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Overview on the development of laser electron accelerators and radiation sources with PW lasers

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Laser wakefield acceleration (LWFA) is one of promising methods for developing next generation electron accelerators due to its huge acceleration field in plasma. Thanks to the recent progress of ultrahigh-intensity laser technologies, we developed two PW Ti:Sapphire laser beamlines [1], one of which has been recently upgraded to a 4-PW beamline. With the completion of multi-PW lasers, we have explored high field science, especially laser-driven electron acceleration based on the LWFA scheme. Through the investigations on relativistic laser-plasma interactions, LWFA has paved the route to develop compact electron accelerators. We succeeded in the generation of high-quality multi-GeV electron beams by using dual stage acceleration [2] and by controlling the waveform of PW laser pulses. At present, we are in the process of developing a 10-GeV electron beam and a femtosecond gamma-ray source by the Compton backscattering process with the PW lasers. Here, we present the overview on the recent progress in LWFA research with PW lasers and the plan to develop MeV Compton gamma-ray sources using multi-GeV electron beams.

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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, J. Lee, Phys. Rev. Lett. 111, 165002 (2013).*