JANUS
THE NEWSLETTER OF EWELL ASTRONOMICAL SOCIETY

January 2023 EDITION
Editor: ewellastro.editor@gmail.com
Email: ewellastro@gmail.com
Website: https://www.ewellastronomy.org

Editorial

A Happy New Year to all our readers, and welcome to the first edition of Janus for 2023.

Our first talk of the year, on Friday 13th January, entitled "'DSLR Astrophotography", will be given by one of our members Martin Howe. Those of you who are members of the Society's WhatsApp group will have seen some of the stunning pictures which Martin has taken. Hopefully his talk will stimulate others to try and produce their own pictures.

2022 was an eventful year for space exploration, with successes including the completion of NASA's Artemis 1 mission (finally), the inauguration of JWST, and the completion of China's Tiangong space station. 2023 is set to be another busy year, including the following 5 very varied missions:

- Launch of ESA's Jupiter Icy Moons Explorer (Juice) mission
- 1st orbital flight test of SpaceX Starship - 100 tonnes of cargo to LEO
- dearMoon project to take members of the public around the Moon
- Return to earth of asteroid explorer OSIRIS-Rex with up to 1kg of samples from the near-Earth asteroid Bennu
- First private Indian satellite launch by Skyroot Aerospace.

See: *https://theconversation.com/five-space-exploration-missions-to-look-out-for-in-2023-195839* for more information

Finally, as part of a plan to extend its life, NASA is seeking concepts from industry on how they would re-boost the orbit of the Hubble Space Telescope. Some in-orbit servicing would also be required. So, an interesting - and challenging – concept all round!

John

The Solar System January

MERCURY: begins the month as an evening object, having recently passed greatest elongation E. It is, however, almost impossible to observe, reaching its highest point in the sky during daytime and being no higher than 0° above the horizon at dusk. By the end of the month, now a morning object, and having recently passed greatest elongation W, it is still difficult to observe, reaching its highest point in the sky during daytime and being no higher than 4° above the horizon at dawn.

VENUS: recently passed behind the Sun at superior solar conjunction. It begins the month difficult to observe, reaching its highest point in the sky during daytime and being no higher than 5° above the horizon at dusk. By the end of the month, it will become visible around 17:09 UT, 13° above the SW horizon, as dusk fades to darkness. It will then sink towards the horizon, setting 2 hours and 5 minutes after the Sun at 18:52.

MARS: begins the month approaching opposition. Visible in the evening sky, it becomes accessible around 16:26 UT, 25° above the E horizon, as dusk fades to darkness. It will then reach its highest point in the sky at 21:41, 63° above the S horizon, and will continue to be observable until around 04:57, when it sinks below 7° above the NW horizon. By the end of the month, having passed opposition, it remains visible in the evening sky, becoming accessible around 17:19 UT, 50° above the SE horizon, as dusk fades to darkness. It will then reach its highest point in the sky at 19:48, 63° above the S horizon and will continue to be observable until around 02:54, when it sinks below 9° above the NW horizon.

JUPITER: begins the month as an early evening object, now receding into evening twilight. Becoming accessible around 16:26 UT, 36° above the S horizon, as dusk fades to darkness, it will reach its highest point in the sky at 17:21, 37° above the S horizon and

will continue to be observable until around 22:25, when it sinks below 7° above the W horizon. By the end of the month, it will soon pass behind the Sun at solar conjunction. Becoming visible around 17:09 UT, 36° above the SW horizon, as dusk fades to darkness, it will then sink towards the horizon, before setting at 21:49.

SATURN: will soon pass behind the Sun at solar conjunction. It begins the month visible from around 16:51 UT, 18° above the SW horizon, as dusk fades to darkness. It will then sink towards the horizon, setting 3 hours and 39 minutes after the Sun at 19:40. By the end of the month, it is difficult to observe, reaching its highest point in the sky during daytime and being no higher than 3° above the horizon at dusk.

URANUS: is currently an early evening object. It begins the month becoming accessible around 17:31 UT, 43° above the SE horizon, as dusk fades to darkness. It will then reach its highest point in the sky at 20:05, 54° above the S horizon, and will continue to be observable until around 01:07, when it sinks below 21° above the W horizon. By the end of the month, still an early evening object, it will become visible around 18:10 UT, 54° above the S horizon, as dusk fades to darkness. It will then sink towards the horizon, before setting at 01:34.

NEPTUNE: begins the month as an early evening object receding into evening twilight. Difficult to see, it will become visible around 17:31 UT, 33° above the S horizon, as dusk fades to darkness, but will then sink towards the horizon, setting at 22:34. By the end of the month, it will soon pass behind the Sun at solar conjunction, and will remain difficult to see, reaching its highest point in the sky during daytime and being no higher than 21° above the horizon at dusk.

MOON PHASES:

First Quarter	30 Dec
Full Moon	6 Jan
Last Quarter	15 Jan
New Moon	21 Jan
First Quarter	28 Jan

Notable Events:

Observation of some of these events may require a telescope, although some will be visible with the naked eye. More information with times at *https://in-the-sky.org*

January

1 Close approach of the Moon and Uranus
Lunar occultation of Uranus

2 M41 is well placed

3 Conjunction of the Moon and Mars
Close approach of the Moon and Mars
Lunar occultation of Mars

4 Quadrantid meteor shower 2023
The Earth at perihelion

12 C/2022 E3 (ZTF) at perihelion
Mars ends retrograde motion

15 M47 is well placed
NGC 2403 is well placed

19 γ-Ursae Minorid meteor shower 2023

21 Mercury at highest altitude in morning sky

22 Uranus ends retrograde motion

24 Mercury at dichotomy

26 Conjunction of the Moon and Jupiter
Close approach of the Moon and Jupiter
Asteroid 6 Hebe at opposition

29 Close approach of the Moon and Uranus
Lunar occultation of Uranus

30 Mercury at greatest elongation west

20 December Leonis Minorid meteor shower 2022

31 Conjunction of the Moon and Mars
Close approach of the Moon and Mars
Lunar occultation of Mars
96P/Machholz at perigee
96P/Machholz at perihelion
M44 is well placed

Collected Observations (and thoughts) – Gary Walker

Another trip around the Moon by Artemis 1 – 5 Dec

During the afternoon and early evening of 5th December, Artemis 1 again went around the Moon, and I was able to "observe" it on my phone! As Artemis approached the Moon, the Moon appeared a very odd oval shape (presumably the way that my phone presented the image).
Unlike the last time it flew around the Moon, Artemis was approaching the "near side" of the Moon, so the familiar features were visible such as the lunar maria and the crater of Copernicus.

Artemis then went behind the Moon and, as usual, signal was lost. On "requisition of the signal", as Nasa put it, there was a spectacular view of the close-up crescent Moon and, far in the background, a beautiful crescent Earth, clearly in the same phase as the Moon! This made an artistically beautiful view!

The "burn" and pass behind the Moon put Artemis back onto a final course for Planet Earth. Still later, the view showed the Moon slowly receding and getting smaller as Artemis 1 headed for home.

Incidentally, it is now about 50 years since Apollo 17 blasted off to the Moon!

Patrick Moore – 8 Dec

It is now 10 years, since Sir Patrick Moore died, on 9th December 2012. He was nearly 90 years old, and his death certainly marked the end of an era. Although he was the first Patron of our Society he, unfortunately, only gave one or two lectures to it, and these were in its earliest days, around 1967.

His "Sky at Night" BBC 4 programme still carries on, but in a different format from the days when he was running it. It now has three presenters, Dr Maggie Aderin-Pocock, Chris Lintott, and Peter Lawrence. The first two of these are the main presenters, whilst Peter Lawrence often does the amateur astronomer segment, in which he shows the audience what to look for in the sky, and how to do it!

One irritating thing about the programme is that it sometimes goes off air, for a "well deserved break", for as much as 3 months. Also, there is no December programme. In the days of Patrick Moore, the Sky at Night was on every month without fail!

Another difference is that, like virtually all modern documentaries, it "has" to have a 3 minute "prequel" of what is going to come up in the programme. In the days of Patrick Moore, it just started immediately, and Patrick was off just like a horse from the starting gate! He really came into his own with the Apollo Moon Missions, over 50 years ago, now.

The "Sky at Night" magazine, which was started in June 2005 by Patrick Moore, is still going strong, and our Society has its own "Sky at Night" segment, which in the last few years has been presented by our own Ron Canham.

Mars Occultation – 8 Dec

On the night of 7th-8th December, Mars reached Opposition. Ironically, it was actually closest to Earth on 1st December when it reached its maximum angular size of 17.2' arcseconds.

On 7th-8th December, the Moon was Full. As Mars was very close to the Moon, I was able to compare the size of the naked eye Moon, to that of Mars, at different magnifications. I saw that Mars was approximately the same size as the naked eye Moon, at between 222X and 333X, in my telescope.

This was also the night of a rare case of Mars being occulted by the Moon. When Mars was rising, it was already close to the Moon, being only 5 degrees from it at about 7pm. By 11.45pm, it was down to about two and a half degrees separation. It was at the 10 o' clock position from the Moon. By about 4.40am, Mars was just visible with the naked eye as it was now almost touching the Moon!

I watched the "final approach" to the Moon through my telescope, firstly at 62X and then at 222X. Mars contrasted well with the Moon, with its bright orange colour against the yellow glare of the Moon. Mars still appeared quite large, even against the Moon!

Mars quickly reached the Moon’s limb, then slowly started to disappear. Mars became a half planet, and then shrunk from view at about 4.57am.

Due to the (relatively) large angular size of Mars (around 17’ arcseconds), the actual occultation took over half a minute. By contrast, a star will just blink out instantaneously, as they are essentially just points of light. This is because any star is so remote that any angular size it has is incredibly small.

I stupidly missed the reappearance of Mars an hour later, as I had decided to observe at 222X; consequently, I couldn't see the entire Moon in one go, and I made a wrong estimate as to where it would re-emerge, and it had already come out by the time I realised

my mistake. At least I clearly saw Mars before the occultation started!

Following its reappearance, Mars was now at the 5' o clock position from the Moon. As it was a Full Moon, there was no darkness limb for Mars to disappear or reappear from, and it could be followed right to the Moon's limb.

For once, the weather was perfect with a clear, cloudless sky, although there was a heavy frost! Despite being so late in the night, the Moon was still fairly high in the Western sky, both at occultation, and for some time after the re-emergence of Mars.

This is the first time that I have seen an occultation of Mars although, in the past, I have seen 5 occultations of Saturn, and 1 of Jupiter. What a beautiful sight it made, not only through the telescope, but in binoculars, and even with the naked eye.

Artemis 1 Splashdown – 11 Dec

On 11th December, Artemis 1 splashed down - exactly 50 years to the day that Apollo 17 landed on the Moon! As with other key milestone events, I "observed" this final mission milestone on my phone. Well, at least, Artemis 1 came home, unlike the football!

Latest Observations – 17 Dec

Due to the freezing cold conditions during mid-December, there were many clear nights. Unfortunately, it was so cold that the GOTO on my telescope refused to work properly, although it was working correctly in the slightly warmer daytime!

One occasion on which it failed was during the Mars occultation, so I had to use the telescope, manually.

With the naked eye, Mars appeared as a blazing orange beacon of light. It was surprising to see the nearby orange stars of Aldebaran and Betelgeuse, nearby, appearing as no more than orange sparks of light when they normally appear so impressive in the sky.

Jupiter also continued to dominate the evening sky, likewise, appearing as a blazing beacon of light in the sky.

The Sun remained "active", in both white light and Ha light. It still had several sunspots visible upon it.

The Winter Solstice – 21 Dec

On 21st December, it was the Winter Solstice - the shortest day of the year, and the longest night. This came up (inevitably) as the final item on the BBC News, and it showed an astronomer at the Royal Greenwich Observatory, explaining it.

Unfortunately, however, he went on to say that something was happening the next night, but it was only the Ursid meteor shower, which even he said had (only) 5 to 10 meteors per hour. This is not a very active shower! I have to say I'm not a fan of meteor showers, in general, as when I look for them, nothing ever seems to happen. Unlike an eclipse, an occultation, or observing a certain planet, or other celestial body, they are not predictable!

In other news, my telescope GOTO was working fine on 20th December, on a much milder evening. As I said earlier, in the really freezing cold weather, it refused to line up on the stars. I haven't seen my telescope behave like this before!

I saw that the variable star, Mira, was now about magnitude 9, so it was now nearly at minimum magnitude. The variable star of R Lepus was only barely visible, if at all, in my scope, so that must have been at minimum, too!

On 22nd December, there were some more mentions of the Winter Solstice on the BBC News and in the newspapers, showing people gathering at Stonehenge - some were hugging the stones!

More Observations – 29 Dec

Today, I saw Venus for the first time in months. In fact, I have only seen it twice, this year, the last telescope observation being on 26th June, and then on 12th August, low in the dawn sky. It has been, what astronomers refer to as "badly placed" in the sky, as it has been very low down, or even behind the Sun.

This evening, I managed to see it with my telescope, through extensive cirrus cloud, in

the early evening. I managed to get it in view, by using my GOTO, despite it still being daylight, so I couldn't actually align correctly on the two stars required for the GOTO. Usually, I need to hunt around for Venus when doing this and, quite often, I fail to get it at all! Today, however, Venus actually moved into my low power field of view, which happens incredibly rarely! It was still very low down in the SW sky, even at about 3.37pm, when I saw it.

Venus appeared as a small round disk, which meant that it was at its furthest from Earth…..and at its least interesting! It was 10.3' arcseconds in size, and at 96% phase. Later in the evening, I saw a conjunction of Jupiter and a Half Moon (which happens once a month). Even with the naked eye, they made a spectacular sight, although such conjunctions are, of course, of no scientific importance. The Moon and Jupiter were about 5 degrees apart.

Later still, I observed Mars, which was now very high up to the South. I could easily see the dark feature of Syrtis Major, with its two arms extending either side of it, Mare Tyrhrenum and Sinus Sabaeus. Once again, I could see the beautiful blue /violet haze on the Northern limb.

Mars had now shrunk down to 14.9' arcseconds in size - over 2' arcseconds lost since early December.

Dark Skies Measurement Devices

From the editor: Shazia Webster kindly forwarded the information below to me. I have yet to look into it further, but it may be of interest to some members. I hasten to add that I have no idea how much the devices cost!

Hi Shazia,

We are pleased to announce the rollout of our new pilot **Light Monitor Grant Program**. By partnering with **Asterion**, we are providing SQM devices to measure the quality of the night sky, as well as the Opple Light Master III device, which can measure the CCT of light sources.

These specialized devices can be valuable tools to collect data required for applications to the **International Dark Sky Places Program**. By offering these devices in our Lighting Device Program, a Dark Sky Place applicant, IDA Chapter, or Delegate can use them to monitor light pollution without needing to purchase a new device on their own.

This program is intended to supplement funding barriers from groups who wish to monitor artificial light at night or CCT and need additional assistance to do so. If extenuating circumstances prevent you or your Chapter from purchasing these light monitors on your own, please fill out this **form** with as much detail as possible about the measuring location and intended use of these devices. Your response should include a summary of growing dark-sky efforts in your area and how you plan to use the requested device to support these efforts.

For groups who are interested in purchasing permanent devices for their own uses, you can use the following links:

Sky Quality Meters:
Unihedron website

Opple Light Master III:
Opple website
Ali Express or **Amazon** (we recommend the Pro 3 version)

We will also be holding an informational meeting about the program on Monday, December 12th at 10 am PST (1 pm EST, 6 pm UTC). To automatically convert the time to your local time, please visit this **link**. You can register for the meeting **here**.

Thank you all so much for your efforts to protect the night. We hope this program expands the availability of dark sky efforts around the globe! Please reach out to me at bettymaya@darksky.org with any additional questions.

With gratitude,

Object of the month: Hyades – Martin Howe

The Hyades open cluster is often seen as the poor sibling to its rival open cluster in Taurus, the Pleiades. In fact, one version of the mythology has them as sisters (or step-sisters) of each other so maybe the use of the phrase sibling is very apt!

However, the Hyades is a great sight in its own right, with its very distinctive V shape forming the head and horns of Taurus the bull. It is very easy to find in the night sky with several aids to finding its whereabouts. In early January it is about 45 degrees above the horizon towards the Southeast by 7pm.

One way to find the Hyades is by finding the first magnitude red star Aldebaran (the 14th brightest star in the sky). Aldebaran forms part of the Hyades asterism but is not actually a physical member of the cluster, lying much closer at about 65 light years compared to the cluster itself at about 153 light years. Another way to find the Hyades is by extending a line westward through the belt of Orion until you reach Aldebaran and the Hyades. The Hyades also lies a little over halfway between Orion and the Pleiades cluster, making it another easy way to find it.

Another good signpost, at least in early and late January, is Mars. Mars will be bright red in early January and impossible to miss high in the East / Southeast. During the first and last weeks of January Mars, named after the Roman god of war, will be cavorting between the two groups of sisters - the Pleiades and Hyades.

Image credit: Stellarium

The main stars of the Hyades (excluding Aldebaran) are of magnitude +3 or +4, but the cluster itself contains hundreds of stars. It is thought to be about 625 million years old (compared to its much younger siblings in the Pleaides cluster at 'just' 100 million years). Hence whereas the Pleaides cluster is full of very bright hot young blue stars still surrounded by remnants of the dust and gas from which they were formed, the Hyades contains much older stars including red giants and white dwarfs.

This image of the Hyades above was cropped from 23x60 second exposures using a Canon 5DmkIII set at ISO 3200 plus a 200mm lens operating at f/5.6. This was mounted on a Skywatcher Star Adventurer mount and taken from a dark sky site in the south of France.

James Webb space telescope uncovers chemical secrets of distant world – paving the way for studying Earth-like planets

Acknowledgement: This article was written by Joanna Barstow, Ernest Rutherford Fellow, The Open University and was published in THE CONVERSATION on 24th November 2022. It is republished in full under a Creative Commons Licence. The original article, with additional links and images can be found here: https://theconversation.com/james-webb-space-telescope-uncovers-chemical-secrets-of-distant-world-paving-the-way-for-studying-earth-like-planets-195224

Since the first planet orbiting a star other than the Sun was discovered in 1995, we have realised that planets and planetary systems are more diverse than we ever imagined. Such distant worlds – exoplanets – give us the opportunity to study how planets behave in different situations. And learning about their atmospheres is a crucial piece of the puzzle.

Nasa's James Webb space telescope (JWST) is the largest telescope in space. Launched on Christmas Day 2021, it is the perfect tool for investigating these worlds. Now my colleagues and I have used the telescope for the first time to unveil the chemical make-up of an exoplanet. And the data, released in preprint form (meaning it has yet to be published in a peer-reviewed journal), suggests some surprising results.

Many exoplanets are too close to their parent stars for even this powerful telescope to distinguish them. But we can use the trick of watching as the planet passes in front of (transits) its star. During transit, the planet blocks a small fraction of the starlight, and an even tinier fraction of the starlight is filtered through the outer layers of the planet's atmosphere.

Gases within the atmosphere absorb some of the light – leaving fingerprints on the starlight in the form of a reduction in brightness at certain colours, or wavelengths. JWST is particularly suited to exoplanet atmosphere studies because it is an infrared telescope. Most of the gases that are in an atmosphere – such as water vapour and carbon dioxide – absorb infrared rather than visible light.

I am part of an international team of exoplanet scientists that has been using JWST to study a roughly Jupiter-sized planet called WASP-39b. Unlike Jupiter, however, this world takes only a few days to orbit its star, so it is being cooked – reaching temperatures exceeding 827°C. This gives us the perfect opportunity to explore how a planetary atmosphere behaves in extreme temperature conditions.

We used JWST to recover the most complete spectrum yet of this fascinating planet. In fact, our work represents the first chemical inventory of the planet's atmosphere.

We already knew that most of this large planet's atmosphere had to be a mixture of hydrogen and helium – the lightest and most abundant gases in the universe. And the Hubble telescope has previously detected water vapour, sodium, and potassium there.

Now, we've been able to confirm our detection and produce a measurement of the amount of water vapour. The data also suggests there are other gases including carbon dioxide, carbon monoxide and, unexpectedly, sulphur dioxide.

Having measurements of how much of each of these gases is present in the atmosphere means we can estimate the relative amounts of the elements that make up the gases – hydrogen, oxygen, carbon, and sulphur. Planets are formed in a disc of dust and gas around a young star, and we expect different amounts of these elements to be available to a baby planet at different distances from the star.

WASP-39b appears to have a relatively low amount of carbon relative to oxygen, indicating it probably formed at a greater distance from the star where it could have easily absorbed water ice from the disc (boosting its oxygen), compared with its current very close orbit. If this planet has migrated, it could help us develop our theories about planet formation, and would support the idea that the giant planets in our Solar System also did a fair bit of moving and shaking early on.

A sulphurous key

The amount of sulphur we detected relative to oxygen is quite high for WASP-39b. We'd expect sulphur in a young planetary system to be more concentrated in bits of rock and rubble than as an atmospheric gas. So, this indicates that WASP-39b might have undergone an unusual number of collisions with sulphur-containing chunks of rock. Some of that sulphur would be released as gas.

In a planet's atmosphere, different chemicals react with each other at different rates depending on how hot it is. Usually, these settle into an equilibrium state, with the total amounts of each gas remaining stable as the reactions balance each other. We managed to predict what gases we would see in WASP-39b's atmosphere for a range of starting points. But none of them came up with sulphur dioxide, instead expecting any sulphur to be locked up in a different gas, hydrogen sulphide.

The missing piece of the chemical jigsaw puzzle was a process called photochemistry. This is when the rates of certain chemical reactions are driven by energy from photons – packets of light – coming from the star, rather than by the temperature of the atmosphere. Because WASP-39b is so

hot, and reactions generally speed up at higher temperatures, we didn't expect photochemistry to be quite as important as it has turned out to be.

The data suggests that water vapour in the atmosphere is split apart by light into oxygen and hydrogen. These products would then react with the gas hydrogen sulphide, eventually stripping away the hydrogen and replacing it with oxygen to form sulphur dioxide.

What's next for JWST?

Photochemistry is even more important on cooler planets that may be habitable – the ozone layer on our own planet is formed via a photochemical process. JWST will be observing the rocky worlds in the Trappist-1 system during its first year of operation. Some of these measurements have already been made - and all these planets have temperatures more akin to Earth's.

Some may even have the right temperature to have liquid water on the surface, and potentially life. Having a good understanding of how photochemistry influences atmospheric composition is going to be critical for interpreting the Webb telescope observations of the Trappist-1 system. This is especially important since an apparent chemical imbalance in an atmosphere might hint at the presence of life, so we need to be aware of other possible explanations for this.

The WASP-39b chemical inventory has shown us just how powerful a tool JWST is. We're at the start of a very exciting era in exoplanet science, so stay tuned.

Important Note:

In order to allow sufficient time to compile Janus and get it on the EAS Website by the 1st of each month any submissions 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:

NEXT MEETING: 8pm Friday 13th January – Nonsuch High School

EAS member Martin Howe will talk on 'DSLR Astrophotography'.

Ron Canham 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, may be sometime around the new moon on 21st January. The precise date and timings of any session will be advised by email and WhatsApp a few days in advance

AD HOC OBSERVING AT WARREN FARM:

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