ASTRONOMY NATURE GUERNSEY

Sagittarius

The Newsletter of the Astronomy Section of La Société Guernesiaise

2019

Forthcoming Events

WEA Star gazing course

Thursdays 7.30 pm at the Observatory
7th February – 14th March
(Enrolment necessary)

Public Open Days

These will comprise a talk or film show and observations if clear.

Bank Holiday Monday, 27th May, 10 am to 12 noon (to observe the Sun)

Thursdays evenings from 25th July (from 9 pm) to 29th August (from 8.30 pm in August).

Thursday, 31st October, from 6 pm.

Monday, 11th November 1.00 to 2.00 pm (Transit of Mercury)

Additional open evenings and talks may be arranged and will be announced via the media and on the Astronomy Section website, www.astronomy.org.gg.

Contents

Section meetings

The Section meets at the Observatory every Tuesday evening at 8.00 pm, often with a discussion topic starting at 9.00 pm, or observing if clear.

Also the last Saturday evening of each month, if clear, except summer, for observing and photography.

Observatory
Rue du Lorier, St Peter's, Guernsey
Tel: 264252
www.astronomy.org.gg

Material for, and enquiries about Sagittarius should be sent to the Editor: davidleconte@suremail.gg.

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Astronomy Section Officers, 2019

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Public relations	David Le Conte
Research	Jason Hill
Library	Jim English & Geoff Falla
Imaging	Jean Dean
IT	Matt Skillet
Website	Owain Catton

EDITOR'S INTRODUCTION

A new closed Facebook page has been set up for Astronomy Section members to communicate with each other. Log into Facebook and go to *Guernsey Astronomy Society Members Group*. Click on + *Join group*. If you are an Astronomy Section member you will then be approved by a page administrator as a member of the Group.

The Astronomy Section's annual subscription is £5.00, by cheque payable to 'La Société Guernesiaise Astronomy Section', and sent to the Honorary Treasurer, Peter Langford, Fief L'Eveque, Rue de la Boullerie, St Andrew's, Guernsey GY6 8XF, Tel: 239575. Alternatively it can be sent to: Account 'La Société Guernesiaise Astronomy', Sort Code 60-09-20, A/C No. 70602964, Reference Your name. Be sure to include your name as reference. It would also be helpful if an email was sent to the Treasurer at pmlang@cwgsy.net.

Members of the Section must be members of La Société Guernesiaise. You can join or renew subscriptions to La Société at the headquarters at Candie Gardens (Tuesday, Thursday or Saturday mornings, 10.30 am to 12 noon), or at www.societe.org.gg/about/join.html.

In last year's *Sagittarius* I said the decision had been made to publish it in A4 format, and distribute it primarily through digital means. In the event, it was decided to publish it as a hard-copy A5 booklet. This year, however, it is being distributed by email and on the Section's website as a pdf file, with just a few hard copies available at the Observatory. It also has the advantage of working hyperlinks. Astrocalendars will no longer be provided, but will be available for purchase.

In addition to the normal Tuesday evening meetings for discussion and observing, it has been decided to hold meetings on the last Saturday of each month, except for the summer. These will be dedicated to observing and astrophotography, and will be led by Jean Dean.

Congratulations to member Pieter Durman for winning the £1000 Griff Caldwell bursary awarded by La Société Guernesiaise. Pieter is studying natural sciences at Cambridge University.

I am again grateful to those who have submitted articles for this 2019 issue. Please keep them coming. Articles can also be published on the website at any time of the year.

David Le Conte

SECRETARY'S REPORT 2018

Our annual business meeting was held a little later than usual, on 13th February. There were no major changes in roles and I remained Section Secretary and Treasurer. As announced last year, Frank Dowding planned to step down from his role as Events Coordinator at the end of March and I took on that function for the remainder of the year.

Educational and outreach events for the general public continued apace. The WEA "Stargazing" course is now in its 17th year and continues to be fully subscribed. David Le Conte has coordinated this course for the entire time but is supported by other members (this year Frank Dowding, Jason Hill Peter Langford, Elaine Mahy and Jean Dean) who give their time in preparation and delivery to continue to make this 6 week course a success. Unfortunately, cloudy skies often make the observational aspects of this course a challenge!

Astrophotography content was included in the WEA course for the first time, and a detailed Astrophotography 6 week course was constructed and coordinated by Jean Dean and held during May. Later in the year there was sufficient interest from the Channel Islands Astrophotography Group to run a shorter, less technical, introductory course which took place in November.

In the summer months, particularly for the entire length of the school summer holidays we organise public open evenings which are always well attended. During the winter we focus on groups, be it youth groups, schools of all ages, company social clubs and Women's Institutes. As mentioned earlier, Frank Dowding stepped down from coordinating these events at the end of our "winter series" at the end of March. He has not only coordinated the events by liaising with the groups but takes an active part by presenting a topic too and his dedication to this task will be sorely missed. This year's events are as follows:

January	Notre Dame School (2 visits)
February	Capelles Primary School.
March	La Hougette School, Ladies College (Year 8 – two visits), 5th Guernsey Scouts, Ladies' College 6th Form
April	**Nature Guernsey Family Day**
May	**Solar Open Day**, Melrose Year 3 Science,
July	**Open Evening**
August	**Open Evening (x 5)**
November	**Halloween Open Evening**, 4th Guernsey Beavers, 10th Cubs, Cobo Guides, North Explorer Scouts

These events could not take place without the support of members including: Frank Dowding, David Le Conte, Jason Hill, Elaine Mahy, Owain Catton, Debby Quertier, Jessica Harris, Geoff Falla, Paul Gavey, Jean Dean, Tom Harvey, Pieter Durman. This is quite an undertaking with many people giving up their time to encourage an interest in science.

The Nature Guernsey initiative was set up by La Société in the Autumn 2017 as a vehicle to seek wider public appeal of the La Société and in particular encourage families to take part in events and to join the organisation. Nature Guernsey is about sections working together, rather than in isolation, to organise events and show what La Société has to offer. I have been a strong supporter of this initiative from the outset and section members supported these events too. Although it must be said that the weather has not been kind to Nature Guernsey events this year but, of course, as astronomers we are used to that! The event in August was cancelled because of bad weather and had been planned to run from early morning (bird ringing) to observing the Perseid meteor shower in the evening.

The Halloween Open Evening in 2017 was a huge success and was no different in 2018. It was an official Nature Guernsey event in 2018 but a pilot event in 2017. This was run over the October half term and started early in order to encourage children to visit. We decided to produce Halloween themed flyers for the event and we were joined by the Entomology Section (with moth trap), Bat Group (who organised walks in the nearby lanes with bat detectors), and the Pollinator Project on hand with information and insect hotels. Some of us dressed for the occasion (lots of children were dressed up!) and the Observatory site was decorated with pumpkin lanterns. The weather was very showery and I had to close the Observatory roof twice early in the evening which made for a stressful event! There was no Moon this year which simplifies public observing when queues are long, but at least Mars was visible for the entire evening.

The summer open evenings were mostly blessed with fine weather, and in particular the first three evenings were very well attended. We were very fortunate with the position of the planets too, with Venus, Mars, Jupiter and Saturn visible at some point on one or more evenings. Two astronomical events occurred on 27th July: a total lunar eclipse (a nearly central eclipse and longest this century!) and the closest approach of Mars to Earth since 2003, and both events created media interest. Our Open Evening was the day before (26th) and we were filmed for a news item to be broadcast the following evening. Sadly, there was little footage used but our telescopes looked more impressive than Jersey's !

We have been fortunate for visiting speakers this year which have been due to collaboration with others islands. Our first was Robin Catchpole from the Institute of Astronomy at Cambridge and was Robin's third visit in four years. The topic was "The Sun and Climate Change" which was an information packed lecture and the Candie lecture theatre was similarly packed with people! Before the event Robin showed me photographs of his laboratory at Cambridge which is essentially a large spectrograph where sunlight (or even moonlight !) can be projected via an external coelostat through a hole in the wall before being split into component parts.

Sark had organised for two visiting astronomers to be on hand for the Perseid meteor shower in August and by assisting with the logistics we were able to utilise both of them too. The first was Professor Ian Morison from the University of Manchester's Jodrell Bank Radio Observatory and perhaps was, to my knowledge, the first radio astronomer we have had to speak in Guernsey. Ian's talk was entitled "Proving Einstein Right" and Ian proved to be a commanding lecturer. Ian described himself, most modestly, as the "Time Lord" of Jodrell Bank and by that he meant that he was involved with Jodrell Bank's interferometry projects such as MERLIN where the timing and processing of signals is critical. Once again the Frossard Lecture Theatre at Candie Museum was filled to capacity.

The second astronomer visiting Sark was Robin Scagell who is the author of a number of popular astronomy books and current president of the Society for Popular Astronomy. He was the guest astronomer at our Open Evening and gave a presentation about current discoveries in the Solar System to a smaller audience in our more modest meeting room at the Observatory. Robin took photographs to compare the night sky in Sark and Guernsey. The Guernsey night sky looked very comparable to Sark, despite the lights from the West Show being noticeable.

Frank Dowding gave an excellent talk about Mars at the Frossard Lecture Theatre. Frank was asked to do this at short notice for the Guernsey Photographic Festival, and his talk complemented the exhibition of Mars photographs from NASA's Mars Reconnaissance Orbiter curated by Xavier Barral.

The Channel Islands Group of Professional Engineers organised a talk by geologist Dr S. Mikhail from St Andrew's University in November, whose talk was entitled "Why Earth developed into a crucible of life, and Venus a hostile wasteland". Dr Mikhail challenged the use of the "habitable zone" as being the sole criteria assessing whether life will be formed on a planet.

Regular talks when we meet on a Tuesday evening have not been so forthcoming this year. The rule is, however, should the evening be clear then we observe with the telescopes and perhaps this has been the case with the clear summer evenings. Once again we have used Royal Institution lectures to supplement our talks. Some highlights are in the table below.

The Bethlehem Star	David Le Conte
The Concept of Mass	RI lecture

Launch of SpaceX Falcon Heavy	Live stream
Astronavigation	Jason Hill
Next generation space vehicles	Frank Dowding
The Saros Cycle	David Le Conte
Newtonian cosmology	Peter Langford
Astronaut Mike Massimo	RI interview
Mars Exploration: Curiosity and Beyond	RI lecture

Our two social events of the year are usually the barbecue in August (which is coincident with the Perseid meteor shower) and the Christmas meal which was held at Moores Hotel in December. The barbecue was not held because we were supporting the Nature Guernsey Family Day and we planned to open the Observatory for public viewing but sadly the weather intervened and this did not happen either.

Colin Spicer
Astronomy Section Secretary

ASTRONOMICAL EVENTS IN 2019

The main highlight year will be a transit of Mercury on 11 November. There will also be a total lunar eclipse on 21 January, coinciding with a supermoon.

PLANETS

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

Date	Elongation	Direction	Time
27 February	18º Eastern	Low in West	After sunset
11 April	28º Western	Low in East	Before sunrise
23 June	25º Eastern	Low in West	After sunset
09 August	19º Western	Low in East	Before sunrise
20 October	25º Eastern	Low in West	After sunset
28 November	20º Western	Low in East	Before sunrise

On the evening of 18 June Mercury will be just 0.2º above Mars.

On 11 November there will be a transit of Mercury across the face of the Sun for 5½ hours, almost four hours of which will be visible from our location. It will start at 12.35 pm. The small black disc of the planet will be seen crossing from the Sun's left side, almost across the centre of the solar disc, mid-transit being at 3.20 pm. The transit will end at 6.00 pm, but by then the Sun and Mercury will have set, at 4.30 pm. We will, however, have seen most of the transit.

It is dangerous to stare at the Sun or to observe it through any optical instrument. At just 10 arc-seconds the disc of Mercury is too small to see through eclipse glasses, so magnification will be required, eg a telescope or binoculars. They must, however, be protected by specialist solar filters. The Astronomy Section's observatory has appropriate equipment to provide safe observation, including a heliostat which projects a solar image onto a screen.

Transits of Mercury are quite rare, but occur much more frequently than transits of Venus. The last transit of Mercury was in 2016, and we were fortunate to observe it on that occasion, as we were in 2003. (The 2006 transit happened during our night-time.) We will have to wait until 2032 for the next one!

Venus will start the year as the "Morning Star" in the eastern pre-dawn sky, reaching greatest western elongation (47º) on 06 January. It will be at superior conjunction on 14 August, and by October will appear in the evening sky for the rest of the year. On the morning of 01 February a very thin crescent Moon will lie between Saturn, Venus and Jupiter low in the southeast sky.

A pdf file of diagrams showing apparitions of Mercury and Venus at sunrise or sunset, produced for the *Yearbook of Astronomy*, are at : https://www.yearbookofastronomy.com/mercury-venus-2019.pdf.

Mars will start the year as an evening object in the west, decreasing in altitude and disappearing by July. It will reach solar conjunction on 02 September, reappearing in October in the east before sunrise. It will remain a distant and small object during the year, not reaching opposition until October 2020.

At the beginning of the year **Jupiter** will be a morning object in the southeast before sunrise. It will reach opposition on 10 June in Ophiuchus, and will then remain an evening object until for the rest of the year, however never reaching a high altitude. On the evening of 09 August it will be just 1.6º from the Moon.

During the summer 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 2019 BAA Handbook (pages 60-68). They can be simulated on software such as StarryNight (http://www.starrynightstore.com/), and some of the many astronomy apps, including the *JupiterMoons* app ($2.99) by Sky & Telescope, 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 will start the year in conjunction with the Sun, and therefore invisible. It will start appearing in February, low in the southeast before sunrise, rising earlier as the months go by. Opposition will be on 09 July in Sagittarius, the planet rising as the Sun sets, and visible all night, but with a maximum altitude of only 18º. It will remain visible as an evening object for the rest of the year. The rings are at a good angle for observation, and its brightest moons, especially Titan, should also be visible.

Saturn has several close visual encounters with the Moon this year. The first is on the morning of 02 February. As the Moon rises in the south-east at 06.16 am Saturn will be behind it, re-emerging from this very brief occultation at 06.30 am. The second is on 29 March at 04.30, when Saturn will be 0.6º above the Moon. And on 05 October at 9.30 pm Saturn will be 0.8º above the Moon, very low in the south-west.

Uranus will be at opposition in Aries on 28 October, at magnitude 5.7. **Neptune** will be at opposition in Aquarius on 10 September, at magnitude 7.8.

PHASES OF THE MOON

New Moon	First Quarter	Full Moon	Last Quarter
Jan 06	Jan 14	Jan 21	Jan 27
Feb 04	Feb 12	Feb 19	Feb 26
Mar 06	Mar 14	Mar 21	Mar 28
Apr 05	Apr 12	Apr 19	Apr 26
May 04	May 12	May 18	May 26
Jun 03	Jun 10	Jun 17	Jun 25
Jul 02	Jul 09	Jul 16	Jul 25
Aug 01	Aug 07	Aug 15	Aug 23
Aug 30	Sep 06	Sep 14	Sep 22
Sep 28	Oct 05	Oct 13	Oct 21
Oct 28	Nov 04	Nov 12	Nov 19
Nov 26	Dec 04	Dec 12	Dec 19
Dec 26			

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 2019 there will be three such moons: on 21 January, 19 February, and 21 March.

DWARF PLANETS AND ASTEROIDS

Pluto will reach opposition on 14 July in Sagittarius, at magnitude 14.2. **Ceres** will be at opposition on 29 May in Scorpius, with magnitude 6.8. The other three dwarf planets (Eris, Makemake and Haumea) are too faint to be seen in most amateur telescopes.

The brightest asteroid **Vesta** will reach opposition on 11 November, when it will be magnitude 6 in Cetus, and about 6º from the Full Moon.

ECLIPSES

Every year there are at least four eclipses: two solar and two lunar. This year there are three solar and two lunar eclipses, but only the lunar ones are visible from Guernsey.

Our best eclipse this year is a total lunar one on the night of 20/21 January in the early hours of the morning. The Moon will start entering the penumbra of the Earth's shadow at 02.35 am and the umbra at 03.33 am, with the Moon then at an altitude of 41º. Totality runs from 04.40 to 05.43 am, mid-eclipse being at 05.12 am. The Moon will leave the umbra at 06.50 am (being then just 10º above the western horizon) and the penumbra at 07.49 am. This is a non-central eclipse, the Moon being towards the top of the shadow. If you want to watch just the main part of the eclipse I suggest good times would be 4.30 to 6.00 am. It should be a nice sight in binoculars, especially as it coincides with a 'supermoon'.

The second lunar eclipse is a partial one, on 16 July. The penumbral part of the eclipse starts while the Moon is still below the horizon. The umbral part starts as the Moon rises, at 9.00 pm, in the south-east. Maximum eclipse occurs at 10.30 pm, the Moon then being 66% eclipsed. The umbral phase ends at midnight, and the penumbral phase at 01.20 am. Times for this eclipse are in BST.

The solar eclipses occur on 06 January (a partial one, not visible from Guernsey), 02 July (a total one visible from the South Pacific and South America), and 26 December (an annular solar eclipse visible in the UAE, Oman, India and Asia). Be sure to take precautions not to look at the Sun directly unless your eyes and/or telescope are properly protected by a specialist solar filter.

OCCULTATIONS

Saturn will be occulted on the morning of 02 February. For details see above.

LUNAR CONJUNCTIONS

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

03 January	Jupiter	Low in east before sunrise	1.8°
12 January	Mars	South-west in evening	5.5°
01 February	Venus	Low in south-east before sunrise	5.8°
29 March	Saturn	Low in south-east in early morning	0.9°
02 April	Venus	Low in south-east before sunrise	3.1°
20 May	Jupiter	Very low in south-east after sunset	2.9º
22 May	Saturn	Very low in south-east around midnight	1.4°
19 June	Saturn	Low in south in morning	0.9°
13 July	Jupiter	Low in south after sunset	1.3°
16 July	Saturn	Very low in south-west before sunrise	2.3°
09 August	Jupiter	Low in south-west in evening	1.6°
08 September	Jupiter	Low in south after sunset	2.3°
03 October	Jupiter	Low in south-west in evening	1.0°
05 October	Saturn	Low in south in evening	1.1°
26 October	Mars	Very low in west after sunset	3.9°
24 November	Mars	South-east before sunrise	3.6°
28 November	Venus & Jupiter	Low in south-west after sunset	1.0 & 2.4°
29 November	Saturn	Low in south-west after sunset	2.1°
23 December	Mars	Low in south-east before sunrise	2.6°

PLANETARY CONJUNCTIONS

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

22 January	Venus and Jupiter	Morning in the east	2.5°
18 February	Venus and Saturn	Morning in the east	1.0°
10 April	Venus and Neptune	Morning in the east	0.3º
18 May	Venus and Uranus	Morning in the south-east	1.1º
18 June	Mercury and Mars	Very low in north-west after sunset	0.2º

METEORS

The **Quadrantids** will peak on the night of 03/04 January, with about 10 per hour, the Moon being quite favourable. The **Perseids** will peak on the night of 12/13 August, with some 80 per hour, but the bright Moon will affect visibility of the fainter ones. The normally richest annual shower, the **Geminids,** will peak on the night of 13/14 December, but the Full Moon will badly affect visibility. By shielding the Moon it may still be possible to see about 20 per hour.

There are, of course, minor meteor showers during the year, and sporadics may be seen at any time. For shower details see the 2019 BAA Handbook, pp99-101. More details are at https://www.imo.net/files/meteor-shower/cal2019.pdf.

COMETS

Comet 46P/Wirtanen may be a naked-eye object at the beginning of the year, fading to a binocular object in February, and still a telescopic object into March. Being in Ursa Major, it will be well-placed for observation.

Detailed comet predictions for 2019 are available on the website of the British Astronomical Association's Comet Section: http://www.ast.cam.ac.uk/~jds/preds19.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

We are now well past the maximum of the sunspot cycle in 2014, but there can still 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.

EQUINOXES AND SOLSTICES

The following are the dates and times of the equinoxes and solstices in 2019:

Vernal Equinox	20 March	21.58 UT
Summer Solstice	21 June	15.54 BST
Autumnal Equinox	23 September	07.50 BST
Winter Solstice	22 December	04.19 UT

SATELLITES

The International Space Station (ISS) is regularly visible from Guernsey, looking like a very bright star crossing our skies from west to east. Also of interest are flashes from the Iridium satellites (which occur virtually every night), and periodic launches of ISS servicing craft. 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.

WEA COURSE

The Astronomy Section's annual six-week WEA "Star Gazing" course at the Observatory will be run from 07 February to 14 March. It is usually over-subscribed, so early enrolment is recommended. See www.wea.org.gg, or telephone 237888.

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 (25 July to 29 August), and possibly on Thursday, 31 October. We will also most likely open during the day on 27 May to observe the Sun. Details of these and any other open events will appear on our website and will be sent to the local media.

REFERENCES

SkyMap Pro and *Starry Night Pro* software
General: http://astropixels.com/ephemeris/astrocal/astrocal2019gmt.html
http://www.seasky.org/astronomy/astronomy-calendar-2019.html

http://www.timeanddate.com/
Lunar occultations: http://asa.usno.navy.mil/SecA/olist19.html
Mercury elongations: https://www.fourmilab.ch/images/3planets/elongation.html
Equinoxes, etc: https://greenwichmeantime.com/longest-day/equinox-solstice-2010-2019/
Planetary conjunctions: https://in-the-sky.org/article.php?term=conjunction&year=2019
Royal Astronomical Society diary, 2019
The Handbook of the British Astronomical Association, 2019

David Le Conte

CALENDAR OF ASTRONOMICAL EVENTS IN 2019

Month	Date	Time	Event
Jan - March		All night	Comet 46P/Wirtanen
January	03	05.20 UT	Earth at perihelion (147,099,766 km)
January	03	Before sunrise	Jupiter conjunction with Moon (1.8º)
January	03/04		Quadrantid meteor shower (favourable)
January	06	Morning	Venus at greatest western elongation (47º)
January	12	Evening	Mars conjunction with Moon (5.5º)
January	20/21	2.35 – 7.49 am	**Total lunar eclipse**
January	21	All night	Supermoon
January	22	Morning	Venus and Jupiter conjunction (2.5º)
February	01	Morning	Saturn, Moon, Venus and Jupiter close
February	02	6.16 – 6.30 am	Saturn occultation by Moon.
February	07	19.30 UT	WEA course starts at Observatory
February	18	Morning	Venus and Saturn conjunction (1.0º)
February	19	All night	Supermoon
February	27	After sunset	Mercury at greatest eastern elongation
March	14	19.30 UT	WEA course – final class
March	20	22.00 UT	Vernal Equinox
March	21	All night	Supermoon
March	31	01.00 UT	BST starts
March	29	Morning	Saturn and Moon conjunction (0.9º)
April	02	After sunset	Venus conjunction with Moon (3.1º)
April	10	Morning	Venus and Neptune conjunction (0.3º)
April	11	Before sunrise	Mercury at greatest western elongation
May	18	Morning	Venus and Uranus conjunction (1.1º)
May	20	After sunset	Jupiter conjunction with Moon (2.9º)
May	22	Midnight	Saturn conjunction with Moon (1.4º)
May	29	All night	Ceres at opposition (magnitude 6.8)
June	10	All night	Jupiter at opposition
June	18	Evening	Mercury 0.2º above Mars
June	19	Morning	Saturn conjunction with Moon (0.9º)
June	21	16.50 BST	Summer Solstice
June	23	After sunset	Mercury at greatest eastern elongation
July	04	23.11 BST	Earth at aphelion (152,104,278 km)
July	09	All night	Saturn at opposition
July	13	After sunset	Jupiter conjunction with Moon (1.3º)
July	14	All night	Pluto at opposition (magnitude 14.2)
July	16	Before sunrise	Saturn conjunction with Moon (2.3º)
July	16/17	21.00 - 01.20 BST	Partial lunar eclipse
July	25	Evening	Observatory Open Evenings start
August	09	Evening	Jupiter conjunction with Moon (1.6º)

August	12/13		Perseid meteor shower (unfavourable)
August	09	Before sunrise	Mercury at greatest western elongation
August	29	Evening	Observatory Open Days end
September	02	Invisible	Mars at solar conjunction
September	08	After sunset	Jupiter conjunction with Moon (2.3º)
September	10	All night	Neptune at opposition (magnitude 7.8)
September	21	16.55 BST	Autumnal Equinox
October	03	Evening	Jupiter conjunction with Moon (1.0º)
October	05	Evening	Saturn conjunction with Moon (1.1º)
October	26	After sunset	Mars conjunction with Moon (3.9º)
October	28	All night	Uranus at opposition (magnitude 5.7)
October	27	02.00 BST	BST ends
October	20	After sunset	Mercury at greatest eastern elongation
November	11	12.35 - 16.30 UT	**Transit of Mercury**
November	11	All night	Vesta at opposition (magnitude 6)
November	24	Before sunrise	Mars conjunction with Moon (3.6º)
November	28	Before sunrise	Mercury at greatest western elongation
November	28	After sunset	Venus & Jupiter conjunction with Moon
November	29	After sunset	Saturn conjunction with Moon (2.1º)
December	13/14		Geminid meteor shower (unfavourable)
December	22	04.21 UT	Winter Solstice
December	23	Before sunrise	Mars conjunction with Moon (2.6º)

ASTROPHOTOGRAPHY

The Hubble Space Telescope (HST) has been orbiting the Earth for 25 years now and has provided a wealth of astronomical data in the form of images of deep space objects that have fascinated scientists, leading to a much greater understanding of the formation of the universe and how it works.

HST images have also brought the universe to life for the general public. Images such as the 'Pillars of Creation' that was released 23 years ago struck a highly resonant chord with the public. Aside from being a very dramatic image it was scientifically significant as it helped us to understand the very nature of creation, as scientists now believe Earth's Sun formed in an environment very similar to the pillars.

Deep space imaging within the visible wavelengths is not limited to orbiting telescope platforms or large ground based research facilities, it can be done by amateur astronomers with a DSLR camera and their telescope. The advantage of putting a digital sensor onto a telescope is that a much deeper, detailed colour image can be acquired when compared to a faint, monochrome view through an eyepiece.

Hubble Space Telescope image of the Eagle Nebula 'Pillars of Creation' (NASA)

In 2018 the Observatory ran two workshops teaching local astronomers and photographers how to take deep space images with a DSLR camera attached to a telescope. To acquire images there are a few challenges that must be overcome:

Firstly, deep space objects are so far away that the photons arriving from it are few and far between so any noise within the image is very noticeable and a single image has a very low signal to noise ratio. Astrophotographers have to learn how to remove the noise using techniques pioneered by NASA and other research observatories. Calibration images are used, which measure fixed pattern electronic noise generated by the camera itself and vignetting caused by the optics. Once the noise has been modeled mathematically it can be subtracted from the images. Random shot noise (named after German physicist Walter

Schottky) is removed by taking multiple images and stacking them to form one final image, which can have a total integration time of many hours.

The second issue is the fact that the Earth is rotating; in Guernsey we are moving at a staggering 675 mph! To counteract this movement and hold a deep space target stationery on a camera sensor for exposures that might be up to 30 minutes long a specialist tracking mount is required which has to be very precisely aligned with the celestial north pole.

Here are some of the images taken on the courses.

Whirlpool Galaxy (Messier 51) and NGC 5195 in the constellation Canes Venatici. This is a classic grand design spiral galaxy with graceful winding arms, which are long lanes consisting of stars, dust and gas. The red areas are giant molecular cloud complexes that are rich in new star forming materials including hydrogen gas. The blue regions are areas of young hot stars. It is thought that the arms of the Whirlpool Galaxy are particularly prominent because of the effects of its close encounter with the small, yellowish galaxy, NGC 5195 sitting at the end of one of the arms. Scientists believe the small galaxy is pulling on the arm causing tidal forces that trigger new star formation. Total integrated imaging time is 110 minutes.

Bode's Galaxy (Messier 81) and the Cigar Galaxy (Messier 82) in the constellation of Ursae Major. Bode's Galaxy (on the left) is another classic grand design spiral galaxy with spiral arms and sinuous dust lanes winding all the way down into its nucleus. The arms contain lots of young, hot blue stars and the central bulge contains much older, redder stars and a black hole some 15 times the mass of the Milky Way's central black hole.

The Cigar Galaxy (on the right) is a starburst galaxy, so called because of its extraordinarily high rate of star formation. The red centre is hydrogen and infrared light indicating rapid star formation, which is due to gravitational interactions with its neighbour Bode's galaxy. Total integrated imaging time 85 minutes.

The Hercules Cluster (Messier 13), right, is a great globular cluster of over 100,000 stars all bound tightly together by their mutual gravity. The stars within the cluster are evolved red and blue giant stars that are thought to be 12 to 13 billion years old, which is almost as old as the universe. Total integrated imaging time was 35 minutes.

The Orion Nebula (M42) and Running Man Nebula (NGC 1973, 1975, 1977) on the next page form part of the Orion Molecular Cloud Complex, which is one of the closest star forming regions to us. The Complex is a mixture of emission, reflection and dark nebulosity.

The centre of the Orion Nebula is home to four bright stars called the Trapezium that light up and shape the hydrogen rich emission nebulosity. The Running Man Nebula is dominated by the characteristic blue colour of young hot starlight reflecting off the interstellar dust that is laced with hydrogen emission nebulosity, which resembles a man running. Weaving through the nebulae are dense lanes of dust that block the starlight from behind. Total integrated imaging time 75 minutes.

The Orion and Running Man Nebulae

The Cave Nebula

The Cave Nebula (SH2-155) in the constellation of Cepheus lies along the plane of our Milky Way and has formed at the boundary of the massive Cepheus B molecular cloud complex where stars are born. This image is mapped in the HST palette where individual gasses are mapped to red, green and blue. The teal colours are oxygen and the gold colours sulphur and hydrogen, which are the building blocks for new stars. Total integrated imaging time 17.5 hours.

Jean M Dean

Image credits
Hubble Space Telescope image of the Eagle Nebula 'Pillars of Creation': NASA.
Whirlpool Galaxy, Bodes and Cigar Galaxies, Hercules Globular Cluster: Astrophotography Workshop, April 2018.
Orion Nebula: Astrophotography Workshop, November 2018.
The Cave Nebula: Jean M Dean, October 2018.

Jean will be running further astrophotography courses. Contact her at jmdean@cwgsy.net for details.

Congratulations to Jean for having her image of Pickering's Triangle (in the Veil Nebula) selected by *Sky at Night* magazine as Photo of the Month for December 2018 (page 28). Also for running two successful astrophotography courses. I was also pleased that my picture of the International Space Station crossing the disc of the Sun appeared in *Astronomy Now* magazine in September 2018 (page 99) – *Ed.*

NEW TELESCOPE

In the summer of 2018 the Section purchased a Celestron Nexstar 8SE telescope. It is a 200mm diameter Schmidt-Cassegrain optical tube mounted on a single fork arm altitude-azimuth computerised GOTO base. The optical tube has a focal length of 2m and f/10 optical speed. The GOTO system is designed for an easy quick set-up by pointing the telescope at any three bright objects in the night sky. From this it will locate itself and then allow the user to slew to any target in the 40,000 object database (subject to visibility above the horizon), which includes solar system bodies, Messier and NGC objects and selection of stars.

For those interested in astrophotography the optical tube can be removed and remounted onto the Section's Skywatcher HEQ5 mount. There is a Celestron field flattener/reducer, which allows it to be used at a focal length of 1.26m and f/6.3 optical speed.

For anyone who would like to learn how to use this mount then come along to a Tuesday meeting or a meeting held on the last Saturday of each month. The telescope is very easy to learn, quick to set up and great fun to use.

Jean Dean

The Section is also purchasing a Skywatcher 80 mm refractor. – *Ed*.

GROTE REBER (1911 - 2002) – A PIONEER OF RADIO ASTRONOMY

Grote Reber was born in Wheaton, Illinois in 1911 and died in Tasmania in 2002, two days short of his 91st birthday. During the 1930s he almost single handedly invented the science of radio astronomy as we know it today. Yet outside radio astronomy observatories his name is almost unknown.

At school and university Grote Reber was an active amateur radio operator. He received his first radio operator's licence before he was 16, one of the qualifications for which was being able to read Morse code at 10 words per minute or higher. Shortly thereafter he was granted a radio station licence under the call sign W9GFZ. In those days the focus of the amateur radio enthusiast was in the design and construction of equipment – abilities that would come in very handy later on. He graduated in electrical engineering from what is now the Illinois Institute of Technology in 1933. Good fortune meant that he had no formal education in astronomy – otherwise he might have been directed into a more orthodox area of research; instead he was able to do entirely his own thing.

Karl Jansky – described by Reber as "the right man at the right place doing the right thing at the right time" – had been employed by Bell Labs in trying to discover the source of shortwave atmospheric interference. This was an important problem in radio broadcasting during the early 1930s, and by examining the residual signal left in the chart recordings Jansky discovered radio waves coming from the Milky Way. Janksy initially thought that as the signal appeared to rise in the east at dawn, cross the meridian at noon and set in the west it must be caused by Sun – not directly, but probably indirectly from solar heating of the upper atmosphere. Happily, the referees of his first paper took so long to review it that the signal was by then crossing due south at 4.30am and it became clear that the signal was following sidereal time and was, in fact, correlated with the Milky Way.

Reber wanted to join Jansky at Bell Labs to continue the research into "cosmic static" as it was then called, but the celestial interference was so weak that Bell Labs could not justify spending any more money on the project, so it was shut down. Reber then consulted the optical astronomers Arnold Struve at Yerkes Observatory and Harlow Shapley at Harvard; Struve had never heard of the phenomenon, but Shapley had. Although Shapley wanted to investigate the matter, the resources at Harvard were already spread too thinly and he couldn't justify starting an entirely new project. Grote Reber then decided to start his own radio astronomy research project.

Reber worked in the radio industry in Chicago in the 1930s and that put him in contact with salesmen from the major thermionic valve manufacturers. In particular, he was able to persuade the representative of RCA to let him have a magnetron that operated at a wavelength of 6cm – a very short wavelength even today. With hindsight it was perhaps unsurprising that Reber could not detect any radio signals of a cosmic origin at that wavelength. He then tried a receiver working at 30cm wavelength; this time although he could still not detect any celestial radiation he was able to detect very strong signals from motor car ignition systems. Things were improving.

In order to make an efficient receiver, the receiving dipole aerial should look at the focussing dish and nowhere else. A circular waveguide of about half a wavelength in size is ideal for housing the active dipole – in other words it needs to be put in a can. Reber discovered that the biggest aluminium sheets commercially available were 6 feet wide and about 12 feet long. This meant that one could be rolled into a can 6 feet long and about 4 feet wide; this corresponds to a frequency of about 160MHz and so this is what Reber used to observe the sky. In 1938 Reber turned on his equipment for the first time at this frequency and discovered that during the day the motor car ignition noise was very loud; so loud, in fact, that it swamped everything else. During the night, however, when the town of Wheaton went to bed and no cars were being driven, he discovered that when the Milky Way went past the beam of the focussing dish of his telescope there was a definite and distinct signal.

When these early results were being examined the optical astronomers were obtaining resolutions of arc minutes or arc seconds; Reber could manage resolution of about five degrees. It was, therefore, virtually impossible even to tell with any certainty what was the source of a particular signal. Remember that all of his early work was conducted using thermionic valves and not transistors, so there was a large amount of thermal noise and not much gain in the amplification. Sadly, the intensity of the celestial radiation at the higher frequencies that would have given greater resolution was so low that the amplifiers Reber was using simply didn't have the performance.

Reber was able, however, to construct a satisfactory receiver that operated at 480MHz using improved equipment that was available after the War. This threefold increase in the working frequency is significant. Philosophically speaking, if a comparative survey is to be conducted there is no point simply increasing the frequency by a factor of 1.5; the difference would be so slight as to make the exercise somewhat futile. A factor of two is the very least that makes sense and a factor of three is almost guaranteed to show some new structure or features in the signals.

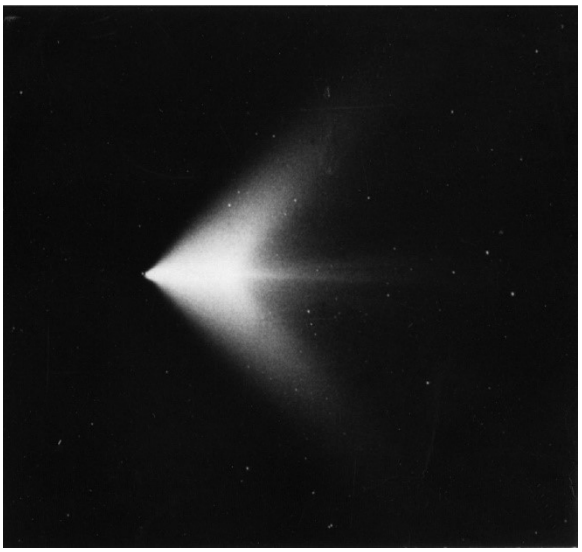
In the 1950s Reber moved to Tasmania – one of the places on the Earth that has a particularly transparent ionosphere as well as looking out towards the interesting centre of the Milky Way. His ashes were divided and sent to various radio astronomy observatories around the world; some are housed in the Control Room at Jodrell Bank.

Jason Hill

APOLLO 8 TLI

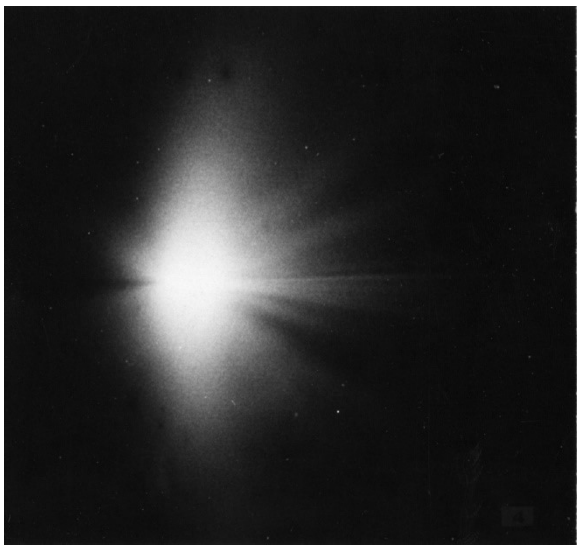
July 2019 marks the 50th anniversary of the Apollo 11 Moon landing, and there will no doubt be many commemorations. It was preceded, however, by the Apollo 8 flight to the Moon in December 2018 – the first time man had left the Earth completely for another object in space.

The Command Module pilot for Apollo 11 was Michael Collins, and he was the Houston-based Capsule Communicator (CAPCOM) for Apollo 8 – the only person allowed to speak to the astronauts. In his autobiography *Carrying the Fire* (a copy of which I have with his signature and a dedication to me) he said: "*Even some of the things which happen on the ground during a flight are magic, such as watching Apollo 8 carrying men away from the earth for the first time in history, an event in many ways more awe-inspiring than landing on the moon.*"



I was one of the few people to see first-hand the momentous event of the Apollo 8 TLI – the Trans-Lunar Injection rocket burn which sent the spacecraft out of Earth orbit towards the Moon on 21 December 1968, and it seems that I was the only one to photograph it.

At the time I was Manager of the Smithsonian Institution's Astrophysical Observing Station on 10,000-foot Mount Haleakala on the island of Maui, Hawaii, with its massive Baker-Nunn satellite-tracking camera – an f/1, 20-inch aperture Schmidt instrument, weighing 3 tons and standing 8-feet tall. Having predictions that the event would take place just above our southern horizon I decided to attempt photography. I set up a direct telephone link with the Observatory's headquarters in Cambridge, Massachusetts, which in turn had a direct link with the Mission Control Center in Houston, so that I could get real-time updates of the time and position of the TLI.



I selected two members of my team to assist in the operation, the TLI performed as predicted, and we succeeded in getting dozens of pictures in the couple of minutes from just before the rocket firing until the spacecraft disappeared behind the mountain. These are the only pictures which exist of the moment men first left the Earth. They received wide publicity at the time – in newspapers and magazines such as *Time* and *Life*. A couple of them are reproduced here, and more, together with my full account, can be seen on the Smithsonian's National Air and Space Museum's website at https://tinyurl.com/y9cz2hgn.

To this day it remains the most wonderful sight I have ever seen.

David Le Conte

PHOTOGRAPHING THE AURORA BOREALIS

Seven years ago my wife and I went on a Hurtigruten ship up the Norwegian coast in search of the aurora borealis or northern lights. The trip was just short of a disaster, with a force 12 gale, a ship which broke down, and thick cloud cover. In November 2018 we decided to try again, choosing an astronomer-led voyage, and going all the way from Bergen to Kirkenes on the Russian border and back again – twelve days in all.

This time the journey was a total success. Astronomer Ian Ridpath gave daily lectures and in the evening was on the top deck keeping a watch for the aurorae so that passengers could be alerted. He pointed out that they are not associated with sunspots, as commonly believed, but on the solar wind created especially by coronal holes and coronal mass ejections, with a two-day advance warning. Displays from spaceweather.com gave indications of the position and extent of the auroral oval and the likelihood of aurorae.

In short, we saw the lights on seven successive evenings, several of which were quite spectacular, with swirling masses of green, sometimes tinged with red. I took many pictures, a couple of which are reproduced here. A full account of the journey and photography, with more pictures, will appear on a link from the Astronomy Section website.

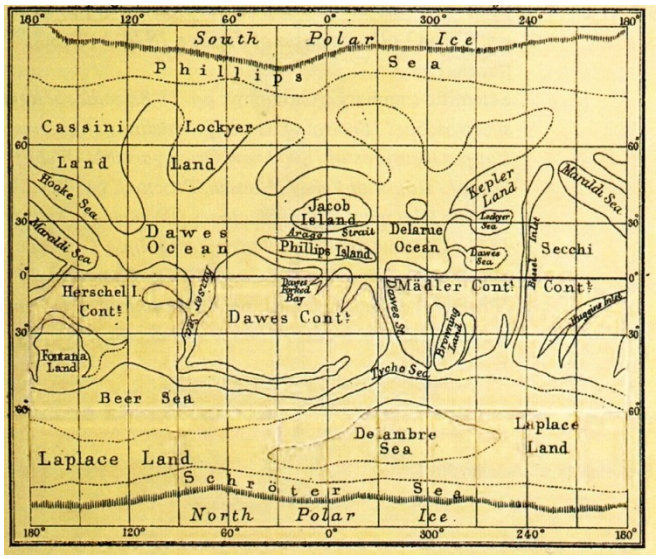
David Le Conte

QUIZ QUESTION

Where can you see the Sun, the Moon, the Southern Cross and Venus together in a cluster? Answer on page 15.

DE LA RUE OCEAN ON MARS

In 1867 English astronomer Richard Proctor prepared a map of Mars and assigned names to the Martian features, including *De La Rue Ocean*, named after the renowned Guernsey-born astronomical photographer Warren De La Rue. The rather unofficial names, which favoured English astronomers, were replaced in 1919 by the International Astronomical Union, and De La Rue Ocean is now known as *Mare Erythraeum* (Arabian Sea), having been referred to as such by Percival Lowell's 1895 map of Mars.



DLeC

Sources: *Society for the History of Astronomy Bulletin*, Issue 30, Autumn 2018, p 17.
Geography of Mars, Wikipedia.

THE CURIOUS CASE OF JOHANNES VON GUMPACH

When I lectured and wrote about Guernsey astronomers in 2013 (*Sagittarius*, Jan-Mar, 2013, p9) I was unaware of this gentleman, and only found out about him a couple of years ago, thanks to a communication from historian Gregory Stevens Cox who had been researching the diaries of Victor Hugo. Von Gumpach was a neighbour of Hugo's in the 1860s, who referred to him as an astronomer. Intrigued, I set out to find out more about him, and soon struck gold by the acquisition of a letter written from him while in Guernsey to no less than Guernseyman Warren De La Rue in London, the latter being then Secretary of the Royal Astronomical Society.

It turns out that the self-styled 'Baron' von Gumpach was a complicated man. There is even doubt as to whether that was his real name. Self-opinionated, he was prolific in publication but given to fanciful ideas about astronomy. Scathing about Newton's theory of gravitation, he engaged in lengthy, largely one-way, correspondence with the

English astronomical luminaries of the day, particularly over the question of the shape of the Earth, which he claimed was fatter at the poles than at the equator, a claim long known to be false.

The more I delved into his life the more intrigued I became. This has resulted in some lengthy research culminating in an article too long for this newsletter. I will, however, be posting it on a link from the Astronomy Section's website.

David Le Conte

THE BARWELL METEORITE

A recent BBC TV programme about asteroids reminded me about a fortuitous experience which I had back in 1965. In the introduction the presenter held up a piece of the meteorite which fell to Earth on Christmas Eve of that year in the small Leicestershire village of Barwell. I happened to be just ten miles away, visiting my then girlfriend, now my wife Dorothy, when I read about it in the local newspaper.

At the time I was working for the Smithsonian Institution's Astrophysical Observatory, and I was aware that the Smithsonian was keen to obtain fresh samples of recent meteorites to test for traces of radioactivity from short-lived isotopes. I therefore went straight away to Barwell, and joined the hunt for pieces of the meteorite. However, two days had elapsed and the obvious pieces had all been picked up, but I did see some which others had collected, particularly a team from the University of Leicester which was trying to gather as many pieces as possible in order to gauge its size. It turned out that it was, and still is, the largest meteorite to fall in Britain in recorded history.

It is estimated that when it entered the Earth's atmosphere it was about the size of a desk, and the amount that reached the Earth was, it is said, the size of a Christmas turkey weighing 44 kg. It broke into many pieces a few hundred feet above the surface, making a loud boom and showering the village, some burying themselves in the ground, others just lying on the top. One piece went through a roof, another bounced off a road and through a window, and reportedly another hit the bonnet of a car, the owner being so angry that he threw the meteorite away! Fortunately, no one was injured. It turned out to be a stony meteorite – a chondrite with an asteroid origin.

The next day I visited the University, spoke with the professor in charge of the project, and made a plea for a piece to be given to the Smithsonian Institution. I am pleased to say that this was successful; very soon the University sent a piece to the Institution's Natural History Museum in Washington, which has one off the largest, perhaps the largest collection of meteorites in the world, and I received a letter of thanks.

I am just sorry that I did not myself come home with any pieces, especially as they now fetch thousands of pounds!

David Le Conte

THE SOUTHERN CROSS OBSERVED FROM GUERNSEY!

I was intrigued by reading an article in the December 2018 issue of the *Journal* of the British Astronomical Association by René Bourtenburg entitled *The visibility of the Southern Cross from Britain*. It pointed out that Crux, the smallest of the 88 constellations and an iconic asterism for southern hemisphere observers, was actually visible from Britain at the time of construction of Stonehenge.

The precession of the equinoxes not only changes the position of the North Celestial Pole amongst the stars, but also changes the positions of the constellations. The article contained calculations, charts and tables to show the changing position of Crux.

I decided to model these changes in *StarryNight* software, and sure enough it shows that the Southern Cross was above Guernsey's southern horizon from around 13,000 BC to 2300 BC. And the future? It will again be visible here from around 13,500 AD. Can't wait!

The Southern Cross just above Guernsey's horizon in 13,500 AD

David Le Conte

ANSWER TO QUIZ QUESTION (page 14)

On Cerro Paranal mountain in the Atacama desert. They are the names of the four telescopes which together make up the Very Large Telescope, in the Mapuche language of the indigenous people of south-central Chile: Antu (Sun), Kueyen (Moon), Melipal (Southern Cross) and Yepun (Venus).

IN MEMORIAM

We were sorry to hear of the deaths of three Guernsey-born people who had associations with the Astronomy Section.

Richard Mallett (1947-2016)

Although Richard died unexpectedly in the UK in 2016 it was only in 2018 that I came across his obituary on a sundial website. With a keen interest in sundials he had given two talks to the Astronomy Section, in 1995 and 1996, about sundials and Indian observatories, especially the Jaipur observatory.

His letter about solar eclipses was published in *Sagittarius* in 1995. In it he corrected the caption of a solar eclipse photograph carried in the previous edition, and mentioned that he had experienced several solar eclipses, with varying success – Finland in 1990, Mexico in 1991, and Morocco in 1995.

Richard was educated at Elizabeth College, read Mathematics with Physics, and worked in computer science in the UK. He never married, living largely as a recluse in the Bedfordshire village of Eaton Bray. We saw him on his occasional visits to Guernsey, and I met him sometimes at the British Sundial Society conferences. He ran that Society's website for a while, and commissioned a vertical sundial carved in Caen stone because of its connections with Guernsey (the ancient sundials in the island being invariably made of that stone), and with noon being marked with a cross similar to the gold cross on the Guernsey flag.

Michael Marshall (1928-2018)

Michael Marshall died on the 26th March 2018, at the age of 89. Michael had been a member of the Astronomy Section for a number of years, particularly in the 1980s. Being fascinated by Mars, he could be guaranteed to be present whenever there was any activity involving the red planet, including lectures and observing. It is indeed a shame for him to have missed the July 2018 Mars opposition, although he was clearly in too frail a condition in his latter years.

He first came to my attention as the author of *The Small Army*, a rollicking schoolboy read about what the boys of Elizabeth College got up to during the school's evacuation to England from 1940 to 1945, and in the aftermath of the return to Guernsey. If half of what he recounted was true their schoolmasters and parents must have been horrified! I am pleased to have a copy dedicated to me over his signature.

A detailed obituary by Richard Heaume appeared in the *Guernsey Press*, 23 April 2018. From that we learn that Michael studied law at Oxford, but ran the Manor Hotel which had been owned by his parents, and was a States Deputy from 1964 to 1972. Although he never practised law his legal background was evident in the publication of several books and booklets, copies of which I have in my collection: *Criminal Law of the Bailiwick of Guernsey*, *A Small Handbook of Guernsey Law*, *Origins of Guernsey Equity and Trusts, and* (with David Ehmann) *The Constitution of Guernsey*. He also wrote *Hitler Invaded Sark*, about that island's Occupation experiences, a story which he felt needed to be told.

Although in recent years we did not see him at the Observatory he was often seen around the Forest parish. I normally ran into him at Forest Stores, where his wicked sense of humour shone through – always a smile and a cheery comment – a real gentleman.

Maureen Pitman (1939-2018)

As a Head Teacher and then Deputy Director of Education in Guernsey, Maureen showed a keen interest in everything educational, and astronomy was no exception. When she heard that my son and I were heading out to Venezuela in 1998 to observe a solar eclipse she immediately jumped at the chance of joining us. We observed it in perfect conditions, a superb way of experiencing one's first total eclipse, and were overwhelmed by the experience.

On the flight back from Caracas to Paris she starting sketching ideas for eclipse T-shirts in anticipation of the 1999 eclipse. She translated these into reality, set up a small business to produce and sell them, and gave her surplus stock to the Astronomy Section, some of which, featuring a picture I took of the eclipse, we still have available.

An excellent travelling companion, she followed this up with accompanying my wife and me on a journey to Zambia to observe the 2001 eclipse, again in perfect conditions. She had previously lived in the country, when it was Northern Rhodesia, and this was her first return visit – a very emotional experience for her.

Her last couple of years were marked with a sequence of operations and treatments because of mesothelioma, a disease associated with exposure to asbestos, suspected as being the result of her work at a UK school where the material was being removed. A very well-known person in the island, it was not surprising that the Town Church was packed out for her funeral.

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