NWASNEWS

Volume23, Issue 2

October 2017

Newsletter for the Wiltshire, Swindon, Beckington Astronomical Societies and Salisbury Plain Observing Group

Wiltshire Society Page	**2**
Swindon Stargazers	**3**
Beckington and Astronomy	4
Apollo Astronauts in UK.	4
Cassini ends its mission	5
Viewing Logs and Images	6-8
Herschel Society Meeting	8
Space News :Data from Opportunity shows equatorial water on Mars. Lunar Observer crash site found New dual object found Mystery of Moonquakes solved? Galaxy shapes give keys Rosetta lander last image viewed Ligo gravity waves. Another found Sub surface ice on Vesta	
IViewing logs, travel notes	9-
What's Up September 2017	15
Constellation of the Month Ursa Major	16-18
Space Station Timings	19
IMAGES, VIEWING SESSIONS and OUTREACH	20

Sharing the Skies

While we have officially swapped the chair and vice chair roles I will still be editing the newsletter.

The AGM enabled us to pass over duties (ha ha ha) and I would like to thank the society for the gift of 6 constellation wine glasses from the society.

Debbie Crokker has agreed to become vice Treasurer, and details have been passed to her for tonight.

I have unfortunately had to help out a lot with Dark Skies Wales this last few weeks and going forward a few more weeks while the Director Allan Trow underwent surgery that has lead to more surgery being needed. We wish him a speedy recovery.

It means I will also be in Spain at the GEO observatory while there are paying visitors there including a journalist which means I will miss the next event in Devizes.

Also a special birthday event in Devizes that Pete Glastonbury is helping to organise. This will now be on the 14th October.

Note the chance to meet Al Worden in Wales on Monday 9th October.

On top of this, with schools being less interested in visits due to curriculum changes, I would like to get back to doing more Sidewalk astronomy in local towns. Perhaps taking a Dobsonian into the centre of local towns when timing and dark dry skies allow.

Clear Skies

Andy

The setting 2day old Moon on equinox eve 21st September from the West Kennet Long Barrow.
A sequence of 20 images stacked using star trails to pick out the thin sliver of the Moon, using Nikon D800 with 28 to 300mm lens on tripod at 300mm.

Andy Burns

Wiltshire Society Page

Wiltshire Astronomical Society

Web site: www.wasnet.org.uk

Meetings 2015/2016Season.

NEW VENUE the Pavilion, Rusty Lane, Seend

Meet 7.30 for 8.00pm start

Date	Speaker	Title
3rd Oct	Prof Richard Harrison, Oxfordshire's national space facility: Over 50 years in Space	
7th Nov	Sally Russell	An Introduction to Astronomical Sketching.
5th Dec 2018	Dr Helen Walker	Mars Orbiters, Rovers & Landers.
2nd Jan	Open Forum	Subject for Beginners (TBA).
6th Feb	Prof. David Southwood	Cassini-Huygens, a Mission to Saturn & Titan.
6th Mar	Andrew Lound	Guardians of the Rings.
3rd Apr	Guy Hurst	George Alcock – The Life & Achievements of this Amazing Observer.
1st May	Paul Money	Triumphs of Voyager: Journey to Jupiter/Splendours of Saturn.
5th Jun	Martin Griffiths	Understanding Stars +AGM.

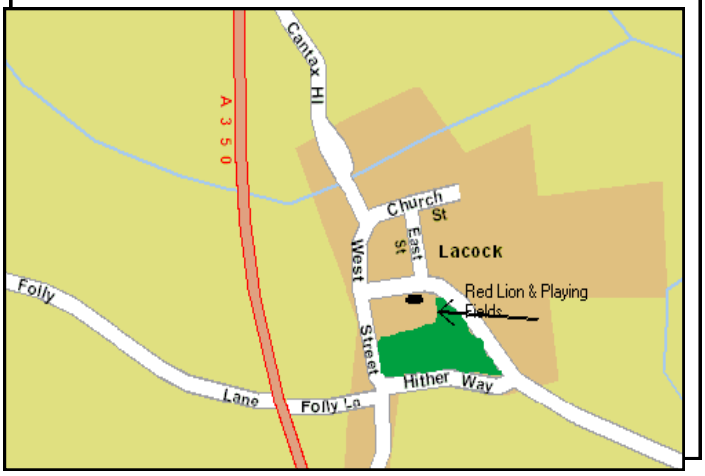
Observing Sessions

The Wiltshire Astronomical Society's observing sessions are open, and we welcome visitors from other societies as well as members of the public to join us.

We will help you set up equipment (as often as you need this help), and let you test anything we have to help you in your choice of future astronomy purchases.

Please treat the lights and return to full working order before leaving. With enough care shown we may get the National Trust to do something with them!

PLEASE see our proposed changes to the observing sessions, contacting and other details. Back Page



Harrison, R.A., J.A. Davies, D. Biesecker, M. Gibbs, The application of heliospheric imaging to space weather operations: lessons learnt from published studies, Space Weather, in press, 2017

Harrison, R.A., J.A. Davies, et al., An analysis of the onset and propagation of the multiple coronal mass ejections of 2010 August 1, ApJ 750, 45, 2012

Davies, J.A., **R.A. Harrison,** et al., A self-similar expansion model for use in solar transient propagation studies, ApJ 750, 23, 2012.

Harrison, R.A., C.J. Davis, C.J. Eyles, D. Bewsher, S. Crothers, J.A. Davies, et al., First imaging of Coronal Mass Ejections in the heliosphere viewed from outside the Sun-Earth line, Solar Phys. 247, 171, 2008

Membership Meeting nights £1.00 for members £3 for visitors

Wiltshire AS Contacts

Keith Bruton Chair, keisana@keisana.plus.com

Vice chair: Andy Burns and newsletter editor.
Email anglesburns@hotmail.com

Bob Johnston (Treasurer) Debbie Croker (vice Treasurer)

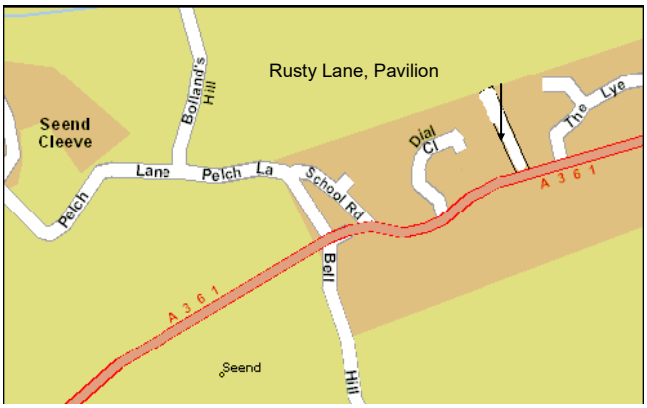
Philip Proven (Hall coordinator) Dave Buckle (Teas)

Peter Chappell (Speaker secretary)

Nick Howes (Technical Guru)

Observing Sessions coordinators: Jon Gale, Tony Vale

Contact via the web site details. This is to protect individuals from unsolicited mailings.



Richard Harrison MBE PhD FRAS FInstP STFC RAL Space

Professor Harrison is an established solar physicist, with over three decades experience in the study of solar activity and solar ejecta, including pioneering work on solar ejection processes, and in the leadership of space-borne solar instrumentation. He led the Space Physics Division at RAL from 2003 to 2015 before taking on the role of RAL Space Chief Scientist. He has been Principal Investigator of key science instruments aboard the ESA SOHO and the NASA STEREO spacecraft, and co-investigator of numerous space instruments, specialising in solar EUV spectral observations and coronal and heliospheric imaging. He is author of over 220 research papers in the professional literature. He was awarded the MBE and Royal Astronomical Society (RAS) Chapman medal, both in 2004, and the RAS Service Award in 2017. He serves on the Space Environment Impact Expert Group (SEIEG) that advises the UK Government on space weather impacts and mitigation.

Professor Harrison's professional career started in the early 1980s with involvement in the NASA Solar Maximum Mission at the University of Birmingham and the High Altitude Observatory, USA. This involved pioneering research and instrument operations activities for both X-ray instrumentation and the HAO coronagraph. This kick-started a keen interest in the onset and propagation of solar ejecta, that was always a major element of his research in exploiting the instruments that he has led on the ESA SOHO and NASA STEREO missions. In particular, the Heliospheric Imagers (HI) on the STEREO spacecraft, for which he is PI, have marked the maturing of instrumentation that can image solar ejecta in the heliosphere.

Swindon Stargazers

Swindon's own astronomy group

The club meets once a month at Liddington Hall, Church Road, Liddington, Swindon, SN4 0HB at 7.30pm. See programme below.

Our Next Meeting: Steve Tonkin – Binocular Astronomy – Friday 20th October

Ad-hoc viewing sessions

Regular stargazing evenings are being organised near Swindon. To join these events please visit our website for further information.

Lately we have been stargazing at Blakehill Farm Nature Reserve near Cricklade, a very good spot with no distractions from car headlights.

We often meet regularly at a lay-by just outside the village of Uffcott, near Wroughton. Directions are also shown on the website link below.

When we use East Kennett, we meet at the public car park just below The Red Lion pub at Avebury; we usually hang on for 10 minutes and then move on to our viewing spot at East Kennett. Information about our evenings and viewing spots can be found here:

http://www.swindonstargazers.com/noticeboard/noticeboard06.htm

If you think you might be interested email the organiser Robin Wilkey (see website). With this you will then be emailed regarding the event, whether it is going ahead or whether it will be cancelled because of cloud etc.
We are a small keen group and I would ask you to note that you DO NOT have to own a telescope to take part, just turn up and have a great evening looking through other people's scopes. We are out there to share an interest and the hobby. There's nothing better than practical astronomy in the great cold British winter! And hot drinks are often available, you can also bring your own.

Enjoy astronomy at it's best!

Members of the Wiltshire Astronomical Society always welcome!

At Liddington Village Hall, Church Road, Liddington, SN4 0HB – 7.30pm onwards

The hall has easy access from Junction 15 of the M4, a map and directions can be found on our website at:

http://www.swindonstargazers.com/clubdiary/directions01.htm

Meeting Dates for 2017:

Friday 20 October 2017

Programme: Steve Tonkin - Binocular Astronomy

Friday 17 November 2017

Programme: Mike Leggett: Exploration of Mars

Friday 15 December 2017

Programme: Christmas Social

Meeting Dates for 2018

Friday 19 January 2018
Programme: Prof. Elizabeth Pearson - The Chelyabinsk Meteor
Friday 16 February 2018
Programme: Prof. Peter Read - Jupiter's Turbulent Atmosphere
Friday 16 March 2018

AGM – plus a talk
Friday 20 April 2018
Programme: TBA
Friday 18 May 2018

Programme: Prof. Harrison - Space Weather
Friday 15 June 2018
Programme: TBA

Website:
http://www.swindonstargazers.com

Chairman: Peter Struve

Tel No: 01793 481547
Email: peter.struve@sky.com
Address: 3 Monkton Close, Park South, Swindon, SN3 2EU

Secretary: Dr Bob Gatten (PhD)
Tel Number: 07913 335475

Email: bob.gatten@ntlworld.com
Address: 17, Euclid Street,

BECKINGTON ASTRONOMICAL SOCIETY

Society Details & Speakers programme can be found on our Website www.beckingtonas.org

General enquiries about the Society can be emailed to chairman@beckingtonas.org.

Our Committee for 2016/2017 is

Steve Hill----------Chairman- 01761 435663

John Ball----------Vice Chairman- 01373 830419

…….john@abbeylands1.freeserve.co.uk

Sandy Whitton---- Secretary-07974-841239

……..sandy.whitton@blueyonder.co.uk

Jacky Collenette---Treasurer…
collenettejacqueline@yahoo.co.uk

Mike Witt---------- Membership-……
mjwitt@blueyonder.co.uk.

John Dolton------
Committee…. member@jdolton.freeserve.co.uk

Meetings take place in Beckington Baptist Church Hall in Beckington Village near Frome.

See the location page for details of how to find us on our website……

Post Code for Sat Nav is BA11 6TB.

Our start time is 7.30pm.

Awaiting new season information.

APOLLO ASTRONAUTS IN UK

September 9th at Milton Keynes.

Moon surface visitor Charlie Duke.

Tickets from £90 to £185…

https://www.eventbrite.co.uk/e/moonwalker-charlie-duke-live-tickets-338

Much cheaper is the return visit by Al Worden to the Rhondda Valley.

Time: 19:00 - 22:00

AN EVENING WITH COL AL WORDEN

Apollo 15 Command Module Pilot

Presented by Dark Sky Wales and Visit RCT.

Join us for an out-of-this-world experience as Colonel Al Worden, Command Module Pilot for Apollo 15, brings his unique show to the The Coliseum Theatre, Aberdare on Monday 9 October 7.00pm.

Al Worden is one of only 24 people to have flown to the Moon and one of only seven men chosen to be Apollo command module pilots.

The evening will be MC'd by Nick Howes, Director of Aerolite Europe and former science writer for the European Space Agency.

"I highly recommend meeting Al Worden! His personality, friendliness and energy made his memories come alive. I felt as though I had been to the Moon with him!"

Tickets cost £17.50, concessions £12.50 are go on sale Tuesday 4 July from the Box Office **on 03000 040 444** or online at www.rct-arts.co.uk. Early booking is advised to avoid disappointment.

Cassini Says Goodbye

By Teagan Wall

On September 15th, the Cassini spacecraft will have its final mission. It will dive into the planet Saturn, gathering information and sending it back to Earth for as long as possible. As it dives, it will burn up in the atmosphere, much like a meteor. Cassini's original mission was supposed to last four years, but it has now been orbiting Saturn for more than 13 years!

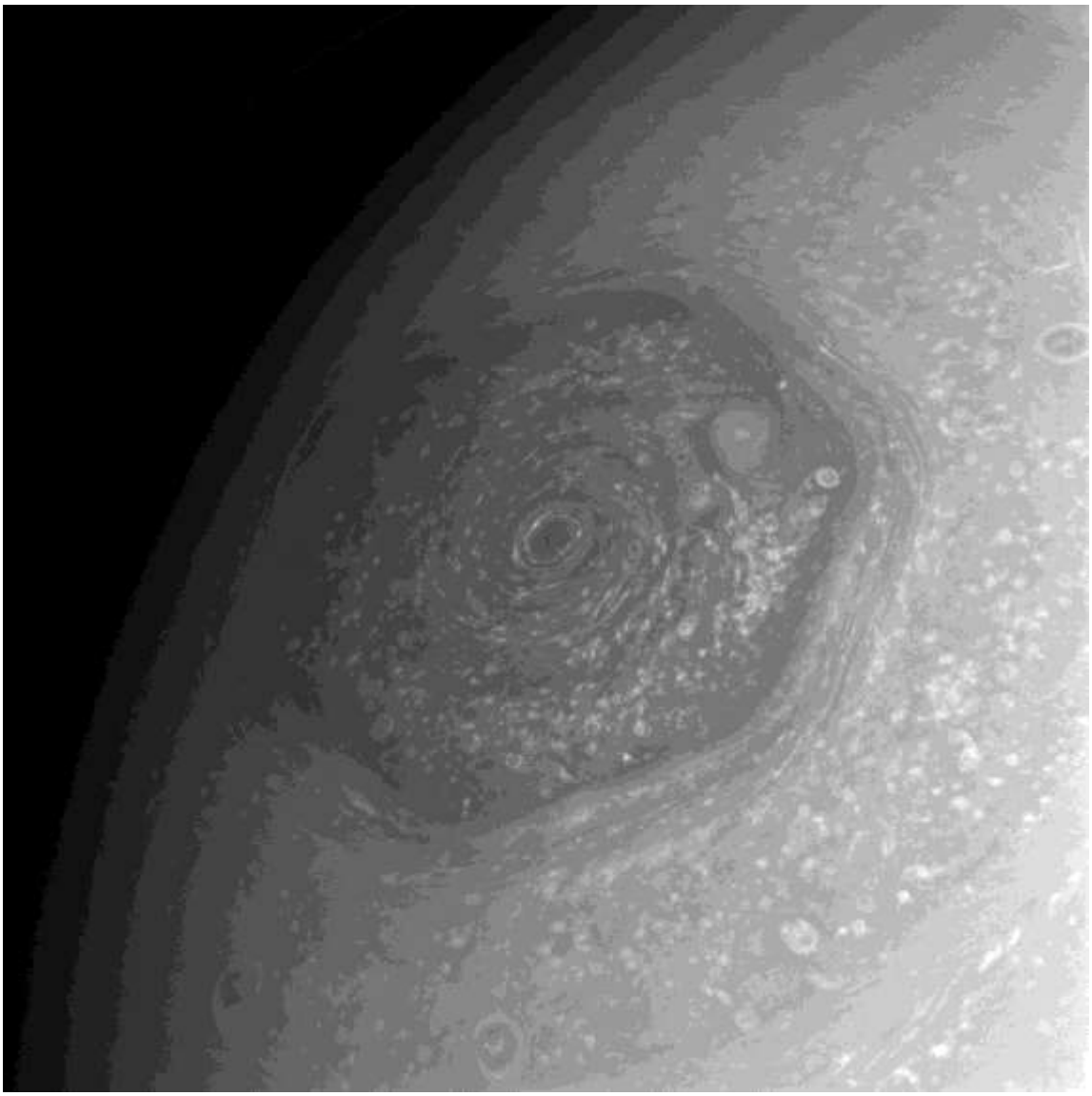
The spacecraft has seen and discovered so many things in that time. In 2010, Cassini saw a massive storm in Saturn's northern hemisphere. During this storm, scientists learned that Saturn's atmosphere has water vapor, which rose to the surface. Cassini also looked at the giant storm at Saturn's north pole. This storm is shaped like a hexagon. NASA used pictures and other data from Cassini to learn how the storm got its six-sided shape.

Cassini also looked at some of Saturn's moons, such as Titan and Enceladus. Titan is Saturn's largest moon. Cassini carried a lander to Titan. The lander, called Huygens, parachuted from Cassini down to the surface of the moon. It turns out, Titan is quite an exciting place! It has seas, rivers, lakes and rain. This means that in some ways, Titan's landscape looks a bit like Earth. However, its seas and rivers aren't made of water—they're made of a chemical called methane.

Cassini also helped us learn that Saturn's moon Enceladus is covered in ice. Underneath the ice is a giant liquid ocean that covers the whole moon. Tall geysers from this ocean spray out of cracks in the ice and into space, like a giant sneeze. Cassini flew through one of these geysers. We learned that the ocean is made of very salty water, along with some of the chemicals that living things need.

If there is life on Enceladus, NASA scientists don't want life from Earth getting mixed in. Tiny living things may have hitched a ride on Cassini when it left Earth. If these germs are still alive, and they land on Enceladus, they could grow and spread. We want to protect Enceladus, so that if we find life, we can be sure it didn't come from Earth. This idea is called planetary protection.

Scientists worry that when Cassini runs out of fuel, it could crash into Titan or Enceladus. So years ago, they came up with a plan to prevent that from happening. Cassini will complete its exploration by diving into Saturn—on purpose. The spacecraft will burn up and become part of the planet it explored. During its final plunge, Cassini will tell us more about Saturn's atmosphere, and protect the moons at the same time. What an exciting way to say goodbye!



To learn more about Saturn, check out NASA Space Place: https://spaceplace.nasa.gov/all-about-saturn

Caption: This image of the hexagonal storm on Saturn's north pole was taken by Cassini in 2013. Image credit: NASA/JPL-Caltech/Space Science Institute

Sidewalk astronomy

From Wikipedia, the free encyclopedia
Jump to: navigation, search

A "*street corner astronomer*" in New York City in 1921.
Sidewalk or **street corner astronomy** refers to the activity of setting up a telescope in an urban setting on a for profit or non-profit basis as an entertainment and/or for public education.

Overview

Examples of people setting up telescopes on urban streets for public astronomical viewing go back well into the 19th century and maybe even further. Sidewalk astronomers and their telescopes have been a common sight in most big cities. There are many examples in the past such as Frank Manning in New Orleans as early as 1930[9] and Mr Grosser in Los Angeles in the 1870s, who not only set up a telescope but also an illuminated microscope. Some sidewalk "pitch men" charged the public to view astronomical objects through their telescope but other astronomers allow people to view for free.[6][10] In more recent years sidewalk astronomy has come to be more associated with altruistic individuals or groups offering views of the nighttime sky as a free public educational service.
Because the sidewalks tend to be in light-polluted areas, sidewalk astronomers often coordinate their activities at times when brighter celestial objects like planets, the moon, and bright stars are visible. During the day, sidewalk astronomy often includes use of a solar filter on the telescope to allow people to view the sun. Telescopes are often larger than the average available "department store telescope", sometimes very large.

Amateur astronomical activities

The Moon and Saturn - typical sidewalk astronomy viewing targets

With the advent and growth of organized amateur astronomical groups, sidewalk astronomy has come to be associated with public education about astronomy via free public viewing for anyone who wishes to look through the telescope. This usually involves individual or a groups of amateur astronomers with small-to-medium-sized telescopes. Organizations such as the San Francisco Sidewalk Astronomers, founded by John Dobson, are organized around the idea of educating people about the universe they live in by having them look through telescopes.[12][13][14][15] Dobson even promoted a design for large inexpensive reflecting telescope that he called a "Sidewalk Telescope", more commonly referred to as the Dobsonian telescope.

MEMBERS VIEWING LOGS and IMAGES

September Log

Chi Cyg is a Mira type variable star lying close to Eta Cygni, halfway along the swan's neck. Its range of magnitude is one of the biggest of all variable stars of any kind and maximum is due around the middle of October. The official range is 5.2 - 13.4 however it reached a maximum of 3.2 in 2013 and it can fade to 14.5. The current light curve is showing an unusual late hump which has taken it to magnitude 4.9 with a few weeks still to go, so this could turn out to be another bright maximum and it should be visible to the naked eye. Meanwhile, the prototype Mira type variable (Omicron Ceti) and the first variable star to be discovered by David Fabricius in 1596 is undergoing one of its faintest minima, has been recorded recently at below magnitude 10.

Miras are stars nearing the end of their lives. They are AGB stars which means core burning has come to an end and fusion is taking place in shells surrounding the core. Variability arises as the star swells and shrinks. As it does so, the surface temperature rises and falls and the spectrum shifts towards and away from the red end. As it shifts towards the red, a bigger proportion of the radiation moves into the invisible infra red and the star appears to dim.

The supernova SN 2017Eaw has now faded a bit below magnitude 15.5 which is close to my limit. I have 2 negative observations of it and its unlikely I will be able to pick it up again but will keep trying for a while longer. Tony Vale

Hi Andy,

After last months talk I thought people may be interested in this picture I took a while ago. I had been out (shopping, I think) and when I got out of the car at home the first thing I saw was this moon with its companion moon dogs, or paraselenae. Two were visible, if I remember correctly, but I only caught one in the photo as the other was just out of sight behind the houses. I dashed indoors to get my camera and took some shots with the camera hand held, braced against

the car roof, which explains the lack of sharpness. Also visible is a fragment of a paraselenic circle - the lunar equivalent of a parhelic circle. You can tell how bright it was by the amount of colour visible in the moon dog, especially considering the moon was directly over the garage lights just close to my house. This was only the second or third moon dog I had seen, and the others were so faint they were in the 'is it or isn't it' category.

The picture was taken on 25/10/2015 at 18:48hr. and the camera was a Nikon D50 with a 18-55mm zoom lens at 18mm. Exposure was 1.6sec at F3.5. As far as I can remember, the only processing was some sharpening and some removal of the moon's glare. Pete Eslick.

Viewing Log for 21st September

It has been a very poor month for me and doing any viewing, comes to a total of nil L! The weather has not been very helpful and when there were clear evenings I had something else planned unfortunately, so the only viewing I did this month was to try and see a very thin crescent Moon near sunset.

On the 20th I noticed an article on the Wiltshire AS Facebook page about a thin crescent Moon being visible not long after sunset for the following evening and as I was free that evening I thought I would go along and see if I could see it assuming the clouds would not block the horizon? Andy Burns had planned to view the event from West Kennett Long Barrow which is about half a mile's walk from the A4. I decided I would take one tripod with the Canon 70D camera and Tam-

ron 150-600mm zoom lens (for close up views of the Sun/ Moon, if clear) and 18-55mm zoom lens (for wide field views of any sunset colours on display). I arrived at the car park

about 30 minutes before sunset and noticed Andy starting to walk to the Long Barrow, I managed to get his attention and we walked up together once I had collected my kit and put my Wellington boots on. I was surprised how dry the ground was as there had been quite a lot of rain over the last day or two? We got to the top of the Long Barrow and were welcomed to clear skies out to the west and the Sun was not more than five degrees above the horizon, so time to get the kit set up and start taking pictures! Andy had got an App out on his phone and this showed us where the thin crescent Moon should be as well as Jupiter (bit further to the east of the Moon). While the Sun was up we could not see the Moon at all? It must have been a good 15 minutes after the Sun had set that I managed to see the Moon, with Andy not having his glasses with him I had to show him the point in the sky with the long zoom lens.

This was another first for me and Astronomy, the closest from New Moon I had ever seen before would be about 2 ½ days

old? This Moon was 1.59 days old or just over 2 % lit J.

Hopefully October with its longer dark skies will be better for me and doing some viewing?

Peter Chappell

Dear Herschellians,

It has been reported that I send out an erroneous version of the poster
with the date as 5th May instead of 5th October.

Apologies, and here is the correct version.

Kind regards,

Tony Symes

BATH ROYAL LITERARY & SCIENTIFIC INSTITUTION

16 Queen Square, Bath, BA1 2HN 01225 312084 www.brlsi.org

HERSCHEL/ASTRONOMY

'Skylark' Britain's First Space Rocket

Robin H Brand

Electronic Engineer; Author of 'Britain's First Space Rocket: the story of the Skylark'

In 1957 'Skylark' was Britain's first sounding rocket to reach space, and became the basis of the country's first space programme and the birth of British science and space technology. Over the next 48 years, hundreds were fired from Australia and around the world, launching into space thousands of scientific instruments that made pioneering observations of the Earth, Sun, stars and galaxies.

Lecture in conjunction with
The British Interplanetary Society

BRLSI

Thurs 5 October 2017 • 7.30 pm

VISITORS £4 • MEMBERS / STUDENTS £2

SPACE NEWS FROM SEPT/OCT

Our Facebook page carries a lot of these news items throughout the month.

Old Mars Odyssey Data Indicates Presence of Ice Around Martian Equator

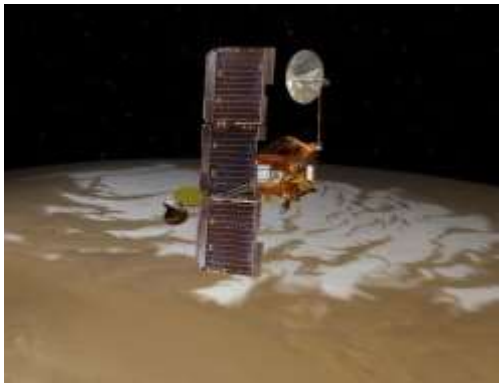
Article written: 2 Oct , 2017

by Matt Williams

Finding a source of Martian water – one that is not confined to Mars' frozen polar regions – has been an ongoing challenge for space agencies and astronomers alike. Between NASA, SpaceX, and every other public and private space venture hoping to conduct crewed mission to Mars in the future, an accessible source of ice would mean the ability to manufacture rocket fuel on sight and provide drinking water for an outpost.

So far, attempt to locate an equatorial source of water ice have failed. But after consulting old data from the longest-running mission to Mars in history – NASA's *Mars Odyssey* spacecraft – a team of researchers from the John Hopkins University Applied Physics Laboratory (JHUAPL) announced that they may have found evidence of a source of water ice in the Medusae Fossae region of Mars.

This region of Mars, which is located in the equatorial region, is situated between the highland-lowland boundary near the Tharsis and Elysium volcanic areas. This area is known for its formation of the same name, which is a soft deposit of easily-erodible material that extends for about 5000 km (3,109 mi) along the equator of Mars. Until now, it was believed to be impossible for water ice to exist there.



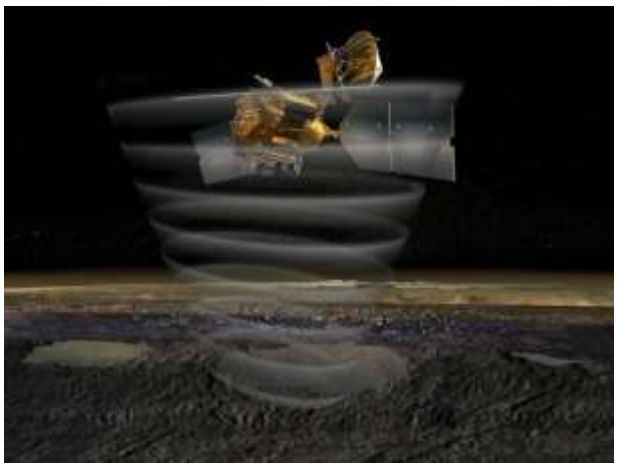
Artist's conception of the Mars Odyssey spacecraft. Credit: NASA/JPL

However, a team led by Jack Wilson – a post-doctoral researcher at the JHUAPL – recently reprocessed data from the *Mars Odyssey* spacecraft that showed unexpected signals. This data was collected between 2002 and 2009 by the mission's neutron spectrometer instrument. After reprocessing the lower-resolution compositional data to bring it into sharper focus, the team found that it contained unexpectedly high signals of hydrogen.

To bring the information into higher-resolution, Wilson and his team applied image-reconstruction techniques that are typically used to reduce blurring and remove noise from medical and spacecraft imaging data. In so doing, the team was able to improve the data's spatial resolution from about 520 km (320 mi) to 290 km (180 mi). Ordinarily, this kind of improvement could only be achieved by getting the spacecraft much closer to the surface.

"It was as if we'd cut the spacecraft's orbital altitude in half," said Wilson, "and it gave us a much better view of what's happening on the surface." And while the neutron spectrometer did not detect water directly, the high abundance of neutrons detected by the spectrometer allowed the research team to calculate the abundance of hydrogen. At high latitudes on Mars, this is considered to be a telltale sign of water ice.

The first time the *Mars Odyssey* spacecraft detected abundant hydrogen was in 2002, which appeared to be coming from subsurface deposits at high latitudes around Mars. These findings were confirmed in 2008, when NASA's *Phoenix Lander* confirmed that the hydrogen took the form of water ice. However, scientists have been operating under the assumption that at lower latitudes, temperatures are too high for water ice to exist.



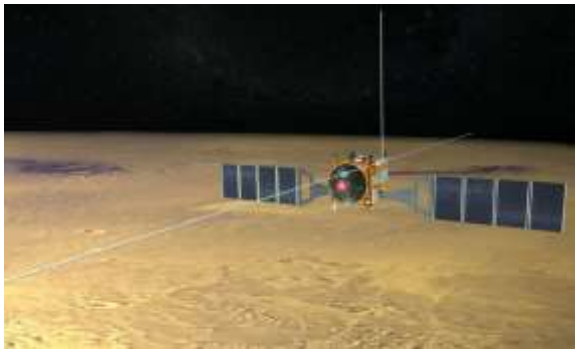
This artist's concept of the Mars Reconnaissance Orbiter highlights the spacecraft's radar capability. Credit: NASA/JPL

In the past, the detection of hydrogen in the equatorial region was thought to be due to the presence of hydrated minerals (i.e. past water). In addition, the *Mars Reconnaissance Orbiter* (MRO) and the ESA's *Mars Express* orbiter have both conducted radar-sounding scans of the area, using their Shallow Subsurface Radar (SHARAD) and Mars Advanced Radar for Subsurface and Ionospheric Sounding (MARSIS) instruments, respectively.

These scans have suggested that there was either low-density volcanic deposits or water ice below the surface, though the results seemed more consistent with their being no water ice to speak of. As Wilson indicated, their results lend themselves to more than one possible explanation, but seem to indicate that water ice could part of the subsurface's makeup:

"[I]f the detected hydrogen were buried ice within the top meter of the surface. there would be more than would fit into pore space in soil… Perhaps the signature could be explained in terms of extensive deposits of hydrated salts, but how these hydrated salts came to be in the formation is also difficult to explain. So for now, the signature remains a mystery worthy of further study, and Mars continues to surprise us."

Given Mars' thin atmosphere and the temperature ranges that are common around the equator – which get as high as 308 K (35 °C; 95 °F) by midday during the summer – it is a mystery how water ice could be preserved there. The leading theory though is that a mixture of ice and dust was deposited from the polar regions in the past. This could have happened back when Mars' axial tilt was greater than it is today.



The MARSIS instrument on the Mars Express is a ground penetrating radar sounder used to look for subsurface water and ice. Credit: ESA

However, those conditions have not been present on Mars for hundreds of thousands or even millions of years. As such, any subsurface ice that was deposited there should be long gone by now. There is also the possibility that subsurface ice could be shielded by layers of hardened dust, but this too is insufficient to explain how water ice could have survived on the timescales involved.

In the end, the presence of abundant hydrogen in the Medusae Fossae region is just another mystery that will require further investigation. The same is true for deposits of water ice in general around the equatorial region of Mars. Such deposits mean that future missions would have a source of water for manufacturing rocket fuel.

This would shave billions of dollars of the costs of individual mission since spacecraft would not need to carry enough fuel for a return trip with them. As such, interplanetary spacecraft could be manufactured that would be smaller, lighter and faster. The presence of equatorial water ice could also be used to provide a steady supply of water for a future base on Mars.

Crews could be rotated in and out of this base once every two years – in a way that is similar to what we currently do with the International Space Station. Or – dare I say it? – a local source of water could be used to supply drinking, sanitation and irrigation water to eventual colonists! No matter how you slice it, finding an accessible source of Martian water is critical to the future of space exploration as we know it!

New observations reveal a lunar orbiter's final resting place

Our Moon is a graveyard of satellite crash sites, including the demise of SMART-1.

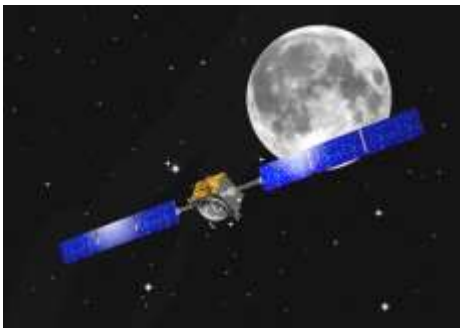
By Alison Klesman | Published: Friday, September 22, 2017

This 66-foot-long gouge, seen running across a pre-existing crater on the Moon, shows the final moments and ultimate resting place of SMART-1.

P. Stooke/B. Foing et al. 2017/ NASA/GSFC/Arizona State University

In September 2006, the European Space Agency (ESA)'s Small Missions for Advanced Research in Technology-1 (SMART-1) successfully ended its three-year Moon-orbiting mission by hurling itself into the lunar surface. The planned crash was meant to simulate meteor impacts on the Moon for study, as well as possibly throw up deeper materials (including water ice) for identification to aid scientists in their study of our Moon's composition. Although the craft's impact was — as intended — recorded via telescope from Earth, recent observations of our planet's satellite have for the first time revealed the exact location of SMART-1's final resting place.

If you're curious, that resting place is 34.262° south and 46.193° west, as presented today at the European Planetary Science Congress 2017 in Riga, Latvia. The site was discovered in data taken by the Lunar Reconnaissance Orbiter by Phil Stooke of Western University, Ontario. Stooke spotted a gash on the lunar surface roughly 66 feet (20 meters) long and 13 feet (4 m) wide, indicating that SMART-1's landing included grazes and bounces along the surface at about 1.2 miles per second (2 km/s).



An artist's impression of SMART-1, an economical mission developed by the ESA to test technologies for future missions.

ESA, CC BY-SA 3.0 IGO

Why was the crash site just recently found? In a press release, ESA SMART-1 Project Scientist Bernard Foing explained, "There were no other spacecraft in orbit at the time to give a close-up view of the impact, and finding the precise location became a 'cold case' for more than 10 years."

This 20-frame sequence shows SMART-1's impact on the lunar surface in 2006, which takes place in just one frame.

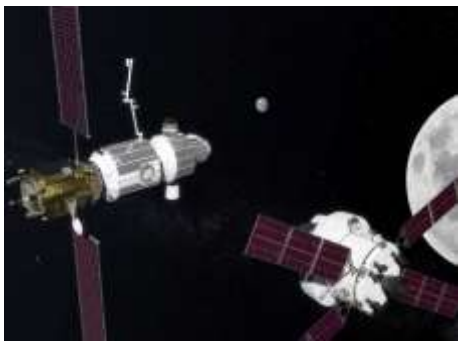
Canada-France-Hawaii Telescope / 2006

Stooke said of his discovery, "Orbit tracking and the impact flash gave a good estimate of the impact location, and very close to that point was a very unusual small feature." That feature shows white ejecta, or material sprayed out along the surface of the Moon due to the impact, stretching 23 feet (7 m) from the first point of impact. Along the gouge, other eject streams occur, indicating three further bounces along the path.

One of the best ways to study an object's surface and, sometimes its interior, is to observe what happens when it is struck. Most material brought back by astronauts is from the very uppermost surface of the Moon, but impacts such as this can dig deeper, revealing what's going on beneath the surface via the ejecta they throw up. Tracing the spacecraft's path will help lunar scientists better characterize the composition of the Moon by comparing the actual results with simulations.

NASA and Russia agree to work together on Moon space station

Posted Sep 27, 2017 by Darrell Etherington (@etherington)



At this year's International Astronautical Congress, NASA and Russia's space agency, Roscosmos, signed a joint

statement expressing their intent to work collaboratively toward the development of a space station further out from Earth, orbiting the Moon, as a staging point for both lunar surface exploration and deeper space science.
This is part of NASA's expressed desire to explore and develop its so-called "deep space gateway" concept, which it intends to be a strategic base from which to expand the range and capabilities of human space exploration. NASA wants to get humans out into space beyond the Moon, in other words, and the gateway concept would establish an orbital space station in the vicinity of the Moon to help make this a more practical possibility.
"While the deep space gateway is still in concept formulation, NASA is pleased to see growing international interest in moving into cislunar space as the next step for advancing human space exploration," Robert Lightfoot, NASA's acting administrator at NASA Headquarters in Washington said in a NASA press release announcing the news. "Statements such as this one signed with Roscosmos show the gateway concept as an enabler to the kind of exploration architecture that is affordable and sustainable."
This is still very early stages in terms of potential collaboration between Roscosmos and NASA — you might say it's an agreement to possibly agree to work together in the future. But it's a good sign for open dialogue about the plan to put a science and exploration facility in orbit around the Moon in the future.

Scientists Just Found Even More Evidence That RNA Is Behind The Origin of Life

Here's how it all began.
DAVID NIELD
22 MAY 2016
AddThis Sharing Buttons
Share to FacebookShare to TwitterShare to Flipboard-Share to Copy Link

Scientists have been closing in on RNA (ribonucleic acid, the close companion of DNA) as being the most likely candidate for the origin of life on Earth, and now even more evidence has come to light to support this idea. Scientists have demonstrated that the key ingredients to make RNA molecules could have been present on the surface of Earth in its earliest days.
The beauty of RNA is that it can act as both a messenger and a catalyst in the human body, and because of those characteristics, scientists have long suspected that it could have helped life come about. However, the new study fills in some of the missing pieces in the puzzle - how two essential building blocks of RNA came into being.

You're no doubt pretty familiar with DNA, the chemical carrying the genetic code that determines our physical characteristics. RNA acts as a kind of messenger for DNA, carrying out its instructions in various ways and controlling the synthesis of proteins through the body.
However, RNA can also store genetic data too, and some scientists think RNA kick-started life on Earth, with DNA coming along later on the evolutionary timeline.
To test this hypothesis, scientists have been trying to replicate the same conditions found in the first stages of Earth's life, to see if RNA could develop. While two of the RNA building blocks - uracil and cytosine - could be produced, the other two - adenine and guanine - remained stubbornly absent.
Now chemists from the Ludwig Maximilian University of Munich in Germany have created conditions where adenine and guanine can be created, as Bob Yirka reports at Phys.org.
The hypothesis is that formic acid found on comets crashing into Earth's surface could have reacted with existing compounds called purines already present in the atmosphere, creating many more purines - including our friends adenine and guanine.
In other words, the research shows a way that all the key ingredients to make RNA molecules could have been present.

If the ingredients were there, then RNA might have been there too, right at the very earliest stages of Earth's formation, making it a credible candidate as the first self-replicating molecule on our planet.
"We now have a pathway that would allow us to use simple molecules that were likely present on the early Earth," lead researcher Thomas Carell told *New Scientist*.
There's more work to be done. The chemical conditions that give rise to adenine and guanine don't match those that can create uracil and cytosine, so we're still missing a few pieces of the puzzle, as Robert F. Service reports at *Science*. It's still not clear how all these bases joined up to form RNA, either.
But despite this, it's an important step forward for the RNA world hypothesis, and an amazing peek back through several billion years' worth of history.
The research has been published in *Science*.

Astronomers discover an asteroid is actually two — and that it's also a comet

Finding makes it a first for a binary asteroid to be also classified as a comet

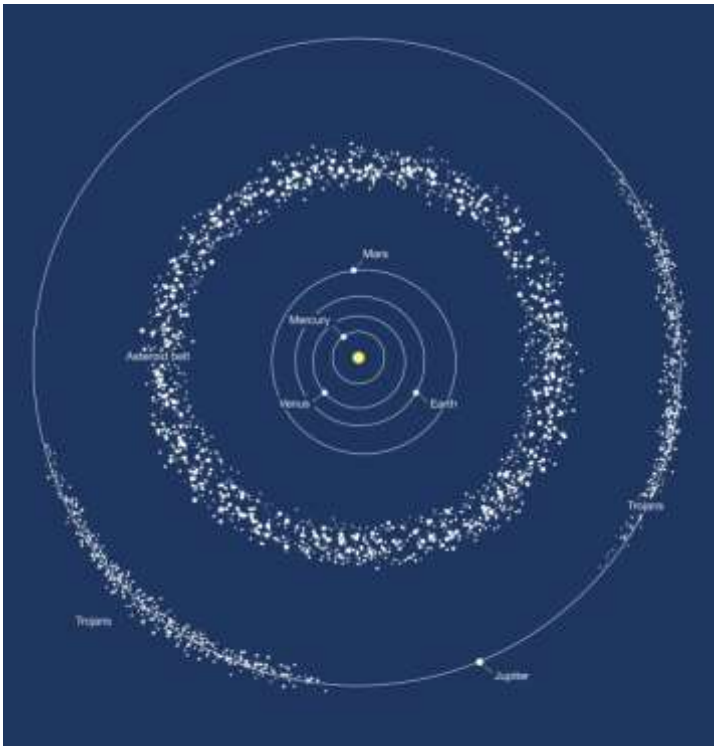
By Nicole Mortillaro, CBC News Posted: Sep 25, 2017 5:00 AM ET Last Updated: Sep 25, 2017 11:32 AM ET

This image from the Hubble Space Telescope reveals two asteroids with comet-like features orbiting each other. These include a bright halo of material, called a coma, and a long tail of dust. (NASA, ESA, and J. Agarwal, Max Planck Institute for Solar System Research)

Nicole Mortillaro
Senior Writer, Science and Technology
Nicole has an avid interest in all things science. As an amateur astronomer, Nicole can be found looking up at the night sky appreciating the marvels of our universe. She is the editor of the Journal of the Royal Astronomical Society of Canada and the author of several books.
When is an asteroid not just an asteroid? When it's a comet.
Astronomers using the Hubble Space Telescope have found that an asteroid discovered in 2006 is actually two — and that it sprouts a tail just like a comet.
While comets originate from beyond Neptune in a region called the Kuiper Belt, asteroids orbit the sun in two locations, the main one being the asteroid belt between the orbits of Mars and Jupiter.
However, in 2011, astronomers discovered that asteroid 300163 (2006 VW139) was displaying some cometary activity and gave it the cometary designation of 288P.
Then, in September 2016, just before it made its closest approach to the sun, astronomers from the Max Planck Institute for Solar System Research imaged the asteroid/comet and got a pleasant surprise. Instead of seeing a single asteroid, they found two.

Why an asteroid (probably) won't wipe us out
Spacecraft on its way to asteroid will slingshot past Earth on Friday
Ancient Canadian meteor strike created hottest rock on Earth

The pair are almost the same mass and size and orbit one another about 100 kilometres apart. This is the first time two asteroids that orbit one another — collectively called a binary asteroid — have also been classified as a comet.



An illustration depicts where most asteroids are found in our solar system: the asteroid belt between Mars and Jupiter, and the Trojans, two groups of asteroids moving ahead of and following Jupiter in its orbit around the Sun. (ESA/Hubble, M. Kornmesser)

While there had been some suspicion that it could be two asteroids, astronomers were thrilled to be able to confirm it.

'It's something we haven't seen yet, and we don't know why'- *Jessica Agarwal, Max Planck Institute for Solar System Research*

"It was very nice to see that, indeed, we had the right suspicion," Jessica Agarwal, lead author of the study published in Nature, and astronomer at the Planck Institute, told CBC News.

There are few asteroids considered to also be comets. That's because comets are made primarily of ice and dust, sprouting tails as they orbit the sun. This occurs due to a process called sublimation, when the ice skips the water stage and goes straight to a gas, producing the tail we see.

Asteroids, on the other hand, are typically rocky, with little water ice. It's believed that millions of these mostly irregularly shaped rocky worlds exist in two regions orbiting the sun.

So to have a binary system with cometary activity is unusual.

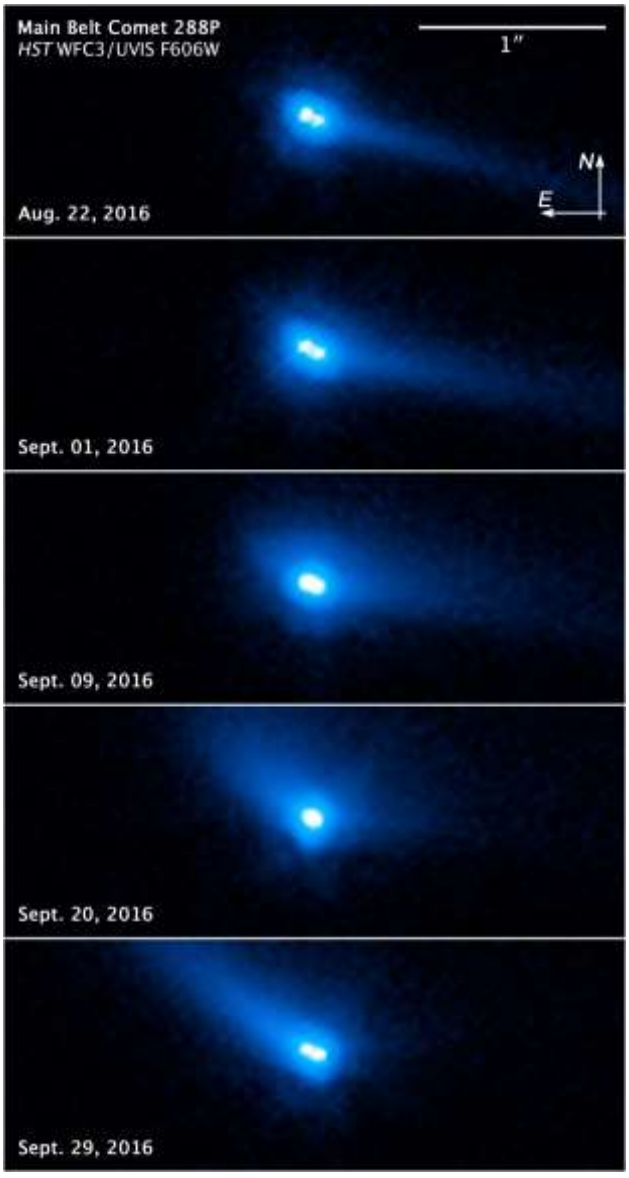
"It's something we haven't seen yet, and we don't know why," Agarwal said.

Answering questions

While asteroids are believed to be as old as the solar system — 4.6 billion years old — the water contained in them is much, much younger. Agarwal explained that models suggest that the ice from this binary asteroid is likely only 5,000 years old.

As for how the binary asteroid came into existence, it's likely a single asteroid was rotating so rapidly that it tore itself apart, revealing the water ice inside.

"And it acted like a little rocket; it was propelling the asteroids further apart, basically," said Agarwal.



These images reveal ongoing activity in the binary system, 288P. (NASA, ESA, and J. Agarwal (Max Planck Institute for Solar System Research))

There are only five known asteroids to have recurring cometary properties, occurring at perihelion, when the asteroid is closest to the sun and the ice warms up, producing the coma, which gives it a fuzzy appearance, and the tail.

One of the questions astronomers hope to answer is how water came to Earth. In the scientific community, two predominant theories have emerged: either it was a comet or an asteroid. Agarwal said she hopes discoveries like this will help solve the mystery.

Meanwhile, there will be further Hubble observations this fall and winter, though the comet will be farther away. But Agarwal said there are still some unanswered questions.

"For instance, one thing I would like to know if both components are active or just one of them is active. This is still something we have to find out."

Apollo sensors solve the mystery of the moonquakes: Researchers say tidal stress is to blame for quakes hundreds of miles beneath the lunar surface

Seismometers placed on the moon during the Apollo 12, 14, 15 and 16 missions

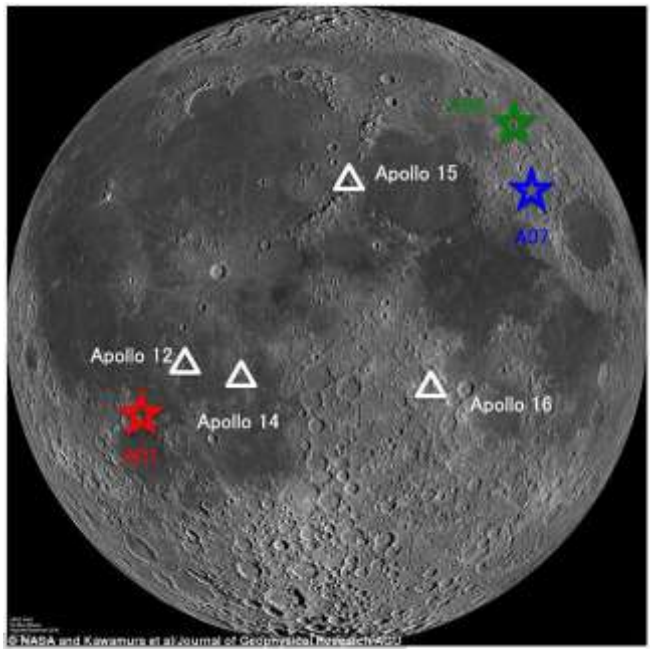
Some moonquakes are as deep as 746 miles under the surface

Gravitational force responsible for creating tides on Earth could be behind them

By Mark Prigg For Dailymail.com

Published: 20:04, 31 August 2017 | Updated: 02:38, 1 September 2017

Researchers believe they may have solved the long running mystery of how quakes happen hundreds of miles under the lunar surface.
They say the same gravitational force responsible for creating tides on Earth could be behind the 'moonquakes' about 800 to 1,200 kilometers (497 to 746 miles) below its surface roughly every 27 days.
Seismometers placed on the moon during the Apollo 12, 14, 15 and 16 missions revealed the strange events.
Scroll down for video



Moonquakes: This image shows the Apollo seismic stations and deep moonquake source regions on the moon used in the research. The lunar globe was taken from Lunar Reconnaissance Orbiter Camera (LROC)courtesy of NASA, and Apollo stations and deep moonquake nests were marked by the study's authors.
The timing of the events - roughly the same as it takes the moon to make a complete circuit around Earth, caused scientists to suspect the moonquakes were a result of tidal stress, but their exact cause remained a source of debate until now.
The **study** in the Journal of Geophysical Research: Planets, a journal of the American Geophysical Union, combined readings from two different seismometers placed on the moon during the Apollo missions in a new way.
'Apollo seismic observation discovered that the Moon is seismically active and the observation detected more than 13000 seismic events,' they wrote.
'Among the detected events, most frequently observed seismic events are deep moonquakes that occur at 800–1200 km depth in the Moon.
'Although intensive studies have been carried out for decades, why and how deep moonquakes occur are remaining mysteries.'
In the study, the team reinvestigated the Apollo deep moonquake data.
'This enabled us to study more than 100 deep moonquakes events while only one event was studied in the previous study, ' the team say.
'With 131 deep moonquakes, we carried out comparative and statistic study of the fault characteristics.
'Our study revealed that the deep moonquake faults are much smoother compared to the terrestrial counterparts and the stress release of the event is as low as the tidal stress between the Earth and the Moon.

This view of the north polar region of the Moon was obtained by NASA's Galileo camera during the spacecraft flyby of the Earth-Moon system on December 7 and 8, 1992
'The correlation between the deep moonquake occurrence and tidal stress has been pointed out and our study supports the idea that the tidal stress is not only triggering the deep moonquakes but also responsible of the whole stress release of the seismic activity.'
The tidal force causes Earth and its oceans to bulge out on the side closest to the moon and the side farthest from the moon.
On the moon, these same forces occurr, and cause a small-scale distortion of the entire planet, which scientists have named a solid-body tide.
These solid-body tides create faults or cracks on the moon, which rub against each other when tidal stress builds up and result in moonquakes.

The Apollo Lunar Surface Experiments Package (ALSEP) comprised a set of scientific instruments placed by the astronauts at the landing site of each of the five Apollo missions to land on the Moon following Apollo 11. This image shows the Apollo 16 package. ALSEP was a collection of geophysical instruments designed to continue to monitor the environment of each Apollo landing site for a period of at least a year after the astronauts had departed. Designed for a life of one year (Apollo 17 was for two), they ended up working for up to 8 years, the experiments permanently shut down by Mission Control on 30 September 1977.
Previous studies of deep moonquakes using the Apollo data were limited, since neither of the two seismic instruments on

the moon entirely captured the signals from the moon's activity—one detected high-frequency seismic activity and the other detected low-frequency seismic activity.
Researchers have uncovered over 200 previously unknown tremors on the moon by analysing data from the Apollo missions.
The find gives new insight into the moon's geology, and reveals four distinct types of quake hit the orbiting body.
The algorithm-based program uncovered 210 previously unknown tremors and scientists at Max Planck Institute for Solar System Research say additional new discoveries will follow.
'The system is trained to recognize deep moonquakes, impacts, and shallow moonquakes, and performs reliably,' wrote the authors.
Apollo 11, the first spacecraft to land on the moon, planted not only an American flag on the mysterious lunar surface but also seismographic equipment.
Since that historic first landing in 1969, Apollo astronauts from four additional missions have placed seismometer stations on the lunar surface through 1972, **Earth Magazine** explains.
Until the hour they were decommissioned in 1977, these stations radioed seismic data from the moon back to Earth.
Analysing the data in the years since, scientists have identified about 13,000 separate tremors, some registering a 5.5 on the Richter scale - a magnitude strong enough to cause slight damage to buildings.
'The algorithm's demonstrated ability to detect rare events and flag previously undefined signal classes as new event types is of particular interest,' wrote the authors.
THE FOUR TYPES OF MOONQUAKE

There are four separate kinds of moonquakes, registering as shadowy echoes on the Apollo mission seismometers.
The first type is deep, occurring about 700 km below the surface, and believed to be caused by tides and linked to its orbit around the earth.
A second type, the result of a meteorite crashing into the surface, takes the form of vibrations.
The third type is thermal in nature; after two weeks of lunar night (and deep-freeze temperatures), the morning sun causes an expansion, and ultimately cracking, of the moon's frigid crust.

The software uncovered 210 previously unknown tremors, and gives new insight into the moon's geology.
Finally, the fourth type is a shallow quake occurring 20 or 30 kilometers (about 12 to 19 miles) below the surface.
While deep moonquakes are generally only magnitude 2 or smaller, they occur on a monthly basis, whereas quakes occurring along the same fault line on Earth may be decades or centuries apart.
Moonquakes also last longer than earthquakes, which typically cease within a few minutes.
Since the moon is much drier and cooler than Earth, the vibrations carry for longer, whereas Earth's more compressible structure acts like a sponge to absorb vibrations.

Moonquakes have been the only confirmed events recorded on any extra-terrestrial body so far, the researchers noted in their new study.
Importantly, lunar tremors look different from the seismic activity seen on Earth, according to NASA Science, and they arise from a different source.
At least one research team wondered, Could there be additional lunar activity not yet discovered in the Apollo seismic data?
To answer this question, Dr. Brigitte Knapmeyer-Endrun and her team developed a unique algorithm similar to those used in speech recognition programs.
After information from one moon tremor is fed into the new algorithm-based program, it is able to search new data and recognize similar patterns.
Running the program on a small subset of data from 1972, the researchers classified more than 50 percent of previously uncategorized events and discovered more than 200 new events not listed in the current lunar event catalog.
The researchers said their new program could identify additional undiscovered events in the existing data and may be useful in 'future seismometer missions to other planets,' including NASA's forthcoming InSight mission to Mars.

Shape of galaxies could shed light on mysteries of space

By Penny Timms
Posted 12 Sep 2017, 8:02amTue 12 Sep 2017, 8:02am
What do a pancake, a sea urchin and a football have in common? According to scientists in Australia, they are all possible shapes of a galaxy.
For more than 90 years, scientists had struggled to understand how to determine a galaxy's shape, but now they think they have cracked the code.
Dr Caroline Foster from the University of Sydney, who was part a team of experts from around the world who conducted the research, said it could help answer some big questions.
"Now that we're able to look at the shape of galaxies, we're able to understand better how they formed," Dr Foster said.
"We live in a galaxy ourselves and we know that our galaxy is quite flat because when you look across the sky, especially from Australia.
"The fact that our galaxy is quite flat tells us a bit about how it formed and so in a way, maybe indirectly, a little bit of where we come from."

Photo: Before now, scientists could really only see galaxies from one angle. (Supplied: NASA)
Dr Foster said that in time, scientists could use the information to help test out some other big astronomy theories.

"There's a lot of literature, mostly on the theoretical side, that discusses how the three-dimensional shape of a galaxy changes as a function of what's happened to them over the course of their life," she said.
"These typically include dark matter in them. Dark matter is one of the mysteries of modern astronomy.
"And if you could pinpoint the true 3D shape of the dark matter behind those galaxies, that would give us a clue as to what dark matter might be."
Scientists examined 845 different galaxies

The researchers were able to reach their conclusions thanks to advances in technology, which now makes it easier to visualise galaxies in three dimensions.
They primarily used a Multi-object Integral Field Spectrograph, an instrument that provides insight into how fast stars and gas are moving and in what direction.
Before now, scientists could really only see galaxies from one angle, so they were not getting the full picture.

Photo: The shape of our own galaxy explains why the Milky Way appears as a strip. (Supplied: NASA)
The Multi-object IFS also allowed the scientists to study 13 galaxies at a time, amounting to a total of 845.
"The faster a galaxy spins around, the flatter it is. And so we know that the spin of the galaxies associated with things that have happened in its history for example," Dr Foster said.
"What we have found is that most galaxies are actually like a beach ball with different degrees of 'squashedness'.
"But we have found there is a population of galaxies as well that doesn't have a necessarily two of its axes that are the same. So we found galaxies that are a bit more potato-shaped."
Dr Foster said the shape of our own galaxy explains why we see a strip of stars making up the Milky Way.
"If our galaxy was more potato-like or more round, we would have stars all across the sky, not just that one strip," she said.
The findings are published in the latest edition of the journal Monthly Notices of the Royal Astronomical Society.

Does the Organic Material of Comets Predate our Solar System?

Press Release - Source: CNRS
Posted September 7, 2017 8:49 PM

©ESA
Comet 67P
The Rosetta space probe discovered a large amount of organic material in the nucleus of comet "Chury."
In an article published by MNRAS on August 31, 2017, two French researchers advance the theory that this matter has its origin in interstellar space and predates the birth of the Solar System.
The ESA's Rosetta mission, which ended in September 2016, found that organic matter made up 40% (by mass) of the nucleus of comet 67P Churyumov-Gerasimenko, a.k.a. Chury. Organic compounds, combining carbon, hydrogen, nitrogen, and oxygen, are building blocks of life on Earth. Yet, according to Jean-Loup Bertaux and Rosine Lallement - from Laboratoire Atmosphères, Milieux, Observations Spatiales (CNRS / UPMC / Université de Versailles Saint-Quentin-en-Yvelines) and the Galaxies, Étoiles, Physique et Instrumentation department of the Paris Observatory (Observatoire de Paris / CNRS / Université Paris Diderot), respectively - these organic molecules were produced in interstellar space, well before the formation of the solar system. Bertaux and Lallement further assert that astronomers are already very familiar with the source of this matter.
For 70 years, scientists have known that analysis of stellar spectra indicates unknown absorptions, throughout interstellar space, at specific wavelengths called the diffuse interstellar bands (DIBs). DIBs are attributed to complex organic molecules that American astrophysicist Theodore Snow believes may constitute the largest known reservoir of organic matter in the universe. This interstellar organic material is usually found in the same proportions. However, very dense clouds of matter like presolar nebulae are exceptions. In the middle of these nebulae, where matter is even denser, DIB absorptions plateau or even drop. This is because the organic molecules responsible for DIBs clump together there. The clumped matter absorbs less radiation than when it floated freely in space.
Such primitive nebulae end up contracting to form a solar system like our own, with planets . . . and comets. The Rosetta mission taught us that comet nuclei form by gentle accretion of grains progressively greater in size. First, small particles stick together to form larger grains. These in turn combine to form still larger chunks, and so on, until we have a comet nucleus a few kilometers wide.
Thus, the organic molecules that formerly populated the primitive nebulae--and that are responsible for DIBs - were probably not destroyed, but instead incorporated into the grains making up cometary nuclei. And there they have remained for 4.6 billion years. A sample-return mission would allow laboratory analysis of cometary organic material and finally reveal the identity of the mysterious interstellar matter underlying observed patterns in stellar spectra.
If cometary organic molecules were indeed produced in interstellar space - and if they played a role in the emergence of life on our planet, as scientists believe today - might they not also have seeded life on many other planets of our galaxy?

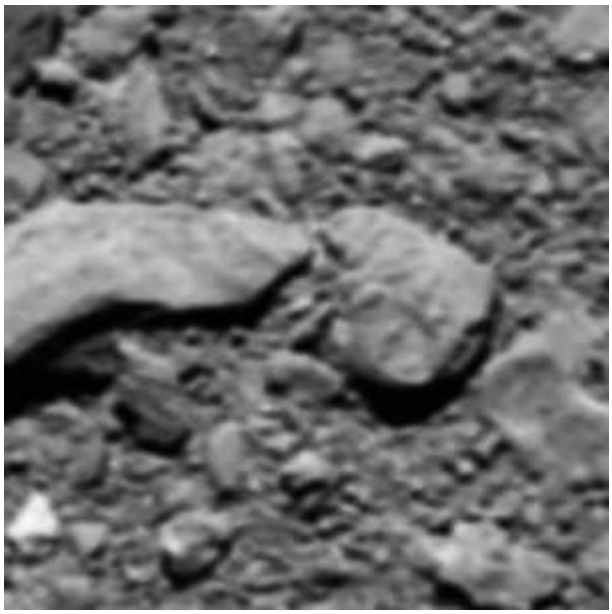
Rosetta Team Finds New, Final Image Hiding in the Data

Article written: 28 Sep , 2017
Updated: 28 Sep , 2017

by Nancy Atkinson

ESA scientists have found one additional image from the Rosetta spacecraft hiding in the telemetry. This new image was found in the last bits of data sent by Rosetta immediately before it shut down on the surface of Comet 67P/Churyumov–Gerasimenko last year.

The new image shows a close-up shot of the rocky, pebbly surface of the comet, and looks somewhat reminiscent of the views the Huygens lander took of the surface of Saturn's moon Titan.



A final image from Rosetta, shortly before it made a controlled impact onto Comet 67P/Churyumov–Gerasimenko on 30 September 2016. Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA.

Planetary astronomer Andy Rivkin noted on Twitter that for size context, he estimates the block just right of center looks to be about the size of a hat. That's a fun comparison to have (not to mention thinking about hats on Comet 67P!)

The picture has a scale of 2 mm/pixel and measures about 1 m across. It's a really 'close' close-up of Comet 67P.

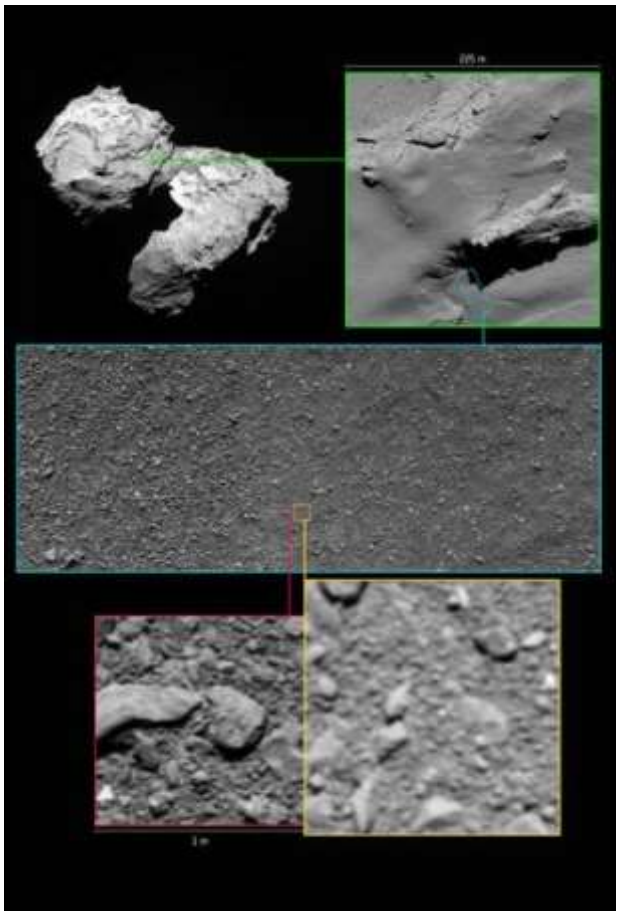
"The last complete image transmitted from Rosetta was the final one that we saw arriving back on Earth in one piece moments before the touchdown at Sais," said Holger Sierks, principal investigator for the OSIRIS camera at the Max Planck Institute for Solar System Research in Göttingen, Germany. "Later, we found a few telemetry packets on our server and thought, wow, that could be another image."

The team explains that the image data were put into telemetry 'packets' aboard Rosetta before they were transmitted to Earth, and the final images were split into six packets. However, for the very last image, the transmission was interrupted after only three full packets. The incomplete data was not recognized as an image by the automatic processing software, but later, the engineers in Göttingen could make sense of these data fragments to reconstruct the image.

You'll notice it is rather blurry. The OSIRIS camera team says this image only has about 53% of the full data and "therefore represents an image with an effective compression ratio of 1:38 compared to the anticipated compression ratio of 1:20, meaning some of the finer detail was lost."

That is, it gets a lot blurrier as you zoom in compared with a full-quality image. They compared it to compressing an image to send via email, versus an uncompressed version that you would print out and hang on your wall.

Rosetta's final resting spot is in a region of active pits in the Ma'at region on the two-lobed, duck-shaped comet.



A montage of the last few images from Rosetta, including the new image, with context of where the features on the last images are located. Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

Launched in 2004, Rosetta traveled nearly 8 billion kilometers and its journey included three Earth flybys and one at Mars, and two asteroid encounters. It arrived at the comet in August 2014 after being in hibernation for 31 months.

After becoming the first spacecraft to orbit a comet, it deployed the Philae lander in November 2014. Philae sent back data for a few days before succumbing to a power loss after it unfortunately landed in a crevice and its solar panels couldn't receive sunlight.

But Rosetta showed us unprecedented views of Comet 67P and monitored the comet's evolution as it made its closest approach and then moved away from the Sun. However, Rosetta and the comet moved too far away from the Sun for the spacecraft to receive enough power to continue operations, so the mission plan was to set the spacecraft down on the comet's surface.

And scientists have continued to sift through the data, and this new image was found. Who knows what else they'll find, hiding the data?

LIGO and Virgo Observatories Detect Black Holes Colliding

Article written: 28 Sep , 2017

by Matt Williams

On February 11th, 2016, scientists at the Laser Interferometer Gravitational-wave Observatory (LIGO) announced the first detection of gravitational waves. This development, which confirmed a prediction made by Einstein's Theory of General Relativity a century ago, has opened up new avenues of research for cosmologists and astrophysicists. Since that time, more detections have been made, all of which were said to be the result of black holes merging.

The latest detection took place on August 14th, 2017, when three observatories – the Advanced LIGO and the Advanced Virgo detectors – simultaneously detected the gravitational waves created by merging black holes. This was the first time that gravitational waves were detected by three different facilities from around the world, thus ushering in a new era of globally-networked research into this cosmic phenomena.

The study which detailed these observations was recently published online by the LIGO Scientific Collaboration and the Virgo Collaboration. Titled "GW170814 : A Three-Detector Observation of Gravitational Waves from a Binary Black Hole Coalescence", this study has also been accepted for publication in the scientific journal *Physical Review Letters*.

Aerial view of the Virgo Observatory. Credit: The Virgo collaboration/CCO 1.0

The event, designated as GW170814, was observed at 10:30:43 UTC (06:30:43 EDT; 03:30:43 PDT) on August 14th, 2017. The event was detected by the National Science Foundation's two LIGO detectors (located in Livingston, Louisiana, and Hanford, Washington) and the Virgo detector located near Pisa, Italy – which is maintained by the National Center for Scientific Research (CNRS) and the National Institute for Nuclear Physics (INFN).

Though not the first instance of gravitational waves being detected, this was the first time that an event was detected by three observatories simultaneously. As France Córdova, the director of the NSF, said in a recent LIGO press release:

"Little more than a year and a half ago, NSF announced that its Laser Interferometer Gravitational Wave Observatory had made the first-ever detection of gravitational waves, which resulted from the collision of two black holes in a galaxy a billion light-years away. Today, we are delighted to announce the first discovery made in partnership between the Virgo gravitational-wave observatory and the LIGO Scientific Collaboration, the first time a gravitational wave detection was observed by these observatories, located thousands of miles apart. This is an exciting milestone in the growing international scientific effort to unlock the extraordinary mysteries of our universe."

Based on the waves detected, the LIGO Scientific Collaboration (LSC) and Virgo collaboration were able to determine the type of event, as well as the mass of the objects involved. According to their study, the event was triggered by the merger of two black holes – which were 31 and 25 Solar Masses, respectively. The event took place about 1.8 billion light years from Earth, and resulted in the formation of a spinning black hole with about 53 Solar Masses.

LIGO's two facilities, located in Livingston, Louisiana, and Hanford, Washington. Credit: ligo.caltech.edu

What this means is that about three Solar Masses were converted into gravitational-wave energy during the merger, which was then detected by LIGO and Virgo. While impressive on its own, this latest detection is merely a taste of what gravitational wave detectors like the LIGO and Virgo collaborations can do now that they have entered their advanced stages, and into cooperation with each other.

Both Advanced LIGO and Advanced Virgo are second-generation gravitational-wave detectors that have taken over from previous ones. The LIGO facilities, which were conceived, built, and are operated by Caltech and MIT, collected data unsuccessfully between 2002 and 2010. However, as of September of 2015, Advanced LIGO went online and began conducting two observing runs – O1 and O2.

Meanwhile, the original Virgo detector conducted observations between 2003 and October of 2011, once again without success. By February of 2017, the integration of the Advanced Virgo detector began, and the instruments went online by the following April. In 2007, Virgo and LIGO also partnered to share and jointly analyze the data recorded by their respective detectors.

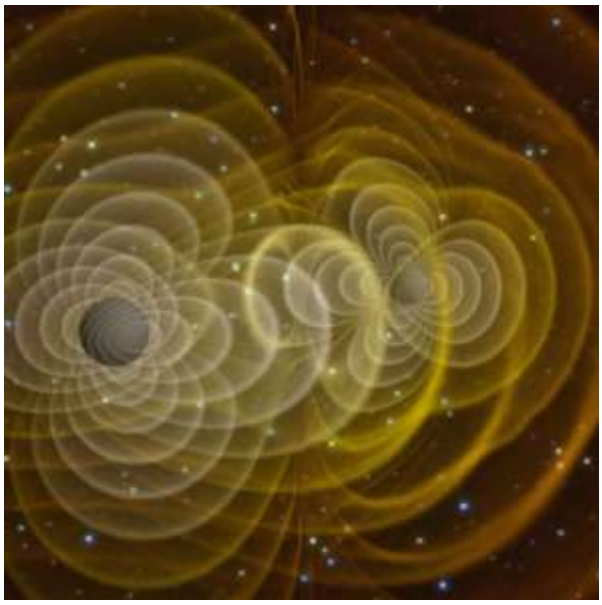
In August of 2017, the Virgo detector joined the O2 run, and the first-ever simultaneous detection took place on August 14th, with data being gathered by all three LIGO and Virgo instruments. As LSC spokesperson David Shoemaker – a researcher with the Massachusetts Institute of Technology (MIT) – indicated, this detection is just the first of many anticipated events.

Artist's impression of two merging black holes, which has been theorized to be a source of gravitational waves. Credit: Bohn, Throwe, Hébert, Henriksson, Bunandar, Taylor, Scheel/ SXS

"This is just the beginning of observations with the network enabled by Virgo and LIGO working together," he said. "With the next observing run planned for fall 2018, we can expect such detections weekly or even more often."

Not only will this mean that scientists have a better shot of detecting future events, but they will also be able to pinpoint them with far greater accuracy. In fact, the transition from a two- to a three-detector network is expected to increase the likelihood of pinpointing the source of GW170814 by a factory of 20. The sky region for GW170814 is just 60 square degrees – more than 10 times smaller than with data from LIGO's interferometers alone.

In addition, the accuracy with which the distance to the source is measured has also benefited from this partnership. As Laura Cadonati, a Georgia Tech professor and the deputy spokesperson of the LSC, explained:
"This increased precision will allow the entire astrophysical community to eventually make even more exciting discoveries, including multi-messenger observations. A smaller search area enables follow-up observations with telescopes and satellites for cosmic events that produce gravitational waves and emissions of light, such as the collision of neutron stars."



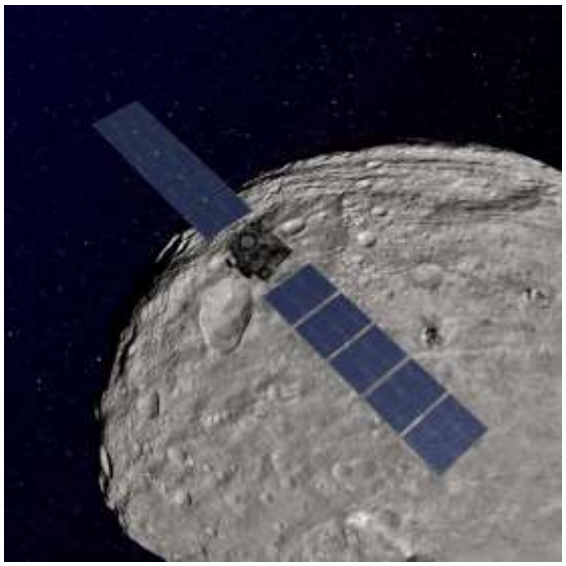
Artist's impression of gravitational waves. Credit: NASA
In the end, bringing more detectors into the gravitational-wave network will also allow for more detailed test's of Einstein's theory of General Relativity. Caltech's David H. Reitze, the executive director of the LIGO Laboratory, also praised the new partnership and what it will allow for.
"With this first joint detection by the Advanced LIGO and Virgo detectors, we have taken one step further into the gravitational-wave cosmos," he said. "Virgo brings a powerful new capability to detect and better locate gravitational-wave sources, one that will undoubtedly lead to exciting and unanticipated results in the future."
The study of gravitational waves is a testament to the growing capability of the world's science teams and the science of interferometry. For decades, the existence of gravitational waves was merely a theory; and by the turn of the century, all attempts to detect them had yielded nothing. But in just the past eighteen months, multiple detections have been made, and dozens more are expected in the coming years.
What's more, thanks to the new global network and the improved instruments and methods, these events are sure to tell us volumes about our Universe and the physics that govern it.

Dawn Probe Finds Evidence of Subsurface Ice on Vesta

Article written: 20 Sep , 2017
Updated: 20 Sep , 2017

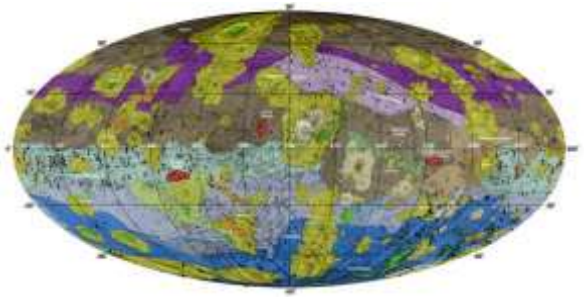
by Matt Williams
In 2011, NASA's *Dawn* spacecraft established orbit around the large asteroid (aka. planetoid) known as Vesta. Over the course of the next 14 months, the probe conducted detailed studies of Vesta's surface with its suite of scientific instruments. These findings revealed much about the planetoid's history, its surface features, and its structure – which is believed to be differentiated, like the rocky planets.

In addition, the probe collected vital information on Vesta's ice content. After spending the past three years sifting through the probe's data, a team of scientists has produced a new study that indicates the possibility of subsurface ice. These findings could have implications when it comes to our understanding of how Solar bodies formed and how water was historically transported throughout the Solar System.
Their study, titled "Orbital Bistatic Radar Observations of Asteroid Vesta by the Dawn Mission", was recently published in the scientific journal *Nature Communications.* Led by Elizabeth Palmer, a graduate student from Western Michigan University, the team relied on data obtained by the communications antenna aboard the Dawn spacecraft to conduct the first orbital bistatic radar (BSR) observation of Vesta.



Artist rendition of Dawn spacecraft orbiting Vesta. Credit: NASA/JPL-Caltech
This antenna – the High-Gain telecommunications Antenna (HGA) – transmitted X-band radio waves during its orbit of Vesta to the Deep Space Network (DSN) antenna on Earth. During the majority of the mission, Dawn's orbit was designed to ensure that the HGA was in the line of sight with ground stations on Earth. However, during occultations – when the probe passed behind Vesta for 5 to 33 minutes at a time – the probe was out of this line of sight.
Nevertheless, the antenna was continuously transmitting telemetry data, which caused the HGA-transmitted radar waves to be reflected off of Vesta's surface. This technique, known as bistatic radar (BSR) observations has been used in the past to study the surfaces of terrestrial bodies like Mercury, Venus, the Moon, Mars, Saturn's moon Titan, and the comet 67P/CG.
But as Palmer explained, using this technique to study a body like Vesta was a first for astronomers:
"This is the first time that a bistatic radar experiment was conducted in orbit around a small body, so this brought several unique challenges compared to the same experiment being done at large bodies like the Moon or Mars. For example, because the gravity field around Vesta is much weaker than Mars, the Dawn spacecraft does not have to orbit at a very high speed to maintain its distance from the surface. The orbital speed of the spacecraft becomes important, though, because the faster the orbit, the more the frequency of the 'surface echo' gets changed (Doppler shifted) compared to the frequency of the 'direct signal' (which is the unimpeded radio signal that travels directly from Dawn's HGA to Earth's Deep Space Network antennas without grazing Vesta's surface). Researchers can tell the difference between a 'surface echo' and the 'direct signal' by their difference in frequency—so with Dawn's slower orbital speed around Vesta, this frequency difference was very small, and required more time for us to process the BSR data and isolate the 'surface

echoes' to measure their strength."



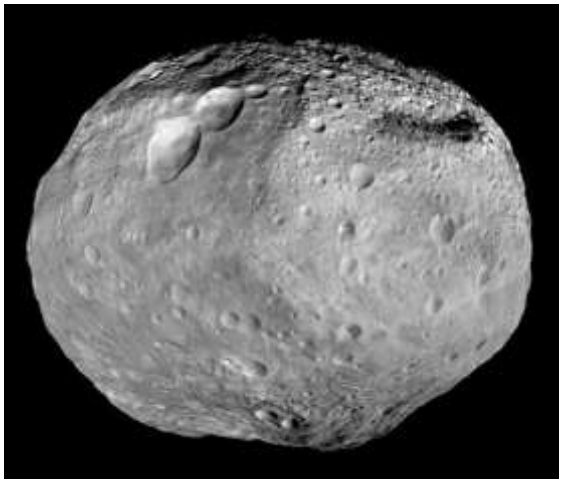
This high-res geological map of Vesta is derived from Dawn spacecraft data. Brown colors represent the oldest, most heavily cratered surface. Credit: NASA/JPL-Caltech/ ASU

By studying the reflected BSR waves, Palmer and her team were able to gain valuable information from Vesta's surface. From this, they observed significant differences in surface radar reflectivity. But unlike the Moon, these variations in surface roughness could not be explained by cratering alone and was likely due to the existence of ground-ice. As Palmer explained:

"We found that this was the result of differences in the roughness of the surface at the scale of a few inches. Stronger surface echoes indicate smoother surfaces, while weaker surface echoes have bounced off of rougher surfaces. When we compared our surface roughness map of Vesta with a map of subsurface hydrogen concentrations—which was measured by Dawn scientists using the Gamma Ray and Neutron Detector (GRaND) on the spacecraft—we found that extensive smoother areas overlapped areas that also had heightened hydrogen concentrations!"

In the end, Palmer and her colleagues concluded that the presence of buried ice (past and/or present) on Vesta was responsible for parts of the surface being smoother than others. Basically, whenever an impact happened on the surface, it transferred a great deal of energy to the subsurface. If buried ice was present there, it would be melted by the impact event, flow to the surface along impact-generated fractures, and then freeze in place.

Much in the same way that moon's like Europa, Ganymede and Titania experience surface renewal because of the way cryovolcanism causes liquid water to reach the surface (where it refreezes), the presence of subsurface ice would cause parts of Vesta' surface to be smoothed out over time. This would ultimately lead to the kinds of uneven terrain that Palmer and her colleagues witnessed.



The planetoid Vesta, which was studied by the Dawn probe between July 2011 and September 2012. Credit: NASA

This theory is supported by the large concentrations of hydrogen that were detected over smoother terrains that measure hundreds of square kilometers. It is also consistent with geomorphological evidence obtained from the Dawn Framing Camera images, which showed signs of of transient water flow over Vesta's surface. This study also contradicted some previously-held assumptions about Vesta.

As Palmer noted, this could also have implications as far as our understanding of the history and evolution of the Solar System is concerned:

"Asteroid Vesta was expected to have depleted any water content long ago through global melting, differentiation, and extensive regolith gardening by impacts from smaller bodies. However, our findings support the idea that buried ice may have existed on Vesta, which is an exciting prospect since Vesta is a protoplanet that represents an early stage in the formation of a planet. The more we learn about where water-ice exists throughout the Solar System, the better we will understand how water was delivered to Earth, and how much was intrinsic to Earth's interior during the early stages of its formation."

This work was sponsored by NASA's Planetary Geology and Geophysics program, a JPL-based effort that focuses on fostering the research of terrestrial-like planets and major satellites in the Solar System. The work was also conducted with the assistance of the USC's Viterbi School of Engineering as part of an ongoing effort to improve radar and microwave imaging to locate subsurface sources of water on planets and other bodies.

Loss of Signal: Cassini Spacecraft Plunges Into Saturn

Article written: 15 Sep , 2017
Updated: 15 Sep , 2017

by Nancy Atkinson

Until the very end, Cassini displayed just how robust and enduring this spacecraft has been throughout its entire 20 years in space and its 13-year mission at Saturn. As Cassini plummeted through the ringed-planet's atmosphere, its thrusters fought the good fight to keep the antenna pointed at Earth for as long as possible, sending as much of the last drops of science data as it could.

Cassini endured about 40 seconds longer than expected before loss of signal was called at 11:55:46 UTC

"I hope you're all deeply proud of this accomplishment," said Cassini Project Manager Earl Maize in JPL's Mission Control Center after Cassini's signal was lost. "This has been an incredible mission, and incredible spacecraft and an incredible team. I'm going to call this the end of mission. Project Manager off the net."

Of course, the actual demise of Cassini took place about an hour and 23 minutes before, as it took that long for the signal to travel the 1.5 billion km distance from Saturn to Earth.

"This is a bittersweet moment for all of us," said JPL Director Mike Watkins, "but I think it is more sweet than bitter because Cassini has been such an incredible mission. This is a great time to celebrate the hard work and dedication of those who have worked on this mission."

Watkins added that almost everything we know about Saturn comes from the Cassini mission. "It made discoveries so compelling that we have to back," he said. "We will go back and fly through the geysers of Encleadus and we'll go back to explore Titan… These are incredibly compelling targets."

Cassini program manager at JPL, Earl Maize, left, and spacecraft operations team manager for the Cassini mission at Saturn, Julie Webster, right, embrace after the Cassini spacecraft plunged into Saturn, Friday, Sept. 15, 2017 at NASA's Jet Propulsion Laboratory in Pasadena, California. Photo Credit: (NASA/Joel Kowsky)

Cassini launched on Oct. 15, 1997, and arrived at Saturn's in 2004. It studied Saturn's rings and sent back postcards almost every day of its journeys around the Saturn system, pictures of complex moons, the intriguing rings and the giant gas planet.

It revealed the moon Enceladus as one of the most geothermally active places in our solar system, showing it to be one of the prime targets in the search for life beyond Earth.

Saturn's active, ocean-bearing moon Enceladus sinks behind the giant planet in a farewell portrait from NASA's Cassini spacecraft. Credits: NASA/JPL-Caltech/Space Science Institute

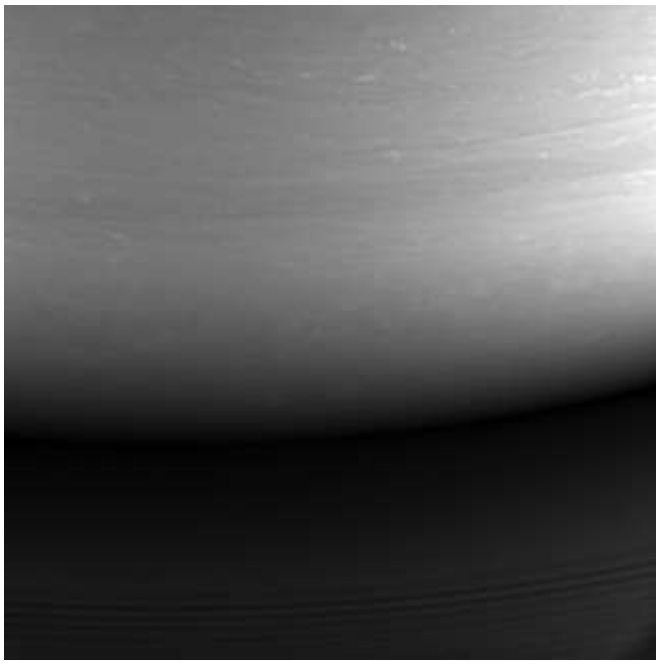
Also, piggybacking along was the Huygens probe to study Saturn's largest moon, Titan. This landing in 2005 was the first spacecraft to land in the outer solar system.

During its final plunge, Cassini's instruments captured data on Saturn's atmosphere, sending a strong signal throughout. As planned, data from eight of Cassini's science instruments will be providing new insights about Saturn, including hints about the planet's formation and evolution, and processes occurring in its atmosphere.

This death plunge ensures Saturn's moons will remain pristine for future exploration.

Over 260 scientists from 17 countries and hundreds of engineers worked with Cassini throughout the entire mission. During Cassini's final days, mission team members from all around the world gathered at JPL to celebrate the achievements of this historic mission.

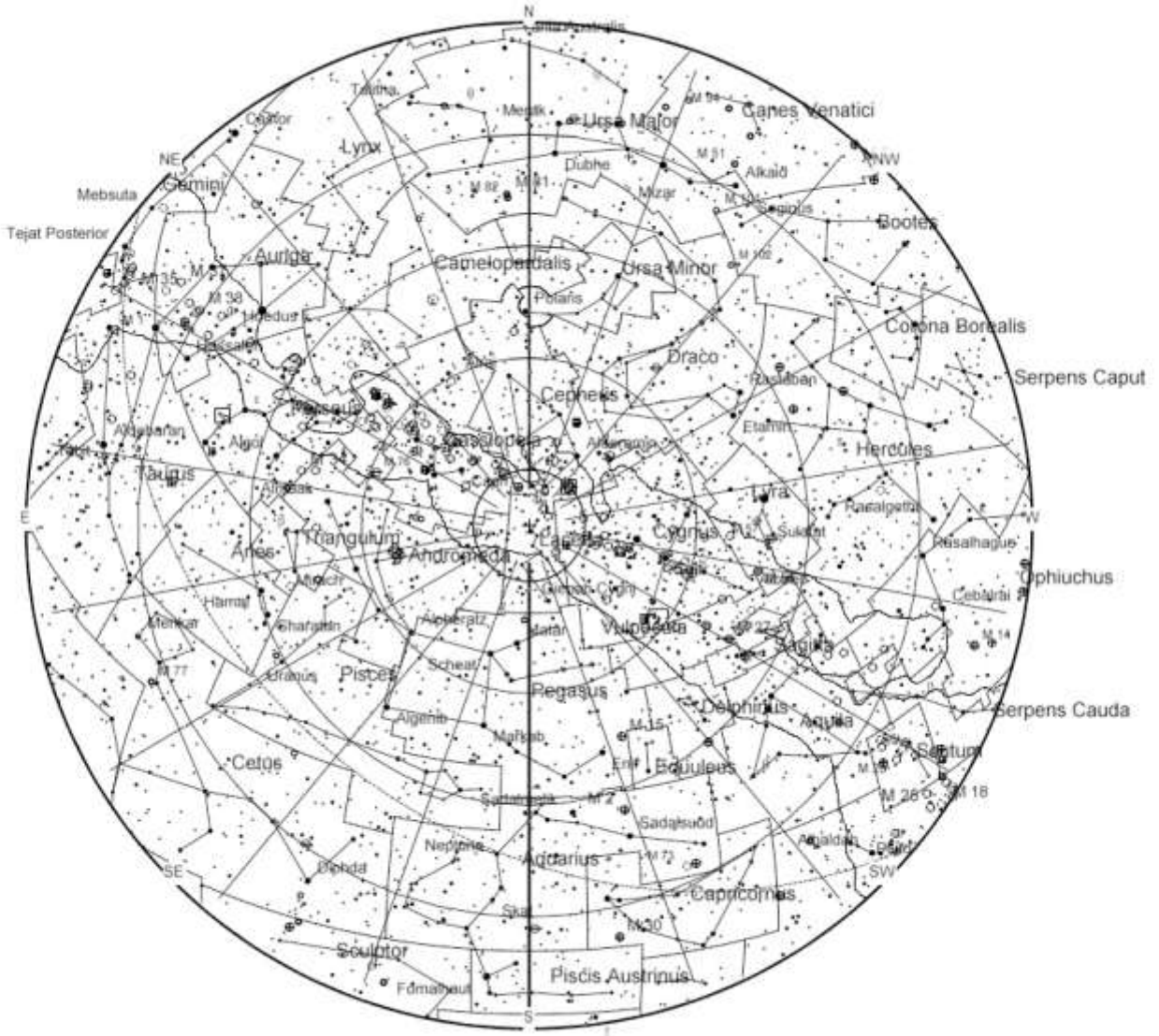
Here is the last picture taken by Cassini's cameras, showing the place where Cassini likely met its demise:



This monochrome view is the last image taken by the imaging cameras on NASA's Cassini spacecraft. It looks toward the planet's night side, lit by reflected light from the rings, and shows the location at which the spacecraft would enter the planet's atmosphere hours later. Credit: NASA/JPL-Caltech/ Space Science Institute

If you can't get enough of Cassini, there will be more information coming about this final data, and of course, you can go look at all the images it has sent back here. Also, NASA has provided an ebook for download that includes information and images from the mission.

WHATS UP, October 2017



October 5 - **Full Moon.** Moon will be directly opposite the Earth from the Sun and will be fully illuminated as seen from Earth. This phase occurs at 18:40 UTC. This full moon was known by early Native American tribes as the Full Hunters Moon because at this time of year the leaves are falling and the game is fat and ready to hunt. This moon has also been known as the Travel Moon and the Blood Moon. This moon is also known as the Harvest Moon. The Harvest Moon is the full moon that occurs closest to the September equinox each year.

October 8 - **Draconids Meteor Shower.** The Draconids is a minor meteor shower producing only about 10 meteors per hour. It is produced by dust grains left behind by comet 21P Giacobini-Zinner, which was first discovered in 1900. The Draconids is an unusual shower in that the best viewing is in the early evening instead of early morning like most other showers. The shower runs annually from October 6-10 and peaks this year on the the night of the 8th. Unfortunately, the nearly full moon will block all but the brightest meteors this year. If you are extremely patient, you may be able to catch a few good ones. Best viewing will be in the early evening from a dark location far away from city lights. Meteors will radiate from the constellation Draco, but can appear anywhere in the sky.

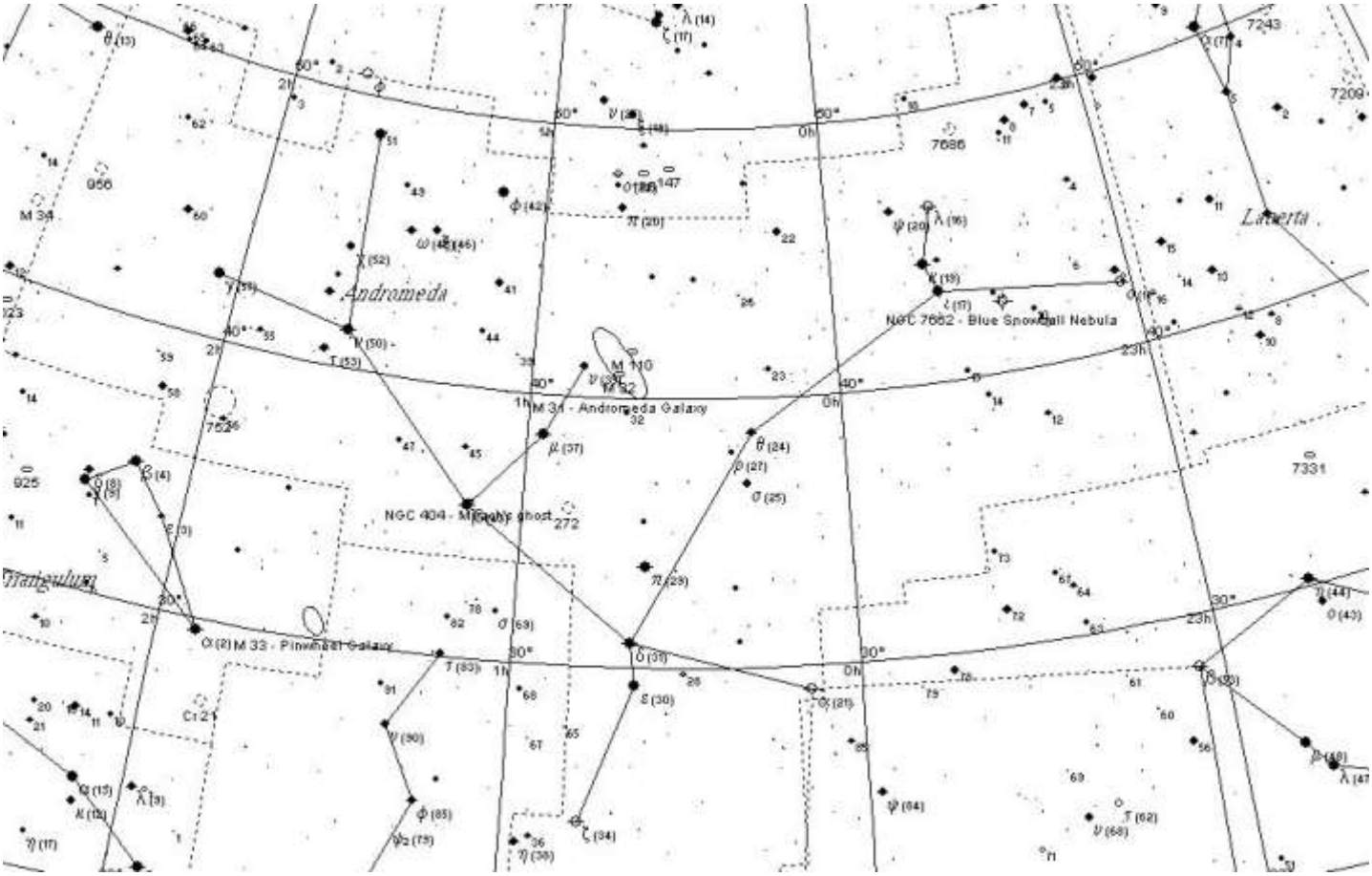
October 19 - **New Moon.** The Moon will located on the same side of the Earth as the Sun and will not be visible in the night sky. This phase occurs at 19:12 UTC. This is the best time of the month to observe faint objects such as galaxies and star clusters because there is no moonlight to interfere.

October 19 - **Uranus at Opposition.** The blue-green planet will be at its closest approach to Earth and its face will be fully illuminated by the Sun. It will be brighter than any other time of the year and will be visible all night long. This is the best time to view Uranus. Due to its distance, it will only appear as a tiny blue-green dot in all but the most powerful telescopes.

October 21, 22 - **Orionids Meteor Shower.** The Orionids is an average shower producing up to 20 meteors per hour at its peak. It is produced by dust grains left behind by comet Halley, which has been known and observed since ancient times. The shower runs annually from October 2 to November 7. It peaks this year on the night of October 21 and the morning of October 22. The crescent moon will set early in the evening leaving dark skies for what should be a good show. Best viewing will be from a dark location after midnight. Meteors will radiate from the constellation Orion, but can appear anywhere in the sky.

November 4 - **Full Moon.** The Moon will be located on the opposite side of the Earth as the Sun and its face will be will be fully illuminated. This phase occurs at 05:23 UTC. This full moon was known by early Native American tribes as the Full Beaver Moon because this was the time of year to set the beaver traps before the swamps and rivers froze. It has also been known as the Frosty Moon and the Hunter's Moon

CONSTELLATIONS OF THE MONTH: ANDROMEDA



The Andromeda Constellation

12 Feb , 2016 by Tammy Plotner

In the 2nd century CE, Greek-Egyptian astronomer Claudius Ptolemaeus (aka. Ptolemy) compiled a list of the then-known 48 constellations. His treatise, known as the *Almagest*, would be used by medieval European and Islamic scholars for over a thousand years to come. Thanks to the development of modern telescopes and astronomy, this list was amended by the early 20th century to include the 88 constellation that are recognized by the International Astronomical Union (IAU) today.

Of these, Andromeda is one of the oldest and most widely recognized. Located north of the celestial equator, this constellation is part of the family of Perseus, Cassiopeia, and Cepheus. Like many constellation that have come down to us from classical antiquity, the Andromeda constellation has deep roots, which may go all the way back to ancient Babylonian astronomy.

Name and Meaning:

Derived from Greek mythology, Andromeda was the daughter of Cassiopeia and Cepheus – the king and queen of ancient Aethopia (modern day Ethopia). Unfortunately, her mother was so vain that she thought herself to be more beautiful than the daughters of Nereus, a god of the sea, which angered the sea god Poseidon. To punish the mother, Andromeda was chained to a rock of the coast as a sacrifice for a sea monster, Cetus (another southern constellation).

Andromeda escaped this fate, thanks to the intervention of Perseus – the greatest Greek hero and slayer of monsters before Heracles. For rescuing her, he demanded Andromeda become his wife, which her parents happily consented to. The two married, had nine children together, and founded the kingdom of Mycenae and its Persideae dynasty. After Andromeda's death, Athena placed her in the sky as a constellation, to honor her.

The Andromeda constellation, from Uranographia *by Johannes Hevelius (1690). Credit: contentdm.lindahall.org*

History of Observation:

The celestial mapping (aka. uranography) of Andromeda comes to us from the Greek tradition, though a female figure in Andromeda's location had appeared earlier in Babylonian astronomy. The stars that make up Pisces and the middle portion of modern Andromeda formed a constellation representing the fertility goddess "Anunitum" (or the "Lady of the Heavens"), who was also the patron goddess of the city of Akkad.

Andromeda is also associated with the Mesopotamian creation story of Tiamat, the goddess of Chaos. According to the legend, Tiamat bore many demons for her husband, Apsu, the god of freshwater. However, she eventually decided to

destroy them as part of a war between the older and youner gods. Eventually, Marduk – a younger-generation god and the patron deity of the city of Babylon – killed her. He then used her body to create the constellations as markers of time for humans.

In Latin, Andromeda was known as the *Mulier Catenata* ("chained woman"), and as the *al-Mar'at al Musalsalah* in Arabic. Other names include Persea ("Perseus' wife") or Cepheis ("Cepheus' daughter"), all of which allude to the constellation's place in classical mythology. Several of the neighboring constellations (Perseus, Cassiopeia, Cetus, and Cepheus) also represent characters in the Perseus myth.

In traditional Chinese astronomy, nine stars from Andromeda and seven stars from Pisces formed an elliptical constellation called "Legs". This constellation either represented the foot of a walking person or a wild boar. Gamma Andromedae and its neighbors were called "Teen Ta Tseang Keun" ("heaven's great general"), representing honor in astrology and a great general in mythology.

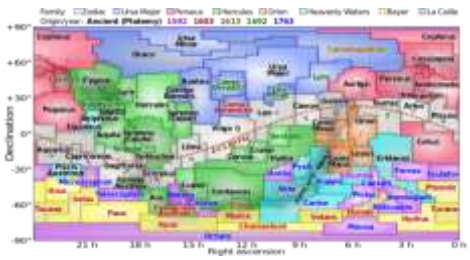
A modern impression of a Neo-Assyrian cylinder seal depicting the forces of chaos led by Tiamat being defeated by Marduk. Credit: Dominique Collon/Wikipedia Commons

Alpha Andromedae and Gamma Pegasi together were designated as the "Wall", representing the eastern wall of the imperial palace and/or the emperor's personal library. The northern swath of Andromeda was also seen as a representation of a horse stable (*tianjiu*, or "stable on sky") and the far western part, along with most of the constellation Lacerta, was known as "Tengshe" – a flying snake.

Hindu legends surrounding Andromeda are similar to the Greek myths, with ancient Sanskrit texts depicting Antarmada chained to a rock. This, along with the fact that the names sound quite similar, has led many scholars to conclude that the astronomical systems are linked.

In the Marshall Islands, the constellations of Andromeda, Cassiopeia, Triangulum, and Aries are incorporated into a single constellation representing a porpoise. Andromeda's bright stars are mostly in the body of the porpoise, while Cassiopeia represents its tail and Aries its head.

Andromeda was one of the original 48 constellations formulated by Ptolemy in his 2nd-century work, *Almagest.* Arab astronomers made use of Ptolemy's constellations, but included a second constellation representing a fish at Andromeda's feet. Since the time of Ptolemy, Andromeda has remained a constellation and is officially recognized by the International Astronomical Union.



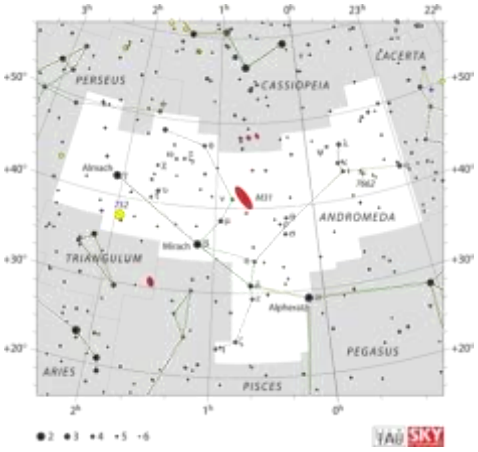
The modern constellations. color-coded by family, with a dotted line denoting the ecliptic. Credit: NASA/Scientific Visualization Studio

But like all modern constellations, it is now defined as a specific region of the sky that includes both Ptolemy's pattern and the surrounding stars. The official boundaries of Andromeda were defined in 1930 by Eugène Delporte. Its right ascension is between 22 h 57.5 m and 2 h 39.3 m, and its declination is between 53.19° and 21.68° in the equatorial coordinate system.

Notable Features:

Andromeda's primary (or Alpha star) is Sirrah (or Alpheratz), a binary star with a visual magnitude of 2.1 and a luminosity of 96. It is the brightest star in the constellation and is located 97 light-years from Earth. In western mythology, it represents Andromeda's head. However, its traditional Arabic meaning – which comes from the phrase *surrat al-faras* – roughly translates to "navel of the steed".

Beta Andromedae is another major feature, a red-hued giant star located 198 light years away. It's name comes from the Arabic phrase al-Maraqq, which means "the loins" or "the loincloth", which is taken from Ptolemy's *Almagest*. To medieval Arab astronomers, Beta Andromedae was actually considered to be part of al-Hut, a constellation representing a larger fish than Pisces at Andromeda's feet.



The Andromeda constellation, taken from the IAUs constellation chart. Credit: IAU/skyandtelescope.com/Roger Sinnott & Rick Fienberg

Gamma Andromedae, which also goes by its traditional Arabic name (Almach) is an orange-hued giant star found at the southern tip of the constellation. Located 358 light-years away, Almach is named for the Arabic phrase *?Anaq al-Ard*, which means "the earth-kid" – a reference to an animal that aids a lion in finding prey. Almach is a multiple star with a yellow primary and a blue-green secondary – which is itself a double star.

According to British astronomer William Herschel, who published his observations of the star as past of "*Continuation of an Account of the Changes that have happened in the relative situation of Double Stars*"(1804): "[the] striking difference in the colour of the two stars, suggests the idea of a sun and its planet, to which the contrast of their unequal size contributes not a little."

Andromeda is also home to a number of Deep Sky Objects. Since Andromeda lies well away from the galactic plane, it does not contain any of the open clusters or bright nebulae of the Milky Way. However, owing to its distance in the sky from the band of obscuring dust, gas, and abundant stars of galaxy, Andromeda's borders contain many other visible distant galaxies.

Color view of M31 (The Andromeda Galaxy). Credit and copyright: Terry Hancock.

The most famous of these is the Andromeda Galaxy (aka. M31, NGC 224), which takes its name from this constellation. Located at an estimated 2.2 million light-years from Earth, this galaxy is one of the most distant objects that is visible to the naked eye. It is also the largest neighboring galaxy to the Milky Way and the largest member of the Local Group of galaxies.

Like the Milky Way, the Andromeda galaxy is barred spiral galaxy, but is over the twice the size (approx. 200,000 light -years in diameter). Despite being visible to the naked eye, it was not recorded until 964 CE by the Arab astronomer al -Sufi. In his *Book of Fixed Stars*, he recorded it as being a "little cloud", and later astronomers believed it to be a distant nebula.

It was not until the 20th century that M31 was recognized for being a neighboring galaxy. And since then, astronomers have also realized that it is one of the few objects in our universe that is blueshifted (i.e. moving towards us). At its current rate of approach – 110 kilometres per second (68 mi/s) – it will collide with the Milky Way Galaxy in about 4 billion years.

The Andromeda Galaxy has two main companions, the faint elliptical galaxies of M32 and M110 (also known as NGC 221 and NGC 205, respectively). Located in close proximity to M31, M32 lies 1° northwest of the constellation's core, while M110 is located o.5° south. M32 was discovered in 1749 by French astronomer Guillaume Le Gentil and has since been found to lie closer to Earth than the Andromeda Galaxy itself. M110 is far fainter than M31 or M32, and is classified as either a dwarf spheroidal galaxy or simply a generic elliptical galaxy.

The Andromeda Galaxy has 15 satellite galaxies in total, nine of these lie in a plane, which has caused astronomers to infer that they have a common origin. Andromeda also has two open star clusters associated with it, the most famous of which is the open cluster NGC 752 (Caldwell 28). NGC 752 features approximately 12 bright stars, although more than 60 stars are visible at low magnifications in a telescope. The other is NGC 7686, which has a similar magnitude (5.6) and contains approximately 20 stars in a diameter of 15 arcminutes, making it a tighter cluster than NGC 752.

There is one prominent planetary nebula in Andromeda: NGC 7662 (Caldwell 22). Also known as the "Blue Snowball Nebula", NGC 7662 lies approximately three degrees southwest of Iota Andromedae and is about 4,000 light-years from Earth. It earned its popular name because it appears as a faint, round, blue-green object in a telescope, with an overall magnitude of 9.2.

The Blue Snowball Nebula, as imaged by NASA's Chandra X-ray Observatory as part the first systematic survey of such objects in the solar neighborhood. Credit: chandra.harvard.edu

Andromeda also has a meteor shower associated with it, known as the Adromedids, which appear every November. his meteor shower peaks in the mid-to-late area of the month, but has a low peak rate of fewer than two meteors an hour. These meteors sometimes appear as red fireballs with trails, and have often associated with Biela's Comet, a comet destroyed in the 19th century that some believe is responsible for the meteoroid stream.

Andromedid meteors are known for being very slow and the shower itself is considered to be diffuse, as meteors can be seen coming from nearby constellations as well as from Andromeda itself. Its radiant is near Cassiopeia, and Occasionally this shower is known spectacular – though the fall rate is usually about 20 per hour.

Finding Andromeda:

The constellation of Andromeda is best known for the Andromeda Galaxy, M31, one of the most famous objects in the sky, which can most easily be found (it can be seen even with the unaided eye once you get away from a light polluted city) and gives an outstanding view in binoculars and small telescopes.

As it is the nearest spiral galaxy to to our Milky Way, it has given scientists ample opportunity to study spiral galaxy structure and evolution. Larger telescopes can easily see two satellite galaxies of M31 as well, elliptical galaxies M32 (half a degree south) and M110 (located one degree northwest). Both are well within range of 4″ telescopes.

For binoculars, the stars of the open star cluster NGC 752 is also an easy target in Andromeda. Containing about 100 member stars scattered over a large area and ranging between magnitudes between 9 and 10, NGC 752 is located near star 56 Andromeda. Other interesting and easy telescopic targets include planetary nebula NGC 7662 and colorful binary star, Gamma Andromeda – Almach.

We have written many interesting articles about on the Andromeda Constellation and its objects. For example, here is What Are The Constellations, Messier 31, The Andromeda Galaxy, and Why is Andromeda Coming Towards Us?

For more information, check out and the Students for the Exploration and Development of Space page on the Andromeda constellation.

ISS PASSES For October 2017 From Heavens Above website maintained by Chris Peat

Date	Brightness	Start	Highest point		End					
	(mag)	Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
03 Oct	-3.9	19:45:15	10°	WSW	19:48:32	81°	S	19:50:48	19°	E
03 Oct	-1.8	21:21:46	10°	W	21:23:27	28°	W	21:23:27	28°	W
04 Oct	-3.9	20:29:37	10°	W	20:32:54	85°	N	20:33:17	68°	E
05 Oct	-3.8	19:37:26	10°	W	19:40:44	86°	N	19:43:05	18°	E
05 Oct	-1.9	21:13:57	10°	W	21:15:44	29°	W	21:15:44	29°	W
06 Oct	-3.9	20:21:46	10°	W	20:25:04	84°	SSW	20:25:31	63°	ESE
07 Oct	-3.8	19:29:35	10°	W	19:32:52	87°	N	19:35:19	17°	E
07 Oct	-1.9	21:06:06	10°	W	21:07:58	28°	WSW	21:07:58	28°	WSW
08 Oct	-3.6	20:13:52	10°	W	20:17:08	62°	SSW	20:17:47	48°	SE
09 Oct	-3.8	19:21:40	10°	W	19:24:57	79°	SSW	19:27:38	15°	ESE
09 Oct	-1.7	20:58:20	10°	W	21:00:17	23°	WSW	21:00:17	23°	WSW
10 Oct	-2.8	20:05:58	10°	W	20:09:05	39°	SSW	20:10:10	29°	SSE
11 Oct	-3.3	19:13:42	10°	W	19:16:56	55°	SSW	19:20:06	10°	ESE
11 Oct	-1.3	20:50:53	10°	WSW	20:52:46	15°	SW	20:52:46	15°	SW
12 Oct	-1.8	19:58:11	10°	W	20:00:53	23°	SSW	20:02:47	14°	SSE
13 Oct	-2.3	19:05:44	10°	W	19:08:46	34°	SSW	19:11:47	10°	SE
14 Oct	-1.0	19:50:53	10°	WSW	19:52:30	13°	SW	19:54:07	10°	SSW
15 Oct	-1.3	18:57:58	10°	W	19:00:27	20°	SW	19:02:57	10°	SSE
17 Oct	-0.6	18:51:00	10°	WSW	18:51:59	11°	SW	18:52:58	10°	SSW
31 Oct	-1.1	05:37:18	10°	S	05:39:33	17°	SE	05:41:48	10°	E
01 Nov	-0.8	04:46:21	10°	SSE	04:47:19	11°	SE	04:48:18	10°	ESE
01 Nov	-2.7	06:20:01	10°	SW	06:23:08	43°	SSE	06:26:17	10°	E
02 Nov	-2.1	05:28:09	12°	SSW	05:30:45	30°	SSE	05:33:40	10°	E
03 Nov	-1.6	04:38:12	20°	SSE	04:38:25	20°	SE	04:40:54	10°	E
03 Nov	-3.5	06:11:15	10°	WSW	06:14:29	67°	SSE	06:17:45	10°	E
04 Nov	-3.1	05:20:45	30°	SW	05:22:01	49°	SSE	05:25:11	10°	E
05 Nov	-1.8	04:30:32	27°	ESE	04:30:32	27°	ESE	04:32:35	10°	E
05 Nov	-3.8	06:03:11	15°	W	06:05:51	87°	SSE	06:09:07	10°	E
06 Nov	-3.8	05:12:53	61°	SW	05:13:18	72°	SSE	05:16:35	10°	E
07 Nov	-1.4	04:22:32	23°	E	04:22:32	23°	E	04:23:59	10°	E
07 Nov	-3.9	05:55:10	21°	W	05:57:12	85°	N	06:00:28	10°	E
08 Nov	-3.8	05:04:46	80°	E	05:04:46	80°	E	05:07:53	10°	E
09 Nov	-0.9	04:14:19	18°	E	04:14:19	18°	E	04:15:17	10°	E
09 Nov	-3.9	05:46:57	29°	W	05:48:29	89°	NNW	05:51:46	10°	E
10 Nov	-3.2	04:56:30	55°	E	04:56:30	55°	E	04:59:09	10°	E
10 Nov	-3.4	06:29:08	10°	W	06:32:17	55°	SSW	06:35:29	10°	ESE
11 Nov	-0.5	04:06:02	14°	E	04:06:02	14°	E	04:06:31	10°	E
11 Nov	-3.8	05:38:40	39°	W	05:39:43	73°	SSW	05:42:58	10°	ESE

END IMAGES, OBSERVING AND OUTREACH

THE MOON FROM2nd October

Last night's near full moon with the saturation tweaked to show the subtle colour variations in the surface colouration of the Moon. Normally the bright light reflection hides the subtle colours that exist, particularly in the seas areas.

The bluer hues of slightly newer material can be seen, and uneven base materials in the huge western Oceanus Procularium and Mare Imbriam.

Tycho's new ray system stands out in this image.

1/750th second, Nikon D7200 with Big Barlow x2 on Televue 127 refracting telescope.

Andy

Wiltshire Astronomical Society Observing Sessions 2017 – 2018		
Date	**Moon Phase**	**Observing Topic**
2017		
20th October	New Moon	Deep sky with targets such as M's 76, 15, 103 and the Double Cluster.
13th November		A spectacular conjunction of Venus and Jupiter will be visible in the morning sky. The two bright planets will be extremely close, appearing only 0.3 degrees apart.
24th November	Quarter moon sets 21:30	Lunar targets and some deep sky objects M's 36, 37, 38, Orion rising, Cassiopeia and Cepheus.
13th – 14th December		Geminids meteor shower
28th December	Christmas Session with Moon	Lunar targets and brighter deep sky objects
2018		
26th January	Waxing gibbous	Lunar targets and brighter deep sky objects
23rd February	Half Moon	Lunar targets and brighter deep sky objects
23rd March	Half moon	Lunar targets and brighter deep sky objects
20th April	Waxing Crescent	Deep sky objects in the Great Bear and Leo
18th May	Slim Crescent	Jupiter low in the south east, and the return of the Summer Triangle

OUTREACH ACTIVITIES

October