accurately. Estimates based on the data of [1] for the BF_3 molecule, which is close to BCl_3, yield rotation splittings of 0.1 - 0.2 cm^{-1}.

We can propose the following generation mechanism for a gas laser with the CO_2-N_2-He-BCl_3 mixture. The ν_3 vibrations of the BCl_3 molecules are resonantly excited in the strong field of the 10-μ emission. This produces population inversion of the ν_3 level relative to the vibrational ν_1 and ν_2 levels. The $\nu_3 \rightarrow \nu_1$ and $\nu_3 \rightarrow \nu_2$ transitions are responsible for the most intense generation. In addition, the second harmonic of the antisymmetrical valence vibration, $2\nu_3$, is excited. It is not excluded that the population of the $2\nu_3$ level is further increased by resonant exchange of vibrational energy with the excited nitrogen. This additional excitation mechanism should be more effective for the $B^{10}Cl_3$ molecules, whose vibration frequency is closer to the vibration frequency of the excited nitrogen. Population inversion at the level $2\nu_3$ thus becomes possible relative to the level $3\nu_2$. The $3\nu_2$ level, in turn, experiences radiative decay in the $3\nu_2 \rightarrow \nu_3$ transitions.

The decay of the lower laser levels ν_1 and ν_2 to the ground state proceeds via collisions with the molecules of the other gases present in the discharge.

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EXPERIMENTS ON NEUTRON OBSERVATION BY FOCUSING POWERFUL LASER EMISSION ON THE SURFACE OF LITHIUM DEUTERIDE

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We report here the results of preliminary investigations aimed at obtaining thermonuclear temperatures in a dense plasma with the aid of powerful laser emission.

It was shown in 1962 [1] that when powerful laser emission is focused on the surface of a solid target containing deuterium, it is possible to obtain a dense plasma with a temperature high enough to produce thermonuclear reactions.

This called for a much higher laser power than was available at that time.

We investigated the possibility of increasing the output energy and power of lasers [2, 3]. The production of nanosecond light pulses of power higher than 10 GW entails damage to the active medium, thus greatly inhibiting experiments on plasma heating. It was observe that the damage threshold power increases when the pulse duration is decreased [2]. Using as the master generator a laser producing ultrashort pulses and having a nonlinear absorber [4], we succeeded in obtaining, after amplification, a light pulse of energy up to 20 J in a time that apparently did not exceed 10^{-11} sec.[1)]

The setup for neutron-observation experiments is shown in Fig. 1. The laser emission

[1)] Separate experiments with the master generator have shown that the duration ranged from 10^{-11} to 10^{-12} sec. The procedure used to measure the pulse duration was described in [5].

was focused with a lens of focal length 60 mm on the surface of lithium deuteride in vacuum. There was no contact between the surface of the target and air. A large scintillation conter was located at a distance 10 cm from the target. The scintillator was made of plastic with a polystyrene base and was in the form of a cylinder of 30 cm diameter, going over into a cone having a smaller base to match the dimensions of the FEU-52 photomultiplier cathode. The total height of the scintillator was 30 cm, and its surface was polished and bordered by a layer of magnesium-oxide powder. The counter was placed in a double duraluminum case with wall thickness 16 mm. The efficiency with which the neutrons from the target were registered in the given geometry was better than 10%.

The photomultiplier pulses and the signal from the Kerr shutter, indicating the instant of arrival of the laser pulse at the target, were fed to a two-beam oscilloscope (S1-17). The photomultiplier operated in the linear mode and its anode-circuit time constant was several dozen microseconds.

Experiments aimed at observing the neutrons were performed in runs of 5 - 10 flashes each. The experimental conditions differed from run to run, owing to the possible changes of the target quality, focusing, and also owing to certain damage in the rods of the input stages of the amplifier. This damage was apparently due to the onset of generation as a result of back scattering from the plasma.

Results obtained in two runs of the experiment are listed in the tables.

Figure 2a shows one of the oscillograms obtained in the absence of coincidences between the signal from the counter and the signal from the Kerr cell. A pulse due to the background is visible. The phone consists of pulses of cosmic origin (ampitude larger than 10 V, with a frequency of several pulses per second) and pulses due to the natural radioactivity of the

Table 1

Energy, J	6	4	17	6	5	6	10	8
Presence of coincidences	no	no	yes	no	no	no	no	no

Table 2

Energy, J	6	10	11	11	8	11
Presence of coincidences	yes	yes	no	yes	no	no

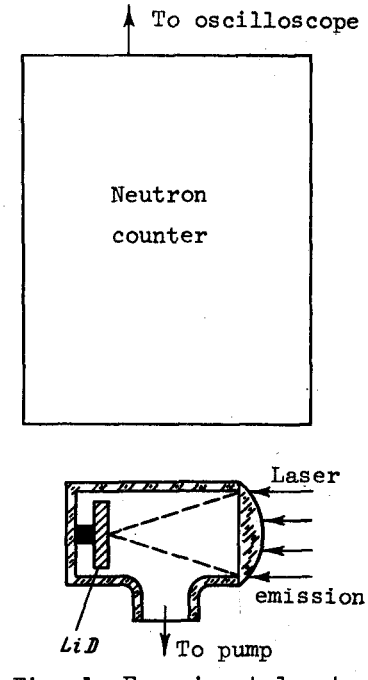

Fig. 1. Experimental setup for neutron observation

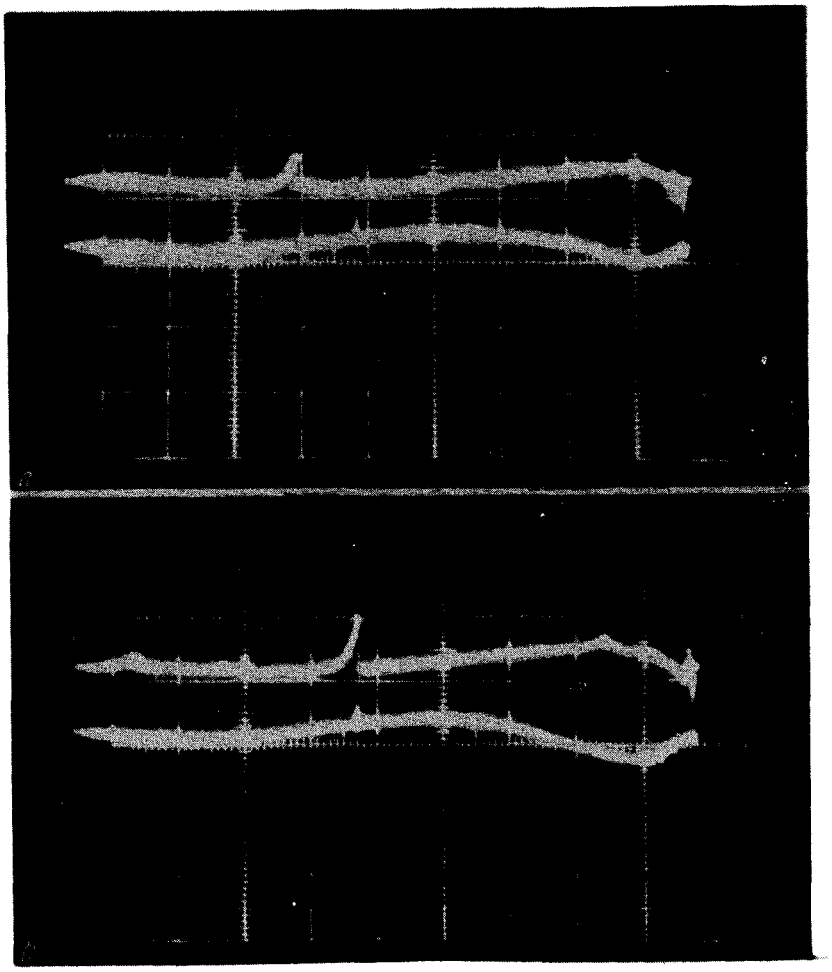

Fig. 2. Oscillograms of pulses from counter (lower trace) and from Kerr shutter (upper trace): a - no pulse coincidence; b - case of coincidence. Sweep duration 200 sec/cm.

scintillator (amplitude several volts, frequency $\sim 10^3$ sec^{-1}). Figure 2b shows one of the oscillograms obtained in the case of coincidence. Calibration of the counter against Cs^{137} and Co^{59} counters has shown that the pulses observed by us in coincidence can belong to single neutrons of energy $\sim$2.5 MeV. All the cases of coincidence occur at flash energies exceeding 6 J. The number of coincidences registered by us in two runs exceeded by 20 times the probability of random coincidence of a background pulse with a Kerr-shutter pulse.

Let us estimate the average energy per particle at an input of 10 J in a time 10^{-11} sec to the plasma. The focal-spot diameter was $\sim$0.2 mm in our case[2]. From the equation for the energy ε acquired by the electron in the field of a light wave

$$\frac{\partial \epsilon}{\partial t} = \frac{e^2 E_0^2}{2 m \omega^2} \nu_{eff}(\epsilon),$$

[1] The spot dimensions were determined from an x-ray photograph of the hot region of the plasma, taken with a pinpoint camera.

where E_0 - field amplitude, e and m - charge and mass of the electron, ω - frequency of light, and $\nu_{eff}(\varepsilon)$ - effective frequency of ion-ion collisions, we obtain $\varepsilon \sim 3 \times 10^4$ eV. The time between the ion-electron collisions is $\sim 3 \times 10^{-13}$ sec and the electron mean free path is $\sim 30\ \mu$. The volume of the heated plasma is consequently $\sim 3 \times 10^{-7}$ cm^3, giving an average energy $\sim 2 \times 10^3$ eV for the deuteron energy. This value agrees with the earlier estimate.

The investigations of plasma heating by powerful laser emission is continuing.

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QUANTUM MAGNETIC "TRAPS" IN METALS

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In investigations of low-temperature properties of metals placed in strong magnetic fields $\vec{H}$ it is customary to neglect the spatial inhomogeneity of the field. Under the conditions of the experiment the field satisfies under the experimental conditions the inequality $R \ll L$ (R - characteristic Larmor radius, $L \sim H/|\nabla H|$). If the effects considered are nonvanishing in the zeroth approximation in the quasiclassical-approach parameter $\kappa = \hbar\Omega_0/\varepsilon_0 \sim 10^{-3} - 10^{-4}$ (Ω_0, ε_0 - characteristic Larmor frequency and energy, respectively), then the condition $R \ll L$ actually makes it possible to assume, with good accuracy, that the field $\vec{H}$ is homogeneous. The situation is noticeably altered, however, when the quantum magnetic-breakdown effect (interband tunnel transitions) [1] becomes appreciable. We shall show in this note that under conditions of magnetic breakdown even very small inhomogeneities of $\vec{H}(\vec{r})$ greatly distort the electron energy spectrum and lead to the formation of unique quantum magnetic traps with characteristic dimensions $\sim\kappa L$. We shall carry out the analysis for a field $\vec{H} \equiv (0, 0, H_z(d))$, which arises, for example, in pulsed fields as a result of skin