Pair production in counter-propagating laser pulses

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Abstract: We study the classical trajectories of electrons in an under-dense plasma in the presence of intense, counter-propagating laser pulses. By computing the photon emissivity and the photon trajectories through a cylindrical model of the intersecting beams we evaluate the local production rate of electron positron pairs via the non-linear Breit-Wheeler process.

Pair production has been reported in several experiments that use intense laser beams either as an accelerator or as a target for electron beams. In counter-propagating beams, however, the laser can simultaneously act as both an accelerator and a target [1]. In beams of intensity $10^{23}-10^{24}\mathrm{Wcm}^{-2}$, electrons radiate gamma rays, which can produce electron-positron pairs on interacting with the laser fields via the non-linear Breit-Wheeler process. The pairs, in their turn, will be accelerated, leading to an electromagnetic cascade that could deplete much of the beam's energy [2]. We present the gamma-ray spectrum and the expected pair yield per electron in realistically modeled laser pulse-trains of both circular and linear polarisation.

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References

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