EPSC Abstracts
Vol. 7 EPSC2012-781 2012
European Planetary Science Congress 2012

MHD fluctuations in the Saturn's magnetosheath

O. Gutynska (1,2), V. Génot (1) and N. André (1)
(1) IRAP, CNRS, 31028 Toulouse, France, (2) Charles University, Prague, Czech Republic

Abstract

The origin and shape of mirror structures are discussed using the observations of magnetic field and plasma data from Cassini spacecraft during 2004-2007 years. We find that these structures show typically large anticorrelation between plasma and magnetic field fluctuations together with large occurrence frequency of magnetic holes closer to the magnetopause. To propose a process of formation and evolution of mirror structures in the Saturn's magnetosheath we attempt to model the age of magnetic structures with an analytic flow model based on an approach similar to the Earth's magnetosheath case [1].

1. Introduction

The magnetosheath of Earth and other planets is typically a high-β, anisotropic environment. Particle reflection at the bowshock and the ion foreshock provide upstream sources of turbulence and free energy to drive local instabilities. On the other hand, magnetic filed line draping and compression at the magnetopause provide sources of free energy which are able to influence the local plasma and turbulence in the magnetosheath (e.g., [2, 3, 4]). Thus, the result is a turbulent magnetosheath with significant power over a wide range of the low-frequency spectrum ([5]).

In this study we investigate origine and shape of mirror structures in the Saturn's magnetosheath comparing the characteristics of waves in different regions.

2. Data set

Our analysis is based on magnetic field data (MAG, [6]) and plasma data (CAPS/ELS, [7]) observed by Cassini spacecraft during its orbiting through Saturn's magnetosheath (2004-2007 years). We used high resolution 1 s magnetic field and 288 s plasma data. The crosscorellations were computed on one hour time intervals. We used five minutes intervals to calculate the third standardized moments (skewness) of magnetic filed fluctuations. To determine magnetosheath boundaries positions we used [8] bowshock and [9] magnetopause models.

3. Summary and Conclusions

In this study we used a statistycal analisys of four years of Cassini observations of magnetic field and plasma density fluctuations. We use the cross-correlation between these two parameters over one hour time window as a rough classification of type of fluctuations. We calculate the skewness of magnetic field fluctuations over five minutes intervals as a critetion that characterise a shape of magnetic structures; it is negative (posive) when magnetic holes (peaks) are observed.

We study the spatial dependence of these two features. For this purpose we normalized the distance between the bowshock and magnetopause and we presented a radial profiles of cross-correlations between magnetic field and plasma density and profiles of skewness for different magnetosheath regions. We show that anticorrelation between plasma and magnetic field as well as negative skewness is observed closer to magnetopause. Using the approach of analitycal flow model similar to the Earth's magnetosheath case [1] we determine the age of mirror structures in the Saturn's magnetosheath.

Acknowledgements

The authors acknowledge the Cassini teams for the CAPS/ELS amd MAG data and the EU FP7 project Europlanet-RI (contract number 228319) http://www.europlanet-ri.eu/ for the support.

References

[1] Genot, V., et al. (2011), Annales Geophysicae, 29, 1849.

[2] Savin, S. P., et al. (2001), Turbulent Boundary Layer at the Border of Geomagnetic Trap, JETP Lett., 74, 547551, doi:10.1134/1.1450288.

[3] Savin, S., et al. (2002), On the properties of turbulent boundary layer over polar cusps, Nonlin. Proc. Geophys., 9, 443-451.

[4] Savin, S., et al. (2004), Magnetosheath-cusp interface, Ann. Geophys., 22, 183-212.

[5] Schwartz, S. J., D. Burgess, and J. J. Moses (1996), Low-frequency waves in the Earth's magnetosheath: present status, Ann. Geophys., 14, 11341150, doi:10.1007/ s005850050376.

[6] Dougherty et al., (2004), Space Science Reviews, Volume 114, Issue 1-4, pp. 331-383.

[7] Young D.T. et al. (2004), Space Science Reviews, Volume 114, Issue 1-4, pp. 1-112

[8] Went al. (2011), Journal of Geophysical Research, Volume 116, Issue A7, CiteID A07202.

[9] Kanani al. (2010), Journal of Geophysical Research, Volume 115, Issue A6, CiteID A06207.