MIRA

2012.1
Number 93
Price 50p

The Journal of the
Coventry and Warwickshire Astronomical Society
http://www.covastro.org.uk/
http://uk.groups.yahoo.com/group/covwarksastro/

Mike Frost Discovers Two Camera Obscuras Nearby

In the grounds of Compton Verney, an elegant stately house, in the Warwickshire countryside near Kineton, east of Stratford-on-Avon, by the lake, is a camera obscura, Top 2 pictures. Bottom picture, a privately-owned camera obscura, Mike visited one Sunday afternoon. The camera obscura, which is in a summerhouse in the back garden, has a lovely view over the local countryside. *See page 9*

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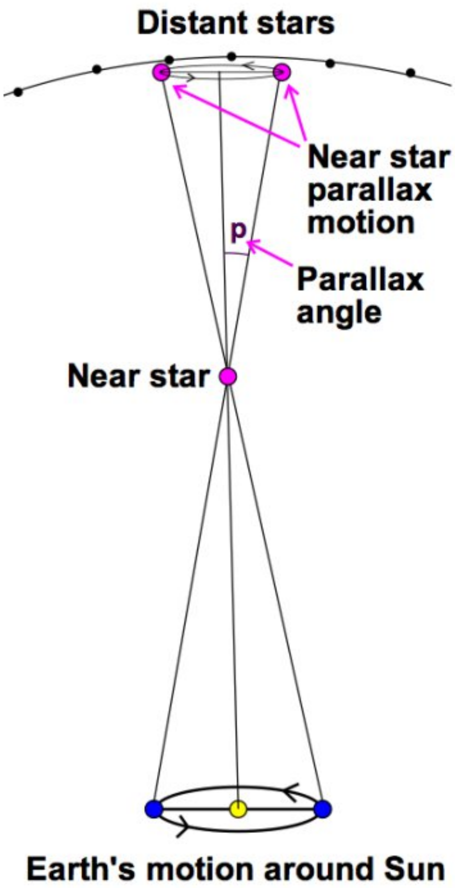
Mapping the Stars

By Paritosh Maulik

The apparent position of an object depends on the position of the observer. A plane flying at a distance appears to move slowly compared to one flying near by. This is the phenomenon of parallax. It can make life difficult; the image composed in the eyepiece of a twin lens camera is not the same as recorded by the camera lens. One has to position correctly to read the analogue instruments. But the ancient Greek astronomers realised that parallax could be used to measure the distances and the sizes of the long distance bodies such as the Earth, the Moon and the Sun. From such measurements they attempted to produce the map of the sky. This method is still in use today, but for higher accuracy the instruments have now moved into space.

When we move from one position to another, the relative position of an object in view appear to change; a nearby object appears to move more compared to a distant object. This is an everyday experience. In the twin lens camera, the viewfinder and the objective lens are not the same and therefore the image as seen by the eye is not exactly the same what is recorded by the film or the CCD chip. Where as in the SLR camera, the objective lens also acts as a viewfinder and the image is a true representation of the composed image. This apparent change is position is called alteration or parallaxis in Greek. Since the measuring position is affected by the position of the observer, it is important that when we measure with a ruler, we must view at 90°. Before the days of digital instruments, in sensitive analogue instruments, the dial used to have a mirror and the correct reading was taken when the needle and the image of the needle on the mirror coincided. The phenomenon of parallax causes some practical problems, for example the telescopic site or the range finder of guns needs to be corrected for parallax. However this phenomenon has some useful applications. Early video games used parallax to give the impression of depth. It can be used to measure distance as well. The position of the stars is measured by using Parallax.



Parallax Formula:

E1 and E2 are the two positions of the Earth after 6 months in its orbit around the Sun and we measure the position of the star from these two positions. The angular radius of the Earth's orbit as observed from the star is called parallax. The distance d to the star (in parsecs) is equal to the reciprocal of the parallax angle p (in arc-seconds):

d (parsec) = 1/ p (arcsec)

The star is very far away from the Earth and therefore the parallax angle is of the order of fraction of a degree. If the parallax angle is 1 arcsecond, the distance is called

1 parsec. 1 arcsecond is $^{1}/_{3600}$ of a degree (1 arc degree = 60 arc minute = 60 *60 arc second)

Expressed in other units

1 parsec = 3.26 light years = 3.09 x 10^{13} km = 206,265 AU.

The website **`http://rml3.com/a20p/parallax_2.htm`**; gives an example of example of measurement of stellar distance from parallax measurement.

A bit of history

Aristarchus (310 – 230 BC) from Greece estimated the relive sizes of the Earth, Moon and the Sun as seen from the Earth. He estimated this by the angle the Moon and the Sun as seen from the Earth. Using some geometry Aristarchus estimated the Earth – Moon distance. He got it nearly right, but underestimated the Earth – Sun distance. Aristarchus also measured the position of the other astronomical objects; he found that the position of the stars does not appear to change. Since the stars are farther away from the Sun and the Moon, he concluded that, the Sun is at the centre of the Universe and the Universe is an infinitely large sphere. The stars are arranged on surface of this large sphere and the Earth goes around the Sun in a circle. The revolution of the Earth around the Sun causes the seasonal variations and the rotation of the Earth around its axis results day and night. Since the position of the stars from the Earth appeared to be fixed, it was concluded that the Earth – Stars distance is very high.

Obviously the concept of heliocentric universe was contrary to the everyday observation and was not accepted. Hipparchus (190 - 120 BC) had access to a large volume of eclipse data from Babylonians. He wanted to calculate the relative sizes and the distances of Earth, the Moon

Object	km	AU	Light Time	Parsec
Moon	3.84×10^{5}	2.57×10^{-3}	1.28[1]	1.25×10^{-8}
Sun	1.50×10^{8}	1.00	499[1]	4.85×10^{-6}
Saturn	1.48×10^{9}	9.54	79.33[2]	4.63×10^{-5}
Proxima Centauri	3.99×10^{13}	2.67×10^{5}	4.22[3]	1.294
Pleiades Cluster	4.26×10^{15}	2.85×10^{7}	450[3]	1.38×10^{2}
LMC/SMC	1.31×10^{17}	8.73×10^{8}	13,803[3]	4.23×10^{3}
Andromeda	2.18×10^{19}	1.45×10^{11}	2,300,000[3]	7.05×10^{5}

[1] light second; [2] light minute; [3] light year

Distance of some astronomical objects in different units

and the Sun. Hipparchus noticed that the if we move from one place on the Earth to another, the relative position Sun does not appear to change appreciably with respect to the background stars, i.e. there is no solar parallax motion. He reasoned that the parallax angle between the star and Sun is too small to measure. Using arithmetic and trigonometry Hipparchus calculated the position of 850 stars to produce the first star catalogue.

The presence of other planets causes Earth's orbital plane to wobble; this is planetary precession. The pole of the Earth also does not move in a perfect circle. The attractions of the Sun and the Moon cause the axis of the Earth to not revolve in a perfect circle. These two phenomena lead to what we call precession of the equinoxes. The position of a star measured in one spring equinox appear to shift westwards during the following equinox. Hipparchus correctly estimated that after 25,000 years the star would be visible is the original position. This is one of the great achievements of Hipparchus. Since Hipparchaus, the measurements of the positions of stars were taken up by other Greek, Roman, and Islamic astronomers.

Attempted to measure the parallax of stars continued. Edmond Haley observed that the positions of some of the stars with respect to other stars do not match those of earlier records; the conclusion was, the relative position of the stars have changed. This is due to the fact that the stars are not fixed. The stars move and this movement of stars as seen from the Earth is called the proper motion of the star. But since the stars are very far away, the parallax angle is very small and the instruments were not capable of measuring such small angles. In the early eighteenth century, astronomers in London attempted to measure the parallax of a star Gamma Draconis (Î³ Dra). It is star marginally brighter than Polaris. This star passes almost overhead in London and it was taken as an ideal candidate to measure the parallax. Even after using the most refined instruments available at that time, the measured value of the parallax was coming out too high. James Bradley eventually explained the reason. It is due to the aberration of light. The direction of light coming from the star gets changed by the movement of the Earth. Light has a finite velocity and therefore by the time light enters the objective and reaches the eye piece the position of the telescope has moved. The apparent position of the star also appears to have changed. Bradley's observations on Gamma Draconis conclusively proved that the Earth goes round the Sun. For more on this, in the excellent write up by Mike Frost in MIRA 91.

Although the measurement of the parallax with reasonable accuracy is credited to Friedrick Wilhelm Bessel, around the same time in 1830s, Thomas Henderson, Friedrick Wilhelm Struve, also came up with reasonably accurate values of parallax of stars.

Sky survey

Over the years there have been many sky surveys to measure the position of astronomical objects. Here are some of the well known surveys.

Palomar Observatory Sky Survey
1.22 m telescope, image collected on photographic plate

Sloan Digital Sky Survey
2.5 m telescope, 120 M pixel CCD camera; 1.5° of sky surveyed at a given exposure.

Anglo – Australian 2dF Survey
3.9 m telescope; digital imaging. At the focal point there are two banks of optical fibre 200 in each bank. This allows measurement of 400 spectra simultaneously.

ROentgane SATellite
Orbiting x-ray satellite; all sky survey in x-ray and ultraviolet light.

ESA Hipparcos (High Precision Parallax Collecting Satellite) Mission
By the middle of twentieth century it became clear that, the Earth based observation for the accurate measurement of the position and proper motion of the stars is restricted by the atmosphere of the Earth. In 1967 French space agency suggested that a space based mission may be more suitable for such a task. But at that time the technology was not there to attempt such an undertaking. Eventually ESA launched its Hipparcos mission to undertake this work. The mission operated between 1989 and 1993.

In the Hipparcos mission, the images were collected by a Schmidt telescope. A mirror system at 58° apart combined two fields of view on the focal plane. On this focal plane there was a glass plate, with 8.2μm thick alternate transparent and opaque lines were etched. A photomultiplier collected the image. The apparent angle between two stars were calculated from the phase difference of the light from two stars. In the final count Hipparcos measured position of nearly 120,000 stars with a median accuracy of slightly better than 0.001 arc-sec (1 milliarc-sec). From the Hipparcos results, it was possible to draw a three dimensional map of the stars.

Another credit of the Hipparcos mission was the experimental confirmation of the bending of light by gravity as predicted by the general theory of relativity. Although the first proof was presented in 1919 from the solar eclipse measurements, the accuracy measurement was of was not very good. Hipparcos confirmed the bending of light by gravity to a far higher accuracy.

ESA Gaia Mission

The next ESA project to map the celestial objects is the Gaia mission scheduled to launch in 2012. It will monitor positions, distances, velocity and brightness of about 10^9 stars over a 5 year period. The selected stars will be observed about 70 times each. It is expected that during this period the mission will also detect exo-solar planets, brown dwarfs and hundreds of thousands of asteroids in the solar system. In addition Gaia mission will provide data such as luminosity, gravity and composition. The expected resolution of the distance measurement is 24 microarcsecond for stars of magnitude 15. The mission is also expected to observe hundreds of thousands of asteroids as well.

Originally the project was to be called **G**lobal **A**strometric **I**nterferometer for **A**strophysics; hence the name **GAIA**. However the original concept of interferometer was changed to the well tested method of Hipparcos mission. Similar to the Hipparcos system, GAIA mission will combine images from two telescopes at an angle.

The mirrors and the telescope structure will be made from silicon carbide. The image will be collected by a large area CCD. The basic function of the instruments will be

Astrometry Accurate measurement of star positions
Photometry Spectral analysis in the range of 320 – 1000 nm, to be used in conjunction with the astrometry study
Spectrometry Grating spectrometer 847 – 874 nm

Location near the L2 point of the Sun – Earth system at about 1.5 million km from the Earth facing away from the Sun

The phenomenon of parallax may cause some inconvenience in everyday life, but we can use it do determine the distances of the far away objects including the extraterrestrial objects. The star map locates and identifies stars, constellations and galaxies. Since pre-history, sky map has been used for navigation. Now a days, space borne instruments use astronomical objects as guidance. Hence an accurate sky map is very useful.

http://astroprofspage.com/archives/730;
http://astroprofspage.com/archives/1011
Mike Frost, MIRA, Number 91, 2011

So physicists have a little problem with a few neutrinos breaking the light speed limit. I read somewhere that they were going 12,000mph over the limit! So what's to get excited about? Why so little over light speed? Why not 10% or 50% faster? If it was warp 2 or 3 as in Star Trek I would start to get excited, but 20 parts per million faster? If you were going to Alpha Centauri at the new neutrino speed, 4 and a bit light years away you'ed get there about 10 minutes earlier, big deal. You would just spend 10 minutes longer waiting for passport control to stamp your passport in the immigration queue.

Some of the dafter papers started to talk about going back in time! Are they kidding? What good is going back 60 nanoseconds? I could do with going back *days* sometimes and I'm sure many of you can think of loads of times when you've said the wrong thing and lived to regret it, I know I have, and I get reminded of them when we have a bit of a disagreement. Sometimes years later!

No, my problem is with gravity. It seems to be changing. Anyone over the age of say 60+ will have noticed this ongoing effect; *that gravity gets stronger as you get older*. It creeps up on you while you are not noticing, when you're out having a good time and enjoying life. Going out to school, collage, work, holidays or asleep. Just living.

You only have to look at small kids to observe this stunning news, have you ever seen them walk? They RUN. They run around as if they are in about a half gee. They run everywhere. And jump. Its easy. And seem to bounce about like Buzz on the lunar surface in one-sixth gee. Their skin and bones may not be quite as strong as a grown adults but it's still plenty strong enough to take knocks and bumps that would floor old folk. Their muscles are not to large for their size but they can jump about with ease. You ask an old person to do what kids can, and you'll get a clip round the ears if you are close enough and they don't have to move far.

I think its all down to elusive graviton particles. These must be very strange and like the Higgs bosons which the scientists at CERN are looking for with the Large Hadron Collider, mysterious heavy particles which are almost undetectable. But the strange thing about these graviton particles is that they only get into older folk and accumulate. The effects can be felt by many elderly people. As you get older they start to lodge and clump together in places like the joints and legs and knees and hips, making the person feel heaver, weighing them down. These particles are not present in kids and so they are not weighed down by them and as we can see, jump and run about with abandon. But as the years go by more and more start to sneak into the tissue and ligaments of older folk. They must be in the food or air or are they whizzing about like neutrinos? You can see the effect of graviton particles by comparing the way 4 year olds get out of a low chair with a 80 year old person. No competition. What about going upstairs? Under 40, its 2 at a time, 80+ a stair lift. Of cause not all old folk seem to be affected with the same degree of graviton particle accumulation, I think I must have a few and feel them some days more than others. Maybe its because I've been round our local star more times than 85% of the planets population. I just hope somebody finds a cure soon before I'm getting weighted down too much with them.

Ivor Clarke

What's in a Name?

By Mike Frost

It's a depressing fact that people think they can buy the right to name stars, and even more depressing that there are companies who claim to be able to sell that right. The only recognized authority for naming stars is the International Astronomical Union, and they don't endorse any commercial enterprise.

It's quite amusing, however, that the most unscrupulous companies try to sell the naming rights to bright naked-eye stars! Do people not realize that the stars in the night sky, seen by generation on generation of the human race, were given their names a long time ago? Most of the names of the common stars were given by the Arabic astronomers around the turn of the last millennium. Any star name which begins with "Al-", such Altair, Aldebaran, Algol, is Arabic for the definite article "The". So Algol is "The Demon Star", Aldebaran "The Following Star", Altair "The Flying Eagle", and so on.

It is possible to attach your name to a naked-eye star, but you have to be pretty sneaky to do it. Niccolo Cacciatore, for example, compiling the Palermo Star atlas in 1814, named two undistinguished stars in Delphinus as Sualocin and Rotanev. Reverse these names and you get Nicolaus Venator, the latinised version of Nicholas Hunter, or …. Niccolo Cacciatore.

The central principle in naming astronomical objects, of course, is that the Discoverer gets to name their Discovery. There's a practical reason for this – the discoverer is by definition the first person to observe their discovery, and can therefore announce both its existence and name to the world. The first person to find themselves in a position to name astronomical objects was, arguably, Galileo Galilei. Galileo's first major discovery was the four major satellites of Jupiter, and the names he chose illustrated one of the early naming protocols. Galileo named his moons "The Medicean Stars", after the Medici family. He was sucking up to his employers!

The idea of currying favour with your patron, or your monarch, was common for a century or two after Galileo. William Herschel wanted to call his first major discovery, the planet we now know as Uranus, "Georgium Sidus", King George's star, to honour the British monarch. Piazzi, discovering the first asteroid, named it Ceres Ferdinandea – Ceres after the goddess of Sicily, where he observed from, and Ferdinandea after King Ferdinand III of Sicily.

You'll notice, however, that none of these names stuck. King George's star might have been a popular name in Britain but it didn't ring true on the continent. Political naming of astronomical objects was not usually popular, but one or two monarchs have snuck into the sky. Alpha Canes Venatici has the name "Cor Caroli", King Charles's Heart, in commemoration of the execution of Charles I. And the constellation of Scutum is a shortened form of "Scutum Sobieski" the shield of Jan Sobieski, Polish warrior king.

But mostly the names which have stuck have no contemporary resonance. Instead, planetary satellites tended to have names from Greek and Roman mythology. The Galilean satellites are now named Io, Europa, Ganymede and Callisto, Jupiter's lovers, male and female (Jupiter's wife, Juno, looks on disdainfully from the asteroid belt). These names were suggested by Simon Marius, who claimed to have discovered the Jovian moons independently of Galileo, and Galileo never accepted them. Piazzi saw the tribute to King Ferdinand unceremoniously dropped, but at least he kept a hand in naming Ceres. Herschel, on the other hand, had to accept a change of name to Uranus.

During the seventeenth and eighteenth century, the protocol seemed to be that the Discoverer got to name, but the choice had to be within cultural limits. The satellites of Jupiter and Saturn, and the early asteroids, all received classical names. Neptune was the subject of a naming war, due to the battle between le Verrier and Adams. Adams's supporters wanted to call the new planet Oceanus, but le Verrier was able to force through his first choice of Neptune, although his later suggestion that it be called "le Verrier" was roundly rejected.

Naming of astronomical objects was a serious matter, and some discoverers went to great pains to make sure names were apposite. Suggestions were received from far and wide, with the discoverer acting as final judge on the decision. The moons of Mars, for example, were given the names Phobos and Deimos by their discoverer, Asaph Hall, following a suggestion by a classics master at Eton. Pluto, famously, was the subject of a naming competition, won by a suggestion by Venetia Burney, a young schoolgirl from Oxford. Not only was the king of the underworld an apposite choice for such a distant object, but the first two letters commemorated Percival Lowell, who financed the search for Planet X but didn't live to see the discovery of Pluto.

The story of the naming of Pluto's first moon is entertaining. James Christy saw that Pluto's image was elongated in some images and correctly deduced this was due to a closely orbiting satellite. He wanted to name the moon after his wife, Charlene, but correctly reasoned that a classical name would be more appropriate. However his pet name for his beloved was a shorted form, "Char-on". Christy tentatively investigated if there was any classical connection to the name Charon and was astounded to find out that, yes, Charon was Pluto's ferryman. How lucky was that!

The object that forced the controversial relegation of Pluto to "dwarf planet" also had an entertaining route to a name. When Michael Brown discovered a large body orbiting beyond Neptune, he nicknamed it Xena, after the ass-kicking heroine of the fantasy TV show "Xena the Warrior Princess". When he discovered that Xena too had a satellite it was promptly named for Xena's sidekick Gabrielle. But the discoverer knew that he had a duty to future generations who might have little knowledge of popular 90s TV shows. He found an elegant solution to the problem. Xena was renamed Eris, the goddess of mischief, and Gabrielle was renamed to Eris's daughter Dysnomia, goddess of lawlessness. But who played Xena in the TV show? Lucy Lawless – so they managed to sneak Xena in through the back door!

Into the twentieth century the pace of discovery turned into a tidal wave, and discoverers got creative in their choices. The names for gods in many different cultures have, I think quite rightly, been co-opted as the names for asteroids and Kuiper belt objects. Why should it just be Mediterranean gods who get to orbit in the skies? Cruithne, which orbits in 1:1 resonance with the Earth, takes its name from Celtic mythology. The trans-Neptunian objects Makemake, Quaoar and Haumea receive names from Rapanui (Easter Island), Tongva (Californian) and Hawaiian mythology respectively. Sedna, whose orbit takes it far into the outer reaches of the solar system, is named for an Inuit god.

Other sources have been plundered. The moons of Uranus, by convention, take their names from Shakespeare and Pope. Craters on the Moon are named after famous scientists and lunar mappers. The male bias on the Moon is counter-balanced by the naming of features on Venus after famous women from history and mythology. The International Astronomical Union issues guidance on naming conventions for features on each of the bodies in the solar system.

But it feels as though the naming system is heaving as the number of known asteroids whizzes past a quarter of a million. All four Beatles have asteroids named for them, as does Mr. Spock (although apparently it was actually the discoverer's cat, with the same name as Star Trek's Vulcan). The British Astronomical Association has its own asteroid, Britastro, and many leading members of that organization (though not Geoffrey or I) have their own asteroids. When I spoke at the British Science Festival at Aston University last year it was announced that the other two speakers, Guy Consolmagno and Ian Morison, each had an asteroid named after them.

And I have not even begun to talk about the huge numbers of discoveries outside the solar system. There are now hundreds of known extra-solar planets, with a likelihood of millions more to follow. There are stars beyond counting, in hundreds of millions of galaxies. Individual objects are still named by the discoverer – a recent example is Hannys Vorweep, spotted in the Galaxy Zoo by Hanny van Arkel. But often the naming is devolved to the person who catalogues objects: Messier and Herschel lend their names to older catalogues, Caldwell (Sir Patrick Caldwell-Moore) and Sharpless to newer catalogues.

We live in straitened times, and I'd like to finish with a bold suggestion. How about selling off the naming rights?

Maybe this sounds tacky – but surely it need not be. Harvard University, the Tate Gallery, the Guggenheim Museum; they're all named after the people who stumped up the cash, and no-one thinks any less of these venerable institutions because of that. In astronomy, the Yerkes and Hooker telescopes and the Allen Array are all named after the financier rather than the users.

So why not sell on the naming rights for objects discovered with a new telescope, in order to pay for that telescope? Or why not finance your career in observational astronomy by acquiring a patron, after whom you promise to name your discoveries? After all, you'd only be following the footsteps of Galileo and Herschel.

Just an idea…

Sources / Further Reading:

The International Astronomical Union's web page on naming conventions is http://www.iau.org/public/naming www.iau.org/public/naming although this is comprehensive rather than comprehensible.

The Wikipedia entries en.wikipedia.org/wiki/Astronomical_naming_conventions and en.wikipedia.org/wiki/Planetary_nomenclature are informative.

The IAU do have an excellent FAQ page on star-naming companies at http://www.iau.org/public/buying_star_names www.iau.org/public/buying_star_names.

"A Bump in the Night", by Govert Schilling, Sky and Telescope, June 2008, p.24, details the discovery of Charon.

"The Search for more Plutos", by Dean Regas, Astronomy, July 2011, p.30 tells the story of Eris.

The conclusion to this article was inspired by an editorial by David Broomhead in the December 2010 edition of the Journal of the Institute of Mathematics, which memorably began "Dear Wayne Rooney…" Professor Broomhead went on to suggest to Wayne that he devoted a small proportion of his salary (reputed to be over a hundred thousand pounds a week) to mathematics, where he could finance the careers of several post-graduate students, in return for which he would receive the naming rights on any mathematical objects or theorems found by these students, a fame which might turn out to be longer-lasting than any accomplishment on the football field.

What's in a Name? Part 2

By Mike Frost

When I wrote "What's in a Name?", I wasn't planning to write a sequel. My aim in the original was to explore the politics and protocols of naming astronomical objects. After I had finished the article, however, I realized that there was an aspect to naming astronomical bodies which I had completely failed to cover.

How do you name a completely new type of object?

When I thought about this a little further, I noticed something quite interesting. The names given to new astronomical objects often turn out to be completely inappropriate!

Consider: Asteroids ("star-like") have nothing to do with stars. Planetary nebulae have nothing to do with planets. And quasars ("quasi-stellar objects") have nothing much to do with stars.

So what is going on? The problem, I think, is that when something completely new is observed, it isn't at all clear what has been discovered. The first name to be given to a new type of object is often simply descriptive.

"Planetary nebula", for example, was the description given by William Herschel, the first person to observe these objects with a telescope good enough to discern a disk. Herschel, who of course had discovered Uranus, was surprised to find objects in the sky which looked just like his newly discovered planet, but didn't move relative to the fixed stars. He called them planetary nebulae because planets were what they looked like, not because that's what he thought they were.

In reality, planetary nebulae are a late stage in the life of many stars. They are formed by red giant stars which throw off their outer envelopes because of a ferociously strong solar wind. It is also likely that many, if not all, planetary nebulae, are associated with close binary star systems, and the extraordinary and beautiful symmetries seen in planetary nebulae may be associated with the rotational axes of these binaries.

None of this was known to William Herschel, and indeed the details are still being worked out. Herschel simply described what he saw.

Asteroids are a little more complicated, because they were discovered as a result of a deliberate search for objects in the gap between Mars and Jupiter. They were first given the name "minor planets", but as more and more minor planets were discovered, the name because less and less appropriate. Asteroid number 1, Ceres, certainly could be termed a minor planet – it's nearly spherical, for example – and indeed these days it is termed a "dwarf planet" along with Pluto, Eris, and other denizens of the outer solar system. But smaller asteroids are basically just rocks, or chips off a larger objects, or nuclei of dead comets. "Asteroid" was descriptive of the fact that, at first glance, an asteroid is indistinguishable from a star.

Astronomical discoveries in the twentieth century received similar descriptive names. Quasars, for example, were known to be powerful radio sources, yet optically they looked indistinguishable from stars – so "quasi-stellar objects" they became, despite being active galactic nuclei in reality. But note that we no longer say "quasi-stellar objects". We shorten to quasars, to hide the original description, or we use a name, "Active Galactic Nuclei" which reflects our current understanding of the physics. If our theories change, then perhaps this too will become an unfashionable name.

In recent years, there has been a movement to attempt to allocate non-judgmental names to new discoveries from the start – or rather, to bury the initial guess into a non-descriptive name. For example, in recent years, we have begun to observe what we believe to be proto-planetary disks around stars, that's to say clouds of dust and rocks which will eventually coalesce into planets. But the official name given to these objects is not Proto-planetary disks, but Proplyds – a shortening of the original name, but one which aims not to rush to judgment as to the explanation of what is being observed.

My favourite recent name is for a class of new asteroids, or Kuiper Belt objects, in the outer solar system. Cubewanos have a particular type of orbit – for what it's worth, they are low eccentricity, low inclination asteroids which are not in an orbital resonance with Neptune (unlike, say, Pluto). It is thought that these are "pure" Kuiper Belt objects which have not undergone any major changes to their orbits since formation. But even if that turns out not to be the case, the theory will not be preserved in the name of these objects.

Where does "Cubewano" come from? It comes from the provisional classification of the first such object found – 1992 QB1 – which simply reflects the year and time of year when it was discovered. "QB1" equals "Cubewan". Not descriptive at all!

Two Nearby Camera Obscuras

By Mike Frost

The year, the British Astronomical Association's Out-of-town week-end was on Jersey, in the Channel Islands. Appropriately, the theme of the week-end was "Astronomy on the move" and there were a series of talks on observing away from home. Dr John Mason gave an excellent talk on his many cruises up the Norwegian coast to observe the Northern Lights. Nick James gave handy hints on how to pack for a total eclipse, and Brian McGee told us where he was planning to send tours to for the next few eclipses. Two Channel Island astronomers spoke - Mike Maunder, the organiser, gave an idiosyncratic and entertaining talk on the "Mark One Eyeball" and David le Conte led us through the Channel Islands' rich heritage of Neolithic sites, many with possible astronomical alignments.

To commence proceedings on the Saturday morning, however, they asked me to speak on "Visiting Camera Obscuras of the World". As you probably know, I am a great fan of the camera obscura, literally a "dark chamber", from which one can observe a projected view of the outside world. I have visited many camera obscuras around the UK, and one in Pretoria, South Africa, so I guess I could just about say that I have visited camera obscuras of the world.

One thing I do know about camera osbcuras is that they have a short half-life. New camera obscuras are built from time to time, and are often opened with great fanfare. I always try to visit a new camera obscura as soon as I can, because I know from bitter experience that they don't always stay open for long. The optics of a camera obscura are open to the elements for long periods of time, and unless they are looked after with care they will rapidly succumb. Many times I have visited a recently opened camera obscura, only to find that it is "closed for maintenance". If I return a year or two later, it is still closed, but there are hopes to re-open it "soon"; a few years after that the camera is permanently closed, and no-one knows what has happened to the optics.

I have been lecturing on camera obscuras for many years, mainly relating research I did in the 1990's, when I assisted Mike Feist of the Foredown Tower camera obscura in his project to document the camera obscuras of the world. So I needed to update my list of active camera obscuras. I found to my disappointment that many of the British camera obscuras I knew from the 90's were now closed, including Foredown Tower (although there are hopes to re-open it "soon"). In the 1990's I felt that there was a golden age of camera obscuras, but by the 2010's my optimism has diminished.

All was not lost, however. There were one or two new camera obscuras in Britain. And in particular there was a privately-owned camera obscura not far from Coventry in Northamptonshire. This belonged to an artist called Gina Glover. You can see details of it on Gina's website, `www.ginaglover.com` Gallery 8 on this website documents the development of her camera obscura over a period of twenty years.

Obviously it's a privately-owned camera obscura,

Over the past twenty years, this small summerhouse as been used for personal exhibitions. She has now turned it into a camera obscura.

so I won't go into detail as to exactly where it is. But I visited one Sunday afternoon; Gina made me very welcome. The camera obscura, which is in a summerhouse in her back garden, has a lovely view over the local countryside.

So I had one more camera obscura to add to my presentation for Jersey. My talk went well, and generated interest. The week-end itself was a great success – on the Saturday evening the Jersey Astronomical Society invited us to their well-equipped observatory in the south-west of the Island, although needless to say the clouds rolled in and we were able to see very little. I spent a week in all on the island and had a great time.

When I returned to the office I was keen to tell my colleagues about my holiday. I was explaining about camera obscuras when one of my workmates said "Oh, I went to see one of those over the week-end"!

It turned out that my colleague had visited a completely new camera obscura, unknown to me, less than twenty miles from Coventry.

It was in the grounds of Compton Verney, a beautiful art gallery in the Warwickshire countryside near Kineton, to the east of Stratford-on-Avon. If you haven't visited Compton Verney yet – go there, it's great! Compton Verney is an elegant stately house designed by Robert Adam, which sits in beautiful grounds landscaped by Capability Brown between 1768 and 1774. There is a permanent collection of classical art, an intriguing folk art gallery, and each season a featured exhibition. I first visited Compton Verney five years ago, when the featured exhibition had a strong astronomical theme - "Starry Messenger", featuring original manuscripts by Galileo and Copernicus and selections of astronomical material chosen by Allan Chapman and Peter Hingley.

In the grounds of Compton Verney, there are a series of large-scale sculptures. The most noticeable are a giant-sized rocking horse which sits in the middle of the lawn, and a large boulder by the drive to the house. The camera obscura is a new addition to the sculptures in the grounds. It is a 2010 installation called Spiegelei by Jem Finer, and sits by the lakeshore with a fine view of the house and grounds. The introductory leaflet describes it as follows:

"Conceived as both a sculptural work on the outside and a working observatory on the inside, Spiegelei reflects and magically inverts the silent world with the beautifully simple technology of the mirror and the lens. Within, the camera obscura is reinvented as an immersive, 360 degree, panoramic projection space, illuminating its spherical interior with an upturned living image of Compton Verney's landscape."

It's a very distinctive building – a garden shed with a large spherical globe sat on top. You enter into the shed, walk up some steps and find yourself at the entry to the globe. Step up and your head is inside the globe. The globe has four lenses inserted into the four compass points of the sphere, which project overlapping images onto the inside of the globe. It's an extraordinary immersive view. The quality of the image is not as good as you would find in conventional camera obscuras, because the sphere interior is rough and metallic, and of course the image is upside down – these problems are usually solved by projecting the image onto a whitened screen, but that's not really the point in this installation.

Being inside a metallic sphere is also great fun aurally. Make a noise and the echo is extraordinary; whistles seem to go on forever! Bang the sphere itself and the noise has a didgeridoo-like quality. I wasn't the only person to express the opinion that I could spend all day in there – but regrettably I had to leave to make room for other visitors.

I'd recommend a trip to Compton Verney. Not just for the camera obscura, which is fun. But the whole site is one of my favourite places to visit – a beautiful house in lovely grounds, showcasing beautiful, provocative and intriguing art.

Go on – visit it!

Compton Verney's camera obscura – a garden shed with a large spherical globe sat on top.

An Ansty Church window

by Ivor Clarke

I was surprised to see this window in the loverly old church at Ansty. This is tucked away behind Ansty Hall and I had no idea it was there until we visited it with the Bedworth Society on a summer evening. A plaque tells the meaning of the different parts of the window:—

This window represents,
The Supremacy of Our Lord Jesus Christ over Creation.
(In Collosians Chapter One, Verse Seventeen, 'He is before all things and by Him all things are held together'. Also in St John's Gospel, Chapter One, Verse Three, 'All things were made by Him and without Him was not anything made that was made')
The head of the figure of Our Lord the King is surrounded by the Alpha and Omega, which denotes that God in Christ is the beginning and the end of all things.
The design also incorporates some of the developments and achievernents of man under God which have been made in the present century, such as, outer space research, satellite communications, hydro-electric dams, computers, Concorde aircraft and heart transplants.
The symbol of the World Council of Churches, 'Oikou Mene', meaning 'One Fellowship' or 'One House', placed above a boat is also incorporated.
Dedicated by the Lord Bishop of Coventry
On the Fifth day of May 1974

StephensonFest – and the weather in Coventry, 1724

By Mike Frost

Professor F. Richard Stephenson of Durham University is well-known amongst historians of astronomy for his sterling work in identifying astronomical events in the written records of historical civilizations. Professor Stephenson celebrates his 70th birthday in 2011, and in his honour a four-day conference, StephensonFest, was organised at Durham University, from 13th – 16th April 2011. The conference attracted historians from four continents, many of them students of Richard's, others students of Wayne Orchiston of James Cook University, Townsville, Australia, who chaired the scientific organising committee.

Richard Stephenson has always been keen to involve the amateur astronomical community in his work, and so the Saturday session was open to amateurs. Two of us took up the offer; myself and John Wilkinson of Newcastle University. I had offered to give a talk on "Henry Beighton's Eclipse Chart". You might remember me writing about this in MIRA 69, in "A Warwickshire Eclipse". One reason why I was keen to visit Durham was because the University Archives contained some material thought to be by Beighton – weather records for Coventry, for the years 1724, 1725, 1732 and 1733. These appeared in an unpublished tract on meteorology by the famous Durham astronomer Thomas Wright, the first person to suggest that the stars of the Milky Way formed an "Island Universe" or, as we would now call it, a galaxy. Wright was a polymath, never quite part of the scientific establishment, but a fountain of ideas on all sorts of subjects; he was a mathematician, instrument maker, architect, garden designer and antiquary. In June 2011 there was conference at Bristol commemorating the 200th anniversary of Wright's birth; but although it featured a talk by the ex-astronomer Royal, Sir Arnold Wolfendale, it was organised by the Landscape Gardening Society.

I drove up to Durham on Friday morning and spent two hours in the afternoon looking at the Thomas Wright files in Durham University's archives, which are held at Palace Green, next to Durham Cathedral. In 1782 Thomas Wright wrote "Speculum Meteorum, or An Essay towards establishing a True Theory of the Weather", with the further sub-title "Analysis to that of the tides, or ebbing and flowing of the Sun, being Founded upon a Lunar Influence of the Sun and the Moon Upon the atmosphere of the Earth". In other words Wright was trying to spot a lunar cycle in the weather.

The tract contains the following: "An Extract of the Observations of the Weather at Coventry for several years successively made by Mr. Tipper, to which are added all the new and full Moons in ye same years..." I have attached one of these tables of measurements, so that you can see what the weather was like in Coventry 179 years ago! There is one entry for each day of the year, which the author has annotated with either: R (rain), S (snow), W (wind), F (frost) or T (thunder) or no entry at all. I had wondered if there might have been an error in the documentation, and a chart for the year 1737, so that I could see what the weather had been like in Coventry on February 18 1737, the date for which Beighton drew his eclipse chart. Regrettably there was no table for 1737 in the archives. Worse, there was a chart for 1724, (see page 12) when south-west England enjoyed a total eclipse on May 11, but there was no weather annotation for May 11 – so I don't know if Coventry had an unclouded view of a very deep partial eclipse on that day.

You'll notice that Wright doesn't attribute the tables to Henry Beighton; rather to Beighton's friend and fellow mathematician, John Tipper, who could not have produced the tables because he died in 1713. A note in the Wright files (dated 1979) by Professor G. Manley states, "The Meteorological Journal that is in this collection is almost certainly for Coventry or nearby, kept by Henry Beighton – a rather well known Mathematician-Draftsman". So I can't be absolutely certain that the tables are by Beighton, although I agree with Prof. Manley that he's the likely author, as he was known to keep careful meteorological records. The handwriting is similar to Beighton's, but it's also similar to Wright's own handwriting, so I can't be sure if the tables are originals or copies. What I find surprising is that even though Beighton and Wright had shared interests, meteorological and astronomical, and even though Beighton had mining interests in the north-east (and installed a steam engine at Oxclose Colliery, County Durham), it doesn't seem that their relationship was close. Or perhaps, by 1782, 30 years after Beighton's death, Thomas Wright had forgotten exactly who produced Coventry's weather records.

Back to StephensonFest, and the Saturday program of talks. There were three talks in the morning session. First up was John Steele, talking about "A Forgotten Episode in the History of the Moon's Secular Acceleration", showing that Edmond Halley was not the only astronomer to suggest that the Moon was receding from the Earth on historical timescales. He was followed by Clifford Cunningham on "The Clash between William Herschel and the Great 'Amateur Astronomer' Johann Schroter" over the apparent angular sizes of the asteroids, which Schroter over-estimated and Herschel under-estimated. I was last on, before lunch, and my presentation on Beighton's eclipse chart and the context of its production was well-received. Sir Arnold Wolfendale, who has long been based in Durham, chatted to me afterwards and, to my great surprise, revealed that he was born in Cambridge Street, Rugby!

Vitor Bonifacio of Aveiro University, Portugal, began the afternoon session with a history of amateur astronomy in Portugal. Wayne Orchiston then gave an interesting presentation on "The Amateur-Turned-Professional Syndrome: Two Case Studies". Dr Orchiston's thesis was that during the early days of Australian astronomy there was little difference between the quality of work carried out by professionals and by the best amateur astronomers, so that on several occasions amateurs were able to step into professional positions.

After a tea-break came the final session. Kevin Yau gave an overview of "The Contribution of Historical Astronomy to the Modern Science" with particular reference to Prof. Stephenson's many contributions. Kevin started by explaining how a missed bus had led to the first fateful meeting with Richard Stephenson, and how differently his career might have gone if the bus had been caught! Finally Dave Green returned to one of Richard Stephenson's most fertile research areas, "Historical Supernova Explosions in Our Galaxy, and their Remnants"

I wish I'd had the time and opportunity to attend the rest of the conference. A number of posters on display indicated some of the other topics presented – for example, the tantalising possibility that a key event in the history of the Asian republic of Georgia might have been caused by a solar eclipse; also biographical material on the Arabic astronomer al-Sufi (903-986), the first person to chart the Andromeda Nebula. I hope this brief review has given some idea of the scope and ambition of the conference.

Happy 70th Birthday Professor Stephenson!

15/35

A Table of the Weather

To Every Day in the Year 1724.

D	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	D
1				W			W	R			F	R	31
2		R		R		W	W				F	F	30
3		R	F	R			R				F	P	29
4		R		W	R	W		R				F	28
5	R	R			R		W	R				F	27
6	R	R			R			R	T			F	26
7	R	F			R		R	R				F	25
8	R	F					R	R		R			24
9	R	F					R		R				23
10	R	R				Hot	R		R				22
11	R	F						R	R			F	21
12		F					R	R	R	R	F	R	20
13	R	F	R	R		R		R	R	R	F	R	19
14		F	W	R			R				F	R	18
15	R	F	W	R		R					R	R	17
16	R	F	R	R				R			R	R	16
17	R	F	R	R			W	R	R			R	15
18	R		W	R		W		R			R	R	14
19	R						R	R			F		13
20	R						R	R			R		12
21	R		W				R	R			R	R	11
22	R		T		R	T	R	R			R	R	10
23	R	R			R						R	F	9
24	R			R	R			R			R		8
25	R			R	R				R			R	7
26	R			R	R				R	R	F	R	6
27	R			R						R	F	R	5
28	R	R	R	R				Hot			F	R	4
29	R^w		R			W	W			W	F	R	3
30			W							F	R	R	2
31	R		W										1
D	31	28	31	30	31	30	31	31	30	31	30	31	D
	24.	8.	5.	13.	9.	2.	11.	17	8.	5.	9.	15.	

Rainy Days in this Year 116.

of Snow – 1