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AN IMPICIT "DRIFT-LORENTZ" PARTICLE MOVER FOR PLASMA AND BEAM SIMULATIONS

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In order to efficiently perform particle simulations in systems with widely varying magnetization, we have developed a "drift-Lorentz mover", which interpolates between full particle dynamics and drift kinetics in such a way as to preserve a physically correct gyroradius and particle drifts for both large and small ratios of the timestep to the cyclotron period.[1]. In order to extend applicability of the mover to systems with plasma frequency exceeding the cyclotron frequency – such as one may have with fully neutralized drift compression of a heavy-ion beam – we have developed an implicit version of the mover. A first step in this direction, in which the polarization charge was added to the field solver, was described previously[2]. Here we describe a fully implicit algorithm (which is analogous to the direct-implicit method for conventional particle-in-cell simulation[3]), a stability analysis of it, its implementation in the WARP code, and several tests of the resultant code. The fully implemented version is electrostatic; we are beginning development of an electromagnetic version, and describe also the status of that effort.

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