

QED cascade in a tightly focused standing wave

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Since 10 PW laser facilities are now being built, the attention is paid to the possibility of achieving electron-positron cascade generation via Breit-Wheeler process in the field of an ultra-intense laser beam. One possible interaction scenario leading to a prolific pair production is the interaction of seed particles with the intense standing wave formed by two colliding laser pulses. The threshold for pair production is of the order 10^{23-24} W/cm² which is now of great importance for multi-PW laser facilities [1]. To achieve such a high intensity, laser pulse has to be focused to a 1 μ m spot size. Since the paraxial approximation is not valid for such tightly focused laser pulse, the appropriate description of electromagnetic fields has to be used. Moreover, tight focusing causes pulse shortening and development of the longitudinal electric field that can affect the interaction [2].

Therefore, we study particle dynamics, gamma emission and pair production in the tightly-focused standing wave formed by counter-propagating laser pulses interacting with an electron target. It is shown, how tight focusing affects the cascade development for a wide set of initial conditions and the threshold for pair production in such a configuration is given.

References

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