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Production of Neutrons by High Intensity Picosecond Laser Interacting with Thick Solid Target at XingGuangIII

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Abstract : This work describes the experiment to produce high-intensity pulsed neutron beams on XingGuangIII laser facility. The high-intensity laser is utilized to drive protons and deuterons, which hit a thick solid target to produce neutrons. The pulse duration of the laser used in the experiment is about 0.8 ps, and the laser energy is around 100 J. Protons and deuterons are accelerated from a 10-μm-thick deuterated polyethylene (CD_2) foil and diagnosed by a Thomson parabola ion-spectrometer. The energy spectrum of neutrons generated via ^{7}Li(d,n) and ^{7}Li(p,n) reaction when proton and deuteron beams hit a 5-mm-thick LiF target is measured by a scintillator-based time-of-flight spectrometer. Results from the neuron measurements show that the maximum neutron energy is about 12.5 MeV and the neutron yield is up to 2×10^9/pulse. The high-intensity pulsed neutron beams demonstrated in this work can provide a valuable neutron source for material research, fast neutron induced fission research, and so on.

Keywords : picosecond laser driven, fast neutron, time-of-flight spectrometry, XinggungIII
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