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Simulations of light-light scattering in quantum vacuum PEDRO CARNEIRO, THOMAS GRISMAYER, LUS SILVA, RICARDO FONSECA, GoLP/IPFN, Instituto Superior Técnico — Facilities such as the Extreme Light Infrastructure (ELI) or the VULCAN 20 PW project, as well as the Petta-Watt SLAC project, coupled with the x-ray LCLSII source will allow to perform the first experiments on the probing of quantum vacuum. In our work, we developed a numerical method to self-consistently solve the nonlinear system of Maxwell's equations including quantum corrections of vacuum polarization. The robustness of our algorithm allied to the ability to integrate this tool within a particle-in-cell (PIC) method, represents an important milestone in modeling future planned experiments to prove the existence of the quantum vacuum. Such experiments aim to measure the induced ellipticity on a x-ray pulse after probing a strong optical pump due to the quantum vacuum fluctuations. We present simulation results of both the ellipticity induced and polarization rotation, using realistic laser parameters of the Petta-Watt SLAC project, and the x-ray LCLSII source, whilst taking into account all finite-size multidimensional effects. We show how the ellipticity induced varies as a function of the distance to the axis of the beam, proving the importance of taking into account finite-size effects. This work serves as an important tool to complement existing efforts within the community to probe the effects of the quantum vacuum, in the strong field regime, for the first time.

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