Summer 2023 Number 40

Kielder Observatory Newsletter

NEWS
Observatory naming

NIGHT SKY
Highlights Aug/Sept/ Oct

SOLAR SYSTEM
Solar eclipses

SCIENCE
Supernovae remnants

EDITORIAL

Although the nights are still short, by the end of the first week in August astronomical darkness will have returned here in the North East. You will see from the News section that we have instigated some very late night (or should that be early morning) events to make the most of the darkest skies.

In space, JWST is still acquiring some fabulous data, and the Euclid satellite has been sucessfully launched on its mission to explore dark energy and dark matter, and returned its first test pictures.

Nigel Metcalfe

Editors: Nigel Metcalfe & Robert Williams

Kielder Observatory Astronomical Society

Registered Charity No: 1153570.

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

https://kielderobservatory.org

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KIELDER OBSERVATORY
Infinite Inspiration

Front cover: The sun on June 9th, credit: Guy Haveron
Rear cover: Crescent moon in the dawn sky, credit: Dan Monk.

Author LJ Ross at the Caroline Herschel dedication.

So the big event in the last few months was the naming of the 16" Meade room the Caroline Herschel Turret on June 23rd, with the unveiling performed by best-selling author LJ Ross, whose books champion the North East, and who rather aptly publishes her books through her own publishing house, Dark Skies Publishing.
Caroline was the first woman to receive a salary as a scientist and discovered several comets. Alongside her brother, William, who was Court Astronomer to George III, they uncovered more than 2,400 astronomical objects over 20 years. Caroline was later awarded a gold medal from the Royal Astronomical Society and was elected an Honorary Member in 1835 for her pioneering work.
This means the two observatories in our original buidling are now named after Sir Patrick Moore and Caroline Herschel, a bit of a contrast, but both in their ways champions of astronomy.
The naming was part of the Observatory's 15th anniversary celebrations.

OBSERVATORY NEWS

The Observatory's portable planetarium in action ...

We have four podcasts for you since the last newsletter:
Artist Melaine King talks about non-digital astrophotography, there is an on-location podcast from the Caroline Herschel naming cermony, lecturer Lauren Napier tells us about about the law in space,
and Ian Brannan and Dan Pye look at great places to stargaze around the North-East (apart from the Observatory itself of course!).
You can find all our podcasts at https://podfollow.com/kielderobs/view

Our Director of Astronomy, Dan Pye, talked about the Observatory on the Steffen Peddie show on BBC Radio Newcastle on 24th July. You can listen to it on BBC Sounds:
https://www.bbc.co.uk/sounds/play/p0fy5qby
We are no. 2 on Tripadvisor's list of the top ten observatories and planetariums in England!
https://www.tripadvisor.co.uk/Attractions-g186217-Activities-c49-t40-England.html
Sadly the Royal Observatory Greenwhich beat us into no. 1 slot, but we have

much darker skies than they do!

Late night discovery events - to compensate for the longer days (and hence lack of dark evenings) in summer, we have introduced some special observing events which start at 00:30 in the morning and run through until 02:30.

Making a scale model of the solar system at one of our Space Kids "Light Year Academy" events.

These are running overnight Thursday/Friday (i.e. starting at 00:30 on Friday morning) throughout August. We have already had a couple in July and they are selling well, so book now!

In fact many dates for the summer holidays are now sold out, so if you'd like to visit us in August you need to be quick to book your place! We have lots of Space Kids sessions covering different topics such as Solar Quest, Searching for Aliens and the ever-popular Rockets and More. Thinking further ahead, we are now taking bookings through to March 2024.

If you want an independent review of what our Introduction to Astronomy session are like then look here: https://www.northeastfamilyadventures.com/post/kielder-observatory-an-introduction-into-astronomy-review

On June 21st , it being the summer solstice, we have put up a Solarcan (https://solarcan.co.uk/) pinhole camera on the side of the Observatory building. This will capture the path of the sun across the sky for the next six months - assuming it isn't cloudy!

The winners of round 2 of our Franks Fellowships will be visiting the Observatory in August .

OBSERVATORY NEWS

The SolarCam is installed.

We have welcomed a new member of staff since the last newsletter - Rosie Braunholtz has joined us as a science communicator. Rosie studied Physics and Astrophysics at university.

Space Kids - Light Year Academy - July

Really lovely bunch of people who are experts in their fields. Fascinating not just for the kids but us grown ups too! Rosie is exactly who I hope my daughter aspires to be when she grows up. My son who we brought along, loved every minute with the team.
Absolutely loved the session, my son absolutely loved every minute of it. Fabulous venue, excellent staff. It really was a wonderful experience and we can't wait to return

Megan, Liverpool


The Caroline Herschel Turret naming ceremony
June 23rd 2023

SOLAR SYSTEM SLOT

The most amazing show visible from Earth

The total eclipse on August 1st 2008, photographed by the author from China.

OK, maybe I'm biased, to if you ever get the chance to see a very special astronomical event, then you should strain every sinew to do so. Which Astronomical event should you go and see – there are quite a few ! - well I certainly recommend a Total Solar Eclipse.

Many people have seen a partial solar eclipse – where the Moon takes a bite out of the Sun – but a much smaller number of people have seen Totality – as it is commonly known – when the disc of the new Moon completely covers up the disc of the Sun.

This event occur about once every 15 to 18 months somewhere across the face of the Earth. It happens because the – apparent- size of the Moon [~0.5degree] is the same as the – apparent - size of the Sun – also ~0.5 degree, in the sky. To put it another way the Sun is ~400x the size of the Moon but is also ~400x further away. If

you want to do an experiment to confirm this, try covering up a Sunflower head with a penny coin – that will give you a rough idea of the scale of the process

Annular Eclipse

Because the orbit of the Moon around the Earth is elongated, if the eclipse takes place with the Moon at or near apogee [its most distant point in its orbit away from the Earth] the – apparent – size of the Moon is just less than that of the Sun – by about a few percent, the Moon will not cover up the Sun and we get an Annular Eclipse. There is one of these coming up later this year. During an Annular Eclipse there is still about 5% of the Sun not covered by the Moon, the sky never gets dark and the event is essentially visible in daylight conditions. Viewing this type of eclipse it is essential that you must use suitable high effective solar filter for your eyes and camera at all times during the entire event, which can last about 2-3 hours from start to finish.

Hybrid Eclipse

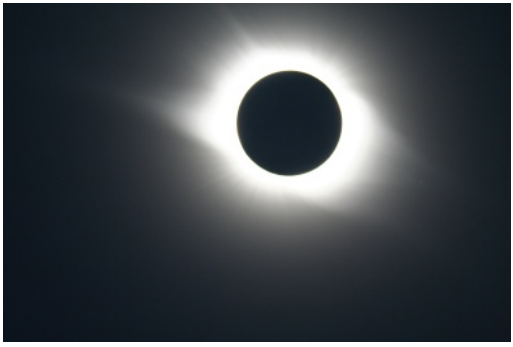
These are much rarer because they rely on a particular celestial geometry between the Sun, Moon and Earth. Here your position along the centre-line determines what you will see. There is a good summary on space.com. The next Hybrid Solar Eclipse will happen on Friday 14th September 2031.

Total Solar Eclipse

A total solar eclipse is a much more exciting beast to view. Like other types of eclipse you have to be in the right place at the right time, along the centre line path of totality which may only be a few km wide. Unlike Partial, Annular or Hybrid solar eclipses the sky will – or rather should – go completely dark.

Here is a link to more information about upcoming events on timeanddate.com

Eclipses are classified by a magnitude setting. If M<1 the eclipse is annular and some of the Sun will be visible at the midpoint of the track. If M=1 the eclipse is total and the sky will go dark – and the solar corona will be visible along with prominences and some of the chromosphere.



The solar corona becomes visible during totality. This is the August 2008 eclipse from China again.

If M>1 [up to a maximum of ~1.05] when the Moon is at perigee [i.e. closest to

SOLAR SYSTEM SLOT

Earth] and the Sun is at or near apogee [i.e. furthest from the Earth], the Sun will hide behind the Moon and the chromosphere may not be visible, but the corona will be visible.

How do you go about viewing a Total Solar Eclipse? Firstly – the next TSE in England will be on September 23rd 2090 – maybe only a few of you will be around to see that one!

Date	Local time	Saros cycle	Magnitude	Duration of totality	Best location	Path width	Totality also visible from
08/24/24	18:18:29	139	1.06	4m38s	Torreon Mexico	198km	C&NE USA, Mexico, Canada
12/08/26	17:47:06	126	1.04	2m18s	Western coast of Iceland	294km	Greenland and Spain
02/08/27	10:07:50	136	1.08	6m23s	Egyptian desert	258km	Spain, Morocco, Algeria, Tunisia, Libya, Suadi Arabia, Yemen, Somalia
22/07/28	02:56:40	146	1.06	5m10s	NW Australia	230km	Australia and New Zealand
01/06/30	06:29:13	128	Annular	5m21s	C. Russia	250km	Algeria, Tunisia, Greece, Ukraine, Parital in UK
25/11/30	06:51:37	133	1.05	3m44s	Southern Pacific Ocean	169km	Botswana, South Africa, Australia, Partial in East Indies, Antarctica
14/11/31	21:07:31	143	1.011 [Hybrid]	1m08s	Solomon Islands [Ocean]	38km	Pacific islands, Panama
30/03/33	18:02:36	120	1.05	2m37s	Alaskan Arctic [boat]	781km	Russian Arctic
20/03/34	10:18:56	130	1.05	4m09s	Chad	159km	Niger, Cameroon, Sudan, Egypt, Saudi Arabia, Iran, Afghanistan, Pakistan, India

The eclipse starts at dawn in the Canadian Arctic, then crosses over the whole of Canada and Greenland. It will be visible – at dusk – across most of the south coast of England along a track about 20km wide. It will also be visible in the English Channel and parts of Normandy in France. It will have a magnitude of 1.056 and totality will last 3 minutes and 6 seconds at maximum extent – which occurs to the east of Greenland/south-west of Iceland, so you will need a boat!

If you want to see an eclipse before then, there is plenty of choice (see the table on the previous page and this list of 21st century eclipses in Wikipedia).

Let's take a closer look at a few of these: To whet your appetite let me provide you will my personal experiences of viewing solar eclipses.

Eclipse No. 1 - 21st June 2001 – I went on a trip to South Africa and Zimbabwe. Starting in South Africa in Cape Town, we then had a few days along the Garden Route [recommendable!] to see the southern coast of Africa. A group of 50 people then joined up with – another group of 450 people [probably those who had had a disappointment on 12/08/1999 !] near Victoria Falls, before heading to Rushinga, Zimbabwe to view the eclipse from a secondary school on the very midpoint of the centre line. As it was my first eclipse I went prepared with binoculars and Mylar solar filter to see the eclipse – which lasted 2 minutes and 10 seconds – Big Tick!

Eclipse No.2 - 4th December 2002 – I went on a trip that started in Johannesburg then

The author preparing for the 2006 eclipse in the Lybian desert.

a few days in the Drakensberg Mountains before viewing the eclipse from Kruger National Park – totality should have been 2m02s – however a local dignitary was flown into the area and there was a 50km exclusion zone around him

so we were outside the centre line – he didn't see it and neither did we! - it was cloudy [South African Rainy season!]. Small tick.

Eclipse No.3 March 29th 2006 – I joined group of Irish astronomers known as the Ecliptomaniacs for a trip to the Libyan desert. Totality lasted 4m06s and it was stunning experience of the eclipse from the desert. I managed to get a shot of totality using a semi-automatic print film camera. During this trip I also took my

Quite a few people turned in the Lybian desert for the 2006 eclipse.

longest exposure of the night sky – a 6hr continuous star trail image using slide transparency film. We also visited the Acacus region [Looks like the surface of Mars] of Libya and the ancient Roman era ruins at the coast near Sabratha – Big Tick!

Eclipse No.4 1st August 2008 - just before the Beijing Olympics I joined a group of about 35 people and we headed for a tour of Beijing, Xian and NW China. Our trip included a visit to the Terracotta Army – highly recommendable - just outside the major city of Xian. Unusually China has a single time zone – based on Beijing. So whilst the eclipse was total at ~5pm Beijing time, the Sun was at local noon in NW China. The Taklimakan Desert is one of the coldest deserts in the world. It is also one of the best places to stargaze from as it is both bone dry and many 100's of kilometres away from a major city. With a totality lasting 2m27s, this was my first real attempt to get a great image of totality – using a DSLR and Borg semi-apo f6.5 76mm refractor as camera lens.

Eclipse No.5 21st August 2017 – this time a trip to Oregon USA. I joined a group of about 200 Americans for a journey to the Pacific NW of the USA. On this trip I was determined to take as many attempts to get some different views of the eclipse. So, I had a DSLR with wide angle lens to get shots of the sky during totality, a DSLR with telephoto lens for close-up views of totality and a GoPro camera to take in the wider view including some sound effects too [of the other members of my group and of the local wildlife too] during the eclipse event itself.

During totality – because the sky goes completely dark, the local wildlife can and will go crazy because they think that dusk is coming. Then – a few minutes later – dawn re-appearers and the animals go back to their normal routines.

So where to next for another eclipse adventure?

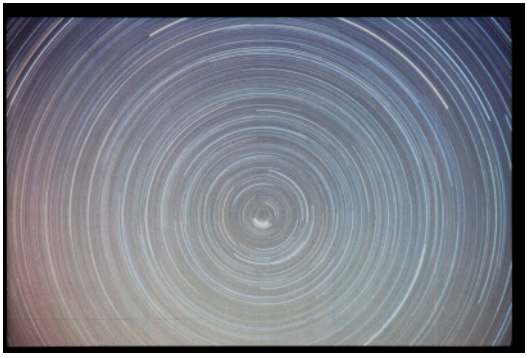
1) August 12th 2026 – quite a good time to visit Iceland if you don't like the cold! - not only that the eclipse takes place on the date of the maximum of the Perseid Meteor Shower. Seeing the meteors at the same time as the eclipse will be quite a special occasion. The eclipse will also be visible across parts of Greenland and Spain – including being total in some major cities of the latter country [Valencia, Zaragoza, Palma and Bilbao]. Maximum duration 2m18s across Greenland.

2) August 2nd 2027. Visible from Gibraltar, southern Spain, northern Africa and Middle East, duration 6m23s – one of the longest totally this century – as seen from Luxor, Egypt.

3) July 22nd 2028, in Northern Australia – Kimberley region, WA, NT, SW Queensland and NSW. Sydney will see ~3m00s of totality. Also on the centre line are Queenstown and Dunedin NZ. If you want to go a bit more remote then head to Christmas Island or Cocos Island.

You can find more information and images on my personal website – www.robs-roamings.info

Robert Williams



The author's 6hr continuous star trail from the Lybian desert.

KIELDER OBSERVATORY
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NIGHT SKY

AUGUST 2023 (times in BST)

Lunar phases

Full moon	01/08/2023	19:31
Last quarter	08/08/2023	11:28
New moon	16/08/2023	10:38
First quarter	24/08/2023	10:57
Full moon	31/08/2023	02:35

PLANET SUMMARY

Mercury and Venus are too close to the Sun to observe. Mars is too close to the Sun to observe. Jupiter is near opposition and will be visible in fairly dark skies between 00:30 and 03:00. Saturn is also close to opposition and will be visible from 23:00 until 03:30. Uranus is a morning object visible from about 01:00 until 03:30.

THE STARS AT 10PM

North – Lyra will be overhead with the two Bears nicely placed along with Cepheus. Auriga will be close to the horizon.
East – Andromeda and Pegasus will be nicely placed. Perseus and Cassiopeia are rising. Cygnus is high up.
South – Aquilla, Serpens Cauda and Ophiuchus are nicely placed.
West – Hercules is nicely placed with Bootes.

METEOR SHOWERS

August is well known for the Perseid Meteor Shower which is visible for most of the whole month. You should see around 50 meteors per hour. The Moon is almost New in 2023 for this shower so hopefully good conditions once it has set at around 8pm on the 12th, with Perseus nicely placed in the sky. Expect around 50 to 100 shooting stars per hour.

COMETS

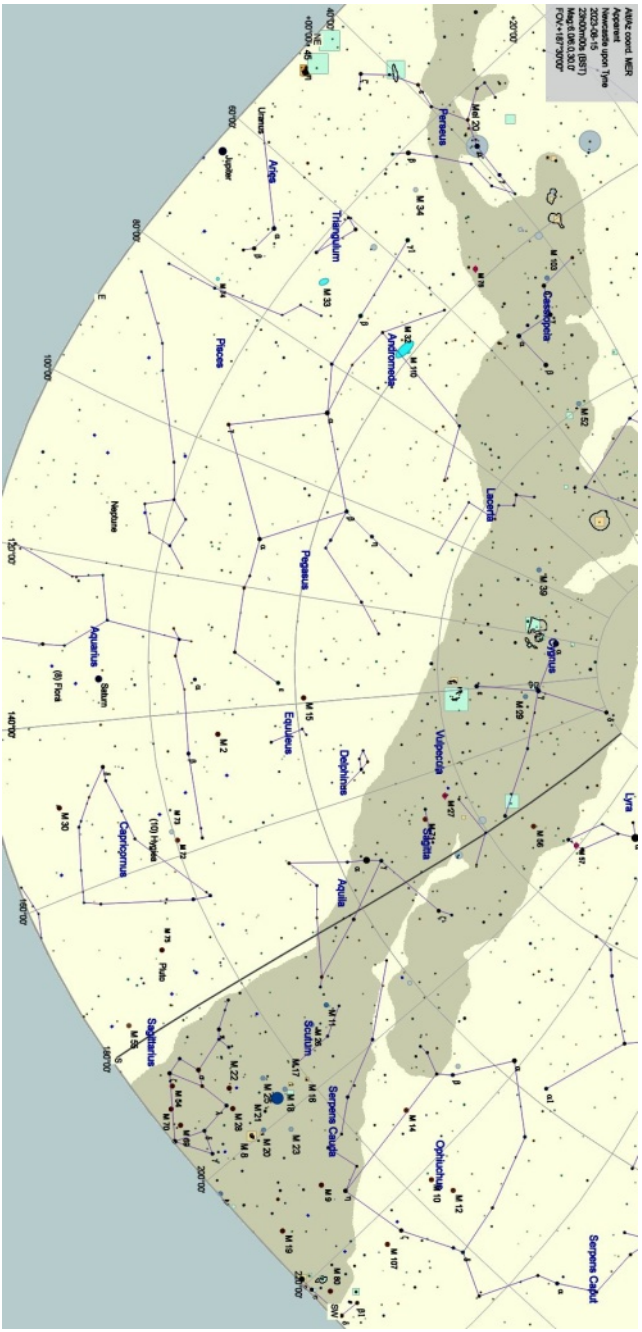
There are no bright comets expected this month.

A good place to check for weekly information on the visibility of comets is http://aerith.net/comet/weekly/current.html

The Planets 15/08/2023

	Sun	Moon	Mercury	Venus	Mars	Jupiter	Saturn	Uranus
Rise	05:37	00:29	08:26	06:20	08:37	22:59	21:16	23:09
Set	20:40	19:42	21:13	19:53	21:39	14:08	07:11	15:02

The sky chart for Newcastle looking SE at 11pm on 15/08/2023.



NIGHT SKY

SEPTEMBER 2023 (times in BST)

Lunar phases

Last quarter	06/09/2023	23:21
New moon	15/09/2023	02:39
First quarter	22/09/2023	20:32
Full moon	29/09/2023	10:57

PLANET SUMMARY

Mercury it too close to the Sun to view this month. Venus will be the morning star, shining brightly in the twilight. Mars is too close to the Sun to view this month. Jupiter will be visible from 23:00 until 05:00. Saturn is close to opposition, and will visible from 21:00 until 05:00. Uranus will be visible from 23:00 until 05:00 and can be found near Jupiuter.

THE STARS AT 9PM

North – Lyra and Cygnus will be overhead with the two Bears nicely placed along with Cepheus. Auriga will be close to the horizon.

East – Andromeda and Pegasus will be nicely placed. Perseus and Cassiopeia are rising. Cygnus is high up.

South – Aquilla, Serpens Cauda and Ophiuchus are nicely placed.

West – Hercules is nicely placed with Bootes.

METEOR SHOWERS

There are no major meteor showers in September.

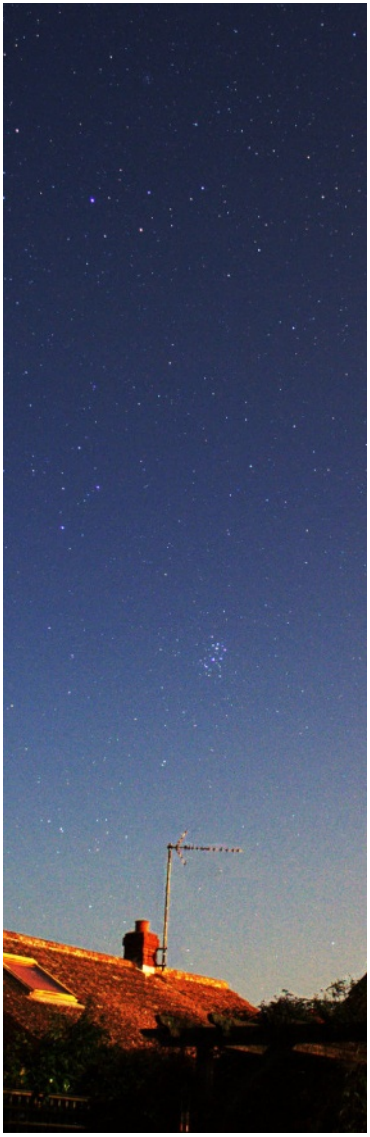
COMETS

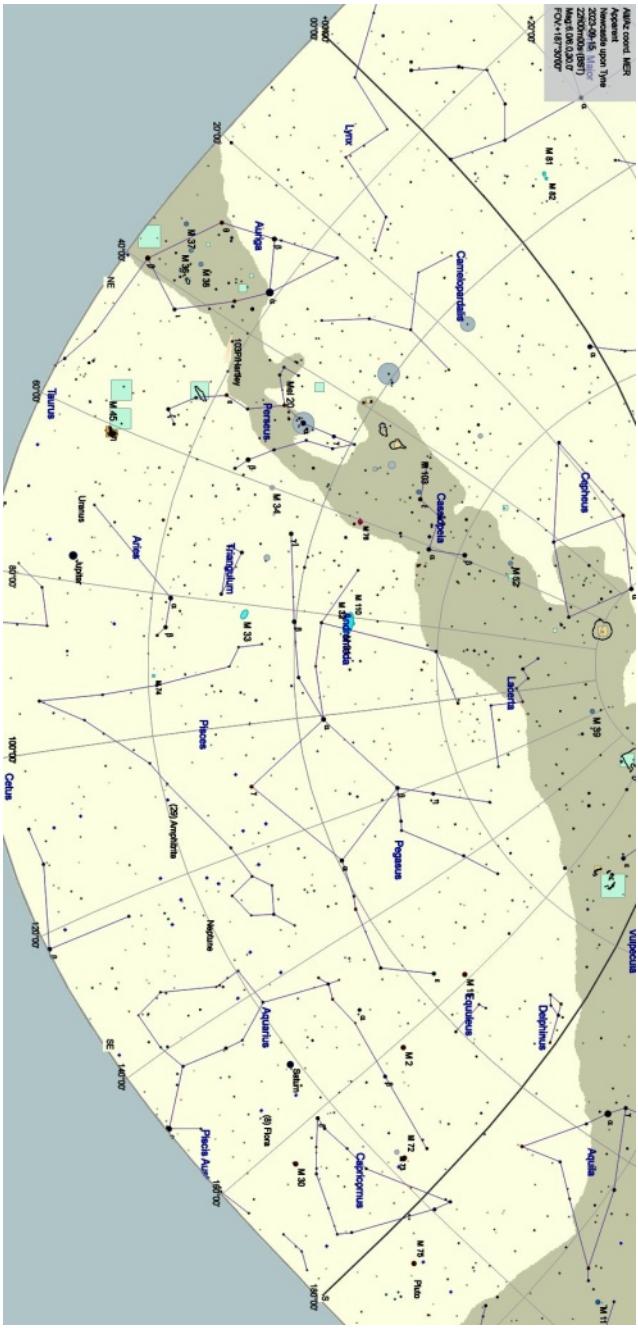
There are no bright comets visible this month.

The Planets 15/09/2023

	Sun	Moon	Mercury	Venus	Mars	Jupiter	Saturn	Uranus
Rise	06:35	06:42	05:17	03:19	08:34	20:48	18:55	20:56
Set	19:24	19:43	18:54	17:41	19:53	11:57	04:38	12:48

The sky map looking E from Newcastle at 10pm on 15/09/2023.





NIGHT SKY

OCTOBER 2023 (times in BST)

Lunar phases

Last quarter	06/10/2023	14:47
New moon	14/10/2023	18:55
First quarter	22/10/2023	04:29
Full moon	28/10/2023	21:24

PLANET SUMMARY

Mercury, Venus and Mars are too close to the Sun this month. Jupiter and Saturn will be visible from about 20:00 until 22:30, in fairly dark skies. Uranus is close to opposition and will be visible from about 20:00 until 0:600.

THE STARS AT 10PM

North – Cepheus will be overhead with the two Bears nicely placed along with Cepheus. Auriga will be close to the horizon.

East – Andromeda and Pegasus will be nicely placed. Perseus and Cassiopeia are rising. Cygnus is high up. Capricornus will be low down.

South – Aquilla, Serpens Cauda and Ophiuchus are nicely placed.

West – Cygnus, Lyra and Hercules are nicely placed with Bootes low down.

METEOR SHOWERS

The major meteor showers of October are:

a) Around 8th October – the Draconids – a minor show but can still put on a show – visible all night in the North – the Moon is thin waning crescent so the sky could be reasonably dark to spot the components of this relatively minor shower

b) Around 20th October – the Orionids – a major shower of the year. In 2023 there will be a first quarter Moon so best time to view this shower will be after midnight.

COMETS

There are no bright comets expected to be visible this month.

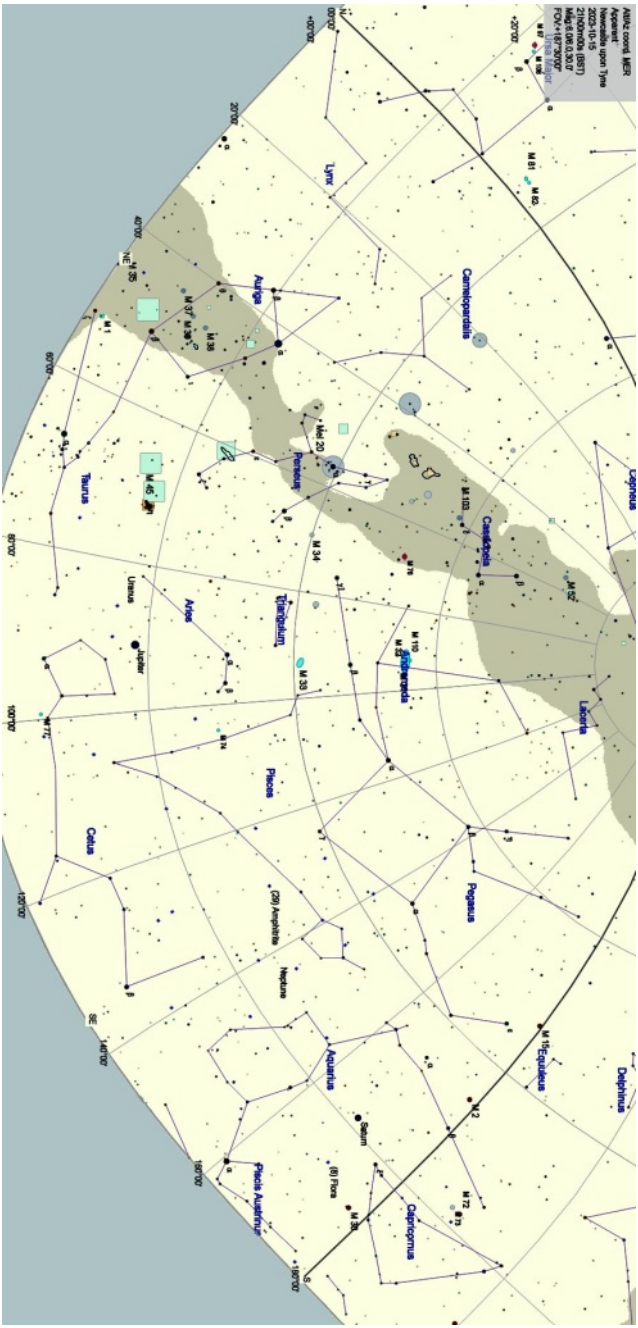
The Planets 15/10/2023

	Sun	Moon	Mercury	Venus	Mars	Jupiter	Saturn	Uranus
Rise	07:32	08:18	07:10	03:05	08:36	18:46	16:55	18:56
Set	18:08	18:13	18:10	16:52	18:24	09:45	02:30	10:45

The sky map looking E from Newcastle at 9pm on 15/10/2023.

Night Sky credits:

Data sourced from Cartes du Ciel, https://www.timeanddate.com/moon/phases/ and https://in-the-sky.org/



SCIENCE SLOT

Supernovae Remnants

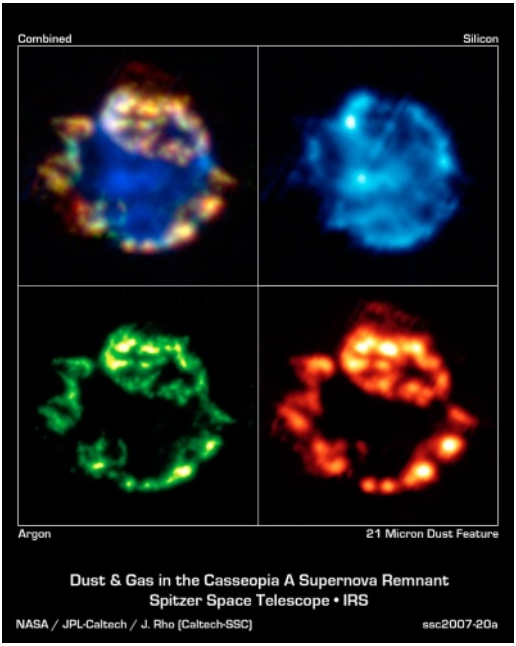
When a star substantially [>=6x] more massive than our Sun reaches the end of its life – which may be only one thousandth as long as our Sun will live [<=5 million years] - its ending will be rather more violent. Processes that will take the Sun a few 10's of millions of years will happen over a few hundred to a thousand years and at much higher temperatures and pressures. As a result the consequences will be in one of a number of types of explosion – a Supernova – and the outcome from this will be either a Neutron Star/Pulsar or Black Hole.

So let's consider some of the easier to locate Supernova Remnants visible in the northern hemisphere:

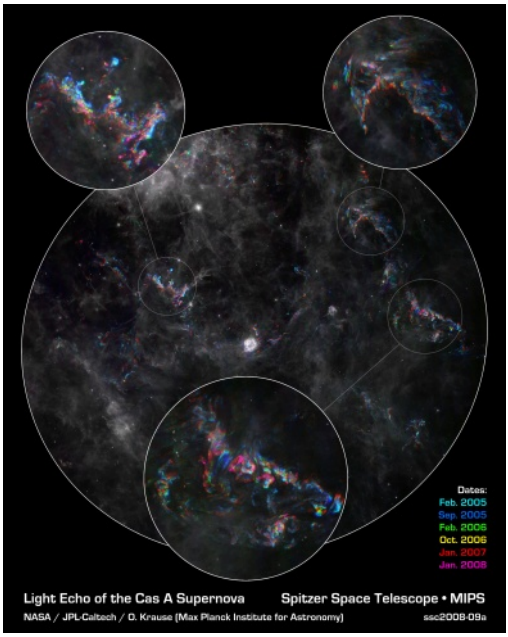
Cassiopeia A is a supernova remnant, containing a pulsar. Of all SNR it is one of the brightest – in the radio waveband – at frequencies above 1GHz [λ<0.3m]. The progenitor star was ~11,000Ly away and since it exploded in ~1667 the expanding bubble is now ~10Ly in diameter.

Unusually, at the time, this explosion was never formally recorded by an observer, though it is possible that John Flamsteed saw it as a 6th magnitude star. The most likely reason for this is that the progenitor star was very massive and underwent a core collapse supernova, ejecting a significant quantity of obscuring dust just prior to the remnant detonating (quite possibility Eta Carina will undergo a similar event sometime in the future). The object quite a low surface brightness, but is viewable in telescopes of >=250mm aperture [visually].

In 1948, Cas A was one of the first radio sources identified by Martin Ryle and Francis Graham-Smith using equipment located at Cambridge. The optical component was identified two years later. The expanding shell of material is now at a temperature of ~30 million Kelvin, moving



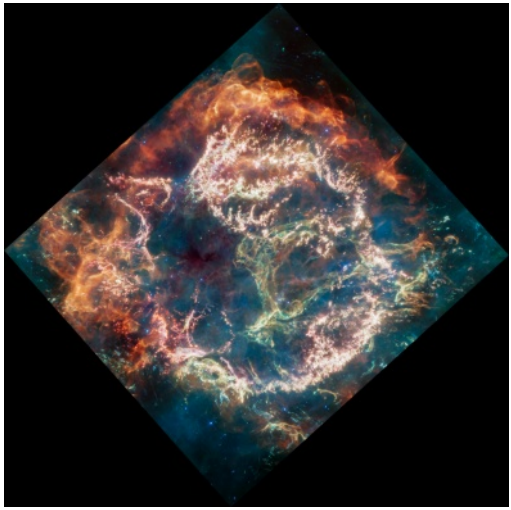
Cassiopeia A as seen by the Spitzer Space Telescope.



Light echoes of the Cassiopeia A supernova seen moving through space by the Spitzer Space Telescope over a three year period.

at around 5000km/s.

Since being first observed by radio telescopes, the shell of energised material is slowly cooling at a rate of about 1% per year. In 1999 The Chandra X-Ray Telescope located a compact and intense X-ray source which is the central Pulsar of the SNR. In 2005, the Spitzer Space Telescope discovered an infra-red reflection echo in a dusty gas cloud close to the SNR which had become re-energised by the higher energy light ejected during the supernova event. This resulted in confirming that the SN event was a type IIb Type II Supernova. This dusty gas cloud may have been ejected by the progenitor star some millennia before the remnant star exploded as a SN. Recently the James Webb Space Telescope has taken its first view of this object.



The JWST image of Cassiopeia A.
Credits: NASA, ESA, CSA, D. Milisavljevic (Purdue), T. Temim (Princeton), I. De Looze (Ghent University). Image Processing: J. DePasquale (STScI).

So, if you want to go in search of Cassiopeia A how do you locate it? Its coordinates are RA $23^h23^m24^s$ Dec $+58^d48^m54^s$ - it's visible in the Autumn sky, but can also be seen at other time of the year too, if you don't mind staying up late or getting up very early. Please check out the attached star chart.

SCIENCE SLOT

Star chart for Cassiopeia A.

Some other Supernova Remnants that might be worth tracking down:

1) Sh2-264 [Lambda Orionis], location RA $05^h26^m37^s$ Dec $+09^d57^m18^s$ - in Orion – visible in late Autumn to Spring – detonated about 1 million years ago – a supermassive star underwent a core-collapse supernova event. The star forms a 'triangle' between Beta and Gamma Orionis, close to his 'head'.

Star chart for Sh2-264.

2) Simeis 147 – the Spaghetti Nebula – RA $05^h39^m06^s$ Dec $+27^d59^m55^s$ – located between Auriga and Taurus. Discovered in 1952, it has a very low brightness requiring long exposure and narrow band imaging. Spanning 3 degrees – 6x apparent width of the Moon in the sky – it is one of the widest nebula of the whole sky as viewed from Earth. At a distance of ~3000Ly it is ~160Ly across. It is known to harbour a millisecond pulsar at its heart.

3) IC443 – location RA $06^h13^m06^s$ Dec $+22^d30^m31^s$ – the Jellyfish Nebula in Gemini. It is ~5000Ly away and detonated sometime between 3,000 and 30,000 years ago, creating a neutron star at its heart. The debris from this event is interacting with dust and gas clouds nearby. There is evidence that the progenitor star ejected at least one shell of material before it went supernova and that material being ejected has already and currently is interacting with nearby dust and gas clouds, creating a Hydroxyl MASER emission. There is some evidence of a gamma ray burster coincident with the object creating the

IC443 taken with a 12" f4 Newtonian reflector and a Canon 1000D.

Credit: Nigel Metcalfe

other emissions. In a different direction the blast wave is beginning to compress an adjacent neutral hydrogen cloud and may likely create the conditions for the formation of new stars in the next million years or so.

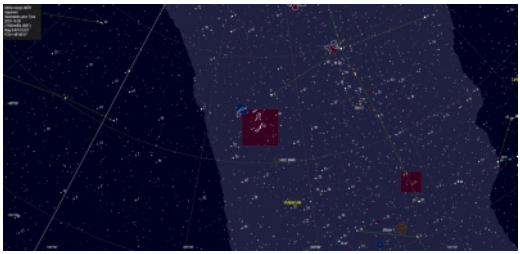
4) Westerhout W50 – location RA $19^h11^m49^s$ Dec $04^d59^m12^s$ - also known as the Manatee Nebula in Aquilla. Located ~18,000Ly away with micro-quasar SS433 very close by. The star which created these objects detonated ~2,000 years ago so we are seeing this SNR very young in its evolution.

5) Westerhout W44 – location $18^h31^m29^s$ Dec $-2^d05^m20^s$ – is a neutron star inside a nebula. 10,400 Ly away and detonated ~ 20,000 years ago. Located near Theta-1 Serpentis, it is buried within the band of the Milky Way

6) CTB1 (Abell 85) – location RA $23^h59^m24^s$ Dec $+62^d26^m51^s$ - has only recently been discovered. It is ~10,000Ly away in the constellation of Cassiopeia. At its heart is a Neutron Star.

7) Kesteven 79 – location RA $18^h52^m48^s$ Dec + $00^d41^m00^s$ is 23,000 Ly distant and ~9,500 years old. Located in Aquila, and also within the Milky Way.

8) Cygnus Loop – the Veil Nebula – a very popular visual and photographic target. Four main components, NGC6960, NGC6992-6995-IC1340, Pickering's Triangle and NGC6974-6979. Also known as Westerlund 79 or Sharpless 103.



Star chart for the Veil Nebula.

Spanning ~3 degrees of sky it is easily found in the wings of Cygnus, the Swan. It is one of the closest SNR's at ~1,750Ly and hence one of the visually brightest.

NGC6992/5 - the Eastern Veil Nebula.

Credit: Robert Williams

Extensively studied in UV and X-Ray it contains an X-ray source with a temperature of ~3M Kelvin. It is thought that the progenitor star weighed in at ~12-15 solar masses and as a consequence

SCIENCE SLOT

the SNR probably contains neutron star powering the visible emissions, though once has not yet been confirmed.

9) Object 3C-58 [SN1181] – location RA $02^h05^m38^s$ Dec+$64^d49^m48^s$. This object may be connected to a supernova event recorded in 1158. However there is evidence that there was a previous event in the same location many thousands of years previously. There are very few 'failed supernova' discovered in the sky, but the evidence suggests that this object may be one of them, in the end though it ultimately did detonate. Unusually the pulsar at the centre of this object is cooling/loosing energy very quickly [as pulsars generally go]. This energy loss – by a very large outflow of neutrons may indicate the presence of a – currently hypothetical – Quark Star.

10) G54.1+0.1 – this is a neutron star – location $19^h30^m31^s$ Dec +$18^d52^m00^s$ – that exploded in ~900BC. It is ~22,000Ly distant and is located in the diminutive constellation of Sagitta, close to the cluster M71.

11) W49B – also known as 3C398 – location RA $19^h11^m09^s$ Dec +$09^d06^m24^s$ - is a remnant formed from a type 1b or 1c supernova event. It exploded ~1000 years ago. It is located 33,000Ly away and current has a radio halo ~4 arc minutes across. There is a sizeable infra red bubble surrounding this object and X-ray telescopes have detected sizeable quantities of radioactive Nickel and Iron in this nebula. It is also very powerful at gamma ray wavelengths as a result of its – relatively – young age. Unlike most other supernovae events it also contains quite a lot of radioactive chromium and manganese [most supernovae generate radioactive nickel and copper]. Again these may be explained by its relative youth since detonation. The information available suggests that the progenitor star weighed in at 25 solar masses and underwent a core collapse prior to explosion. Because of interlaying dust between this object and Earth it is

uncertain whether there is a neutron star or black hole at the heart of this object. This object may be an indication of what Eta Carina may become when it detonates – though Eta Carina is substantially much more massive.

12) SN1054 – the Crab Nebula – location RA $05^h34^m32^s$ Dec $+22^d00^m52^s$ – one of the best recorded SN events. It has

The Crab Nebula taken with a 12" f4 Newtonian and a Canon1000D camera.

Credit: Nigel Metcalfe

been extensively studied at all wavelengths. Though recorded visually in 1054, it was not until John Bevis [1731] and William Parsons [in 1842] that they got a good look at this object. At magnitude 8.4 [Comparable to Saturn's Moon Titan] it is a decent target for visual telescope observing from a dark site on moonless nights and is a well known photographic object. Located ~6,500Ly away it is about 11Ly across [diameter ~7am [ref Moon is ~30am across]] and is expanding at ~1,500km/second. At its centre lies the Crab pulsar – rotating ~30/second. Made famous by Dr Joceleyn Bell Burnell when she recorded LGM1, using the very first radio telescopes in the UK. In the X-ray waveband it is one of the strongest sources of energy above 30KeV and also in the Gamma waveband above 10TeV. It is thought that the supernova was from a star weighing in at around 5 solar masses.

13) SN1572 – Tycho's object – location $00^h52^m20^s$ Dec $+64^d09^m00^s$ - also known as B Cass – this was a type 1a supernova event. It was – somewhat – responsible for debunking the previously held idea of 'fixed heavens'. Extensively observed by Tycho Brahe and also Johannes Kepler – two giants of Renaissance astronomy. During the supernova event it reached magnitude -4 [similar to Venus or Jupiter] and was visible for about 2 years. This was a Type 1a supernova. It is located between 6,500 and 13,000Ly away.

14) SN1604 – Kepler's Object – location RA $17^h30^m42^s$ Dec $-21^d29^m00^s$– this event was well studied as a result of observations from Tycho's object SN 1572. A type 1a supernova located ~20,000Ly away. It caused some controversy at the time since many astronomers were watching the conjunction of Mars and Jupiter and

thought that the 'new star' was somehow mystical [in relation to the Star of Bethlehem]. The object is now a very dim – visual - object [magnitude 19] but a strong source of radio and x-ray emissions. Also since discovery there is evidence that the expanding gas shell is interacting with the secondary object that triggered the explosion.

15) SN1885A – S Andromeda – location RA $00^h42^m43.11^s$ Dec $16^m0.4^s$ – the first supernova event to be observed in a galaxy beyond the Milky Way [in M31]. First seen by a French Astronomer in August 1885, follow up observations by German and Irish astronomers established this as being a supernova event. It reached visual magnitude ~+6 as maximum and was seen to be reddish in colour [unusual!]. It was declared a type 1a supernova event. However peculiarities suggested it was actually a subclass of type 1a and only two other events [SN 1939B and SN2002bj] are of a similar nature, so far discovered. Because this object was so close to the nucleus of M31 it required a large instrument - the 4m Mayall Telescope at Kitt Peak National Observatory - for a detailed investigation. It was also studied with the Hubble Space Telescope which found evidence of Iron, Manganese and Calcium in the objects spectrum.

So, hopefully these objects will get you fascinated in observing – and imaging – supernova remnants.

When and where will the next bright Supernova event happen in our Galaxy? - that is the £64,000 question. Top of the list is Eta Carina – but that is in the southern hemisphere.

In the Northern night sky there are a few candidates.....

1) Betelgeuse – Alpha Orionis – in the past few years Betelgeuse has got the attention of both amateur and professional astronomers alike. It is a 17.5±1.5 solar mass star with spectral class M1-M2 1a-ab Red Supergiant star. It is between 760 and 1,020 times the diameter if the Sun [as wide as the orbit of Saturn] and is between 90,000 and 150,000 x more luminous with a surface temperature of ~3,500 centigrade. It takes around 35 years to rotate on its axis [Sun takes ~30 days!]. Based on current models Betelgeux clock is already ticking down to detonation. When will it happen? – likely in the next 1 million years. If and when it does it may have quite an impact on Earth as its distance [~550Ly] is uncomfortably within the likely blast zone of this star.

2) IK Pegasi – Type 1a SN.

3) Rigel (β Orionis) – Type IIn – peculiar?

4) Rho Cassiopeia - Type IIL.
5) VY Canis Majoris – Type II.
6) Mu Cephei – Type IIn/IIb.
7) WR2 in Cassiopeia – Type 1b/1c – with Gamma Ray Burster possible WR 2.
8) HD179821 in Aquila – Type IIL.

See wikipedia for a more comprehensive list.

Robert Williams

A wide-field view of the Cygnus area taken from Kielder, including the Veil Nebula, top left.

Credit: Robert Williams

Space Kids - Light Year Academy - June

The entire team were brilliant! Liam was particularly engaging and the perfect person to open the presentation. That said, every member of the team displayed not only an impressive expertise in their specialised field but also a dedication to enhancing the visitor experience. The transitions between presentations were seamless, and it was evident that this was a team that functioned really well together, took pride in their respective roles and were delighted to share their knowledge.
Overall, a truly excellent experience, from which we drove away feeling enriched and amazed! We had a 90-minute car journey there and back and, although the return journey was quite late for my young daughter, it was definitely worth it. She can't wait to tell her school friends about the experience! My thanks to all involved.

Jonathan – Scottish Borders

GALLERY

We would love to display your images here, whether they are taken up at Kielder or not. Please send them to

admin@kielderobservatory.org

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

KIELDER OBSERVATORY
Infinite Inspiration

A new supernova in the bright spiral galaxy Messier 101 caused some excitement amongst the amatuer astronomical community, as this galaxy is a popular target for astrophotography. Here is it is seen from Kielder.

Credit: Dan Monk.

Some of our guests contemplate the beauty of the Kielder night skies.

GALLERY

The first quarter moon, always a good time to look at craters.

Credit: Guy Haveron

GALLERY

View from the Gillian Dickinson Astro_imaging Academy building.

Sunspots taken from the Observatory on May 31st (through a solar filter).

Noctilucent clouds seen from the Observatory overnight on June 14th/15th.

The trek up the forest path is well worth the trouble once you reach the car park. Greeted by a friendly volunteer we then proceeded into the observatory where Guy gave an amazing talk. I am not exaggerating when I say it was jaw dropping. There was one point when I suddenly became aware that my mouth was wide open in amazement. The photos and graphics made you realise just how insignificant our world and also our own Sun are in the grand scheme of things. It really is mind blowing. Having visited a few years ago I was impressed at how much more is now known since then. Sadly the cloud cover meant that we were unable to star watch, but the staff still managed to give us a great night. Thank you for such a different sort of adventure.

Liz, Whitley Bay

Kielder Observatory - a beacon for dark skies

https://kielderobservatory.org

KIELDER OBSERVATORY

Infinite Inspiration