ORBIT

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The magazine of the Irish Astronomical Society

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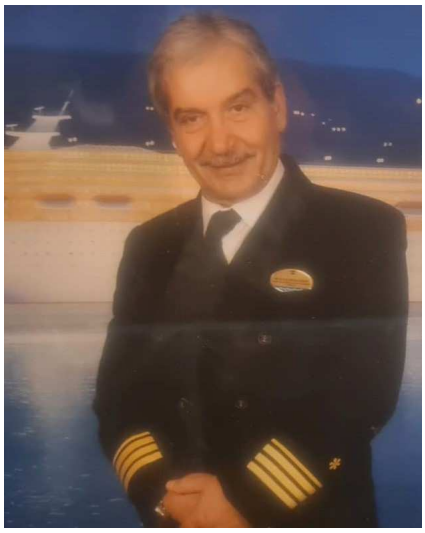
Contents

On the cover

Nicola Fletcher's trip to Yllas National Park (68° N) in Finnish Lapland earlier this year coincided with a stunning display of northern lights. Nicola was staying in a glass cabin so had a good opportunity to see the aurora. The aurora began around midnight on 16th April and continued until 4am, with the best views of multicoloured curtains from 12-1am.

The cover photos were taken on a mirrorless Canon R6 with a Canon EF 14mm f/2.8 L II USM lens, at 5 sec exposure, ISO 1000. Images were minimally processed in Adobe Lightroom.

IAS News



The Society would like to acknowledge the very generous donation of astronomical equipment by the family of the late Nicolas Mengessidis. Nicolas had a life-long interest in astronomy and that tied in with his career served with Royal Caribbean Cruise Lines. Many thanks also to a family friend, Rod Large, who has been in touch with us about Nicolas.

* * *

Cassandra Fontaine is a UCD Masters student who has been helping the IAS for a number of months now in areas of social media presence. She has contributed many posts to sites such as Facebook and Instagram, and has been working with John Dolan on this. We are very grateful for all that Cassandra has done to help raise the Society's profile.

* * *

We are currently planning a Society outing to Birr Castle on September 16th which will also coincide with an astrophotography workshop being organised by Marty McCormack. More details to follow in due course.

News notes

Euclid to hunt for Dark Matter

The ESA's *Euclid* mission is scheduled to launch this July on a SpaceX rocket from Cape Canaveral. The craft will be placed at the Sun-Earth L2 point where it will make a 3D-map of the Universe (with time as the third dimension) by observing billions of galaxies out to 10 billion light-years, across more than a third of the sky.

While dark energy accelerates the expansion of the Universe and dark matter governs the growth of cosmic structures, scientists remain unsure about what dark energy and dark matter actually are. By observing the Universe evolving over the past 10 billion years, Euclid will reveal how it has expanded and how structure has formed over cosmic history – and from this, astronomers can infer the properties of dark energy, dark matter and gravity, to reveal more about their precise nature.

The origin of the Geminids

The Geminid meteor shower in December are one of the most reliable of the year and are associated with the asteroid 3200 Phaethon, found in 1983.

Phaeton is an odd asteroid, just 6 kilometres across. It's not icy, but it has been seen with a dusty tail, leading some to refer to it as a dusty comet. Phaeton's orbit takes it within 0.14 AU of the Sun, where its surface is baked like a dry lake bed, causing a trail of dust.

Astronomers have assumed that the Geminid dust trail formed gradually as dust accumulated with each of Phaeton's orbits, following the cometary process. But a new study finds this isn't the case. Instead the team found the Geminids appeared rapidly.

They used data from the Parker Solar Probe, which measured the size and composition of Geminid dust particles as well as their relative speed and direction.

The best model from the analysis implies that the origin of the Geminids was not slow and steady, but rather due to an impact event where Phaeton was struck by a smaller asteroid. While it addresses one of the problems with the "dusty comet" model, it only suggests an impact event as one scenario.

Earth's rapid formation

Earth formed about 4.6 billion years ago. That simplistic statement is a good starting point for understanding our planet and Solar System. But, obviously, Earth didn't form all at once. The usual number given for the process is about 100 million years.

New research suggests that Earth formed more quickly in only a few million years.

The 100 million-year number is part of a general scientific narrative describing Earth. Earth cooled, an atmosphere coalesced, then a magnetic shield, plate tectonics, single-celled life in the oceans, etc. Another significant part of the narrative suggests that after it formed, it acquired its water through chance collisions with asteroids and comets.

A paper in the journal *Nature* shows that the Earth formed by the very fast accumulation of small millimetre-sized pebbles. Based on the findings, it appears that the presence of water on Earth is a by-product of its formation.

Oort Cloud planets?

Our solar system has had a chaotic past. Earth and the other planets are now in stable orbits, but while they were forming they experienced drastic location shifts. Jupiter was likely much closer to the Sun than it is now, and its shift not only shifted other planets but also cleared the solar system of debris, tossing much of it to the Oort Cloud.

The Oort Cloud is at the gravitational edge of the solar system. While most of the Oort Cloud debris is likely relatively small, it's possible that there are planet-sized objects lurking out there.

Some of the debris cast out of the inner solar system was probably thrown even farther. Given such speed, they escaped the Sun's gravity and were set adrift in interstellar space. We know this is possible because we've had at least two cometary visitors from other star systems. We have also observed rogue planets that have broken the gravitational ties of their parent star.

But this also raises an interesting question. If a young planetary system can cast off comets and planets, can other star systems capture some of these worlds?

The gravitational dance is a bit tricky, because to be cast off a planet has to gain enough kinetic energy to leave the pull of its star. But that also means it is difficult for another star system to keep it. However, if the gravitational tug of the galaxy itself can dampen the motion of a rogue planet, and thus a small fraction of celestial encounters will see a star catch the planet and claim it as a new world. The best chance for this is not when a planet passes close to a star, but rather when it drifts just within its Oort cloud.

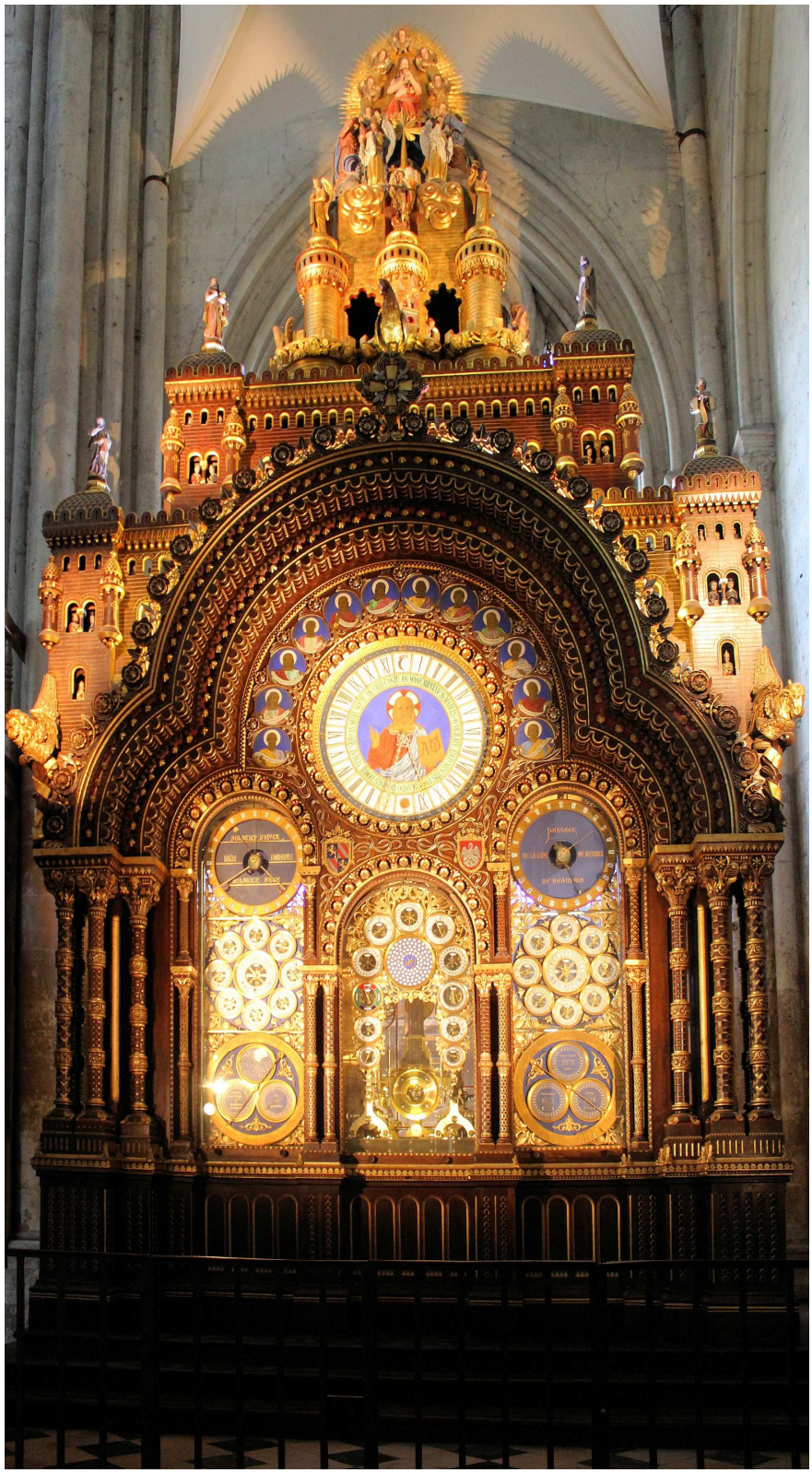
Passing time at Beauvais

by Peter Denman

For Irish travellers heading to Paris via Ryanair, Beauvais in northern France is simply where they land to take a coach transfer for the ninety-minute ride onwards to the city of light. But Beauvais has its own treasures. It is the site of a huge but still incomplete Gothic cathedral from the thirteenth century, dominating the city's skyline. And inside the cathedral are two items which might be worth the attention of anyone interested in astronomical curiosities.

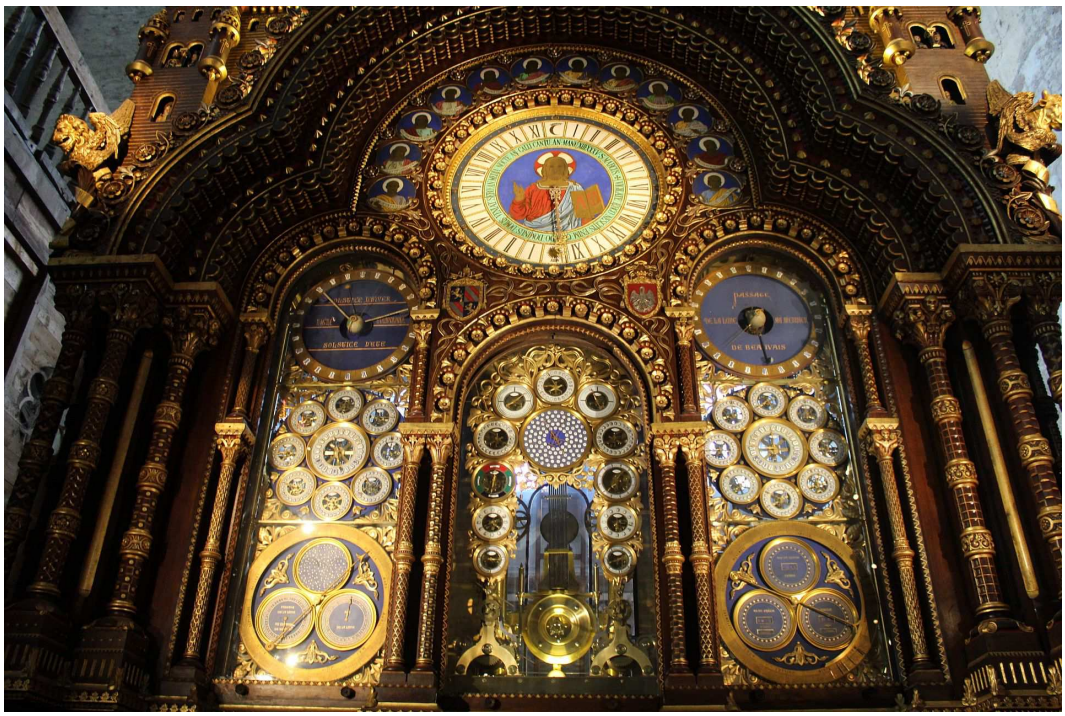
The cathedral has two significant astronomical clocks. One is a medieval clock dating from the fourteenth or fifteenth century, its face showing twelve hours and the phases of the moon. This is possibly the oldest fully preserved and functioning mechanical clock in Europe, and thus of considerable historical significance to horologists.

But the really eye-catching piece is of more recent date – an astronomical clock constructed in the 1860s, the masterpiece of a local clockmaker named Auguste-Lucien Verité. Verite's clock is an imposing construction, about forty feet high, sixteen feet wide, and over six feet in depth. The elaborate oak case is covered in gold leaf and conceals the eighteen weights and multiple escapements and oscillators that drive the clock's many displays, automata and sound effects. There are 52 dials showing, among other information, the times of sunrise, sunset, moonrise, and moonset; the phases of the moon, the solstices, the position of the planets and stars, sidereal time, the declination of the sun, the seasons, the length of the day, the difference between true and mean time, the date of Easter, the current time in 18 cities around the world (Sydney, Rome, Constantinople . . .), and the tidal hours. And of course, it gives the "public" or civic time on the large central dial, marked with twenty-four hours. All such knowledge (and much more) is



the astronomical clock in Beauvais Cathedral (all photos by Peter)

available to us through a mobile phone nowadays, but in the nineteenth century this instrument did an impressive job in collating a range of information.



Close-up of the various dials that are part of the astronomical clock

Above the display dials are ranged some seventy mechanical moving figures and tableaux enacting the Last Judgement - that is, the end of time – every hour on the hour. These are arranged hierarchically, with the earthly estates on the lower levels – soldiers, tradesmen, a ship sailing past a castle, - all overlooked by a large figure of Christ at the apex, surrounded by biblical figures and trumpet-blowing angels. With a wave of his arm, Christ is shown dispensing judgement as he consigns some figures to paradise and others to hell.

An astronomical clock cannot really be regarded as an astronomical instrument; rather, it is a resource that uses and deploys astronomical data. It was suggested earlier that the Beauvais clock is a curiosity, given its mix of post-enlightenment mechanical precision, extended view across the globe and cosmos, and apocalyptic medieval imagery. It is also wonderful. There are or have been many other astronomical clocks in France and other European countries, but few as ornate and elaborate as this one (was there ever one in Ireland?); many are just a matter of two or three display dials. Most date from medieval times, and may have been produced in order to exhibit a clockmaker's prowess or to please a patron, or to satisfy civic pride.

The historian Lynne White in her book Medieval Technology and Social Change has written of the importance of such clocks generally in the late middle ages. “”Some of the civic pride which earlier had expended itself in cathedral-building now was diverted to the construction of astronomical clocks of astounding intricacy and elaboration. No European community felt able to hold up its head unless in its midst the planets wheeled in cycles and epicycles, while angels trumpeted, cocks crew, and apostles, kings and prophets marched and counter-marched at the booming of the hours.” The clock at Beauvais exhibits all these features – apart from the epicycles. As such, it is a remarkable nineteenth-century throwback that reworks the ambitions of the fourteenth century and perpetuates a lineage extending back through astrolabes and orreries to the Antikythera mechanism of ancient Greece.

Explore more at…

en.wikipedia.org/wiki/Beauvais_astronomical_clock

paulmarina.com/beauvais-cathedral/

The Moon dial on the astronomical clock

Sun, Moon, Sea, and Stars

in Western Australia

by Angela O'Connell

Somebody once asked me how far would I go to see a total solar eclipse? I thought about it and decided that it depended on the location. Now, I know that I should have said 16,000 kilometres because that's the approximate distance from Ireland to the small town of Exmouth on a narrow piece of land on the very remote North West Cape, Western Australia where the most recent solar eclipse was visible on April 20, 2023.

We opted for an ocean cruise that would take us into the path of totality and sailed on board the P&O ship, the *Pacific Explorer*.

Billed as the "Ningaloo King of Eclipses" cruise, it was a five-day trip that would take us up along the West Coast of Australia, from Fremantle just south of Perth, around the Ningaloo Coast and into the eclipse path near Exmouth and then return us to Fremantle.

We were in good company as both Fred Espenak, renowned eclipse chaser, author and photographer, otherwise known as Mr Eclipse and Michael Zeiler, specialist eclipse mapmaker were on board. Some of the other passengers included a Sky and Telescope group of 140 people. Our eclipse expert and host was Kelly Beatty, retired editor of Sky and Telescope. Furthermore there were guest astronomers on board from the Astronomical Society of Australia and they were going to provide talks on cutting-edge astronomy in Australia. This would be an 'astrofest' with a difference!

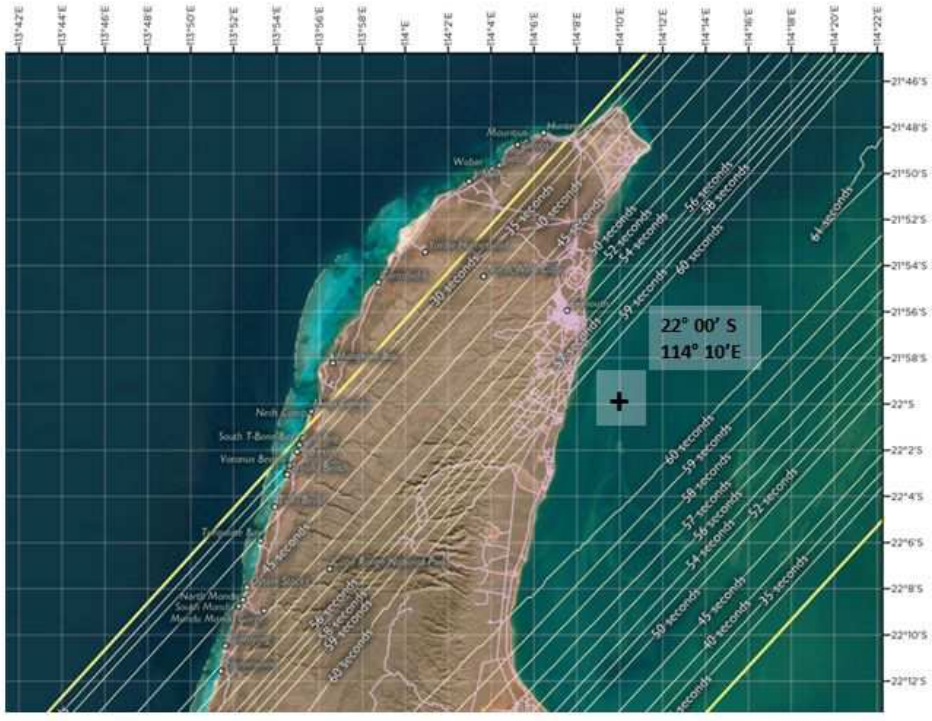
We were going to witness a hybrid solar eclipse, which would track over the North West Cape. A hybrid combines elements of both an annular and a total eclipse. The annular part took place at the beginning and end of the track while we were expecting to see a total eclipse from near Exmouth. One of the features of a hybrid eclipse is that the sun and moon are virtually the same size and this emphasises Baily's beads and the crimson chromosphere.

We were optimistic that there would be clear skies on eclipse day. The Southern Cross had been visible in the night sky all week and there was a magnificent sunset the evening before eclipse day. We were not disappointed. When we awoke on the day there was a beautiful blue sky and the ship sat stationary just offshore in the Exmouth Gulf.

The captain had decided, with input from Kelly Beatty, that they would anchor a short distance from the coast where there was the best option for maximum eclipse viewing with 60 seconds of totality.

We adjourned to deck 14, the Lido Sundeck, aft, by the Oasis Pool, not too far from the ship's Pantry, the buffet restaurant, where we could go and get breakfast or a snack as required.

First contact, when the moon took the first bite out of the sun's disc, was spot on, a reassuring sign that the cosmic wheels were turning precisely on time. It was 10:04 AM and the show had begun.



➤ Detailed eclipse track at the NW Cape, Western Australia with our estimated position marked at 22° 00' S, 114° 10' E.

Map courtesy of Michael Zeiler/GreatAmericanEclipse.com

The Australians have a practice of acknowledging the Traditional Owners of the land on which they travel and paying respects to their Elders. In this case, the Jinigudira, were acknowledged at the lectures presented on board, as the Aboriginal owners and custodians of the Country along the Ningaloo Coast.

Angela and Terry viewing the partial phases with Sky and Telescope eclipse viewers

The Halper family with their handcrafted eclipse viewers, highlighting their travels Down Under. One of them has actually used a Covid test kit for decoration!

The light fell as the moon made its journey through the sky, obscuring the sun's disc over the following 90 minutes or thereabouts. We spent time observing its progress with eclipse viewers provided by *Sky and Telescope*. It was also possible to project the sun's image onto a sheet of paper with binoculars, and get views of the partial phase.

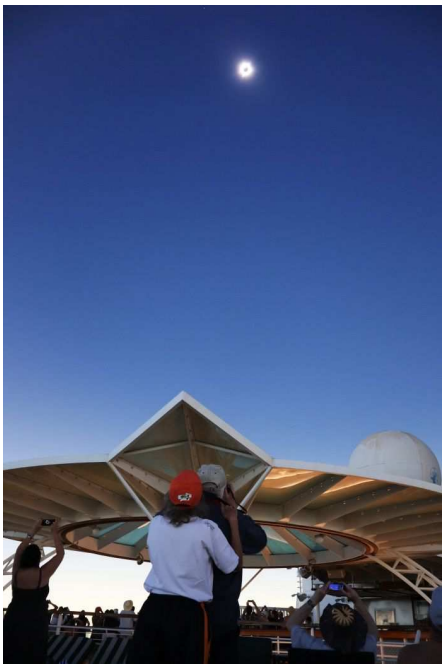
Everyone had settled down at this stage and the decks were crowded with good-humoured expectant observers some lounging on deckchairs chatting, others reading novels and some younger kids were swimming. There were many native Australians on board, curious to see their first eclipse. And of course, regular eclipse chasers, like ourselves were present along with a few serious photographers, easily spotted with their telescopes and cameras.

The cheering and clapping began as we were suddenly plunged into a deep twilight. Second contact came and totality had begun. It was truly a beautiful sight. With my binoculars I could see the huge black disc of the moon aligned with the sun and surrounded by tiny beads of light. The corona appeared with fine white streamers flowing out in a wonderful symmetric pattern. It was the classic butterfly shape, typical of solar maximum. A large red prominence arced out of the sun's disc looping back to it at the 9 PM position. I could see the planet Jupiter, visible just above the sun in the same field of view.

There was a double intensity of diamond rings at the end, both a solitaire and a baguette. The darkness dispersed as the shadow rushed away. It was a high impact eclipse, taking place over just 60 seconds! Nonetheless, time seemed to be suspended during the spectacle. There was great jubilation and celebration at third contact, when it was over. Spectators were already making plans to see another. Luckily for the Australians, there are four more eclipses coming up in Australia in the next 15 years.

➤ *Totality from our location at the Oasis Pool, Lido sundeck*

➤➤ *Ningaloo Solar Eclipse at third contact. (c) Ship's Photo Gallery, Pacific Explorer.*



Skynotes

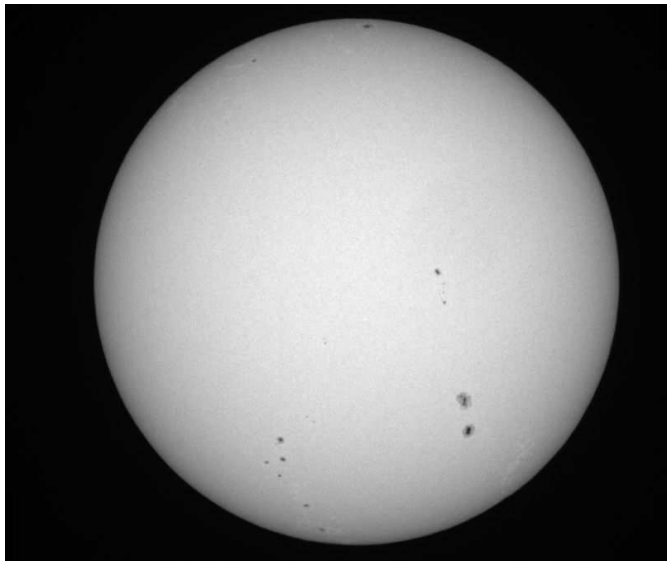
by Michael McCreary

July to September 2023

Universal Time is used throughout - add 1 hour for Irish Summer Time

The Sun

- On July 1st, just 11 days after the summer solstice, The Sun is in the constellation of Gemini. Sunrise at Dublin that day is 04:01. It transits the meridian at 12:28 at 57.96º altitude. Sunset is 20:56.
- On the 6th of July, the Earth is at its furthest distance from Sun for the year. Called aphelion, the Sun will be approximately 152.1 million km away.
- The autumnal equinox occurs on the 23rd of September at 06:51h. On this day, the Sun crosses the celestial equator travelling from north to south.
- The equation of time is zero on the 1st of September when the Sun transits at 12:24. Sundials show the correct time on this day.
- Sunspot activity for Solar Cycle 25 is far above expectations. Again, a reminder to always uses suitable equipment to view the Sun safely.
- The next solar eclipse is an annular one. Taking place on the 14th of October, it will cross North, Central and South America. Nothing will be seen from Ireland



Michael Murphy took this image of the Sun on May 30th at 9am using an Altair Lightwave EDR70 refractor equipped with a TS Herschel wedge.

Camera was a ZWO ASi120MM. The images were captured in SharpCap and processed in Imppg and Pixinsight.

The Planets

Mercury is a poorly positioned evening planet, best seen low in the WNW as the sky darkens at the end of July. August sees the planet remain near the western horizon, but very low and setting only a little over one hour after sunset. Mercury's morning visibility begins on September 16th when it should be visible to the unaided eye. Its greatest elongation in September is at 18º in the morning sky on the 22nd.

Venus is visible as a thin crescent, in our July evening sky in the west. However, it will be lost in the solar glare by the end of the month. On the 12th, Venus, Regulus (in Leo), and Mars are in a 5.5º long line slanting towards the western horizon. Venus is at inferior conjunction on August 13th(between Earth and Sun) and therefore not visible. It returns to morning visibility on the 26th, rising at 05:10h (mag. -4.3). By September, it is an impressively bright morning planet rising four hours before the Sun.

Mars is very low in our evening skies in the constellation of Leo, setting one hour after sunset on the 31st of July. It may be briefly seen in August before being lost in the solar glare. In September, Mars is furthest from the Earth, so at this small apparent size needs a telescope to observe.

Jupiter is an improving morning planet, best observed at the end of July. There is a crescent Moon nearby on the 12th. August sees the King of the planets rising late in the evening and blazing brightly in Leo. On, September 4th, the mag. -2.6 planet is stationary and will then begin its retrograde motion.

Saturn rises just after midnight on the July 1st and is best observed at the end of that month. On August 3rd, the planet is in conjunction with the Moon in Aquarius. Saturn is at opposition on August 27th at mag. 0.4. In September, Saturn should be an easily observed evening planet and reaches 24º altitude when on the meridian (due south).

Uranus is a morning object in July at mag. 5.8 so binoculars are a better option to catch it. The planet pops up in the evening sky from September 18th.

Neptune is stationary on July 1st and will then begin its retrograde motion. It will become visible in our evening sky at the end of August at mag. 7.8 in Pisces. Steadily held binoculars or a small telescope are required to see it. The planet reaches opposition on September the 20th and is therefore at its best visibility of the year.

Variable Stars

Algol (β Persei, varies from 2.1m to 3.4m)**:** Minima are predicted for Jul 16d 03h 22m; Jul 19d 00h 11m; Aug 8d 01h 51m; Aug 10d 22h 40m; Sept 20d 02h 01m; Sept 22d 22h 49m.

The following Mira-type stars are approaching maximum: R Com (Jul, mag. 8.2); S CrB (Jul, mag. 7.3); RS Leo (Jul, mag. 9.7); X Oph (Aug, mag 6.8); R Aqr (Aug, mag 6.5); V CrB (Sep, mag 7.5); X Cam (Sep mag. 8.1). All dates and magnitudes for Mira stars are approximate.

Meteors

The **Delta Aquarids** (south component) peak on the 28th of July. This is a morning sky shower.

The **Alpha Capricornids**, a minor shower with a ZHR of 5, reach their maximum on the 30th of July.

The **Perseids** peak at 03h on the morning of August 13th this year. Conditions are favourable as their maximum occurs three days before New Moon.

Bright star lunar occultations (at Dublin) - *produced with IOTA's Occult 4 software*

Date	Star (Mag.)	Event (and Cusp Angle °)	Moon Ill.
Aug 5	27 Psc (4.9)	reappears 1h 21m 47s (40N)	-84%
Aug 5	29 Psc (5.1)	reappears 3h 25m 46s (53N)	-84%
Aug 29	37 Cap (5.7)	disappears 22h 00m 54s (32N)	+98%
Sep 5	Delta Ari (4.4)	disappears 3h 44m 38s (-50N) / reappears 4h 50m 10s (74N)	-68%
Sep 5	32 Tau (5.6)	reappears 23h 22m 57s (25S)	-59%
Sep 8	136 Tau (4.6)	disappears 1h 30m 41s (-20N) / reappears 2h 01m 31s (42N)	-38%
Sep 10	76 Gem (5.3)	reappears 2h 54m 41s (38S)	-20%
Sep 28	27 Psc (4.9)	disappears 21h 42m 45s (88N)	100%
Sep 28	29 Psc (5.1)	disappears 23h 35m 24s (83S)	100%

Cusp Angle (CA) is the angle of the event around the limb of the Moon measured from the nearest cusp. Negative values (-) indicate a bright limb event. The cusps are usually N (north) or S (south) but can be E (east) or W (west) near Full Moon.

Stock and his clusters

July 8th is the one hundredth anniversary of the birth of Jürgen Stock (1923-2004), a German astronomer whose named is appended to 24 sparse open star clusters scattered along the Milky Way. He catalogued these groups while undertaking a photographic survey in 1951. Most are challenging to recognise but many of us will have observed the more prominent Stock 2 (the Muscleman Cluster) in Cassiopeia, and Stock 23 (Pazmino's Cluster) in Camelopardalis. Of the 24 found by Stock, four are too far south to be seen from here.

Stock began his career in Cleveland, Ohio and was later asked to do site tests in Chile for the University of Chicago who were looking to establish an observatory there with a 1.5-m instrument. His trip was to have only lasted a few weeks but Stock ended up spending three years conducting detailed surveys throughout the region. Stock's reports about the quality of the surveyed sites also came to the attention of the young European Southern Observatory organisation who were about to sign contracts with South Africa, and these convinced them to instead join the Americans in Chile.

An observing article about Stock clusters appears in an issue of the RASC journal at tinyurl.com/2mm85brc and sketches of all the objects by Belgian amateur Jef de Wit are gathered at tinyurl.com/489h3tyj

A list of Stock clusters by constellation is at www.stellar-journeys.org/cluster-stock-tour.htm and filtering the (version 8.1) SAC database from www.saguaroastro.org/sac-downloads/ will give their coordinates, etc.

- JF

Lunar phases and Lunation

Each cycle of the Moon (new moon to new moon) is called a lunation and each lunation is given a specific sequential number.

There are various numbering systems, each differing only by when the first new moon in the sequence is. A popular system is the **Brown Lunation Number** which refers to Lunation 1 as the new moon of January 17 1923.

You will note in our lunar phase table for January to March 2023 that the Lunation Duration varies from month to month. In fact the difference between the shortest possible lunation and the longest is approximately eight hours, which is significant.

The reason of the variation is because the Earth-Moon system does not move at constant speeds in perfect circles. Throughout the year the alignment of the elliptical path of the Moon relative to the Earth's orbital path around the Sun changes as does the movement of both bodies. This means that the period of time between each new moon will vary from month to month. It also gives rise to the phenomenon known as **libration**.

Major Librations Jul - Sept 2023: Maximum librations are given below for the period - note that libration is still favourable two to three days before and after a given date.

Date	Size (°)	P.A. (°)
Jul 15	7.2	219
Jul 28	8.4	66
Aug 10	8.2	229
Aug 26	9.0	55
Sep 7	8.9	229
Sep 23	8.9	43

Moon's Phases

Lunation	New Moon	First Quarter	Full Moon	Third Quarter	Lun/Duration
1243			Jul 03d 12h 38m	Jul 10d 02h 47m	29d 13h 55m
1244	Jul 17d 19h 31m	Jul 25d 23h 06m	Aug 01d 19h 31m	Aug 08d 11h 28m	29d 15h 06m
1245	Aug 16d 10h 38m	Aug 24d 10h 57m	Aug 31d 02h 35m	Sep 06d 23h 21m	29d 16h 02m
1246	Sep 15d 02h 39m	Sep 22d 20h 31m	Sep 29d 10h 57m		29d 16h 15m

Perigee and Apogee

The Moon's orbit path around Earth is elliptical in shape. This means the distance between Earth and the lunar orbit varies from day to day. The point of the path that is closest to Earth is called **perigee** and the point furthest from Earth is called **apogee**. When the full moon occurs at perigee, the Moon appears at its largest from Earth and is popularly known as a Super-Moon. When it occurs at the apogee it is at its smallest and is occasionally referred to as a Micro-Moon. The closest full moon of 2023 is that of August 31st.

Perigee		Apogee	
Date & Time	Distance	Date & Time	Distance
Jul 04d 23h 24m	360,149 km	Jul 20d 07h 56m	406,289 km
Aug 02d 06h 52m	357,311 km	Aug 16d 12h 54m	406,289 km
Aug 30d 16h 54m	357,181 km	Sep 12d 16h 42m	406,291 km
Sep 28d 01h 59m	359,181 km		

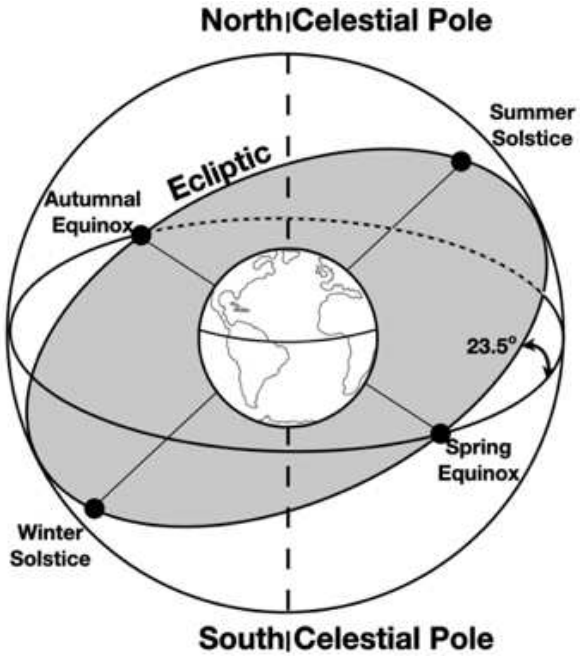
Full moon on September 29th is just a day after perigee and is also this year's Harvest Moon. The term is given to the full moon which falls closest to the autumn equinox.

The Moon and the Planets

Due to the relatively close proximity of the Moon to the Earth and because the Moon rotates around the Earth, the end result is that the Moon appears to move across the sky from West to East relative to the backdrop of stars and planets.

The Moon's orbital plane has a 5° tilt to the Earth's orbital plane around the Sun and so the Moon is always located somewhere between 5 degrees above and 5 degrees below the ecliptic which is the line the Sun appears to trace out in the sky throughout the year (see diagram, below). This is also the region where we can locate the planets and the zodiacal constellations.

So, during its journey, the Moon appears to pass in front of, or very close to various planets and stars. The complex movements of the planets, the Earth and the Moon's tilt means that these events vary greatly from month to month. The table below lists some upcoming lunar-planetary close approaches.



DATE	TIME	EVENT
Jul 07	03:10	Saturn 2.7°N of Moon
Jul 08	14:12	Neptune 2.5°N of Moon
Jul 11	21:21	Jupiter 2.2°S of Moon
Jul 12	17:48	Uranus 2.3°S of Moon
Jul 19	08:56	Mercury 3.5°S of Moon
Jul 20	08:37	Venus 7.9°S of Moon
Jul 21	04:00	Mars 3.3°S of Moon
Aug 03	10:26	Saturn 1.5°N of Moon
Aug 04	22:02	Neptune 2.5°N of Moon
Aug 08	09:44	Jupiter 2.9°S of Moon
Aug 09	01:03	Uranus 2.6°S of Moon

DATE	TIME	EVENT
Aug 10	01:47	Venus 13.3°S of Moon
Aug 18	11:26	Mercury 6.9°S of Moon
Aug 18	23:07	Mars 2.2°S of Moon
Aug 30	18:08	Saturn 2.5°N of Moon
Sep 01	07:21	Neptune 1.4°N of Moon
Sep 04	19:47	Jupiter 3.3°S of Moon
Sep 05	08:45	Uranus 2.8°S of Moon
Sep 11	12:59	Venus 11.4°S of Moon
Sep 13	17:40	Mercury 6.0°S of Moon
Sep 16	19:20	Mars 0.7°S of Moon
Sep 27	01:29	Saturn 2.7°N of Moon

Observation experiment

Even though there is approximately 29.5 days between each full moon, it only takes the Moon approximately 27.3 days to complete one orbit of the Earth. The discrepancy is due to the fact that a full moon occurs when the Sun, Earth and Moon are in alignment but as the Moon goes around the Earth, the Earth is going around the Sun. So by the time the Moon makes a full Earth orbit, our relative position to the Sun has shifted and so the Moon has to travel a bit further to again align with the two bodies.

It is easy to measure the time between two full moons, but to measure an orbit around the Earth is more difficult. Over the course of the three months, Saturn only moves about 5° along the ecliptic (that's only 1.4% of the entire ecliptic circle) so, its position over the period is relatively the same. As we can see from the table, in that period, the Moon makes three complete circuits of the ecliptic between July 7th and September 27th (i.e. it starts off near Saturn and passes it three times). That is 82 days and if we divide this by 3 we get 27.3 days – i.e. the period it takes the Moon to fully orbit the Earth – It's amazing what you can deduce just with simple observations.

Did you know?

Even though we are at the height of Summer in the Northern Hemisphere, on July 6th at 20:06 the Earth will be 152,093,251 km from the Sun. This is furthest it will be from the Sun in 2023 (i.e., its point of Aphelion). It's nearly 5 million km further from the Sun at it closest point (Perihelion) on the 6th of January.

90 with the C-90

by Kevin Berwick

For various reasons, I didn't get much observing done this Spring. It certainly wasn't due to a lack of clear nights; I feel it has been very clear here in Dublin recently. However, where I live on the coast, it has been quite misty when cloud-free and this has put me off from observing some nights.

Of course, the main reason I haven't observed is sheer unadulterated laziness. I am simply making excuses. Physicists often overlook one of the most powerful forces in nature, the force of attraction between the human rear end and a couch as night approaches. I need to try harder.

In this article, I look at a couple of bright stars that are often overlooked in night sky guides. The article concludes with a look at the Beehive cluster, M44.

Pollux

Gemini, the Twins, is a distinctive constellation that, for me, marks the depths of Winter here in the Northern hemisphere. Unlike many constellations, it actually does look like a pair of stick figures rising almost horizontally above the rooftops from my garden. Somewhat more poetically, Alfred Lord Tennyson, in his poem "Maud", name-checks both Auriga and Gemini to identify the season of Winter as

> *….and the Charioteer*
> *And starry Gemini hang like glorious crowns*
> *Over Orion's grave low down in the west.*

In the C90, Pollux is a yellow/orange star in a fairly blank region of sky, devoid of other stars. It is interesting to compare it to its non-identical twin, Castor, which is bluish white and, presumably, much hotter than Pollux.

"Who Mourns for Adonais?" (1967), is an episode of *Star Trek: The Original Series* written by Gilbert Ralston and Gene L. Coon. In it, the star ship *Enterprise* is approaching Pollux on a survey mission. Suddenly, a huge energy field in the shape of a glowing green hand materializes and seizes the *Enterprise*. An apparition who identifies himself as the god Apollo appears on the bridge and invites the crew down to the planet—an invitation they can't refuse.

Critics noted that the episode, while occasionally memorable, was "undone by lazy scripting and bizarre dialogue". I must watch it as a matter of urgency.

α Leonis (Regulus)

It is very easy to locate Regulus at the base of the Sickle asterism, a pattern representing the head of the constellation Leo. Although a prominent star, this object often gets very little mention in guides to the night sky. This is odd, considering that Regulus is one of the principal stars of the Spring sky and can be easily seen with the naked eye.

Quite frankly, once viewed telescopically, it's quite apparent why this is the case, as it consists of a fairly nondescript wide bright white optical double.

An interesting characteristic of Regulus is its fast rotation rate of 317km/s, which causes the equator to bulge, making the star look squashed, but not through the C90 I'm afraid. Regulus is approximately one-third wider at the equator than at its polar diameter.

In the TV series, *Babylon 5*, (1993–1998) the Regulus system is the location of the Earth Alliance's first extrasolar colony.

M44

The constellation Cancer, the Crab, when viewed with the naked eye, lacks visual punch. However, it contains some very impressive deep sky objects for the motivated observer. First up has to be the open cluster, M44, the Beehive, so-called because some believe it looks like a swarm of bees around a hive. In ancient China it was known as Tseih She Ke, the Exhalation of Piled-up Corpses, since it was believed to consist of the last breaths of the dying, condensed to form a mist. One of the earliest records of naked eye observations of Mercury occurred in China on the 9th of June, A.D. 118, when the planet passed within 1° of the cluster.

The Beehive is a similar size to the Pleiades, M45. S J O'Meara says in his book, *The Messier Objects*, that many of the stars are double. Indeed, some are triple. There are some subtly tinted stars in the Beehive, but they are not at all obvious, with most of the stars appearing whitish.

Of course, colour perception isn't what it used to be. We live in an era where highly saturated colours are the norm. Smartphone and Tablet screens have incredibly saturated displays, leaving modern retinas jaded and unable to appreciate the more subtle colourations present in the natural world. Admiral W.H. Smyth, born in 1788, is possibly the most famous observer of heavenly colours, publishing his observations in his seminal *Bedford Catalogue*. The book is replete with colourful - some would say fanciful - descriptions of colour in the sky. Wonderfully antiquated terms including smalt blue, topaz and flushed white are all present in the Admiral's visual palette.

M44 is an absolute delight to sweep up in the C90 with the 32mm Plössl. It is difficult to find, particularly for this author, a test for his abysmal star hopping skills. It consists of lots of fairly bright stars in a barren part of the sky. Two small equilateral triangles in middle of cluster are well worth looking for.

That concludes the article for this issue. Thanks for reading. More next time.

Observer's Corner

compiled by Aubrey Glazier

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Welcome to the Observer's Corner where all sorts of individuals offer us reports, sketches and images of many celestial wonders during the day and night time. James has been reminiscing about his fascinating experiences from his past. John has successfully observed and imaged an astounding supernova in M101. We have exquisite sketches from Deirdre, and images from Mick, Michael and Ken. Lastly I've seen a very colourful carbon star, doubles in Cepheus, Leo, and one in Boötes – plus a clair-obscure feature on the Moon. I must applaud everyone for a very fine Observer's Corner.

from James O'Connor

The "ashen light" (*lumiere cendrée*) of Venus: I had thought that the "ashen light" of the dark side of Venus had been relegated to the trash bin along with the canals of Mars but, apparently, this is not so. An article in the May 2023 number of *Sky & Telescope* indicates that the issue is still open and that the *Parker Solar Probe* is scheduled to attempt to collect data relevant to the matter during its next (and final) flyby of the planet in November 2024.

The author of the article (Tom Dobbins) claims to have observed the ashen light just once (about forty years ago). I can claim to equal him in this and add another less certain one, made the previous day. My observations were made on three successive evenings in June 1955, using a 15-cm. reflector and a power of x155. The first evening's results were negative, the second doubtful and the third positive. The planet was due to come to inferior conjunction with the sun on June 22 and at the time of my observations presented only a very thin illuminated crescent (phase about .01). Unfortunately, cloud prevented observation on the evenings immediately following

The notes that I made at the time were as follows:

1956 June 8: Illuminated crescent now very thin; searched for *lumiere cendrée* without success.

1956 June 9: I thought I could see the *lumiere cendrée* extending over at least part of the dark hemisphere. It looked reddish brown in colour and seemed to be of differing intensity in different parts.

1956 June 10: My notes for that evening include the following "I definitely saw the phosphorescence (i.e., the *lumiere cendrée*) on the dark side. There could be no doubt about it."

I can add, though I did not put down anything on the point at the time, that the intensity (or lack thereof) seemed to vary from place to place and seemed to be fainter the further away one looked from the illuminated crescent.

So, there is our choice: reality or illusion? I would like to think the former but I can't come down on one side or the other. But I would like to see the issue finally settled.

ξ Ursae Majoris (Alula Australis): I observed this object on 2023 May 12. I found the main components readily separable with a power of x175 on my 30 cm. reflector. Both looked plain white. The components are of magnitude 4.3 and 4.8, respectively, with a current separation of 2.4" of arc. The orbital period is 60 years. Both are themselves spectroscopic binaries.

A lot of time has passed since my first observation of this object. That was on 1954 April 25, using my first home-built telescope, a 15-cm. Newtonian. Being aware even in those early days of the object's rather short orbital period I used to wonder a little bit about whether I would live long enough to witness an entire circuit. Thankfully, I have achieved this – with a bit to spare. These initial thoughts may have been sparked by the fact that, at the time of my initial observation, the companion was directly south of the primary, making it (with the telescopic inversion) appear in the "twelve o'clock" position. It was back to this position in 2014 and has since moved on so as to have completed a total of 400° in angular movement with respect to the primary since 1954.

As Robert Burnham points out in his "Celestial Handbook", this star was the first to have its orbit computed, by M. Savary, in 1828. He quotes Agnes Clerke's phrasing: "the star was the subject of the first experiment in the extension of Newtonian principles to the general universe."

from John O'Neill

Sunspot counts: March – May 2023: Counts were conducted on 42 days during this period. The maximum count I observed was on 9th March when the Wolf Number was W=133, while the minimum count was on 18th March when the Wolf Number was W=35. All observations were reported to the AAVSO Solar Section. I used 70 mm and 85 mm refractors equipped with Thousand Oaks Type 2+ solar filters.

111 Ate 18-19 March 2023: Lies in Sextans, 2.7° SE of Pi Leonis. I estimated the magnitude of the asteroid to be 11.5. 28 cm SCT at 80x. 00:30 UT. Clear sky with good transparency.

760 Massinga 20-21 March 2023: Easy enough object. Lies 2.5° SE of Beta Tauri. Magnitude estimate 11.3. 28 cm SCT at 80x. 00:35 UT. Clear sky with goodish transparency.

Three asteroids 13-14 May 2023: All with a 28 cm SCT. Clear sky. Goodish transparency

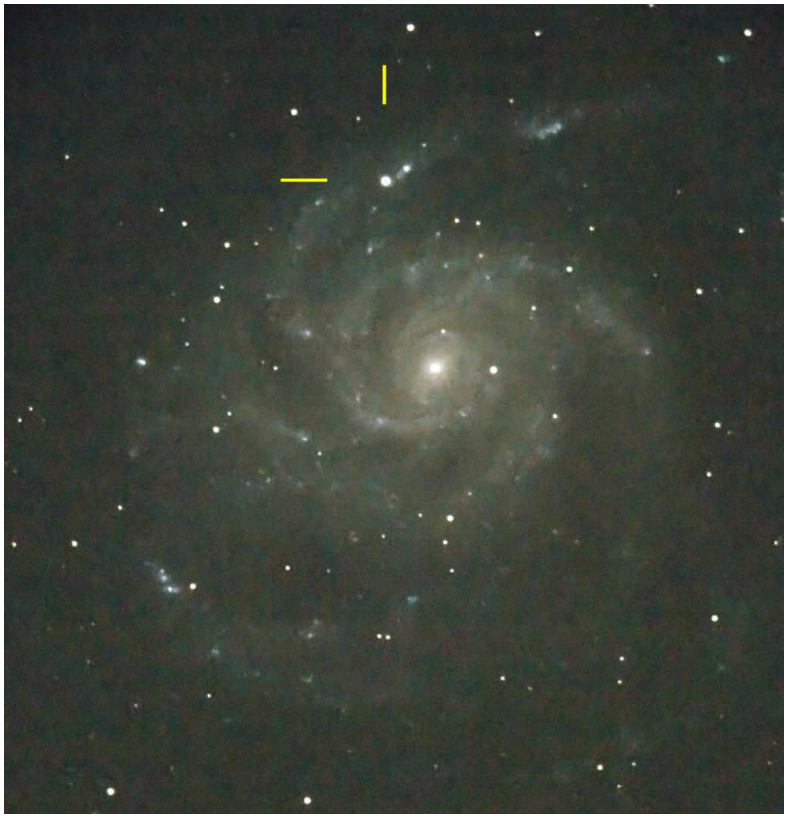
17 Thetis: An easy (11th mag.) object in an easy field 22' NE of Delta Virginis. 02:30 UT. 80x.

30 Elektra: Magnitude estimate 12.8. Lies in Boötes. 117x.

45 Eugenia: Nice 11th mag. object near perihelic opposition in the extreme north of Scorpius. 80x.

137 Meliboea 27-28 May 2023: Appears rather as a faint, but definite object in Libra (predicted mag. 12.3). 04:00 UT. 28 cm SCT at 117x. Clear sky with good transparency. 9 day old Moon.

Supernova in M101 May 2023: This object appeared in the face-on spiral galaxy Messier 101 and was designated as SN 2023ixf. I estimated the magnitude of the SN: 11.1 at 03:27 UT on 22-23 May; 11.0 at 03:03 UT on 26-27 May; 11.2 at 03:14 UT on 27-28 May. 20 cm SCT at about 80x. Back in 2011, this galaxy also hosted a SN (2011fe) which I estimated as reaching mag 10.0 during mid-September of that year.



Tick marks indicate SN 2023ixf in this image by John O'Neill on May 27th. 20x30s frames with a DSLR. 20cm SCT at f/6.3.

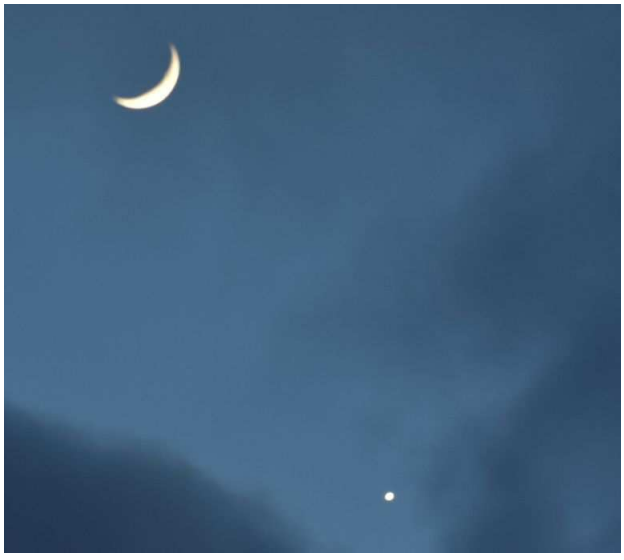
Lunar Occultation of Jupiter 16-17 May 2023: This was a daylight event with the Sun at an altitude of 25°, so I had to be careful not to point the telescope at the Sun, as the elongation was just 26°. Initially, nothing was seen in the bright field of view, until I tweaked the focuser. Then, a fading planet appeared near a likewise thin lunar crescent. There was a hint of the SEB on Jupiter, but none of its satellites were visible. First Contact was predicted for my site to be at 11:45:50 UT and I saw that it did indeed occur very close to this time. More and more of the planet was slipping behind the bright lunar limb until it disappeared completely. From 1st to 2nd contact took 1 min 10 sec. I did not observe the reappearance. I used the 28 cm SCT at 80x and 117x with a GoTo mount. Clear sky with good transparency. Site: Topsfield, MA, USA.

Mick McCreary took the image of the 7 day old moon on the right from the Sugarloaf car park on Friday 26th May 2023. You can see plenty of Mare, some mountains and craters, and Montes Haemus on the southern edge of Mare Serenitatis.

Ken Finlay had just got home from church on 23rd April last and saw the Moon and Venus very close together.

The Moon was a 4 day old waxing crescent in Taurus.

This image is with a Nikon D5600 at f/5.6. ISO 200 & 300mm lens.



from Aubrey Glazier

I own a William Optics 158 mm f/7 apo refractor supported by a Berlebach Planet alt-az mount and a William Optics 70 mm f/6 small apo refractor with mirror diagonals fitted at all times on both scopes.

Mar 7: Some years ago, an astronomical friend challenged me to find stars before sunset with my telescope. Having successfully achieved this feat with the following stars: mag: -0.06 Arcturus, the double star mag: +2.6 Izar (split in two at 112x), mag: + 0.09 Vega, mag: 1.4 Regulus and mag: +0.08 Betelgeuse, it had to be the turn of Capella now. Its magnitude is +0.06 and it has a spectral class of G8.

My small apo found the star easily at 17.56UT using my 11x 2" eyepiece. Capella was almost directly overhead at the time and observed a full 17 minutes before sunset which occurred at 18.13UT. At 112x in the main scope its yellow colour looked very good. Has anyone else ever tried to observe a star that is normally not seen until after sunset?

These doubles are in Cepheus: STF 2 is a true binary. Magnitudes: A = 6.7. B = 6.9. Separation (sep) = 0.96". Position Angle (PA) = 13.9˚. This double was a task to split at 225x, but with my WO 4mm eyepiece I saw a tiniest black gap between the 2 stars at 280x. Success! STF 2 is my first <1" split of 2023. STF stands for Fredrich Georg Wilhelm von Struve (1793-1864).

Mar 14: STF 13 is a true binary and my 2nd <1" split of 2023 and it's a bit fainter than STF 2. Magnitudes: A = 7. B = 7.1. Sep = 0.96". PA = 47.6˚. Because its separation is the same as STF 2, I had a clean split at 280x again with STF 13.

A 801 is an uncertain double. Magnitudes: A = 10.1. B = 10.2. Sep = 2". PA = 231˚. This double looked very nicely split from 140x up to 320x. The primary was slightly (G0) yellow. The secondary was white. The "A" designation stands for Robert Grant Aitken (1864-1951)

Mar 16: Fellow IAS member Darren phoned me to ask what I was looking for on this particular night. I told him I was looking for a carbon star. Suddenly I exclaimed that I had found it! S Cephei is my 114th observed carbon star, and its colour was intensely red from 112x up to 167x. I rarely see truly red stars with my apo refractor. This one looked utterly spectacular!

My wife Valerie joined me, and she said its colour was ripe tomato red. Seeing S Cephei was the perfect way to end my time in King Cepheus. Its spectral class is C7. The magnitude variability of it was discovered by Karl Heinke in 1858. On April 6 I estimated its magnitude as +8.6 on www.aavso.org. It can vary in magnitude from 6.6 to 12.5 in a 484.4 day period..

Mar 26: John Flannery recently gave a fascinating lecture on clair-obscur objects on the Moon. One such feature was the "Snail". There was a 5 day old crescent Luna visible from my back garden this night.

Straight away I could see the very large 124km crater Fracastorius in the southern part of Mare Nectaris at 112x. The western rim of this crater was fully illuminated by the Sun. Sitting on top of it was an extra 28km crater called Fracastorius D. Both the 100km long rim and the crater looked very like a giant snail with its shell on its back! I was amazed. It reminded me of some 1950s sci-fi movie. Also on the same night I observed the 140km Rima Janssen for the first time.

I observed the scarlet rose variable star R Leonis during the following nights and estimated these magnitudes on www.aavso.org. April 6: 7.5. April 14: 7.1. April 20: 6.7. May 12: 6.2. May 26: 6.0. It got brighter and brighter as the weeks went by. R Leonis was the fourth variable star ever discovered. Julius August Koch (1752-1817) was the discoverer of this hugely popular object in 1782.

These next few doubles are in Leo.

Apr 15: STF 1435 is a faint but true binary. Magnitudes: A = 10.3. B = 10.7. Sep = 8.5". PA = 203˚. 112x was sufficient to split it.

STF 1439 is a true binary. Magnitudes: A = 8.3. B = 8.9. Sep = 1.33". PA = 68˚. I needed 225x to get the split. The primary is slight yellow. The secondary is white

May 12: STF 1446 is a true binary. Magnitudes: A = 9.3. B = 10. Sep = 5.5". PA = 250˚. Delightful tight splits at 112x and 140x. The primary is yellow-white. The secondary is white.

May 23: STF 1447 is and uncertain double. Magnitudes: A = 7.5. B = 8.9. Sep = 4.6". PA = 124˚. I had a beautifully tight split at 112x. I refused to go higher in magnification.

May 26: Five members of the IAS were in the Sugarloaf car park this evening. There were three colourful stars very close to the brightest -4.4 magnitude planet Venus. Using my 2-inch 28mm 2˚ fov eyepiece I could fit in each of these stars: the F8 yellow-white 7.9 mag. star SAO 79416, the K7 8.6 mag. almond brown star SAO 79473 and the lovely 8th mag. rich orange carbon star NQ Geminorum. What a conjunction that was to behold!

On the same night, there was a 7.2 day old Moon. The 30km crater I noticed just beyond the lunar terminator was Horrocks. It looked rather eerie. All around it was darkness and its interior too. Jeremiah Horrocks hailed from Liverpool but died at the age of 22. He was the first man to observe a Transit of Venus in 1639 with a telescope.

Jun 2: I finish with a fine true binary in Boötes called STF 1884. Magnitudes: A = 6.6. B = 7.5. Sep = 2.15". PA = 54.3˚. I was somewhat surprised to see a narrow but decent split at a mere 112x. But I did increase up to 225x and the yellow-white primary and its white secondary looked splendid. STF 1884 is about 3˚ south of Izar

Sketches by Deirdre Kelleghan

June 2nd 2023: 13:20 - 14:15 UT Active Regions 3315 and 3319 plus a cracker of a filament. PST 40 / 8 mm TVP e.p. yielding 50x. Soft Pastels, pencil and brush on black card.

The remnants of AR 3315 on the sun's limb had a bright plage area under the sunspot, which appeared to the eye curved. Two tiny proms on the edge of either side of it. This was followed some distance behind by AR 3319 with its large sunspots, one with a scattering of smaller spots. Again I could see a hint of pink in the penumbra around that larger sunspot. Plus some very bright plage areas.

Then below all this action was a massive dark filament with tunnel-like arcs spreading out for hundreds if not thousands of km. The seeing was much better today, so I was grateful for that extra clarity. The occasional Jinny Joe seed landed on my drawing as I drew in a wild part of our garden. Killadoon, Co Mayo.

Supernova SN2023ixf

The supernova SN2023ixf in M101, the Pinwheel Galaxy, was first reported in mid-May, and with a clear sky at the end of the month I put up my “smart” eQuinox telescope in the back garden around midnight here in downtown Maynooth. At this stage the supernova had brightened to magnitude 11 or more. There was ambient light, a waxing moon and slight haze on the night, but during half-an-hour of images stacking at four-second intervals the galaxy and its recent addition emerged. The image captured is shown here, with the prominent supernova marked at the end of one of the spiral arms. As it happens, the Pinwheel Galaxy was one of the first objects I captured in the eQuinox when purchased – not quite “first light”, but nearly. I include that photograph for comparison, marking where the supernova isn’t. The orientation is different - the image was taken in October, with a shorter exposure (9 minutes) but under the darker skies of west Kerry.

- Peter Denman