Sagittarius

The Newsletter of the Astronomy Section of La Société Guernesiaise

October – December 2013

Forthcoming Events

Public Open Evening

(note Friday)

8th November: 6.00 pm

Astronomy Section Christmas Meal

Tuesday, 3rd December: 8.00 pm
(venue to be confirmed)

New format will be that Public Open Evenings will be on a Thursday evening and will comprise a talk or film show, with a clear night for observation being a bonus!

Section meets at the Observatory every Tuesday evening at 8.00 pm

Inside

Inserts

Star chart

Sunset, sunrise, moonset and moonrise times

Autumn Skies: Pegasus, Jupiter's return, and a Special Comet.

Pegasus is one of the major constellations, and is regarded as a centrepiece of our autumn sky. The constellation can be seen rising in the eastern part of the evening sky, reaching a due south position by about 10 pm in mid October.

The main part of Pegasus is easily recognizable, having a very large square shape, and with a bright star marking each of its corners. At the top right corner, two additional stars a short distance away form a regular triangle, making it even easier to recognize 'The Great Square of Pegasus' as it rises into the sky.

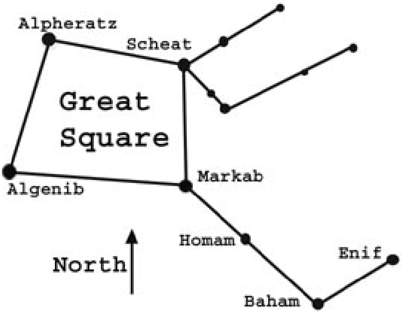

Figure 1: Constellation of Pegasus

With its clear shape and bright stars, the constellation was known to the ancient Greeks and the Egyptians as 'The Winged Horse' – the Great Square representing the body of the horse. As a favourite feature of the night sky, the depiction of a winged horse was also used on coins of the classical period.

The brightest star of Pegasus is Markab, at the bottom right corner of the square. At the top right of the shape is the second brightest star, officially known as beta Pegasi. This is a red giant variable star, varying in brightness over an irregular period. The top left or northeast corner has the bright star Alpheratz, which was previously the delta star. of Pegasus, but is now assigned to the adjoining constellation of Andromeda, and having a line of well spaced bright stars extending away northwards.

There are several different kinds of objects to be seen in Pegasus. The star cluster M15 is one of the finest concentrated globular clusters seen in the autumn sky. The cluster has a brightness of magnitude 6, just visible to the naked eye, and is a good object for binoculars or telescopes, which can begin to resolve at least the outer parts of this mass of stars. It can be found to the west of and below the lower part of the Pegasus square, a short distance beyond Epsilon Pegasi - a yellow supergiant double star of second magnitude with a small, magnitude 9 companion star.

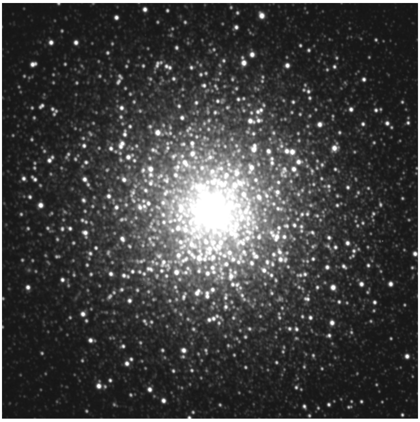

Figure 2: M15 globular cluster

One of the more recent developments in modern astronomy has been the discovery of evidence that planets are in orbit around other stars, many light years away from our own solar system of planets. It was in 1992 that the first evidence was found, of planets orbiting a ‘pulsar’, a rapidly rotating neutron star. This was discovered as a result of finding variations in radio wave pulses from the pulsar. In 1995 there was the first definite evidence of a planet in orbit around a normal star, - and this was in the constellation of Pegasus. When the star 51 Pegasi was identified as being very similar to our own Sun, astronomers at the University of Geneva then confirmed that the star had a slight and regular wobble effect, evidently caused by the gravitational effect of an unseen companion.

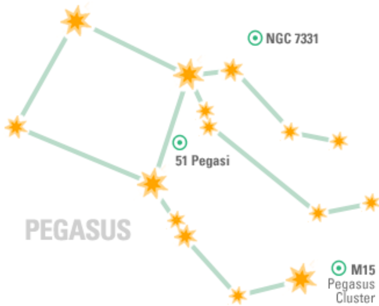

Figure 3: Location of 51 Pegasi and M15

The discovery of extrasolar planets, or ‘exoplanets’ has increased steadily in recent years, mostly at first from this detection of the gravitational effects on a parent star, sometimes also indicating the presence of more than one planet and allowing the orbit and mass of unseen planetary companions to be calculated. Another increasingly used method of detecting exoplanets is from transits of planets across a star, if a planetary orbit happens to be in the line of observation, and in these cases slight but regular variations in brightness can be identified.

In different ways, the total number of such planet discoveries already exceeds many hundreds, and with the first detected atmospheres in the case of transiting planets now able to be analysed by means of spectroscopy.

The Return of Jupiter.

There are usually one or more planets visible in the evening sky, and this autumn has the return of Jupiter - the largest by far of the planets, being around a thousand times the size of our Earth.

By the end of October Jupiter will be seen rising above the eastern horizon during the late evening, and not far from the twin stars of Gemini. Jupiter will continue to be visible from November onwards in the southeast and more southerly part of the evening sky, through and into the New Year. With its size and dense cloudy atmosphere, Jupiter reflects a lot of sunlight, and is of interest for several reasons. The well known 'Great Red Spot' on Jupiter is a semi-permanent feature of uncertain cause, but is usually regarded by astronomers as a giant storm. It varies in colour and visibility, sometimes becoming difficult to see or disappearing, but has always been noted and at about the same latitude location since the early history of telescopic observations.

There are also two Equatorial Belts of darker material on Jupiter, at similar distances and latitudes north and south of the planet's equator. The belts are often visible clearly like parallel lines, but with one or the other sometimes becoming less obvious or also completely disappearing from view.

Jupiter also has its many and varied moons, with its four major moons of particular interest. These can be seen by using binoculars or with a telescope as just points of light, changing constantly in relative positions as they orbit the planet at different speeds and distances. Spacecraft missions to Jupiter have revealed that the moon Io has constantly active volcanoes, evidently caused by the gravitational effects of Jupiter, and with the most active volcanoes at latitudes of around 19 degrees north and south of Io's equator - similar to the main features on Jupiter. The more distant moon Europa has a surface of cracked ice indicating movement, and thought to be covering an extensive layer of water, probably warmed also by Jupiter's gravitational effect.

Comet Ison - a Special Comet.

A very unusual event which is being anticipated this autumn is the promised appearance of a new comet, expected to become very bright as it passes closer to the Sun, much closer than most other comets seen in the past. Comets are occasional visitors to the inner part of the solar system, but a comet needs to have a large enough nucleus developing a good tail to be seen easily.

The new comet was discovered on September 21, 2012, by two Russian astronomers making observations for the International Scientific Optical Network (ISON). The comet's early visibility at that time - when it was still in the outer part of the solar system and near Jupiter's orbit was rather a surprise. A comet would not usually be expected to gain much of a warming effect on its icy materials at such a great distance from the Sun.

For some months there seemed to be little change in the appearance of the comet, with just a small tail visible, but a year later and within the orbit of Jupiter the comet was found to be developing in a more active way, heading for the centre of the solar system. Calculations of Comet Ison's track have shown that it can be expected to come as close as about one diameter or less away from the Sun's surface.

Comets of this kind have been named sungrazers, and previous rare ones have been known to disappear into the Sun or break up, because of the huge gravitational or other effects. Comets can be unpredictable because of the content of the core, and how this nucleus reacts to the solar radiation, also the effects in this case of an extremely close approach.

With a bright nucleus and with one or more tails of ionized gas and other cometary material coming away from it, the comet has already been found to be producing many tons of fine material every minute and it is hoped that Comet Ison will remain intact and visible in the morning sky before sunrise. After its predicted tight turn around the Sun at the end of November, the comet could remain visible for several weeks, also with the opportunity of perhaps seeing it in the evening sky after sunset, if the comet continues on its outward path as expected.

Of historical and perhaps local interest too, an important sungrazing comet was seen in a previous century. Tewfik's Comet was discovered in 1882 during a total eclipse of the Sun in May of that year. It was the first time that a comet had been discovered in this way, and photographed. Very unusually, there was a 'Great Comet' seen during each of the years 1880, 1881 and 1882.

Our own local Society of Natural Science and Local Research, La Societe Guernesiaise, was founded in 1882, and it must be wondered perhaps if any early astronomers in Guernsey may have taken a particular interest in the new Society being formed at that time.

Geoff Falla

Journey to the Centre of the Galaxy

In their classic textbook on relativity, "Gravitation" by Misner, Thorne and Wheeler, the authors pose the following question. How long would it take for the occupants of a rocket ship to travel the approximately 30,000 light years from the Earth to the centre of the Galaxy? Assume they maintain an acceleration of one "earth gravity" (10^3 cm/sec^2) for half the trip, then decelerate at one earth gravity for the remaining half.

Despite the title of the book, for this question the authors want you to ignore the effects of gravity. So we assume that the rocket ship starts off close to Earth but free from Earth's gravity and that it also avoids passing too close to any stars for their gravity to have any effect. In the jargon of relativity we assume we are in 'flat' spacetime.

Now although the authors show you how to work out the answer it is left as an exercise and there are no answers in the back of the book. So, bearing in mind how easy it is to miss out a few factors of ten, if anyone checks my answers and finds them to be wrong I will be happy to issue a correction. With that caveat here are my results.

It is easy to imagine that with the rocket ship accelerating at earth gravity (incidentally providing a comfortable environment for the occupants) the spacecraft will soon achieve a speed that is an appreciable fraction of the speed of light. In fact I calculate that from the viewpoint of the people back on Earth the spacecraft will be travelling at over 99% of the speed of light after just 7 years. The spacecraft spends so much of its journey at so close to the speed of light that it only takes a couple more years than the 30,000 years that light takes for the spacecraft to reach the centre of the Galaxy.

The question though was not how long the journey takes from the viewpoint of observers on Earth but how long it takes for the spacecraft occupants. For this we have to take into account the relativistic effects of time dilation and length contraction. For the occupants of the spacecraft time on Earth goes slower and distances contract. As the speed builds up the effect becomes more significant and there is a dramatic impact on the overall journey time. If my calculations are correct the time for the occupants to the half way point, when the spaceship flips around and goes from accelerating to decelerating, is only 9.85 years. So their total journey time is just 19.7 years. It is possible therefore for the spacecraft occupants to journey to the centre of the Galaxy, have a quick look round, and be back within 40 years. The only problem is that when they get back 60,000 years will have elapsed on Earth and things might look a bit different.

The authors of "Gravitation" then ask a supplementary question, which is what fraction of the initial mass of the rocket ship can be payload for the journey. They tell you to assume a rocket that converts rest mass into radiation and ejects all the radiation out of the back of the rocket with 100 per cent efficiency and perfect collimation. That is we can convert mass to energy using $E = mc^2$ and assume all the energy produced is used to accelerate or decelerate the rocket with none wasted. As with all major expeditions the problem is that most of the fuel you burn initially is used to accelerate the fuel you have to carry to use later in the journey. The result is that the amount of fuel you need to carry increases exponentially as the journey time increases. I calculate that for the journey to the centre of the Galaxy the payload would be just a billionth of the initial mass of the rocket, and that's for an engine that is 100% efficient!

Peter Langford

[If you are further interested in this topic then type "Relativistic Rocket" into your search engine.]

Geoff Falla's regular roundup of articles from popular Astronomy and Space Journals

A Century of Discovery. A summary of the key developments during the past century of astronomy, from Einstein's Special Relativity theory to Hubble's discovery of 'island universes' - galaxies; the expansion of the cosmos, the development of the 'big bang' theory, radio astronomy, the discovery of pulsars, the age of space missions, and the discovery that other stars also have planets. (Astronomy Now, July 2013)

UK Astronaut for Space Station mission. The first official UK astronaut for twenty years, since Helen Sharman's visit to Russia's Mir Space Station, Major Tim Peake, a former military test pilot, is due to travel to the International Space Station in 2015. Astronomy Now editor Keith Cooper's interview with Major Peake about his training for the mission, his work, and his role for the UK Space Agency. (Astronomy Now, July 2013)

Secrets of the Brightest Objects in the Universe. Quasars, Quasi-stellar radio sources, were noted during the previous century as being at extreme distances but unexpectedly bright sources of light. These centres of active galaxies are now better understood, as being activated black holes, and with 3C 273 - the nearest one, being of particular importance. (Astronomy, July 2013)

Remembering the astronomer Carl Sagan. The famous astronomer Carl Sagan is remembered, in particular for his epic television series 'Cosmos'- a Personal Voyage, and seen by more than 500 million people worldwide. It was acclaimed as an outstanding presentation of astronomy and the exploration of our solar system. (Astronomy, July 2013)

Great Astronomical Discoveries. To celebrate the 40th anniversary of the best-selling magazine 'Astronomy', a selection of 40 greatest discoveries, not in a considered order of importance - which would be different for cosmologists and planetary specialists - but in order of distance, from solar system discoveries to stars and galaxies, observations and cosmological breakthroughs. (Astronomy, August 2013)

Mysteries of the Universe. Knowledge about the universe has been expanding continuously, with surprises along the way. It is now understood that the expansion of the universe is speeding up, that the observable has a limit, but that there must be more beyond that horizon. A summary of the many questions relating to the universe, with most of the answers as presently understood - but with many mysteries still to be explained.
(Astronomy, August 2013)

A matter of Cosmic Principle. Recent observations confirm that there are features in the universe which defy explanation, according to the conventional view that the universe is the same in all directions, and that this may require rewriting the fundamental principles as presently understood. (Astronomy, August 2013)

Exoplanets Everywhere. Since the discovery almost twenty years ago that planets are in orbit around other stars apart from our own Sun, the pace of discovery has been accelerating, in particular with the launch of the Kepler space telescope. It is now estimated from the most recent evidence that there are as many planets as there are stars. (Sky & Telescope, August 2013)

The Women who created Modern Astronomy. The part played by several women at Harvard College Observatory, examining photographic plates in detail, with spectroscopic observations of stars, and establishing a classification of stars into an accepted system of seven basic types according to their mass and temperatures. (Sky and Telescope, August 2013)

The Milky Way. All of the stars which we see in the sky are part of our own Milky Way galaxy. A guide to observing the Milky Way's main band of stars, star clusters and nebulae, which can be seen extending overhead through the constellations of Cygnus and Aquila, and southwards to Sagittarius and Scorpius. (Astronomy Now, August 2013)

Solar Storm Warning. The solar cycle of sunspot activity is broadly predictable, but the behaviour of the Sun - particularly at times of maximum activity, is unpredictable. Solar flares and coronal mass ejections of material from the Sun's surface release energy, which can interact strongly with Earth's magnetic field. This can produce disruption of communications and power supply, and could be a danger during the present peak of solar activity. (Astronomy, September 2013)

Comet Ison. A report on what promises to become, perhaps, the brightest comet for many years.

Comet Ison was discovered in September 2012. By September this year the comet was inside the orbit of Jupiter, and is due to be visible not far from Mars and passing close to the star Regulus, in the eastern sky before dawn during October. The comet is expected to be at its brightest towards the end of November. (Astronomy, September 2013)

Curiosity's Year on Mars. It is a year since the largest Mars Rover vehicle Curiosity landed on the red planet. An account of the NASA mission's achievement and progress at Curiosity's location of Gale Crater, close to interesting geological formations of the nearby Mount Sharp, where organic materials may exist, and due to be investigated during the coming year. (Astronomy Now, September 2013)

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