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Analysis of the Alfvenic transition layer at the outer boundary of the cusp: 3D large scale PIC simulation

DongSheng Cai (1), Bertrand Lembege (2), Amin Esmaeili (1), and Ken-ichi Nishikawa (3)

(1) University of Tsukuba, CS, Tsukuba, Japan (cai@cs.tsukuba.ac.jp), (2) LATMOS-CNRS-UVSQ-IPSL, 11 Boulevard D'Alembert 78120 , Guyancourt, France (e-mail: bertrand.lembege@latmos.ipsl.fr) , (3) NASA-Huntsville, Huntsville, USA (e-mail: Ken-Ichi.Nishikawa-1@nasa.gov)

Statistical experimental observations of the cusp boundaries from CLUSTER mission made by Lavraud et al. (2005) have clearly evidenced the presence of a transition layer inside the magnetosheath near the outer boundary of the cusp, This layer charaterized by Log(MA)=1 allows a transition from superAlfvenic to subAlfvenic bulk flow from the exterior to the interior side of of the outer cusp and has been mainly observed experimentally as the interplanetary magnetic field (IMF) is Northward. The role of this layer is important in order to understand the flow variations (and later the entry and precipitation of particles) when penetrating the outer boundary of the cusp. In order to analyse this layer, very large 3D PIC simulations of the global solar wind-terrestrial magnetosphere interaction have been performed, and the attention has been focussed on the cusp region and its nearby surroundings only. Present results retrieve quite well the presence of this layer within the meridian plane for exactly Northward IMF, but its location differs in the sense that it is located slightly below the X reconnection region associated to the nearby magnetopause (above the outer boundary of the cusp). In order to clarify this question, an extensive study has been performed by performing: (i) a 3D mapping of this transition layer in order to analyze more precisely the possible spatial extension of this layer on the magnetosphere flanks for a fixed Northward IMF orientation; (ii) a parametric study in order to analyze the impact of the IMF direction outside Northward on the main features of this transition layer.