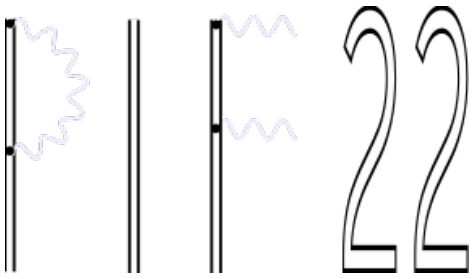

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Nonlinear Compton scattering and nonlinear Breit-Wheeler pair production including the damping of particle states

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In the presence of an electromagnetic background plane-wave field, electron, positron, and photon states are not stable, because electrons and positrons emit photons and photons decay into electron-positron pairs. This decay of the particle states leads to an exponential damping term in the probabilities of single nonlinear Compton scattering and nonlinear Breit-Wheeler pair production [1]. We present analytical and numerical results on the probabilities of nonlinear Compton scattering and nonlinear Breit-Wheeler pair production including the particle states'decay within the locally-constant field approximation [2]. First, the probabilities and some of their asymptotic values are computed analytically. Then, several plots of the total and differential probabilities for different pulse lengths and for different spin and polarization quantum numbers are shown. We stress that it is crucial to take into account the damping of the states in order for the probabilities to stay always below unity and we show that the damping factors also scale with the intensity and pulse duration of the background field. In the case of nonlinear Compton scattering we show numerically that the total probability behaves like a Poissonian distribution for sufficiently low initial electron energies such that the photon recoil is negligible.

[1] T. Podszus and A. Di Piazza, Phys. Rev. D 104, 016014 (2021).

[2] T. Podszus, V. Dinu, and A. Di Piazza, arXiv:2206.10345.

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