FEBRUARY 2020 EDITION
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Editorial:

Welcome to the February edition of Janus. Don't forget that there are 29 days in February this year – so, weather permitting, that means an extra day for viewing!

January saw exchanges amongst the WhatsApp group about a range of events including the launch of the latest set of Starlink satellites by SpaceX, the 10 Jan Penumbral Lunar Eclipse, and the Moon and Venus close to each other on 28 Jan. Some messages were accompanied by images, which adds to the interest. Stephen has previously stressed his desire that members use Social Media to share items of potential interest to others - please continue to do this using WhatsApp or any other means.

In another WhatsApp, Stephen shared a piece from the Metro newspaper discussing three of the best hotels with stargazing observatories – one in Utah, one in Iceland and one in Northumberland. I haven't stayed in any of these, but I have stayed at the Sunriver Resort, Bend, Oregon which has within its extensive grounds a nature reserve and observatory (for details visit https://www.snco.org). I keep meaning to write a piece about the observatory - suffice to say it has around 30 telescopes and benefits from around 300 clear nights a year!

As is often the case, there are a few planetary viewing opportunities this month, some of which may also present a photo opportunity. I have identified these in a separate section under the heading of "Planetary viewing highlights this month".

John

The Solar System February

MERCURY: recently passed behind the Sun at superior solar conjunction and, at the beginning of the month is not observable, reaching its highest point in the sky during daytime and a maximum elevation of 6° above the horizon at dusk. Passing in front of the Sun at inferior solar conjunction on 26 February, it remains difficult to observe being very close to the Sun, at a separation of only 7° from it.

VENUS: is emerging into the evening sky as it approaches greatest elongation East. At the beginning of the month, it will become visible around 17:08 UT as the dusk sky fades, 26° above the SW horizon. It will then sink towards the horizon, setting 3 hours and 50 minutes after the Sun at 20:34 UT. By the end of the month, it will become visible around 17:57 UT as the dusk sky fades, 34° above the SW horizon, before sinking towards the horizon, setting at 21:54 UT.

MARS: is currently emerging from behind the Sun. Throughout the month, it is not observable. Reaching its highest point in the sky during daytime, it will be no more than 10° or 11° above the horizon at dawn.

JUPITER: recently passed behind the Sun at solar conjunction. Early in the month, it is not observable, reaching its highest point in the sky during daytime and being no higher than 5° above the horizon at dawn. By the end of the month, however, it is visible in the dawn sky, rising at 04:47 UT – 2 hours and 1 minute before the Sun – and reaching an altitude of 9° above the SE horizon before fading from view as dawn breaks around 06:25 UT.

SATURN: recently passed behind the Sun at solar conjunction and, throughout the month, it is not observable. At the beginning of the month, it will reach its highest point in the sky during daytime and be on the horizon at dawn. At the end of the month, it will again reach its highest point in the sky during daytime and be no higher than 5° above the horizon at dawn.

URANUS: is currently an early evening object, now receding into evening twilight. It will become visible around 18:09 UT as the dusk sky fades, 49° above the S horizon. It will then sink towards the horizon, setting at 00:27 UT. By the end of the month, it will soon pass behind the Sun at solar conjunction and will become visible around 18:54 UT as the dusk sky fades, 33° above the SW horizon. It will then sink towards the horizon, setting at 22:38 UT.

NEPTUNE: will soon pass behind the Sun at solar conjunction. At the beginning of the month it is not observable, reaching its highest point in the sky during daytime and being no higher than 16° above the horizon at dusk. By the end of the month, it is still not readily observable since it will be very close to the Sun, at a separation of only 8° from it.

Planetary viewing highlights this month

7 Feb – 18:40 UT

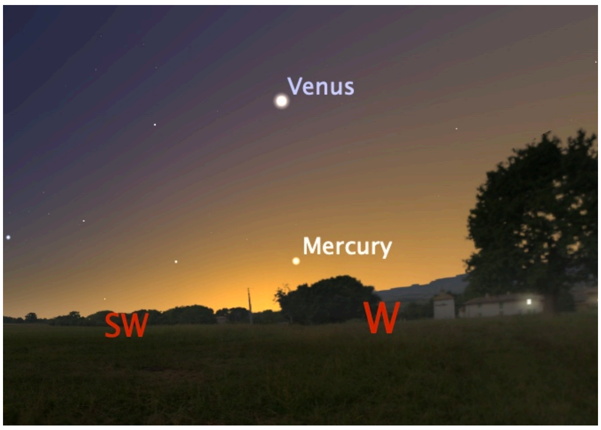


Image: Stellarium

After sunset, low in the southwest, Venus will lie above Mercury. Venus will be easy to see, but to spot Mercury below it a low horizon - and perhaps binoculars - will be needed.

18 Feb – 05:00 UT

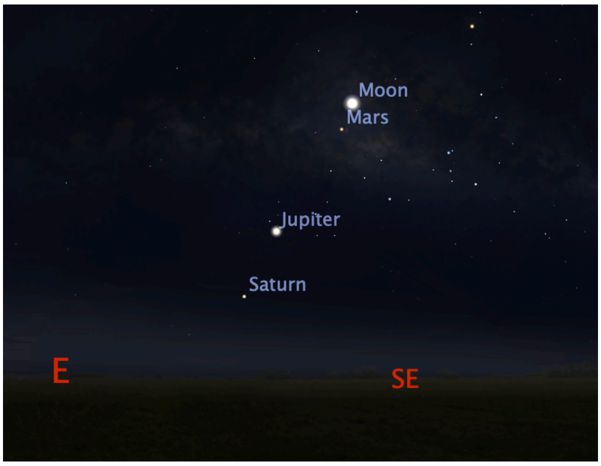


Image: Stellarium

The Moon, Mars, Jupiter and Saturn will be in a line and will rise higher in the sky as dawn approaches , although Saturn may be too low in the sky to be visible.

27 Feb – 18:30 UT

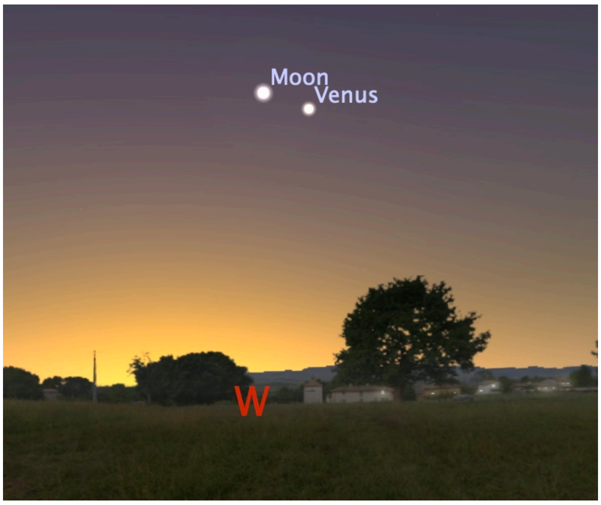


Image: Stellarium

After sunset on the 27th, and given a low horizon towards the west, you may be able to spot a very thin crescent Moon lying to the upper left of Venus.

29 Feb – 05:20 UT

Image: Stellarium

Saturn, Jupiter and Mars will be in a line in the predawn sky.

MOON PHASES:

First Quarter	2 February
Full Moon	9 February
Last Quarter	15 February
New Moon	23 February

The Penumbral Lunar Eclipse – Gary Walker

I observed the Penumbral eclipse of the Moon, on the early evening of 10 January. A penumbral eclipse shadow will only dim the Moon very slightly, and subtly, because it is the outer part of the Earth's shadow, not the inner umbral part. Hence, a Penumbral eclipse will never be as good as an Umbral partial or total lunar eclipse.

Despite initially unfavorable impressions, the sky cleared in time, and the eclipse was at a sociable time! Uniquely, I observed it en-route from Banstead to Cheam, as of course it was the EAS meeting that night!

I first observed the eclipse, at Banstead at around 18:30 UT, then again at Cheam, when I got off the bus around 19:12 UT and, finally, on arrival at Nonsuch High School, around 19:23 UT.

The entire eclipse began at 17:07 UT, and ended at 21:12 UT. However, due to the subtleness of the penumbral shadow, it only really became more "obvious" at eclipse "maximum" which was reached at 19:10 UT (just about the time that I arrived in Cheam!).

With the naked eye, I could just pick out that there was something "odd" about the Moon in the lower right hand quadrant. I had brought along my 10 X 50 binoculars and, through them, I could see that the Moon was slightly dulled in the lower right-hand quadrant but bright over the rest of it. Nevertheless, I found that the penumbral shadow was significantly more prominent in the images that I took, especially with an exposure of 1/2000th of a second at F3.5.

I was able to see the slight dimming effect between 18:30 UT and 19:25 UT.

I have found before, that camera images show the effect far better than the naked eye or binoculars.

I saw that the BBC 6pm News mentioned this eclipse, but only because of media excitement about it being a so called "Wolf Moon" (whatever that is!).

Usually, I only see the Penumbral shadow on the Moon, after the post-umbral phase of a lunar eclipse has ended. In this case, one can still see that a part of the Moon's limb, is dimmed, and appears fuzzy.

Once, On 10 December 2011, I observed Moonrise when a lunar eclipse had just finished. However, I could still see (and photograph) the penumbral shadow. As I noted earlier, penumbral eclipses are easier to see in images than they are visually with the unaided eye or binoculars.

More observations of Betelgeuse – Gary Walker

I observed Betelgeuse with the naked eye on the evening of 17 January, and it appeared to be of about the same magnitude as Bellatrix (The star to its west, opposite it). Bellatrix has a magnitude of about 1.64, so Betelgeuse must be currently about the same value, and somewhat fainter than in December; it still hasn't blown – at least, not yet!

I also saw that the star, Aldeberan (in Taurus), seemed to be about twice as bright as Betelgeuse (Aldeberan is approximately of magnitude 0.75).

Observation of SpaceX Satellite Constellation – Gary Walker

On the evening of 19 January, at around. 19.15 UT, I became aware of a whole line of satellites crossing the sky from the SW to the NE. I didn't actually count them, but there must have been at least a dozen of them. They passed just "below" the Pleides (i.e. just to the East of them). They seemed to be of about the 2nd magnitude, possibly a bit brighter. They were all following exactly the same trajectory, about 7-8 degrees apart.

In the SW sky, where they were coming from, they naturally appeared to be bunched up.

No doubt, these satellites will be "scratching" somebody's astronomical images!

Gaia 20ADQ – a large transiting body – John Murrell (or how long is a piece of string

In addition to high precision measurements of the position of stars, ESA's GAIA satellite (https://www.cosmos.esa.int/web/gaia) also provides high precision photometry in 3 bands, although most of the photometry data will not be available until Data Release 3 (DR3)at the end of 2021. However, the photometry data is monitored by a team at Cambridge (England) for transient events; to date they have published almost eleven thousand transient events.

On 8 January 2020 they published a new event identified at GAIA20ADQ (http://gsaweb.ast.cam.ac.uk/alerts/alert/Gaia20adq/). When I checked this event, it looked quite unusual (see Figure 1) in that it appeared to have an almost constant magnitude with several large dips, the latest being 2.08 magnitudes. This equates to around 84% of the light fading.

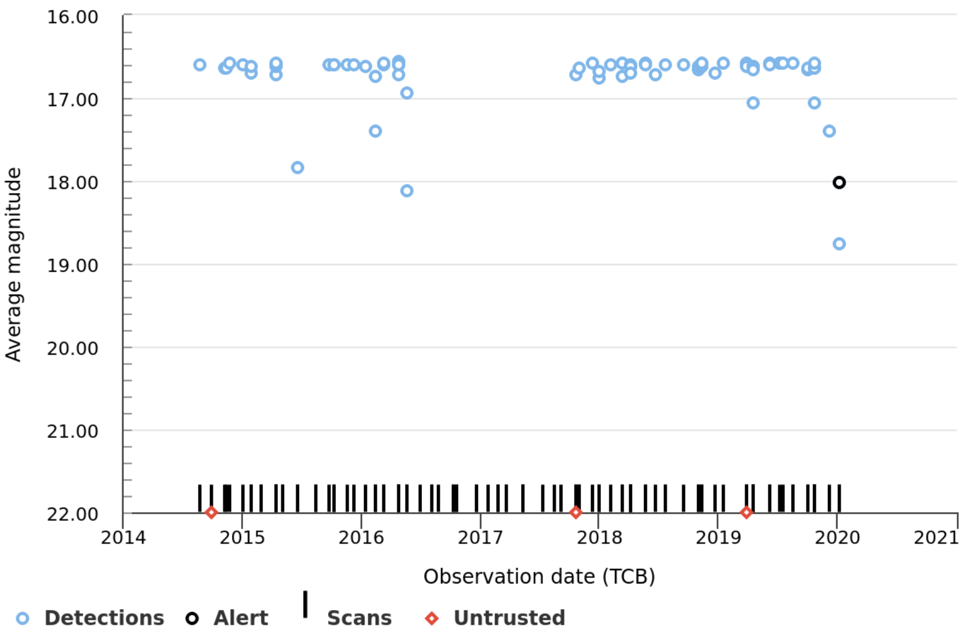


Figure 1: Light curve for GAia20ADQ

The light curve shows some evidence of 5 separate dips which could indicate that the occultation is the result of a large orbiting body.

To determine if the events were periodic, I needed a tool to analyse the light curve to determine if the 5 events were individual measurements of a periodic occultation. An internet search for appropriate software was not very successful; what looked like a useful tool appeared to be infected by a virus. However, the search did locate a paper "A period-finding method for sparse randomly spaced observations or 'How long is a piece of string?'" by M. M. Dworetsky (a copy of the paper is available at https://academic.oup.com/mnras/article/203/4/917/1029604 – {open access}). Briefly, the method involves folding the data around a trial period and then calculating how long the line is that joins all the points in the resultant phase diagram. You then select another trial period to see if the result is shorter or longer. If the result is shorter you keep the new result, if it is longer you keep the original one. Try enough times and you hopefully get to the correct period. This type of repetitive calculation is the sort of thing computers are good at, so I thought that I could implement it with a spreadsheet. It might not work as fast as writing it in proper code, but is a lot quicker to write, and allows a phase graph of the current result to be shown easily.

Having written a spreadsheet and, using the “solver” function to determine the best result, this worked quite well, but it tended to find periods that were harmonics or sub-harmonics of the correct result. This is a result of the problem being strongly non-linear, so it converges on a “good” result even though there are better results at multiples of the period.

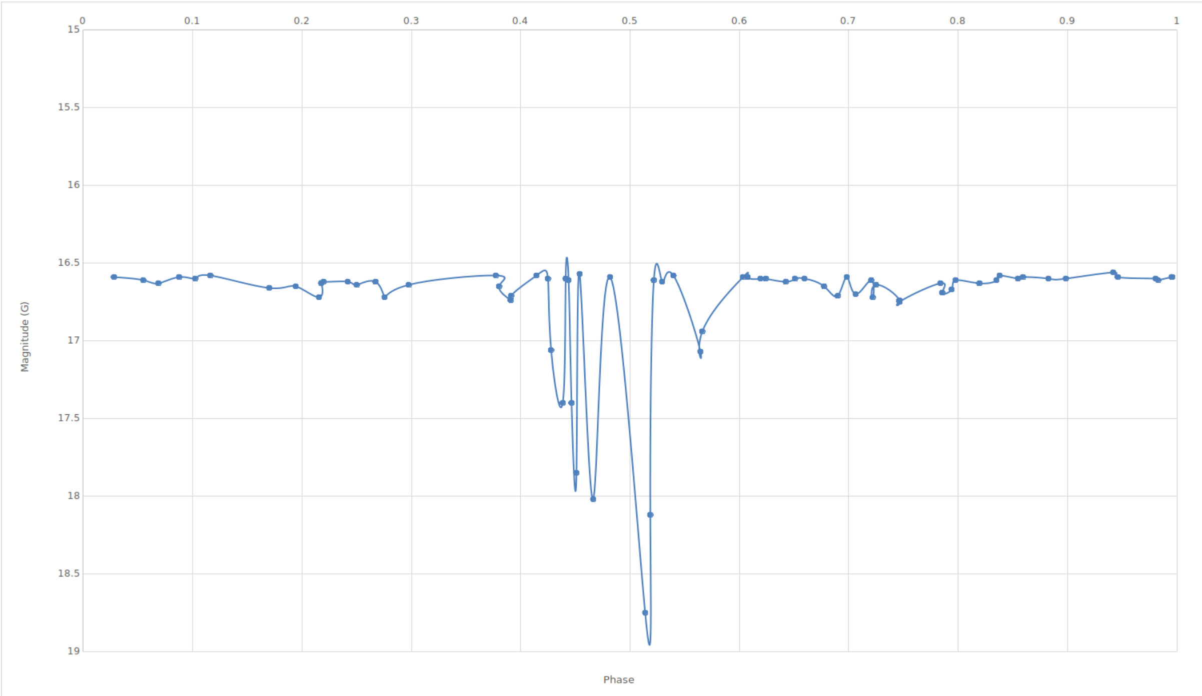


Figure 2: Period of 1.55618 days (TCB) – one third of real period

Figure 2 shows the folded magnitude curve with the phase horizontally; this result converged on a period a third of the final result.

There is evidence of a transit, but there are a number of points at the mean level during the transit. As a result, the length of the line joining the points was 14.88 MagPhase. A perfect phase diagram with a 2-magnitude dip and no noise in the magnitude reading would be expected to give a result in the order of 5.4 for a rectangular transit and a bit less than this if the sides slope as expected in a real transit.

Trialing periods two and three times that obtained above gave the result in Figure 3 with a period of 4.66855052306242 days TCB. When looking at the diagram, remember that the right-hand edge of the phase diagram joins onto the left hand edge so that the points make one transit. The length of the joining line is 5.066 MagPhase so is quite reasonable and shows it is a good result (and shows just how good the Gaia Photometry is).

I will write a bit more about the star and the occulting body in the next edition of Janus.
Meanwhile if anyone is interested in a copy of the spreadsheet, together with some guidance on how to use it please contact me at EAS2020@JohnMurrell.org.uk

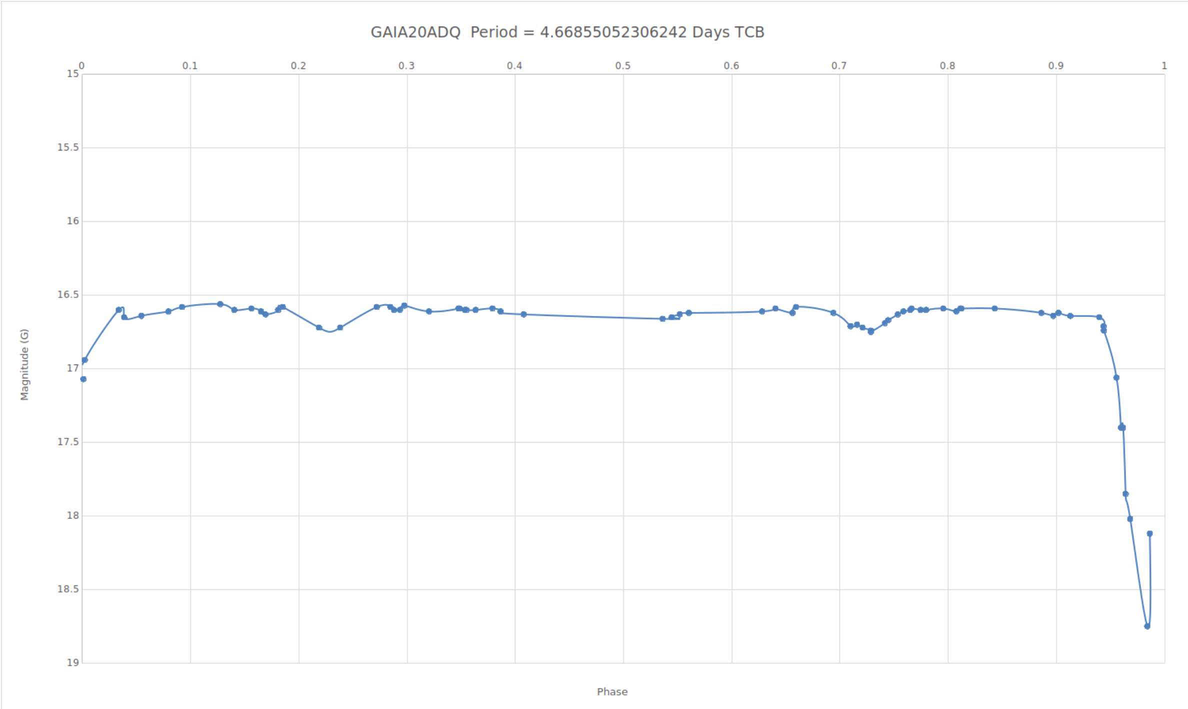


Figure 3: Final result with a period of 4.66855... Days

Figures 1,2 & 3 are copyright John Murrell 2020.
I acknowledge ESA Gaia, DPAC and the Photometric Science Alerts Team (http://gsaweb.ast.cam.ac.uk/alerts) for providing the data this article is based on.

The difference between UTC and GMT – John Murrell

In the December edition of Janus, it was stated that Universal Time (UTC) is the same as GMT. As any Time Lord will tell you there is, in fact, a subtle difference. The GMT second is derived from the average of the Earth's rotation over a year hence there are 365 x 24 X 60 x 60 = 31,536,000 GMT seconds in a year (a leap year has an extra 86,400 GMT seconds). As the Earth does not rotate at a constant rate and is slowing down due to friction from the tides amongst other things the GMT second has to get longer to meet the fixed number in a year.

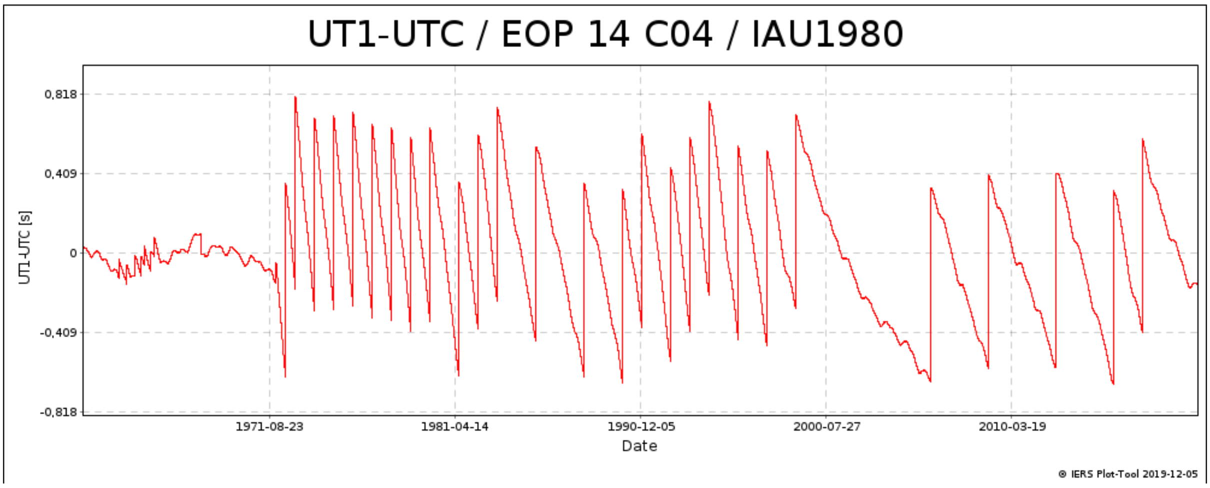
Before we describe UTC we need to understand that atomic clocks are more stable than the Earth's rotation and as a result the changes in the Earth's rotation could be measured. As time is fundamental to a lot of physics measurements the variable GMT second was replaced by the TAI (International Atomic Time) second derived from a worldwide network of atomic clocks. This ensures that for instance the speed of light does not change as the GMT second changes. However living on the surface of the Earth we see astronomical phenomena such as sunrise, sunset and transits which depend on the rotation of the Earth and are thus related to GMT.

Since GMT is slowly drifting away from TAI time it would be awkward to use TAI for astronomical use as corrections would need to be added for the times of all astronomical phenomena. As a compromise UTC was created which is kept within 0.9 seconds of GMT. As described above there are a fixed number of variable length GMT seconds in a year so to allow UTC to keep within 0.9 seconds it has a variable number of fixed length seconds in a year. To achieve this, one or two leap seconds are added to the last minute of June and or December though the definition of UTC allows them to be added to the end of other months if required. Provision is also made for the last minute to have one or two seconds less in the event this is required. Thus the last minute of the UTC month may have 58, 59, 60, 61 or 62 seconds depending on the Earth's rotation speed.

The requirement for adding or removing seconds at the end of the month is determined by the The International Earth Rotation and Reference System Service (IERS), their web pages at *https://www.iers.org* has a lot of interesting information including when the next leap seconds will be added. Leap seconds are normally added at the end of December or June as required. So far only single positive leap seconds have been added. The document 'Bulletin C' contains announcements about UTC seconds and also shows that UTC is currently 37 seconds behind TAI. GMT is not defined on this site as its use is deprecated due to poor definition and also it alters depending on where on the Earth it is observed from due to polar wobble. An better GMT is known as UT1 and it is this time difference that is kept to within 0.9 seconds. The data page at https://www.iers.org/IERS/EN/DataProducts/EarthOrientationData/eop.html shows the current difference between UT1 & UTC and thus shows the changes in the Earth rotation. The current version is reproduced below. The vertical steps are due to the introduction of leap seconds. Kinks can be seen in the curve particularly around the year 2000, these are annual variations largely due to the freezing and melting of water at the poles. It is unclear why the rate of slowing change around 2000 as evidenced by the change in the slope of the diagonal lines. The part of the graph before 1971 should be ignored as more frequent fractional leap seconds were used.

Computer and other electronic system clocks have problems when leap seconds occur mostly due to lazy programming and a lack of a specified way to allow for leap seconds. As a result when a leap second occurs a lot of computer times will be in error by one second and most will take some time to correct this. Some systems such as Amazon are known to start the correction before the leap second happens and others adjust after the event. You may not think a second difference is important but in high speed automatic trading in international currency exchanges an error in the time can cost billions of pounds. As a panacea to this the International Telecommunications Union who regulate such things are considering a proposal to stop the use of leap seconds. This would solve the problem for some but would in the long term result in UTC and GMT diverging due to the lack of leap seconds. This would then result in interesting challenges to other users. Do you follow UTC which will be shown on your computer and other systems and ignore the fact that that eventually UTC will have diverged from GMT enough that we may be getting up and working at night ? Astronomers including amateur astronomers who need to use GMT or UTC1 to point automated telescopes will need to allow for the difference between UTC & UT1 when setting their telescope time.

To keep this article to a sensible length this is a simplified version of the difference – in reality there are other things that need to be considered such as the changes in TAI due to the impact of gravity and moving clocks as described in Einstein's theories of relativity. If you want more information contact your local Time Lord !



To check your understanding here are some quiz questions:

1. which year(s) since UTC was introduced in 1971 had the most (UTC) seconds ?
2. how many (UTC) seconds were there in that year ?
3. Which year(s) had the most GMT seconds ?
4. How many (GMT) seconds were there in this/these year(s) ?

Answers in next month's Janus

Mindful Astronomy – Stephen

Image: Seen above a doorway in Kingston-upon-Thames

Most of my 40 plus years of astronomy have been about pretty serious observing. I always considered myself to be an amateur scientist, and much of the observing work that I have done has been research-based. This is what I have come to describe as *results-oriented astronomy*, and as this title would suggest, it has all been about outputs; be they images or data for writing research papers. Success in this endeavour is measured in terms of the number of images published online, and the number of research papers produced, as well as the accumulation of volumes of observational records. In this way, a good observing session is one that produces plenty of output. If this sounds familiar, it is because it sounds like a *job*.

When you practice results-oriented astronomy, it means that you are focused (no pun intended) entirely on the end result, and the actual process of getting to that end result is reduced to a series of tasks undertaken solely for that purpose. The telescope and other equipment become tools, and malfunctions, weather and the neighbour's security light become obstructions, or at least variables to obtaining results. Time becomes the enemy, and the many frustrations of performing practical astronomy become stressors.

Imaging is a particularly good example of this. Anyone who images on a regular basis will agree that most of the observing session is spent managing equipment and processing outputs. The fact of being outside at night while everyone else is asleep becomes merely an inconvenience worth tolerating for the sake of the end result - a nice picture of some astronomical object. Success seeds the need for further success, and before long the whole experience becomes more about producing better and better images than about the astronomy itself. Ask an astro-imager when they last actually *looked* through their telescope other than to check an object is centred, and they will struggle to answer the question, before jumping to the defence of their art by pointing out to you that they can see far more by imaging than by visual observing.

So, this was the stage that I was at when I began to struggle with astronomy, and to find it stressful. Partly it was driven by improving and more affordable technology that now allows the amateur to work to a pseudo-professional standard, and partly it was driven by my own self-importance. I had a reputation to maintain as an experienced astronomer, and the maintenance of that reputation required constant output. The infamous Yaqi sorcerer, don Jaun Matus used to talk about personal power and energy, and the fact that certain routines in a person's life could preserve or even increase their available energy, while others were deleterious and drained energy. The difference was largely dictated by whether the routine was driven by self-importance, and he advocated keeping an inventory of personal routines in order to analyse where personal energy was being wasted.

This got me thinking - what was I doing to my beloved vocation of astronomy? Why was I allowing the joy to be sucked out of it by the need for results? Why did my heart sink whenever I looked outside and saw a clear sky? It was because I knew that I had to get out there and get results, with all the frustrations and stress that came with that!

For a while I lost heart with astronomy - before I really understood what was going wrong. I thought that the stress was coming from not having enough time in my life for *doing* astronomy. I could sense the clock ticking all the while I was outside with my telescope, which caused me to rush and get frustrated when things conspired against me. I decided to all but give up observing, and began a process of “rationalising” astronomy - selling a lot of my equipment, and actively stepping away from it all - trying to focus my attention on other more wholesome activities, one of which was Mindfulness meditation. I had reduced myself to one good telescope and astronomy would become a wholly casual affair from now on - something to be done rarely when I had some spare time and the weather was right, and there would be no imaging, and no obsessive record-keeping.

All went according to plan. I was now spending no more than perhaps a couple of hours a month observing, mostly only during those sleepless nights that we all have every so often, and my life became centred around Mindfulness practice and a more spiritual existence. Observing became more enjoyable and, as I found myself taking only brief notes, the need for outputs faded away, and I found myself becoming far more engaged in the actual *experience* of observing. I noted in my journal that I hoped for a more spiritual experience of astronomy going forward, and it was at this point that I had something of an epitome.

Mindfulness teaches us to be fully present in the here and now. In our busy modern lives we spend most of our time living in the past - remembering a time when everything seemed so much better, or ruminating about a time when we were wronged in some way - or in the future, living in fear of what may be, or planning for some mythical “better day”. While we are doing this, our activities of daily living are basically running on autopilot, so we are seldom fully present in what we are doing. If you doubt this, then try being fully present for the whole of ten deep slow breaths. Try this now. Your mind likely started to wander by about breath three.

This failure to be present in the moment, leads to stress and anxiety, dissatisfaction with Life, and a lack of appreciation of the beauty and joy of the present moment, whatever we may be doing.

You might say that when I was doing results-oriented astronomy, I was living outside the present moment, focusing on the future of results, with perhaps a smattering of reliving the past, when things didn’t go to plan. Otherwise I was probably thinking about things that had happened at work that day, what was likely to happen tomorrow, and how quickly my observing time was running out. Seldom, if ever, was I fully present in the *doing* of the astronomy! Astronomy was being reduced to a process, carried out largely on autopilot, in a hurry, with only the end result in mind.

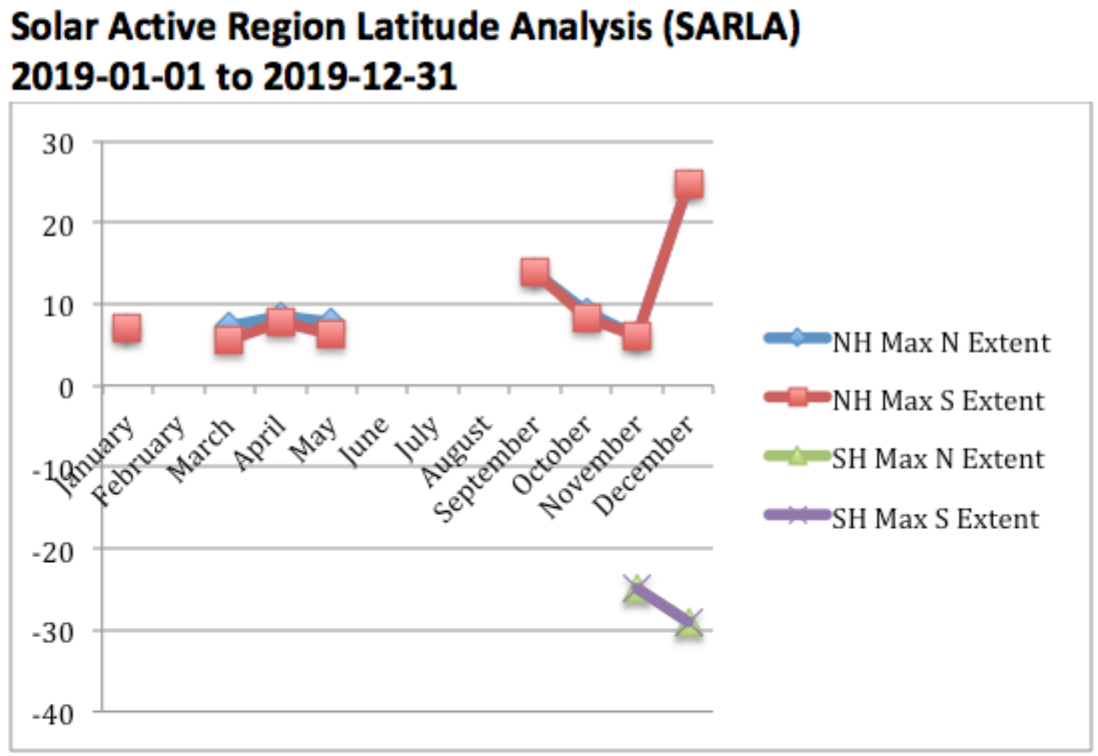
So, this gave me the idea of *Mindful Astronomy*. I thought that if I could only let go of the need for results, and return to observing for the sheer joy of doing so, it would surely be a better experience. If I could let go of self-importance while observing, and the need to tell others of my accomplishments at the eyepiece, then I could fully enjoy the wonderful sights to be beheld. And if I could be fully present in the *doing* of the astronomy, then time would stand still instead of racing by.

So that is what I did, and more. I got rid of my computerised mount and reverted back to using a manual mount. This put me back in touch with the telescope and made me acutely aware of the rotation of our planet as I tracked objects across the sky manually - I became a *part* of the telescope. I took more time to stop peering through the telescope, and just look up at the sky, to fully realise what I was looking at, and the breath-taking distances across which I was looking.

If I had a wise Buddha sitting by my telescope when I became stressed about the time running out, and I asked him *“What’s the time?”,* he would calmly reply *“The time is NOW!”* and we as astronomers should realise perhaps better than anyone, that time is actually irrelevant in space. It is an invention of Humankind, originally designed to track the movement of the Heavens, and of travellers upon the Earth's surface. Only in recent times has it been put to work to order our lives, and to drive us to try to cram more and more doing into each unforgiving moment.

When you do astronomy mindfully, there is no need for time. You can immerse yourself fully in the moment, and in the Universe itself, and just be! You can make time stand still. All of this makes me wonder - is there a place for astronomy as *therapy*? For people who suffer with anxiety or depression, the all-consuming, immersive nature of astronomy could indeed be therapeutic. The Royal Astronomical Society are doing pioneering work with astronomy in prisons as a means to rehabilitate offenders, and I believe that we are only just dipping our toes into what could be a huge reservoir of potential to use astronomy to make a positive contribution to society. I will certainly be looking into this idea in more detail over the coming year.

Solar Active Region Latitude Analysis (SARLA) Project 2019 Results - Stephen



Data outages: Data outage from 2019-05-21 to 2019-08-16
Data outage 2019-12-01 to 2019-12-18

What is SARLA?

Analysis of the latitudes of occurrence of solar active regions can be used to indicate an approximate measure of the progress of the solar activity cycle. As illustrated in the famous Butterfly Diagram, active regions tend to occur at high latitudes in the early stages of the solar cycle, but the band of activity moves gradually closer to the solar equator as the cycle approaches maximum. Following solar maximum, there is a period of low levels of activity (solar minimum), before active regions begin once again to appear at high latitudes, signalling the start of the next solar cycle.

I have previously used SARLA very successfully to analyse the most active years of Cycle 24, the report for which can be found at:
https://ryebrookspace.weebly.com/uploads/5/0/0/0/50005359/using_solar_active_region_latitude_analysis_to_monitor_solar_cycle_progress.pdf
There was some criticism of the work because I had used active region latitudes, rather than sunspot latitudes, but my rationale is that not all active regions produce sunspots, so by only observing sunspot latitudes we would be effectively ignoring some of the available data.

2019 SARLA Methodology: I have collected data for the whole of 2019 using www.solarmonitor.org who publish daily latitude and longitude coordinates for solar active regions. These were collected on a daily basis and entered onto a spreadsheet. At the end of each month, the average northernmost and southernmost extents of active regions for both the northern solar hemisphere and the southern solar hemisphere were calculated and entered into a table of monthly values. These were then used to generate the graphical chart above. The chart is a representation of the average latitudes of solar active regions for each month of the year.

Limitations of the Data: There was a significant data outage between the end of May and the middle of August, that has generated a gap in the plot for both hemispheres. The short gap between January and March though, is caused by a complete absence of solar activity in keeping with solar minimum.

Findings: As would be expected, for most of 2019, there was minimal or no solar activity, with active regions appearing close to the solar equator. What little activity there was, is confined to the northern hemisphere. This is entirely consistent with solar minimum.

During November and December however, the chart shows recrudescence of solar activity in both hemispheres, and indeed toward the end of December active regions begin to appear at high latitudes in both hemispheres. This demonstrates a marked divergence of solar activity away from the solar equator, as might be expected at the start of a new solar cycle. A return of active region activity in the southern hemisphere also tends to suggest the beginnings of a new solar cycle.

Impression: The results are highly suggestive of the commencement of solar cycle 25.*

Plan: Continued surveillance during 2020 will likely confirm whether the results are trending in favour of the above impression. I am planning to publish monthly graphs of SARLA results in Janus, to give some indication of how the solar cycle is progressing. At the end of 2020, I will again calculate the monthly averages, and generate an annual chart.

*Active region latitude is not the only measure of solar cycle progression, and indeed analysis of the magnetic arrangement of active regions is a more accurate means of identifying the commencement of the next solar cycle. However, there is not sufficient scope within this study to include other factors, and findings presented here should be read in conjunction with other studies in order to formulate a more comprehensive overview of the state of the solar cycle.

Up Next:

NEXT MEETING: Friday 14 February 2020 Nonsuch, High School for Girls Library 8pm.

Rachael Livermore will speak on a subject to be agreed.

Ron Canham will also give his usual presentation on the sky at night for the coming month.

NEXT USER GROUP: Tuesday 4 February 2020, Nonsuch High School for Girls 8pm.

This is an informal session for members to meet and discuss anything related to their telescopes and sky events and, if weather permits, to go up on the roof for observing.

Enter via the Main Entrance opposite the Car Park

NEXT DENBIES OBSERVING SESSION:

The next observing session will be on the first clear night between Monday 17 February at 7:30pm and Wednesday 19 February at 7:30pm.

Please check back closer to the time as weather and clear skies will affect the date.

AD HOC OBSERVING AT WARREN FARM:

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