



The Newsletter
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Covers events between 1st December 2005 and 28th February 2006

List of Contents

General	1
New Staff Members	2
Visitors	2
Appointments	2
Prizes and Awards	3
Grants and Contracts Awarded	3
Telescope/Satellite Time Awards/Proposals	3
Mission Status and Developments	3
News from the Groups	4
Publications	7
Invited Talks and Lectures (National and International)	13
Conference and Workshop Presentations (National and International).....	13
Media Broadcasts and Features	14
Outreach	14
Next Issue	14

General

Sarah and Ady had their new baby on 15th December – a baby girl named Leona Catherine.

Snowdrops have been planted in the garden at MSSL in memory of Margaret Osborne. We hope to create a carpet of these, her favourite flowers, on the lawn at the top of the South Drive. Snowdrops are best transplanted now when they are “in the green” and our gardener Ray would be pleased to receive any plants you would like to contribute.



Dr. Graziella Branduardi-Raymont (l) with Chris Bridge, Alex Blustin Tracey Poole, Rhaana Starling and John Lapington (l-r) who received their awards at the ceremony at UCL on 8th December.

New Staff Members

We welcome Roberto Mignani to the astro group. Roberto is an experienced astronomer from ESO, and his main interest is neutron stars, although he has a wide range of interests within astronomy.

Visitors

- Marina Galand, Cesar Bertucci and Alex Law (all from Imperial College) visited the planetary science group to discuss Cassini Titan data on Feb 06.
- Malcolm Dunlop from RAL visited the Plasma Physics group on 28 Feb.
- Durgash Tripathi from University of Cambridge visited the solar group and gave a seminar on 18 Jan.
- Balázs Pintér from University of Sheffield visited the solar group and gave a seminar on 8 March.

Appointments

- Alex Blustin has been awarded a 3-year PPARC Postdoctoral Fellowship to investigate ionised outflows and the connection between black hole and galaxy evolution.
- Tom Dwelly has taken a postdoc in the astronomy group at Southampton University, starting 1 March 2006. We wish him good luck. He is still tidying up the last of his thesis, and his farewell celebrations are waiting until his Phd is submitted.

- Geraint Jones has been awarded a 5-year PPARC advanced fellowship at MSSL to work on 'Mass transfer in our planetary system', using Cassini, Mars Express and Venus Express data. He will start by March 2007.
- Andrew Coates was Co-convenor of 'Titan Revealed - Latest findings from Cassini/Huygens measurements', RAS specialist discussion meeting, 10 Feb 2006.

Prizes and Awards

The Alan Johnstone Prize was awarded to Steven Fuerst on 16 Dec. 2005. Steven has made very significant contributions to the fundamental physics of how energy is transported in extreme conditions, for example close to the event horizons of black holes and at the very early stages of the universe. He is now working at the Kavli Institute for Particle Astrophysics at Stanford University.

Grants and Contracts Awarded

PPARC – hyperspectral camera system - startup (£20k)

The Cluster Operations grant was further extended, although at a reduced level, by PPARC.

Telescope/Satellite Time Awards/Proposals

Space-based telescope time awards:

Alex Blustin was awarded 130 ks observing time on XMM-Newton to observe the Seyfert 1 galaxy H 0557-385.

Mission Status and Developments

Aurora/ExoMars - Andrew Coates and Andrew Griffiths attended the ExoMars payload meeting with ESA and Alcatel Alenia.

Cassini-Huygens - Titan flybys on 26 Dec. (first tail pass) and 27 Feb. (second tail encounter). The instrument is working well.

Cluster - We had a Cluster Active Archive PEACE Instrument meeting with ESA CAA managers on 17 Jan. Hina Khan and Andrew Fazakerley attended the Cluster Active Archive Cross-Calibration Meeting on 2-3 Feb.

Cross-Scale - An ESA ITT for an industrial study into mission feasibility recently closed. We hope that results of this will be out later this year. Related Science issues will be discussed at both the forthcoming EGU meeting in Vienna and the next Cluster workshop in Toulouse.

Cryosat - CryoSat 2 mission has been approved by PB- EO and is now funded by ESA.

Jupiter/Europa Cosmic Visions – Andrew Coates and Rob Gowen attended the first meeting of this proposal team in Paris in December.

KuaFu - First KuaFu Science Team meeting was held and Andrew Fazakerley presented a paper on the proposed FPI instrument 12-13 Jan.

Mars Express - Andrew Coates and Yasir Soobiah attended the Mars conference in Kiruna and Mars Express team meeting.

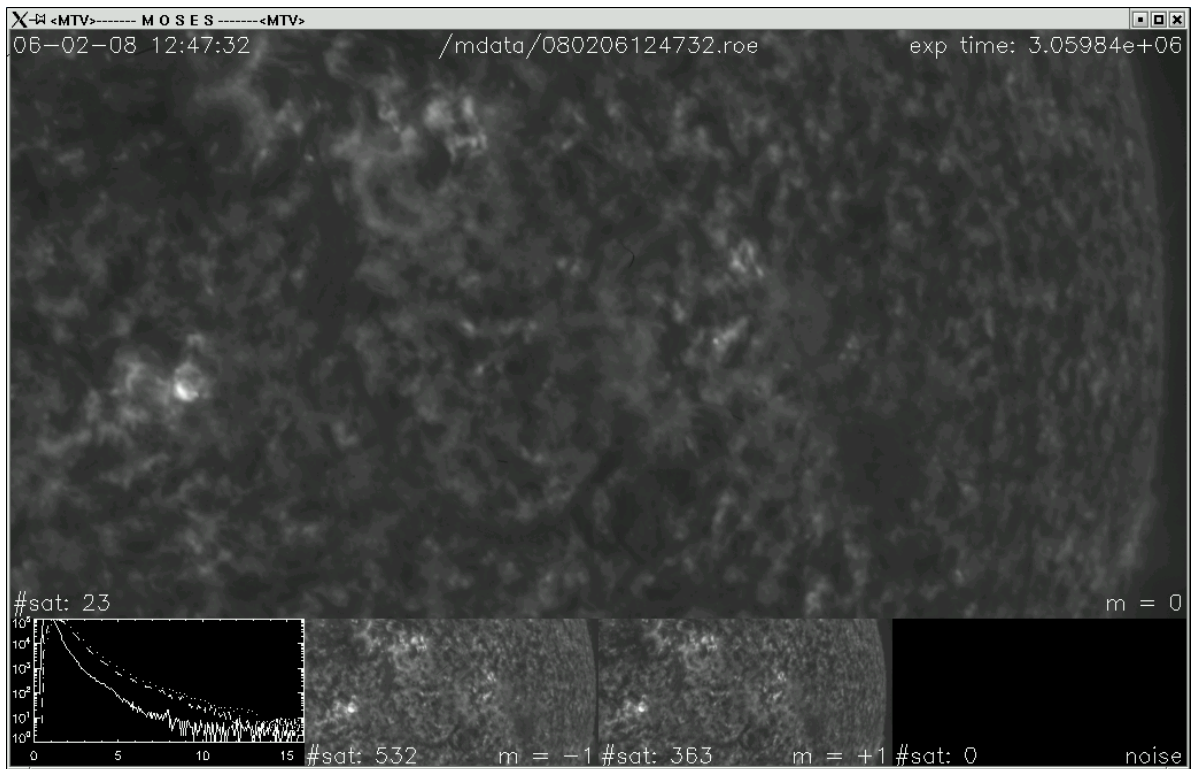
Solar-B EIS - In January MSSL hosted a meeting of consortia members to discuss the ground-based software and to see demonstrations of some of the tools under

development. In particular the planning tool was used to produce studies by those present and this testing has now been widened to include other users from the UK Solar community.

Solar Orbiter - Development work for a possible electrostatic analyser for Solar Orbiter continues within the laboratory.

Venus Express - Andrew Coates and Dhiren attended the Venus Express team meeting. Instrument commissioning went well; we see the solar wind. Arrival (Venus Orbit Insertion) on 11 April.

Moses – The MOSES rocket payload was successfully launched on 8 Feb from White Sands Missile Range, New Mexico. The data looks excellent and we are now in the process of analysing it. This picture shows MOSES flight data. The upper figure is an image of the SUN image on ccd 0 (ie. order 0 image). The 4 small figures at the bottom show: a) image intensity histogram; b) order -1 image; c) order +1 image and d) the noise respectively.



Thanks to Charles C. Kankelborg (Montana State University, US) for providing us with this data.

News from the Groups

Andrew Coates reports on Giotto's encounter with Halley's Comet: 20 years ago!

It was the year of the tragic Challenger disaster – but UCL-MSSL was making good news in space and making history too. The Giotto spacecraft carried 10 instruments, including one led by UCL-MSSL just 596 km (MSSL-ESOC!) from comet Halley on the night of 13-14 March, with some spectacular results.

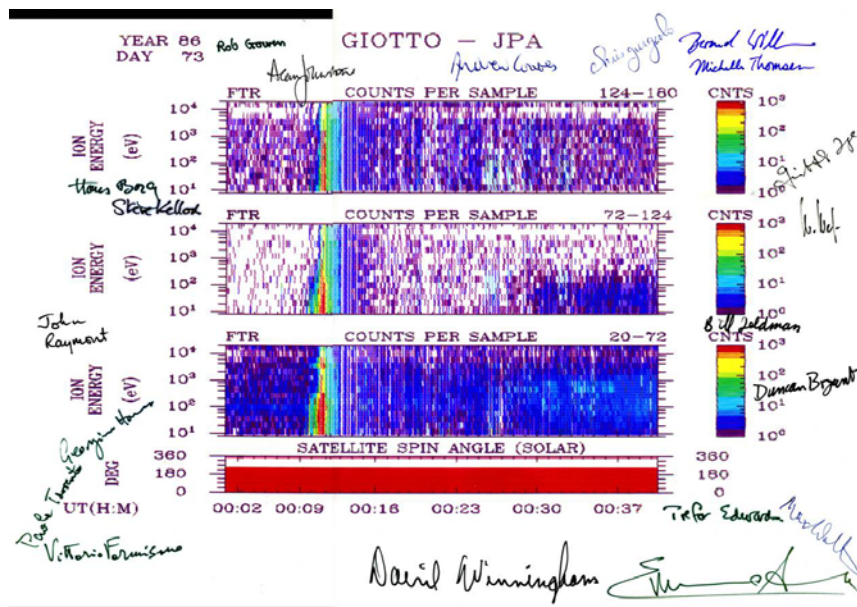
Giotto was ESA's first solo interplanetary space mission, launched in 1985 on the penultimate Ariane 1 rocket. In many ways ESA itself can be thought of as 'coming of

age' with this first bold step on its own out of Earth orbit. To date, Giotto collected the most complete set of data we have from a comet - the famous comet Halley.

13-14 March 1986 was called the 'night of the comet'. The MSSL team at ESA's ESOC facility in Darmstadt included Alan Johnstone (PI of the Johnstone Plasma Analyser), Andrew Coates (Experiment Manager), John Raymond (operations support) and Rob Gowen (software support). Len Culhane was also present as a supporting VIP. Many people at the lab had contributed to the success of our instrument. Notable amongst these were John Coker, Fred Little, Steve Kellock, Jim Bowles, Peter Sheather, Joe Ootes, and many others. The instrument consisted of 3 units – the Fast Ion Sensor (MSSL), the Implanted Ion Sensor (MPS Lindau) and the Data Processing unit (IFSI-CNR, Rome). Also at ESOC were many other scientists on our international team, from MPAe (now MPS) Germany, IFSI-CNR (Italy), Kiruna Geophysical Institute (now IRF) Sweden, SwRI, USA and RAL, as well as team members from the other experiments. An additional floor had been built on the ESOC main building to house them all. The world's media trucks and cameras were assembled, the marquees were up, the champagne was on ice. The stage was set for an historic encounter.

Comets are ancient members of our solar system, the building blocks of the outer planets' cores. They are little changed since the beginning of the solar system 4.6 billion years ago. Most comets are now in two 'storage' regions, the Oort Cloud and the Kuiper Belt. Every now and then, one of their orbits is disturbed and a comet enters the inner solar system, orbiting the Sun. Halley came from the Oort cloud. When it nears the Sun, volatile material, mainly water, sublimates away from the comet's nucleus and becomes ionized by sunlight. This slows the solar wind flow and produces the comet's plasma tail. This was the process we were studying in action – a process we now know is also at work in the loss of atmospheric material from Mars,

Venus. Titan, Enceladus and probably Pluto.



During the day on the 12th the excitement was tangible. We first reported cometary ions at 9am, before any other instrument detected the comet (later analysis shows ions earlier than this from JPA and EPA). The amount increased through the day; during the afternoon the solar wind visibly slowed,

Plot of results from MSSL's Fast Ion sensor at closest approach to comet Halley - produced and signed by team members on the 'night of the comet'. The plot shows the unexpected (red) burst of particles as Giotto entered the magnetic cavity, and data gaps related to the spacecraft's nutation following a dust impact

eventually at 19:22 we detected the bow shock. And the automatic software to follow the rapidly changing solar wind (UK specified, Italian built) worked well! Closest approach was just after midnight (3 minutes after on board, 11 minutes after on the ground due to light travel time). As time went on we saw increasing cometary ions, further unexpected and mysterious boundaries. Then a quiet period before finally a burst of particles as we entered the magnetic cavity – long expected, but Giotto is still the only spacecraft to have seen this.

Then loss of the signal temporarily, periodically being detected and analysed then lost again, and we realized that Giotto was nutating on its spin axis after a dust impact. This had been expected and on-board dampers reduced this in the following hours. But JPA had survived and we were still seeing data! Some damage had occurred to JPA and changes of state – John Raymond and I frantically worked out which commands (in hexadecimal) to send via the ESOC team – they still say how polite we were asking for these over the voice loops at such a hectic time for the spacecraft - while other team members talked to Patrick Moore, swigged champagne and looked in awe at the data. We were at the heart of discovery – our champagne came later. The pictures on the night reportedly disappointed Prime Minister Margaret Thatcher – but she still wrote a congratulatory letter and invited Alan to No.10 later to find out what it was all about.

Along with several other instruments, JPA survived what Halley threw at it at a relative speed of 68.4 km/s and we received good results on the outbound leg. Giotto also encountered a much weaker comet, Grigg-Skjellerup, in July 1992 – a factor 100 weaker but with some exciting results to compare.

Overall, Giotto found many unexpected features. It was the first time a cometary nucleus was seen – but unexpectedly it was dark as coal, and the activity was confined to well-defined jets. Giotto proved that comets really are ancient members of the solar system. The number of known ‘parent’ gas molecules increased from 11 to 38 that night, and heavy hydrocarbons were seen. Thanks to JPA and the other plasma instruments, we now know more of how cometary plasma tails form. It took over a decade to fully analyse our results. But the onset of activity with distance from the Sun was left to be measured by Rosetta in 2014.

It was a privilege to be there on the night of the comet, and at the anniversary celebration on the same date 20 years later – as all of the talks there showed, we learned a lot from Giotto – more than any other cometary mission so far. We also raised a glass to absent friends.



The Giotto-JPA team at MSSL with a model of the spacecraft (kindly lent by Giotto prime contactor British Aerospace for the MSSL open days), taken in April 1986

Solar Group's Giulio Del Zanna reports on the recent release of CHIANTI v.5.

CHIANTI has now become the most widely-used atomic package to study solar and stellar coronae. For optically thin collisionally-excited plasmas this database is the most complete and up-to-date. Its major features include - inclusion of ionization and recombination effects in level population calculation - photoexcitation from any user-provided radiation field - software to account for non-Maxwellian distribution of velocities - new data for Fe IX, Fe X, Fe XII, Fe XV (EUV), important for missions such as SOLAR-B/EIS - new data for Fe XVII to Fe XXIV (X-rays), important for the analysis of Chandra and XMM-Newton data - new data for n=3 to n=3 N-like and O-like transitions (UV) - new ions (P XIV, XV; Cl II, X, XI, XII, XVII; K V, XVII, XIX; Ca VII, VIII; Co XX; Zn XXIII) - many existing ion data-sets have been updated - the software has been improved and speeded up considerably.

Access to data, software and documentation can be obtained through:
http://www.mssl.ucl.ac.uk/www_solar/chianti/.

(Reference: E. Landi, G. Del Zanna, P.R. Young, K.P. Dere, H.E. Mason, M. Landini, 2006, The Astrophysical Journal Supplement Series, 162, 261.)

Publications - Refereed

S & CP authors are shown in upper case.

A. Published

- DEL ZANNA, G., Benchmarking atomic data for astrophysics: Fe-XXIV, *Astron. & Astrophys.*, 447, 761-768, 2006. This is the first complete benchmark of Fe XXIV emission lines, important for laboratory and astrophysical plasmas (in particular for Chandra and XMM-Newton). [10.1051/0004-6361:20042511](https://doi.org/10.1051/0004-6361:20042511)
- DEL ZANNA, G., Berlicki, A., Mason, H.E. & Schmieder, B., Multi-wavelength observations of the M1 flare of October 22, 2002, *Solar Phys.*, 234, 95-113, 2006. In this paper we describe unique spatially-resolved spectroscopic observations performed with SOHO/CDS during the impulsive phase of an M1-class solar flare. Strong up-flows were observed in the ribbons, and related to the overall morphology of the event. [10.1007/s11207-006-0016-6](https://doi.org/10.1007/s11207-006-0016-6)
- HENDERSON, P.D., OWEN, C.J., ALEXEEV, I.V., Slavin, J., FAZAKERLEY, A.N., Lucek, E. & Reme, H., Cluster observations of flux rope structures in the near-tail, *Ann. Geophys.*, 24, 2, 651-666, 2006. This paper examines flux ropes in the night-side magnetosphere, interpreted as evidence for multiple X line reconnection. This mechanism is important for the study of the breakup of current sheets around substorm onset.
- Lundin, R., Winningham, D., Barabash, S., Frahm, R., Holmstrom, M., Sauvaud, A., Fedorov, A., Asamura, K., COATES, A.J., SOOBIAH, Y., Hsieh, K.C., Grande, M., Koskinen, H., Kallio, E., Kozyra, J., Woch, J., Fraenz, M., Brain, D., Luhmann, J., McKenna-Lawlor, S., Orsini, R.S., Brandt, P. & Wurz, P., Plasma acceleration above Martian magnetic anomalies, *Science*, 311, 5763, 980-983, 2006. [10.1126/science.1122071](https://doi.org/10.1126/science.1122071)
- Retino, A., Vaivads, A., Andre, M.M., Sahraoui, F., Khotyaintsev, Y., Pickett, J.S., Bavasano-Cattaneo, M.B., Marcucci, M.F., Morooka, M., OWEN, C.J., Buchert, S. & Cornilleau-Wehrlin, N., The structure of the separatrix region close to a

- magnetic reconnection X-line: Cluster observations, *Geophys. Res. Let.*, 33, L06101, 2006. [10.1029/2005GL024650](https://doi.org/10.1029/2005GL024650)
- Tokar, R.L., Johnson, R.E., Hill, T.W., Pontius, D.H., Kurth, W.S., Crary, F.J., Young, D.T., Thomsen, M.F., Reisenfeld, D.B., COATES, A.J., LEWIS, G.R., Sittler, E.C. & Gurnett, D.A., The interaction of Saturn's plasma with the atmosphere of Enceladus: Cassini observations, *Science*, 311, 5766, 1409-1412, 2006. [10.1126/science.1121061](https://doi.org/10.1126/science.1121061)
- Witthoeft, M.C., Badnell, N.R., DEL ZANNA, G., Berrington, K.A., Pelan, J.C., Marshall, F., Mezaros, P., Nousek, J.A & Osborne, J.P., Atomic data from the Iron Project LX. Electron-impact excitation of $n=3,4$ levels of Fe¹⁷⁺, *Astron. & Astrophys.*, 446, 361-366, 2006. This is the first accurate scattering calculation performed on Fe XVIII, an ion that produces some of the strongest emission lines in the spectra of the flaring Sun and of active stars. The new calculations modify theoretical intensities by factors up to three, thus removing some of the long-standing discrepancies with observations. [10.1051/0004-6361:20053631](https://doi.org/10.1051/0004-6361:20053631)

B. In Press

- Barabash, S., Sauvaud, J.-A., Gunell, H., Andersson, H., Grigoriev, A., Brinkfeldt, K., Holmstrom, M., Lundin, R., Yamauchi, M., Asamura, K., Baumjohann, W., Zhang, T., COATES, A.J., LINDER, D.R., KATARIA, D.O., Curtis, C.C., Hsieh, K.C., Sandel, B.R., Fedorov, A., Mazelle, C., Thocaven, J.-J., Grande, M., Koskinen, H.E.J., Kallio, E., Sales, T., Riihela, P., Kozyra, J., Krupp, N., Woch, J., Luhmann, J., McKenna-Lawlor, S., Orsini, S., Cerulli-Irelli, R., Mura, M., Milillo, M., Maggi, M., Roelof, E., Brandt, P., Russell, C.T., Szego, K., Winningham, J.D., Frahm, R.A., Scherrer, J., Sharber, J.R., Wurz, P. & Bochsler, P., The Analyser of Space Plasmas and Energetic Atoms (ASPERA-4) for the Venus Express mission, *Planet. Space Sci.*, 2006.
- Brinkfeldt, K., Gunell, H., Brandt, P.C., Barabash, S., Frahm, R.A., Winningham, J.D., Kallio, E., Holmstrom, M., Futaana, Y., Ekenback, A., Lundin, R., Andersson, H., Yamauchi, M., Grigoriev, A., Sharber, J.R., Scherrer, J., COATES, A.J., LINDER, D.R., KATARIA, D.O., Koskinen, H., Sales, T., Riihela, P., Schmidt, W., Kozyra, J., Luhmann, J., Roelof, E., Williams, D., Livi, S., Curtis, C.C., Hsieh, K.C., Sandel, B.R., Grande, M., CARTER, M., Sauvaud, J.-A., Fedorov, A., Thocaven, J.-J., McKenna-Lawlor, S., Orsini, S., Cerulli-Irelli, R., Maggi, M., Wurz, P., Bochsler, P., Krupp, N., Woch, J., Fraenz, M., Asamura, K. & Dierker, C., Observations of energetic neutral atoms on the nightside of Mars, *ICARUS*, 2006.
- Carlsson, E., Fedorov, A., Barabash, S., Budnik, E., Grigoriev, A., Gunell, H., Nilsson, H., Sauvaud, J.-A., Lundin, R., Futaana, Y., Holmstrom, M., Andersson, H., Yamauchi, M., Winningham, J.D., Frahm, R.A., Sharber, J.R., Scherrer, J., COATES, A.J., LINDER, D.R., KATARIA, D.O., Kallio, E., Koskinen, H., Sales, T., Riihela, P., Schmidt, W., Kozyra, J., Luhmann, J., Roelof, E., Williams, D., Livi, S., Curtis, C.C., Hsieh, K.C., Sandel, B.R., Grande, M., Carter, M., Thocaven, J.-J., McKenna-Lawlor, S., Orsini, S., Cerulli-Irelli, R., Maggi, M., Wurz, P., Bochsler, P., Krupp, N., Woch, J., Fraenz, M., Asamura, K. & Dierker, C., Mass composition of the escaping plasma at Mars, implications for carbon inventory, *ICARUS*, 2006.
- Cravens, T. E., Clark, J., Bhardwaj, A., Elsner, R., Waite, J. H., Maurellis, A. N., Gladstone, G. R. & BRANDUARDI-RAYMONT, G., X-ray Emission from the Outer Planets: Albedo for Scattering and Fluorescence of Solar X-rays, *J. Geophys. Res.*, 2006. The paper presents the results of calculations of the

scattering albedo for soft X-rays of Jupiter and Saturn's atmospheres. The model calculations are compared and found to be in good agreement with recent X-ray observations of the two planets.

- DE PASQUALE, M., Piro, L., Gendre, B., Amati, L., Antonelli, L.A., Costa, E., Feroci, M., Frontera, F., Nicastro, L., Soffitta, P., & In't Zand, J.M.J., The BeppoSAX catalog of GRB X-ray afterglow observations, *Astron. & Astrophys.*, 2006. We present the catalog of all GRB X-ray afterglows observed by BeppoSAX for the whole mission, with the results of time and spectral analysis.
- Dubin, E., Lundin, R., Franz, M., Woch, J., Barabash, S., Fedorov, A., Winningham, D., Krupp, N., Sauvaud, J.-A., Holmstrom, M., Andersson, H., Yamauchi, M., Grigoriev, A., Thocaven, J.-J., Frahm, R., Sharber, J., Asamura, K., COATES, A., Curtis, C., Hsieh, K.S., Sandel, B., Grande, M., CARTER, M., Koskinen, H., Kallio, E., Riihela, P., Schmidt, W., Sales, T., Kozyra, J., Luhmann, J., McKenna-Lawlor, S., Cerulli-Irelli, R., Orsini, S., Maggi, M., Roelof, E., Williams, D., Livi, S., Bochsler, P. & Dierker, C., Electric fields within the Martian magnetosphere and ion extraction, ASPERA-3, ICARUS, 2006.
- Evans, P. A., Hellier, C. & RAMSAY, G., XMM-Newton observations of the complex spin pulse of the intermediate polar IP Gem, *Mon. Not. R. astr. Soc.*, 2006. The binary system PQ Gem shows a complex pulsation which is caused by a spinning white dwarf, which varies markedly with wavelength. Building on previous work, we show how a model in which the accretion flows along skewed magnetic field lines viewed at the correct inclination can explain all the major features of the lightcurves at all wavelengths.
- Fraenz, M., Winningham, D., Dubin, E., Roussos, E., Woch, J., Barabash, S., Lundin, R., Holmstrom, M., Andersson, H., Yamauchi, M., Grigoriev, A., Frahm, R.A., Sharber, J.R., Scherrer, J., COATES, A.J., LINDER, D.R., KATARIA, D.O., Kallio, E., Sles, T., Riihela, P., Schmidt, W., Koskinen, H.E.J., Kozyra, J., Luhmann, J., Roelof, E., Williams, D., Livi, S., Curtis, C.C., Hsieh, K.C., Sandel, B.R., Grande, M., CARTER, M., Sauvaud, J.-A., Fedorov, A., Thocaven, J.-J., McKenna-Lawlor, S., Orsini, S., Cerulli-Irelli, R., Maggi, M., Wurz, P., Bochsler, P., Krupp, N., Asamura, K. & Dierker, C., Plasma intrusion above Mars crustal fields - Mars Express ASPERA observations, ICARUS, 2006.
- Frahm, R.A., Winningham, D., Sharber, J.R., Scherrer, J.R., Jeffers, S.J., COATES, A.J., LINDER, D.R., KATARIA, D.O., Lundin, R., Barabash, S., Holmstrom, M., Andersson, H., Yamauchi, m., Grigoriev, A., Kallio, E., Koskinen, H., Sales, T., Riihela, P., Schmidt, W., Kozyra, J.U., Luhmann, J.G., Roelof, E.C., Williams, D.J., Livi, S., Curtis, C.C., Hsieh, K.C., Sandel, B.R., Grande, M., CARTER, M., Sauvaud, J.-A., Fedorov, A., Thocaven, J.-J., McKenna-Lawlor, S., Orsini, S., Cerulli-Irelli, R., Maggi, M., Wurz, P., Bochsler, P., Krupp, N., Woch, J., Fraenz, M., Asamura, K. & Dierker, C., Carbon Dioxide photoelectron peaks at Mars, ICARUS, 2006.
- Futaana, Y., Barabash, S., Grigoriev, A., Holmstrom, M., Kallio, E., Bradt, P.C., Gunell, H., Brinkfeldt, K., Lundin, R., Andersson, H., Yamauchi, M., Winningham, J.D., Frahm, R.A., Sharber, J.R., Scherrer, J., COATES, A.J., LIINDER, D.R., KATARIA, D.O., Sales, T., Riihela, P., Schmidt, W., Koskinen, H., Kozyra, J., Luhmann, J., Roelof, E., Williams, D., Livi, S., Curtis, C.C., Hsieh, K.C., Sandel, B.R., Grande, M., Carter, M., Sauvaud, J.-A., Fedorov, A., Thocaven, J.-J., McKenna-Lawlor, S., Orsini, S., Cerulli-Irelli, R., Maggi, M., Wurz, P., Bochsler, P., Krupp, N., Woch, J., Fraenz, M., Asamura, K. & Dierker, C., Subsolar ENA jet at Mars, ICARUS, 2006.

- Futaana, Y., Barabash, S., Grigoriev, A., Holmstrom, M., Kallio, E., Brandt, P.C., Gunnell, H., Brinkfeld, K., Lundin, R., Andersson, H., Yamauchi, M., Winningham, J.D., Frahm, R.A., Sharber, J.R., Scherrer, J.R., COATES, A.J., LINDER, D.R., KATARIA, D.O., Sales, T., Riihela, P., Schmidt, W., Koskinen, H., Kozyra, J., Luhmann, J., Roelof, E., Williams, D., Livi, S., Curtis, C.C., Hsieh, K.C., Sandel, B.R., Grande, M., Carter, M., Sauvaud, J.-A., Fedorov, A., Thocaven, J.-J., McKenna-Lawlor, S., Orsini, S., Cerulli-Irelli, R., Maggi, M., Wurz, P., Bochsler, P., Krupp, N., Woch, J., Fraenz, M., Asamura, K. & Dierker, C., First observation of ENA emissions from the Martian upper atmosphere, ICARUS, 2006.
- Galli, A., Wurz, P., Andersson, H., Yamauchi, M., Kallio, E., Riihela, P., Sales, T., Schmidt, W., Roelof, E.C., Williams, D., Brandt, P.C., Livi, S., Winningham, J.D., Frahm, R.A., Sharber, J.F., Scherrer, J., COATES, A.J., LINDER, D.R., KATARIA, D.O., Koskinen, H.E.J., Kozyra, J., Luhmann, J., Curtis, C.C., Ksieh, K.C., Sandel, B.R., Grande, M., Carter, M., Sauvaud, J.-A., Fedorov, A., Thocavens, J.-J., McKenna-Lawlor, S., Orsini, S., Cerulli-Irelli, R., Maggi, M., Bochsler, P., Krupp, N., Woch, J., Fraenz, M., Asamura, K. & Dierker, C., Direct measurements of energetic neutral hydrogen in the Interplanetary Medium, *Astrophys. J.*, 2006.
- Gibson, S., Fan, Y., Toeroek, T. & Kliem, B., The evolving Sigmoid: evidence for magnetic flux ropes in the corona before, during and after CMEs, 2006.
- Gunell, H., Brinkfeldt, K., Holmstrom, M., Brandt, P., Barabash, S., Kallio, E., Ekenback, A., Futaana, Y., Lundin, R., Andersson, H., Yamauchi, M., Grigoriev, A., Winningham, D., Frahm, R.A., Sharber, J.R., Scherrer, J., COATES, A.J., LINDER, D.R., KATARIA, D.O., Sales, T., Riihela, P., Schmidt, W., Koskinen, H.E.J., Kozyra, J., Luhmann, J., Roelof, E., Williams, D., Livi, S., Curtis, C.C., Hsieh, K.C., Sandel, B.R., Grande, M., CARTER, M., Sauvaud, J.-A., Fedorov, A., Thocaven, J.-J., McKenna-Lawlor, S., Orsini, S., Cerulli-Irelli, R., Maggi, M., Wurz, P., Bochsler, P., Krupp, N., Woch, J., Fraenz, M., Asamura, K. & Dierker, C., Measurements and simulations of energetic neutral atoms produced by charge exchange at Mars, ICARUS, 2006.
- Kallio, E., Barabash, S., Brinkfeldt, K., Gunell, H., Holmstrom, M., Futaana, Y., Schmidt, W., Sales, T., Koskinen, H., Riihela, P., Lundin, R., Andersson, H., Yamauchi, M., Grigoriev, A., Winningham, J.D., Frahm, R.A., Sharber, J.R., Scherrer, J., COATES, A.J., LINDER, D.R., KATARIA, D.O., Kozyra, J., Luhmann, J.G., Roelof, E., Williams, D., Livi, S., Brandt, C.P., Curtis, C.C., Hsieh, K.C., Sandel, B.R., Grande, M., Carter, M., Sauvaud, J.-A., Fedorov, A., Thocaven, J.-J., McKenna-Lawlor, S., Orsini, S., Cerulli-Irelli, R., Maggi, M., Wurz, P., Bochsler, P., Krupp, N., Woch, J., Asamura, K. & Dierker, C., Energetic neutral atoms (ENA) at Mars: properties of the hydrogen atoms produced upstream of the Martian bow shock and implications for an ENA sounding technique, ICARUS, 2006.
- Kallio, E., Fedorov, A., Budnik, E., Sales, T., Janhunen, P., Schmidt, W., Koskinen, H., Riihela, P., Barabash, S., Lundin, R., Holmstrom, M., Gunell, H., Brinkfeldt, K., Futaana, H., Andersson, H., Yamauchi, M., Grigoriev, A., Sauvaud, J.-A., Thocaven, J.-J., Winningham, D.J., Frahm, R.A., Sharber, J.R., Scherrer, J., COATES, A.J., LINDER, D.R., KATARIA, D.O., Kozyra, J., Luhmann, J.G., Roelof, E., Williams, D., Livi, S., Curtis, C.C., Hsieh, K.C., Sandel, B.R., Grande, M., Carter, M., McKenna-Lawlor, S., Maggi, M., Wurz, P., Bochsler, P., Krupp, N., Woch, J., Fraenz, M., Asamura, K. & Dierker, C., Ion escape at Mars:

Comparison of a 3-D hybrid simulation with Mars Express IMA/ASPERA-3 measurements, ICARUS, 2006.

- Liemohn, M.W., Frahm, R., Winningham, J.D., Ma, Y., Barabash, S., Lundin, R., Kozyra, J.U., Nagy, A.F., Bougher, S.M., Bell, J., Brain, D., Mitchell, D., Luhmann, J., Holmstrom, M., Andersson, H., Yamauchi, M., Grigoriev, A., McKenna-Lawlor, S., Sharber, J.R., Scherrer, J.R., Jeffers, S.J., COATES, A.J., LINDER, D.R., KATARIA, D.O., Kallio, E., Koskinen, H., Sales, T., Riihela, P., Schmidt, W., Roelof, E., Williams, D., Livi, S., Curtis, C.C., Hsieh, K.C., Sandel, B.R., Grande, M., Carter, M., Sauvaud, J.-A., Fedorov, A., Thocaven, J.-J., Orsini, S., Cerulli-Irelli, R., Maggi, M., Wurz, P., Bochsler, P., Krupp, N., Woch, J., Fraenz, M., Asamura, K. & Dierker, C., Numerical interpretation of high-altitude photoelectron observations, ICARUS, 2006.
- Lundin, R., Winningham, D., Barabash, S., Frahm, R., Andersson, H., Holmstrom, M., Grigoriev, A., Yamauchi, M., Sharber, J.R., Sauvaud, J.-A., Fedorov, A., Budnik, E., Thocaven, J.-J., Asamura, K., Hayakawa, H., COATES, A.J., LINDER, D.R., KATARIA, D.O., Curtis, C., Hsieh, K.C., Sandel, B.R., Grande, M., CARTER, M., Reading, D.H., Koskinen, H., Kallio, E., Riihela, P., Schmidt, W., Sales, T., Kozyra, J., Krupp, N., Woch, J., Fraenz, M., Luhmann, J., McKenna-Lawlor, S., Cerulli-Irelli, R., Orsini, S., Maggi, M., Roelof, E., Williams, D., Livi, S., Brandt, P., Wurz, P. & Bochsler, P., Ionospheric plasma acceleration at Mars: ASPERA-3 results, ICARUS, 2006.
- PAGE, M.J., LOARING, N.S., DWELLY, T., MASON, K.O., McHardy, I.M., Gunn, K., Moss, D., Sasseen, T., Cordova, F., Kennea, J. & Seymour, N., X-ray spectra of sources in the 13H XMM-Newton/Chandra deep field, Mon. Not. R. astr. Soc., 2006. One of the drivers of XMM-Newton was to be able to do X-ray spectroscopy on faint sources. In this paper we do just that, and show that X-ray emitting stars and quasars can be told apart just from the shapes of their X-ray spectra.
- Winningham, J.D., Frahm, R.A., Sharber, J.R., COATES, A.J., LINDER, D.R., SOOBIAH, Y., Kallio, E., Koskinen, H., Sales, T., Riihela, P., Schmidt, W., Espley, J.R., Lundin, R., Barabash, S., Holmstrom, M., Andersson, H., Yamauchi, M., Grigoriev, A., Scherrer, J.R., Jeffers, S.J., KATARIA, D.O., Kozyra, J.U., Luhmann, J.G., Roelof, E.C., Williams, D.J., Livi, S., Curtis, C.C., Hsieh, K.C., Sandel, B.R., Grande, M., CARTER, M., Sauvaud, J.-A., Fedorov, A., Thocaven, J.-J., McKenna-Lawlor, S., Orsini, S., Cerulli-Irelli, R., Maggi, M., Wurz, P., Bochsler, P., Krupp, N., Woch, J., Fraenz, M., Asamura, K. & Dierker, C., Oscillations in the induced Martian magnetosphere, ICARUS, 2006.

Publications - Non-refereed

A. Published

- COATES, A.J., Our solar system, *Advances in Astronomy: from the Big Bang to the Solar System*, Royal Society Series on Advances in Science, Vol. 1, 305-330, 2005.
- DEL ZANNA, G & Mason, H.E., Spectral diagnostic capabilities of Solar-B EIS, *Adv. Space Res.*, 36, 1503-1511, 2005. We provide the community with simulated EIS intensities to aid in the scientific planning. The best atomic data have been used. A discussion of some of the potential plasma diagnostics is also included.

- Fontaine, D., Teste, A., Maggiolo, R., Sauvaud, J.-A. & FAZAKERLEY, A.N., Polar cap particle acceleration: electron dynamics associated with ion flows, in Proceeding of Cluster and Double Star Symposium, ESA-598, (Eds.), ESA, 2005.
- KHAN, H., FAZAKERLEY, A.N., WILSON, R.J., LAHIFF, A.D. & TAYLOR, M.G.G.T., Plasma Electron and Current Experiment (PEACE) data contributions to the Cluster Active Archive (CAA), in Proceeding of Cluster and Double Star Symposium, SP-598, ESA, 2005.
- KHAN, H., Laakso, H., Dunlop, M., TAYLOR, M.G.G.T., Escoubet, C.P. & Opgenoorth, H., Inner mechanisms of flux transfer events observed by Cluster using high time resolution EFW data, in Proceeding of Cluster and Double Star Symposium, SP-598, ESA, 2005.
- OWEN, C.J., ALEXEEV, I.V., MARCHAUDON, A. & BOGDANOVA, Y.V., Cluster observations of the field and plasma structure of current sheets in the solar wind, in Proceedings of Solar Wind 11/SOHO 16 Conference, Whistler, Canada, 17-23 June 2005, SP-592, ESA, 2005.
- Roux, A., LeContel, O., Fontaine, D., Robert, D., Louarn, P. & FAZAKERLEY, A.N., Substorm theories and Cluster multi-point measurements, in Proceeding of Cluster and Double Star Symposium, ESA, 2005.
- HENDERSON, P.D., OWEN, C.J., ALEXEEV, I.V., Slavin, J., FAZAKERLEY, A.N., Lucek, E. & Reme, H., Cluster observations of flux rope structures in the near-tail, in Proceedings Cluster and Double Star Symposium – 5th Anniversary of Cluster in Space, ESTEC, 19 - 23 September 2005 , ESA SP-598, January 2006, 2006.
- Pickett, J.S., Chen, L.-J., Gurnett, D.A., Swanner, J.M., Santolik, O., Decreau, P.M.E., Beghin, C., Sundkvist, D., Lefebvre, B., Goldstein, M.L., Lavraud, B., Lucek, E., Kessel, R., Lakhina, G.S., Singh, S.V., Reddy, R.V., Tsurutani, B.T., Reme, H. & FAZAKERLEY, A., Shedding new light on solitary waves observed in space, in Proceedings of Cluster and Double Star Symposium, SP-598, ESA, 2006.
- TAYLOR, M.G.G.T., Lavraud, B., Thomsen, M.F., FAZAKERLEY, A.N., Dunlop, M.W., Davies, J.A., Escoubet, C.P., Laakso, H., KHAN, H., Masson, A., Opgenoorth, H.J., Friedel, R.H., Reme, H., Carr, C.M., Zhang, T.L. & Lucek, E.A., Multi-satellite observations of the near Earth plasma sheet and Flank magnetopause: response to the 5th December 2004 CME, in Proceeding of the Cluster and Double Star Symposium, SP-598, ESA, 2006.

B. In Press

- Barabash, S., Sauvaud, J.-A., Gunell, H., Andersson, H., Grigoriev, A., Brinkfeldt, E., Carlsson, E., Holmstrom, M., Lundin, R., Yamauchi, M., Asamura, K., Baumjohann, W., Zhang, T., COATES, A.J., LINDER, D.R., KATARIA, D.O., Curtis, C.C., Hsieh, K.C., Sandel, B.R., Fedorov, A., Mazelle, C., Thocaven, J.-J., Grande, M., Koskinen, H.E.J., Kallio, E., Sales, T., Riihela, P., Kozyra, J., Krupp, N., Woch, J., Luhmann, J., McKenna-Lawlor, S., Orsini, S., Cerulli-Irelli, R., Mura, M., Milillo, M., Maggi, M., Roelof, E., Brandt, P., Russell, C.T., Szego, K., Winningham, J.D., Frahm, R.A., Scherrer, J., Sharber, J.R., Wurz, P. & Bochsler, P., The Analyzer of Space Plasmas and Energetic Atoms (ASPERA-4) for the Venus Express Mission, ESA-SP on the Venus Express mission, 2006.
- Hospodarsky, G.B., Kurth, W.S., Gurnett, D.A., Zarka, P., Canu, P., Dougherty, M., Jones, G.H., COATES, A.J., RYMER, A. & Young, D.T., Observations of

Langmuir waves detected by the Cassini spacecraft, in Proceedings of 6th International Workshop on Planetary and Solar Radio Emissions (PRE VI), 2006.

Invited Talks and Lectures (National and International)

Sarah Matthews - invited talk at the joint RAS/IOP discussion meeting on LISA in January (Solar Energetic Particle Events:possibilities for early warnings and parameterization);

Louise Harra - organized this year's annual Solar UK missions forum which was held at UCL on 23/24 Feb. Louise, Len Culhane and David Williams gave presentations on Solar-B, Elizabeth Auden on eSDO and Sarah Matthews on ATST.

Andrew Coates – cometary plasma tails, presented at RAS discussion meeting on Comets: From Antiquity to the Present Day, 9 December 2005.

Hazel McAndrews - two seminars on Saturn's magnetopause at Los Alamos National Laboratory, New Mexico, and the Applied Physics Lab at John Hopkins University, Maryland on the 1 and 9 of March respectively.

Ilya Alexeev - seminar at Imperial College, London: Alexeev et al., X-line using polar rain electrons, 14 Feb. 2006.

Conference and Workshop Presentations (National and International)

Members of the Planetary Science group gave presentations at:

- RAS MIST meeting, London, 25 November 2005. (2)
- AGU Fall meeting, San Fransisco, 5-9 December 2005. (15)
- RAS meeting Titan revealed, 10 Feb 2006. (1)
- Kiruna Mars Workshop: Solar wind interaction and atmospheric evolution, Kiruna, Sweden, 27 Feb-1 Mar 2006. (6)

Members of the Plasma Physics group gave presentations at:

- AGU Fall meeting, San Fransisco, 5-9 Dec. 2005. Andrew Fazakerley co-authored 23 abstracts and gave a talk (Fazakerley, A.N. Alexeev, I., Marchaudon, A., Owen, C.J., Carr, C.M., Lucek, E. & Reme, H., Magnetotail Science with Double Star and Cluster). The following co-authored abstracts – Chris Owen (5), Ilya Alexeev (1) and Yulia Bogdanova (2).
- Cluster Active Archive meeting, 3-12 Jan. 2006. Andrew Fazakerley and Hina Khan gave talks.
- KuaFu Science Team meeting, 12-13 Jan. 2006. Andrew Fazakerley presented a paper on the proposed FPI instrument.
- International Space Science Institute working group on Magnetotail Transients – Chris Owen gave presentations and participated in their meeting at Bern, Switzerland, 6-10 Feb. 2006. The group is working on a review paper of transient effects in the magnetotail, as well as collaboration on a number of scientific studies, both to be completed later this year.

Media Broadcasts and Features

Andrew Coates

- Interview on Beagle 2 possible sighting on Mars and Aurora/ExoMars, BBC Southern Counties Radio
- Interviews on New Horizons (Pluto) mission on CNN, BBC World TV, Radio Free Europe/Radio Liberty
- Interview on BBC World Service, Newshour, on new extrasolar planet detection (5.5 Earth masses at 2.6 AU)

Andrew Coates and Hazel McAndrews

- quoted on Cassini-Huygens in the Independent 1 Dec. 2005, Aerospace careers section p11.

Lucie Green

- BBC World Service news interview for launch of New Horizons to Pluto.

Outreach

There has been a busy schedule of outreach activities during the last three months.

On 11 January an open evening coordinated by Andrew Coates was run for the Villagers local group. Alan Smith, Andrew Coates and Lucie Green gave talks that provided an overview of the current research at the lab.

Lucie Green gave a talk on Solar Physics to the Crayford Adult Education and Astronomical Society group on 19 Jan.

Tracey Poole visited two Brownie units to run 'Space and Stargazing evenings'. These cover the requirements for the Brownies' Stargazing Badge. Activities include a journey through the Solar System where the Brownies learn about the planets and the phases of the moon, a game based on the Greek mythology of 6 constellations, a craft where Brownies make their own Star Finders, and a chance to use the Star Finders outside if the skies are clear.

A group of 15 Woldingham Sixth formers visited MSSL on 9 Feb. After talks from Steve Welch on adaptive optics, and Ian Heburn on ADR technology, they toured some of the lab facilities. (Lucie Green coordinator)

A group of staff from Hurtwood House visited the lab on 13 Feb. They were taken on a tour of the lab facilities after an informal talk about the history of the lab given by Lucie Green. They thoroughly enjoyed their visit and look forward to starting up a football tournament with the lab. (Tracey Poole coordinator)

Lucie Green gave a talk on the Sun to Young at Heart local group.

Lucie Green has taken on a consultancy for the new Stockley Academy at West Drayton. She will help the school establish a new and inspirational space options programme.

Next Issue

The next issue of the Department of Space and Climate Physics Newsletter (Volume 4, Issue 1) will be published in June 2006. This will cover activities from 1 March 2006 to 31 May 2006.