PPPS 2019



Contribution ID: 943

Type: Poster

2P27 - PIC-DSMC numerical grid heating in collisional plasmas: Application to streamer discharge simulations

Tuesday 25 June 2019 13:00 (1h 30m)

Numerical heating due to the mesh size being larger than the Debye length is well understood for collisionless PIC simulations [1]. However, the importance of grid heating in collisional, partially ionized plasmas such as streamer discharges is less understood. In these plasma regimes the artificial heating of the plasma can, at least theoretically, be mitigated by collisional energy transfer to the dense background gas. On the other hand, elastic energy transfer is extremely inefficient and by inaccurately increasing the electron temperature both the electronic excitation and ionization rates will increase, potentially leading to significant error in the plasma evolution and the streamer channel density and temperature. To some extent, whether one cares about the numerical error introduced depends on the quantity of interest. Specifically, while the density and temperature of the streamer channel may not affect the streamer velocity or branching, it would most likely change the current carried through the channel. In the present work we investigate how numerical heating in collisional plasmas affect various quantities such as the electron energy distribution function and net ionization coefficient for several cases across a range of mesh sizes. The cases include a 0D, extremely low E/n plasma representing the streamer channel, a 1D fixed-field "electron avalanche" case representing the streamer tip region, and a 2D simulation of a streamer.

[1] C.K. Birdsall and A.B. Langdon, Plasma Physics via Computer Simulation (2005).

 Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

Authors: MOORE, Chris (Sandia National Labs); JINDAL, Ashish (Sandia National Laboratories); FIERRO, Andrew (Sandia National Laboratories); CARTWRIGHT, Keith (Sandia National Laboratories); HOPKINS, Matthew (Sandia National Laboratories)

Presenter: MOORE, Chris (Sandia National Labs)

Session Classification: Poster - Microwave Generation and Plasma Interactions and Pulsed Power Switches and Components

Track Classification: 2.5 Codes and Modeling