

Prof. David Burgess

Title: Hybrid Simulation Techniques for Space Plasmas

Abstract.

In many space plasmas the overall system size is large enough for protons to govern much of the physical processes operating in the system and particularly at boundaries within the system. This can be understood by considering that a perturbation which steepens from fluid/MHD scales first encounters proton kinetic scales. Electron and minority ions effects play additional roles at smaller and larger scales, respectively. In order to model the kinetic effects of ion physics in space plasma systems, the so-called hybrid simulation technique is widely used. Ions are treated as simulation particles, but the electron response is modelled using a fluid description. This provides a compromise between MHD and full particle simulations, which captures ion kinetic effects. The foundations and numerical methods used in hybrid simulations are reviewed, as well as some examples.