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Charge conserving current deposition scheme for PIC simulations in modified spherical coordinates[1] F. CRUZ, T. GRISMAYER, R.A. FONSECA, L.O. SILVA, GoLP/IPFN, Instituto Superior Tecnico, Lisbon, Portugal — Global models of pulsar magnetospheres have been actively pursued in recent years. Both macro and microscopic (PIC) descriptions have been used, showing that collective processes of e-e+ plasmas dominate the global structure of pulsar magnetospheres. Since these systems are best described in spherical coordinates, the algorithms used in cartesian simulations must be generalized. A problem of particular interest is that of charge conservation in PIC simulations. The complex geometry and irregular grids used to improve the efficiency of these algorithms represent major challenges in the design of a charge conserving scheme. Here we present a new first-order current deposition scheme for a 2D axisymmetric, log-spaced radial grid, that rigorously conserves charge. We benchmark this scheme in different scenarios, by integrating it with a spherical Yee scheme and Boris/Vay pushers. The results show that charge is conserved to machine precision, making it unnecessary to correct the electric field to guarantee charge conservation. This scheme will be particularly important for future studies aiming to bridge the microscopic physical processes of e-e+ plasma generation due to QED cascades, its self-consistent acceleration and radiative losses to the global dynamics of pulsar magnetospheres.

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Fabio Cruz
GoLP/IPFN, Instituto Superior Tecnico, Lisbon, Portugal

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