Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Positivity-Preserving Space-Time DG-FEM for Kinetic Vlasov Models of Plasma[1] DAVID SEAL, JAMES ROSSMANITH, University of Wisconsin - Madison — The Vlasov system describes the evolution of a collisionless plasma, represented through one or more PDFs that interact via electromagnetic forces. One of the main difficulties in numerically solving this system is the severe time-step restriction that arises from parts of the PDF associated with large velocities. The dominant approach in the plasma physics community for removing these time-step restrictions is the so-called particle-in-cell (PIC) method, which discretizes the distribution function into a set of macro-particles, while the electromagnetic field is represented on a mesh. In this work we present an alternative to the PIC methodology using high-order space-time DG-FEM. A novel aspect of this work is that we formulate the method in such a way that the most expensive part of the numerical update (i.e., the solution of a large system of algebraic equation) is linear. Positivity-preserving limiters are developed that ensure that the numerically computed solution remains physical. The proposed method is applied to several test cases.

[1]This work was supported in part by NSF grants DMS-0711885 and DMS-1016202.

James Rossmanith
University of Wisconsin - Madison

Date submitted: 15 Jul 2011 Electronic form version 1.4