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Accelerated Monte Carlo Methods for Coulomb Collisions[1] RUSSEL CAFLISCH, RICHARD WANG, YANGHONG HUANG, University of California, Los Angeles, BRUCE COHEN, ANDRIS DIMITS, Lawrence Livermore National Laboratory — We present accelerated computational method for Coulomb collisions in a plasma, through significant improvements in our earlier hybrid method that combines a Monte Carlo particle simulation and a fluid dynamic solver in a single uniform method throughout phase space. We derive an improved formulation of the detailed balance constraint on the thermalization and dethermalization probabilities. We define a parameterized set of thermalization and dethermalization probabilities and optimize the choice of parameters to achieve the fastest computation time for a specified accuracy level. We mathematically analyze the validity of the thermalization and dethermalization step in the context of a simple drift-diffusion model that includes long range interactions as in Coulomb collisions. Finally, we formulate a higher order stochastic method for solving the drift diffusion model using a Milstein correction.

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