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Laser and Beam Hybrid Wakefield Accelerator TIANHONG WANG, School of Applied and Engineering Physics, Cornell University, VLADIMIR KHUDIK, Department of Physics, The University of Texas at Austin, GENNADY SHVETS, School of Applied and Engineering Physics, Cornell University — We report a new wakefield acceleration scheme where a laser pulse and an electron driver bunch are overlapped to drive a wakefield in the blowout regime. The laser pulse can provide direct laser acceleration (DLA) to the driver bunch. The driver bunch is then accelerated through the DLA mechanism instead of being decelerated by its wakefield [1], and its propagation distance is extended by several times. Additionally, the plasma channel sustained by the driver bunch also helps to guide the laser pulse by creating a plasma bubble. This combination can achieve 10GeV energy gain of the electron at a single stage. We also describe the simulation tool we used: an efficient full 3D quasi-static PIC code with the ability to capture sophisticated particle-laser resonance interactions over distances exceeding tens of centimeters. This code solves simple and advanced quasi-static equations[2] without complicate predict-correct algorithm. An in-house parallel multigrid algorithm is developed which shows good scalabilities on the machine with thousands of cores. Comparison between the new code and the first-principle PIC code will be presented. [1] V. N. Khudik, et al. Physics of Plasmas 25.8 (2018): 083101. [2] T. Wang, et al. Physics of Plasmas 24.10 (2017): 103117.

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