Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Development of high performance particle in cell code for the exascale age[1] GIOVANNI LAPENTA, JORGE AMAYA, KU Leuven, DIEGO GONZALEZ, KU Leuven-Herrero, DEEP-EST H2020 CONSORTIUM COLLABORATION[2] — Magnetized plasmas are most effectively described by magneto-hydrodynamics, MHD, a fluid theory based on describing some fields defined in space: electromagnetic fields, density, velocity and temperature of the plasma. However, microphysics processes need kinetic theory, where statistical distributions of particles are governed by the Boltzmann equation. While fluid models are based on the ordinary space and time, kinetic models require a six dimensional space, called phase space, besides time. The two methods are not separated but rather interact to determine the system evolution. Arriving at a single self-consistent model is the goal of our research. We present a new approach developed with the goal of extending the reach of kinetic models to the fluid scales. Kinetic models are a higher order description and all fluid effects are included in them. However, the cost in terms of computing power is much higher and it has been so far prohibitively expensive to treat space weather events fully kinetically. We have now designed a new method capable of reducing that cost by several orders of magnitude making it possible for kinetic models to study macroscopic systems. [1] Lapenta et al, JCP, 334 (2017): 349-366. JPP, 83.2 (2017).

[1]H2020 Deep-EST consortium (European Commission)
[2]http://www.deep-projects.eu/

Giovanni Lapenta
KU Leuven

Date submitted: 14 Jul 2017 Electronic form version 1.4