hydrogen at 130 atm by the focused beam of a Q-switched ruby laser of 100 MW power and 15 nsec pulse duration (when SRS was produced in the working medium). One of the interacting infrared waves was the third Stokes component of the SRS in hydrogen. It is convenient to use this line, since it is close in frequency to $\Omega_M/2$ (we recall that the interaction is maximal here). To record the parametric-interaction effect we registered the oscillations at frequency ω_2. The registration system consisted of a monochromator, to the output of which was connected a germanium photoresistor doped with gold. The signal from the photoresistor was further fed to a high-speed oscilloscope. Pulses of infrared radiation with wavelengths 4.50 and 5.16 μ (corresponding to the difference frequency ω_2 and the third Stokes frequency ω_1) were recorded with approximately identical intensity, demonstrating the sufficiently large parametric interaction. The latter circumstance is important, since it is determined by the coherent-interaction length. We note also that the deduction that the dispersion is weak, and by the same token that the coherent-interaction length is large, is evidenced by our observation of 5 lines in the anti-Stokes region: 5388, 4403, 3723, 3217, and 2844 Å, the local intensity of the fifth anti-Stokes line amounting in the best case to 5% of the intensity of the first anti-Stokes line.

It follows therefore from the experimental data on observation of parametric interaction between infrared waves and coherent molecular oscillations, that we can hope to obtain self-excitation at infrared frequencies by selecting resonators for these frequencies.

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EFFECT OF SMALL TERBIUM IMPURITIES ON THE MAGNETOSTRICTION OF YTTRIUM IRON GARNET

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It was established in [1,2] that small impurities of terbium in yttrium iron garnet (YIG) exert a strong influence on the magnetic anisotropy of the resonance field and on the line width of the ferromagnetic resonance absorption in the low-temperature region. The high sensitivity of the parameters of the ferromagnetic resonance of YIG to small terbium impurities is related in these papers to the special orbital state of these ions.

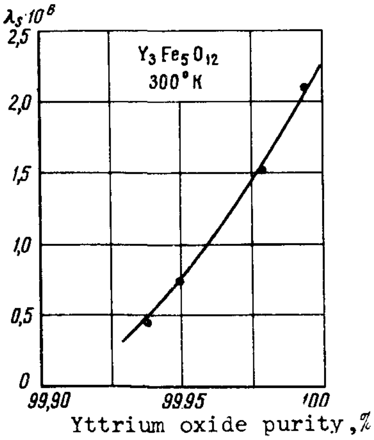

Fig. 1

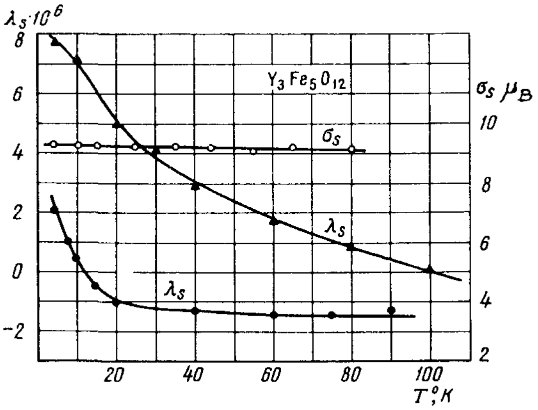

Fig. 2

We have established in the present investigation that at low temperatures the magnetostriction of YIG is highly sensitive to small terbium impurities. For a polycrystalline sample made from the purest yttrium oxide YO-00 (99.99%), the saturation magnetostriction at room temperature is negative and amounts, according to our measurements, to -2.16×10^{-6}, in good agreement with the data obtained in [3]. Figure 1 shows the dependence of the longitudinal saturation magnetostriction of YIG at room temperature on the degree of purity of the initial yttrium oxide (the same analytically pure iron oxide was used for the preparation of all the samples). It is seen from Fig. 1 that the negative magnetostriction of YIG decreases rapidly with decreasing purity of the initial yttrium oxide. The greatest effect on the magnitude of the YIG magnetostriction should be exerted by the terbium impurity. This follows from the fact that terbium iron garnet has positive magnetostriction at room temperature [4,5], which according to our measurements increases sharply with decreasing temperature, attaining at 4.2°K the tremendous value $+2 \times 10^{-3}$ (positive magnetostriction is observed also in europium iron garnet, but there was absolutely no europium impurity in our original oxides). Thus, upon addition of even small amounts of terbium ions to YIG we can expect a reduction in the magnitude and even a change in the sign of the magnetostriction of YIG, especially at low temperatures.

Figure 2 shows the temperature dependences of the magnetostriction and saturation magnetization for two YIG samples of different degree of purity (▲ -- yttrium oxide 99.940% pure, ● -- 99.995%). We see, in accord with the foregoing, that the magnetostriction becomes positive with decreasing temperature, and that the positive component of the magnetostriction exerts the greatest influence at low temperatures. The reason is that in this case the magnetostriction due to the terbium ions increases sharply so that even the most insignificant terbium impurities cause not only a decrease in the magnetostriction at 300°K, but also a reversal of the sign of the magnetostriction in the region of helium temperatures. The magnetostriction of the most contaminated sample becomes positive here even at 100°K, whereas for a sample made of 99.996% pure yttrium oxide the sign reversal is observed only at ~10°K.

It must be noted that no anomalies were observed on the temperature dependence we obtained for the saturation magnetization of the same samples (Fig. 2). This indicates that the saturation magnetization is a characteristic insensitive to the terbium impurities. This absence of correlation between the magnetization and magnetostriction of yttrium iron garnet containing rare-earth impurity is apparently due to the fact that at low temperatures the decisive role is played by the magnetoelastic energy, causing the change in the coupling between the orbital momentum of the rare-earth ion and the intracrystalline field of the iron garnet. However, the detailed character of this mechanism is still unclear.

In conclusion we note that the temperature dependence of the magnetostriction constant of YIG can serve as a qualitative indicator of the degree of purity of the investigated sample (or of the oxide from which it is made), the sensitivity of the magnetostriction to the terbium impurity being apparently much higher than that of the existing methods for spectral analysis of rare-earth oxides. Thus, in the purest yttrium oxide (99.996%) from which one of our samples was made, spectral analysis (sensitivity 0.002%) showed no terbium-oxide impurities, yet their presence is clearly disclosed by the anomalous variation of the temperature dependence of the YIG saturation magnetostriction.

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CHECK ON T-INVARIANCE IN THE $\pi^+ \to e^+ + \nu + \gamma$ DECAY

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Bernstein et al. [1] advanced the hypothesis that electromagnetic interactions of hadrons are not invariant under time reversal. In this letter we consider a possible check on this hypothesis in the radiative pion decay

$$\pi^+ \to e^+ + \nu + \gamma$$

by observing the polarization of the γ quanta.

Experimental data on this decay are given in [2,3]. A theoretical analysis is presented in [4-6]. The matrix element is represented in the form of a sum of three parts, corresponding to the accomapnying radiation and to the vector and axial-vector transitions

$$M = M_{IB} + M_V + M_A, \qquad (1)$$

where