

FAS Newsletter

Federation of Astronomical Societies

<http://www.fedastro.org.uk>

FAS CONVENTION & AGM

19th October 2013 - Cambridge

As usual the 2014 FAS Annual Convention was an enjoyable event. The talks were all entertaining and enlightening, many went home with 'new toys' and there was much chatter between attendees who meet up only on this one occasion a year.

Particular thanks must go to Sean Elvidge who stood in to give a talk at very short notice, when one of the speakers was unable to attend. In addition to having his arm twisted to give the talk, he also succumbed to being 'sweet-talked' by Samuel George, into taking on the role of Webmaster for the FAS - for which we are all very grateful.

The talks were generally about things undertaken by the professional astronomers, such as a Mars mission and Magnetic Fields. All such talks are avidly soaked up, but the description of the construction of a large (600mm) dobsonian telescope was particularly fascinating. This was probably because, many listeners probably felt that here was 'something I could do' - but never get around to. Actually it was a real work of art and all involved are to be congratulated.

The FAS AGM was fitted in between the talks and in general went as expected - apart from the proposal on Regional Groups. Of which more later.

Particular thanks were expressed to the retiring members of the FAS Council after their sterling work on behalf of amateur astronomy. In no particular order they are:

Richard Sargent - who has been successfully, Minutes Secretary, President and latterly Vice-President.

John Axtell - who has worked tirelessly on the rather thankless and administratively complex job of Membership Secretary.

Samuel George - who has transformed the FAS website and also worked with Dave Evetts on the 2013 Convention.

Dave Evetts - who, with Samuel George organised the 2013 Convention

John Evans - elected member 'without portfolio' who did much work on the FAS Telescope project, which unfortunately came to nothing.

Following elections at the 2013 AGM, the FAS Council welcomes the following new members:

Mike Pritchard - Membership Secretary

Eleanor Jenkins - Meetings Organiser

Sean Elvidge - Webmaster

Tony Questa - PLI Officer

Graham Bryant - Member of Council



Taking the opportunity to drink tea, chat and then buy bits

One of the proposals from FAS Council on the AGM agenda was the discontinuing of Regional Groups. This was discussed at length at the AGM and finally the proposal was not adopted.

The reasons for the Council making this proposal were that after a great deal of effort, over 10 plus years, in trying to encourage member societies to work together on a local basis and to form Regional Groups, it was concluded that apart from one example, these efforts had been in vain.

Under the existing constitution each Region has the right to nominate a member onto the FAS Council.

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STARGAZING LIVE

At the time of putting this edition together we were all looking forward to the BBC's Stargazing Live programmes.

My society, Kernow Astronomers, are heavily involved in organising our event timed to ride on the back of the publicity created by Stargazing Live 2014.

Last year we were lucky that the cloud lady relented and gave us clear skies that night. Let us hope she is equally kind this time.

The reason in mentioning this is to encourage all of you, who are organising similar events, to send me reports, with photographs of course, on how your events went. I would like to think I will get a number of such reports to publish in the next edition.

Editor

ANNOUNCEMENTS

BAA Deep Sky Section Annual Meeting 2014 Saturday 15th March 2014

The Deco, Abington Square, Northampton NN1 4AE

<http://www.thedeco.co.uk/>

SPEAKERS

Dale Holt - "Using a deep sky video camera to observe the Hickson Compact Galaxy groups"

Stewart Moore - "Great Balls of Fire - The Glory of Globulars"

Grant Privett - "Digging in the Dirt: Adventures with image noise"

Ian Sharp - "Remote imaging the deep sky"

Professor Albert Zijlstra (University of Manchester) - "Latest developments in planetary nebulae research"

Price: £10 to BAA members & members of BAA affiliated societies

£15 to non-members. All welcome.

Includes tea and coffee refreshments, buffet lunch.

Entrance payable at the door, no advance booking

Traders: Astronomia, BAA Sales

If you are intending to attend it would help to let us know for planning catering requirements - email deepsky@britastro.org

More details and programme at <http://britastro.org/dss>

The North West Astronomy Festival 2013



The North West Astronomy Festival took place on Saturday and Sunday the 26th and 27th of October 2013 at The Heath in Runcorn. The first event of its kind in the North of England can, without doubt, claim to have been a great success!

With a wide variety of activities, stalls and displays, there was something for all ages, interests and experiences, turning The Heath into a spectacle of stars, planets and space!

Runcorn is an excellent location being equidistant from Manchester, Liverpool and Chester and is a neutral position in the centre of the North West area of regional clubs. With a plentiful supply of hotels close to the event venue and in easy reach of the motorway and rail network, it is an ideal location for a regional event. Some feedback suggested that being in a more public area in a town centre would be beneficial to attract passing visitors. However, this must be balanced with the ease of accessibility of an out of town location.

The Heath as a festival venue received impressive feedback, from traders, presenters and visitors; there was a unanimously positive response with particular reference made to the space, light, layout and facilities. Particularly important was the extensive free parking – something in seriously short supply at many events and conferences in city centres. The events hall, lecture theatre and additional smaller rooms meant that we were able to create individual activity zones, which added to the experience for visitors. Foodini restaurant provided a space to escape and refuel and the sofas were very popular with tired visitors. The disabled facilities were good and access was commented upon favourably.

The Presentations

The presentations were the talking point of the event with so many people mentioning the variety, the quality and particularly how accessible they were for all.

Sheila Kanini launched the festival and sessions in the lecture theatre in style, with a hugely popular presentation 'A Solar System Family Portrait'.

Mark Thomson increased his following with his wonderful talk 'A Down to Earth Guide to the Cosmos' and after the presentation, Mark signed many copies of his book of the same name, for delighted visitors.

Mark also took part in Astronomers Question Time, alongside the other presenters, chaired very ably by Dr Joanna Jarvis from the Open University, not an easy job with such an enthusiastic

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EQUIPMENT REVIEW

First light for the QHY5L-II-C

The 20 inch telescope in the dome had been out of use for a while due to pointing issues when doing Supernova runs. The telescope would 'get lost' and was attributed to a poor drive system. The new system will have better machined surfaces and high resolution on axis encoders. The 16 inch F4 is getting close to being ready to replace it before the dome telescope is re-built with a better drive system. So it was decided to convert the 20" telescope to planetary/visual observing until it was ready for the upgrade.

I trawled the internet for the 'Best Planetary' camera. Of course there were many out there and much difference in opinion and price. So I opted for a low cost colour option to get started. This was the relatively new QHY5L-II-C camera. This is a 1.2 mega pixel camera at a cost of £169.

The telescope was converted quickly and the drive system tweaked as best it could be. The Starlight express CCD was moved to the 6 inch F5 'piggy back' telescope to be used as a 'plate solve' electronic automatic finder which now works well with the much larger field than the 20 inch.

Jupiter was rising quickly and the images at first were very disappointing. The seeing was VERY bad and Jupiter was 'wiggling' all over the place.

After a few hours the sky stabilised a little and I managed to get close to a best focus. I had in the back of my mind a slight concern over the 20 inch (made by Norman Oldham many



years ago after I dropped the 18 inch mirror!) that the optic was not excellent but OK. Higher power gave slightly 'soft' planetary images, but it was unclear if this was dome 'seeing'? We intend to test soon with the Bath Interferometer to 'see' how good it really is.

Data was captured in AVI format with the supplied High performance software from QHY. Registax 6 was used to process the video and the final image. I still have a lot to learn from Registax and also how to get the best from the telescope. The image was under sampled (no Barlow was used and the ROC was 2000mm at F4), and I had no intention that night of taking 'real images' just to test only. But even with poor seeing and no Barlow, the results are encouraging. No Damian Peach, but I think higher sampling, better PC for faster sampling rates, improved mirror quality (if it needs it), better seeing and things will get a lot better.

Image is 100 best frames stacked from a 1000 frame AVI. IO is to the left of Jupiter. I used the following link as a start, but changed the Wavelet settings as the image became too 'false'.

<http://www.sunspot51.com/Registax6/Registax6.htm>

Dave Thomson

Courtesy: Liverpool AS Newsletter

PRESIDENT'S SPOT

Happy New year to you all.

As this is the first newsletter since the convention I'll start by expressing my thanks to John Axtell & Samuel George for arranging the convention and thanking all the other council members & Brian Lister from Cambridge AS for making the day such a success.

As you may have been aware, we sold all the tickets for the convention well in advance of the day. Obviously some people were disappointed that they were unable to get tickets but we have a responsibility to meet the health and safety requirements of the lecture theatre and I'm sure you would agree that it is better to know in advance that all the tickets were sold than turn up on the door (after a potentially long drive) and find that no tickets were available. We did make available free AGM only tickets for societies to attend the AGM and traders and I know a few societies took us up on that offer.

I hope that you are having a good Stargazing Live – this is a wonderful opportunity to interact with the public and raise the profile of astronomy & your society in the local area. I know my own society has a packed programme and have already had people asking to join. We visit the local country parks, RSPB reserve & a local historic house to take astronomy to the public as well as events at our observatory and meeting room. If you can create these relationships with other bodies you may be able to enhance these with other events later in the year outside of Stargazing Live. Just contact them and ask if you can do an event together. Obviously this is very dependent on having a membership who is willing to help out at these events.

The National Astronomy Week 2014 is arranged for the first week in March (1st to 8th) to coincide with the apparition of Jupiter this year & also the star count initiative from the Campaign to Protect Rural England. Don't forget to put these dates in your calendar and arrange some public events to piggyback on the national publicity that will occur. The FAS is financially supporting NAW2014 along with the SPA and British Association of Planetaria (BAP). See www.astronomyweek.org.uk for more details.

That's all for now.

Gary Gawthrop

(Continued from page 1)

The exception to this rule is SAGAS (*Southern Area*), who are a very active group which holds regular meetings and stages events in their area, which stretches roughly from Kent down to Hampshire.

SAGAS, however, is a rather special case, in that it was formed well before the FAS was created.

The members of societies within SAGAS at the recent AGM spoke eloquently about SAGAS and how they should retain the right to send a representative to Council. This eloquence was obviously effective and when it came to the vote, the proposal was rejected.

The FAS President said that Council accepts the vote and will take this message back to have further discussions.

Obviously, whilst this vote gave continuance for SAGAS to have a representative on Council, it has done nothing regarding the problems of lack of regional representation elsewhere in the UK.

This subject will, inevitably, be raised again in the future, but it will require considerable thought and discussion in order to come up with an organisational system that works for the benefit of all member societies.

BOOK REVIEWS

Planetary Climates

by Andrew P Ingersoll

Publisher: Princeton University Press ISBN: 978 1400848232 £19.95

Here I am embarking on my first ever book review and I've been asked to offer an overview of this rather in depth technical book known as "Planetary Climates". Add to that, that I'm dyslexic and that I didn't really learn to read until in my 20's it's fair to say that I viewed the prospect with some trepidation.

So how did I find it?

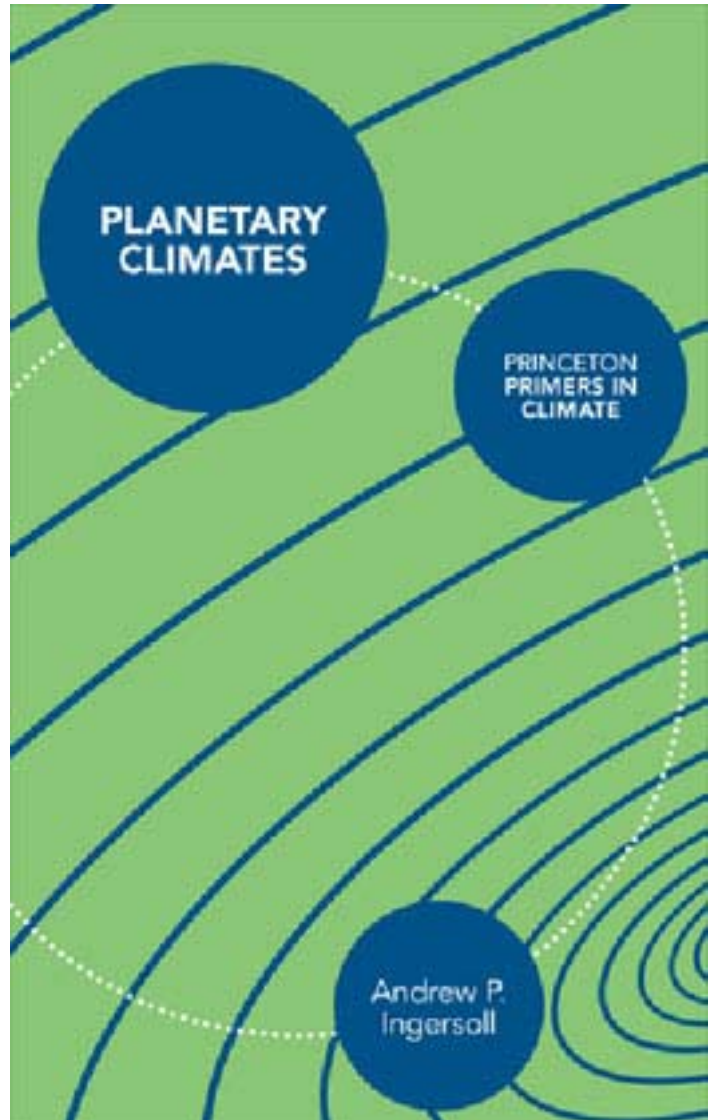
It's fair to say that the book goes into more depth than my intellect will allow understanding, however, this led to my first surprise. I actually didn't mind at all that there are bits that went straight over my head. The book was written in a way that I could accept this and still enjoy the way it was written, and for the content I couldn't grasp? Well that didn't seem to matter.

The format of the book is that of a tour of the Solar System. It starts with an introduction of the Diversity of Planetary Climates and then moves to discussion of the climate of Venus and how it is believed the climate has evolved. Each chapter moves further from our Sun through Mars, Titan, Moons and Small Planets, Jupiter, Saturn, Uranus, Neptune and Exoplanets along with a Conclusion. Some of the planets are split into 2 chapters, the first being more simple and the second containing more challenging information.

Hot Air Ballooning on Jupiter? Yes this was discussed and was one of the most visual and exciting bits of the book for me. Of course it wasn't about man attempting to do it just a way of discussing the composition of the atmosphere and some of the issues we would face if we were there.

Something that I received from the book that was very important to me, was the honesty.

Although the book is offered as an authority on climate and climate change, it openly acknowledges that the science is a changing one. The author hypothesises and highlights that the more we understand about climate and climate progression on other parts of the universe the better the chance we will learn to understand our own. Don't take that to mean the author doesn't put across strongly his views and beliefs. He does this in compelling and confident way. After all Andrew P Ingersoll, is listed as the Earle C Anthony Professor of Planetary Science at the California Institute of Technology. He is regarded as an expert on the weather and climate of Earth and other planets. It's just that while he believes the points are largely correct he accepts that understanding will develop and change.



In conclusion;

If you're interested in the way things work this book may have something for you. I found parts of it very challenging, and although I can't remember all that I read, I did enjoy it. As a person that is sceptical of some of the climate science I found it worthwhile. If you're better read or just a better reader than me you may find you get plenty from it as it contains a wealth of information.

Ian Bastin,

DREAMS of OTHER WORLDS

The amazing story of unmanned space exploration

by Chris Impey and Holly Henry

Publisher: Princeton University Press ISBN: 978 1400848812 £24.95

The clue to the tenor of this book is in the title; *amazing*.

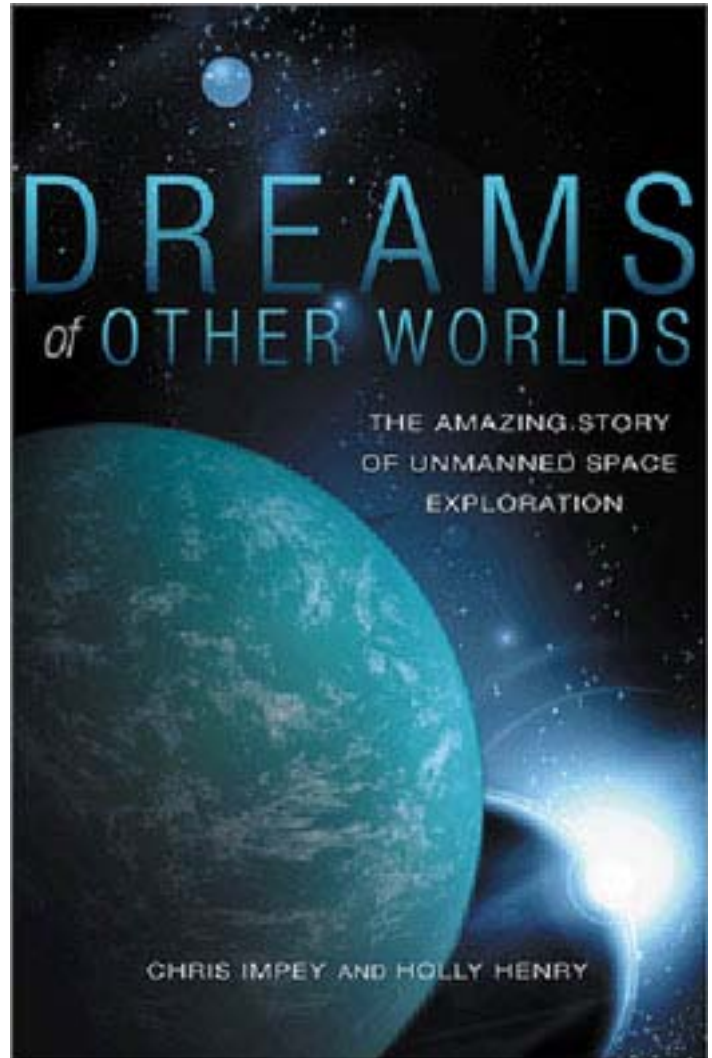
It is an enthusiastic celebration of how in just the last forty years (only half a lifetime!) we have used our ingenuity and cutting edge technology to explore and try to understand the Universe near and far and the huge leaps in understanding that has been gained from it. This book covers the era of unmanned exploration post the Apollo Moon landings by astronauts where superpower politics drove the push into space. But this is all about the pure quest for knowledge and collaborative exploration without anyone leaving the ground to go where no man has gone before. It is about bring the Universe closer for inspection.

It sets the scene by describing how the Greeks of the ancient world saw and interpreted the Universe and then takes the eleven diverse missions devised since the early 1970s that have been launched for us to see further and to better understand it all "out there".

The missions covered are: the Viking landers and Spirit and Opportunity Rovers exploring Mars, Voyager and Cassini passing by the gas giants and moons, Stardust collecting debris from a comet, SOHO observing our restless Sun, Hipparcos mapping our Milky Way, the orbiting space telescopes of Hubble (optical), Spitzer (Infra red) and Chandra (X-Ray) and finally WMAP mapping the cosmic background radiation.

The collaboration of Impey, a professor of Astronomy and Henry, a professor English creates a text of lyrical style but packing in the numbers and bright nuggets of detailed science to give the whole book a feeling of wonderment at what has been achieved in just forty years of exploration. Rather than a dry scientific tome it is peppered with the human side of these endeavours with many quotes and stories. The use of many descriptive adjectives lifts this book from a dense science history to an exciting celebration of human achievement and collaboration.

The range of exploration extends from the landing on and trundling around on our near neighbour the Red Planet to check for signs of previous life through to sampling of a comet's tail for debris from an ancient past and on to almost the edge of the Universe in distance and back in time to the Big Bang. There are a relatively small number of high quality mono photos and diagrams and a colour plate section as samples to illustrate the achievements of the missions described more fully and succinctly in the text. Each chapter and subsection is titled with an intriguing and pithy heading that captures the excitement and achievement of the missions.



The final chapter "New Horizons, New Worlds" looks at the current leap forward of the Curiosity mission to Mars and the planned missions to the Jovian moons that most certainly contain liquid water under the icy crusts and possibilities of life within. It discusses the Planck mission that supersedes WMAP, and also looks forward to the imminent Gaia mission that takes the baton from Hipparchos and finally the scheduled James Webb Space Telescope that will be the huge successor to Hubble seeing more and further.

The last four decades of unmanned exploration has unveiled a Universe of great complexity, beauty but with more questions to answer. What will we see in the next forty years? This book wets that appetite to keep looking. Highly recommended.

Glynn Bernallick

The UNIVERSE in ZERO WORDS By Dana Mackenzie

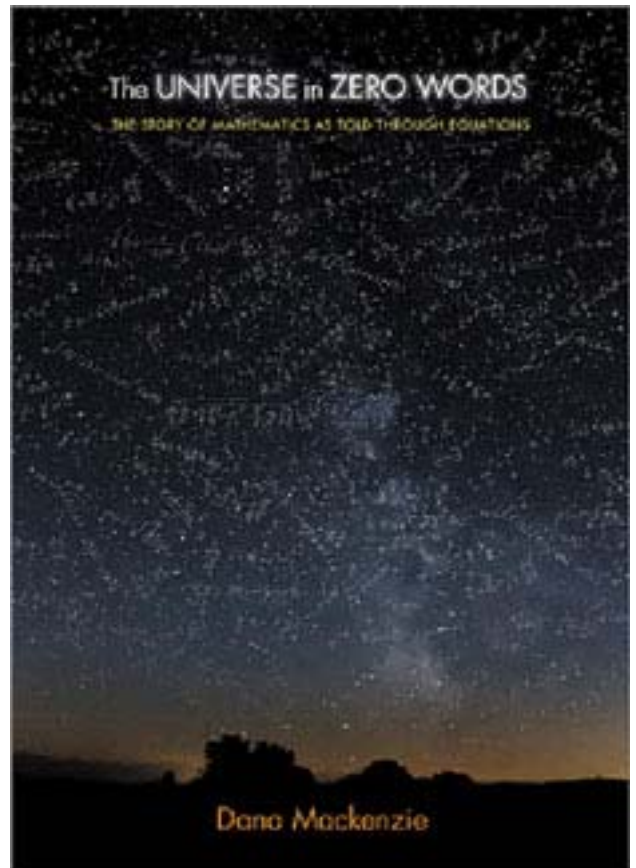
Publisher: Princeton University Press ISBN: 978 1400841684 £13.95

Although my working life as an engineer would never have been possible without a pretty thorough and seemingly wide ranging working knowledge of mathematics, I'm sure most of my fellow practitioners would nod their heads in sympathetic agreement that the range of what we individually practise is but a tiny part of a methodology that does literally describe the universe.

That this book should set out to present those descriptive equations, their historical context and the remarkable people who produced them would seem daunting enough. To succeed with such a readable and accessible text as Mr Mackenzie has done, is a truly laudable achievement, further enhanced by beautiful illustrations and scripts. I cannot claim to understand all that I read, particularly as the story progresses to the intricacies of modern mathematical theories, but that is the nature of the subject. That did not put me off in the slightest, as I have no doubt that re-reading of sections at leisure will be rewarded with further insights.

If you have more than a passing interest in maths, and how the world and the universe work, I warmly recommend that you find a place on your bookshelf for this delightful book. I expect to be dipping into mine for many years to come.

M Griffiths.



A TREAT ONLY FOR THE KIDS??

Filming "Absolute Genius 2" with Dick and Dom for CBBC to be broadcast 2014



Now is your chance to watch kid's TV with a good excuse!!

Courtesy: Liverpool AS Newsletter

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and talkative panel and audience!

Nick Howes shared his incredible comet knowledge and enthusiasm in 'A Tail of Two Comets' - a story with actions! As an added bonus, Nick presented the very latest data on Comet ISON and followed up his presentation with a mini comet workshop.

A practical demonstration of making a comet by Andrew during Nicks presentation, made a great double act!

We had a fascinating and emotional account of his visit to the VLT and Atacama Desert by Gary Fildes Director of the Kielder Observatory. Andy Newsam from JMLU was his usual very entertaining self with an educational talk about the National Schools Observatory and their work. His fascinating presentation 'Exploring the Dynamic Universe' concluded the presentation sessions at this year's festival.

Traders

The traders were delighted with the amount of space and the variety of trade stands and the layout of the events hall. From telescopes to NASA memorabilia and space T shirts and mugs to books and magazines, there was something for everyone!

Whilst we may not have had the number of visitors we would have liked, traders reported a real advantage in having time to talk to customers, spend time advising and discussing what they were looking for and building ongoing relationships with those people buying astronomy equipment.

They have also told us that it was the first time that they had actually had time to talk to other traders and have recognised a



Mark Thomson signing a copy of his book

need to work together to provide a complimentary range of items, each taking a specific area of the market, rather than being in competition with each other. Indeed, so good were the building of relationships that they have formed a Traders Committee for the festival in 2014 and together will fund the national advertising and publicity campaign for the 2014 festival.

Education and Outreach

The education and outreach teams were kept very busy with a lively and enthusiastic audience. STFC outreach counted 150 people in their Stardome on Saturday and a further 150 on the Sunday, with many young children getting their first experience of a dark night sky.

The children had a great afternoon! Made rockets, made Top Trumps cards, designed constellations, guessed the weight of a meteorite, and were blown away by the space lab planetarium! And learned about plasma, static, galaxies, how to find the North Star, and about sun telescopes. Wow! Thank you for organising what was a brilliant day!

JMLU outreach and UKSEDS had a fantastic time entertaining both young and old and the STEM students street science captivated many with their close-up, hands on experience of

science.

Women Rock Science and UKWIAN were hugely popular – wonderful to see so many young girls interested in astronomy – astronomers and astronauts of the future.

Gerard Gilligan, Hon Secretary of Liverpool Astronomical Society represented the BAA Dark Skies Campaign, enlightening many visitors to the wonders of a truly dark sky and how we



Astronomers Question Time, alongside the other presenters, chaired very ably by Dr Joanna Jarvis

can all play a part in the campaign, along with Robert Ince from the Scottish Dark Sky Observatory showcasing an amazing dark sky site not so far from the North West of England.

We had wonderful stands from Astro for Fun and The Astronomy Centre, with Mid-Cheshire, Blackpool, Salford Astronomical Societies representing the local clubs and we were lucky enough for some breaks in the clouds to enjoy the awesome Solar Scope from Keele Observatory.

And the raffle proved hugely popular with many staying until the end of Sunday to see who would win the meteorite – very pleased that it was won by a teacher from a local school who is hopefully going to share it with her pupils!

Summary

Over the two days around 400 people of all ages, enjoyed the festival both professional, expert, amateurs and beginner astronomers, with about 70 people enjoying the Saturday evening meal and entertainment and witnessing festival presenters and staff "Flash Mob" a rendition of Space Oddity, inspired by Chris Hadfield in the ISS.

Perhaps for us, the greatest success comes from the relationships, collaborations and joint projects that have come out



A practical demonstration of making a comet by Andrew during Nicks presentation, made a great double act!

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of the meetings that occurred at the festival. There are some very exciting discussions going on and it seems that the legacy from 2013 will still be seen well into next year.

We would like to say a huge thank you to everyone who gave their time and support to the festival. The presenters, our volunteers who worked tirelessly all weekend and students from the local schools, college and university – we could not have done this without you.



Concentration on Mark Thompsons face as he works on the timed NSO Moon jigsaw challenge!

The message for next year is loud and very clear – **more of the same** (and no... we do not have the energy to run it more than once a year - despite pleas from more than one visitor)!

The main task for next year is to double the visitor numbers and on this point we have already started work in collaboration with a number of organisations and potential sponsors.



And how popular were the meteorites? They fascinated both the children and adults alike and being able to actually see and touch stunning objects from space proved a big hit!



We do not want to lose the atmosphere – something we have heard over and over again from everyone who took part in the festival. So the challenge is to keep it interesting and original and whilst recognising the pressures to grow bigger and better, we want to retain the 'festival' feel, the intimacy and personal feel that this year's festival achieved.

The dates, for next year's "North West Astronomy Festival" are 11th and 12th October 2014 and details for our next event in January and further events throughout 2014 can be found on our website www.theknowledgeobservatory.co.uk.

Follow @NWAstFest2014 on Twitter and on Facebook for all the latest information and email contact@theknowledgeobservatory.com to receive our newsletter 'Watch This Space'.

Courtesy: Liverpool AS Newsletter



Tweetup was enjoyed by many people who regularly tweet and follow each other yet have never met. Both professional and amateurs were able to identify each other in the Tweetup Cafe and many have remarked how good it was to put a face to a twitter identity and to be able to talk face to face.

Asteroid Diversity Points to a "Snow Globe" Solar System

Our solar system seems like a neat and orderly place, with small, rocky worlds near the Sun and big, gaseous worlds farther out, all eight planets following orbital paths unchanged since they formed.

However, the true history of the solar system is more riotous. Giant planets migrated in and out, tossing interplanetary flotsam and jetsam far and wide. New clues to this tumultuous past come from the asteroid belt.

"We found that the giant planets shook up the asteroids like flakes in a snow globe," says lead author Francesca DeMeo, a Hubble postdoctoral fellow at the Harvard-Smithsonian Center for Astrophysics.

Millions of asteroids circle the Sun between the orbits of Mars and Jupiter, in a region known as the main asteroid belt. Traditionally, they were viewed as the pieces of a failed planet that was prevented from forming by the influence of Jupiter's powerful gravity. Their compositions seemed to vary methodically from drier to wetter,



In this artist's conception, Jupiter's migration through the solar system has swept asteroids out of stable orbits, sending them careening into one another. As the gas giant planets migrated, they stirred the contents of the solar system. Objects from as close to the Sun as Mercury, and as far out as Neptune, all collected in the main asteroid belt, leading to the diverse composition we see today. Credit: David A. Aguilar (CfA)



due to the drop in temperature as you move away from the Sun.

That traditional view changed as astronomers recognized that the current residents of the main asteroid belt weren't all there from the start. In the early history of our solar system the giant planets ran amok, migrating inward and outward substantially. Jupiter may have moved as close to the Sun as Mars is now. In the process, it swept the asteroid belt nearly clean, leaving only a tenth of one percent of its original population.

Astronomers have theorized that long-ago asteroid impacts delivered much of the water now filling Earth's oceans, as shown in this artist's conception. If true, the stirring provided by migrating planets may have been essential to bringing those asteroids.

As the planets migrated, they stirred the contents of the solar system. Objects from as close to the Sun as Mercury, and as far out as Neptune, all collected in the main asteroid belt.

"The asteroid belt is a melting

pot of objects arriving from diverse locations and backgrounds," explains DeMeo.

Using data from the Sloan Digital Sky Survey, DeMeo and co-author Benoit Carry (Paris Observatory) examined the compositions of thousands of asteroids within the main belt. They found that the asteroid belt is more diverse than previously realized, especially when you look at the smaller asteroids.

This finding has interesting implications for the history of Earth. Astronomers have theorized that long-ago asteroid impacts delivered much of the water now filling Earth's oceans. If true, the stirring provided by migrating planets may have been essential to bringing those asteroids.

This raises the question of whether an Earth-like exoplanet would also require a rain of asteroids to bring water and make it habitable. If so, then Earth-like worlds might be rarer than we thought.

The paper describing these findings appears in the January 30, 2014 issue of [Nature](#).

*Posted 30 Jan 2014
www.technology.org*

First weather map of brown dwarf: Surface of nearest brown dwarf charted

ESO's Very Large Telescope has been used to create the first ever map of the weather on the surface of the nearest brown dwarf to Earth. An international team has made a chart of the dark and light features on WISE J104915.57-531906.1B, which is informally known as Luhman 16B and is one of two recently discovered brown dwarfs forming a pair only six light-years from the Sun.

The new results are being published in the 30 January 2014 issue of the journal *Nature*.

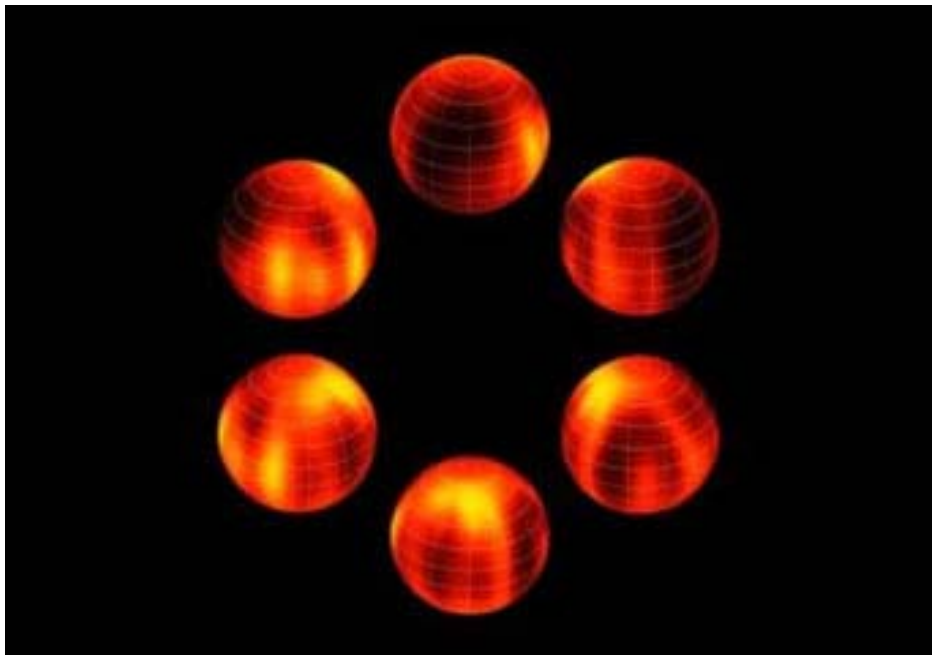
Brown dwarfs fill the gap between giant gas planets, such as Jupiter and Saturn, and faint cool stars. They do not contain enough mass to initiate nuclear fusion in their cores and can only glow feebly at infrared wavelengths of light. The first confirmed brown dwarf was only found twenty years ago and only a few hundred of these elusive objects are known.

The closest brown dwarfs to the Solar System form a pair called Luhman 16AB [1] that lies just six light-years from Earth in the southern constellation of Vela (The Sail). This pair is the third closest system to the Earth, after Alpha Centauri and Barnard's Star, but it was only discovered in early 2013. The fainter component, Luhman 16B, had already been found to be changing slightly in brightness every few hours as it rotated -- a clue that it might have marked surface features.

Now astronomers have used the power of ESO's Very Large Telescope (VLT) not just to image these brown dwarfs, but to map out dark and light features on the surface of Luhman 16B.

Ian Crossfield (Max Planck Institute for Astronomy, Heidelberg, Germany), the lead author of the new paper, sums up the results: "Previous observations suggested that brown dwarfs might have mottled surfaces, but now we can actually map them. Soon, we will be able to watch cloud patterns form, evolve, and dissipate on this brown dwarf -- eventually, exometeorologists may be able to predict whether a visitor to Luhman 16B could expect clear or cloudy skies."

To map the surface the astronomers used a clever technique. They observed the brown dwarfs using the CRIFRES instrument



ESO's Very Large Telescope has been used to create the first ever map of the weather on the surface of the nearest brown dwarf to Earth. An international team has made a chart of the dark and light features on WISE J104915.57-531906.1B, which is informally known as Luhman 16B and is one of two recently discovered brown dwarfs forming a pair only six light-years from the Sun. The figure shows the object at six equally spaced times as it rotates once on its axis.

Credit: Image courtesy of ESO/I. Crossfield

on the VLT. This allowed them not just to see the changing brightness as Luhman 16B rotated, but also to see whether dark and light features were moving away from, or towards the observer. By combining all this information they could recreate a map of the dark and light patches of the surface.

The atmospheres of brown dwarfs are very similar to those of hot gas giant exoplanets, so by studying comparatively easy-to-observe brown dwarfs [2] astronomers can also learn more about the atmospheres of young, giant planets -- many of which will be found in the near future with the new SPHERE instrument that will be installed on the VLT in 2014.

Crossfield ends on a personal note: "Our brown dwarf map helps bring us one step closer to the goal of understanding weather patterns in other solar systems. From an early age I was brought up to appreciate the beauty and utility of maps. It's exciting that we're starting to map objects out beyond the Solar System!"

Notes

[1] This pair was discovered by the American astronomer Kevin Luhman on images from the WISE infrared survey satellite. It is formally known as WISE

J104915.57-531906.1, but a shorter form was suggested as being much more convenient. As Luhman had already discovered fifteen double stars the name Luhman 16 was adopted. Following the usual conventions for naming double stars, Luhman 16A is the brighter of the two components, the secondary is named Luhman 16B and the pair is referred to as Luhman 16AB.

[2] Hot Jupiter exoplanets lie very close to their parent stars, which are much brighter. This makes it almost impossible to observe the faint glow from the planet, which is swamped by starlight. But in the case of brown dwarfs there is nothing to overwhelm the dim glow from the object itself, so it is much easier to make sensitive measurements.

Story Source:

The above story is based on materials provided by: [European Southern Observatory \(ESO\)](http://www.eso.org).

January 29, 2014
Wwww.sciencedaily.com

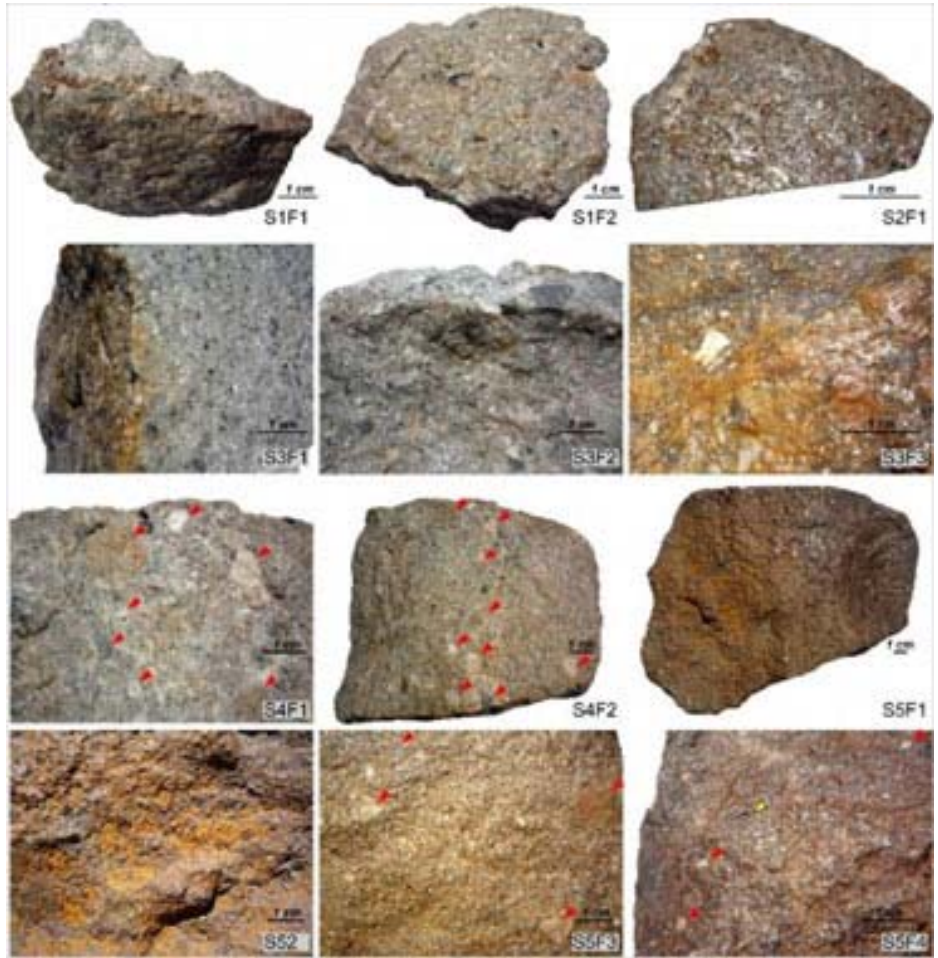
Tunguska meteorite, 1908: could its origins be Mars-related?

Last week a team of Russian scientists published a new paper titled “Tunguska cosmic body of 1908: is it from planet Mars?” The authors analysed various remnants in the Siberian area of the severe explosion observed back in June 30, 1908 to find any possible relation between the cause of this disaster and one of its hypothetical sources, the Red Planet.

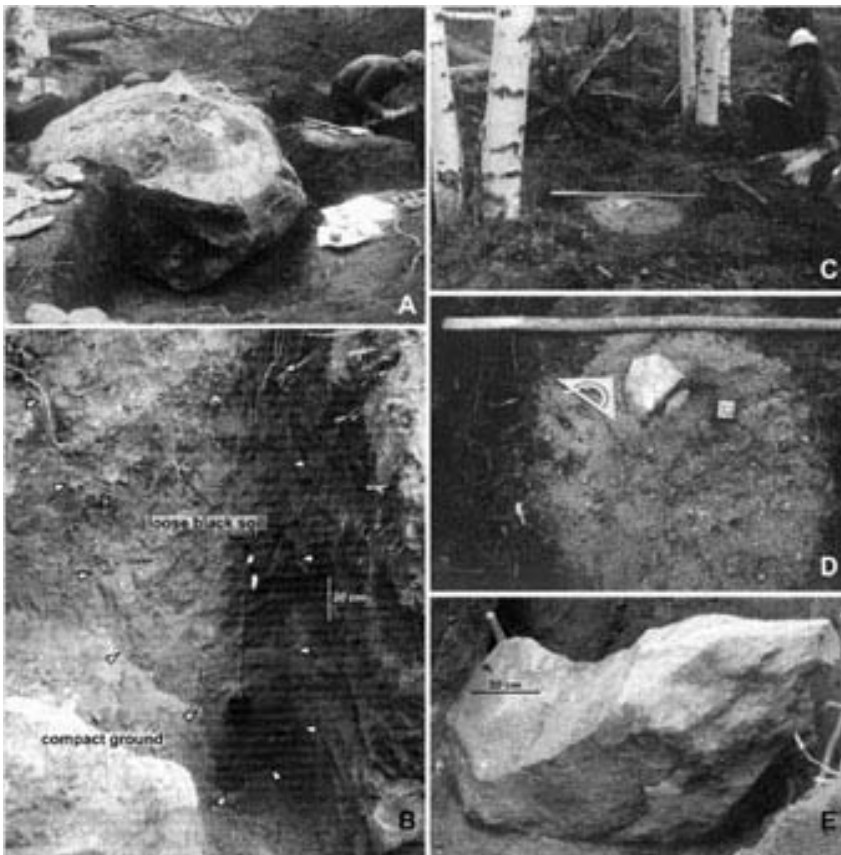
The exact origin of Tunguska meteorite is still mostly a mystery, although more than 100 years have passed since the event. Apparently, the explosion [was caused by a space object](#), which had entered Earth’s atmosphere at a hypersonic velocity. Since then there have been many claims regarding the discovery of interesting and sometimes ‘strange’ objects that could have formed in the aftermath. However, most of these reports either have not been verified, or the evidence was lost before any significant chemical analysis could be accomplished.

This situation started to change during the recent years. In 2013 Russian scientist Andrey Zlobin has published a paper, in which he [claimed to have found some pebbles](#) – remnants from the Tunguska meteor. He described the chemical composition of those potential remnants from the explosion in the paper and noted that one of the specimens consisted of “quartz-like” substance with the visible traces of melting on the surface.

The authors of the current study note



Images of five specimens from John’s Stone. Photos taken in 2013. Red arrows indicate half-cleaved shear-fractured pebbles. Yellow arrow indicates crack in the crust. S1F1 & S1F2: Two views of light-toned specimen 1 with characteristic bowed shape, smoother outer surface, and freshly



that the finding described by Andrey Zlobin is interesting due to the fact that the quartz-containing rocks have been recently identified on Mars, whereas this mineral is rarely found in meteorites here on Earth. The researchers note that this argument was the main cause to consider Mars as a potential origin of the Tunguska meteorite.

The team surveyed the results of the previous studies on this phenomenon, including the eyewitness’ reports from that time and subsequent excavations, as well as aerial photos of the location. This data was used to reconstruct the patterns and positions of the rock shards and pebbles that originally belonged to a larger boulder discovered in July 19, 1972, known under the name [John’s Stone](#).

Some of the available specimens of the shear-fractured splinter fragments of the John’s Stone contain glassy coatings that indicate the effect of heat generated during the meteorite impact. The team performed an experiment to reproduce the same

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Photos (1972) of John’s Stone and related findings. Images Courtesy of the researchers.

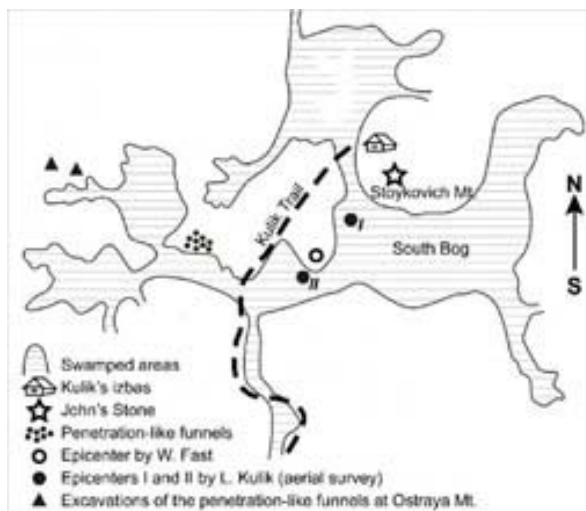
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crystalline structure on another rock fragment obtained from the John's Stone. Sadly, this experiment was not successful: the specimen disintegrated after heating by a 5000 K plasma beam.

Despite this failure, the authors claim that, most likely, the John's Stone is not of the local origin, although it shares some similarities with other rocks found in this area. The claim is supported by the analysis of its mineral structure, chemical composition of the rock, surrounding soil layers density, abundance and positions of the surrounding splinters with glassy coatings. Also, the reconstructed trajectory and landing velocity of the John's Stone agrees well with the estimated trajectory of the Tunguska cosmic body flight.

The team notes that the results of the current study – in particular, the hypothesis about the Martian origin of John's Stone – should be verified further by an independent international interdisciplinary research group.

By Alius Noreika, Source: www.technology.org
January 27, 2014



Schematic map of the epicenter area of the Tunguska catastrophe of 1908. Location of John's Stone and penetration funnel-like structures.

'Rogue' asteroids may be the norm

To get an idea of how the early solar system may have formed, scientists often look to asteroids. These relics of rock and dust represent what today's planets may have been before they differentiated into bodies of core, mantle, and crust.

In the 1980s, scientists' view of the solar system's asteroids was essentially static: Asteroids that formed near the sun remained near the sun; those that formed farther out stayed on the outskirts. But in the last decade, astronomers have detected asteroids with compositions unexpected for their locations in space: Those that looked like they formed in warmer environments were found further out in the solar system, and vice versa. Scientists considered these objects to be anomalous "rogue" asteroids.

But now, a new map developed by researchers from MIT and the Paris Observatory charts the size, composition, and location of more than 100,000 asteroids throughout the solar system, and shows that rogue asteroids are actually more common than previously thought. Particularly in the solar system's main asteroid belt — between Mars and Jupiter — the researchers found a compositionally diverse mix of asteroids.

The new asteroid map suggests that the early solar system may have undergone dramatic changes before the planets assumed their current alignment. For instance, Jupiter may have drifted closer to the sun, dragging with it a host of asteroids that originally formed in the colder edges of the solar system, before moving back out to its current position. Jupiter's migration may have simultaneously knocked around more close-in asteroids, scattering them outward.

"It's like Jupiter bowled a strike through the asteroid belt," says Francesca DeMeo, who did much of the mapping as a postdoc in MIT's Department of Earth, Atmospheric and Planetary Sciences. "Everything that was there moves, so you have this melting pot of material coming from all over the solar system."

DeMeo says the new map will help theorists flesh out such theories of how the solar system evolved early in its history. She and Benoit Carry of the Paris Observatory have published details of the map in *Nature*.

From a trickle to a river

To create a comprehensive asteroid map, the researchers first analyzed data from the Sloan Digital Sky Survey, which uses a large telescope in New Mexico to take in spectral images of hundreds of thousands of galaxies. Included in the survey is data from more than 100,000 asteroids in the solar system. DeMeo grouped these asteroids by size, location, and composition. She defined this last category by asteroids' origins — whether in a



Image credit: ESO

warmer or colder environment — a characteristic that can be determined by whether an asteroid's surface is more reflective at redder or bluer wavelengths.

The team then had to account for any observational biases. While the survey includes more than 100,000 asteroids, these are the brightest such objects in the sky. Asteroids that are smaller and less reflective are much harder to pick out, meaning that an asteroid map based on observations may unintentionally leave out an entire population of asteroids.

To avoid any bias in their mapping, the researchers determined that the survey most likely includes every asteroid down to a diameter of five kilometers. At this size limit, they were able to produce an accurate picture of the asteroid belt. The researchers grouped the asteroids by size and composition, and mapped them into distinct regions of the solar system where the asteroids were observed.

From their map, they observed that for larger asteroids, the traditional pattern holds true: The further one gets from the sun, the colder the asteroids appear. But for smaller asteroids, this trend seems to break down. Those that look to have formed in warmer environments can be found not just close to the sun, but throughout the solar system — and asteroids that resemble colder bodies beyond Jupiter can also be found in the inner asteroid belt, closer to Mars.

As the team writes in its paper, "the trickle of asteroids discovered in unexpected locations has turned into a river. We now see that all asteroid types exist in every region of the main belt."

A shifting solar system

(Continued on page 13)

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The compositional diversity seen in this new asteroid map may add weight to a theory of planetary migration called the Grand Tack model. This model lays out a scenario in which Jupiter, within the first few million years of the solar system's creation, migrated as close to the sun as Mars is today. During its migration, Jupiter may have moved right through the asteroid belt, scattering its contents and repopulating it with asteroids from both the inner and outer solar system before moving back out to its current position — a picture that is very different from the traditional, static view of a solar system that formed and stayed essentially in place for the past 4.5 billion years.

"That [theory] has been completely turned on its head," DeMeo says. "Today we think the absolute opposite: Everything's been moved around a lot and the solar system has been very dynamic."

Clark Chapman, a senior research scientist at the Southwest Research Institute in Boulder, Colo., says the new map is a welcome update to the asteroid maps he and his colleagues developed in the 1980s, which included only those asteroids measuring 20 kilometers or more in diameter. In the past two decades, he says, scientists have made leaps in their understanding of asteroids' dynamics and evolutionary history, which DeMeo and Carry

have now put into context.

"What they have done is attempted to at least qualitatively describe how the unexpected relationships between asteroid size, distance from the sun, and composition fit into the current dynamical models and other insights from the past two decades," Chapman says. "I'm very glad that this basic research has been done, and I think it is a most welcome contribution to understanding the solar system."

DeMeo adds that the early pinballing of asteroids around the solar system may have had big impacts — literally — on Earth. For instance, colder asteroids that formed further out likely contained ice. When they were brought closer in by planetary migrations, they may have collided with Earth, leaving remnants of ice that eventually melted into water.

"The story of what the asteroid belt is telling us also relates to how Earth developed water, and how it stayed in this Goldilocks region of habitability today," DeMeo says.

Original Source: [MIT](#)

Courtesy: [technology.org](#) 30 January 2014

Interplanetary dust particles could deliver water and organics to jump-start life on Earth

Researchers from the University of Hawaii -- Manoa (UHM) School of Ocean and Earth Science and Technology (SOEST), Lawrence Livermore National Laboratory, Lawrence Berkeley National Laboratory, and University of California -- Berkeley discovered that interplanetary dust particles (IDPs) could deliver water and organics to Earth and other terrestrial planets.

Interplanetary dust, dust that has come from comets, asteroids, and leftover debris from the birth of the solar system, continually rains down on Earth and other Solar System bodies. These particles are bombarded by solar wind, predominately hydrogen ions. This ion bombardment knocks the atoms out of order in the silicate mineral crystal and leaves behind oxygen that is more available to react with hydrogen, for example, to create water molecules.

"It is a thrilling possibility that this influx of dust has acted as a continuous rainfall of little reaction vessels containing both the water and organics needed for the eventual origin of life on Earth and possibly Mars," said Hope Ishii, new Associate Researcher in the Hawaii Institute of Geophysics and Planetology (HIGP) at UHM SOEST and co-author of the study. This mechanism of delivering both water and organics simultaneously would also work for exoplanets, worlds that orbit other stars. These raw ingredients of dust and hydrogen ions from their parent star would allow the process to happen in almost any planetary system.

Implications of this work are potentially huge: Airless bodies in space such as asteroids and the Moon, with ubiquitous silicate minerals, are constantly being exposed to solar wind irradiation that can generate water. In fact, this mechanism of water formation would help explain remotely sensed data of the Moon, which discovered OH and preliminary water, and

possibly explains the source of water ice in permanently shadowed regions of the Moon.

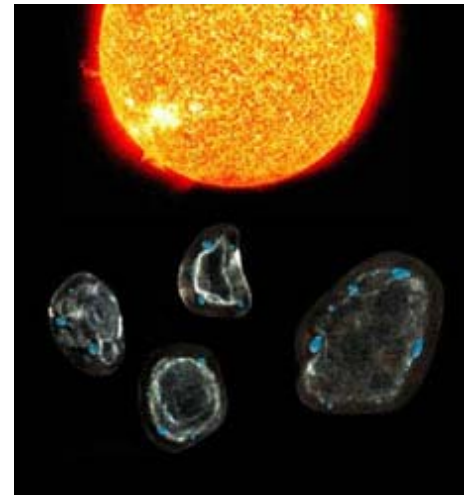
"Perhaps more exciting," said Ishii, "interplanetary dust, especially dust from primitive asteroids and comets, has long been known to carry organic carbon species that survive entering the Earth's atmosphere, and we have now demonstrated that it also carries solar-wind-generated water. So we have shown for the first time that water and organics can be delivered together."

It has been known since the Apollo-era, when astronauts brought back rocks and soil from the Moon, that solar wind causes the chemical makeup of the dust's surface layer to change. Hence, the idea that solar wind irradiation might produce water-species has been around since then, but whether it actually does produce water has been debated. The reasons for the uncertainty are that the amount of water produced is small and it is localized in very thin rims on the surfaces of silicate minerals so that older analytical techniques were unable to confirm the presence of water.

Using a state-of-the-art transmission electron microscope, the scientists have now actually detected water produced by solar-wind irradiation in the space-weathered rims on silicate minerals in interplanetary dust particles. Further, on the bases of laboratory-irradiated minerals that have similar amorphous rims, they were able to conclude that the water forms from the interaction of solar wind hydrogen ions (H+) with oxygen in the silicate mineral grains.

This recent work does not suggest how much water may have been delivered to Earth in this manner from IDPs.

"In no way do we suggest that it was sufficient to form oceans, for example," said Ishii. "However, the relevance of our



The surfaces of tiny interplanetary dust particles are space-weathered by the solar wind, causing amorphous rims to form on their surfaces. Hydrogen ions in the solar wind react with oxygen in the rims to form tiny water-filled vesicles (blue). This mechanism of water formation almost certainly occurs in other planetary systems with potential implications for the origin of life throughout the galaxy.

work is not the origin of the Earth's oceans but that we have shown continuous, co-delivery of water and organics intimately intermixed."

In future work, the scientists will attempt to estimate water abundances delivered to Earth by IDPs. Further, they will explore in more detail what other organic (carbon-based) and inorganic species are present in the water in the vesicles in interplanetary dust rims.

January 24, 2014
Source: [University of Hawaii](#)
Courtesy: [Science Daily](#)

Rosetta wide awake as check-up continues

Following last week's wake-up of the Rosetta comet-chaser, ESA's flight controllers have conducted the first in a series of health checks aimed at assessing how well it came through 31 months of hibernation.

After its long deep-space hibernation, Europe's Rosetta spacecraft woke up on 20 January to begin the final leg of its 10-year journey to comet 67P/Churyumov-Gerasimenko.

Rosetta's first signal after exiting hibernation was received by both NASA's Goldstone and Canberra ground stations at 18:18 GMT/19:18 CET on 20 January 2014, during the first window of opportunity the spacecraft had to communicate with Earth. It was immediately confirmed in ESA's space operations centre in Darmstadt and the successful wake-up announced via the @ESA_Rosetta twitter account, which tweeted: "Hello, World!". *Copyright ESA/J. Mai*

Its first signal was received at 18:18 GMT (19:18 CET) at ESA's control centre in Darmstadt, Germany. Receipt confirmed that Rosetta had exited hibernation, warmed up and – as planned – switched itself into 'safe mode', a basic level of functionality, transmitting a simple radio tone via its S-band transmitter and waiting for instructions from Earth.

Within several hours, the Flight Control Team had established full control, switching on the more powerful X-band transmitter. This allowed high-rate housekeeping information to provide a detailed look at the health and status of crucial propulsion, attitude-keeping and power systems, among many others.

"We were most concerned about power, and seeing if the solar arrays were generating sufficient electricity to support the planned recommissioning activities," says Andrea Accomazzo, Spacecraft Operations Manager.

"But even though we were still 673 million km from the Sun, we were getting enough power and the arrays appear to have come through hibernation with no degradation."



Back online

Since then, several days of detailed checks have allowed the team to determine that the rest of the comet-chaser's systems are also working as expected.

Reactivation of three of the four reaction wheels – spinning gyroscopes used to control attitude – went flawlessly. The fourth wheel should be reactivated in the coming weeks.

"We are now back online with a fully functional spacecraft," reports Andrea.

The Rosetta orbiter will analyse comet 67P/Churyumov-Gerasimenko and its environment using a suite of 11 instruments:

ALICE: Ultraviolet Imaging Spectrometer – (characterising the composition of the comet nucleus and coma)

CONSERT: Comet Nucleus Sounding Experiment by Radio wave Transmission (studying the internal structure of the comet with lander Philae)

COSIMA: Cometary Secondary Ion Mass Analyser (studying the composition of the dust in the comet's coma)

GIADA: Grain Impact Analyser and Dust Accumulator (measuring the number, mass, momentum and velocity distribution of dust grains in the near-comet environment)

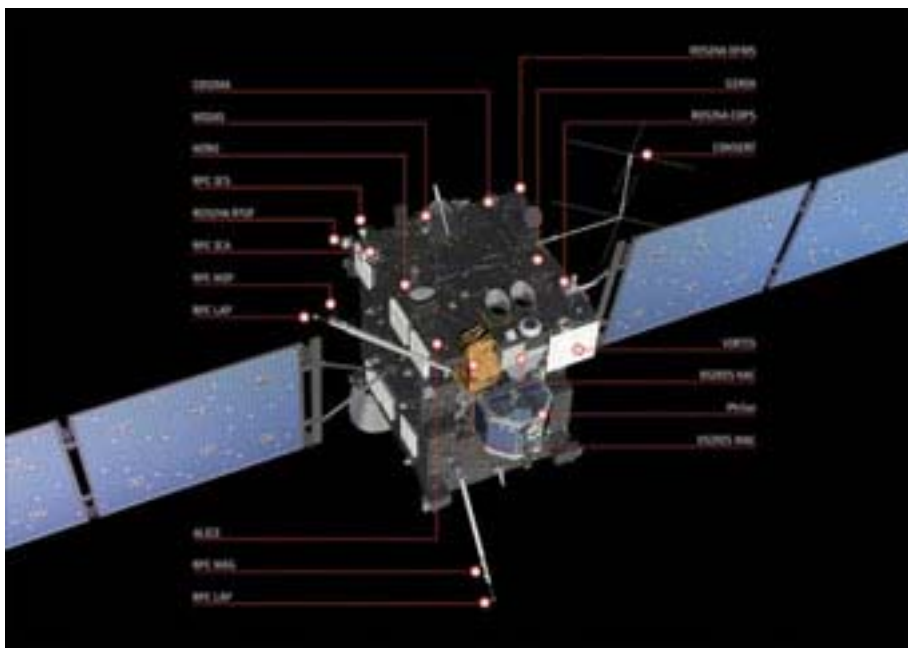
MIDAS: Micro-Imaging Dust Analysis System (studying the dust environment of the comet)

MIRO: Microwave Instrument for the Rosetta Orbiter (investigating the nature of the cometary nucleus, outgassing from the nucleus and development of the coma)

OSIRIS: Optical, Spectroscopic, and Infrared Remote Imaging System Camera (a dual camera imaging system consisting of a narrow angle (NAC) and wide angle camera (WAC) and operating in the visible, near infrared and near ultraviolet wavelength range)

ROSINA: Rosetta Orbiter Spectrometer for Ion and Neutral Analysis (determining the composition of the comet's atmosphere and ionosphere, and measuring the temperature, velocity and density of the gas flow, comprising: DFMS (Double-focusing mass spectrometer), RTOF (Reflectron Time-Of-Flight mass spectrometer) and COPS (Comet Pressure

(Continued on page 15)



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Sensor))

RPC: Rosetta Plasma Consortium (studying the plasma environment of the comet, comprising: ICA (Ion Composition Analyser), IES (Ion and Electron Sensor), LAP (Langmuir Probe), MAG (Fluxgate Magnetometer), MIP (Mutual Impedance Probe), PIU (Plasma Interface Unit))

RSI: Radio Science Investigation (tracking the motion of the spacecraft to infer details of the comet environment and nucleus)

VIRTIS: Visible and Infrared Thermal Imaging Spectrometer (studying the nature of the comet nucleus and the gases in the coma). Image Copyright ESA/ATG medialab

The next few weeks will be dedicated to testing and configuring onboard flight systems, including the solid-state mass memory, used to store science and operations data prior to download.

Catching Rosetta's wake-up signal using one of NASA's 70 m-diameter dishes was not without challenges.

Even after 31 months of no contact, however, the team at ESOC could predict the spacecraft's location in the sky to within just 2000 km at a distance of 807 million km – equivalent to a tiny fraction the size of a full Moon.

"We're now recording tracking station data and in a few days will be able to conduct the first full orbit determination since wake up," says Frank Dreger, Head of Flight Dynamics at ESOC.

Science instrument commissioning

The next phase, lasting through April, will see science teams recommissioning Rosetta's 11 scientific instruments. This will be done on individual schedules coordinated by the Rosetta Mission Operations Centre in ESOC.

In March, Rosetta's lander, Philae, will also be switched on for the first time since hibernation. It, too, will be recommissioned to confirm its control systems and 10 instruments are working.

"Over the next three months we will be making sure that each instrument is ready to perform once we finally arrive at the comet, after 10 years journeying through the Solar System," says Fred Jansen, Rosetta Mission Manager.

Matt Taylor, Rosetta Project Scientist, adds: "Rosetta is equipped with a range of experiments that will tell us everything about the characteristics of this comet and how its behaviour changes as we get closer to the Sun, ultimately giving us a better picture of the role comets have played in our Solar System's evolution."

Starting in February, status updates will be posted regularly in the [Rosetta blog](#).

Source: [ESA](#)

Courtesy: [Technology.org](#)

29 January 2014

River of hydrogen flowing through space observed

Astronomers have discovered what could be a never-before-seen river of hydrogen flowing through space. This very faint, very tenuous filament of gas is streaming into the nearby galaxy NGC 6946 and may help explain how certain spiral galaxies keep up their steady pace of star formation.

Using the National Science Foundation's Robert C. Byrd Green Bank Telescope (GBT), astronomer D.J. Pisano from West Virginia University has discovered what could be a never-before-seen river of hydrogen flowing through space. This very faint, very tenuous filament of gas is streaming into the nearby galaxy NGC 6946 and may help explain how certain spiral galaxies keep up their steady pace of star formation.

"We knew that the fuel for star formation had to come from somewhere. So far, however, we've detected only about 10 percent of what would be necessary to explain what we observe in many galaxies," said Pisano. "A leading theory is that rivers of hydrogen -- known as cold flows -- may be ferrying hydrogen through intergalactic space, clandestinely fueling star formation. But this tenuous hydrogen has been simply too diffuse to detect, until now."

Spiral galaxies, like our own Milky Way, typically maintain a rather tranquil but steady pace of star formation. Others, like NGC 6946, which is located approximately 22 million light-years from Earth on the border of the constellations Cepheus and Cygnus, are much more active, though less-so than more extreme starburst galaxies. This raises the question of what is fueling the sustained star formation in this and similar spiral galaxies.

Earlier studies of the galactic neighborhood around NGC 6946 with the Westerbork Synthesis Radio Telescope (WSRT) in the Netherlands have revealed an extended halo of hydrogen (a feature commonly seen in spiral galaxies, which may be formed

(Continued on page 16)



This composite image contains three distinct features: the bright star-filled central region of galaxy NGC 6946 in optical light (blue), the dense hydrogen tracing out the galaxy's sweeping spiral arms and galactic halo (orange), and the extremely diffuse and extended field of hydrogen engulfing NGC 6946 and its companions (red). The new GBT data show the faintly glowing hydrogen bridging the gulf between the larger galaxy and its smaller companions. This faint structure is precisely what astronomers expect to appear as hydrogen flows from the intergalactic medium into galaxies or from a past encounter between galaxies

Credit: D.J. Pisano (WVU); B. Saxton (NRAO/AUI/NSF); Palomar Observatory – Space Telescope Science Institute 2nd Digital Sky Survey (Caltech); Westerbork Synthesis Radio Telescope

Bright star reveals new Neptune-size exoplanet

A team of astronomers has discovered a new exoplanet, christened Kepler-410A b. The planet is about the size of Neptune and orbits the brightest star in a double star system 425 light years from Earth.

An international team of astronomers at Stellar Astrophysics Centre in Aarhus, Denmark, has discovered a new exoplanet, christened Kepler-410A b. The planet is about the size of Neptune and orbits the brightest star in a double star system 425 light years from Earth.

By studying the star around which the planet revolves, they found that the star's rotation appears to be well-aligned with the planetary movement. The object can be well-studied because the star is relatively bright, it can be seen if strong binoculars are used. The planet orbits one star of what appears to be a binary star, and the orbit is not circular but slightly eccentric. The planet is a bit larger than our Earth, with a radius of about 2.8 times that of our planet. With a period of around 18 days, it is much closer to its star than Earth is to our sun, and therefore unlikely to be suitable for life due to its high temperature. Perturbations on the discovered planet indicate that there is likely another, as of yet unknown planet in the system.

After the first discovery of the first exoplanet (a planet around which doesn't orbit our Sun, but another star), the number of planets has increased up to around 1000 currently known exoplanets. Kepler-410A b is interesting because it can be studied in detail. It has been observed for four years with the Kepler space

(Continued from page 15)

by hydrogen ejected from the disk of the galaxy by intense star formation and supernova explosions). A cold flow, however, would be hydrogen from a completely different source: gas from intergalactic space that has never been heated to extreme temperatures by a galaxy's star birth or supernova processes.

Using the GBT, Pisano was able to detect the glow emitted by neutral hydrogen gas connecting NGC 6946 with its cosmic neighbors. This signal was simply below the detection threshold of other telescopes. The GBT's unique capabilities, including its immense single dish, unblocked aperture, and location in the National Radio Quiet Zone, enabled it to detect this tenuous radio light.

Astronomers have long theorized that larger galaxies could receive a constant influx of cold hydrogen by siphoning it off other less-massive companions.

In looking at NGC 6946, the GBT detected just the sort of filamentary structure that would be present in a cold flow, though there is another probable explanation for what has been observed. It's also possible that sometime in the past this galaxy had a close encounter and passed by its neighbors, leaving a ribbon of neutral atomic hydrogen in its wake.

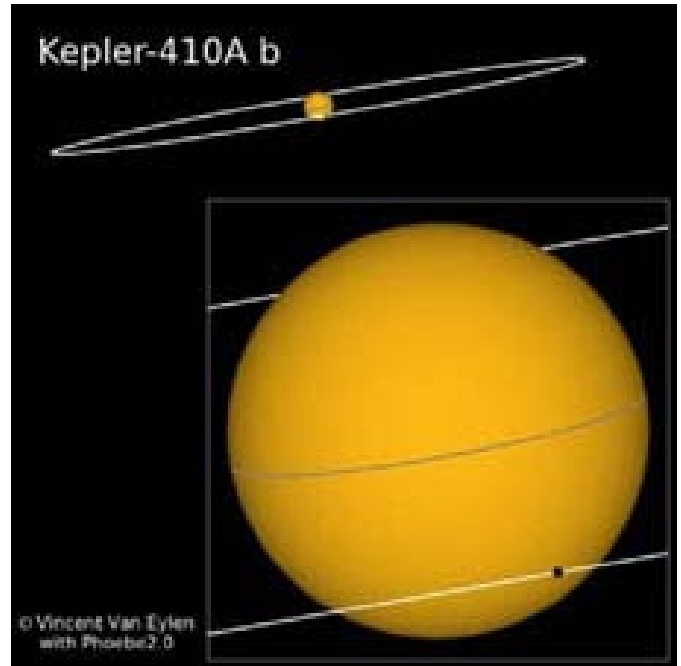
If that were the case, however, there should be a small but observable population of stars in the filaments. Further studies will help to confirm the nature of this observation and could shine light on the possible role that cold flows play in the evolution of galaxies.

These results are published in the *Astronomical Journal*.

The 100-meter GBT is operated by the National Radio Astronomy Observatory (NRAO) and located in the National Radio Quiet Zone and the West Virginia Radio Astronomy Zone, which protect the incredibly sensitive telescope from unwanted radio interference.

The National Radio Astronomy Observatory is a facility of the National Science Foundation, operated under cooperative agreement by Associated Universities, Inc.

Source: National Radio Astronomy Observatory
Courtesy: Science Daily
27 January 2014



This is an artist impression of the star Kepler-410A. The black dot represents the planet Kepler-410A b, as it moves in front of the star, blocking a small part of the star light and thereby allowing it to be indirectly detected. The stellar companion Kepler-410B is about 10,000 times further away from the planet and is not shown on the image.

Credit: Vincent Van Eylen

telescope, a NASA satellite which has monitored the brightness of more than 150,000 stars simultaneously, to look for small regularly-recurring dips in the light, which are indicative of the presence of an exoplanet.

The exquisite quality of the Kepler data has allowed a very detailed study of the host star. On top of that, the star is rather bright; it is in fact the third brightest exoplanet host star discovered by Kepler. This has allowed the team to study tiny variations in the stellar brightness caused by stellar pulsations, a technique which is called asteroseismology. Thereby they have been able to measure stellar properties such as its mass and radius to an accuracy of a few percent.

"Ultimately, to understand anything about exoplanets, we need to understand the stars they revolve around. In this case, asteroseismology has even allowed us to measure the inclination angle of the star. We now know we are looking at the equator of the star, not at the pole. This can be compared with the orbit of the planet to learn about planetary formation. The star is around 2.7 giga-years old and is a little larger than the Sun. We will never be able to go there, as it is located at around 425 lightyears from Earth," says lead author Vincent Van Eylen.

Because of the brightness of the star, it is a suitable target for further observations. The team has accurately measured the times of transit and found it doesn't cross the star exactly every 17.8 days, but is slightly perturbed: the planet is sometimes up to 15 minutes late or early. These perturbations indicate that there could be another planet present, slightly pulling or pushing Kepler-410A b around.

"We are confident that there is another planet, but because it doesn't move in front of the star, we don't yet know what it is like," says Vincent Van Eylen.

The above story is based on [materials](#) provided by [Aarhus University](#).

Courtesy: Science Daily
22 January 2014