From Night to Knight

Congratulations to Sir Patrick Moore on becoming a Knight of the Realm in the New Year's honours list. This more than deserved award was bestowed on him in recognition of his lifetime work in the field of astronomy. His monthly 'Sky at Night' TV programme, numerous published books, regular appearances and events, as well as his observational study and scientific knowledge of the Universe have made him a leading light in his field, well respected by other professionals and the layman. With his "down to earth" way of talking to people he has brought astronomy to the masses, and taught us with passion about the wonders of the night sky. Well done Sir Patrick Moore.

Jessica Harris

Messier Marathon

We have decided to have another go at a Messier Marathon (to observe all 109 objects in the Messier catalogue in a single night) this year. The best time is at New Moon near the end of March but as we have to take into account getting up for work the next day we are selecting the nearest Saturday, which is **March 24th, 2001**. Those who are interested should let me know. We would aim to start by 8.30 pm at the latest.

Debby Quertier

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Joint Secretary	Debby Quertier	725760
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Copy deadline for next publication is 15th March

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Sagittarius

The Newsletter of the Astronomy Section of La Société Guernesiaise

January - March 2001

Forthcoming events

Annual Business Meeting
Tuesday, 6th February
8 pm at the Observatory

Messier Marathon
Saturday, 24th March
8 pm then through the night at the Observatory

A Lander for Mars
Talk by Prof Colin Pillinger
Wednesday, 25th April
8.30 pm at the
Duke of Richmond Hotel
by invitation of the Channel Islands Group of Professional Engineers.
Please advise David Le Conte (264847) if you wish to attend

In addition, the Section meets at the Observatory every Tuesday evening, and Friday if clear for observing.

In this issue

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The International Space Station
The Story of Time
Jupiter events in 2001

Inside

Centre inserts

Star chart
Moon phases
Sunset and sunrise times

Astronomical events in 2001

***David Le Conte** picks out the events to look out for during the year*

Eclipses

The year starts with a conveniently timed, early evening total lunar eclipse, on the 9th January. The Moon will enter the Earth's penumbral shadow at 5.43 pm, with the recently risen Moon still low in the East. But it is at 6.42 pm, when it starts entering the umbra, that observers will first see a small "bite" taken out of the Moon. At this time the Moon will be at an altitude of 20°.

There is a total solar eclipse on the 21st June, but you will have to go to Africa to see it.

The bite will grow over the next hour, and by 7.49 pm the Moon will be totally eclipsed, and now at an altitude of over 30°. The total phase will last for over an hour, mid-eclipse being at 8:20 pm.

The Moon will not disappear entirely, however, as sunlight passing either side of the Earth will cast a red glow on the Moon's surface - the degree of redness and darkness being determined by conditions in the Earth's atmosphere. Also, as this is not a central eclipse we can expect that one side of the Moon will appear considerably brighter than the other.

The eclipse takes place while the Moon is in the constellation Gemini. It will be just below the two bright twin stars, Castor and Pollux, and should present a beautiful sight, hanging like a red ball against the background of stars. The $3\frac{1}{2}$ magnitude star Delta Geminorum will be just $1\frac{1}{2}°$ above and to the right, and the "Clown Face" or "Eskimo" Nebula will be less than one degree below the Moon. This is a "planetary nebula", being the remnants of a star which has come to the end of its natural life, and appears ring-like in large telescopes, its names being attributed to its face-like appearance. It is doubtful, however, that this faint ($8\frac{1}{2}$ magnitude) object will be visible, even in telescopes, as it will be so close to the light of the Moon, even though eclipsed.

At 8.52 pm the total phase of the eclipse will have ended, and the bright Moon will start reappearing. An hour later, by 9.59 pm the full Moon will again be visible, reasserting its accustomed brightness when it finally exits the penumbra, at 10.57 pm.

There is a total solar eclipse on the 21st June, but you will have to go to Africa to see it.

The Planets

Mercury will be visible low in the west on late January evenings, the crescent Moon appearing nearby on the 26th of that month. It makes its best evening appearance in May, being just above Jupiter on the 19th. Mercury can again be seen in the morning in October, low in the east. Late in the month, and in the first few days of November, it is close to Venus, being within $\frac{1}{2}°$ on the 30th October.

The planet Venus will appear in the west in evening skies in January and February, but by March it will be very low and its brilliance will fade as its orbit takes it between the Earth and the Sun. It reappears low in the eastern morning sky in April, and is visible until October, being within one degree of Jupiter on the morning of 6th August.

One significant planetary event this year is the opposition of the planet Mars in June - the best for ten years

One significant planetary event this year is the opposition of the planet Mars in June - the best for ten years. It will come as close as 68 million km (42 million miles) to the Earth, providing good views of the surface detail. Opposition actually occurs on the 13th June, but the planet will be visible from May, appearing bright in the south-east after midnight. Unfortunately for us in Guernsey, during this opposition Mars will be at a very southerly declination (26° S), and it will, therefore, be very low in our skies, never getting more than 14° above the horizon at opposition. In June it is best observed about 1.00 am. By July it will be low in the south, and in August it will be low in the south-south-east.

Jupiter and Saturn will be visible in the evening skies for the first four months of the year, remaining within a few degrees of each other throughout this period. They appear in the south-east in January, moving to the south in February and March, and then low in the west in April. The spectacular pair will be made even more so by their appearance amongst the bright stars of the constellation Taurus. In fact, Jupiter, the brighter of the two, will be between the Pleiades open cluster and Taurus's brightest star Aldebaran, and by April the two planets will virtually straddle the Hyades open cluster. The Moon will appear in the same area as these planets on the evenings of the 6th January, 2nd February, 1st and 29th March and the 26th April. The first quarter Moon near the Hyades and Jupiter on the 29th March should make an exceptionally beautiful sight.

The first quarter Moon near the Hyades and Jupiter on the 29th March should make an exceptionally beautiful sight

Saturn reappears in the late evenings of October, in the east, becoming bright amongst the stars of Taurus by November, and at opposition near the star Aldebaran on the 3rd December. Jupiter starts reappearing in the east sky in the evenings of November, and reaches opposition on the 31st December.

Occultations

There will be two occultations of Saturn by the Moon, and a few of moderately bright stars during the year:

* Saturn and its moons will be occulted on the 3rd November, between 9.01 pm and 9.59 pm, and again on the night of the 31st November/1st December, between 2.25 am and 3.25 am.

* On the night of the 3rd/4th March the dark part of the first quarter Moon will

hide the 3rd magnitude star Zeta Tauri at 8 minutes past midnight, and it will reappear from behind the Moon's illuminated side at 1.05 am. This will be a central occultation, and therefore a long one.

* A short, grazing occultation will take place on the 31st March, of the 3.3 magnitude star Eta Geminorum, from 10.13 pm to 10.20 pm.

* On the night of 1st/2nd April, Delta Geminorum, a 3.5 magnitude star, will be occulted between 0.05 am and 0.33 am.

* Another 3.5 magnitude star, Epsilon Tauri, will be occulted between 7.08 pm and 7.56 pm on the 30th November.

Meteors

The Perseid meteor shower will appear as usual on and about the 11th August, but morning observations will be hampered by the last-quarter Moon.

The Leonids will make their appearance on the moonless nights of the 17th / 18th November.

The Highlight of the Year

There is no clear single highlight this year. The lunar eclipse on the 9th January could well be one, but the possibility of cloud at that time of year must, of course, be countenanced. The close opposition of Mars would usually be of considerable significance, but its southerly declination will not help observations from our latitude.

The long, slow procession of the planets Jupiter and Saturn, well-placed amongst the bright star-field of Taurus, must, therefore, be the highlight of the year. Both should present superb telescopic views. Jupiter and its moons always provide interesting sights. Watch, especially, for appearances of its Great Red Spot, and for transits, shadows, eclipses and occultations of its moons. Saturn, its rings extended as open as they ever get, will also be a brilliant sight.

The long, slow procession of the planets Jupiter and Saturn, well-placed amongst the bright star-field of Taurus, must, therefore, be the highlight of the year

David Le Conte

References used:

Skywatch 2001. Sky Publishing Corporation

SkyMapPro. CA Marriott

GrayStel. GrayStel Software Ltd

Postscript - Lunar Eclipse

With the help of publicity provided by the Section there was plenty of interest in the lunar eclipse on January 9th. A press photographer and reporter joined the group gathered at the Observatory. David Le Conte was set up to record the progress of the eclipse by taking a series of photographs through the telescope. Unfortunately most of the event could only be seen through cloud, if at all, but a break in the cloud for about three minutes around 8.15 pm did give a clear view of the eclipsed Moon for those lucky enough to be watching then.

Peter Langford

The International Space Station

*On 21st November **Frank Dowding** gave a talk to the Section about the International Space Station, illustrated by pictures and a model. Here are the highlights of his talk.*

All science fiction writers depict a space station as a wheel which is slowly turning in space in order to give those on board artificial gravity. The International Space Station, however, does not have gravity, for two reasons. One is the expense. The other is that it would defeat the object. By having a zero gravity environment many experiments can be carried out that would be impossible on Earth, such as blending alloys to make near-perfect metals and studying the growth of plant life. Even a flame behaves differently without gravity. The effect on astronauts after long periods of weightlessness can also be studied.

To understand how the International Space Station became a reality we have to look back to the early nineteen-seventies. The Apollo Moon landings had recently finished and both the Soviet Union and the United States were looking further afield, perhaps to Mars. Before they could attempt that, however, they would first need to build a space station. Both nations independently put into orbit a modified version of the top stage of their three-stage rockets. The Soviet Union called theirs Salyut and the United States called theirs Skylab. Both were very successful and in February 1974 they docked together in space. Although the United States only had Skylab for one year the Soviet Union's programme continued, with subsequent improved versions of Salyut, for eleven years until 1982. By this time the Soviet Union was starting to build Mir, a much larger space station altogether.

Meanwhile NASA, the body responsible for developing American space technology, could see they were a long way behind. So, in 1984, President Reagan announced that NASA would build a space station, big enough for seven people, to be completed by 1995. It would be called 'Freedom'. When the project was finally costed, however, the US Congress would not agree to fund it. By now Mir had been launched and was proving very successful. NASA designed a modified version of Freedom, called 'Alpha', but again Congress turned it down for reasons of cost.

NASA was very impressed by Mir and, after many political and engineering meetings, NASA proposed to Congress to build a space station with Russia's assistance

NASA was very impressed by Mir and, after many political and engineering meetings, NASA proposed to Congress to build a space station with Russia's assistance, using both its expertise and finance. Other nations would also be asked to contribute finance or work in kind. Nevertheless America would always be in control. It would be called 'The International Space Station'. To this Congress agreed.

For the next two years American and Russian astronauts collaborated on Mir. Between 1996 and 1998 American space shuttles docked with Mir nine times and the crews from both nations helped each other to develop new ways of living and working in space.

To construct the International Space Station each section has to be built on the ground then transported into orbit where the sections are joined together. At the time of writing there are three sections in place. The first was made and launched by the Russians, but paid for by NASA. It is called 'Zarya', meaning 'sunrise' in Russian. It was launched on 20 November 1998. It weighs twenty tons and is 43 feet long and 13 feet wide. Initially it held many of the tools necessary for later construction but it also has toilet and shower facilities plus a video conference centre.

The next section was built, launched and paid for by NASA. It is called 'Unity' and was joined to the forward end of Zarya. Unity provides the interface between Russian and American equipment. The Russians work with 28 volts, for example, whereas the United States uses 120 volts. Unity was taken into orbit in the cargo bay of the Shuttle Endeavor. It was 'bolted on' to Zarya by Commander Robert Cabana, shuttle pilot Rick Sturckon and mission specialists Sergei Krikalyev and Nancy Currie.

The third section was crucial to the whole mission. Called 'Zvezda' it was to contain a computer to automatically fire thrusters to keep the Station in correct orbit, plus life support and communication systems. Russia was to pay for Zvezda, but by now the Russian economy was collapsing. For the next year everything was in doubt, the Russian scientists were not being paid and both NASA and Congress were becoming frustrated. Eventually NASA suggested that if America bought some of Russia's hardware the money could be used to pay the Russian scientists to stop them leaving to work for rogue countries making missiles. Congress agreed and Russia launched Zvezda on July 12, 2000.

Over the next five years, if all goes well, the European Space Agency, Japan, Brazil, Russia and America will be assembling a vehicle about the size of a football pitch

That is really where we are today. Three sections out of twenty are in place and working perfectly. There is a crew of three on board, Commander Bill Shepherd, Soyuz Commander Yuri Gidzenko and flight engineer Sergei Krikalev. Most of their day is taken up checking the equipment on board, checking computer systems, performing video conferencing with schools and exercising on the treadmill and bicycle machine.

Over the next five years, if all goes well, the European Space Agency, Japan, Brazil, Russia and America will be assembling a vehicle about the size of a football pitch. The living and laboratory areas will be in volume about that of a jumbo jet. Each unit will have a specific purpose, either accommodation, life support or scientific experiments. Time will tell if Russia will be as committed as originally planned.

The cost of the project is enormous. It was expected to be in the region of $70 billion and is now estimated to be $100 billion. But, as the once head of NASA's Advanced Research Unit said, "With so many countries working together to achieve a common destiny, and the Russian scientists working for peaceful purposes, maybe we should not be measuring this in dollars".

Frank Dowding

Seeing Mir and the ISS

The ISS is currently visible in the morning at times varying from around 5 am to 7 am. Mir is visible in the evening sky until mid-January and then in the early morning at the end of the month. This will be the last chance to see Mir as it is intended to bring it down to Earth at the end of February.

There is another Shuttle mission to the ISS due shortly. The mission in late October was successful and the Space Shuttle, followed by the ISS, were clearly seen as they made their way across the sky. There will be more chances to see both the ISS and Shuttle. You can obtain times for seeing Mir and the ISS from "Astronomy & Space" magazine's telephone newsline on **0891 881950**. Do note that the times given are subject to change and it is advisable to check your source of times, either the phone line or the internet, regularly and then go out five to ten minutes before the stated time.

Debby Quertier

The Search for E.T.

Sun and Earth afloat in space,
Nurturing the human race,
Is there life elsewhere maybe,
Somewhere on that starry sea?

Now the hunt is on to seek,
If we are indeed unique,
Radio waves and interception,
May reveal communication.

Many planets found afar,
Orbiting some other stars,
Sometime soon we may well find,
There is more than humankind.

And perhaps not such a quest,
If E.T. has found us first.

Geoff Falla

The Story of Time
by Geoff Falla

We are all aware of time passing, and whether we make good use of it, or if we feel that we are sometimes wasting time, there is no turning the clock back. It seems very appropriate to have marked 2000 years of time with an exhibition, and what better place than Greenwich - the home of Greenwich Mean Time, or Universal Time, the term generally used in astronomy. Greenwich, with its famous observatory, has been the site of the Prime Meridian since 1884. The line of longitude between the Earth's north and south poles is set here at O degrees, with time zones of one hour at each 15 degrees east and west of the Greenwich site. The Meridian building at the Observatory, with the actual line marked out, is aligned on an exact north-south axis.

> *Paris does, however, now coordinate the world's time signals*

At one time, there was a French ambition to establish a prime meridian running through Paris, which would have achieved perhaps another European ideal, that of Euro Time, but the idea did not reach fruition. Paris does, however, now coordinate the world's time signals using atomic clocks for millisecond accuracy. The prime meridian could also have been located at a site in the ancient world, such as the Great Pyramid in Egypt, which although more than 4,000 years old is aligned to true north with equal if not better accuracy than the Greenwich meridian building. It was in Egypt that the concept of the 24 hour day was first introduced, with hourly time during the day and night marked by the apparent movement of the Sun or the stars across the sky.

I was accompanied on a visit to the Story of Time exhibition by Pat Elliott, a member of the Society of Popular Astronomy. She is also a member of the Friends of the National Maritime Museum, where the exhibition was held, and has visited our own observatory when staying in the island. We decided on a river trip as it was a fine day for the visit, leaving the Thames Embankment near Charing Cross in the morning and allowing plenty of time to see the exhibition before the late afternoon return.

The exhibition was displayed in the Queen's House building at Greenwich, with over 500 exhibits which had been gathered from some 150 museums worldwide. There were different themes throughout the various rooms, with sections depicting the creation of time, the measurement of time, and how it has been illustrated in art. If you were to be asked how many ways there could be to indicate and measure time you would probably think of several, including clocks and sundials, but there are many other methods of measuring time. Some of these are by mechanical means, while others are more simple and depend on nature. There was a magnificent display of clocks and watches of all sizes, many adorned with gold, silver or precious

stones, including some items from the Royal collection. The English clockmaker John Harrison achieved fame for having invented a new type of clock for use at sea which did not rely on a pendulum. The H1 clock, usually on display at the Greenwich Observatory, was followed by the much more compact H4 watch which was tested on a voyage to the West Indies in 1761. It lost only a few seconds during the voyage, and proved that a ship's longitude position could be fixed with great accuracy.

One of the oldest methods of measuring time is by using gravity. The Chinese and the Egyptians used forms of water clock, known as a clepsydra. By filling a container with water, a small hole at the bottom would allow water to flow out gradually at a known rate to fill another container. A similar idea using gravity is in the form of a sand clock, a glass container with a narrow neck. In the case of just a few minutes timing needed there is the egg timer. One example of a sand clock on display measured an hour, with the extra novelty of being gradually emptied in 15 minute sections.

> *The positions of the stars and constellations have a regular yearly cycle which can be used to follow the changing time during the night and seasons*

A favourite and relatively simple way of indicating time through the day is of course by the use of a sundial. The shadow cast on the dial or scale in any number of ingenious ways, sometimes incorporating a sculpture, and the changing seasons can also be shown since the length of the shadow changes throughout the year. Our own Liberation monument uses an exact length of shadow to mark timed events on one particular historic day - May 9th. Seasonal changes can also be determined by different positions in the rising or setting of the Sun and Moon. Knowledge of celestial movements was incorporated into the alignment of many ancient monuments such as at Stonehenge, marking the summer solstice sunrise, or other seasonal events. The phases of the Moon can be used to measure time through the cycle of the lunar month, and there is the rise and fall of the tides on a twice daily basis. The positions of the stars and constellations have a regular yearly cycle which can be used to follow the changing time during the night and seasons. We are all familiar with the major constellations of summer and winter, Cygnus and the Milky Way overhead on summer evenings and Orion in the winter sky. Plants and animals even have natural timed rhythms, biological or body clocks. We have our own pattern of sleeping and waking following the circadian rhythm, affected by the amount of daylight and darkness.

One invention to measure time used a burning candle, linked by a spring to clock hands. More modern methods include the use of quartz and atomic clocks. Quartz vibrates at an exact number of times per second, so that when a small electric current is passed through it from a battery the vibrations can be counted electronically and the time displayed. The most accurate atomic clocks use changes taking place within atoms to keep track of time.

When it comes to looking back into the past, there are several ways in which time can be measured or past events dated with some accuracy. At the exhibition there was a large section of a tree cut from a Giant Californian Redwood. This was felled at the end of the 19th century, when it was found to be well over a thousand years old. The study of tree rings can be used for dating from the number of annual growth rings, and can identify climate changes or more particular events in history such as drought years, or more catastrophic events, from the width of the individual rings. Further back into prehistoric time, radio carbon dating can be used for identifying the date of remains. Carbon 14 is present in all living things, and the amount of radioactive decay which follows at a known rate can be measured to discover when the subject was living. The pattern of evolution, the dating of the dinosaurs and the fossil record can be discovered in this way. Even the age of rock can be found as radioactive elements are trapped in rock when it is formed, and scientists can measure the energy which is again given out at a known rate to calculate the age of a rock formation.

Light takes over 2 million years to arrive from the Andromeda galaxy

To appreciate time on a grand scale we have only to look at the sky on a clear night. Everything we see is not as it is now, but as it was in the past. Reflected sunlight from the Moon and planets, and light from the stars, takes time to reach us - just over a second from the Moon, an hour or more from the major outer planets, and several years from even the closest stars in our own galaxy of stars. Light takes over 2 million years to arrive from the Andromeda galaxy, the only one close enough to be visible with the naked eye. The most distant galaxies are immensely far away in space and time, up to around 15 thousand million light years from us. We are only aware of events long after they have happened. The birth of a new star, or sometimes the supernova explosion of a star can only be seen when the light finally arrives after a long journey from another part of the galaxy or the universe beyond.

So, as we turn over the calendar to a new year, or make notes in our diary - yes, that is another way of measuring time, and perhaps you can think of some others.

Geoff Falla

Astronomy and Space - References for further reading

compiled by Geoff Falla

Gravity. Articles on: The Search for Gravity Waves, as predicted by Einstein, the Dynamic World of General Relativity, Einstein's grand vision of physics and the theory developed in 1915 to succeed Newton's theory of gravity, and A History of Gravitational Theory - celestial mechanics and the importance of eclipse observations and orbital motions in defining gravitational theory. *Sky and Telescope, October 2000*

Observing Jupiter. A guide to the observation of the solar system's largest planet, now well placed in the evening sky. *Sky and Telescope, October 2000*

Space Travel in the Next Century. Feature articles on the prospects for space exploration, and the new forms of propulsion which will be necessary including plasma rockets, space tethers and solar sails. *Astronomy Now, October 2000*

Cosmic Rays. The detection of cosmic rays - energetic particles from space, the search for their origin and source of energy. *Astronomy Now, October 2000*

Globular Star Clusters. These clusters formed in the very early history of our galaxy. The study of their nature and distribution is helping to reveal information about the age of the Universe, and how galaxies form. *Astronomy, October 2000*

Cometary Suicides. Sun grazing comets, and those which dive into the Sun itself are being found by amateur astronomers using images from the SOHO space craft's coronagraph instrument. *The Planetary Report, September/ October 2000*

Moons of the Gas Giants. The moons of Jupiter, Saturn, Uranus and Neptune. A set of articles describing the history of discoveries, observing the moons, and the surprisingly diverse nature of these planetary companions. *Astronomy Now, November 2000*

Extrasolar Planets. The recent discovery of 9 new extrasolar planets brings the total number found orbiting other stars to more than 50, all discovered in the last 10 years. *Astronomy, November 2000*

Astrophotography. The art of astrophotography and a selection of impressive images by Jay Ouellet, currently President of the Royal Astronomical Society of Canada in Quebec. *Astronomy, November 2000*

Artistry - Solar Eclipses. The art of depicting solar eclipses. A century ago this was really the only way of recording the appearance of an eclipse. *Sky and Telescope, December 2000*

New Products for Astronomy. Some of the interesting products, telescopes and accessories newly introduced during the year. *Sky and Telescope, December 2000*

3-D Universe. A selection of 3-D photographs of the surface of Mars, the Earth, and star clusters. *Astronomy, December 2000*

Solar Cycle at Peak. The largest Sunspot group in 10 years was recorded in September. Photographs of its appearance and progress across the solar surface. *Astronomy and Space, December 2000*

Binocular Astronomy. For a wider view of the sky than can be seen with a telescope. How to get the best out of binocular astronomy. *Astronomy and Space, December 2000*

SETI's Bright Future. SETI - the search for extraterrestrial intelligence, has concentrated on using radio telescopes to detect signals. An optical search to use and detect light signals is one alternative. *Astronomy Now, December 2000*

Digital Imaging with a CCD. Advice on the purchase and use of CCD equipment. How to overcome practical difficulties such as focus, with examples of image processing, and a selection of some of the best images. *Astronomy Now, December 2000*

Baikonur - Russia's Spaceport. Russia's rocket launch site in Kazakhstan, where vehicles have been launched to the Mir space station and now to the new International Space Station assembly. *Astronomy Now, December 2000*

Geoff Falla

Jupiter events in 2001
by David Le Conte

With Jupiter in an excellent position for evening observations during the first four months of 2001, I felt it would be useful to chart the events of Jupiter's four Galilean moons and its Great Red Spot during these months. Using software freely available on the Internet, I have selected just those events which are visible between sunset and 1:00 am (or the setting of Jupiter, if earlier), which are the times when we usually observe. However, details of events at other times are available if anyone wants them. Times include summer time when applicable, and should be accurate to about a minute (more for the Great Red Spot).

The explanations of the terms are as follows:-

An **eclipse** of a Jovian moon occurs when it moves through the **shadow** of Jupiter.

An **occultation** of a moon occurs when it moves **behind** Jupiter.

A **transit** of a moon occurs when it moves **in front of** Jupiter, when it becomes almost invisible.

A **shadow transit** occurs when the shadow of a moon, cast by the Sun, moves **across** Jupiter's disk The shadow may be seen through a telescope as a small black dot on Jupiter.

Full explanatory details and diagrams can be found on the internet at http://occsec.wellington.net.nz/jovian/jovphen.htm

The transit times for the Great Red Spot are given; look for it a couple of hours either side of these times.

JANUARY

15

17:44 Europa Transit starts
19:51 Europa Shadow transit starts
20:19 Europa Transit ends
22:28 Europa Shadow transit ends

16

00:00 Great Red Spot Transits
19:51 Great Red Spot Transits
22:31 Io Transit starts
23:37 Io Shadow transit starts

17

00:42 Io Transit ends
16:43 Europa Eclipse ends
19:51 Io Occultation starts
23:08 Io Eclipse ends

18

16:59 Io Transit starts
18:06 Io Shadow transit starts
18:12 Ganymede Occultation ends
19:10 Io Transit ends
20:17 Io Shadow transit ends
20:35 Ganymede Eclipse starts
21:29 Great Red Spot Transits
22:46 Ganymede Eclipse ends

19

17:37 Io Eclipse ends
17:21 Great Red Spot Transits

20

23:08 Great Red Spot Transits

21

18:59 Great Red Spot Transits

22

20:09 Europa Transit starts
22:27 Europa Shadow transit starts
22:45 Europa Transit ends

23

20:38 Great Red Spot Transits

24

16:30 Great Red Spot Transits
19:22 Europa Eclipse ends
21:41 Io Occultation starts

25

18:49 Io Transit starts
19:45 Ganymede Occultation starts
20:01 Io Shadow transit starts
21:00 Io Transit ends
21:54 Ganymede Occultation ends
22:13 Io Shadow transit ends
22:17 Great Red Spot Transits

26

00:35 Ganymede Eclipse starts
16:09 Io Occultation starts
19:32 Io Eclipse ends

27

23:55 Great Red Spot Transits

28

19:47 Great Red Spot Transits

29

22:37 Europa Transit starts

30

21:26 Great Red Spot Transits

31

17:17 Great Red Spot Transits
22:00 Europa Eclipse ends
23:33 Io Occultation starts

FEBRUARY

01

00:00 Io Occultation starts
20:41 Io Transit starts
21:57 Io Shadow transit starts
22:53 Io Transit ends
23:04 Great Red Spot Transits
23:30 Ganymede Occultation starts

02

00:09 Io Shadow transit ends
16:58 Europa Shadow transit ends
18:01 Io Occultation starts
18:56 Great Red Spot Transits
21:27 Io Eclipse ends

03

17:21 Io Transit ends
18:38 Io Shadow transit ends

04

00:43 Great Red Spot Transits
20:35 Great Red Spot Transits

05

18:40 Ganymede Shadow transit starts

FEBRUARY

05
20:53 Ganymede Shadow transit ends
16:26 Great Red Spot Transits
06
22:13 Great Red Spot Transits
07
18:05 Great Red Spot Transits
19:21 Europa Occultation starts
08
00:39 Europa Eclipse ends
22:34 Io Transit starts.
23.52 Great Red Spot Transits
23:53 Io Shadow transit starts
09
00:46 Io Transit ends
19:35 Europa Shadow transit ends
19:44 Great Red Spot Transits
19:54 Io Occultation starts
23:23 Io Eclipse ends
10
18:22 Io Shadow transit starts
19:14 Io Transit ends
20:34 Io Shadow transit ends
11
17:51 Io Eclipse ends
21:23 Great Red Spot Transits
12
19:36 Ganymede Transit ends
22:41 Ganymede Shadow transit starts
13
00:55 Ganymede Shadow transit ends
23:01 Great Red Spot Transits
14
18:53 Great Red Spot Transits
21.56 Europa Occultation starts
15
00:35 Europa Occultation ends
00:38 Europa Eclipse starts
16
00:29 Io Transit starts
00:40 Great Red Spot Transits
19:33 Europa Transit ends
19:33 Europa Shadow transit starts
20:32 Great Red Spot Transits
21:48 Io Occultation starts
22:11 Europa Shadow transit ends
18
19:47 Io Eclipse ends
22:11 Great Red Spot Transits
19
18:02 Great Red Spot Transits
21:18 Ganymede Transit starts
23:34 Ganymede Transit ends
20
23:50 Great Red Spot Transits
21
19:41 Great Red Spot Transits
22
00:33 Europa Occultation starts
23
18:56 Ganymede Eclipse ends
19:32 Europa Transit starts
21:20 Great Red Spot Transits
22:09 Europa Transit ends
22:09 Europa Shadow transit starts
23:43 Io Occultation starts
24
00:47 Europa Shadow transit ends
20:53 Io Transit starts
22:13 Io Shadow transit starts
23:05 Io Transit ends
25
00:25 Io Shadow transit ends
18:12 Io Occultation starts
19:15 Europa Eclipse ends
21:42 Io Eclipse ends
22:59 Great Red Spot Transits
26
18:51 Great Red Spot Transits
18:54 Io Shadow transit ends
28
00:38 Great Red Spot Transits
20:30 Great Red Spot Transits

MARCH

02
20:41 Ganymede Eclipse starts
22:09 Great Red Spot Transits
22:09 Europa Transit starts
22:58 Ganymede Eclipse ends

MARCH

03
00:45 Europa Shadow transit starts
00:47 Europa Transit ends
18:01 Great Red Spot Transits
22:50 Io Transit starts
04
00:09 Io Shadow transit starts
19:13 Europa Occultation ends
19:14 Europa Eclipse starts
20:08 Io Occultation starts
21:54 Europa Eclipse ends
23:37 Io Eclipse ends
23:48 Great Red Spot Transits
05
18:38 Io Shadow transit starts
19:31 Io Transit ends
19:40 Great Red Spot Transits
20:50 Io Shadow transit ends
06
18:06 Io Eclipse ends
07
21:19 Great Red Spot Transits
08
17:10 Great Red Spot Transits
09
19:26 Ganymede Occultation starts
21:47 Ganymede Occultation ends
22:58 Great Red Spot Transits
10
00:41 Ganymede Eclipse starts
00:48 Europa Transit starts
18:49 Great Red Spot Transits
11
00:48 Io Transit starts
19:16 Europa Occultation starts
22:05 Io Occultation starts
12
00:33 Europa Eclipse ends
19:17 Io Transit starts
20:29 Great Red Spot Transits
20:34 Io Shadow transit starts
21:29 Io Transit ends
22:46 Io Shadow transit ends
13
19:16 Europa Shadow transit ends
20:01 Io Eclipse ends
14
22:08 Great Red Spot Transits
16
23:37 Ganymede Occultation starts
23:47 Great Red Spot Transits
17
19:38 Great Red Spot Transits
18
22:00 Europa Occultation starts
19
00:03 Io Occultation starts
21:16 Io Transit starts
21:18 Great Red Spot Transits
22:30 Io Shadow transit starts
23:28 Io Transit ends
20
00:42 Io Shadow transit ends
18:33 Io Occultation starts
18:47 Ganymede Shadow transit starts
19:14 Europa Shadow transit starts
19:28 Europa Transit ends
21:06 Ganymede Shadow transit ends
21:52 Europa Shadow transit ends
21:57 Io Eclipse ends
21
19:11 Io Shadow transit ends
22:57 Great Red Spot Transits

More Jupiter events available on request.

David Le Conte

Annual Business Meeting

The date of the Annual Business Meeting this year will be **Tuesday 6th February, 2001**, which is around the Full Moon when conditions are not so good for observing. There are several important matters to discuss so please come along for 8 pm.

Debby Quertier