Geophysical Research Abstracts
Vol. 12, EGU2010-11159, 2010
EGU General Assembly 2010

2D PIC simulations of a curved supercritical shock: dynamics of the whistler precursor

Joël Stienlet (1), Philippe Savoini (1), and Bertrand Lembege (2)
(1) LPP, France (joel.stienlet@lpp.polytechnique.fr), (2) LATMOS, France

The whistler precursor emitted from the curved terrestrial shock front plays an important role in pre-decelerating and heating the incoming solar wind. Most previous works have mainly analyzed the features of the whistler precursor emission for a 1D planar shock where it is forced to propagate along the shock normal (Liewer and al, 1991) or to propagate obliquely with respect to a fixed shock normal direction in 2D planar shock simulation (Krauss-Varban et al., 1995). In the present case, the dynamics of the precursor is analyzed with the help of a 2D full particle simulation for a continuously curved shock within the angular range $90^o \geq \theta_{Bn} \geq 45^o$ where θ_{Bn} is the angle between the shock normal and the upstream magnetostatic field. Both electrons and ions dynamics are described by a self consistent approach. Our results show that (i) the whistler precursor extends far from the shock front mainly along the magnetostatic field (projected on the simulation plane) and not along the shock normal; (ii) the width of these curved wave fronts (precursor) strongly decreases when moving far from the shock front; (iii) at the shock front, the precursor is emitted within an angular range much larger than that predicted by linear theory; (iv) the damping rate of the whistler precursor is analyzed for different directions of the shock normal. Wave particle energy transfer is analysed, and these results will be discussed and compared with previous 1D and 2D simulations of planar shocks; (v) the whistler precursor is not monochromatic, and interferences between modes are evidenced by beats and wave-packets in front of the shock. The impact of this effect on damping rate measurements will be discussed.