of the reconciliation of the boundary and initial conditions of the discharge with its self-organization improves the possibility of stable forced evolution of the system towards a TN state. At a hot-plasma containment time $\gtrsim 10^{-4}$ sec, according to Lawson's criterion, the particle density for a d-t mixture is $\lesssim 10^{18}$ cm^{-3}. To establish the ability of the system to overcome the TN limit, appropriate experiments must be performed. It is not excluded that such an approach can improve the TN capabilities of a few other systems, too.

We note incidentally that by freezing the working medium on the discharge boundaries it is easy to overcome also the difficulties in the production of pinches with stabilizing "jackets" (in which interest has increased anew [6]), by setting the vapor pressure at a level that is convenient for the breakdown of long gaps. The rate of current growth can then be programmed in such a way that the intensity of the shock waves that transfer the energy to the chamber walls is decreased (to ensure that the total pressure $nkT + H_\phi^2/8\pi$ grows almost uniformly over the discharge cross section).

1) Repeated ignition occurs at $I < I_m$ without complete deviation of the current sheath from the circuit (see, e.g., [2]) with almost constant L and R.

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SELF-INDUCED TRANSPARENCY IN SEMICONDUCTOR BY SINGLE-PHOTON EXCITATION BY AN ULTRASHORT LIGHT PULSE

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Self-induced transparency was observed experimentally in a semiconductor following single-photon excitation by ultrashort light pulses.

A number of recent theoretical papers [1 - 4] are devoted to coherent interaction of high-power laser radiation with a semiconductor in the case when the duration of the light pulse is shorter than the transverse-relaxation time of the medium ($\tau \ll T_2$) and $\Theta_0 = (\mu/\hbar)\int_{-\infty}^{\infty} E dt > \pi$, where E is the slow amplitude of the light-pulse field on entering the medium and μ is the dipole matrix element of the transition. The phenomenon consists of an appreciable decrease of the absorption by the semiconductor of the ultrashort light pulses whose group velocities are smaller by one order of magnitude than the velocity of light in the given material. After coherently exciting an electron-hole pair in the interband absorption, the light pulse loses energy on its leading front; this energy is returned to it on the trailing edge by induced reradiation. The condition $\tau \ll T_2$ imposes definite limitation on the relation between the width of the forbidden band of the semiconductor and the exciting-light quantum energy [1], since T_2 depends on the kinetic energy of the produced electrons and decreases when this energy increases, owing to interaction with the optical phonons.

We present here the results of experiments aimed at observing self-induced transparency by single-photon interaction between ultrashort light pulses and a semiconductor[1].

The experimental setup is shown in Fig. 1. A $CdS_{0.6}Se_{0.4}$ sample grown from the gas phase, with a forbidden band width $E_g \simeq 2.3$ eV (T = 77°K) was cooled to liquid-nitrogen temperature to increase the transverse relaxation time T . The sample length ℓ was 4 mm. The crystal was illuminated with ultrashort pulses of the second harmonic ($h\nu$ = 2.34 of a mode-locked neodymium laser. The pulse duration ($\tau \lesssim 2\times10^{-11}$ sec) was monitored with an FER-2 photochronograph having a time resolution 2×10^{-11} sec. Measurements by the method of collisions in a two-photon-absorbing ZnS crystal with approximate forbidden band 3.6 eV have made it possible to estimate the average pulse duration in a train of ultrashort pulses ($\bar{\tau} \simeq 5\times10^{-12}$ sec) [7]. The pulsed power density in the unfocused beam could reach 10^9 W/cm^2 in the unfocused beam. The choice of the pump source (giant power, low pulse duration) and of a cooled crystal with forbidden band $E_g \sim h\nu$

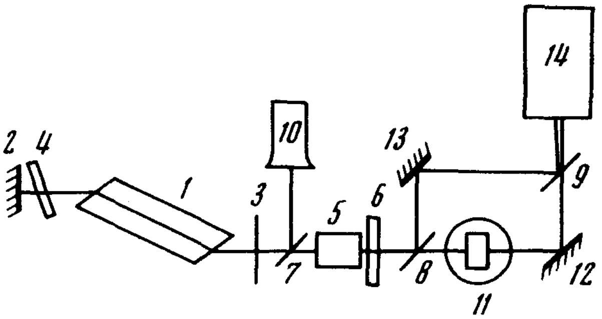

Fig. 1. Experimental setup: 1 - mode-locked neodymium laser; 2, 3 - mirrors coated on wedge-like substrates; 4 - cell with bleaching filter; 5 - KDP crystal; 6 - S3S22 filter; 7, 8, 9 - glass plates; 10 - FEK-15 coaxial photocell for synchronizing the sweep of the FER-2 photochronograph; 11 - nitrogen cryostat; 13 - aluminum mirrors, 14 - FER-2 apparatus.

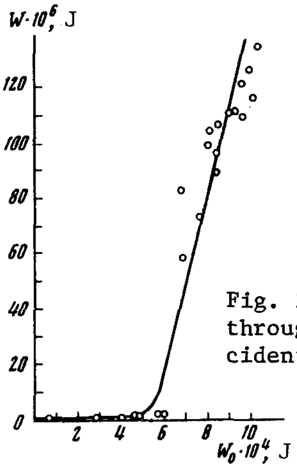

Fig. 2. Energy passing through crystal vs incident radiation energy.

was dictated by the above-mentioned conditions for observing self-induced transparency. The energy of the incident radiation and that transmitted through the sample was measured with special systems based on FSK-1 photoresistors and graduated with the IMO-2 calorimeter. The sensitivity of the measuring system was not worse than 10^{-6} J. The delays of the light pulses incident on and passing through the crystal were measured with the photochronograph. The two beams (see Fig. 1) were aimed at different sections of the slit of the FER-2 instrument.

Figure 2 shows the dependence of the energy passing through the crystal (W) on the energy of the incident radiation (W_0) when the sample is illuminated with a train of ultrashort pulses. It reveals a characteristic sharp increase in the transparency of the $CdS_{0.6}Se_{0.4}$, by more than two orders of magnitude. The sample transmission coefficient G reaches 0.2 (compared with $G \leq 10^{-3}$ as measured with a DFS-12 double monochromator). The slight increase in the radiation power density (not enough to damage the front face of the sample) as a result of focusing leads to an appreciable additional increase of the transparency. When the picosecond-pulse generator is replaced by a Q-switched generator ($\tau = 3\times10^{-8}$ sec) it was impossible to register any radiation passing through the crystal.

The delay of the light pulse passing through the crystal ($\Delta t = 0.15 - 0.2$ nsec) relative to the time of passage of the reference pulse was registered with the aid of the FER-2 photochronograph operating in the fast-sweep mode (with only one axial period of the radiation viewed on the photochronograms). The number of pulses per axial period and their relative intensities varied from flash to flash. It should be noted that delay was registered only for the pulses with maximum intensity. The measured value of Δt makes it possible to estimate the speed of light propagation in the crystal from the formula $V = c(1 + c\Delta t/\ell)^{-1}$. $V = 2.5\times10^9$ cm/sec at $\Delta t = 0.15$ nsec.

The observed high value of the transmission of the light by the $CdS_{0.6}Se_{0.4}$ crystal and the delay of the ultrashort pulses allows us to assume that these phenomena are connected with self-induced transparency in the semiconductor following single-photon excitation.

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