

Development of 10 GeV electron acceleration with 4-PW laser

Friday, 16 October 2015 14:00 (20 minutes)

Laser-plasma interactions in relativistic regime brought a tremendous advancements of compact particle accelerators and radiation sources. Rapid progresses of ultrashort high-power laser technology has reached to output power of PW, which can provide a chance to explore new regime of relativistic laser-plasma interactions. We have developed two PW Ti:Sapphire laser beamlines with the peak powers of 1.0 PW and 1.5 PW [1], which were successfully applied to generate a 3-GeV electron [2] and 93-MeV proton beams [3]. Here, we will present the progresses of electron acceleration with PW laser pulses and the plans for development of 10 GeV electron beam driven by 4 PW laser pulses. We are in the progress of upgrading our PW laser to reach 4-PW peak power with 20-fs pulse duration and 80-J energy, which can provide a chance to accelerate electron beam beyond 10 GeV. The development of laser-plasma accelerator beyond 10 GeV will advance the applications of laser-plasma electron accelerators to high-energy gamma-ray generation, pair production and laser-based photo-nuclear physics.

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[2] H. T. Kim, K. H. Pae, H. J. Cha, I. J. Kim, T. J. Yu, J. H. Sung, S. K. Lee, T. M. Jeong, and J. Lee, *Phys. Rev. Lett.* 111, 165002 (2013).

[3] I. J. Kim et al., *Arxiv* 1411.5734.

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Session Classification: Frontiers in laser technology

Track Classification: Presentations