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Experiment research progress of the short-pulse laser driven neutron source at the Laser Fusion Research Center

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Short Abstract: Intense short-pulse laser driven neutron source (LDNS) has the characteristics of micro focus, short pulse duration and high fluence. It has attracted extensive attention and interests in the world. LDNS of the laser-ion driven method (pitcher-catcher method) is most possible to achieve high yield and to meet the application requirements.

Our research group had carried out many experiments about LDNS in the XGIII laser facility at the Laser Fusion Research Center of the Chinese Academy of Physics, and hitherto reaches the yield of $2x10^9$ n/sr using a 147 J picosecond laser with intensity of 6×10^{19}W/cm^2. Compare with our former experiments, the yield is increased about 10 times by using advanced TNSA target and more efficient convertor. Another interesting experiment was performed on the SILEX-II Petawatt laser facility. Laser accelerated lithium ions hit the CD_2 foil and highly directional neutron beam was generated with the ratio of yield between 0°and 90°greater than 10 and the FWHM of neutron emission angle smaller than 40°. Simulation shows that more directional neutron beam can be realized by quasi-monoenergetic Li ions with energy just greater the the Q valure of H(^{7}Li, n)^{7}Be reaction. This kind of neutron source has great advantage in neutron application such as neutron spectroscopy and radiography because the shield of neutrons on the sides can be greatly reduced.

References

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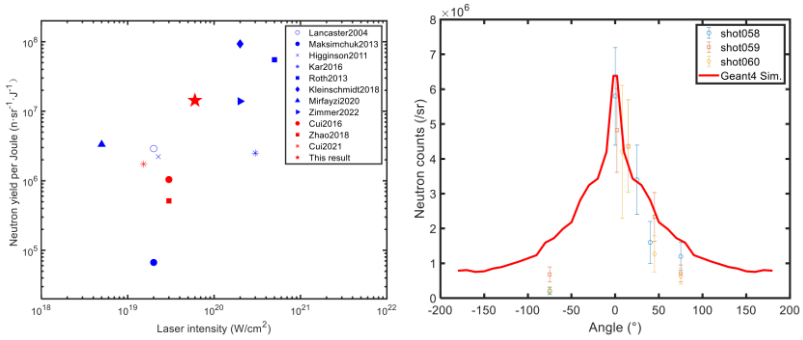

Figure 1 Experimental generation efficiency of neutron (left) and the experimental results of the neutron yield varied with angles (right).