FAS Newsletter

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

40th FAS Annual Convention and AGM

After several years at The Institute of Astronomy of Cambridge University, the Annual Convention and AGM of the FAS returned to Birmingham, this time to the University.

Originally the Bramall Music Building was the intended venue, but a last minute hitch meant that it had to be moved to the Poynting Institute, a short distance away. This change did lead to a little confusion, as some people arrived before the signs telling of the change were posted at the Bramhall building.

The event was organised principally by Sean Elvidge, of Birmingham Uni but at the last minute he had to go off to a course-related conference elsewhere. Sean however had organised a team of enthusiastic helpers, who very efficiently ran the event on the ground. The FAS is grateful to Sean and his team for these efforts.

The convention was opened by FAS President Gary Gawthrope and the event was kicked off by Professor Bill Chaplin who gave a talk entitled 'Music of the Stars'.

Following the break Dr Christopher Berry talked to us about 'The Gravitational Universe: Black Holes and Gravitational Waves'.

Dr Christopher Berry

During the lunch break there was the opportunity to meet with astronomy students and see some of their telescopes and discuss their various astro activities.

After lunch- the tradition spot– the FAS AGM was held. The business of the day was conducted and appointments to the FAS Council were conformed, although the vacancies on Council (see p2) were highlighted.

The opening talk of the afternoon was given by Maggie Lieu. Entitled 'Human Exploration of Mars', Maggie is UK Mars One candidate, in that she has volunteered to be part of the 'one-way' mission to Mars and has already

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PRESIDENT'S SPOT

VACANT

Editor's Comments

The use of the word VACANT does not imply that the President of the FAS is 'vacant', it simply means that we do not have one!

After quite a few years serving on the FAS Council culminating being President, Gary Gawthrope stood down at the 2014 AGM. Also several other long serving members retired, which has left us with the need to recruit some new people to join the FAS Council.

The FAS is no different from its member societies, in that it is run by a small group of volunteers, who in turn, come from amongst the member societies. Without such volunteers the societies would not exist and the same is true for the FAS.

The saying 'Use it or Lose it' can be accurately applied in this case. Without the FAS, member societies would have great difficulty in obtaining the necessary public liability insurance (at reasonable cost) so essential in this day and age, and would lose the other services that the FAS provides.

So - please give some thought to putting your shoulder to this particular wheel. The demands are not great, in that we meet about three times a year, usually in London, on a Saturday and the FAS will cover travel expenses.

If you are interested and want further information please contact the FAS Secretary—or myself.

Come on in *'the water is not too cold'* !!

(Continued from page 1)

passed through various selection stages and is hopeful of final selection.

FAS President introduces Maggie Lieu, the would-be Mars explorer

The final talk, 'Small Satellites, Big Ambitions' was given by Professor Matthew Angling.

In parallel with the convention there were a range of traders and other organisation represented in the lounge where there was a consistent supply of teas, coffees and biscuits for the whole day.

The delegates to the convention seemed to enjoy the event and most were looking forward to next year.

Once again thanks have to expressed to Sean Elvidge and all the local helpers who were vital in making the event a success.

For your diary:

The South West Astronomy Festival is held in August every year and is a celebration and exhibition of astronomy. View the stars from our planetarium; Learn about planets and space with presentations from top names in the world of astronomy; plus activities for the young, trade stalls, local clubs, advice and guidance. Something for all ages, interests and experiences.

South West Astronomy Fair
8th August 2015
Norman Lockyer Observatory

- *Displays by NLO Interest Groups - Observers, Imagers, Spectroscopy, AstroScouts and the Lockyer Technology Centre*
- *Trade Marquee (including NLO raffle and shop)*
- *Historic Telescope Talks*
- *Planetarium Shows*
- *Siderostat in operation*
- *Solar Observing*
- *Economy Astronomy*
- *Institute of Physics*
- *Visiting Local Astronomy Groups*
- *Catering provided by Jaspers Event Catering*

Norman Lockyer Observatory,
Salcombe Hill Road, Sidmouth, Devon, EX10 0NY
http://www.normanlockyer.com/

Demise of Tavistock AS

It is with some regret to have to report that due to numbers of members declining to 5 and the fact that two of these are due to move out of the area, it was decided to wind up Tavistock Astronomical Society.

At a final meeting of the society the decision was made, at which time it was also decided that the remaining balance in the TAS accounts should be donated to the FAS.

It is particularly sad to me as several years ago, I and several members of my society visited TAS and presented a number of talks on practical astroimaging. At that time they had quite a few members and seemed quite vibrant. A sign of the times perhaps.

Frank Johns

WORTHING AS VISIT THE MULLARD SPACE SCIENCE LABORATORY

On the 13th September 2014 eight members of the Worthing Astronomical Society visited an open day of the Mullard Space Science Laboratory that began at 2.00pm and ended at 5.00pm. The public attendance was limited to one hundred. We travelled the 40 miles to Dorking on a car sharing bases and there was no entrance fee.

The MSSL is part of the University College London which was founded in 1826 and MSSL was created as part of UCL in 1963 for mathematical and physical studies. The director is Professor Alan Smith. UCL is one of the world's leading multidisciplinary universities with 21,000 students from over 140 counties and 8,000 staff, and has more professors, and more Nobel Peace Prize winners than any other UK university. Today it is a true academic powerhouse.

MSSL designs and develops instruments carried on space probes that are sent to investigate the sun, our moon, planets and their satellites, comets and asteroids. Studies of the space environment such as space weather and magnetic fields are also observed. These instruments look at the universe across a multitude of wavelengths from ultraviolet to infra-red.

Among the extensive list of successful probes that have investigated in the solar system and the very depths of the universe are Galileo, Cassini, Cluster, Swift involved with ultraviolet and Herschel that inspects very early galaxies in infra-red. Much of MSSL work comes from the European Space Agency and National Aeronautics Space Administration. They do not undertake military work.

Over the years many of Worthing Astronomical Society's guest speakers have come from MSSL. Such as Professor Andrew Coates, Dr Chris Arridge and Professor Graziella Branduardi-Raymont.

We received four short lectures throughout the day by staff and students about space missions upon which they work. First was Louise Harra who spoke about the Solar Orbiter which is due to be launched in July 2017. It is intended to perform detailed measurements of the inner heliosphere and nascent solar wind and close observations of the polar regions. It will orbit the sun very closely in an eccentric orbit moving as close as 60 solar radii. Then Professor Andrew Coates spoke about the ExoMars mission due to be launched in two parts, the

Schiaparelli lander in 2016 and in 2018 the Trace Gas Orbiter.

This is an ESA/Russian mission and two of the large Russian Proton rockets will be used. It will search for present and previous life on Mars. The third lecture of the day was by student Kim Birkett called Chasing Comets which became very entertaining when she informed us what a comet was made of and showed a list of ingredients. Dr Lucie Green then appeared wearing a chef's hat and began making one. After a few minutes the audience were delighted to be able to inspect an irregular steaming black rock the size of a shoe box. The final lecture by George Seabroke who is involved with Gala that is already in space and busy mapping a billion stars in three dimensions in the local Milky Way and local group. It is expected that tens of thousands of Jupiter size planets will be discovered beyond our solar system and up to 500,000 quasars and tens of thousands of new asteroids and comets within our solar system. The spacecraft will monitor each of its target stars 70 times over a period of five years. This is mind blowing stuff.

At the end of our visit a few of us were shown through sealed glass doors equipment testing areas. Instruments produced here may have to function for many years in extreme harsh environments and when out in space if there is a breakdown it could mean the end of the mission, so testing is taken very seriously over long periods.

This truly was a remarkable visit which left us all spellbound.

On behalf of all our members who came, I express our most sincere thanks to all the staff and students who gave their time to us.

Graham Boots
Worthing AS

‘Only a Little’ Astronomy on La Palma

In mid-October 2014, 4 members of Kernow Astronomers, plus two wives, headed off from chilly Cornwall for a week of sun and astronomy on the island of La Palma in the Canaries.

The journey from SW Britain to La Palma is slightly complicated as there are no direct flights so, four hours after leaving Bristol, we landed at Tenerife South airport and set out to find our transport for the transfer to the North airport. We had hired an 8-seater minibus for this but our driver led us off to a 56-seater coach, which we had all to ourselves. Arriving in the north we were offered an earlier flight for the onward journey to La Palma and so arrived at our destination an hour earlier than planned.

Obviously this was intended to be partly an astronomy holiday, given the reputation La Palma has for clear stable skies and no light pollution, but we were met with the prediction of thunderstorms and significant cloud for the whole week. So we prepared to make the most of the warm weather during the days and take whatever observing we could do as a bonus. Unfortunately the weather forecast proved to be correct.

A 12” Go-to Dobsonian telescope had been hired for three days to make the most of any viewing opportunities and, although relatively expensive, it came with a money-back guarantee if the conditions were unfavourable. We only paid for one night!

Some of the many observatories on the mountain top.

Although doing any actual astronomy was very restricted on this occasion, La Palma’s location and superb astronomical seeing has led to the building of 16 observatories on the upper slopes of the Roque de Los Muchachos volcano. Regular guided tours to one of these are available several times a week, depending on the availability of the observatories. Three of our party were booked onto a tour, starting at 09:00 on the Tuesday morning. The ascent to the top of the volcano is an hour and half drive along a road consisting almost entirely of hair-pin bends, so after an early start, and a slight detour to the wrong building, we finally arrived and met our guide, Sheila Crosby. Sheila was an engineering student from Leeds who went to work on La Palma in 1990 and never left. She now conducts the tours of the observatories she used to work in. Commentating in English and Spanish, Sheila first gave us an overview of the history and diversity of some of the different observatories and why La Palma was chosen as the site for such a complex. After that, we drove up to one of the four helipads (built to accommodate the arrival of four royal families for the inauguration of the site in 1985) for a wide view of the site and the amazing scenery before moving on to tour the William Herschel Telescope.

Standing in the air-conditioned building at the foot of the scope which houses a 4.2m diameter mirror, I’m sure everyone’s first thoughts are ‘Wow, it’s big’. From its opening in 1987 until 2009 it was the biggest optical telescope in Europe. Although now rather old by world-class telescope standards, the WHT still hosts a wide range of astronomical instruments including numerous digital cameras, spectrographs and adaptive optics. The tour came to end after an hour and we were left to take in the views from the outside of the observatory.

Inside the William Herschel Telescope Dome

From here it is only a short drive up to the highest point of the island and some incredible views of the beautiful and rugged volcanic and mountainous scenery, much of it above the cloud level. Looking back to the complex the large telescope buildings resemble small pieces of Lego perched on the edge of the huge volcano crater.

La Palma is the greenest of the Canary Islands and carries the nickname “la Isla Bonita”, the subject of a well-known Madonna hit song. The island caters as much for the more active visitor as for the sun-worshippers. Numerous well signposted walking and riding routes cover the whole island, from the sea-level beaches and coastal towns to the highest volcano peaks. Scenery ranges from beautiful old towns to rich green pine forests and barren volcanic landscapes, all of which are well maintained.

There are many miradors (look out points) on the island, some of which contain information for astronomers, such as where to find Polaris, which is indicated by large signposts. From the miradors up in the pine forest there are spectacular views down to the sea and

Inside a volcano crater – near the famous fault line!

of huge numbers of banana plantations, which seems to be the main crop grown here.

A mirador—during the day (sunny and hot)

A mirador—during the night (visibility near zero)!!

It is well worth exploring the whole of the island. We found pretty little towns with wonderful architecture, views and places to eat – there's no danger of going hungry. The capital, Santa Cruz, looks very colonial and is a particularly attractive town which has a museum housed in a ship. Many of the properties have balconies which look lovely covered in flowers and the town seems justifiably proud of this. San Andrés on the east coast has a lovely area next to the church as does Los Sauces, a town which is just a short drive away.

Also worth visiting is the San Antonio volcano. This last erupted in 1971 and now has a tourist centre and walks along the crater rim giving magnificent views both of the crater interior with new pine tree growth and the barren, ash covered exterior slopes.

All in all, La Palma is a beautiful and interesting island and is well worth a visit, whether or not astronomy is your thing.

Phil Brotherwood

A typical balcony in Santa Cruz—hung with plants

NORTH STAFFS AS CELEBRATE 40 years

The North Staffordshire Astronomical Society, founded in 1974, this year take great pride in celebrating their 40th birthday. The Society has recently achieved appointments of Captain Al Bean as Patron of Inspiration and Professor Rob Jeffries as Honorary President.

Captain Al Bean was the fourth man to set foot on the moon during the Apollo 12 mission in November 1969 and NSAS is incredibly pleased to announce the appointment of Al Bean as their Patron of Inspiration.

Rob Jeffries is Professor of Astrophysics at Keele University and his appointment as Honorary President is ideal to strengthen relations between the Society and Keele Observatory.

The NSAS is an enthusiastic group of keen astronomers from all walks of life. The Society meets monthly on the first Tuesday of the month in Newcastle under Lyme and welcomes new members of all ages and abilities.

The Society has a keen involvement in outreach activities to bring astronomy to the public and have worked with their local Scout group, exhibited at the library and have hosted a Stargazing event last year together with the council at Park Hall Country Park.

The event was a great success and the Society is planning Park Hall 2 for February next year.

The Society actively encourages its members to take part in observing activities and has recently purchased a solar scope which provides breathtaking views of our sun. The scope will be available on loan for Society members.

NSAS hold regular observing nights at a dark observing site where like-minded people meet. The observing nights are open to all members of any ability and provide a great opportunity to observe the night sky with the naked eye, binoculars and various Society owned telescopes at a location away from the light polluted skies of the city.

The observing nights are also very popular with members interested in astro-imaging.

The Society has a dedicated Astro Imaging Group for people interested in taking images of deep sky objects like nebulae, galaxies or star clusters or the moon's surface and planets of the solar system, using DSLR's, webcams and dedicated CCD cameras.

The imaging group have dedicated meetings on the third Monday of the month at the dark observing site for practical astro-imaging work if the weather allows or workshops on all aspects of astro-imaging from equipment, "how to" talks and demonstrations and image processing.

The topics of the general Society meetings are of varying subjects and include talks by members of the Society, practical demonstrations and invited guest speakers.

Again as part of the 40th birthday celebrations, NSAS are pleased to announce a headline talk by Dr Allan Chapman, a very well known and respected speaker in Astronomy circles in November. This event will be open to the public and once details are finalised, further information on this special event can be found on the Society's website in the near future.

If you live in our general area and are interested in Astronomy, but are not sure where to start or where to go or if you are a seasoned astronomer looking for some like minded people, the Society would like to invite you to join them at one of their upcoming meetings.

The Society's website has recently undergone a complete make over and provides up to date information on the activities of the Society, meetings times and venue, contact details, upcoming events and other news.

The website of North Staffordshire Astronomical Society can be found at: www.northstaffsas.co.uk

For further information contact the secretary, Duncan Richardson

Email secretary@northstaffsas.co.uk

Telephone 07752 042688

The North West Astronomy Festival

The Heath - Runcorn, Cheshire - Saturday & Sunday October 11th—12th

This was the second year of this yearly event, and a true festival of the great science of astronomy it turned out to be. Organised by the Knowledge Observatory, with all profits go forward supporting its astronomy programme for local people disengaged from education, training and employment. Sue and Andrew Davies and their team of KO ambassadors put together another outstanding weekend of wonderful and action packed program. This consisted of presentations, lectures, trade stalls, telescope workshops; solar observations, meteorite sales, and yes the Liverpool Astronomical Society were there with our own PR desk, along with several local societies.

Our promotion desk was staffed by the Society's own team of helpers, Steve Southern, Ali Southern, Geoff Sim, Jim Lawless, Dave Bentley, with society staff photographers, Alan Dennett, and Jim Stacey on hand to record every moment for years to come. The local newspaper later featured a short report and image of LAS members, which was published the following week.

The weekend was held with the *BBC Sky at Night Magazine* being the festival's official social media partner, and this was reflected in the truly star studied line up of speakers and surprise guests. Almost all the *BBC Sky at Night* Presenters and reporters were in attendance, with Chris Lintott being the big surprise on Saturday, when he joined the Astronomers question time, which for me was the highlight of the first day. The Saturday evening theatre show, and supper was standing room only, and the highlight here was, by all accounts, an excellent performance by celebrity impersonator and Sky at Night presenter Jon Culshaw, and also astronomer & comedian Helen Keen.

The serious side of amateur and professional astronomical research and observation was represented by Will Gater, Phillippa Browning, Nick Howes, and excellent detailed imaging of UK and world renowned astro-photographer Damian Peach. His detailed imaging of the planet Jupiter, and its moons, makes me ask the question does he take them while on board the International Space Station, and not his back garden in Southern England.

Well with the trade stands, several pockets, wallets, and purses were emptied of monies, and many goodie bags were taken away over the weekend. The raffle was also popular, and the astronomy rock from Blackpool & District Astronomical Society appeared to be very popular. Perhaps we should sell Liver-Bird cakes next time. We managed to attract thirty potential new members, both young and old, and my two hundred Society information leaflets quickly disappeared. It is report that overall the festival event sold well over 1000 tickets.

All in all a very successful two days for Astronomy not just in the North West of England and the UK, but indeed the international audience. The Society will without question be represented again next year. So keep the weekend of October 3th - 4th 2015 free of any other engagements. Be rest assured, you will not be disappointed.

I would like to thank all the society membership who supported our own stand/information desk, and on behalf of the society we thank Sue and Andrew, and all at Knowledge Observatory for the detailed planning, and hard work in staging yet another unforgettable two days, and maybe late nights! Until next year we wish Knowledge Observatory every success in its continued work and goals.

Images with thanks to Alan Dennett & Jim Stacey.

Report by Gerard Gilligan.

An Interstellar Trip...

Other than the sun, our nearestsstar is ***Proxima Centauri*** at 4.24 light years. The open cluster M45 known as ***The Seven Sisters***, or as ***The Pleiades***, is a hundred times more distant at about 420 light years. Yet I made the apparently interstellar journey to them in little under two days! How can this be without the advantage of ***Star Trek***'s warp drive?

The answer is that last February, I visited the Swiss village of ***Les Pléiades***, which is at an altitude of 1348m, a little way inland from the northern shore of ***Lac Léman*** (Lake Geneva) and close to Montreux. My journey of about 750 miles, by rail, was as follows:

Depart Wem 12:37 to overnight in London, depart St Pancras 10:34 by Eurostar, then TGV to overnight in Geneva; leave Geneva 09:30, changing at Vevey and Blonay to join ***'Le Train des Etoiles'*** i.e. the Train of the Stars, for the trip to Les Pléiades arriving at 11:22.

(for railway buffs, from Vevey the line is metre gauge, and the upper section from Blonay uses the Strub rack system).

Unfortunately due to the quantity of snow (it is a winter sports resort) and my schedule for further travel and sightseeing, I was unable to explore beyond the small railway station, which is the terminus of the line. I have not been able to establish why the village is so named. Due to its elevation the village offers splendid views over the lake and distant mountains, including Mont Blanc. In keeping with its name, the village has a number of astronomical features. A street is named ***Sentier des Planètes***, and there is a thematic trail called ***Astro Pléiades*** that focuses on the cosmos, the planets and our solar system.

The trail is dedicated to Swiss astronaut **Claude Nicollier** (shown above), born in nearby Vevey, who flew on four shuttle missions. Four different stations on the trail present information that is of interest to those interested in space. The first explains *'Earth as an Observatory'*, the second is dedicated to *'Secrets of the Sun System'*. The third station explains the closest fixed stars, and the fourth our galaxy, the Milky Way.

Mervyn Pritchard, Shropshire AS

At last—a 'telescope service station'

Having had my C925 for quite a while now and as it suffered 'some dampness' when the slot cover of my observatory was torn off during a particularly violent storm, I had been wanting to get it serviced and cleaned properly. And if the collimation could be made spot-on, then that would be a bonus!!

For several years I have been looking for someone who provides such a service to no avail. The importer/distributor of the scope showed little interest in helping, having returned a very curt response to my enquiry.

Furthermore, I have always had some misgivings about going to a telescope seller, because of a, maybe misconceived, view that they would be more interested in convincing me I needed a new scope rather than refurbishing an old one.


The C925 on the optical bench

Recently, however, when visiting the AstroBuySell website, I spotted a small logo for someone I had not seen before - SC Telescopes. Upon investigating further I discovered that SC stood for Steve Collingwood, who for many years was the technical scope guru at Telescope House, and is therefore an expert with telescopes in general and Meade in particular.

In the past Steve had refurbished Patrick Moore's scopes at his Selsey observatory and also is regularly involved with maintaining the large scopes at Herstmonceux.

Steve left TH in early 2014 and now provides his experience and expertise to the greater astronomy community.

I emailed Steve to check whether he would be prepared to take on my Celestron, which of course, he was pleased to do, so I put the scope into its original packing and duly had it couriered up to his workshop in Kent. Steve did say he would prefer it if I would collect the scope rather than leave the accurate collimating to the questionable handling of a delivery company.

Steve had the scope just before this Christmas and I arranged to travel from Cornwall to pick it up on 2nd January. When I arrived the scope was still mounted on his optical bench, so that I could be shown the collimation, which seemed to be superb. Furthermore the front corrector looked so clean that for a moment I wondered if it was new!!

Now, I will have to wait for the next clear night to check collimation on a real star—which may be a while– knowing that new scopes (and probably refurbished ones as well) are packed with at least a month of cloudy skies.

Anyone interested can find more about Steve and his wide experience, from his website: ***www.sctelescopes.com***

If you have a scope which needs attention, why not give Steve a go.

In my opinion, a service we have needed for a long time now.

Frank Johns

December Workshop at OASI (Orwell AS):
'Rømer Revisited Reprised'

On the cold night of 10th December, members gathered in the warmth of Nacton Village Hall to hear James Appleton's report back on what is probably the final chapter (for now!) in OASI's quest to measure the speed of light.

Many members will recall how this quest grew out of a couple of workshops I ran in 2011 and 2012 where I measured the speed of light terrestrially by various means including a pulsed laser reflected multiple times up and down the hall, a laser with high speed rotating mirror, and by measuring the spacing between hot-spots in a microwave oven using cheese slices (which gave the most accurate answer but assumes you accept that light and microwaves have the same speed).

At the time I briefly covered historical methods including 'Rømer's Method' using timings of eclipses of the moons of Jupiter, but noted that even using tables of predicted eclipses it was hard to get a satisfactory result.

My efforts piqued James' interest, and together with Martin Cook and Alan Smith they initiated a project to make observations of Jupiter moon events over a period of about a year, and then use Rømer's Method to analyse the results and derive an estimate of the speed of light. They presented initial results at a workshop in 2013, and used the occasion to launch a wider appeal for observations to the OASI membership, including advice on how to make such observations with accurate timing, and how to report them on a web form.

The December 2014 workshop was the result of James' analysis of the full resulting data set of about 100 observations. The excellent model of Jupiter with Io from 2013 was brought out of retirement (and pumped back up to full pressure!) and used to remind us of the various orbital effects that add variability to the timings of eclipses.

James walked us through the various effects, how large they are, and how they vary, showing that estimation of the speed of light using Rømer's Method can be highly inaccurate unless the effects are all understood and accounted for - or you are just lucky as to the period when you make observations. He also reminded us that Rømer himself did not put a figure on the

speed (being unable to since the absolute scale of the solar system was not known at that time), but only sought to demonstrate that light had a finite rather than infinite speed.

James has written a comprehensive paper covering his analysis of the results, which he has submitted to the BAA for publication. As he noted, surprisingly little seems to have been published before analysing Romer's Method or attempting to use it as the basis for an amateur observing project, so together we seem to have done something rather original here.

James received a warm round of applause for his highly professional work, and discussions continued over tea and biscuits - special chocolate ones in view of the season, thanks as usual to Nicky and Pete for arranging the refreshments.

Oh – and our final figure for the speed of light? - you'll have to ask James ;-)

Mike Whybray

oasi.org.uk

Courtesy: OASI News No. 504

Asteroid That Flew Past Earth Has Moon

January 27, 2015 Update:

The Goldstone scientists observing 2004 BL86 are part of a team of astronomers from around the world who have been characterizing the asteroid. Spectroscopic observations of 2004 BL86 made by Vishnu Reddy, a research scientist at the Planetary Science Institute in Tucson, using the NASA Infrared Telescope Facility on Mauna Kea, Hawaii, indicate the asteroid's spectral signature is similar to that of massive asteroid Vesta. Located in the heart of the solar system's main asteroid belt, asteroid Vesta was the recent destination of NASA's Dawn mission, which is now on its way to the icy world Ceres.

Scientists working with NASA's 230-foot-wide (70-meter) Deep Space Network antenna at Goldstone, California, have released the first radar images of asteroid 2004 BL86. The images show the asteroid, which made its closest approach on Jan. 26, 2015 at 8:19 a.m. PST (11:19 a.m. EST) at a distance of about 745,000 miles (1.2 million kilometers, or 3.1 times the distance from Earth to the moon), has its own small moon.

The 20 individual images used in the movie were generated from data collected at Goldstone on Jan. 26, 2015. They show the primary body is approximately 1,100 feet (325 meters) across and has a small moon approximately 230 feet (70 meters) across. In the near-Earth population, about 16 percent of asteroids that are about 655 feet (200 meters) or larger are a binary (the primary asteroid with a smaller asteroid moon orbiting it) or even triple systems (two moons). The resolution on the radar images is 13 feet (4 meters) per pixel.

The trajectory of asteroid 2004 BL86 is well understood. Monday's flyby was the closest approach the asteroid will make to Earth for at least the next two centuries. It is also the closest a known asteroid this size will come to Earth until asteroid 1999 AN10 flies past our planet in 2027.

Asteroid 2004 BL86 was discovered on Jan. 30, 2004, by the Lincoln Near-Earth Asteroid Research (LINEAR) survey in White Sands, New Mexico.

Radar is a powerful technique for studying an asteroid's size, shape, rotation state, surface features and surface roughness, and for improving the calculation of asteroid orbits. Radar measurements of asteroid distances and velocities often enable computation of asteroid orbits much further into the future than if radar observations weren't available.

NASA places a high priority on tracking asteroids and protecting our home planet from them. In fact, the U.S. has the most robust and productive survey and detection program for discovering near-Earth objects (NEOs). To date, U.S. assets have discovered over 98 percent of the known NEOs.

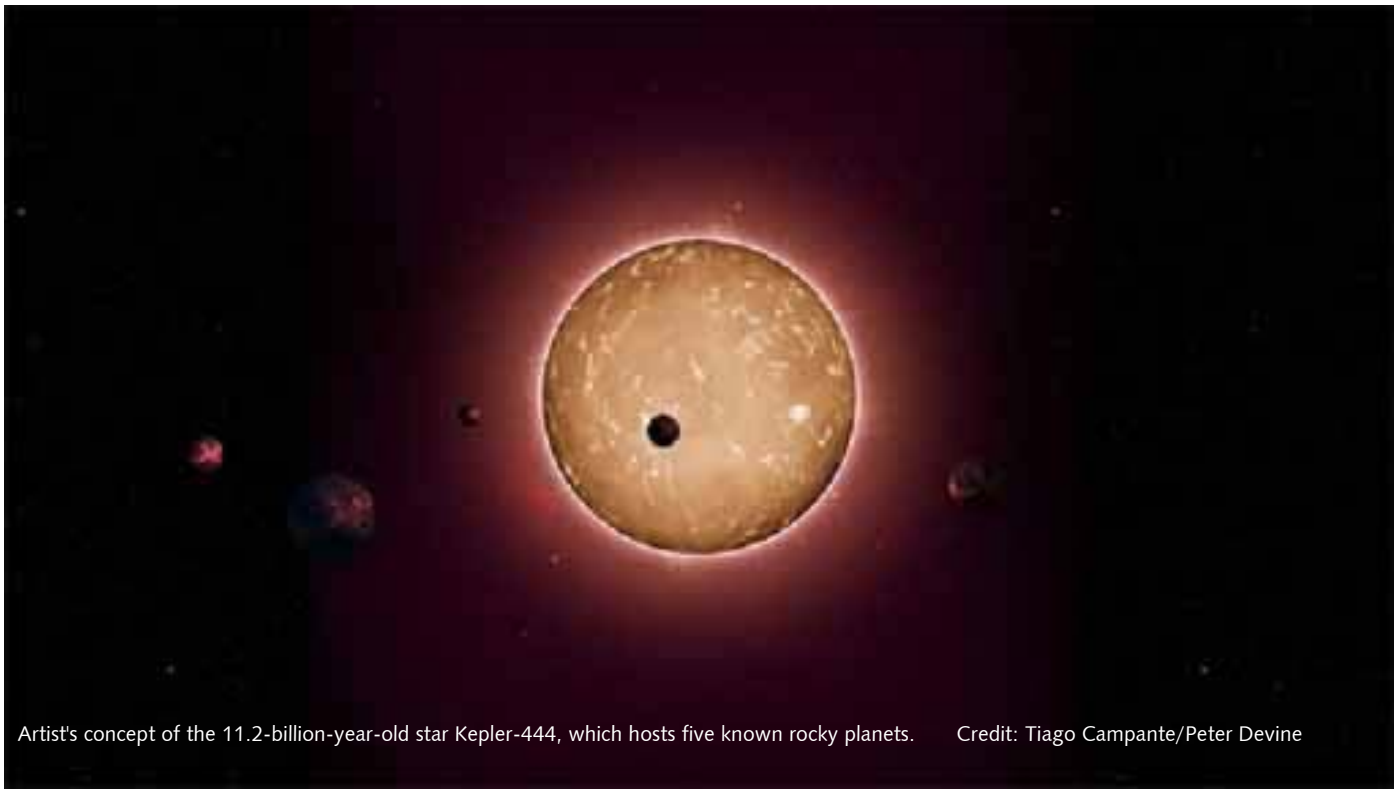
In addition to the resources NASA puts into understanding asteroids, it also partners with other U.S. government agencies, university-based astronomers, and space science institutes across the country, often with grants, interagency transfers and other contracts from NASA, and also with international space agencies and institutions that are working to track and better understand these objects.

NASA's Near-Earth Object Program at NASA Headquarters, Washington, manages and funds the search, study and monitoring of asteroids and comets whose orbits periodically bring them close to Earth. JPL manages the Near-Earth Object Program Office for NASA's Science Mission Directorate in Washington. JPL is a division of the California Institute of Technology in Pasadena.

Courtesy: JPL Pasadena

Found! 5 Ancient Alien Planets Nearly As Old As the Universe

by Mike Wall, Space.com Senior Writer | January 27, 2015



Artist's concept of the 11.2-billion-year-old star Kepler-444, which hosts five known rocky planets. Credit: Tiago Campante/Peter Devine

Five rocky alien worlds that are 80 percent as old as the universe itself have been discovered, suggesting that Earth-size planets have been a feature of the Milky Way galaxy almost since its beginning.

The newfound exoplanets circle Kepler-444, an 11.2-billion-year-old star about 25 percent smaller than the sun that lies 117 light-years from Earth. All of the worlds are Venus-size or smaller and are therefore rocky, though scientists know nothing else about their composition.

All five alien planets complete an orbit in less than 10 days, meaning they're almost certainly too hot to support life as we know it. But Kepler-444 hints at the existence of other ancient planetary systems that may be more hospitable, researchers said.

"We now know that Earth-sized planets have formed throughout most of the universe's 13.8-billion-year history, which could provide scope for the existence of ancient life in the galaxy," lead study author Tiago Campante, of the University of Birmingham in England, said in a statement.

For perspective, Earth and everything else in our own solar system formed about 4.6 billion years ago.

Campante and his colleagues discovered Kepler-444 and its five known planets after analyzing data gathered by NASA's Kepler space telescope. Kepler hunts for planets by noting the tiny brightness dips caused when they cross their host star's face from the spacecraft's perspective.

Kepler can also pick up brightness changes caused by sound waves within the star that affect its temperature and thus its luminosity. Studying these natural oscillations — a strategy known as asteroseismology — can help scientists determine a star's size, mass and age.

"When asteroseismology emerged about two decades ago, we could only use it on the sun and a few bright stars, but thanks to Kepler, we can now apply the technique to literally thousands of stars," said co-author Daniel Huber, of the University of Sydney in Australia.

"Asteroseismology allows us to precisely measure the radius of Kepler-444 and hence the sizes of its planets," he added. "For the smallest planet in the Kepler-444 system, which is slightly larger than Mercury, we measured its size with an uncertainty of only 100 kilometers [62 miles]."

The $600 million Kepler mission launched in March 2009, tasked with helping scientists determine how commonly Earth-like planets occur throughout the Milky Way. The spacecraft has discovered more than 1,000 explanets to date, with more than 3,000 additional "candidates" awaiting confirmation by follow-up analysis or observations.

Kepler's original planet hunt ended in May 2013, when the second of its four orientation-maintaining reaction wheels failed. But scientists are still combing through the instrument's huge data set, as the new study shows. And Kepler has embarked upon a new mission called K2, which is continuing the exoplanet search but also includes observations of other cosmic objects and phenomena.

The new study was published today (Jan. 27) in The Astrophysical Journal.

Courtesy: space.com

What Are The Orion's Belt Stars?

by ELIZABETH HOWELL - Universe Today on JANUARY 28, 2015

Orion dominates the winter sky in the northern hemisphere. Its large size and collection of bright stars — such as Betelgeuse at the shoulder, Rigel below the belt, and the three stars in the belt — make it easy to spot, even for beginning stargazers.

The constellation Orion. Credit: Matthew Spinelli NASA/APOD

So how about those stars in the belt? They're one of the most famous asterisms in Western culture, but beyond what we see with our eyes, what are their astronomical properties?

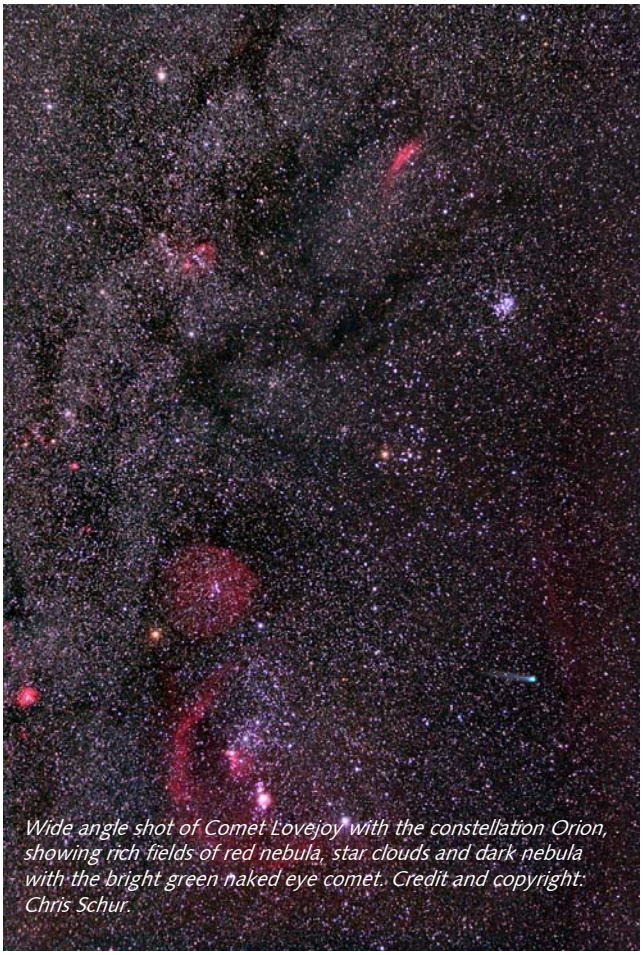
Introduction to Orion

First, a brief word about the constellation itself. In many mythologies, the shape is seen as a human figure — and in Greek mythology, it was named after a hunter, according to a web page from the Chandra X-Ray Observatory.

There are several "reasons" in mythology for why Orion ended up in the sky. One was because he was too boastful about how many animals he could kill — so he was put there to teach humility, since he and his dogs (Canis Major and Canis Minor) chase after animals in the sky but can't catch them. Some say he died from a scorpion bite, and other legends say he was killed by his lover Artemis accidentally, when her brother Apollo tricked her to shooting an arrow at him.

Because Orion is on the celestial equator, Chandra adds, it is easy to see all over the world: "Ancient Indians saw the figure as a king who had been shot by an arrow (represented by the stars in Orion's belt). Ancient Egyptians thought the stars in the belt represented the resting place of the soul of the god Osiris. The Arabs saw the constellation as the figure of a giant."

In this image, the submillimetre-wavelength glow of the dust clouds is overlaid on a view of the region in the more familiar visible light, from the Digitized Sky Survey 2. The large bright cloud in the upper right of the image is the well-known Orion Nebula, also called Messier 42. Credit: ESO/Digitized Sky Survey 2



Wide angle shot of Comet Lovejoy with the constellation Orion, showing rich fields of red nebula, star clouds and dark nebula with the bright green naked eye comet. Credit and copyright: Chris Schur.

The Orion's belt stars

The three stars in the belt are Mintaka, Alnilam and Alnitak. According to an astronomer with the National Radio Astronomy Observatory, Ronald Maddlaena, these are the meanings of the three stars: Mintaka (on the west) means "belt", Alnilam (in centre) means "belt of pearls" and Altnitak (right) means "girdle." The three range between 800 and 1,000 light-years from Earth.

The stars "probably formed at about the same time some ten million years ago from the molecular clouds astronomers have found in Orion," wrote Maddalena.

Here are their properties compared to the Sun:

Mintaka: 20 times more massive and 7,000 times brighter. (Surface temperature 60,000 Fahrenheit.)

Alnilam: 20 times more massive and 18,000 times brigher. (Surface temperature 50,000 Fahrenheit.)

Alnitak: 20 times more massive and 10,000 times brighter. (Surface temperature 60,000 Fahrenheit).

To further blow your mind — these stars also have companion stars orbiting with them, so what you see from Earth with the naked eye isn't necessarily what you always get.

We have written many articles about Orion's Belt for Universe Today. Here's an article about Orion's Belt, and here's an article about the Orion Nebula. We've also done many episodes of Astronomy Cast about stars, such as this: Episode 12: Where Do Baby Stars Come From?

Courtesy: Universe Today

Engineer advances new daytime star tracker

Source: NASA/Goddard Space Flight Center

Scientists who use high-altitude scientific balloons have high hopes for their instruments in the future. Although the floating behemoths that carry their instruments far into the stratosphere can stay aloft for days on end, data collection typically happens during the night when starlight can be detected. The instruments that operate during the day are limited in their field of view due to overbearing sunlight.

An engineer at NASA's Wallops Flight Facility (WFF), located on Virginia's Eastern Shore, is working on a low-cost, off-the-shelf solution to overcome the challenges of collecting data in daylight.

Under WFF's Balloon Program, engineer Scott Heatwole and his team are developing a precision attitude sensor or star tracker that would be able to locate points of reference, or in other words, stars, during daylight hours. These points of reference serve as landmarks that help orient the instrument so that it can find the target of interest.

The star tracker is being developed specifically for the Wallops Arc Second Pointer (WASP), which would use the star tracker's data to point a balloon-borne scientific payload with incredible accuracy and stability. Currently, WASP usually employs the commonly used ST5000 star tracker. However, this device cannot image in the daytime even at 120,000 feet where scientific balloons operate. Though relatively dark at those altitudes, the scattering of sunlight off the atmosphere can overwhelm the starlight in most star cameras.

"A precision attitude sensor capable of working in the daylight would extend science operations through the day which would significantly increase the amount of science collected," Heatwole said. "Currently, the only precision attitude sensor available in daytime is a sun sensor, and this isn't ideal because it provides only two axes of attitude and is not precise over a range of targets across the sky."

Although others have developed custom star trackers that enable around-the-clock science gathering, no one has pulled together an inexpensive, ready-to-go package that includes cameras, computers, and the algorithms necessary to process data and eliminate excess visible light in real time. "That's what we're trying to do," Heatwole said, adding that his daytime star tracker consists of a commercial firewire camera attached to a lens and baffle that help filter out visible light, allowing it to sense points of reference in the near-infrared wavelength bands.

In 2014, a prototype of the device flew on two WASP missions. The first, the flight of the HyperSpectral Imager for Climate Science (HySICS) collected radiance data as WASP pointed the instrument toward the Earth, the sun, and the Moon. The goal was to see what the star tracker saw at 120,000 feet.

The second WASP mission, launched a couple months later in October, carried the Observatory for Planetary Investigations from the Stratosphere (OPIS). Its mission was to gather time measurements of Jupiter's atmospheric structure -- a challenge for the new star tracker because the gas giant is a bright object.

"Our algorithm didn't work as we had hoped," Heatwole said, adding that it did not filter out the excess light as expected.

Wallops engineer Scott Heatwole and his team are developing a precision attitude sensor or star tracker that would be able to locate points of reference, or, in other words, stars, during daylight hours. Heatwole specifically developed the technology for the Wallops Arc Second Pointer.
Credit: Patrick Black/NASA

Heatwole, however, is unfazed. Over the coming months, he plans to fine-tune the algorithms to eliminate the extra light experienced during the OPIS mission and then retest the technology during a sounding rocket flight this summer and additional WASP missions in 2016 and 2017.

"We're trying to increase the capabilities of WASP," Heatwole explained. "No company is going to go out and build this. No one is going to develop an off-the-shelf, low-cost daytime star tracker and put all the components in one package. WASP requires an attitude sensor that is capable in the daytime. That's what we hope to create."

Courtesy: Science Daily

iPhone Astrophotography: How to Take Amazing Images of the Sky with Your Smartphone Tonight!

by DAVID DICKINSON , Universe Today

An Iphone portrait of the classical solar system. All photos credit and copyright: Andrew Symes.

Got a smartphone and a telescope?

It's a sight now common at many star parties. Frequently, you see folks roaming through the darkness, illuminated smartphone aimed skyward. Certainly, the wealth of free planetarium apps has done lots to kindle a renewed interest in the night sky.

Inevitably, after peering through the eyepiece of a telescope, the question then arises:

"Can I get a picture of that with my phone?"

The short answer is yes, with a little skill and patience.

Now simply aiming a camera at the eyepiece of a telescope — known as afocal astrophotography — and shooting without removing the camera lens and physically coupling it to the telescope is a tricky balancing act. Back in the olden days, the Moon and perhaps the brighter planets were the only bright target within bounds of afocal film photographers, and only then after a lengthy set of estimations to hit the correct focal length. The advent of digital cameras and 'live preview' means that you can now simply aim, shoot, and throw away or delete anything off center or out of focus. Digital 'film' is cheap, and most folks simply use trial and error to get the 'keepers'. The Moon is an especially bright and easy target for beginners to practice on.

Of course, your typical smartphone, like a webcam, has an imaging chip much smaller than a DSLR. This is why astrophotographers are often tempted to take out a second mortgage ("we don't really *need* that second car, do we?" is a common spousal refrain) in pursuit of excellence. Another drawback is that through a smartphone, a planet may look like an overexposed blob. A simple but effective way to get around this is to affix a light reducing filter to the eyepiece. In fact, I've used a variable polarizer during live broadcasts of the Virtual Star Party to great effect. And as with webcam imaging, smartphone astrophotographers now often use automated stacking programs to clean up images and tease out detail. Being an old timer, my faves are still K3CCD Tools and Registax, though many young guns out there now use DeepSkyStacker as well.

Now, I'll admit, I'm an 'Android guy,' and I have put most of my efforts over the years into planetary imaging with a homemade webcam. We therefore sought out in-the-field expertise from someone on the forefront of iPhone astrophotography. Andrew Symes has been taking images of the solar system and beyond with his iPhone coupled to his Celestron NexStar 8" SE telescope for years. He also has one of the few handles on Twitter that we're envious of, @FailedProtostar. He also

Andrew Symes' imaging setup.

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A gibbous Moon, an easy first pic!

ventures out into the chilly nights frequent to his native of Ottawa, Canada to practice his craft, as he observes in temperatures that would drop a Tauntaun.

We caught up with Andrew recently to ask him about some tips of the trade.

Universe Today: I know from doing webcam photography that acquiring, centering and focusing are often more than half the battle. Any tips for accomplishing these?

Andrew: Acquiring, centering, and focusing the objects I'm photographing is definitely the big challenge! To speed and simplify the process, I have a dedicated eyepiece that I use in

An 'iPhone Sun' shot in hydrogen alpha through a Coronado PST.

A comparison of the first image of the Orion Nebula (M42) shot in

association with my phone and adapter. Before even heading outside, I attach the adapter to this eyepiece, insert my phone, and hold the unit up to a light source to see if the camera lens is properly aligned with the eyepiece. It usually takes a bit of fiddling to get things set properly because if the adapter and eyepiece are not perfectly aligned, nothing will show up on the camera screen. It's better to get that process out of the way in a lit environment than outside in the dark. I then set that unit aside, and use a separate "adapter-less" zoom eyepiece to locate and center the object in the telescope. Once I've acquired the object and am successfully tracking it, I remove my zoom eyepiece and drop in the eyepiece/adapter/phone combo. At that point, the object is usually visible on screen but out of focus since the focus required for the iPhone is different from what works for my eyes! To ensure proper focus, I display the object on my phone's screen using a live video app called FiLMiC Pro and adjust the focus until it is sharp. I use that app because it has a digital zoom function that lets me get a closer look at the object than the standard iPhone video camera view. Only once I'm confident that I've achieved good focus and am tracking the object properly, will I start to record video or shoot individual frames.

Yes, that's Comet C/2014 Q2 Lovejoy shot with an iPhone!

Universe Today: A question I always like to ask everyone… what was your biggest mistake? Are there any pitfalls to avoid?

Andrew: There are a few pitfalls to avoid when doing iPhone astrophotography. In the past, I would attach the adapter outside while the eyepiece was in the telescope but this caused a number of problems. Often, I would accidentally bump the object out of view while attaching and adjusting the adapter and

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An iPhone capture of Messier 13.

have to align everything all over again. The weather is also often cold here, and it's VERY difficult to attach the adapter properly with gloves on, so I would either get really cold hands or spend a lot of unnecessary time fumbling with the adapter with gloved hands. For those reasons, I now prepare the eyepiece/adapter/phone unit indoors in advance as described above. I also now make sure that my iPhone is fully charged before heading outdoors as I've found that the iPhone battery drains very quickly when the camera is running constantly — especially in cold weather. Even with an almost-full battery, there are times here in winter when the phone will simply shut down due to the low temperature so I make sure to only start capturing photos/videos once I'm completely confident in my setup.

Universe Today: You're really pushing the envelope by doing deep sky astro-pics with an iPhone … anything else that you're experimenting with or working on?

Andrew: My main focus is definitely still on iPhone astrophotography because I like the quick and "light" setup. I don't need to bring a laptop outside and don't need equipment that I wouldn't normally have on me anyway (other than the adapter itself.) So, I want to keep pushing the envelope with what I can capture using the phone and my goal is now is to see how far I can go with deep-sky objects. I'd really like to add the Ring and Dumbbell Nebulae to my portfolio, for example, and see if it's possible to grab even fainter ones. There are also some non-deep sky targets I'd like to try. I haven't been successful at capturing a telescopic photo of the ISS, and would love to see if I can catch it transiting the Sun or Moon with my phone. I also still need to capture Uranus and Neptune to round out a solar system collage I put together in 2014!

Lastly, I'm continually experimenting with photo apps to see which are best at capturing and/or processing telescopic images, and have just started using both an iPhone 4S and iPhone 6 to take photos and video. Surprisingly, I still prefer the 4S for planetary imaging as I haven't been able to properly capture the true colors of planets with the iPhone 6 yet. The 6 has better camera resolution but seems to be adjusting the exposure of small, faint objects like planets differently than the 4S, so I need to change my routine and techniques to compensate. The methods I've become accustomed to using with the 4S don't seem to translate directly to the 6 so I have some learning yet to do!

Amazing stuff, for sure. And to think, we were all gas-hypering film and using absurdly long focal lengths to get blurry planetary images just a few decades ago!

-Check out more of Andrew's images, as well as read more about how he does it.

Courtesy: Universe Today

Dwarf Planet Ceres Reveals Tantalizing Details in Best Photos Yet

by Calla Cofield, Space.com Staff Writer

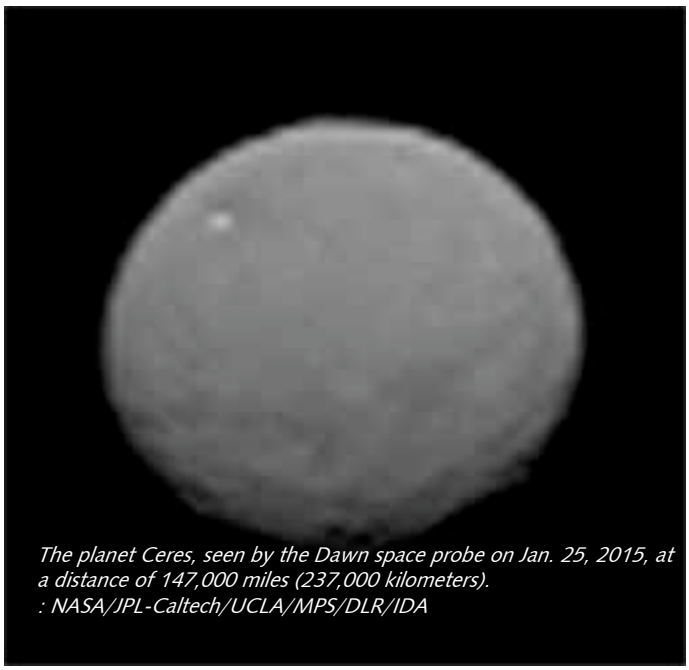
Tantalizing new images of Ceres, the nearest dwarf planet to Earth, are revealing never-before-seen surface features of the mysterious spacerock.

The new images of Ceres were taken at a distance of 147,000 miles (237,000 kilometers) on Jan. 25 by NASA's Dawn space probe. The images hint at the presence of craters and other surface features that telescopes have never been able to resolve on Ceres before. However, scientists said the images have not yet revealed the nature of Ceres'mysterious white spot.

"We are already seeing areas and details on Ceres popping out that had not been seen before. For instance, there are several dark features in the southern hemisphere that might be craters within a region that is darker overall," Carol Raymond, deputy principal investigator of the Dawn missionat JPL, said in a statement. "Ceres is showing us tantalizing features that are whetting our appetite for the detailed exploration to come." [Dwarf Planet or Asteroid? Amazing Photos of Ceres]

Ceres is a dwarf planet that lies in the asteroid belt between Mars and Jupiter. It is the smallest-known dwarf planet in the solar system, but it is the largest body in the asteroid belt, and is sometimes characterized as an asteroid.

The Dawn spacecraft is rapidly approaching Ceres and is set to begin orbiting it on March 6. This close location will allow



The planet Ceres, seen by the Dawn space probe on Jan. 25, 2015, at a distance of 147,000 miles (237,000 kilometers).
: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

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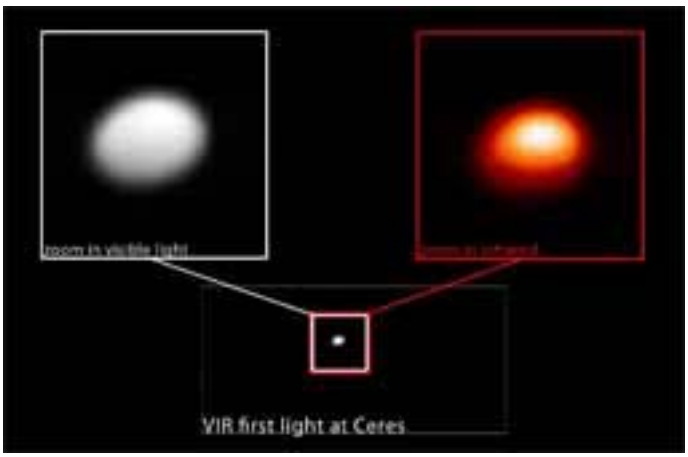
Dawn to study the mysterious body in greater detail. Dawn's proximity to Ceres is giving it a uniquely sharp view of the dwarf planet: Dawn's images of Ceres are now a 30 percent higher resolution than those taken by the Hubble Space Telescope.



The dwarf planet Ceres, seen by the Dawn space probe on Jan. 13, 2015, in optical light and infrared (right). In the infrared image, white indicates hotter than red.
Credit: NASA/JPL-Caltech/UCLA/ASI/INAF

Scientists are already anticipating finding many fascinating features on Ceres. It is possible, according to NASA's statement, that there is liquid water beneath the surface of Ceres, and that it once harboured an entire subsurface ocean. Scientists have already observed plumes of water vapor erupting off the surface of the space rock, and these could be coming from ice volcanoes.

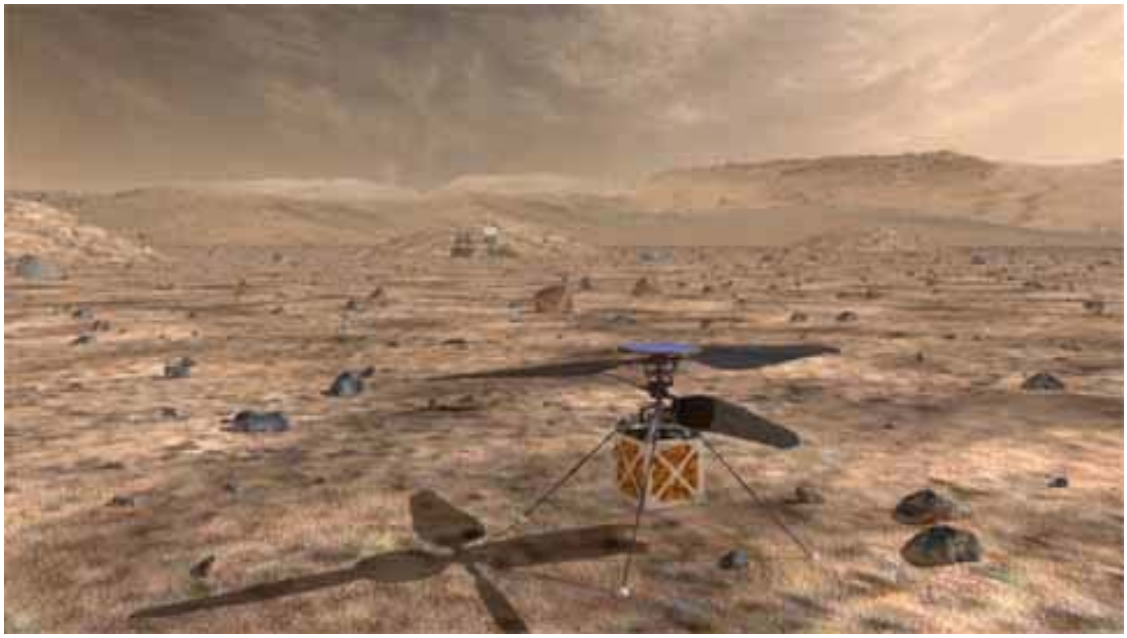
There is also the mysterious white spot on Ceres, which can be seen in the upper left quadrant of the new photos. The scientists say they can confirm that something on the surface of Ceres is reflecting sunlight, but they cannot yet say what.

On Jan. 13, Dawn also captured an image of Ceres in infrared light, which offers a look at the temperature of the planet. NASA scientists have not yet said what can be learned from this image.

Launched in 2007, the Dawn probe has also visited the asteroid Vesta, the second-largest object in the asteroid belt between Mars and Jupiter. Studying objects like Vesta and Ceres can help scientists answer questions about how planets, moons and other objects in our solar system formed

Courtesy: Space.com

Helicopter could be 'scout' for Mars rovers



A proposed helicopter could triple the distances that Mars rovers can drive in a Martian day and help pinpoint interesting targets for study.

Credit: Image courtesy of NASA/Jet Propulsion Laboratory

Getting around on Mars is tricky business. Each NASA rover has delivered a wealth of information about the history and composition of the Red Planet, but a rover's vision is limited by the view of onboard cameras, and images from spacecraft orbiting Mars are the only other clues to where to drive it. To have a better sense of where to go and what's worth studying on Mars, it could be useful to have a low-flying scout.

Enter the Mars Helicopter, a proposed add-on to Mars rovers of the future that could potentially triple the distance these vehicles currently drive in a Martian day, and deliver a new level of visual information for choosing which sites to explore.

The helicopter would fly ahead of the rover almost every day, checking out various possible points of interest and helping engineers back on Earth plan the best driving route.

Scientists could also use the helicopter images to look for features for the rover to study in further detail. Another part of the helicopter's job would be to check out the best places for the rover to collect key samples and rocks for a cache, which a next-generation rover could pick up later.

The vehicle is envisioned to weigh 2.2 pounds (1 kilogram) and measure 3.6 feet (1.1 meters) across from the tip of one blade to the other. The prototype body looks like a medium-size cubic tissue box.

The current design is a proof-of-concept technology demonstration that has been tested at NASA's Jet Propulsion Laboratory, Pasadena, California.

Courtesy: Science Daily

New Horizons: Exploring Pluto and Beyond

by Elizabeth Howell, Space.com Contributor

New Horizons is a NASA spacecraft on its way to the dwarf planet Pluto. It scooted by Jupiter in 2007, and will pass by Pluto in July 2015 before possibly heading farther into the Kuiper Belt — a massive zone of icy bodies beyond Neptune.

Investigators with the Hubble Space Telescope have identified a few targets for the spacecraft after it zooms by Pluto and its moons, but the missionextension depends on how well New Horizons is performing at that time and if it can receive approval in NASA's budget.

When the spacecraft reaches Pluto, it will be only the fifth one to head so far away from Earth (the other ones being Pioneer 10 and Pioneer 11, and Voyager 1 and Voyager 2, which are either in the outer solar system or in the case of Voyager 1, interstellar space.)

Pluto's distance — about 3 billion miles (5 billion kilometers) from Earth — presented power challenges for New Horizon's designers, since the sun's rays are too weak to generate power. There will also be long communications delays for those staying in touch with the 1,054-pound spacecraft; at Pluto, it will take 4.5 hours for a one-way message to get there from Earth.

Further, our understanding of the Pluto system keeps changing. The planet was discovered in 1930 by astronomer Clyde Tombaugh at the Lowell Observatory. Since then, we've discovered new moons — which can also be seen as dangerous obstacles for a spacecraft, if not accounted for. And in 2006 — shortly after New Horizons launched — astronomers voted to demote Pluto from its planetary status. New Horizons carries some of Tombaugh's ashes.

This is a montage of New Horizons images of Jupiter and its volcanic moon Io, taken during the spacecraft's Jupiter flyby . The image was released in Oct. 2007.
Credit: NASA/Johns Hopkins University Applied Physics Laboratory/ Southwest Research Institute

This artist's concept shows NASA's New Horizons spacecraft during its 2015 encounter with Pluto and its moon, Charon.
Credit: Southwest Research Institute

Design challenges for long missions

Spacecraft typically have a set design lifetime, similar to warranties onelectronics or cars. Over time, solar particles, cosmic rays and other phenomena can degrade the surface of the spacecraft or mess up the electronics. This makes long missions such as New Horizons especially challenging.

"You've got to remember that it takes 9.5 years to even get to where we want to take the mission," said Glen Fountain, the New Horizons mission project manager from Johns Hopkins University Applied Physics Laboratory, in a 2006 interview with NASA.

"So we need a highly reliable system," he said. "So, we have built into the electronics nearly two of everything. We are redundant. We have two guidance control processors, computers. We have two command and data handling processors. We have two solid-state recorders. Even if there is a failure, you can switch from one to the other."

Another question, Fountain acknowledged, was how to handle power when the sun is too weak to provide solar power. New Horizons carries nuclear power (more precisely, a radioisotope thermoelectric generator) on board to solve this problem.

Mission Control kept the spacecraft in deep hibernation after a quick pass by Jupiter in February 2007. New Horizons underwent periodic wakeups until a last emerging from hibernation for good in December 2014, which will last through the "Pluto encounter" of 2015.

NASA did a detailed systems check of the spacecraft once a year to make sure it's working properly and to, if necessary, make adjustments to its path to Pluto. The spacecraft also ferried a basic signal back to Earth once a week.

Zipping by Jupiter

New Horizons launched Jan. 19, 2006, on an Atlas V rocket from Cape Canaveral Air Force Station in Florida. A power outage and high winds delayed two previous launch attempts, but New Horizons made it safely into space on the third try.

The spacecraft's first destination was Jupiter, in February and March 2007. New Horizons passed by less than 1.4 million miles (2.4 million km) of the solar system's largest planet, making it the first spacecraft to swing by since the Galileo probe finished its mission at Jupiter in 2003.

Among New Horizons' first pictures were some of Io, Jupi-

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ter's volcanic moon. The spacecraft captured the clearest pictures ever of the Tvashtar volcano on Io, showing volcanic fallout that was bigger than the state of Texas.

Additionally, the spacecraft flew through a stream of charged particles swirling behind Jupiter. It found large bubbles of charged particles, or plasma, and also revealed variations in the stream.

At the time, astronomers said the observations could help with understanding the environment around "hot Jupiter" planets found at other stars.

Plans for Pluto

One of the principal aims of New Horizons is to figure out the origins of Pluto and its companion Charon, a moon that is more than half Pluto's size. At the time, Pluto and Charon were considered a double planet (although the definition of Pluto changed, as will be explained below.)

NASA believed Charon formed when Pluto hit another big object long ago, creating debris that circled around Pluto and eventually formed Charon. It's a similar theory to how Earth's moon formed, so the scientists hoped to understand the creation of our moon better by looking at Charon's origins.
Scientists are also eager to learn about the visual differences between Charon and Pluto. From Hubble observations, researchers deduced Pluto is far more reflective than Charon, and that Pluto has an atmosphere while Charon does not.

NASA further speculated that Pluto might even have volcanic activity, because the Voyager 2 spacecraft spotted possible volcanoes (to researchers' surprise) on Triton, a moon of Neptune that is of a similar size and composition.
New Horizons crossed Neptune's orbit in August 2014, and in September, the spacecraft team released pictures that the machine took of a small moon called Hydra that summer. The goal was not only to take the pictures, but to do a simulated "satellite search" — it's possible there are other moons of Pluto that are just waiting to be discovered, when the spacecraft gets closer.
The spacecraft emerged from hibernation again in December 2014, representing the first of a series of milestones as New Horizons approaches Pluto. "Technically, this was routine, since the wake-up was a procedure that we'd done many times before," said Glen Fountain, New Horizons project manager at the Johns Hopkins Applied Physics Laboratory, in a statement. "Symbolically, however, this is a big deal. It means the start of our pre-encounter operations."

Pluto's planetary status changes

Ten years can be a long time in planetary science, and that is particularly true of Pluto. Since New Horizons left our planet in 2006, we've discovered another moon nearby Pluto. Planners have made course corrections to keep the spacecraft away from Pluto's moons.

Further, Pluto was demoted from its position as the ninth planet in our solar system. In August 2006, members of the International Astronomical Union (IAU) — the global body that governs astronomy names and other matters — met in a general assembly to decide on the definition of a planet.

This vote was called in response to the recent discoveries of large bodies in the Kuiper Belt, an area beyond Neptune believed to contain trillions of objects.
On Aug. 24, 2006, IAU representatives determined three features all planets must possess:

1. They must orbit the sun (and not another body, as a moon orbits a planet).
2. They must have enough mass to form a round shape.
3. They must be large enough to clean out bits of rock and other matter in the area around their orbits.

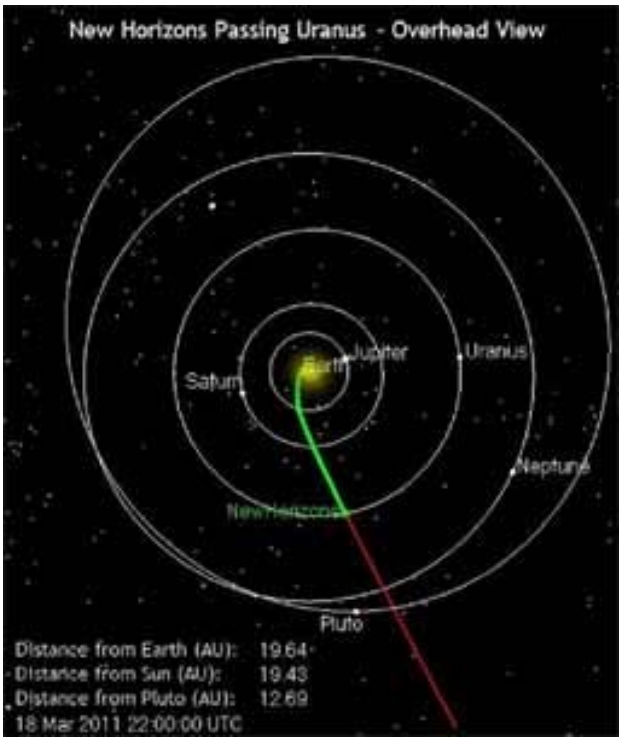
Pluto didn't meet all the classifications, and was reclassified as a dwarf planet.

The decision drew fire from Alan Stern, the principal investigator of the New Horizons mission. "I'm embarrassed for astronomy. Less than 5 percent of the world's astronomers voted," he said in a 2006 interview with Space.com. "This definition stinks, for technical reasons."

The decision is still controversial, years later. Little is known about Pluto because it is so far away from Earth, but we have been able to increase our understanding of it by peering at the planet with the Hubble Space Telescope and other observatories. More fuel may be added to the debate as NASA's Dawn spacecraft gets close-up to Ceres this year, one of the largest members of our solar system's asteroid belt.

Post-Pluto

It is expected that New Horizon's arrival at Pluto will give us more data about its surface, its moons and its environment, which can better refine our knowledge of the dwarf planet and its system.
Over the northern hemisphere summer of 2014, investigators used the Hubble Space Telescope to see if there were any Kuiper Belt objects within reach of New Horizons after it concludes its Pluto mission. Scientists identified three candidates, with each of them at least 1 billion miles (1.6 billion kilometers) beyond the dwarf planet.



An overhead view of the New Horizons spacecraft's path across

The team plans to make a pitch to NASA for extended operations in 2016, to take a closer look at one of these worlds. Meanwhile, even after the mission ends, a group of scientists, artists, engineers and more are proposing placing a sort of message from Earth on the free hard drive space on the New Horizons spacecraft.

"When New Horizons gets past Pluto, [and] has done all its data and is going on the slow boat to the heliopause [the boundary between the solar system and interstellar space], then it might be possible to just reprogram about 100 megabytes of its memory and upload a new sights and sounds of Earth that are not created by a small group of scientists but, in fact, are globally crowdsourced," said Jill Tarter, who is the co-founder of the SETI (Search for Extraterrestrial Intelligence) Institute, in 2013. *Courtesy: Space.com*

Astronomers See a Massive Black Hole Tear a Star Apart

by VANESSA JANEK - **Universe Today**

When a star encounters a black hole, tidal forces stretch the star into an elongated blob before tearing it apart, as seen in these images from a computer simulation by James Guillochon of Harvard University.

A telescope peers into the blackness of deep space. Suddenly – a brilliant flash of light appears that wasn't there before. What could it be? A supernova? Two massively dense stars fusing together? Perhaps a gamma ray burst?

Five years ago, researchers using the ROTSE IIIb telescope at McDonald Observatory noticed just such an event. But far from being your run-of-the-mill stellar explosion or neutron star merger, the astronomers believe that this tiny flare was, in fact, evidence of a supermassive black hole at the center of a distant galaxy, tearing a star to shreds.

Astronomers at McDonald had been using the telescope to scan the skies for such nascent flashes for years, as part of the ROTSE Supernova Verification Project (SNVP). And at first blush, the event seen in early 2009, which the researches nicknamed "Dougie," looked just like many of the other supernovae they had discovered over the course of the project. With a blazing – 22.5-magnitude absolute brightness, the event fit squarely within the class of superluminous supernovae that the researchers were already familiar with.

But as time went on and more data on Dougie rolled in, the astronomers began to change their minds. X-ray observations made by the orbiting Swift satellite and optical spectra taken by McDonald's Hobby-Eberly Telescope revealed an evolving light curve and chemical makeup that didn't fit with computer simulations of superluminous supernovae. Likewise, Dougie didn't appear to be a neutron star merger, which would have reached peak luminosity far more quickly than was observed, or a gamma ray burst, which, even at an angle, would have appeared far brighter in x-ray light.

That left only one option: a so-called "tidal disruption event," or the carnage and spaghettification that occurs when a star wanders too close to a black hole's horizon. J. Craig Wheeler, head of the supernova group at The University of Texas at Austin and a member of the team that discovered Dougie, explained that at short distances, a black hole's gravity exerts a much stronger pull on the side of the star nearest to it than it does on the star's opposite side. He explained, "These especially large tides can be strong enough that you pull the star out into a noodle."

The team refined their models of the event and came to a surprising conclusion: having drawn in Dougie's stellar material a bit faster than it could handle, the black hole was now "choking" on its latest meal. This is due to an astrophysical principle called the Eddington Limit, which states that a black hole of a given size can only handle so much infalling material. After this limit has been reached, any additional intake of matter exerts more outward pressure than the black hole's gravity can compensate for. This pressure increase has a kind of rebound effect, throwing off material from the black hole's accretion disk along with heat and light. Such a burst of energy accounts for at least part of Dougie's brightness, but also indicates that the original dying star – a star not unlike our own Sun – wasn't going down without a fight.

Combining these observations with the mathematics of the Eddington Limit, the researchers estimated the black hole's size to be about 1 million solar masses – a rather small black hole, at the center of a rather small galaxy, three billion light years away. Discoveries like these not only allow astronomers to better understand the physics of black holes, but also properties of their often unassuming home galaxies. After all, mused Wheeler, "Who knew this little guy had a black hole?"

Courtesy: Universe Today