

Abstract Submitted
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New Breakthroughs and Challenges in Kinetic Simulations of the Magnetosphere YURI OMELCHENKO, H. KARIMABADI, X. VU, V. ROYTERSHTEYN, SciberQuest, Inc/UCSD, B. LORING, LBNL — Global magnetospheric simulations have long been carried out with MHD. These simulations have proven useful in studies of the global dynamics of the magnetosphere with the goal of predicting eminent features of substorms and other global events. However, it is well known that the magnetosphere is dominated by kinetic ion and electron effects, and many key aspects of the magnetosphere relating to transport and structure of boundaries await global kinetic simulations. With the advent of petascale computing and a number of recent algorithmic innovations, we have been able to conduct first-ever 3D global hybrid (electron fluid, kinetic ions) and 2D global full PIC simulations. Here we show several specific science issues that we have been able to address for the first time. This includes formation of flux transfer events at the dayside magnetopause and associated flows, plasma depletion layer, and flux ropes in the magnetotail. We also discuss new models for extended hybrid simulations as well as the proposed coupling of global hybrid simulations with physically driven ionospheric models which include ion outflow.

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