

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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Project Information:

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.

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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.; Trávníček, 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

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