of the laser light fluxes. N was taken to be $N = [\int_0^t i(t)dt]/e$, where i(t) is the photocurrent as a function of the pulse time and e is the electron charge. The value of η is defined as the ratio of N to the number of laser photons incident on the sample, i.e., $\eta = N/(E_{las}/h\nu_{las})$.

As follows from Table 2, the efficiency of n- and (n + 1)-photon processes differ by 1 - 2 orders of magnitude, owing both to the change in the photoconductivity excitation probability and to the considerable difference in the absorption coefficients of the AHC at the wavelengths of the multiphoton processes. A detailed analysis of the $\eta(F, n, \kappa)$ dependence will be presented in the next communication.

[1] J. J. Hopfield and J. M. Worlock, Phys. Rev. Lett. 11, 414 (1963); Phys. Rev. 137, 1455 (1965).
[2] V. S. Dneprovskii, D. N. Klyshko, and A. N. Penin, ZhETF Pis. Red. 3, 385 (1966) [JETP Lett. 3, 251 (1966)].
[3] M. L. Kats, Lyuminestsentsiya i elektronno-dyrochnye protsessy v fotokhimicheski okrashennykh kristallakh shchelochno-galoidnykh soedinenii (Luminescence and Electron-hole Processes in Photochemically Colored Alkali Halide Crystals), Saratov, 1960.
[4] L. V. Keldysh, Zh. Eksp.Teor. Fiz. 47, 1945 (1964) [Sov. Phys.-JETP 20, 1307 (1965)].

INFLUENCE OF STIMULATED EMISSION ON THE FORMATION OF MOLECULAR IODINE

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We observed an influence of the stimulated emission on the formation of molecular iodine in a photodissociation laser operating with C_3F_7I molecules, in which the lasing occurs via the transition $I(5^2P_{1/2}) \rightarrow I(5^2P_{3/2})$ [1]. This affords, in principle, certain opportunities for controlling the kinetics of the processes in the active medium of the laser.

The working volume in which the photochemical reaction took place was a quartz tube (length 30.8 cm, diameter 1.7 cm) with windows at the Brewster angle. The pump was a xenon IFP-500 lamp operating in the pulsed mode (energy 415 J, flash duration about 80 μsec). The generation pulse duration was ∿30 μsec. Combinations of mirrors with different reflection coefficients were used. The iodine was determined by titration. The results are listed in the table. It follows from the table that the greatest iodine release takes place in the absence of mirrors, and the smallest in the presence of mirrors with a reflection coefficient (R) equal to ∿100%. The iodine release in the experiments without mirrors is 2.4 times larger than when two mirrors with R = 100% are used. This dependence of the amount of iodine released on the Q of the resonator is connected with the peculiarities of the chemical reactions between the excited iodine atoms, the initial molecules, and the photodissociation products.

As is well known [2], the radiative lifetime of the state $I(5^2P_{1/2})$ is ∿0.13 sec. At a pressure 98.8 mm Hg, the lifetime of the excited atoms of iodine decreases, as a result of collisions, to 10^{-4} - 10^{-3} sec [2]. In the field of the resonator made up of the reflecting mirrors, the lifetime of approximately 2/3 of the excited atoms (taking the statistical weights into account) is reduced still further by the stimulated emission (to 10^{-6} - 10^{-5} sec), as a result of which a decrease takes place in the number of the excited iodine atoms taking part

No	R_1, %	R_2, %	$I_2 \cdot 10^3$, g	E, J
1	100	100	1,19 ± 0,08	0,013
2	81	100	1,36 ± 0,03	0,206
3	16	100	1,80 ± 0,2	0,418
4	16	20	2,21 ± 0,11	0,162
5	–	100	2,42 ± 0,12	0,074
6	0	100	2,69 ± 0,03	–
7	0	0	2,82 ± 0,03	–

Note. 1) I_2, g - experimentally determined amount of molecular iodine; E, J - output energy, measured accurate to 20%. 2) The slightly lower amount of iodine released in experiment 5 compared with experiment 6 is due to partial reflection of the radiation from the calorimeter lens.

in the reaction:

$$I^* + C_3F_7I \rightarrow {}^{\bullet}C_3F_7 + I_2. \qquad (1)$$

This process is all the more probable, since the concentration of the initial molecules is large compared with the number of dissociating molecules (only 5% of the C_3F_7I molecules dissociate at a pressure 98.8 mm Hg).

As a result of the reaction (1) and the reaction

$$I + I + M \rightarrow I_2 + M$$

the amount of molecular iodine produced after generation (if $R_1 = R_2 \approx 100\%$) should be 1.5 times smaller than in experiments without mirrors, whereas the actual factor is 2.4 (see the table). It is possible that exothermal recombinations of the radicals with the iodine atoms and molecules also take place in the laser tube. The influence of the stimulated emission on the formation of molecular iodine, observed in these experiments, should be observed also in the case of other iodine compounds used as working media in photodissociation lasers.

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[1] J. V. V. Kasper, J. H. Parker, G. C. Pimentel, J. Chem. Phys. 43, 1827 (1965).
[2] R. J. Donovan and D. Husain, Trans. Faraday Soc. 62, 517, 11, (1966).