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The Multi Level Multi Domain (MLMD) method: a semi-implicit adaptive algorithm for Particle In Cell plasma simulations MARIA ELENA INNOCENTI, KU Leuven, Leuven, Belgium, ARNAUD BECK, Laboratoire Leprince-Ringuet, Ecole Polytechnique, CNRS-IN2P3, France, STEFANO MARKIDIS, HPCViz Department, KTH Royal Institute of Technology, Stockholm, Sweden, GIOVANNI LAPENTA, KU Leuven, Leuven, Belgium — Particle in Cell (PIC) simulations of plasmas are not bound anymore by the stability constraints of explicit algorithms. Semi implicit and fully implicit methods allow to use larger grid spacings and time steps. Adaptive Mesh Refinement (AMR) techniques permit to locally change the simulation resolution. The code proposed in Innocenti et al., 2013 and Beck et al., 2013 is however the first to combine the advantages of both. The use of the Implicit Moment Method allows to taylor the resolution used in each level to the physical scales of interest and to use high Refinement Factors (RF) between the levels. The Multi Level Multi Domain (MLMD) structure, where all levels are simulated as complete domains, conjugates algorithmic and practical advantages. The different levels evolve according to the local dynamics and achieve optimal level interlocking. Also, the capabilities of the Object Oriented programming model are fully exploited. The MLMD algorithm is demonstrated with magnetic reconnection and collisionless shocks simulations with very high RFs between the levels. Notable computational gains are achieved with respect to simulations performed on the entire domain with the higher resolution. Beck A. et al. (2013). submitted. Innocenti M.E. et al. (2013). JCP, 238(0):115-140

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