JANUS

THE NEWSLETTER OF EWELL ASTRONOMICAL SOCIETY

JANUARY 2020 EDITION

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Editorial:

Welcome to the January edition of Janus which is, of course, the first edition of 2020 – so, a Happy New Year to all, and welcome also to a new decade.

Last month's edition prompted a few comments – which I very much welcome. Rather than including them as free standing articles, I have decided to introduce a "Letters to the Editor" section. This is intended to provide a forum for short comments on published pieces and, where appropriate, responses to these from authors of the original pieces. My intention is to stimulate feed-back and interaction without folk feeling the need to write a full article – they can simply e-mail their thoughts as a contribution to the debate. This method of contributing should be seen as complimenting rather than replacing the Social Media options already available. At the AGM, Stephen stressed his desire that members use Social Media to share items of potential interest to others. Please continue to do this.

As a follow-up to his article on the availability of papers free of charge from the arXiv (archive), John Murrell has provided a further synopsis of a paper which is available free of charge from a different source. I'm sure that many of you will have found interesting papers from the many sources you routinely access. If these are available from a free to view source, then please send me a brief synopsis so that it can be shared with other members.

John

The Solar System January

MERCURY: starts the month not readily observable due to it being very close to the Sun, at a separation of only 5° from it. By the end of the month, having recently passed behind the Sun at superior solar conjunction, it is still not observable reaching its highest point in the sky during daytime and being no higher than 5° above the horizon at dusk.

VENUS: recently passed behind the Sun at superior solar conjunction and, at the beginning of the month, will become visible around 16:24 UT as the dusk sky fades, 15° above the SW horizon. It will then sink towards the horizon, setting 3 hours and 1 minute after the Sun at 18:58 UT. By the end of the month it is emerging into the evening sky as it approaches greatest elongation E and will become visible around 17:06 UT as the dusk sky fades, 26° above the SW horizon. It will then sink towards the horizon, setting 3 hours and 49 minutes after the Sun at 20:31 UT.

MARS: is currently emerging from behind the Sun and at the beginning of the month is visible in the dawn sky, rising at 04:45 UT - 3 hours and 21 minutes before the Sun – and reaching an altitude of 14° above the SE horizon before fading from view as dawn breaks around 07:01 UT. By the end of the month, it is no longer observable, reaching its highest point in the sky during daytime and being no higher than 12° above the horizon at dawn.

JUPITER: recently passed behind the Sun at solar conjunction and, early in the month is not readily observable since it is very close to the Sun, at a separation of only 3° from it. By the end of the month, it is still not observable, reaching its highest point in the sky during daytime and being no higher than 5° above the horizon at dawn.

SATURN: will soon pass behind the Sun at solar conjunction and, throughout the month, is not observable. It will reach its highest point in the sky during daytime and is below the horizon at dusk.

URANUS: is an early evening object, receding into evening twilight. At the beginning of the month, it is visible in the evening sky, becoming accessible around 17:29 UT as the dusk sky fades, 44° above the SE horizon. It will then reach its highest point in the sky at 19:19 UT, 50° above the S horizon. It will continue to be observable until around 00:05 UT, when it sinks below 21° above the W horizon. By the end of the month, it will become visible around 18:07 UT as the dusk sky fades, 49° above the S horizon. It will then sink towards the horizon, before setting at 00:31 UT.

NEPTUNE: begins the month as an early evening object, receding into evening twilight. It will become visible around 17:29 UT as the dusk sky fades, 30° above the S horizon, before sinking towards the horizon, setting at 22:00 UT. By the end of the month, it will soon pass behind the Sun at solar conjunction. It will no longer be observable, reaching its highest point in the sky during daytime and being no higher than 16° above the horizon at dusk.

MOON PHASES:

First Quarter	3 January
Full Moon	10 January
Last Quarter	17 January
New Moon	26 January

A Sunspot for Christmas – Gary Walker

As any Solar Observers will know, the Sun has been depressingly blank for weeks – it actually reached 39 spotless days! Then, on 23 December, I saw a flare or plage near the lower left-hand limb. The next day, Christmas Eve, I saw a spot - admittedly only a tiny, pathetic spot, but still a spot. On Christmas Day, it had a smaller follower spot (Sunspots will often form a pair of a leading and a following Sunspot).

Even in ha light, there have not been many prominances, and plages and filiments have also been virtually non-existent.

From the arXiv (archive) – December 2019 John Murrell

Following my “from the arXiv” in the previous edition of Janus here is another interesting paper that caught my eye. This is a bit of a cheat in that it is not on the arXiv but is free access so meets the criteria for being freely available.

Variable stars are of interest for many reasons; the light curves provide an insight into the type of star and also allow the current flavour of the year, transiting exoplanets to be discovered. Measuring the brightness of variable stars can be done by amateur astronomers and large number of measurements are in the British Astronomical Society and American Association of Variable Star Observers (AAVSO) databases. The observations are taken in a variety of bandwidths from the V (visual) to those taken in specific filters. These provide detailed light curves, but little work has been done on how the colour, which is a measure of temperature changes as the light curve varies.

ESA’s GAIA satellite’s primary mission is to measure the positions, distances and proper motions of a billion stars. As an adjunct of this each time the satellite measures a star it also takes a measurement of its broadband (G band) brightness. This is supplemented by measurements using Blue and Red filters. The ratio of the measurements in the Blue & Red filters is related to the surface temperature of the star. The colour ratio as a proxy for temperature can be plotted against the intrinsic brightness of the star giving the familiar Hertzsprung – Russell diagram.

The authors of the paper “Gaia Data Release 2: Variable stars in the colour-absolute magnitude diagram”, available at https://www.aanda.org/articles/aa/full_html/2019/03/aa33304-18/aa33304-18.html, have used the temporal variability in brightness & colour to give a new view of variable stars. For those unfamiliar with the zoo of variable star types, the diagram in Figure 1 of this paper shows the enclosures where most of them are found.

The paper shows where the different types of variable can be found on the HR diagram. The colour variability for different variable types is shown in Figure 11. On a two-

dimensional graph it is difficult to show the temporal variability curves. As part of the paper the authors have provided a link to an animation (https://www.aanda.org/10.1051/0004-6361/201833304/olm) which gives a view of the temporal evolution of the brightness & colour. There is a lot happening in this animation and it will probably need to be viewed several times to see all the changes. The paper is a good summary of the different types of variable stars and is worth reading just for that.

Have you found an interesting paper on arXiv (or any other free to view source)? If so, send the editor a brief synopsis so it can be shared with other members.

Reducing the impact of Starlink Satellites on Astronomy – John Davey

Members may recall discussions at a meeting earlier in 2019 regarding the potential disruption of astronomical observations by the Starlink constellation of satellites designed to provide worldwide internet access. A recent item in Space News suggests that SpaceX has a fix in play to make its bright Starlink satellites less disruptive to astronomy. The report is summarised in the following paragraphs.

After the first satellites were launched in May, astronomers noticed that they are quite reflective and bright. With SpaceX reporting it wants to put up to 24,000 of these satellites in the sky, astronomers became increasingly concerned about them washing out parts of the night sky. Now the company plans to treat one of the satellites with a special coating, designed to reduce reflections, when the next group is launched in late December.

SpaceX had, apparently, not anticipated problems with reflective satellites. In a recent interview, president and chief operating officer Gwynne Shotwell said "No one thought of this. We didn't think of it. The astronomy community didn't think of it, but once reports came to SpaceX of the bright satellites, the company began looking into fixes for the satellites."

A fuller text is at: https://spacenews.com/spacex-working-on-fix-for-starlink-satellites-so-they-dont-disrupt-astronomy/

Annular Eclipse and Venus observation – Gary Walker

There was an Annular Solar Eclipse across Asia on Boxing Day. I was surprised that as many as 4 national newspapers showed photos of it - including the "Star"! There was even a brief (as usual) final item on the BBC News. Given that annular eclipses usually don't get as much coverage as Total ones, it was probably a slow news day!

I observed Venus on 29 December. It is now of gibbous phase (83%), and fairly small in angular size (about 12.7' arcseconds). However, it is worth noting that Earth is about the same size as Venus so, from Venus (naturally enough, above the clouds!), Earth would appear about the same angular size in a telescope. Thus, one can imagine how Earth appears, as seen from Venus, each time you observe it via a telescope! This rule applies for Venus and Earth, all of the time. Venus was just under 7° West of a new moon, on this night.

Is Betelgeuse about to blow? – Gary Walker

There has been some speculation about Betelgeuse - the “top left-hand” star in Orion -- as it has been reportedly fainter than normal. Betelgeuse is a Red Giant Star, which is expected to eventually go supernova.

I looked at this star on 29 December, and it did seem a bit dim - maybe slightly dimmer than Bellatrix - the “top right-hand” star in Orion. However, due to its instability, Betelgeuse has always been slightly variable in nature. Betelgeuse appears noticeably orange in colour, even to the naked eye, and even more so, with any optical aid.

If we are lucky enough to see it blow in our lifetime, what a wonderful sight it would be, with a blazing star, perhaps as bright as the Full Moon. What a lot of new light pollution it would cause! There’s no need to worry that it might occur in the Summer, as it will still be visible, even in daylight!

The problem is, no one knows exactly WHEN it will explode - anytime between now and about a million years time. It’s even possible that Betelgeuse has already exploded, but the light of the Supernovas is yet to reach us,

as it's around 600 light years away. This means we may possibly be seeing something which no longer exists at all!

So, in the words of the 1950's sci-fi film, just "Keep Looking! Keep watching the skies"!

Is the Moon a Planet? – John Murrell

Our Moon is normally considered a moon as it orbits the Earth, however this is not quite true as both the Moon and the Earth orbit their joint barycentre. This is located about 1/8th of the Earths diameter below the surface in the direction of the Moon. It is only this close to the centre of the Earth as the Moon has a much smaller mass than the Earth.

If life had developed on the Moon rather than the Earth the inhabitants would have had a rather different view to us. If they lived on the far side of the moon they would be aware it rotated every 27 (Earth) days but may not be aware of what it rotated around. Those living on the Earth side would be aware of the Earth as it hangs in about the same point it their sky day & night. However they would view the Earth as moving against the stars and could easily conclude that the Moon orbited the Earth.

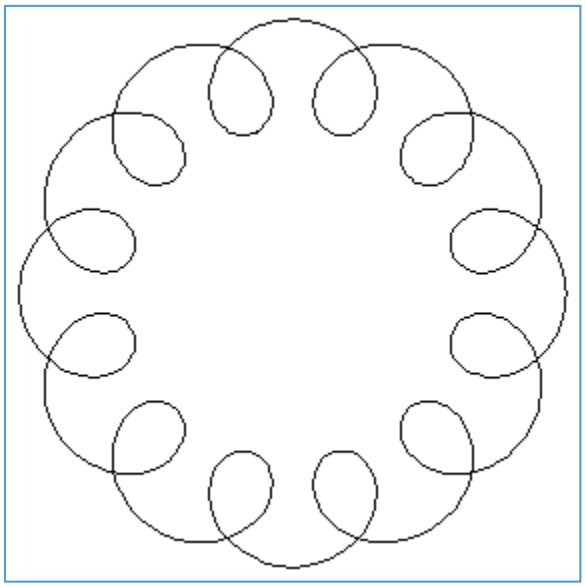

Figure 1: Moon orbit viewed from Polaris

People who lived on a planet orbiting a star in the direction of Polaris so they would see a plan view of the Solar System would have a very different view of the Earth Moon system to our terracentric ideas.

If you look for information on how the moon orbits the Earth as viewed from outside the solar system you often see a diagram similar to Figure 1.

In this diagram, it appears that the moon does orbit the Earth, but it is also completely wrong! The diameter of the Moon's orbit is very much exaggerated in comparison to the distance to the Sun, this gives a completely misleading impression.

A true to scale diagram of the orbit of the Earth Moon system shows a different picture. Figure 2 shows a small part of the orbit drawn to scale.

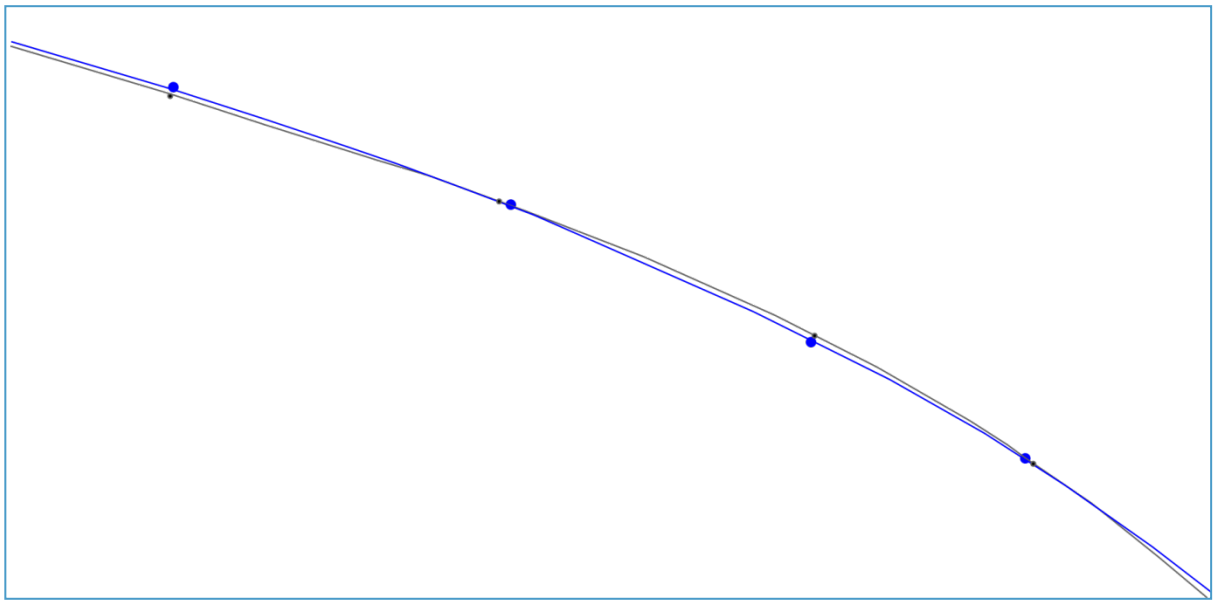

Figure 2 - Section of the Earth–Moon system's trajectory around the Sun (to scale): Orbital path of the Earth in Blue, Orbital path of the Moon in Grey

The difference to the view in Figure 1 is due both to the Moon's distance to the Earth only being about 1/180th of the barycentre Sun distance, and the Orbital velocity of the Moon round the Earth, at about 1 km/s, being small in comparison to the velocity of the Earth Moon system around the Sun at around 30km/s. As a result, the two bodies appear to follow much the same path, with the one nearest the Sun swapping roughly every 13 days. Both orbits are concave with respect to the Sun.

An observer in the plane of the solar system watching the transit would see a single transit, though there would be subtle changes in the entry & exit curves as well as the dip in intensity depending on where the Moon was relative to the Earth.

In view of this I believe that if the Earth Moon system was viewed by an outside observer, they would conclude that the Earth Moon system is a double planet rather than a planet with an orbiting moon.

Having the Moon as a planet increases the number of planets in the habitable zone but decreases the probability that have life to 1 in 4 rather than 1 in 3. It would also return the Solar System to having 9 planets so the website "Nine Planets" would be correct again!

I am sure this will raise some comments – email me at EAS2020@JohnMurrell.org.uk,and let me know your views.

Letters to the Editor

3 December 2019 – Gary Walker

I've just read John Murrell's piece "Observations of the Transit of Mercury 11th November 2019" in December's Janus. It struck a particular chord when he discussed checking where and when his garden was in sunlight. I was doing this same exercise on the previous days (and on earlier days), as it was essential to see how long the Sun would actually be visible from my back garden. This is particularly important at this time of year, when the Sun is at a low altitude; in any case, even in the best conditions, the Sun would set long before the end of the Transit - the transit finished at 18.02 GMT, but sunset was around 16.17 GMT.

On the previous day, I saw from my back garden that the sun was still (technically) visible at 15:40 GMT, although shining behind the tree-line.

On the day of the transit, I originally observed from the middle of my back garden, but had to move up the garden when the sun started to go behind the trees.

As the Sun eventually disappeared behind solid cloud, I decided not to invoke "Plan B" – i.e. going over the fields to see the rest of the transit. In any case, I had managed to get good views of it between 12:37 GMT and 14:57 GMT.

It was just as well that for the 31st May 2003 Solar Eclipse, which occurred at sunrise, I had checked where and when it was visible from my garden. I found on previous mornings that the Sun would be too low in the sky to be seen from my garden, so I had to go down the road and over the fields to get a good view of it.

All this shows the importance of doing a "dress rehearsal" before any such event, especially if the object to be observed is likely to be low in the sky at any point.

6 December 29, 2019 – John Murrell

I read with interest Stephen's article (EAS Observational Records Archive – Dec 2019 Janus) on the establishment of records of Observations by EAS members. However, I must disagree about his suggestion that dates are recorded in the form ddmmyyyy. It is better to record the dates in the format defined by the international standard ISO8501. In this standard, dates and times are defined in the format "yyyymmddThhmmss.sssZ", where yyyy is the 4 digit year, mm is the month (with a leading zero if required), hh is the hours (with leading zero if required), mm is the minutes and ss.sss are the seconds with a decimal part as required. T is the separator between the Date & Time, and Z indicates the time is

in UTC and the time zone is zero - i.e. the time zone for the UK.

There are a couple of advantages of this format other than compliance with the ISO standard. First, when an observation is made overnight it is useful to show the date as 21-22 or 22-23 to be clear on which night and morning the observation was made. This is particularly useful where observations span midnight UTC but, due to daylight saving, the date changes an hour earlier.

The second reason is that, if observations are recorded in the ISO format, they should be sorted by computers into the correct time order.

The ISO dates can only be used from 1583 due to the adoption of the Gregorian calendar. If, for any reason, you are using dates before this you need to use a monotonic date and time scale such as the Julian Calendar or the modified Julian Calendar.

Editor's Note: In anticipation of receiving John Murrell's letter (we'd already had an exchange of views), I discussed the main points in it with Stephen at the Society's AGM. His response follows.

Astronomical Record-keeping - Best Practice Update - Stephen

I am very grateful to John Murrell for pointing out that my standard for recording date and time is actually incorrect and that we should in fact be using the ISO Standard of yyyymmdd, rather than ddmmyyyy as I had suggested.

I must confess that I didn't know about the ISO Standard, but there is no shame in this - that's how learning takes place, and it is through these learning experiences that we individually develop our practice, as well as developing a description of best practice. I have changed my date & time recording practices going forward.

I have included a description of the relevant ISO Standard below, which is taken from https://www.gov.uk/government/publications/open-standards-for-government/date-times-and-time-stamps-standard
I'm not sure how I feel about the recording of the UTC - it seems more complicated than it needs to be. The whole idea of Universal Time for astronomy is that observers across the globe are all working to a common time zone, so there seems little benefit to indicating the local time. I am happy for time to be recorded in GMT hhmm format using the 24h clock. If you are recording events such as occultations or transits, you will likely want to be more precise by adding seconds to arrive at hhmmss.

Like all obvious things in life, once pointed out it makes complete sense to record dates in this format, particularly if you are storing them electronically. By starting with the year, all files for 2019 will be grouped, then within those all files for each month will be grouped, and within each month the dates will be listed in order.

Update on Recording of Time:

- *Use ISO 8601 to the level of accuracy you require when a date or date and time is being recorded or exchanged in an IT system.*
- *List date and time elements in descending order of size (years, months, days, hours, minutes, seconds, milliseconds, and microseconds).*
- *This profile is based on the assumption that you're using local time. A Coordinated Universal Time (UTC) offset may be added. For example, 2017-05-16T10:30:56+01:00 shows the instant of the 16 May 2017 at 30 minutes and 56 seconds past 10am. The offset in this example is British summer time (BST), one hour ahead of UTC.*
- *The standard's format has a fixed number of digits padded with leading zeros to support different levels of accuracy. The lowest level is four digits to represent a year, and as you increase accuracy by adding the month, week or day the digits replace the zero padding. When using a less accurate date, include hyphen separators to avoid user confusion, for example, separate the digits for the year and the month - YYYY-MM.*
- *If required, separate time from the date by a 'T' character and record in a 24-hour format with 2 digits per element. The time format uses a ':' separator between hours and minutes.*

Up Next:

NEXT MEETING: Friday 10 January 2020 Nonsuch High School for Girls Library 8pm.

Sarah Hutton 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 DENBIES OBSERVING SESSION:

The next observing session will be on the first clear night between Friday 17 and Wednesday 22 January.

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.