NWASNEWS

Volume22, Issue 2

October 2016

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

Busy Time in September

Let loose the dogs of war!

Had a very, very busy September doing astronomical based things, fortunately a lot of it was spent at the telescope observing or imaging, but there was a lot of early working stretched communications to the limit.

The day after our talk by Nick about Apollo he got in touch with the opportunity to have an Apollo astronaul come to Wiltshire for a talk, date end of September early October. Great no meeting to gather society views (as members you are all entitled to comment on large spending ventures like this one). The figures were very grey… but Nick could source a bigger venue and extra talks at a school in Marlborough, I could try to get the committee to reply to questions about funds and thoughts for progress… All while I was in Spain with very slow internet and poor phone reception, but we also get Allan Trow at Dark Sky Wales involved… good job too, in four days it became apparent our hall available day was a no go for Wiltshire visit, but using outreach grant we received (and had part used for panels) in August 2015 (it was mentioned in accounts part of AGM).

It was a bit of an albatross if we didn't use it within a certain period so it was very convenient to put this to the fund that brought Al Worden to Treorchy venue, and the society got plenty of complementary tickets as recompense.

These were offered over two weeks to members of the society and we eventually had 12 takers for tickets (10 arrived).

The important thing is that it clears the grant fund in time for any future queries by Aviva. The event was very successful, with over 650 people hearing the first Apollo astronaut to visit Wales… ever.

Well done Nick and Allan.

Meanwhile, whilst in Spain the BAA variable star section asked for observations of a rare type of Nova going off in Scorpio. Very low down in the sky, and because it was and Iron rich star BEHIND a dark nebula, it was very dim and red colour shifted.

Amazingly managed two series of image runs across three days, to get the only images seen from Europe in the first week.

This week has also added good imaging time, though some local this high cloud shifted the images to the blue, with star halos, it was a very good month for personal, Wiltshire and grunt work behind the scenes astronomy.

Clear skies

Andy

Something you don't get to see from the UK.. In Scorpio/Sagittarius border are a whole series of dust intervening between glowing hydrogen active regions and us here around Sol. The Griffin Observatory in Spain is low enough to see these. Here the Cats Paw Nebula, ngc6334. 6" iStar fluorite refractor, Nikon D810a, 60 seconds, ISO1200.

Wiltshire Society Page

Wiltshire Astronomical Society
Web site: www.wasnet.org.uk
Meetings 2015/2016Season.
NEW VENUE the Pavilion, Rusty Lane, Seend
Meet 7.30 for 8.00pm start

2016

June 7th *The Current State of SETI : Martin Griffiths*

NEW SEASON

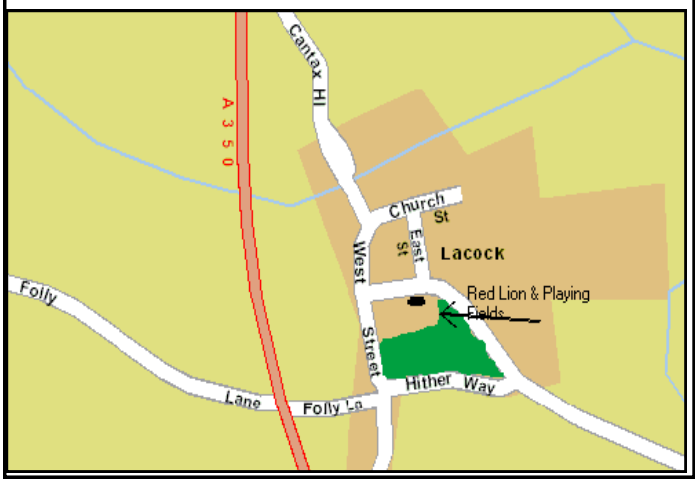
4 Oct	Paul Money, Images of the Universe
1 Nov	Philip Perkins, Imaging the Cosmos
6 Dec	Andrew Lound, Saturn – Lord of the Rings
3 Jan	TBA (Probable beginners set up session)
7 Feb	Professor david Southwood, 10 Years of Space Science at the European Space Agency
7 Mar	Steve Tonkin, And yet it Moves!
4 Apr	Dr Chris North, Telescopes through the Ages
2 May	Martin Griffiths, Planetary Nebulae Marathon
6 Jun	Mark Radice, Observing from the Caribbean + AGM

Observing Sessions

The Wiltshire Astronomical Society's observing sessions are open, and we welcome visitors from other societies as well as members of the public to join us.
We will help you set up equipment (as often as you need this help), and let you test anything we have to help you in your choice of future astronomy purchases.

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

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



Membership Meeting nights £1.00 for members £3 for visitors

Wiltshire AS Contacts

Andy Burns (Chairman, and Editor) Tel: 01249 654541, email: anglesburns@hotmail.com

Vice chair: Keith Bruton

Bob Johnston (Treasurer)

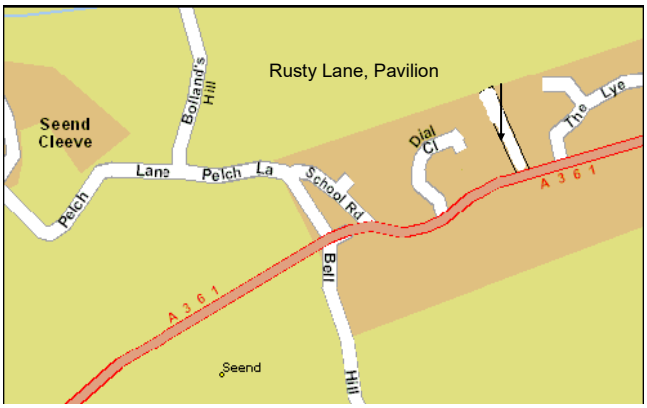
Philip Proven (Hall coordinator)

Peter Chappell (Speaker secretary)

Nick Howes (Technical Guru)

Observing Sessions coordinators: Jon Gale, Tony Vale

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



Paul Money

Paul L Money FRAS, FBIS, is an astronomer based in Lincolnshire, England. He is well known for his extensive talks and is the reviews editor of the BBC Sky at Night magazine. He broadcasts occasionally on BBC Radio Lincolnshire. He was awarded the 'Eric Zucker' award for 2002/2003 for contributions to Astronomy by the Federation of Astronomical Societies. In October 2012 he was also awarded the Sir Arthur Clarke Lifetime Achievement Award for 2012 by the British Rocketry Oral History Project for his active promotion of astronomy and space to the public. From 2004 until 2013 he was one of the three Astronomers on the Omega Holidays Northern Lights Flights and was also a Solar Eclipse Astronomer for their 2006 Turkey Solar Eclipse Trip and their 2009 China Solar Eclipse trip. In 2008 he was the Solar Eclipse expert and part of the expedition team for Poseidon Arctic Voyages on board the Russian Nuclear powered Ice Breaker 'Yamal' for the 2 August 2008 Solar Eclipse, viewed from the Arctic ice near the Franz Joseph Lands Islands.

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.

Ad-hoc viewing sessions

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

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

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

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

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

If you think you might be interested email the organiser Robin Wilkey (see website). With this you will then be emailed regarding the event, whether it is going ahead or whether it will be cancelled because of cloud etc.

We are a small keen group and I would ask you to note that you DO NOT have to own a telescope to take part, just turn up and have a great evening looking through other people's scopes. We are out there to share an interest and the hobby. There's nothing better than practical astronomy in the great cold British winter! And hot drinks are often available, you can also bring your own.

Enjoy astronomy at it's best!

Members of the Wiltshire Astronomical Society always welcome!

Meetings for 2016

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

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

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

Friday 21 Oct 2016

Programme: Owen Brazell - Planetary Nebulae

Friday 18 Nov 2016

Programme: Mike Leggett: Exploration of Mars

Friday 16 Dec 2016

Programme: Christmas Social at The Village Inn, Liddington

Meeting Dates for 2017:

Friday 20 January 2017
Programme: Sally Russell - Astronomical Sketching

Friday 17 February 2017

Programme: David Boyd - Spectroscopy

Friday 17 March 2017

Programme: AGM plus Dr Bob Gatten - Using the Faulkes Telescope Project's remote telescopes, results so far

Friday 24 April 2017

Programme: Dr Pauline Norris - The Ancient Egyptians and their Astronomy

Friday 19 May 2017

Programme: Martin Griffiths - Contact with extraterrestrials, how will it affect us

Friday 16 June 2017

Programme: Paul Roche - Robotic Astronomy

Website:

http://www.swindonstargazers.com

Chairman: Peter Struve

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

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

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

Swindon, SN1 2JW

BECKINGTON ASTRONOMICAL SOCIETY

We also have a new website www.beckingtonas.org where details of our programme and other useful information can be found. General enquiries about the society can be emailed to chairman@beckingtonas.org

So our committee is now:

Steve Hill, Chairman/Imaging 01761 435663
John Ball, Vice Chairman 01373 830419
Alan Aked, Treasurer 01373 830232
Rosie Wilks, Secretary 01225445814
Mike Witt, Membership 01373 303784
John Dolton, Telescope Hardware 01225335832

Meetings take place in Beckington Baptist Church Hall (see the location page for details of how to get to us) and start at 7:30pm.

2016

Oct 21st:	*Spectroscopy*	Hugh Allen
Nov 18th:	*TBD*	Dick Cardy
2017		
Jan 20th:	*Tales from the Dark Side (Pt. 2)*	Mike Witt
Feb 17th:	*John Herschel: A man of his time*	Andy Burns
Mar 17th:	*The Sun*	Ron Westmaas
Apr 21st:	*Observing the Solar System*	Mark Radice
May 19th:	*Imaging Colloquium*	Steve Hill

SALISBURY PLAIN OBSERVING GROUP

Where do you meet?

We meet at a variety of sites, including Pewsey Downs, Everleigh, Bratton Camp, Redhorn Hill and Whitesheet Hill. The sites are cold in winter so you will need warm clothing and a flask. We are always looking for good sites around the edge of the Plain.

Do I join?

No. We are not a club. We meet informally, so aside from contacting our friends to give a yes or no to meeting up, that's it.

I am a beginner—am I welcome?

Of course you are — whether you have a telescope, binoculars or just your eyes, there will be someone to observe with. We have a variety of equipment and are always happy for newcomers to look through.

So I just turn up?

Essentially yes, but please drop us an email as parking can be an issue at some of the meeting areas or at the pubs.

I am more experienced—what's in it for me?

If you have observing experience we prepare a monthly observing list chosen in rotation by the group. We pick some easy objects, some moderate and some tough ones. If you are experienced, why not share what you know?

Any ground rules for a session?

Common sense applies in the group; red light is essential to preserve night vision; we park cars so you can leave when you wish and not disturb others with your headlights.

Contact Details

Our Website

www.spogastro.co.uk

Our Email

spogastro@googlemail.com

Twitter

http://twitter.com/SPOGAstro

Facebook

http://www.facebook.com/group.php?gid=119305144780224

One Incredible Galaxy Cluster Yields Two Types of Gravitational Lenses

By Ethan Siegel

There is this great idea that if you look hard enough and long enough at any region of space, your line of sight will eventually run into a luminous object: a star, a galaxy or a cluster of galaxies. In reality, the universe is finite in age, so this isn't quite the case. There are objects that emit light from the past 13.7 billion years—99 percent of the age of the universe—but none before that. Even in theory, there are no stars or galaxies to see beyond that time, as light is limited by the amount of time it has to travel.

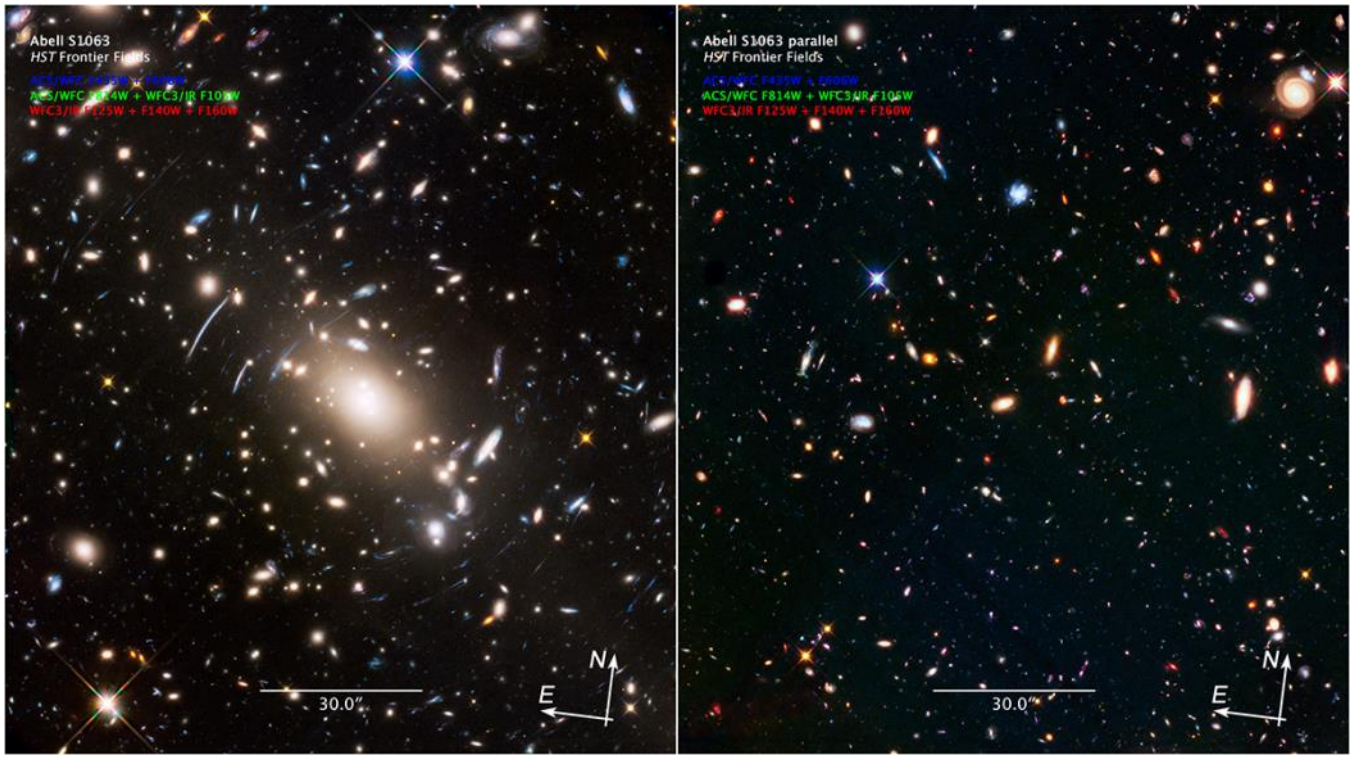
But with the advent of large, powerful space telescopes that can collect data for the equivalent of millions of seconds of observing time, in both visible light and infrared wavelengths, we can see nearly to the edge of all that's accessible to us.

The most massive compact, bound structures in the universe are galaxy clusters that are hundreds or even thousands of times the mass of the Milky Way. One of them, Abell S1063, was the target of a recent set of Hubble Space Telescope observations as part of the Frontier Fields program. While the Advanced Camera for Surveys instrument imaged the cluster, another instrument, the Wide Field Camera 3, used an optical trick to image a parallel field, offset by just a few arc minutes. Then the technique was reversed, giving us an unprecedentedly deep view of two closely aligned fields simultaneously, with wavelengths ranging from 435 to 1600 nanometers.

With a huge, towering galaxy cluster in one field and no comparably massive objects in the other, the effects of both weak and strong gravitational lensing are readily apparent. The galaxy cluster—over 100 trillion times the mass of our sun—warps the fabric of space. This causes background light to bend around it, converging on our eyes another four billion light years away. From behind the cluster, the light from distant galaxies is stretched, magnified, distorted, and bent into arcs and multiple images: a classic example of strong gravitational lensing. But in a subtler fashion, the less optimally aligned galaxies are distorted as well; they are stretched into elliptical shapes along concentric circles surrounding the cluster.

A visual inspection yields more of these tangential alignments than radial ones in the cluster field, while the parallel field exhibits no such shape distortion. This effect, known as weak gravitational lensing, is a very powerful technique for obtaining galaxy cluster masses independent of any other conditions. In this serendipitous image, both types of lensing can be discerned by the naked eye. When the James Webb Space Telescope launches in 2018, gravitational lensing may well empower us to see all the way back to the very first stars and galaxies.

If you're interested in teaching kids about how these large telescopes "see," be sure to see our article on this topic at the NASA Space Place: http://spaceplace.nasa.gov/telescope-mirrors/en/



Galaxy cluster Abell S1063 (left) as imaged with the Hubble Space Telescope as part of the Frontier Fields program. The distorted images of the background galaxies are a consequence of the warped space dues to Einstein's general relativity; the parallel field (right) shows no such effects. Image credit: NASA, ESA and Jennifer Lotz (STScI)

This article is provided by NASA Space Place.

With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology.

Visit **spaceplace.nasa.gov** to explore space and Earth science!

SPACE NEWS

Rosetta's last photos of comet 67P/Churyumov-Gerasimenko

October 1, 2016 Stephen Clark

Just before settling to a soft crash landing Friday, the European Space Agency's Rosetta spacecraft captured close-range images of comet 67P/Churyumov-Gerasimenko, peering into a stadium-sized pit and recording a final dataset to keep scientists busy long after the mission's end.

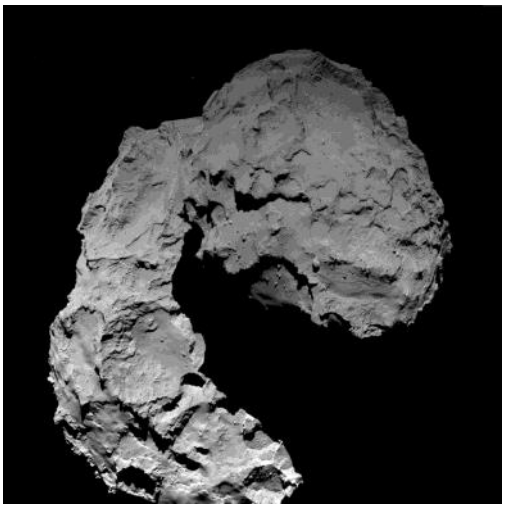
The craft's OSIRIS science camera took images throughout Rosetta's descent and sent the data back to Earth in real-time. The final image came from an altitude of 65 feet (20 meters) above the comet, just before ground controllers received the last signal from Rosetta at 1119 GMT (7:19 a.m. EDT).

Holger Sierks, the OSIRIS instrument's principal investigator, discussed the photos in a presentation Friday at the European Space Operations Center in Darmstadt, Germany.

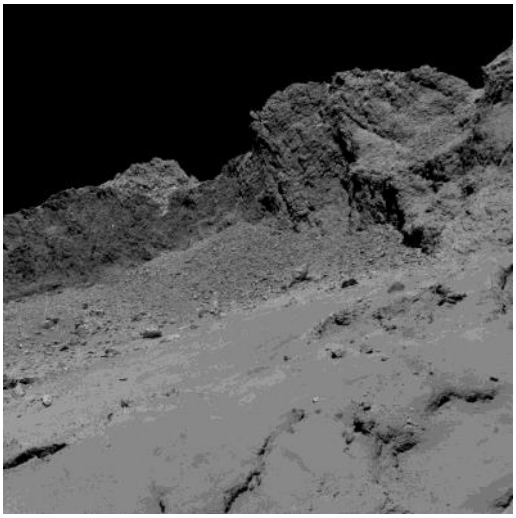
Rosetta set down next to an open pit named Deir el-Medina, a feature resembling a sinkhole measuring about 330 feet (100 meters) wide and 165 feet (50 meters) deep. In the final image sequence, the spacecraft turned to look inside the pit, revealing debris strewn across the bottom, material scientists believe fell away from the pit's frozen walls.

Pits like Deir el-Medina, named for an archaeological site in Egypt, are a likely source for jets of dust and vapor that streamed away from the comet last year.

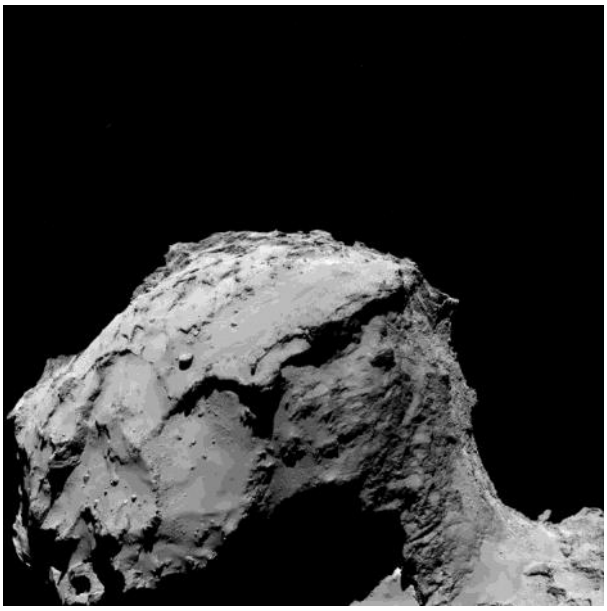
Some of Rosetta's final images are posted below.



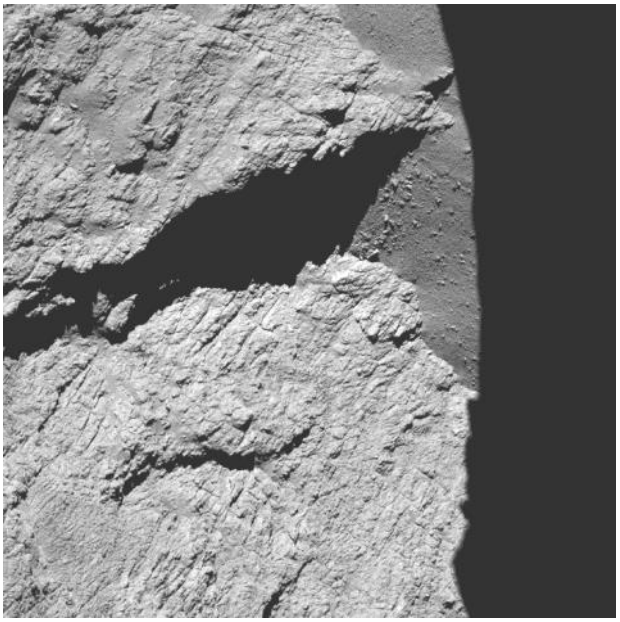
Rosetta's OSIRIS wide-angle camera captured this shot of comet 67P/Churyumov-Gerasimenko at 1149 GMT (7:49 a.m. EDT) Thursday at a distance of 14.2 miles (22.9 kilometers) from the nucleus. Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA



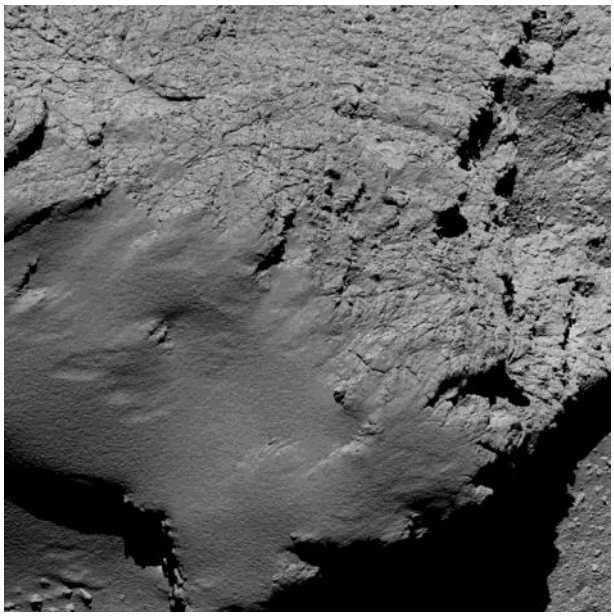
The OSIRIS camera's narrow-angle camera took this picture of comet 67P/Churyumov-Gerasimenko at 0120 GMT on Sept. 30 (9:20 p.m. EDT on Sept. 29) at a distance of 10 miles (16 kilometers).
Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA



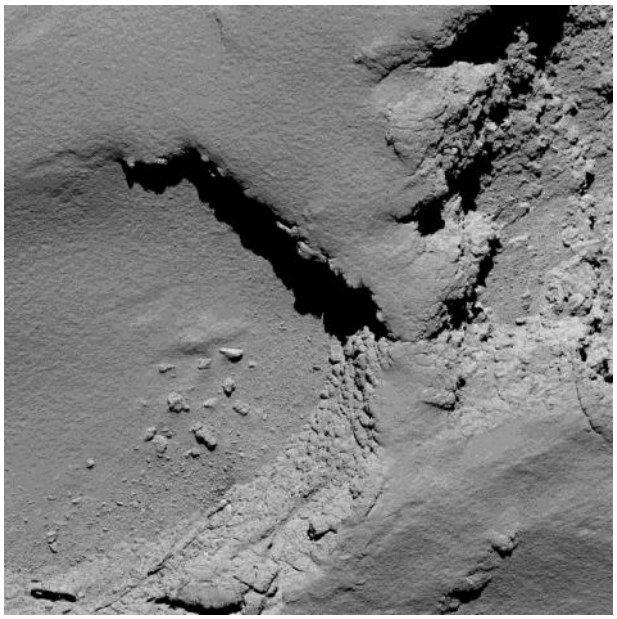
The OSIRIS wide-angle camera took this image of comet 67P/Churyumov-Gerasimenko at 0217 GMT on Sept. 30 (10:17 p.m. EDT on Sept. 29) at a range of 9.6 miles (15.5 kilometers). The field-of-view in this picture stretches about 2 miles (3.2 kilometers) across, and the resolution is 5.11 feet (1.56 meters) per pixel. Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA



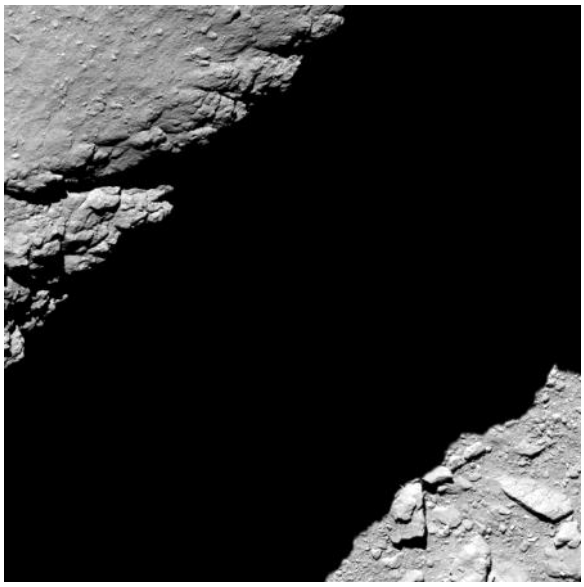
Rosetta's OSIRIS narrow-angle camera recorded this view of comet 67P/Churyumov-Gerasimenko from a distance of 7.3 miles (11.7 kilometers) at 0525 GMT (1:25 a.m. EDT) on Sept. 30. The field-of-view stretches nearly 1,500 feet (450 meters) across, and the resolution is about 8.7 inches (22 centimeters) per pixel. Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA



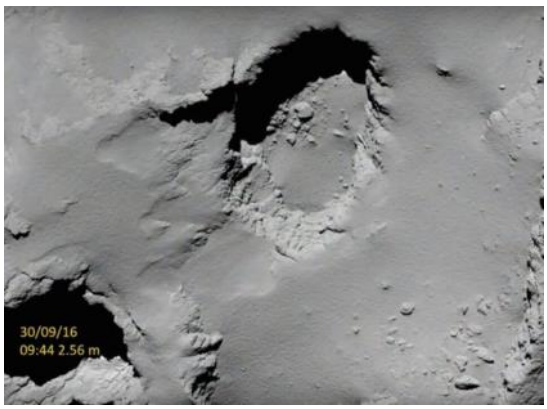
Rosetta's OSIRIS narrow-angle camera captured this view of comet 67P/Churyumov-Gerasimenko from a distance of 5.5 miles (8.9 kilometers) at 0653 GMT (2:53 a.m. EDT) no Sept. 30. The field-of-view stretches nearly 1,150 feet (350 meters) across, and the resolution is 6.7 inches (17 centimeters) per pixel. Credit: Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA



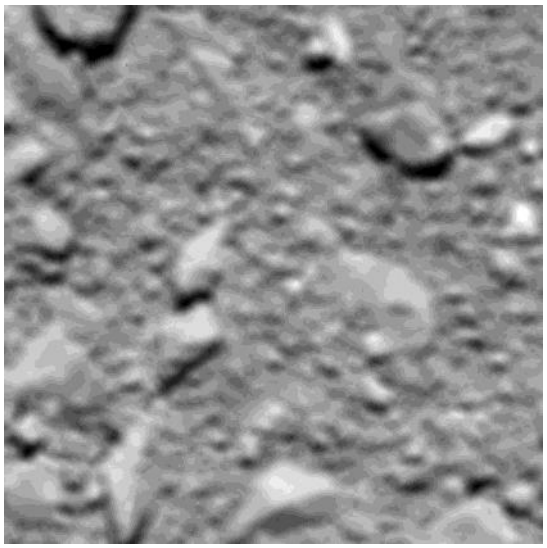
Rosetta's OSIRIS narrow-angle camera captured this image of comet 67P/Churyumov-Gerasimenko from a distance of 3.6 miles (5.8 kilometers) at 0818 GMT (4:18 a.m. EDT) on Sept. 30. The field-of-view stretches about 740 feet (225 meters) across, and the resolution is about 4.3 inches (11 centimeters) per pixel. Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA



Rosetta's OSIRIS narrow-angle camera recorded this image of comet 67P/Churyumov-Gerasimenko from a distance of less than 4,000 feet (1.2 kilometers) at 1014 GMT (6:14 a.m. EDT) on Sept. 30. The image shows part of the wall of the Deir el-Medina pit in shadow. The field-of-view stretches about 110 feet (33 meters) across, and the resolution is about 0.9 inches (2.3 centimeters) per pixel. Credit: ESA/Rosetta/MPS for OSIRIS Team



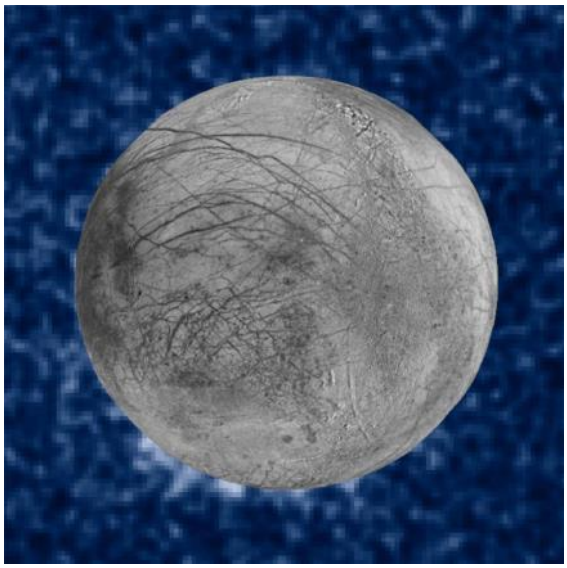
MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDAThis view of the Deir el-Medina pit was captured by the OSIRIS wide-angle camera about 55 minutes before landing. Credit: ESA/Rosetta/MPS for OSIRIS Team



MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDAThe final view from Rosetta's OSIRIS wide-angle camera was taken about 65 feet

(20 meters) from the comet shortly before impact. The blurry image has a field-of-view stretching about 8 feet (2.4 meters) across, with a resolution of one-fifth of an inch (5 millimeters) per pixel. Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/ DASP/IDA

Possible water plumes spotted above Europa
September 26, 2016 William Harwood



This composite image shows suspected plumes of water vapor erupting at the 7 o'clock position off the limb of Jupiter's moon Europa. The plumes, photographed by NASA's Hubble's Space Telescope Imaging Spectrograph, were seen in silhouette as the moon passed in front of Jupiter. Credits: NASA/ESA/W. Sparks (STScI)/ USGS Astrogeology Science Center

The Hubble Space Telescope has again spotted what appear to be towering plumes of water vapor erupting from Jupiter's moon Europa, hinting that future spacecraft may be able to sample the hidden sea, a possible abode of life, without having to drill through miles of rock-hard ice, researchers said Monday.

"Today's results increase our confidence that water and other materials from Europa's hidden ocean might be on the surface and available for us to study," said Paul Hertz, director of astrophysics at NASA Headquarters in Washington.

The observations, and earlier Hubble studies that found signs of plumes using a different technique, are at the limits of the space telescope's capabilities, and researchers cautioned they were not yet ready to say with certainty that water plumes have, in fact, been detected.

But William Sparks, an astronomer with the Space Telescope Science Institute in Baltimore who led the latest study, said no other known natural phenomenon can explain the observations.

"I'm not aware of any other plausible natural explanation," he told reporters. "The only other possible explanation that we've been considering is the possibility of some internal instrumental effect."

That said, the presumed plumes "appear to be real, the statistical signifiance is pretty good and I don't know of any other natural alternative," Sparks said.

Europa is one of four bright moons orbiting Jupiter that were discovered by Galileo in 1610. It is roughly the size of Earth's moon but its composition is very different.

Based primarily on data from NASA's aptly-named Galileo Jupiter orbiter in the 1990s, scientists believe an icy crust covers a vast salt water ocean containing twice the water in all of Earth's seas.

That ocean is heated and kept from freezing primarily by tidal stresses, the constant squeezing and stretching the moon experiences due to Jupiter's enormous gravity as it swings around the giant planet every 3.5 days.

Given water, energy and, possibly, organic compounds, the sub-surface ocean is a possible abode of life and is therefore of major interest to astrobiologists. NASA is in the initial stages of developing a spacecraft to explore the moon through repeated flybys in the 2020s.

A major question mark has been how thick Europa's crust might be and how difficult it might be to one day drill through it to collect samples of the ocean below. But if the plumes are eventually confirmed, as appears likely, drilling might not be necessary.

"If there are plumes emerging from Europa, it's significant because it means we may be able to explore that ocean for organic chemicals, or even signs of life, without having to drill through unknown miles of ice," Sparks said.

In 2012, a team of researchers using the Hubble Space Telescope's imaging spectrograph spotted what appeared to be water vapor more than 100 miles above Europa's south pole.

Sparks' team used a different technique, observing the limb of the moon in ultraviolet light as it passed in front of Jupiter. During three of 10 observations, background light was absorbed by what the researchers concluded were likely plumes of water vapor towering 125 miles above the surface.

The two techniques have not yet seen plumes at the same time, suggesting they may be sporadic and short lived. Additional Hubble observations are being analyzed, more are planned and NASA's much more powerful James Webb Space Telescope, scheduled for launch in November 2018, will bring even more sensitive instruments to bear.

"Europa's ocean is considered to be one of the most promising places that could potentially harbor life in the solar system," Geoff Yoder, acting associate administrator for NASA's Science Mission Directorate, said in a statement. "These plumes, if they do indeed exist, may provide another way to sample Europa's subsurface."

Ready Or Not, Musk Is Dragging Us Into Interplanetary Species Status

Article Updated: 28 Sep , 2016

by Evan Gough

Today, Elon Musk elaborated on his plans to make humanity a planet-faring species. We've known for a long time that Mars is SpaceX's destination, but the fine details haven't been revealed. In today's talk at the International Astronautical Congress (IAC), Musk revealed a game-changer for travel to Mars, and beyond.

If anyone has ever guessed that Musk's plans involved a refuelling ship, I've never heard them say it out loud. But that's exactly what Musk revealed. SpaceX plans to launch a Mars-bound craft into orbit, then launch a refuelling craft to refill the interplanetary ship's fuel tanks. Only then would the Interplanetary Transport System (ITS) depart for Mars. SpaceX's proposed system is all about lowering the cost of travel to Mars. Only when the cost is lowered, does a sustained presence there become realistic. And Musk's ITS system will definitely lower the cost.

Traditional space travel would cost $10 billion to get one person to Mars. Musk said that they can get it down to the median cost of a house in the US, about $200,000 US. The idea is that anyone who really wanted to could save up enough money and go to Mars. Musk did acknowledge that it will be tricky to reduce the cost of the Earth to Mars trip by a whopping 5 million percent.

There are four keys to reducing the cost:

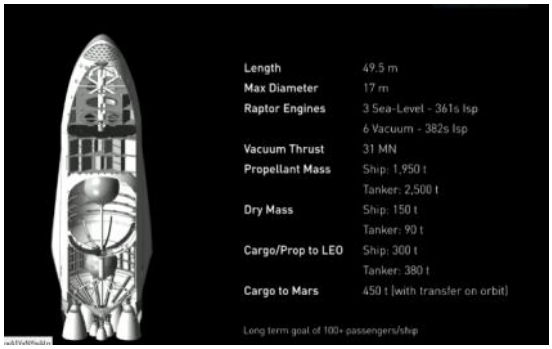
- full reusability
- refilling in orbit

- propellant production on Mars
- right propellant

The ITS would feature reusable boosters, reusable spaceships, and refuelling in orbit. The interplanetary ship would be launched into orbit around Earth and parked there. Fuel ships would make 3 to 5 trips to fill the tank of the interplanetary ship waiting in orbit. From there, Musk thinks that the trip to Mars could take as little as 80 days. In the more distant future, that could be cut to 30 days.

The ITS requires an extraordinarily powerful booster, featuring 42 of SpaceX's Raptor engines. Image: SpaceX

If this whole system isn't shocking enough, and thrilling enough, for you, Musk has more than just one of these craft in mind. He imagines a fleet of them, perhaps 1,000, travelling en masse back and forth to Mars.



The ITS and its vital statistics. Image: SpaceX

The driving force behind all this is, of course, making Mars possible. In his presentation, Musk said we have two paths. One is to stay on Earth and face extinction from some doomsday event. The other is to become an interplanetary species, and use Mars to back up Earth's biosphere. The SpaceX system is designed to make the second path possible.

Musk talked about the need to create a self-sustaining city in its own right. That obviously won't happen right away, but it'll never happen unless transport to Mars, and back, becomes feasible. With the proposed SpaceX system, Mars will be an option. Musk thinks that the ITS could also get us to one of the Jovian moons, if we could create fuel production and depots. In fact, he said we can probably go all the way to Pluto and beyond.

The ITS requires huge fuel tanks, one of which is seen here at SpaceX's production facility. Image: SpaceX

There are a lot of challenges for this system. It's far from a done deal. The system will require newer, more powerful engines. But SpaceX is already working on that. It's called the Raptor, and testing has already begun.

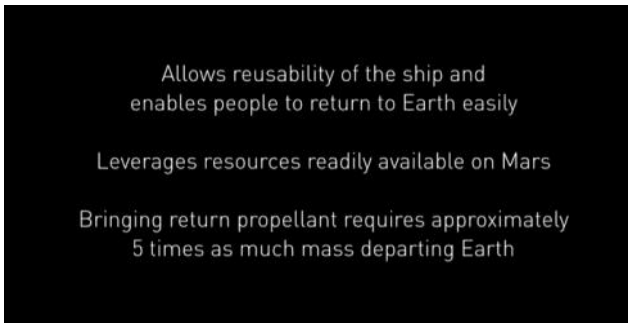
Musk talked about the impressive exploration done on Mars by NASA and other agencies, but stressed that it's time to take things further and aim for a sustained presence on Mars. To that end, SpaceX plans on sending a craft to Mars during every Earth-Mars opposition, which happens about every 2 years. Initially, that will be done with an unmanned Dragon capsule.

The mood at Musk's presentation was one of excitement. The crowd was definitely there to see him. There was one humorous moment when Musk remarked "Timelines. I'm not the best at this sort of thing." This is a nod to the difficulties with creating a timeline for something like the ITS. But really, what agency can adhere to strict schedules when doing something that's never been done before? Especially in the realm of interplanetary travel?

The excitement surrounding Musk's plans for travel to Mars is palpable. That's understandable, considering the magnitude of what he's talking about, and considering how long people have dreamed of going to Mars. The fact that someone with a track record like SpaceX's is starting to lay the groundwork for travel to, and a presence on Mars, is exciting. There's no way around it.

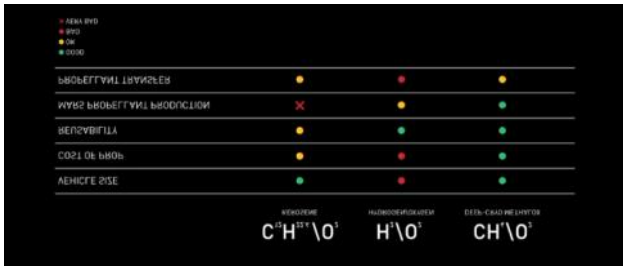
But there are lots of questions. Musk is the first to admit that he doesn't have all the answers. He says up front that he sees his role as developing the transport system. Once that is moving ahead, others will address the challenges of establishing a presence on Mars.

One of the primary questions is around energy, and there are two sides to that. Fuel processing will have to be established quickly on Mars if the ships are to return to Earth.



This slide from Musk's presentation show some of the considerations around producing fuel on Mars. Image: SpaceX

Musk also talked about the three possible fuel types to be derived on Mars.



This slide from Musk's presentation shows the availability/desirability of the three types of fuel that could be derived from Mars. Image: SpaceX

The ITS ships will be able to carry a large payload, so it's possible that the parts and pieces for a fuel plant could be pre-built somehow, then sent to Mars. There is an enormous amount of detail missing when it comes right down to it, but human ingenuity being what it is, this may be solvable.

Assuming that a rocket fuel plant could be assembled on Mars, that begs the second energy question. Creating this fuel will in itself require lots of energy. Much more than solar can provide. Musk briefly mentioned the possibility of nuclear energy, but didn't go into detail. That's understand-

able, because he clearly sees his role as developing the transportation system.
Establishing nuclear energy on Mars would also require a lot of infrastructure. On Earth, uranium processing is an enormous task. How will that be done on Mars? Is there enough uranium in Mars' crust? Conventional atomic reactors use water, lots of it, to produce energy. Where will that water come from on Mars? Will the same amount be needed?
Or will thorium reactors be used? If you're not up on thorium reactors, they are different than uranium reactors and are worth reading about. They use thorium for fuel, not uranium, and are different in other ways. They're safer and produce less waste, but is there sufficient thorium available on Mars? Thorium is much more plentiful in Earth's crust than uranium.
Small Modular Reactors (SMRs) are being developed for use on Earth. They are built in one location, then moved to their operational location. They can be linked together and require less sophisticated operators. Perhaps SMRs using thorium will provide the energy required for the ITS to work.
These questions are all important of course, and they bear thinking about. But one thing that can't be denied is Musk's vision. Anyone that wants humanity to survive, or that grew up reading science fiction, will love what Musk is doing. For that matter, anyone with a sense of adventure will love Musk.
Musk's overall vision of us as a planet-faring species is something that will be a long time coming, I think. Fleets of interplanetary cargo ships plying the solar system, with fuelling depots along the way. An established human presence on Mars, the Moon, and perhaps the moons of the gas giants, and all the way out to Pluto.
It seems like a fanciful dream, but remember what Musk said at the start of his presentation. There are really only two paths. The first is to restrict ourselves to Earth, and die at the hands of some sort of extinction event.
The second path is to head outward and expand throughout the solar system.
It's not science fiction anymore. It's simple survival.

Why Are Stars Different Colors?

Article Updated: 24 Sep , 2016

by Matt Williams
Stars are beautiful, wondrous things. Much like planets, planetoids and other stellar bodies, they come in many sizes, shapes, and even colors. And over the course of many centuries, astronomers have come to discern several different types of stars based on these fundamental characteristics.
For instance, the color of a star – which varies from bluish-white and yellow to orange and red – is primarily due to its composition and effective temperature. And at all times, stars emit light which is a combination of several different wavelengths. On top of that, the color of a star can change over time.

Composition:

Different elements emit different wavelengths of electromagnetic radiation when heated. In the case of stars, his includes its main constituents (hydrogen and helium), but also the various trace elements that make it up. The color that we see is the combination of these different electromagnetic wavelengths, which are referred to as as a Planck's curve.

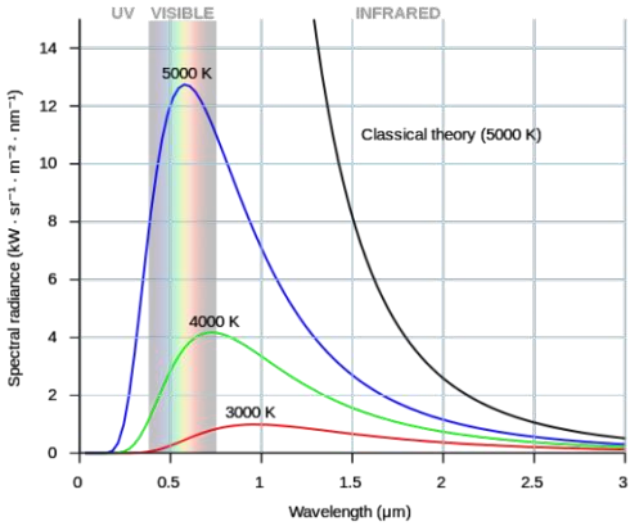


Diagram illustrating Wein's Law, which describes the emission of radiation from a black body based on its peak wavelength. Credit: Wikipedia Commons/Darth
The wavelength at which a star emits the most light is called the star's "peak wavelength" (which known as Wien's Law), which is the peak of its Planck curve. However, how that light appears to the human eye is also mitigated by the contributions of the other parts of its Planck curve.
In short, when the various colors of the spectrum are combined, they appear white to the naked eye. This will make the apparent color of the star appear lighter than where star's peak wavelength falls on the color spectrum. Consider our Sun. Despite the fact that its peak emission wavelength corresponds to the green part of the spectrum, its color appears pale yellow.
A star's composition is the result of its formation history. Ever star is born of a nebula made up of gas and dust, and each one is different. While nebulas in the interstellar medium are largely composed of hydrogen, which is the main fuel for star creation, they also carry other elements. The overall mass of the nebula, as well as the various elements that make it up, determine what kind of star will result.
The change in color these elements add to stars is not very obvious, but can be studied thanks to the method known as spectroanalysis. By examining the various wavelengths a star produces using a spectrometer, scientists are able to determine what elements are being burned inside.

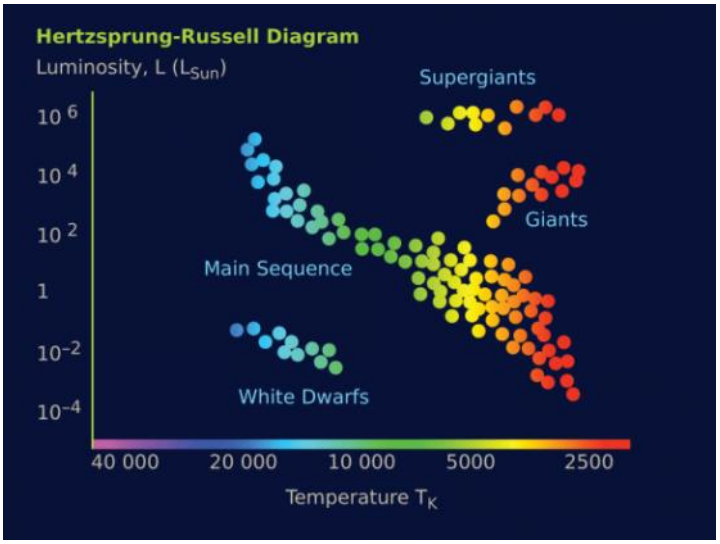
Temperature and Distance:

The other major factor effecting a star's color is its temperature. As stars increase in heat, the overall radiated energy increases, and the peak of the curve moves to shorter wavelengths. In other words, as a star becomes hotter, the light it emits is pushed further and further towards the blue end of the spectrum. As stars grow colder, the situation is reversed (see below).
A third and final factor that will effect what light a star appears to be emitting is known as the Doppler Effect. When it comes to sound, light, and other waves, the frequency can increase or decrease based on the distance between the source and the observer.
When it comes to astronomy, this effect causes the what is known as "redshift" and "blueshift" – where the visible light coming from a distant star is shifted towards the red end of the spectrum if it is moving away, and the blue end if it is moving closer.

Modern Classification:

Modern astronomy classifies stars based on their essential characteristics, which includes their spectral class (i.e. color), temperature, size, and brightness. Most stars are currently classified under the Morgan–Keenan (MK) system, which

classifies stars based on temperature using the letters *O*, *B*, *A*, *F*, *G*, *K*, and *M*, – O being the hottest and M the coolest.
Each letter class is then subdivided using a numeric digit with *0* being hottest and *9* being coolest (e.g. O1 to M9 are the hottest to coldest stars). In the MK system, a luminosity class is added using Roman numerals. These are based on the width of certain absorption lines in the star's spectrum (which vary with the density of the atmosphere), thus distinguishing giant stars from dwarfs.
Luminosity classes 0 and I apply to hyper- or supergiants; classes II, III and IV apply to bright, regular giants, and subgiants, respectively; class V is for main-sequence stars; and class VI and VII apply to subdwarfs and dwarf stars. There is also the Hertzsprung-Russell diagram, which relates stellar classification to absolute magnitude (i.e. intrinsic brightness), luminosity, and surface temperature.
The same classification for spectral types are used, ranging from blue and white at one end to red at the other, which is then combined with the stars Absolute Visual Magnitude (expressed as Mv) to place them on a 2-dimensional chart (see below).



The Hertzspirg-Russel diagram, showing the relation between star's color, AM. luminosity, and temperature. Credit: astronomy.starrynight.com
On average, stars in the O-range are hotter than other classes, reaching effective temperatures of up to 30,000 K. At the same time, they are also larger and more massive, reaching sizes of over 6 and a half solar radii and up to 16 solar masses. At the lower end, K and M type stars (orange and red dwarfs) tend to be cooler (ranging from 2400 to 5700 K), measuring 0.7 to 0.96 times that of our Sun, and being anywhere from 0.08 to 0.8 as massive.

Stellar Evolution:

Stars also go through an evolutionary life cycle, during which time their sizes, temperatures and colors change. For example, when our Sun exhausts all the hydrogen in its the core, it will become unstable and collapse under its own weight. This will cause the core to heat up and get denser, causing the Sun to grow in size. At this point, it will have left its Main Sequence phase and entered into the Red Giant Phase of its life, which (as the name would suggest) will be characterized by expansion and it becoming a deep red. When this happens, it is theorized that our Sun will expand to encompass the orbits of Mercury and even Venus.
Earth, if it survives this expansion, will be so close that it will be rendered uninhabitable. When our Sun then reaches its post-Red Giant Phase, the Sun will begin to eject mass, leaving an exposed core known as a white dwarf. This remnant will survive for trillions of years before fading to black.
This is believed to be the case with all stars that have between 0.5 to 1 Solar Mass (half, or as much mass of our Sun). The situation is slightly different when it comes to low mass stars (i.e. red dwarfs), which typically have around 0.1 Solar Masses.
It is believed that these stars can remain in their Main Sequence for some six to twelve trillion years and will not experience a Red Giant Phase. However, they will gradually increase in both temperature and luminosity, and will exist for several hundred billion more years before they eventually collapse into a white dwarf.

On the other hand, supergiant stars (up to 100 Solar Masses or more) have so much mass in their cores that they will likely experience helium ignition as soon as they exhaust their supplies of hydrogen. As such, they will likely not survive to become Red Supergiants, and will instead end their lives in a massive supernova.
To break it all down, stars vary in color depending on their chemical compositions, their respective sizes and their temperatures. Over time, as these characteristics change (as a result of them spending their fuel) many will darken and become redder, while others will explode magnificently. The more stars observe, the more we come to know about our Universe and its long, long history!
We have written many articles about stars on Universe Today. Here's What is the Biggest Star in the Universe?, What is a Binary Star?, Do Stars Move?, What are the Most Famous Stars?, What is the Brightest Star in the Sky, Past and Future?
Want more information on stars? Here's Hubblesite's News Releases about Stars, and more information from NASA's imagine the Universe.

Blue Origin Goes Big With New Glenn Rocket

Size comparison between the New Glenn and all other rockets currently in operations (with the Saturn V for comparison). Credit: Blue Origin

Article Updated: 17 Sep , 2016

by Matt Williams
Space exploration is becoming a lucrative domain for private aerospace companies (aka. the NewSpace industry). With opportunities for launch and resupply services growing, costs dwindling, and the cancellation of the Space Shuttle Program, private companies have been stepping up in recent years to provide their own launch vehicles and services to fill the gap.
Take Jeff Bezos, for example. Back in 2000, the founder of Amazon.com created Blue Origin to fulfill his lifelong dream of colonizing space. For years, Bezos and the company he founded have been working to produce their own fleet of reusable rockets. And as of the morning of Monday, Sept. 12th, he unveiled their newest and heaviest rocket – the *New Glenn.*
Much like SpaceX, Blue Origin has been committed to the creation of reusable rocket technology. This was made clear with the development of the *New Shepard* suborbital rocket, which was unveiled in 2006. Named in honor of the first American astronaut to go into space (Alan Shepard), this rocket made its first flight in April of 2015 and has had an impressive record, nailing four out of five soft landings in the space of just over a year.

New Shepard comes in for a landing with drag brakes and landing gear deployed. Credit: Blue Origin.

With the *New Glenn* – named in honor of astronaut John Glenn, the first American astronaut to orbit the Earth – the company now intends to take the next step, offering launch services beyond Low-Earth Orbit (LEO) and for crewed missions. As Bezos said during the press conference:

"New Glenn is designed to launch commercial satellites and to fly humans into space. The three-stage variant-with its high specific impulse hydrogen upper stage—is capable of flying demanding beyond-LEO missions."

According to Bezos, Blue Origin will have both a two-stage and three-stage variant of the rocket. Whereas the two-stage will provide heavier lift capacity to LEO, the three-stage will be able to reach further, and will the company's go-to when sending crewed missions into space. Work on the rocket began back in 2012, and the company hopes to make their first launch prior to 2020.

As Bezos said during the unveiling, this rocket carries on in the same tradition that inspired the creation of the *New Shepard*:

"Building, flying, landing, and re-flying New Shepard has taught us so much about how to design for practical, operable reusability. And New Glenn incorporates all of those learnings. Named in honor of John Glenn, the first American to orbit Earth, New Glenn is 23 feet in diameter and lifts off with 3.85 million pounds of thrust from seven BE-4 engines. Burning liquefied natural gas and liquid oxygen, these are the same BE-4 engines that will power United Launch Alliance's new Vulcan rocket."

A United Launch Alliance (ULA) Delta IV rocket launching from Cape Canaveral Air Force Station, Fl, on July 23rd, 2015. Credit: Ken Kremer/kenkremer.com

The rocket will have a sea-level thrust of 1.746 million kg (3.85 million lbs), placing it ahead of the *Delta IV Heavy* – which has a sea-level thrust of about 900,000 kg (2 million lbs) – but behind the 2.268 million kg (5 million lbs) of the *Falcon Heavy*. Both variants will be powered by BE-4 engines, which are also manufactured by Blue Origin. The third-stage also employs a single vacuum-optimized BE-3 engine that burns liquid hydrogen and liquid oxygen.

However, the most interesting facet of the *New Glenn* is the fact that it will be reusable, with its first stage providing braking thrust and deployable legs (similar to the *Falcon 9*). In creating a heavy lift rocket that employs a retrievable first-stage, Blue Origin has signaled its intent to give SpaceX a run for its money when it comes to the development of reusable rocket technology.

It is also likely to raise the company's profile, which has so far been limited to conducting sub-orbital research for NASA and dabbling in the space-tourism industry. But once the *New Glenn* is up and running, it is likely to begin securing contracts to provide resupply services the ISS, as well as contracts with companies and research institutions to place satellites in orbit.

The Falcon Heavy, once operational, will be the most powerful rocket in the world. Credit: spacex.com

According to *The Verge*, Bezos also hinted that his company has another project in mind – called the *New Armstrong*. While no details have been given just yet, the name of this rocket is a clear allusion to the Moon Landing, and hints that the company may have designs on possible moon missions in the coming decades.

This is an exciting time for the NewSpace industry. In the coming months, SpaceX is expected to conduct the first launch of the Falcon Heavy, which will be the most powerful rocket built in the US since the retirement of the Apollo program's Saturn V launcher. And if they keep to their current schedule, Blue Origin will be following this in a few years time with the launch of the largest rocket of the post-Apollo era.

Big rockets and big lift capacities can mean only thing: big things lie ahead of us!

Further Reading: ArsTechnica, The Verge, Blue Origin

MEMBERS VIEWING LOGS and IMAGES

As always the best laid plans come to grief through bad timing. One day after the last meeting (Nick talking about Apollo) we got informed of the arrival of Al Worden on a possible lecture tour late September on his way to Europe, but it was expensive and vague. The best we could do in the week while I was in Spain, just to add to the pain, was consult the committee, find out possible venues (well done Nick) and sort funds. Not easy. In the end his dates clashed with STEM work he was doing elsewhere but we coordinated Dark Dky Wales into the loop and they got venue and regional council assistance so they could put the event on in Treochy. With funding we received from Aviva last summer for outreach we could send this money to assist the event (DSW just about broke even) and we managed a dozen complimentary tickets I could offer to members via e-mail. It was a great event with an excellent speaker who refused to cow tow to some of the management at NASA.

Andy

Apollo Astronaut - Al Worden

Station Road, Treorchy, Rhondda Cynon Taff, Rhondda, Cynon, Taff, CF42 6NL, Wales

01 October 2016

Apollo Astronaut - Al Worden: One of only 24 people to fly to the Moon.

Dark Sky Wales is honoured to announce that with support from Rhondda Cynon Taf Council it will
be hosting Colonel Al Worden Command Module Pilot for Apollo 15 at the Parc and Dare, Treorchy on October 1st, 2016. The evening will be MC'd by Nick Howes director of Aerolite Europe and former science writer for the European Space Agency.

Tickets go on sale Monday 12th September priced at £15. Demand is likely to be high so please

Al Worden will available to sign books and pictures after the lecture, please indicate if you would be interested in attending this session, Books £30, Pictures £10.

That was a good evening ! thanks for fixing it up.
Regards
Grant

Meanwhile Dave was using our name to get into a visit at Madeira...

Dear Laurindo,

Having now safely returned to the UK, I once again would like to thank you for your time and hospitality in showing me around your Astronomy Department at the University of Maderia. It was very interesting to learn about your researches into looking for Black-Holes and also to see some of the equipment that your students have developed during their studies. It was also interesting to learn about the association of Lord Kelvin (Thompson) with the island of Maderia and the laying of the transatlantic telegraphy cable. I wish you every success with your outreach activities in the local schools and community and I hope that you are successful in your fundraising plans and future installation of optical and radio observatories up in the mountains.

With very best wishes,
Dave.

From: Laurindo Sobrinho <sobrinho@uma.pt>
Sent: 13 September 2016 14:24
To: David Buckle
Cc: sobrinho@uma.pt
Subject: Re: Visiting Funchal 15th to 29th Sept for Holiday

Dear David,

I will be glad to welcome you at Madeira University and talk to you about our activities within the field of Astronomy. It is the beginning of a new semester and I do not know what will be my schedule during the next two weeks. I think that the best day would be tuesday after 11 a.m. or during the afternoon. Please contact me via email or phone me (#######).

Kind regards,
Laurindo Sobrinho
Astronomy Group at Madeira University (GAUMa)

At 19:56 09-09-2016, you wrote:

Hi,

I am a member of Wiltshire Astronomical Society (WAS) in the UK,

http://www.wasnet.org.uk/

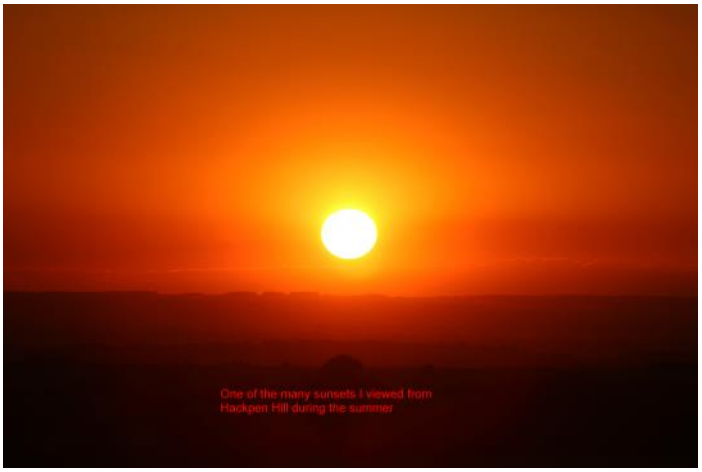
My wife and I are visiting Madeira for the first time next week (Thursday) and are staying in Funchal, near the Marina. WAS regularly arrange outreach activities with local schools, Guides and Scout Groups, etc, and I would be interested to meet with any local amateurs and/or arrange a visit to see your University Campus/Astronomy Dept, if at all possible.

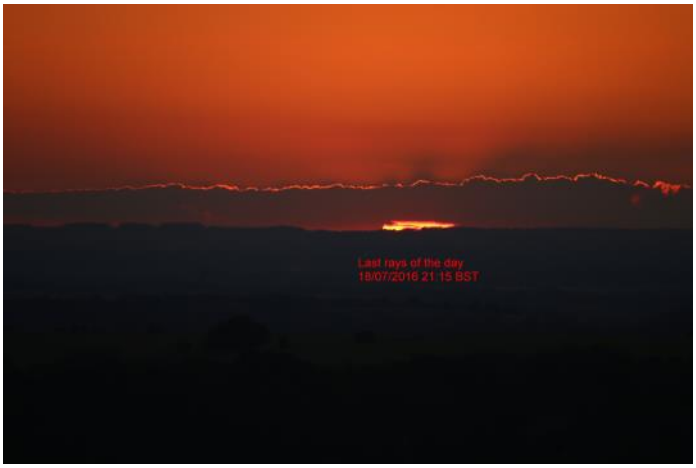
If anyone wishes to meet up, please email me before the 15th.

Best wishes and clear skies,

Dave.

Last month I thought I had put in some images by Peter Chappell in his observing logs. But in the final edit I had pdf problems and these did not get in. As punishment he has not submitted logs for September…
So here are his shots of Sunset and Venus, Mars and Saturn from Hackpen Hill…





RARE FeNova Imaged from GEO (only European images).

Meanwhile over in Spain I was able to grab the shots taken from Europe of a rare Nova of on Iron rich star. So I was chasing a magnitude 11 red dot low in the Scorpio part of the of the dust lanes in the Milky Way.
Couldn't have done it without the coordinates being made available to Kath Griffiths, co Director at the Griffon Observatory, and the work done in the UK by Tony Vale to read the star maps he could use in the variable star list… But the EQ8 mount worked well, and I grabbed shots using the 6" refractor, Nikon D810A, 60 seconds at 1200ISO, and two days later added a televue Big Barlow 2X lens into the image train. Delighted to get this first and only image...

Following my confirmation of sighting the above Nova on 10th September from the Griffon observatory in southern Spain (Griffin Educational Observatory at 35 degrees N) I thought you would be interested in seeing the digital evidence. This was a team effort from myself, Tony Vale another BAA member, and Andy Burns who is chair of the Wiltshire Astronomical Society.

Kind Regards
Kathy Griffiths

Following my recent email , Andy Burns has just sent me this latest picture showing a smaller area and so higher resolution. The red shift is due to dust diffraction.

Kind Regards
Kathy Griffiths

Hi Andy,

The image shows the Nova and some comparison stars marked up.

Sounds like lunch was good as usual !

Regards,

Tony

I think the colour is real. It was described as a "highly reddened galactic classical Fe-II type nova" by spectroscopists in the AAVSO alert notice.
From the previous image I got the magnitude around 11.9 by comparison. It would be good to repeat the excercise with the same comparison stars with last night's image. Visual observations recorded so far range from 11.8 to 12.3 and photometry (v filter) about 11,6 but the last observation was

the night before last.

Sent from my iPad Tony Vale

Hi Andy,

Thanks for this. There are a good selection of comparison stars in that field. I would make it still around 12. It looks close to the 11.9 mag star at about 11 o'clock in the picture and a good bit fainter than the mag 10.8 one nearby.

Enjoy your last day. We've got thunder storms alternating with blazing sunshine here. I need to mow the lawn but I would be dicing with death if I try it now.

Regards,

Tony

Sent from my iPad

On 13 Sep 2016, at 10:14, Andrew Burns <anglesburns@hotmail.com> wrote:

This is a much compressed file but it is the full field of view. I put a 2x Big Barlow unit in the focal train to get in closer. The camera has the M* mode, meaning it takes out the red/infra red filtration on cameras for day time use. It means good reproduction of h-alpha band width regions. But it is software wired in to the camera.

The full file is around 34Mb, and would take 4 hours to upload!

Andy

Certainly these pictures show how difficult it was to pick out at this magnitude, but the reddened nova is there.

But it was a good trip, with 5 nights out 6 doing astronomy.

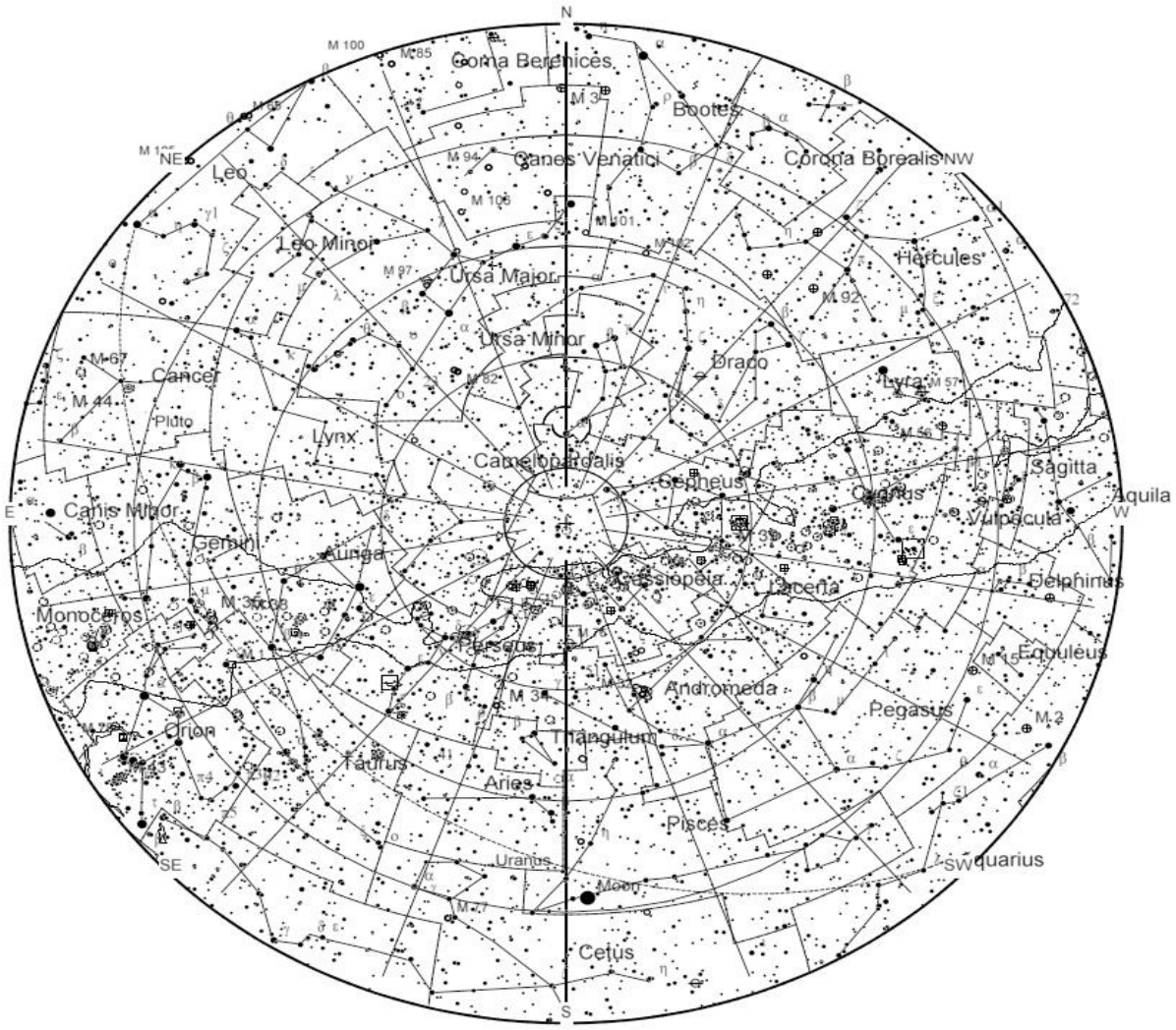
This is M17 the Swan Nebula.

Here is the triffid nebula, at low resolution to allow posting from Spain low band width rates.

The M31 and M110, M32.

Back home for the viewing evening...

WHATS UP, OCTOBER 2016



October 7 - **Draconids Meteor Shower.** The Draconids is a minor meteor shower producing only about 10 meteors per hour. It is produced by dust grains left behind by comet 21P Giacobini-Zinner, which was first discovered in 1900. The Draconids is an unusual shower in that the best viewing is in the early evening instead of early morning like most other showers. The shower runs annually from October 6-10 and peaks this year on the the night of the 7th. The first quarter moon will block the fainter meteors in the early evening. It will set shortly after midnight leaving darker skies for observing any lingering stragglers. Best viewing will be in the early evening from a dark location far away from city lights. Meteors will radiate from the constellation Draco, but can appear anywhere in the sky.

October 15 - **Uranus at Opposition.** The blue-green planet will be at its closest approach to Earth and its face will be fully illuminated by the Sun. It will be brighter than any other time of the year and will be visible all night long. This is the best time to view Uranus. Due to its distance, the planet will only appear as a tiny blue-green dot in all but the most powerful telescopes.

October 16 - **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 04:23 UTC. This full moon was known by early Native American tribes as the Full Hunters Moon because at this time of year the leaves are falling and the game is fat and ready to hunt. This moon has also been known as the Travel Moon and the Blood Moon. This is also the first of three supermoons for 2016. The Moon will be at its closest approach to the Earth and may look slightly larger and brighter than usual.

October 20, 21 - **Orionids Meteor Shower.** The Orionids is an average shower producing up to 20 meteors per hour at its peak. It is produced by dust grains left behind by comet Halley, which has been known and observed since ancient times. The shower runs annually from October 2 to November 7. It peaks this year on the night of October 21 and the morning of October 22. The second quarter moon will block some of the fainter meteors this year, but the Orionids tend to be fairly bright so it could still be a good show. Best viewing will be from a dark location after midnight. Meteors will radiate from the constellation Orion, but can appear anywhere in the sky.

October 30 - **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 17:38 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.

November 4, 5 - **Taurids Meteor Shower.** The Taurids is a long-running minor meteor shower producing only about 5-10 meteors per hour. It is unusual in that it consists of two separate streams. The first is produced by dust grains left behind by Asteroid 2004 TG10. The second stream is produced by debris left behind by Comet 2P Encke. The shower runs annually from September 7 to December 10. It peaks this year on the the night of November 4. The first quarter moon will set just after midnight leaving dark skies for viewing. Best viewing will be just after midnight from a dark location far away from city lights. Meteors will radiate from the constellation Taurus, but can appear anywhere in the sky.

AURORA...WHO NEEDS SUNSPOTS?

It is widely thought that auroras require sunspots. Explosions in the magnetic canopies of sunspots can trigger geomagnetic storms and beautiful Arctic Lights. In fact, sunspots are not required. Behold this display, which appeared over Lohtaja, Finland, on Oct. 2nd when the sunspot number was near zero:

"Bright auroras appeared around 11pm local time," says photographer Aku Kankaanpää. "The lights didn't last very long, but they lit up the stormy sea and seashore stones."

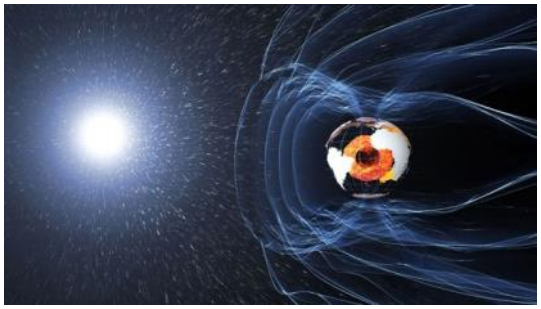
The cause of the display was a stream of solar wind, which has been pressing against Earth's magnetic field for days. The pressure is igniting intermittent geomagnetic storms and auroras around the Arctic Circle. The sunspot number is still low on Oct 3rd. Nevertheless, more auroras are possible tonight as the solar wind continues to blow.

How Can You see the Northern Lights?

The Northern Lights have fascinated human beings for millennia. In fact, their existence has informed the mythology of many cultures, including the Inuit, Northern Cree, and ancient Norse. They were also a source of intense fascination for the ancient Greeks and Romans, and were seen as a sign from God by medieval Europeans.
Thanks to the birth of modern astronomy, we now know what causes both the Aurora Borealis and its southern sibling – Aurora Australis. Nevertheless, they remain the subject of intense fascination, scientific research, and are a major tourist draw. For those who live north of 60° latitude, this fantastic light show is also a regular occurrence.
C a u s e s :

Aurora Borealis (and Australis) is caused by interactions between energetic particles from the Sun and the Earth's magnetic field. The invisible field lines of Earth's magnetoshere travel from the Earth's northern magnetic pole to its southern magnetic pole. When charged particles reach the magnetic field, they are deflected, creating a "bow shock" (so-named because of its apparent shape) around Earth.
However, Earth's magnetic field is weaker at the poles, and some particles are therefore able to enter the Earth's atmosphere and collide with gas particles in these regions. These collisions emit light that we perceive as wavy and dancing, and are generally a pale, yellowish-green in color. The variations in color are due to the type of gas particles that are colliding. The common yellowish-green is produced by oxygen molecules located about 100 km (60 miles) above the Earth, whereas high-altitude oxygen – at heights of up to 320 km (200 miles) – produce all-red auroras. Meanwhile, interactions between charged particles and nitrogen will produces blue or purplish-red auroras.
V a r i a b i l i t y :

The visibility of the northern (and southern) lights depends on a lot of factors, much like any other type of meteorological activity. Though they are generally visible in the far northern and southern regions of the globe, there have been instances in the past where the lights were visible as close to the equator as Mexico.
In places like Alaska, Norther Canada, Norway and Siberia, the northern lights are often seen every night of the week in the winter. Though they occur year-round, they are only visible when it is rather dark out. Hence why they are more discernible during the months where the nights are longer.

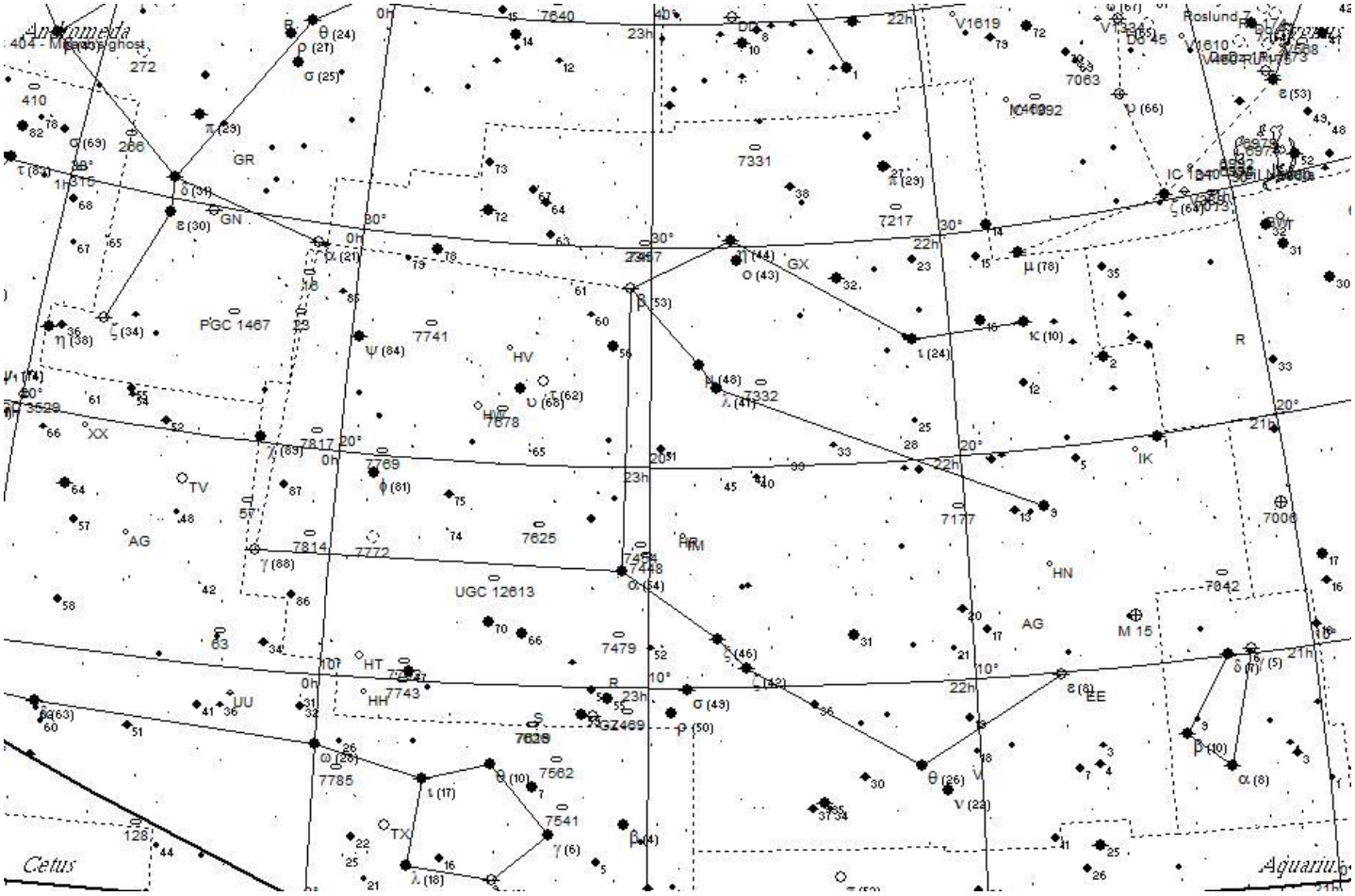


The magnetic field and electric currents in and around Earth generate complex forces, and also lead to the phenomena known as aurorae. Credit: ESA/ATG medialab
Because they depend on the solar wind, auroras are more plentiful during peak periods of activity in the Solar Cycle. This cycle takes places every 11 years, and is marked by the increase and decrease of sunspots on the sun's surface. The greatest number of sunspots in any given solar cycle is designated as a "Solar Maximum", whereas the lowest number is a "Solar Minimum."
A Solar Maximum also accords with bright regions appearing in the Sun's corona, which are rooted in the lower sunspots. Scientists track these active regions since they are often the origin of eruptions on the Sun, such as solar flares or coronal mass ejections.
The most recent solar minimum occurred in 2008. As of January 2010, the Sun's surface began to increase in activity, which began with the release of a lower-intensity M-class flare. The Sun continued to get more active, culminating in a Solar Maximum by the summer of 2013.
L o c a t i o n s f o r V i e w i n g :

The ideal places to view the Northern Lights are naturally located in geographical regions north of 60° latitude. These include northern Canada, Greenland, Iceland, Scandinavia, Alaska, and Northern Russia. Many organizations maintain websites dedicated to tracking optimal viewing conditions.

An image captured of the northern lights, which appear pale purple and red, though the primary color visible to the eye was green. Credit: Bob Kin

CONSTELLATIONS OF THE MONTH: Pegasus



Pegasus, the winged horse, flew out of the head of Medusa when Perseus slew her. It was fathered by Poseidon, some time earlier, and waited for the Gorgon's death to appear. (Medusa's story is told under the constellation "Cepheus".)

> Athene gave Pegasus to Bellerophon (a grandson of Sisyphus), who used the winged creature in his fight against the Chimaera - a monstrous female with three heads.
>
> Bellerophon shot arrows at the beast as he flew above her on Pegasus, then he stuck between her jaws a huge lump of lead. The monster's own breath melted the lead, which then flowed down her throat and burned her to death.

Now Bellerophon was sent off on another mission, which he accomplished with equal aplomb. Flushed with victory, he flew off for Olympus, home of the gods, as if he too were immortal. Zeus sent a gadfly, which stung Pegasus on the bum, and Bellerophon was kicked off the horse.

Pegasus went alone to Olympus, where he was used by Zeus to carry around his thunderbolts. As for Bellerophon, for his presumption of greatness, he wandered about the earth for the rest of his life, blind, lame, and shunned by man, until dying of old age.

Pegasus is a conspicuous constellation which includes the so-called "Great Square of Pegasus". However it must now share the northeast corner of the square with Andromeda: *delta Pegasus* was given to Andromeda, to provide the lady with a head!

The stars are generally second and third magnitude. There are several interesting binaries here, a curious flare star, and one outstanding deep sky object.

Double stars in Pegasus:

> *Kappa Pegasi* is a very close binary, with an orbit of only 11.52 years: 4.8, 5.3; presently the companion is at PA 132 degrees and separation of only 0.2".
>
> *37 Pegasi* is another close binary, with an orbit of 140 years: 5.8, 7.1; presently the companion is found at PA 118 degrees and separation of 0.8".
>
> *85 Pegasi* is a well-known close binary with orbit of 26.27 years: 5.8, 8.9; currently the companion is at PA 149 degrees and separation of 0.8".

Variable stars in Pegasus:

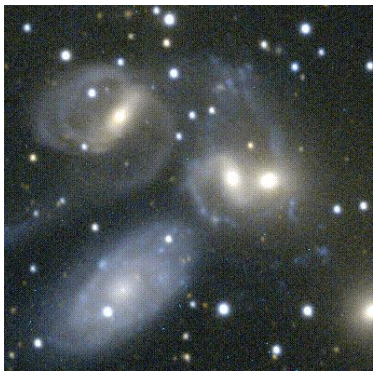
Epsilon Pegasi is an irregular (Lb type) variable, and a flare star with a relatively cool shell. This supergiant can get as bright as 0.7 magnitude, and dimmer than 3.5. Generally it stays around 2.4.

Deep Sky Objects in Pegasus:

Pegasus has many galaxies and an outstanding globular cluster.

NGC 7331 is a spiral galaxy resembling the Milky Way Galaxy; it's as if we were looking at outselves from fifty million light years away.

NGC 7479 is a barred spiral galaxy about three degrees due south of alpha Pegasi.



Stephan's Quintet is a noted cluster of galaxies half a degree SSW of NGC 7331. See how many of the five you can spot (three is average, four is good).

M15 (NGC 7078) is one of the finest globular clusters in the heavens, very bright and compact, at 35,000 to 40,000 light years away. It is found four degrees NW of epsilon Pegasi.

Globular cluster M15 is among the more conspicuous of these great stellar swarms. At a distance of about 33,600 light years, its diameter of 18.0 arc min corresponds to a linear extension of about 175 light years, and its total visual brightness of 6.2 magnitudes corresponds to an absolute magnitude of -9.17, or roughly 360,000 times that of our sun. Its brightest stars are about of apparent magnitude 12.6 or absolute magnitude -2.8 or a luminosity of 1,000 times that of our Sun, and its horizontal branch giants are about of magnitude 15.6. Its overall spectral type has been determined as F3 or F4. The globular cluster is approaching us at 107 km/sec.

In amateur instruments, M30 appears somewhat smaller, perhaps about 7 arc minutes visually and 12.3 arc minutes photographically. On the other hand, the tidal radius of this globular cluster, beyond which member stars would escape because of the Milky Way galaxy's tidal forces is a bit larger: 21.5 arc minutes, corresponding to a distance of 210 light years from the cluster's center.

This globular cluster has the third rank in known variable star population, after M3 and Omega Centauri; a total of 112 variables have been identified. One of them is apparently a Cepheid of Type II (a W Virginis star).

M15 is perhaps the densest of all (globular) star clusters in our Milky Way galaxy. The Hubble Space Telescope has photographically resolved its superdense core. M15's core has undergone a process of contraction called "core collapse", which is common in the dynamical evolution of globulars; of the 150 known globular cluster within our Milky Way Galaxy according to W.E. Harris' database, 21 have been found to contain a collapsed core (among them, besides M15, the Messier globulars M30 and M70), and there are 8 more candidates, among them M62. This central core is extremely small compared to the cluster, only about 0.14 arc minutes (8,4 arc seconds) in angular diameter, corresponding to a linear extent of roughly 1.4 light years. The half-mass radius is 1.06 arc min, or linearly about 10 light years - half the mass of this cluster is concentrated in the innermost sphere of that radius. It is still unclear if the central core of M15 is packed so dense simply because of the mutual gravitational interaction of the stars it is made of, or if it houses a dense, supermassive object, which would be resembling the supermassive objects in galactic nuclei. The one in M15 would among the nearest and better observable to us, being only little more remote than the Galactic Center and much less obscured by interstellar matter. Although the true nature of these objects remains obscure for the moment, many scientists believe they are strong candidates for "Black Holes".

M15 was discovered by Jean-Dominique Maraldi (Maraldi II, 1709-88) on September 7, 1746 while he was looking for De Chéseaux' comet; he described it as 'A nebulous star, fairly bright and composed of many stars'. Charles Messier, who cataloged it on June 3, 1764, and Johann Elert Bode couldn't make this out and described it as 'nebula without stars,' so that it remained to William Herschel in 1783 to resolve this fine star cluster.

M15 was the first globular cluster in which a planetary nebula, Pease 1 or K 648 ("K" for "Kuster"), could be identified (Pease 1928, on photographic plates taken at Mt. Wilson in 1927). Leos Ondra has provided more information on this planetary nebula. In 1976 Peterson has reported a possible second planetary nebula in this globular, situated near its center, which was however never confirmed since (thanks to Leos Ondra for pointing out this fact), so that Pease 1 remains one of only four known planetary nebulae in Milky Way globular clusters.

M15 can be found extremely easily: Find the 2nd mag star Epsilon Pegasi, and Theta Pegasi SE of it. Follow the line from Theta over Epsilon and find M15 3 1/2 deg W and 2 1/4 deg N of Epsilon. A 6th mag star is about 20' away to the East, another one of mag 7.5 about 5' to the NNE.

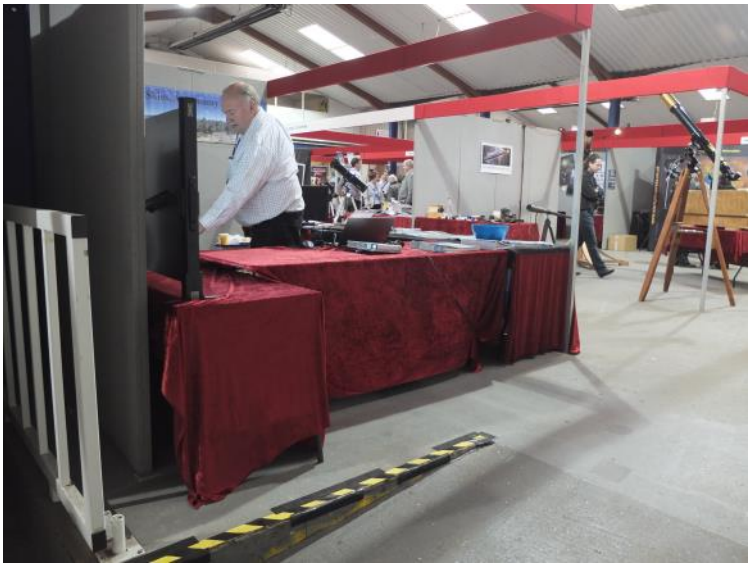
With its apparent visual brightness of magnitude 6.2, M15 is about at the limit of visibility for the naked eye under very good conditions. The slightest optical aid, opera glass or small binoculars, reveals it as a round nebulous object. It appears as a round mottled nebula in 4-inch telescopes, with at best the very brightest stars visible, but otherwise unresolved in a fine star field. In larger telescopes more and more stars become visible the outer parts are resolved, with a more irregular, non-circular outline. The compact core, however, stays unresolved even in large amateur telescopes, but the brightest stars can be glimpsed even there. Chains and streams of stars seem to radiate out of this core in all directions, but less concentrated toward the West.

Upcoming Local Astronomy Events.

The International Astronomy Show

The International Astronomy Show really is a show by two astronomers for astronomers, both passionate to bring you a world class show to remember, and a show that will now be a permanent fixture on the Astronomy calendar.
Friday 14th October 9.00am – 6.00pm
Saturday 15th October 9.00am – 5.00pm

Stoneleigh Park



Lecturers

Gary Palmer

Nigel A Ball

Dr Andrew Pontzen

Professor Gerry Gilmore

Dr Kate Russo

Rebecca Smethurst

Pete Lawrence

Nigel Henbest 2

Nigel Henbest

Dr Melanie Windridge

Ticket Sales

Vendors

Andy Green's Planetarium

AWR Technology

Dark Skies Tenerife

Nigel A Ball Photography

Msg Meteorites

nPAE

British Astronomical Association

W&W Astro

Astroparts

Crystal Nebule

Webb Deep-Sky Society

Book Signing Heather Couper Nigel Henbest

Dark Skies Jewellery & Artworks

Pulsar Observatories/Pulsar Optical

Telescope House Ltd

Orion Optics UK

Astrograph Ltd

Cambridge University Press

Sky at Night Magazine

Opticron

Astronomy Now Magazine

Atik Cameras

Widescreen Centre and many more.

IAS In Space

Imaging Competition

Image Competition Winners

Gallery

ISS PASSES For Summer 2016 From Heavens Above website maintained by Chris Peat

Date	Brightness	Start			Highest point			End		
	(mag)	Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
06 Sep	-0.9	05:49:53	10°	S	05:52:12	18°	SE	05:54:31	10°	E
07 Sep	-0.6	04:58:47	10°	SSE	04:59:55	11°	SE	05:01:04	10°	ESE
08 Sep	-1.9	05:40:24	10°	SSW	05:43:20	30°	SSE	05:46:16	10°	E
09 Sep	-1.4	04:49:46	17°	S	04:50:57	20°	SE	04:53:28	10°	E
10 Sep	-0.6	03:59:23	12°	SE	03:59:23	12°	SE	04:00:17	10°	ESE
10 Sep	-2.8	05:32:01	15°	SW	05:34:31	50°	SSE	05:37:42	10°	E
11 Sep	-2.3	04:41:35	33°	S	04:42:02	34°	SSE	04:45:03	10°	E
12 Sep	-0.8	03:51:06	17°	ESE	03:51:06	17°	ESE	03:52:17	10°	E
12 Sep	-3.3	05:23:44	22°	WSW	05:25:43	73°	SSE	05:29:00	10°	E
13 Sep	-3.1	04:33:13	55°	SSE	04:33:13	55°	SSE	04:36:23	10°	E
13 Sep	-3.3	06:06:17	10°	W	06:09:35	84°	N	06:12:52	10°	E
14 Sep	-0.7	03:42:41	18°	E	03:42:41	18°	E	03:43:43	10°	E
14 Sep	-3.4	05:15:19	28°	W	05:16:56	89°	N	05:20:14	10°	E
15 Sep	-3.0	04:24:47	61°	E	04:24:47	61°	E	04:27:35	10°	E
15 Sep	-3.3	05:57:29	10°	W	06:00:47	90°	NNW	06:04:04	10°	E
16 Sep	-0.4	03:34:15	15°	E	03:34:15	15°	E	03:34:56	10°	E
16 Sep	-3.4	05:06:52	35°	W	05:08:07	85°	N	05:11:25	10°	E
17 Sep	-2.3	04:16:22	44°	E	04:16:22	44°	E	04:18:45	10°	E
17 Sep	-3.3	05:49:00	13°	W	05:51:55	72°	SSW	05:55:11	10°	ESE
18 Sep	0.0	03:25:53	11°	E	03:25:53	11°	E	03:26:03	10°	E
18 Sep	-3.4	04:58:32	51°	W	04:59:15	87°	S	05:02:32	10°	E
19 Sep	-1.5	04:08:07	29°	E	04:08:07	29°	E	04:09:51	10°	E
19 Sep	-3.0	05:40:46	18°	W	05:42:56	49°	SSW	05:46:07	10°	SE
20 Sep	-3.3	04:50:26	65°	S	04:50:26	65°	S	04:53:33	10°	ESE
21 Sep	-0.6	04:00:13	15°	ESE	04:00:13	15°	ESE	04:00:54	10°	ESE
21 Se	-2.4	05:32:54	25°	WSW	05:33:50	30°	SSW	05:36:44	10°	SSE
22 Sep	-1.6	04:42:50	24°	SE	04:42:50	24°	SE	04:44:21	10°	SE
22 Sep	-1.1	06:16:01	10°	WSW	06:17:02	11°	SW	06:18:03	10°	SSW
23 Sep	-1.3	05:25:37	15°	SSW	05:25:37	15°	SSW	05:26:50	10°	S
29 Sep	-1.1	20:01:56	10°	SSE	20:02:50	12°	SSE	20:02:50	12°	SSE
30 Sep	-1.7	20:43:29	10°	SW	20:45:13	24°	SSW	20:45:13	24°	SSW
01 Oct	-1.8	19:51:12	10°	SSW	19:53:45	21°	SE	19:54:48	18°	ESE
01 Oct	-0.7	21:26:35	10°	WSW	21:27:26	17°	WSW	21:27:26	17°	WSW
02 Oct	-3.1	20:33:51	10°	SW	20:36:53	51°	S	20:36:53	51°	S
03 Oct	-2.5	19:41:13	10°	SW	19:44:15	36°	SSE	19:46:13	18°	E
03 Oct	-1.3	21:17:15	10°	W	21:18:50	26°	W	21:18:50	26°	W
04 Oct	-3.4	20:24:23	10°	WSW	20:27:39	75°	SSE	20:28:04	61°	ESE
05 Oct	-3.1	19:31:34	10°	WSW	19:34:47	57°	SSE	19:37:15	16°	E
05 Oct	-1.6	21:07:55	10°	W	21:09:52	33°	W	21:09:52	33°	W
06 Oct	-3.4	20:15:00	10°	W	20:18:16	89°	N	20:18:59	51°	E
06 Oct	0.1	21:51:27	10°	W	21:51:36	11°	W	21:51:36	11°	W
07 Oct	-3.3	19:22:04	10°	WSW	19:25:20	79°	SSE	19:28:05	14°	E
07 Oct	-1.9	20:58:31	10°	W	21:00:41	38	W	21:00:41	38°	W
08 Oct	-3.4	20:05:34	10°	W	20:08:51	85°	N	20:09:45	45°	E
08 Oct	0.0	21:42:02	10°	W	21:42:21	12°	W	21:42:21	12°	W

END IMAGES

The sword scabbard in Oirion, taken yesterday morning. Orion is now beginning to show in the skies around midnight, and it will get earlier through the autumn months.

The sword scabbard shows a lot of nebulosities despite the thin cloud which made this a challenging night,.

The running man at the top, NGC 1975.

Then M43 above the huge bright M42 Orion nebula that extends down past the bottom star of the sword, Nair al Saif and the surround nebulosity of NGC 1980.

Nikon D810a 60seconds exposure, 2000iso, through the TMB 102 telescope, Albion mount.

Date	Moon Phase	Observing Topic
2016		
Friday October 28th	Waning crescent (sets 5pm)	Deep Sky
Friday November 25th	Waning crescent (sets 3pm)	Deep sky
Tuesday 13th / Wednesday 14th December	*Full*	*Geminids meteors*
Friday December 30th	Waxing crescent (Sets 6 pm)	Deep Sky & Lunar targets (Xmas session, meet at 6pm)
2017		
Friday 27th January	New Moon	Deep Sky
Friday 24th February	Waning crescent (sets 3pm)	Deep Sky
Friday 24th March	Waning crescent (sets around 2pm)	Deep Sky
Friday 28th April	Waxing crescent (sets 11pm)	Deep Sky & Lunar targets
Friday 26th May	Waxing crescent (sets around 10pm)	Deep Sky & Lunar targets

OUTREACH ACTIVITIES

September/October date to be arranged for clear sky window. Chippenham 10th Scout troup. Westmeade Fields.

Early January 2017? Star Gazing Live

January 26th Lacock Positives Photographic Society Talk.