by the scattering of the phonons by electrons. Thus, the stronger-than-cubic dependence of the thermal conductivity on the temperature observed in our experiments at $T \leq 2.5°K$ (and accordingly the growth of ℓ_{eff} in the interval 1.3 - 2.5°K) can be attributed to the influence of frequent normal collisions between the phonons in the volume of the sample.

It is interesting to note that inasmuch as the condition $\ell^N_{pp} << \ell^R$ is sufficiently well satisfied for perfect samples of Bi at helium temperatures, "second sound" (i.e., weakly damped temperature waves) can propagate in principle in such crystals in the phonon gas. We are presently carrying out investigations in this direction.

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INFLUENCE OF LASER RADIATION ON INSTABILITY IN YTTRIUM IRON GARNETS WITH PARALLEL PUMPING

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We report here the results of an investigation of instabilities arising in yttrium iron garnets acted upon simultaneously by parallel pumping and by laser radiation of wavelength $\lambda = 1.06\ \mu$.

We used in the experiment a sample of $Y_3Fe_5O_{12}$ in the form of a disk of 5 mm diameter and 1.9 mm thickness. If the sample is placed in a constant field H_0 and in an alternating magnetic field parallel to it $h_{\sim}$ (a rectangular resonator in the H_{012} mode is used), applied in the plane of the disk, spin-wave instability sets in at a microwave power exceeding the critical value [1]. The frequencies of the parametrically-excited spin waves $\omega_c = \omega/2$ and the magnitude and the direction of the wave vectors vary in wide limits. Further increase of the microwave-signal power leads to the occurrence of low-frequency oscillations of magnetization. The threshold curves of the spin-wave instability h_{cr} and of the low-frequency oscillations for our sample are shown in Fig. 1.

With simultaneous action of parallel pumping and laser radiation, we registered the variation of these instabilities. The laser beam was propagated normal to the plane of the disk. The laser-signal power density on the front face of the disk (the beam was focused on the rear face of the sample) could be varied with the aid of calibrated neutral filters. Both signals - pump with duration $\tau_p = 300$ μsec and laser with $\tau_L = 120$ μsec - were synchronized to act simultaneously. Typical oscillograms of the processes observed by us are shown in Fig. 2.

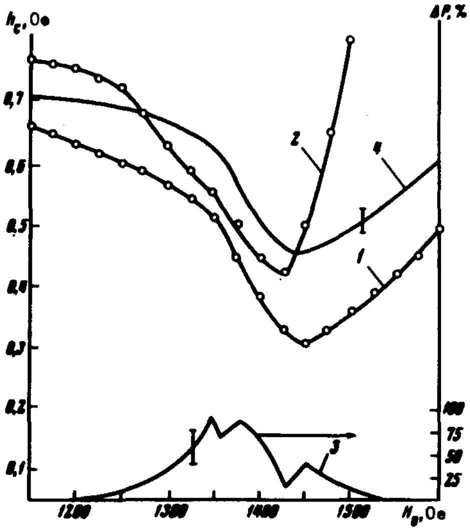

Fig. 1. Threshold curves of the instabilities in the case of parallel pumping, and their variation under the influence of a laser signal: 1 - threshold curve of spin-wave instability, 2 - threshold curve of low-frequency magnetization oscillations, 3 - change of microwave power absorbed by the sample during the time of action of the laser pulse ($S \simeq 8$ kW/cm^2), 4 - threshold curve of low-frequency oscillations of the magnetization during the time of action of the laser pulse ($S \simeq 20$ kW/cm^2).

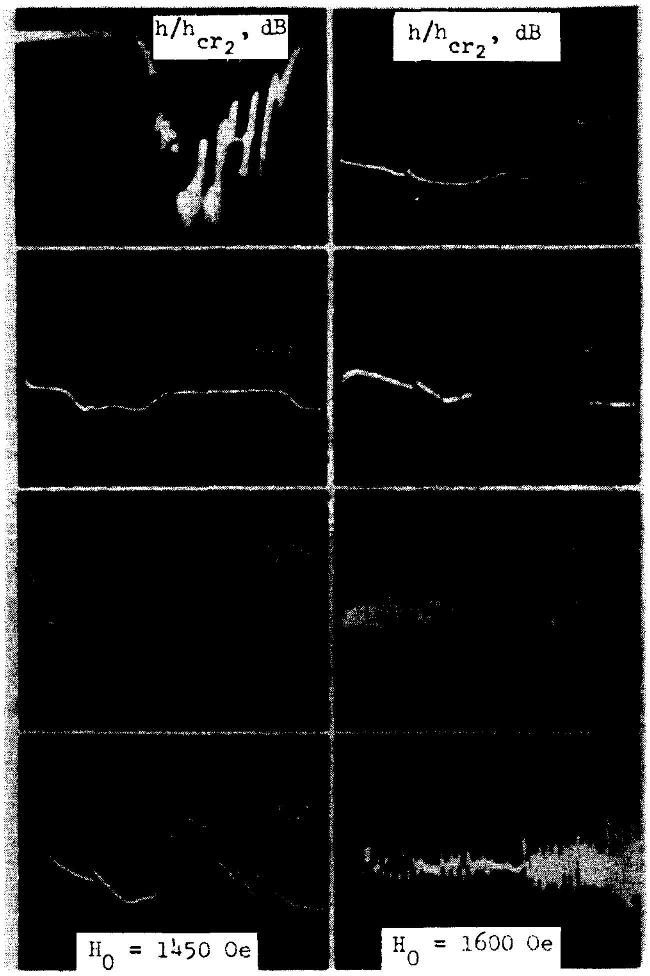

Fig. 2. Oscillograms of microwave pulse reflected from the resonator. The sweep duration on all the oscillograms except the lower one of Fig. 2b is 50 μsec/cm; the sweep duration on the lower picture of Fig. 2b is 6 μsec/cm. Upper picture 2a - laser pulse. Lower picture 2b - expanded oscillogram of Fig. 2b at h/h_{cr_2} = 5 dB.

During the time of action of the laser pulse we observed a characteristic increase of the threshold of the spin-wave instability. This process is not the same for different values of the constant field H_0. To determine the optimal conditions of the variation of the threshold, we plotted the dependence of the rise of the threshold on the constant field H_0 for identical "chunks" of the microwave pulse, i.e., at equal power absorbed by the spin system. The measurements were performed at a laser power density on the front face of the sample $S \simeq 8$ kW/cm^2. This dependence is shown in Fig. 1, from which it is seen that the increase of the threshold is significant in a wide range of constant magnetic fields, with a maximum shift of about 100 Oe from the field H_c at which the critical amplitude of the microwave signal has the minimum value. This plot reveals two singularities corresponding to the points of magnetoacoustic resonance ($H_0 \simeq 1430$ Oe) and to the point in which the magnitudes of the wave vectors of the parametrically excited spin wave and of the laser signal are equal to each other ($H_0 \simeq 1359$ Oe). The increase of the threshold of the spin-wave instability at a constant field

$H \approx 1450$ Oe and a laser-beam power density on the front face of the sample $S \approx 60$ kW/cm^2 is illustrated by Fig. 2a. We see that the excitation of the spin waves vanishes completely at a small excess of the microwave signal over the threshold during the time of action of the laser pulse, i.e., there is a 100% increase of the threshold. With further excess of power over threshold, the change of the threshold acquires the shape of the laser pulse. We note that the increase of the threshold of the spin-wave instability was observed also by the authors of [2]. At the same time, we did not observe the threshold decrease noted by these authors.

In addition, we observed a change in the threshold of the low-frequency oscillations during the time of action of the laser pulse. The change of this threshold at a laser-signal power density $S \approx 20$ kW/cm^2 is shown in Fig. 1. In the region of constant magnetic fields H_0, where an excess of the threshold of the spin-wave instability was observed, there takes place a rise in the threshold of the low-frequency oscillations. At other values of the constant magnetic fields, we observed a lowering of the threshold of the low-frequency oscillations of the magnetization [3]. In these fields, the amplitude of the high-frequency oscillations increases during the time of action of the laser pulse, as is illustrated in Fig. 2b, which was obtained at a constant field $H_0 =$ 1600 Oe and a laser-radiation power density $S \approx 60$ kW/cm^2. It is characteristic that their frequency during the time of action of the laser pulse remains constant and equals $\sim$1.2 MHz for our sample.

Our results cannot be attributed to direct spin-orbit interaction of the laser radiation with the spin waves excited by the parallel pump in the $Y_3Fe_5O_{12}$, all the more since calculation and numerical estimates show that the threshold of this interaction is higher by two orders of magnitude than that observed in the experiment [4].

We note that the increase of the threshold of the spin-wave instability under the influence of the laser radiation is quite reminiscent of the similar process occurring when elastic oscillations act on a crystal [1]. We have carried out a simple additional experiment. The laser radiation was directed on our yttrium iron garnet sample (without parallel pumping), and a piezoelectric pickup was secured to the second face of the garnet. Upon irradiation of the crystal by the laser radiation, we registered excitation of elastic oscillations in the sample; the frequency of these oscillations was $\sim$1.2 MHz, corresponding to the fundamental acoustic resonance of our sample, and the amplitude of the oscillations increased with increasing power density of the laser signal.

In this connection we assume that the change of the threshold of the spin-wave instability and of the low-frequency oscillations occurs via other oscillations excited in the yttrium iron garnet by the laser radiation.

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