



The Newsletter - Volume 6, Issue 1

16th July 2008

Covers events between 1st March 2008 and 31st May 2008

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General

Congratulations to Mike Emes for winning “The Great Egg Drop” competition which was organized by Lin Gilbert.

Jason and Christy Tandy have a new addition to the family, Harry James Tandy, born 30 April, 9lb, 11oz, brother to Jonathan and Rose.

Yulia Bogdanova left the Space Plasmas Group to take up a lectureship at La Trobe University in Australia. She had been in the group for over 5 years and we wish her well in her new post.

Andrew Lahiff has also left MSSL, resigning his post in the PEACE Operations Team which he has been part of since June 2003. Andrew has made many strong contributions in this role, notably in the area of sensor calibration, moments software and data management.

We welcomed Gill Watson back to PEACE Operations team in April, after her maternity leave.

Matthew West left the Cluster PEACE Operation Team on 28 May to take up a position at the Royal Observatory of Belgium.

New Staff Members

Durgesh Tripathi joined the Solar group on 19 May.

Visitors

Hazel McAndrews and Rob Wilson visited MSSL to work with the Cassini ELS team.

Professor Janusz and Dr Barbara Sylwester visited MSSL and worked with Ken Phillips during their 3-week stay, analyzing data from the RESIK spectrometer and completing a paper which has now been accepted for publication in *Astrophysical Journal Letters* (see www.mssl.ucl.ac.uk/~kjhp/RECENT_PAPERS). Janusz gave an MSSL seminar and talk at the RAS meeting which will appear in *Observatory* magazine.

As part of the Plasma Group Seminar Series, Dr. Jim Wild, from Lancaster University, gave a seminar on 'Magnetospheric substorms: triggers, onsets and ionospheric responses'.

Prizes and Awards

Claire Foullon was awarded an RAS Grant and a Nuffield Foundation Grant to fund an undergraduate research bursary on "Periodicities in the Solar Wind".

Michelle Murray was elected to the newly formed council of UK Solar Physics (UKSP).

Chris Owen was appointed to serve on the STFC 'ad hoc' Committee tasked with reviewing the community response to the STFC Programmatic Review in the fields of Solar Physics and Solar Terrestrial Physics.

Appointments (e.g. Editorial Boards or Committees)

Claire Foullon was elected to serve on the UCL Research Strategy Committee for a two-year term with effect from 2008-2009.

Proposals

Much activity has taken place over the period covered by the Newsletter in preparing STFC grant applications to support the Laboratory plans for participation in the ESA's Cosmic Vision programme for new missions: Andrew Coates is proposing an instrument package to study plasma, aerosol and carry out imaging onboard one of the missions to the outer planets, and Graziella is proposing to incorporate an X-ray imaging spectrometer in the same mission.

Cosmic Visions instrument proposals were submitted to STFC for instrument studies on Titan Saturn System Mission (TTSM), Europa Jupiter System Mission (EJSM) and Marco Polo.

Chris Owen (PI):

PPRP Proposal For The Role Of MSSL In The Solar Orbiter SWA

PRD Proposal for UCL/MSSL Studies Of Particle Instrumentation For The Cross-Scale Mission (A Cosmic Visions 2015-2025 Candidate Mission)

Andrew Fazakerley (PI):

Cluster Oversight Committee Proposal for the extension of post-launch support funding for Cluster PEACE and CAA operations through to March 2010.

Roberto Soria is PI or co-I in the following Chandra proposals:

- the colliding galaxies NGC7714/15 (with B. Smith et al);
- the face-on grand-design spiral M83 (with W. Blair et al);
- faint X-ray sources in the nearest galaxy, M31; detecting proper motion in nearby X-ray sources (with R. Di Stefano et al);
- the galaxy NGC2903 in the M81 group; ULXs in a sample of star-forming, colliding Arp galaxies (with D. Swartz et al);

- search for young X-ray pulsars created by historical supernovae in nearby galaxies (with R. Perna).

Grants and Contracts Awarded

- a small 'bridging' grant by STFC to commence studies on the particle instrumentation for Cross-Scale (an ESA Cosmic Visions candidate mission) while the full proposal is evaluated. (PI Chris Owen)
- an extension of the ESA Cluster Active Archive contract for preparation of PEACE data (2006-2009) which runs from June 2008 to November 2010. (PI Andrew Fazakerley)
- ExoMars PanCam, STFC, for 2008-9, A.Coates PI
- a UK-China Research Fellowship, funded by the UK Department for Innovation, Universities and Skills, was awarded to Robert Soria who visited Tsinghua University (Beijing) for 6 weeks.

Mission Status and Developments

Cassini – the instrument is working well and a new geometric factor has recently been adopted due to the hard work of Gethyn Lewis and the ELS team. There have been many science presentations at recent meetings.

Cluster – the PEACE instruments on all four Cluster spacecraft are functioning well and collecting data. During May, the spin axis of one of the spacecraft was tilted by 45 degrees, to enable measurements of electric and magnetic plasma wave data with activity along the spin axis. Normally such data is only available in the spin plane. The selected spacecraft was flying close to a second spacecraft, so the pair provided 3D wave data - this may be a "first" in space plasma studies.

Cluster PEACE electron 3D ground moments are now publicly available from the Cluster Active Archive. More details can be found at <http://caa.estec.esa.int/caa/news.xml>. Further work on PEACE archiving continues.

The third Cluster Active Archive annual Operations Review was held in May. The review panel was very impressed with progress, according to their report.

Cross-Scale - Chris Owen is on the ESA Science Study Team for Cross-Scale, which has written the first issues of the Science Requirements Document and Payload Definition Document so that the ESA-sponsored industrial studies can begin. MSSL has submitted a proposal to STFC for study money for the particle instrumentation for Cross-Scale (PI Chris Owen).

Double Star - TC-2 continues to operate, although it experiences power and thermal problems during some months of the year, which are associated with the uncontrolled drift of its spin axis direction. The PEACE instrument works well.

EJSM (Europa Jupiter System Mission) – Andrew Coates attended EJSM Science meeting, Frascati (Apr 21-22).

ExoMars - Andrew Coates and Andrew Griffiths attended the first ExoMars Science Working team (7-9 April, ESTEC), also held a PanCam team meeting at EGU (Andrew Coates, Andrew Griffiths and Peter Muller attended), attended oversight committee meeting (Leicester, 23 April, AJC+ADG), 3D vision meeting Aberystwyth (28-30 April, AJC, ADG, JPM)

Kua-Fu - activities funded under the Kua-Fu PRD grant awarded last year (PI Andrew Fazakerley) are continuing.

Solar Orbiter – a proposal was submitted to STFC for the funding required for the MSSL involvement in the Solar Orbiter Solar Wind Analyser Suite (PI Chris Owen). This will be reviewed by the STFC PPRP during June. Thanks to all those involved in putting this together.

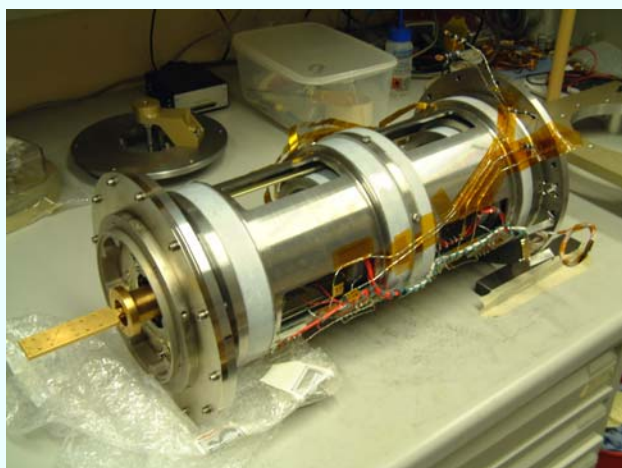
TSSM (Titan Saturn System Mission) – Andrew Coates attended Joint Science Definition Team meetings in Paris (March 17) and Oxnard, CA (May 8-9). AJC and Rob Gowen attended TSSM Science meeting (Meudon, March 17-19).

Venus Express and Mars Express – instruments operating well. Results presented at VEX science workshop at La Thuile (where AJC and Sharon Tsang represented ASPERA). First papers published (including Coates et al. 2008) and another submitted (Tsang et al. 2008).

News from the Cryogenics Physics Group

Formal delivery to ESA of the world's first flight level cryogen free milli-kelvin cooler (an adiabatic demagnetisation refrigerator – ADR) by the MSSL cryogenic physics group will occur on the 9th July, although the cooler will not physically move as it will be on loan to us for continued XEUS development. XEUS is ESA's next X-ray observatory mission. This occasion marks a milestone for the group and space coolers as a whole. Not only is this the first in the world, as previous coolers have been liquid helium based, but it also achieves the lowest temperature of any other flight cooler. A temperature of 26 mK (26 thousandths of a degree above absolute zero) has been reached. The cooler was developed under contract to ESA (with significant PPARC – now STFC support) with EADS Astrium (Stevenage) as prime contractor. The goal was to develop, as a technology build up to the XEUS mission, a 50 mK cooler that can be used to cool TES detectors. These detectors require a temperature of 50 mK in order to detect single X-ray photons and measure their energy to a few eV.

The ADR works by the interaction of a magnetic field and the electrons in a paramagnetic material pre-cooled to the required temperature (for us this is 4 K). In order to achieve 26 mK within a spacecraft environment we have used a two stage ADR (called a double ADR) which uses two paramagnetic materials (Dysprosium Gallium Garnet – DGG and Chromium potassium Alum – CPA). The double ADR uses a 3 Tesla magnetic field generated by 6 superconducting magnets. In order to stop the magnetic field propagating in to the intended spacecraft a further 4 superconducting magnets are used to confine the magnetic field. As the magnetic forces are large a specialist material had to be created which comprises of a mixture of aluminium and silicon carbide. To create the superconducting magnets 300 km of 0.1 mm superconducting wire was used to wind the magnet coils.



Work is now focused on refining the cooler for the proposed XEUS mission narrow field instrument (NFI). A great deal of thanks goes to everyone that worked on the project but hopefully this is only the beginning.

The photograph below shows the actual ADR cooler before integration in to the ground test cryostat. The gold plated finger on the left is the 26mK stage

Publications - Refereed

S & CP authors are shown in upper case.

A. Published

ARRIDGE, C.S., Russell, C.T., Khurana, K.K., Achilleos, N., Cowley, S.W.H., Dougherty, M.K., Southwood, D.J. & Bunce, E.J., Saturn's magnetodisc current sheet, *J. Geophys. Res.*, 113(A4), A03214, -, 2008. [10.1029/2007JA012540](https://doi.org/10.1029/2007JA012540)

COATES, A.J., Frahm, R.A. & LINDER, D.R., Ionospheric photoelectrons at Venus: initial observations by ASPERA-4 ELS, *Planet. Space Sci.*, 56, 6, 802-806, 2008. Our first publication from Venus Express. This paper is the first detection of ionospheric photoelectrons at Venus - and we show that the photoelectrons are from oxygen rather than carbon dioxide.

COATES, A.J., Frahm, R.A., LINDER, D.R., KATARIA, D.O., SOOBIAH, Y., COLLINSON, G., Sharber, J.R., Winningham, J.D., Jeffers, S.J., Barabash, S., Sauvaud, J.-A., Lundin, R., Holmstrom, M., Futaana, Y., Yamauchi, M., Grigoriev, A., Andersson, H., Gunell, H., Fedorov, A., Thocaven, J.-J., Zhang, T., Baumjohann, W., Kallio, E., Koskinen, H., Kozyra, J.U., Liemohn, M.W., Ma, Y., Galli, A., Wurz, P., Bochsler, P., Brain, D., Roelof, E.C., Brandt, P., Krupp, N., Woch, J., Fraenz, M., Dubinin, E., McKenna-Lawlor, S., Orsini, S., Cerulli-Irelli, R., Mura, A., Milillo, A., Maggi, M., Curtis, C.C., Sandel, B.R., Hsieh, K.C., Szego, K., Asamura, A. & Grande, M., Ionospheric photoelectrons at Venus: initial observations by ASPERA-4 ELS, *Planet. Space Sci.*, 56, iss.6, 802-806, 2008. Our first publication from Venus Express. This paper is the first detection of ionospheric photoelectrons at Venus - and we show that the photoelectrons are from oxygen rather than carbon dioxide.

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B. In Press

ARRIDGE, C.S., André, N., Achilleos, N., Khurana, K.K., Bertucci, C.L., GILBERT, L.K., LEWIS, G.R., COATES, A.J. & Dougherty, M.K., Thermal electron periodicities at 20Rs in Saturn's magnetosphere, *Geophysical Research Letters*, 2008.

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Grisé, F., Pakull, M.W., SORIA, R., Motch, C., Smith, I.A., Ryder, S.D. & Bottcher, M., The ultraluminous X-ray source NGC 1313 X-2 - Its optical counterpart and environment, *Astron. & Astrophys.*, 2008. We study the stellar population around this accreting black hole.

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Schippers, P., Blanc, M., André, N., Dandouras, I., LEWIS, G.R., GILBERT, L.A., Persoon, A.M., Krupp, N., Gurnett, D.A., COATES, A.J., Krimigis, S.M., Young, D.T. Dougherty & M.K., D.T. Dougherty., Multi-instrument analysis of electron populations in Saturn's magnetosphere, *J. Geophys. Res.*, 2008.

SORIA, R. & Perna, R., The oldest X-ray supernovae: X-ray emission from 1941C, 1959D, 1968D, *Astrophys. J.*, 2008. We study the three oldest X-ray counterparts of historical supernovae; we discuss whether they are due to the expanding shells of shocked gas or to young pulsars.

Storrie-Lombardi, M.C., MULLER, J-P., Fisk, M.R., GRIFFITHS, A.D. & COATES, A.J., Potential for non-destructive astrochemistry using the ExoMars PanCam, *Geophysical Research Letters*, 2008.

Sylwester, J., Sylwester, B. & PHILLIPS, K.J.H., RESIK observations of He-like Argon X-ray line emission in solar flares, *Astrophys. J. Lett.*, 2008. Observations of some argon lines using the RESIK X-ray spectrometer during solar flares have been analyzed, comparing line ratios with temperatures from GOES. The comparison gives the S/Ar abundance ratio which is the coronal value, confirming the so-called FIP effect, and nonthermal effects are identified.

Publications - Non-refereed

A. Published

Atkins, C., Doel, P., Yao, J., Brooks, D., Thompson, S., Willingale, R., Feldman, C., Button, T., Zhang, D. & JAMES, A., Active X-ray mirror development at UCL: preliminary results, in 3rd International Symposium on Advanced Optical Manufacturing and Testing Technologies: Large Mirrors and Telescopes. Proceedings of the SPIE, 6721, 67210T-, Zhang, Yudong; Jiang, Wenhan; Cho, Myung K. (Eds.), 2007. [10.1117/12.782955](https://doi.org/10.1117/12.782955)

Doel, P., Atkins, C., Thomson, S., Brooks, D., Yao, J., Feldman, C., Willingale, R., Button, T., Zhang, D. & JAMES, A., Large thin adaptive X-ray mirrors, in Advances in X-Ray/EUV Optics and Components II. Proceedings of the SPIE, 67050, 67050M-, Ali M.; Morawe, Christian; Goto, Shunji (Eds.), SPIE, 2007. [10.1117/12.734608](https://doi.org/10.1117/12.734608)

PhD's Awarded

Lewis Dartnell, Computer modelling and experimental work on the astrobiological implications of the Martian subsurface ionising radiation environment, successful viva May 2008.

Teaching Developments (eg New Courses)

Chris Arridge has been delivering post-graduate space physics lectures to students from the solar,

planetary and plasma physics groups and organising journal review sessions covering seminal papers in space physics.

Invited Talks and Conferences

Chris Arridge gave an invited seminar at the Department of Physics and Astronomy, University of Leicester on 21 May 2008.

National Astronomy Meeting, Belfast, 31 March-4 April 2008:

- Chris Arridge gave an invited talk on behalf of the planetary group: ARRIDGE, C.S., A.J. COATES, G.H. JONES, S. GRIMALD, S. KANANI, S. TSANG, A. WELLBROCK, Recent studies at Saturn and Venus with Cassini and Venus Express.
- Graziella Branduardi-Raymont gave two talks: one on the relationship between planetary and white dwarf magnetospheres, the other on the X-ray emissions from Jupiter and Saturn.

Graziella also talked at the Europlanet Workshop in Liege, and gave a plenary presentation on X-rays from our solar system at the X-ray Universe 2008 conference in Granada in late May.

Andrew Coates gave an invited talk at the Isradynamics conference at the Dead Sea, Israel (COATES, A.J., Ion pickup and mass loading in the solar system – and beyond? 12-18 May 2008.

Roberto Soria gave a seminar on ultraluminous X-ray sources at Tsinghua University and one at Peking University on X-ray supernovae and young pulsars.

Conference and Workshop Presentations

Cluster SOWG/SWT, 10 March, Tenerife – attended by Andrew Fazakerley and Iryna Rozum; the PEACE SWT status report was given by Iryna Rozum. The separation strategy for 2009/dayside was agreed at the SOWG. Solar wind turbulence studies will be prioritised in early spring, and auroral acceleration region studies in late spring. There were preliminary discussions of a science case for a further mission extension.

Cluster Active Archive workshop, 11-15 March, Tenerife – oral presentations given by Andrew Fazakerley (2 at the Cross-calibration Workshop, 1 for the school, and an invited science talk), Iryna Rozum (CAA PEACE data products) and Andrew Walsh; a poster presented by Kimberley Steed and a poster by Andrew Fazakerley.

NAM/UKSP/MIST, 1-4 April, Belfast – Chris Owen, Claire Foullon and Andrew Fazakerley conveners of the sessions on 'Magnetic Reconnection', 'From the Sun to Earth and Beyond' and 'STP Mission Forum' respectively; Claire Foullon and Andrew Fazakerley chairing their sessions; oral presentations given by Andrew Fazakerley (2) and Andrew Walsh; a poster presented by Kimberley Steed and a poster by Claire Foullon. Chris Arridge gave a presentation.

- C.S. ARRIDGE, N. Achilleos, Y.V. BOGDANOVA, E.J. Bunce, A.J. COATES, S.W.H. Cowley, M.K. Dougherty, A.N. FAZAKERLEY, K.C. Hansen, T.W. Hill, G.H. JONES, K.K. Khurana, H.J. McAndrews, C.T. Russell, D.S. Talboys, R.J. Wilson, B. Zieger, Cassini observations in Saturn's southern polar cusp.

EGU General Assembly, 14-18 April, Vienna – oral presentations given by Sandrine Grimald and Andrew Walsh; a poster presented by Sandrine Grimald and 2 posters by Andrew Fazakerley.

International Conference on Substorms 9, 4-9 May, Schloss Seggau, Leibnitz, Austria – Chris Owen co-convened and acted as rapporteur for the session 'Formation and instabilities of substorm current sheet/plasma sheet'.

ESA Venus Express Science Workshop, La Thuile (Italy), March 3-8 2008 - Andrew Coates and Sharon Tsang gave talks.

- TSANG, S.M.E., A.J. COATES, R.A. Frahm, J.D. Winningham and S. Barabash, Photoelectron observations at Venus: case studies.
- COATES, A.J., S.M.E. TSANG, F.Crary, D.T.Young, R.A.Frahm, J.D.Winningham, R.Lundin, S.Barabash, Venus-solar wind interaction: comparisons with Titan.

Cassini MAPS workshop, MPS Lindau, Germany, 2-4 April 2008 - Andrew Coates, Annie Wellbrock, Sheila Kanani, Geraint Jones gave talks.

- A.J. COATES, G.R. LEWIS, D.T. Young, J.H. Waite Jr. F.J. Crary, A. WELLBROCK, Negative ions at Titan: update from CAPS ELS.
- A. WELLBROCK, A.J. COATES et al, CAPS observations of T40, presented at Cassini MAPS workshop, MPS Lindau, Germany, 2-4 April 2008.

- A. COATES, G. JONES, S. KANANI, C. ARRIDGE, A. WELLBROCK, Frank Crary, Dave Young & CAPS team, Negative ions at Enceladus?
- JONES G. H., et al., Icy moon microsignatures: Combined observations from MIMI-LEMMS and CAPS-ELS ?
- KANANI, S., et al., Modelling the size and shape of Saturn's magnetosphere using dynamic pressure balance global configuration/dynamics 1?
- JONES G. H., et al., CAPS-ELS observations during the 2008 March 12 Enceladus flyby.

Planetary group representation on 18 papers at EGU assembly, Vienna, 13-18 April 2008

- André, N.; ARRIDGE, C. S.; Lamy, L.; Louarn, P.; Bunce, E. J.; Cecconi, B.; COATES, A. J.; Cowley, S. H.; Dougherty, M. K.; Hansen, K. C.; THE CASSINI TAIL TEAM, Magnetic Field Variations in the Saturnian Magnetotail Induced by Solar Wind Pressure Enhancements.
- ARRIDGE, CS; Khurana, KK; André, N; McAndrews, HJ; Russell, CT; Sittler, EC; COATES, AJ; Dougherty, MK, Periodic crossings of Saturn's magnetospheric current/plasma sheet observed by Cassini CAPS/ELS and MAG.
- Bertucci, C.; Achilleos, N.; Modolo, R.; COATES, A.J.; Szego, K.; Masters, A.; Ma, Y.; Simon, S. ; Russell, C.T.; Mazelle, C.; The T32 Team, Remnant Kronian Magnetic Fields at Titan During Magnetosheath Excursion: Cassini T32 Observations.
- COLLINSON, G.A.; KATARIA, D.O.; COATES, A.J.; TSANG, S.M.E; Frahm, R.; Winningham, J.D. ; Barabash, S., Electron optical study of the Venus Express ASPERA- ELS Top-Hat Electrostatic Analyser.
- Fraenz, M.; Dubinin, E.; Martinecz, C.; Roussos, E.; Woch, J.; COATES, A.J.; Barabash, S.; Lundin, R.; Zhang, T.L., Plasma Boundaries at Mars and Venus.
- GRIFFITHS, A; COATES, A; MULLER, J; Storrie-Lombardi, M; Jaumann, R; Josset, J; Paar, G; Barnes, D, Enhancing the Effectiveness of the ExoMars PanCam Instrument for Astrobiology.
- KANANI, S., C.S. ARRIDGE, G.H. JONES, H.J. McAndrews, A.N. FAZAKERLEY, S.M. Krimigis and N. Sergis (2008). Modelling the size and shape of Saturn's magnetopause using dynamic pressure balance.
- Khurana, K.K., D.G. Mitchell, C.S. ARRIDGE, M.K. Dougherty, C.T. Russell, C. Paranicas and N. Krupp (2008). The mystery of rotational signals from Saturn's magnetosphere revealed.
- Ma, Y. J.; Russell, C. T.; Nagy, A. F.; Bertucci, C.; Neubauer, F. M.; Dougherty, M. K.; Cravens, T. E.; COATES, A. J.; Wahlund, J-E.; Crary, F.J., Real-time Global MHD Simulations of Cassini T32 flyby.
- Najib, D.; Nagy, A.; Toth, G.; Tenishev, V. ; Jia, Y.; Ma, Y.; Khurana, K.; COATES, A., Numerical simulations of the interaction of Enceladus' interaction with Saturn's magnetosphere using a 3D multi-species, Hall MHD model.
- Paar, G.; Oberst, J.; Barnes, D.P.; GRIFFITHS, A.D.; Jaumann, R.; COATES, A.J.; MULLER, J.-P.; Gao, Y.; Li, R., ExoMars Panoramic Camera 3D Vision: Expected Quality of Rover Surroundings Description.
- Roussos, E.; Fraenz, M.; Dubinin, E.; Woch, J.; Martinecz, C.; Barabash, S.; Lundin, R.; COATES, A. J.; ASPERA-3 Team, The origin of energetic electron asymmetries in the induced magnetosphere of Mars.
- Schippers, P.; Blanc, M.; André, N.; Dandouras, I.; Santos-Costa, D.; COATES, A.J. ; Young, D.T; Krimigis, S.M., Analysis of intercalibrated Plasma Observations in Saturn's magnetosphere.
- Schmitz, N.; COATES, A. ; GRIFFITHS, A.; Hauber, E. ; Jaumann, R.; Michaelis, H., The High Resolution Channel of the ExoMars PanCam - Science and Technology.
- Simon, S.; Kleindienst, G.; Wiehle, S.; Motschmann, U.; Glassmeier, K.H.; Bertucci, C.L.; Dougherty, M.K.; ARRIDGE, C.S.; COATES, A.J., Titan's plasma interaction during the Cassini T32 and T34 flybys: 3D multispecies hybrid simulations.
- Sittler, E; Hartle, R; Cooper, J; Johnson, R; COATES, A, Heavy Ion Formation in Titan's Ionosphere, Magnetospheric Introduction of Free Oxygen and Source of Titan's Aerosols?
- Szego, K.; Bebesi, Z.; Dobe, Z.; Fraenz, M.; Fedorov, A.; Barabash, S.; COATES, A.J.; Zhang, T.L., The ion flow below the magnetic barrier at Venus.
- Szego, K.; Bertucci, C.; COATES, A.J.; Bebesi, Z.; Erdos, G.; Hartle, R.; Sittler, E.C.; Young, D.T., The properties of the ion flow before the T32 flyby.
- Ye, S.; Gurnett, D.; Fischer, G.; Menietti, J.D.; Kurth, W.; Wang, Z.; Hospodarsky, G.; Rymer, A. ; Young, D.; COATES, A., Saturnian narrowband radio emissions: In-situ studies of the source.

Planetary group representation on 5 papers at AGU Joint Assembly, Fort Lauderdale, 27-30 May 2008

- McAndrews, H J, Thomsen, M F, Sittler, E C, Jackman, C M, ARRIDGE, C S, COATES, A.J., Dougherty, M K, Henderson, M G, Tokar, R L, Wilson, R J, Plasma in the Nightside Magnetosphere and the Implications for Global Circulation.

- Hartle, R E, Sittler, E C, Lipatov, A, Bertucci, C, COATES, A J, Szego, K, Shappirio, M D, Simpson, D G, Effects of Pickup Ions on Titan's Interaction With Saturn's Magnetosphere During the T9 Flyby.
- Sittler, E C, Hartle, R E, Lipatov, A, Bertucci, C, COATES, A, Szego, K, Shappirio, M, Simpson, D G, Composition of Upstream Flow for Titan's Interaction with Saturn's Magnetosphere during T9 Flyby.
- Burch, J L, Goldstein, J, Mokashi, P, Lewis, W S, Paty, C, Young, D T, COATES, A J, Dougherty, M K, Andre, N, Cause of the Saturn Plasma Periodicity.
- Morooka, M W, Modolo, R, Wahlund, J, Persoon, A, Kurth, W S, Gurnett, D A, COATES, A J, LEWIS, G R, Plasma density of Saturn's magnetosphere.

Media Broadcasts and Features

A.Coates:

- Interview on Spin FM, Dublin, on lightning and its effect on planes, 11 April 2008.

G. H. Jones:

- Rhea debris disk story appeared in >200 international media outlets during March, including CNN, National Geographic, etc.
- interview with CBC Radio, Canada, on possible rings around Rhea, March 4, 2008.
- JPL podcast on possible rings around Rhea, March 6, 2008.
- interview on BBC Radio Cymru on astronomical phenomena that are reported as UFOs, 14 May, 2008.

A team of Rocket Scientists from MSSL (C.Owen, A.Coates, G.Jones, P.Muller) appeared on University Challenge: The Professionals, 14 April 2008.

Outreach

A group of students from Collyers, Horsham visited the lab.

Geraint Jones, talk to Year 3 pupils on "Exploring the Solar System", Sandfield Primary School, Guildford.

Press Releases

G. H. Jones:

- NASA JPL Press Release (March 6) and STFC press release (March 7): "Saturn's moon Rhea may have rings, too, Cassini discovers".

UCL Press Release - Successful first test of high speed 'penetrator' – 6 June 2008.

High speed 'penetrators' that could one day be used to breach the surface of planets have successfully



passed their first test in the UK, accelerating to 700 miles per hour before striking their target. A team led by UCL (University College London) test-fired the projectiles in Wales, recording a peak of 20,000 gee upon impact (where humans can survive up to 10 gee). Penetrators, which can carry data-collecting systems and sensors, are being developed as an alternative to manned space flight for the future exploration of moons in our solar system.

The team, led by Professor Alan Smith from UCL's Mullard Space Science Laboratory, Birkbeck College, Imperial College, the Open University, University of Surrey and QinetiQ ran the first three test

firings of the high speed penetrators at QinetiQ's long test track in Pendine, South Wales in May 2008. The projectiles were secured to a rocket sledge and fired along a rail track.

The penetrators, which contained a data- and sample-collecting system, a variety of sensors, accelerometers, a seismometer and a mass spectrometer (for analysis) hit a sand target at around 700 miles per hour. The electronics remained fully operational during impact, recording the deceleration in minute detail which peaked at about 20,000 gee (20,000 times the acceleration due to gravity, where humans can only survive around 10 gee).



Penetrator technology is being developed for future space exploration, to pierce the surface of planetary bodies such as our moon and the icy moons of Jupiter and Saturn. Penetrators offer a low cost approach to planetary exploration, but the enormous impact forces have meant that scientists have so far been reluctant to trust them.

Professor Smith said: "Prior to this trial, we had to rely on computer modelling and analysis. As far as we can tell the trial has been enormously successful, with all aspects of the electronics working correctly during and after the impact. I congratulate the team on this really impressive achievement – to get everything right first time is wonderful, and a tribute to British technology and innovation."

The impact trial is part of a series of technical developments and studies in preparation for future planetary space missions. These include the proposed UK MoonLITE mission to the Moon which is hoped to be launched in 2013, and possible missions

to moons of the outer planets – Europa, Ganymede, Enceladous and Titan. The trials were funded by the Science and Technology Facilities Council as part of MSSL's Rolling Grant.

Professor Smith leads the UK penetrator consortium which is a grouping of British universities (UCL, Birkbeck College, Imperial College, Leicester University, Open University, and University of Surrey) and UK industries (Astrium, QinetiQ and Surrey Satellite Technology Ltd).



Acknowledgements

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Next Issue

The next issue of The Newsletter (Volume 6, Issue 2) will be published in September 2008. This will cover activities from 1 June 2008 to 31 August 2008.