Ultra-Bright Synchrotron-Like Gamma Rays From Laser Wire Target Interaction

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With the rapid development of laser facilities around the word, table-top gamma ray source based on laser plasma interaction becomes more and more important for its potential applications in medicine, science, and engineering[1,2]. By using three-dimensional particle-in-cell simulations with radiation reaction effect incorporated[3,4], we study the foil dynamics during intense laser wire target interaction. When a circularly polarized laser pulse at an intensity of 10^21W/cm^2 irradiates a solid wire target with a transverse radius of 1.0 micrometers and a longitudinal length of 7 micrometers, electrons dragged out from the skin-length oscillate in the circularly polarized laser field transversely and are accelerated by the ponderomotive force in the forward direction. The electrons beyond the skin-length in the target reflux and move in the opposite direction to the laser propagation, providing a large amount of electrons for transverse oscillation. Finally, ultra-bright femto-class synchrotron-like gamma rays with a cutt-off photon energy of about 10MeV are emitted in a very small cone angle, which may diverse applications in future[1,5].

[1] S. Cipiccia, et al., *Nat. Phys.* 7, 867-871 (2011).
[2] T.P. Yu, et al., *Phys. Rev. Lett.* 110, 045001 (2013).
[3] A. Pukhov, et al., *J. Plasma Phys.* 61, 425–433 (1999).
[4] T.P. Yu, et al., *Phys. Plasmas,* in press (2014)
[5] M. Schnell, et al., *Nat. Commun*. 4, 2421 (2013)