which characterize the time variation of the volume of the region subtaneded respectively by the shock wave and the forward boundary of the explosion products. The values of $v_f(t^0)$ and $v_{ep}(t^0)$ were calculated from the data of [3]. From the data shown in the figure it follows that when $t \leq t_0$ the region of explosion in an external field behaves like an ideally conducting body with radius v_{eff}. The law of motion of the boundary surface is determined from the condition

$$\int_0 \sigma(v_{eff} t') \, dt' \simeq 2{,}3,$$

which obviously yields, for a strong shock wave, $v_{eff}(t) \approx v_f(t)$ and for a weak one $v_{eff}(t) < v_f(t)$.

The time dependence of the measured perturbed field E(t) (which yields simultaneously the time dependence of the produced dipole moment, since the measurements are made in the near zone) is connected with the space-time distribution of the conductivity behind the front, which in turn is influenced by the distribution of the temperatures, the possible non-equivalence of the ionization processes, and a number of other factors.

A more detailed study of the laws of motion $v_{eff}(t)$ for explosions in an electric field will make it possible to obtain additional data concerning these processes. Difficulties may arise here in connection with the influence of the pulsed field generated by the explosion products [2] also when $E_0 = 0$, but it is obviously that by increasing E_0 it is possible to make the influence of this factor as small as desired.

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MULTIPHOTON EXCITATION OF THE PHOTOCONDUCTIVITY IN ALKALI-HALIDE CRYSTALS BY LASER EMISSION

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Two-photon absorption in pure alkali-halide crystals (AHC) was first observed by Hopfield and Worlock [1]. They presented the results of a theoretical and experimental study of the two-quantum absorption spectra of KI and CsI in the region of the exciton absorption band. Multiphoton excitation of photoconductivity in an NaCl crystal exposed to light from a Q-switched ruby laser was investigated somewhat later [2]. The results of the latter study point to a 5-photon process of light absorption. Measurements of multiphoton absorption of crystals add greatly to the available spectroscopic data and raise a number of questions connected with the determination of the efficiency of multiquantum processes, satisfaction of the selection rules, the mechanism of the transfer of the electron into the conduction band in the case of exciton absorption, and others.

We observed and investigated the photoconductivity of a number of AHC (NaCl, KCl, KBr, NaBr, KI), produced by illuminating the samples with ruby and neodymium lasers operating in the normal generation regime. The energy of each laser could be varied from 0.1 to 10 J at a pulse duration 0.5 - 2 msec. The laser emission was focused onto the sample, which was

placed between the plates of a parallel-plate capacitor, the voltage on which ranged from 0.5 to 1.5 kV. The effect of the polarization of the dielectric was reduced to a minimum by synchronizing the laser flash with the instant when the capacitor was connected to the power supply. The photocurrent pulse was registered by an oscilloscope with a photographic camera. The 6 x 6 x 1 mm samples used for the measurements were cleaved from single crystals grown from the melt by the Kyropoulos method. The initial salts of KhCh (chemically pure) grade were subjected to additional special purification.

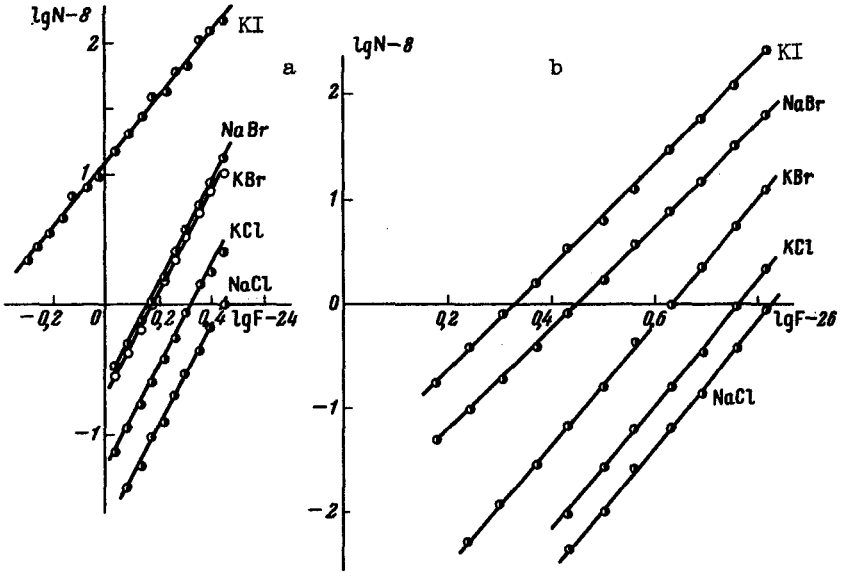
In all the measurements, the duration of the photocurrent pulse was 300 - 500 μsec longer than the duration of the laser flash, and the pulse rise time was 200 - 300 μsec.

The figure shows , on a logarithmic scale, the number of induced electrons N in the conduction band against the light fluxes of the ruby (F_r) and neodymium (F_n) lasers. The experimental points, obtained by averaging 9 - 12 measurements, fit well on straight lines,

Table 1

Slopes of logN vs. logF lines

Crystal	Ruby laser	Nd laser
NaCl	4,00	6,08
KCl	3,93	6,06
KBr	4,05	5,98
NaBr	4,05	5,02
KI	2,65	5,02



Number of conduction electrons vs. light fluxes of ruby (a) and neodymium (b) lasers for certain AHC

the slopes of which are shown in Table 1 for the investigated AHC. The experimentally obtained values of n are very close to integers. If the relation $N \sim F^n$ is satisfied, this indicates multiquantum excitation of the photocurrent in the investigated AHC. However, the mechanism of transferring the electrons to the conduction band is apparently different for different crystals, and calls for a study.

When the excitation is with a ruby laser, the mechanism of occurrence of the photocurrent in KBr and NaBr (n = 4) is clear. In this case the wavelength corresponding to $4h\nu_r$ falls in the spectral region of the second fundamental-absorption band (λ_{max} = 173 nm) [3], due to a band-band transition. The absorption processes of lower orders cannot be observed for these crystals, since even λ = 231.4 nm, corresponding to $3h\nu_r$, is outside the region of intrinsic absorption of KBr and NaBr.

The four-photon excitation of the photoconductivities of KCl and NaCl, and the three-photon excitation of KI, correspond to the exciton absorption bands of these crystals [3], and the appearance of the photocurrent is here apparently the consequence of rapid ionization of the excitons.

In excitation with a neodymium laser, the direct six-photon ionization (λ = 176.6 nm for $6h\nu_n$), corresponding to a band-band transition of the electron, is observed only for KBr. Exciton excitation cannot be expected here, for a reason similar to that indicated above. For all the remaining AHC investigated by us, the photocurrent induced by the neodymium laser is the result of 5- or 6-photon excitation of excitons and their subsequent dissociation. The latter can occur either under the influence of the field of a strong electromagnetic wave [4] or as a result of absorption of light energy by the inhomogeneities and impurities of the "pure" crystals, causing nonstationary heating and strong local vibrations of the lattice near the defects. However, since the laser operated in our experiment in the ordinary regime, the probability of the second process is apparently larger than that of the first. In the Q-switched regime and in the case when the laser beam is sharply focused on the sample, the first process should predominate, in accordance with [4], but in this case n = 5 for NaCl [2] and not 4 (Table 1).

The measurements make it possible to estimate quantitatively the total number of the conduction electrons, N, taking part in the production of the photocurrent, and also the efficiency η of the process in n-photon excitation of the photoconductivity for several values

Table 2

Values of N and η for certain AHC

Photocurrent cm^{-2}/sec^{-1}	Crystal	n	N	η
$F_r = 10^{24}$	KI	3	$1{,}5 \cdot 10^9$	$8{,}8 \cdot 10^{-11}$
	KCl	4	$7{,}5 \cdot 10^6$	$4{,}3 \cdot 10^{-13}$
$F_n = 1{,}7 \cdot 10^{26}$	NaBr	5	$9{,}3 \cdot 10^6$	$1{,}75 \cdot 10^{-13}$
	KBr	6	$4{,}7 \cdot 10^5$	$8{,}85 \cdot 10^{-15}$

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.

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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