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QED Effects at Grazing Incidence on Solid-State-Targets

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New laser facilities will reach intensities of 10^{23}W cm^{-2}. This advance enables novel experimental setups in the study of laser-plasma interaction. In these setups with extreme fields quantum electrodynamic (QED) effects like photon emission via non-linear Compton scattering and Breit-Wheeler pair production become important.

We study high-intensity lasers grazing the surface of a solid-state target by two-dimensional particle-in-cell simulations with QED effects included. The two laser beams collide at the target surface at a grazing angle. Due to the fields near the target surface electrons are extracted and accelerated. Finally, the extracted electrons collide with the counter-propagating laser, which triggers many QED effects and leads to a QED cascade under a sufficient laser intensity. Here, the processes are studied for various laser intensities and angle of incidence and finally compared to a seeded vacuum cascade. Our results show that the proposed target can yield many order of magnitude more secondary particles and develop a QED cascade at lower laser intensities than the seeded vacuum alone.

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