ASTRONOMY NATURE GUERNSEY

Sagittarius

The Newsletter of the Astronomy Section of La Société Guernesiaise

2020

Forthcoming Events

Star gazing course

Thursdays 7.30 pm at the Observatory
13th February – 12th March
(Enrolment necessary)

Public Open Days

These will comprise a talk or film show and observations if clear. The first half hour each evening will be a presentation about Guernsey astronomy history as part of *Heritage75*.

Thursdays evenings from 23rd July (from 8.30 pm) to 27th August (from 8.00 pm in August).

Thursday, 22nd October, 6.30-8.30 pm.

Additional open days, especially for solar observing, and talks may be arranged and will be announced via the media, on the Astronomy Section website, www.astronomy.org.gg, and on the Section's Facebook pages.

Online versions of this and past newsletters are at http://www.astronomy.org.gg/more/newsletters.

Contents

Section meetings

The Section meets at the Observatory every Tuesday evening at 8.00 pm, sometimes with a discussion topic. Also the last Saturday evening of each month, if clear, except summer, for observing and photography.

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www.astronomy.org.gg

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Astronomy Section Officers, 2020

Secretary	Jean Dean
Hon. Treasurer	Peter Langford
Membership	Peter Langford
Editor	Tom Harvey
Group visits	Elaine Mahy
Open Days	Jean Dean
Courses	Jean Dean
Equipment mtce.	Allan Phillips
Public relations	Elaine Mahy
Research	Jason Hill
Library	Clive Stubbings
Imaging	Jean Dean
IT	Owain Catton
Website	Owain Catton

ASTRONOMY SECTION REPORT 2019

The Milky Way from the Guernsey Observatory (Jean Dean)

ANNUAL BUSINESS MEETING

The Astronomy Section's Annual Business Meeting was held on the 22nd January. In the light of Secretary Colin Spicer's decision to resign a new Section Secretary was sought. Unfortunately no one was prepared to take on the role, so the position was left vacant. During the year members Elaine Mahy and David Le Conte represented the Section at some Société Council meetings.

Other positions on the Section's Committee, however, were all filled: Peter Langford as Honorary Treasurer and Membership Secretary, Elaine Mahy as Activities Coordinator, Jean Dean responsible for Open Days and imaging, David Le Conte as Public Relations Officer and Editor of the Section's annual newsletter *Sagittarius*, Jason Hill for Research, Owain Catton for the website and, with Matt Skillet and Kieran Phillips, for IT, and Facilities maintenance and the Library being shared by George de Carteret and Jim English.

The purchase of several new items of equipment was agreed: a Skywatcher 80mm refractor with field flattener, polar alignment device and Bahtinov mask; a 120 mm refractor; an 8-inch SCT reflector; GOTO mounts; a green laser pointer; Microsoft Office software; and a phone camera eyepiece adapter.

With the ability to distribute *Sagittarius* electronically to members, and a decision to discontinue the free distribution of Astrocalendars, it was decided to reduce the Section's annual subscription rate to £5.

TALKS AND MEMBER EVENTS

On the 6th July Claudio Dandolo of the company *Telescopi Italiani* gave a talk to Section members about his design of astrographs and on research possibilities that are within the reach of amateurs with small and medium sized telescopes, especially in the identification of exoplanets.

Partial lunar eclipse over Herm, 16 July 2019 (Elaine Mahy)

On the 16th July, the 50th anniversary of the launch of Apollo 11 to the Moon, David Le Conte gave a talk entitled *Man on the Moon*. It has been estimated that some 400,000 people were involved in this exciting achievement, David being one of them. He described the Apollo programme using original footage from the time, and some of his own Apollo photographs taken when he worked for the Smithsonian Astrophysical Observatory under a NASA contact in the USA. Following the talk members observed the start of the partial lunar eclipse from Candie Gardens.

On the 13th August the annual Perseid meteor barbecue was held at the Observatory. Following the barbecue members observed meteors. Despite the bright Moon several were seen.

2019 marked the centenary of the solar eclipse which was used to test one of Albert Einstein's General Relativity Theory predictions, the proof of which made him famous. On the 17th October Dr Robin Catchpole of the Institute of Astronomy in Cambridge gave a talk entitled *Eclipse 1919: That changed the way we see the world*, about this momentous event, the two expeditions sent to observe the eclipse from Africa and South America, and the pivotal role played by Sir Arthur Eddington. Dr Catchpole's talks are always popular and informative, and this one was no exception.

Regular Tuesday evening meetings continued throughout the year, often with a discussion or video lecture.

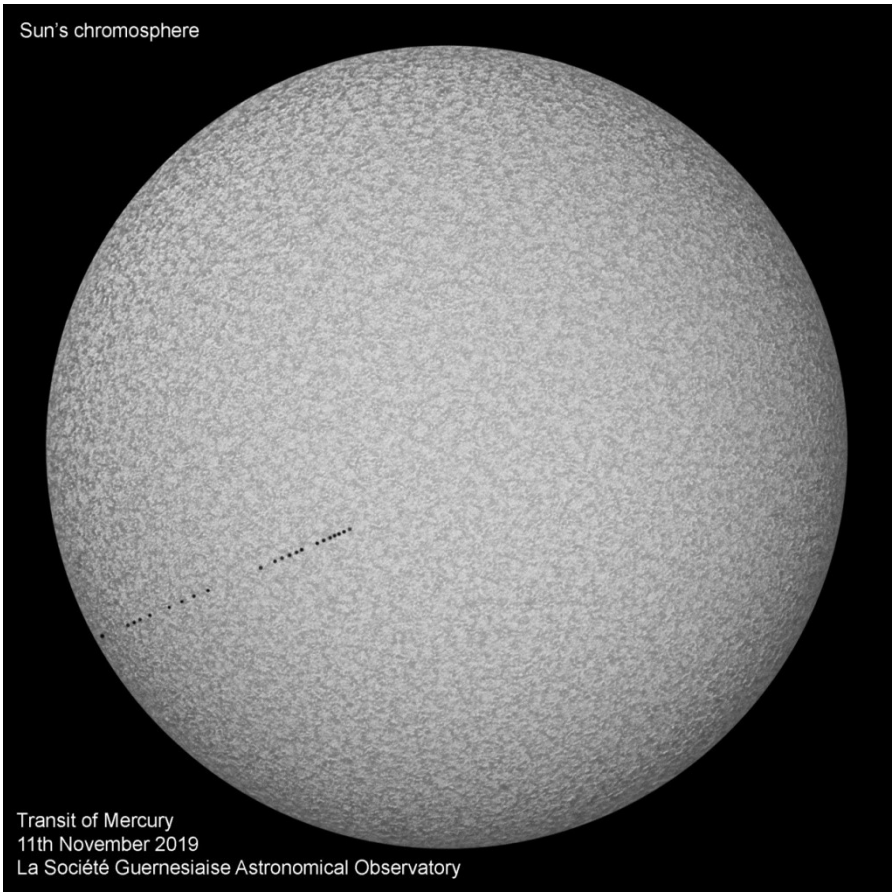
During autumn, Elaine Mahy has run a Beginners Night Sky course for interested members of the section, earlier on Tuesday evenings. This has helped some newer and/or less experienced members become more familiar with some basic astronomy topics, to get more from their membership of the section, and become more able to help with section activities and outreach.

The Section's website had remained virtually unchanged in format since its inception some 20 or more years ago. An entirely new website was created by Owain Catton and went live in December.

OPEN EVENTS

This year we started our programme of open events with a Solar Open Day on the 27th May Bank Holiday. The weather was excellent for observing the Sun with a variety of telescopes observing the photosphere, a heliostat projecting a solar image and an additional live feed from NASA's Solar Dynamics Observatory. We also had a poster display in the main building and members on hand to explain solar science. A second Solar Open Day was held in August with the addition of a hydrogen-alpha solar scope to observe the chromosphere and solar prominences. Unfortunately, sunspots were not visible on either occasion as the sun's activity is at a minimum at the moment and there has not been any substantial sunspot activity since May.

The summer open evenings were held every Thursday throughout the school holidays and we had clear skies for each event. The public were treated to magnificent views of the planets Saturn, Jupiter and Mars, and the Moon. Individual stars were viewed and colours discussed, Vega and Arcturus being favourites, along with the visual double Albireo. As the evenings drew in a little bit the telescopes were turned towards deep space and the Ring and Dumbbell planetary nebulae, a selection of globular clusters such as the Hercules cluster and even deeper towards galaxies such as Bode's, Andromeda and the starburst Cigar Galaxy. The darker evenings also allowed visitors to see the Milky Way in all its splendour. Talks on astronomy were given by Jason Hill, which as always were very popular. The open evenings were rounded off by a Halloween themed Nature Guernsey event on 31 October, where the Bat and Entomology Sections joined in.



The final open event this year was a rare astronomical event, the transit of Mercury. Fortunately, the clouds cleared long enough to get some excellent views and allow members, the press and public to take some photographs through a telescope. It was viewed through a variety of instruments including a Herschel Wedge on the 5-inch Takahashi refractor, which gave a lovely high contrast view. Using her own telescope with an Hα filter Jean Dean took a sequence of images against the background of the solar chromosphere.

All the public open events were very well attended and Jean Dean, who organised most of them, would like to thank all those members who have helped make them a great success in 2019.

Jean Dean

IMAGING

A Beginners Astrophotography Course was run by Jean Dean in March/April. Students learnt how to photograph the Moon and Milky Way using tripods and portable trackers, and they were introduced to deep space astrophotography using GOTO equatorial mounts, telescopes and a variety of software applications. In November an advanced deep space astrophotography course was run with more of a practical element where students learnt about advanced equipment and processing techniques. Both courses were full and have led to new membership. Jean would like to thank Owain Catton, Allan Phillips and David Le Conte for helping with these courses.

The Andromeda Galaxy (Jean Dean)

MAINTENANCE

During the spring and early summer, a considerable amount of external maintenance was carried out. Painting included all external and some internal woodwork, masonry and the observatory building. Some rotten woodwork on the shed was replaced with uPVC. The toilet was painted inside and generally made to look less like an old outhouse! The steelwork supporting the roll-off roof was wire brushed, primed and painted. The manual winch and bracket attaching the ropes to the roof were rewelded and painted, thanks to member Allan Phillips. New pulley ropes and elastic tensioners were installed. A second telescope pad was laid in the grassed area.

Gardening included removal of the dead gorse bushes at the front which created more parking space, removal of the old, sprawling compost heap and re-grassing of the area, the construction of a new timber frame for composting grass cuttings. Ruts in the grassed area were filled in and re-grassed. During the spring and summer nettles and wild flowers were allowed to grow up around the edge of the hedging to create a pollinator patch and attract insects. To the western boundary where there is a sudden drop-off fencing was built from old wooden pallets. All this work was organised and carried out by Jean Dean, who thanks all the members and her husband Peter who gave their time and helped.

The main fuse board in the kitchen was replaced with a modern RCD unit. Many thanks to member Richard Sweet, a qualified electrician, for doing this. A second-hand projector bought from the Spectrum camera club was installed, and gives an excellent image.

The Meade corrector plate was cleaned and the worm/spur gears in the mount adjusted. The Takahashi was sent to France for a service which included disassembling the lens cell, cleaning, re-spacing and collimation. The worn focuser rack and pinion were also replaced. Getting the Takahashi to France was not an easy task and we would like to thank Tom Harvey for arranging this. The All-Sky camera was taken down and serviced, the USB lead was replaced and this seems to have cured the intermittent issues we were having with the camera shutting down.

OTHER NEWS

Jean Dean's superb image of the Rosette Nebula in the constellation Monoceros the Unicorn was selected as NASA's Astronomy Picture of the Day for the 12th April 2019. It can be seen at https://apod.nasa.gov/apod/ap190412.html, and is reproduced here with her kind permission. She captured the image with 13 hours total integration time, using a monochrome CCD camera with red, green, blue, Hα, OIII and SII filters. Each was

combined into a single image and then the 6 images were combined at the Observatory into the final full colour image.

Jean explains that a camera allows us to see much deeper into space. The image shows a molecular cloud complex some 5,000 light-years away which is a stellar nursery where new stars are being formed, possibly together with new planets and moons and the possibility of life.

Congratulations were also due to Jean for being elected a Fellow of the Royal Astronomical Society. Former Section member Colin Gaudion, who now lives in Canada, was also elected a Fellow.

The annual 6-week WEA Star Gazing course, was run for the 18th consecutive year in February and March, and was, as always, fully subscribed. It was organised by David Le Conte, with major participation by members Elaine Mahy, Frank Dowding, Jason Hill, Jean Dean and Peter Langford.

The current Observatory lease expired at the end of October, and a new five-year lease was negotiated In early November, however the site, together with the adjoining bunker, was sold by the landlord, although the new lease remained active. Thanks are due to member Advocate Jason Hill and to La Société President Yvonne Burford, with the assistance of David Le Conte and Jean Dean, for accomplishing this most necessary task.

Two of the founder members of the Section, Geoff Falla and Frank Dowding, have all but retired this year, retaining an interest in the Section and making occasional appearances, but taking less of an active role. Both have been stalwart members for almost half a century, and the Section owes a great deal to their leadership and support during that time. David Le Conte, a member for over forty years, has also largely retired.

GROUP VISITS

Elaine Mahy took over managing the visits from schools, clubs and groups in January 2019. Elaine had been involved over the previous year or so in these visits, which had been organised by Frank Dowding for many years, and by Colin Spicer for the latter part of 2018.

We hosted 8 visits in the early part of 2019 from January to March; then 3 visits in November.

The best times for younger visitors are November to February, when sunsets are earlier. Shoulder months of October and March are also suitable for older groups.

We hosted groups aged 6-18 with their adult helpers: 2 Beaver groups (10th Guernsey Sea Scout Group, 2nd Beavers), 2 Cub groups (4th Cub Scout, 8th Guernsey Cubs), 3 Primary School groups (Vauvert Year 5 and 6, Hautes Capelles Year 5, Castel Year 5), 3 secondary school groups (Grammar School Year 13 Physics, St Sampson's High, Elizabeth College Science Club), one group of mixed-age children - the Guernsey Deaf Children's Society. In total we welcomed around 300 children to the Observatory.

Helpers and Resources

Running the presentations and telescopes / observing in 2019 for our group visits were: Elaine Mahy, Frank Dowding, David Le Conte, Jason Hill and Jean Dean.

Various of our newer members provided support on some visits: Kieran Philips, Daniel Woodland, Nick Wild and Clive and Jen Stubbings.

Presentations for younger visitors are about the Solar System to match their study topics. For older groups we have a variety of presentations available.

During the last few years we have added to our telescope kit :

- Skywatcher HEQ5 Pro portable equatorial mount, which works with various telescopes.
- Celestron Nexstar 8SE telescope on an alt-azimuth mount
- Skywatcher Esprit 80mm triplet refractor telescope to work with the HEQ5 Pro mount.

Therefore we have had more flexibility in how we run visits – occasionally we have used portable telescopes only where rain has threatened, or run with a third person on a portable telescope so we can split down a large group further. Our main telescope setup with the Meade 16" and Takahashi 5" telescopes in our telescope building was used many times, as we have done in the past. When the weather is cloudy we can describe the different telescopes and how they work, and show pictures of some of the objects we can view.

We are amazed by the knowledge and interest of some of our young visitors – although we try to answer every question, someone will always ask a question we cannot answer!

Donations

Donations received for group visits in 2019 totalled £324.80.

Jean Dean, Elaine Mahy and David Le Conte

ASTRONOMICAL EVENTS IN 2020

A disappointing year for eclipses, but we do have a good Mars opposition to look forward to, as well as a grazing pass of Vesta with a star, and a very close conjunction of Jupiter and Saturn.

Planets

Mercury will be visible in the periods around its greatest elongations:

Date	Elongation	Direction	Time
10 February	18º Eastern	Low in West	After sunset
24 March	28º Western	Low in East	Before sunrise
04 June	24º Eastern	Low in West	After sunset
22 July	20º Western	Low in East	Before sunrise
01 October	26º Eastern	Low in West	After sunset
10 November	19º Western	Low in East	Before sunrise

Venus will start the year as the "Evening Star" low in the south-western sky after sunset, and getting higher in the sky until 24 March when it reaches greatest eastern elongation (46º). It will be at inferior conjunction on 03 June, and will then become the "Morning Star" in the east before sunrise, reaching greatest western elongation (46º) on 13 August. It will remain visible in the morning for the remainder of the year.

At the beginning of the year Mars will be visible in the east in the morning before sunrise, and will then rise earlier and earlier, rising at sunset when it is at opposition on 13 October. It will remain a good evening object for the remainder of the year.

This opposition of Mars will be a good one, although not quite as good as that in 2018. It will be 63 million km (39 million miles) away, and have a diameter of 22 arc-seconds. Although Mars oppositions occur every two years, close oppositions of Mars occur with a cycle of 15 to 17 years. The next good one will not be until 2035, so make the most of this one!

Jupiter will rise in the east just before sunrise in January, but will rise progressively earlier, reaching opposition on 14 July in Sagittarius. It will then remain an evening object for the rest of the year. It will be accompanied by Saturn, the two planets making a very close approach to each other of just 6 arc-minutes on 21 December.

When Jupiter is visible we will have good views of the four Galilean moons, atmospheric bands on the planet's disc, and the Great Red Spot. Transit, shadow and occultation events involving Jupiter's moons can be calculated using a Java script at http://www.skyandtelescope.com/wp-content/observing-tools/jupiter_moons/jupiter.html on the *Sky & Telescope* website. (You may need to register at http://tinyurl.com/24kp25 and remember to enter the date in the US format: month/day/year). They can also be found in the 2020 BAA Handbook (pages 69-78). They can be simulated on software such as StarryNight (http://www.starrynightstore.com/), and some of the many astronomy apps, some of which also gives the transit times of the Great Red Spot. The Spot's transit times are also available at http://www.skyandtelescope.com/observing/celestial-objects-to-watch/transit-times-of-jupiters-great-red-spot/ (again using the US date format).

Saturn closely follows Jupiter across the sky throughout the year, and they should make a lovely pair, although never rising higher than about 18 degrees. It reaches opposition on 20 July. The rings are still at a good angle for observation, and its brightest moons, especially Titan, should also be visible.

Uranus will be at opposition in Aries on 31 October, at magnitude 5.7. Neptune will be at opposition in Aquarius on 11 September, at magnitude 7.8.

Phases of the Moon

New Moon	First Quarter	Full Moon	Last Quarter
	Jan 03	Jan 10	Jan 17
Jan 24	Feb 02	Feb 09	Feb 15
Feb 23	Mar 02	Mar 09	Mar 16
Mar 24	Apr 01	Apr 08	Apr 14
Apr 23	Apr 30	May 07	May 14
My 22	May 30	Jun 05	Jun 13
Jun 21	Jun 28	Jul 05	Jul 12
Jul 20	Jul 27	Aug 03	Aug 11
Aug 19	Aug 25	Sep 02	Sep 10
Sep 17	Sep 24	Oct 01	Oct 10
Oct 16	Oct 23	Oct 31	Nov 08
Nov 15	Nov 22	Nov 30	Dec 08
Dec 14	Dec 21	Dec 30	

Supermoons

So-called 'supermoons' occur when the Full Moon happens to coincide with the Moon's closest approach to Earth ('perigee'), and therefore appear larger than usual. In 2020 there will be four such moons: on 09 February, 09 March, 08 April and 07 May.

Dwarf planets and asteroids

Pluto will reach opposition on 15 July, in Sagittarius just 1.5 degrees from Jupiter, at magnitude 14.2. Ceres will be at opposition on 28 August in Aquarius, with magnitude 7.2. The other three dwarf planets (Eris, Makemake and Haumea) are too faint to be seen in most amateur telescopes.

The brightest asteroid, Vesta, will be visible, but does not reach opposition this year. However, it is predicted to have a close stellar pass on 11 February (see below under Occultations).

Eclipses

This is a poor year for eclipses, with just three penumbral lunar eclipses and not solar eclipses visible from Guernsey.

On 10 January the Moon will undergo a penumbral eclipse, all of which will be visible from Guernsey. It starts at 17.05 and ends at 21.14, maximum eclipse will be at 19.10. On 05 June there will be another penumbral lunar eclipse, but only the last hour will be visible, from moonrise at 21.02 until 22.06 BST. And there will be a third penumbral lunar eclipse on 05 July, but again only an hour will be visible, from 04.04 to moonset at 05.07 BST. A fourth such eclipse, on 30 November, will not be visible from here.

An annular solar eclipse on 21 June will not be visible from Guernsey, being seen only from central East Africa and the southern part of Asia, including northern India. A total solar eclipse on 14 December will only be visible from Chile, Argentina, the South Pacific and South Atlantic.

Occultations

The brightest (7th magnitude) asteroid Vesta is predicted to occult the 6th magnitude star HIP14439 on 11 February at 21.58 UTC, but from Guernsey it appears that it will be a very close pass (3 arcseconds) to the star at 22.27, as modelled on *StarryNight*. It may well be possible to see movement of the asteroid as it passes the star. It will be at an altitude of 24º in the west. Of course, although the two objects will appear close to each other they are at vastly different distances. Vesta will be about 2.5 astronomical units (about 20 light-minutes) away, while the star's distance is over 300 light-years.

Lunar conjunctions

The best conjunctions of the Moon and the bright planets, with their positions and separations are:

01 August	Jupiter	Low in south in evening	2.5°
09 August	Mars	Low in south before sunrise	2.5°
06 September	Mars	Low in south-west before sunrise	0.6°
03 October	Mars	Low in west before sunrise	1.0°

Planetary conjunctions

The best conjunctions between planets, with their positions and separations, are:

27 January	Venus and Neptune	South-west after sunset	0.1º
20 March	Mars and Jupiter	Low in south-east before sunrise	0.7º
21 December	Jupiter and Saturn	Very low in south-west after sunset	0.1º

Meteors

The Quadrantids will peak on the night of 03/04 January, with about 10 per hour, the Moon at First Quarter will be quite favourable. The Perseids will peak on the night of 12/13 August, with some 80 per hour, and with the Moon at Last Quarter will again be quite favourable. The richest annual shower, the Geminids**,** will peak on the night of 13/14 December, and the New Moon will make for very good visibility.

There are, of course, minor meteor showers during the year, and sporadics may be seen at any time. For shower details see the 2020 BAA Handbook, pp99-101.

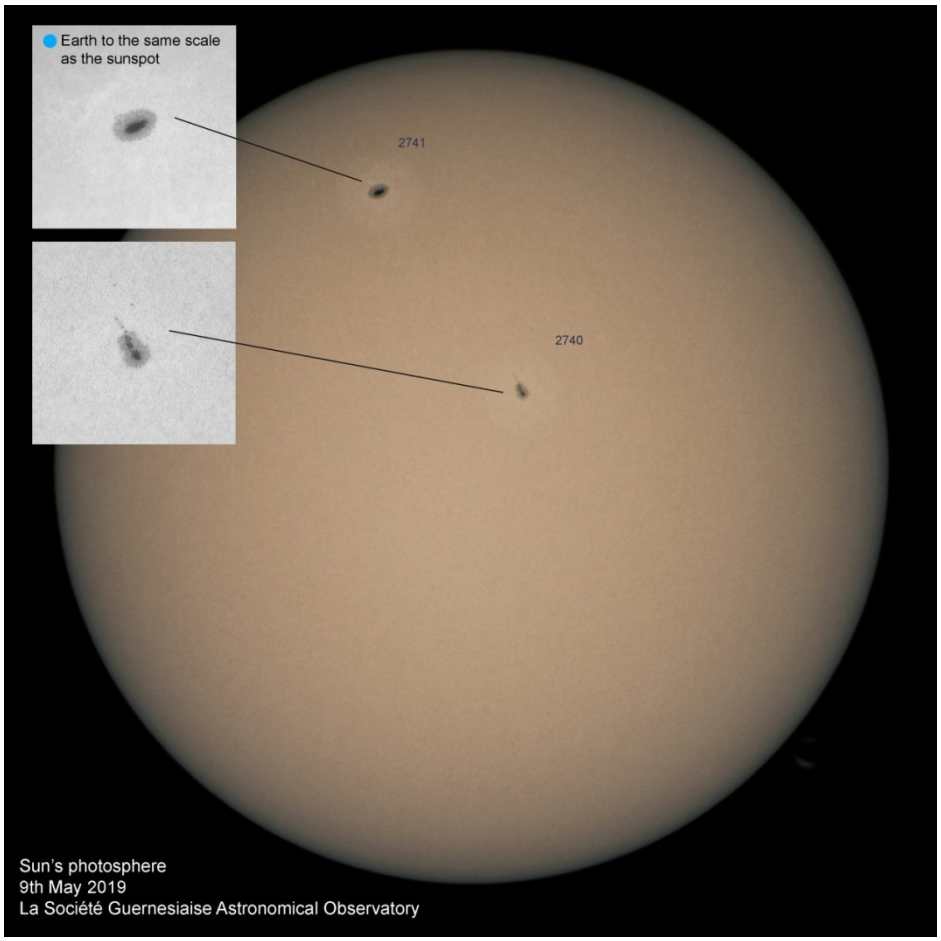
Comets

Comet C/2017 T2 PANSTARRS is well-placed for observation as a circumpolar object during the first few months of the year, and may just reach naked-eye visibility (magnitude 6) in May, when it will be at perihelion.

Periodic comet 88P/ Howell is conveniently placed for early morning observation until June. It reaches perihelion in late September, but will then be a southern hemisphere object, although it may be visible as a 9th magnitude object in the early evening low in the south-east..

Detailed comet predictions for 2020 are available on the website of the British Astronomical Association's Comet Section: http://www.ast.cam.ac.uk/~jds/preds20.pdf. Also check the Heavens-Above website (heavens-above.com) for star charts showing comet positions, and use programs such as StarryNight for detailed location charts.

The Sun



There has been a dearth of sunspots since the last solar maximum in 2014, which was a not significant one. However, the new solar cycle appears to have started, so we can hopefully see a progressive increase in sunspots as we head towards the next solar maximum in about five years. There can be outbursts of activity, not only of sunspots but also of coronal holes and coronal mass ejections, which can result in displays of the aurora borealis (and australis) at high latitudes. Details of sunspot numbers are at www.ips.gov.au/Solar/1/6, and real-time views of the Sun are at https://umbra.nascom.nasa.gov/newsite/images.html. Auroral alerts, with lots of other information, are at www.spaceweather.com.

Jean Dean photographed sunspots on Liberation Day, 2019

Equinoxes and solstices

The following are the dates and times of the equinoxes and solstices in 2020:

Vernal Equinox	20 March	03.49 UTC
Summer Solstice	20 June	22.43 BST
Autumnal Equinox	22 September	14.30 BST
Winter Solstice	21 December	10.02 UTC

Satellites

The International Space Station (ISS) is regularly visible from Guernsey, looking like a very bright star crossing our skies from west to east. With the decommissioning of Iridium satellites flashes from them are now quite rare. Many other, fainter, satellites appear every night. Details of the times and directions of visibility (together with sky charts and much more) can be obtained from www.heavens-above.com, linked from our webpage www.astronomy.org.gg/iss.htm.

Courses

The Astronomy Section's annual "Star Gazing" course at the Observatory will be run from 06 February to 12 March. This year the Section will be running it itself, rather than through the WEA which it has done for the past 18 years. It is being organised by Jean Dean. However, it filled up very quickly so there are no spaces left. Details are on our website (www.astronomy.org.gg) and Facebook page (https://www.facebook.com/AstronomyGuernsey).

Additional courses may be run during the year, including astrophotography courses.

Open days

The Observatory will be open to the public again for a number of evenings during the year, including weekly openings on Thursdays during the summer school holidays (23 July to 27 August). Details will appear on our website and will be sent to the local media. This year the summer open evenings will start a half-hour early during which there will be a presentation about historical Guernsey astronomers, as part of *Heritage75*.

Further open days for observing the Sun will most likely be held. And there will probably be an open evening in October.

David Le Conte

References

SkyMap Pro and *Starry Night Pro* software
General: http://www.seasky.org/astronomy/astronomy-calendar-2020.html
http://astropixels.com/ephemeris/astrocal/astrocal2020gmt.html
http://www.timeanddate.com/
Equinoxes, etc: https://www.weather.gov/media/ind/seasons.pdf
Royal Astronomical Society diary, 2020
The Handbook of the British Astronomical Association, 2020

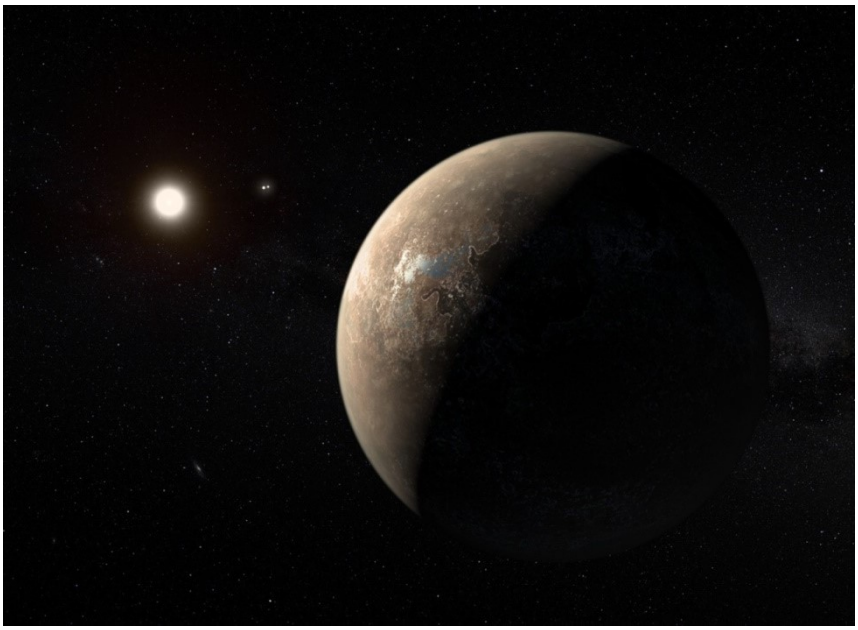
Comet Iwamoto in Leo,
14th February 2019
by Elaine Mahy

CALENDAR OF ASTRONOMICAL EVENTS IN 2020

Month	Date	Time	Event
Jan- Jun			Comet 88P/Howell
January	03/04		Quadrantid meteor shower (favourable)
January	05	07.49 UTC	Earth at perihelion (147,091,144 km)
January	10	Evening	Penumbral lunar eclipse
January	27	After sunset	Venus and Neptune conjunction (05.1º)
February	06	19.30 UT	Star gazing course starts at Observatory
February	09	All night	Supermoon
February	10	After sunset	Mercury at greatest eastern elongation
February	11	21.58 UTC	**Vesta close to star HIP14439.**
March	09	All night	Supermoon
March	12	19.30 UT	Star gazing course – final class
March	20	03.51 UTC	Vernal Equinox
March	20	Before sunrise	Mars and Jupiter conjunction (0.7º)
March	24	Before sunrise	Mercury at greatest western elongation
March	24	Evening	Venus at greatest eastern elongation (46º)
March	29	01.00 UT	BST starts
April	08	All night	Supermoon
May	07	All night	Supermoon
May			Comet C/2017 PANSTARRS at perihelion
June	04	After sunset	Mercury at greatest eastern elongation
June	05	Evening	Penumbral lunar eclipse
June	20	22.45 BST	Summer Solstice
July	04	12.56 BST	Earth at aphelion (152,095,296 km)
July	05	Before sunrise	Penumbral lunar eclipse
July	14	All night	Jupiter at opposition
July	15	All night	Pluto at opposition (magnitude 14.2)
July	20	All night	Saturn at opposition
July	22	Before sunrise	Mercury at greatest western elongation
July	23	Evening	Observatory Open Evenings start
August	01	After sunset	Jupiter conjunction with Moon (2.5º)
August	09	Before sunrise	Mars conjunction with Moon (2.5º)
August	12/13		Perseid meteor shower (favourable)
August	13	Morning	Venus at greatest western elongation (46º)
August	27	Evening	Observatory Open Days end
August	28	All night	Ceres at opposition
September	06	Before sunrise	Mars conjunction with Moon (0.6º)
September	11	All night	Neptune at opposition (magnitude 7.8)
September	22	14.32 BST	Autumnal Equinox
October	01	After sunset	Mercury at greatest eastern elongation
October	03	Before sunrise	Mars conjunction with Moon (1.0º)
October	13	All night	**Mars at opposition**
October	25	02.00 BST	BST ends
October	31	All night	Uranus at opposition (magnitude 5.7)
November	10	Before sunrise	Mercury at greatest western elongation
December	13/14		Geminid meteor shower (favourable)
December	21	After sunset	Jupiter and Saturn conjunction (0.1º)
December	21	10.04 UT	Winter Solstice

A TRIP TO PROXIMA CENTAURI B

As more exoplanets are discovered there's no doubt that one day we will want to go and visit them. The nearest exoplanet discovered so far is orbiting Proxima Centauri b, one of the three stars in the Alpha Centauri system, the closest set of stars to our solar system, some 4.2 light years away. For now we are just exploring our own solar system, so 4.2 light years is far too formidable a distance to contemplate travelling.



Artist's impression of Alpha Centauri b (ESO)

However, what about in the future? It is a common misconception that if a star is 4.2 light years away then it would take an astronaut, even travelling at the speed of light, 4.2 years to get there. That ignores the effects of Einstein's theory of special relativity. In fact, if an astronaut could travel at the speed of light, she would arrive at her destination instantaneously! Of course it is not possible for a material object like an astronaut to travel at the speed of light. However, if she could travel at an appreciable fraction of the speed of light the astronaut's journey time could be significantly reduced relative to the time elapsed back on Earth. For instance, travelling at 60% of the speed of light the journey time to Proxima Centauri for the astronaut would be 5.6 years while for the people on Earth her journey time would be 7 years. At 80% of the speed of light the astronaut's journey time would be 3.2 years, while for the people back on Earth 5.3 years would have elapsed.

Those journeys would involve an initial rapid acceleration to get up to speed, a few years of weightless travel and a rapid deceleration when the astronaut arrived at her destination. A more pleasant journey would be to accelerate at a steady 1g for half the trip, building up speed all the way, then flip the spaceship around and decelerate at 1g for the second half of the trip to steadily reduce the speed down again. The astronaut on board would then experience an artificial gravity just like back on Earth. How long would that trip take? For the astronaut the trip would take just 3.5 years. For the people back on Earth the astronaut's journey time would be 5.8 years. In the middle of the trip, when she flips the spaceship around, she would be travelling at her maximum speed of nearly 95% of the speed of light. If at the end of her journey the astronaut sent a message to say she had arrived it would take 4.2 years before the message got back to Earth so, with the journey time and message time, it would be 10 years from the time the astronaut set off before Earth learned that she had reached her destination.

We are not used to time disparities between different observers. However there is nothing paradoxical about it. Imagine you set off in a journey in your car while your partner stays at home with her car parked in the drive. When you return it's no surprise to find that the mileage change on your car is different to that on your partner's. You have made a journey and she hasn't. Relativity tells us that there's not just a mileage difference for the two cars but also a time difference for the two cars' clocks. When speeds are very low compared to the speed of light the time difference is imperceptible, but nevertheless a time difference exists and it is no more paradoxical than the mileage difference. Incidentally it's always the stay-at-home person whose clock shows the greatest time elapsed.

Peter Langford

THE MOON CLOSE UP

While we may not be able to get a close view of Alpha Centauri we do know from the Apollo pictures taken 50 years ago what the Moon looks like from its surface. But I think the following description of what the Apollo astronauts saw when they approached it is particularly dramatic. It is taken from Apollo 11 astronaut Michael Collins's autobiography *Carrying the Fire* (pp387-8), an autographed copy of which is in my possession.

"*Our first shock comes as we stop our spinning motion and swing ourselves around so as to bring the moon into view. We have not been able to see the moon for nearly a day now, and the change in its appearance is dramatic, spectacular and electrifying. The moon I have known all my life, that two-dimensional, small yellow disk in the sky, has gone away somewhere, to be replaced by the most awesome sphere I have ever seen. To begin with it is huge, completely filling our window. Second, it is three-dimensional. The belly of it bulges out towards us in such a pronounced fashion that I almost feel I can reach out and touch it, while its surface obviously recedes towards the edges. It is between us and the sun, creating the most splendid lighting conditions imaginable. The sun casts a halo around it, shining on its rear surface, and the sunlight which comes*

cascading around its rim serves mainly to make the moon itself seem mysterious and subtle by comparison, emphasizing the size and texture of its dimly lit and pockmarked surface.

"*To add to the dramatic effect, we find we can see the stars again. We are in the shadow of the moon now, in darkness for the first time in three days, and the elusive stars have reappeared as if called especially for this occasion. The 360-degree disk of the moon, brilliantly illuminated around its rim by the hidden rays of the sun, divides itself into two distinct central regions, One is nearly black, while the other basks in a whitish light reflected from the surface of the earth. Earthshine on the moon is considerably brighter than moonshine on the earth. The vague reddish-yellow of the sun's corona, the blanched white of earthshine, and the pure black of the star-studded surrounding sky all combine to cast a bluish glow over the moon. This cool, magnificent sphere hangs there ominously, a formidable presence without sound or motion, issuing us no invitation to invade its domain. Neil sums it up: "It's a view worth the price of the trip." And somewhat scary too, although no one says that*."

DLeC

A LUNAR WINDOW

Talking about the Moon, I have for some time wondered about the significance of a stained-glass window in St Saviour's Church. It shows St Francis of Assisi, and depicts prominently what could almost be taken to be a solar eclipse, but which must be a thin crescent moon, the unlit part of the moon's disc illuminated by earthshine and clearly visible. The phase would suggest perhaps a one-day-old moon.

Intrigued, I consulted the authority on ecclesiastical history, the Reverend Leslie Craske, who had been Rector of St Saviour's. In a pamphlet he had written about the windows in the church, he described it as "*an exquisite little portrait of St Francis, given anonymously to commemorate a parish mission in which the Franciscans took part. The artist is Lawrence Lee, who also designed the windows in the Chapel of St Apolline in the parish. He was among an outstanding group of artists who, in a radical break with tradition, designed the seventy windows in Coventry Cathedral after the war*." The 10-day Franciscan Mission which the window commemorates was in October 1975 and consisted of two Friars and two Sisters.

He was able to throw light on the significance of the moon, drawing my attention to a canticle composed by the saint, and which includes the verses:

Be praised, my Lord, for all your creation
and especially for our Brother Sun,
who brings us the day and the light;
he is strong and shines magnificently.
O Lord, we think of you when we look at him.

Be praised, my Lord, for Sister Moon,
and for the stars
which you have set shining and lovely
in the heavens.

I thought that perhaps the window could be regarded as being based on the words of St Francis's canticle, showing the moon partially illuminated by the sun (and earth). The window depicts St Francis with birds, a rabbit, tree, flowers, fruit, and possibly stars, his hands outstretched as if to show that all these creations are reasons to praise God. He believed that all creatures should show such praise and that humans have a duty to protect nature. He himself had a great love for animals and the environment. In this respect he was perhaps hundreds of years before his time. The Roman Catholic Church regards him as the Patron Saint of Ecology.

Reverend Craske points out, however, that St Francis was himself referred to as Brother Sun, with Sister Moon referring to St Clare, the founder of the Franciscan Order which bears her name (known as the 'Poor Clares'). His predecessor at St Saviour's church was the Reverend Frank Cooper, who had an interest in the two saints, sometimes referring to himself as Brother Francis and to a member of the congregation as Sister Clare.

Reverend Craske says that at the time of the window's dedication in 1978 there was considerable interest in the two saints, encouraged by an American film produced in 1972 called *'Brother Sun and Sister Moon*'. Symbolism in Christian tradition is that Clare, in founding her Order of Poor Clares in imitation of Francis and his friars, was the New Moon reflecting the light of the Sun. He feels sure that is what the window portrays. I am grateful for this interpretation of it, which enhances my appreciation of this beautiful window.

David Le Conte

QUIZ QUESTIONS (Answers on page 15)

1. Still on the subject of the Moon: how many men have been to it?
2. Where in the solar system might you find the planet Theia?
3. The period of a pendulum depends entirely on its length, not its weight. So why does adding an old penny onto the pendulum of Big Ben's clock make it go faster?

ARE WE ON AN AGONIC LINE?

It's difficult to say exactly! Agonic lines are lines on the Earth where the magnetic declination (the angle between magnetic north and true north) is zero. In September 2019 there was a news item that the Greenwich meridian was (temporarily) on such a line, the magnetic north pole lying on that meridian. So for a time magnetic compasses pointed towards true north as well as magnetic north for the first time in 360 years. It got me wondering when Guernsey would be (or had been) on such a line.

The magnetic poles wander about, making prediction of their positions difficult. For hundreds of years the north magnetic pole has been west of the Greenwich meridian, but in recent years it has been unexpectedly speeding up in an eastward direction. In 2019 it crossed the 180º meridian, in line with the 0º meridian. It is hard to predict what it will do next, but on the assumption it keeps going at the same rate it is going to cross the 182.6º meridian (in line with our 2.6º longitude) sometime soon.

There are several models of magnetic declination, including the US and British World Magnetic Model (WMM), and the US International Geomagnetic Reference Field (IGRF). Online calculators give historical data, but future data is very limited. They do, however, give an indication of the rate of change from which some idea of future declinations can be deduced.

For our location, on 31 December 2019, the WMM model gives a magnetic declination of 0.61ºW±0.36º, changing 0.18ºE per year. The IGRF model gives 0.74ºW, changing 0.15ºE per year. The WWM model, therefore, gives a result of May 2022, while the IGRF model gives November 2023 as the date on which our compass needles will indicate true north. It remains to be seen which, if either, is correct.

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References

https://phys.org/news/2019-09-magnetic-north-true-align.html
https://ngdc.noaa.gov/geomag/calculators/magcalc.shtml#declination
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LATE 19TH CENTURY MATHS

I have been looking at an ancestor's exercise book from the 1880s and have been fascinated by some of the maths questions. Here are just a few which have an astronomical flavour, and others which today appear curious, being anachronistic. Answers, with comments, are on page 15.

a. Find the length of the lunar month which contains 2,551,442 seconds.

b. The circumference of the Earth contains 132 millions of feet; express the same in miles.

c. Light travels at the rate of 192,500 miles a second. If the Sun's light takes 8m 13s in reaching us, what is its distance from the Earth?

d. What is the accurate length of the solar year, which contains 31,556,928 seconds?

e. Sound travels at the rate of 1130 feet a second. How far is a thunder cloud, when the sound follows the flash after 7 seconds?

f. How many times will a coach wheel turn in going from Cambridge to London, a distance of 52 miles, the circumference of the wheel being 16ft 6 inches?

g. A Jewish shekel weighed 219 grains Troy, and was worth 2s 3½d. What was the weight of a talent containing 3000 shekels? And the value of 10,000 talents?

h. Divide £115 10s among 5 men and 6 women, giving each man thrice the share of a woman.

i. The battering ram employed by Titus against the walls of Jerusalem weighed 100,000 lbs. How many tons did it contain?

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FORTHCOMING ECLIPSES

Eclipses are always interesting events – with the possible exception of penumbral lunar eclipses of which we have no less than four in 2020. Although the next few years bring a number of lunar eclipses we have to wait until 2029 to see the whole of a total lunar eclipse from Guernsey. There will be a few solar eclipses, the one in 2026 being a particularly good one. All are, of course, partial, the next total solar eclipse here being in 2081 (followed closely by another in 2090!). Here is a list of Guernsey eclipses for the decade.

Partial Solar eclipses

2021	June 10	30%	2026	August 12	95%
2022	October 25	19%	2027	August 02	58%
2025	March 29	42%	2028	January 26	69%

Lunar eclipses

2020	January 12	Penumbral	All visible
2020	June 05	Penumbral	Partially visible
2020	July 05	Penumbral	Partially visible
2020	November 20	Penumbral	Partially visible
2021	November 19	Partial	Partially visible
2022	May 16	Total	Partially visible
2023	October 28	Partial	All visible
2024	March 25	Penumbral	Partially visible
2024	September 18	Partial	All visible
2025	March 14	Total	Partially visible
2025	September 07	Total	Partially visible
2027	February 20	Penumbral	All visible
2028	January 12	Partial	All visible
2028	July 06	Partial	Partially visible
2028	December 31	Total	Partially visible
2029	June 26	Total	Partially visible
2029	December 20	Total	All visible

SOME (SLIGHT) GUERNSEY CONNECTIONS WITH THE HST

I was reminded recently of a couple of slight connections between Guernsey and the Hubble Space Telescope when I came across an entry in my parents' visitors book for 17 June 1977. At that time I was working at Kitt Peak National Observatory (KPNO) in Arizona. Dr Don Hall was in charge of producing infrared spectroscopic instrumentation and detectors, and very large diffraction gratings, and incidentally operated the largest spectrometer in the world as a test instrument.

He told me one day that he and his family were planning to visit Jersey during a forthcoming visit to the UK. I urged him to visit Guernsey instead, and he took up my suggestion. While in the island he, his wife Sandy and son Andrew visited my parents and had tea in the house where I now live.

Initially a solar scientist he changed to studies of star formation and galactic phenomena. He went on to the development of very large (8m+) telescopes, became Director of the Institute of Astronomy at the University of Hawaii, being in charge of the Mauna Kea Observatory as well as the University's Haleakala Observatory on the site where I had worked in 1968-9. In 2009 the final HST camera (the Wide Field Camera 3), for which he was responsible, was installed. He is now on the science team for the Near Infrared Camera being built for the James Webb Space Telescope, which is scheduled to replace the HST.

The second connection with the HST arose in 1978 when NASA invited organisations to submit proposals to run the HST, then just referred to as the Large Space Telescope. KPNO was run by the Association of Universities for Research in Astronomy (AURA), and AURA was preparing a bid. This was appropriate as KPNO's model of running an observatory as a service for astronomers world-wide was eminently transferrable to the HST concept.

As AURA's Acting Head of Administration I was tasked with compiling the draft of the administrative part of the bid, including details of how the HST would be administered and how the links with all the various organisations involved would work. To what extent my paper formed part of the final submission I do not know as by then I had decided to leave KPNO and return to Guernsey. But the bid was indeed successful, and AURA established, and still runs, the Space Telescope Science Institute in Baltimore, funded by NASA, and is due to run the replacement for the HST, the James Webb telescope.

And who was its Deputy Director in its early years? None other than my former colleague and Guernsey visitor, Don Hall.

DLeC

PLANET-PLANET OCCULTATIONS

An article in the January 2020 edition of *Astronomy* magazine listed occultations of planets by other planets, as seen from Earth, in the 19th and 21st centuries (there being none in the 20th century). I used *StarryNight* to check whether any had been, or will be, visible from Guernsey. It turns out that most are close conjunctions as seen from here. The results are:

Date	Planets	Separation distance	Altitude	Night/Day
1808 December 09	Mercury/Saturn	20 arc-secs	50º	Night
1818 January 03	Venus/Jupiter	Occultation	60º	Night
2065 November 22	Venus/Jupiter	Graze	21º	Day
2067 July 15	Mercury/Neptune	8 arc-secs	61º	Day
2079 August 11	Mercury/Mars	Occultation	-16º	Night
2088 October 27	Mercury/Jupiter	8 arc-secs	25º	Day
2094 April 07	Mercury/Jupiter	Occultation	43º	Day

So it appears that the only occultation visible from Guernsey was the one of 1818. I very much doubt, however, whether anyone observed it, or even realised it was happening.

The occultation of 2094 will be within a degree and a half of the Sun, so I very much doubt that it will be observable.

ANSWERS TO QUIZ QUESTIONS (page 13)

1. Twenty-four. Although just 12 men walked on the lunar surface, others went around the Moon, so went *to* the Moon. There were nine manned lunar missions, with three astronauts on each: Apollos 8, and 10-17. Apollos 8 and 10 orbited the Moon. Only Apollos 11, 12 and 14-17 landed on the Moon, but even the unsuccessful Apollo 13 followed a circumlunar trajectory. That makes 27 men. However three of them went twice: Jim Lovell (Apollos 8 and 13), John Young (Apollos 10 and 16), and Eugene Cernan (Apollos 10 and 17), so there were 24.
2. On the Earth and the Moon. Theia is the name given to the planet that is thought to have hit the Earth and formed the Moon, so its remains should be found on both bodies.
3. It raises the pendulum's centre of gravity, in effect shortening its 4.4m length (period 4 seconds). Pre-decimal pennies are used to regulate the clock mechanism. Adding one penny causes the clock to gain two-fifths of a second in 24 hours.

ANSWERS TO MATHS QUESTIONS (page 13)

a. 29d 12h 44m 3s. This is the *synodic month*, based on the lunar phases (ie with respect to the Sun). The *sidereal month*, the period of the Moon's orbit (ie with respect to the stars), is 27d 43m 12s.
b. 25,000 miles. The accepted value for the Earth's circumference is 24,901 miles around the equator, and 24,860 miles around the poles.
c. 94,902,500 miles. The speed of light is actually 186,287.490 miles/sec, and it takes light 8m 19s to travel from the Sun to the Earth. So the distance is really 92,957,457.5 miles.
d. 365d 5h 48m 48s. The solar, or *tropical year* is measured from vernal equinox to vernal equinox. It changes slightly from year to year, and in 2000 was 365d 5d 48m 45s.
e. 1 mile 2 furlongs 216 yards 2 feet.
f. 16,640 times.
g. 15cwt and £3,437,500.
h. Men: £16. 10s each, women: £5. 10s each(!).
i. 44 tons 12 cwt 3 grs 12 lbs.

FOOD FOR THOUGHT

Questions extracted from a recent Royal Astronomical Society survey of Fellows:

In your opinion, what is the greatest astronomical discovery, and what astronomical discovery do you think we will discover in the future?

Which planet would you live on, and why?

Star Trails, 03 December 2019
3hrs 10mins fisheye defished looking south to Ladies Bay and Vale Church
by Elaine Mahy

OH DEAR!

Why is it that film and TV producers can spend millions on creating shows and not spend a few bob on getting professional advice when including astronomical events?

I recently watched the popular British TV series called *Luther*. In the first episode of the first series we are introduced to a young and supposedly brilliant astrophysicist who says: "*This is a black hole. It consumes matter, sucks it in and crushes it beyond existence.*"

Any astrophysicist will tell you that black holes do not "suck" matter. Matter falls into them under the force of gravity, just like any other body. It is just that when matter passes the event horizon that there is no escape.

Even more galling is that on the balcony of her apartment was a small refractor of the cheapest kind – an instrument an astrophysicist would hardly be likely to own.

Films are rife with astronomical errors. I recall one called *Out to Sea*, starring Walter Matthau and Jack Lemmon, in which a full moon was shown the night before a solar eclipse!

And in a film entitled *Did you hear about the Morgans?* Hugh Grant and Sarah Jessica Parker have a glorious view of the night sky. He says "*Good God, is that right?*" She replies "*I don't know. I've never seen anything like it in New York outside the Planetarium!*" Well might they make these comments; the setting is Wyoming at a latitude of 44½ºN, whereas the sky is that of a latitude of about 20ºN!

Oh dear!

DLeC