

CAPS Input to Cassini Quarterly Report

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November 2005-January 2006

CAPS Accomplishments

- T9 Titan encounter (Dec. 26, 2005)
 - Distant crossing of Titan's plasma wake ($\sim 5R_T$)
 - Wide wake ($\sim 4 R_T$) and offset towards Saturn
 - Unexpected ion composition
 - Heavy ions from Titan on the edges of the wake
 - 2, ~ 16 & ~ 32 AMU/q ions on the side away from Saturn
 - Just 2 AMU/q ions and protons on the other side
 - No heavy ions from Titan in center of wake
 - Just hot protons
- Crossing of Rhea's wake at 500 km altitude, Nov 26, 2005
 - Absorption of ions and electrons
 - Non-gyrotropic ion absorption ($R_{Rhea} \sim$ average ion gyroradius)
 - Sharp cut-off in electron spectra at 300 eV (leapfrog effect?)
- Continued ongoing observations of dawn-side magnetospheric boundaries
- High resolution measurements of the inner magnetosphere, Dec 24-25, 2005 and Jan 17-18, 2006
 - Analysis still in progress
 - Dec. data very good quality, Jan. still being processed

CAPS Accomplishments

- Journal papers:
 - Published during this quarter: 7.
 - Total papers published over the mission: 53.
 - Total papers currently submitted or in press: 16.
- Conference papers:
 - Total papers presented in the last quarter: 25.
 - Total papers presented over the mission: 107.

CAPS Plans

Upcoming science activities (next quarter)

- T11 and T13 Titan encounters
 - Feb. 27 (1813 km alt.) & Apr. 30 (1855 km alt.)
 - Two crossings of Titan's plasma wake/downstream ionosphere
 - Good spacecraft pointing for CAPS on both encounters
 - T12 is upstream & spacecraft pointing is not good for CAPS
- Complete a series of observations dawn-side magnetospheric boundaries
 - Ongoing since rev 0/A
 - End March 14, 2006 (inbound rev 22)
 - Apoapsis shift into over night side of Saturn
- First observations of Saturn's magnetotail
 - March 23 to April 20 (Rev 22/23)
 - Apoapsis at $68 R_S$, 02:45 local time

CAPS Plans

- Meetings next quarter:
 - EGU in Vienna
 - CAPS Team meeting in Budapest
 - A.J. Coates is a co-convenor of a meeting at the Royal Astronomical Society: 'Titan Revealed - Latest findings from Cassini/Huygens measurements', Feb. 10, 2006.
 - Several Team members are attending and presenting at the "Icy Satellites Workshop" at JPL, January 30-31, 2006.

CAPS Backup Material

- Backup Material
 - Listing of Publications
 - Listing of Science Talks
 - Listing of Public Outreach and Inreach activities

Publications during the last quarter

1. Lepping, R.P., E. C. Sittler Jr., W. H. Mish and S. A. Curtis, Analysis of waves in Saturn's dayside magnetosphere: Voyager 1 observations, JGR, Vol. 110, A05201, doi:10.1029/2004JA010559, 2005.
2. Sittler, E. C., Jr., R. E. Hartle, A. F. Vinas, R. E. Johnson, H. T. Smith and I. Mueller-Wodarg, Titan interaction with Saturn's magnetosphere: Voyager 1 results revisited, JGR, Vol. 110, A09302, doi:10.1029/2004JA010759, 2005.
3. Hartle, R. E., E. C. Sittler Jr., F.M. Neubauer, R. E. Johnson, H. T. Smith, F. Crary, D. J. McComas, D. T. Young, A. J. Coates, D. Simpson, S. Bolton, D. Reisenfeld, Szego, J.-J. Berthelier, A. M. Rymer, J. Vilppola, J. Steinberg, and N. Andre, Preliminary interpretation of Titan plasma interaction as observed by the Cassini Plasma Spectrometer: Comparisons with Voyager 1, GRL, doi: 10.1029/2005GL024817R, 2006.
4. Teolis, B.D., R. A. Vidal, J. Shi, and R. A. Baragiola, Mechanisms of O₂ Sputtering from Water Ice by keV Ions, Phys. Rev. B 72 (2005) 245422 + 9, 2005.
5. Johnson, R.E., P.D. Cooper, T.I. Quickenden, G.A. Grieves, T.M. Orlando, Production of oxygen by electronically induced dissociations in ice, J. Chem Phys. 123, 184715-184715-8, 2005.

Publications during the last quarter

6. Michael, M. and R.E. Johnson, "Energy deposition of pickup ions and heating of Titan's atmosphere", *Planetary & Space Sci.* 53, 1510-1514 (2005).
7. Johnson, R.E., M. Liu, and E.C. Sittler, "Plasma-Induced Clearing and Redistribution of Material Embedded in Planetary Magnetospheres", *GRL* 32, L24201, doi:10.1029/2005GL024275, 2005.

Publications submitted or in press

1. E. C. Sittler Jr, M. Thomsen, R. E. Johnson, R. E. Hartle, M. Burger, D. Chornay, M. D. Shappirio, D. Simpson, H. T. Smith, A. J. Coates, A. M. Rymer, D. J. McComas, D. T. Young, D. Reisenfeld, M. Dougherty, and N. Andre, Initial results on Saturn's inner plasmasphere as observed by Cassini: Comparison with Voyager, Submitted to Planetary and Space Science, 2006.
2. R. E. Hartle, E. C. Sittler Jr., F. M. Neubauer, R. E. Johnson, H. T. Smith, F. Crary, D. J. McComas, D. T. Young, A. J. Coates, D. Simpson, S. Bolton, D. Reisenfeld, K. Szego, J. J. Berthelier, A. Rymer, J. Vilppola, J. T. Steinberg, N. Andre, Initial Interpretation of Titan Plasma Interaction as Observed by the Cassini Plasma Spectrometer: Comparisons with Voyager 1, Submitted to Planetary and Space Science, 2005.
3. A.M.Rymer, A.J.Coates, M.F.Thomsen, M.K.Dougherty, W.S.Kurth, N.P.Meredith, D.T.Young, F.J.Crary, K.Szego, D.G.Mitchell, N.Krupp, Overview of plasma and magnetic field transitions with distance and with solar wind Mach numbers down the dusk flank of the Jovian bow shock as observed with the Cassini Plasma Spectrometer and Flux Gate Magnetometer, submitted to J. Geophys. Res., 2005.
4. Pontius, D. H., Jr., and T. W. Hill, Distributed mass loading near Enceladus, to be submitted to *JGR*, 2006.

Publications submitted or in press

5. Hill, T. W., Effect of the acceleration current on the centrifugal interchange instability, *J. Geophys. Res.*, in press, 2006.
6. M. Bouhram, R. E. Johnson, J.-J. Berthelier, J.-M. Illiano, R. L. Tokar, D. T. Young, and F. J. Crary, A test-particle model of the atmosphere/ionosphere system of Saturn's main rings, submitted to *Geophys. Res. Lett.*, 2005.
7. Bouhram, M., J.-J. Berthelier, J.-M. Illiano, R.E. Johnson, R.L. Tokar, F.J. Crary, and D.T. Young: Le halo ionosphérique autour des anneaux de Saturne, *C.R. Physique*, submitted, 2005.
8. Bouhram, M., J.-J. Berthelier, J.-M. Illiano, H.T. Smith, E.C. Sittler, F.J. Crary, and D.T. Young: Le Satellite Encelade source d'ions N⁺ dans la magnétosphère de Saturne, *C.R. Physique*, submitted, 2005.
9. F. J. Crary, D. T. Young, R.A. Baragiola, B.L. Barraclough, J.-J. Berthelier, M. Blanc, M. Bouhram, A.J. Coates, R.E. Hartle, T.W. Hill, R.E. Johnson, D.J. McComas, M. Michael, D. Reisenfeld, E.C. Sittler, H.T. Smith, J.T. Steinberg, K. Szego, M.F. Thomsen: Dynamics and Composition of Plasma at Titan, *Science* . In review, 2005.
10. Hartle, R. E. and E. C. Sittler, Jr., Pickup Ion Phase Space Distributions: Effects of Atmospheric Spatial Gradients, *JGR*, to be submitted, 2006.

Publications submitted or in press

11. H. J. McAndrews, C. J. Owen, A. J. Coates, A. M. Rymer, M. F. Thomsen, J. Gosling, J. Burch, M. K. Dougherty, D. T. Young, Initial results from the Cassini CAPS-ELS instrument at the magnetopause of Saturn, submitted to *GRL*, 2005.
12. R.E. Johnson, J.G.Luhmann, R.L. Tokar, M. Bouhram, J.J. Berthelier, E.C. Sittler, J.F. Cooper, T.W. Hill, H.T. Smith, M. Michael, M. Liu, F.J. Crary, D.T. Young, Production, Ionization and Redistribution of O₂ in Saturn's Ring Atmosphere, Submitted to *Icarus*, 2005.
13. Sittler, E. C. Jr., M. Blanc and J.D. Richardson, Proposed model for Saturn's auroral response to the solar wind, *JGR*, submitted, 2005.
14. E.C. Sittler Jr., R.E. Johnson, H.T. Smith, J.D. Richardson, S. Jurac, M. Moore, J.F. Cooper, B. H. Mauk, M. Michael, C. Paranicas, T. P. Armstrong, and B. Tsurutani, Energetic nitrogen within the inner magnetosphere of Saturn, *JGR*, submitted, 2005.
15. R.L.Tokar, R.E.Johnson, T.W.Hill, D.H.Pontius, F. J.Crary, D.B.Reisenfeld, A.J. Coates, W.S. Kurth, M.F. Thomsen, L.Gilbert, D.T. Young, E.C. Sittler, M.H. Burger and D.A.Gurnett, The Interaction of the Atmosphere of Enceladus with Saturn's Plasma, in press, *Science*, 2006.
16. Luhmann, J.G, R.E. Johnson, R.L. Tokar, T. Cravens, "A model of the ionosphere of Saturn's toroidal ring atmosphere', *Icarus* (2006) in press.

Conference Presentations

1. A.J.Coates and the CAPS team, talks at 4th London Space Plasma Seminar series, Imperial College, 16 Nov 2005: (1) A CAPS view of Saturn's magnetosphere near the orbit of Titan, (2) Saturn/Titan interaction from CAPS-ELS.
2. H J McAndrews, C J Owen, A J Coates, M F Thomsen, C S Arridge, C Bertucci, M K Dougherty and the CAPS team, Searching for evidence of reconnection at Saturn's magnetopause, presented at RAS MIST meeting, London, 25 November 2005.
3. M Galand, B Lanchester, A Coates and R Yelle, Energy sources upon Earth's and Titan's upper atmospheres, presented at RAS MIST meeting, London, 25 November 2005.
4. R. A. Baragiola, Solid state astrophysics / astrochemistry: Some contributions from the laboratory, Balseiro Physics Congress, Bariloche, Argentina, Dec. 2005.

Fall 2006 AGU Presentations

1. C S Arridge, M K Dougherty, K K Khurana, C T Russell, N Andre, A J Coates, F Crary, S M Krimigis, J S Leisner, B H Mauk, C Paranicas, A M Rymer, E C Sittler, M F Thomsen, D T Young, Cassini's View of Stress Balance in Saturn's Magnetosphere.
2. R.A. Baragiola, F J Crary, D J McComas, A Eviatar, D T Young, Inner Magnetospheric Nitrogen Source Detected at Saturn.
3. C. Bertucci, F. Neubauer, A. Law, M. K. Dougherty, J.E. Wahlund, K. Szego, A. Coates, D. Young, C. S. Arridge, C. T. Russell, and N. Achilleos, Titan's interaction with its plasma environment.
4. M. Bouhram, R.E. Johnson, J.-J. Berthelier, J-M. Illiano, R.L. Tokar, A Model of the Ionospheric System of Saturn's Main Rings
5. M H Burger, E C Sittler, R E Johnson, V I Shematovich, R L Tokar, The Surprising, Humid Atmosphere at Enceladus.
6. F. J. Crary, R. Goldstein, D. Reisenfeld, E. C. Sittler, H. T. Smith, and D. T. Young, The composition of Saturn's magnetosphere.
7. F J Crary, R Goldstein, T W Hill, M F Thomsen, R L Tokar, H T Smith, D T Young, Plasma conditions and composition away from Enceladus.
8. J.-F. Crifo, S. Rodionov, K. Szego, T. Hill, H. Waite, A 3-d gas dynamical model of the neutral gas environment of Enceladus.
9. A Eviatar, H T Smith, R E Johnson, R Goldstein, D T Young, E C Sittler, Where has all the Nitrogen Gone?
10. R Goldstein, J Berthelier, M Bouhram, A J Coates, F J Crary, A Eviatar, W F Huebner, M Shapirio, H T Smith, D T Young, Plasma Composition Near Enceladus.

Fall 2006 AGU Presentations

11. Hansen, K C, Gombosi, T I, Arridge, C S, Coates, A J, Esposito, L W, Kurth, W S, Leisner, J S, Mitchell, D G, Richardson, J D, Russell, C T, Rymer, A M, Sittler, E, Thomsen, M F, Ion Mass-loading and Time Variability in the Saturn's Magnetosphere.
12. R E Hartle, E C Sittler Jr, F M Neubauer, R E Johnson, F Crary, D J McComas, D T Young, A J Coates, D J Simpson, S Bolton, D Reisenfeld, K Szego, J Berthelier, Neutral Exosphere Densities and Structures at Titan Inferred from Pickup Ions Observed by CAPS.
13. R.E. Johnson, M Burger, E C Sittler, J D Richardson, S Jurac, The Enceladus Neutral Cloud and the OH Torus.
14. Kurth, W S, Gurnett, D A, Hospodarsky, G B, Dougherty, M K, Arridge, C S, Achilleos, N A, Andre, N, Crary, F J, McAndrews, H J, Szego, K, Rymer, A M, Krimigis, S M, Mitchell, D G, Krupp, N, Hamilton, D C, Hansen, K C, Saturn's Magnetospheric Boundaries.
15. M Michael, R E Johnson, V I Shematovich, V D La Haye, H Waite, M C Wong, Heating of the Upper Atmosphere and the Expansion of the Corona of Titan.
16. D. G. Mitchell, C. Paranicas, S. M. Krimigis, M. Dougherty, D. Young, F. Crary, W. S. Kurth, D. Gurnett, K. C. Hansen, S. Kempf, R. Srama, and the MIMI team, Magnetospheric interaction with Saturn's icy satellites
17. E.C. Sittler, S Ledvina, J G Luhmann, F Leblanc, Inner Magnetospheric Nitrogen Source Detected at Saturn.

Fall 2006 AGU Presentations

18. E C Sittler Jr., N Andre, M Blanc, A J Coates, R E Johnson, R A Baragiola, R E Hartle, D Reisenfeld, M F Thomsen, D Chornay, M D Shappirio, D G Simpson, M Dougherty, F Crary, D J McComas, D T Young, Ion Production and Loss within Saturn's Inner Magnetosphere: Cassini Results.
19. H T Smith, M D Shappirio, E C Sittler, D Reisenfeld, R E Johnson, R A
20. R L Tokar, E C Sittler, R E Johnson, M F Thomsen, F J Crary, D T Young, T W Hill, A J Coates, D A Gurnett, R A Baragiola, M H Burger, Thermal Plasma Flow Near Enceladus: Evidence for the 'Missing' Water Source?
21. K Szego, Z Bebesi, G Erdos, L Foldy, F Crary, D T Young, A J Coates, A Rymer, R E Hartle, E C Sittler, J J Berthelier, M Bouhram, M F Thomsen, A Eviatar, Indirect evidence for a neutral hydrogen cloud around Titan.

Outreach & Inreach

- Duane Pontius, "The Enceladus Flux Tube", seminar presented at Rice University (10/31/2005) and SwRI (10/24/2005).
- R.E. Johnson, "Cassini at Saturn," NASA Langley Research Center, Nov., 2005.