

Interaction between multi-PW class laser pulses and underdense plasmas

M. Yano¹, A. Zhidkov², T. Hosokai^{1,2,3}, R. Kodama^{1,2,4}

¹*Graduate School of Engineering, Osaka University, 2-1, Yamadaoka, Suita, Osaka 565-0871, Japan*

²*Photon Pioneers Center, Osaka University, 2-1, Yamadaoka, Suita, Osaka 565-0871, Japan*

³*Innovative Light Sources Division, RIKEN SPring-8 Center, 1-1-1, Kouto, Sayo-cho, Sayo-gun, Hyogo 679-5148, Japan*

⁴*Institute of Laser Engineering, Osaka University, 2-1, Yamadaoka, Suita, Osaka 565-0871, Japan*

Regular electron sub-systems undergoing super-acceleration, which may be important experimental objects for vacuum and space-time researches, are shown to be created in underdense plasma irradiated by multi-PW laser pulses with intensity over 10^{22} W/cm². For the first time, the interaction of multi-PW laser pulses with underdense plasma, in the regime of strong relativistic wave-breaking, is investigated via 3D particle-in-cell simulation. Effects of pulse self-focusing, ion motion, and radiation friction on the interaction and formation of regular electron sub-systems under super-acceleration are examined. We estimate scattering broadening of Thomson scattering from the electron sub-system for detection of space time effects.