Sagittarius

The Newsletter of the Astronomy Section of La Société Guernesiaise

2015

Forthcoming Events

WEA Course

Thursdays 7.30 pm at the Observatory

5th February – 12th March
(Enrolment necessary)

Public Open Evenings

Friday 27th March, 7.30 pm

Thursdays during summer

school holidays

Thursday 29th October, 6.00 pm

Public Open Evenings will comprise a talk or film show, with a clear night for observation being a bonus!

Public Open Day

Monday, 25 May, 10.30 am to 12.30 pm

July 11th and 12th – West Coast Weekend of shipwrecks, science and nature with Museums and La Société Guernesiaise

The Section meets at the Observatory every Tuesday evening at 8.00 pm.

Inside

SECRETARY'S REPORT 2014

Our year started Thursday January 9th when we held an open evening to coincide with the BBC Stargazing Live programme. We had registered our request to be included at an earlier date, which enabled us to receive calendars from the BBC with an astronomical theme to hand out to our visitors. It was a very pleasant evening with occasional clouds, so we were able to use the telescopes for most of the time. As usual our lecture theatre was a good standby for those in need of a sit down or to be entertained out of the cold.

We held our AGM on Tuesday February 4th. One particular item led to considerable discussion. It was decided that our quarterly Sagittarius magazine would become more efficient in an on line form; Colin Spicer, although not at the meeting had tendered his resignation as editor and had recommended this idea. The main point here was that if a new event were to take place, then we could choose our date and notify members by email, rather than wait for the next magazine issue. Our members without a regular access to a computer would receive the same information by letter post. It was also decided that a Christmas or January magazine would be retained. The editor for this was not elected at the AGM, but later Colin Gaudion accepted the position.

February 6th was the first night of our WEA Stargazing course which David Le Conte leads every year. This is a course held over six Thursday evenings. We were fortunate with the weather this year so telescope viewing was able to form an important part of the course.

On March 7th we held an open evening to coincide with National Astronomy Week. This event is not held every year; the national organizers put it together to promote a significant happening. On this occasion it was to recognize that the large planet Jupiter would be at its closest to us for many years. As with the BBC the organizers sent us items to distribute to our visitors; in this case it was excellent star charts.

Also in march Sue Daly gave us a talk on photographing and filming the dark skies over Sark. Sue is a resident of Sark and enjoys worldwide acclaim for her varied filming of the Channel Island waters and coast line. Sue has only recently turned her camera to the sky. We invited members of the photographic community to join us for an inspiring and entertaining evening held at the Frossard Theatre at Candie Gardens.

Sark enjoyed an astronomical festival during the Easter weekend of April 18th to 21st. Val and I were fortunate to have been invited to this event and thoroughly enjoyed the hospitality and friendship of the Sark Astronomy Society SASTROS. Our weekend included a dinner with Annie Dachinger, a tour of the night sky with visiting astronomer Bob Bower and attending a talk by the 'peoples astronomer' from Greenwich observatory Dr Marek Kukula, who gave an excellent and detailed talk on the history of photographing the night sky. The weather was quite beautiful

for that weekend and the night sky really was full of stars. Between leaving Sark on Easter Monday and returning to London on Tuesday morning, Dr Kukula found time to give us a talk at the Candie Gardens Theatre entitled 'Do black holes really exist?'. We are indebted to Dr Marek Kukula to have found time within his busy schedule to have done this. We all listened intently as Marek is a recognized authority on this subject. Marek's talk along with others, is an example of how we are able to notify our members without waiting for our next Sagittarius magazine. Instead we notified everyone by email and by letter post to those without the use of a computer. Other examples circulated in this way have been the list of talks around the country each month by other astronomy clubs and telescopes which came up for sale. It would be useful for the committee to know if this has been favourably received or otherwise by members. On a similar topic, our web page astronomy.org.gg has grown in stature and has become even more interesting. In particular David Le Conte with assistance from Geoff Falla, has listed every Sagittarius newsletter containing indexed articles by members back to its inception in 1993. This is a very interesting area for browsing and research. Our new Editor Colin Gaudion has added facebook and twitter and is always looking at new ways to display items. The web page is well worth keeping ourselves up to date.

Our viewing with the Meade computerised telescope was quite exceptional. Leading up to spring Jupiter and Mars were particularly clear along with various galaxies, globular clusters and nebulae.

During the summer months from May to around August the evenings stay very light, particularly around June when it does not become dark until at least ten o'clock. This is when there is a certain amount of maintenance to take care of, this year it was painting. Our Landlord Mrs Lenfestey had kindly renewed the shed window for us, so now the walls needed a coat of paint to finish the job. We also painted the telescope building as parts were showing signs of neglect. Roger Chandler always does a good job in cutting the grass and it was all looking presentable.

On May 26th we did something different. We staged an open morning instead of an open evening. Using ultra safe equipment, we invited people to come and view the sun. We also invited visiting astronomer James Fradgley who gave everyone present some very interesting talks. This proved very successful in spite of the sun being not as cooperative as it might have, but our equipment to project the sun's image to a screen had moderate success and everyone who came seemed to enjoy themselves. The Guernsey Press did an excellent article, paying tribute to the astronomy section of La Société Guernesiaise.

On May 21st The Channel Islands Group of Professional Engineers invited us to a talk they had organized at Cobo Bay Hotel by visiting astronomer Robin Catchpole, entitled 'Comets and Asteroids'. This was a very enjoyable evening and we thank the engineers for it.

July 24th was the first of our weekly open evenings which we hold during the School holidays. The evenings are still quite light but the children do not have school the next day, so they can come and bring their parents. We also have many holiday makers who very often comment on our clear skies. It was a very good summer and these evenings were well attended.

The last event of the summer was our barbecue. We always hold this on or about August 12th. It coincides with the Perseid Meteor shower. We all bring our own food with salads to share with one another. Then cook it on the barbecue and settle down to watch the show. This particular evening the moon was quite bright which cancelled out a lot of meteors, but a number of spectacular ones more than made up for it.

Tamara Timothy, Managing Editor of GBG magazine asked if she could do a feature on the observatory and its members. This duly went ahead on Tuesday October 14th at the observatory and was an evening enjoyed by everyone. Tamara wrote quite a glowing report on us individually in the November magazine issue. Also in November, the Aurigny In Flight magazine 'Envoyage' did a splendid article on our Public Relations officer David Le Conte.

It has always been our intention to share our telescopes with the people of Guernsey and this year has been no exception. We have hosted nine open evenings and eight group bookings. This is where a group of people such as social clubs, scouts and schools arrange a quality time with us for an hour or so, rather than the busy open evenings. We welcome these groups, it always becomes a pleasant evening and if the skies are cloudy, then our lecture theatre comes into its own.

At this moment our flagship telescope is not in working order, the motor is refusing to turn. But at this time of writing a replacement motor has arrived from Wisconsin, it has been installed so in a short while things should be back to normal. Fortunately we do have back up telescopes.

Our Christmas dinner this year was held at the Hotel Havelet; an evening enjoyed by all and at the last meeting at the observatory on Tuesday December 16th Judy Porter brought some delicious mince pies and chocolate cake; an excellent way to finish a very good year.

I thank everyone for their help during 2014 and I wish you all a happy and prosperous 2015.

Frank Dowding
Secretary of La Société Guernesiaise
Astronomy section.

Tides

by David Le Conte

Living in Guernsey, with its tidal range of over ten metres, the twice-a-day tides affect all of our lives – be it for a day on the beach, fishing, boating, or indeed just driving when the tides are high, the wind is strong, and the waves come crashing over the coastal roads, sometimes bringing with them quite large stones.

We are all aware that the tides are caused by the force due to gravity exerted on the oceans by the Moon, are associated with the Moon's phases, and to a lesser extent are affected by the Sun and the atmospheric pressure. But what are the details of the process?

Let us first look at the relative distances and sizes of the Moon and the Sun. In round terms the Moon's diameter is 3,500 km – about a quarter that of the Earth, and it is 400,000 km away. The Sun is much more massive – 27 million times the Moon's mass. And it is 1.4 million km wide – 109 times the Earth's diameter, or 400 times that of the Moon. The Sun could contain 1.3 million Earths, or over 64 million Moons.

But the Sun is also 150 million km away – that is about 400 times further than the Moon. The fact that the Sun is 400 times larger than the Moon and 400 times further away results in them appearing to us to be the same size. But this is purely a coincidence, producing spectacular eclipses when the Moon exactly covers the Sun, enabling the Sun's corona – its outer atmosphere – to be visible.

The effect of the Moon

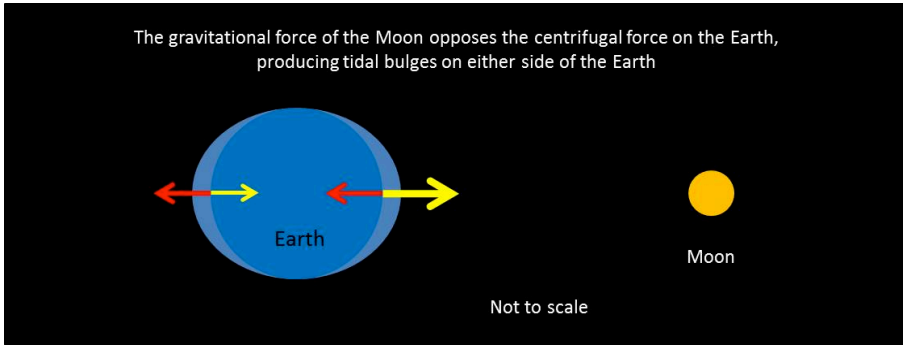
So how does the Moon create the tides, and why are there two tides per day?

The gravitational force of the Moon is greater on the side of the Earth facing the Moon than it is on the other side. This is because it is a bit closer to the Moon and because the gravitational force falls off by the square of the distance.

The Moon orbits the Earth with a 27.3-day period (the 'Sidereal Month'), but the Earth is also moving in its orbit, so with respect to the Sun the Moon's orbital period is, on average, 29.5 days (the 'Synodic Month'). This creates the changing lunar phases.

The Moon's orbit, however, is not around the centre of the Earth. Both bodies mutually revolve about their combined centre of mass, and this produces a wobbling motion of the Earth. This wobbling motion results in a centrifugal force on the Earth away from the Moon, and that force acts equally everywhere on and inside the Earth.

On the side of the Earth facing the Moon the Moon's gravitational force exceeds the centrifugal force, pulling the oceans towards the Moon. But on the other side the centrifugal force exceeds the gravitational force. There is, therefore, a net force towards the Moon on the side of the Earth facing it, but away from the Moon on the other side. So the oceans are pulled towards the Moon on the side facing it, but away from the Moon on the other side.



But the process is complex, largely because of the Moon's complex motion:

- The Moon's orbit is not circular but elliptical, so its distance varies. This makes the Moon appear to us to wobble and to get larger and smaller. During its orbital cycle it is alternately further from and nearer to the Earth by 12%.

- Because of the revolution of the Moon around the Earth the Earth rotates with respect to the Moon with a period of 24 hrs 50 min. Hence the tide times do not repeat day by day but progress over the lunar month.

- The Moon's declination (the amount by which it deviates from the celestial equator) changes by ±28° over a 27 day period.

- Over an 18-year period the Moon's declination (its angle to the Earth's equator) changes between 18° and 28°.

The effect of the Sun

Further complexities are caused by the fact that the Sun also produces tides. The tidal forces produced by the Moon and the Sun are inversely proportional to the cube of their distance from the Earth. The Sun is, of course, much further away than the Moon, but it is so massive that its tidal force is 46% that of the Moon.

The tides produced by the Sun and the Moon are additive, being greatest when the Sun, Earth and Moon are in line ('syzygy'), at New Moon and Full Moon, resulting in spring tides. And least when they are at right-angles ('quadrature') at First and Last Quarter Moons, producing neap tides. The full cycle of two neaps and two springs therefore takes 29½ days, corresponding to the Moon's synodic period.

But, like those of the Moon, the Sun's effects are also complex:

- The Sun's declination changes by ±23° over a 6-month period.

- The Earth's orbit around the Sun is, like that of the Moon around the Earth, elliptical,

and this makes a 3¼% difference in its distance from the Sun during the course of the year, being closest in our northern hemisphere winter and furthest in the summer.

- The path of the Earth around the Sun is called the ecliptic. The Earth's axis of rotation is not at right angles to the plane of the ecliptic, but is inclined by 23½ degrees.

  (These two effects (the ellipticity of the Earth's orbit and the Earth's inclination to the ecliptic) result in the familiar figure-of-eight analemma – the deviation of the real Sun from the mean Sun which governs clock time.)

- The Moon's orbit is inclined at 5 degrees to the ecliptic.

Tide predictions

All these factors result in a very complex tidal generation process, and consequent difficulties in predicting the times and heights of tides, especially as they are not only dependent on the motions of the Moon about the Earth and that of the Earth about the Sun, but are very much affected by local topography. This is very apparent in the Bay of Mont St Michel, where tidal action is subject to a funnelling effect because of the shape and shelving of the bay.

Tide predictions, such as those prepared by the UK Hydrographic Office, therefore rely on a harmonic method, the tides being made up of many components called 'partial tides'.

Although those predictions can generally be relied upon, the actual tidal heights experienced on a particular day are affected by atmospheric pressure and by wind, and these are factors which cannot be incorporated in the published tide tables.

The tide tables are calculated for an average barometric pressure of about 1016mb in the English Channel. A difference of 1mb can change the tide height by about 0.01 metres, low pressure raising it and high pressure depressing it, and can result in actual tides deviating from predicted tides by 0.3 metres. These changes are not immediate or necessarily responses to local pressure, however; they are responses to average change in pressure over a large area.

The wind effect can also be considerable. Strong onshore winds will create higher tides, while offshore winds will depress them. Long-shore winds and sudden changes of wind direction can create storm surges.

Tides and Moon phases

The dependence of the tides on the position of the Moon with respect to the Sun means that the tide times are fairly consistent with Moon phases. For example, at New and Full Moon high tide occurs around 6.30 am. At that time the New Moon is rising and the Full Moon is setting. At First and Last Quarter Moons high tide is around 11.00 am. At that time the First Quarter Moon is rising and Last Quarter Moon is setting.

The table shows the times and heights of high water for the various phases of the Moon. Earliest times and highest tides for each phase are in **bold;** latest times and lowest tides are in *italics*. Note that these are not the highest and lowest tides of the month because those occur a couple of days after the phase.

Comparison of high tide times and heights (metres) with Moon phases

Month (2014)	New Moon		First Quarter		Full Moon		Last Quarter	
Jan	**06:03**	**9.4**	11:33	**8.0**	06:35	*8.8*	11:19	7.5
Feb	06:42	9.8	11:41	7.3	*06:51*	8.9	*11:54*	*7.2*
Mar	06:26	9.8	*11:53*	*6.6*	06:25	8.9	11:38	7.3
Apr	*06:50*	**9.9**	11:15	6.7	06:31	9.0	11:32	7.4
May	06:26	9.4	11:47	6.7	06:42	9.1	11:25	7.8
Jun	06:04	8.8	11:07	7.1	06:21	9.0	11:10	**8.2**
Jul	06:27	*8.5*	11:15	7.3	06:05	8.9	11:36	7.9
Aug	06:47	*8.5*	11:25	7.3	06:43	9.5	10:59	8.0
Sep	06:23	8.6	10:52	7.5	06:25	**9.7**	11:06	7.3
Oct	06:29	8.9	**10:32**	7.7	**06:03**	**9.7**	**10:30**	7.4
Nov	06:33	9.1	11:29	7.6	06:24	**9.7**	10:49	*7.2*
Dec	06:04	9.1	11:18	8.0	06:03	9.2	11:04	*7.2*
Average	**06:26**	**9.2**	**11:20**	**7.3**	**06:25**	**9.2**	**11:15**	**7.5**

Equinox tides

At the vernal and autumnal equinoxes the Sun is over the equator, and this produces a large tidal range, especially if the Moon is also New or Full. When the Moon is also a perigee at this time the tides can be very large. This will happen in March 2015, when the Sun and the Moon are precisely aligned, producing a solar eclipse on 20 March. The highest tide of 10.3 metres occurs two days later, on 22 March. The lowest tide is on the same day, at 0.1 metres, giving a tidal range of 10.2 metres.

David Le Conte

References:

Waves, Tides and Shallow-Water Processes, Pergamon/The Open University,1989.

UK Hydrographic Office website (www.ukho.gov.uk).

National Oceanography Centre website (noc.ac.uk).

See also:

The Moon and the Tides, by Frank Dowding, in *Sagittarius*, 2001 October-December, p5.

Tides and Eclipses, by Peter Langford, in *Sagittarius*, 2006 July-September, p7.

This article is based on a talk given by the author to the Guernsey Yacht Club on 17 July 2014.

Astronomical Events in 2015
as seen from Guernsey

We can look forward to two super eclipses this year: a major partial solar eclipse on 20 March, and a total lunar eclipse on 28 September.

There will also be not one but three occultations of the bright star Aldebaran by the Moon. And as usual there will be good opportunities for observing the planets and meteor showers.

PLANETS

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

Date	Elongation	Direction to look	Time	Comments
14 January	19º Eastern	Low in west	After sunset	Close to Venus
24 February	27º Western	Low in East	Before sunrise	Too low
07 May	21º Eastern	Low in West	After sunset	Between Venus & Mars
24 June	22º Western	Low in East	Before sunrise	
04 September	27º Eastern	Low in West	After sunset	Too low
16 October	18º Western	Low in East	Before sunrise	
29 December	20º Eastern	Low in West	After sunset	Near Venus, Mars & Jupiter

The best times will be mid-January, early May, and late December evenings, and mid-October mornings.

Venus is the "Evening Star" in the west from the beginning of the year, reaching maximum eastern elongation (45°) on 06 June, and maximum brightness (-4.5) on 12 July. After inferior conjunction on 15 August it appears as the 'Morning Star' in the east from late August, and remains as such throughout the remainder of the year, reaching maximum western elongation (46°) on 26 October.

At the beginning of the year **Mars** appears low in the west after sunset. It will be in conjunction with Venus on 22 February, when the two planets will appear side by side, just half a degree apart. Conjunction with Mercury is on 22 April, and it will disappear from view at conjunction with the Sun in mid-June. In July it will start appearing low in the east before sunrise, and will remain visible in the morning for the rest of the year, getting higher and higher. On 18 October it will be less than half a degree from Jupiter. It will not reach opposition, however, until May 2016.

Jupiter is at opposition on 06 February in Cancer. With a favourable declination approaching +18º it will, as in recent years, dominate our evening skies in the first half of the year and beyond, as it moves towards Leo and solar conjunction on 26 August. Thereafter it will appear in the eastern morning sky.

We can again expect excellent views of its moons, atmospheric bands on its disc, and the Great Red Spot. Transit, shadow and occultation events involving Jupiter's moons can be calculated using a Java script on the *Sky & Telescope* website (register at http://tinyurl.com/24kp25 and remember to enter the date in the US format: month/day/year). They can also be simulated on software such as StarryNight (http://www.starrynightstore.com/), and there is the *JupiterMoons* app by Sky & Telescope, which also gives the transit times of the Great Red Spot.

On the morning of 24 January between 06.26 and 06.52 UT there will be a triple shadow transit event. Details (from the *Sky & Telescope* website) are:

Time	Event
03:10 UT	Callisto's shadow begins to cross Jupiter.
04:36 UT	Io's shadow begins to cross Jupiter.
04:56 UT	Io begins transit of Jupiter.
06:18 UT	Callisto begins transit of Jupiter.
06:26 UT	Europa's shadow begins to cross Jupiter.
06:52 UT	Io's shadow leaves Jupiter's disk.

Saturn's visibility in 2015 is very similar to last year's. It starts as a morning object, rising in the east in the constellation Libra about 05.00 UT. It will rise earlier and earlier, and by April will be rising at about 23.00. It will reach opposition on 23 May, rising as the Sun sets, and visible all night. It will remain visible, progressively as an evening object, until October. Its declination is still low, so it will not reach a very high altitude. However, with the rings at a good angle it will still present a beautiful sight in telescopes, and its brightest moons, especially Titan, should be visible.

Uranus will be at opposition in Pisces on 12 October, at magnitude 5.7. **Neptune** will be at opposition in Aquarius on 01 September, at magnitude 8.

DWARF PLANETS AND ASTEROIDS

Pluto will reach opposition on 26 July, at magnitude 14, close to Saturn in Libra. NASA's New Horizons spacecraft, launched in 2006, will fly past it on 14 July.

Ceres reaches opposition on the same day in the same part of the sky, in Sagittarius at magnitude 7. NASA's Dawn spacecraft is due to start orbiting it in April, later than planned because a high-energy particle event forced it to enter safe mode for a while, which cut out its ion drive system. (See http://dawn.jpl.nasa.gov/.)

The other three dwarf planets (Eris, Makemake and Haumea) are too faint to be seen in most amateur telescopes. The brightest asteroid, **Vesta** is at opposition on 29 September, at magnitude 6 in Cetus.

ECLIPSES

We are overdue for eclipses, and this year brings two good ones.

Partial solar eclipse – 20 March

The first occurs on Friday, 20 March when the Sun will be totally eclipsed as seen from the Faroes or Svalbard (or from cruise ships off Iceland, for example). The further north you go in the UK the better it is. In Inverness, for example, the eclipse magnitude will be 96%, compared with Guernsey's 86%.

Nevertheless, for us this will be an excellent partial eclipse – the best since 1999. It starts at 08.19 when the Sun, having risen at 06.15, is at an altitude of 19º. The Moon will then gradually creep in front of the Sun, until maximum eclipse at 09.25, when almost 86% of the Sun will be covered by the Moon. The eclipse will end at 10.35, by which time the Sun's altitude will be 35º.

Members of the Astronomy Section of La Société are welcome to the Guernsey Observatory for this event. It will not, however, be open to the public.

It is dangerous to look at the Sun directly, and extremely dangerous to use any optical instrument such as binoculars or telescope. There are safe methods of viewing a partial solar eclipse, including projection methods and the use of filters specifically designed for this purpose. Further details can be found at: http://www.mreclipse.com/Totality2/TotalityCh11.html and http://www.skyandtelescope.com/observing/how-to-watch-a-partial-solar-eclipse-safely/. Detailed advice on telescope projection and filters is at the Society for Popular Astronomy's Solar Section website: http://www.popastro.com/solar/index.php.

Solar filters can be obtained from several specialist suppliers in the UK. Authoritative articles about solar filter safety are at http://eclipse.gsfc.nasa.gov/SEhelp/safety2.html and http://www.skyandtelescope.com/observing/solar-filter-safety/.

This eclipse occurs at the vernal equinox, when, within a day or two, there are naturally large spring tides. With the Sun and Moon so precisely aligned on this occasion, and with lunar perigee occurring just a few hours earlier – at 19.39 on 19 March – we can expect exceptionally large tides. Indeed, the UK Hydrographic Office is predicting a tide of 10.3 metres for Guernsey on 22 March.

The eclipse is one of the Saros 120 series, the last of which was in 1997, the next of the series being in 2033. The NASA website for this eclipse is at http://eclipse.gsfc.nasa.gov/SEgoogle/SEgoogle2001/SE2015Mar20Tgoogle.html

The next solar eclipse visible from Guernsey will be on 21 August 2017.

It will, however, be only a minor one (13%) at sunset. The next good solar eclipse (95%) will be on 12 August 2026, and the next total solar eclipse in Guernsey will be on 03 September 2081!

Total lunar eclipse – 28 September

On the night of 27/28 September we will have a **total eclipse of the Moon**, albeit in the middle of the night. The total phase will last 1hr 12m. The details (in BST) are:

Event	Time
Moon enters penumbra:	01.10
Moon enters umbra:	02.06
Start of totality:	03.10
Maximum eclipse:	03.47
End of totality:	04.23
Moon leaves umbra:	05.27
Moon leaves penumbra:	06.23

A partial solar eclipse on 13 September will not be visible from Guernsey – only from Southern Africa and Antarctica. And a total lunar eclipse on 04 April will also not be visible.

The next total lunar eclipse visible from Guernsey will be in 2018, but it will not be as good as the September 2015 one.

OCCULTATIONS AND CONJUNCTIONS

There are three occultations of Aldebaran by the Moon this year:

Date	Time
05 September	05.45 to 07.03 BST
29 October	22.43 to 23.41 BST
23 December	18.05 to 19.05 UT

Conjunctions of planets with the Moon, with their separations (for best times see table at end of the article):

Planet	
Venus:	07 December 2º
Mars:	06 December 0.7º
Jupiter:	04 December 2º
Saturn:	16 January 1.5º
	12 March 2º
	05 May 3º
	01 June 1º
	28 June 1.5º
	22 August 2º
	16 October 2º
	10 December 2º
Uranus:	09 July 1.5º
	05 August 3º
	29 September 1.3º
	22 November 1.4º
	20 December 1.7º

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

11 January	Mercury and Venus	0.7°
22 February	Venus and Mars	0.5°
04 March	Venus and Uranus	0.1º
11 March	Mars and Uranus	0.3º
22 April	Mercury and Mars	1.25°
01 July	Venus and Jupiter	0.5°
06/07 August	Mercury	

	and Jupiter	1°
18 October	Mars and Jupiter	0.4°
25 October	Venus and Jupiter	1.2°
03 November	Mars and Venus	0.4°

METEORS

The **Quadrantids** peak on the night of 03/04 January, unfortunately coinciding with an almost Full Moon. The **Perseids** peak on the morning of 13 August, with up to 80 per hour. With the New Moon occurring on the 14th conditions for observing these meteors are excellent. The richest annual shower, the **Geminids**, with some 100 per hour, peaks on the night of 13/14 December. With New Moon on the 11th, the thin crescent Moon will be setting about 6.30 pm on the 13th, so, given clear skies, conditions should be good for this shower.

There are, of course, minor meteor showers during the year, and sporadics may be seen at any time.

COMETS

As was demonstrated last year with the fizzling of Comet ISON, the behaviour of comets is notoriously difficult to predict. However, a couple of comets may well be visible from our northern location.

2013 US10 (Catalina) will be mainly visible from the southern hemisphere, but it will appear low in the east in our morning skies from mid-November, probably reaching naked-eye visibility. On the mornings of 07 and 08 December it will be close to Venus and the crescent Moon.

67P/Churymov-Gerasimenko has been in the news as the comet being studied by the Rosetta spacecraft and its lander Philae. It is due to reach perihelion on 13 August, and may reach magnitude 9 to 11 in late September as a morning object in the east. Terrestrial observations are being encouraged to support the spacecraft observations.

C2014 Q2 (Lovejoy) has been visible in our skies during January.

Detailed comet predictions for 2015 are available on the website of the British Astronomical Association's Comet Section: http://www.ast.cam.ac.uk/~jds/preds15.pdf. Also check the Heavens-Above website (www.heavens-above.com) for star charts showing comet positions.

THE SUN

We are now past the maximum of the sunspot cycle, and we can expect numbers to decline. Nevertheless, there can be outbursts of activity, with displays of the aurora borealis (and australis) at high latitudes. Indeed, as recently as October 2014 the largest sunspot group in 24 years appeared. Details of sunspot numbers are at www.ips.gov.au/Solar/1/6, and auroral alerts, with lots of other information, is at www.spaceweather.com.

EQUINOXES AND SOLSTICES

The following are the dates and times of the equinoxes and solstices in 2015:

Vernal Equinox	20 March	22.44 UT
Summer Solstice	21 June	17.37 BST
Autumnal Equinox	23 September	09.20 BST
Winter Solstice	22 December	04.47 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, 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 website, www.astronomy.org.gg

WEA COURSE

The Astronomy Section's annual six-week WEA "Star Gazing" course at the Observatory will be run from 05 February to 12 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 Thursday evenings during the year, including weekly openings during the summer holidays (23 July to 27 August), and on 29 October. There will probably also be a spring opening, and perhaps a daytime one for observing the Sun. Details will appear on the website (www.astronomy.org.gg) and in local media.

REFERENCES

SkyMap Pro and *Starry Night Pro* software
RAS diary 2015

CALENDAR OF ASTRONOMICAL EVENTS IN 2015

Month	Date	Time	Event
January	04	06.37 UT	Earth at perihelion
January	03/04		Quadrantid meteor shower (unfavourable)
January	11	After sunset	Mercury and Venus conjunction (0.7º)
January	14	After sunset	Mercury at greatest eastern elongation
January	16	Morning	Moon and Saturn conjunction (1.5º)
January	24	Morning	Jupiter's moons triple shadow event
February	05	19.30 UT	WEA course starts at Observatory
February	06	All night	Jupiter at opposition

February	22	After sunset	Venus and Mars conjunction (0.5º)
March	04	After sunset	Venus and Uranus conjunction (0.1º)
March	11	After sunset	Mars and Uranus conjunction (0.3º)
March	12	Morning	Moon and Saturn conjunction (2º)
March	12	19.30 UT	WEA course – final class
March	20	22.44 UT	Vernal Equinox
March	20	08.19 – 10.35 UT	Solar eclipse (86% in Guernsey)
March	29	01.00 UT	BST starts
February	24	Before sunrise	Mercury at greatest western elongation
April			*Dawn* spacecraft arrives at Ceres
April	22	After sunset	Mercury and Mars conjunction (1.3º)
May	05	Evening	Moon and Saturn conjunction (3º)
May	07	After sunset	Mercury at greatest eastern elongation
May	23	All night	Saturn at opposition
June	01	Evening	Moon and Saturn conjunction (1º)
June	06	After sunset	Venus at maximum eastern elongation
June	06	Evening	Venus at maximum eastern elongation
June	14	All night	Ceres at opposition (magnitude 7)
Mid-June			Mars conjunction with Sun
June	21	17.37 BST	Summer Solstice
June	24	Before sunrise	Mercury at greatest western elongation
June	28	Early morning	Moon and Saturn conjunction (1.5º)
July	01	Evening	Venus and Jupiter conjunction (0.5°)
July	02	All night	Pluto at opposition (magnitude 14)
July	06	20.41 BST	Earth at aphelion
July	09	Morning	Moon and Uranus conjunction (1.5º)
July	12	Evening	Venus at maximum brightness (-4.5)
July	14		*Horizons* spacecraft flyby of Pluto
July	23	Evening	Observatory Open Evenings start
August	05	Morning	Moon and Uranus conjunction (3º)
August	06/07	After sunset	Mercury and Jupiter conjunction (1°)
August	12/13		Perseid meteor shower (favourable)
August	13		Comet 67P/C-G at perihelion
August	15		Venus at inferior conjunction
August	22	Early evening	Moon and Saturn conjunction (2º)
August	26		Jupiter conjunction with Sun
August	27	Evening	Observatory Open Days end
September	01	All night	Neptune at opposition (magnitude 8)
September	05	05.45 to 07.03 BST	Lunar occultation of Aldebaran
September	16	After sunset	Mercury at greatest eastern elongation
September	23	09.20 BST	Autumnal Equinox
September	late	Morning	Comet 67P/C-G may be visible
September	28	01.10 - 06.23 BST	Total lunar eclipse
September	29	Early morning	Moon and Uranus conjunction (1.3º)
September	29	All night	Vesta at opposition (magnitude 6)
October	16	Early evening	Moon and Saturn conjunction (2º)

October	12	All night	Uranus at opposition (magnitude 5.7)
October	16	Before sunrise	Mercury at greatest western elongation
October	18	Morning	Mars and Jupiter conjunction (0.4°)
October	25	02.00 BST	BST ends
October	25	Morning	Venus and Jupiter conjunction (1.2°)
October	26	Before sunrise	Venus at maximum western elongation
October	29	18.00 BST	Observatory Open Evening
October	29	22.43 to 23.41 BST	Lunar occultation of Aldebaran
November	03	Morning	Mars and Venus conjunction (0.4°)
November	Mid	Morning	Comet 2013 US10 (Catalina) low in east
November	22	Early evening	Moon and Uranus conjunction (1.4º)
December	04	Morning	Moon and Jupiter conjunction (2º)
December	04	18.05 to 19.05 UT	Lunar occultation of Aldebaran
December	06	Morning	Moon and Mars conjunction (0.7º)
December	07/08	Morning	Comet 2013 US10 (Catalina) near Venus
December	07	Morning	Moon and Venus conjunction (2º)
December	10	Early evening	Moon and Saturn conjunction (2º)
December	13/14		Geminid meteor shower (favourable)
December	20	Morning	Moon and Uranus conjunction (1.7º)
December	22	04.47 UT	Winter Solstice
December	29	After sunset	Mercury at greatest eastern elongation

Astronomy Section History, Part 2 - Into the 21st Century

With plans submitted and approved in October 1992, work began on building the observatory and telescope installation. Excavation machine work by John Lesbirel and concreting by builder Alan Le Prevost for foundations and pillars was completed by the end of the year, with the assistance of astronomy section members, for main building work to begin in 1993.

The beginning of 1993 also marked the launch of the Section's more comprehensive newsletter Sagittarius, compiled by David Le Conte, and named after that constellation because of Guernsey's most favourable southern observatory position in the British Isles.

Main construction work for the observatory began in January 1993, with the design based on a strong wooden building with roll-off roof and large fold-down panels for lower angle observations.

The choice of suitable cladding material for the building seemed difficult, until it became known that new electricity generator equipment had arrived in the island. The equipment had been transported in large packing cases made of strong wooden planking, and on David Le Conte's initiative the States Electricity Board was very willing to save this material from dumping by offering it to the Astronomy Section. This was a very suitable solution for cladding the

lower half of the building. Other unwanted material at the States Works Department could also be used, so that almost all of the observatory structure was obtained from recyclable materials, with assembly of the frame and covering materials completed during the first two months of the year.

During February Dr Lawrence Pilkington's 14 inch Celestron telescope and Schmidt camera were installed and aligned, with Mars being the first object to be observed. At the beginning of the month David Williams, Head of Beechwood School, gave a talk at the observatory on the history of radio astronomy, with its use of dish aerial, array and interferometer equipment.

With the observatory operational, the astronomer Patrick Moore was invited to the island for the official opening ceremony. He arrived on March 9th, visiting the observatory briefly before attending an evening meal with astronomy section members at the Fleur du Jardin Hotel. After that, there was a return to the observatory to view Mars at its closest for very many years. The following day the observatory was opened, well attended by those involved in its construction, and Patrick Moore was presented with a very suitable knitted Guernsey, with the presentation by new Section Secretary Geoff Falla on behalf of Section members. In the evening Patrick Moore gave a talk at Beau Sejour on the subject 'Looking for Life - a Survey of the Solar System', and during his short stay there was also time for Press and TV interviews and other talks.

On April 6th, the 21st anniversary since the astronomy section was formed, David Falla gave a talk on Particle Astronomy, with cosmic rays such as from supernovae, and neutrinos from stars such as the Sun.

The first year of the new Sagittarius newsletter was received with much approval, increasing in content with articles in particular by David Williams on the origins of days and months as units of time, and by Mark Humphrys beginning a major series of articles with the local group of galaxies, and major constellations. Daniel Cave also began a series of valuable contributions, beginning with the new generation of telescopes including the Hubble Space Telescope.

At the Annual Business Meeting in January 1994, it was decided to install solar mirrors so that solar activity could be shown. Two six inch mirrors - a flat reflecting mirror and a concave focusing one with a focal length of about 70 feet, the distance to near the back boundary of the observatory site.

On May 10th there was observation of the best partial eclipse of the Sun for twenty years, using the Section's C-11 telescope having a built-in filter for the purpose. A device made by Section member Roger Chandler for the projection of solar images was also used with good effect.

In September a proposal was put to the States of Guernsey for the construction

of a granite obelisk monument at the harbour Weighbridge, to mark the 50th anniversary of the island's liberation from the German occupation. The monument, designed by artist Eric Snell, including a curved wall to show the Sun's shadow point accurately during the day of liberation, also needed much calculation work completed by David Le Conte, and was approved.

The two solar mirrors, which had been ordered for the observatory early in 1994, arrived in February 1995 and proved satisfactory, giving about an 8 inch diameter image of the Sun when projected onto a screen on the inner wall of the main building.

There was fine weather on May 9th 1995 for the ceremony at the new Liberation Monument, with a huge crowd present, and attended by HRH Prince Charles for the unveiling of the obelisk. The Astronomy Section also put on a display on the Albert Pier for the day, with Peter Langford arranging transport of the C-11 telescope from the observatory, and display material.

In November, for a Millennium Ideas Forum a proposal was submitted on behalf of the Astronomy Section for a Camera Obscura viewing system to be built at Castle Cornet, but the preference was for the excellent tapestry of local history at St James.

March 1996 provided good opportunities for viewing Comet Hyakutake, with three public open evenings at the observatory, and on April 3rd a total eclipse of the Moon was photographed with remarkable success by Daniel Cave, providing a multiple image of the eclipse stages.

By September the large Comet Hale-Bopp became easily visible, with its progress followed during the later months of the year. At the beginning of 1997 Patrick Moore came on another visit to the island, for a talk on January 18th at Beau Sejour with the subject 'Into Space', being 40 years since the first artificial satellite was launched into orbit, and there had been many satellites and spacecraft launched since then for astronomical research.

For a total eclipse of the Moon during the early evening of September 16th, several telescopes were taken to the car park at Jerbourg Point. Several hundred people came, with the Section's C-11 telescope, Debbie Quertier's Newtonian, and Brian Le Page's Celestron all being used with queues at each telescope.

At the Annual Business Meeting in January 1998, Ken Staples was elected as Secretary of the Section, with Geoff Falla as Facilities Officer for site maintenance and the Library, and Frank Dowding Research Officer, to keep up to date with astronomy and space developments. It was also announced that application was being made to the Le Riche Centenary Fund for a contribution to the cost of a new Meade telescope, with La Societe Guernesiaise having agreed to pay half the cost of the new observatory building.

On April 14th, David Falla gave a talk at the observatory 'Advances in Astrophysics', including particular reference to solar activity and magnetic fields, with the Sun's activity increasing towards a peak, and on November 17th Frank Dowding gave a talk on 'Moons of the Solar System'. In preparation for the 1999 total eclipse of the Sun, and visible locally, special viewing spectacles were being made available from David Le Conte's company Eclipse 99 Ltd, with the Section receiving profits from the sales.

In April 1999, Debbie Quertier and Jessica Harris became Joint Secretaries of the Astronomy Section, giving interviews on Radio Guernsey and on Channel Television. Preparations were being made for this year of the decade, with a rare total eclipse of the Sun due to be seen along a narrow track across part of Cornwall, the English Channel and including Alderney. On June 17th Patrick Moore opened an eclipse display at Candie Museum, and on August 9th the astronomer and writer Heather Couper also returned to the island, giving a talk 'Darkness at Noon' for the coming eclipse. A book on The Channel Islands Millennium Eclipse was produced by David Le Conte, published by La Societe.

The Royal Astronomical Society held its National Astronomy Meeting in Guernsey for several hundred astronomers during the week of the eclipse, with a day free for a visit to Alderney on August 11th. Eclipse day was fine with sunny periods, allowing the different stages of the eclipse to be observed successfully, with Jessica Harris producing a comprehensive summary of the day's experiences and transport of telescope equipment to Alderney for the occasion.

There was another Open Day at the observatory on October 26th, with several hundred people visiting, and interviews for a Guernsey Press feature. It was announced that fundraising was going well for the purchase of a larger telescope.

With funds available, new telescope equipment including a 16 inch Meade reflector and a 5 inch Takahashi refractor supplied by True Technology arrived on December 2nd, and after final adjustments was ready for observations, with the official launch date on March 10th, 2000, an opening for Societe members on the following day, and public open evening on March 14th.

In the New Year's Honours list, Patrick Moore became a Knight of the Realm in 2001, in recognition of his lifetime work as a leading light in astronomy, including Sir Patrick's several visits to the island.

Apart from Open Evenings, the Astronomy Section has arranged group visits to the observatory by schools and various organisations. Articles appearing in the Section's Sagittarius publication are too many to be mentioned individually, but can be sourced by reference to the Section's Website.

Although many of the events in astronomy can be predicted, there are also the unexpected events such as the sudden arrival of a large meteor, often producing a spectacular effect from burning up or fragmenting in the atmosphere. One of the most remarkable events towards the end of the 20th century was in 1994. It was a much more distant happening, when Comet Shoemaker-Levy 9 was seen to have broken up near Jupiter, evidently caused by Jupiter's huge gravitational effect. On July 19th that year and on several following nights, Astronomy Section members and visitors to the Observatory were able to see the effect as the comet fragments began impacting on Jupiter, producing large markings in the planet's atmosphere.

Geoff Falla

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