Project Details

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Selection Year: 2006
Program Element: Focused Science Topic

Topic: Solar wind plasma entry and transport in the magnetosphere

Project Title:
Formation of Earth's Low-Latitude Boundary Layer and Cold, Dense Plasma Sheet under Northward IMF

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Summary:
Observations have shown the occurrence of unusually cold and dense plasma in the near-Earth tail of the magnetosphere. This cold, dense plasma sheet (CDPS) is known to form during intervals of northward interplanetary magnetic field (IMF) and to be of solar wind origin. It is further often observed to penetrate close to Earth during conditions of enhanced convection. This proposal addresses the science topic of solar wind plasma penetration and transport through the magnetopause and subsequently into the inner magnetosphere in order to assess the potential role of the CDPS in magnetospheric dynamics and geomagnetic activity. It aims to answer the following specific scientific questions:

A. How and where does solar wind plasma enter the low-latitude boundary layer (LLBL) and plasma sheet under conditions of northward IMF?

B. How and when are the double high-latitude reconnection, Kelvin-Helmholtz instability and wave-particle diffusion processes operative?

C. What is the contribution of each process in terms of plasma transfer as a function of solar wind conditions?

D. How is the CDPS material subsequently transported inward and what is its effect on geomagnetic activity?

E. Does the CDPS have an influence on solar wind/CME geoeffectiveness through a preconditioning of the magnetosphere?

We will answer these questions through a combination of data from key magnetospheric science missions (Cluster, Geotail) and solar wind measurements (Wind, ACE), together with the large database of geosynchronous plasma observations from the Los Alamos instruments. We will additionally test the viability of specific processes by detailed data and model simulation comparisons. This proposal directly contributes to the 'Solar wind plasma entry and transport in the magnetosphere (T3c)' focused science topic of the 'Living with a star targeted research and technology' NASA ROSES 2005 research announcement.

Publication References:

Summary: no summary

Reference:
Lavraud, B.; Thomsen, M. F.; Lefebvre, B.; Schwartz, S. J.; Seki, K.; Phan, T. D.; Wang, Y. L.; Fazakerley, A.; RèMe, H.; Balogh , A.; (2006), Evidence for newly closed magnetosheath field lines at the dayside magnetopause under northward IMF, Journal of Geophysical Research: Space Physics, Volume 111, Issue A5, CiteID A05211, doi: 10.1029/2005JA011266

Summary: no summary

Reference: Lavraud, B.; Thomsen, M. F.; Borovsky, J. E.; Denton, M. H.; Pulkkinen, T. I.; (2006), Magnetosphere preconditioning under northward IMF: Evidence from the study of coronal mass ejection and corotating interaction region geoeffectiveness, Journal of Geophysical Research: Space Physics, Volume 111, Issue A9, CiteID A09208, doi: 10.1029/2005JA011566

Summary: no summary

Reference:
Lavraud, B.; Thomsen, M. F.; Wing, S.; Fujimoto, M.; Denton, M. H.; Borovsky, J. E.; Aasnes, A.; Seki, K.; Weygand, J. M.; (2006), Observation of two distinct cold, dense ion populations at geosynchronous orbit: local time asymmetry, solar wind dependence and origin, Annales Geophysicae, Volume 24, Issue 12, 2006, pp.3451-3465, doi: 10.5194/angeo-24-3451-2006

Summary: no summary

Reference:
Taylor, M. G. G. T.; Lavraud, B.; Escoubet, C. P.; Milan, S. E.; Nykyri, K.; Dunlop, M. W.; Davies, J. A.; Friedel, R. H. W.; Frey, H.; Bogdanova, Y. V.; Åsnes, A.; Laakso, H.; TrávníCek, P.; Masson, A.; Opgenoorth, H.; Vallat, C.; Fazakerley, A. N.; Lahiff, A. D.; Owen, C. J.; Pitout, F.; Pu, Z.; Shen, C.; Zong, Q. G.; Rème, H.; Scudder, J.; Zhang, T. L.; (2008), The plasma sheet and boundary layers under northward IMF: A multi-point and multi-instrument perspective, Advances in Space Research, Volume 41, Issue 10, p. 1619-1629, doi: 10.1016/j.asr.2007.10.013

Summary: no summary

Reference: Li, Wenhui; Raeder, Joachim; Thomsen, Michelle F.; Lavraud, Benoit; (2008), Solar wind plasma entry into the magnetosphere under northward IMF conditions, Journal of Geophysical Research: Space Physics, Volume 113, Issue A4, CiteID A04204, doi: 10.1029/2007JA012604