face can take part in the scattering of carriers of opposite sign, since by virtue of the Pauli principle the particles situated deep under the Fermi level cannot change their energy by the amount ~kT which is transferred by carrier collision. In addition, the scattered carrier should also remain in the strip ~kT after the collision. Allowance for these limitations leads to the following dependence of the mobility on the density and on the temperature [5]

$$\mu \sim n^{4/3} T^2. \qquad (3)$$

This expression describes correctly the temperature dependence, but leads to a somewhat weaker dependence on the density. Formula (3) has been derived under the assumption that the density is so high that $r_n n^{1/3} \gg 1$, whereas at the highest densities attained in the present experiments $r_n n^{1/3} \approx 1$. This is why the discrepancy between the experimental results and the theory is not unexpected.

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GENERATION IN POLYMETHINE DYE SOLUTIONS EXCITED BY NEODYMIUM-GLASS LASER EMISSION (λ = 1.06 μ)

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The feasibility of generation by organic dyes has uncovered new possibilities for effective frequency conversion of the emission of powerful lasers in a wide spectral interval. So far, dyes were used for frequency conversion of ruby-laser emission [1-4] and of the harmonics of the emission of ruby and neodymium-glass lasers [5]. There is no published report of direct conversion of neodymium laser emission at λ = 1.06 μ. Yet the conversion of this emission with the aid of dyes is of undisputed scientific and practical interest, since the neodymium-glass laser is one of the most powerful solid-state lasers. In addition, the use of lasers of this type can extend the spectral range of the converted radiation towards longer wavelenths (λ > 1.06 μ). We therefore attempted to convert the 1.06-μ neodymium-laser

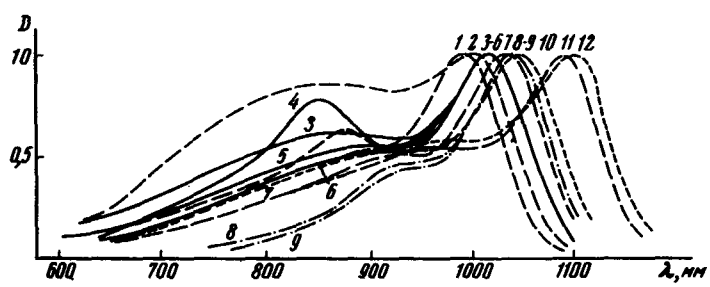

Fig. 1. Absorption spectra of dye solutions in nitrobenzene.

emission by exciting generation in solutions of a number of polymethine dyes. The results are reported in this communication.

One of the first polymethane dies used in our experiment was 3,3'-diethyl-9,11:15,17-dineopentylene-thia-pentacarbocyanine iodide (No. 6 in the table). We note that a solution of this dye was first used as a passive shutter for a neodymium-glass laser [6]. Besides this dye, we investigated the solutions of 11 other specially synthesized dyes of different pentacarbocyanines, which absorb in the 1.06-μ region, but differ in the position of the absorption and luminescence bands. The absorption spectra of the dyes employed by us (in nitrobenzene solution) are shown in Fig. 1, and the wavelengths of the absorption maxima are listed in the table.

Wavelengths of the absorption-band maxima and of the centers and widths of the generation bands of solutions of polymethine dyes

Dye No.	Solvent	Wavelength of absorption-band maximum, Å	Transmission coefficient λ = 1.06 μ, %	Wavelength of center of generation spectrum, Å	Width of generation band, A
1	Nitrobenzene	9950	1.5	10925	230
2	"	10000	3.2	10890	240
3	"	10200	7.0	10925	220
4	"	10200	0.1	10980	210
5	"	10200	0.1	11035	200
6	"	10250	0.1	10925	200
7	"	10350	0.3	11040	190
7	Ethyl alcohol	10000	0.1	11095	460
8	Nitrobenzene	10400	0.1	11095	170
9	"	10400	0.1	11120 11470	130 170
10	"	10450	0.1	11140 11480	70 150
11	"	10900	7.0	11570	230
12	"	11000	4.0	11680	270

To obtain generation, we used a "longitudinal" excitation scheme, similar to that described earlier [2]. The excitation source was a neodymium-glass laser Q-switched with the aid of a passive shutter. The radiation power density of the giant laser pulse was ~ 50 MW/cm^2. The width of the emission spectrum of the giant pulse did not exceed 0.03 cm^{-1}. We investigated the dye solutions (in nitrobenzene and in ethyl alcohol) listed in the table with transmission coefficients at λ = 1.06 μ ranging from 0.05 to 7%. The length of the cell with the solution was d = 5 mm. The emission spectra were recorded with the aid of an STE-1

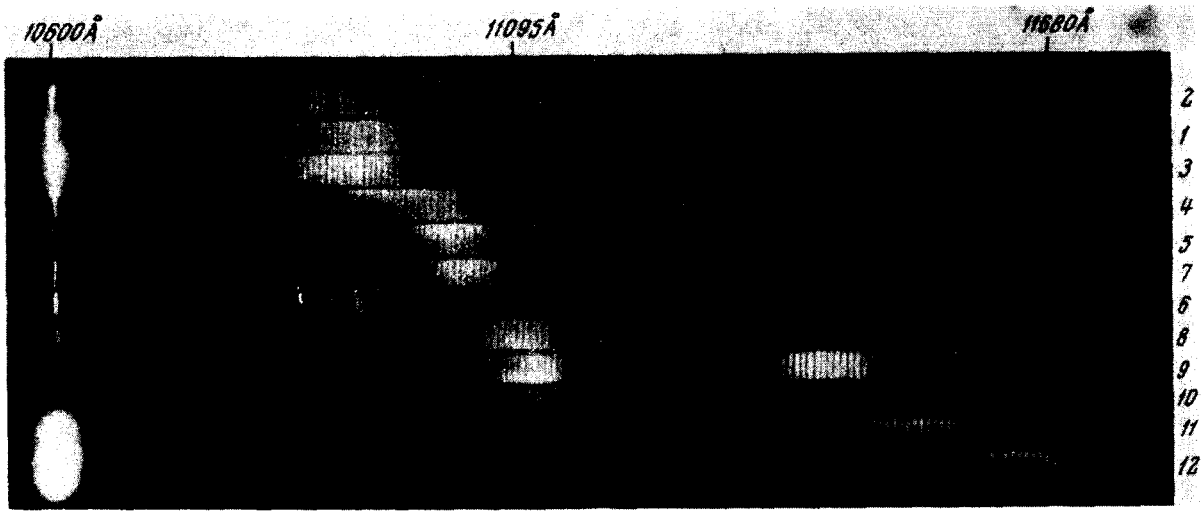

Fig. 2. Generation spectra of dye solutions in nitrobenzene. The single line corresponds to the 1.06-μ neodymium-laser emission.

diffraction spectrograph.

Generation was obtained in the solution of all the investigated dyes. The generation spectra are shown in Fig. 2. They constitute bands of width ranging in our experiments from 100 to 460 Å. The spectra reveal a structure similar to that observed in the excitation of cyanine dyes by ruby laser emission [2]; the structure is apparently due to the selective properties of the compound cavity [7].

The positions of the centers of the generation bands varied for the different dyes, from 10890 to 11680 Å (see the table). For certain dyes (Nos. 9 and 10 in the table) generation was observed simultaneously in two spectral regions. The change of the concentration of the solution or of the cell length led to a shift of the generation bands, as is typical also of other dyes [2,3].

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The following last paragraph was omitted:

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