



**The Newsletter - Volume 7, Issue 4**

**29<sup>th</sup> March 2010**

**Covers events between 1<sup>st</sup> December 2009 and 28<sup>th</sup> February 2010**

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**General**

Congratulations to Mark and Rebecca Hailey on the birth of their daughter Philippa.

**New Staff Members**

Vineeth Shetty has joined the lab to work with Bob Bentley. Samantha Oates continues her work in the Astrophysics Group following submission of her PhD thesis.

**Visitors**

Dr Ineke De Moortel from University of St Andrews visited the lab in February to collaborate with David Williams. She gave a talk entitled "3D Numerical Simulations of Transverse Coronal Loop Oscillations".

Dr Sarah Badman visited MSSL in December to give a talk entitled "Multi-instrument studies of Saturn's aurora" and discuss SuperDARN and SPEAR operations in conjunction with Cluster.

**Prizes and Awards**

Professor George Doscheck, head of the Solar Terrestrial Relationships Branch at the Naval Research Laboratory, Washington, was appointed an Honorary Professor of UCL. He gave a lecture at MSSL after an introduction by the Dean of the Faculty, Richard Catlow and Len Culhane.

**Appointments (e.g. Editorial Boards or Committees)**

Peter Muller has been appointed as "Chair of STFC Aurora Advisory Committee" for an initial period of 2 years from 1/1/2010.

## News from the Astrophysics Group

### ***XMM-NEWTON - A DECADE IN SPACE!***

XMM-Newton, the most powerful X-ray observatory ever built and launched into space, is a cornerstone mission of the European Space Agency Horizon 2000 programme. Its observations have revolutionised the way we view the hottest and most exotic regions of the Universe, and have impacted on every aspect of astronomy, from the largest structures in space, galaxy clusters, and supermassive blackholes at the heart of distant galaxies, to exploding stars in our own Milky Way, the magnetic activity of young stars and the atmospheres of planets. XMM-Newton instrumentation, comprising the European Photon Imaging Cameras (EPIC), the Reflection Grating Spectrometer (RGS) and the Optical Monitor (OM), continues to perform outstandingly well, even after 10 years of operations in space and over 600 million kilometers on the clock.



On 8 December the whole Laboratory was invited to share into a celebration of the 10th anniversary of the launch of the XMM-Newton observatory. MSSL has contributed and continues to contribute substantially to this mission, being PI institute for the OM and Co-I for the RGS. On the day there were four talks, covering the development of the OM hardware, problems encountered and solutions achieved (Alan Smith), the science that has been and is being returned by the OM (Mark Cropper) and RGS (Graziella), and a look to future enterprises in X-ray astronomy (Mat Page). This was followed by a much appreciated buffet lunch for all. MSSL staff that contributed in many different ways to the two XMM-Newton projects, and that are no longer working with us, were invited and quite a number of them managed to attend. We were very pleased to see them back, and understand they enjoyed the occasion very much.



On 10 December (the actual 10th anniversary of the launch) a few MSSL staff currently working for XMM-Newton OM and RGS participated in a meeting organised by ESA at the European Space Astronomy Centre at Villafraanca, near Madrid, to review the scientific discoveries made possible by XMM-Newton (Graziella was invited to talk on X-rays from solar system objects). This was followed by a dinner at the Opera in the centre of Madrid, where we had the chance to share common memories of many years of work, difficulties and successes, with many colleagues from collaborating institutes and ESA.

XMM-Newton has achieved an impressive record as highlighted below:

- There have been 2291 refereed papers produced with XMM data
- Approximately 110 PhD theses were submitted based on XMM data. A whole new generation of Astronomers have graduated from XMM school
- The satellite has consumed around 40% of the on-board fuel; hence it has a life expectancy of many years to come
- Past work was focused on short term observations (average of one day) to cover as many targets as possible. Present and future work will be focused on deep observations (many days' observation).

## Proposals Submitted

PPRP proposal for the next 18 months development on the Solar Orbiter SWA and EUI investigations.

## Telescope/Satellite Time Awards/Proposals

Roberto Soria was co-I in two successful XMM-Newton proposals, for the study of the halos of M31 and M104 (PI: Rosanne Di Stefano, Harvard CfA)

Roberto was also involved in three proposals:

- Australia Telescope Compact Array proposal to map the cocoon and radio lobes of a microquasar in NGC 7793.
- A SALT proposals (with N. Loaring and M. Pakull) to study a microquasar in NGC 7793. Another SALT proposal (with N. Loaring, P. Kuin and D. Buckley) to study a strange tidal tail in a galaxy.
- Three HST/WFC3 proposals, to look at the optical nebula around a microquasar, a tidal tail in a galaxy, and the counterpart of an alleged intermediate-mass black hole.

## Mission Status and Developments

**Cassini** - CAPS ELS continues to operate well with a number of interesting flybys of Titan, Enceladus and Rhea in the period.

**Cross-Scale** - The Cross-Scale project was presented at the Cosmic Vision Meeting in Paris on 1 December, and the team subsequently answered questions from the ESA advisory structure. Unfortunately the mission was not selected for the next phase of Cosmic Vision by the ESA SPC. As such the work on the mission at MSSL will stop forthwith. Chris Owen and Andrew Fazakerley, as a member of the ESA mission science study team and the prospective leader of the electron instrumentation respectively, would like to formally thank all members of MSSL who have worked hard to contribute to the various studies that were undertaken on Cross-Scale over the last 2 years.

**EJSM** - A kickoff meeting of the JuMMP (Jupiter Moon and Magnetosphere Plasma environment) team was held at SwRI on 5-7 Jan. A further team meeting is planned at MSSL. Andrew Coates attended the PPRP meeting in York on 20 Jan. (extension to EJSM funding at MSSL) and we await the outcome. A Joint Science Definition Team was held in Monrovia on 27-29 Jan., Andrew Coates (member) and Rob Gowen (penetrators) attended.

**ExoMars-PanCam** - Development is proceeding well. A number of meetings were held during this period including a Mast interface meeting at MSSL on 10 Dec. (with ESA, Astrium, DLR and others) and software meeting in Turin attended by Peter Yuen. In addition a recosting was required by the oversight committee; Craig Leff, Andrew Griffiths and Andrew Coates attended a meeting on 8 Feb. at Cranfield. Recosting still underway.

**Hinode-EIS** - Last September the Japanese satellite Hinode celebrated its 3rd anniversary. EIS, one of 3 instruments on-board, was built by a consortium (MSSL/RAL, NAOJ, ISAS and UiO) led by MSSL. Since launch EIS has performed 2,293,000 exposures, both imaging and spectroscopy, which has resulted in 188 published papers. The latest results and the future science work planned for this instrument was most recently discussed at the EIS team meeting held at MSSL, 22-24 Feb.

**Solar Orbiter** - The Solar Orbiter project was presented at the Cosmic Vision Meeting in Paris on 1 Dec., and subsequently selected for the next phase by the ESA SPC. The 3<sup>rd</sup> SWT was held on the 2 Dec., and attended by Chris Owen in his role as SWA PI. Many MSSL staff have been heavily involved in writing a new proposal to STFC, submitted on 11 Feb., to cover the costs of the next 18 month Cosmic Vision phase. Chris Owen, Chris Brockley Blatt, Barry Hancock and Andrew Fazakerley attended and led the SWA team meeting in Toulouse, 22-24 Feb. In addition, a number of teleconferences have been held with the ESA project office, and team teleconferences are continuing fortnightly.

**VEx/MEx** - ASPERA ELS still working well on both missions. Andrew Coates attended the 7-8 Dec ASPERA meeting in Bern.

## Publications – Refereed

### Published

Arridge, C.S., H.J. McAndrews, C.M. Jackman, C. Forsyth, A.P. Walsh, E.C. Sittler, L.K. Gilbert, G.R. Lewis, C.T. Russell, A.J. Coates, M.K. Dougherty, G.A. Collinson, A. Wellbrock D.T. Young, Plasma electrons in Saturn's magnetotail: structure, distribution and energisation, Planetary and Space Science, Volume 57, Issues 14-15, December 2009, Pages 2032-2047, doi:10.1016/j.pss.2009.09.007, online Sep print Dec 2009.



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#### **Publications - Non-refereed**

##### **Published**

- Forsyth, C., Longden, N., Walsh, A. P., Wicks, R. Autumn MIST 2009 Astronomy & Geophysics, 51, 1.27-1.35, 2010.
- Soria, R., Pakull, M., Broderick, J., Corbel, S., & Motch, C., "Radio lobes and X-ray hot spots of the extraordinary microquasar in NGC 7793", proceedings of the conference "X-Ray Astronomy 2009", eds A. Comastri et al., Bologna, Sep 2009, arXiv0912.2732.

##### **PhDs Awarded**

Glyn Collinson successfully defended his PhD thesis on 15 Dec. He has taken up a position at Goddard Space Flight Center.

##### **Invited Talks and Conferences**

A large number of Solar Group members attended the Hinode 3 conference in Japan. Main contributions are listed below:

- Deborah Baker - "Identifying the main driver of active region outflows" (talk).
- Lucie Green - flux formation and eruption in the solar atmosphere (talk).
- Louise Harra - "The slow solar wind: from formation on the Sun to the Earth" (talk).
- Alison Wallace - "Does magnetic helicity effect active region evolution and energetics?" (talk).

Sarah Matthews - sunspot light-bridges (poster).

Sergei Zharkov - investigation of (sub)-photospheric properties of coronal holes (poster).

Santiago Vargas Dominguez - the evolution of small-scale magnetic features in the solar photosphere (2 posters).

4th HELAS International Conference in Lanzarote, Canary Islands.

Sergei Zharkov , "Evidence of magneto-acoustic waves in photospheric observations of a sunspot". (Talk)

ISSI workshop on Enceladus as an Active Moon, Jan, 2010.

Kanani, S. J. et al., "Overview of low energy electron observations in the vicinity of Saturn's moon Enceladus". (Talk)

RAS Specialist Discussion Meeting on Solar Wind - Magnetosphere - Ionosphere Interactions within the Solar System, 11 Dec 2009. Talks:-

Kanani, S., C. S. Arridge, G. H. Jones, A. N. Fazakerley, H. J. McAndrews, N. Sergis, S. M. Krimigis, M. K. Dougherty, A. J. Coates, D. T. Young, K. C. Hansen and N. Krupp, A new form of Saturn's magnetopause using a dynamic pressure balance model, based on in-situ, multi-instrument Cassini measurements.

Coates, A.J., S. M. E. Tsang, A. Wellbrock, R. A. Frahm, J. D. Winningham, S. Barabash, R. Lundin, D. T. Young and F. Crary, Ionospheric photoelectrons: comparing Earth, Mars, Venus and Titan.

Wellbrock, A., A. J. Coates, G. H. Jones, C. S. Arridge, G. R. Lewis, B. A. Magee, J. H. Waite, E. C. Sittler, F. J. Crary and D. T. Young, Negative ions at Titan – density trends.

Arridge, C.S., Y. V. Bogdanova, E. J. Bunce, S. W. H. Cowley, A. N. Fazakerley, C. T. Russell, N. Achilleos, B. Cecconi, A. J. Coates, M. K. Dougherty, K. C. Hansen, S. J. Kanani, K. K. Khurana, L. Lamy, D. S. Talboys, P. Zarka, and B. Zieger, Cassini observations of Saturn's polar cusp.

Masters, A., N. Achilleos, N. Sergis, M. K. Dougherty, M. G. Kivelson, M. F. Thomsen, C. S. Arridge, S. M. Krimigis, H. J. McAndrews, S. J. Kanani, N. Krupp, A. J. Coates, Cassini observations of a Kelvin-Helmholtz vortex in Saturn's outer magnetosphere.

Jackman, C., C. S. Arridge, J. A. Slavin, S. E.

Milan, L. Lamy, M. K. Dougherty, A. J. Coates, The impact of the solar wind on Saturn's magnetotail lobes and current sheet.

AGU fall meeting, San Fransisco, 14-18 Dec. 2009. Talks -

Coates, A.J.; G. H. Jones; G. Lewis; A. Wellbrock; D. T. Young; F. J. Crary; R. E. Johnson; T. W. Hill, Negative Ions in the Enceladus (Invited).

Coates, A.J.; G. H. Jones; C. S. Arridge; A. Wellbrock; D. T. Young; F. J. Crary; R. L. Tokar; R. E. Johnson; T. W. Hill; C. S. Paty, Electrons at Enceladus: recent encounters.

Jones, G.H.; E. Roussos; A. J. Coates; C. S. Arridge; S. J. Kanani; D. T. Young; N. Krupp; S. M. Krimigis; R. A. Baragiola; J. Berthelier; M. H. Burger; J. F. Cooper; F. J. Crary; R. E. Johnson; H. R. Martens; D. B. Reisenfeld; R. L. Tokar; R. J. Wilson, Rhea's interaction with Saturn's magnetosphere: Evidence for a plasma source.

Wellbrock, A.; A. J. Coates; G. H. Jones; C. S. Arridge; G. Lewis; B. Magee; J. H. Waite; E. C. Sittler; F. J. Crary; D. T. Young Negative ions at Titan - density trends.

Masters, A.; N. A. Achilleos; N. Sergis; M. K. Dougherty; M. G. Kivelson; C. S. Arridge; S. M. Krimigis; H. J. McAndrews; M. F. Thomsen; S. J. Kanani; N. Krupp; A. J. Coates, Cassini observations of a vortex structure in Saturn's dayside magnetosphere driven by the Kelvin-Helmholtz instability.

Kanani, S. J., et al., A moon's spiky tail: low energy electron enhancements in the plasma wake of Enceladus.

Tsang, S.M.; A. J. Coates; G. H. Jones; R. A. Frahm; J. D. Winningham; A. Fedorov; S. Barabash; R. Lundin An Improved Short Study of Ionospheric Photoelectrons at Venus.

Richard, M.S.; T. E. Cravens; I. P. Robertson; J. H. Waite; J. Wahlund; F. J. Crary; A. J. Coates, Energetics of Titan's Ionosphere: Model and Cassini Data Comparisons.

Ma, Y.; C. T. Russell; A. F. Nagy; G. Toth; M. K. Dougherty; T. E. Cravens; A. Wellbrock; A. J. Coates; P. Garnier; J. Wahlund; F. J. Crary, Ion Loss from Titan's Atmosphere versus Local Time: A two-fluid MHD Study.

Frahm, R.A.; J. D. Winningham; J. R. Sharber; R. Lundin; S. Barabash; F. Duru; D. A. Gurnett; A. J. Coates; S. M. Tsang; M. Delva; T. Zhang, Solar Wind Halo/Strahl Interaction with the

Atmospheres/Ionospheres of Mars and Venus.

Menietti, J.D.; R. L. Mutel; L. Lamy; C. S. Arridge; D. A. Gurnett; B. Cecconi; P. M. Zarka; A. J. Coates, Growth Rate Analysis of Ordinary Mode Saturn Kilometric Radiation.

Jackman, C.M.; C. S. Arridge; M. K. Dougherty; A. J. Coates Properties of the magnetic field and plasma in the kronian magnetotail lobes and current sheet.

Leisner, J.S.; G. B. Hospodarsky; A. Masters; C. S. Arridge; W. S. Kurth; K. M. Sigsbee; D. A. Gurnett; A. J. Coates; M. K. Dougherty Langmuir Waves Associated with the Kelvin-Helmholtz Instability at Saturn's Magnetopause.

Nemeth, Z.; K. Szego; G. Erdos; L. Foldy; A. Rymer; M. F. Thomsen; E. C. Sittler; A. J. Coates; A. Wellbrock Global Features of Ion Distributions Near Titan.

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A. J. Coates; O. Santolik, A Survey of Electron Beams Associated With Saturnian Auroral Hiss.

16th National Space Science Symposium, 24-27 Feb., Rajkot, India.

Coates, A.J., ExoMars Pancam, and plasma investigations at Mars and the Moon.

Coates, A.J., ExoMars Pancam & plasma investigations at Mars, Venus and Titan, seminar presented at Physical Research Laboratory, Ahmedabad, India, 22 Feb. (Invited seminar)

Roberto Soria gave a seminar at Mount Stromlo Observatory, on non-nuclear black holes.

### Media Broadcasts and Features

Andrew Coates:

- Interviewed for BBC World Service 'World Update', and BBC1 6 News at Six, on NASA future exploration, 1 Feb.
- Letter and article in the Times, 5 Feb., on Cassini funding. Interview on BBC London 94.9 (Vanessa Feltz).
- Negative ions at Enceladus, JPL, UCL and STFC press releases, BBC, Telegraph, Mail, Discovery News, Astronomy Now, Space.com, Scientific American, Times of India, Physorg, msnbc, Discover, spaceref.com
- Interviews on BBC News Channel and BBC World TV, 10 Feb., on Solar Dynamics Observatory and space weather.

Lucie Green:

- Interviewed for a short film for BBC online on the Sun and stellar evolution.

Louise Harra:

- BBC news article about the current awakening of the Sun after a period of low activity that could generate unpredictable sat-nav errors. Louise explains how the Solar Dynamics Observatory (SDO) will look at the Sun's magnetic field.

### Outreach

Lucie Green:

- gave a solar system science talk at Guildford Cathedral and "Science with Hinode" talks to Belfast Astronomical Society and to Crawley Astronomical Society. Lucie also contributed to The Times' science magazine Eureka with an article on the Sun.

Sheila Kanani:

- gave a talk entitled, "Lord of the Rings, a journey to Saturn on board the Cassini spacecraft" at La Sainte Catholic School in

Kentish Town. Sheila also ran their after school science club on the topic, "Mission to Mars" , 23 Feb.

- ran the "Mission to Mars" workshop for Italian students who came to the lab on 15 Feb.
- recorded a podcast on 24 Feb. for UCL's "Bright Club: Light", which will be aired in due course.

Adam Masters:

- gave a talk at Sutton Grammar School for Boys in Sutton, introducing the Cassini-Huygens Mission to Saturn and Titan.

Roberto Soria:

- UCL Diploma Club talk on "black holes as cosmic engines", 21 Jan.

### Press Releases

Peter Muller reports that a very significant paper on the discovery of thermokast lakes at the equator of Mars has been published in "Geology", (jointly authored with colleagues from Imperial College). This is the clearest sign yet of liquid water at the equator of Mars at a significant epoch, some 2.7 billion years before present when life first evolved on the Earth. Our unique ability to generate 3D terrain maps of the martial surface at resolutions down to sub-metre is the key reason why we are able to provide very strong evidence.

Further details are available at:

[http://www.mssl.ucl.ac.uk/general/news/Mars\\_Lakes\\_20100104/marslakes\\_20100104.htm](http://www.mssl.ucl.ac.uk/general/news/Mars_Lakes_20100104/marslakes_20100104.htm)

### Other News Items/Activities

Rob Bedington organized a National Instruments LabView workshop at MSSL on 26 January.

### Next Issue

The next issue of The Newsletter (Volume 8, Issue 1) will be published in June 2010. This will cover activities from 1 March 2010 to 31 May 2010.