2.5D Adaptive Mesh PIC-Vlasov Hybrid Method for Laser-Matter Interactions in the Presence of Strong Gradients

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The ultra-intense laser light interaction with solid targets [1,2] is characterized with high gradients of the plasma density, $n_p^{\max}/n_{cr} \approx 100$, which makes direct PIC modeling questionable from both numerical accuracy and numerical efficiency standpoints. Presently we are developing a hybrid approach to resolve these two issues. To capture moving sharp fronts we deploy adaptive quadrilateral grid RRC method [3,4], which automatically follows high-gradient region. To assure accurate resolution of the phase space and reduce statistical noise, the PIC-Vlasov hybrid method [5,6] was expanded to the relativistic case and combined with the adaptive mesh. We discuss the peculiarities of the new numerical procedure, including electromagnetic solver and the gather-scatter algorithms realization on the RRC mesh, PIC-Vlasov step, etc. We will demonstrate the efficiency of the new hybrid scheme by simulating a thin foil irradiation with a micron-sized CPA laser spot at the relativistic vacuum field intensity.

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