Multi-PW laser driven electron acceleration and applications

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Laser wakefield acceleration (LWFA) can realize compact electron accelerators using significantly higher acceleration field than that of conventional rf accelerators. The progress of laser technologies reached PW peak power [1] and advanced the energy of laser electron accelerators to several GeV energy range [2,3]. Recently, we accomplished upgrading one of our PW beamlines to 4 PW peak power [4] and started applying it to LWFA experiments. In the recent experiments, we obtained 4.5 GeV electron beam by applying a 2.5 PW laser pulse to a 7-cm helium gas cell target. In the experiment, we observed the charge of the electron beam was noticeably enhanced through the ionization injection scheme implemented by adding 1 % neon to the helium gas. Here, we present the recent progress in LWFA research with multi-PW lasers. In addition, we will discuss new LWFA schemes for improving beam quality. These developments of high energy electron beam with multi-PW lasers will open gateways to investigate nonlinear QED phenomena and nuclear processes.

Reference

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