



3D kinetic simulations of the global interaction between the solar wind and the magnetosphere

Jorge Amaya, Yana Maneva, Jan Deca, and Giovanni Lapenta
Centre for mathematical Plasma-Astrophysics, KU Leuven, Belgium

We performed three dimensional simulations of the interaction between the solar wind and the magnetosphere, using the self-consistent fully kinetic code iPic3D. The main objective of our simulations is to link the global interaction phenomena to the local turbulence and reconnection processes in the magnetosphere. Other numerical approaches have been used before to study this problem, including MHD, hybrid and Vlasov codes. However, only particle-in-cell codes offer the possibility to study the kinetic effects of the diffusion regions of the Earth environment that drive the energy transfer from the solar wind to the magnetosphere. Previous attempts to perform such kinds of simulations were limited to unphysical thermal velocities of the ion and electron species, small simulation boxes or cell sizes that do not capture the local kinetic effects at the magnetopause. Using the implicit moment Particle-in-Cell approach we performed simulations that can capture these small scale effects and, at the same time, allow to study large scale phenomena such as the bow shock and the development of the magnetotail. We expect that these results will be used to maximize the impact of future space missions, such as THOR, MMS and BepiColombo, by improving our understanding of the planetary environment, from the conditions observed in the solar wind to the turbulence and reconnection processes downstream of the bow shock.