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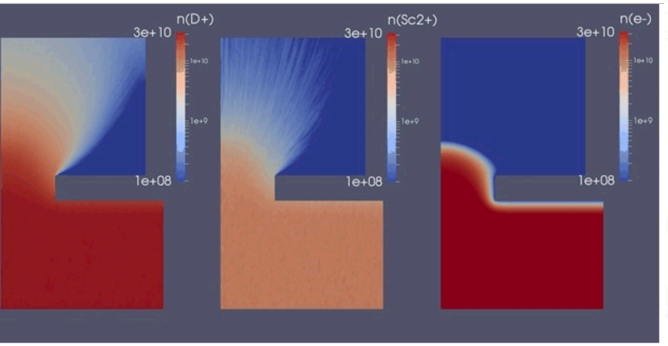

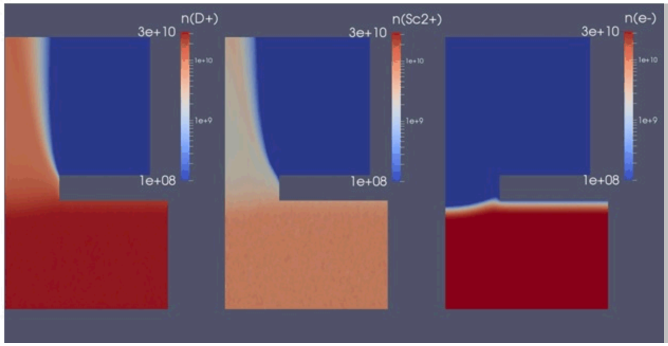

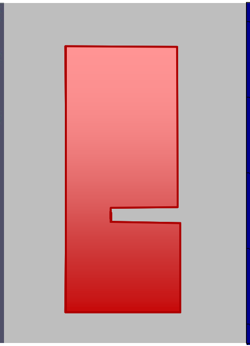

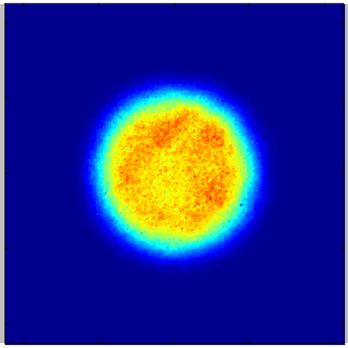

Arc Initiation and Plasma Transport

Grillet, 01513, 181169 / 05.12.01

FY16 Q2 P&EM Reporting NewsNote

March 10, 2016

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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Arc Initiation and Plasma Transport

Grillet, 01513, 181169/05.12.01

P&EM News Note:

Aleph Collision Algorithm Verification: Sandia is developing Aleph as an advanced plasma transport and kinetics simulation code to improve science based design of NW components. Atomistic collision and energy partitioning algorithms have been rigorously verified against published data for the plasma modeling code Aleph. Using a model problem of heat flux through a rarified gas, we have shown that the Aleph algorithms converge as expected over a range of time and spatial discretizations. Heat flux is a sensitive function of many atomic scale processes including collision rates between atoms, how atoms pick up energy from surfaces and also how energy is distributed between particles after a collision. Aleph demonstrated linear convergence in both space and time. Since most plasma applications utilize discretizations that are at least an order of magnitude smaller then shown in the graph below in order to correctly resolve other plasma dynamics, the errors in calculating energy transfer are expected to be minimal. These ASC PE&M funded studies give our NW component designers confidence that Aleph can correctly predict atomic momentum and energy transfer processes for their applications. This supports out ultimate goal of enabling science based design of complex multi-physics plasma devices with Aleph. (POC: Anne M. Grillet, amgrill@sandia.gov)

Summary: Researchers have rigorously verified collision and energy partitioning algorithms to give our users confidence that Aleph can correctly predict these atomic processes for their applications.

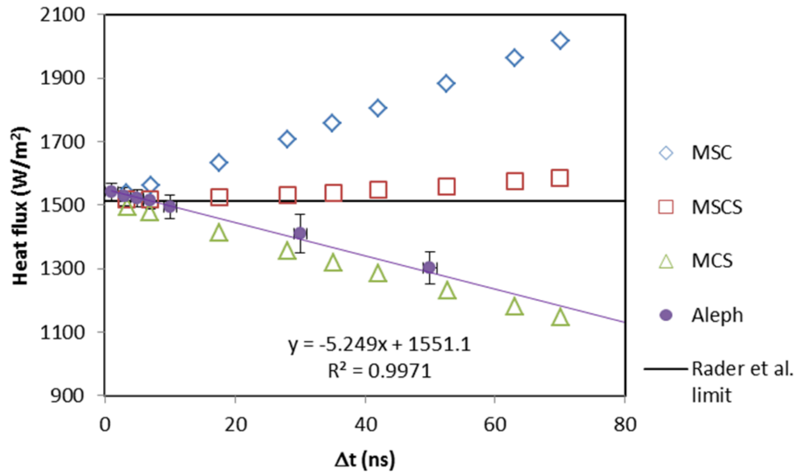

Figure: The calculated heat flux in a rarified gas as a function of temporal discretization showing the expected first order convergence behavior compared to published results by Rader et al. (2006) for several Direct Simulation Monte Carlo algorithms.