Pair creation and high harmonic generation induced by relativistic oscillating plasma mirror

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The laser-plasma interactions are dominated by the QED regime when the forthcoming lasers are approaching the intensities of $10^{23\text{-}24}$ W/cm^2. Here a regime of the high brightness γ-photon emission and e^+e^- pair creation accompanied with the high harmonic generation is proposed. The incident intense laser field is reflected by the relativistic oscillating mirror and generates the focused attosecond pulse with enhanced intensity. A large number of gamma photons are produced by the collisions between the energetic electrons and the high harmonic pulses. The emitted photons are counter-propagating through the strong laser field which provides a large cross section for the Breit-wheeler process. Relativistic positron bunches are generated and accelerated in the reflected laser field. The peak intensity of the γ-ray reaches 0.74 PW with the brilliance of 2×10^{24} s^{-1}mm^{-2} mrad^{-2} (0.1%BW)$^{-1}$ (at 58 MeV). A GeV positron beam is obtained with density of 4×10^{21} cm^{-3} and a particle number of 5.6×10^9.

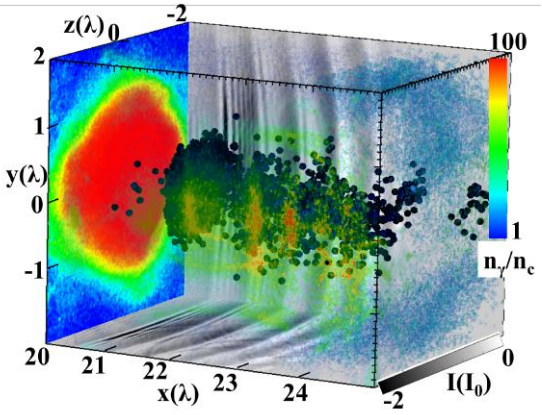

FIG. 1 The result from 3D PIC simulation. The black and white strips represent the reflected high harmonics. The colourful clouds and the dark dots are the photons and positrons. The cross section of the transverse laser field is projected in the y-z plane.

References

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[2] Y. J. Gu, S. Weber, Opt. Express, **26**, 19932 (2018).