In addition to these cases, 1855 V-events were registered in the chamber. (This figure takes into account the scanning efficiency, which was the same for V-events and events with three and more electron-positron pairs.) 21% of these events should be attributed to nuclear interactions and to $K_1^0 \to \pi^+\pi^-$. Having 110 cases of the decay $K_2^0 \to 3\pi^0$ with three and more electron-positron pairs, and knowing that the efficiency with which the chamber registers γ quanta of energy ~ 100 MeV amounts to 0.4, we can find that the probability of the $K_2^0 \to 3\pi^0$ decay relative to all the decays of the K_2^0 meson amounts to 0.2 ± 0.06. The reduced error, in addition to statistical errors, indicates the uncertainty in the efficiency of registration of the γ quanta from the $K_2^0 \to 3\pi^0$ decay. This result agrees with the data obtained in [1] and with theoretical predictions (23.6%) obtained assuming that the $\Delta T = 1/2$ rule holds [5].

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INVESTIGATION OF THE TEMPERATURE DEPENDENCE OF THE SATURATION MAGNETIZATION OF Gd

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THE purpose of the present work was to investigate the temperature dependence of the saturation magnetization of Gd at low temperatures (from 4.2 to 30°K). The investigation was carried out using the method described in detail earlier,[1] i.e., we measured the magnetization change ΔI when the temperature was altered from T to that of liquid helium. The sample was in the form of a polycrystalline gadolinium cylinder, 110 mm long and 8 mm in diameter, containing the following impurities: 1.0% I, 0.01% Ca, 0.06% Fe, 0.02% Cu.

It is known[2,3] that the intrinsic temperature dependence of the saturation magnetization should be investigated in sufficiently strong magnetic fields. The intensity of such fields can be found by analyzing the dependence of ΔI on H. Figure 1 shows the experimental dependence of ΔI on H for Gd. If the measurements are made in fields H stronger than 15,000 Oe, the results obtained reflect well the intrinsic temperature dependence of the saturation magnetization.

Our measurements were carried out in a field H = 18,600 Oe. Figure 2 shows the experimental dependence of ΔI on T. The value of ΔI was determined to within 5%. The error in the determination of T between 4.2 and 10–12°K amounted to 7–5%; above 12°K, it was 2%.

The experimental points do not fit the curve described by the law $I = I_0(1 - CT^{3/2})$. We may at-

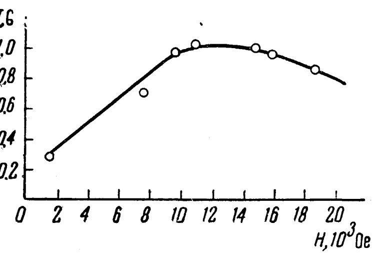

FIG. 1

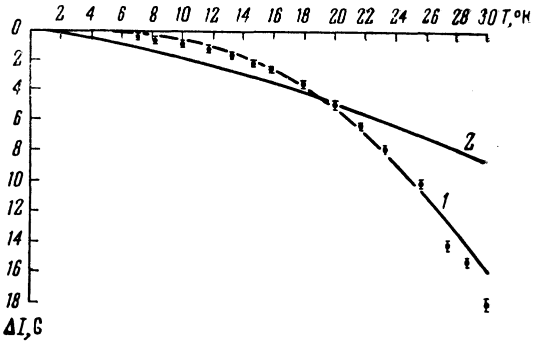

FIG. 2

tempt to interpret our results according to Niira[3], who showed that, in the case of a ferromagnet with the hexagonal close-packed structure, the following temperature dependence of the magnetization obtains:

$$I = I_0 - AT^{3/2}\exp(-\Delta/T). \qquad (1)$$

Figure 2 shows that the experimental points fit well the theoretical curve of type 1 with the parameters A = 0.25 G/deg$^{3/2}$, Δ = 30 deg K, selected to obtain the best fit with the experimental data.

For comparison, Fig. 2 includes curve 2, which is described by Bloch's law.

The results obtained indicate, according to Niira[3], the presence of a gap Δ = 30 deg K in the energy spectrum of spin waves in Gd.

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OPTICAL EXCITATION OF SEMICONDUCTORS

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At present semiconductor lasers are excited either by injection of current carriers across a p-n junction[1] or by a beam of fast electrons[2]. The optical method of excitation for producing population inversion in semiconductors has been considered in a number of papers[3-5]. An experimental investigation of the recombination radiation excited by a powerful ruby laser has been carried out previously[6].

We consider here the excitation of semiconductors by monochromatic radiation at a frequency which slightly exceeds the frequency of the intrinsic-absorption band edge. At high radiation intensities the sum of the quasi-Fermi levels of the electrons and holes $\mu_e + \mu_p$ is approximately equal to the energy of the incident quanta $\hbar\omega_1$ (the so-called saturation effect, cf. [7]). In this situation there will be a certain band of frequencies $\Delta\omega$, satisfying the relation $\hbar\omega < \mu_e + \mu_p$, for which there will be population inversion and at which laser action is possible. Since semiconductors have broad, continuous absorption bands the frequency of the exciting light may be made close to the lasing frequency $\hbar\omega_0$, resulting in high efficiency laser action.

A large number of independent and hence incoherent semiconductor p-n junction lasers can be used as the source of monochromatic excitation. In this case the whole system may be treated as a converter of incoherent monochromatic radiation into coherent radiation, with high transformation efficiency.

In the case of direct transitions the gain coefficient can be written in the form[1]

$$k(\omega) = B(\omega)(\hbar\omega - \Delta)^{1/2}[f_e(\varepsilon_e) + f_p(\varepsilon_p) - 1], \qquad (1)$$

where f_e and f_p are the distribution functions for electrons and holes whose energies ϵ_e and ϵ_p are determined by the laws of conservation of energy and quasi-momentum, and where Δ is the width of the forbidden band. If the dimensions of the system are considerably larger than the wavelength of the radiation, the condition for self-excitation of the laser has the form

$$k(\omega_0) = L^{-1}\ln R^{-1} + \varkappa, \qquad (2)$$

where L is the separation between the mirrors of the cavity, R is the reflectivity, κ is the absorption coefficient due to free carriers, impurities, etc, and ω_0 is the frequency at which $k(\omega)$ is a maximum. Equation (2) and the condition $\partial k/\partial\omega = 0$ for $\omega = \omega_0$ determine the value of the sum of the electron and hole quasi-Fermi levels which corresponds to the oscillation threshold.

It has been shown[7] that when semiconductors are excited by intense monochromatic light the sum of the quasi-Fermi levels is given by the expression