JANUS
THE NEWSLETTER OF EWELL ASTRONOMICAL SOCIETY

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

Editorial

Welcome to the December edition of Janus – the last of 2023!

As noted last month, there will be no December lecture; instead, we will have our AGM. Please attend if you can and see if you can win the quiz!

December is a historic month for what is one of the longest (if not THE longest) established satellite programmes in history. Fifty years ago this month, the US Navstar GPS programme was approved. This was the beginning of satellite navigation (SatNav) as we now know it. Initially conceived for military use, it took until September 1983 - almost 10 years - for the then US President, Ronald Reagan, to declare that, once operational, GPS would be made available to civilian aircraft. This followed the tragic shooting down of a Korean Airlines aircraft that, as a result of a navigation error, had inadvertently drifted into Soviet airspace. However, it took until December 1993 (a further 10 years) for GPS to achieve an initial operational capability and for an FAA certified GPS receiver to become available. Six years later, a GPS receiver was incorporated into a Finnish mobile phone for the first time.

There are now many more SatNav systems available: In addition to GPS, Apple's iPhone 15 supports Russia's Glonass, Europe's Galileo, China's BeiDou, Japan's QZSS and India's NavIC.

These systems are now more commonly referred to as PNT (Precise Navigation and Timing) systems, and it is the precise timing element which is fundamental to much of modern-day life. For example, it ensures the synchronisation of on-line banking transactions and provides the timing for the internet. Where would we be without these or the navigation capability?!

John

SkyUpdate
What's up this month?

The Solar System December

MERCURY: begins the month emerging into the evening sky as it approaches greatest elongation E. It will be difficult to observe, reaching its highest point in the sky during daytime and being no higher than 1° above the horizon at dusk. It remains difficult to see as the month progresses and by the end of the month, approaching greatest elongation W, it will still reach its highest point in the sky during daytime and be no higher than 4° above the horizon at dawn.

VENUS: is visible as a morning object, having recently passed greatest elongation W. It begins the month rising at 03:33 and will reach an altitude of 26° above the SE horizon before fading from view as dawn breaks at around 07:16. Visible throughout the month, it ends the month rising at 04:54 – 3 hours and 9 minutes before the Sun – and reaching an altitude of 16° above the SE horizon before fading from view as dawn breaks at around 07:38.

MARS: recently passed behind the Sun at solar conjunction. Throughout the month, it is not readily observable since it is very close to the Sun, at a separation of only 3° from it at the beginning of the month and only 12° from it at the end.

JUPITER: recently passed opposition and begins the month visible in the evening sky, becoming accessible around 16:19 16° above the E horizon, as dusk fades to darkness. It will then reach its highest point in the sky at 21:38, 51° above the S horizon, and will continue to be observable until around 03:49, when it sinks below 7° above the W horizon. By the end of the month, still visible in the evening sky, it becomes accessible around 16:25, 35° above the SE horizon, as dusk fades to darkness. Reaching its highest point in the sky at 19:34, 50° above the S horizon, it will continue to be observable until around 01:43, when it sinks below 7° above the W horizon.

SATURN: is currently an early evening object, now receding into evening twilight. It begins the month visible in the evening sky, becoming accessible around 16:43, 24° above the S horizon, as dusk fades to darkness. It will then reach its highest point in the sky at 17:33, 25° above the S horizon, and will continue to be observable until around 21:04, when it sinks below 11° above the SW horizon. By the end of the month, it will soon pass behind the Sun at solar conjunction. It will become visible at around 16:51, 24° above the S horizon, as dusk fades to darkness, and will then sink towards the horizon, setting at 20:45.

URANUS: recently passed opposition and begins the month visible in the evening sky, becoming accessible around 17:23, 21° above the E horizon, as dusk fades to darkness. It will then reach its highest point in the sky at 22:29, 56° above the S horizon, and will continue to be observable until around 03:39, when it sinks below 21° above the W horizon. By the end of the month, it is an early evening object, and is visible in the evening sky, becoming accessible around 17:30, 41° above the SE horizon, as dusk fades to darkness. Reaching its highest point in the sky at 20:27, 55° above the S horizon, it will continue to be observable until around 01:35, when it sinks below 21° above the W horizon.

NEPTUNE: is currently an early evening object, now receding into evening twilight. It begins the month visible in the evening sky, becoming accessible around 17:23, 31° above the SE horizon, as dusk fades to darkness. Reaching its highest point in the sky at 19:01, 35° above the S horizon, it will continue to be observable until around 22:12, when it sinks below 21° above the SW horizon. By the end of the month, still an early evening object, now receding into evening twilight, it will become visible at around 17:30, 35° above the S horizon, as dusk fades to darkness. It will then sink towards the horizon, setting at 22:51.

MOON PHASES:

Full Moon	27 November
Last Quarter	5 December
New Moon	12 December
First Quarter	19 December
Full Moon	27 December

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*

December

2	Pheonicid meteor shower 2023
4	Mercury at greatest elongation east
6	Neptune ends retrograde motion December φ-Cassiopeid meteor shower 2023
7	Puppid-Velid meteor shower 2023
8	Mercury at dichotomy
9	Close approach of the Moon and Venus Monocerotid meteor shower 2023
10	Mercury at highest altitude in evening sky
12	σ-Hydrid meteor shower 2023 Large Magellanic Cloud is well placed
14	Conjunction of the Moon and Mercury Geminid meteor shower 2023
15	Running Man cluster well placed Orion Nebula well placed
16	Comae Berenicid meteor shower 2023
17	Close approach of the Moon and Saturn
19	Lunar occultation of Neptune
20	December Leonis Minorid meteor shower 2023
21	Asteroid 4 Vesta at opposition
22	December solstice Close approach of the Moon and Jupiter Mercury at inferior solar conjunction Asteroid 9 Metis at opposition
23	Ursid meteor shower 2023
24	Close approach of the Moon and M45
25	Comet 62P/Tsuchinshan passes perihelion
26	Lunar occultation of Beta Tauri
28	Asteroid 5 Astraea at opposition
29	Cluster NGC 2232 is well placed

30	Rosette Nebula is well placed
31	Jupiter ends retrograde motion

January

2	The cluster Messier 41 is well placed
3	The Earth at perihelion
4	Quadrantid meteor shower 2024
6	Mercury at highest altitude in morning sky
7	Mercury at dichotomy
8	Lunar occultation of Antares Conjunction of Moon and Venus
9	Conjunction of Moon and Mercury
10	Conjunction of Moon and Mars
12	Mercury at greatest elongation west
14	Close approach of Moon and Saturn
15	Lunar occultation of Neptune Cluster Messier 47 is well placed NGC 2403 is well placed
17	Conjunction of Venus and Ceres Cluster NGC 2451 is well placed
18	Close approach of the Moon and Jupiter
19	γ-Ursae Minorid meteor shower 2024
20	Asteroid 354 Eleonora at opposition Close approach of the Moon and M45 134340 Pluto at solar conjunction Cluster NGC 2516 is well placed
22	Lunar occultation of Beta Tauri
24	The cluster NGC 2547 is well placed
27	Uranus ends retrograde motion Conjunction of Mercury and Mars Close approach of Mercury and Mars
31	Beehive cluster is well placed Omicron Velorum cluster is well placed

Collected Observations (and thoughts) – Gary Walker

Occultation of Venus – Posted 9 Nov

I just managed to see the occultation of Venus by a waning crescent Moon on the morning of 9 November. This was despite a fairly cloudy sky, with only occasional breaks in the clouds. At about 9.14am, I could easily see the Moon high up in the South. What was more interesting was the fact that Venus was also easily visible to the naked eye, despite it being fully daylight, with the sun in the sky!

This phenomenon is because one's naked eye is focused on the Moon, which means that Venus was also easily visible with the naked eye! This is due to your eye being focused on "infinity". Normally, if Venus is on its own in the sky, it is very difficult to see without binoculars, because your eyes are not focusing on "infinity".

By about 9.48am, in my 11 X 80 binoculars, Venus made a spectacular sight, appearing like a bright star upon the limb of the Moon. It appeared very beautiful - like a diamond ring!

I just managed to see Venus being occulted through my telescope. Venus took several seconds to disappear as, unlike a star, it is an object with a reasonably large angular size, (about 20' arcseconds), not a point source. Venus appeared to turn into a bright "bar" of light against the Moon's limb, which looked a weird sight, before slowly fading away. Presumably, I was seeing the more "straight" dark-side part of the limb of Venus disappearing, last of all, as the curved daylight part went first!

The cloud came over again, so I had no chance of seeing the reappearance at 10.48am. I couldn't even see the Moon later on in the morning, when the clouds inevitably broke up!

However, at least I did manage to see some of this event, so that is a win in this country, with the difficult weather all the time.

I last saw a Venus occultation in 2007. I have also seen one of Jupiter, one of Mars (last December) and, for some reason, 5 of Saturn!

The Moon will usually pass "near" a certain planet once a month, but in most cases will miss the planet – either that, or the occultation will only be visible from part of the Earth!

More on the visibility of Venus in daytime – Posted 10 Nov

When George Washington was being inaugurated for his second term in office, in 1865, a curious thing started to happen in the crowds of people attending it in Washington DC. First, a few started pointing up at the sky, and then more and more people in the crowd began doing the same. Then George Washington himself saw what was going on, and he, too, saw the planet Venus in the daytime sky with his naked eye. A similar thing also occurred to Napoleon Bonoparte!

Obviously, one would need a clear sky for this observation, as even pesky cirrus cloud would blot it out!

I have usually never managed to see Venus in the daytime without optical aid, but when it was very close to the Moon - as in today's occultation - my eyes were focused for both the Moon and Venus, so Venus was easy to see with my unaided eye! It makes you wonder how on earth, you missed it before! Normally, though, one's eyes are never quite focused on "infinity", so Venus doesn't pop out into view.

Another time, I managed to glimpse it was when I focused my eyes on a cumulus cloud that was passing very close to Venus, and then I also saw Venus. This was only a year, or two, ago. Usually, I have to use my binoculars, at least, and even that is very difficult, unless I know exactly where Venus is in the sky. Unfortunately, you don't generally get a handy celestial body close enough to Venus to see it like this!

"Houston we have a problem"…. – Posted 18 Nov

I watched the second test flight launch of the SpaceX Starship on my phone at about 1.05pm, (UK time!). It launched successfully, but at the second stage separation, it all went pear-shaped! They commented that it experienced a "rapid, unscheduled, disassembly" just like they did the previous time. In other words, it failed again!

Moon Halo – Posted 26 Nov. 23

On the night of 25 November, there was a beautiful large halo around the Moon. This was due to the cirrus clouds in the sky. In addition, Jupiter was only about 6 degrees to the SW of the Moon. Jupiter was well "inside" the halo but, a few years ago, I saw Jupiter right on the halo itself, appearing like a diamond ring!

I saw today on social media posts that others had seen and photographed this sight. At the present time, the Moon passes close to Jupiter once a month, but occultations of it are surprisingly rare.

Halos around the Moon, or the Sun, are not uncommon, but they still can look beautiful. They appear when the Moon, or Sun, is shining through a layer of cirrus cloud, and sometimes with "Sun Dogs", or "mock suns" to either side, appearing rainbow tinted. These phenomena are often an indication of approaching rain, and this proved to be the case, about 24 hours later!

Solar Prominences & Filaments - Ron Johnson

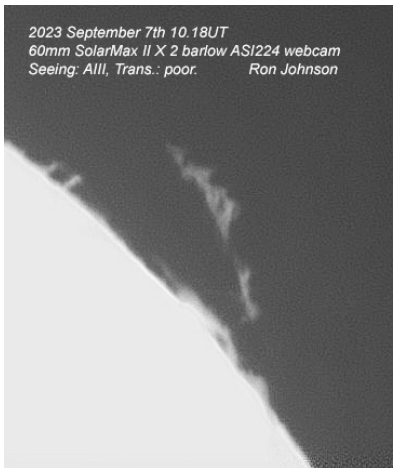
Never look at the Sun with the naked eye or through any optical instrument unless it is fitted with a certified solar filter.

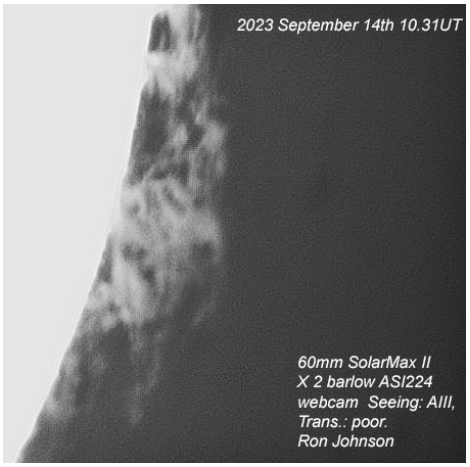
A solar prominence is a cloud of gas suspended above the surface of the Sun. A prominence has a temperature of the order of 10, 000K and a density many times that of the surrounding chromosphere.

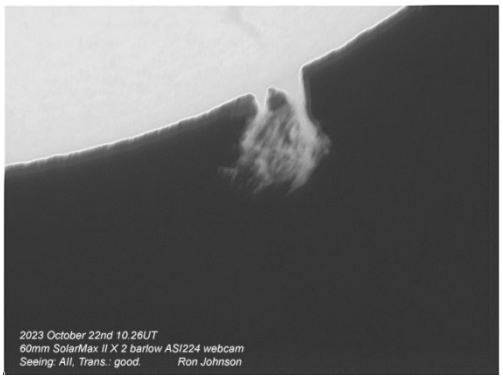
Prominences can be seen in elevation on the Sun's limb, but when seen against the solar disc, in plan, they appear dark and are known as filaments. Prominences can reach heights of many thousands of kilometres above the chromosphere.

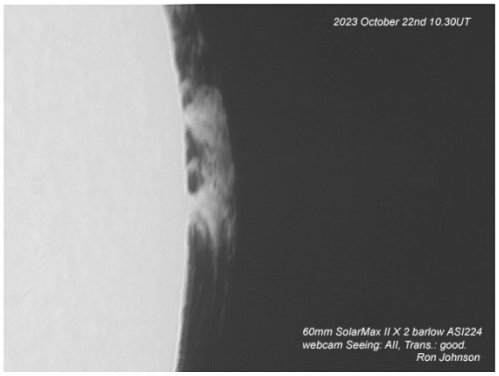
The following images are recent examples of solar prominences.

The images were obtained using a 60mm Ha SolarMax II telescope, X 2 Barlow and an ASI224 monochrome webcam.

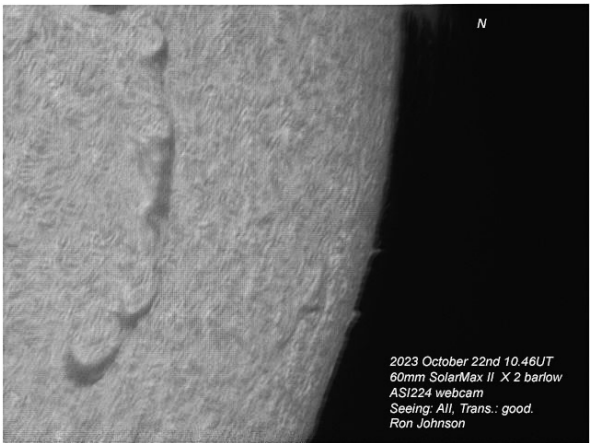


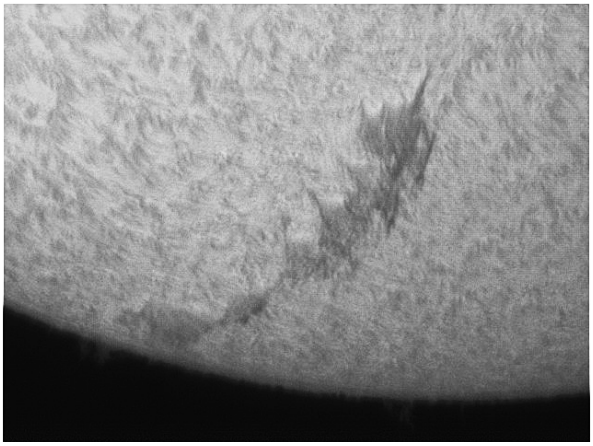


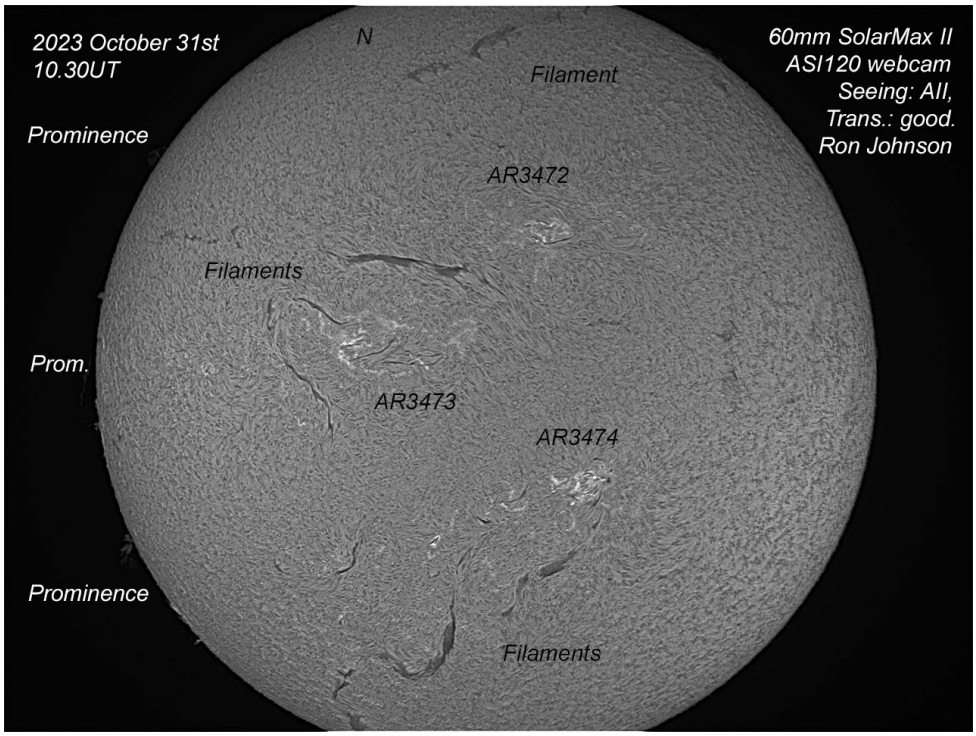




The following images show a variety of filaments against the solar disc. Some filaments can stretch for several hundred thousand kilometers.







Object of the month – Jupiter – Martin Howe

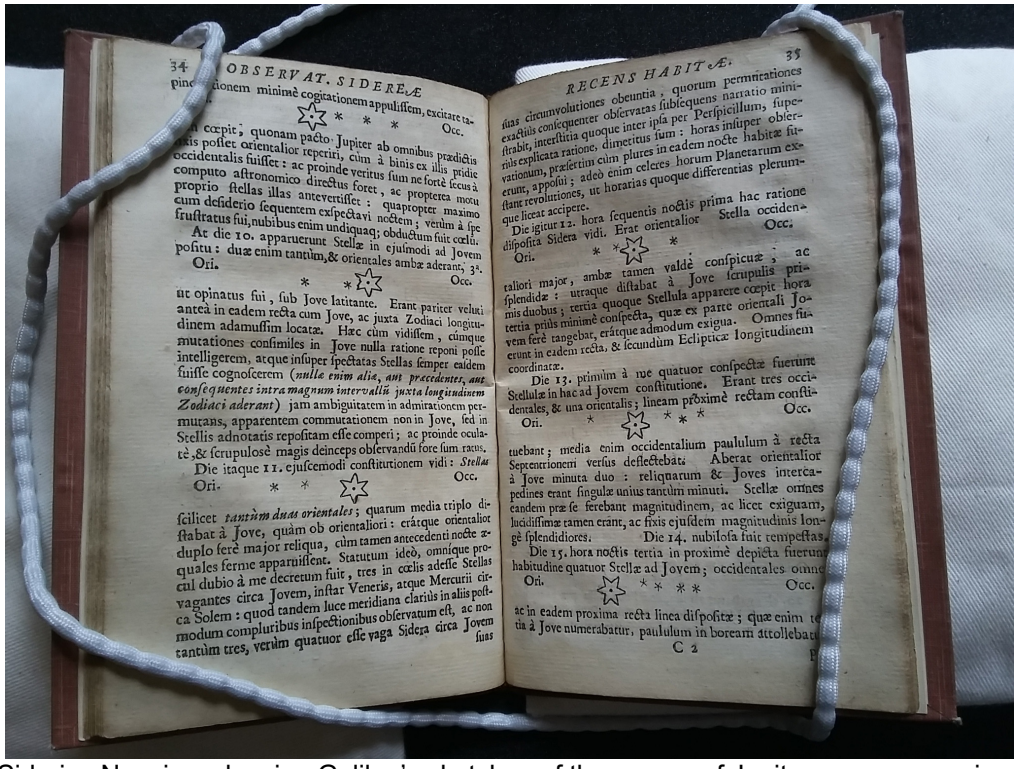
Last month I wrote about the magnificent planet Saturn – this month it is Saturn's partner in crime, Jupiter. In particular, between them, they were instrumental in influencing the structure of the solar system we see today through a process of planetary migration. This is a fascinating subject and far too broad to cover here, but worth a follow up internet search if you are interested in reading more about it.

Also, like Saturn, as one of the brightest planets visible in the night sky, Jupiter featured prominently in the early observations by Galileo. Galileo was the first to observe that Jupiter had four bright moons in attendance, which are now named collectively in his honour as the Galilean moons. Galileo identified that these objects orbited Jupiter and not the Sun. This provided very strong observational evidence that contradicted the ruling doctrine at the time that all bodies orbited the Earth, with the Earth in the centre of the solar system. This got Galileo into a lot of trouble with the Church at the time, being found guilty of heresy, and placed under house arrest for the rest of his life.

Galileo documented his observations in letters that were subsequently published in a small volume called Siderius Nuncius (readily obtainable in a very readable English translation).
On 7 January 1610, he notes:

> *"…Jupiter presented himself. And since I had prepared for myself a superlative instrument, I saw (which earlier had not happened because of the weakness of the other instruments) that three little stars were positioned near him – small but yet very bright. Although I believed them to be among the number of fixed stars, they nevertheless intrigued me because they appeared to be arranged exactly along a straight line."*

He then followed these objects for a number of days and observed that they appeared to 'dance' around Jupiter, and so could not have been among the "fixed" stars.



Siderius Nuncius, showing Galileo's sketches of the moons of Jupiter over successive days, and how they appeared to dance around Jupiter.

Jupiter is currently very prominent in the evening sky – by far the brightest object after the Moon at magnitude – 2.8, having passed opposition on 3 November. On 1 December, Jupiter rises at about 14:30, and crosses the meridian (due south) about 21:30, so nicely placed in the early evening. A good pair of binoculars (probably outperforming Galileo's early telescopes!) are sufficient to see the Galilean moons, and a small telescope of even 70mm or so will show a sizeable disc with the coloured bands of clouds on Jupiter. There is plenty of information available on the internet, as well as astronomy magazines such as Astronomy Now, detailing the positions of the moons each day, as well as the visibility of the great red spot. The free planetarium software Stellarium is also great for showing the different positions of the moons and the great red spot at different dates and times.

The image below was taken with a 127mm refractor on 2023-11-11 and shows the great red spot and the Galilean moons Io and Europa.

How we're building the world's biggest optical telescope to crack some of the greatest puzzles in science

Acknowledgement: This article was written by Derryck Telford Reid, Professor of Physics, Heriot-Watt University and was published in THE CONVERSATION on 8th November 2023. 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/how-were-building-the-worlds-biggest-optical-telescope-to-crack-some-of-the-greatest-puzzles-in-science-217012*

Astronomers get to ask some of the most fundamental questions there are, ranging from whether we're alone in the cosmos to what the nature of the mysterious dark energy and dark matter making up most of the universe is.

Now a large group of astronomers from all over the world is building the biggest optical telescope ever – the Extremely Large Telescope (ELT) — in Chile. Once construction is completed in 2028, it could provide answers that transform our knowledge of the universe.

With its 39-metre diameter primary mirror, the ELT will contain the largest, most perfect reflecting surface ever made. Its light-collecting power will exceed that of all other large telescopes combined, enabling it to detect objects millions of times fainter than the human eye can see.

There are several reasons why we need such a telescope. Its incredible sensitivity will let it image some of the first galaxies ever formed, with light that has travelled for 13 billion years to reach the telescope. Observations of such distant objects may allow us to refine our understanding of cosmology and the nature of dark matter and dark energy.

Alien life

The ELT may also offer an answer to the most fundamental question of all: are we alone in the universe? The ELT is expected to be the first telescope to track down Earth-like exoplanets — planets that orbit other stars but have a similar mass, orbit and proximity to their host as Earth.

Occupying the so-called Goldilocks zone, these Earth-like planets will orbit their star at just the right distance for water to neither boil nor freeze – providing the conditions for life to exist.

The ELT's camera will have six times better resolution than that of the James Webb Space Telescope, allowing it to take the clearest images yet of exoplanets. But fascinating as these pictures will be, they will not tell the whole story.

To learn if life is likely to exist on an exoplanet, astronomers must complement imaging with spectroscopy. While images reveal shape, size and structure, spectra tell us about the speed, temperature and even the chemistry of astronomical objects.

The ELT will contain not one, but four spectrographs — instruments that disperse light into its constituent colours, much like the iconic prism on the Pink Floyd's The Dark Side of the Moon album cover.
Each about the size of a minibus, and carefully environmentally controlled for stability, these spectrographs underpin all of the ELT's key science cases. For giant exoplanets, the Harmoni instrument will analyse light that has travelled through their atmospheres, looking for the signs of water, oxygen, methane, carbon dioxide and other gases that indicate the existence of life.

To detect much smaller Earth-like exoplanets, the more specialised Andes instrument will be needed. With a cost of around €35 million (£30 million), Andes will be able to detect tiny changes in the wavelength of light.

From previous satellite missions, astronomers already have a good idea of where to look in the sky for exoplanets. Indeed, there have been several thousand confirmed or "candidate" exoplanets detected using the "transit method". Here, a space telescope stares at a patch of sky containing thousands of stars and looks for tiny, periodic dips in their intensities, caused when an orbiting planet passes in front of its star.

But Andes will use a different method to hunt for other Earths. As an exoplanet orbits its host star, its gravity tugs on the star, making it wobble. This movement is incredibly small; Earth's orbit causes the Sun to oscillate at just 10 centimetres per second — the walking speed of a tortoise.

Just as the pitch of an ambulance siren rises and falls as it travels towards and away from us, the wavelength of light observed from a wobbling star increases and decreases as the planet traces out its orbit.

Remarkably, Andes will be able to detect this minuscule change in the light's colour. Starlight, while essentially continuous ("white") from the ultraviolet to the infrared, contains bands where atoms in the outer region of the star absorb specific wavelengths as the light escapes, appearing dark in the spectra.

Tiny shifts in the positions of these features - around 1/10,000th of a pixel on the Andes sensor - may, over months and years, reveal the periodic wobbles. This could ultimately help us to find an Earth 2.0.

At Heriot-Watt University, we are piloting the development of a laser systemknown as a frequency comb, that will enable Andes to reach such exquisite precision. Like the millimetre ticks on a ruler, the laser will calibrate the Andes spectrograph by providing a spectrum of light structured as thousands of regularly spaced wavelengths.

This scale will remain constant over decades, mitigating the measurement errors that occur from environmental changes in temperature and pressure.

With the ELT's construction cost coming in at €1.45 billion, some will question the value of the project. But astronomy has a significance that spans millennia and transcends cultures and national borders. It is only by looking far outside our Solar System that we can gain a perspective beyond the here and now.

Important Note:

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:

NEXT MEETING: 8pm Friday 8 December – Nonsuch High School

EAS Annual General Meeting

In addition to hearing reports from the Chairman, Secretary and Treasurer there ill be a quiz and other events including Ron Canham's customary presentation on the sky at night for the coming month.

NEXT USER GROUP:

Suspended until further notice.

The next session, allowing for moon rise & set times and cloud conditions, should be sometime around the new moon which is on 12 December.

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 6-16 December.

AD HOC OBSERVING AT WARREN FARM:

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