6th Asia-Pacific Conference on Plasma Physics, 9-14 Oct, 2022, Remote e-conference

High charge electrons and bright x-ray source driven by 100s-TW laser pulse

Jinqing Yu[1], Ronghao Hu[2], Ruixian Huang[1], Xueqing Yan[3,4]

[1] Hunan Provincial Key Laboratory of High-Energy Scale Physics and Applications, School of Physics and Electronics, Hunan University, [2] Sichuan University, [3] State Key Lab. of Nuclear Physics and Technology, and Key Laboratory of HEDP of the Ministry of Education, CAPT, Peking University, [3] Collaborative Innovation Center of Extreme Optics, Shanxi University

e-mail (speaker): jinqing.yu@hnu.edu.cn

Recent progress in the x-ray sources basing on laser wakefeild acceleration enables the possibility to explore basic scientific fields, however, the application is still limited by the flux and brightness of the source. we report a novel regime to generate a high-charge electron beam (>10nC) and a bright Betatron X-ray source utilized by compact laser (~100s TW) and sub-critical density plasma. In this regime, the electron acceleration is dominated by the LWFA and combined with DLA, to take the advantages of LWFA in beam collimation and DLA in high-charge. 3DPIC simulations are performed by using a compact femtosecond laser pulse of ~5.5 J and sub-critical density plasma. It is found that more than 1×10^{12} photons can be generated with a peak brightness of 7.8×10^{22} photons/s/mm^2/mrad^2/0.1%BW at 10keV. The photon flux is more than two orders of magnitude higher than that generated from the typical laser wakefield electron acceleration. This flexible and compact scheme may provide a wide range of applications requiring bright and large number photons in scientific research, medicine, industry, etc.

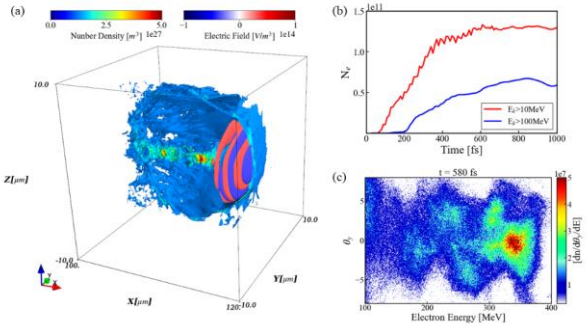

Figure. (a) The electron density distribution in the 3D simulation, (b) the red (blue) line represents the number of the electrons with kinetic energy higher than 10 MeV (100 MeV) at different time, (c) the spectral-angular distribution of the electrons with energy higher than 100 MeV.