

Spring 2017 Number 15

Kielder Observatory Newsletter



CBEEBIES
STARGAZE WITH
KIELDER!

NEWS

TV stars!

SCIENCE

Supermassive black
holes.

OBSERVING

Highlights
Apr/May/June/July

TIDAL LOCKING

Why does the moon show
the same face?



EDITORIAL

Firstly an apology that this edition has been delayed by the Easter break - in recompense we have given you an extra month's worth of night sky notes! We also take a look at black holes, and why the Moon always shows the same face to the Earth. Late Spring is one of my favourite times of the year - the galaxy season is in full swing, with Virgo and Leo riding high in the sky with their feast of Messier objects. However, to remind us that summer is on the way, the clocks have changed and the hours of darkness are diminishing - but don't worry, there will still be plenty to keep you interested at Kielder!

Nigel Metcalfe

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newsletter@kielderobservatory.org

Kielder Observatory Astronomical Society

Registered Charity No: 1153570.

Patron: Sir Arnold Wolfendale 14th Astronomer Royal

Kielder Observatory Astronomical Society is a Charitable Incorporated Organisation.

Its aims are to

- * Promote interest in the science of astronomy to the general public
- * Facilitate education of members of the public in the science of astronomy
- * Maintain an astronomical observatory in Kielder Forest to support the above aims

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DIRECTOR'S CUT

Spring is now well and truly upon us with the dark winter nights almost a distant



memory; soon to be replaced with the warmer and brighter nights of springtime. Historically from these northern climes its long been the wastelands for astronomy during the lighter months, but not so at the Kielder Observatory, there is still much to be had.

Observers attending events into early May still have plenty of observing after 10pm, with astronomical darkness still upon us, the constellation of Virgo sitting nicely in the south, with its retinue of distant galaxies. The Milky Way rises steadily in the east towards midnight bringing with it the summer constellations of Cygnus and Lyra, star fields adorn this part of the night sky and make it a binocular heaven.

Heading into June and July is when things can get very interesting. With the return of the Noctilucent clouds, or NLCs. These polar mesospheric phenomena are a sight to behold with the wispy silver grey clouds

only making an appearance long after sunset. Add to that the occasional aurora on the darker nights and summer as you can see is far from dead for the observer. However if it is stars you crave and good deep sky astronomy then it too can still be had. With the giant cluster in Hercules (M13) visible all through the summer with our scopes and the brighter clusters forming plenty of objects worth observing. The finale however has to be Saturn, albeit very low in the sky as it hugs the galactic centre, it still rises high enough to be able to resolve the ring system and some planetary detail.

So as you can see don't desert us during the summer as it tends to be some of the most beautiful nights we have.

On a separate note work is at last about to start on the new observatory, the long awaited agreements are now being finalised with the trustees and we are hopeful the new facility will be available for the new season starting in August.

Well I will end my contribution as ever with a big thank you to you all for supporting the facility in your own ways from the staff and volunteers to our trustees admin team and support staff and partners to the most important of all the Visitor, it's your observatory and thank you.

Gary Fildes (FRAS MSc Hon.Caus.)



KOAS NEWS

TRUSTEE NOTES

The trustees met on January 31st, but there have been one of two changes amongst the trustees since then, and since the last newsletter, not least of which was that long standing chairman Rob Little has resigned both as chair and as a trustee. Rob had been with us since the CIO was founded, and in many ways was instrumental in getting KOAS to where it is today. We are all very grateful for the work he has done. However, he felt now was the right time to move on, so for the moment the trustees are working with a rotating chairman for each meeting. Richard Dale, who was reported as joining us last time, has also decided that he cannot dedicate the time required at the moment. However, on a positive note, Fiona Standfield has joined as a trustee. Educated at the Universities of Leeds, Caen and Oxford, Fiona began her career as a fast-track Civil Servant in Whitehall, subsequently teaching Modern Foreign Languages and working in the House of Commons, before joining Royal Mail plc, where she had a thirteen-year career undertaking operational, training and managements posts both at home and abroad. Returning to the North East, Fiona set up her own consultancy practice

providing language services, project management and business development support to SMEs. Most recently, she has been Director Newcastle Science City and North East Programme Director Safe Families for Children. Currently she is working in and with Social Enterprises across the region, and is also employed by the Ministry of Justice as a Specialist (mental health) Lay Tribunal Member and is a Non-Executive Director of Together for Children - Sunderland. Fiona enjoys a variety of voluntary positions including being a Trustee of Vindolanda, Chair of Northumberland based performance arts company November Club, a member of the Common Purpose North East Advisory Panel, and Chair of the North East Advisory Panel for the charity Safe Families for Children.

At the moment the trustees are busy negotiating the terms of a new lease with the Forestry Commission (who own the observatory building), and a special meeting of the trustees took place on March 29th to discuss this. Hopefully we should have more on this in the next newsletter.

The trustees meet again at the end of April.



OBSERVATORY NEWS



BBC Look North film Gary for an item on the new observatory building.

The observatory has been featured on the BBC children's channel CBeebies, in their Stargazing series! The first episodes were broadcast between March 27-31st and featured our very own Becki Cooper. There have been two additional filming sessions, another for CBeebies that Hayden Goodfellow starred in (due to be broadcast in late 2017) and a special film day for an educational series called Discover Education Espresso that Gary and Hayden handled and is a national

educational programme providing digital learning in schools. All these events have been highly successful and we have had very positive feedback. We are continuing to receive a high level of enquiries to host similar events - this is all great publicity for the Observatory and the participants (and film / production crews !) all seem to enjoy themselves.

Details of the new building, the funding of which we announced in the last



OBSERVATORY NEWS

newsletter, were released to the press in mid-February - it will be fully accessible and comprise a single storey building housing a fully automated telescope with retractable roof, presentation room, kitchen and toilet facilities. In addition there will be external observation with fully accessible deck areas. The new observatory aims to open its doors to visitors in early Autumn. We currently welcome over 23,000 visitors per year and we expect the new facilities to attract even more educational and community groups from visiting schools, colleges and community groups from across the North East.

We also had some publicity for the new 16" telescope, with the Northern Echo doing a nice article on March 20th (http://www.thenorthernecho.co.uk/news/15169209.New_16_inch_telescope_installed/).



Heather Woodfine is our new Customer Service Administrator.

On the staff front we welcomed Heather Woodfine, our new Customer Service Administrator, who joined the team on

"What a place to visit!! The staff were so knowledgeable and passionate about the night sky that we were mesmerised by what we saw. Our knowledge of planets and stars before the visit was very limited but even so we found the whole subject so interesting due to the way it was put across. We were also so lucky you see the Northern Lights whilst we were there but even if we hadn't seen them we would still recommend a visit just for the experience. One not to be missed."

Linda from Leeds



OBSERVATORY NEWS

10th April. Heather graduated from Leeds University with a degree in Modern Languages. She spent 12 months as the administrator for the Sunderland Maritime Heritage, a charity which she is still involved in as a Trustee. She also worked as an administrator with Paragon in Pallion, Sunderland.

Gary spoke at the Schools North East annual dinner and presentation event on 16 March which was a very good opportunity to address over 200 teachers from across the North East on the work of the observatory and inspiring young people to think about STEM subjects and science careers. Gary was welcomed and introduced by Mike Parker, Director of Schools North East and shared a platform with Lord David Putnam who is the Patron of Schools North East. We have already had several follow up opportunities from schools from across the region.

We have a new exciting series of events entitled "An Evening with Gary Fildes". These run around midnight on alternate Thursday evenings until June. This is a chance to spend a night with our Founder & Director and listen as he uses his enthusiastic teaching to create a wonderful atmosphere of learning. These



Gary all dressed up for the Schools North East annual dinner!

small and intimate evenings are aimed to give you plenty of one to one time with Gary as well as more time on the telescopes. So bring your telescopes, cameras and bags of enthusiasm for a night you won't forget!

On the subject of Gary, the paperback version of his book "An Astronomer's Tale" was released on April 6th. It has also been translated and will shortly be going on sale in Germany and Holland.



OBSERVATORY NEWS

As an interesting aside, as Northumberland International Dark Sky Park celebrated its third anniversary in



Posing for the press release for the new telescope!

December, research showed that astro-tourism is developing into a significant contributor to the county's visitor economy. Market research carried out after a Dark Skies autumn and winter marketing campaign, led by Northumberland International Dark Sky Park, found that 63% of respondents had visited the county between October 2015

and February 2016, compared to 9.5% the previous year. Earlier this year, satellite maps of England's light pollution and dark skies released by the Campaign to Protect Rural England showed that Northumberland is the darkest national park with 96% of the area having pristine night skies.

* * * *



"So glad we made the trip, although it was cloudy and we couldn't see the stars we did manage to see the moon with it's craters with the powerful telescopes on site. The talk given by Gary Fildes was both amusing and informative, when we split into our three groups the remaining personnel were equally as informative. Would highly recommend a visit, especially the hot chocolate (wait for the sales pitch - it was great)."

Paul from Durham



SCIENCE SLOT

Professional astrophysicist David Rosario takes a look at what goes on in the mysterious heart of our galaxy and many others ...

The heart of our Galaxy does not rise very high here in the North of England, but it is a spectacular sight in Southern Latitudes where it can shimmer overhead on long winter nights in August. One can see a distinct thickening in the band of the Milky Way which marks the central bulge of our Galaxy, and a dark sky will bring out the bands of interstellar dust in the Galaxy's plane. The Galaxy's nucleus itself is a special place, the point around which every single star in our huge system revolves. But it is hidden from human eyes by those vast curtains of dust. To see it, we need special cameras that are sensitive to infra-red light, to which dust is almost transparent. Taking advantage of this fact, our best telescopes with state-of-the-art infra-red instruments now routinely monitor the Galactic nucleus (or Galactic Centre [GC]), a region of constant bustle that exists in stark contrast to the quiet environs of our own Sun more than 24 thousand light-years away.

In early 2002, an astounding event was

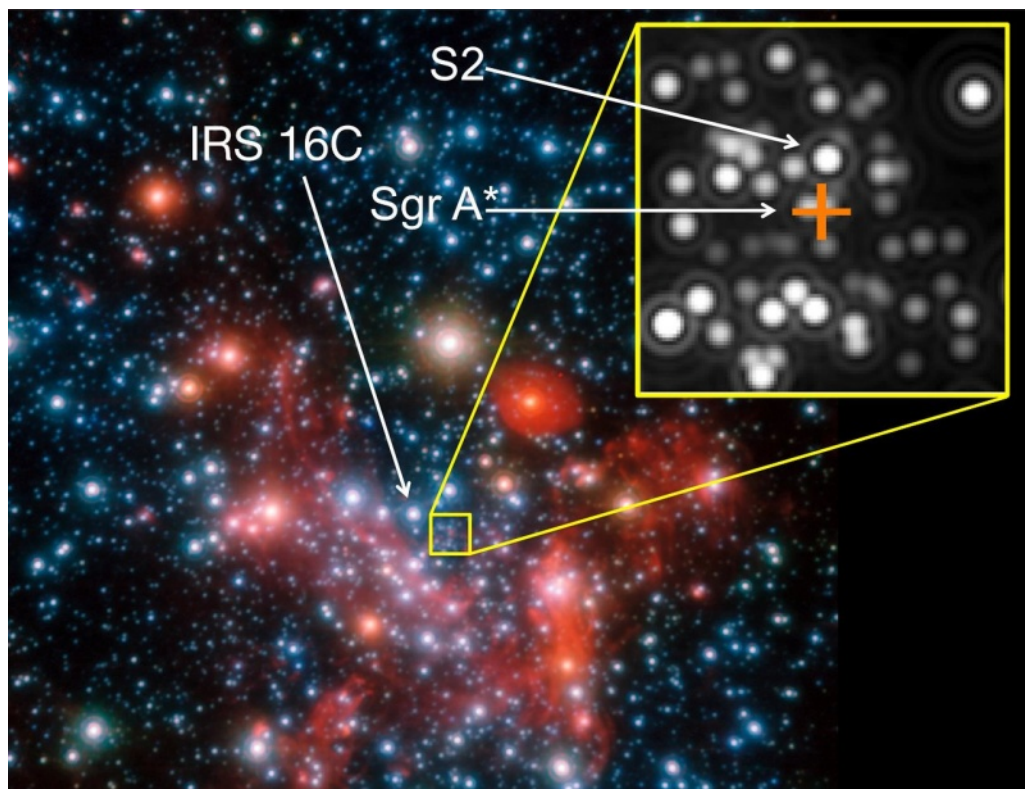
observed in the GC ^{*} (see <http://www.eso.org/public/news/eso0226/>). A bright Blue Giant star called S2, 15 times as massive as our own Sun, whipped around an unseen object at a mind-numbing 3000 miles **per second**. At the closest approach ("periastron") of its vast elliptical orbit, S2 was only 17 light hours from its mysterious attractor, a bit more distant than our solar system is wide. The simple mathematics of gravity allowed astronomers to calculate the mass of the strange object at the centre of the star's orbit, which worked out to be an unimaginably huge 4 million Suns. Despite its enormity, the absence of any light from the attractor tells us that it is one of those most arcane of astronomical objects, a supermassive black hole (SMBH). Indeed, the motions of stars in the GC provides some of the best scientific evidence for the actual existence of black holes, supermassive or otherwise.

The tell-tale sign of the presence of a SMBH is its effects on the motions of objects in its vicinity, acted upon by its immense gravity. A popular misconception

^{*} It actually took place well before humans walked the continent of North America, but light only travels at a finite speed.



SCIENCE SLOT



A multi-colour infrared image of the region around the centre of our Galaxy, taken with the adaptive-optics system on the Very Large Telescope in Chile. The inset is a zoom-in to the inner light year around the super-massive black hole (position marked with an orange cross). The current location of the fast star S2 is shown, but in 2002 it was much closer to the black hole. IRS 16C is a star in the foreground used as a calibration reference for the adaptive optics system.

Credit: ESO/MPE/S. Gillessen et al.

is that black holes suck material in like a cosmic vacuum cleaner, but this only happens if the material can get to within a few times the size of a black hole, a region of space only as large as the solar system. Except in the most extreme of

circumstances, stars that are many tens of light years away from a SMBH will still feel its presence and pull, yet remain safely whole. In the last two decades, astronomers have searched widely for fast-moving stars and interstellar gas in



SCIENCE SLOT

the centres of nearby galaxies beyond our own. And these they found in droves!

Almost every large galaxy in the Universe around us harbours a supermassive black hole. This is one of the most fascinating astronomical discoveries of the new Millennium. The Great Andromeda Galaxy, our nearest spiral neighbour, has a SMBH that weighs in at 150 million Suns, almost 40 times more than the one in our own Galaxy. M87, the giant elliptical galaxy at the heart of the Virgo Cluster, is the host of a SMBH that is the mass of 6,400 million Suns! In the same way that a central hall always seems to spring up when a town grows beyond a certain size, once a galaxy becomes big enough to settle into the stately spiral or elliptical forms, a SMBH also ends up growing in tandem. In fact, there is a hitherto poorly explained yet well documented relationship between a galaxy's mass and the mass of its SMBH. This points to a remarkable idea: nuclear black holes grow in lock-step with the galaxies they reside in (their hosts, in the parlance of most researchers) (see <http://www.annualreviews.org/doi/abs/10.1146/annurev-astro-082708-101811>).

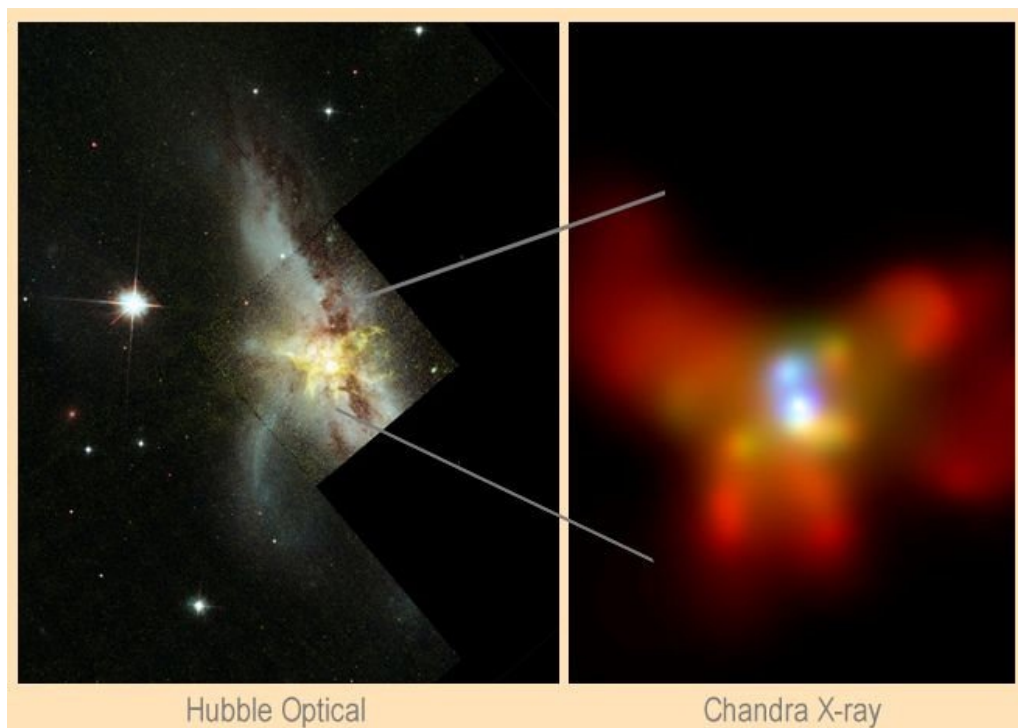
To understand why this idea is so

revolutionary, it is worth reiterating how tiny a SMBH is compared to the grand scale of a typical galaxy. The very biggest SMBHs only get a bit larger than our solar system, several light-hours in size. This is minuscule if placed against the hundreds of thousands of light-years that have to be crossed to traverse a galaxy. If a galaxy were the size of a dinner plate, a large SMBH would be the size of a molecule of sugar at its very centre. How then can these two vastly different objects grow together?

The answer may lie in two very important features of a galactic SMBH: its location and its nature. Being black holes, these monsters can only grow. Anything that falls into them can never escape, so their mass can only go up with time. If two galaxies collide, a common enough occurrence in their lifetimes, their SMBHs sink quickly to their centres like heavy stones in water. There they can merge together to make an even bigger SMBH. This behaviour ensures that a SMBH almost never strays far from the nucleus of their host galaxy. And the nucleus, as we know, is a special place. It is the very focus of activity in a galaxy, the deepest point in its gravity well. Gas, dust and stars continuously sink to the nucleus,



SCIENCE SLOT



(Left:) Visible light multi-colour image of NGC 6240, a violent merger of two galaxies 400 million light years away. This image is taken with the Hubble Space Telescope. (Right:) Multi-colour image of X-ray light from the Chandra X-ray Observatory showing the central region of the merger, in which we see two accreting SMBHs (blue-white spots), 3000 light years apart. They will eventually merge to make a larger black hole.

Credits: R.P. van der Marel & J.Gerssen, S.Komossa et al., MPE, CXC, NASA

whether rapidly after collisions of galaxies or slowly, like silt in a turbulent stream. And when they reach there, they encounter the SMBH, one of the most powerful forces in nature. If a small but fixed amount of the material in a galaxy can eventually fall in (or, using astronomer-speak, "accrete on to") the

black hole, this would allow its SMBH to grow with the galaxy.

The details of the physics that bring this infalling material right into the maw of the black hole, its event horizon, are not trivial. Our best understanding is that some of the matter, about half in most



SCIENCE SLOT

circumstances, finally accretes, while the rest, in response, is actually flung out of the nucleus at very high speeds. The energy to achieve this comes from the enormous mass and density of the black hole. In such strong gravity, the material that does finally reach the black hole can heat up tremendously, rising in temperature from the extreme cold of deep space to millions of degrees by the time it enters the event horizon. This, ironically, makes accreting black holes some of the brightest things in the Universe!

In the constellation of Leo, not far from Sigma Leonis, is a object that looks like a very faint star (visible only in the infrared), but is in fact one of the most distant objects known, an astounding 233 billion light-years away (redshift of 7.08). This is the quasar ULAS J112001.48+064124.3 (<http://www.nature.com/nature/journal/v474/n7353/full/nature10159.html>), and the

only reason we can see it is because, at its centre, half an Earth's worth of super-heated gas is falling **every second** into a black hole of 2 billion Suns. How exactly such an incredibly big black hole could have formed just 700 million years after the Big Bang is still an open question. The answer will likely tell us something fundamental about how SMBHs grow and why they seem to be so closely related to their galaxies. This topic of research is extremely active right now, and astronomers at Durham University are making important contributions to the field. Stay tuned to your science news channels for developments as they come along!

Dr David Rosario is a Postdoctoral Research Fellow in the Centre for Extragalactic Astronomy at Durham University.

Not been to Kielder yet?

Then why not book one of our events for you or your family?

Advanced booking is essential. Weekend events can fill up several weeks in advance. Please book online at <http://www.kielderobservatory.org/events/> or call us on 0191 265 5510. We can also be contacted at admin@kielderobservatory.org



NIGHT SKY

APRIL 2017 (times in BST)

Lunar phases

First quarter	03/04/2017	19:39
Full moon	11/04/2017	07:08
Last quarter	19/04/2017	10:56
New moon	26/04/2017	13:15

PLANET SUMMARY

Mercury is close to solar conjunction and is lost in the evening twilight. Venus is a challenging morning object rising about 75 minutes before sunrise. Mars is visible low in the west after sunset. Jupiter is almost at opposition this month. Saturn is still a morning object. Uranus is in solar conjunction and not visible this month.

THE STARS AT 10PM (BST)

North – Ursa Minor, Cepheus, Cassiopeia and Perseus are nicely placed

East – Hercules and Bootes are nicely placed

South – Leo and Virgo are well placed for viewing – Saturn is easily found within the body of Virgo – near the bright star Spica – alpha Virginis. Cancer is to the top RHS of Leo.

The Planets 15/04/2017

	Sun	Mercury	Venus	Moon	Mars	Jupiter	Saturn	Uranus
Rise	06:07	06:04	04:45	23:33	07:05	19:02	01:32	06:11
Transit	13:07	13:32	11:14	04:03	15:05	00:40	05:23	13:04
Set	20:08	21:00	17:32	08:33	23:06	06:14	09:15	19:56

West – Ursa Major is high up with Gemini still visible – but Orion is now setting.

METEOR SHOWERS

There is the April Lyrids – active between the 16th and 25th of April – Lyra is visible all night but early morning is best for this shower. A waning Moon will make observing this shower challenging.

COMETS

Comet 2015/ER61 PANSTARRS may put on quite a show during the summer months and is visible from around April [in Capricornus]– at magnitude 7, until late summer [July – Pisces / Aries] when it may get quite a bit brighter.

Meanwhile, Comet 41P/Tuttle-Giacobini-Kresak is still a binocular object in Draco for much of April.

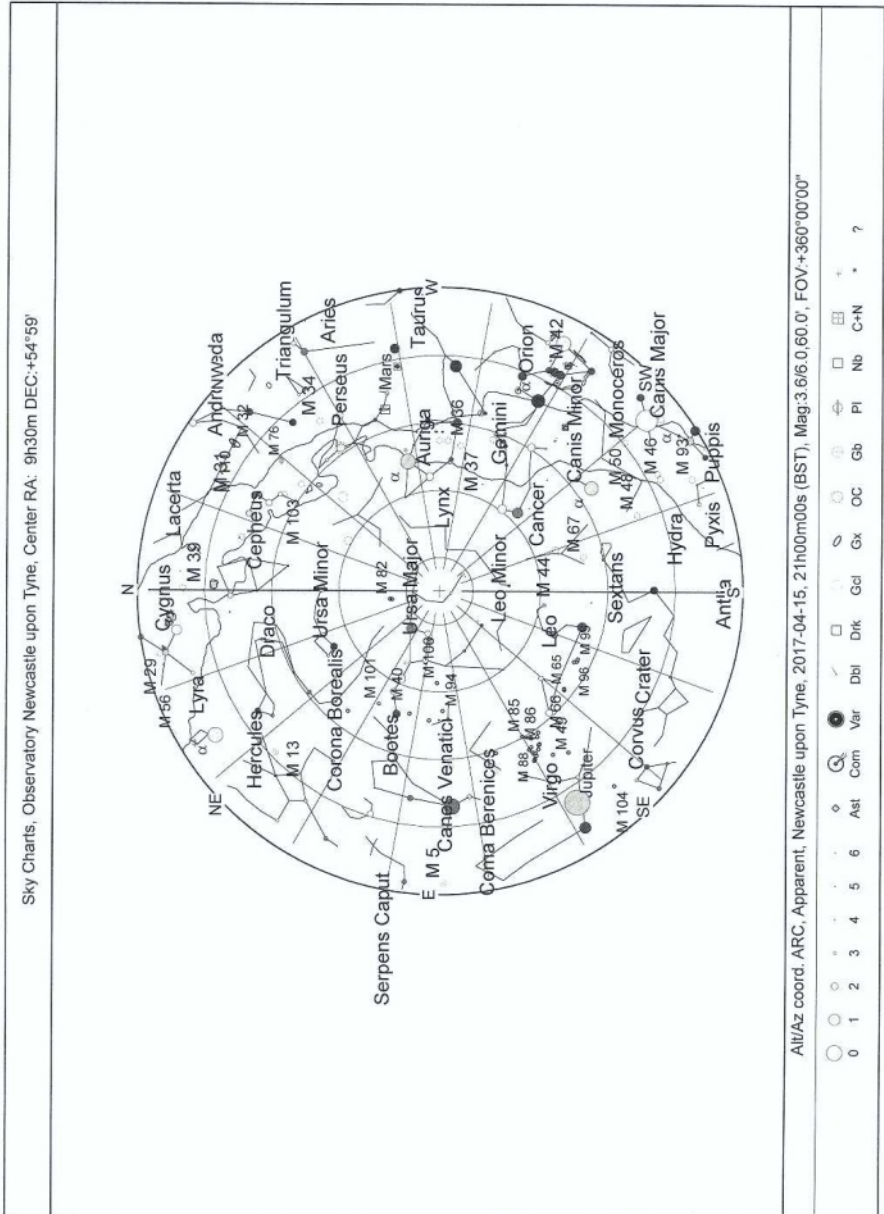


Comet 41P/Tuttle-Giacobini-Kresak



NIGHT SKY

April night sky.





NIGHT SKY

MAY 2017 (times in BST)

Lunar phases

First quarter	03/05/2017	03:46
Full moon	10/05/2017	22:42
Last quarter	19/05/2017	01:32
New moon	25/05/2017	20:44

PLANET SUMMARY

Mercury is in solar conjunction. Venus will be visible low in the east before sunrise. Mars will be visible low in the west after sunset. Jupiter will be visible for most of the hours of darkness. Saturn is a morning object getting closer to opposition. Uranus is not visible this month.

THE STARS AT 10PM (BST)

North – The two Bears are nicely placed

East – Bootes and Hercules are nicely placed. Virgo is high up in the sky

South – Leo and Virgo are easily found at this time of year.

West – Gemini is still visible in the early evening once it gets dark.

METEOR SHOWERS

There are no major meteor showers in May.

COMETS

Comet 2015/ER61 PANSTARRS may put on quite a show during the summer months – see the information for April.



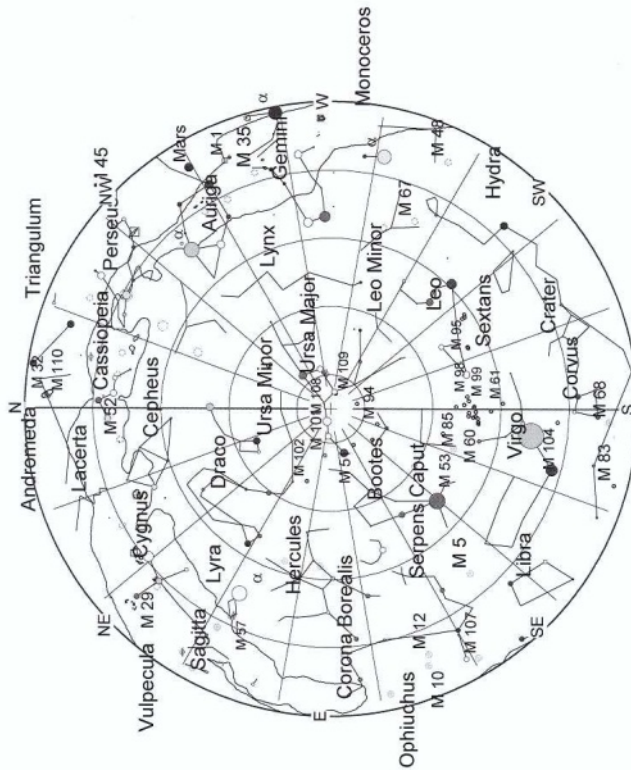
Messier 3, a Globular Cluster in Canes Venatici, is prominent in May.

The Planets 15/05/2017

	Sun	Mercury	Venus	Moon	Mars	Jupiter	Saturn	Uranus
Rise	05:07	04:40	03:52	00:06	06:06	16:46	23:52	04:16
Transit	13:04	11:28	10:14	04:21	14:34	22:26	03:21	11:12
Set	21:02	18:17	16:37	08:36	23:03	04:11	07:12	18:08



Sky Charts, Observatory Newcastle upon Tyne, Center RA: 12h29m DEC: +54°59'



Alt/Az coord. ARC, Apparent, Newcastle upon Tyne, 2017-05-15, 22h00m00s (BST), Mag:3.6/6.0,60.0', FOV:+360°00'00"

- 0 1 2 3 4 5 6 Ast Com Var Dbl Dtk Gcd Gx OC Gb Pb Nb C+N *



NIGHT SKY

JUNE 2017 (times in BST)

Lunar phases

First quarter	01/06/2017	13:42
Full moon	09/06/2017	14:10
Last quarter	17/06/2017	12:33
New moon	24/06/2017	03:31

PLANET SUMMARY

Mercury is lost in the evening twilight. Venus is a difficult object in the morning twilight. Mars is in conjunction with the Sun and not visible this month. Jupiter is visible low in the west after sunset. Saturn is also visible in the western sky after sunset. Uranus is a morning object.

THE STARS AT 11PM (BST)

North – The two bears are nicely placed with Cepheus – the King - at a nice altitude for viewing. Cassiopeia and Perseus are low down
East – Cygnus and Lyra are nicely placed and Ophiuchus and Serpens are in the south-east
South – The head of Scorpio skirts the horizon. Saturn is low in the South in

The Planets 15/06/2017

	Sun	Mercury	Venus	Moon	Mars	Jupiter	Saturn	Uranus
Rise	04:38	04:10	02:52	00:35	05:28	14:40	21:13	02:17
Transit	13:08	12:35	10:02	05:29	14:03	20:21	01:10	09:15
Set	21:38	21:03	17:14	10:32	22:37	02:06	05:02	16:14

Ophiuchus.

West – Jupiter is nicely placed in Virgo with Leo low down.

METEOR SHOWERS

There are no bright meteor showers in June. However the Noctilucent cloud season will be starting.

COMETS

Comet 2015 V2 Johnson may be visible in June 2017.



Summer is a good time for Globular Clusters. Here is Messier 5 in Serpens.





NIGHT SKY

JULY 2017 (times in BST)

Lunar phases

First quarter	01/07/2017	01:51
Full moon	09/07/2017	05:06
Last quarter	16/07/2017	20:25
New moon	23/07/2017	10:45
First quarter	30/07/2017	16:23

PLANET SUMMARY

Mercury is too close to the Sun to be safely viewed. Venus is a morning object visible for about 1 hour in twilight but is not visible at dusk. Mars is in conjunction with the Sun and not visible this month.

Jupiter is an evening object visible low in the west the sky gets dark at around 2300. Saturn is visible for most of the hours of darkness around midnight.

Uranus is a morning object.

THE STARS AT 11PM (BST)

North – The two Bears will be around along with Cepheus and Cygnus in the north east and Perseus near the northern horizon.

East – Draco is high up with Cygnus lying

nicely placed for viewing – this will be a good time to view the late Summer Milky Way. Pegasus is near the horizon.

South – Hercules is overhead with Ophiuchus nicely placed. Scorpio is near the southern horizon.

West – Coronal Borealis is high up with Virgo low down and Leo about to set neat midnight.

METEOR SHOWERS

There are no bright meteor showers in July.

COMETS

There are no bright comets expected in July.



Night Sky credits: Lunar and planetary data sourced from Cybersky 5

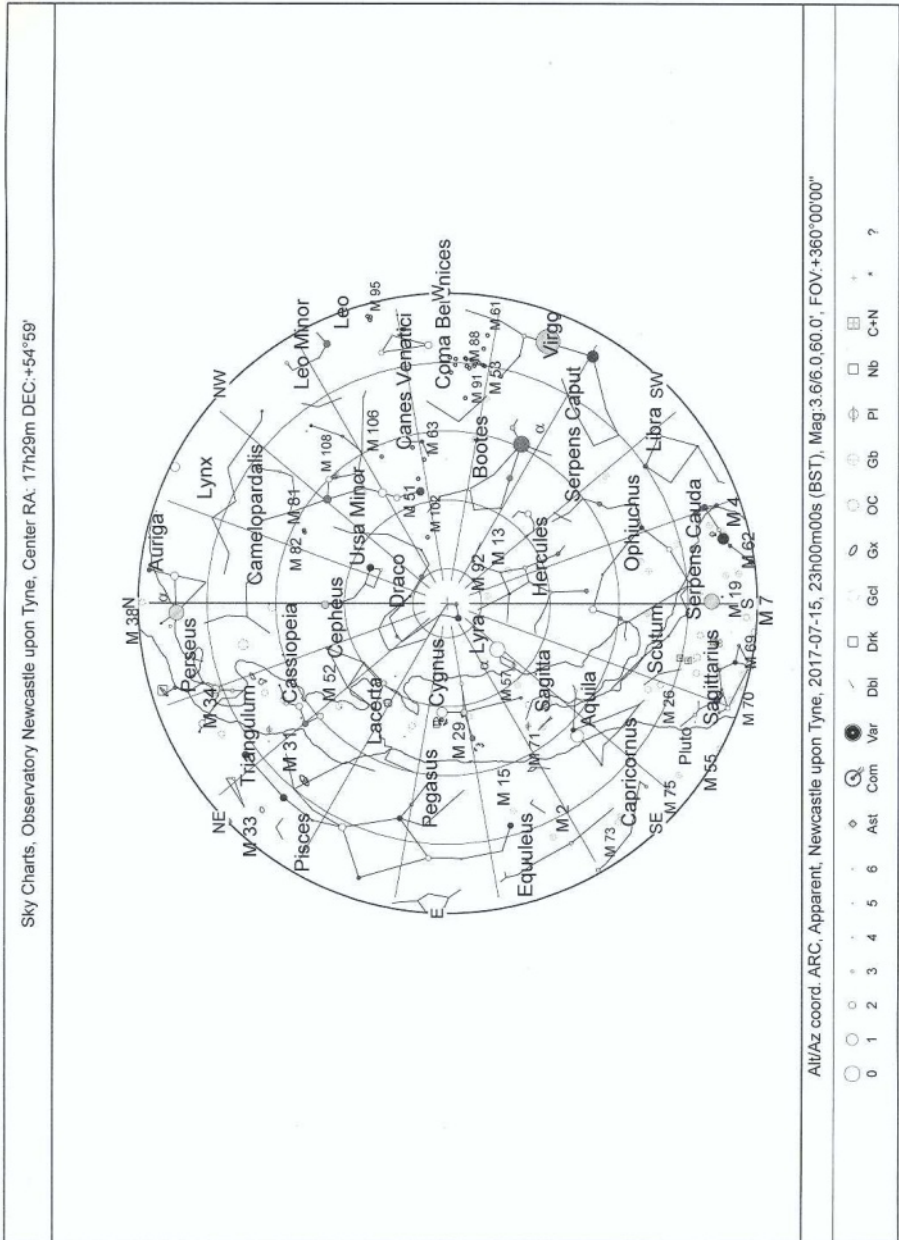
The Planets 15/07/2017

	Sun	Mercury	Venus	Moon	Mars	Jupiter	Saturn	Uranus
Rise	04:57	07:04	02:13	00:00	05:13	12:53	19:06	00:20
Transit	13:13	14:48	10:15	05:49	13:29	18:30	22:59	07:20
Set	21:28	22:30	18:17	11:56	21:45	00:10	02:55	14:20



NIGHT SKY

July night sky.





OBSERVERS' SLOT

A Familiar Face: The Story of our One Sided Moon



The Lunar near side from Gateshead.

© The author

Our Moon is certainly one of the most incredible things in our skies. Its friendly, familiar face has looked back at our planet for many millions of years, and as many million faces have gazed back at its cratered surface, illuminated by its pale white light. Humankind has always had a special connection with the face of our closest celestial neighbour, its grey sphere becoming the focus of countless pages of literature, pieces of music, or works of art. Perhaps one of the most comforting things about our Moon is that its face never changes in our sky, we always see just the one side, staring back as our planet rotates beneath it. Does the Moon have a strange secret on its far side? Is it hiding

its “ugly face” as to please humanity? Is it a secret alien observation station full of giant mutant lizards?! (probably not). Thankfully, the truth of the matter has less to do with aliens, and more to do with a process known as tidal locking.

The reason we only see the one face of our Moon is because the Moon rotates on its axis, i.e. the length of one Lunar “day” is exactly the same as the time it takes to orbit the Earth once (a lunar “year” if you like). This means that as the Moon travels around Earth on its 27.3 day orbit, it spins at just the right speed so that only one side of it ever faces the Earth. This process is known as tidal locking. It may seem like the most amazing co-incidence that these two periods of time “just so happened” to match exactly, but in actual fact, tidal locking has nothing to do with co-incidence and far more to do with gravity. In fact, almost every major moon of the solar system is tidally locked to the planet it orbits and planets can even become tidally locked to their stars if they orbit close enough! You may have heard in the news recently about a star system, TRAPPIST-1, with 7 Earth like planets orbiting one star. All 7 planets in that system are thought to be tidally locked to their star, like our moon is to Earth,

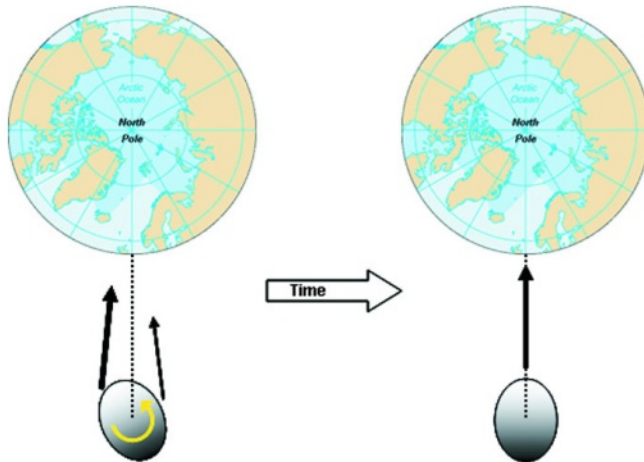


OBSERVERS' SLOT

making for one side of eternal day, and another side in a cold, infinitely long night. The Moon may be forever locked to Earth now, but 4.4 Billion years ago, just after the Moon had formed, it orbited the Earth far closer, and span at a much faster rate, meaning both sides could be seen from Earth. However, because gravity pulls on objects with a stronger force the closer you get to that object, the near side of the Moon experienced just a bit more force than the far side. Amazingly, this force was (and still is) just enough to pull the Moon into a very slight oval shape. (Like a slightly squashed grape, if you like)

On Earth, the force is very small, but it is

enough to make an oval shape in our oceans! This “bulge” closest to and furthest from the Moon cause our high tides and because the Earth rotates in 24h, we pass through two bulges in a day, which is why high tides are usually around 12 hours apart! Anyway, back to the early Moon! As the early Moon did rotate faster than it orbited the Earth, this bulge of rock was carried slightly “forward”, so that the bulge of rock was no longer at 90° to the Earth! (This is seen best in the above image on the left hand side). This bulge of rock now experiences the pull of gravity not along the straight line towards Earth, but at a very tiny angle. This tiny angle meant that the pull of gravity from Earth

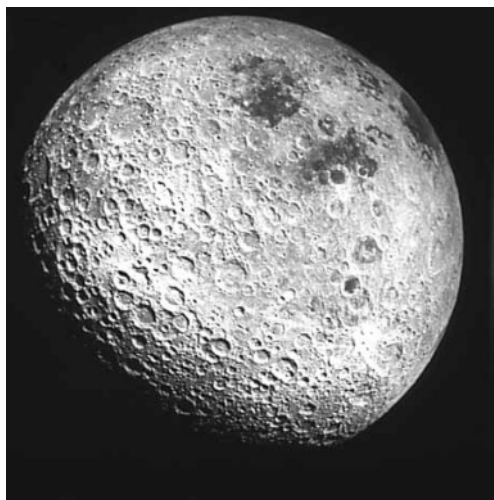


Tidal locking mechanics. Earth's gravitational pull on the closer bulge is stronger than on the further bulge (left). The resulting torque slows down the Moon's counter-clockwise rotation. Eventually the two bulges are locked into line (right) with the Earth-Moon axis (dashed line).

© Canadian Society of Exploration Geophysicists



OBSERVERS' SLOT



Lunar farside from Apollo 11.

© Lunar and Planetary Institute/NASA

now very slightly pulled on the Moon, against the direction of its rotation. It may only be small but this slight pull in the opposite direction acted like a brake on the Moon's rotation! This "Earth brake" slowed the Moon down surprisingly quickly, achieving full locking in only 20 million years or so! (Of course, 20 million years isn't exactly "quick" but considering the age of the Moon, it means it has been tidally locked for 99.5% of its life!)

As the Moon slowed down, the angle between its bulge and the imaginary line from the Moon's centre to Earth's centre got smaller, and so the speed at which it slowed down also decreased. At the point where the Moon's spin and the Moon's orbit took the same amount of time, the bulge will have lined up perfectly with the Earth, and so the braking effect no longer slows down the Moon's spin, and from that day on our Moon has only shown the Earth it's one, beautiful face. So the next time you go out to look at the Moon, be it through your telescope, with binoculars, or with your own two eyes, think of the Moon's forgotten face, and why we only ever see half of our loveliest cosmic neighbour!

Finn Burrridge

Sources:

<http://astronomy.stackexchange.com/questions/1859/when-did-the-moon-stop>

<http://www.universetoday.com/123391/what-is-tidal-locking/>

"Habitability of Exomoons at the Hill Radius or Tidal locking Radius" -Natalie R. Hinkel and Stephen R. Kane August 12 2013 (The American Astronomical Society)

"Visited for the first time last night and it was even better than I expected it to be! The guys were clearly so passionate about what they do and I learned so much! The views with and without telescopes were beautiful! Can't wait to come back again."

Hayley-Beth, Whitley Bay



GALLERY



Back to our usual image gallery for this edition.
Remember that we would love to display your
images here - please send them to

newsletter@kielderobservatory.org

along with a brief description of how and when they were taken.



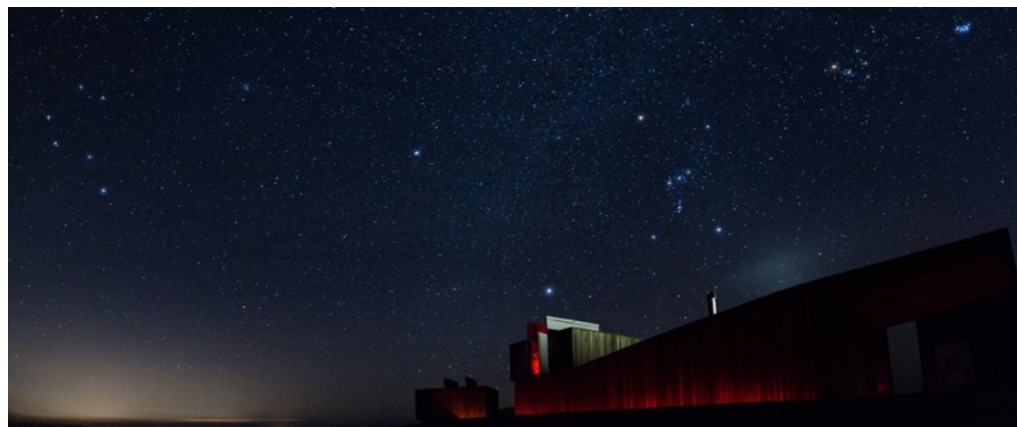
The North America Nebula in Cygnus (NGC7000) taken with a Canon 60Da DSLR with a Borg 76 Eco scope on an Avalon M-zero mount at the Spring Kielder Star Camp. Taken by Robert Williams.



GALLERY



Messier 51, the Whirlpool Galaxy. This is a 6 minute exposure taken with the new 16" telescope at Kielder.



A lovely panoramic shot over the Observatory, showing the constellations of Orion and Taurus to the right, and Leo to the left. The bright star above centre is Procyon.




GALLERY



The Zodiacal light, seen from the Observatory in late March. This band of light, which seems to stretch up from the horizon, is caused by sunlight scattered off dust in the Solar System.



Finally, those mugs are on their travels again! John Austin sends this from a familiar location 'down-under'.



"My partner and I visited the observatory on Thursday 16th March, we were very lucky the skies were crystal clear. The whole experience was amazing, from start to end. The tutors were fantastic, very knowledgeable and made it very enjoyable for us beginners!

...
Still in awe of the whole evening, breathe taking and a memory which will stay with us for a very long time. Cannot recommend enough!"

Laura, West Midlands

KOAS: Your Window to the Universe

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