

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

Transit of Mercury

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Firstly can I welcome Bob Mizon MBE to the Wiltshire Society for the first visit for many years. He will be talking about oddities in our Solar System... several of whom it could be argued are in this room...

Bob has well deserved MBE for the tireless work he has done in promoting the Campaign for Dark Skies.

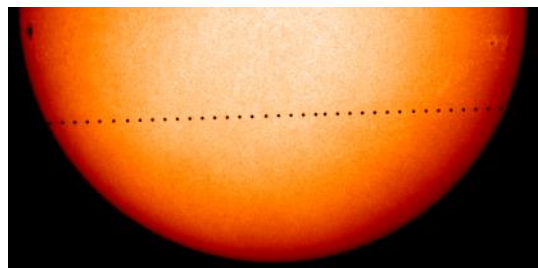
This has led to many sites being declared as international Dark Sky areas within Britain, From the Isle of Sark, through Exmoor, Wales and up to Scotland (oh how we wish there was a campaign for clear skies)... but thank you Bob for your tireless work in promoting astronomy.

The big event of the month is something Bob can do little about. The transit of Mercury on Monday 9th May, first contact at 12:21 and last contact at 19:42 BST.

This is quite a rare event, all since the 16th Century occurring in May or November, and November transits outnumber May transits 2:1. Next will be Nov 2032 and the next full transit visible from UK in May 7th 2049. I doubt if I will be carry telescopes around the landscape then!

This transit we have been invited to put on a viewing session near the visitor centre at Stonehenge. After many emails and phone calls I got the final site go ahead yesterday!

We will be arriving at 11am to unload equipment, then set up ready for the 12:21 start. The physical size of Mercury is tiny by comparison to Venus transits, so tele-



scopic equipment is needed to project, or with specialised filters directly view. But all telescopes will need to be manned, and very few will be tracking the Sun (unsafe for viewing in case glue melts inside the equipment opening holes).

I need volunteers right through the afternoon until packing away at 20:00 hours.

Please give names at the desk and times you will be available. First look at the weather for Monday shows potential showers, with sunshine. So the spot be the stoneage hut for equipment retreat will be vital.

I will have relevant screens there including one just made for transit events. Sunspot activity may be visible, and most sunspots are bigger than the Mercury dot.

Volunteers need to be able to use various mount types and telescopes, and be able to give warnings and information about the Sun and transits....

Clear skies Andy

One of the pains of imaging astronomy is the prevalence of light pollution.

I have an observatory in the centre of Chippenham, luckily with a railway behind. But trying to see anything lower than 40 degrees above the horizon can be a problem.

Wiltshire Council has done a lot to help, with a turn off of none major route lights after midnight.

But I live off a major route (firebrigade) and with the river through this centre of town and mist events pull the lighting up into the sky as can be seen in this unprocessed photograph.

Changes in lighting types to LEDs isn't helping, light pollution filters cannot cope.

Bob Mizon is on of the leading lights in the Campaign for Dark Skies but certain situations are difficult to solve.

Andy Burns



Wiltshire Society Page

Wiltshire Astronomical Society

Web site: www.wasnet.org.uk

Meetings 2015/2016Season.

NEW VENUE the Pavilion, Rusty Lane, Seend

Meet 7.30 for 8.00pm start

2016

May 3rd *Oddities of the Solar System* : Bob Mizon

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

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)

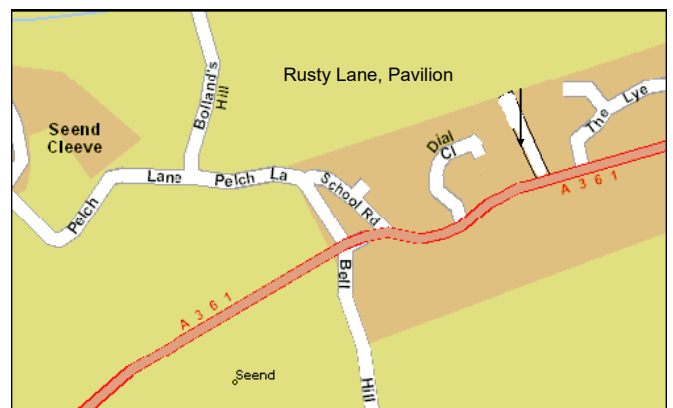
Philip Proven (Hall coordinator)

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.



Observing Sessions

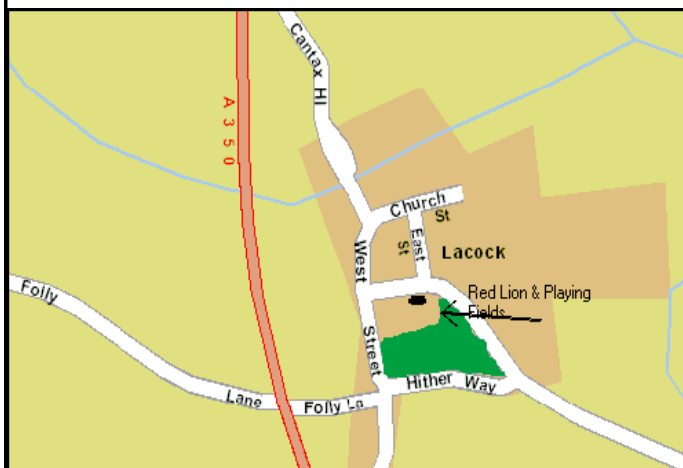
The Wiltshire Astronomical Society's observing sessions are open, and we welcome visitors from other societies as well as members of the public to join us.

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



Well-known Dorset astronomer Bob Mizon M.B.E., F.R.A.S. is one of the most experienced travelling planetarium operators in the UK. He is a qualified teacher, and professional communicator to audi-

ences of all ages. With the modern inflatable Mizar Planetarium, based in Wimborne, Bob can bring the night sky to schools, youth groups, Scouts, Guides, Brownies, Cubs, societies, clubs, public events and exhibitions, etc. within a radius of approximately 250 km (150 miles). The Planetarium holds up to 35 people for each presentation, in a self-contained, darkened environment.

Bob was awarded the M.B.E. in the Queen's Birthday Honours list in 2010, for services to astronomy education.



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.

The Transit of Mercury at Avebury!

Swindon Stargazers Transit of Mercury viewing event at Avebury, between Swindon and Devizes - May be in the stone circle, or may be near the National Trust Cafe and Shop.

Set-up will be 11:30am, ready for first contact at 12:11 BST.

We do hope, of course, that it will be a clear day!

Our next regular meeting will be on 20th May, when Owen Brazell will speak on 'Observing Dark Nebula'.

Ad-hoc viewing sessions

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

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

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

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

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

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

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

Enjoy astronomy at it's best!

Members of the Wiltshire Astronomical Society always welcome!

At Liddington Village Hall, Church Road, Liddington, SN4 0HB – 7.30pm onwards
NOTE NEW START TIME!

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 20 May 2016

Programme: Owen Brazell: Shrouds of Night - Observing Dark Nebulae

Friday 17 Jun 2016

Programme: James Fradgely: How (on Earth) Did Life Start

Friday 16 Sep 2016

Programme: Guy Hurst: Star Clusters

Friday 21 Oct 2016

Programme: Paul Roche: Robotic Astronomy

Friday 18 Nov 2016

Programme: Mike Leggett: Exploration of Mars

Friday 16 Dec 2016

Programme: Christmas Social

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.

Date	Title	Speaker
20 th May	<i>Tales from the Dark</i>	Mike Witt
17 th June	Annual General Meeting <i>Member Talks</i>	

The programme and details of how to contact the society are at www.beckingtonas.org

SOFTWARE AND APPS

Here is my first foray into this for some time. Where possible I choosing readily available and free software for PCs Macs or Apps for phones.

This first list is for YOU to check and report if it is the software you want me to review, otherwise I will run with my own software choice.

Firstly how do find what is up in the sky at any particuly day/night/time.

There are many sorts of app for the phone (Android or iPhone)

Google Sky Map

Planets

Starmap

Astronomist

Sky Safari Pro (it does have a free version and runs on Macs and iPhones plus Android... not PCs yet.)

How Aurora warnings: Aurora Watch alert works very well this year and gives audible warnings.

Satellite prediction

ProSat, SatelliteAR, ISS Detector

There is even an excellent weather predictor for viewing

Clear Outside for Android showed Fridays viewing window from days in advance.

For Deep Sky Objects, DS Browsers tells you what is up.

And the Moon, Moon HD is OK but for the sky I much prefer the bigger screen versions for the PCs and Macs.

Sky Charts:

Cartes du Ciel

Stellarium both free

Sky Safari Pro

Or the Sky are the expensiveoptions but give you so much more information.

The Moon on PCs and MACs there is one standout programme and it is free. Virtual Moon Atlas.

There are others I know, but these keep me informed and allow viewing session planning. Next month some image processing software.

Andy

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>



Hubble Shatters The Cosmic Record For Most Distant Galaxy

By Ethan Siegel

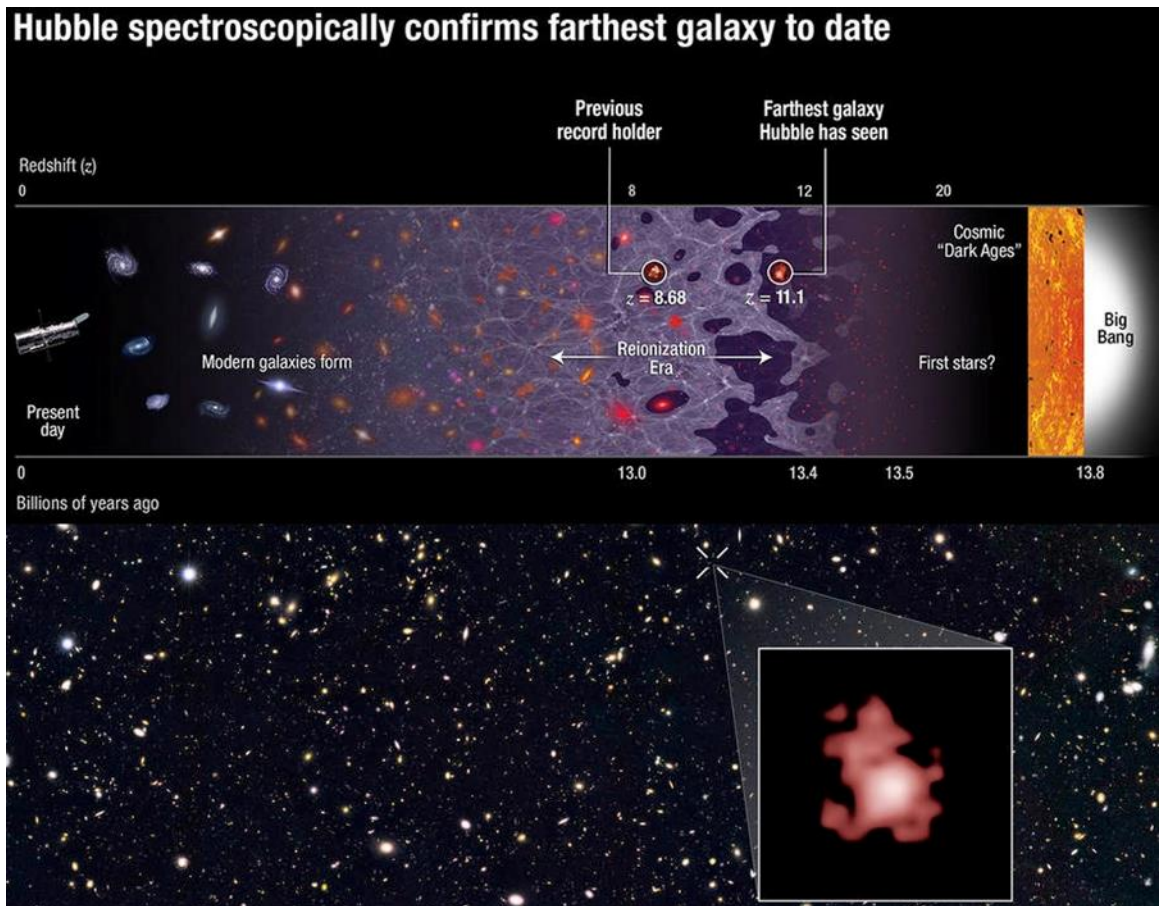
The farther away you look in the distant universe, the harder it is to see what's out there. This isn't simply because more distant objects appear fainter, although that's true. It isn't because the universe is expanding, and so the light has farther to go before it reaches you, although that's true, too. The reality is that if you built the largest optical telescope you could imagine -- even one that was the size of an entire planet -- you still wouldn't see the new cosmic record-holder that Hubble just discovered: galaxy GN-z11, whose light traveled for 13.4 billion years, or 97% the age of the universe, before finally reaching our eyes.

There were two special coincidences that had to line up for Hubble to find this: one was a remarkable technical achievement, while the other was pure luck. By extending Hubble's vision away from the ultraviolet and optical and into the infrared, past 800 nanometers all the way out to 1.6 microns, Hubble became sensitive to light that was severely stretched and redshifted by the expansion of the universe. The most energetic light that hot, young, newly forming stars produce is the Lyman- α line, which is produced at an ultraviolet wavelength of just 121.567 nanometers. But at high redshifts, that line passed not just into the visible but all the way through to the infrared, and for the newly discovered galaxy, GN-z11, its whopping redshift of **11.1** pushed that line all the way out to 1471 nanometers, more than double the limit of visible light!

Hubble itself did the follow-up spectroscopic observations to confirm the existence of this galaxy, but it also got lucky: the only reason this light was visible is because the region of space between this galaxy and our eyes is mostly ionized, which *isn't true* of most locations in the universe at this early time! A redshift of 11.1 corresponds to just 400 million years after the Big Bang, and the hot radiation from young stars doesn't ionize the majority of the universe until 550 million years have passed. In

most directions, this galaxy would be invisible, as the neutral gas would block this light, the same way the light from the center of our galaxy is blocked by the dust lanes in the galactic plane. To see farther back, to the universe's first true galaxies, it will take the James Webb Space Telescope. Webb's infrared eyes are much less sensitive to the light-extinction caused by neutral gas than instruments like Hubble. Webb may reach back to a redshift of 15 or even 20 or more, and discover the true answer to one of the universe's greatest mysteries: when the first galaxies came into existence!

Images credit: (top); NASA, ESA, P. Oesch (Yale University), G. Brammer (STScI), P. van Dokkum (Yale Uni-



versity), and G. Illingworth (University of California, Santa Cruz) (bottom), of the galaxy GN-z11, the most distant and highest-redshifted galaxy ever discovered and spectroscopically confirmed thus far.

SPACE NEWS

Departure of Europe's first Mars rover delayed to 2020

May 2, 2016 Stephen Clark



Artist's concept of

the ExoMars rover. Credit: ESA

Europe's ExoMars rover will not be ready for launch in 2018, officials said Monday, forcing a two-year delay for the ambitious mission to drill into the Martian surface and search for the remnants of past life.

Delays in the development of the European-built rover and a Russian stationary landing platform, coupled with the late delivery of scientific instruments, left no chance the mission could meet its target launch date in May 2018, the European Space Agency and Roscosmos said in a joint statement Monday.

Officials have signaled a possible delay in the ExoMars rover launch for months, warning that the robot's development faced schedule pressures stemming from difficulties securing final manufacturing contracts with industry and delays in the mission's science payload.

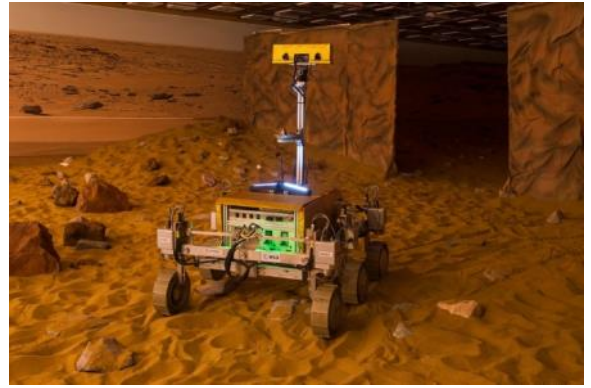
The launch of the European-Russian Mars mission is now scheduled for July 2020, the next time Mars and Earth are correctly positioned in their orbits to permit a direct trip between the planets. The landing on Mars will slip from January 2019 to April 2021.

The mission will launch on a Russian Proton rocket from the Baikonur Cosmodrome in Kazakhstan.

Russia is also building the landing module to carry the ExoMars rover through the Martian atmosphere to the surface. Europe is providing guidance systems and a landing radar to accompany the Russian descent stage, plus a carrier spacecraft to ferry the mission on the nearly year-long cruise from liftoff to arrival at Mars.

After touching down on Mars, the mobile rover will drive off its Russian-made landing pad, which will conduct its own scientific investigations in one place.

The centerpiece of the rover's science payload is a drill to probe up to 2 meters, or nearly 7 feet, into the red planet's subsurface to extract core samples for analysis by the craft's miniature on-board laboratory. Scientists have never studied material from so deep below the Martian surface, where biomarkers and organic molecules could survive from life forms that may have inhabited the planet when it was warmer and wetter billions of years ago.



A

prototype of the ExoMars rover is seen here during an April 29 test in which astronaut Tim Peake on the International Space Station drove the robot in a test cell at an Airbus Defense and Space plant in Britain built to represent the Martian surface. Airbus DS is the contractor selected to build the ExoMars rover in the UK. Credit: UK Space Agency (Max Alexander)

A tiger team established by ESA and Roscosmos in late 2015 evaluated whether the ExoMars rover mission could remain on schedule for 2018. The team presented its final report to the Joint ExoMars Steering Board, or JESB, in Moscow, the space agencies said Monday.

"Having assessed the possible ways to ensure successful mission implementation, the JESB concluded that, taking into account the delays in European and Russian industrial activities and deliveries of the scientific payload, a launch in 2020 would be the best solution," the agencies said in a joint statement.

ESA Director General Johann-Dietrich Woerner and Roscosmos head Igor Komarov agreed to move the launch to the next available launch window, officials said.

The delay will add costs to the ExoMars program, and managers will an updated schedule and budget to ESA member states as soon as June. A previously-scheduled meeting of European government representatives in December will decide whether to approve the added cost.

The ExoMars mission comes in two parts, with the first segment already en route to Mars after a blastoff in March aboard a Proton booster. That mission, known as ExoMars 2016, includes a European orbiter designed to measure trace gases in the Martian atmosphere, including methane, and a short-lived battery-powered lander to prove out technologies required for the 2020 mission.

ESA says its portion of the ExoMars mission — comprising the 2016 and 2020 launches — will cost about 1.2 billion euros (\$1.4 billion), but the agency had not secured the full slate of funding from its member states to cover the projected cost.

Before the rover's delay from 2018 to 2020, ESA officials said its members needed to approve between 150 million and 200 million euros (\$173 million to \$230 million) later this year just to cover the funding shortfall for the 2018 launch.

That figure is likely to rise with the delay to 2020, which will incur additional costs to store the spacecraft after its completion and to keep the industrial team on the job another two years through launch.

ESA has been in months of tough negotiations with ExoMars lead developer Thales Alenia Space over the price of the rover mission's final contract.

Italy is leading the ExoMars program, with Thales' Italian division taking charge of all European industrial work. Britain is ExoMars' second-biggest financial backer, and Airbus Defense and Space's factory in Stevenage north of London is charged with building the rover vehicle itself.

Hold-down test firing complete for next SpaceX launch

May 2, 2016 Stephen Clark



File

photo of a Falcon 9 rocket's static fire test at Cape Canaveral's Complex 40 launch pad. Credit: SpaceX

SpaceX technicians are attaching a Japanese communications satellite to the top of a Falcon 9 rocket ahead of a planned launch Thursday morning from Cape Canaveral.

The JCSAT 14 communications satellite, made in California by Space Systems/Loral, is fueled and encapsulated inside the Falcon 9 rocket's payload fairing. Workers were expected to connect the satellite with the launcher's second stage inside the Falcon 9 hangar as soon as Monday.

The rocket passed a key preflight test Sunday evening, when SpaceX's launch team fueled the Falcon 9 with super-chilled kerosene and liquid oxygen and fired its nine Merlin 1D first stage engines for several seconds at Cape Canaveral's Complex 40 launch pad.

Hold-down restraints kept the rocket on the ground during the brief static fire test, a customary all-up check of the Falcon 9 and its ground systems before the real countdown begins.

The static fire occurred without the mission's satellite payload on-board, and SpaceX planned to return the rocket to its hangar, where the JCSAT 14 spacecraft and the Falcon 9's nose cone were scheduled to be added.

The Falcon 9's fourth launch of the year is set for 1:21 a.m. EDT (0521 GMT) Thursday at the opening of a two-hour launch window.

There is an 80 percent chance of favorable weather for Thursday's launch attempt, according to the official launch forecast issued by the U.S. Air Force's 45th Weather Squadron.

A late-season frontal boundary is approaching Florida early the week, with rain and thunderstorms in the forecast for Wednesday.

"On Wednesday, more widespread rain and thunderstorms associated with the frontal boundary will move through the spaceport," forecasters wrote in the Air Force weather outlook. "A few of the storms may contain hail and strong winds. The front is expected to be south of the area, with conditions clearing by the launch window."

The primary weather concerns for Thursday morning are liftoff winds and the thick cloud rule, the Air Force weather team wrote in their forecast.

The outlook calls for scattered clouds at 12,000 feet and 28,000 feet, northwest winds at 20 to 25 mph, and a temperature of 68 degrees Fahrenheit at launch time.

If the launch is delayed to Friday morning, conditions should improve somewhat with a 10 percent chance of weather violating one of the Falcon 9 weather rules.

Owned by SKY Perfect JSAT Corp. of Tokyo, JCSAT 14 will provide television broadcast programming, data network services and broadband Internet connectivity across Asia, Russia, Oceania and the Pacific islands for a 15-year mission.

The Falcon 9 will deploy the JCSAT 14 satellite in an egg-shaped geostationary transfer orbit about a half-hour after liftoff, and the spacecraft's on-board thrusters will steer it into a circular orbit nearly 22,300 miles (about 35,700 kilometers) over the equator within a few weeks.

The distant orbit targeted by Thursday's launch will require almost all of the Falcon 9's propellant load, leaving little leftover fuel for landing maneuvers to touch down on a platform floating several hundred miles east of Cape Canaveral in the Atlantic Ocean.

"Following stage separation, the first stage of Falcon 9 will attempt an experimental landing on the 'Of Course I Still Love You' droneship," SpaceX said in a post on the company's website. "Given this mission's GTO destination, the first-stage will be subject to extreme velocities and re-entry heating, making a successful landing unlikely."

SpaceX successfully landed a rocket on the drone ship for the first time last month after a launch from Cape Canaveral with a Dragon supply ship. That mission went into low Earth orbit on the way to the International Space Station, requiring less speed than the orbit targeted on Thursday's flight.

Photos: Soyuz launch inaugurates new Russian spaceport

April 29, 2016 Stephen Clark

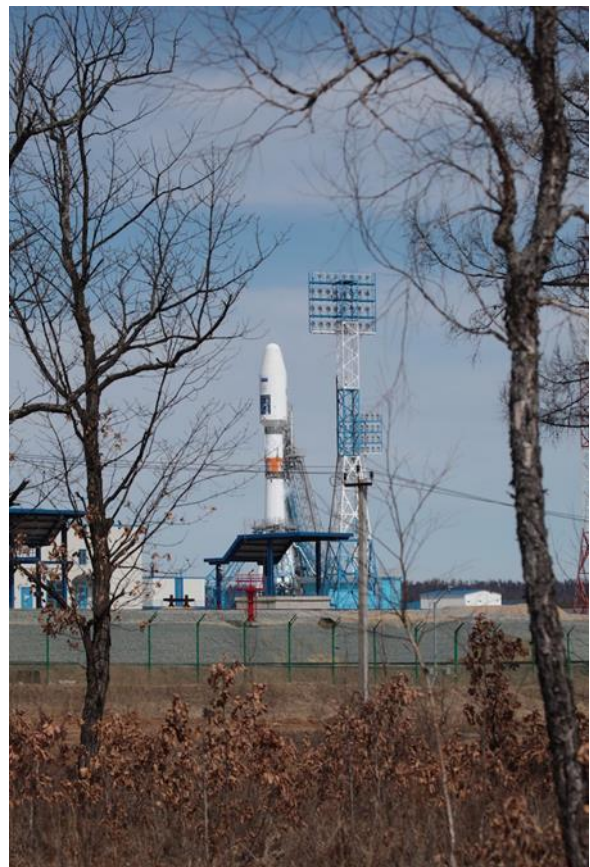
The first launch from the nearly \$3 billion Vostochny Cosmodrome took off Thursday, carrying three satellites into orbit from the new spaceport nestled in Russia's forested Far East.

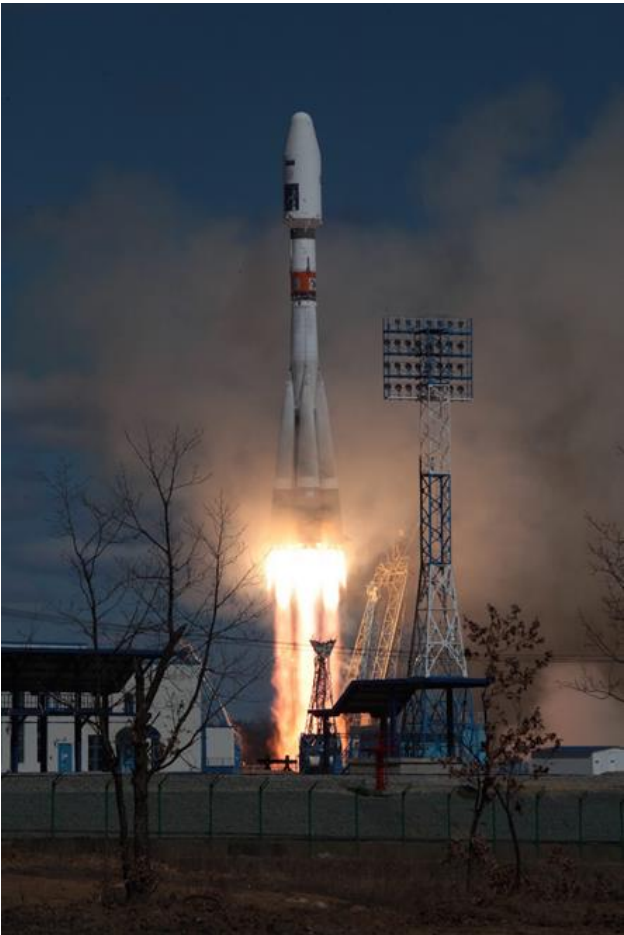
A Soyuz-2.1a rocket lifted off at 0201 GMT Thursday (10:01 p.m. EDT Wednesday) from Vostochny. Russian President Vladimir Putin attended the launch.

The Russian space agency, Roscosmos, announced before the flight that the launch would be broadcast live on television and on the agency's website. But those plans mysteriously changed on launch day, with Roscosmos's official YouTube channel only streaming video of the liftoff on a time delay a few minutes later.

Roscosmos did release a set of spectacular images of the

launch, which are presented below.





Europe's Sentinel satellites generating huge 'Big Data' archive

April 28, 2016 Stephen Clark



This full resolution subset of the first Sentinel 1B image captured Thursday shows Norway's Nordaustlandet island in the Svalbard archipelago, covered by the Austfonna ice cap. Contains modified Copernicus Sentinel data [2016], processed by ESA with a second radar surveillance satellite already returning images less than three days after launch, managers in charge of Europe's growing fleet of Sentinel environment-monitoring spacecraft will grapple with an immense 'Big Data' challenge as the multibillion-dollar program enters a new phase.

More than 30,000 users have signed up to access data acquired from Europe's Sentinel satellites, and 5 petabytes of data have come from the Sentinel 1A satellite alone, according to European Space Agency officials managing the program.

"That's a lot of demand because one user can be as big as Google, who is downloading systematically all of our data and has an archive of Sentinel data which is exactly as big as our archive, because they download everything," said Guido Levrini, ESA's manager of the Sentinel satellite program. "That only counts as one user, then you add another 29,999. But they're not all as big as Google."

The Sentinel satellites are part of the European Commission's Copernicus program, a network of spacecraft and data processing centers that will comprise the world's largest environmental satellite system in history.

The data on Earth's oceans, ice masses, land surfaces and atmosphere is distributed for free to anyone registered with the Copernicus program.

"Let me make no bones about it, Copernicus is ambitious, and with the launch of Sentinel 1B, we have raised the threshold and stepped up the pace of delivering data from space," said Peter Breger, deputy head of the Copernicus unit at the European Commission.

Sentinel 1B, the newest satellite in the network, launched Monday aboard a Soyuz rocket from French Guiana. On Thursday, the spacecraft's radar instrument returned its first image.

The C-band radar transmits pulses of energy toward Earth and measures the signals that bounce off water, ice and soil to

generate an image. It scans Earth in strips as the spacecraft circles the planet over the poles every 100 minutes.

The first 250-kilometer-wide (155-mile) image strip taken at 0537 GMT (1:37 a.m. EDT) Thursday sweeps north to south across the Barents Sea, including part of the Svalbard archipelago in the Norwegian Arctic. The full-resolution image is more than 70 megabytes in size, and can be downloaded [here](#).

"It may feel a little like a routine because we launched three Sentinel satellites in less than 12 months, but of course it is not," said Volker Liebig, ESA's director of Earth observation programs, in a press release.



Artist's concept of the Sentinel 1B satellite with solar arrays and radar antenna deployed. Credit: ESA/ATG medialab

Engineers at the European Space Operations Center in Darmstadt, Germany, looked over the satellite as it completed a complex choreography of deployments in the first half-day after Monday's launch. The C-band radar array, made by Airbus Defense and Space, launched folded up against the main body of the spacecraft with its power-generating solar panels.

The antenna's five panels and the satellite's solar array wings unfurled one step at a time to a length of 12 meters (40 feet) and 10 meters (33 feet), respectively.

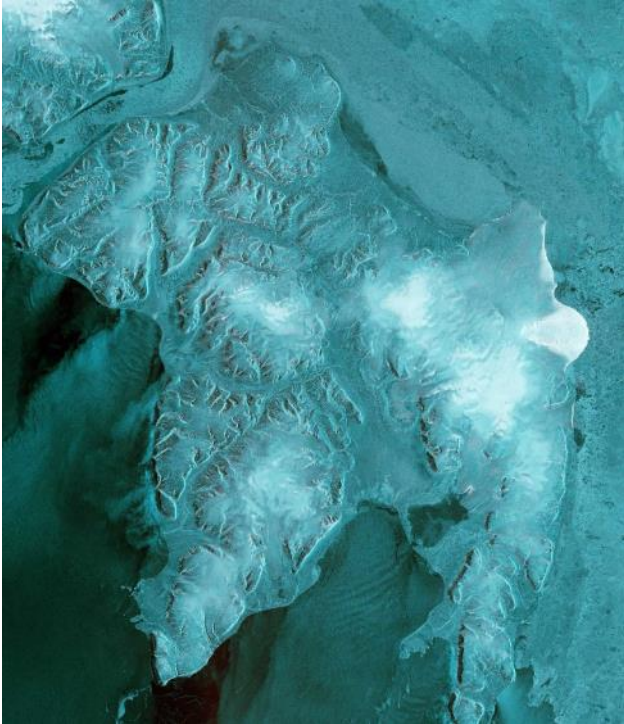
"Getting a satellite into orbit is always thrilling, and every time we do this I am quite nervous," Liebig said. "Our engineers and industry have shown what we can achieve with this fourth Sentinel delivering a first image in record time. We have another important part of the Copernicus missions in orbit. A great achievement from a great team."

Manufactured by Thales Alenia Space, the 2,164-kilogram (4,770-pound) Sentinel 1B satellite is designed to function at least seven years, with propellant reserves for 12 years of operations. It will become operational in July after several months of tests and calibration.

In its most high-resolution mapping mode, the Sentinel radar returns images with a pixel size of 5 meters, or about 16 feet, with a swath width of 80 kilometers, or about 50 miles.

But the satellite can adjust the radar sensor to a wide-angle mode to see a strip of Earth as wide as 450 kilometers, or 280 miles, trading resolution for viewing area.

Radar imagery produced by the Sentinel 1 satellites is good for tracking ships, sea ice, earthquakes, volcanic activity, oil spills, and emergency response services.



This full resolution subset of Sentinel 1B's first data take shows Edgeøya or Edge Island, which is one of the islands making up the Svalbard archipelago. Contains modified Copernicus Sentinel data [2016], processed by ESA. While readying future Sentinel satellites for launch remains a challenge, officials are now studying how to keep the flow of environmental data flowing to end users as more spacecraft are set to join the constellation.

Sentinel 1B is identical to the Sentinel 1A radar satellite launched in 2014, and the new craft will fine-tune its orbit to fly 180 degrees away from its partner nearly 700 kilometers (435 miles) above Earth. The positioning of the two satellites in orbit will drop the time it takes to get a new radar image of any place on Earth from 12 days to no more than six days, and as little as one to three days in polar regions.

Europe has developed a space-based communications network to help route Sentinel data from the satellites to ground stations using laser links, which transfer information at up to 1.8 gigabits per second, 90 times faster than a typical modern Internet connection.

The first laser relay station launched in January, and another one is due for launch next year to contend with the extensive Sentinel data haul.

"Up to now, in two years of operations, Sentinel 1A has generated 5 petabytes of data, which is a lot of data, much more than most end users are used to dealing with, and a magnitude more than what we have generated in the past with previous missions," Levrini said. "Now, with the arrival of Sentinel 1B, the data production capability will be doubled."

Spacecraft operators hope to increase the data intake of the Sentinel 1 satellites even more by the end of 2016, meaning additional radar imagery will funnel through the Copernicus data processing center to users.

"By the end of the year, we will generate three times as much data as generated today by the combination of Sentinel 1A and Sentinel 1B," Levrini said.

Sentinel 1A's data output so far is equivalent to 4 million downloads of nearly 500,000 images, officials said.

"I'll tell you (that) you don't download a radar image if you

don't really need it," Liebig said.

Radar images are not as straightforward to interpret as optical images produced by the Sentinel 2 satellite series.

The benefits of radar are its resistance to clouds and darkness. Radar-equipped satellites like Sentinel 1A and 1B can see through inclement weather and image regions of Earth at night, such as polar regions in winter.

Copernicus not only counts European institutions and multinational companies like Google among its users. The U.S. government will be a major client, too.

The U.S. State Department and the European Commission signed an agreement in October 2015 to allow NASA, NOAA, the U.S. Geological Survey enhanced access to Sentinel satellite data.

Levrini said the three Sentinel satellites launched before this week — Sentinel 1A, 2A and 3A — are all working perfectly, returning radar images, optical photos, and data on the health and conditions of the world's oceans.

The next satellite to launch into the fleet is Sentinel 5 Precursor, an atmospheric chemistry mission, no earlier than October aboard a Russian Rockot booster.

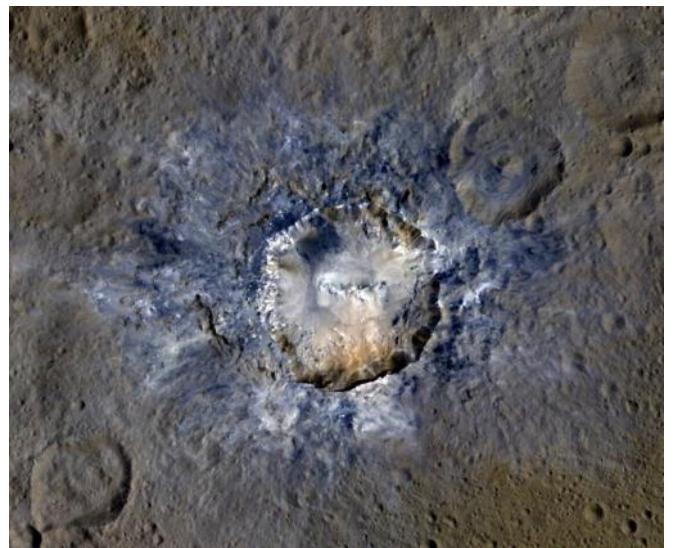
European officials divide the Sentinel satellites into six families, each with different purposes. The second members of the optical imaging and ocean families — Sentinel 2B and 3B — are scheduled for liftoff by the end of 2017.

The European Commission and ESA have procured follow-on Sentinel satellites to replace the first-generation spacecraft, including Sentinel 1C and 1D, to ensure Copernicus data remains uninterrupted through at least 2030.

"Our experience is it is sometimes a complex process to arrive up to the point of getting on the launch pad," Levrini said in an interview with Spaceflight Now. "You have to solve many technical issues, and it's a real challenge, but once launched in space the performance of the satellites is ideal."

Landslides and Bright Craters on Ceres Revealed in Marvelous New Images from Dawn

21 Apr , 2016 by [Ken Kremer](#)



Ceres' Haulani Crater, with a diameter of 21 miles (34 kilometers), shows evidence of landslides from its crater rim. Credits: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

Now in orbit for just over a year at dwarf planet Ceres, [NASA's Dawn spacecraft](#) continues to astound us with new discoveries gleaned from spectral and imagery data captured at ever decreasing orbits as well as since the probe arrived

last December at the lowest altitude it will ever reach during the mission.

Mission scientists have just released marvelous new images of Haulani and Oxo craters revealing landslides and mysterious slumps at several of the mysterious bright craters on Ceres – the largest asteroid in the main Asteroid Belt between Mars and Jupiter.

The newly released image of oddly shaped Haulani crater above, shows the crater in enhanced color and reveals evidence of landslides emanating from its crater rim.

“Rays of bluish ejected material are prominent in this image. The color blue in such views has been associated with young features on Ceres,” according to the Dawn science team.

“Enhanced color allows scientists to gain insight into materials and how they relate to surface morphology.”

Look at the image closely and you’ll see its actually polygonal in nature – meaning it resembles a shape made of straight lines – unlike most craters in our solar system which are nearly circular.

“The straight edges of some Cerean craters, including Haulani, result from pre-existing stress patterns and faults beneath the surface,” says the science team.

Haulani Crater has a diameter of 21 miles (34 kilometers) and apparently was formed by an impacting object relatively recently in geologic time and is also one of the brightest areas on Ceres.

“Haulani perfectly displays the properties we would expect from a fresh impact into the surface of Ceres. The crater floor is largely free of impacts, and it contrasts sharply in color from older parts of the surface,” said Martin Hoffmann, co-investigator on the Dawn framing camera team, based at the Max Planck Institute for Solar System Research, Göttingen, Germany, in a statement.

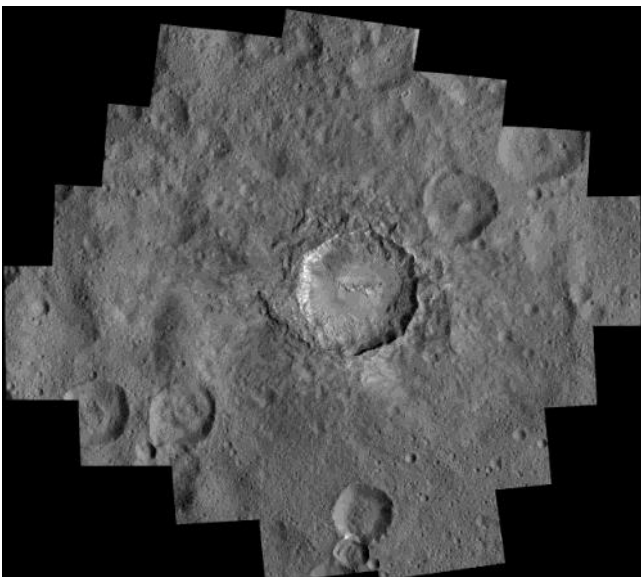
The enhanced color image was created from data gathered at Dawn’s High Altitude Mapping Orbit (HAMO), while orbiting at an altitude of 915 miles (1,470 kilometers) from Ceres.

Data from Dawn’s VIR instrument shows that Haulani’s surface is comprised of different materials than its surroundings.

“False-color images of Haulani show that material excavated by an impact is different than the general surface composition of Ceres. The diversity of materials implies either that there is a mixed layer underneath, or that the impact itself changed the properties of the materials,” said Maria Cristina de Sanctis, the VIR instrument lead scientist, based at the National Institute of Astrophysics, Rome.

Since mid-December, Dawn has been orbiting Ceres in its Low Altitude Mapping Orbit (LAMO), at a distance of 240 miles (385 kilometers) from Ceres, resulting in the most stunning images ever of the dwarf planet.

By way of comparison the much higher resolution image of Haulani crater below, is a mosaic of views assembled from multiple images taken from LAMO at less than a third of the HAMO image distance – at only 240 miles (385 kilometers) above Ceres.



Haulani Crater at LAMO. NASA’s Dawn spacecraft took this mosaic view of Haulani Crater at a distance of 240 miles (385 kilometers) from the surface of Ceres. Credits: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA/PSI

Dawn has also been busy imaging Oxo Crater, which despite its small size of merely 6-mile-wide (10-kilometer-wide) actually counts as a “hidden treasure” on Ceres – because it’s the second-brightest feature on Ceres!

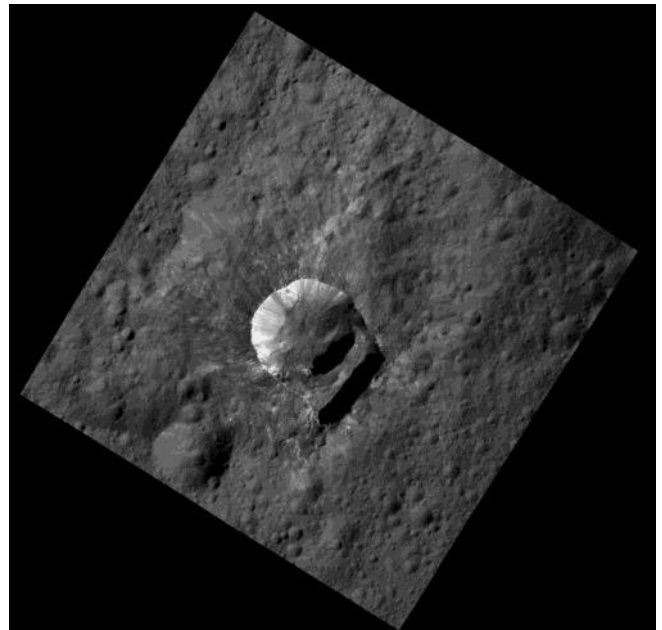
Only the mysterious bright region comprising a multitude of spots inside Occator Crater shine more brightly on Ceres.

Most importantly, Oxo Crater is the only place on Ceres where Dawn has detected water at the surface so far. Via VIR, Dawn data indicate that the water exists either in the form of ice or hydrated minerals. Scientists speculate that the water was exposed either during a landslide or an impact.

“Little Oxo may be poised to make a big contribution to understanding the upper crust of Ceres,” said Chris Russell, principal investigator of the mission, based at the University of California, Los Angeles.

The signatures of minerals detected on the floor of Oxo crater appears to be different from the rest of Ceres.

Furthermore Oxo is “also unique because of the relatively large “slump” in its crater rim, where a mass of material has dropped below the surface.”



Oxo Crater on Ceres is unique because of the relatively large “slump” in its crater rim. The 6-mile-wide (10-kilometer-wide) Oxo crater is the second-brightest feature on Ceres. Credits: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA/PSI

Dawn is Earth’s first probe in human history to explore any dwarf planet, the first to explore Ceres up close and the first to orbit two celestial bodies.

The asteroid Vesta was Dawn’s first orbital target where it conducted extensive observations of the bizarre world for over a year in 2011 and 2012.

The mission is expected to last until at least later into 2016, and possibly longer, depending upon fuel reserves.

Dawn will remain at its current altitude at LAMO for the rest of its mission, and indefinitely afterward, even when no further communications are possible.

Stay tuned here for [Ken’s](#) continuing Earth and planetary science and human spaceflight news.

Do We Live in a Special Part of the Universe?

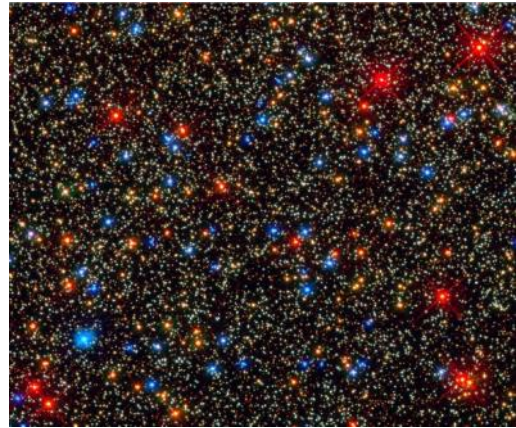
1 Apr , 2016 by [Fraser Cain](#) Video

We've already talked about how you're living at the center of the Universe. Now, I'm not going to say that the whole Universe revolves around you... but we both know it does. So does this mean that there's something special about where we live? This is a reasonable line of thinking, and it was how modern science got its start. The first astronomers assumed that the Sun, Moon, planets and stars orbited around the Earth. That the Earth was a very special and unique place, distinct from the rest of the Universe. But as astronomers started puzzling out the nature of the laws of physics, they realized that the Earth wasn't as special as they thought. In fact, the laws of nature that govern the forces on Earth are the same everywhere in the Universe. As Isaac Newton untangled the laws of gravity here on Earth, he realized it must be the same forces that caused the Moon to go around the Earth, and the planets to go around the Sun. That the light from the Sun is the same phenomenon as the light from other stars.



ESO's La Silla Observatory in northern Chile. Credit: Iztok Bončina / ESO

When astronomers consider the Universe at the largest scales, they assume that it's homogeneous, and isotropic. Technical words, I know, so here's what they mean. When astronomers say the Universe is homogeneous, this means that observers in any part of the Universe will see roughly the same view as observers in any other part. There might be local differences, like our mostly harmless planet Earth, orbiting the future course of an interstellar bypass. Or a desert planet with two suns, or a swampy world in the Dagobah system. At the smallest scales, they'll be different. But as you move to larger and larger scales, it's all just planets, stars, galaxies, galaxy clusters and black holes. And if you unfocus your eyes, it all looks pretty much the same. Isotropic means that the Universe looks the same in every direction. If you were floating alone in the cosmic void, you could look left, right, up, down out to the edge of the observable Universe and see galaxies, galaxy clusters and eventually the cosmic microwave background radiation in all directions. Every direction looks the same. This is known as the cosmological principle, and it's one of the foundations of astronomy, because it means that we have a chance at understanding the physical laws of the Universe. If the Universe wasn't homogeneous and isotropic, then it would mean that the physical laws as we understand them are impossible to comprehend. Just over the cosmological horizon, the force of gravity might act in reverse, the speed of light might be slower than walking speed, and unicorns could be real. That could be true, but we have to assume it's not. And our current observations, at least to a sphere 13.8 billion light years around us in all directions, confirm this.



The Hubble Telescope's view of Omega Centauri. Credit: NASA / ESA / The Hubble SM4 ERO Team

While we don't live in a special place in the Universe, we do live in a special time in the Universe. In the distant future, billions or even trillions of years from now, galaxies will be flying away from us so quickly that their light will never reach us. The cosmic background microwave radiation will be red-shifted so far that it's completely undetectable. Future astronomers will have no idea that there was ever a greater cosmology beyond the Milky Way itself. The evidence of the Big Bang and the ongoing expansion of the Universe will be lost forever. If we didn't happen to live when we do now, within billions of years of the beginning of the Universe, we'd never know the truth. We can't feel special about our place in the Universe, it's probably the same wherever you go. But we can feel special about our time in the Universe. Future astronomers will never understand the cosmology and history of the cosmos the way we do now.

MEMBERS VIEWING LOGS and IMAGES

Hi Andy,

For a change it is not just Nick Howes who gets his pictures in an UK astronomy magazine. I sent three pictures into Astronomy Now in a long shot that one might be used and they liked my effort during the partial phase of the



eclipse. They called it a 'splendid image' and hopefully members of WAS who have not seen it will like it? It is on page 39 of May's edition.

Peter

TRANSIT OF MERCURY COMMUNICATIONS

Thank you for getting in touch yesterday, it enables me to drop things into line so we are geared up for the transit and be most affective for your visitors on the day.

Just a reminder of the times for the transit. Start 12:12 British Summer Time finish 19:42 BST.

I will need at least 45 minutes to set up the full equipment assuming good weather, and 20 minutes to pack up.

This leaves one of the outstanding issues: I will need to bring my van (VW T5 size) to the area where the buses pickup visitors transferring the stones though at the far end of the area, nearest to the hut 4. This will be at both ends of the session and I will need to unload for 15 minutes then move the van back to the normal parking area, and again loading up at 20:00 BST. This is fundamental to our abilities to perform any viewing on the day, and I must have confirmation that this will be possible by Monday 2nd May.

My volunteers will be issued with 'solar viewing expert' hi viz jackets with Wiltshire Astronomical Society on them also, so identifying us will be easy. I will have some volunteers turning up to help loading/unloading/protection of equipment (around £20,000 worth), and volunteers changing through the day.

I have a meeting with them on Tuesday evening so need everything ready by then.

Press and advertising for the event. It has been agreed that I contact BBC radio Wiltshire and as soon as I get any indication of their visiting I will let you know.

The announcements will be only aired on the day to limit 'astronomers only' visitors filling the car park. Any advertising of the event is to be low key.

You are still to let me know if car parking charges will be applied on the day. This will need to be known before a speak to BBC. I am assuming that our members will not be charged as we are offering our services for free.

I will produce some display panels of information about transits for the day, paid for by the society.

If the weather is not good we can come in reduced numbers and put on a small display in hut 4, perhaps leaving at normal visitor closing time.

Andy Burns (as chair Wiltshire Astronomical Society).

Hi Andy,

Apologies for the delay from me, we have had a mad few days. Many thanks for sending through your documentation, we have public liability insurance that covers third party events on site, but for your information the public liability information you sent through looks like it expired in March this year, unless I'm missing something! The risk assessments are fab thank you, and I have no concerns re safety of the event.

In regards to bringing your van onto the site to unload and load your equipment, that is not a problem. When you arrive, please make yourself known to a member of the team and ask for Cerian or Maureen who will be able to sort out your access. If you can park in the far side of the turning circle that would be fab and then park in the normal visitor parking area. There will also be no parking charges on that day so you and your team will not be charged.

And just to confirm, you will be in the grassed area with telescopes just away from the huts and there will be a team with a laptop in hut 4 as well. We will put out our 'Event Here Today' poster as well so that people on site will be directed your way. I will not be on site that day but the team are aware of the plan.

If you have any further queries, please do not hesitate to contact me.

Stonehenge Site manager...

Viewing Log for 16th of April

Had a free Saturday evening and the sky was clear so I decided I would carry on my Messier marathon list before the lack of dark skies would stop me for the summer!

I went to my usual viewing spot at Uffcott just south of Swindon off the A4361 and this time was joined by Mike Partridge from Swindon Stargazers, I had my Meade LX90 set up and ready to view by 21:20 I would again be using a Pentax XW 14mm eye piece which would give a magnification of about 143. While I was setting up I noticed a bright object setting to the North West and wondered if this was Mercury, a planet I had only seen about five times from the shores of the UK? After completing the set up I instructed the scope to go to Mercury and as I thought it was the planet J, could not make out any phase of the planet as it could only be about 7° above the horizon! Next object was Jupiter riding high in the southern part of the sky, could only make out three moons

this time, after looking at a planetarium later on Callisto was out to the East with Europa and Ganymede out to the West of Jupiter, Io had only just gone behind the planet about 20 minutes earlier L, so I would miss this moon for this session.

Now to carry on with the marathon, I would be looking at the bowl of Virgo and the surrounding area, a part of the sky I was not very familiar with? First target was M53 a Globular Cluster (G C) in Coma Berenices, this G C had a bright centre, the next object also in Coma, the Black-Eye Galaxy (M64) looked like a Fuzzy Blob (F B) which I find most Spiral Galaxies (S G) to be? M3 another G C made up for the last one, it looked very good thru the eye piece, not far below M13 the brightest G C in the northern hemisphere. The next three objects in M98 - M100 I had to use averted vision to locate them as all of them are around mag 10 and S G's. The next five objects were all Elliptical Galaxies (E G), starting with M85 in Coma before going over the border and into Virgo for M84, M86, M87 and finally M89. At least M87 was a bit different being a large F B to look at! The next five objects were all Faint Fuzzy Blobs (F F B) in M90, M88, M91, M58 and M59. All of these are S G's and had to use averted vision for the last three to view. M60 was a bit better to look at, only being an F B yet M49 which was also an E G was bright to look at. Back to the F F B's again and M61, at least the last Messier object in Virgo was a delight to look, M104 also known as the Sombrero Galaxy was a thin line across the sky. As I was in Virgo there was an object from the Herschel 400 list I had not logged yet, so I went to NGC4845 which turned out to be a very F F B to look at! Finally I had a look at the 76.2% lit Moon and had a good view along the Terminator, the line that separates day from night on the surface of the Moon. It is possible that if I looked at the Messier objects with the Moon not around they might have been a bit easier to see?

It was now 22:58 and there was a light layer of frost on our equipment, so it was time to pack up the gear and go home, during this 90 minute session we only had two cars go pass us so our night vision was not really affected too much of course having a $\frac{3}{4}$ Moon in the sky meant we would not have full night vision available to us but you must get out when you can as this country has too many cloudy night for us astronomers.

Clear skies.

Peter Chappell

Viewing Log for 29th of April

Tony Vale had arranged the monthly Wiltshire AS viewing session with clear skies, not a normal thing we are used to, well done Tony for that J.

I arrived at Lacock and had my equipment set up and ready to view by 21:45, there was only four scopes in action this night, Andy had a few people around him so I went up the playing field a bit to keep out of their way, Tony was already viewing when I met him, he was viewing Variable Stars, a subject I had never done before just like trying to see the Great Red Spot on Jupiter!

I knew I would not be able to see many Messier objects as Lacock does not have the low horizon clearness like Uffcott has to offer and the security light in the car park could be a pain at times! Andy decided to put some tape over the sensor and after about ten minutes the field went fairly dark so our night vision would not be too bad for the session? I was too late to see Mercury, it was still above the horizon but hiding behind the village of Lacock so I had a look at Jupiter instead, this time all of the big moons were on view with Callisto out to the east and Io, Europa and Ganymede out to the west of Jupiter. Now to carry on with the list, first object was M68 a Globular Cluster (G C)

in Hydra for G C's it looked small to view? The next object also in Hydra, M83 was hiding behind a tree so I would have to come back to this object at another session. For G C's in brightness in the northern hemisphere you cannot really beat M5 in Serpens Caput or M13 (brightest) and M92 in Hercules, a lot of people often overlook M92 which is a pity as it is a good G C to view? For about an hour I could not do anymore unseen objects from the Messier list, so I had a look at some old ones. I could put M65 and M66 (part of the Leo triplet of galaxies) in the same field of view using a 14mm eye piece, the other galaxy NGC3628 was not far away. I also went back to NGC4845 a member from the Herschel 400 list I looked at when the Moon was $\frac{3}{4}$ lit, this time I made the Spiral Galaxy to be a faint blob instead of the very faint fuzzy blob as I noted it from my viewing log of April 16th? So it does help having the Moon out of the way when trying to do Deep Sky objects! By now, Lyra had cleared a tree so I had a look at M57 (Ring Nebula) second best Planetary Nebula to look at after M27 (Dumbbell Nebula) in the northern hemisphere and final object for the night M56 another G C similar to M68. It was now 23:15 and everybody else was starting to pack up so I followed them as well, like the last time there was a frost around so all my equipment would need drying once I got home. Lucky for me, Dawn was on a visit to her mother in Barnsley, South Yorkshire so I could leave all the kit drying in the front room without getting any comments about it!

Clear skies.

Peter Chappell

Log April 2016

Tony Vale

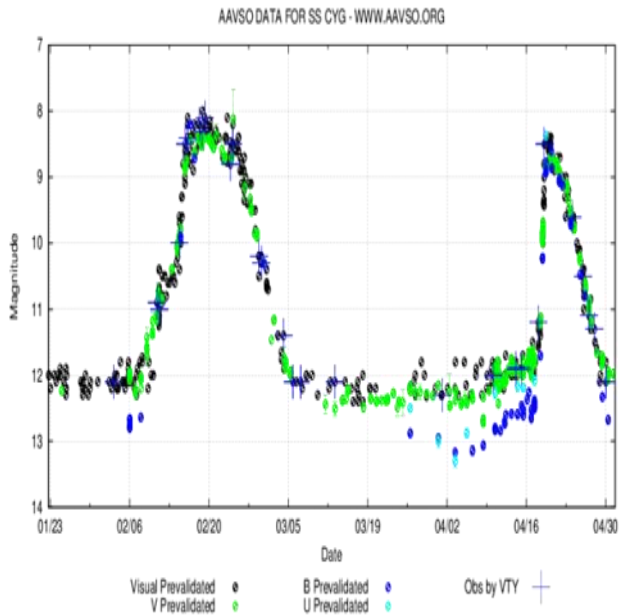
Variable star observations totalled 68 this month bringing the overall total to now to 730 In my February log I described the observing campaign organised through the AAVSO to support researchers attempting to obtain multi frequency observations of the dwarf nova, SS Cygni. Their objective was to identify radio jets which have only rarely been observed in association with white dwarves and which are expected to occur in the early stages of outburst. Amateur observers were asked to make frequent observations of the star, whose outburst was imminent and report them to the AASO as early as possible so that professional observations could start as soon as the outburst began. The outburst which followed began around 10th February and is the first of the two outbursts shown in the light curve below. In the event, the professional observations were not triggered because it was decided that the outburst was anomalous (note the gradient of the light curve just after it began and also the kink before continuing to full outburst). The next outburst was due in early April and it was decided to try again then.

In early April I was fortunate enough to be in the south of Spain, at the Griffon Educational Observatory in El Bosque. So although Cygnus was not rising until early in morning I was still able to make frequent observations. After a number of observations in quiescence (around magnitude 12) on the morning of 18th April I recorded it at 11.2 and raised an alert. The next morning I saw it at 8.5 which was close to its peak outburst. It had therefore increased its visible light output by a factor of around 25 (ie, from quiescence to peak) in little over a day. By the morning of 30th April it was 12.1, back in quiescence. My observations are highlighted (observer code VTY) in the light curve below.

The researchers have been excellent at keeping observers up to date through the AAVSO forum, which has helped to maintain enthusiasm and interest. They advised that observations began with the e-MERLIN array and the AMI radio telescopes based in the UK and also the Swift X-ray orbiting telescope on 19th April with many hours of observations scheduled through the outburst.

At the same time another Dwarf Nova campaign has been running through the AAVSO by the Universities of Cape Town and Nijmegen. The objective was to use the VLA to

observe five Dwarf Novae; RX And, U Gem, YZ Cnc, SU Uma and Z Cam during quiescence. Quiescent observations have been obtained with all these stars except RX And which is difficult to observe at this time of year so the campaign remains active until those observations have been obtained.



Tony

SETTING UP GEO (GRIFFON EDUCATIONAL OBSERVATORY)

Andy Burns

The project in Spain has been going on for years, with many successful trips by paying customers and society members coming as guests over the last 7 years. It was set up to fulfil the needs seen at the time: students were going on practical astronomy courses and leaving unable to set up a telescope and indeed, some had problems even seeing the sky.

The ebb and flow of various personal problems, the viability of astronomy courses at universities have always been tripping points, but one thing had always been a major issue for me as equipment supplier and director at the site: The mounting in the main dome and the size of the telescope being used in the main dome.

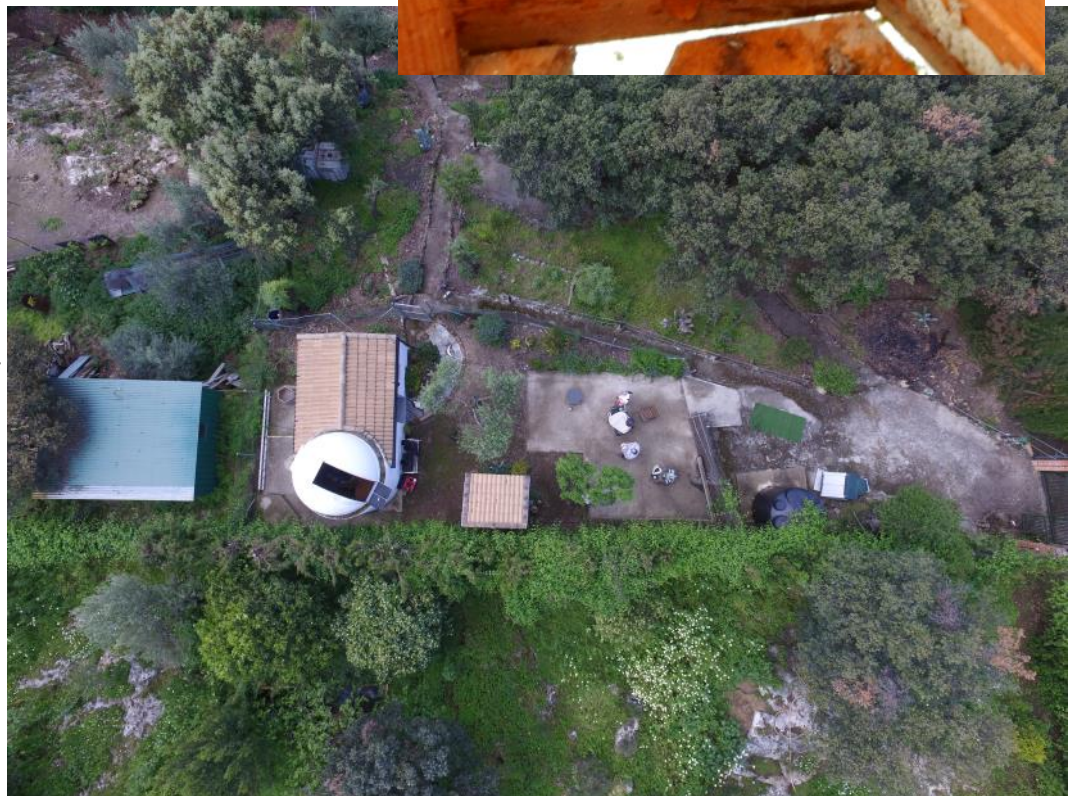
This was sorted two years ago, but final alignment was impossible until permission was got from neighbours to trim trees that had grown tens of feet in this period. Another earthquake hit last November, 4.7 on the richter scale less than 3 miles south of the observatory.

After Easter I went down (with Tony Vale) and we got sky conditions good enough to test the outer solid mount-

ed pier and EQ6 (perfectly aligned still - enabling 8 hours tracking of the Sun), and one evening to set up the new EQ8 mount. This was done, calibration of various Dobsonians done and excess equipment and back up gear brought back to Wiltshire.

The alignment was showing no perceived star movement in 3 minute exposures, and the goto working well –but cloud prevented to much testing.

The bottom line is we now have a great system ready for organised visits to Spain, southern Andalucia. Direct Ryan air flights to Jerez (or one stop Iberia flights via Madrid) will get you to this well placed 35minute journey airport. Malaga, Gibraltar and Sevilla are other destination airports to get down to the site. Accomodation in the village 3km away is cheap as is the local food and drink. Do come at future invites...

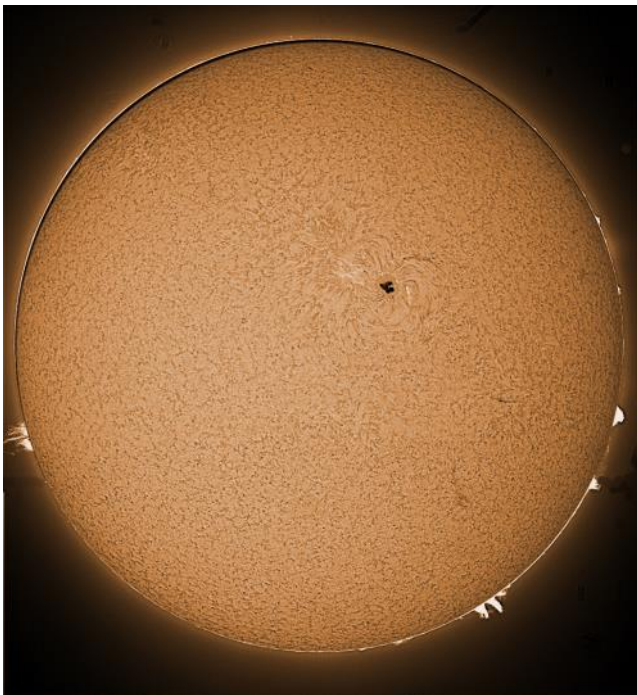




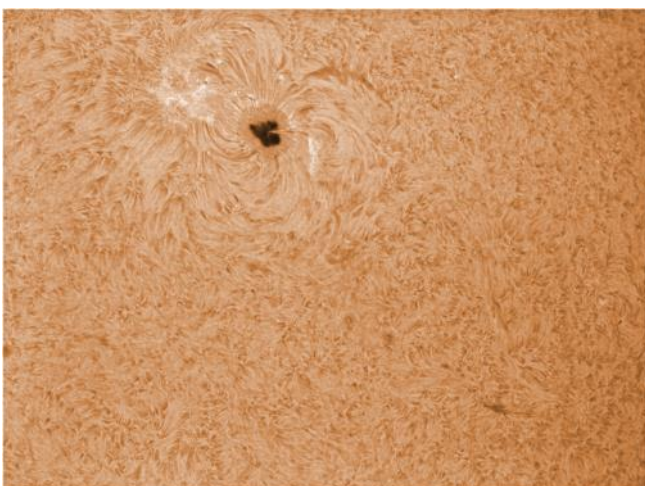
Check exposure as thin cloud covered Orion! 6" refractor.



Even from the local village with street lights the Milky Way can be easily picked up. Saturn and Mars mid right.



Solar image from the outside pier, Solarscope 60mm.



Moon set from the back of the villa I rent in town.

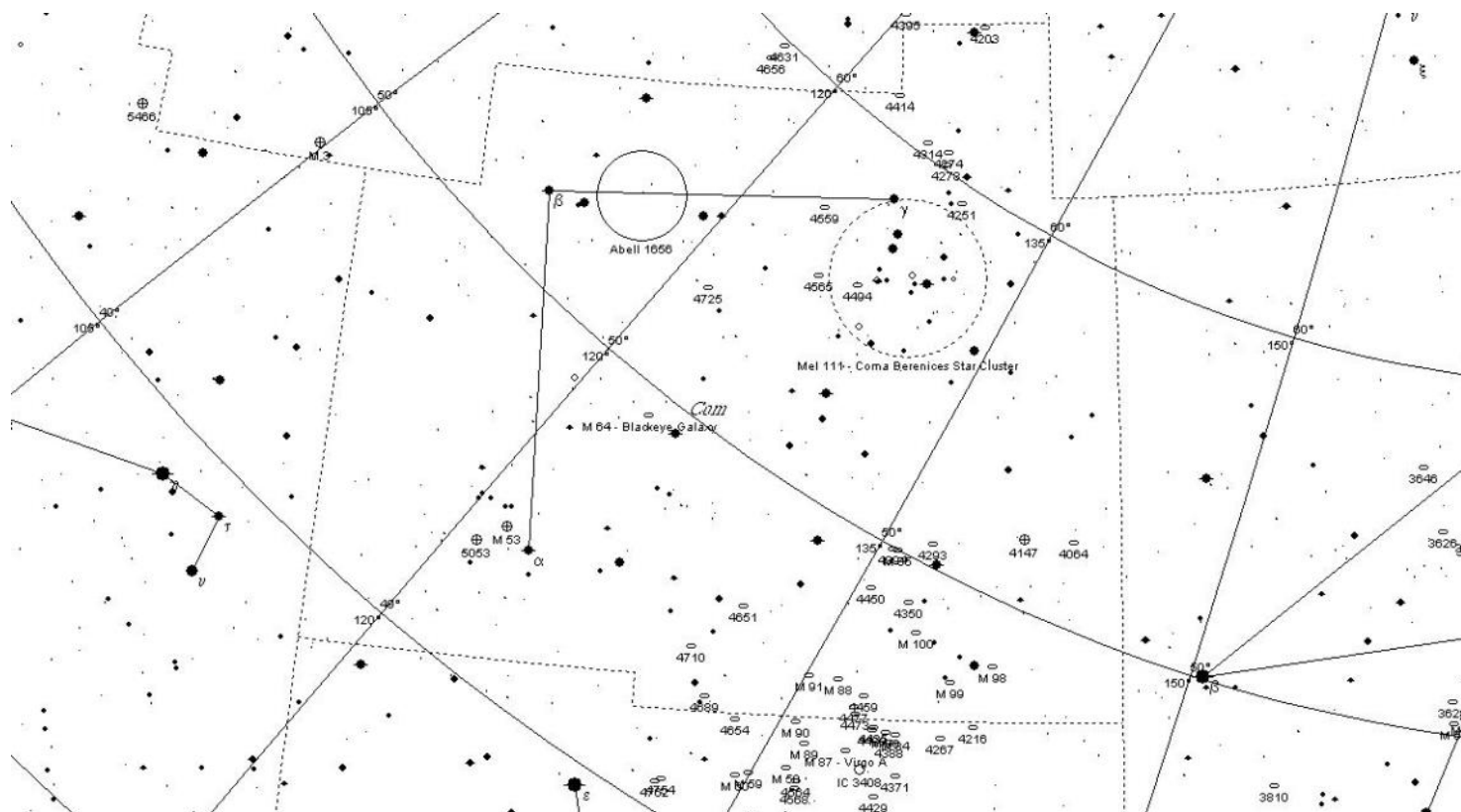


Wiltshire Astronomical Society Observing List & Sky Notes April 2016

Deep Sky Objects

Object Ref / Name	Type	Position	Constellation	Observing Notes								
Algieba (γ Leonis)	DS	RA 10h 19m 58s Dec 19° 50m 30s	Leo	Algieba is the third star in the sickle of Leo moving upwards from Regulus. Its a double star with a yellow primary (mag 2.4) and an orange secondary (mag 3.6) separated from it by 4.6". The system is 125 ly (light years) from us and the components are about 300 AU (Astronomical Units, the Earth-Sun distance) apart. There may also be a planet roughly 10 ten times Jupiter's mass orbiting close to the primary. As it's bright, it is well seen in twilight. De-focussing might bring out the colours.								
Sombrero Galaxy (M104)	GX	RA 12h 39m 59s Dec -11° 37m 22s	Virgo	This unusual galaxy has a large nucleus and a prominent dust lane which are both visible with medium to large apertures on dark nights. The central bulge contains an unusually large number of globular clusters compared to other galaxies. The dust lane forms a ring around the nucleus and is believed to be the site of star formation within the Galaxy. It's about 30 million ly away.								
Owl Nebula (M97)	PN	RA 11h 14m 47s Dec 55° 0m 59s	Ursa Major	The Owl nebula is a planetary nebula and takes its name from the drawing of it by Lord Rosse. Planetary nebulae are the result of roughly sun sized stars running out of fuel, (or more correctly, being insufficiently massive to continue fusing the material in their cores). When this happens, the core collapses and the outer layers of the star are blown away. What we see as an expanding shell of gas is the outer layers of the dying star moving rapidly away from the dense core, now a very hot white dwarf. It gives us a glimpse of the future, about 5bn years from now and the death of the sun. The Owl nebula is about 2 ly across and 2,000 ly away. Filters may help, if you find it difficult to spot.								
Leo Trio (M65, M66 & NGC3628)	GX	RA 11h 20m 16s Dec 13° 17m 16s	Leo	These three spiral galaxies are all about 20 million ly away, all about the same size as each other (a bit smaller than the Milky Way) and lie within the same, low power field of view. M65 and M66 are fuller and rounder, NGC 3628 is a faint slash of light and may be a challenge in medium apertures. If it's not a good night.								
M3	GC	RA 13h 43m 10s Dec 28° 22m 31s	Canes Venatici	This globular cluster is one of the brightest visible from the northern hemisphere. It is more than 200 ly across, 40,000 ly away and may consist of as many as 500,000 stars in total. The age of globular clusters can be determined from the proportion of stars which have had time to evolve into red giants. These calculations reveal globular clusters to be typically 10 bn years old. Spectroscopy shows their stars to be metal poor compared to stars like the sun (metals are any element other than hydrogen or helium in astrophysics (- but not in chemistry !)) which means they contain little or no supernova debris and are therefore, probably, among the oldest stars in the universe.								
Beehive Cluster (M44)	OC	RA 8h 40m 11s Dec 19° 45m 11s	Cancer	The Beehive cluster is big and bright enough to be seen with the naked eye on a clear night. It is probably best seen in binoculars or the finder of a telescope. With telescopic magnifications you will tend to look through it. The cluster is about 500 ly away and is 15 ly across. It consists of around 400 stars.								
Cor Caroli	DS & VS	RA 8h 40m 11s Dec 19° 45m 11s	Canes Venatici	Cor Caroli means "Charles's Heart" and is named after England's King Charles I who was executed in 1649. The star is a double with a blue primary, around magnitude 2.8 and a yellow 5.5 mag secondary with a separation of 19". Again, de-focus to bring out the colour. Spectroscopy reveals the primary to be unusual with large quantities of silicon, mercury and europium present. It is the prototype of a class of variable stars whose strong magnetic fields produce extensive sunspots which cause variations in brightness as the star rotates.								
Whirlpool Galaxy (M51)	GX	RA 13h 29m 52s Dec 47° 11m 43s	Ursa Major	Lord Rosse was the first to see the spiral structure of this galaxy with the largest telescope in the world at the time, the 72" "Leviathan" at Birr Castle in Ireland. In fact this object consists of two galaxies, M51 and NGC 5195, a dwarf companion which is interacting with M51. It is believed that the pronounced spiral structure of M51 is the result of NGC 5195 passing through the disc of M51 in our direction around 500 million years ago and crossing back about 50 to 100 million years ago to its present location, slightly behind M51 from our perspective.								
KEY	PN planetary nebula	EN emission nebula	BN bright nebula	DN dark nebula	RN reflection nebula	OC open cluster	GX galaxy	AST asterism	VS variable star	DS double star	SNR supernova remnant	GC Globular Cluster

CONSTELLATIONS OF THE MONTH: COMA BERENICES



**Transit Date of principal star:
9 April**

Coma Berenices refers to a classical story concerning the hair of Berenice, the wife of Ptolemy III of Egypt. While the story is an old one, the constellation is relatively new, being introduced by Tycho Brahe (1546-1601).

According to the story, Ptolemy had waged a long war on the Assyrians, since it was they who had killed his sister. As Ptolemy returned successfully from the war, his wife Berenice had her beautiful tresses ceremoniously clipped and given to Aphrodite, laid out on the temple altar.

As the evening's festivities continued, the shorn hair was discovered to be missing. The priests might be sacrificed, if the queen's hair couldn't be found. It was the astronomer Conon of Samos who came to their rescue - proclaiming that Aphrodite had accepted the gift of Berenice's hair, which now shown brightly in the heavens next to Leo.

The stars that form the constellation really aren't that remarkable to look at, only a handful of fourth-magnitude stars, including three Bayer stars. Yet there are several fine binaries, eight Messier objects and the Coma Star cluster, not included in Messier's list.

From *Denebola* (*beta Leonis*) draw a line to the bright star to the southeast, *Arcturus* (*alpha Bootis*). Alpha Comae is found on this line at about the midpoint.

Now proceed north from *alpha Comae* to *beta Comae* and then west about the same distance to *gamma Comae*. These three stars form half of a nearly perfect square. They aren't very prominent, and you will have to have a nice dark night in order to study them.

Alpha Comae, sometimes called *Diadem*, has the same diameter as our Sun, and is 62 light years away with a luminosity of nearly three. It's a rapid motion binary (see below) and in the same field is the globular cluster M53 (see below).

Beta Comae is actually the brightest star in the constellation, and certainly the closest at 27 light years. It too has a diameter equal to the Sun.

Gamma Comae is an orange star about 260 light years away. It is in the same region as the well-known Coma Star Cluster, but isn't a member of that group.

Double stars in Coma Berenices:

Alpha Comae is a rapid binary of two equal stars (5.05, 5.08). The companion orbits every 25.87 years and is presently decreasing; the current (2000) separation is less than 0.05". The orbit is an unusual one, seen perfectly edge-on.

Zeta Comae is a fixed binary: (6.0, 7.5; PA 237°, separation 3.6").

17 Comae and *24 Comae* are two binaries with contrasting companions.

17 Comae is one of the members of the Coma Star Cluster. The primary is white, the companion a soft blue: 5.3, 6.6; PA 251°, separation 145.3".

From *gamma Comae* follow the slight arc of stars south that bend to the east. First comes *14 Comae*, then *15*, and finally *17*.

24 Comae is even more spectacular: a fixed binary with an orange primary and emerald component. (5.2, 6.5; PA 271°, separation 20.3").

This binary is located eight degrees west of alpha Comae and one degree north.

35 Comae is a slow double with an orbit of over 300 years. However, unlike most long period binaries, this one is presently quite close. The companion is beginning to emerge from its close pass with the primary, gradually lengthening its separation, recently having achieved one arc second of separation. The present values are: 5.2, 7.2; PA 185° and separation 1.04".

35 Comae is in a fairly barren part of the sky, found five degrees northwest of alpha Comae.

Struve 1633 is a very pleasant fixed binary: 7.1, 7.2; PA 245°, separation 9.0". To find it start from *gamma Comae*, then drop down exactly one degree south where you'll find *14 Comae*. *Struve 1633* is one degree to the west.

Struve 1639 is a closer binary: 6.8, 7.8; PA 327°, 1.6". This is a slow moving binary with an orbit of 678 years.

This double star makes a small triangle with *12 Comae* and *13 Comae*. Start at *14 Comae* and look south. The bright star to the east is *15 Comae*, while below this and to the west is *13 Comae*. Nearby, immediately southwest, is *12 Comae*. Now look between these two stars to the southeast, where

you'll find the third point in the triangle. This is Struve 1639. (Not shown on the chart due to crowding.)

Variable stars in Coma Berenices:

The constellation doesn't have a wealth of variable stars. We list the two variables that might be of some interest.

13 Comae is an alpha-CV type variable with very small range (5.15-5.18).

R Comae is a long-period variable with period of 362.82 days, and range of 7.1 to 14.6. Thus the maximums are nearly a year apart. In the year 2000 the maximum should occur in the first week of December.

Deep Sky Objects in Coma Berenices:

There are eight Messier objects (M53, M64, M85, M88, M91, M98, M99, and M100), as well as a number of other fine galaxies, with NGC 4565 being the best of the bunch.

However the best object is the unrivalled open cluster known as 'The Coma Star Cluster'.

The Coma Star Cluster



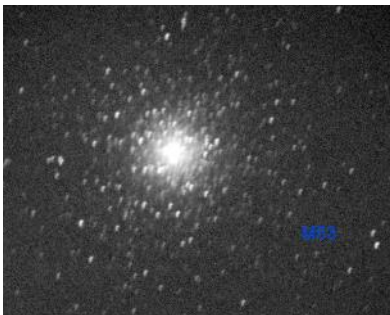
Best seen in binoculars, the cluster fills the entire field of view: about 40 stars spread out over a five degree area. The cluster was once

known as the tuft of hair at the end of Leo's tail. It now constitutes Berenice's golden tresses.

The cluster extends south from *gamma Com* (which is not, however, a member). At about 270 light years away, the cluster is one of the closest to our solar system.

The brightest member of the cluster is 12 Comae. Other fourth-magnitude members are 13 and 14 Comae, and another thirty or so fainter stars go to make this one of the loveliest sight in the heavens. (Picture taken at viewing session, Lacock, 50mm lens. 30seconds ISO800

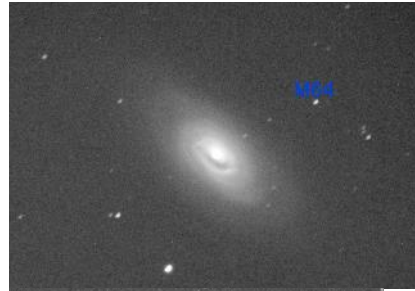
The Messier Objects in Coma Berenices



M53 is a globular star cluster one degree northeast of *alpha Comae*. The brightest Messier in the constellation (7.7), it tends to be most impressive with larger telescopes, which are needed to resolve the individual stars. The cluster is

thought to be 65,000 light years away.

M64, the *Black Eye Galaxy*, is a bright (8.5) compact spiral one degree east-northeast of 35 Comae. The "black eye" can only be seen under ideal conditions with



large telescopes. The galaxy is over 20 million light years away.



M85 is a bright spiral galaxy and member of the Virgo Galaxy Cluster, most of which is found about five degrees further south. All the remaining deep sky objects discussed also belong to this cluster.



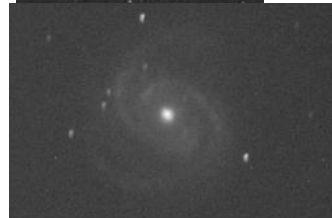
M91 (NGC 4548) is another spiral galaxy, but is a rather confusing object, sometimes being labelled *M58*. It is a rather faint galaxy (10.2) and one wonders why, with so many galaxies in the region, spreading down through Virgo, that this one was chosen by Messier.



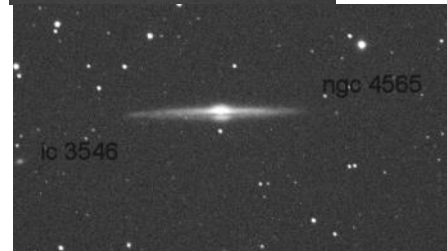
M98 is a faint (10.1) spiral seen practically edge-on, lying just half a degree west of 6 Comae.



M99 is roughly one and a half degrees east-southeast of *M98*. An open spiral seen face on, its several arms are visible in large scopes. It has a brightness of 9.8.



M100 is the largest of these spiral galaxies, although difficult to appreciate in small telescopes. It's seen face-on, and has a brightness of 9.4.



NGC 4565 is a well-known edge-on spiral with highly visible dust lane from end to end. It's the largest galaxy of its type and has a visual magnitude of 9.6. The galaxy is found one degree due east of

17 Comae.

Coma Berenices has many more deep sky objects, particularly the southern regions, where it borders Virgo. This is a fertile part of the sky to investigate, as the evenings grow a little warmer and more inviting.

ISS PASSES For April/May 2016

From Heavens Above website maintained by Chris Peat

Date	Brightness	Start	Highest			End				
	(mag)	Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
12 May	-1.3	04:32:26	10°	SSW	04:34:51	19°	SE	04:37:17	10°	E
13 May	-0.9	03:40:47	10°	SSE	03:42:14	12°	SE	03:43:41	10°	ESE
14 May	-2.2	04:22:22	10°	SW	04:25:18	32°	SSE	04:28:17	10°	E

Heavens above website has been down for two days so I am unable to update this page.

If you have Android or iPhones I suggest the following apps:

Prosat

Space Station Finder

ISS spotter

Satellite Tracker

END IMAGES

Gamma Cassiopeia, or the only modern name Navi (Ivan backwards, the middle name of pioneering NASA astronaut Gus Grissom), is a strange variable star, and the centre star of the 'W' of Cassiopeia. Strange X ray emissions come from the star and the nebula resultant can be seen in this 60second exposure from Chippenham observing site, 102mm TMB, and ISO 800, Nikon D810A.



Date	Moon Phase	Observing Topic
2016		
Monday 9th May		<i>Transit of Mercury</i>
Friday 27 th May	Waning gibbous	
Wiltshire Astronomical Society Observing Sessions 2015 – 2016		

OUTREACH ACTIVITIES

Some evening sessions are being arranged.

May 9th 11:30-20:00, Stonehenge, Transit of Mercury.