Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

A Fluid-Kinetic Particle-in-Cell Solver[1] STEFANO MARKIDIS, High Performance Computing and Visualization (HPCViz) Department, KTH Royal Institute of Technology, PIERRE HENRI, University of Pisa, GIOVANNI LAPENTA, KU Leuven, KJELL RONNMARK, MARIA HAMRIN, Umea University, ERWIN LAURE, High Performance Computing and Visualization (HPCViz) Department, KTH Royal Institute of Technology — A fluid solver that retains kinetic effects by using the Particle-in-Cell (PIC) algorithm is presented in the context of future coupled fluid-kinetic plasma simulations. The fluid continuity and momentum equations together with the second order formulation of Maxwell's equations are solved concurrently using the finite volume box scheme. The pressure tensor in the fluid momentum equation is self-consistently computed using the computational particles. The electric field is corrected to take into account the discrepancies between the fluid densities calculated from the fluid equation and the one calculated directly from the computational particles. The magnetic field is determined from Faraday's law. Finally, the position and velocity of the computational particles are advanced in time. The fluid-kinetic PIC solver is implemented starting from the iPIC3D code, a massively parallel fully kinetic code. The fluid-kinetic PIC solver method could be used in spatial regions where kinetic effects are important, while a traditional fluid solver would be used in regions of space where the kinetic effects are negligible to save computational time. Therefore, the proposed scheme is a promising approach for coupling fluid and kinetic methods in a unified framework.

[1]This research has received funding from the European Commission's FP7 Program inside the grant agreements CRESTA (cresta-project.eu) and SWIFF (swiff.eu)

Stefano Markidis
High Performance Computing and Visualization (HPCViz) Department,
KTH Royal Institute of Technology

Date submitted: 20 Jul 2012 Electronic form version 1.4