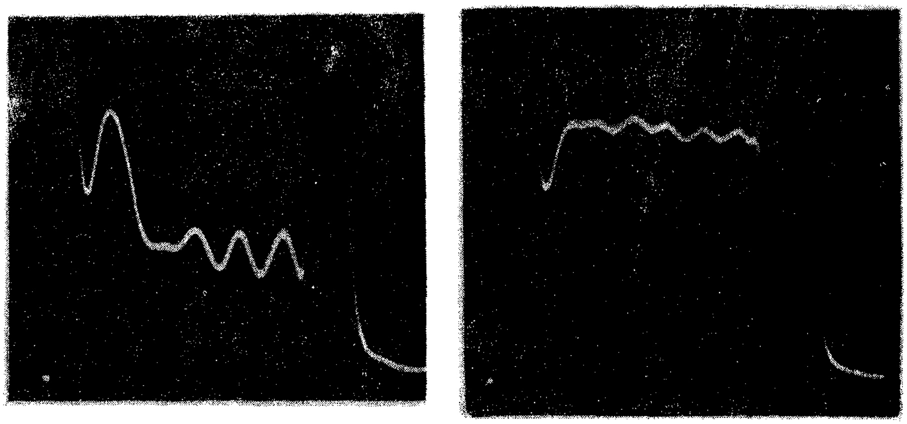
Fig. 2

Fig. 1. Dependence of critical fields on H_0: 1) Ordinary PESW, 2) second instability, 3) third instability. The measurements were made on an $Li_{0.5}Fe_{2.34}Ga_{0.16}O_4$ crystal magnetized along <111>, at 300°K.

Fig. 2. Oscillograms of auto-modulation oscillations: a) ordinary PESW, b) second instability (signal attenuated 10 dB), H_0 = 1640 Oe, temperature 300°K.

threshold effects which, to our knowledge, were never investigated before. In these effects, an increase of the exciting power above a critical value P_{crit} corresponding to the PESW threshold gives rise to the appearance of new instability thresholds. Just as the first threshold P_{crit}, they are revealed by a strong change in the reflection coefficient of a resonator containing the crystal. This change occurs at a definite value of the power. For the majority of the investigated ferrites, two thresholds are distinctly observed. The first corresponds to the ordinary PESW threshold. Other thresholds are assumed by us to be due to parametric excitation of other groups of spin waves. The field dependence of the second threshold (Fig. 1) is analogous to the usually observed dependence of h_{crit} on H_0 in PESW, and the region of its existence coincides with the interval of H_0 in which the ordinary PESW is observed, independently of the magnetization of the crystal. The magnitude of the magnetizing field $H_1(2)$, corresponding to the minimum of the critical field $h_{crit}(2)$ of the second instability, is usually larger by about 30Oe than the value of the field H_1 of the ordinary PESW (see the table). For the $Li_{0.5}Fe_{2.34}Ga_{0.16}O_4$ crystal, a third threshold was observed in addition to the second (Fig. 1).

Crystal	$4\pi M$, G (300°K)	min h_{crit}, Oe	min $h_{crit}(2)$, Oe	H_1, Oe	$H_1(2)$, Oe
$Y_3Fe_5O_{12}$	1773	0,81	2,95	1470	1505
$Li_{0,5}Fe_{2,34}Al_{0,16}O_4$	2720	1,44	4,07	1187	1258
$NiFe_2O_4$	3300	1,77	4,06	1275	1226
$Li_{0,5}Fe_{2,5}O_4$	3660	1,11	2,22	1382	1420
$Li_{0,5}Fe_{2,34}Ga_{0,16}O_4$	4000	1,05	3,16	1590	1610
$Li_{0,5}Fe_{2,07}Ga_{0,43}O_4$	4320	1,30	4,52	1768	1750

The measurements have shown that the threshold of the second instability is anisotropic. For certain ferrites, the second threshold, just as the first, is accompanied by auto-modulation oscillations. These are observed particularly clearly in nickel ferrits (Fig. 2). The observed effects do not depend on the surface finish of the samples. With increasing sample diameter, the thresholds have a tendency to come closer together.

The region where the secondary thresholds are observed, and the independence of this region of the magnetization suggest that the observed effects are connected with excitation of the wave group (2). The auto-modulation can be attributed either to the inertial nonlinearity mechanism proposed by Monosov [4], or else possibly to a phenomenon well known in radio, wherein the energy becomes redistributed among parametrically coupled systems.

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MEASUREMENT OF THE DIFFERENTIAL ELASTIC SCATTERING AND IONIZATION CROSS SECTIONS OF ATOMIC SYSTEMS

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The differential scattering cross sections of atomic systems, as is well known, yield the most detailed information concerning the character of their interaction. In this paper, for the purpose of investigating the interactions at short distances (interaction-energy interval 1 - 100 eV), we determine the differential elastic scattering and ionization cross sections and the interaction potentials of the systems He-He, Ne-Ne, Ar-Ar, Kr-Kr, Xe-Xe, N_2-N_2.

The differential cross sections were obtained by measuring the angular distribution of $I(\alpha)$, the current of particles scattered in a movable detector inclined at different angles α to the beam axis, at different initial beam energies. In these measurements we used the method of setup described in detail in [1]. Besides the neutral particles, we observed particles with altered charge states in the scattered current, and therefore we registered in the measurements not only the neutral current $I^0(\alpha)$, but also the current $I^+(\alpha)$ produced by ion scattering. To eliminate the differences between the efficiencies with which the detector registered the ions and the neutrals, the first dynode of the electron multiplier was grounded.

In analogy with the determination of the current of particles scattered in the energy interval between θ and $\theta + d\theta$, we can write for the current intercepted by a detector subtending an angle range from $\theta_{min}(\alpha)$ to $\theta_{max}(\alpha)$ the following expression:

$$I(a) = 2\pi n \ell I_0 \int_{\Delta\theta(a)} f_a(\theta)\sigma(\theta, E) d\cos\theta. \qquad (1)$$

Here I_0 is the initial intensity of the monoenergetic beam, n the density, and ℓ the target length. The function $f_\alpha(\theta)$ in (1) defines the registration