Nuclear Astrophysics Using Laser-Driven Neutrons

T Hayakawa[1,2]

[1]*Institute of Laser Engineering, Osaka University, 5650871, Osaka, Japan. Contact Phone: +81774806116*
[2]*Kansai Photon Science Institute, National Institutes for Quantum and Radiological Science and Technology, 6190215, Kyoto, Japan. Contact Phone: +81774806116*
Contact Email: hayakawa.takehito@qst.go.jp

Progress in laser physics enabled us to generate various particles such as electrons, photons, and protons through laser plasma interactions. At present, protons could be accelerated up to several tens MeV. When we install a secondary target behind the primary target to generate neutrons through nuclear reactions, neutrons are effectively produced. These laser-driven particles have remarkable advantages for study of nuclear physics. They have a relatively short pulse, high flux, and continues energy distribution. These features are suitable for the study of nuclear astrophysics such as stellar nucleosynthesis. We have proposed the study of nuclear astrophysics using laser-driven neutrons. We have demonstrated generation of neutrons using the LFEX laser at Osaka University. It is possible to generate a neutron pulse with flux of 10^{10} neutrons/shot using a single laser shot. We have measured energy spectra using activation method and present generation of decay acceleration through an isomer. This is a hint for understanding unresolved phenomenon occurred in early phase of the solar system formation. We also discuss the perspective of the study of nuclear astrophysics using laser-driven neutrons.