FAS Newsletter

Federation of Astronomical Societies http://www.fedastro.org.uk

FAS Annual Convention 2015

Report by Callum Potter

The Federation of Astronomical Societies Annual Convention is always a good day out, and this year's was no exception, with around about 130 attending.

It was held on October 24th at the University of Birmingham's Poynting Building. The Poynting Building remembers Sir John Henry Poynting the first professor of physics at the University of Birmingham. He seems to have been an interesting character, and worked out how to describe the direction and magnitude of electromagnetic waves with the "Poynting Vector", and was the first to work out an accurate determination of the mass of the Earth.

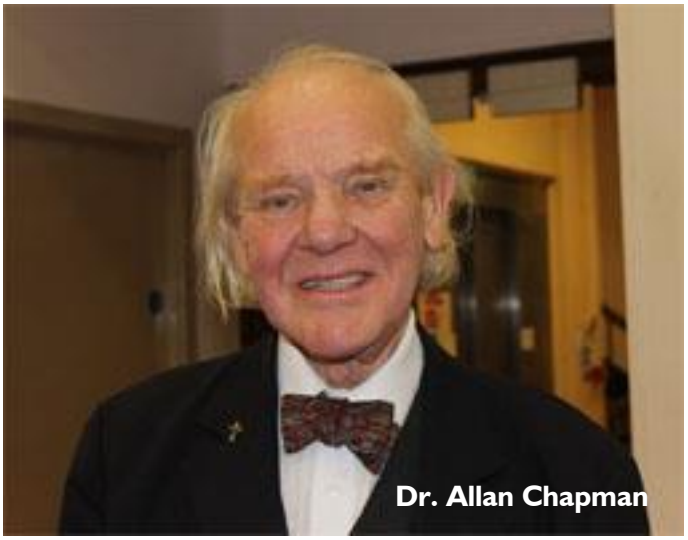
The iconic clock tower at the University

I found out there is a straight train from Tewkesbury to the University so I thought I would give it a try – it worked out quite well. Car parking at the University is free at the weekends too – not that everyone was aware of that though.

First up on the day was Darryl Sergison who gave a talk entitled "Stellar Birth, the first 10Myr" – looking at places where stars are born, the early days of stars before they start 'burning' nuclear fuel, and the techniques that can be used to observe. This is quite a popular area for amateurs who want to do science, and there is a lot of pro-am collaboration – measuring the brightness of variable stars and taking spectra (which is becoming more popular now that commercial instruments are readily available).

The 'blue plaque' commemorating Professor Poynter after whom this

Professor David Valls-Gabaud of the University of Cambridge followed with "Gravitational lensing or how to detect and measure the warps of space-time". Being the International Year of Light and the 100th anniversary of Einstein's General Theory of Relativity, there have been quite a lot of lectures about this sort of topic, but this was a really interesting talk about



Dr. Allan Chapman

gravitational lensing. The bending of star light as predicted by Einstein's theory has resulted in many more observational techniques than you might expect. Gravitational lensing by galaxies and clusters of galaxies lets us probe the most distant objects in the universe and determine the distribution of dark matter. Micro-lensing by stars has been used to discover exo-planets. And at the biggest scale gravitational lensing is being used as an indicator of the shape of the universe. There are opportunities for amateurs

Dr Darryl Sergison

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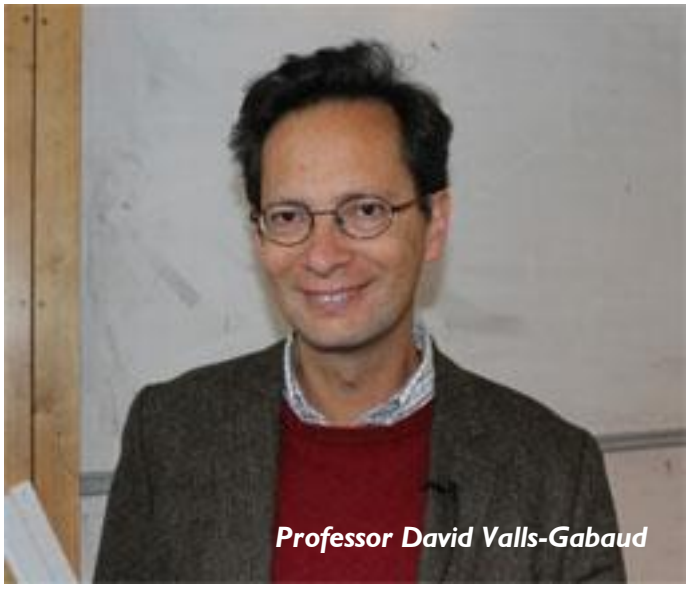
to contribute to the search for gravitational lenses through the citizen science project spacewarps.org

Professor Valls-Gabaud also brought an optical counterpart demonstrator of a gravitational lens, which is like the foot of a wine glass.

Sadly, heavy rain and cloud meant that the lunchtime activities of telescope tours and solar observing could not take place.

After lunch was the FAS AGM.



Professor David Valls-Gabaud

The FAS has been suffering over the past few years without sufficient volunteers, and there are quite a few vacancies on the Council so the meeting was chaired by FAS Newsletter editor Frank Johns. The AGM had a usual sort of agenda – the finances are sound, and next year's subscriptions will be the same as this. A decision on any prompt-paying discount is still to be taken. For the election of council, there were a few vacancies that are unfilled – volunteers were requested from the audience, and attendees were asked to take this message back to the member societies. So here you are – if you would be interested in helping out on the FAS council, then please get in touch with the FAS Secretary (Shaun O'Dell). Positions vacant are: President, Vice-President, Minutes Secretary, Convention Organiser, Convention Speakers Organiser, and possibly one or two ordinary members of council (without portfolio).

Professor Nigel Mason

The afternoon talks kicked off with recently completed PhD student Joe Walshe's talk on "Thank your lucky stars". Joe is a nuclear physicist at Birmingham, and explained how some nuclear reactions are preferred, and showed how in stars the elements are created where the chances of reactions are rather low, but is essential for stars to last as long as they do.

Professor Nigel Mason of the Open University followed talking on "Chemistry in the Cosmos", looking principally into the questions of "how did life start on Earth?", and "is there life elsewhere in the universe?". Although it's possible to create complex molecules in the lab, and observe them in space, there are no good explanations of how these can combine to produce the building blocks of life; cells, RNA and DNA. Probes to plan-

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A tea break between lectures

(Continued from page 2)

ets and moons in our solar system are still to find concrete indicators, and observations of exoplanets are being actively pursued, but again indicators are either hard to detect. A new European project Europlanet (www.europlanet-eu.org) will promote collaboration with citizen science projects in this field.

Professor Martin Hendry of Glasgow University returned to "Einstein's Universe" with a talk mainly about the gravitational wave detector LIGO. Although gravitational waves have yet to be detected, LIGO's recent revamp will improve its sensitivity and promises that they may be observed for the first time in the next few years – an exciting time for the project.

Topping off the day was the ever-popular Dr. Allan Chapman who talked about the life of Sir John Herschel, son of William Herschel. John has perhaps become overlooked in favour of his father, but was a key person in the development of astronomy and science in his era. In addition to observations from South Africa, he made strides in cosmology, encouraged women's contributions to science and mathematics, and collaborated with Henry Fox Talbot on the development of photography.

Birminham AS display

Gravitational Lens Model

More relevant blue plaques at the Poynting Building showing the breadth of physics that has been undertaken at Birmingham Uni.

FAS Annual General Meeting

As Callum Potter mentioned in his report on the Convention, elsewhere in this Newsletter, the 2015 FAS AGM followed the usual agenda, with little discussion or actions required resulting from the minutes of the 2014 AGM.

The accounts were distributed and the current financial position of the FAS was outlined by the Treasurer, Peter Cooke. Very little discussion on these figures transpired, so it must be assumed that the delegates were reasonably satisfied with the presentation.

However, when it came to the election of officers and members of Council, the acting chairman explained that for the past several years, members had been standing down after considerable time spent on Council, with few replacements coming on to assist in these various FAS activities. The details of post-holders and vacancies are listed in the adjacent table.

This problem has now reached a critical state and unless this situation can be reversed, the first casualty is likely to be the 2016 FAS Convention.

It was explained that organising the Convention has two quite different activities.

The first is **Speaker Co-ordinator**, *where the holder will contact possible speakers and draw up a proposed programme of talks for the event. This, obviously, is an important role bearing in mind the quality of the speakers and their subjects are crucial, particularly in the range of topics covered. Ideally the Speaker Co-Ordinator will have good contacts with relevant Universities, etc.*

The second is **Convention Organiser**, *where the prime requirement is co-ordinating the event itself. This will cover securing a range of traders and other such organisations to attend, securing the venue, liaising with local societies to ensure sufficient manpower resources will be available for the event, including refreshment arrangments, etc. It is considered that this position should be undertaken by a member volunteer who is reasonably local to the venue.*

Obviously, the Speaker Co-ordinator and Convention Organiser, would have the active support of the rest of Council in order to assist and advise.

One other position, where a volunteer would greatly assist Council (and in particular, our hard-pressed Hon Sec) is that of **Minutes Secretary**.

It is also considered helpful if there were several members of Council who have no particular duties—'without portfolio', the reason being that regularly there are short term activities that arise from time to time, and such members can undertake these without adding to the load of the other members of Council, who, after all,are only volunteers.

So, the AGM was closed with the message 'Volunteers Required'

Postscript: *I am please to report that since this appeal was made, three members have put there names forward to help. Very encouraging!! - Ed*

Position	2014/5 Holder	Proposed
President	Vacant	Vacancy
Vice-President	Vacant	Vacancy
Secretary – (Acting President)	Shaun O'Dell	Shaun O'Dell
Minutes Secretary	Shaun O'Dell	Vacancy
Treasurer	Peter Cooke	Peter Cooke
Membership Sec.	Mike Pritchard	Mike Pritchard
Website	Sean Elvidge	Vacancy
Convention Speaker Co-ordinator	Sean Elvidge	Vacancy
Convention Organiser	Sean Elvidge	Vacancy
Newsletter Editor	Frank Johns	Frank Johns
Publications Officer	Frank Johns	Frank Johns
Handbook Editor	Frank Johns	Frank Johns
PLI Officer	Tony Questa	Tony Questa
Publications Distribution	Adrian Roach	Adrian Roach
Council Member*	Graham Bryant	Graham Bryant
Council Member*	Vacancy	Vacancy
Council Member*	Vacancy	Vacancy
Astrocalendar - Data Compiler	Tony Williams (Liverpool AS)	Robert Williams (Hudderfield AS)

LETTERS

Dear Frank,

As a professional historian, I took the ICT AS question as a challenge and to my surprise (somewhat) it has completed defeated me. I have consulted Google Books which usually sheds some light on things with zero success and my books from the period (e.g. the Yearbooks of Astronomy for the late 1960s) do not list any society which could be even remotely construed as ICT AS. There are two specific problems here, one is that initials are notoriously hard to pin down on the internet and even worse ICT is a well-used set of initials for information and communication technology (as you will be aware of course). It would help considerably if one knew what ICT stood for which is what the question is about really. I have wondered if the CT could stand for College of Technology (the 1960s being a great period for CofTs), but if the society is UK-based (correct?), I cannot think of one which would be ICT.

Has someone given you the answer yet?

Best wishes,

Peter Morris

Dear Sir,

I have just come across your newsletter.

A reader has asked for help regarding I.C.T. AS. I have some information that might be useful.

I.C.T. was a good size company and presumably the AS was setup by some of its employess. This company merged with EELM to form a new company ICL (still existing i believe). This merger to the best of my memory took place late '68 or '69.

I believe I.C.T. was a midlands company. Perhaps the AS carried on in that area under a new name?

Regards,

David Hewlett

Hello

In the Letters section, Roger asks about ICT AS.

Is it possibly International Computers and Tabulators? It was formed in 1959, and eventually became part of ICL in 1968.

Regards, Chris

Reading AS and former ICL employee!

Solarsphere Astronomical and Music Festival

The first Solarsphere Astronomical and Music Festival took place at Penmaeur Farm, Builth Wells in Wales from 15th to 17th August and was attended by members of the Society. In addition to dark sky and solar observing the three day event featured talks by the President Elect of the Royal Astronomical Society, Professor John Zarnecki; Solar Scientist and Sky at Night presenter, Professor Lucie Greene; Astrophotographer, Damian Peach; Astrophysicist, Dr. Megan Argo; the Astronomer and Science Writer, Will Gater and specialist Aurora Photographer, Nigel Ball. Additional events included video presentations in an astrodome by Cosmos Planetarium, a 3D Astronomy Show presented by AstroCymru and a video presentation entitled "The Evolution Project" presented by Mark Townley. A

Professor John Zarnecki and an LAS Young Astronomer

variety of astronomy related activities were also available for young astronomers which included rocket making and space art. Live music sessions were provided by a variety of bands.

Solarsphere opened on the Friday with an introductory talk by Pete Williamson who together with his daughter Sarah Jane had organised the event. Pete is a freelance astronomer working in the media and has a particular interest in Solar Astronomy. Sarah Jane is also a keen astronomer.

The Festival Site: Builth Wells, South Wales

The programme for the festival was outlined in the large seated facility where the talks and presentations would take place. As the astronomy and music enthusiasts arrived during the late afternoon and evening, live music was presented on stage in the separate events area with an opportunity for people to socialise in the bar and catering areas. Observing conditions were quite good on this first night which was dry and mild conditions with well broken clouds.

Saturday proved to be an excellent day for solar observing with long periods of sunshine and plenty of blue skies. The opening talk of the festival was given in the afternoon by Damian Peach who gave a presentation on techniques for photographing planets which included many stunning examples of his work and later in the afternoon Will Gater gave an informative and interesting talk on the subject of Exoplanets. Early in the evening Professor John Zarnecki, who was voted President Elect of The Royal Astronomical Society in May, delivered his presentation. John, who has previously served as R.A.S. Vice-President, explained that this was his first formal talk as R.A.S. President Elect and gave an excellent talk which outlined the missions which have successfully landed spacecraft on other celestial bodies including Mercury, The Moon, Mars, Titan and comet 67P Churyumov-Gerasimenko. His talk was appropriately entitled "Happy Landings".

The Sunday programme of talks included presentations by Nigel Ball who showed a selection of his amazing photographs of aurora; a talk by Astrophysicist Dr. Megan Argo from Jodrell Bank and a presentation by Professor Lucie Greene who talked on the limits of our Solar System from her perspective as a Solar Scientist. The day itself provided excellent conditions for Solar observation and later skies were mainly clear to the delight of all present as the festival drew to a close.

Solarsphere 2015 was a great success and well deserved congratulations and thanks must go to Pete, Sarah Jane and all those involved in making the event so memorable. We are looking forward to Solarsphere 2016 which will take place from 12th to 15th August. Details are available on their website.

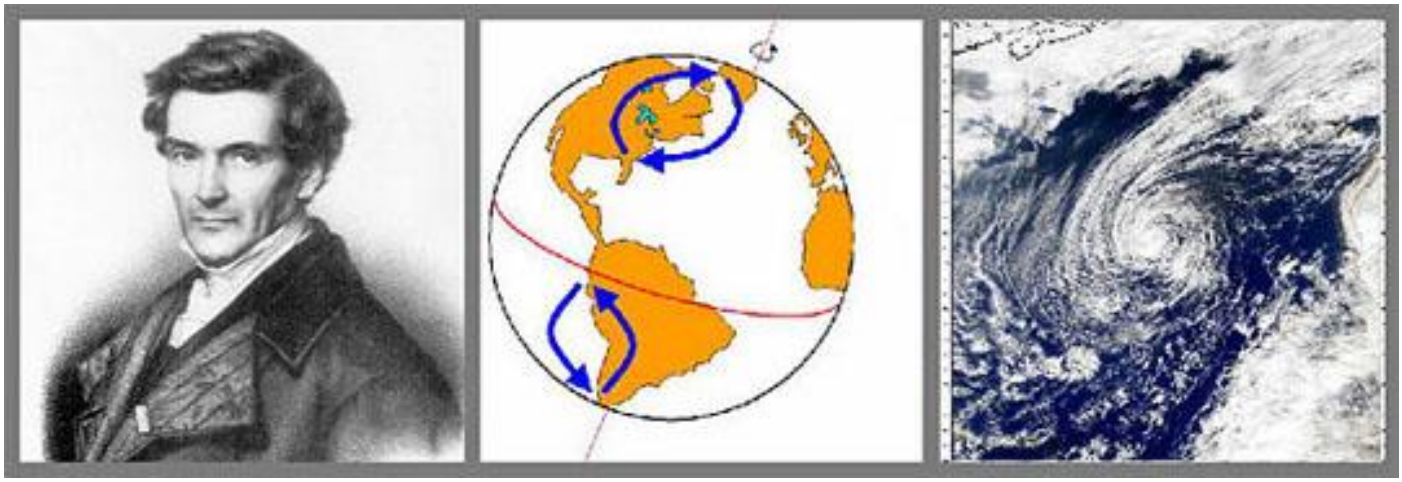
http://www.solarsphere.events/

Phil & John Williams
LAS Newsletter

Photo Credits: John Williams

Pete and Sarah Jane: Festival organisers

My 'new' Hero.



On a recent visit to Paris I made the obligatory pilgrimage to the Pantheon to witness Leon Foucault's Pendulum slowly marking out the hours of the day.

The present pendulum is one of several used by Foucault and was installed in October 1995 as a "Science is Fun" demonstration and replicates the first public demonstration, in this same place during March 1851 that the Earth really does rotate on its Axis.

Although Copernicus and Galileo had pointed out this truth centuries before, there had been no scientific proof that rotation was a fact, even though the movement of the heavenly bodies suggested this was true this pendulum brought home the fact even to the most reticent doubter.

The proof is simple to understand, according to Newton's laws a pendulum will oscillate back and forth along a fixed path and will not deviate unless an external force is applied. Since Foucault's pendulum does seem to deviate, its path seems to rotate in about 30 hours, the simplest explanation is that the path is fixed and the entire Pantheon is rotating around the pendulum.

Not just the Pantheon of course, but the entire planet.

So how fast does it rotate, asking myself this simple question took me back to my school science lessons more than half a century ago, Coriolis' law states that the surface of the earth rotates locally at sin lat 15 degrees per hour, where sin lat is the sine of the observer's latitude, and 15 degrees is a daily rotation of 360 degrees divided by the number of hours in that day.

So who was Coriolis?

Like Foucault he was a French physicist, a genius of note who, had he lived longer, might have challenged Newton's position as one of the world's greatest ever scientists.

His fame comes from his explanation of why bathwater spins as it goes down the plughole, this is no simple parlour trick as the same equations that govern bathwater also control rotating tropical storms, Coriolis' math's are used daily by meteorologists to track and predict hurricanes thus saving countless lives.

But Coriolis had no interest in weather, when he was working on the question he was employed by King Louis XVI's military to find what was going wrong with their new long range artillery.

The problem was the guns were missing the targets; every shell fired by every gun seemed to be veering off to the right, the longer the range, the further off to the right went the shell.

Eventually Coriolis found the answer, the guns were not at fault, it was the targets that were moving. Not moving on the ground, but moving with the rotation of the Earth.

After the shell had left the gun barrel it was free to fly along a perfectly straight path unaffected by external forces, by the time it arrives at its destination after many seconds in the air, the target was no longer there, swept away by the rotating earth.

Artillery today is under the guidance of sophisticated software, Huge guns on Battleships have a range of 20 or more miles and before firing, the target's position is transferred from the Radar into a computer that calculates velocity, drag, wind forces and most important the Coriolis effect before pointing the gun at the place where it predicts the target will be when the shell arrives there.

So, Foucault's experiment, although the first public demonstration, was not the first proof. Because Coriolis was working for the military we must assume that he was working under some secrecy, and perhaps for that reason his results made no impact on the astronomers of the day. He has however, made an impact on me.

Everybody has heroes, I certainly have, Newton and Galileo are in my top ten, so is Leon Foucault, (1819~1869).

But from today I shall have to move somebody out to make room for Gustave Coriolis, (1792~1843), a revolutionary scientist who's proof of the Earth's rotation preceded that of Leon Foucault by a good 30 years, my new Hero.

Alan Ledbury
Walsall Astronomical Society.

Liverpool AS take astronomy to Deeside Sailing Club and to Mill Dam, Kirkby by Brendan Martin

Deeside Sailing Club: Thursday 8th October 2015.

This was the second time we had been invited to Deeside sailing club as part of "Science week" and we arrived just in time for a dramatic sunset, we set our scopes up on the lawn in front of the clubhouse while Ken Clark prepared to give a talk on Comets inside.

The evening had promised much but the clouds rolled in and hopes were dashed.

Ken gave his talk to a good crowd of about 40 people but as he finished it was still cloudy so I set up and gave a talk entitled "A Stars Life", at the end of my talk the space station was due to go overhead, and as the cloud cover had started to break everyone went outside and through broken cloud were able to see the pass and then some targets in the sky such as M13, M57 and M31.

There were 12 LAS members present,

Thanks to Alan Dennett for the images.

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Mill Dam, Kirkby: Friday 9th October 2015.

Hot on the heels of Deeside Sailing Cub came Mill Dam, Kirkby, this was the first time we had done this event for a long time.

Gordon Lavender, the ranger for Stadt Moers had moved to Mill Dam over the summer and asked if we would do a "Sidewalk " event for him, and we duly obliged.

We turned up at the venue to clear skies although it was still bright, I gave a talk hoping that by the time I finished it would be nice and dark, it was, but it had also clouded over, nothing new there then!

There was approximately 60 members of the public along with 12 members of the LAS.

Thanks to Jim Stacy and Alan Dennett for the images.

Courtesy: LAS Newsletter

Shropshire AS Astro-Imager of the Year

The seed of an *astro-imaging* competition emerged from the confirmation of Pete Lawrence (of Sky at Night fame) as the presenter at the sixth Shropshire AS annual lecture. As with all committee decisions the concept festered before a consensus of a way forward was reached. Following initial reservations there is the desire it will become an annual event, watch this space.

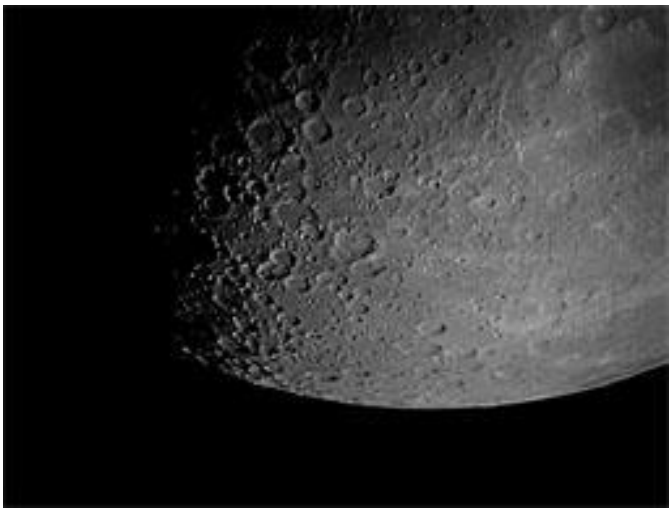
Deciding who was to carry off the Astro-Imager winner's trophy in the first Shropshire Astronomical Societies (SAS) competition proved difficult for the panel of judges. Standards proved to be high and produced some exceptional images across all categories. Winners Christine Morton (under 16), Jane Newell (society member) and Alan Jones (Shropshire resident) won subscriptions to SPA Young Stargazer, Astronomy Now and Sky at Night respectively, with Jane scooping the trophy for Astro-Imager of the year.

These winners, together with other highly recommended images by Pete Williamson and Tania Jones, were awarded their prizes by Sky at Night presenter Pete Lawrence at the annual lecture of the SAS, who shared his expertise and experience of the Aurora Borealis to a large audience at Meole Brace School Science College. This new venture by the society encouraging stargazers of all abilities and ages to share the wonders of the night sky proved to be very popular and will be repeated again next year. So with the dark nights with us get your cameras out and get snapping.

A judges comment by planetary imager David Woodward: "For years I have wanted the society to hold a photo-competition but I have had to wait until the technology caught up; it is so much easier now for individuals to make and submit images. What I hadn't anticipated was that the first competition would be open to such a wide range of people, including non-members and teenagers! It was a pleasure to be one of the judges and get to use my accumulated if strictly limited knowledge to help come up with what I hope are the

Not able to be present to receive her trophy on the night SAS member Jane Newell receives her awards from chairman Peter Gunn at a later data. In addition to a year's subscription to Astronomy Now and a copy of Shooting Stars by Nik Szymanek. Jane's star trail image was awarded best in show earning her a copy of Astronomy Photographer of the Year

Receiving a copy of and a year's subscription to SPA 'Young Stargazer' from Pete Lawrence is under 16 winner Christine Morton for her close up image of the moon.



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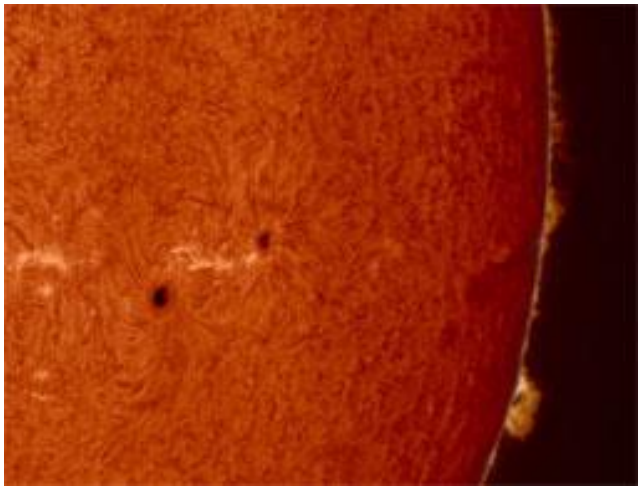
most deserving winners. It's a pity that the message didn't get through to youngsters and to some of the societies more experienced imagers but we have made a start. Next time it will be even better."

A judges comment by deep sky imager Andrew Johnson: "I was very excited when the photo competition was announced and delighted to be asked to provide technical input as a judge, much as I would have liked to entered it myself! Even with just under 40 entries short listing winners in each category was no easy task and picking overall winners was even harder. There were a lot of high quality images from people with equipment ranging from phone cams through to some top of the range astro-imaging gear making it very difficult to choose between entrants. There were a lot of photos I would love to have awarded prizes to, both from both a compositional as well as technical perspective, sadly, we had to pick three winners and runners -up and separating the top two in each category was a tough choice. I'd like to thank everyone who spent the time taking, processing and sending in an entry and giving us all such a hard time in picking this year's winners and congratulate all of you for making this such a success."

Shropshire resident and SAS member Alan Jones wins his subscription to Sky at Night for his image of Jupiter.

A winners reflection by Jane Newell: "I was so surprised when I found out I had won both the member's category and over all. It's an honour to be the first winner of the Trophy!! Over the past 12 months I've learnt so much about astro-imaging through society members, in particular from Kev Wildgoose and his excellent astro-imaging course and also Andrew Johnson, through his talk on Astrophotography and the helpful advice he has given me along the way. When taking my winning image, I was actually trying to capture a Persieus Meteor. When it came to editing I realized not only had I not captured any but the images I had were very clear, so I decided to combine all the images and Star Trails was the end result. That sums up astro-imaging for me. Frustrating and rewarding in equal measure."



Highly recommended were Pete Williamson (FRAS) for his image of sun activity AR241 and Tania Jones for Fades to Grey receiving their copies of Nik Szymanek's book.

All winners also received a copy of Shooting Stars by Nik Szymanek.

Report by Steve Szwajkun

Cassini Completes Final Close Enceladus Flyby

Cassini will continue to monitor activity on Enceladus from a distance, through to the end of its mission in Sept. 2017.

By Jet Propulsion Laboratory, Pasadena, California

NASA's Cassini spacecraft has begun transmitting data and images from the mission's final close flyby of Saturn's active moon Enceladus. Cassini passed Enceladus at a distance of 3,106 miles (4,999 kilometers) on Saturday, Dec. 19, at 9:49 a.m. PST (12:49 p.m. EST).

"This final Enceladus flyby elicits feelings of both sadness and triumph," said Earl Maize, Cassini project manager at JPL. "While we're sad to have the close flybys behind us, we've placed the capstone on an incredible decade of investigating one of the most intriguing bodies in the solar system."

Cassini will continue to monitor activity on Enceladus from a distance, through the end of its mission in Sept. 2017. Future encounters will be much farther away — at closest, more than four times farther than this latest encounter.

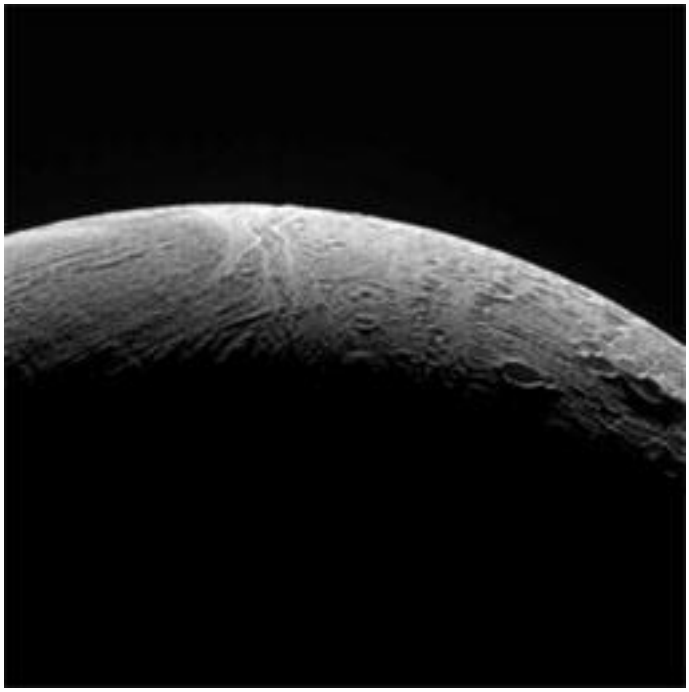
NASA's Cassini spacecraft paused during its final close flyby of Enceladus to focus on the icy moon's craggy, dimly lit limb, with the planet Saturn beyond.

NASA/JPL-Caltech/Space Science Institute

This was the 22nd Enceladus encounter of Cassini's mission. The spacecraft's discovery of geologic activity there, not long after arriving at Saturn, prompted changes to the mission's flight plan to maximize the number and quality of flybys of the icy moon.

"We bid a poignant goodbye to our close views of this amazing icy world," said Linda Spilker, the mission's project scientist at NASA's Jet Propulsion Laboratory in Pasadena, California. "Cassini has made so many breathtaking discoveries about Enceladus, yet so much more remains to be done to answer that pivotal question, 'Does this tiny ocean world harbor life?'

After revealing Enceladus' surprising geologic activity in 2005, Cassini made a series of discoveries about the material gushing from warm fractures near its south pole. Scientists announced strong evidence for a regional subsurface sea in 2014, revising their understanding in 2015 to confirm that the moon hosts a global ocean beneath its icy crust.



NASA's Cassini spacecraft peered out over the northern territory on Saturn's moon Enceladus, capturing this view of two different terrain types. A region of older terrain covered in craters that have been modified by geological processes is seen at right, while at left is a province of relatively craterless, and presumably more youthful, wrinkled terrain. Cassini acquired the view during its final close flyby of Enceladus, on Dec. 19, 2015.

NASA/JPL-Caltech/Space Science Institute

Hubble reveals diversity of exoplanet atmosphere

Largest ever comparative study solves missing water mystery

Date: December 14, 2015
Source: ESA/Hubble Information Centre

Astronomers have used the NASA/ESA Hubble Space Telescope and the NASA Spitzer Space Telescope to study the atmospheres of ten hot, Jupiter-sized exoplanets in detail, the largest number of such planets ever studied. The team was able to discover why some of these worlds seem to have less water than expected -- a long-standing mystery. The results are published in *Nature*.

To date, astronomers have discovered nearly 2000 planets orbiting other stars. Some of these planets are known as 'hot Jupiters', hot, gaseous planets with characteristics similar to those of Jupiter. They orbit very close to their stars, making their surface hot, and the planets tricky to study in detail without being overwhelmed by bright starlight.

Due to this difficulty, Hubble has only explored a handful of 'hot Jupiters' in the past, across a limited wavelength range. These initial studies have found several planets to hold less water than expected opo1436a , opo1354a .

This image shows an artist's impression of the ten hot Jupiter exoplanets studied by David Sing and his colleagues. From top left to to lower left these planets are WASP-12b, WASP-6b, WASP-31b, WASP-39b, HD 189733b, HAT-P-12b, WASP-17b, WASP-19b, HAT-P-1b and HD 209458b. *Credit: ESA/Hubble & NASA*

Now, an international team of astronomers has tackled the problem by making the largest ever study of hot Jupiters, exploring and comparing ten such planets in a bid to understand their atmospheres [1]. Only three of these planetary atmospheres had previously been studied in detail; this new sample forms the largest ever spectroscopic catalogue of exoplanet atmospheres.

The team used multiple observations from both the NASA/ESA Hubble Space Telescope and NASA's Spitzer Space Telescope. Using the power of both telescopes allowed the team to study the planets, which are of various masses, sizes, and temperatures, across an unprecedented range of wavelengths [2].

"I'm really excited to finally 'see' this wide group of planets together, as this is the first time we've had sufficient wavelength coverage to be able to compare multiple features from one planet to another," says David Sing of the University of Exeter, UK, lead author of the new paper. "We found the planetary atmospheres to be much more diverse than we expected."

All of the planets have a favourable orbit that brings them between their parent star and Earth. As the exoplanet passes in front of its host star, as seen from Earth, some of this starlight travels through the planet's outer atmosphere. "The atmosphere leaves its unique fingerprint on the starlight, which we can study when the light reaches us," explains co-author Hannah Wakeford, now at NASA Goddard Space Flight Center, USA.

These fingerprints allowed the team to extract the signatures from various elements and molecules -- including water -- and to distinguish between cloudy and cloud-free exoplanets, a property that could explain the missing water mystery.

The team's models revealed that, while apparently cloud-free exoplanets showed strong signs of water, the atmospheres of those hot Jupiters with faint water signals also contained clouds and haze -- both of which are known to hide water from view. Mystery solved!

"The alternative to this is that planets form in an environment deprived of water -- but this would require us to completely rethink our current theories of how planets are born," explained co-author Jonathan Fortney of the University of California, Santa Cruz, USA. "Our results have ruled out the dry scenario, and strongly suggest that it's simply clouds hiding the water from prying eyes."

The study of exoplanetary atmospheres is currently in its infancy, with only a handful of observations taken so far. Hubble's successor, the James Webb Space Telescope , will open a new infrared window on the study of exoplanets and their atmospheres.

Notes

[1] To date, studies of exoplanet atmospheres have been dominated by a small number of well-studied planets. The team used Hubble and Spitzer observations of two such planets, HD 209458b heic0303, opo0707b and HD 189733b heic1312, heic0720a, and used Hubble to observe eight other exoplanets -- WASP-6b, WASP-12b, WASP-17b, WASP-19b, WASP-31b, WASP-39b, HAT-P-1b, HAT-P-12b. These planets have a broad range of physical parameters.

[2] The observations spanned from the ultraviolet (0.3 micrometres) to the mid-infrared (4.5 micrometres).

Story Source:

The above post is reprinted from materials provided by **ESA/Hubble Information Centre**.

Courtesy: phys.com

U.S. demonstrates production of fuel for missions to the solar system and beyond

Date: December 23, 2015
Source: NASA/Jet Propulsion Laboratory

The first U.S. production in nearly 30 years of a specialized fuel to power future deep space missions has been completed by researchers at the Department of Energy's Oak Ridge National Laboratory (ORNL) in Tennessee.

The production of 50 grams of plutonium-238 -roughly the mass of a golf ball -- marks the first demonstration in the United States since the Savannah River Plant in South Carolina ceased production in the late 1980s.

Radioisotope power systems convert heat from the natural radioactive decay of the isotope plutonium-238 into electricity. These systems have been used to power the exploration of the solar system and beyond, from the Viking missions on Mars, to the Voyager spacecraft entering interplanetary space, and most recently powering the Curiosity Mars Rover and the New Horizons spacecraft sailing past Pluto.

"This significant achievement by our team mates at DOE signals a new renaissance in the exploration of our solar system," said John Grunsfeld, associate administrator for NASA's Science Mission Directorate in Washington. "Radioisotope power systems are a key tool to power the next generation of planetary orbiters, landers and rovers in our quest to unravel the mysteries of the universe."

The success of the engineers and technicians at ORNL comes two years after the project formally started with NASA funding, building on many years of research and testing. This demonstration of the key steps in fuel production will ensure that this vital space power technology will be available to provide electricity and heat for ambitious exploration missions of the solar system in this decade and beyond. In all, 27 past U.S. space missions have used this radioisotope power for their electricity and heat.

The Department of Energy (DOE) has successfully and safely provided radioisotope power systems for NASA, Navy and Air Force missions for more than 50 years.

"As we seek to expand our knowledge of the universe, the Department of Energy will help ensure that our spacecraft have the power supply necessary to go farther than ever before," said Franklin Orr, Under Secretary for Science and Energy at DOE. "We're proud to work with NASA in this endeavor, and we look forward to our continued partnership."

The currently available radioisotope power system, also supplied to NASA by the DOE, is called the Multi-Mission Radioisotope Thermoelectric Generator (MMRTG). Essentially a nuclear battery, an MMRTG can provide about 110 watts of electrical power to a spacecraft and its science instruments at the beginning of a mission. On some missions, such as NASA's Curiosity Mars rover (now deep into its third Earth year seeking signs of habitable conditions on the Red Planet), the excess heat from the MMRTG can also be used to keep spacecraft systems warm in cold environments.

The next NASA mission planning to use an MMRTG is the Mars 2020 rover, due to be launched as part of NASA's Journey to Mars, to seek signs of past life on the Red Planet, test technology for human exploration, and gather samples of rocks and soil that could be returned to Earth in the future. Two (unfueled) MMRTGs are currently built and in storage at DOE facilities; one is reserved for Mars 2020, and the other could be used on a future mission. Fabrication of the fuel pellets for the Mars 2020 MMRTG, using the existing U.S. supply of plutonium dioxide, is already underway.

Researchers will analyze the sample for chemical purity and plutonium-238 content to determine whether adjustments need to be made before scaling up the process.

With continued coordination, both agencies plan to increase production after this important demonstration milestone and will start with about 12 ounces (300 to 400 grams) of plutonium dioxide per year. After implementing greater automation and scaling up the process, ORNL will produce an average of 3.3 pounds (1.5 kilograms) in subsequent years.

This self-portrait of NASA's Mars rover Curiosity combines dozens of exposures taken by the rover's Mars Hand Lens Imager (MAHLI) during the 177th Martian day, or sol, of Curiosity's work on Mars (Feb. 3, 2013), plus three exposures taken during Sol 270 (May 10, 2013) to update the appearance of part of the ground beside the rover.
Credit: NASA/JPL-Caltech/MSSS

Of the 77 pounds (35 kilograms) of existing plutonium-238, about half provide enough heat to meet power specifications of planned spacecraft. The remainder, due to its age, does not meet specifications, but can be blended with newly produced Pu-238 to extend the usable inventory.

The DOE's Office of Nuclear Energy develops, manufactures, tests and delivers radioisotope power systems for space exploration and national security missions and maintains responsibility for nuclear safety throughout all aspects of the missions.

NASA's Radioisotope Power System (RPS) program, managed by NASA Glenn Research Center in Cleveland, is funding the development of new, higher efficiency thermoelectric materials that could be incorporated into a next-generation enhanced MMRTG that would provide about 25 percent more power at the start of a typical mission, and 50 percent more power at the end of a mission.

NASA's Jet Propulsion Laboratory, Pasadena, California, is part of the RPS program and manages several missions that utilize radioisotope power, including the Curiosity Mars rover and the Cassini spacecraft at Saturn.

Story Source:
The above post is reprinted from materials provided by NASA/Jet Propulsion Laboratory.

Courtesy: sciencedaily.com

James Webb mirrors meet halfway mark

The installation of its ninth mirror marks the halfway completion point for the James Webb Space Telescope's segmented primary mirror.

Date: December 29, 2015 Source: NASA's Goddard Space Flight Center, Greenbelt, Maryland

This rare overhead shot of the James Webb Space Telescope shows the nine primary flight mirrors installed on the telescope structure in a clean room at NASA's Goddard Space Flight Center in Greenbelt, Maryland.

NASA's Goddard Space Flight Center/Chris Gunn

Inside NASA's Goddard Space Flight Center's massive clean room in Greenbelt, Maryland, the ninth flight mirror was installed onto the telescope structure with a robotic arm. This marks the halfway completion point for the James Webb Space Telescope's segmented primary mirror.

The James Webb Space Telescope team has been working tirelessly to install all 18 of Webb's mirror segments onto the telescope structure.

"The years of planning and practicing is really paying dividends and the progress is really rewarding for everyone to see," said NASA's Optical Telescope Element Manager Lee Feinberg.

In these NASA images, the engineering team is seen using a robotic arm to lift and lower the hexagonal-shaped segment that measures just over 4.2 feet (1.3 meters) across and weighs approximately 88 pounds (40 kilograms). After being pieced together, the 18 primary mirror segments will work together as one large 21.3-foot (6.5-meter) mirror. The full installation is expected to be complete early in 2016.

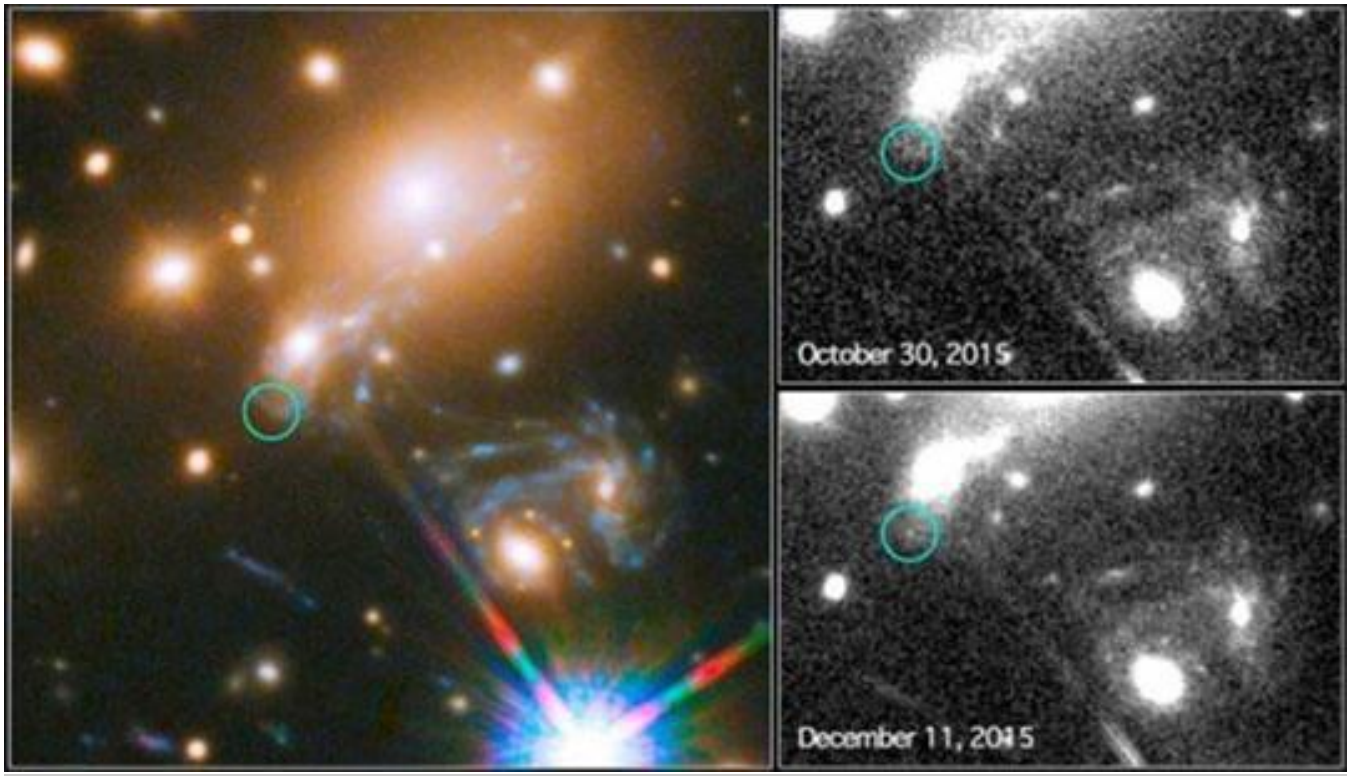
The James Webb Space Telescope is the scientific successor to NASA's Hubble Space Telescope. It will be the most powerful space telescope ever built. Webb is an international project led by NASA with its partners, the European Space Agency and the Canadian Space Agency.

You can watch the telescope's installation process live anytime on the JWST Webb Cam.

Courtesy: astronomy.com

Engineers worked tirelessly to install the ninth primary flight mirror onto the telescope structure.
NASA's Goddard Space Flight Center/Chris Gunn

Hubble captures first-ever predicted exploding star



This image composite shows the search for the supernova, nicknamed Refsdal, using the NASA/ESA Hubble Space Telescope. The image to the left shows a part of the the deep field observation of the galaxy cluster MACS J1149.5+2223 from the Frontier Fields program. The circle indicates the predicted position of the newest appearance of the supernova. To the lower right the Einstein cross event from late 2014 is visible. The image on the top right shows observations by Hubble from October 2015, taken at the beginning of observation program to detect the newest appearance of the supernova. The image on the lower right shows the discovery of the Refsdal Supernova on Dec. 11, 2015, as predicted by several different models. Credit: NASA & ESA and P. Kelly (University of California, Berkeley)

The NASA/ESA Hubble Space Telescope has captured the image of the first -ever predicted supernova explosion. The reappearance of the Refsdal supernova was calculated from different models of the galaxy cluster whose immense gravity is warping the supernova's light.

Many stars end their lives with a with a bang, but only a few of these stellar explosions have been caught in the act. When they are, spotting them successfully has been down to pure luck -- until now. On 11 December 2015 astronomers not only imaged a supernova in action, but saw it when and where they had predicted it would be.

The supernova, nicknamed Refsdal [1], has been spotted in the galaxy cluster MACS J1149.5+2223. While the light from the cluster has taken about five billion years to reach us, the supernova itself exploded much earlier, nearly 10 billion years ago [2].

Refsdal's story began in November 2014 when scientists spotted four separate images of the supernova in a rare arrangement known as an Einstein Cross around a galaxy within MACS J1149.5+2223 (heic1505 -- http://www.spacetelescope.org/news/heic1505/) [3]. The cosmic optical illusion was due to the mass of a single galaxy within the cluster warping and magnifying the light from the distant stellar explosion in a process known as gravitational lensing [4].

"While studying the supernova, we realised that the galaxy in which it exploded is already known to be a galaxy that is being lensed by the cluster," explains Steve Rodney, co-author, from the University of South Carolina. "The supernova's host galaxy appears to us in at least three distinct images caused by the warping mass of the galaxy cluster."

These multiple images of the galaxy presented a rare opportunity. As the matter in the cluster -- both dark and visible -- is distributed unevenly, the light creating each of these images takes a different path with a different length. Therefore the images of the host galaxy of the supernova are visible at different times.

Using other lensed galaxies within the cluster and combining them with the discovery of the Einstein Cross event in 2014, astronomers were able to make precise predictions for the reappearance of the supernova. Their calculations also indicated that the supernova appeared once before in a third image of the host galaxy in 1998 -- an event not observed by any telescope. To make these predictions they had to use some very sophisticated modelling techniques.

"We used seven different models of the cluster to calculate when and where the supernova was going to appear in the future. It was a huge effort from the community to gather the necessary input data using Hubble, VLT-MUSE, and Keck and to construct the lens models," explains Tommaso Treu, lead author of the modelling comparison paper, from the University of California at Los Angeles, USA. "And remarkably all seven models predicted approximately the same time frame for when the new image of the exploding star would appear."

Since the end of October 2015 Hubble has been periodically peering at MACS J1149.5+2223, hoping to observe the unique rerun of the distant explosion and prove the models correct. On 11 December Refsdal finally made its predicted, but nonetheless showstopping, reappearance.

"Hubble has showcased the modern scientific method at its best," comments Patrick Kelly, lead author of the discovery and re-appearance papers and co-author of the modelling comparison paper from the University of California Berkeley, USA. "Testing predictions through observations provides powerful means of improving our understanding of the cosmos."

The detection of Refsdal's reappearance served as a unique opportunity for astronomers to test their models of how mass -- especially that of mysterious dark matter -- is distributed within this galaxy cluster. Astronomers are now eager to see what other surprises the ongoing Hubble Frontier Fields programme will bring to light.

Notes

[1] The supernova has been nicknamed Refsdal in honour of the Norwegian astronomer Sjur Refusal, who, in 1964, first proposed using time-delayed images from a lensed supernova to study the expansion of the Universe.

[2] The W. M. Keck Observatory on Mauna Kea, in Hawaii, was used to measure the redshift of the supernova's host galaxy ($z = 1.491$), which is a proxy to its distance.

[3] Hubble observed MACS J1149.5+2223 as part of the Grism Lens Amplified Survey from Space (GLASS -- http://glass.physics.ucsb.edu/) and the Frontier Fields programme. Both surveys are exploiting the lensing properties of galaxy clusters to examine the dark matter within them and some of the most distant galaxies beyond them.

[4] Gravitational lensing magnifies the light from fainter, background objects, allowing Hubble to spy galaxies it would otherwise not be able to detect. The process was first predicted by Albert Einstein and is now being exploited by the Frontier Fields programme in order to find some of the most distant galaxies in the Universe.

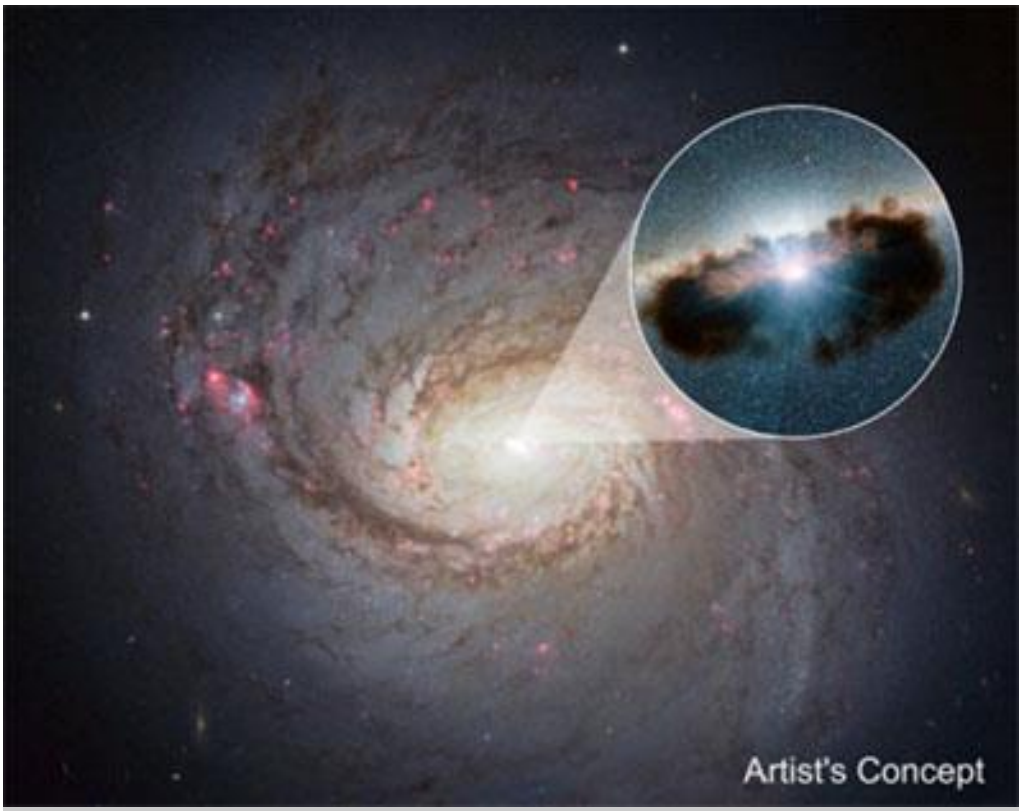
Story Source: ESA/Hubble Information Centre.

Courtesy: sciencedaily.com

NuSTAR finds cosmic clumpy doughnut around black hole

Date: December 17, 2015
Source: NASA/Jet Propulsion Laboratory

The most massive black holes in the universe are often encircled by thick, doughnut-shaped disks of gas and dust. This deep-space doughnut material ultimately feeds and nourishes the growing black holes tucked inside.



Galaxy 1068 can be seen in close-up in this view from NASA's Hubble Space Telescope. NuSTAR's high-energy X-rays eyes were able to obtain the best view yet into the hidden lair of the galaxy's central, supermassive black hole.

Until recently, telescopes weren't able to penetrate some of these doughnuts, also known as tori.

"Originally, we thought that some black holes were hidden behind walls or screens of material that could not be seen through," said Andrea Marinucci of the Roma Tre University in Italy, lead author of a new Monthly Notices of the Royal Astronomical Society study describing results from NASA's Nuclear Spectroscopic Telescope Array, or NuSTAR, and the European Space Agency's XMM-Newton space observatory.

With its X-ray vision, NuSTAR recently peered inside one of the densest of these doughnuts known to surround a supermassive black hole. This black hole lies at the center of a well-studied spiral galaxy called NGC 1068, located 47 million light-years away in the Cetus constellation.

The observations revealed a clumpy, cosmic doughnut.

"The rotating material is not a simple, rounded doughnut as originally thought, but clumpy," said Marinucci.

Doughnut-shaped disks of gas and dust around supermassive black holes were first proposed in the mid-1980s to explain why some black holes are hidden behind gas and dust, while others are not. The idea is that the orientation of the doughnut relative to Earth affects the way we perceive a black hole and its intense radiation. If the doughnut is viewed edge-on, the black hole is blocked. If the doughnut is viewed face-on, the black hole and its surrounding, blazing materials can be detected. This idea is referred to as the unified model because it neatly joins together the different black hole types, based solely upon orientation.

In the past decade, astronomers have been finding hints that these doughnuts aren't as smoothly shaped as once thought. They are more like defective, lumpy doughnuts that a doughnut shop might throw away.

The new discovery is the first time this clumpiness has been observed in an ultra-thick doughnut, and supports the idea that this phenomenon may be common. The research is important for understanding the growth and evolution of massive black holes and their host galaxies.

"We don't fully understand why some supermassive black holes are so heavily obscured, or why the surrounding material is clumpy," said co-author Poshak Gandhi of the University of Southampton in the United Kingdom. "This is a subject of hot research."

Both NuSTAR and XMM-Newton observed the supermassive black hole in NGC 1068 simultaneously on two occasions between 2014 to 2015. On one of those occasions, in August 2014, NuSTAR observed a spike in brightness. NuSTAR observes X-rays in a higher-energy range than XMM-Newton, and those high-energy X-rays can uniquely pierce thick clouds around the black hole. The scientists say the spike in high-energy X-rays was due to a clearing in the thickness of the material entombing the supermassive black hole.

"It's like a cloudy day, when the clouds partially move away from the sun to let more light shine through," said Marinucci.

NGC 1068 is well known to astronomers as the first black hole to give birth to the unification idea. "But it is only with NuSTAR that we now have a direct glimpse of its black hole through such clouds, albeit fleeting, allowing a better test of the unification concept," said Marinucci.

The team says that future research will address the question of what causes the unevenness in doughnuts. The answer could come in many flavors. It's possible that a black hole generates turbulence as it chomps on nearby material. Or, the energy given off by young stars could stir up turbulence, which would then percolate outward through the doughnut. Another possibility is that the clumps may come from material falling onto the doughnut. As galaxies form, material migrates toward the center, where the density and gravity is greatest. The material tends to fall in clumps, almost like a falling stream of water condensing into droplets as it hits the ground.

"We'd like to figure out if the unevenness of the material is being generated from outside the doughnut, or within it," said Gandhi.

"These coordinated observations with NuSTAR and XMM-Newton show yet again the exciting science possible when these satellites work together," said Daniel Stern, NuSTAR project scientist at NASA's Jet Propulsion Laboratory in Pasadena, California.

For more information on NuSTAR, visit:
http://www.nasa.gov/nustar
http://www.nustar.caltech.edu/

Story Source:

The above post is reprinted from materials provided by **NASA/Jet Propulsion Laboratory**.

Courtesy: sciencedaily.com