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Particle-in-cell simulations of neutron star magnetospheres including general relativity effects[1] RUI TORRES, FABIO CRUZ, THOMAS GRISMAYER, LUIS SILVA, Instituto Superior Tecnico — The magnetospheres of compact objects such as neutron stars and black holes, commonly connected to some of the most violent events in the Universe, are complex systems that comprise quantum electrodynamic (QED) processes, kinetic-scale pair plasma physics and general relativity (GR). To study such intricate and exotic systems, advanced simulation techniques are required. In this work, we present a GR module recently developed for the particle-in-cell code OSIRIS, including a field solver and a new particle pusher for arbitrary curvilinear coordinate systems. We present two-dimensional simulations performed with this GR-PIC module of neutron star magnetospheres, and discuss the differences in the plasma current distribution in the vicinity of the star when compared to classical simulations of these systems for different ratios between the Schwarzschild and the stellar radii. We also discuss preliminary steps to extend this code to simulate black hole magnetospheres.

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