INVESTIGATION OF THE ANGULAR DISTRIBUTION OF NEUTRON EMISSION GENERATED BY THE ACTION OF A POWERFUL SHORT LASER PULSE ON DIFFERENT SOLID-STATE TARGETS [[1]](#footnote-1)\*)

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Experiments on the angular distribution of DD neutrons generated in nuclear reactions upon irradiation of a (CD2)n target have been performed in the “Neodymium” laser facility. Apart from the main pulse, prepulses were observed in the experiment. Measurements have shown that neutrons have an isotropic angular distribution. Experimental results have been analysed using hydrodynamic calculations accounting for the ponderomotive force. The ion heating mechanism in a shock wave emerging under the action of the ponderomotive pressure of the main pulse in the supercritical region of the plasma has been considered. It is shown that neutrons are generated mainly in the supercritical plasma heated by the ion heat wave. The time of plasma cooling due to hydrodynamic spreading turns out to be much longer than the isotropization time of the ion velocity distribution function due to Coulomb collisions. In these conditions, the neutron angular distribution must be isotropic.

Experiments have also been carried out to measure the angular distribution of neutrons produced in 7Li(p, n)7Be nuclear reactions. A beam of protons was generated on the rear side of a thin aluminium target irradiated by laser radiation with a maximum flux density of 3 × 1018 W cm–2 (λ = 1.055 m). Traces of organic compounds on the target surface were the source of protons. Protons were incident on a massive LiF target in which the above nuclear reactions occurred.
Our measurements have shown that the neutron flux is anisotropic with a degree of anisotropy equal to 2. We have analyzed the angular distribution of the neutron flux using numerical calculations. We show that at certain proton beam parameters characterizing the energy and angular spectra of protons, it is possible to reproduce the experimentally measured angular distribution of the neutron flux. There are proton beam parameters at which the degree of anisotropy of the neutron flux can be increased several-fold compared to the experimentally measured one.

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/It/ru/CA-Demchenko.docx) [↑](#footnote-ref-1)