

A Reduced Model for Breit-Wheeler Pair Production by a Gamma-Flash and a Gaussian or Laguerre-Gaussian Laser Beam of Arbitrary Polarization

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We examine the decay of a flash of γ photons into electron-positron pairs as it collides with an intense laser field (non-linear Breit-Wheeler process).

We propose a simple semi-analytical model aimed at describing the interaction of the photons with a Gaussian (G) or Laguerre-Gaussian (LG) laser beam of arbitrary polarization [1]. This model allows estimating the number of primary pairs produced and explore the role of the laser peak intensity versus the focal spot size and shape at constant laser energy, chosen to match experimental constraints. In the case of LG beams, the influence of the order of the LG beams on pair creation is examined, and it is found that above a given threshold, a higher order of the LG parameter is more favorable than a higher peak intensity. This result is generalised to a Gaussian beam: above the same threshold, larger spot size is preferable to tight focusing.

Our results match very well with three-dimensional particle-in-cell simulations and are used to guide upcoming experimental campaigns.

References

- [1] A Mercuri-Baron, M Grech, F Niel, A Grassi, M Lobet, A Di Piazza and C Riconda, arXiv:2105.12458 (2021)