

P2.2016 High-energy photon generation in ultrarelativistic laser-plasma interactions

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Forthcoming multi-petawatt laser systems (e.g., CoReLS, Apollon, ELI, CAEP-PW) will soon make it possible to achieve laser intensities in excess of 10^{22} - 10^{23} Wcm². Laser-matter interactions under such extreme conditions will give rise to copious synchrotron or Bremsstrahlung emission of γ -ray photons, which may subsequently convert into electron-positron pairs, through the Breit-Wheeler or Bethe-Heitler processes [1]. These phenomena may strongly alter the mechanisms that are known to rule the laser-plasma interaction at lower laser intensities.

A self-consistent modeling of the future experiments requires the widely used particle-in-cell (PIC) codes to include the aforementioned high-energy processes. Such is the case for the code CALDER developed at CEA/DAM, which now describes all relevant radiation and pair production processes [2, 3]. Using this simulation tool, we present a number of recent results on high-energy radiation by 10^{22} Wcm⁻² laser pulses, likely available during the first years of operation of the aforementioned facilities.

First, we review the properties of synchrotron emission in laser-driven plasmas of varying density, complementing previous work on this topic [5]. We then address the potential of nanowire-array targets for enhancing synchrotron emission. We examine the dependencies of the photon spectra on the target parameters, and compare the performance of nanowire targets with that of uniform plasmas. Finally, we study the competition between Bremsstrahlung and synchrotron emission in copper foils.

References

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