Near-Earth space in five and six dimensions: recent results from the Vlasiator model

Lucile Turc*[1]

[1]Department of Physics, University of Helsinki – Finlande

Résumé

Vlasiator is an open-source hybrid-Vlasov model developed at the University of Helsinki and designed to perform global simulations of the solar wind-magnetosphere interaction at Earth. In the hybrid-Vlasov approach, electrons are a massless charge-neutralising fluid while ions are modelled as velocity distribution functions, governed by Vlasov's equation, thereby enabling a self-consistent description of ion kinetic processes. Vlasiator employs the full strength of the Earth's dipole and thus provides results that are directly comparable with spacecraft observations without additional rescaling. This allows studying ion kinetic processes in their global context, revealing how local processes affect global dynamics and vice-versa. Because of the large computational cost of the hybrid-Vlasov approach, most studies employing Vlasiator have been to date limited to two dimensions in ordinary space. However, recent developments to the code, including the addition of adaptive mesh refinement, are now allowing us to run the model in 6D – 3 dimensions in ordinary space and 3 dimensions in velocity space – opening up a whole new realm of investigations. In this presentation, I will review some of the recent studies carried out with Vlasiator, ranging from foreshock processes on the dayside to nightside tail dynamics, and I will discuss the importance of the global view provided by simulations to refine our understanding of near-Earth space dynamics.

*Intervenant