Abstract Submitted
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LightningBoltz: a distributed spectral solver for the Boltzmann equation GEORGE WILKIE, Princeton Plasma Physics Laboratory — The Boltzmann equation forms the foundation of almost all of plasma physics, as well as other subfields of physics and engineering. Recent advances in applied mathematics have made routine direct numerical solution well within reach. A conservative spectral method is being applied to obtain more accurate coupling between high fidelity gyrokinetic and neutral simulation models. In addition, a standalone solver for more general application has been developed. Recent advances include the addition of spatial dependence, field acceleration, and implicit time-stepping. The algorithm has been benchmarked against a manufactured solution for Maxwell molecules, and against the Chapman-Enskog fluid expansion at low Knudsen number. Results for electron swarm parameters in weakly ionized plasmas are compared with other approaches to solving the Boltzmann equation. One-dimensional simulation of neutrals under detachment conditions is also demonstrated as a proof-of-principle. The precomputed discrete collision operators allow all these cases to be run locally on a workstation or laptop, even with the nonlinear collision operator.

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