Progress on an energy-conserving, asymptotic-preserving orbit integrator for implicit PIC simulations of arbitrarily magnetized plasmas[1]
LEE RICKETSON, Lawrence Livermore Natl Lab, LUIS CHACN, GUANGYE CHEN, Los Alamos Natl Lab — We build on previous work [1], which developed an implicit, asymptotic preserving (AP) time-integrator for charged particle motion that (a) correctly recovers guiding center motion when stepping over the gyro-period, (b) converges to full-orbit motion in the small time-step limit, and (c) conserves energy exactly. We extend the scheme to additionally capture the finite Larmor radius effects that appear in many applications. This is done by alternating large and small time-steps in a coordinated fashion. New restrictions on time-step size are derived, which leads to an adaptive time-stepping strategy. Results from simple test problems verify the AP behavior and strict conservation properties. Finally, we report on progress in implementing the new method in an implicit PIC scheme [2]. [1] L.F. Ricketson, and L. Chacón. Journal of Computational Physics (2020): 109639. [2] G. Chen, L. Chacón, and D.C. Barnes. Journal of Computational Physics 230.18 (2011): 7018-7036.

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