

Conditions for QED cascade development in counter-propagating Laguerre-Gauss beams

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When a charge particle interacts with a laser pulse in the regime of strong field quantum electrodynamics, two main processes are of importance, hard photon emission by nonlinear Compton scattering, and electron-positron creation by nonlinear Breit-Wheeler. If the field is strong enough those two processes can in principle be coupled to achieve what is called a cascade, an exponential increase in the number of electron-positron pairs.

A recent work suggests that a cascade could be initiated with one laser pulse [1]. However the required intensity would be far beyond what is expected in the near future.

A more promising configuration involves two counter-propagating laser pulses, as discussed in several numerical and theoretical studies [2, 3, 4, 5]. However these works only consider Gaussian laser pulses. Here we present the result of 3D Particle In Cell simulations using the code SMILEI [6] in which we explore the optimal configuration to produce a cascade using Laguerre-Gauss (LG) pulses. We discuss the effect of polarisation and LG beam order in the field configuration, and study the role of the latter conjugated with the intensity in the triggering and efficiency of the cascade development.

References

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