thebigbang

October 2010, No. 92

The amateur astronomer's guide to the sky

M42:
wisps of the Orion Nebula

▶▶▶ Page 6

"...Schiller was interested in renaming the constellations according to Biblical and religious references. Thus, in his atlas Orion became St. Joseph, Ursa Major became St. Peter's Boat, Canis Major became King David, Cassiopeia became Mary Magdalene, and so on..."

Julius Schiller's atlas of the Christian constellations

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The Astronomical Society of Malta

MCST
MALTA COUNCIL FOR SCIENCE & TECHNOLOGY

editor's report

'Islands of astronomy'

This is the title of a paper co-authored by Dr. Godfrey Baldacchino (University of Prince Edward Island, Canada) and Dr. Alexander Gatt (University of Malta) and published in the *Island Studies Journal*, Vol. 4, No.1 (2009). It is the authors' contribution to the International Year of Astronomy 2009.

The two astronomy enthusiasts present a global review of islands and their connections with astronomy throughout history up to the present times. They found eight distinct yet interlocking reasons why islands have been important to astronomy. Perhaps the most significant is the islands' locations, favouring various types of astronomical research such as tracking artificial satellites and monitoring significant celestial events.

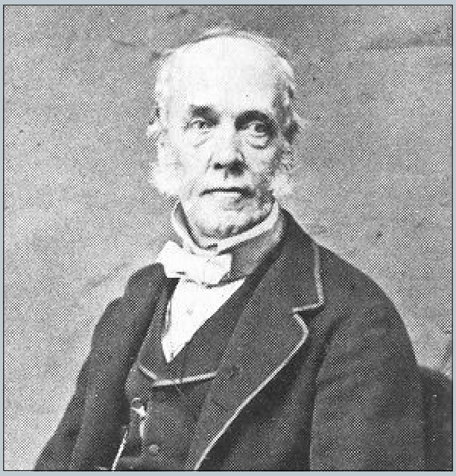
Some islands are found beyond the continents. Thus, they occupy latitudes and longitudes which are well away from the frequented professional observatories. Such far-flung islands are more suitable for the observation of celestial events which may not be fully or conveniently observable from the continental sites. One of the examples sited by the authors is Captain James Cook's expedition to Tahiti (in the Pacific Ocean) in 1769 to observe the transit of Venus across the Sun's surface; that event was not favourably visible from much of Europe and North America.

Malta's case is dealt with in some detail. In the 19th century, the English astronomer William Lassell set up his observatory first at Valletta and later at Sliema. In the latter period he used what was then the largest movable reflecting telescope in the world (aperture 116 cm). In the 1960s the University of Cambridge, England, set up a Solar Research Station at Tal-Virtù in Rabat. In this case the Malta site was chosen from other candidate locations including Nice, Mallorca, Sicily, Crete, Cyprus and Rhodes.

Some islands have also served as launch sites of artificial satellites. For example, from 1963 to 1982 France used the Kerguelen Islands in the Indian Ocean as a sub-orbital rocket launch site for 186 launches. In addition, NASA created an 'emergency' landing facility for the space shuttle on Easter Island in the southeast Pacific Ocean.

The full article may be downloaded from [www.researchgate.net/publication/26624930_Islands_of_Astronomy].■

Tony Tanti,
Editor.



SOURCE: [www.klima-luft.de]

William Lassell's Malta expeditions in the 19th century opened the eyes of north European astronomers to what we now call 'prime sky locations' for big telescopes.

SOURCE: *Solar Physics* 4 (1968)

The building at Tal-Virtù, Rabat, Malta, which housed the Cambridge Solar Research Station during the 1960s and early 1970s.

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ON THE COVER

Few cosmic vistas excite the imagination like the Orion Nebula. The richness of the nebula and the stellar cluster embedded in it, make it an ideal and unique target for astrophotographers. Leonard Ellul Mercer imaged the nebula on February 4, 2010, from his observatory at Attard. He used an SBIG ST10-XME CCD camera attached to his TAK FSQ 106ED telescope.

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feature article

Julius Schiller's atlas of the Christian constellations

Tony Tanti

In the 17th century, the German lawyer and map maker Julius Schiller published a star atlas that depicted the constellations as Biblical and early Christian figures.

Since prehistoric times, Man has been fascinated with the solemn and mysterious parade of the celestial luminaries across the night sky. As the earliest-known texts of various ancient cultures attest, the stars were commonly grouped into constellation figures which were believed to represent divine persons, sacred animals and other objects of religious importance.

Each of the major cultures stemming from the Near and Far East, and the New World developed an indigenous system of constellation figures and associated legends which were recorded in written texts or depicted in maps or on globes.

Of these various constellation systems, the Sumerian-Babylonian one proved to be the most influential as it was the system that through successive adoptions, modifications and additions by Greek, Roman, Islamic and European astronomers, evolved into the defined system of 88 constellations that we use today.

Traditionally, astronomers plot the positions of the stars and the constellation figures in two ways:

Internal view: The constellation figures are depicted on an imaginary celestial sphere as seen from an observer placed in the centre. This is the method commonly adopted in celestial atlases and is most suited for astronomical observations.

External view: The constellation figures are depicted on an imaginary celestial sphere as viewed from the outside. This is the method commonly adopted in celestial globes and is more suited for artistic or tutorial purposes.

During the 17th and 18th centuries, a number of beautiful sky atlases depicting the constellations according to ancient Greek mythology were produced in Europe. The constellations were given allegorical visual representations of heroes and heroines, real and imaginary animals, as well as scientific instruments and artistic tools.

These images were placed in celestial latitude and longitude coordinate systems that allowed the positions of the stars to be mapped in the sky, and formed the backdrop for predictions of the location of the planets and other heavenly bodies throughout the year.

In addition, these atlases contained diagrams of the solar system that reflected both contemporary and ancient cosmological systems, thus tracing the development of Man's view of his place in the universe.

Such images have generally disappeared from modern celestial charts, which instead focus on showing stars and deep-sky objects most of which are not visible with the naked eye.

Johann Bayer's *Uranometria Omnium Asterismorum...* was a major step forward in celestial cartography. First published in 1603, it set the standard for future star atlases due to its beauty and accuracy. One such atlas that was influenced by Bayer's work was Julius Schiller's *Coelum Stellatum Christianum*, published in 1627, the same year of his death.

Julius Schiller (c. 1580-1627) was a prominent Catholic figure who like Bayer practiced law in Augsburg, Germany. He was also a renowned medieval map-maker and an amateur astronomer.

SOURCE: [www.lindahall.org]

The engraved title page of Julius Schiller's star atlas *Coelum Stellatum Christianum.*

feature article

Messier 42, the great stellar nursery of Orion

Tony Tanti

400 years ago, a French amateur astronomer discovered the famous Orion Nebula — a vast star-forming cavern of swirling gas and dust.

The Orion Nebula (M42, NGC 1976) is the brightest diffuse nebula in the sky, and also one of the brightest deep sky objects of all. Shining with the brightness of a star of 4th magnitude, it is visible with the naked eye under moderately good conditions, and rewarding in telescopes of every size. It is also a big object in the sky, extending to over 1° in diameter, thus covering more than four times the area of the full Moon.

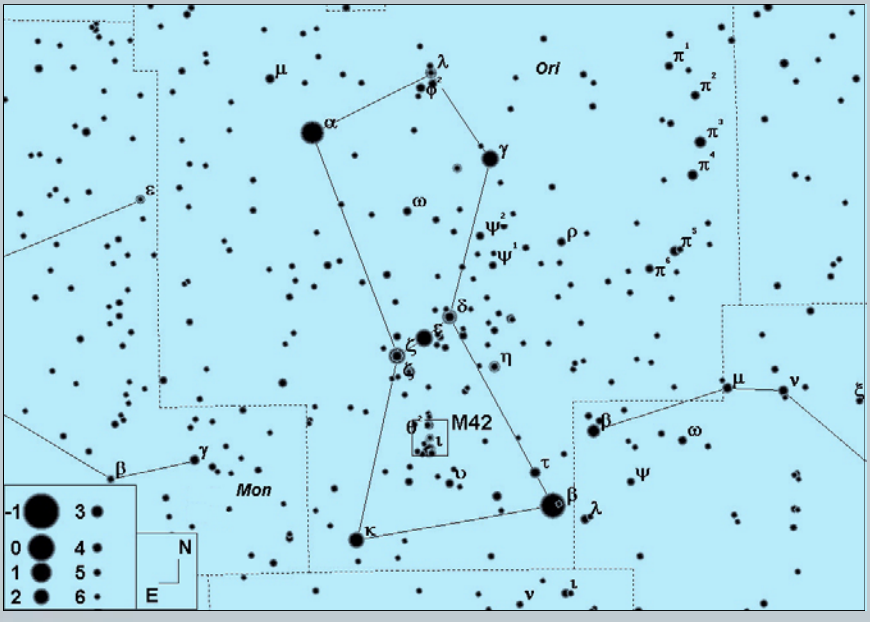
The Orion Nebula is located at a distance of about 1,300 (or perhaps 1,400) light-years. At this distance, its apparent size corresponds to a linear diameter of about 25 light-years.

As the Orion Nebula is so well visible to the naked eye, one may wonder why its nebulous nature was apparently not documented before the invention of the telescope. In particular, neither Ptolemy (c.90-c.168 AD) in the *Almagest*, nor Al Sufi (903-986 AD) in his *Book of Fixed Stars* noted this nebula, even though they both listed patches of nebulosity elsewhere in the night sky. Curiously, the nebula was also not mentioned by Galileo, even though he made telescopic observations of this part of the constellation in 1610 and 1617. This has led to some speculation that a flare-up of the illuminating stars may have increased the brightness of the nebula. Only some Mayan folk tales may be interpreted in a way suggesting that these native Americans may have known of this nebulous object in the sky.

The Orion Nebula is generally credited as being discovered telescopically in late 1610 by the French lawyer Nicholas-Claude Fabri de Peiresc. He noted in his own records: [November 26, 1610] "In Orione media... Ex duabis stellis composita nubecula quandam illuminata prima fronte referebat coelo non oio sereno." [In the middle of Orion... Composed of two stars, there is a nebula [..]]. De Peiresc made several other sightings of the Orion Nebula in the following months.

Peiresc's observations were not published but only reported in his observation log book. They were brought to light by Guillaume Bigourdan in 1916. The nebula was independently found in 1611 by the Jesuit astronomer Johann Baptist Cysatus (1588-1657) of Lucerne, Switzerland, who compared it to a comet. The first known drawing of the Orion Nebula was made by Giovanni Batista Hodierna, and the nebula found its way into Charles Messier's list as object number 42.

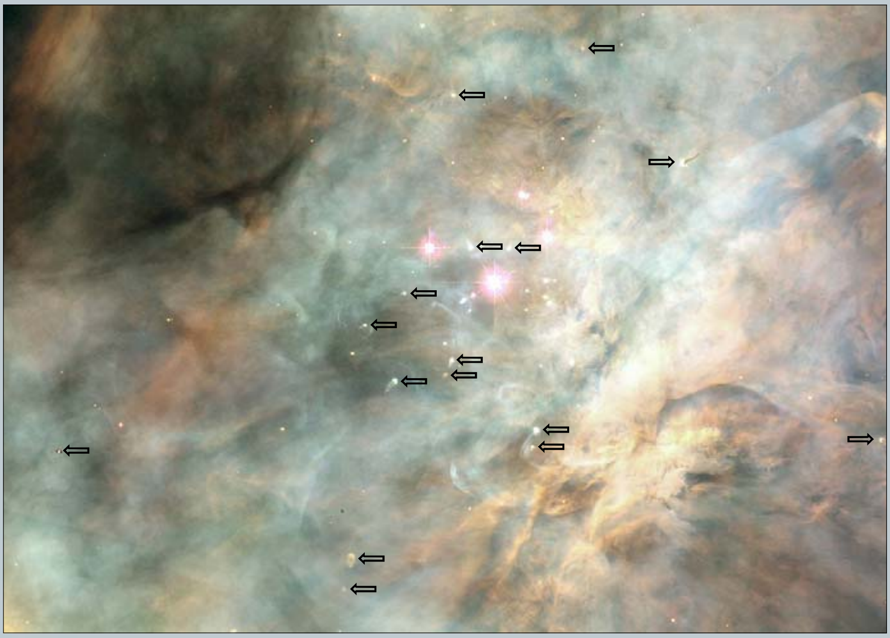
The gaseous nature of the Orion Nebula was revealed in 1865 with the help of spectroscopic observations by



Guide 8.0

SOURCE: [http://en.wikipedia.org]

Above: **The wonderful Orion Nebula (M42) can be found very easily about 4° south of the prominent Belt of Orion (the three bright stars in the centre of the map). It marks the Hunter's Sword which dangles from his belt.** ***Right:*** **Nicholas-Claude Fabri de Peiresc (1580-1637), the discoverer of the Orion Nebula.**



SOURCE: [www.nasaimages.org]

A section of the Orion Nebula with proplyds (arrowed) from the Hubble Space Telescope. The most obvious ones are near the Trapezium (the four bright stars above centre) and some of them have tails. Light pressure from the Trapezium is blowing away some of the gas and dust that forms the proplyds.

William Huggins. On September 30, 1880, M42 was the first nebula to be successfully photographed, by Henry Draper. Consequently, on March 14, 1882, Henry Draper obtained a second, better photograph of the nebula, which also clearly showed M43, a few degrees to the north.

The Orion Nebula is the brightest and most conspicuous part of a much larger cloud of gas and dust which extends over 10°, well over half the constellation of Orion. The linear extent of this giant cloud is several hundreds of light-years. It can be visualised by long exposure photographs and contains, besides the Orion nebula near its centre, other objects, often famous on their own, such as Barnard's Loop, the Horsehead Nebula, and the reflection nebulae around M78.

At the heart of the nebula is the multiple star system θ Orionis, also called the Trapezium, so-named because it looks like a tiny trapezoid. There are actually six stars here, though you need a moderately large telescope to resolve them all. The stars of the Trapezium, which are just 100,000 years old, have blown a bubble in the surrounding gas that gives us a view of the nebula’s inner core.

This gem in the sky has been observed continuously by the Hubble Space Telescope (HST). The telescope provided basic information about the process of star and planet formation. It discovered a large number of stars with circumstellar material which have been called ‘proplyds’ (short for protoplanetary disks). This discovery provided for the first time direct evidence for material around other stars that would eventually develop into solid bodies like planets, comets etc.

Viewing the Orion Nebula with binoculars

Orion the Hunter is best viewed in the winter months anytime after 8 p.m. Face southeast and look up to find the constellation. Orion is the most easily identified star group in the sky except for perhaps the Plough in Ursa Major. It consists of several bright stars and the main body of Orion is a rectangle with bright stars in opposite corners along with a three-star Belt across the Waist of the Hunter.

Once you have found Orion look at his Belt. The three stars that compose it are bright enough to not be mistaken as anything else. When you have found the Belt, look down from the middle star. There will be three stars that seem to be hanging from the Belt in such a way that they seem to form a Sword.

Observe the Sword of Orion closely. The three stars are not bright by the standards of the rest of this sparkling constellation but can be seen without difficulty, even when it is not totally dark outside. Raise your binoculars and focus them on the Belt and Sword region of Orion. Make sure that your eyes have become adjusted to the darkness.

Slowly sweep down with your binoculars until you find the middle ‘star’ of the Sword. It will not appear as a point of light such as the other stars do, but as a hazy patch. This is the Orion Nebula. Once you have found it you will be able to show it to your family and friends without any difficultly. Realise that with binoculars the nebula will not look at all as spectacular as the deep space photographs that depict it, but it is still a great sight to behold.■

Further reading: Watch the 3D volume visualisation of the Orion Nebula on *Youtube* [www.youtube.com/watch?v=UCp-XKeSvSY] constructed by VisLab in Australia from images obtained by the Hubble Space Telescope.

A sketch of the Orion Nebula made by the author on the evening of February 9, 1977, with an 80-mm refractor, magnification 96. Note the Trapezium near the centre.

Jupiter loses a belt — a familiar planet looks very strange

When Jupiter reappeared in the predawn sky last spring to begin its 2010 apparition, observers were struck by a dramatic change in the planet's appearance. The planet's huge, rusty-hued band of clouds known as the South Equatorial Belt (SEB) had vanished.

The first to note the SEB's disappearance was Australian amateur Anthony Wesley who was photographing the planet on May 9. Wesley is a veteran Jupiter watcher who discovered a dark blemish on the gas giant in July 2009 that turned out to be an impact on Jupiter, most likely from a comet. Wesley also spotted a giant blizzard on Saturn earlier this year.

This is not the first time that the SEB has faded from view, and it probably will not be the last. The SEB disappeared in 1973-75, 1989-90, 1993, and 2007. The 2007 fading was terminated rather early, but in other years the SEB was almost absent, as at present.

Jupiter is wrapped in cloudy yellow, brown and white stripes, created by winds that blow at various latitudes and in different directions. The colours of the cloud bands reflect slight differences in chemical composition. Propelled by strong wind, these clouds can whisk around the planet at hundreds of kilometres per hour.

High-elevation clouds can be found in the 'belt' regions of Jupiter's atmosphere. Belt clouds are darker than those in the relatively low-elevation 'zone' regions. The winds in belts and zones flow in opposite directions.

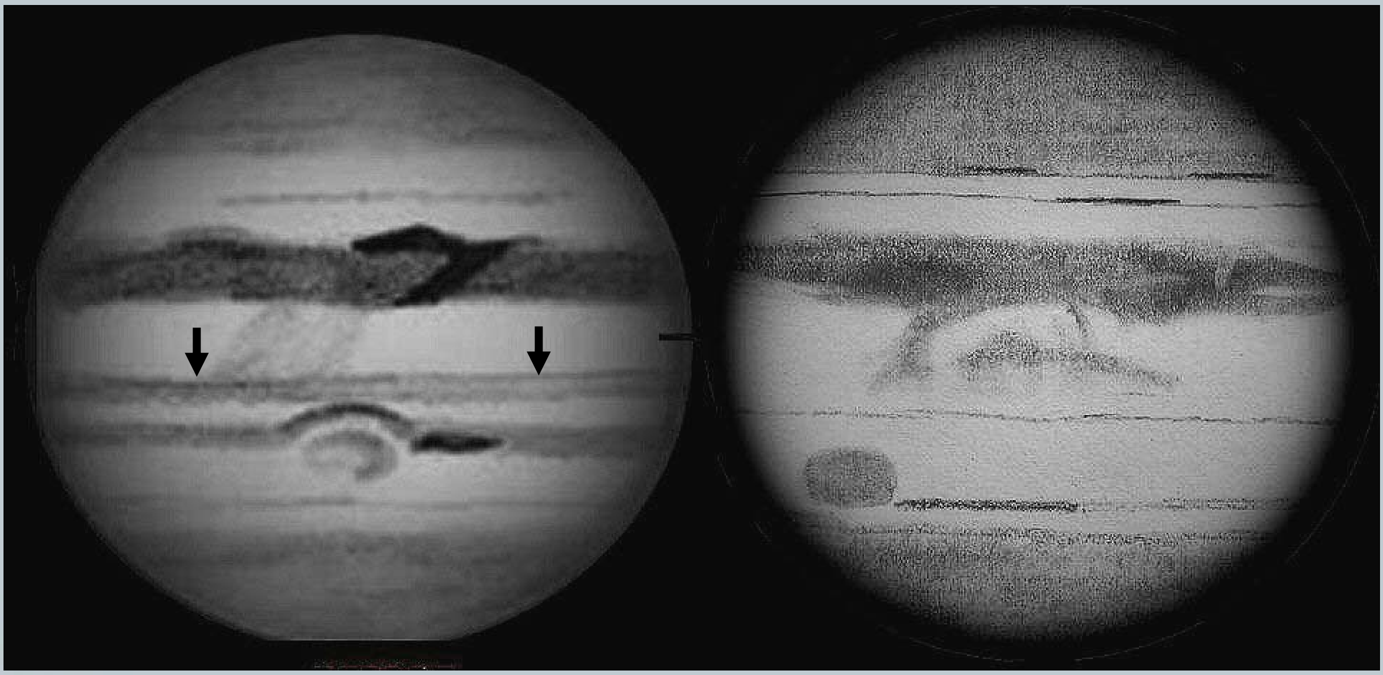
Jupiter's trademark Great Red Spot, a massive storm that could fit two Earths inside, is typically found along the edges of the planet's SEB.

The SEB itself is also massive in size — the cloudy band is twice as wide as Earth and more than 20 times as long. In fact, the loss of such an enormous 'stripe' can be seen with ease from Earth.

In any size telescope, Jupiter's appearance has always been marked with two broad equatorial belts. Anyone who turns his/her telescope on Jupiter at the moment will see a planet with only one belt — a very strange sight.

Scientists can, however, look forward to the SEB's return, which can be a dramatic experience. They expect a spectacular outburst of storms and vortices when the 'SEB Revival' begins. Normally, the revival starts at a single point, and the disturbance spreads out rapidly around the planet from there, often becoming spectacular even for amateurs equipped with medium-sized telescopes. Although we cannot predict when or where it will start, based on past events, it could be any time in the next 2 years.

Jupiter, is currently shining very bright high in the south in the middle of the night.■



These comparison drawings of Jupiter, made by Dr. Charles Galdies with a 20.3-cm Schmidt-Cassegrain telescope at magnification 167, show the planet's lost South Equatorial Belt. *Above left:* Jupiter with its Southern Equatorial Belt (arrowed) and the oval red spot as seen on October 4, 2009, at 22:20 Universal time. *Above right:* A sketch made on August 7, 2010, at 22:40 Universal Time evidently shows the missing South Equatorial Belt and the freely floating red spot.

Mira shines at maximum light

Every autumn as the constellation Cetus enters the evening sky, starwatchers everywhere look for Mira, the brightest of the long-period variable stars. With a period averaging 332 days, Mira comes to maximum one month earlier each year. In 2010, Mira should be at its maximum brightness in October. It will probably be easily visible to the naked eye through the end of November.

Mira is located in a dim region about 10° southwest of of Cetus' head and 30° southwest of the Pleiades and Hyades star clusters. Cetus is still low in the east-southeastern sky at the times for which the all-sky map distributed with the September *Newsletter* is plotted. An hour or two later Cetus will be higher and easier to see.

Credit for the discovery of Mira is traditionally given to David Fabricius (1564-1617) a Dutch clergyman and amateur astronomer. On August 13, 1596, he noticed a 'new' star in the neck of Cetus. The intruder was missing from every star catalogue, atlas and globe that Fabricius checked. He saw it again at the beginning of September and watched it fade below naked-eye visibility around mid-October.

There is, however, a good chance that Fabricius' observations were not the first of Mira on record. Just four years earlier, Korean and Chinese astronomers had noted a 'guest star' in Cetus on November 28, 1592, that remained visible for 15 months (presumably not all the time). This could have been Mira seen at separate maxima four and three cycles earlier than Fabricius' sighting.

When Fabricius saw Mira, he believed it to be a nova, like the one seen by Tycho Brahe in 1572 in Cassiopeia (which is today classed as a supernova). Not until 1667 was it realised by Ismael Boulliau (1605-1694) that the star repeatedly brightens and fades.

Johannes Hewelcke (better known by his Latinised name Hevelius) began observing Mira regularly in 1648, and in 1662 he published a pamphlet about the star entitled *Historiola Mirae Stellae*, 'Brief History of the Wonderful Star.' This is widely given as the source of the star's popular name, though apparently Fabricius was first to call Mira, 'The Wonderful.'

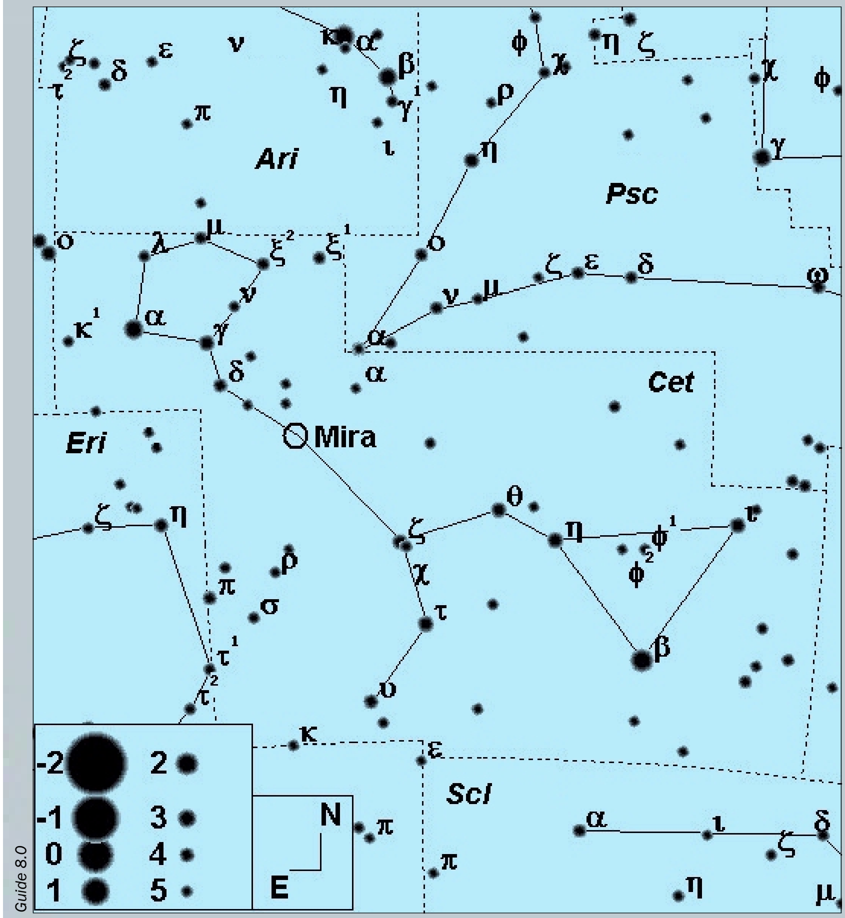
Attempts to explain Mira's behaviour began as soon as its periodic nature was recognised. Boulliau thought the star was a rotating globe, almost uniformly dim except for one very bright spot. Pierre de Maupertuis (1698-1759) suggested Mira was a flattened object resembling Saturn's rings seen in different orientations at different times. Edward Pigott (1753-1825) thought the star was eclipsed periodically by an opaque satellite. Most of these early ideas have turned out to be the correct explanations for other types of variable stars, but not for Mira!

The correct explanation was finally provided by Sir Arthur Eddington, who demonstrated in 1926 that Mira-type stars are pulsating much the way Cepheid variables do, but with longer periods because of their more distended physical size. We now know that Mira is also a binary star.

Estimates of Mira's distance made prior to the launch of the Hipparcos satellite ranged from about 100 to nearly 600 light-years. Data from the Hipparcos satellite now suggests a distance of 418 light-years, albeit with a margin of error of about 14%.

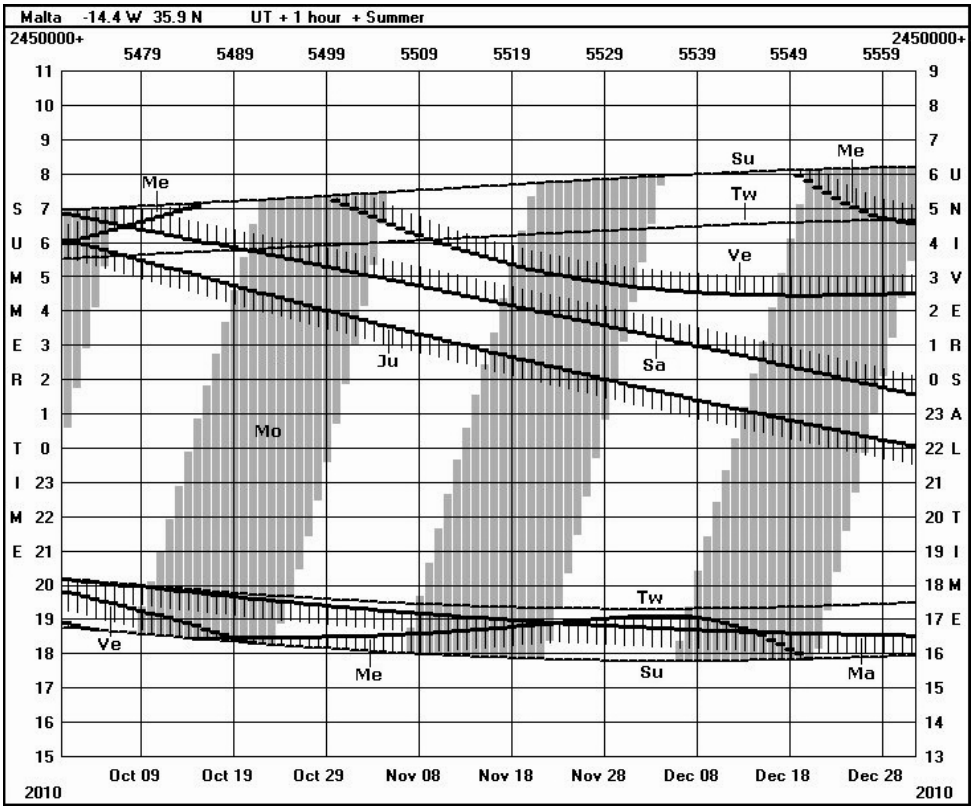
The giant's diameter could be about 400 times the Sun's, big enough to include the orbit of Mars, and of course Earth's.

The *Handbook* of the British Astronomical Association predicts that Mira will reach a peak



Mira is an easy target for binoculars and sometimes the naked-eye. Also called Omicron (o) Ceti, it is the prototype long-period variable star.

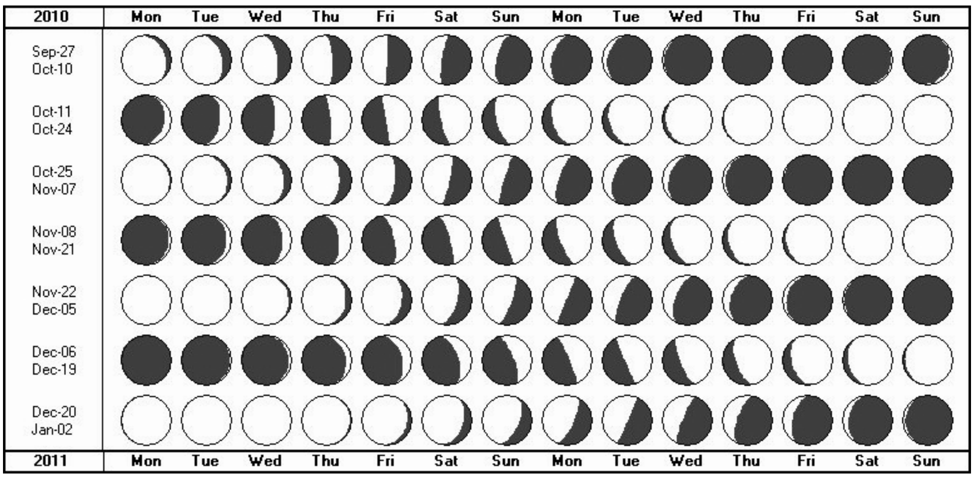
sky agenda autumn 2010



THE SKY TONIGHT: For any date during autumn, the chart above tells the time when astronomical events occur during the night. Dates on the chart run horizontally from left to right. Time runs vertically from bottom to top, and is labelled along the left and right sides. Find the date you want on the bottom side of the chart, and read upward to find the times of the rising and setting of the Sun, Moon and the five naked-eye planets, as well as the beginning and end of astronomical twilight (Sun 18° below the horizon). Tick marks on planet lines denote rising if above, setting if below a line.

As an example, take the night of October 9-10: the Sun (Su) sets at 18.6 hrs Central European Summer Time, Venus (Ve) sets at 19.3 hrs, the Moon (Mo) sets at 19.5 hrs, Mars (Ma) sets at 20.0 hrs, twilight (Tw) ends at 20.0 hrs, Jupiter (Ju) sets at 5.5 hrs, twilight begins at 5.7 hrs, Saturn (Sa) rises at 6.4 hrs, Mercury rises at 6.6 hrs, and the Sun (Su) rises at 7.1 hrs. Julian dates (each day begins at 12:00 Universal time) are given at the top of the chart. Thus, the Julian date of the night October 9-10 is 2455479.

PHASES OF THE MOON: The chart below shows the phases of the Moon for each day during the next three months. The phases are drawn for 0 h Universal time (2 h Central European Summer Time) on the date indicated and are arranged fortnightly. The diagrams on this page were created with the *GraphDark* 1.06 software.



October

01: Saturn in conjunction with the Sun.
08: Mercury 0.°6 south of Mars (too close to the Sun).
16: The variable star Mira Ceti at maximum; see page 10.
17: Mercury at superior conjunction (on the far side of the Sun).
20: Periodic Comet 103P/Hartley 2 closest to Earth, distance 18 million km; this is Hartley 2's closest approach since its 1986 discovery and one of the closest approaches of any comet in the last few centuries; the comet should be an easy binocular object in Auriga.
24: Mercury 7.°2 north of Venus (too close to the Sun).
29: Venus at inferior conjunction (between Sun and Earth).
30: Fifth lunar phase (first quarter) of the month.

November

04: NASA's EPOXI spacecraft flies by the nucleus of Comet Hartley 2.
05: Taurid meteor shower at maximum; ZHR 10; very favourable.
12: Autumn equinox on Mars.
18: Leonid meteor shower at maximum; ZHR 20; unfavourable.
21: Mercury 1.°7 south of Mars (in the evening sky).

December

01: Mercury at greatest elongation east (21°); visible in the morning sky.
14: Geminid meteor shower at maximum; ZHR 100; Moon a problem before midnight; see page 11. Mercury 1.°0 north of Mars (in the evening sky).
20: Mercury at inferior conjunction.
21: Total lunar eclipse; in Malta the Moon sets at 7:11 a.m. CET during the first penumbral phase. The nearly full Moon occults μ Geminorum (mag. 2.9); the star will reappear at the dark limb at 6:51 p.m. CET at position angle (PA) 234°.
22: Winter solstice at 00:38 CET.
27: Pluto in conjunction with the Sun.