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Observation scenario of knock-on-tail shape using Doppler-broadening

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The knock-on tail formed by nuclear elastic scattering (NES)[1] due to high energy particles gives various effects to fusion plasma. So far, observation experiment of knock-on tail was only conducted by measuring knock-on tail due to NES caused by alpha-particles using deuterium-tritium plasma at JET [2]. In this experiment, however, quantitative estimation of NES effect is insufficient. We proposed observation method of knock-on tail using gamma-ray-generating and neutron-generating nuclear reaction in a proton-beam-injected deuterium plasma at LHD. The gamma-rays and neutrons due to 6Li(d,n)7Be, 6Li(d,p)7Li, and D(d,n)3He reactions will be utilized for the observation. However, it is difficult to identify the formed knock-on tail by using this method under high-temperature plasma conditions where the gamma -ray and neutron generation rates increase. In order to solve this problem, we newly propose the observation method using Doppler effects for the gamma-ray-generating reactions, 6Li(d,n)7Be, 6Li(d,p)7Li reactions. It is also expected that the possibility to evaluate the shape of knock-on tail on velocity distribution function. In this study, we showed validity of this method for the proposed experiment by simulation.
[1]J. J. Devaney and M. L. Stein, Nucl. Sci. Eng., 46, 323(1971).
[2]J. Källne, et al., Phys. Rev. Lett., 85, 1246(2000).

Eligible for student paper award?

Yes

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