where ν is the frequency of the collisions between the electron and the neutral atoms, E the amplitude of the alternating electric field in the plasma, E_0 the intensity of the constant electric field, and δ the fraction of the energy transferred to the electrons by the neutral atoms in the collisions. Our estimates yield the same order of magnitude, $h \sim 10^{-2}$, for both cases.

To clarify the possible mechanism of parametric amplification, and als the effect of the suppression of ion-acoustic instability, further investigations are necessary.

When this communication was being readied for publication, we have learned of another investigation [6] in which parametric excitation of ion sound was observed at a frequency $f = 2f_0$.

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SHAPING OF LASER PULSES WITH THE AID OF TWO-PHOTON ABSORPTION IN GaAs

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The production of powerful light pulses with adjustable duration is very important for practical purposes. However, the duration of "giant" pulses from Q-switched lasers amounts to only a few nanoseconds.

To control the duration of tiant pulses, it is possible to use the mechanism of two-photon absorption in a semiconducting plate inserted in the laser cavity [1, 2].

The experiments were performed with a neodymium-glass laser ($\lambda = 1.06\ \mu$). The nonlinear element was n-GaAs 1 mm thick ($\Delta E = 1.43$ eV). The laser was Q-switched by two methods: with a total internal reflection prism and a passive shutter, i.e., a cell with a dye solution in nitrobenzene. The GaAs plate was finished with high precision, made translucent, and placed inside the laser cavity.

The radiation receiver was a coaxial photocell (FEK-09) with resolution 10^{-10} sec. The recording unit was an S1-11 oscilloscope with an amplifier bandwidth 200 MHz. The investigation of the influence of two-photon absorption in the semiconductor on the pulse of the laser Q-switched with a rotating prism yielded an increase in the duration of the giant radiation pulse. The maximum duration amounted to 450 nsec in our experiments. The pulse duration increased monotonically with increasing pump energy. The amplitude of the intensity on the oscillograms changed insignificantly when the pump energy was increased. A typical pulse shape obtained from a laser Q-switched with the aid of aprism and a semiconductor is shown in Fig. 1.

When the Q-switching was with the aid of a passive shutter, the cell was placed in the cavity near the 100% mirror, while the GaAs sample was placed near the semitransparent mirror.

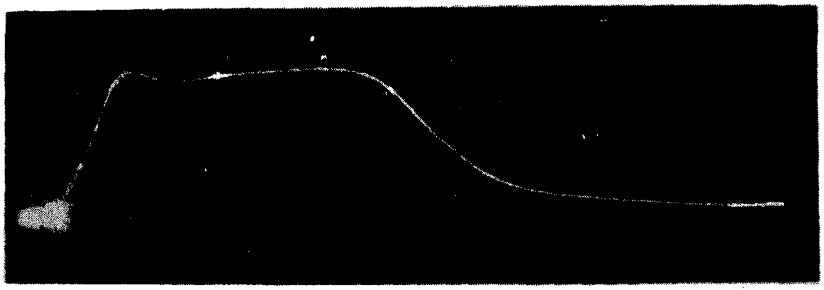

Fig. 1

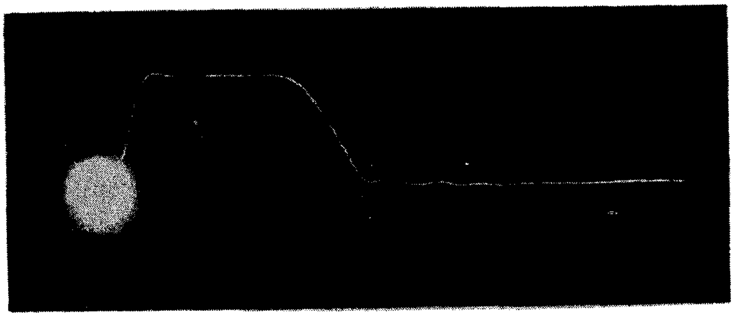

Fig. 2

Without the semiconductor in the laser cavity, the radiated pulses had a bell-shaped form with duration 20 nsec.

After the semiconductor was inserted in the cavity, the laser emitted a pulse of 200 nsec duration, with rise and fall times 40 nsec, and the intensity amplitude remained almost constant. The pulse duration was independent of the pump energy. A typical form of the pulse obtained from a laser Q-switched by a passive shutter and with a semiconductor is shown in Fig. 2.

The energy of the converted pulses was approximately one-fourth the pulse energy in the absence of the semiconductor in the cavity in both cases. The pulse amplitude decreased with increasing plate thickness.

Let us consider the dependence of the coefficient of two-photon absorption in the semiconducting plate on the laser-emission intensity. At low intensity levels, when the leading front of the radiation pulse is shaped, the coefficient of two-photon absorption in the semiconductor is still small, and has practically no effect on the laser pulse shaping. When a certain value of the radiation intensity is reached, and the two-photon absorption coefficient increases enough to make the absorption in the semiconductor appreciable, the gain of the system becomes equal to the losses in it. This stops the growth of the radiation intensity, i.e., limits the amplitude of the laser pulse.

When the two-photon absorption coefficient reaches a value at which limitation of the pulse sets in, the Q of the laser cavity decreases. This limits the intensity of the stimulated transitions in the laser active medium, and thus increases the time during which the energy stored in the inverted state is emitted, i.e., increases the pulse duration. The more energy stored in the inverted state, the larger the time necessary to de-excite the active atoms, and consequently the longer the pulse.

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BREAKDOWN OF LIQUID AND GASEOUS HELIUM BY A LASER BEAM, AND OBSERVATION OF STIMULATED MANDEL'SHTAM-BRILLOUIN SCATTERING IN LIQUID HELIUM

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1. A low-temperature method of measuring the threshold parameters of the breakdown of liquid and gaseous helium was proposed in [1]. A diagram of the experimental setup is shown in Fig. 1. The laser power is 10 MW, the pulse duration 30 - 35 nsec, and the radius of the focused spot 10^{-2} cm. By increasing the helium pressure in the Dewar to 2.2 atm we were able to obtain information on the breakdown of the helium in the region between the liquid and gas desnities at an equilibrium pressure of 1 atm. The dependence of the threshold electric field intensity E in the light wave on the helium density ρ (Fig. 2, different symbols correspond to different experiments) indicates that the liquid helium can be regarded in this case as a dense gas. The magnitude of the threshold fields and the course of the curve are close to those obtained in [2, 3] at room temperature and at high helium pressures.

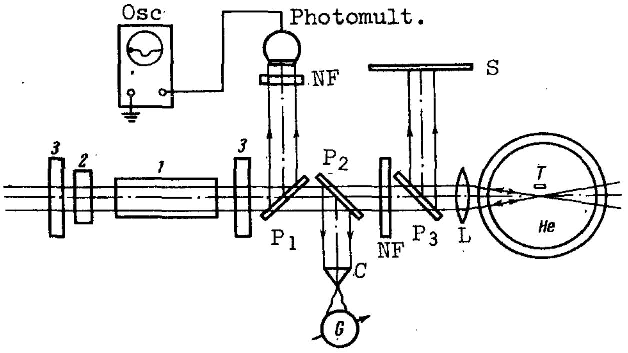

Fig. 1. 1 - ruby crystal, 2 - saturable filter, 3 - removable mirrors, NF - neutral filters, T - Allen-Bradley thermometer, C - vacuum calorimeter, P_1, P_2, P_3 - deflecting glass plates, S - screen, L - lens.

The low-temperature method makes it possible to obtain a very pure dense medium, since all the impurities are frozen out and precipitated. It was of very great interest, therefore, to use this method to investigate the question of the origin of the first "bare" electrons initiating the cascade ionization of the dense medium under the influence of the laser beam. The breakdown of the helium at low temperatures

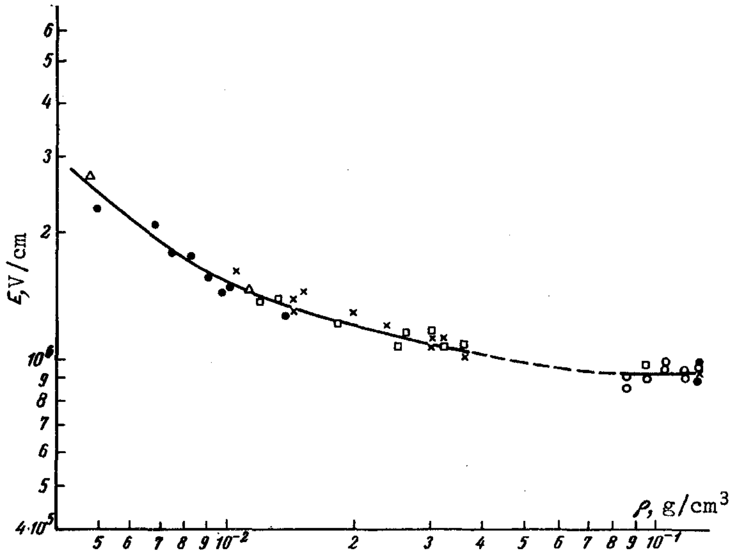

Fig. 2