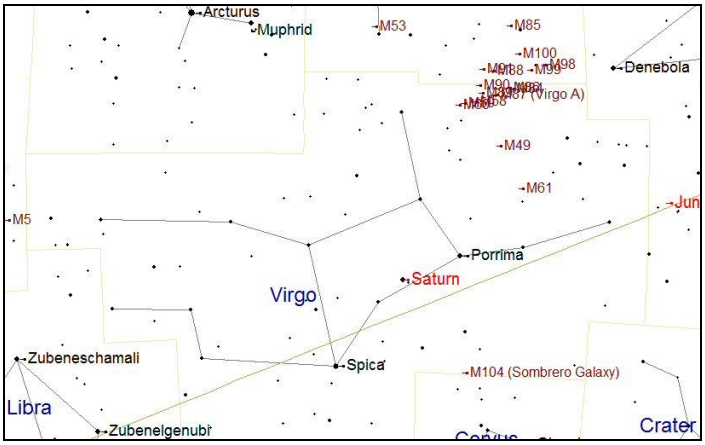
NEWBURY ASTRONOMICAL SOCIETY
BEGINNERS MAGAZINE - APRIL 2011

THE CONSTELLATION OF VIRGO



Virgo is one of the constellations of the Zodiac and sits on the imaginary line known as the Ecliptic. The Ecliptic is shown as the line running from the centre right to the bottom left corner on the chart above. This line represents the apparent path that the Sun, Moon and planets take as they cross the sky. In astrology the constellations that the ecliptic passes through are known as the constellations of the Zodiac. The signs that are used to represent these constellations are known as the signs of the Zodiac.

As Earth orbits the Sun (once a year) the constellations of the Zodiac appear to move slowly across the sky from east to west. Virgo appears over the eastern horizon in the spring and follows the constellation of Leo across the sky. The star Denebola (the tail of Leo the Lion) can be seen in the top right corner of the chart above. The constellation of Libra follows Virgo and can be seen in the bottom left corner of the chart above.

The constellation of Virgo is not very well positioned for observing from Britain as it is always low in the sky. It does however host many interesting objects. The real interest for astronomers is the cluster of galaxies that spans a large area of sky running through Virgo into Coma Berenices and spilling over into Leo. Eleven of these galaxies are bright enough to have been included in Charles Messier's catalogue of 'fuzzy' objects (objects that amateur astronomers are interested in).

M64 is a beautiful spiral galaxy known as the Black Eye Galaxy and is one of the most interesting. It is called the Black Eye because it has a dark lane of dust close to its nucleus.

M64 The Black Eye Galaxy

The Constellation of Virgo appears over the eastern horizon at about 20:00 BST at the beginning of April and 18:00 by the end. There is only one bright star in Virgo and that is Spica. All the stars except Spica will be difficult to see in the murky air close to the horizon so Spica would normally be the first indication that Virgo had risen at 21:00 BST in the beginning of April. However there is another bright object in Virgo this year, the beautiful planet Saturn which rises at 19:30 at the beginning of the month and 17:30 by the end.

Spica is a bright blue / white 'B' class star that shines with an apparent magnitude of +0.98. It has an intrinsic brightness 2300 times brighter than our Sun. It is 280 light years away and is the 16th brightest star that we can see in our sky. When examined using a spectroscope Spica appears to have two separate spectra indicating it is comprised of two stars. They are so close together that they cannot be separated using any telescope.

The thing about Virgo that really excites astronomers is the richness of galaxies in this area. The Virgo Cluster is the largest group of nearby galaxies that are within reach of amateur astronomers using modest sized telescopes. Part of the cluster can be seen at the top right of the chart opposite. Only the brightest galaxies are labelled in the chart. It is thought that the Virgo Cluster is gravitationally associated with our own local cluster as part of a super cluster of galaxies. For the average amateur astronomer these galaxies can just be seen as fuzzy patches of light. However it is incredible to think that the light entering our eyes left these galaxies over 65 million years ago, while dinosaurs were walking the Earth.

Saturn is the main interest in Virgo this year and it will be reaching opposition on 3rd April. This is when Saturn will be due south at midnight and means that it is dead centre of the sky when we are at the centre of Earth's dark side. Saturn will also be at its highest point and its best position in the sky for observing at this time. The ring system is beginning to open up now after being closed during 2009 and 2010 so more detail on this magnificent planet can be seen. See the article on Page 3.

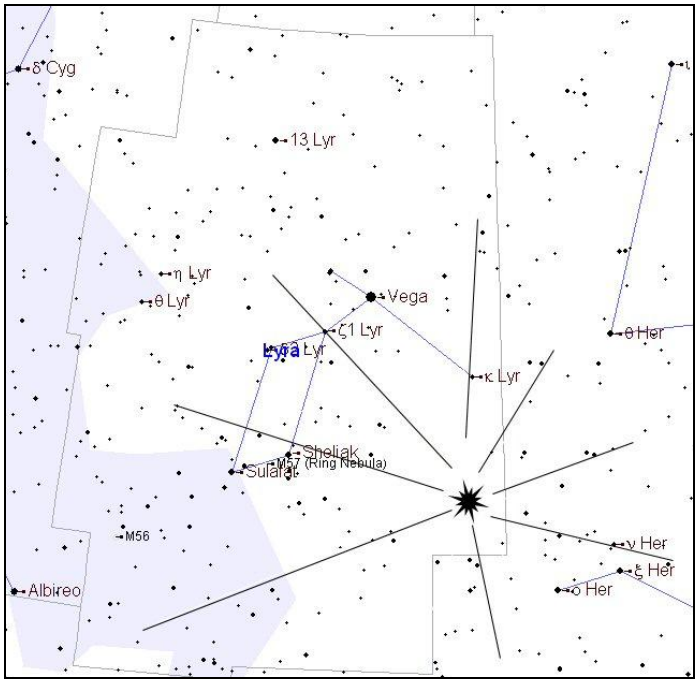
Saturn imaged by Steve Harris on 13th March 2011

VISITORS FROM SPACE – THE LYRID METEOR SHOWER

During April every year there is an increase in the number of meteors, normally between 19th and 24th, this increase in numbers is known as a Meteor Shower. The April shower is known as the Lyrids. The best time to watch for the Lyrids will be the evening of 22nd and morning of 23rd April especially around 01:00 when the shower should be at its peak.

Some bright meteors originate from collisions between lumps of rock and metal called asteroids located between Mars and Saturn; these are generally bright and normally appear singly.
The types of meteors that occur in showers originate from comets and are much more common than the 'Fireballs' that originate from asteroids. A comet can be thought of as a giant dirty snowball. As the comet approaches the Sun, the frozen gases and water boil off and are blown away by the radiation from the Sun. Dust particles released by the melt are heavier and therefore continue more or less on the same orbit. These particles spread out along the orbit path and may eventually form a complete ring around the Sun. Once a year the earth may pass through this stream of particles that then enter the atmosphere as meteors. Travelling at between 11 and 76 kilometres per second they burn up in the thin atmosphere at a height of about 100 kilometres.

Different particle streams may be inclined at different angles to the Earth's orbit, therefore meteors can enter the atmosphere at almost any angle but each stream always appears to radiate from the same area of the sky each year. The shower this month will appear to radiate from the constellation of Lyra which is why it is called Lyrids. The Leonids are the brightest shower and are seen in November. They are associated with Comet Temple – Tuttle that returned to loop around the Sun back in 1998.



The Lyrid radiant point

The Radiant point of the Lyrid meteor shower is always located to the west of the familiar shape of Lyra and its very bright star Vega. See Lyra on the chart above and the top left of the chart on Page 6. Although Lyra does not appear over the eastern horizon until 10 o'clock BST meteors may be seen rising up over the horizon before the constellation appears. The number of meteors is usually at its highest after midnight because at this time Earth is ploughing headlong into the particle stream.

No equipment is needed to observe meteors, just sit on a reclining chair or lie on the ground and look up. On any night there will be a few stray meteors called sporadic meteors but during showers there may be as many as one or more every minute. A meteor shower usually lasts from a few days to a couple of weeks, often with a peak in the middle of the period. Even if you have no equipment, it can be quite interesting and good fun to plot on a star chart the path of any meteor seen. At the end of the observing session it should be possible to trace the paths of most of the meteor trails back to the radiant point in Lyra. It is usually easier to do this with two or three other people so the task of marking the paths and observing can be shared. One person cannot cover the whole area of sky that the meteors can travel across.
If you have a camera with a shutter that can be held open for a period of time the meteor radiant can be photographed. The camera can be mounted on a tripod or simply placed on a table or wall with the shutter open. If left long enough the rotation of the Earth will cause the stars to form streaks or arcs around the pole star. The longer the shutter is left open the more meteors may be caught on camera. The picture below shows what can be achieved using this simple piece of equipment.

The very active Leonid meteor shower 2001

It is also possible to use a video camera to film the meteors. To do this, point the camera up into the sky towards the east. If the camera has night vision, then turn it on or slow down the shutter speed. Switch the camera on and wait and see what you catch. The following table lists the main meteor showers and the date of the evening of the shower peak.

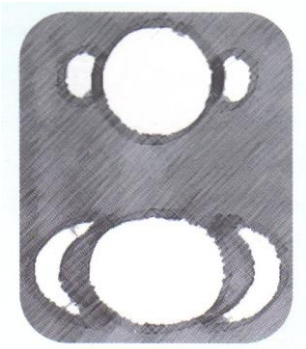
PERIOD	SHOWER NAME	MAXIMUM
Jan 1 - 4	Quadrantids	Jan 3
April 19 - 24	**Lyrids**	**April 22**
May 1 - 8	Eta Aquarids	May 4
June 17 - 26	Ophiuchids	June 19
July 15 - Aug 15	Delta Aquarids	July 27
July 15 - Aug 20	Piscis Aquarids	July 31
July 15 - Aug 25	Capricornids	Aug 2
July 27 - Aug17	Perseids	Aug 12
Oct 6 – Oct 10	Draconids	Oct 8th
Oct 15 - 25	Orionids	Oct 21
Oct 26 - Nov 16	Taurids	Nov 3
Nov 15 - 20	**Leonids**	**Nov 17**
Dec 9 - 14	Geminids	Dec 13
Dec 17 - 24	Ursids	Dec 23

SATURN – THE RINGED PLANET

Saturn, with its magnificent ring system, is surely the easiest planet to recognise. Any poster or cartoon depicting a space scene will almost certainly have a planet with a ring system looking somewhat like Saturn. All the large outer planets also have ring systems but these are all feeble compared to Saturn's.

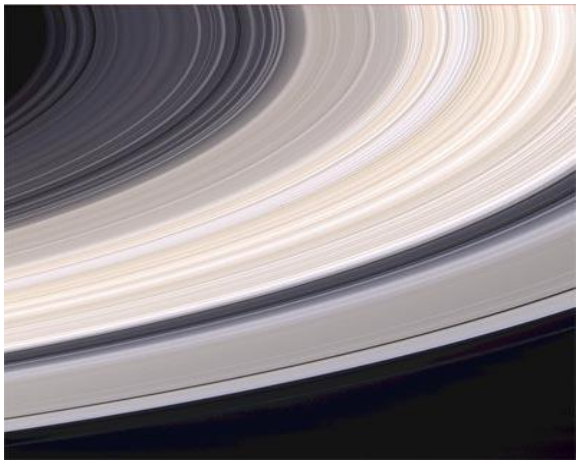
Saturn imaged in 2003 with the rings wide open

Since the very early days of telescope astronomy Saturn appeared to have something odd about it. Galileo thought it sometimes looked as it had 'ears' or handles like a jug. His first telescopes in the early 1600's were too small and too primitive to see any detail.



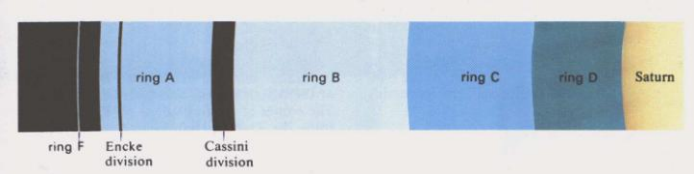
Galileo's sketch of Saturn with 'ears' 1610

In 1655 Christian Huygens recognised that Saturn had a ring. It wasn't until 1675 that Giovanni Cassini recorded seeing the gap in the rings that is now named after him. As the size and quality of telescope optics improved more detail could be made out. We generally think of Saturn as having 'a ring' but in fact it has a complex ring system comprised of hundreds of rings. Until the planet was visited by exploratory probes the finer details of the ring system could not be fully appreciated.



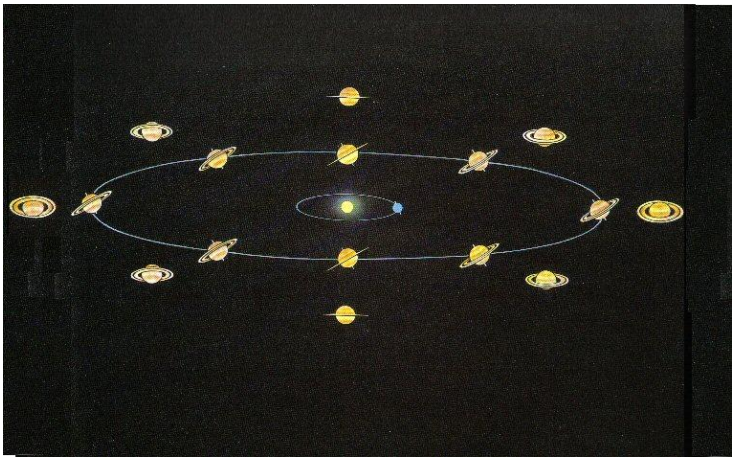
The rings imaged by the Cassini Probe in 2005

It has not been conclusively established how the ring system was formed. One theory is that a comet strayed too close to Saturn and the enormous gravitational forces pulled the comet apart. The lumps of water ice and dust were pulled into orbit around the giant planet. Until recently it was a mystery how the rings had lasted so long. Studies had estimated that the rings had been in existence for at least a million years and perhaps much longer. When the Pioneer II probe passed close to Saturn in 1979 it imaged two moons orbiting on the outside of the ring system. These moons named Pandora and Prometheus were found to be moving the particles in the rings and preventing them from straying out of their positions and falling into the planet. These moons became known as 'Shepherd Moons' because they appeared to be herding the ring like a shepherd looking after his flock of sheep.



The designations of the main rings

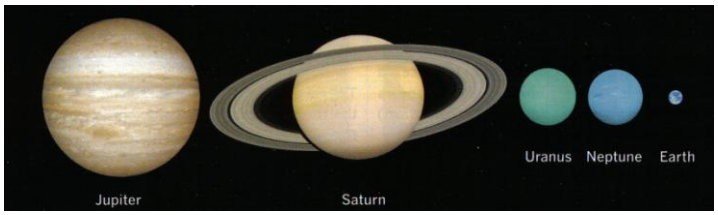
Although the rings are permanent, at least in terms of our lifetime, they do appear and disappear over a periods of about 7 years. This is because we on Earth view the rings from different angles as we and Saturn orbit the Sun. In 2003 we were looking at Saturn when it was tilted with its south pole towards us. (Shown at the extreme left position in the diagram below). We were therefore able to see the ring system tilted towards us. In this position we could see the underside of the rings wide open, as shown in the image at the beginning of this article.



After 7½ years Saturn will have completed approximately a quarter of its 30 year long orbit around the Sun and will be at the lower position shown in the diagram above. Therefore in 2009 we were looking at Saturn side on. As the rings are very thin they will disappear almost completely for a few months. Over the next 7½ years the rings will gradually open out again until in 2017 we will see the top surface tilted towards us as show in the position at the right of the diagram. The closing sequence will then continue until 2025 when we will again view the rings side on as shown at the top position in the diagram. Eventually in 2032 Saturn will return the same position it was in 2003 where the rings will be tilted towards Earth and wide open again.

The rings are beginning to look impressive again, even in a small telescope (100mm aperture). Over the next 5 years they will appear to open out fully. During 2009 and 2010 the rings were difficult to see even using larger telescopes now they are easy to see.

Saturn is the second largest planet in our Solar System after Jupiter. The planet itself is 120,000 km in diameter at the equator but is flattened to 108,000 km at the poles due to its rapid rotation. Although Saturn is 10 times the diameter of Earth it rotates on its axis (1 day) in only 10 hours 14 minutes. The rings are 275,000 km (170,000 miles) across but may be less than a hundred metres thick. To put this in perspective, the ring diameter is almost the same as the distance from Earth to the Moon. The rings are made up of millions of small pieces of mainly water ice and possibly some rocks varying in size from a few millimetres to a few metres across.



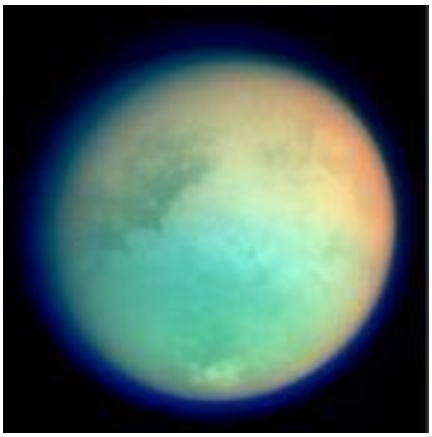
The sizes of the giant outer planets compared to Earth

Like Jupiter, Saturn is a gas giant planet. This means it has no solid surface that a probe craft could land on. The majority of the planet (96.3%) is made up of Hydrogen gas with 3.7% Helium and traces of Ammonia and Methane.

Despite being 1.4 billion kilometres from the Sun, huge summer storms erupt in the hemisphere facing the Sun. Just last month the Cassini Probe observed a storm break out and spread all the way around the planet. The cloud markings are not as distinct as those on Jupiter but the storms are just as violent.

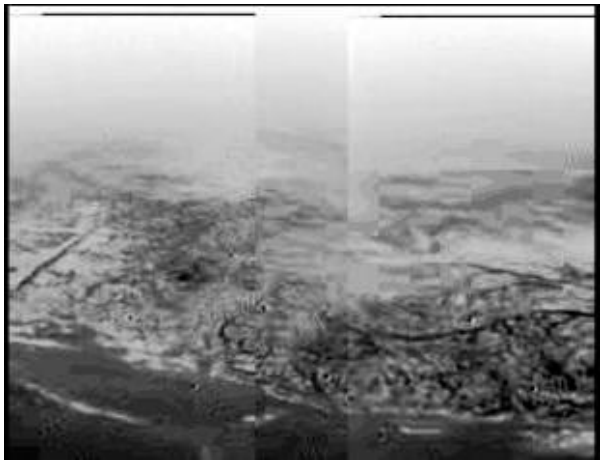
SATURN'S MOONS

Saturn has dozens of moons, both large and small. Titan is the largest at 5,150 km in diameter and is one of the most intriguing moons in our solar system. It has a thick atmosphere and appears to have oceans, clouds and rain, all comprised of Methane, rather than water as on Earth.



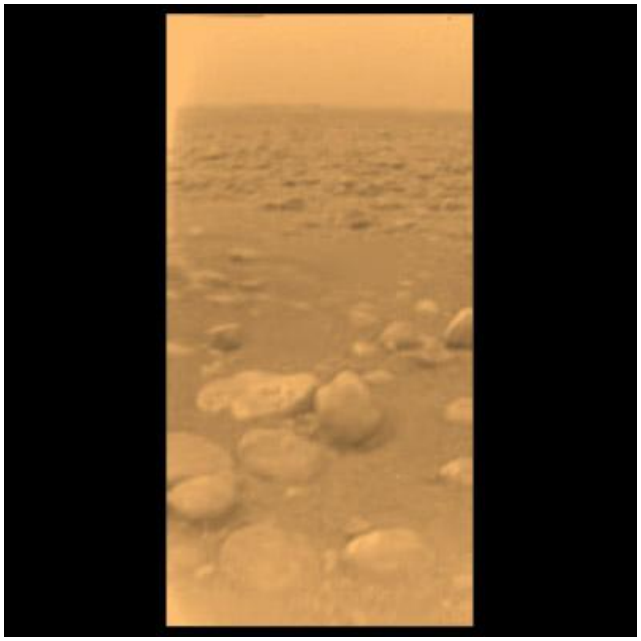
Titan imaged by Cassini in 2005

A space probe called Huygens, which was part of the Cassini - Huygens probe, landed on Titan in January 2005. The Huygens lander had a camera on board that took pictures as it descended on a parachute through the atmosphere. The following image appears to show a shoreline on the edge of a sea. The sea is not water but liquid or frozen Methane gas at about -180°C. There also appear to be gullies or streams running from the frozen land towards the sea. These may be run-off channels formed by methane rain or where frozen Methane has melted and flowed down to the Methane sea.



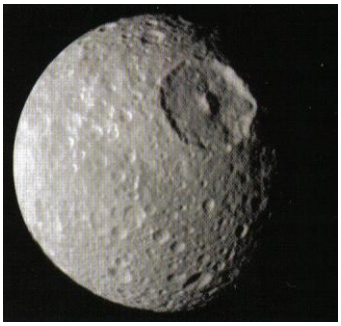
An image taken by Huygens as it descended to the surface

As Huygens touched down a probe was pushed into the surface to establish what the surface might be made of. The result seemed to indicate that it had landed on something like damp sand. It is now thought that the surface might have been partly frozen Methane. The last image taken by Huygens was of the surface beside the landing site. It showed rocks of water ice that appeared to be rounded like pebbles in a stream. These may have been washed along when liquid Methane flowed over the surface during a slightly warmer period.



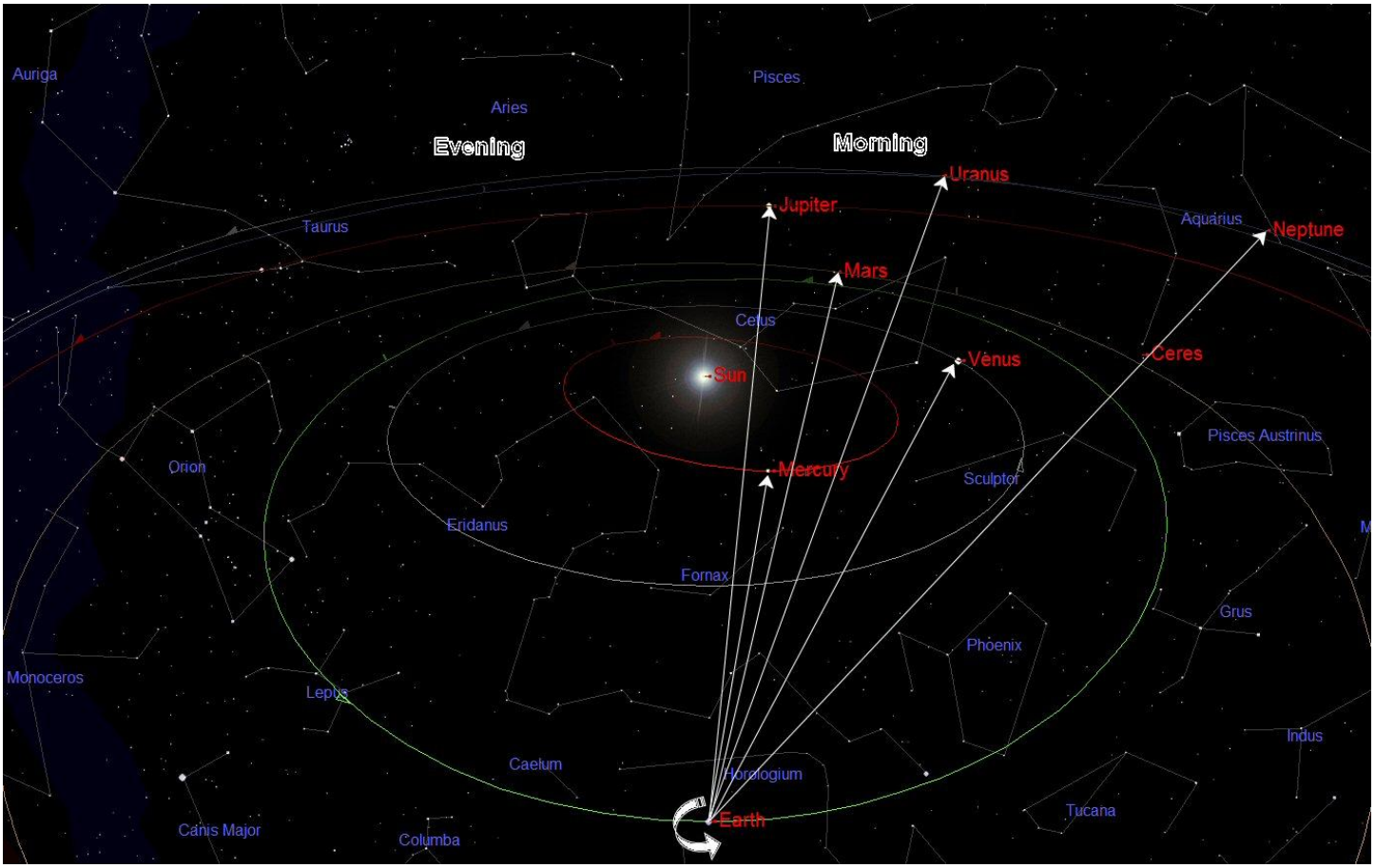
The last image taken on the surface of Titan

Saturn has eighteen other significant moons of various sizes. One interesting looking moon is Mimas which has a huge crater compared to its size.



Saturn's moon Mimas

THE SOLAR SYSTEM THIS MONTH



The positions of the planets in the middle of this month (Saturn is behind our point of view)

The chart above shows the positions of the planets as viewed from Earth in the middle of April. Earth rotates anti-clockwise therefore objects will appear over the eastern horizon in the morning in sequence starting from Neptune followed by Venus. Uranus, Mars, Mercury and Jupiter will rise just before the Sun but will be lost in the Sun's glare.

MERCURY sets in the west soon after the Sun at the beginning of the month. On 23rd March it was at greatest elongation and at its best position for observing for the whole of this year. After greatest elongation Mercury began moving back towards the Sun. On 9th April Mercury will be between Earth and the Sun then emerge as a morning object.

VENUS rises over the eastern horizon at about 05:30 at the beginning of the month and is visible as a bright star in the early morning sky until about 06:00 when the sky brightens. A telescope will show it at its '¾ Moon shaped' gibbous phase.

MARS is very close to the Sun and will not be visible until it has moved further away from the Sun later this year. During May this year there will be an interesting grouping with Mercury, Venus and Jupiter in the east just before sunrise.

JUPITER is very close to the Sun and not observable.

SATURN rises over the eastern horizon at about 19:15 at the beginning of the month and 17:45 by the end of the month and will reach opposition on 4th April. It will therefore be visible for most of the night. The rings are opening out now after being closed up and almost disappearing last year.

URANUS is very close to the Sun and not observable.

NEPTUNE is moving out from conjunction with the Sun and will just be visible (with great difficulty) in the east before sunrise.

METEORS. There is a fairly good shower this month with its peak of activity at around 01:00 on 23rd April. See Page 2.

THE MOON is always a good target for binoculars or a small telescope. It is also the first object for a beginner to go for because it is large and bright. The best times for observing the Moon will be during the periods 6th – 15th and 21st – 29th April. During these times the terminator (the boundary between light and dark) will cross the surface bringing different areas into better view due to the long shadows being cast by the sunlight. During full Moon there are no significant shadows so details are difficult to make out.

THE SUN has an eleven year cycle of increasing sunspot activity. The period of maximum activity has been very sparse until a few months ago, however a number of large spots appeared during December 2010 and January 2011. February was quiet but during March there were a number of very good Sunspot groups. The Solar maximum will reach its expected peak during 2013 when there should be more activity and Sun Spots.

NEWBURY ASTRONOMICAL SOCIETY MEETING

1st April — The Latest Results from SWIFT

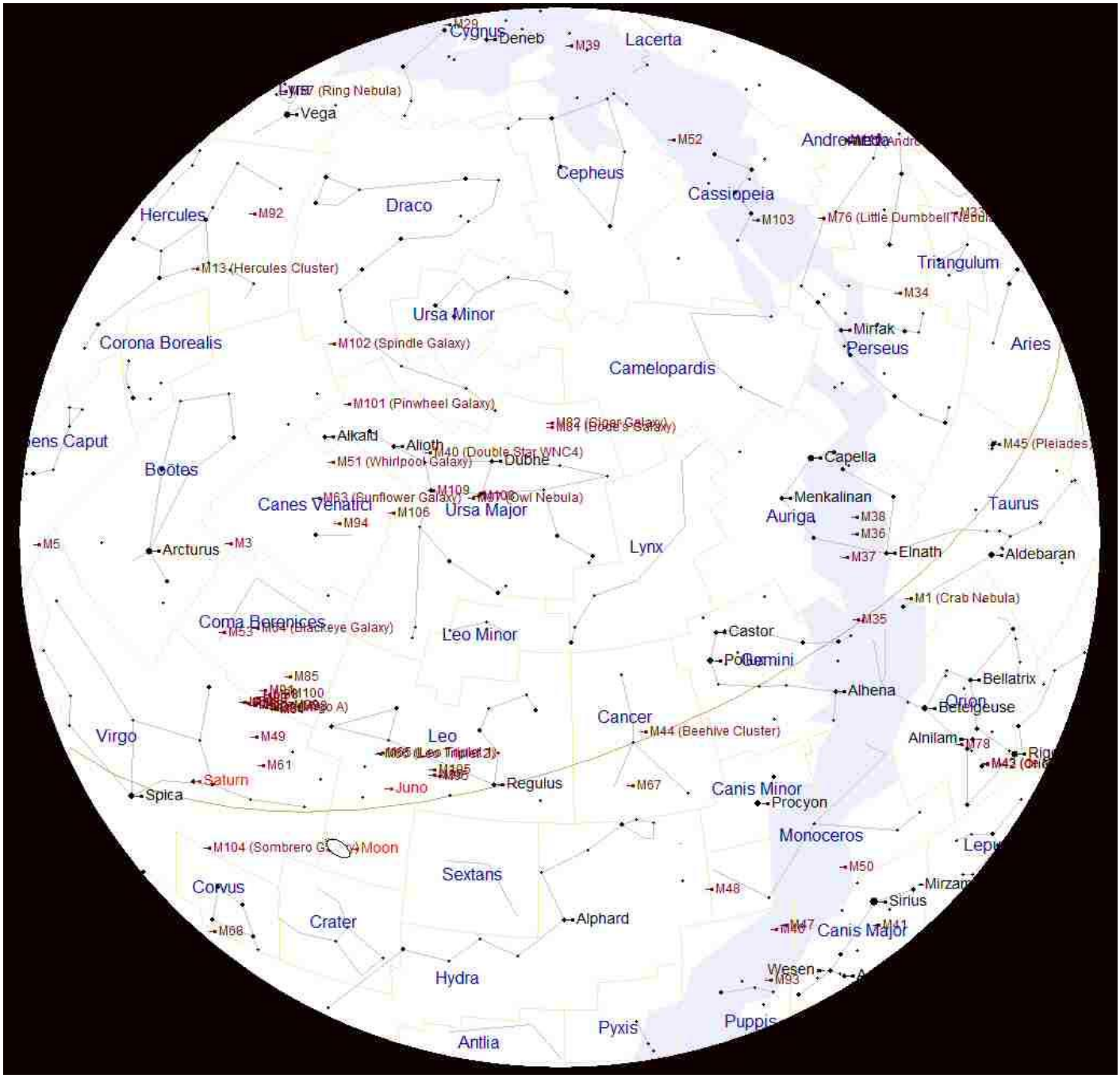
Website: **www.newburyas.org.uk**

THE NEXT NEWBURY BEGINNERS MEETING

20th April — Mercury and MESSENGER

Website: **www.naasbeginners.co.uk**

THE SKY THIS MONTH



The chart above shows the night sky as it appears on 15th April at 9 o'clock British Summer Time (BST). As the Earth orbits the Sun and we look out into space each night the stars will appear to have moved across the sky by a small amount. Every month Earth moves one twelfth of its circuit around the Sun, this amounts to 30 degrees each month. There are about 30 days in each month so each night the stars appear to move about 1 degree. The sky will therefore appear the same as shown on the chart above at 10 o'clock BST at the beginning of the month and at 8 o'clock BST at the end of the month. Due to the Earth rotating once every 24 hours, the stars also appear to move 15º (360º divided by 24) each hour from east to west.

The centre of the chart will be the position in the sky directly overhead. This month the brilliant star Capella in the constellation of Auriga is almost directly overhead. First we need to find some familiar objects so we can get our bearings. The Pole Star **Polaris** can be easily found by first finding the familiar shape of the Great Bear 'Ursa Major' that is also sometimes called the Plough or even the Big Dipper by the Americans. Ursa Major is visible throughout the year from Britain and is always quite easy to find. This month it is almost directly overhead. Look for the distinctive saucepan shape, four stars forming the bowl and three stars forming the handle. Follow an imaginary line, up from the two stars in the bowl furthest from the handle. These will point the way to Polaris which will be to the north of overhead at about 50º above the northern horizon. Polaris is the only moderately bright star in a fairly empty patch of sky. When you have found Polaris turn completely around and you will be facing south. To use this chart, position yourself looking south and hold the chart above your eyes.

The planets in the evening sky are: Saturn.

The planets in the morning sky are: Mercury, Venus, Mars, Jupiter, Uranus and Neptune.