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Invited Session

Challenging Tasks in Laser Wakefield Acceleration with PW Lasers

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Laser-produced plasmas have been explored as media to accelerate charged particles. When an intense laser pulse is focused to a gaseous medium, the plasma wave excited can accelerate an injected electron bunch, called the laser wakefield acceleration scheme. Since the acceleration field in the plasma wave, ~ 1 GV/cm, is larger by several orders of magnitude than in a conventional accelerator, the laser wakefield acceleration can provide a means to construct compact high energy accelerators. Investigations on laser-driven particle acceleration have thus paved the route to develop compact particle accelerators and also radiation sources.

Recent advancement of ultra-high intensity lasers has offered opportunities to investigate laser-matter interactions in the relativistic regime. At CoReLS two PW Ti:Sapphire laser beamlines with powers of 1.0 PW and 1.5 PW at 30 fs were developed [1]. These PW lasers have been successfully applied to generate multi-GeV electron [2] and energetic proton beams [3]. One of the PW laser beamlines is being upgraded to a 4-PW laser, which will be utilized to generate a 10-GeV electron beam. In addition, we plan to carry out all optical Compton backscattering to generate MeV gamma-rays from the scattering between a laser-accelerated GeV electron beam and another laser beam – challenging tasks to explore nonlinear QED effects in photon-particle interactions.

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[2] H. T. Kim *et al.*, Phys. Rev. Lett. 111, 165002 (2013).

[3] I J. Kim *et al.*, Phys. Rev. Lett. 111, 165003 (2013).

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