Prospects for producing XUV bursts by laser-plasma interactions in the regime of relativistic electronic spring

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High-intensity lasers provide an opportunity to drive controllable, relativistic plasma dynamics through the irradiation of solids. In this way, the laser energy can be converted into extreme ultraviolet (XUV) radiation with tailored properties such as high brightness, ultra-short duration and tunable polarization. In the regime of relativistic electronic spring (RES), the irradiated plasma acts as a spring, repeatedly accumulating and releasing the incident energy in the form of XUV bursts within every optical cycle. These bursts can be a hundred times higher in intensity as compared to the incident radiation. This manifests a distinct difference from the relativistic oscillating mirror (ROM) regime, which implies subcycle phase variations without the change of amplitude. In our study, we analyse the prospects of using the RES regime for creating laser-based sources of tailored XUV pulses. We use the theoretical principles proposed in [1] to develop a theory of the process applicable to an arbitrary density profile, laser pulse shape and polarization [2]. The theory indicates that there are clear possibilities for tuning the ellipticity of the generated XUV bursts by adjusting the laser polarization and other interaction parameters [3]. We also demonstrate that the efficient generation of XUV bursts is achievable, and even enhanced, by the density gradients that naturally emerge in laser-solid interactions due to the effect of finite contrast [4]. Finally, we assess the possibility of using the generated XUV busts for driving wake-fields in solids [5].

References:

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