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Compton Scattering in Delayed Counter-Propagating Laser Beams Irradiating Solid Target

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In the realm of quantum dynamics, electrons can absorb one or several photons and emit a photon with higher energy through Compton scattering. A novel scheme, i.e. using electrons accelerated by laser-plasma interaction to collide head-on with laser to create ultra-bright γ-rays has already attracted lots of attention in the past decades. However, the number of accelerated electrons is limited in this scheme. In order to increase the number of electrons participated in the Compton scattering, we propose to a new regime by using the delayed counter-propagating laser beams. After the first laser deposits energy into the target and heats the electrons, a dense electron zone will be formed in the rear side of the target. When the second laser irradiates this zone, nonlinear Compton scattering will occur and a large number of γ-rays will thus be generated. Such γ-ray emissions are continuous in the period from the time when laser starting interaction with electron zone to the time when the reflected laser moving away from the electron zone. The simulation results show that in this regime, both the average density of electrons participated in the Compton scattering and the interaction area are increased significantly.

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