NOVEMBER 2019 EDITION

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Editorial:

Welcome to the November edition of Janus.

This month John Murrell continues his series of articles on Image Metadata in Astronomy. He also writes about an unusual observatory in London and the frustrations of trying to obtain free access to detailed scientific papers on astronomical topics.

For the first time in a while there is no article from Gary – has his observing been hampered by the weather? Instead, I've written a small item on a "casual" observing session whilst on holiday in France.

John's frustration at being unable to view papers is not unique. I've seen the same thing. I receive copies of "Space Daily", an e-mail publication with links to other space related publications. Examples of recent items of possible interest have included:

- Stormy cluster weather could unleash black hole power
- Violent flaring at the heart of a black hole system – related paper published in MNRAS 490 and available free.
- Ancient microbes are living inside Europe's deepest meteorite crater.
- When Exoplanets Collide – explains that dramatic glimpses of the aftermath of a collision between two exoplanets is giving a view on what can happen when planets crash into each other. A similar event in our own solar system may, perhaps, have formed our Moon. Full study results have been published in the Astrophysical Journal - payment required to access it.

"Pay walls" are clearly not uncommon!!

John

The Solar System November

MERCURY: will not be visible at the beginning of the month, rising around mid-day, reaching its highest point in the sky during daytime, and setting before dusk. By the end of the month, having passed greatest elongation West on 28 November, it will be visible in the dawn sky, rising at 05:43, 1 hour and 57 minutes before the Sun, and reaching an altitude of 10° above the south-eastern horizon before fading from view as dawn breaks around 07:07.

VENUS: will not be visible this month. Rising after the Sun, it will reach its highest point in the sky during daytime. At the beginning of the month it will be no higher than 2° above the horizon at dusk, and by the end of the month still only 6° above the horizon at dusk.

MARS: will be difficult to observe this month reaching its highest point in the sky during daytime. At the beginning of the month it will be no higher than 7° above the horizon at dawn, and by the end of the month still less than 13° above the horizon at dawn.

JUPITER: will be visible for much of the month. At the beginning of the month it becomes visible around 16:54 as the dusk sky fades, 10° above the south-western horizon. It will then sink towards the horizon, setting 2 hours and 12 minutes after the Sun at 18:43. By the end of the month it will probably not be visible as it will reach its highest point in the sky during daytime and be no more than 5° above the horizon at dusk.

SATURN: is currently an early evening object, now receding into evening twilight. At the beginning of the month it will become visible around 17:12 as the dusk sky fades, 15° above the southern horizon. It will then

sink towards the horizon, setting 3 hours and 52 minutes after the Sun at 20:23. By the end of the month, it will become visible around 16:38, 12° above the south-western horizon, sinking towards the horizon, before setting 2 hours and 50 minutes after the Sun at 18:41.

URANUS: recently passed opposition and is visible throughout the month. At the beginning of the month it becomes accessible around 18:40, at an altitude of 20° above the eastern horizon, before reaching its highest point in the sky at 23:24, 50° above the southern horizon. It becomes inaccessible around 04:13 when it sinks below 21° above the western horizon. By the end of the month, it becomes accessible around 17:21, 26° above the eastern horizon, reaches its highest point in the sky at 21:26, 50° above the southern horizon, then sinks below 21° above the western horizon around 02:13.

NEPTUNE: is currently an early evening object. Visible in the evening sky, at the beginning of the month it becomes accessible around 17:53, 23° above the south-eastern horizon. Reaching its highest point in the sky at 20:26, 31° above the southern horizon, it continues to be observable until around 23:12, when it sinks below 22° above the south-western horizon. By the end of the month, it becomes accessible around 17:21, 29° above the southern horizon. Reaching its highest point in the sky at 18:31, 31° above the southern horizon, it continues to be observable until around 21:16, when it sinks below 22° above the south-western horizon.

MOON PHASES:

New Moon	28 October
First Quarter	4 November
Full Moon	12 November
Last Quarter	19 November
New Moon	26 November

Free access to Astronomy Papers with arXiv[1] – John Murrell

As it was cloudy for the October observing group meeting, we ended up having a general discussion. One of the many topics we discussed was access to published papers on astronomy.

Readers may be aware that the integrity of the scientific publishing process relies on the peer review of papers prior to publication. This involves the editors of the journal that the draft has been submitted to sending the paper to a peer who reviews the paper and makes comments to the original author. Based on these, the author may change his paper. In view of the peer review comments and the author's changes, the editor will then decide to publish the paper or not. The paper is then printed and distributed; electronic copies are normally available on the publisher's web site behind a pay wall.

This process costs money and is typically financed both by the prospective author paying a publication fee, and readers paying to access the published paper. For those working in academic institutions, the access fees are typically paid by the libraries, but those of us without academic access the fees can be daunting.

The advent of the internet has removed the cost of distribution of printed copies and has resulted in a movement toward open access where papers are available to anyone with internet access for free.

One major repository for open access papers is the archive server arXiv.org. Despite its name, this site holds a large number of pre-prints of papers prior to publication (and peer review). Several areas of science are covered by this site, but here we are concerned with the section for Astrophysics. This has a number of sub-sections as can be seen from the home page above. In addition to search facilities that allow you to search selected field you can also view the latest papers.

As might be expected, the papers range in complexity from the relatively easy to the impenetrable. My strategy is to look at the title – if I understand that I look at the abstract, and if I can understand that and am interested in the subject I have a look at the paper.

An example of where this site is useful was a recent BBC web page on "Milky Way's centre exploded 3.5 million years ago". The page is

a bit superficial and I wanted to find more detailed information. This BBC page has a link to the Astrophysical Journal, but at the time of writing it does not appear the paper has been published. Even if it had, the price to get a copy would be several 10's of US dollars.

Searching for the BBC title in arXiv did not produce a pre-print of the paper, but an alternative search on the authors name "Joss Bland-Hawthorn" produced a recent paper at https://arxiv.org/abs/1910.02225 which gives lots more information.

The only thing to be aware of is that the papers are normally submitted prior to the peer review process and may thus contain errors or be totally wrong! If they state that they have been accepted for publication by a journal, they have normally passed peer review and should be OK.

Some journals such as Nature prohibit publication of pre-prints or the published paper on arXiv, so you will not find them. In addition, some authors may not submit papers to the arXiv, but this is becoming rarer as more people use the service to keep up to date with the latest research.

[1] *The 'Xi' in arXiv represents the Greek Letter 'chi'. So, the site name is a play on 'archive'.*

Image metadata in astronomy part 3: Image Metadata and FITS files – John Murrell

In part 2, I provided a link to a copy of the HST data used to create the famous 'Pillars of creation' image. In this part I will show you how the metadata contained in one of these images can be used to show the HST image in the context of the broader nebula, and how to identify objects within the image.

First you need to install and open the Aladin Sky Atlas (freeware from https://aladin.u-strasbg.fr/). When you open the program you will be presented with a splash screen showing details about the programme overlaid on an image of M81 & M82. The first step is to open the HST Hydrogen Alpha image of the Pillars of Creation - the easiest way to do this is to locate the file "656nmos.fits" on your computer. Note: the file is supplied as compressed .ZIP files, you need to decompress them first. When you have located the file drag & drop it into the main part of the Aladin window. The image should now open; it will be on its side due to the orientation of the HST when the image was taken. This is easy to fix by using the menu command 'view' and then 'North Up East Left'.

To view the HST image in the wider context of the Eagle Nebula you need to load a wider field image. The best one to start with is the Digital Sky Survey image. Just above the image area is a star followed by DSS, click on this and you will get a background view of the nebula. At this stage it is best to zoom out a bit by moving the zoom slider a little to the left so you can see 'the Eagle'. At this stage the HST image will be invisible. To overlay it you need to move the small red slider below the line '656nmos[0'] a bit to the right. As you do this the slider turns green and the HST should appear as an overlay which becomes less transparent as the slider is moved to the right. One thing you should notice is that there are stars in the HST image (shown as black dots) that are not visible in the DSS image, including one prominent one just below the top pillar of creation.

The program uses the image metadata in the HST FITS image to locate it on the sky and show it with the correct orientation and size. As the position is known it is relatively easy to identify the star that is visible in the HST image, but appears to be missing from the DSS image.

To do this click the button above the image area marked with '* Simbad', this should overlay a set of boxes that show the position of all the objects in the image in the Simbad database. Note: you may need to zoom out and then in a bit to get them to appear. As you should notice there is a box marking the position of the 'bright' star that appears in the HST image.

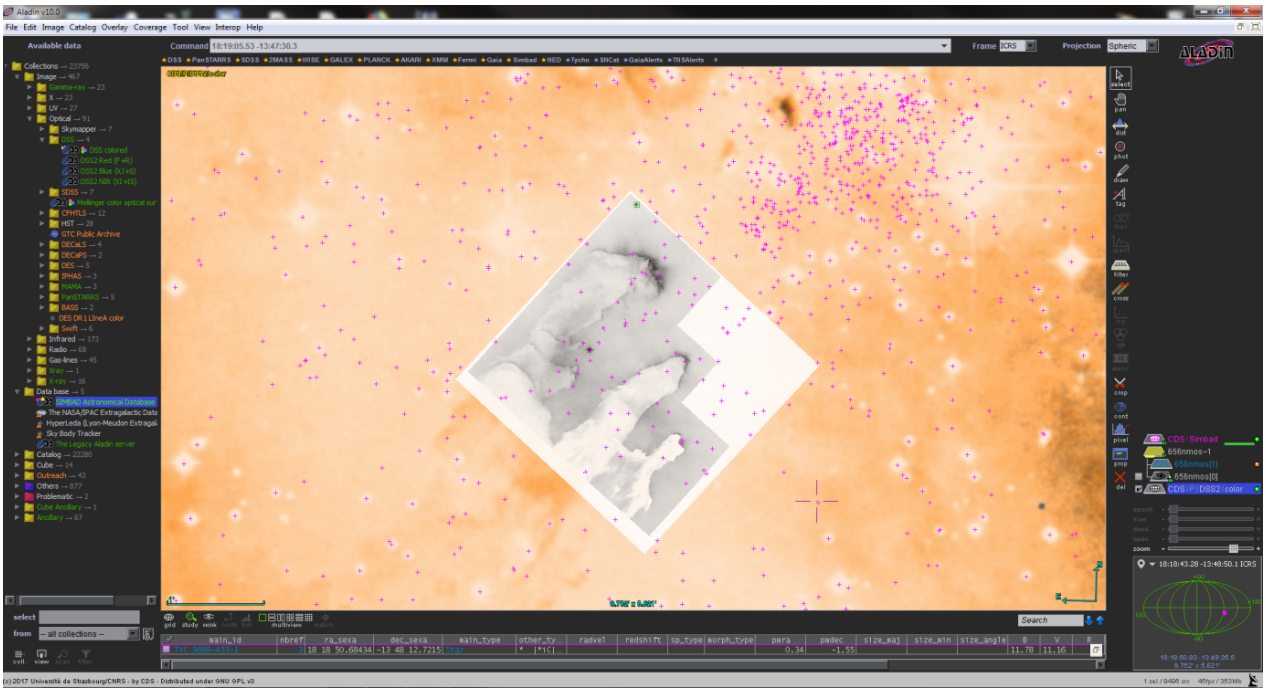
To find the information on the star, you need to change the pointer operation to the 'select' mode by selecting the second button down to the right of the image area.

Note: the programme starts with the cursor in the ‘pan’ mode allowing you to click & drag the image. This is shown by the pointer being a hand. When you change to the select mode the cursor will change to a pointer.

Starting at the top left of the unknown star, click and drag the green box that appears. When you release the pointer the box around the star should remain green and the data for the star will appear below the image. It should show it as BD-13 4930, summary data is shown to the right including its spectral type 09.7IIIp and the Blue (9.7) and Visual (9.45) magnitudes.

The screen you finally end up with should be similar to the image below. If you have any questions email me at: EAS2019@JohnMurrell.org.uk or have a look at my website at www.JohnMurrell.org.uk.

A challenge for you – there is a black stellar looking object near the bottom right of the image that does not appear in the Sinbad data base – what do you think it is?



Hunting for stellar parallax – an unusual London Observatory – John Murrell

When Ron Johnson spoke to our society in June 2019 on “Observatories - a Grand Tour”, he told us about a number of the major ground-based observatories and a few of the unusual ones. In contrast, I have been interested in observatories in and around Surrey, and also the unusual observatories.

On a recent visit to London I was walking up Fish Street Hill when I saw one of these more unusual observatories. Amongst its interesting features are that the “tube” is built of Portland Stone and inside the tube there are 311 steps each 6” high. I have provided an image of it below – you may know it as the Monument to the Great Fire of London. While the design of the monument is attributed to Christopher Wren it is apparent that the Natural Philosopher, Architect and Polymath Robert Hooke - who was also Surveyor to The City of London - was either the actual designer or had a significant input into the design and construction. When the monument was designed in 1671 one of the great unsolved problems in astronomy was whether the parallax of stars could be measured and, if so, this would allow the distance to the stars to be determined. To do this required measurements to be taken 6 months apart, so it was important that the telescope was stable. The telescope also needed a very long focal length to measure the small changes in angle over a year. As architect of the Monument, Hooke took the

opportunity to incorporate a telescope into the design. The objective lens was mounted in the “flaming gilt-bronze urn” on the top of the column, and an eyepiece was provided in a small room below the level of the current entrance. The direction that the “telescope” points at cannot be moved of course but the star Gamma Draconis was a suitable target as it passed through the zenith.

Did Hooke manage to measure the parallax of Gamma Draconic with his Portland stone telescope? Unfortunately, no - that had to wait to 1838 when the German astronomer Fredrich Bassel measured the parallax of the star 61 Cygni.

I have seen a couple of reasons for why the telescope failed – some sources blame the vibrations caused by the traffic on Fish Street hill as this was the main road leading to the Old London Bridge. I have also seen the suggestion that sunlight caused the stone to expand and the tower bent and slowly straightened as it cooled. The monument was not however a total scientific failure. Hooke used it to show how the pressure on a barometer falls as you take it higher. The 6” steps allowed measurements to be taken at defined heights. Also, as the second tallest building in London next to St. Pauls Cathedral it provided a laboratory for experiments with long pendulums this being more convenient than using the inside of the cathedral.

The telescope


The objective lens mount

Night Sky in Rural France – John Davey

My wife and I, together with some friends, recently enjoyed a short holiday in the Limousin Region of France. We stayed in a renovated rectory in a small village called Abjat-sur-Bandiat about 40miles SW of Limoges. Most evenings were cloudy, but on our last evening – 3 October – the sky was almost totally cloudless.

It was only a short trip and, having only carry-on luggage, I had opted not to take my DSLR and tripod, just a compact camera – a Panasonic Lumix with a 30x zoom lens equivalent to (in full frame DSLR terms) 24mm – 720mm, and optical image stabilisation. Nonetheless, I managed to get some reasonable images of Jupiter close to a 5-day old crescent moon, two of which are reproduced in this short piece.

The images were taken between 19:37 and 19:40 CET (17:37 – 17:40 UT), which more or less coincided with Sunset that day, so it wasn't by any means totally dark. Those who have experience of photographing objects in the night sky will be familiar with the difficulty of getting the exposure right. Such problems are greatly exacerbated with a compact camera that has a small sensor on which to record the image, and a small maximum aperture, particularly at long focal lengths.

Exposure details: 1/125 sec @ f6.4, ISO 3200, 720mm equivalent focal length

Exposure details: 1/15 sec @f6.4, ISO 3200, 720mm equivalent focal length

The first image reveals some detail in the Moon's surface, and the Moon has a yellow tinge – presumably because the Sun had not totally set. The Moon also has more of a crescent look to it.

The second image is brighter but, due to it having 3 stops more exposure, the detail in the Moon's surface has burnt out. Also, due to motion blur, Jupiter appears to be larger than in the first image. This becomes more apparent if the image is blown up.

I tried producing a composite image by merging the two but, because the camera was not on a tripod, the image geometry was fractionally different between the two images making it impossible to register them.

Although both images are acceptable as a record, their limitations become very apparent if they are blown up to a larger size. The "black" sky becomes speckled with a variety of reddish spots which is due to pixel "noise" resulting from the inability of the very small sensor in the camera to cope adequately with the high sensitivity required to get a short enough exposure to hand-hold the camera – I should have taken a tripod which would have allowed me to use a lower sensitivity and longer exposure!

Later in the evening, around midnight, the sky had darkened, and the streetlights were turned off (how considerate!). This made it possible to see the milky way, but photographing it was out of the question. I made some futile attempts with the camera laid on its back on the ground but, with a maximum possible exposure of 4 seconds it was never going to work. Previous experience indicates that an exposure of at least 20 secs (or image stacking) is required.

So, what did I learn from all this? Only what I already knew – imaging objects in the night sky is difficult without something more capable than a pocket compact camera.

Up Next:

NEXT MEETING: Friday 8 November 2019 Nonsuch High School for Girls Library 8pm.

There will be a Presentation by Graham Bryant entitled "One Month to save the Hubble Space Telescope".

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

NEXT VIEWING GROUPS: Tuesday 5 November 2019 and Wednesday 4 December 2019 Nonsuch High School for Girls 8pm.

These are informal sessions 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.

NEXT DENBIES OBSERVING SESSION:

Please watch our social media and email alerts for updates.

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.