Geophysical Research Abstracts
Vol. 17, EGU2015-2764, 2015
EGU General Assembly 2015

Evidence of downstream high speed jets by a non-stationary and rippled front of quasi-parallel shock: 2-D hybrid simulations

Yufei Hao (1,2), Quanming Lu (1,2), Bertrand Lembege (3), Can Huang (1), Mingyu Wu (1), Fan Guo (4), Lican Shan (1), Jian Zheng (5), and Shui Wang (1)

(1) CAS Key LGE, USTC, DGPS, Hefei 230026, China (yfhao11@gmail.com;qmlu@ustc.edu.cn), (2) CICAST, Harbin 150000 , China. (qmlu@ustc.edu.cn), (3) LATMOS-UVSQ, Guyancourt, 78240, France(lembege@latmos.ipsl.fr), (4) LANL, Los Alamos, New Mexico, 87545, USA(guofan.ustc@gmail.com), (5) CAS Key LGE, DMP, USTC, Hefei 230026, China(jzheng@ustc.edu.cn)

Experimental observations from space missions (including Cluster more recently) have clearly revealed the existence of high speed jets (HSJ) in the downstream region of the quasi-parallel terrestrial bow shock. Presently, two-dimensional (2-D) hybrid simulations are performed to reproduce and investigate the formation of such HSJ through a rippled quasi-parallel shock front. The simulation results show (i) that such shock fronts are strongly nonstationary (self reformation) along the shock normal, and (ii) that ripples are evidenced along the shock front as the upstream ULF waves (excited by interaction between incoming and reflected ions) are convected back to the front by the solar wind and contribute to the rippling formation. Then, these ripples are inherent structures of a quasi-parallel shock and the self reformation of the shock is not synchronous along the surface of the shock front. As a consequence, new incoming solar wind ions interact differently at different locations along the shock surface, and some can be only deflected (instead of being decelerated) at locations where ripples are large enough to play the role of local « secondary » shock. Therefore, the ion bulk velocity is also different locally after ions are transmitted dowstream, and local high-speed jets patterns are formed somewhere downstream.
After a short reminder of main quasi-parallel shock features, this presentation will focus (i) on experimental observations of HSJ, (ii) on our preliminary simulation results obtained on HSJ, (iii) on their relationship with local bursty patterns of (turbulent) magnetic field evidenced at the front, and (iv) on the spatial and time scales of HSJ to be compared later on with experimental observations. Such downstream HSJ are shown to be generated by the nonstationary shock front itself and do not require any upstream perturbations (such as tangential/rotational discontinuity, HFA, etc..) to be convected by the solar wind and to interact with the shock front before penetrating downstream.