RADIATION EMISSION FROM ULTRA-RELATIVISTIC PLASMA ELECTRONS IN SHORT-PULSE LASER LIGHT INTERACTIONS

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Intense femtosecond laser light incident on overcritical density plasmas has shown to emit a prolific number of high-order harmonics of the driver frequency, with spectra characterized by power-law decays $P_m \sim m^{-p}$, where m denotes the harmonic order and p the spectral decay index. When the laser pulse is p-polarized, plasma effects do modify the harmonic spectrum, weakening the so-called universal decay with p=8/3 to p=5/3, or below. In this work appeal is made to a single particle radiation model in support of the predictions from particle-in-cell (PIC) simulations. Using this numerical technique we further show that the emission radiated by electrons -that are relativistically accelerated by the laser field inside the plasma, after being expelled into vacuum, the so-called Brunel electrons- is characterized not only by the plasma line but also by ultraviolet harmonic orders described by the 5/3 decay index. Results obtained from these simulations suggest that for ultra-relativistic light intensities, the spectral decay index is further reduced, with p now in the range $2/3 \leq p \leq 4/3$. This reduction is indicative of a transition from the regime where Brunel-induced plasma radiation influences the spectrum to one dominated by bremsstrahlung emission from the Brunel electrons.