Abstract Submitted
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Accelerated Monte Carlo Methods for Coulomb Collisions[1] MARK ROSIN, LEE RICKETSON, Univ of California - Los Angeles, ANDRIS DIMITS, Lawrence Livermore National Lab, RUSSEL CAFLISCH, Univ of California - Los Angeles, BRUCE COHEN, Lawrence Livermore National Lab — We present a new highly efficient multi-level Monte Carlo (MLMC) simulation algorithm for Coulomb collisions in a plasma. The scheme, initially developed and used successfully for applications in financial mathematics, is applied here to kinetic plasmas for the first time. The method is based on a Langevin treatment of the Landau-Fokker-Planck equation and has a rich history derived from the works of Einstein and Chandrasekhar. The MLMC scheme successfully reduces the computational cost of achieving an RMS error ϵ in the numerical solution to collisional plasma problems from $\mathcal{O}(\epsilon^{-\ni})$ - for the standard state-of-the-art Langevin and binary collision algorithms - to a theoretically optimal $\mathcal{O}(\epsilon^{-\in})$ scaling, when used in conjunction with an underlying Milstein discretization to the Langevin equation. In the test case presented here, the method accelerates simulations by factors of up to 100. We summarize the scheme, present some tricks for improving its efficiency yet further, and discuss the method's range of applicability.

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