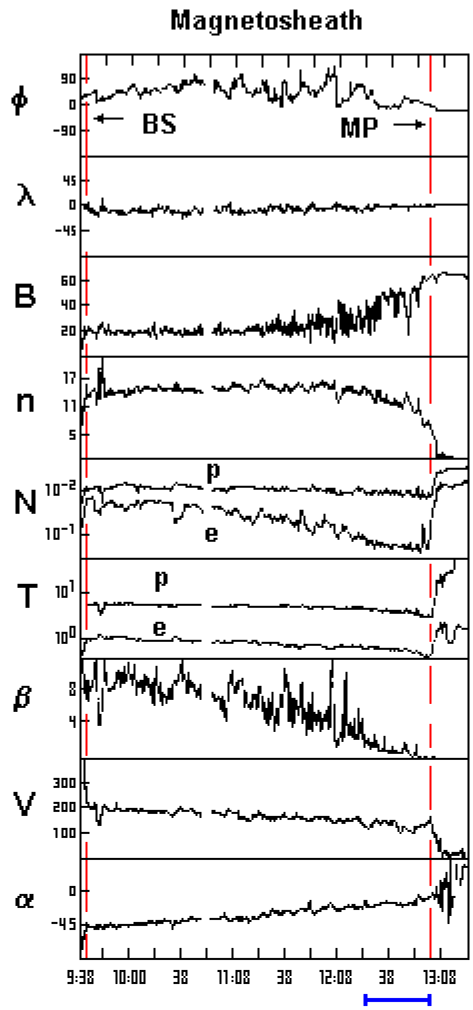
Magnetosheath

Introduction

The region between the bow shock and the magnetopause is called the magnetosheath. The particles in this region originate from the shocked solar wind, as can be defined from their charge state and composition (Gloeckler et al., 1986). The plasma density typically decreases from the bow shock to the magnetopause; however, it is always higher than the magnetospheric plasma density. The magnetic field is weaker than the magnetospheric field, and it is deflected from the near-IMF orientation in the outer magnetosheath toward a draped orientation near the magnetopause. Some of these basic features can be seen in the figure that shows an overview of inbound pass of magnetosheath at the equatorial plane (Phan et al., 1994). Note that energetic particles (N) are much more abundant in the magnetosphere than in the magnetosheath.



Plasma and magnetic field

Typical magnetosheath particle energies are 1 keV/e for ions and about 100 eV for electrons. Densities are typically around 20 cm^-3^. Fluctuations in the plasma (and also magnetic) parameters are very typical, and may be due to passages of solar wind features like shocks and tangential discontinuities or different types of waves. Variations can also be due to the radial gradient of the parameters combined with radial motion of the bow shock - magnetosheath - magnetopause system, which can be driven by changes in the IMF orientation (Sibeck and Gosling, 1996).

The angle between the magnetosheath and magnetospheric magnetic fields defines the magnetic shear across the magnetopause. When the magnetic shear is low (< 30 degrees), a **magnetosheath transition layer**, also called the "**plasma depletion layer**" is formed just outside the magnetopause (marked with the blue line in the figure). The magnetic field direction inside the magnetosheath is important also for the proposed merging process with the geomagnetic field. It is the north-south direction of the field that matters in that case.

Precipitation and other phenomena

The magnetosheath plasma forms an important part of the low energy dayside auroral precipitation. This is because the plasma has an entry to the ionosphere via the dayside cusps and the magnetospheric boundary layer.

A characteristic feature of magnetosheath is the existence of narrowband electromagnetic waves termed "lion roars" (see whistler waves). Just as many magnetospheric regions, also magnetosheath contains broadband electrostatic noise (BEN; Anderson et al., 1982).

References

- Anderson, R. R., C. C. Harvey, M. M. Hoppe, B. T. Tsurutani, T. E. Eastman, and J. Etcheto, Plasma waves near the magnetopause,*J. Geophys. Res., 87*, 2087-2107, 1982.
- Gloeckler, G., et al., Solar wind carbon, nitrogen and oxygen abundances measured in the Earth's magnetosheath with AMPTE/CCE, *Geophys. Res. Lett., 13*, 793, 1986.
- Phan, T.-D., G. Paschmann, W. Baumjohann, N. Sckopke, and H. Luhr, The magnetosheath region adjacent to the dayside magnetopause: AMPTE/IRM observations, *J. Geophys. Res., 99*, 121-141, 1994.
- Sibeck, D. G., and J. T. Gosling, Magnetosheath density fluctuations and magnetopause motion, *J. Geophys. Res., 101*, 31-40, 1996.