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A fluid-kinetic model for describing geometrically complex systems

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In describing the evolution of collisionless space plasmas one of the main problem is to catch, at the same time, the global fluid-like evolution of large-scale structures and the kinetic behaviour of the medium itself. Kinetic processes, in turn, are not simply superposed to the large-scale dynamics but are able to strongly influence the global evolution, as in the case of magnetic reconnection or small-scale turbulence. Furthermore the geometrical complexity of several systems should be treated using non-trivial boundary conditions that are able to manage plasma configurations with strong gradients at the boundaries of the domain of interest.
For this reason we implemented numerically a new model that is able to retain, in a fluid framework, the dominant kinetic effects for the evolution of the large scales, i.e electron inertia terms, anisotropic pressure, finite Larmor radius effects and linearised Landau damping. Its great advantage over full-kinetic models is the possibility of adopting open boundary conditions, based on projected MHD characteristics, that allow us to have non-reflecting boundaries, to inject waves and turbulences from the boundaries and, above all, to study the evolution of complex equilibrium configurations.
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