Experiments with Shanghai Super-intense Ultrafast Laser Facility and the Station of Extreme Light

Baifei Shen[1,2]

[1] *Department of Physics, Shanghai Normal University, Shanghai 200234, China.*
[2] *State 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.*
bfshen@shnu,edu.cn

The Shanghai Super-intense Ultrafast Laser Facility (SULF) with a ten PW laser will be completed in the end of 2018. The research platform for Ultrafast Sub-atomic Physics at SULF will be focused on the production of energetic beams and their applications. Laser driven proton acceleration with solid and gas targets is planned. [1] Protons will be polarized and accelerated in a special way. Laser driven electrons will be used to generate positron beams [2] and intense gamma rays, especially in the near QED regime. Nuclear physics by using laser driven protons and gamma rays are considered.

The Station of Extreme Light (SEL) at Shanghai Coherent Light Facility (SCLF) has been approved to be built. The 100 PW laser of SEL will not only be used for exploring vacuum birefringence [3] and other vacuum QED effects with the help of the hard XFEL, but also accelerate protons to more than 10GeV which can be used for anti-proton production. [4] Thanks to the high production efficiency of gamma ray in the QED regime, nuclear photonics will be one of the most important research fields. [5, 6]

1．H. Zhang, B.F. Shen et al., Collisionless Shock Acceleration of High-Flux Quasi monoenergetic Proton Beams Driven by Circularly Polarized Laser Pulses, PHYSICAL REVIEW LETTERS 119, 164801 (2017)
2. Tongjun Xu, Baifei Shen et al.,Ultrashort megaelectronvolt positron beam generation based on laser-accelerated electrons, PHYSICS OF PLASMAS 23, 033109 (2016)
3. Baifei Shen et al., Exploring vacuum birefringence based on a 100 PW laser and an x-ray free electron laser beam, Plasma Phys. Control. Fusion 60, 044002(2018).
4. Shun Li, Zhikun Pei, Baifei Shen et al., Physics of Plasmas 25, 023111 (2018).
5. L. L. Ji, A. Pukhov, E. N. Nerush, I. Yu. Kostyukov, B. F. Shen, and K. U. Akli, Energy partition, gamma-ray emission, and radiation reaction in the near-quantum electrodynamical regime of laser-plasma interaction, PHYSICS OF PLASMAS 21, 023109 (2014)
6. Shun Li, Baifei Shen et al., Ultrafast multi-MeV gamma-ray beam produced by laser-accelerated electrons，PHYSICS OF PLASMAS 24, 093104 (2017)