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Rethinking Electrostatic Solvers in Particle Simulations for the Exascale Era JAN DECA, Centre for Plasma Astrophysics/KU Leuven, STEFANO MARKIDIS, High Performance Computing and Visualization Department/KTH Royal Institute of Technology, GIOVANNI LAPENTA, Centre for Plasma Astrophysics/KU Leuven, ERIK JÁRLEBERG, ROSSEN APOSTOLOV, ERWIN LAURE, High Performance Computing and Visualization Department/KTH Royal Institute of Technology, CENTRE FOR PLASMA ASTROPHYSICS/KU LEUVEN TEAM, HIGH PERFORMANCE COMPUTING AND VISUALIZATION DEPARTMENT/KTH ROYAL INSTITUTE OF TECHNOLOGY TEAM — In preparation to the exascale era, an alternative approach to calculate the electrostatic forces in Particle Mesh (PM) methods is proposed. While the traditional techniques are based on the calculation of the electrostatic potential by solving the Poisson equation, in the new approach the electric field is calculated by solving Ampère's law. When the Ampere's law is discretized explicitly in time, the electric field values on the mesh are simply updated from the previous values. In this way, the electrostatic solver becomes an embarrassingly parallel problem, making the algorithm extremely scalable and suitable for exascale computing platforms. An implementation PM code with the new electrostatic solver is presented to show that the proposed method produces correct results. It is a very promising algorithm for exascale PM simulations.

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