Generation of high-charge electron bunch and ultrafast gamma-ray beam in laser-plasma accelerator

Jiancai Xu¹, Baifei Shen¹,²,³, Tongjun Xu¹, Shun Li¹, Yong Yu¹, Jinfeng Li¹, Xinliang Wang¹, Xiaoming Lu¹, Cheng Wang¹, Xiaoyan Liang¹, Yuxin Leng¹, Ruxin Li¹ and Zhizhan Xu¹

¹State Key Laboratory of High Field Laser Physics, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, P. O. Box 800-211, Shanghai 201800, China
²Department of Physics, Shanghai Normal University, Shanghai 200234, China
³Collaborative Innovation Center of IFSA (CICIFSA), Shanghai Jiao Tong University, Shanghai 200240, China

High-charge electron bunch with broad energy spectrum has been experimentally produced during interaction between high-intensity femtosecond laser pulse and clustering gas jet with near critical density. The energetic electron bunch reaches the charge of 10nC with cut-off energy of 50 MeV and full divergence angle of 15°. When this high-charge energetic electron bunch shots into high-Z target with different thickness of several millimetres, ultrafast MeV position beam and gamma-ray beam are produced. The gamma-ray beam with broad energy spectrum reaches high-flux of 10¹⁰ photons per shot. This ultrafast high-flux MeV gamma-ray beams are promising sources for photonuclear reaction, non-destructive inspection and other potential applications.