High Z ion acceleration physics with ultra-intense short pulse laser light

Yasuhiko Sentoku[1]
[1]Institute of Laser Engineering, Osaka University
e-mail (speaker): sentoku-y@ile.osaka-u.ac.jp
As an AAPPS-DPP standard, we do not need to add your postal address.

Laser-matter interactions in the relativistic regime, where the laser intensity exceeds 1020 W/cm2, have opened up innovative applications such as intense x-ray and neutron sources, and compact particle accelerators. Especially, fast high Z ions are attractive for the nuclear physics and as a source of conventional accelerator. We study the high Z ion acceleration with extreme intense laser light interacting with a thin foil target with a help of a state-of-the-art collisional particle-in-cell code, PICLS. The strong sheath field generated thru the laser-matter interaction enables to ionize atoms on the target surface to highly charge states instantaneously and accelerate them simultaneously. Collisional impact ionizations also proceed and compete to the field ionizations inside the target. The ionization dynamics at the target rear surface is the key to determine the characteristic of the high Z ion acceleration. We see the rapid ionization of the rear surface atoms with the evolution of the sheath field together with collisional ionization waves running from the front side. We derived a simple scaling of the sheath field amplitude theoretically. This scaling is useful to estimate the effect of the field ionization/acceleration.

Funding Acknowledgment:
Supported by JSPS KAKENHI No. JP15K21767.