

P4.2018 Physics of the laser-plasma interface in the relativistic regime of interaction

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See the full abstract here:

<http://ocs.ciemat.es/EPS2019ABS/pdf/P4.2018.pdf>

The interaction between relativistically intense lasers and near-critical plasmas is a rich field of study, both for basic and applied science, e.g. providing the possibility for producing singularly intense and short XUV bursts of radiation. There are several models describing the highly complex and nonlinear dynamics at the surface of interaction between the laser and the plasma. The relativistic electron spring (RES) model [1] constitutes an example of such, which accurately describes the position and radiation from the electron sheath formed at the vacuum-plasma interface. However, the model assumes that the sheath has zero thickness, limiting the possibilities to describe the peak intensity and duration of XUV-bursts, which appear as a singularity of the theory, e.g. depending on the γ -factors for electrons in the sheath. Here, we show that the RES model can be extended to include a description of the γ -distribution of electrons, which is proportional to the thickness of the sheath, or equivalently to its total energy. Guided by analytical estimates and simulations, it is indicated that the layer thickness $\Delta x \sim a_0^\alpha$, with $\alpha \sim 0.5$, which implies that the similarity normalized quantities $\gamma_{\text{max}}/a_0^2$, where max is the maximum γ -factor, as well as W/a_0^2 , where W is the energy in the sheath, go to zero for high a_0 , showing that a description of properties of the layer relevant for applications (such as the generation of high harmonics) goes beyond S-parameter similarity.

References

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- [2] B. Svedung Wettervik, M. Marklund, A. Gonoskov, Physics of the laser-plasma interface in the relativistic regime of interaction, arXiv:1901.04175 [physics.plasm-ph], 2019.

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