

$\alpha\text{-Fe}_2\text{O}_3$  [8, 9], which is connected with the jump of the vector  $\vec{l}$  in the (001) plane.

The experimentally obtained value of the gap at the phase transition point is  $\omega_0 = 0.88 \times 10^{12} \text{ sec}^{-2}$ . Extrapolation of our results to  $\omega = 0$  yields  $H_{\perp} = 134 \pm 4 \text{ kOe}$ . Using this value of  $H_{\perp}$  and the values of  $H_E = 2M_0B = 770 \text{ kOe}$  and  $H_D = 2M_0e = 241 \text{ kOe}$  ( $M_0$  is the magnetic moment of  $1 \text{ cm}^3$  of the sublattice), taken from the plots of [4], we can calculate the anisotropy field  $H_A = 2M_0a = 123 \text{ kOe}$ , which is in good agreement with the value obtained using the  $m(H)|_{H \rightarrow 0}$  dependence given in the cited paper. Knowing  $H_E$ ,  $H_A$ , and  $H_D$  we can calculate  $\omega_0$ . The results agree with the value of  $\omega_0$  of [7] if the  $g$  factor for the given branch of the AFMR is chosen equal to 4. The same value,  $g = 4$ , was obtained in the study of AFMR in  $\text{CoCO}_3$  [10].

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#### GENERATION OF NEUTRONS IN A LASER $\text{CD}_2$ PLASMA HEATED BY PULSES OF NANOSECOND DURATION

N.G. Basov, V.A. Boiko, S.M. Zakharov, O.N. Krokhin, and G.V. Sklizkov  
 P.N. Lebedev Physics Institute, USSR Academy of Sciences  
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1. Neutrons resulting from laser heating of a plasma containing deuterium ions were registered to date both in the case of picosecond [1, 2] and nanosecond [3] pulses. These experiments differ both in the heating regimes (the heat conduction and gasdynamic regimes) and in the chemical composition of the target.

In this paper we report registration of neutrons following heating of the plasma by a pulse of laser radiation with parameters close to those of [3], but unlike in the cited investigation, the target was deuterated polyethylene  $(\text{CD}_2)_n$ . The presence of heavy ions in the deuterium plasma should lead, according to [4], to an increase of the temperature and to a decrease of the

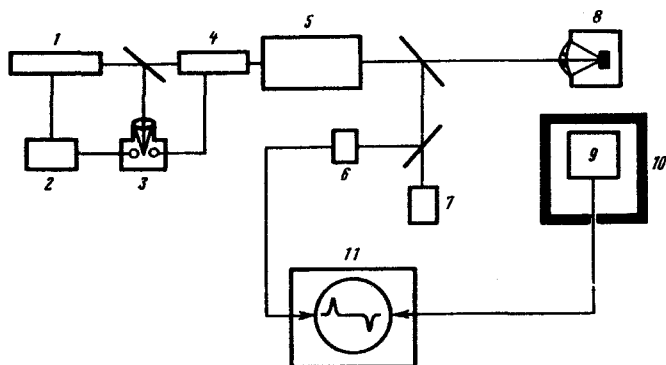


Fig. 1. Experimental setup: 1 - Q-switched neodymium laser, 2 - square-wave generator, 3 - laser-ignited discharge gap producing a pulse at the cutoff shutter, 4, 5 - system of amplifying stages, 6 - coaxial photocell, 7 - calorimeter, 8 - chamber with target, 9 - scintillation detector, 10 - lead screen, 11 - oscilloscope.

A beam divergence not worse than  $5 \times 10^{-4}$  rad, the dimension of the heated area was determined by the lens and amounted to  $1 \times 10^{-4}$  cm<sup>2</sup>. The laser produced an energy of ~80 J, but for better stability of the results, the experiments were performed at lower values of the energy. The radiation was focused on the surface of the target.

The x ray and neutron radiation were registered with a photomultiplier and a plastic scintillator having a diameter 8 cm and a length 8 cm. The

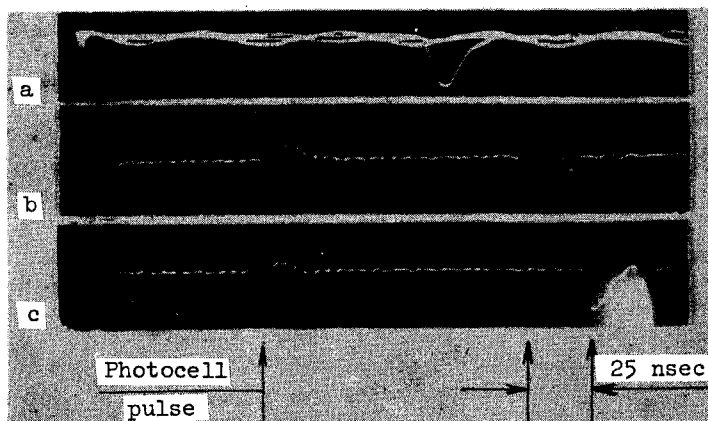


Fig. 2. a - Oscillogram of laser pulse, frequency of calibration sinusoid 100 MHz; b, c - oscillograms of pulses from neutron detector located 10 and 60 cm away from the target, respectively; a laser pulse of increased amplitude is registered at the start of the sweep.

density compared with pure deuterium

$$T = T_D Z^{2/3} \left( \frac{2}{Z+1} \right)^{2/3} \left( \frac{A}{2} \right)^{2/9},$$

$$N = N_D Z^{-1} \left( \frac{2}{Z+1} \right)^{1/2} \left( \frac{A}{2} \right)^{1/6},$$

where  $Z$  and  $A$  are the average charge and weight of the ion, and  $T_D$  and  $N_D$  are the temperature and density in the case of pure deuterium.

2. The heating was with a neodymium laser with five amplification stages. The experimental setup is shown in Fig. 1. The laser beam was focused with the aid of a lens with  $f = 100$  mm on a target made of powdered polyethylene and located in vacuum. The radiation pulse shape is shown in Fig. 2a.

The photomultiplier registered the light flash from the recoil protons in the case of neutron registration and from the photoelectrons and the Compton electrons in the case of registration of x radiation.

3. Figures 2b and 2c show pulses from the neutron detector at a scintillator - target distance 10 and 60 cm, respectively. The time marker was a laser pulse from a coaxial photocell, registered with the same sweep. The time of flight of the neutrons was determined from the relative delay of the neutron pulses. This time amounted to 25 nsec, corresponding to a neutron velocity  $2 \times 10^9$  cm/sec, acquired as a result of the reaction. The scintillator and the photomultiplier were screened by a lead screen 1.5 cm thick to protect it against the hard

x radiation, the quantum energy of which was estimated in special experiments with thick aluminum (1.5 cm) and copper (0.5 cm) filters. These measurements, carried out at a lower laser power, have demonstrated the presence of quanta with energy 100 keV and above. In all probability these  $\gamma$  quanta are knocked out from the walls of the chamber by the fast electrons, since covering the region where the detector is directly visible from the focal point with a thick lead filter (which certainly did not pass the  $\gamma$  quanta) did not lead to a noticeable decrease of the flux. The mechanism of formation of the fast electrons in the laser plasma is not clear.

The minimum number of neutrons can be easily estimated from the fact that at a distance of 60 cm the photomultiplier registered not less than one neutron. This gives for the total number of neutrons not less than  $10^3$ . The neutrons were registered with the energy decreased to 14 J.

In conclusion, we note that the use of heavy targets in the non-equilibrium heating regime, as noted in [5], may turn out to be promising for obtaining powerful deuteron sources.

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#### POPULATION INVERSION OF THE LEVELS OF THE NUCLEAR MAGNETIC SYSTEM OF THIN-FILM $\text{Co}^{59}$ FOLLOWING PULSED MAGNETIZATION REVERSAL

N.M. Salanskii, I.A. Lyapunov, and V.K. Mal'tsev  
 Physics Institute of the Siberian Division of the USSR Academy of Sciences  
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In [1] there was discussed a possibility of obtaining inverted population of the levels of the nuclear magnetic system of a ferromagnet by pulsed reversal of magnetization. The gist of the process occurring in this case is as follows.

In the equilibrium state the vector of nuclear magnetization  $\mu$  in the ferromagnet is antiparallel to the vector of the electronic magnetization  $M$ . If a pulsed magnetic field causes the electronic magnetization to reverse polarity relative to the anisotropy axis during a time much shorter than the half-cycle of NMR, then  $\mu$  turns out to be parallel to  $M$ , and if this non-equilibrium state exists for a sufficiently long time in comparison with the period of the nuclear precession, then at the NMR frequency the nuclear system will have maser properties.

For a fast rotation of  $M$  through  $180^\circ$ , the nuclear-magnetization component  $\mu_z$  is given according to [1] by

$$\mu_z = \frac{\mu}{1 + \sigma^2} \left[ 1 + \sigma^2 \cos \pi \sqrt{1 + \frac{1}{\sigma^2}} \right], \quad (1)$$