JANUS
THE NEWSLETTER OF EWELL ASTRONOMICAL SOCIETY

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Editorial

Welcome to the September edition of Janus, the first of a new EAS year. Firstly, a reminder that the annual summer picnic takes place on Saturday 7 September from 5:30pm to 11:00pm, at Headley Heath. Fingers crossed for a relaxed (and fine) evening meeting up with other Society members and viewing the night sky. The gathering also provides an opportunity for a Telescope Surgery where members can get help with any setup or usage issues they may be experiencing.

September also sees the first lecture of the new season, when Martin Lumm MBE, FRAS will talk about the "Star of Bethlehem".

Did you know that dung beetles use the Milky Way to navigate at night?! Now others are looking to use it for similar purposes - more at *https://www.spacedaily.com/reports/Milky_Way_Navigation_in_Dung_Beetles_Inspires_Advanced_Drone_and_Satellite_Systems_999.html*

JAXA announced on 26 August that it had ended its Moon lander operation after losing communication with its SLIM lunar lander. After 8 months, attempts to communicate with the lander following 3 frigid lunar nights (6 cold weeks) were unsuccessful. Judging that there was no prospect of restoring communication with SLIM, at around 14:40 BST on 23 August they sent a command to stop SLIM's activity. By this time, SLIM had already continued to transmit information on its status and the surrounding environment for much longer than expected.

Starlink's effect on astronomy has been aired many times. China has now launched a rival giving rise to more concerns (see later piece)!

John

The Solar System September

MERCURY: begins the month emerging into the morning sky as it approaches greatest elongation west. It will be difficult to see, reaching its highest point in the sky during daytime, and being no higher than 6° above the horizon at dawn. Difficult to see throughout the month, by the end of the month, having recently passed behind the Sun at superior solar conjunction, it remains not readily observable, being very close to the Sun, at a separation of only 1° from it.

VENUS: recently passed behind the Sun at superior solar conjunction. Throughout the month, it is slightly difficult to see, reaching its highest point in the sky during daytime and only ever being between 2°and 3° above the horizon at dusk.

MARS: begins the month emerging from behind the Sun and is visible in the dawn sky, rising at 23:50 BST and reaching an altitude of 48° above the SE horizon before fading from view as dawn breaks at around 05:25. By the end of the month, it remains visible in the dawn sky, rising at 23:09 BST and reaching an altitude of 59° above the SE horizon before fading from view as dawn breaks at around 06:17.

JUPITER: is currently emerging from behind the Sun. It begins the month visible in the dawn sky, rising at 23:20 BST and reaching an altitude of 55° above the SE horizon before fading from view as dawn breaks at around 05:49. By the end of the month, it is visible in the morning sky, rising at 22:39 BST when it reaches an altitude of 7°above the NE horizon. It will then reach its highest point in the sky at 05:43, 61° above the S horizon, before being lost to dawn twilight around 06:37, 59° above the SW horizon.

SATURN: begins the month approaching opposition. Visible in the morning sky, it becomes accessible around 21:24, when it reaches an altitude of 11° above the SE horizon. Reaching its highest point in the sky at 01:30, 31° above the S horizon it will be lost to dawn twilight around 05:28, 12° above

the SW horizon. By the end of the month, having recently passed opposition, it will become accessible at around 19:23, when it rises to an altitude of 11° above the SE horizon. Reaching its highest point in the sky at 23:24, 30° above the S horizon, it will become inaccessible at around 03:26 when it sinks below 11° above the SW horizon.

URANUS: is currently emerging from behind the Sun. It begins the month visible in the dawn sky, rising at 22:08 BST and reaching an altitude of 54° above the SE horizon before fading from view as dawn breaks at around 04:45. By the end of the month, visible as a morning object, it will rise at 22:42 BST when it reaches an altitude of 21° above the E horizon. It will then reach its highest point in the sky at 04:00, 57° above the S horizon, and will be lost to dawn twilight around 05:38, 52° above the SW horizon.

NEPTUNE: begins the month approaching opposition. Visible in the morning sky, it becomes accessible around 22:53, when it reaches an altitude of 21° above the SE horizon. Reaching its highest point in the sky at 02:15, 36° above the S horizon, it will eventually be lost to dawn twilight around 04:45, 28° above the SW horizon. By the end of the month, having recently passed opposition, it will become accessible at around 20:59, when it rises to an altitude of 21° above the SE horizon. Reaching its highest point in the sky at 00:18, 36° above the S horizon, it will become inaccessible at around 03:37 when it sinks below 21° above the SW horizon.

MOON PHASES:

3New Moon	3 September
First Quarter	11 September
Full Moon	18 September
Last Quarter	24 September
New Moon	2 October

Notable Events:

Some observations will require a telescope, others will be visible with the naked eye. More information at *https://in-the-sky.org*

September

1 Conjunction of the Moon and Mercury
Uranus enters retrograde motion

2 Asteroid 194 Prokne at opposition

5 Mercury at greatest elongation west
Close approach of the Moon and Venus
Lunar occultation of Venus
The Moon at apogee
The Moon at perihelion

6 Mercury at highest altitude in morning sky
Mercury at dichotomy
Lunar occultation of Spica

8 Saturn at opposition

9 September ε-Perseid meteor shower 2024
Mercury at perihelion

10 Lunar occultation of Antares

15 The Moon at aphelion

17 Close approach of the Moon and Saturn
Lunar occultation of Saturn

18 Partial lunar eclipse
Lunar occultation of Neptune
The Moon at perigee

21 Neptune at opposition

22 Close approach of the Moon and M45
September equinox

23 Close approach of the Moon and Jupiter

24 Lunar occultation of Beta Tauri
NGC 55 is well placed

25 Close approach of the Moon and Mars

27 Daytime Sextantid meteor shower 2024
Comet C/2023 A3 (Tsuchinshan-ATLAS) passes perihelion
47 Tuc is well placed

29 Asteroid 20 Massalia at opposition

30 Mercury at superior solar conjunction

October

1 The Andromeda Galaxy is well placed

2 Annular solar eclipse
The Moon at apogee

3 136472 Makemake at solar conjunction
NGC 253 is well placed

4 Small Magellanic Cloud is well placed
NGC 300 is well placed

5 October Camelopardalid meteor shower 2024
Close approach of the Moon and Venus
The Moon at perihelion

6 NGC 362 is well placed

7 Lunar occultation of Antares

8 Draconid meteor shower 2024

9 Jupiter enters retrograde motion

10 Southern Taurid meteor shower 2024

11 δ-Aurigid meteor shower 2024

12 Comet C/2023 A3 (Tsuchinshan-ATLAS) passes perigee

14 Close approach of the Moon and Saturn
Lunar occultation of Saturn
The Triangulum Galaxy is well placed

15 The Moon at aphelion
Lunar occultation of Neptune

17 The Moon at perigee
Asteroid 19 Fortuna at opposition

18 136199 Eris at opposition
ε-Geminid meteor shower 2024

19 Close approach of the Moon and M45

21 Orionid meteor shower 2024
Close approach of the Moon and Jupiter
Lunar occultation of Beta Tauri

23 Mercury at aphelion
Close approach of the Moon and Mars

24 Leonis Minorid meteor shower 2024
136108 Haumea at solar conjunction

26 The Perseus Double Cluster is well placed

27 Asteroid 1036 Ganymed at opposition

29 The Moon at apogee

30 Venus at aphelion

Collected Observations (and thoughts) – Gary Walker

The Veil Nebula – Posted 2 August

On seeing this month's article by Martin Howe on the Veil Nebula, I can add that I have seen parts of the Veil Nebula in Cyprus over the years, lastly on the night of 18-19 June. This is a particularly difficult Nebula to view, as it is impossible to get the whole thing into the same field of view, even at your lowest power, because it is about 3 degrees in angular size. My lowest power at 62X only has about a half degree field of view! However, the last time I observed it, I managed to see NGC 6995, 6992, and 6960.

NGC 6995, appeared as a long, very dim ribbon of light, even with my Oxygen 111 filter in place, with the star, 51 Cyni “embedded” in the nebula. NGC 6992, appeared as a dim, small, fuzzy patch, close to a star, and NGC 6960 appeared as a very dim, ribbon like band of light. Such observations, of course, need a dark, moonless night, really clear skies, and the use of an Oxygen 111 filter is essential!

I also tried seeing the nebulosity in M16, by using an Ultra Block filter, and I may have seen a small, dim, fuzzy patch within the star cluster of NGC 6611. However, I have never managed to see the nebulosity of M20, even with a filter!

Gamma Cygni. (Sadr) – Posted 3 August

In the article by Martin Howe in the July Janus, the object of the month was the star, Gamma Sadr in Cygnus. I have noticed in the past, when viewing through my binoculars, that there is a beautiful circle of stars surrounding Sadr. Of this circle of stars, I counted at least 17 stars, which appeared like a large open star cluster, but is really an asterism!

This asterism extends out to about, 3-4 degrees in all. It does not seem to have a nickname, unlike most asterisms, star cluster, nebulae, or galaxies. However, it can also be seen as a question mark, as it has a curling "tail" extending to the South of it! The sky is full of asterisms (i.e. mini - constellations).

The Return of the King! – Posted 4 August

In the past few weeks, Jupiter, along with Mars, has started to reestablish its presence in the early morning sky!

Early this morning, at around 2.15am, I observed them both for the first time. They were only about 4 degrees apart. Jupiter was still too low to observe properly. I was last able to observe it back in January, this year, some 6 months, ago.

I last saw Mars on 20 June last year, i.e. over 13 months ago! Mars always takes a long time to reappear, as it is lost in the solar glare for so long, and it is usually lost from observation for about a year at a time. It always takes far longer than planets such as Jupiter or Saturn to reappear!

Naturally, as Mars was only 5.9' arcseconds in angular size, it appeared as a very small disk in my telescope, even at 300X. At 62X, and 100X, the disk was only just visible as the size of a pinhead! Even at 300X, it was still only appearing at about the size of a

marble and, of course, no features were visible on it!

However, Saturn is now rising much earlier, and was fairly high in the sky, by this time. It is also well away from Jupiter and Mars!

Mars and Comet Olbers – Posted 5 August

When you think that Mars currently only has an angular size of about 6' arcseconds, and can be as small as only 3.5' arcseconds, you realise that it is scarcely larger than Uranus, Neptune, or even, Mercury. In addition, Mars remains very small for most of its "season"!

On the evening of 4 August, I managed to find Comet Olbers again, after failing to do so on the previous few days. The sky was darker, even though I was observing at the usual time, which clearly made it easier to find!

I saw that the comet had a strong central condensation, surrounded by the usual fuzzy envelope and, possibly, a short, faint tail pointing in a NE direction. Surprisingly, I found the best view of it came at a 222X magnification.

Latest Observations – Posted 8 August

Early this morning, Jupiter, Mars, and the orange star, Aldebaran, made a beautiful "triangle" in the Eastern sky.

Jupiter had both Equatorial Belts visible, although I thought that the Northern Equatorial Belt was a bit broader than the Southern Equatorial Belt.

I have continued observing Comet Olbers throughout the first week of August. Unfortunately, it is still in an awkward position, low in the NW sky, which only gives me a fairly short "window of observation", where it is visible between a tree and some houses!

Despite a poor weather forecast the previous day, last night was beautifully clear and cloudless, dead calm, and fairly warm. I was also pleased to have no dewing problems!

One can now see that Autumn is on its way; you can always tell when you can see the Pleaides rising in the East! I could also see M31 easily, with my 11X80 binoculars, appearing as a bright fuzzy oval patch. Ironically, I find that it appears more like a galaxy (and its photographs) when viewed with binoculars, than it does through my telescope, even though it appears brighter and larger in the scope!

I observed the galaxy, NGC 7331 - also in Pegasus – and, with my telescope, it clearly appears on edge, and elongated N-S.

The Perseus Double Cluster always appears spectacular in my scope. I find it one of, if not, the most beautiful of open star clusters, with numerous bright stars, filling the 62X eyepiece, and further, with a myriad of stars!

I had a look at the globular cluster of M15, also in Pegasus. It is near a handy bright star, useful for accurate focusing on M15! The globular appeared bright, with a clearly defined bright centre, surrounded by a fainter fuzzy Halo, but I could not actually be sure of resolving any stars in it.

A few other fuzzy objects, such as two planetary nebulae, are also handily situated close to a bright star, such as the "Eskimo Nebula" NGC 2392, in Gemini (not yet visible at this time of the year!), and the "Cats Eye Nebula" of NGC 6543 in Draco! Having a bright star to focus on makes it a lot easier to make sure that Deep Sky Objects are correctly in focus, being as, by definition, they will be fuzzy in nature!

As the Square of Pegasus was high up in the sky, I did a count of how many stars I could see within the Square (not including the Square, itself). I could see 5 stars within the Square, which according to a Sky & Telescope article, indicates that my sky is "average" and heading towards "good" in terms of darkness. It also means that my local sky has a" limiting magnitude" of about magnitude 5.5.

The" brightest" stars visible within the Square, are of magnitude 4.4, so not difficult to see with my naked eyes!

This constellation is a good test of how dark your local night sky is. Although I could see at least 5 stars, in REALLY dark skies, up to 35 stars can be seen!

The Sun – Posted 10 August

This week, there has been another huge spot on the Sun, with multiple umbrae. Today, for example, and on previous days, there has been a "chain" of Sunspots extending all the way across the disk of the Sun, many of them, of medium size, or larger!

Now 25 Years since the Total Solar Eclipse of 1999 – Posted 11 August

Today marks exactly 25 years, (a quarter of a century!) since the Total Solar Eclipse of 11 August 1999.

I went on a sea trip and observed it in the English Channel, between Portsmouth and Le Harve, on the ship, "The Pride of Le Harve".

Despite some patchy cloud, I managed to see the entirety of this eclipse. Of course, the light levels did not really drop until very close to totality, but I saw that the Western sky appeared dark, as if a thunderstorm was approaching! First Contact was at 9.59am, and Totality began about 11.15am. Last Contact was at 12.40pm.

I just had my 10X50 binoculars to watch the eclipse with, as I don't have a car, so could not take my 60mm telescope. I had 3 separate cameras to photograph it, and I managed to get some fairly good photos!

I saw at least 3 Prominences, and the Corona. Through my binoculars, I could see the magnetic lines within it. Totality lasted for about 2 minutes.

My 60mm refractor was, however, still providing good service for this eclipse, as I had previously given my Mum and Dad a "crash course" in Solar Projection! They obtained some good photos of the thin crescent of the Sun, and the drop in light levels, which made the environment appear like early morning, or evening time!

In Banstead, where Mum and Dad were, the Sun was 96% eclipsed. Whilst not getting dark, there was a noticeable drop in light levels, and people told me about the gloom and that it felt cold. Maximum eclipse was at 11.19am.

Unfortunately, at least two people that I knew went indoors, or sent their child indoors, as they were frightened of going blind. Indeed, some of the media, and some self-proclaimed "experts" - including Professor Liam Donaldson (the government's Chief Medical Officer) - were informing the public not to directly observe the eclipse, but to watch it on TV! He was even saying that the eclipse glasses were unsafe. Even Sir Patrick Moore was appalled by this over reaction to safety, despite his frequent warnings about how to observe the Sun safely.

The trouble was that these media people were speaking about the dangers of observing the eclipse yet couldn't be bothered to explain how to observe it, safely! Thus, people were confused, and some decided not to observe it, directly! So, a once in a lifetime experience could have been ruined for some by over cautious "experts" that were not even astronomers! Even today, this is still a reoccurring problem, with every eclipse!

Some of these "experts" may have only told people not to observe the eclipse, directly, as they were afraid of being sued!

For once, this story was THE top item on the news channels! It was funny seeing in some newsagents, the following day, the newspapers all spread out along the shelves, all with images of the Total Eclipse on the front covers, appearing like a load of eyes!

The buzz word, at this time was the word, "eerie"!

It is truly amazing that this eclipse is now so far in the past, and yet, when I was a child, it seemed to be so far in the future! The same is true for Halley's Comet in 1985-1986!

Before that eclipse, news of its coming appeared across different types of media, especially in Cornwall and Devon, where places and events were being set up for it. Unfortunately, it was mostly cloudy in this area, but some lucky people did manage to see totality through holes in the cloud. The best views from there, were from a Hercules aeroplane flying above the clouds! Sir Patrick Moore was clouded out, in Cornwall, too!

Ironically, from elsewhere in the UK, the weather was far better, and the eclipse, although not total, was easily seen!

A load of guidebooks for observing the eclipse appeared in the bookshops in 1999, and I bought all of them, of course! The same thing happened in 1985, on the approach of Halley's Comet.

Jupiter – Mars Conjunction – Posted 15 August

From the beginning of August, Jupiter and Mars have been drawing closer together. On 4 August, they were about 4 degrees apart (well within the field of view of my 10X50 binoculars), and on 11 August, they were down to 2.5 degrees apart.

Today, they were at their closest, being less than half a degree apart! This meant that they were easily both visible in the 62X eyepiece of my 8" SCT, and just both visible in the 100X eyepiece!

They made a beautiful sight, even with the naked eye, and in binoculars. The orange colour of Mars contrasted vividly with the yellow colour of Jupiter!

Of course, Jupiter was significantly larger than Mars, being over 36' arcseconds in angular size, whilst Mars was only 6' arcseconds in size. Thus, Mars was 6X smaller than Jupiter!

Planetary Conjunctions are of no scientific importance, but they can make a beautiful sight! It is so rare to be able to fit more than one planet in any telescopic field of view. Also, one can directly compare and contrast the characteristics of the two planets, without having to move the telescope from one planet to the other across the sky!

Who can forget the Great Conjunction of December 2020 when Jupiter and Saturn, were in conjunction, and were close enough to even fit in an eyepiece at 333X!

More on the Jupiter – Mars Conjunction – Posted 17 August

Today, Jupiter and Mars were still making a beautiful sight, to the naked eye, and with binoculars. They were now, about a degree, or so, apart.

Mars still appeared very small, even at 300X, but then it is still very small at only just above 6' arcseconds. I thought that I might have just been able to see a hint of a dark feature on it, but I wasn't entirely sure. However, Syrtis Major, was on Mars at this time!

A weird moon! – Posted 18 August

Late yesterday evening, the sky was overcast, but amazingly enough, the gibbous Moon was clearly visible, despite being very low down in the Southern sky. Usually, low altitude objects in cloudy conditions are far less likely to be seen, than those high up.

The Moon was dimmed, but still very sharp, and even stranger, it appeared a beautiful banana yellow to orange colour!

I later heard that the Moon turned this colour because of smoke from wildfires in North America hanging over the UK. This is similar to the Red Sun of 16 October 2017, when wildfires and Saharan sand were blown over the UK, which made the Sun turn spectacularly red, in the early afternoon.

Over the past two days (17-18 August), even in the daytime, the sky has been covered by a thin, high, haze, creating a pale blue sky, rather than a deep blue one. At night, only a few of the brightest stars were visible with the naked eye, (plus, of course, the Moon!).

On 19 August, there were reports of the sky and Sun being orange in colour, but I didn't notice any colour.

This was reported at the end of the BBC News (of course!), and Peter Lawrence from the Sky at Night was talking about it. On 19-20 August, there was the "Blue SuperMoon". This was visible, intermittently through clouds but, unfortunately, with no weird colours! The only time it displayed any colour was on 17 (and to a lesser extent 18) August.

The moon Occulting Saturn – Posted 21 August

Early this morning, at 4:28am, Saturn was occulated by an almost Full Moon!

This was the first time in years for such an event, although, in the past, I have seen at

least 5 occultations of Saturn between the 1990's and about 2007!

Yesterday evening, the Moon and Saturn were rising after about 10pm, and were still about 4 degrees apart, at this time. However, by 3:20am, they were less than half a degree apart, and both easily visible in the 62X eyepiece field of view.

Unfortunately, by then, the previously cloudless sky had a lot of extensive cirrus bands across it. This, and the fact that Saturn was very close to a Full Moon, made it appear harder to see, even in my telescope.

Even earlier on, at 10pm, the previous evening, Saturn was difficult to see with the naked eye, because of the glare and proximity of the bright Moon.

However, I managed to view the occultation of Saturn. In the last few minutes, I could actually see it moving, and sinking towards the Moon's limb. It was swallowed up by the Moon over a period several of seconds as, of course, Saturn has a noticeable angular size, unlike that of a star, that has essentially no size, so will blink out instantly!

However, the reappearance of Saturn from behind the Moon after 5.20am, was much more dramatic, as it emerged from the shadowed side. Despite the sky getting light, this event was still easy to see, and the cirrus clouds had, by now, disappeared!

I first saw a very dim, ghostly, image of Saturn by the Moon's limb, and then, the proceeding ring of Saturn started to appear, followed by the globe of the planet, appearing first as a sort of crescent, and then, as a half-phase, or "half Saturn"! Then the rings on the other side of the planet started to appear, and slowly come out of the shadow of the Moon, too. Despite being edge on, this still looked dramatic and beautiful. This sequence appeared very weird!

I watched Saturn gradually moving away from the Moon's limb, for over 20 minutes afterwards.

So, I have now seen six occultations of Saturn, by the Moon, but only two of Venus, and one each of Mars and Jupiter!

These events are not necessarily important, scientifically, but are beautiful to watch and image!

Also, this morning, Jupiter and Mars were now separated by about 4 degrees, since their Conjunction, on 15 August, but they still appear quite close together with the naked eye!

When Saturn was first occulated, it moved down behind the Moon's limb, in a horizontal fashion. When it reappeared, it came out end on, with the first of the rings, followed by the planet itself, and then the other side of the rings! Thus, it came out, "sideways", so to speak, from the Moon!

The end of Comet Olbers (for me)! – Posted 28 August

I last saw Comet Olbers on 10 and, possibly, 16 August; now I can't see it anymore - in any case, it has now faded to magnitude 8.

This has always been an awkward comet to observe, as it has always been low down in the Western sky, making it that much harder to see, and It was always fairly hard to pick up in my telescope. As I first saw this comet on 14 July, I observed it for about a month in all.

SpaceX satellites get the blues! – Posted 28 August

Late yesterday evening, I saw a blue coloured satellite crossing the sky. I remembered that back in June, I saw a train of blue SpaceX satellites crossing the sky.

This is because SpaceX has now made their satellites appear dimmer. As a result, they appear a beautiful sapphire blue colour, which makes a change from the usual yellowish colour of every other satellite in the sky! Although dimmer, I estimated that this satellite still reached a magnitude of about 2 or 3.

The Moon was once covered by an ocean of molten rock, data from India's space mission suggests

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Data from India's recent Chandrayaan-3 mission supports the idea that an ocean of molten rock once covered the Moon. Scientists from the mission have published their new findings in the journal Nature.

On August 23 2023, a lander called Vikram successfully touched down on the lunar surface. Controllers then deployed a rover called Pragyan, which had been stowed on Vikram, to explore the landing site.

The location where Vikram touched down was further south than any other landing craft had previously been on the Moon. It gave scientists an insight into geology of the Moon that had not yet been sampled.

Pragyan's measurements found that the particular mix of chemical elements in the lunar soil (or regolith) surrounding the lander was relatively uniform. This regolith was primarily made up of a white rock type called ferroan anorthosite.

The scientists say the chemical composition of the lunar south pole regolith is intermediate between those of samples from two locations in the Moon's equatorial region: those collected by astronauts on the US Apollo 16 flight in 1972, and those returned to Earth by the robotic Luna-20 mission, flown by the Soviet Union the same year.

The broad similarity in the chemical compositions of all these samples, despite the fact they came from very distant geographical locations on the Moon, supports the idea that a single magma ocean covered the Moon early in its history.

The Moon is thought to have formed when a Mars-sized planet collided with Earth, ejecting rock that subsequently coalesced to form our planet's only satellite. The lunar magma ocean is thought to have been present from its formation to tens or hundreds of millions of years afterwards.

The cooling and crystallisation of this magma ocean eventually led to the ferroan anorthosite rocks that make up the Moon's crust.

Orbital measurements

Geologically, the lunar highlands are thought to partially represent the ancient lunar crust. Chandrayaan-3, Apollo 16 and Luna 20 all landed in highland regions, allowing comparisons. As such, it presented an opportunity to test predictions of the theory that the Moon was covered in a global ocean of liquid rock – known as the lunar magma ocean (LMO) model.

The authors highlight how their measurements show the uniformity in the composition of the Moon's surface over several tens of metres where the rover was operating.

“Ground-truth” measurements such as these are crucial for interpreting observations made by orbiting spacecraft. For example, the authors compared these results with data from two previous Indian lunar missions, Chandrayaan-1and -2, which both measured the lunar surface from orbit.

The consistency between these earlier spacecraft measurements and those made by the Pragyan rover gives new confidence to the orbital datasets. The orbital data suggests the lunar surface in this region is uniform in its chemical composition over an area of several kilometres.

These measurements are also invaluable when it comes to interpreting lunar meteorites. These are samples of rock ejected into space from the lunar surface when a space rock collides with the Moon.

These rock fragments may later enter the Earth’s atmosphere, and some even hit the ground. These represent fantastic samples, as the random nature in which they are thrown from different parts of the Moon means we receive samples from areas not visited by previous missions.

However, precisely because of this random mode of sampling, it is difficult to know where on the Moon they have come from, preventing us from placing them in their proper context. So, the Pragyan rover measurements help us build a picture of what different regions of the Moon look like, and how our meteorite samples compare.

Nearside and farside

The lunar magma ocean model was first conceived following the return of samples from the Apollo 11 mission. That mission landed in an area dominated by dark basaltic rock (think of the stuff produced by volcanoes in Iceland or Hawaii). However, researchers at the time noticed the Apollo 11 soils also contained fragments of white rock, rich in the mineral anorthite, which was given the name ferroan anorthosite.

This observation led to the suggestion that the white rock represented tiny fragments of the original, ancient lunar crust. As the magma ocean cooled, denser minerals such as olivine and pyroxene sank to form a deeper layer called the mantle, while the ferroan anorthosite – being less dense than the surrounding magma – floated to form the Moon’s first crust.

Since the original lunar magma ocean models were proposed, various suggestions have been made to explain additional complexities about lunar samples and geological observations of the Moon more generally – for example, the fact that the lunar nearside crust appears to be much thinner than that of the farside.

Equally, it is unclear exactly why the nearside has experienced so much more volcanic activity, resulting in it being dominated by vast plains of dark basaltic rock, while the farside appears to comprise more of ferroan anorthosite.

In trying to address these problems, researchers have developed detailed models to explain how the lunar crust formed and was later modified by volcanic eruptions and impact cratering. Some models have predicted multiple layers to the lunar crust, with the ferroan anorthosite rocks at the top and more magnesium-rich rocks underneath.

Interestingly, the composition measured in this study is not what would be expected of the pristine ferroan anorthosite thought to have comprised the ancient lunar crusts. Instead, it contains more magnesium.

This observation indicates a higher concentration of certain minerals in the lunar crust than was suggested by the original lunar magma ocean models. The authors suggest their measurements may represent a mixed composition of the ferroan anorthosite rock that makes up the ancient lunar crust, together with material from the underlying layers of more magnesium-rich rocks.

These different layers of material would have been mixed by the excavation of material during impact cratering on the Moon. In particular, the Chandrayaan-3 landing site would probably have been covered by about 1.5-2km of ejected rock from the so-called “South Pole-Aitken” impact basin – a 2,500km diameter depression in the surface that is thought to have been created by a colossal impact event early in the Moon’s history.

Later impact cratering events would have further mixed and distributed this material, resulting in the kind of chemical signature measured by the Chandrayaan-3 mission in this study.

Object of the Month – The Wizard Nebula (NGC 7380) – Martin Howe

This month we go hunting in Cepheus, in mythology, the King of Aethiopia, the husband of Cassiopeia and father of Andromeda. These three constellations are all adjacent to each other and currently rising in the east-to-north-eastern sky.

Cepheus is home to a few interesting nebulae, including the Cave nebula and the Elephant’s Trunk nebula. Also in this list is NGC 7380, which is an emission nebula. As an aside, there are three types of nebulae:

1. Emission nebulae – these are where the gas is excited by a nearby high energy source which ionises the gas resulting in the emission of photons of light at specific wavelengths, depending on the type of gas;
2. Reflection nebulae – these are where light from nearby stars, as the name suggests, is simply reflected off of gas and dust;
3. Dark nebulae – these are where thick gas and dust clouds block the light from the background stars and so are very noticeable when see against the background of bright star fields within the Milky Way.

NGC 7380 consists of a small open cluster of very new stars (in the order of 5 million years old), and it is these new hot energetic stars that are exciting the remnants of the star-forming region of gas and thus causing it to emit photons.

NGC 7380 is about 7,000 light years away, and covering a diameter of about 25 arcminutes, so just a little smaller than the size of the full Moon. NGC 7380 was discovered by Caroline Herschel in 1787. At a listed (integrated) magnitude of +7.2 it should in theory be visible in binoculars from a dark sky site, however this brightness is ‘spread out’ over the whole area of the nebula so in reality will be harder to see than the listed magnitude might suggest. However, as with all emission nebulae, it does respond well to narrow-band imaging.

The image below was taken using a mono CCD camera and narrow band filters through a 127mm refractor. The composite image consisted of six 5-minute exposures though each of an Ha, OIII and SII filter. These filters block all wavelengths of light except those of specific common nebula emissions – in this case, hydrogen-alpha, oxygen 3, and sulphur 2. Each of these images are assigned a different colour and then combined in order to create a “colour” image.

NGC 7380, as with many of the larger and brighter nebulae, has attracted its own informal name, and in this case goes by the moniker of the Wizard nebula. I do struggle to see a clear shape of a wizard, but I can maybe see how it came by its name if you rotate the image below 90^{o} anticlockwise and maybe make out a head of a bearded man, with flowing robes, and an outstretched wand? However, NGC 7380 also goes by the lesser-used name of the Flying Horse nebula, which I can more readily make out in the orientation of the image below, with the head to the right, front legs below, and wings outstretched above. Either way, you need a bit of imagination (and a glass or two of wine) to make out these namesake shapes!

More problems for astronomers from latest Starlink rival? – John Davey

On 6 August, China took a significant step towards establishing a vast satellite network (a mega-constellation) in low Earth orbit (LEO) with the successful launch of the first 18 satellites of its "Thousand Sails" project. This ambitious endeavour, led by Shanghai Spacecom Satellite Technology (SSST), aims to deploy a constellation of more than 14,000 satellites to provide global internet coverage and enhance China's space-based capabilities.

The Thousand Sails project, also known as the Qianfan constellation, is China's answer to the growing demand for satellite-based internet services and represents yet another mega-constellation to rival SpaceX's Starlink (6898 launched to date), Eutelsat's OneWeb (640 launched to date) and others. The constellation will consist of flat-panel satellites weighing approximately 300 kg each, orbiting at an altitude of around 800km. This puts them at a lower altitude than OneWeb (1200km), but above Starlink (340-600km). Unlike Starlink, but like Oneweb, the satellites are in Polar orbit. This means they will travel in a direction which is roughly from North to South rather than West to East.

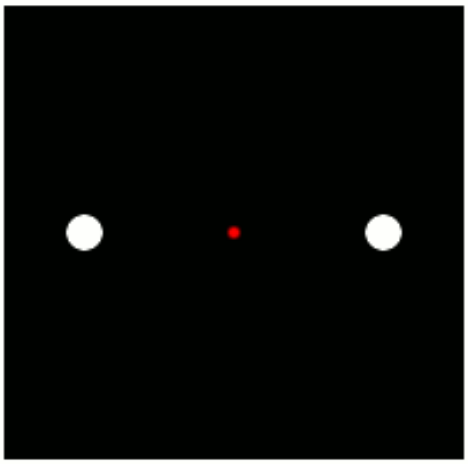
The deployment of the Thousand Sails constellation will be carried out in phases. The first phase will involve the launch of 1,296 satellites, with 648 planned for deployment by the end of 2025 to provide regional network coverage. SSST has indicated that 108 satellites will be launched in 2024, with batches of 36 and 54 following the initial 18. The full constellation of more than 14,000 satellites will take several years to become operational.

Amateur astronomers have monitored the first set of Qianfan satellites since their launch. Their observations show that the satellites can be as bright as magnitude 4 when passing directly overhead, bright enough to be seen by the naked eye. They are considerably brighter than Starlink satellites despite being in higher orbits, suggesting a lack of measures to mitigate their brightness. Without such measures, astronomers warn the Qianfan satellites would pose a major problem for astronomers. [More information at: *https://skyandtelescope.org/uncategorized/observers-report-first-views-of-the-chinese-thousand-sails-satellites/*]

Aside from the potential issues for astronomers, there are also significant launch and orbital debris concerns. The first batch of 18 satellites was successfully launched using a Long March 6A rocket from the Taiyuan Satellite Launch Centre in northern China. While the launch was a success, it raised concerns about the creation of orbital debris. The rocket's upper stage reportedly experienced a breakup event, resulting in a debris field along the satellites' orbital path. U.S. Space Force confirmed the breakup event and is currently tracking the debris pieces to ensure spaceflight safety. The presence of debris at the satellites' altitude, where atmospheric drag is minimal, poses a long-term threat to many other spacecraft in LEO. As the project progresses and more launches occur, the potential accumulation of space debris becomes a growing concern.

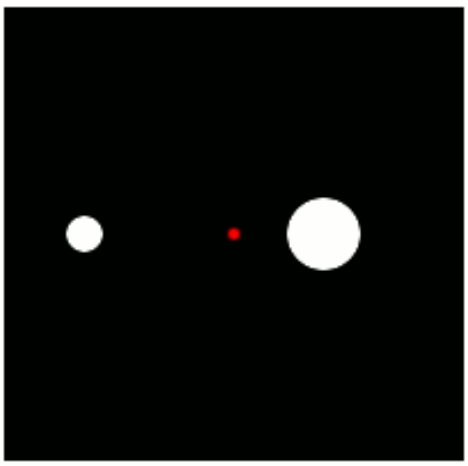
Does the moon really orbit around the earth? – John Davey

I recently came across the substance of this piece and thought it might interest (or irritate) the pedants amongst our readers!!

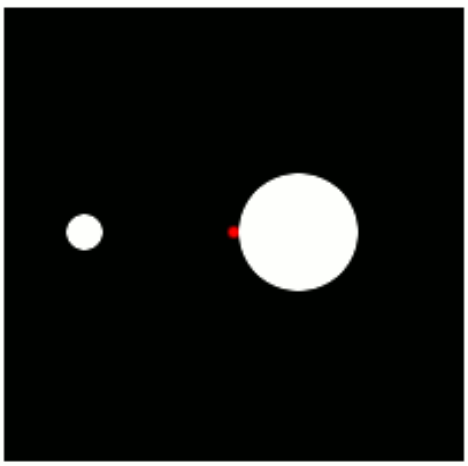


Contrary to popular belief, the moon doesn't really orbit around the earth. Rather, it orbits around the centre of mass of the moon-earth system. This is because both the moon and the earth are gravitationally pulling on each other and are moving in response to this pulling. Furthermore, this is true of all orbits.

The planets in our solar system orbit the centre of mass of the solar system, not the centre of the sun. The stars and solar systems in our galaxy orbit the centre of mass of the galaxy, not the supermassive black hole at the centre of the galaxy. If the supermassive black hole at the centre of our galaxy magically vanished from existence, most of the stars in the galaxy would continue orbiting the centre of mass of the galaxy as if nothing had happened. Only the stars very close to the black hole would be affected.



As the graphic on the right attempts to show, the larger the mismatch between the mass of the one astronomical body and the mass of the other astronomical body (such as between the moon and the earth), the closer the centre of mass of that two-body centre (depicted as a red dot) sits to the centre of the more massive body.



Therefore, when a very low-mass object and a very high-mass object are in mutual orbit, the centre of mass of the system is very close to the geometric centre of the high-mass object, and saying that the low-mass orbits the high-mass object is an excellent approximation.

Focussing on the moon-earth system, let's look at some real numbers. The masses of the earth and the moon are, respectively, 5.9722×10^{24} kg and 7.3477×10^{22} kg. So, the mass of the earth is 81.25 times that of the moon. The average distance between the earth and the moon is 384,400 km (it varies between 405,696 km at apogee and 363,104 km at perigee). Add to this the radius of each body (1737 km for the moon and 6367 km for the earth) and we have a figure of 392,504 km for the distance between the centres of mass of the two bodies. If the two bodies were at the extremes of an imaginary balance beam, then, for the beam to balance, the balance point would be 4772 km from the centre of the earth and 387,732 km from the centre of the moon. This would put the balance point within the earth itself, although not at its centre!

Thus, in the case of the moon and earth, saying that the moon orbits the earth, whilst technically incorrect, is an excellent approximation.

Important Reminder:

To allow sufficient time to compile Janus and place it on the EAS Website by the 1st of the month any submissions for publication are required at least 3 days before the end of the month. Any items received after this date will be held over until the following month.

Up Next:

ANNUAL PICNIC: 5:30 pm-11:00 pm
Saturday 7 September – Hedley Heath

Bring a picnic for a relaxed evening meeting up with other Society members and viewing the night sky (weather permitting). We will also take the opportunity for a Telescope Surgery where we can help with any setup or usage issues you may be experiencing.

NEXT MEETING: 8pm Friday 13 September – Nonsuch High School

Martin Lumm MBE, Fellow of the Royal Astronomical Society (FRAS) will talk about the "Star of Bethlehem".

There will also give a presentation on the sky at night for the coming month.

NEXT USER GROUP:

Suspended until further notice.

NEXT DENBIES OBSERVING SESSION:

The next session, allowing for moon rise & set times and cloud conditions, should be sometime around the new moon which is on 2 September.

The precise date and timings of any session will be advised by email and WhatsApp a few days in advance but should be within the period 26 August – 6 September.

AD HOC OBSERVING AT WARREN FARM:

These will be at short notice when the weather is favourable. Please watch our WhatsApp feed for alert