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Onset of the formation of ultra-intense single cycle laser pulses in plasmas JORGE VIEIRA, FREDERICO FIUZA, LUIS SILVA, Instituto Superior Tecnico, WARREN MORI, University of California, Los Angeles — The formation of ultra-intense single cycle few-fs laser pulses in plasmas is dominated by self-steepening. In this work the onset of self-steepening is examined using the photon-kinetic equations. Known results regarding the self-compression of long laser pulses are readily recovered and generalized. In the short pulse limit, the threshold, and initial rates for self-steepening are determined. Our results suggest that initially mildly relativistic plasma responses provide ideal conditions both for the on-set of self-steepening and also for ultra-short/intense laser pulse generation. In addition, it is shown that the on-set of longitudinal modulations occurs first, but at a slower rate than the transverse self-focusing. We present 3D PIC simulations illustrating the process, and find very good agreement between the model and 1D PIC simulations in OSIRIS. A physical picture of the process suggests that self-steepening is similar to longitudinal asymmetric self-focusing.

Jorge Vieira
Instituto Superior Técnico

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