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**Modeling of Laser wakefield acceleration in the Lorentz boosted frame using UPIC-EMMA and OSIRIS** PEICHENG YU, UCLA, XINLU XU, Tsinghua University Beijing, VIKTOR DECYK, FRANK TSUNG, UCLA, JORGE VIEIRA, RICARDO FONSECA, IST Portugal, WEI LU, Tsinghua University Beijing, LUIS SILVA, IST Portugal, WARREN MORI, UCLA, UCLA TEAM, TSINGHUA UNIVERSITY BEIJING TEAM, IST PORTUGAL TEAM — We present the capability of investigating physics of laser wakefield accelerator (LWFA) in nonlinear regimes using various approaches. This includes simulating the physics using OSIRIS 3D code in the lab and boosted frame. We also implemented hybrid 3D algorithm into OSIRIS which uses an algorithm with a PIC description in r-z and a gridless description in phi [A.F. Lifschitz, et. al., JCP. 228, 1803 (2009)]. This algorithm greatly reduce the computation load by describing the three-dimensional (3D) physics problem of laser-plasma interaction with essentially two-dimensional if the expansion is truncated. The hybrid 3D OSIRIS code can be used to simulate the nonlinear physics in LWFA in both lab and boosted frames. Combining the hybrid 3D and boosted frame approaches potentially provides unprecedented speedups. Furthermore, we can simulate the same problems in a boosted frame using the spectral EM-PIC code UPIC-EMMA which solves the Maxwell's equation in Fourier space. By applying a recipe to systematically reduce the numerical Cerenkov instability (NCI) in the spspectral code, we are able to conduct LWFA Lorentz boosted frame simulation at arbitrary gamma with no signs of NCI.

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