NWASNEWS

Volume24, Issue 5

January 2019

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

Belated Happy New Year

Due to the fall of the calendar, that horrible manmade constriction of time we had to delay our monthly meeting to next available day we could get the meeting hall, which is the 15th January. I hope this doesn't put off to many people to our meeting. Luckily it is only us we are upsetting with no speakers needed for our forum question and answers meeting for newbies and oldies like myself.

I always feel that if one person is bold enough to ask a question that has been troubling them then you can bet there are another 10 members who have the same issues. The forums then became an ideal 'drinks machine' conversation point where the committee, and in particular the speaker secretary can get a feel for the speaker and speaker topics that the members need to fill in the gaps of their knowledge. You have to appreciate how hard this can be in a society with practical and armchair astronomers , beginners and experienced, youngster and some way over the toppers, new comers and old lags of the society all mixing in the same room.

I hope we can get it right, well for most of the members, most of the time.

Another 'forum and voice' area we have had trouble keeping fresh and functional has been our web site. We needed someone who has regular attendance so we could keep the feel of the society going, the Facebook page is OK but a bit limiting when posting a lot of files and background details all the time. Sam Franklin stepped in and I hope I warned him enough about the potential issues I foresaw, and I expect these didn't cover all the problems that cropped up. But he is going to give us a presentation at the start of the meeting but I leave you with a big request. Please use it! Not just to see what one or two of the regular contributors are doing, but also to ask questions, post late 'private view sessions, viewing logs or your own astronomy cv's may help you connect with similar people to share the journey in our wonderful hobby.

Schools have become slightly more active in the curriculum and outreach areas, with year 1's doing simple Moon, Earth and Moon topics and year 5's covering space as a topic. Some of the requests for help may be later than we would like but I think we do a lot that is appreciated around the county.

I have quite a few commitmnets coming up with Dark Sky Wales in Luton taking 2 weeks in February, then I am going on a long self promised journey to northern Iceland to catch the Aurora which means I'll miss the March meeting (speaker is my DSW colleague Martin Griffiths), but if anyone can do the 4 page meeting newsletter I'll be grateful.

If anyone wants to come to Spain and the observatory there around April 26th to 29th then I will arrange something.

Happy New Year., Astrofest is coming and a Star Cound in February.

Big 32pp issue!

Clear Skies Andy

The Comet that almost wasn't.

Comet Wirtanen 46P was amazingly one of the 10 closest comet passes to the Earth in the past 120 years, but it is a very small comet, around 1km across so the surface activity was very low,

Here at nearly closest to the Earth on 18th December it was around 2 degrees West of the Pleiades, and a disappointing 8th magnitude. On this evening it was a mere 11.8 million km away.

Andy Burns

30seconds (bright Moon less than 30 degrees away) using 127mm refractor.

Wiltshire Society Page

Wiltshire Astronomical Society

Web site: www.wasnet.org.uk

Meetings 2018/2019Season.

NEW VENUE the Pavilion, Rusty Lane, Seend

Meet 7.30 for 8.00pm start

Date	Speaker	Title
2019		
15 Jan	Open Forum/Beginners Meet.	
5 Feb	Prof. David Southwood:	Mars: Delirium, Delight & Disasters, some personal stories.
5 Mar	Martin Griffiths:	'Universal Death' or How the Universe is trying to kill us.
2 Apr	Chris Starr:	A Most beautiful Moon – A History of Lunar Exploration.
7 May	Mark Radice:	Observing the Solar System.
4 Jun	Jon Gale:	Observing the Herschel 400.

Forum Meeting

I have received several questions from members seeking answers to problems and questions they have, and these are at many levels of experience so I hope you bare with us, and, indeed, not be too worried to ask some of the basic astronomy questions in the future.

We may have time for open to the floor questions but these will be answered on the fly, but they are valued because they can help the speaker secretary book speakers and topics to help put your astronomy on the right foot in the future.

Sam Franklin will kick off the evening with the developments he has made to our society web page. He has put a lot of time into this and I hope you all take a look the site.

I will also call on one or two of our members to help answer/augment some of the topics raised by the questions asked. A few of them would take a whole meeting to go through in detail so I hope we can do it justice and give you all something to use/think about in the future.

Andy Burns

Membership Meeting nights £1.00 for members £3 for visitors

Wiltshire AS Contacts

Keith Bruton Chair, keisana@tiscali.co.uk

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)

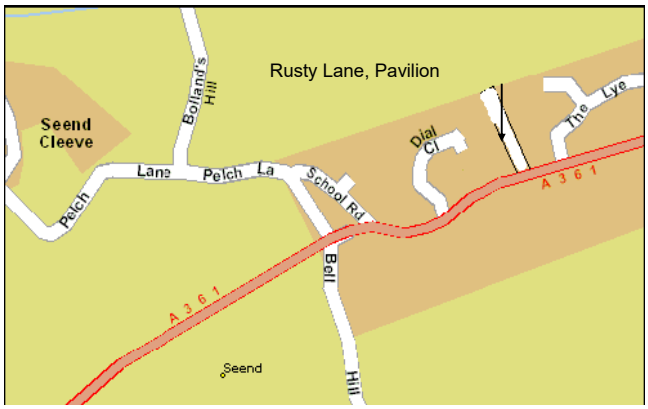
Peter Chappell (Speaker secretary)

Nick Howes (Technical Guru)

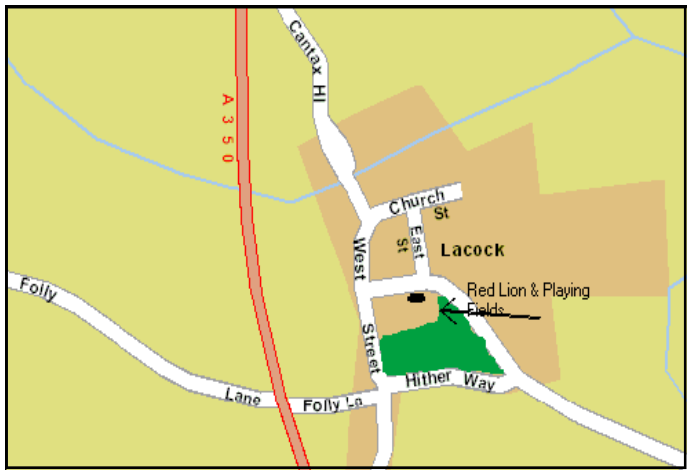
Observing Sessions coordinators: Jon Gale, Tony Vale

Web coordinator: Sam Franklin

Contact via the web site details.



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

Note this year we have moved away from the '4th Friday of the month' routine to get away from nights when the Moon is too bright to view other objects, so may be 1st Friday of month...

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.

Stargazing Season

We have quite a few observers at Swindon Stargazers so we are very much looking forward to the winter season.

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.ht

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!

Meetings 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.ht

Meeting Dates for 2019

Friday 18 January 2019
Programme: Ray Doran, Reaction Engines: SABRE: Unlocking the future of Hypersonic Flight and Space Access

Friday 15 February 2019
Programme: Graham Bryant: Astronomical Events that have effected Human History

Friday 15 March 2019
Programme: AGM plus Viv Williams: Astro Imaging - the Basics

Friday 12 April 2019

Programme: Dr. Sarah Bosman: Dark Matter the most distant Objects

Friday 17 May 2019

Programme: Mark Woodland FRAS: Exoplanents and the Charterhouse Exoplanet Project

Friday 21 June 2019
Programme: TBA

Website:

http://www.swindonstargazers.co

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,
Swindon, SN1 2JW

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

Chairman: Steve Hill (email chairman@beckingtonas.org)
Treasurer: John Ball
Secretary: Sandy Whitton
Ordinary Member: Mike Witt

People can find out more about us at www.beckingtonas.org

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.

18th January	*The Mathematical Universe*	Steve Hill
15th February	*Journey to the Edge of the Solar System*	Chris Starr
15th March	*How Old Is It?*	Stephen Tonkin
26th April	*Observing and Sketching the Deep Sky*	Mark Radice
17th May	*The Herschel 400*	Jonathan Gale
21st June	Annual General Meeting *Member Talks*	

This article is distributed by NASA Night Sky Network

The Night Sky Network program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit nightsky.jpl.nasa.org to find local clubs, events, and more!

January's Evening Eclipse and Morning Conjunctions

By David Prosper

Observers in the Americas are treated to an evening **total lunar eclipse** this month. Early risers can spot some striking morning conjunctions between **Venus**, **Jupiter**, and the **Moon** late in January.

A **total lunar eclipse** will occur on **January 20th** and be visible from start to finish for observers located in North and South America. This eclipse might be a treat for folks with early bedtimes; western observers can even watch the whole event before midnight. Lunar eclipses takes several hours to complete and are at their most impressive during total eclipse, or totality, when the Moon is completely enveloped by the umbra, the darkest part of Earth's shadow. During totality the color of the Moon can change to a bright orange or red thanks to the sunlight bending through the Earth's atmosphere - the same reason we see pink sunsets. The eclipse begins at 10:34 pm Eastern Standard Time, with totality beginning at 11:41 pm. The total eclipse lasts for slightly over an hour, ending at 12:43 am. The eclipse finishes when the Moon fully emerges from Earth's shadow by 1:51 am. Convert these times to your own time zone to plan your own eclipse watching; for example, observers under Pacific Standard Time will see the eclipse start at 7:34 pm and end by 10:51 pm.

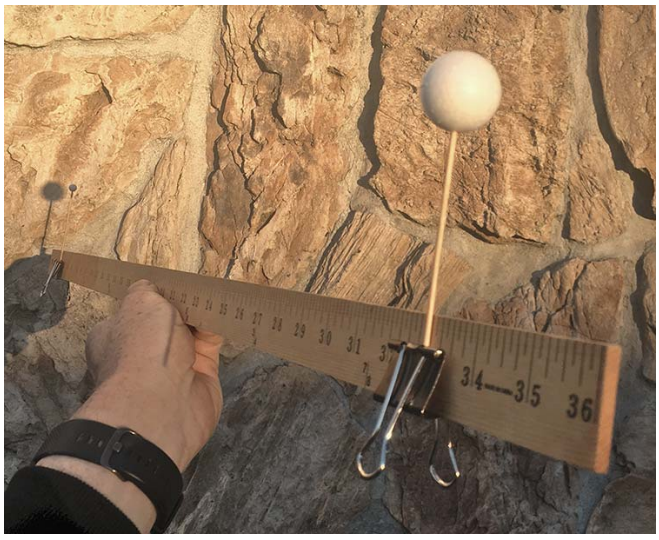
Lunar eclipses offer observers a unique opportunity to judge how much the Moon's glare can interfere with stargazing. On eclipse night the Moon will be in **Cancer**, a constellation made up of dim stars. How many stars you can see near the full Moon before or after the eclipse? How many stars can you see during the total eclipse? The difference may surprise you. During these observations, you may spot a fuzzy cloud of stars relatively close to the Moon; this is known as the "**Beehive Cluster**," **M44**, or **Praesepe**. It's an open cluster of stars thought to be about 600 million year old and a little under 600 light years distant. Praesepe looks fantastic through binoculars.

Mars is visible in the evening and sets before midnight. It is still bright but has faded considerably since its closest approach to Earth last summer. Watch the red planet travel through the constellation Pisces throughout January.

Venus makes notable early morning appearances beside both **Jupiter** and the **Moon** later this month; make sure to get up about an hour before sunrise for the best views of these events. First, Venus and Jupiter approach each other during the third full week of January. Watch their conjunction on the 22nd, when the planets appear to pass just under 2 ½ degrees of each other. The next week, observe Venus in a close conjunction with a crescent Moon the morning of the 31st. For many observers their closest pass - just over half a degree apart, or less than a thumb's width held at arm's length - will occur after sunrise. Since Venus and the Moon are so bright you may st1ill be able to spot them, even after sunrise. Have you ever seen Venus in the daytime?

If you have missed **Saturn** this winter, watch for the ringed planet's return by the end of the month, when it rises right before sunrise in Sagittarius. See if you can spot it after observing Venus' conjunctions!

You can catch up on all of NASA's current and future missions at nasa.gov



Caption:

*Have you ever wondered how eclipses occur? You can model the Earth-Moon system using just a couple of small balls and a measuring stick to find out! The "**yardstick eclipse**" model shown here is set up to demonstrate a lunar eclipse. The "Earth" ball (front, right) casts its shadow on the smaller "Moon" ball (rear, left). You can also simulate a solar eclipse just by flipping this model around. You can even use the Sun as your light source! Find more details on this simple eclipse model at **bit.ly/yardstickeclipse***

MEMBERS VIEWING LOGS and IMAGES

Viewing Log for 4th of January

This was going to be my first viewing session of 2019 and I hope it would be better than the last two I had done which were stopped by cloud after under an hour of viewing!

The sky was clear, crisp and cold in Swindon as I loaded up the car; I knew I had a small window before the clouds would roll in and finish the evening for me? I arrived at my usual viewing place of Uffcott and had my Meade LX 90 set up and ready by 19:07, as usual I would be using my Pentax 14 mm eye piece giving a magnification of around 143. I also brought along my 15x70 binoculars as comet P46 Wirtanen was still in the evening sky and I hope to catch it. I also brought along some camera gear in case I could get the odd picture of the comet?

The temperature read – 2°C in the car and with no wind it was a pleasant but cold night to do some viewing. First object to view would be Mars, currently I am having problems with my GOTO equipment when selecting Solar Systems objects, they would not be in the field of view yet deep sky objects would be? Very strange! Mars was not in my eye piece but was in the finder scope, so I had to manually adjust the scope to view the planet, with it being much higher in the sky it was easy to view but I think it has now gone too far for any real viewing with me? So I went off to Uranus and Neptune, neither of these ice giants were in the eye piece, even doing manual adjustments I am not sure if I found them or not? So leaving the telescope alone for a while I tried to find the comet with my binoculars which were sitting in the far reaches of Ursa Major to the east of the pan. This area of sky does not have many bright stars to guide me in, so it would be a case of scanning the sky and hopefully pick it up? It did not help that Ursa Major was sitting over the sky glow of Swindon and I could see clouds starting to roll in from that direction. After about 15 minutes of trying I gave up and decided to look at M 45, the Pleiades with the binoculars. The view was great, nice to be able to get all seven stars in the same field of view, with my telescope I can only get a few of them as the field of view is too narrow. A while ago John Gale showed me how to find M 27, the Dumbbell nebula using star hop method (not normal for me to use this method!) with Cygnus very low in the north western sky I had ago. I found Albireo (the double star at the head of the Swan) and went south looking for the triangle of four stars, two of the stars act as a pointer to M 27. After a bit of scanning the area I managed to pick out the nebula, it was hard to find but it was there. By now the cloud had rolled across a lot of the sky, so it was back to the telescope and pick out M 42 and 43, as usual these objects were great to look at. My final object of the evening would be the Hyades, the nearest open cluster to us at a distance of 151 light years! These also look great to view with the binoculars.

By now the cloud had won and I gave up at 19:43, in this short time about eight cars had gone pass me which could affect my night vision if I did not stop and look away from their headlights? Normally I go out viewing a bit later in the evening, so I have less chance of seeing any cars around, let's hope my next session is a bit longer than the one I had that night.

Clear skies.

Peter Chappell

M27 Dumbbell. Image Andy Burns, Nikon D810A, 60seconds, ISO 1600, I Star 6" reflector.

February Star Count

From : allfassocs@fedastro.org.uk
Date : 13/01/2019 - 21:15 (GMT)
To : allfassocs@fedastro.org.uk
Subject : [Allfassocs] "Star Count 2019"

Dear FAS Member, This information from the website of the Campaign to Protect Rural England entitled "Star Count 2019" is a campaign to help map light pollution from 2 February to 23 February and requires your participation: https://www.cpre.org.uk/what-we-do/countryside/dark-skies/star-count-2019?utm_medium=email&utm_source=engagingnetworks&utm_campaign=campaigns-update-2019-jan&utm_content=Campaigns+Update+2019+Jan

We hope that this will be of interest to your members and ultimately will help the campaign for dark skies.

Regards, Richard Field

Hi Andy,

Happy New Year!

Attached are images for the WAS January Newsletter.

Solargraph - June 2018 Solstice to December 2018 Solstice overlooking the Vale of Pewsey.

02/01/2019
Jupiter, Crescent Moon, Earthshine and Venus in the early dawn sky. It was freezing, my tripod began to ice up!
Canon G16, F2.8, 1 sec, ISO 800
F1.8, 15 sec, ISO 800

02/01/2019
ISS arching over Moon and Venus between 06:08 – 06:11. A very high pass (89 degrees, I think), so I got a crick in the neck trying to follow it.
Canon 1100D, Rokinon 8mm (effective focal length 13mm)
F3.5, 15 Sec, ISO 1600.
20 images layered with Starstax and star trails removed in Gimp.
Clear Skies,
John.

SPACE NEWS FOR DECEMBER

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

January 6 - **Partial Solar Eclipse.** A partial solar eclipse occurs when the Moon covers only a part of the Sun, sometimes resembling a bite taken out of a cookie. A partial solar eclipse can only be safely observed with a special solar filter or by looking at the Sun's reflection. The partial eclipse will be visible in parts of eastern Asia and the northern Pacific Ocean. It will be best seen from northeastern Russia with 62% coverage.

January 21 - **Full Moon, Supermoon.** 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 05:16 UTC. This full moon was known by early Native American tribes as the Full Wolf Moon because this was the time of year when hungry wolf packs howled outside their camps. This moon has also been know as the Old Moon and the Moon After Yule. This is also the first of three supermoons for 2019. The Moon will be at its closest approach to the Earth and may look slightly larger and brighter than usual.

January 22 - **Conjunction of Venus and Jupiter.** A conjunction of Venus and Jupiter will be visible on January 22. The two bright planets will be visible within 2.4 degrees of each other in the early morning sky. Look for this impressive sight in the east just before sunrise.

January 21 - **Total Lunar Eclipse.** A total lunar eclipse occurs when the Moon passes completely through the Earth's dark shadow, or umbra. During this type of eclipse, the Moon will gradually get darker and then take on a rusty or blood red color. The eclipse will be visible throughout most of North America, South America, the eastern Pacific Ocean, western Atlantic Ocean, extreme western Europe, and extreme western Africa.

February 4 - **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 21:03 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.

Messier 76 – the NGC 650/651 Planetary Nebula

During the 18th century, famed French astronomer Charles Messier noticed the presence of several "nebulous objects" while surveying the night sky. Originally mistaking these objects for comets, he began to catalog them so that others would not make the same mistake. Today, the resulting list (known as the Messier Catalog) includes over 100 objects and is one of the most influential catalogs of Deep Space Objects.

One of these objects is the Messier 76 (aka. the Little Dumbbell Nebula, the Barbell Nebula, or the Cork Nebula) a planetary nebula located about 2,500 light years away in the Perseus Constellation. While it is easy to find because of its proximity to the Cassiopeia Constellation (located just south of it), the faintness of this nebula makes it one of the more difficult Messier Objects to observe.

Description:

Located some 2,500 light years away from Earth, the shell of this dying star expands over space for a distance of about 1.23 light years – yet the halo around it continues on for close to another 12. Inside is a 16.6 magnitude central star, burning away at a temperature of approximately 60,000 K!

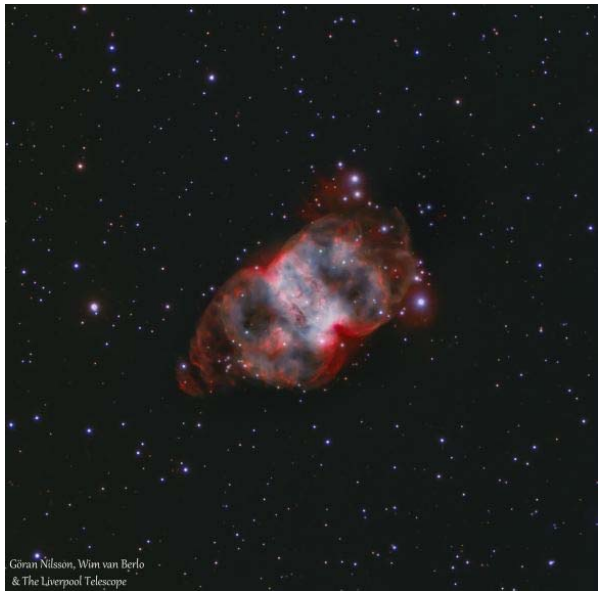


Image of The Little Dumbbell Nebula taken by the Liverpool Telescope. Credit: Göran Nilsson, Wim van Berlo/ The Liverpool Telescope

One day, perhaps in another 30 billion years, it will cool down a bit, becoming a white dwarf star. But just what makes its shape – its shape? As Toshiya Ueta of the NASA Ames Research Center said in a 2006 study:

"We present the far-infrared (IR) maps of a bipolar planetary nebula (PN), NGC 650, at 24, 70, and 160 [nanometers], taken with the Multiband Imaging Photometer for Spitzer (MIPS) on board the Spitzer Space Telescope. While the two-peak emission structure seen in all MIPS bands suggests the presence of a near edge-on dusty torus, the distinct emission structure indicates the presence of two distinct emission components in the central torus. Based on the spatial correlation of these two far-IR emission components with respect to various optical line emission, we conclude that the emission is largely due to the [O IV] line arising from highly ionized regions behind the ionization front, whereas the other emissions are due to dust continuum arising from low-temperature dust in the remnant asymptotic giant branch (AGB) wind shell. The far-IR nebula structure also suggests that the enhancement of mass loss at the end of the AGB phase has occurred isotropically, but has ensued only in the equatorial directions while ceasing in the polar directions. The present data also show evidence for the prolate spheroidal distribution of matter in this bipolar PN. The AGB mass-loss history reconstructed in this PN is thus consistent with what has been previously proposed based on the

past optical and mid-IR imaging surveys of the post-AGB shells."

So it's bi-polar – just another crazy planetary nebula. But could it be blowing bubbles? According to some researchers, it could. These include M. Bryce (et al), who indicated the following in a 1996 study:

"High spatial and spectral resolution observations of the H?, [N II]6584A and [O III]5007A emission line profiles from the planetary nebula NGC 650-1 have been obtained with the Isaac Newton and William Herschel Telescopes using the Manchester echelle spectrometer. These observations, and additional narrow-band images obtained using the San Pedro Martir telescope, are compared with synthesised images and spectra based on the generalised interacting stellar winds (GISW) models (involving a slow wind strongly concentrated towards the equatorial plane) and a good correspondence is found, confirming NGC 650-1 to be a bipolar wind-driven bubble orientated at an inclination of ~75deg with the NW lobe pointing towards the observer. There is a bright central ring with two attached (inner) lobes, which show typical expansion velocities of ~43km/s and ~60km/s respectively. Outside the inner lobes are the fainter outer lobes which are observed to have a very low expansion velocity (~5km/s), and which have on one side (SE) a polar cap which shows higher velocities again (~20km/s). The nature of these outer lobes remains unclear."

The Little Dumbbell Nebula (M76). Credit: Adam Block/ Mount Lemmon SkyCenter/University of Arizona

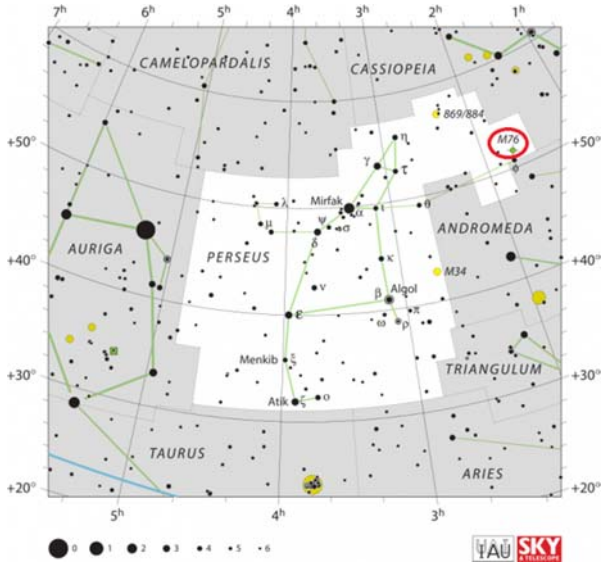
History of Observation:

One thing is very clear – this faint shell was discovered by Pierre Mechain on the night September 5th, 1780. He then handed it over to Charles Messier, who observed it, determined its position and added it to his catalog as object #76 on October 21st, 1780.

"Nebula at the right foot of Andromeda, seen by M. Mechain on September 5, 1780, and he reports: "This nebula contains no star; it is small and faint". On the following October 21, M. Messier looked for it with his achromatic telescope, and it seemed to him that it was composed of nothing but small stars, containing nebulosity, and that the least light employed to illuminate the micrometer wires causes it disappear: its position was determined from the star Phi Andromedae, of fourth magnitude."

In 1787, Sir William Herschel would privately study Mechain's find and be the first to see a dual form: "Two nebulae close together. Both very bright. Distance 2′. One is south preceding and the other north following. One is 76 of the Connoissance." Since that time, most observers perceive two distinct regions and perhaps even more? Just ask historical astronomer, Admiral Smyth:

"An oval pearly white nebula, nearly half-way between Gamma Andromedae and Delta Cassiopeiae; close to the toe of Andromeda, though figured in the precincts of Perseus. It trends north and south, with two stars preceding by 11s and 50s, and two following nearly on the same parallel, by 19s and 36s; and just np of it is the double star above registered, of which A is 9 magnitude, white; and B 14, dusky. When first discovered, Mechain considered it a mass of nebulosity; but Messier thought it was a compressed cluster; and William Herschel that it was an irresolvable double nebula. It has an intensely rich vicinity, and with its companions, was closely watched in my observatory, as a gauge of light, during the total eclipse of the moon, on the 13th of October, 1837, being remarkably well seen during the darkness, and gradually fading as the moon emerged. In 1842, I consulted Mr. Challis upon the definition of this nebula in the great Northumberland equatorial, and he replied: "I looked at the nebula, as you desired, and thought it had a sprangled appearance. The resolution, however, was very doubtful."



The location of Messier 76 in the Perseus Constellation. Credit: IAU and Sky & Telescope magazine (Roger Sinnott & Rick Fienberg)

Locating Messier 76:

Because this planetary nebula is small and faint, it isn't a good binocular target and will require dark skies even for a telescope. The easiest way to find the M76 is to start from the 3.5 magnitude star 51 Andromedae and make you way about a finger width (2 degrees) north-northeast until you come to 4th-magnitude Phi Persei, a variable star. From here aim your telescope less than a degree northwest of the star, and you will have M76 in the eyepiece field of view.

In a small telescope, you'll see a distinctive, odd-shaped glow that will take on more structure and form as aperture increases. Very large telescopes will not only see double lobed structure, but the additional faint halo ring as well. Not for light polluted skies or moonlit nights!

Object Name: Messier 76
Alternative Designations: M76, NGC 650/651, Little Dumbbell Planetary, Cork Nebula, Butterfly Nebula, and Barbell Nebula
Object Type: Planetary Nebula
Constellation: Perseus
Right Ascension: 01 : 42.4 (h:m)
Declination: +51 : 34 (deg:m)
Distance: 3.4 (kly)
Visual Brightness: 10.1 (mag)
Apparent Dimension: 2.7×1.8 (arc min)

Astronomers See the Exact Moment a Supernova Turned into a Black Hole (or Neutron Star)

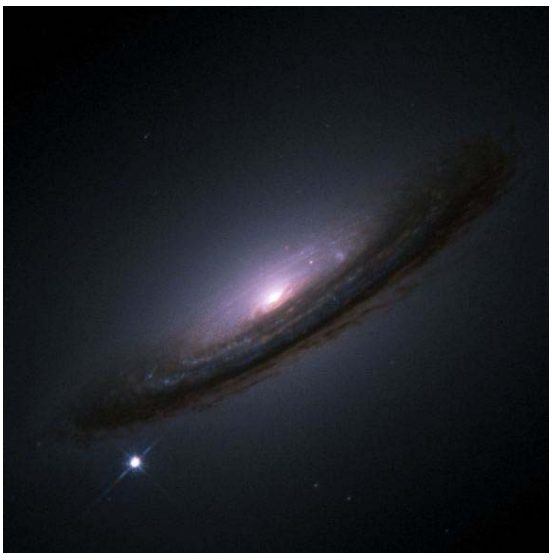
On June 17th 2018, the ATLAS (Asteroid Terrestrial-impact Last Alert System) survey's twin telescopes spotted something extraordinarily bright in the sky. The source was 200 million light years away in the constellation Hercules. The object was given the name AT2018cow or "The Cow." The Cow flared up quickly, and then just as quickly it was gone.

What was it?

A Type of Supernova?

At first, the obvious answer was a supernova. When a transient bright spot flares up in the sky, that's the first thing astronomers think, and the first thing they try to confirm, or rule out.

There are different types of supernovae. The most well-known occurs at the end of a massive star's life. In this case, a star can no longer sustain fusion in its core. Eventually, gravity overpowers the star and it collapses. This causes a massive explosion that outputs an enormous amount of energy for several months.



Supernovae are so bright that they outshine their host galaxy. This is SN1994D, on the lower left, outshining its host galaxy NGC 4526. Image Credit: By NASA/ESA, CC BY 3.0, https://commons.wikimedia.org/w/index.php?curid=407520

Another kind is caused by a white dwarf in a binary system with another star. A white dwarf can accrete matter from its companion until it reaches a critical mass and runaway fusion happens. This type of supernova can be 5 billion times brighter than the Sun.

"We know from theory that black holes and neutron stars form when a star dies, but we've never seen them right after they are born. Never."

Raffaella Margutti, Northwestern University

Supernova aren't exactly rare, depending on how you look at it. There are about three of them every hundred years in the Milky Way. But with all the powerful telescopes on Earth, we see them well outside our own galaxy because they're so bright. ATLAS, the telescope system that spotted the Cow, has spotted 2,795 supernovae since it began operations in 2015. Amateur astronomers even discover them.

But all supernovae light up for several months. The Cow didn't last that long. It only flared brightly for about 16 days. Its short duration ruled out a supernova.

"We knew right away that this source went from inactive to peak luminosity within just a few days," Margutti said. "That was enough to get everybody excited because it was so unusual and, by astronomical standards, it was very close by."

Black Hole? Or Neutron Star?

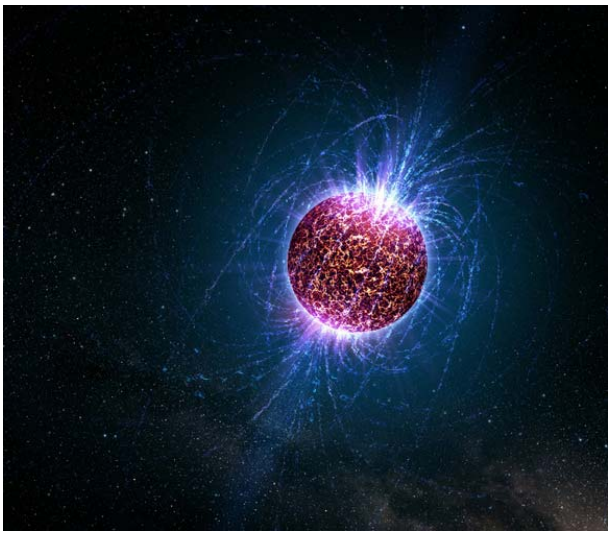
Like a supernova, the Cow was also extraordinarily bright. But it was between 10 to 100 times brighter than a supernova. For astronomers, watching an active supernova is exciting, but the Cow was something else, and nobody was sure what. Excitement and curiosity spread.

"We thought it must be a supernova," Margutti said. "But what we observed challenged our current notions of stellar death."

"We think that 'The Cow' is the formation of an accreting black hole or neutron star."

Raffaella Margutti, Northwestern University

A team of astronomers led by Raffaella Margutti at Northwestern University went to work. Astronomers study stellar deaths in visible light, but the team combined several types of observations from different telescopes to help them understand what they were seeing. They analyzed the Cow's chemical composition, and it included hydrogen and helium. That ruled out merging compact objects as a cause.



Artist concept of a neutron star. Credit: NASA

They gathered images in hard X-rays, X-rays, gamma waves, and radio-waves. They used a who's who of telescopes to study the Cow, including the Keck Observatory, the MMT Observatory, the SoAR telescope, NuSTAR, INTEGRAL, and XMM Newton to study the Cow. Since they weren't relying only on visible light, they were able to study the Cow long after its initial flaring had died down. They began to speculate on what they were seeing.

"Our team used high-energy X-ray data to show that the Cow has characteristics similar to a compact body like a black hole or neutron star consuming material. But based on what we saw in other wavelengths, we think this was a special case and that we may have observed – for the first time – the creation of a compact body in real time."

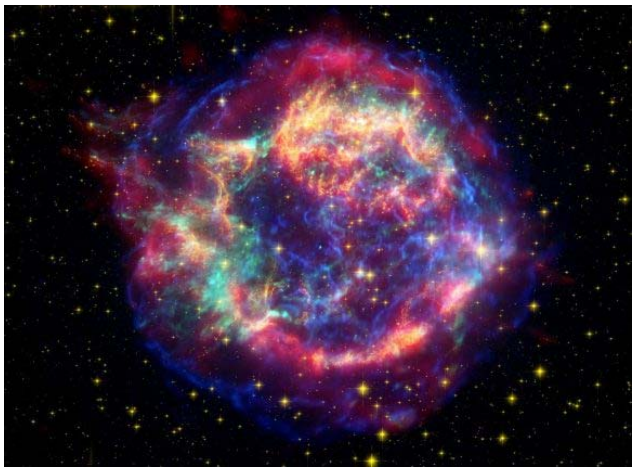
The team thinks they've witnessed the exact moment that a supernova collapsed to form a compact object; either a black hole or a neutron star.

"We think that 'The Cow' is the formation of an accreting black hole or neutron star," said Northwestern's Raffaella Margutti, who led the research. "We know from theory that black holes and neutron stars form when a star dies, but we've never seen them right after they are born. Never."

The Naked Cow

Stars collapse into black holes and neutron stars all the time. The event itself isn't exactly rare. But seeing it happen is rare. Margutti and the rest of the team were able to study the Cow so closely because in a way, it was naked.

Typically, when a star collapses into a black hole or a neutron star, the event is hidden from sight inside a shroud of gas and dust left over from the preceding supernova. In this case, there was 10 times less material than their normally is. The astronomers were able to look directly into the heart of the event, called the "central engine."



Typically, a supernova is surrounded by a dense cloud of ejecta. This is a mosaic image of Cassiopeia A, a supernova remnant, taken by the Hubble and Spitzer Space Telescopes. Credit: NASA/JPL-Caltech/STScI/ CXC/SAO

"A 'lightbulb' was sitting deep inside the ejecta of the explosion," Margutti said. "It would have been hard to see this in a normal stellar explosion. But The Cow had very little ejecta mass, which allowed us to view the central engine's radiation directly."

The Cow is also close to us, in astronomical terms, making it easier to study. It's only 200 million light years away, in the dwarf galaxy CGCG 137-068.

Margutti and her team presented their results at the 233rd American Astronomical Meeting last week. Their results are also published in a paper.

Or, It Could Be Something Else

Another team of astronomers, led by Paul Kuin from, an astrophysicist at University College London, came to a different conclusion. They think that the Cow is a star that's been ripped apart in what's called a "tidal disruption event."

"We've never seen anything exactly like the Cow, which is very exciting."

Amy Lien, University of Maryland, NASA's Goddard Space Flight Center

A tidal disruption event happens to a star that approaches a powerful black hole. The gravity from the black hole tears the star apart into a stream of gas. The black hole flings the tail of the gas stream out of the black hole system, but the leading edge of the stream swirls around the hole and eventually collides with itself.

"We've never seen anything exactly like the Cow, which is very exciting," said Amy Lien, an assistant research scientist at the University of Maryland, Baltimore County and NASA's Goddard Space Flight Center in Greenbelt, Maryland. "We think a tidal disruption created the quick, really unusual burst of light at the beginning of the event and best explains Swift's multiwavelength observations as it faded over the next few months."

This second team of researchers think that the star that got shredded was a white dwarf, the same type of star

that our Sun will eventually become. They also calculated the size of the black hole and concluded that it's mass would be between 100,000 to 1 million times the Sun's. This makes it an enormous black hole, similar in size to the one at the center of the Cow's galaxy. That would be very unusual, but not impossible.

"The Cow produced a large cloud of debris in a very short time," said lead author Paul Kuin, an astrophysicist at University College London (UCL). "Shredding a bigger star to produce a cloud like this would take a bigger black hole, result in a slower brightness increase and take longer for the debris to be consumed."

Kuin's team also shared their findings at the 233rd AAS Meeting, and their results were published in a paper.

Sources:

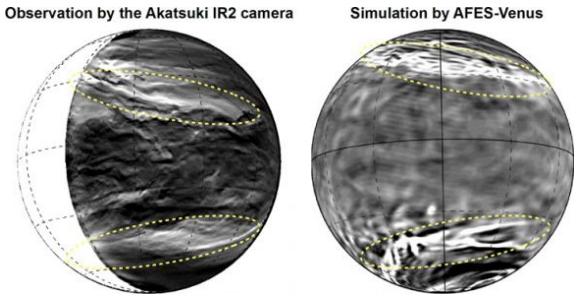
Northwestern UniversityPress Release: Birth of a black hole or neutron star captured for first time

NASA Press Release: Holy Cow! Mysterious Blast Studied with NASA Telescopes

Research Paper: An embedded X-ray source shines through the aspherical AT2018cow: revealing the inner workings of the most luminous fast-evolving optical transients

Research Paper: Swift spectra of AT2018cow: A White Dwarf Tidal Disruption Event?

Giant Streak Structure Found in Venus' Cloudtops



A team of researchers in Japan has discovered a gigantic streak structure in the cloud tops of Venus. The discovery is based on observations of Venus by the Japanese spacecraft Akatsuki. The findings were published in January 9th in the journal Nature Communications.

Venus is unlike any other planet in the Solar System. The entire planet is shrouded in thick clouds of sulfuric acid between altitudes of 45 km to 70 km. This thick shroud has prevented scientists from studying Earth's so-called "sister planet" in detail. But Japanese researchers are making progress.

Uh oh, Hubble's Wide Field Camera 3 is Down

On January 8th, an important piece of equipment on the Hubble Space Telescope went down. The Wide Field Camera 3 (WFC3) suspended its operations because of a hardware. The Hubble team is investigating the anomaly, and during this time the space telescope's other instruments are working normally and continuing their science operations.

The WFC3 was installed on the Hubble in 2009. It replaced the Wide Field and Planetary Camera 2 (WFPC2). The WFC3 is the most technologically advanced instrument on the Hubble, and it has captured some of the most stunning and famous images ever captured.

Again the problems with government workers being unpaid in the USA is affecting communications with Hubble.

Canadian Telescope Finds 13 More Fast Radio Bursts Including the Second One Ever Seen Repeating

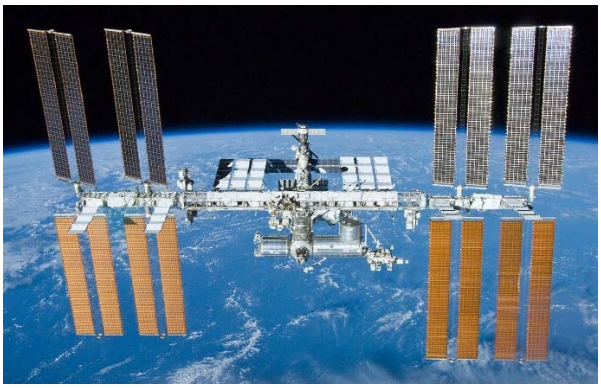
Canadian scientists using the CHIME (Canadian Hydrogen Intensity Mapping Experiment) have detected 13 FRBs (Fast Radio Bursts), including the second-ever repeating one. And they think they'll find even more.

CHIME is an innovative radio telescope in the Okanagan Valley region in British Columbia, Canada. It was completed in 2017, and its mission is to act as a kind of time machine. CHIME will help astronomers understand the shape, structure, and fate of the universe by measuring the composition of dark energy.

CHIME's unique design also makes it well-suited for detecting fast radio bursts.

Extreme Bacteria on the Space Station are Evolving to Handle the

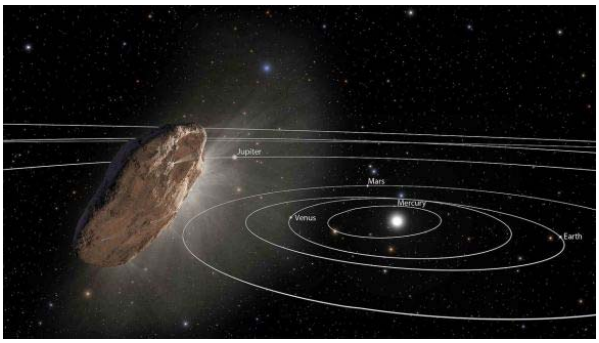
Harsh Conditions, not to Make Astronauts Sick



For years, scientists have been conducting studies aboard the International Space Station (ISS) to determine the effects of living in space on humans and micro-organisms. In addition to the high levels of radiation, there are also worries that long-term exposure to microgravity could cause genetic mutations. Understanding these, and coming up with counter-measures, is essential if humanity is to become a truly space-faring species.

Interestingly enough, a team of researchers from Northwestern University recently conducted a study with bacteria that was kept aboard the ISS. Contrary to what many suspected, the bacteria did not mutate into a drug-resistant super strain, but instead mutated to adapt to its environment. These results could be vital when it comes to understanding how living beings will adapt to the stressful environment of space.

Interstellar Objects like Oumuamua Probably Crash into the Sun Every 30 Years or so and 2 Pass Within the Orbit of Mercury



On October 19th, 2017, the Panoramic Survey Telescope and Rapid Response System-1 (Pan-STARRS-1) in Hawaii announced the first-ever detection of an interstellar object, named 1I/2017 U1 (aka. 'Oumuamua). In the months that followed, multiple follow-up observations were conducted to learn more about this visitor, as well as resolve the dispute about whether it was a comet and an asteroid.

Rather than resolving the dispute, additional observations only deepened the mystery, even giving rise to suggestions that it might be an extra-terrestrial solar sail. For this reason, scientists are very interested in finding other examples of 'Oumuamua-like objects. According to a recent study by a team of Harvard astrophysicists, it is possible that interstellar objects enter our system and end up falling into in our Sun somewhat regularly.

TESS Finds its Third Planet, a sub-Neptune with a 36-Day Orbit

After only three months of operation, NASA's TESS (Transiting Exoplanet Survey Satellite) spacecraft is delivering on its mission to find more exoplanets. A new paper presents the latest finding: a sub-Neptune planet with a 36-day orbit around its star. This is the third confirmed exoplanet that TESS has found.

The planet orbits a K-dwarf star about 52 light years away, in the constellation Reticulum. In astronomical terms, this makes the planet pretty close to us, and a great candidate for follow-up observations. Even better, it may have a sibling planet about the same size as Earth.

China's Yutu-2 rover is on the move on the far side of the Moon

The China National Space Administration (CNSA) accomplished a historic feat last week (Thurs. Jan. 3rd) by landing a robotic mission on the "dark side" of the Moon. Known as the *Chang'e-4* mission, this lander-rover combination will explore the Moon's South Pole-Aitken Basin as part of China's ongoing effort to conduct lunar exploration.

The ultimate goal is to pave the way for an eventual crewed mission that will see Chinese astronauts land on the Moon for the first time. And on Friday, Jan. 4th (Beijing time), the CNSA announced that the mission's scientific and technical personnel had carried out last minute-checks before the *Yutu-2* ("Jade Rabbit-2") rover disembarked from the lander to begin exploring the lunar surface.

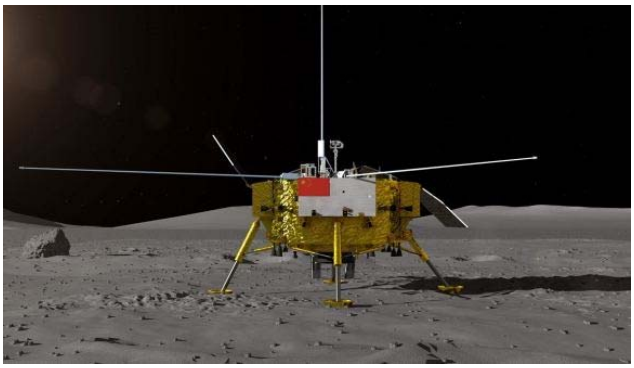
The mission's various scientific payloads were also checked and verified before the rover took to the surface. This included the three radio antennas, which were deployed at 04:00 pm Beijing time on Jan. 4th (03:00 am EDT; 12:00 am PDT on Jan. 3rd). They then established an uplink with the relay satellite (*Queqiao*) that will allow the lander and rover to communicate with mission controllers on Earth.

Image of the Yutu-2 rover disembarking from the Chang'e-4 mission's lander. Credit: CNSA

The controllers also took the time to deploy the rover's solar panels and verify that the mission's scientific payload (altogether, seven instruments and cameras) were all in working order. In addition to the instruments inherited from the *Chang'e-3* mission there's also three new instruments that are the result of international collaborations.

These include the Lunar Lander Neutrons and Dosimetry (LND), which will be responsible for exploring the radiation environment in the vicinity of the lander; the Advanced Small Analyzer for Neutrals (ASAN), which will measure energy spectra of energetic neutral atoms originating from reflected solar wind ions; and the Netherlands-China Low-Frequency Explorer (NCLE) on the relay satellite *Queqiao*.

Once these checks were complete, the *Yutu-2* rover rolled off of the lander at 10:22 pm local time (09:00 am EDT; 06:00 am PDT). The lander then took a series of images that showed the rover rolling onto the lunar surface and then stopping at a point not far from the landing spot. The rover then began conducting scientific operations at this location, which is the first point in its planned exploration path.



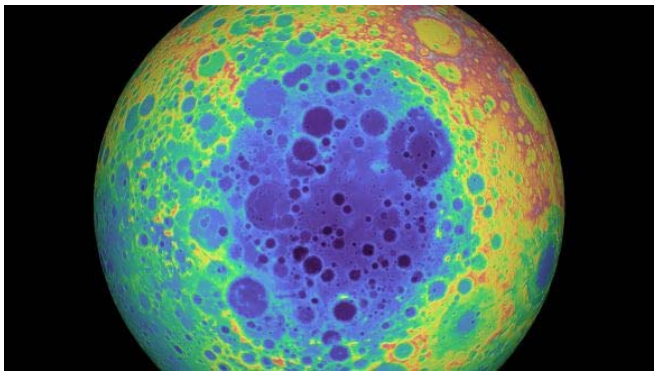
Artist's impression of the Chang'e-4 lander on the lunar surface. Credit: CNSA

Over the course of the next three months, the mission will study the ancient impact basin to learn more about the early Solar System and the origins of the Moon. The *Yutu-2* rover will also be the first mission to directly study the deposits of water ice that have been observed in the South Pole-Aitken Basin in recent years.

The lander will also conduct some rather interesting research during the course of the mission to determine if terrestrial creatures can grow in lunar gravity. This will be done through its special payload (the Lunar Micro Ecosystem), a heated and pressurized stainless steel container that contains seeds and insect eggs.

In addition to enabling China's first crewed mission to the Moon, these studies could also play a vital role in the construction of a lunar outpost. In recent years, China has indicated that it may be working with the European Space Agency to create this outpost, which the ESA has described as an "international Moon village" that will be the spiritual successor to the ISS.

Other scientific objectives include measuring the chemical composition of lunar rocks and regolith, measuring lunar surface temperatures, studying cosmic rays, and observing the solar corona to learn more about the evolution and transport of Coronal Mass Ejections (CME) between the Sun and the Earth.



Elevation data of the Moon showing the South Pole-Aitken Basin. Credit: NASA/GSFC/University of Arizona

Researchers also hope to conduct low-frequency radio observations of the cosmos from the far side of the Moon, where atmospheric interference and radio signals from Earth will not be an issue. Studies using the radio telescope aboard the *Queqiao* satellite are therefore expected to reveal things about the early Universe that would otherwise not be possible.

However, as Harvard professor Abraham Loeb noted, the relay satellite itself could be a source of radio contaminate for the sky. As he told Universe Today via email:

"The relay satellite communicates with Earth using radio waves. If similar relay stations were to hover above the far side of the Moon in the future and use radio waves to communicate with Earth, they will interfere (in the same way that radio and TV stations do on Earth) with radio observatories that would be placed on the far side of the Moon. This will negate the key advantage of the far side for radio astronomy, being free of radio interference from Earth."

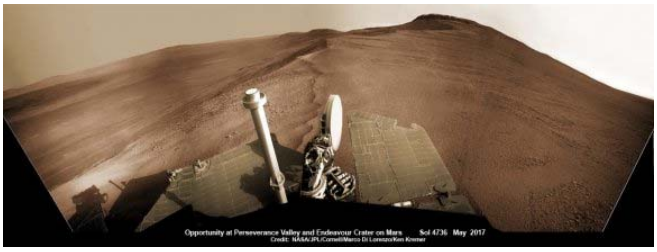
Even if the experiments with the satellite prove that we cannot feasibly conduct radio astronomy on the far side of the Moon, the mission is certain to yield valuable scientific information. The mission has already been a milestone for the CNSA, being the first to make a soft landing on the Moon and the first mission in history to land on the far side of the lunar surface.

China has taken some very big steps in recent years and built up its space program to the point that it is considered a rival to those of Russian and the United States. With a crewed mission planned for the coming decades, many are drawing comparisons to the Apollo Era. And with both Roscosmos planning their own lu-

nar missions and NASA looking to return to the Moon, the coming years are sure to be very exciting!

Further Reading: Phys.org, NASA Spaceflight

Still no Word from Opportunity



Could this be the end of the Opportunity rover? There's been no signal from the rover since last summer, when a massive global dust storm descended on it. But even though the craft has been silent and unreachable for six-and-a-half months, NASA hasn't given up.

When Opportunity landed at Meridiani Planum on Mars in January 2004, it's planned mission length was only 90 days. Since that day, which seems so long ago now, 15 years have passed, and over one billion people have been born on Earth. Six months ago, the rover stopped working, maybe for good. So by every measure, Opportunity has been a stunning success.

With the Budget in the USA unsigned all employees that work for the government (including NASA employees) are not being paid, and work around communications with probes and other projects have come to a halt…

The SpaceX Starhopper has Three Raptor Engines on the Bottom

This year, SpaceX will test out a miniaturized version of its super-heavy launch vehicle, which is known as the *Starship* (aka. the Big Falcon Rocket). This test launch will validate the design of the rocket and how it fairs at supersonic speeds and deals with the cryogenic environment of space. It will also serve as an opportunity to conduct the delivery of the next batch of SpaceX's Starlink satellites.

Recently, Musk tweeted images of sections of the mini-Starship (Starship Alpha, the Starship hopper) being brought out at the company's South Texas Launch Site in Boca Chica, Texas, for assembly. From the latest images that have been shared by multiple sources, it is clear that SpaceX crews have been working round the clock and through the holidays to get the hopper ready for its test flight later this year.

Interesting to see Elon Musk has begun cutting jobs in his Space projects, with 10% cut in employees enforced at contract renewal.

JANUARY 3, 2019 BY EVAN GOUGH

See a Simulation of the Moon for Every Day in 2019

It's always easier to show someone a picture of something rather than to use 1,000 words to explain it. The people at NASA's Scientific Visualization Studio (SVS) know this, and they're experts. Every year they release a simulation of the Moon that shows what the Moon will look like to us each day.

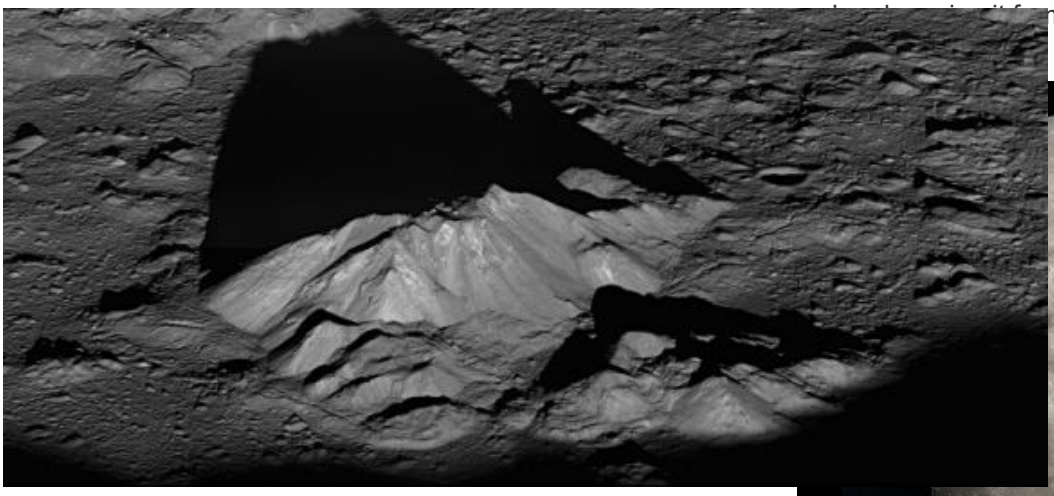
NASA's Moon simulator uses images and data captured by the Lunar Reconnaissance Orbiter (LRO) to recreate the Moon on each hour of each day of each month in 2018. You can input any date and time to view the Moon (Dial-a-Moon) as it will appear at that time. You can also watch a video of the Moon over the course of the entire year. Along the way, you might learn something.

A screenshot of NASA's Moon simulator. The simulator not only shows us the face of the Moon each hour of each day, but also labels the craters on the terminator line. It also shows
the geocentric phase, libration, position angle of the axis, and apparent diameter of the Moon. Image: NASA SVS/Ernie Wright.

NASA's Moon Simulator relies on the Lunar Reconnaissance Orbiter. The LRO has been in orbit around the Moon since June 2009. The LRO has two missions: The first is to map the surface of the Moon and identify possible future landing sites close to in-situ resources. That was called the Exploration Mission, and that was completed in September 2010. After that, the Science Mission began, and is ongoing.

Throughout its time at the Moon, the LRO has relied heavily on two of its instruments. The Lunar Orbiter Laser Altimeter (LOLA) generates a high-resolution 3D map of the Moon's surface, including slope and roughness. LROC, the Lunar Reconnaissance Orbiter Camera, captures hi-res black and white images of the surface, down to 1 meter resolution. It also captures color and ultraviolet images.

m. Told you you'd learn some-



A bit of Moon eye candy courtesy of NASA's LRO. This is sunrise on the central peak inside the Tycho crater, named after astronomer Tycho Brahe. Image Credit: NASA/GSFC/Arizona State University

The result of all the LRO's work is a detailed map of the surface of the Moon. And rather than hog all that data just for selecting landing sites for future missions to the Moon, NASA has created a simulation of the Moon for all to enjoy. And while enjoying it, you can learn a few things.

The Moon Always Shows Us the Same Face (Sort Of)

Most people know that the Moon is tidally locked to Earth. It doesn't rotate on its axis, and we always see the same face. That's why there's a Pink Floyd album called "The Dark Side of the Moon." But it's not absolutely true.

The Moon actually shifts a little up there, showing us a slightly different face over time. It's called "libration," and it's caused by the Moon's tilt and the shape of its orbit. In the Moon simulator, you can see it wobble. The wobble is the libration.

NASA's simulation of the Moon in action. Credit: NASA SVS/Ernie Wright.

The Moon isn't Always the Same Distance From Earth

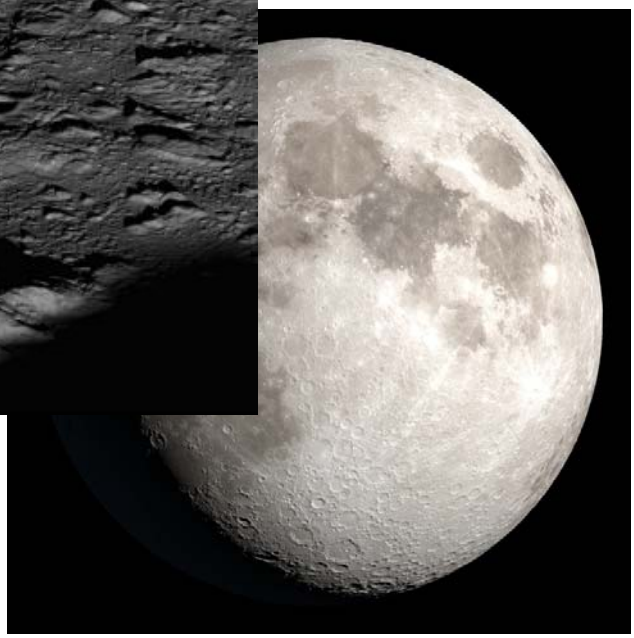
This may be a little more obvious to us. Nothing is static in space, certainly not the Moon and the Earth. The distance between the two bodies varies by up to 14%. When they're furthest apart, that's called the apogee, and when it's closest, that's called the perigee. When the internet heats up with talk of a "Super Moon", that means the Moon is near perigee.

The Moon also rock and rolls a little up there. In the animation, it looks like it's rolling back and forth on the sub-Earth point. According to NASA, "The roll angle is given by the **position angle** of the axis, which is the angle of the Moon's north pole relative to celestial north."

The Phases of the Moon

It's the phases of the Moon that stare us right in the face. As the Moon orbits Earth, the angle of the Sun shining on the Moon changes, and a differing amount of its surface is illuminated. The phases of the Moon change according to what's called a "synodic month," which is about 29.53 days. That's about 2.2 days longer than a sidereal month, which is how long it takes the Moon to orbit the Earth. (A sidereal month is about 27.3 days.)

Everything in space is moving, so there really is no single measurement of what a "month" is. It depends on where



This is what the Moon will look like on my birthday in 2019. Pretty cool. Image Credit: NASA/Ernie Wright

As the Sun's angle changes, the phase of the Moon changes. It starts with a waxing, or growing, crescent Moon. You can see it in the West as the Sun sets.

When the Moon reaches first quarter, with a quarter of its surface illuminated, the Moon is higher in the sky at sunset, and sets at around midnight. When full Moon phase arrives, the Moon rises at sunset (everyone's seen that and it is amazing!) and is high up in the sky at midnight.

The third quarter Moon can be seen in the daylit western sky long after the Sun has come up.

According to the simulation of the Moon, this is what the next Full Moon will look like to us, on January 20th, 2019. (When you look at a Full Moon with a telescope, you almost need sunglasses, it's so bright.)

The next full Moon according to the simulation of the Moon. Image Credit: NASA SVS/Ernie Wright

If you've got a hankering to visualize the Moon on some future date in the upcoming year, check out the Simulation of the Moon. If you have a backyard telescope, or even a pair of binoculars, the simulation can help you plan and understand your observations. Or if it's way too cloudy to see the real Moon, the simulator can help.

The guy responsible for all this mesmerizing brain candy is Ernie Wright. He's almost famous for his fantastic work. You can check out his other NASA space visualization work at the NASA SVS page right here.

Here's one of my favorites, a five-minute 4K tour of the Moon. Enjoy!

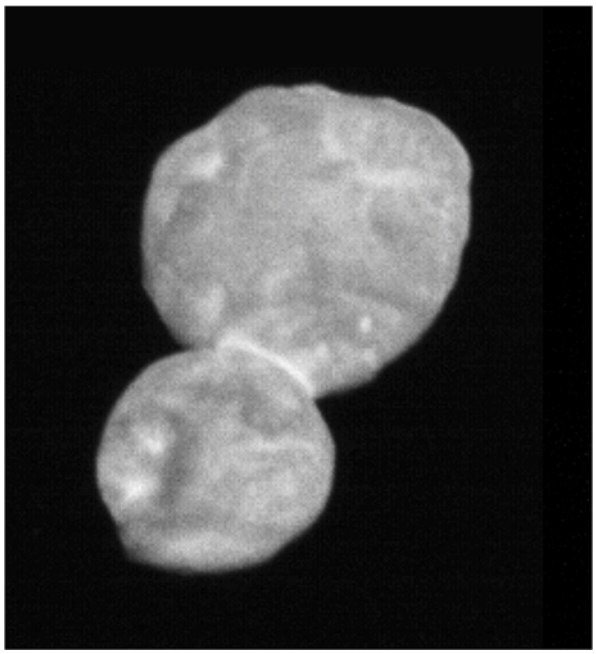
Sources:

NASA's Scientific Visualization Studio: Moon Phase and Libration, 2019.

NASA's SVS: Tour of the Moon 4K Redux

NASA's Lunar Reconnaissance Orbiter

Wikipedia Entry: Lunar Phase



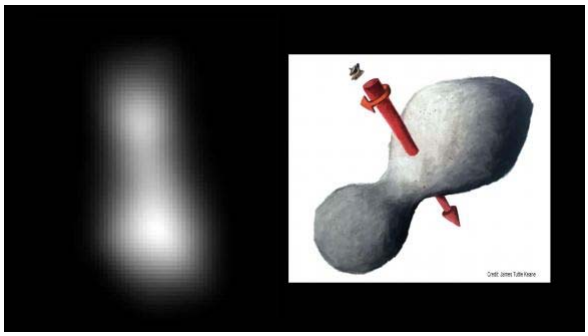
The Pictures are Here! New Horizons Close Up View of 2014 MU69

POSTED ON JANUARY 2, 2019 BY MATT WILLIAMS

On December 31st, 2018, NASA and the *New Horizon*'s team (plus millions of people watching the live stream at home) rang in the New Year by watching the *New Horizons* mission make the first rendezvous in history with a Kuiper Belt Object (KBO). About thirty minutes after the probe conducted its flyby of Ultima Thule (2014 MU69), the mission controllers were treated to the first clear images ever taken of a KBO.

Since the first approach photographs were released (which were pixilated and blurry), the *New Horizons* team has released new images from the spacecraft that show Ultimate Thule in color and greater detail. It's appearance, which resembles that of a snowman, beautifully illustrates the kinds of processes that created our Solar System roughly four and a half billion years ago.

The first image (shown at top), was taken by the spacecraft's Long-Range Reconnaissance Imager (LORRI) at 05:01 UTC (01:01 EDT) on January 1st, 2019. The image was taken when the spacecraft was 28,000 km (18,000 mi) away, or just 30 minutes, away from making its closest approach to Ultima Thule. It was also a vast improvement over images snapped the day before, which provided more hints about Ultima Thule's shape and rotation.



Composite of two images (left) taken by New Horizons' high-resolution Long-Range Reconnaissance Imager (LORRI) and an artist's impression (right) of Ultima Thule's appearance. Credit: NASA/JHUAPL/SwRI; sketch courtesy of James Tuttle Keane

As Alan Stern, the principle investigator of the New Horizons mission from the Southwest Research Institute (SwRI), said in a recent NASA press release:

"This flyby is a historic achievement. Never before has any spacecraft team tracked down such a small body at such high speed so far away in the abyss of space. New Horizons has set a new bar for state-of-the-art spacecraft navigation."

The new image also resolved the debate about the nature of Ultima Thule. Initially, the *New Horizon*'s team believed that the object was a spherical chunk of ice and rock measuring 18-41 km (10-30 mi) in diameter. However, after an occultation observation that took place in Aug of 2017, the mission team revised this prediction.

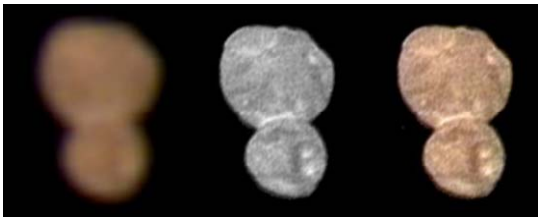
From then on, the mission team was of the mind that Ultima Thule was actually a large object with a chunk taken out of it (an "extreme prolate spheroid") or two objects orbiting very closely together or touching (a close or contact binary). The new images revealed that the object is in fact a contact binary, consisting of two spheres that measure 31 km (19 mi) from end to end.

The team has dubbed the larger sphere "Ultima", which measures 19 km (12 mi) in diameter, and the smaller sphere "Thule" (14 km; 9 mi). They also claim that the two spheres are likely to have come together very shortly after the formation of the Solar System. By their estimates, this would have happened about 4.45 billion years ago, or 50 million years after the Solar System formed.

As Jeff Moore – the New Horizons Geology and Geophysics team lead – explained it, this means that Ultima Thule is basically a preserved record of the Solar System's ancient past:

"New Horizons is like a time machine, taking us back to the birth of the solar system. We are seeing a physical representation of the beginning of planetary formation, frozen in time. Studying Ultima Thule is helping us understand how planets form — both those in our own Solar System and those orbiting other stars in our galaxy."

The team also shared a color photograph of Ultima Thule (shown below), which was taken at 04:08 am UTC (12:08 am EDT) on January 1st, 2019, when the probe was 137,000 km (85,000 mi) from Ultima Thule. This image was taken by the craft's Multispectral Visible Imaging Camera (MVIC), which combines light from the infrared, red and blue channels.



The first color image of Ultima Thule, taken at a distance of 137,000 km (85,000 mi) at 04:08 am UTC on January 1st, 2019. Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute

The color photo was then combined with the image taken by the LORRI camera (which has nearly five times the spatial resolution of the MVIC) to produce a detailed image that shows the color uniformity of the Ultima and Thule lobes. The improved resolution also draws attention to the object's "neck", where the two lobes are connected.

In the coming weeks and months, data from the New Horizons' flyby will continue to be received by the mission controllers. Included in this will be a series of much higher-resolution images that will provide an even greater look at Ultima Thule, currently the farthest object from Earth to ever be photographed by a spacecraft.

As Helene Winters, New Horizons' Project Manager, indicated, it won't stop there. "In the coming months, New Horizons will transmit dozens of data sets to Earth, and we'll write new chapters in the story of Ultima Thule — and the solar system," she said.

Further Reading: JHUAPL

India is Going to be Sending Three People to Space in Three Years

One of the most notable features of the modern space age is the way that new participants are entering the fray. In addition to the traditional contenders – NASA and Roscosmos – China has become a major player in space in recent decades. And in 2022, according tor recent statements, India will join the club too when it becomes the fourth nation to send a crewed mission to space.

During a cabinet-level meeting that took place on Friday, Dec. 25th, the government of India announced that the Indian Space Research Organization's (ISRO) first crewed mission to space will consist of a three-astronaut team being sent to orbit. The government also announced that they had a approved a budget of $1.4 billion to fund the development of the requisite technology and infrastructure for the program.

This Crater on Mars Traps the Cold, and Remains Filled With Ice, All Year Round

On June 2nd, 2003, the European Space Agency's *Mars Express* mission left Earth to begin its journey to Mars. Six months later (on December 25th) the spacecraft fired its main engine and entered orbit around Mars. This Christmas will therefore mark the fifteenth anniversary of the orbiter's arrival and all the observations it has made of the Red Planet since then.

Appropriately, the *Mars Express* mission was able to commemorate this occasion by capturing some beautiful photos of a Martian crater that remains filled with ice all year round. This feature is known as the Korolev crater, which measures 82 km (51 mi) in diameter and is located in the northern lowlands, just south of the northern polar ice cap.

InSight Just Placed its Seismometer onto the Surface of Mars to Listen for Marsquakes

NASA's InSight lander has deployed its first instrument on the surface of Mars. On December 19th, the stationary lander used its robotic arm to deploy the SEIS (Seismic Experiment for Interior Structure), marking the first time a seismometer has been placed on the surface of another planet. This is a milestone for the mission, and one that comes well ahead of schedule.

InSight landed on Mars at Elysium Planitia on November 26th. Since then, it's been checking out its immediate surroundings with its cameras to find the perfect spot to deploy the seismometer, and its other deployable instrument, the HP3 (Heat Flow and Physical Properties Package.) Mission planners allocated several weeks for instrument site selection, so this is well ahead of schedule.

"InSight's timetable of activities on Mars has gone better than we hoped," said InSight Project Manager Tom Hoffman, who is based at NASA's Jet Propulsion Laboratory in Pasadena, California. "Getting the seismometer safely on the ground is an awesome Christmas present."

Next to InSight's harrowing descent and landing, instrument placement is the next critical step. To get it right, the engineering team relied on a unique testing facility here on Earth, at JPL. They built a test-bed as a mock-up of InSight's location on Mars, and practiced placing the seismometer with InSight's twin, ForeSight.

At the InSight lander test-bed facility at JPL, engineers sculpt a gravel-like material into a replica of InSight's landing site on Mars. The wood marks the boundaries of the lander's instrument placement zone. Image Credit: NASA/JPL-Caltech/IPGP

Pre-testing instrument placement here on Earth before issuing commands to InSight was crucial. The team created what they call a Martian rock-garden, raking and scooping gravel material into an exact replica of InSight's landing spot. The team called it Marsforming.

Engineers used some sophisticated technology to get things just right at the test-bed. Using augmented reality headsets, the team projected Digital Terrain Models (DTM) onto the test-bed, and precision cameras measured each feature they replicated. It took them four hours to create the test-bed, down to any detail larger than about one half inch.

InSight Project Manager Tom Hoffman (standing) and engineer Marleen Sundgaard wear Microsoft HoloLens augmented reality headsets, which project digital terrain models of InSight's landing location on Mars over the test-bed. Image Credit: NASA/JPL-Caltech/IPGP

The test-bed also contains a full-scale working model of the InSight lander, called ForeSight. After recreating the real lander's conditions on Mars at the test-bed, engineers practiced placing the seismometer with Foresight's robotic arm. Engineers say they're fortunate that InSight's landing spot was nice and flat, and free of large rocks, which could damage the wires connecting the instruments to the lander.

"It's the flat parking lot the landing team promised us." – Marleen Sundgaard, JPL.

"It's great for the science we want to do," said JPL's Marleen Sundgaard, who is guiding the test-bed work. "It's the flat parking lot the landing team promised us. You calculate the probability of rocks in the area and hope the odds are in your favor."

"All around us, there are rocks that were ejected from nearby craters. These can be launched miles across the landscape, depending on the impact size," said Nate Williams, a JPL post-doctoral researcher working with the mission. "Thankfully, there just aren't a lot of rocks right in front of us."

The team spent several days practicing the instrument placement at the test bed. Wearing Microsoft HoloLens headsets, the team saw a glowing red Martian surface with the blue contour lines of the Digital Terrain Model from the actual terrain in front of InSight on Mars. This isn't the first time that NASA has used the HoloLens for lander operations. For the last several years, scientists with NASA's Curiosity rover have used the HoloLens in conjunction with custom software called OnSight. It lets them "walk" on Mars and make decisions about what to study next.

Go Time

On the morning of Monday, December 17th, the engineering team at the rock garden was satisfied that they could get SEIS exactly where the science team wanted it. They had practiced all the movements for the instrument placement arm, and were confident they could place the instrument while keeping the instrument tether clear of rocks. They also confirmed that the Heat Flow Probe can be placed in its desired location, about 1.2 meters (4 ft.) to the left of the seismometer.

On Tuesday, Dec. 18th, the commands were issued to Insight to place SEIS on the Martian surface. On December 19th, InSight used its robotic arm to place SEIS in its chosen location, 1.636 meters, or 5.367 feet, away. This is about the furthest that the arm can reach.

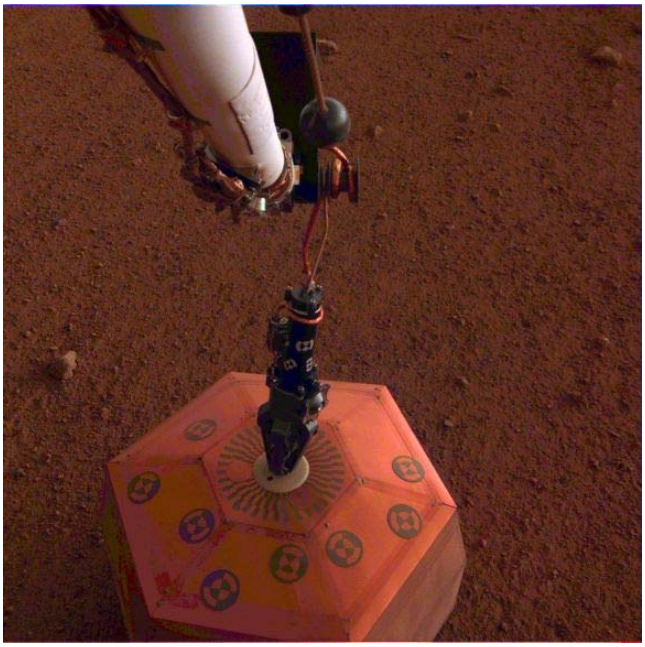
According to the InSight team, placement of SEIS was critical to mission success. InSight has other instruments, but a failed placement would've hampered the mission significantly. There's still some work required to level the seismometer. It's sitting on ground that is tilted about 2 or 3 degrees. Once it's levelled, data should start flowing.

It'll take several additional weeks after instrument placement for scientists and engineers to make sure the data is as clear as possible. They may need to adjust SEIS' tether to minimize noise, and in early January, they will place the thermal and wind cover over the

seismometer. In late January, the InSight team plans to place the Heat Flow and Physical Properties Package.

"Having the seismometer on the ground is like holding a phone up to your ear," – Philippe Lognonné, principal investigator of SEIS from Institut de Physique du Globe de Paris (IPGP) and Paris Diderot University.

SEIS will give us a look inside Mars. The instrument will listen for Marsquakes, and will analyze the seismic waves as they pass through the planet. The data will paint a picture of the interior structure. "Having the seismometer on the ground is like holding a phone up to your ear," said Philippe Lognonné, principal investigator of SEIS from Institut de Physique du Globe de Paris (IPGP) and Paris Diderot University. "We're thrilled that we're now in the best position to listen to all the seismic waves from below Mars' surface and from its deep interior."



NASA's Mars InSight lander has deployed its seismometer on the surface of Mars, marking an important milestone for the mission. Image Credit: NASA/JPL-Caltech

With SEIS in position and ready to get to work, and with a site for the HP3 selected, InSight is well on its way to meeting its science objectives. Another experiment, RISE (Rotation and Interior Structure Experiment) is already underway. RISE doesn't use a deployable instrument. It's a radio science experiment that uses the lander's X band radio to provide precise measurements of planetary rotation. Data from RISE will be combined with data from other Mars landers and orbiters to calculate the size and density of Mars' core and mantle.

InSight's planned mission length is 709 sols, or 728 days. Once the mission is completed, we'll have a lot more detailed knowledge of Mars' deep interior. Hopefully, we'll also learn a lot about how other rocky planets formed.

Sources:

NASA Press Release: NASA's InSight Places First Instrument on Mars

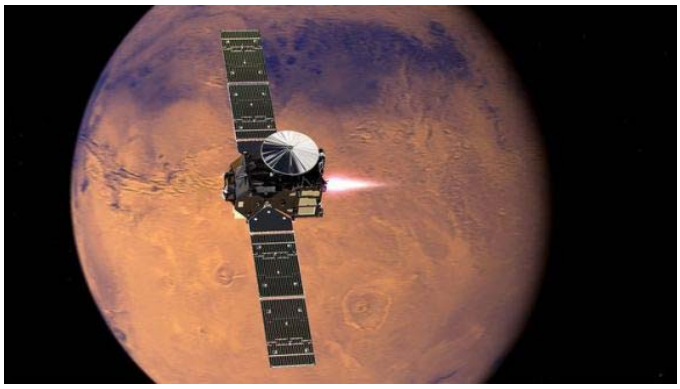
NASA Press Release: InSight Engineers Have Made a Martian Rock Garden

NASA Press Release: Mars Virtual Reality Software Wins NASA Award

NASA: Mars InSight Mission

DECEMBER 20, 2018

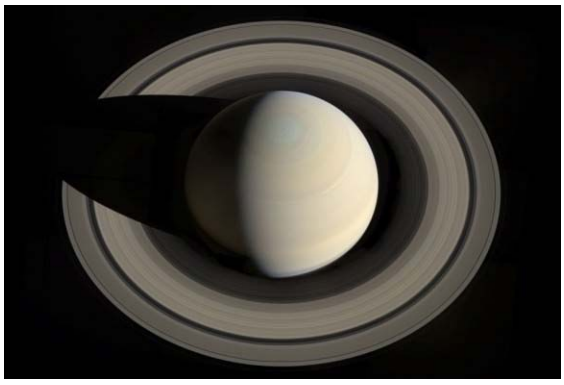
Remember the Discovery of Methane in the Martian Atmosphere? Now Scientists Can't Find any Evidence of it, at all



In 2003, scientists from NASA's Goddard Space Center made the first-ever detection of trace amounts of methane in Mars' atmosphere, a find which was confirmed a year later by the ESA's *Mars Express* orbiter. In December of 2014, the Curiosity rover detected a tenfold spike of methane at the base of Mount Sharp, and later uncovered evidence that Mars has a seasonal methane cycle, where levels peak in the late northern summer.

Since it's discovery, the existence of methane on Mars has been considered one of the strongest lines of evidence for the existence of past or present life. So it was quite the downer last week (on Dec. 12th) when the science team behind one of the ESA's *ExoMars Trace Gas Orbiter* (TGO) spectrometers announced that they had found no traces of methane in Mars' atmosphere.

Saturn is Losing its Rings, Fast. They Could be Gone Within 100 Million Years



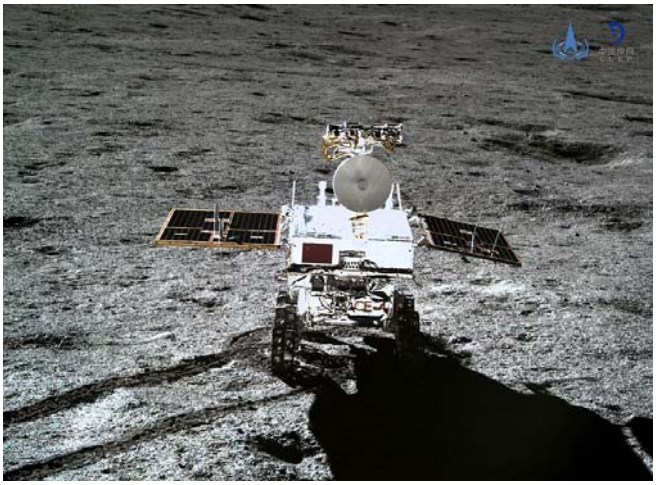
It has been almost forty years since the *Voyager 1* and *2* missions visited the Saturn system. As the probes flew by the gas giant, they were able to capture some stunning, high-resolution images of the planet's atmosphere, its many moons, and its iconic ring system. In addition, the probes also revealed that Saturn was slowly losing its rings, at a rate that would see them gone in about 100 million years.

More recently, the *Cassini* orbiter visited the Saturn system and spent over 12 years studying the planet, its moons and its ring system. And according to new re-

search based on *Cassini's* data, it appears that Saturn is losing its rings at the maximum rate predicted by the *Voyager* missions. According to the study, Saturn's rings are being gobbled up by the gas giant at a rate that means they could be gone in less 100 million years.

China releases more images from far side of the moon

January 13, 2019 Stephen Clark



China's Yutu 2 rover on the far side of the moon. This image was released by Chinese space officials Friday, Jan. 11. Credit: CNSA/CLEP

Chinese officials on Friday released more imagery from the Chang'e 4 mission, a robotic lander and rover exploring the far side of the moon after a successful landing Jan. 3.

The imagery released Friday included a new view of China's Yutu 2 rover captured by a camera aboard the Chang'e 4 lander, a panoramic vista of the austere lunar landscape, and a sped-up video showing the spacecraft's final descent to the moon from the view of the probe's descent camera.

Chang'e 4 was set to enter a low-power sleep mode Sunday as the sun set on the landing site in Von Kármán crater, a bowl-shaped depression measuring around 110 miles (180 kilometers) in diameter located in the southern hemisphere of the far side of the moon.

Nighttime lasts 14 days on the lunar surface as the moon orbits the Earth once every 28 days, and temperatures are predicted to dip to minus 297 degrees Fahrenheit (minus 183 degrees Celsius) as the sun disappears below the horizon at Von Kármán crater.

Chang'e 4 will switch to a "sleep mode" as night falls as solar energy will no longer be available to power the probe. The spacecraft carries a radioisotope heat source and power generator to keep warm and generate electricity when the sun is below the horizon. The device was developed in collaboration between Russian and Chinese experts, according to China's state-run Xinhua news agency.

The small electricity generator is not big enough to power the entire lander, but it will allow sensors to gather temperature data on the lunar surface throughout the night, Xinhua reported, a capability not carried on Chang'e 3, China's previous lunar lander which touched down on the near side of the moon in 2013.

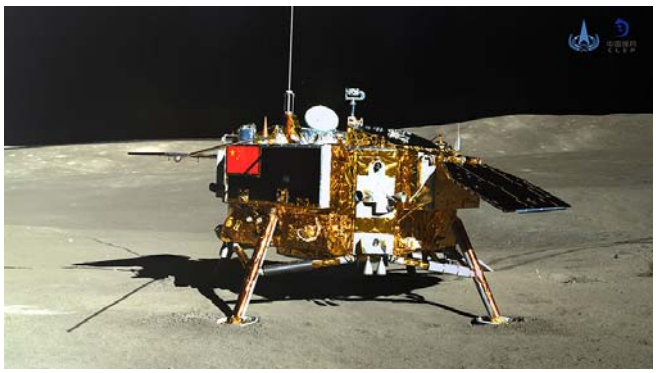
The descent camera video shows the Chang'e 4 spacecraft approaching the lunar surface, first flying on a horizontal trajectory, then transitioning to a vertical descent phase.

Chang'e 4's landing sequence lasted around 12 minutes, beginning with ignition of the probe's variable-thrust descent engine to slow the craft's horizontal velocity from 3,800 mph (1.7 kilometers) per second to nearly zero. Then the spacecraft pitched over, a maneuver visible in the video released by the China National Space Administration on Friday, at an altitude of around 20,000 feet (6 kilometers) above the moon.

The video released by the Chinese space agency is sped up about two-and-a-half times normal speed, and it illustrates the difficulty of navigating across the airless lunar landscape. It's challenging to visually ascertain the lander's altitude, or gauge the relative size of the numerous craters visible in the video, but Chang'e 4 carried a laser ranging instrument to measure the spacecraft's altitude and descent rate, feeding data to the probe's guidance computer throughout the landing sequence.

The Chang'e 4 spacecraft paused its descent around 330 feet (100 meters) above the surface to search for safest place to touch down, using hazard avoidance algorithms to steer clear of craters and boulders. In the final seconds of the landing, Chang'e 4's engine can be seen kicking up first before plopping down on four legs, achieving the first-ever soft landing on the far side of the moon at 0226 GMT on Jan. 3 (9:26 p.m. EST on Jan. 2).

Early results from the Chang'e 4 mission suggest the landing site in Von Kármán crater has fewer rocks strewn on its surface than Chang'e 3's landing site on the near side of the moon. The surface at Von Kármán crater also appears to be covered in a thicker layer of fine dust.



A camera on China's Yutu 2 lunar rover took this picture of the Chang'e 4 lander, emblazoned with the Chinese flag, after arriving on the moon earlier this month. Shadows of the 16-foot (5-meter) antennas for the lander's low-frequency radio spectrometer instrument are also visible in this image. Chinese space officials released this picture Jan. 11. Credit: CNSA/CLEP

The far side of the moon is more rugged than the near side, so Chinese officials adjusted the descent trajectory for the Chang'e 4 mission to a more vertical profile from the curved profile used on Chang'e 3, China's previous lunar lander which touched down on the near side in 2013.

“We chose a vertical descent strategy to avoid the influence of the mountains on the flight track,” said Zhang He, executive director of the Chang’e 4 probe project from the China Academy of Space Technology, said in a report published by the Xinhua news agency.

On Earth, the landing craft weighs around 2,600 pounds (1,200 kilograms) without its propellant, and is about the size of a car. A few hours after landing, China’s 297-pound (135-kilogram) Yutu 2 rover rolled off the Chang’e 4 stationary landing platform to begin exploring.

The Yutu 2 rover was named after the mobile robot named Yutu that flew on the Chang’e 3 mission to the moon in 2013. Yutu means “jade rabbit” in Chinese, and is the name of the pet rabbit of the moon goddess Chang’e in Chinese folklore, the namesake of China’s lunar missions.

Chang’e 4’s lander and rover were originally built as spares for Chang’e 3, then modified for a new mission on the back side of the moon after Chang’e 3’s successful landing.

A video released by Chinese space officials are posted on YouTube by the Planetary Society shows the Yutu 2 rover driving on the moon, then using its wheels to turn in place.

Chang’e 4 carries a low frequency radio spectrometer developed by Chinese scientists for astrophysics research. A German-developed neutron and dosimetry instrument on the stationary lander will measure radiation levels at the Chang’e 4 landing site, collecting data that could be useful in planning human exploration of the lunar far side, studying solar activity, and gauging the underground water content in Von Kármán crater.

Yutu 2 hosts a ground-penetrating radar to study geologic layers buried under the landing site, and a visible and near-infrared spectrometer to gather data on soil composition. Chinese officials approved the addition of a Swedish instrument on the rover to study the interaction between the solar wind and the lunar surface, which is not shielded by an atmosphere from the bombardment of charged particles originating at the sun.

Chang’e 4 also delivered to the moon a student-designed carrier containing potato seeds and silkworm eggs. University students and scientists will monitor the growth of the organisms, which are housed inside a chamber and fed natural light and nutrients once on the lunar surface.

Chinese officials said Chang’e 4’s landing site is located at 177.6 degrees east longitude and 45.5 degrees south latitude on the moon, in a region known as South Pole-Aitken basin. The basin covers a large swath of the lunar far side’s southern hemisphere, and is believed by scientists to be one of the most ancient impact sites in the solar system, created when a large asteroid or comet struck the moon.

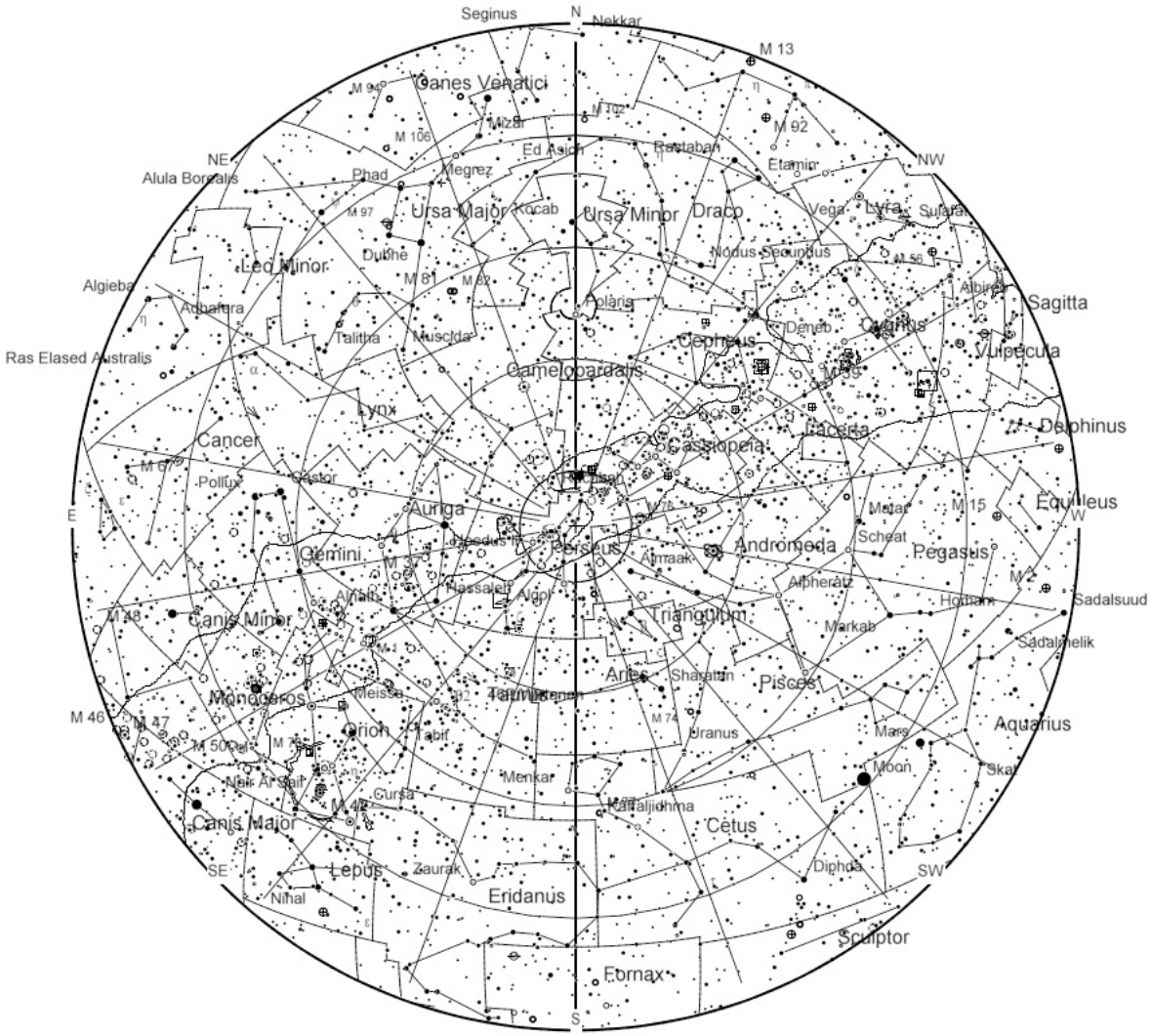
China launched last year. The Queqiao, or “magpie bridge,” spacecraft is positioned beyond the moon, with an antenna in view of both Chang’e 4 and Earth, allowing it to relay commands and signals between ground controllers and the lander.

Chang’e 4 was the 20th spacecraft in history to safely land on the moon, and China’s second lunar lander. China’s next lunar mission, Chang’e 5, could launch by the end of 2019 to land on the moon, scoop up samples and return the specimens to scientists on Earth for analysis in ground-based labs.

This panoramic view was captured by a camera on-board the Chang’e 4 lander, showing the Yutu 2 rover and its tracks on the lunar surface. Credit: CNSA/CLEP

Scientific data and images from Chang’e 4 are relayed back to Earth through a dedicated communications satellite

WHATS UP, JANUARY 2019



January 6 - **Partial Solar Eclipse.** A partial solar eclipse occurs when the Moon covers only a part of the Sun, sometimes resembling a bite taken out of a cookie. A partial solar eclipse can only be safely observed with a special solar filter or by looking at the Sun's reflection. The partial eclipse will be visible in parts of eastern Asia and the northern Pacific Ocean. It will be best seen from northeastern Russia with 62% coverage.

January 21 - **Full Moon, Supermoon.** 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 05:16 UTC. This full moon was known by early Native American tribes as the Full Wolf Moon because this was the time of year when hungry wolf packs howled outside their camps. This moon has also been know as the Old Moon and the Moon After Yule. This is also the first of three supermoons for 2019. The Moon will be at its closest approach to the Earth and may look slightly larger and brighter than usual.

January 22 - **Conjunction of Venus and Jupiter.** A conjunction of Venus and Jupiter will be visible on January 22. The two bright planets will be visible within 2.4 degrees of each other in the early morning sky. Look for this impressive sight in the east just before sunrise.

January 21 - **Total Lunar Eclipse.** A total lunar eclipse occurs when the Moon passes completely through the Earth's dark shadow, or umbra. During this type of eclipse, the Moon will gradually get darker and then take on a rusty or blood red color. The eclipse will be visible throughout most of North America, South America, the eastern Pacific Ocean, western Atlantic Ocean, extreme western Europe, and extreme western Africa.

February 4 - **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 21:03 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.

Super blood moon UK 2019: When and where can you see the lunar eclipse?

Tom Herbert 07/01/2019

Stargazers can look forward to a rare lunar phenomenon which will be visible from the UK later this month.

A glowing red "super blood moon eclipse" will delight astronomers and enthusiasts for around three hours on January 21.

The first lunar phenomenon of the year will see the moon appear red as light from the Sun is completely blocked out by the earth.

But what exactly is a "super blood moon eclipse" and when and where will you be able to see it?

What is a "super blood moon eclipse"?

The rare event is actually a combination of two different celestial phenomenons - a total lunar eclipse and a supermoon.

Otherwise known as a blood moon, a total lunar eclipse causes the moon to glow blood red as the shadow of the earth casts a hue on the moon as it passes directly between the sun and the moon.

Sunlight filtered through the earth's atmosphere bounces back onto the moon's surface, and because the light waves are stretched out, they appear red when they strike the moon's surface.

This is what gives the moon its reddish tinge which, while not "blood" red as its name suggests, has a copper-like colour.

Anna Ross, an astronomer at the Royal Observatory, previously told the Standard: "We only see them from here in the UK about once every other year, and it will also coincide with a supermoon (so when the moon is at its closest point to the Earth in its orbit).

"These events only coincide around one every in three total lunar eclipses making it even more exciting."

A supermoon happens only when a full moon aligns with the point closest to the earth in the moon's elliptical orbit.

During this time, the moon will appear 14 per cent bigger and 30 per cent brighter than usual as it reaches its closes point to Earth.

When and where can I see the super blood moon?

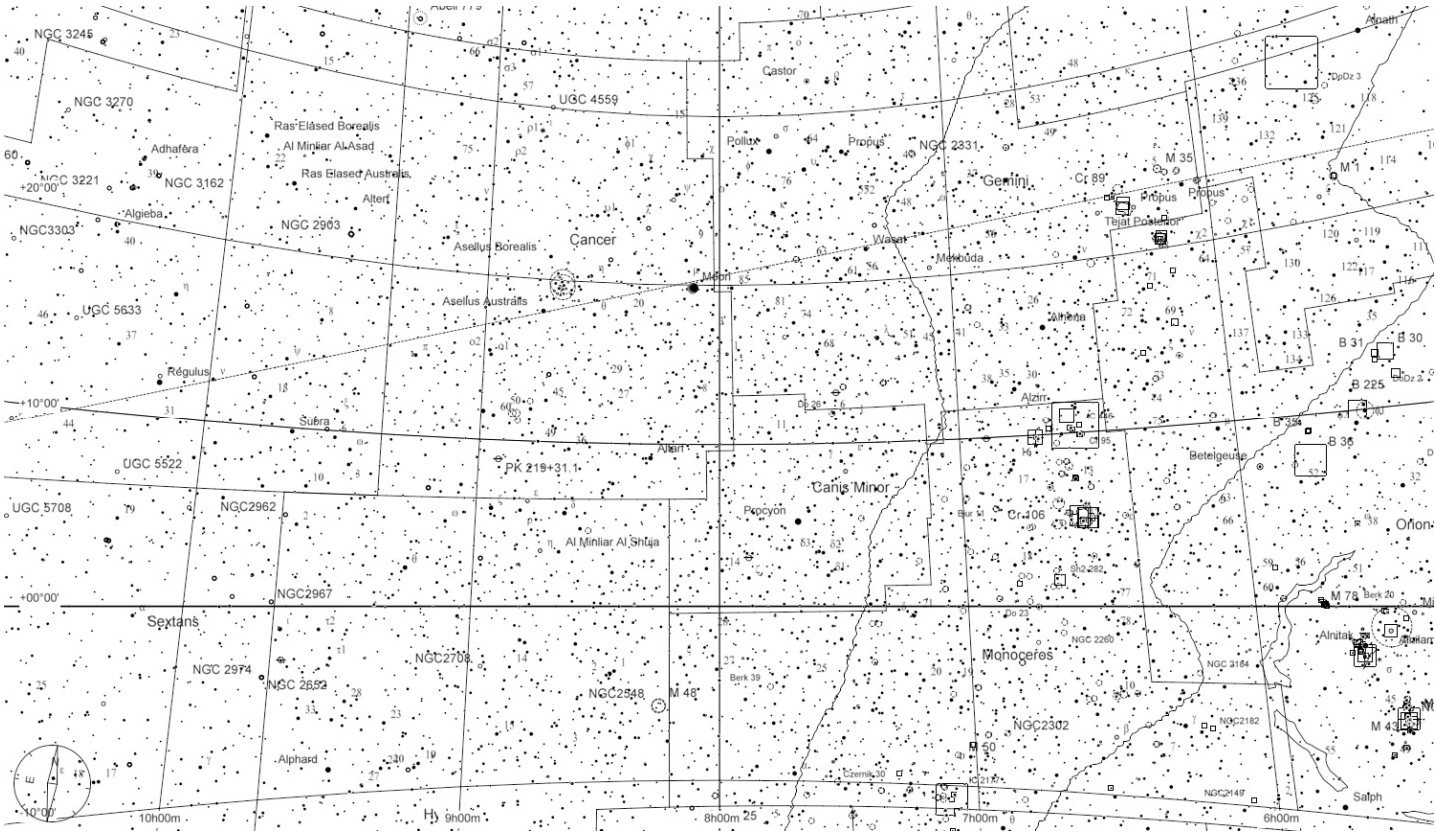
The best time to see this lunar spectacle from the UK will be just before 5.15am on January 21.

Visible over the Americas and northern and western Europe, the event is set to start just after 2.30am and will last until 7.48am - meaning you can catch it anywhere outside.

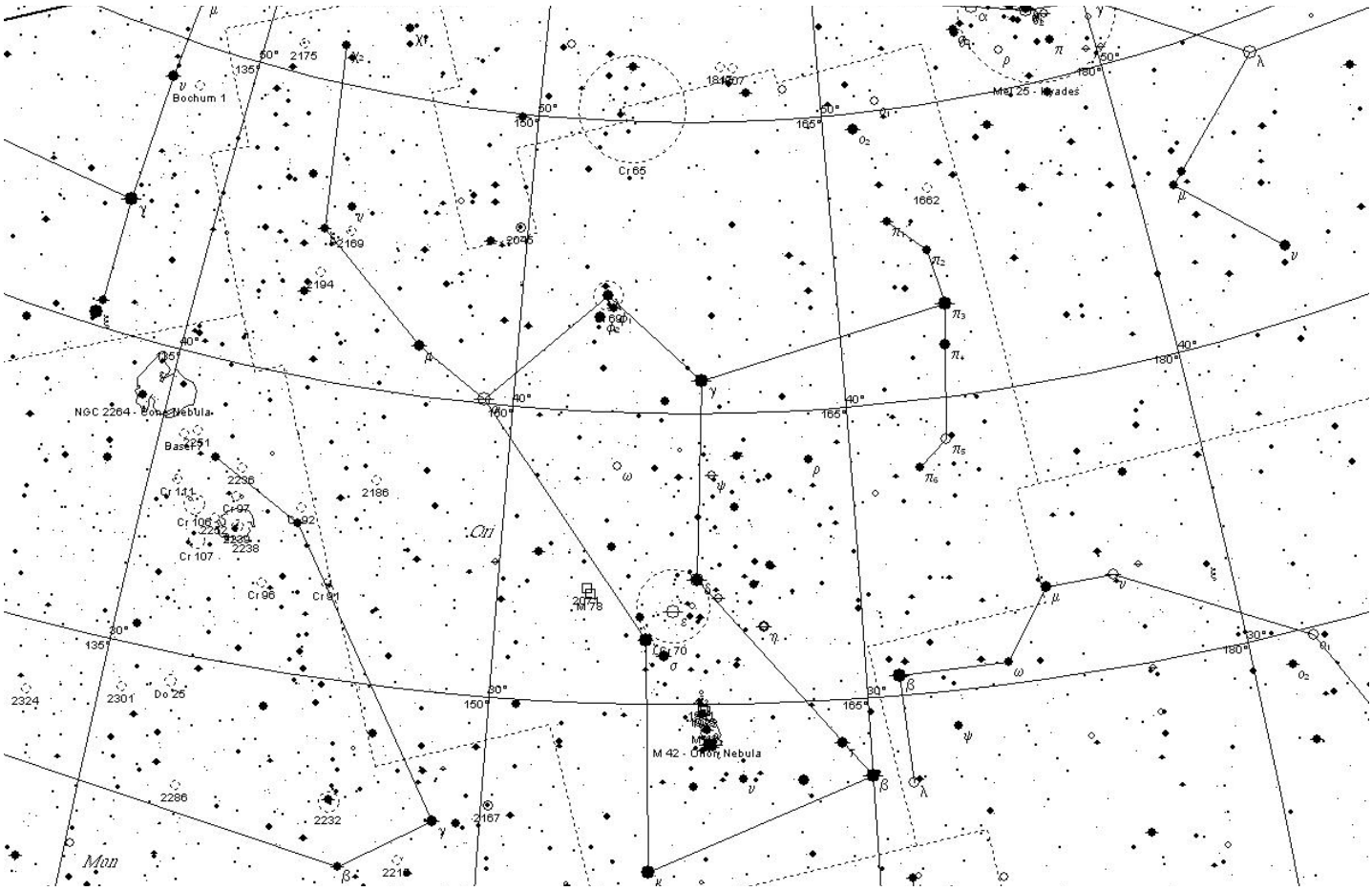
Some parts of the very edge of western Africa will be able to catch a glimpse of the event, while the rest of Europa and Asia will only get to see a partial eclipse towards the end.

Andy

Below is the sky map for the period of full eclipse. One of the thrilling sights is when the Moon goes into eclipse and the stars come out that glare had stopped us seeing while the full moon was there.



CONSTELLATIONS OF THE MONTH: ORION



Transit Date of principal star:
20 December

Orion is the master of the winter skies. He lords over the heavens from late fall to early spring, with his hunting dog Sirius trailing at his feet.

The mythic tales of Orion go as far back as the Hittites, who flourished from the Second Millenium BC to around 1200 BC.

One story from this culture gives an interesting account of Orion's death. Here he is called Aqhat, and was a handsome and famous hunter. The Battle-Goddess Anat fell in love with Aqhat, but when he refused to lend her his bow, she sent another man to steal it. This chap bungled the job, and wound up killing Aqhat and dropping the bow into the sea. This is said to explain the astronomical fact that Orion and the Bow (an older version of the constellation) drops below the horizon for two months every spring.

Like all myths borrowed from several sources over a great length of time, the Greek stories offer many variations. Generally speaking, Orion was known as the "dweller of the mountain", and was famous for his prowess both as a hunter and as a lover. But when he boasted that he would eventually rid the earth of all the wild animals, his doom may have been sealed.

It might have been the Earth Goddess herself who sent the deadly scorpion to Orion. Or possibly Apollo, concerned that Orion had designs on his sister, Artemis. Thus Apollo may have told the Earth Goddess of Orion's boast. In any case, it seems clear that it was the Earth Goddess who sent the scorpion on its mission.

Some stories have the scorpion killing Orion with its sting. However the general consensus is that he engaged the scorpion in battle but quickly realised its armour was impervious to any mortal's attack. Orion then jumped into the sea and swam toward Delos. But Apollo had witnessed Orion's struggle with the scorpion and would not let him escape so easily. He challenged his sister Artemis, who was an excellent shot, if she could hit that small black object far away in the sea, the head -- he told her -- of an infamous and treacherous villan. Artemis struck the object with her first shot. She then swam out to retrieve her victim's corpse, and discovered she had killed Orion. Artemis implored the gods to restore his life, but Zeus objected. So she put Orion's image in the heavens.

In his eternal hunting, Orion is careful to keep well ahead of the scorpion. In fact Orion has disappeared over the horizon by the time Scorpio rises in the east, as it becomes his turn to rule the evening sky.

Finding Orion should be no problem. Its <u>stars</u> are some of the most familiar in all the heavens. Question: can you name the three stars that make up Orion's Belt. (Answer below.)

Above the belt, slightly to the left, is *Betelgeuse, alpha Orionis.*

Betelgeuse, the right arm of Orion (or "armpit" as the name suggests), glows with a dull red. Although labelled *alpha Orionis*, it is less bright than *beta Orionis* (Rigel), in the opposite corner of the constellation, to the southwest. Yet if slightly less bright, it is much larger, estimated at around 250 Suns. If one were to replace our Sun with Betelgeuse, its size would completely engulf the Earth and extend as far as Mars.

As the brightest star in Orion, *Rigel* ranks as the seventh brightest star in all the heavens, just behind Capella. It is a visual binary; its companion is much fainter, but quite visible if you are persistent enough (PA 202º, 9.4").

The other corners of the constellation are formed by *Bellatrix (gamma Orionis)* and *Saiph (kappa Orionis)*. It was once thought that all women born under the sign of Bellatrix would be fortunate and have the gift of speech. The star's name is often translated as Female Warrior or Amazon, and another name sometimes seen is "Amazon Star".

The constellation's main feature is of course the three stars which form the "belt" across the middle of Orion: from west to east *Mintaka, Alnilam,* and *Alnitak*. Even the Bible makes reference to this famous group. God, while pointing out how all-powerful he was, is purported to have asked Job if he (Job)

was able to "loose the bands of Orion" (*Job* 38.31).

The last of these stars is also known as *zeta Orionis*, and is a well known triple star system. The primary is a blue-white star, and its companion (165º, 2.3") is a dull red. Close by, just to the south, is the renowned Horsehead Nebula, a so-called dark nebula that is not visible in scopes but quite spectacular in long-exposure photographs.

Binary stars in Orion:

There are many double stars in this constellation visible in small telescopes. Below are several selected from a wide list.

Beta Orionis (Rigel) has a 10.4 visual magnitude companion at 202º and a wide 9.5" separation. This is a fixed system.

Lambda Orionis (between Betelgeuse and Bellatrix) is another fixed binary, with a 5.5 companion at PA 43º and 4.4" away.

Theta[1] is a complex system of fixed stars. The four brightest form The Trapezium, an outstanding multiple system for small telescopes. AB is at a position angle of 32º and separation 8.8", AC: PA 132º, 12.7", and AD: PA 96º, 21.5".

Theta[2] is also a fine binary, a triple system to the southeast of The Trapezium. Component B is a binocular object: 6.4 magnitude at a position angle of 92º and separation 52.5". Component C (8.5) is even wider: PA 98º and separation 128.72".

Sigma Orionis is one of the few orbiting binaries found in Orion. Component B has an orbit of 158 years and is one of the few components that traces a not-quite-perfect circle. That's to say, we see it nearly face on, as a wheel spinning around its hub.

The separation never changes much from its current distance of only 0.2". Its 2000.0 position angle is 132º.

Much easier to resolve is component E, with a visual magnitude of 6.7, this is a binocular object at a position angle of 61º and separtion of 42".

Zeta Orionis (1.9, 4.0) has a very slow orbit of 1509 years, and is currently at 165º and 2.3" separation.

Variable stars in Orion:

A dozen stars in this constellation are visible in small scopes, but most of them are of the EA type of eclipsing binaries, which change very little. These include two stars of the Trapezium (theta 1A and 1B).

EA variables are old stars, nearing the end of their evolutionary process. The companion has grown to the size of a subgiant, perhaps equal in size to its primary. But their luminosities are quite different; thus, as the dimmer companion revolves around its primary, variations in the total brightness occur.

The maximum brightness occurs of course when the two are not eclipsed, with each one adding its luminosity to the total output. Two minima also occur: the principal minimum is when the companion blocks out the primary; while a secondary minimum occurs when the companion is eclipsed by the primary.

The only interesting Mira-type regular variable is *U Orionis*, which usually has a brightness of 4.8 but every 368.3 days it drops down to 13. In 2000 the minimum is scheduled to occur on 5 December.

Deep Sky Objects in Orion:

M42, The Orion Nebula is perhaps the most photographed deep sky object in the heavens, a vast nebula of gas and dust exquisitely lit by surrounding stars.

This is a celestial nursery; soon (that's to say, in several hundred million years) young stars will appear from this wealth of cosmic matter.

Inside the nebula is the fascinating four-star system known as

The Trapezium: theta 1A, 1B, 1C, and 1D - four stars held together by common gravity (actually at least two other stars are part of this complex system.) They are visible in medium sized telescopes and, with the nebula, form one of the most beautiful binary systems in the heavens.

M43 (NGC 1982) is a detached part of the Orion Nebula, with a ninth magnitude central star. A dark lane of gas separates M43 from M42, although the two are actually part of the same vast cloud.

M78 (NGC 2068) is a faint reflection nebula NE of Alnitak (zeta Ori), that looks best in long-exposure photographs.

The Horsehead Nebula is an intriguing and devilishly difficult dark nebula found just between zeta Orionis and sigma Orionis, visible in medium to large telescopes given the right sky conditions. An H-Beta filter is also helpful.

ISS PASSES For December 2018 From Heavens Above website maintained by Chris Peat

Date	Brightness	Start	Highest point		End					
	(mag)	Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
23 Jan	-1.4	19:09:42	10°	SSW	19:10:43	16°	SSW	19:10:43	16°	SSW
24 Jan	-1.9	18:18:27	10°	S	18:20:43	17°	SE	18:21:05	17°	SE
24 Jan	-0.5	19:53:31	10°	WSW	19:53:46	12°	WSW	19:53:46	12°	WSW
25 Jan	-1.4	17:27:57	10°	SSE	17:28:59	11°	SE	17:30:01	10°	ESE
25 Jan	-2.7	19:01:42	10°	SW	19:04:03	36°	SSW	19:04:03	36°	SSW
26 Jan	-2.6	18:10:01	10°	SSW	18:12:57	30°	SSE	18:14:17	22°	ESE
26 Jan	-1.1	19:45:55	10°	WSW	19:46:58	19°	WSW	19:46:58	19°	WSW
27 Jan	-3.8	18:53:57	10°	WSW	18:57:08	67°	S	18:57:08	67°	S
28 Jan	-3.3	18:02:03	10°	SW	18:05:14	50°	SSE	18:07:15	20°	E
28 Jan	-1.6	19:38:22	10°	W	19:39:55	26°	W	19:39:55	26°	W
29 Jan	-4.0	18:46:19	10°	W	18:49:37	88°	SSE	18:50:01	66°	E
30 Jan	-3.8	17:54:17	10°	WSW	17:57:33	74°	SSE	18:00:05	16°	E
30 Jan	-2.1	19:30:46	10°	W	19:32:45	34°	W	19:32:45	34°	W
31 Jan	-3.9	18:38:41	10°	W	18:41:59	84°	N	18:42:49	48°	E
31 Jan	-0.3	20:15:12	10°	W	20:15:29	12°	W	20:15:29	12°	W
01 Feb	-3.8	17:46:36	10°	W	17:49:53	89°	NNW	17:52:52	12°	E
01 Feb	-2.8	19:23:06	10°	W	19:25:33	45°	W	19:25:33	45°	W
02 Feb	-3.9	18:31:01	10°	W	18:34:19	89°	SSE	18:35:38	34°	E
02 Feb	-0.7	20:07:34	10°	W	20:08:18	15°	W	20:08:18	15°	W
03 Feb	-3.8	17:38:54	10°	W	17:42:12	85°	N	17:45:30	10°	E
03 Feb	-3.2	19:15:25	10°	W	19:18:25	51°	SW	19:18:25	51°	SW
04 Feb	-3.6	18:23:16	10°	W	18:26:33	70°	SSW	18:28:35	21°	ESE
04 Feb	-0.9	20:00:05	10°	W	20:01:16	17°	WSW	20:01:16	17°	WSW
05 Feb	-2.4	19:07:44	10°	W	19:10:43	32°	SSW	19:11:31	28°	S
06 Feb	-2.9	18:15:30	10°	W	18:18:41	46°	SSW	18:21:51	10°	SE
06 Feb	-0.8	19:53:15	10°	WSW	19:54:34	12°	SW	19:54:34	12°	SW
07 Feb	-1.3	19:00:16	10°	W	19:02:39	19°	SW	19:05:01	10°	S
08 Feb	-1.8	18:07:49	10°	W	18:10:40	28°	SSW	18:13:31	10°	SSE
10 Feb	-0.9	18:00:25	10°	WSW	18:02:30	16°	SW	18:04:35	10°	S

FORUM QUESTIONS and ANSWERS

1. Back Focus - this has always confused me and I have struggles to achieve focus on my Atik One with off axis guider. And have had no luck contacting Atik to resolve it either

So exactly what is it, how does it relate to using a scope with a camera (DSLR or dedicated astrocam), How do you achieve it if you don't have enough or even have too much (reducers, barlow, spacers etc)

May be there are some diagrams somewhere that could be used to explain it better.

Back focus is the distance from the end of your eyepiece drawtube to the focal plane of your telescope. It varies greatly depending on the type of telescope:

· Schmidt-Cassegrain telescopes (SCTs) typically have generous back focus distances of approximately 5 in. Similarly, Maksutov-Cassegrains (Maks) also have large back focus distances.

· Newtonian reflectors have much smaller back focus distances, sometimes as little as 1-2 in.

· Refractors usually have large back focus distances; their long drawtubes can travel well inside focus, too.

Back focus directly impacts your ability to use accessories with your telescope. With limited back focus, you may not be able to use Barlows, focal reducers, binoviewers, SLRs, and 2 in eyepieces. The design most heavily impacted is the Newtonian due to its short back focus; the only two possible fixes are to move the mirror and its cell up in the tube and/or get a low-profile eyepiece focuser.

Combining accessories can also cause back focus problems. Focal reducers also reduce back focus and, when used for prime-focus photography with an SLR, there may not be enough back focus left to accommodate the approximately 50 mm needed for the camera body. This is true even with an SCT's long back focus distance.

For refractors, a related issue is back travel. Many refractors won't work straight-through with eyepieces or small cameras at infinity because the drawtube won't extend that far. A solution that works is to use extension tubes, such as a star diagonal--it acts as a drawtube extension.

Another situation you may encounter is focal plane access when combining various accessories. As one example, some 2 in diagonals won't achieve focus when used with short-focal length 1.25 in eyepieces because the focal plane is buried too far down in the big diagonal, out of reach of the small eyepiece. Here you'll have to try another combination - switch from a 2 in to a smaller 1.25 in diagonal to get a focus.

2. Polar Alignment - what is it why is it important (if it is) and when and also Different ways of achieving it. e.g. Polar scopes, Sharp Cap, Drift alignment, Polemaster etc

3. Some good safe dark(ish) sky areas in the North Wilts that would be good for beginners to go to - This was discussed in a conversation at the last meeting on Tuesday where it was suggested that 'ad hoc' observing evenings (when skies are clear) and could be organised by any individual via Facebook or similar Maybe adding post codes or grid refs to easily find via google maps.

One of the key components is lighting however it is being used, and there are examples of good and forms of ALL lighting across the county. So for ad-hoc arrangements it is best to manage the lighting or expectation of where you are viewing.

Weather conditions (lights reflect off wet surfaces) excluding the dreaded cloud can have severe implications.

Dry cold steady clear conditions can bring in dewing problems.

Height of the object to be viewed… if low down (less than 20degrees) you are looking through more atmosphere (even without cloud or mist) this can distort objects, hence scintillation.

Accessibility is another requirement, car parking and level set up areas are needed.

No one site is good for all conditions and directions of view, but areas like Alton Barnes car park are fair if no military action in progress.

Looking North in North Wiltshire is a problem, you have to be West of Swindon and go North of the M4. The Vineyard at Foxham has a large useful car park.

Hackpen Hill has a car park a good Western views (planetary alignments at Sunset etc).

Bratton camp and Westbury Whitehorse has good Easterly views and fair to the South, but a lot of dog shit to contend with.

You may be looking for foreground interest if imaging sky events and the Milky Way. Avebury and Silbury are OK but can have pollution issues. Stonehenge has been ruled out by closures of the byways.

Overhead (30degrees around the zenith) then a lot more options are available.

Use local features to cover lights, but they can get in the way too!

4. Filters. The different types (RGB and Narrowband) which ones to use and when in both visual and astrophotography. Where to put them in the train and maybe a quick brief on how to use them in filterwheels and stack images with them....though that may be an entire meeting on its own!!

I am not a fan of filters in imaging, when you can shoot in raw mode and get rid of colour pollution issues in processing. Visually the occasional OIII or Halpha (not solar) can be useful when viewing certain nebula but unless you a shooting with a mono Astro camera and want RGB or other combinations I think the loss in light transmission is worse than the benefits. Light pollution filters do work, but the introduction of so many different light sources (Sodium, Mercury, LEDs etc) makes these very difficult to determine what is best.

Star work requires expensive narrow band filters to produce accurate work. I had two stolen from Spain by a university user… £600 down the drain.

Yes I have tweaked green, red and orange filters to view Mars features and the do work visually.

Solar work is another area where I happily (and essentially) use filters. Thousand Oaks solar filters are excellent, Halpha filters excellent and give unique views of out star. For sunspots the Herschel wedge gives very good viewing, even through thin cloud. If you use Milar remember not to make it stretched, it works better if sagging a bit.

5. Celestial Sphere, what is it, how does it work?

In astronomy and navigation, the **celestial sphere** is an abstract sphere that has an arbitrarily large radius and is concentric to Earth. All objects in the sky can be conceived as being projected upon the inner surface of the celestial sphere, which may be centered on Earth or the observer. If centered on the observer, half of the sphere would resemble a hemispherical screen over the observing location.

The celestial sphere is a practical tool for spherical astronomy, allowing astronomers to specify the apparent positions of objects in the sky if their distances are unknown or irrelevant. In the equatorial coordinate system, the celestial equator divides the celestial sphere into two halves: the northern and southern celestial hemispheres.

Because astronomical objects are at such remote distances, casual observation of the sky offers no information on their actual distances. All celestial objects seem equally far away, as if fixed onto the inside of a sphere with a large but unknown radius,[1] which appears to rotate westward overhead; meanwhile, Earth underfoot seems to remain still. For purposes of spherical astronomy, which is concerned only with the directions to celestial objects, it makes no difference if this is actually the case or if it is Earth that is rotating while the celestial sphere is stationary.

The celestial sphere can be considered to be infinite in radius. This means any point within it, including that occupied by the observer, can be considered the center. It also means that all parallel lines, be they millimetres apart or across the Solar System from each other, will seem to intersect the sphere at a single point, analogous to the vanishing point of graphical perspective.[2] All parallel planes will seem to intersect the sphere in a coincident great circle[3] (a "vanishing circle").

Conversely, observers looking toward the same point on an infinite-radius celestial sphere will be looking along parallel lines, and observers looking toward the same great circle, along parallel planes. On an infinite-radius celestial sphere, all observers see the same things in the same direction.

For some objects, this is over-simplified. Objects which are relatively near to the observer (for instance, the Moon) will seem to change position against the distant celestial sphere if the observer moves far enough, say, from one side of planet Earth to the other. This effect, known as parallax, can be represented as a small offset from a mean position. The celestial sphere can be considered to be centered at the Earth's center, the Sun's center, or any other convenient location, and offsets from positions referred to these centers can be calculated.[4]

In this way, astronomers can predict geocentric or heliocentric positions of objects on the celestial sphere, without the need to calculate the individual geometry of any particular observer, and the utility of the celestial sphere is maintained. Individual observers can work out their own small offsets from the mean positions, if necessary. In many cases in astronomy, the offsets are insignificant.

The celestial sphere can thus be thought of as a kind of astronomical shorthand, and is applied very frequently by astronomers. For instance, the *Astronomical Almanac* for 2010 lists the apparent geocentric position of the Moon on January 1 at 00:00:00.00 Terrestrial Time, in equatorial coordinates, as right ascension $6^{h}\ 57^{m}\ 48.86^{s}$, declination +23° 30' 05.5". Implied in this position is that it is as projected onto the celestial sphere; any observer at any location looking in that direction would see the "geocentric Moon" in the same place against the stars. For many rough uses (e.g. calculating an approximate phase of the Moon), this position, as seen from the Earth's center, is adequate.

For applications requiring precision (e.g. calculating the shadow path of an eclipse), the *Almanac* gives formulae and methods for calculating the *topocentric* coordinates, that is, as seen from a particular place on the Earth's surface, based on the geocentric position.[5] This greatly abbreviates the amount of detail necessary in such almanacs, as each observer can handle their own specific circumstances.

Celestial coordinate systems[edit]

These concepts are important for understanding celestial coordinate systems, frameworks for measuring the positions of objects in the sky. Certain reference lines and planes on Earth, when projected onto the celestial sphere, form the bases of the reference systems. These include the Earth's equator, axis, and orbit. At their intersections with the celestial sphere, these form the celestial equator, the north and south celestial poles, and the ecliptic, respectively.[6] As the celestial sphere is considered arbitrary or infinite in

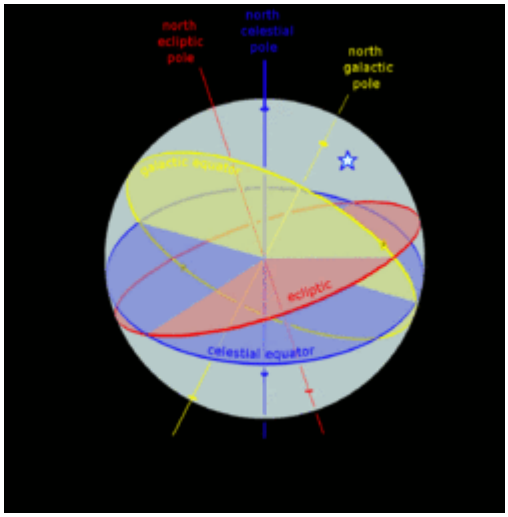
radius, all observers see the celestial equator, celestial poles, and ecliptic at the same place against the background stars.

From these bases, directions toward objects in the sky can be quantified by constructing celestial coordinate systems. Similar to geographic longitude and latitude, the equatorial coordinate system specifies positions relative to the celestial equator and celestial poles, using right ascension and declination. The ecliptic coordinate system specifies positions relative to the ecliptic (Earth's orbit), using ecliptic longitude and latitude. Besides the equatorial and ecliptic systems, some other celestial coordinate systems, like the galactic coordinate system, are more appropriate for particular purposes.

History[edit]

Main article: History of astronomy

The ancients assumed the literal truth of stars attached to a celestial sphere, revolving about the Earth in one day, and a fixed Earth.[7] The Eudoxan planetary model, on which the Aristotelian and Ptolemaic models were based, was the first geometric explanation for the "wandering" of the classical planets.[8] The outer most of these "crystal spheres" was thought to carry the fixed stars. Eudoxus used 27 concentric spherical solids to answer Plato's challenge: "By the assumption of what uniform and orderly motions can the apparent motions of the planets be accounted for?"[9]



A star's galactic, ecliptic, and equatorial coordinates, as projected on the celestial sphere. Ecliptic and equatorial coordinates share the vernal equinox as the primary direction, and galactic coordinates are referred to the galactic center. The origin of coordinates (the "center of the sphere") is ambiguous; see celestial sphere for more information.

Celestial coordinate system

From Wikipedia, the free encyclopedia

Jump to navigationJump to search

System for specifying positions of celestial objects

For other uses of Celestial, see Celestial (disambiguation).

In astronomy, a **celestial coordinate system** (or **celestial reference system**) is a system for specifying positions of celestial objects: satellites, planets, stars, galaxies, and so on. Coordinate systems can specify an object's position in three-dimensional space or plot merely its direction on a celestial sphere, if the object's distance is unknown or trivial.

The coordinate systems are implemented in either spherical or rectangular coordinates. Spherical coordinates, projected on the celestial sphere, are analogous to the geographic coordinate system used on the surface of Earth. These differ in their choice of fundamental plane, which divides the celestial sphere into two equal hemispheres along a great circle. Rectangular coordinates, in appropriate units, are simply the cartesian equivalent of the spherical coordinates, with the same fundamental (*x, y*) plane and primary (*x*-axis) direction. Each coordinate system is named after its choice of fundamental plane.

Contents

Coordinate systems[edit]

The following table lists the common coordinate systems in use by the astronomical community. The fundamental plane divides the celestial sphere into two equal hemispheres and defines the baseline for the latitudinal coordinates, similar to the equator in the geographic coordinate system. The poles are located at ±90° from the fundamental plane. The primary direction is the starting point of the longitudinal coordinates. The origin is the zero distance point, the "center of the celestial sphere", although the definition of celestial sphere is ambiguous about the definition of its center point.

Horizontal system[edit]

Main article: Horizontal coordinate system

The *horizontal*, or altitude-azimuth, system is based on the position of the observer on Earth, which revolves around its own axis once per sidereal day (23 hours, 56 minutes and 4.091 seconds) in relation to the star background. The positioning of a celestial object by the horizontal system varies with time, but is a useful coordinate system for locating and tracking objects for observers on Earth. It is based on the position of stars relative to an observer's ideal horizon.

Equatorial system[edit]

Main article: Equatorial coordinate system

The *equatorial* coordinate system is centered at Earth's center, but fixed relative to the celestial poles and the vernal equinox. The coordinates are based on the location of stars relative to Earth's equator if it were projected out to an infinite distance. The equatorial describes the sky as seen from the solar system, and modern star maps almost exclusively use equatorial coordinates.

The *equatorial* system is the normal coordinate system for most professional and many amateur astronomers having an equatorial mount that follows the movement of the sky during the night. Celestial objects are found by adjusting the telescope's or other instrument's scales so that they match the equatorial coordinates of the selected object to observe.

Popular choices of pole and equator are the older B1950 and the modern J2000 systems, but a pole and equator "of date" can also be used, meaning one appropriate to the date under consideration, such as when a measurement of the position of a planet or spacecraft is made. There are also subdivisions into "mean of date" coordinates, which average out or ignore nutation, and "true of date," which include nutation.

Ecliptic system[edit]

Main article: Ecliptic coordinate system

The fundamental plane is the plane of the Earth's orbit, called the ecliptic plane. There are two principal variants of the ecliptic coordinate system: geocentric ecliptic coordinates centered on the Earth and heliocentric ecliptic coordinates centered on the center of mass of the solar system.

The geocentric ecliptic system was the principal coordinate system for ancient astronomy and is still useful for computing the apparent motions of the Sun, Moon, and planets.[2]

The heliocentric ecliptic system describes the planets' orbital movement around the Sun, and centers on the barycenter of the solar system (i.e. very close to the center of the Sun). The system is primarily used for computing the positions of planets and other solar system bodies, as well as defining their orbital elements.

Galactic system[edit]

Main article: Galactic coordinate system

The galactic coordinate system uses the approximate plane of our galaxy as its fundamental plane. The solar system is still the center of the coordinate system, and the zero point is defined as the direction towards the galactic center. Galactic latitude resembles the elevation above the galactic plane and galactic longitude determines direction relative to the center of the galaxy.

END IMAGES, OBSERVING AND OUTREACH

The Morning of 2nd January. A Crescent Moon and Venus rising through one of my local trees.

A 300mm lens on Nikon D7200, ISO 640, 2second exposures (24) stacked Startrails free software. From upstairs side window using tripod on the window sill.

The exposure was chosen to show a little of the Earthshine on the Moon. The small bright object also dotted along is the star Zuben Elakrab in Libra.

Wiltshire Astronomical Society	**Observing Sessions 2018 – 2019**	
Date	**Moon Phase (%)**	**Moonrise**
2019		
21st January	Total Lunar Eclipse	Starts 03:30 am
25th January	Waning Gibbous (70%)	10.36 pm
22nd February	Waning Gibbous (84%)	9.31 pm
29th March	Waning Crescent (32%)	After midnight
26th April	Waning Gibbous (58%)	After midnight
24th May	Waning gibbous (75%)	After midnight

OUTREACH

To be arranged Great Wishford School, nr Wilton. Viewing evening

Kings Lodge Year 1/2s Moon talk and viewing from 5pm To be re arranged due to heating problem

February 28th Westbury Leigh Primary School, afternoon talk and viewing evening

July 4th-5th Nibley Music Festival