New Zenith

The Monthly Magazine of the Vectis Astronomical Society

Vol 16 Issue 7 August 2008

Society News

From the Chairman

A total solar eclipse will be visible from a narrow corridor of the Earth on Friday, 1st August. The path of the Moon's shadow begins in Canada and extends across northern Greenland, the Arctic, central Russia, Mongolia, and China. A partial eclipse will be able to be seen from a much broader path, which includes northeastern North America, most of Europe and Asia. From the Isle of Wight, about 20% of the Sun will be hidden between about 9:00 and 9:30 UT (10:00 - 10:30 BST). However, you probably won't be able to notice any difference in the amount of daylight.

If anyone is going eclipse chasing, I wish you clear skies and a wonderful time. *For more eclipse details see page 3*. For those who can't make it, the following web site will show a live webcast from China.
http://sunearthday.gsfc.nasa.gov/2008eclipse/

Remember, NEVER look directly at the Sun.

One of the summer's most popular observing events, the Perseid meteor shower is due to peak between 11-12 August. There should be increasing activity towards dawn on the 12th, and as the waxing gibbous moon sets at about 23:20 on August 11, an early morning vigil may be called for. During this time, a meteor a minute may be seen coming from the direction of Perseus (just below Cassiopeia). The Perseid meteors are produced by debris from Comet 109P/Swift-Tuttle. Incoming meteoroids can be travelling as fast as 60 km/s as they enter the Earth's atmosphere. Being so fast, many Perseids, particularly the brighter ones, often leave behind persistent ionisation trails. *For more meteor details see page 4*.

Clear Skies!
Dr Lucy Rogers
Chairman, Vectis Astronomical Society

Annual General Meeting

The Vectis Astronomical Society AGM will be held on August 22nd 2008 at the Newport Parish Church Centre (Town Lane, Newport).

Nomination forms were included with previous editions of NZ.

As there is a lot to get through, the meeting will start at 7pm - VAS is **your** Society so please make every effort to attend.

VAS Website: www.vectis-astro.org.uk

Submissions or letters to New Zenith are always welcome and should be sent to:

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Material for the next issue by the 6th of the month please.

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Registered Charity No 1046091

Contents

*VAS 2008 - Meeting Programme**

Aug 22nd	**7pm - AGM** and Astrophotography - *Philip Perkins*
Sep 26th	The Tunguska Event - *David Smith FInst, FRAS*
Oct 24th	Beyond the Eyepiece - *Peter Burgess*
Nov 28th	Historic Telescopes of Cambridge University - *Mark Hurn*

** Correct at time of publication*
The Member's night planned for September has been postponed for the time being.

Dates for your Diary

AGM. The Vectis Astronomical Society AGM will be held on August 22nd 2008 at 7pm. Committee nomination forms were included with last month's NZ.

Observatory Anniversary. To celebrate the 10th anniversary of the Observatory we have booked the nearby pavilion for the afternoon of Sunday 28th September. See "Observatory 10 Years On" on page 8 for more details.

Garlic Festival. If you can help as a Marshal at this year's festival, 16th/17th August, please contact Richard Flux ASAP. As in previous years, members will help on the site and, in return, a donation is made to VAS funds.

HAG Visit. We are hoping to arrange a visit to the Hampshire Astronomical Group. If you are interested please contact Richard Flux.

New Members

We have 3 new members this month:

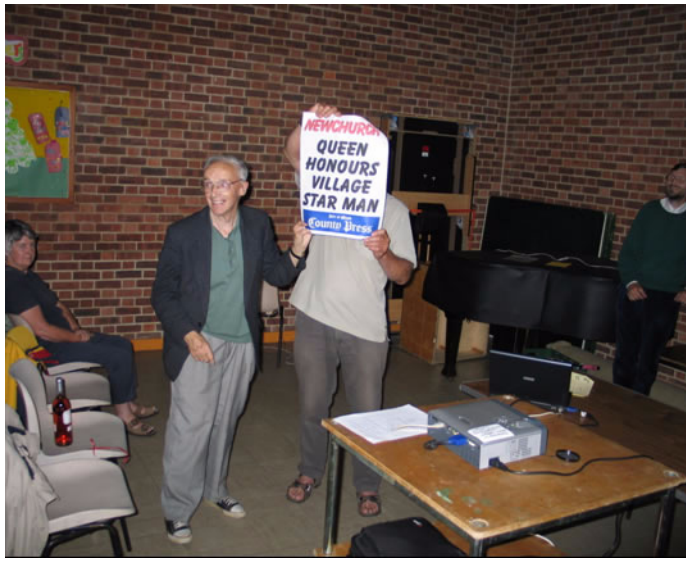
- Mr. A. Cocks
- Mr. E. McFadden
- Mrs S. Willis McFadden

Welcome to VAS!

Tony Plucknett

"The only way of discovering the limits of the possible is to venture a little way past them into the impossible."
- Clarke's Second Law

John Smith MBE



The story behind this picture is that John's MBE was not mentioned on the Apse Heath Post Office billboard and I went in to the County Press office to give them a telling off about it. What had been posted was some obscure tale of somebody using drugs to stay awake to watch TV boxing - not in the same class at all.

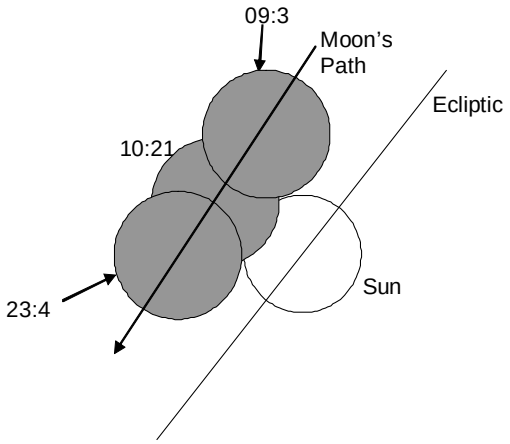
The upshot was that the CP Editor phoned me to say that John's poster would be put up, albeit a week late, and a pristine copy would await my collection at the Post Office on the Friday of the VAS meeting last month. Said copy was handed to John after I made a brief presentation about his being chosen for the gong. John was absolutely overwhelmed by it all.

John Langley

This Month's Night Sky

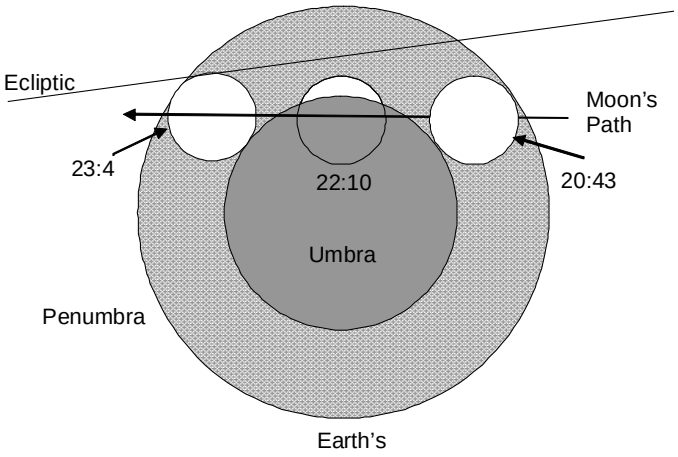
Moon Phases

New	1st Qtr	Full	Last Qtr
1st & 30th	8th	16th	23rd



Solar eclipse August 1

Observers in the British Isles are treated to two eclipses this month; on the 1st a 27% partial eclipse of the Sun may be seen with maximum occurring at 10:21. At this time the Sun will be 40 degrees high in the south west so unless you have a block of flats in front of you there is an excellent opportunity to observe the event which starts at 09:36 and ends at 10:59. **It must be stressed that direct observation either with or without optical aid is to be avoided unless correct filters are used. Instead project the Sun's image through a pair of binoculars or a telescope onto a sheet of white card at the focal point. Observation of the projected image is therefore perfectly safe.**



Lunar eclipse August

On the 16th a partial eclipse of the Moon which is perfectly safe to observe directly. Partiality starts at 20:43 with the moon just above the horizon at an azimuth of 117° - in the east-south-east. Mid-eclipse, when a little over 81% of the Moon is immersed in the Earth's umbral shadow, is at 22:10 with the Moon lying only 12° above the south east horizon. Partiality ends at 23:45 and throughout the eclipse the Moon's north polar regions remain outside of the Earth's shadow and appear dazzlingly white in contrast to the eclipsed portion.

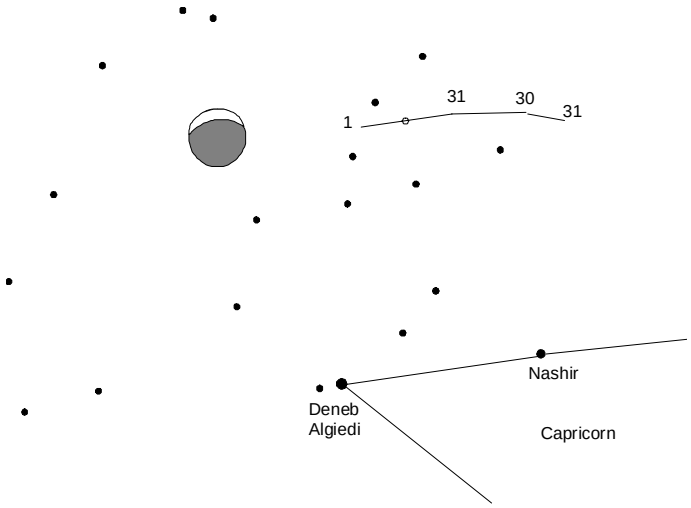
Planets

MARS and **SATURN** are unfavourable.

MERCURY is not on view at the moment but **VENUS** is starting to stretch away from the Sun and will soon appear in the evening sky shortly after sunset.

JUPITER is visible right from sunset and is still very much worth a long lingering look through a telescope. With the planet's apparent disk being so large recordings made with a CCD camera or a webcam can be altered using image enhancement software to bring out subtle detail. Professional looking images are often being produced by resourceful amateurs.

URANUS is close to opposition and **NEPTUNE** is at opposition on the 15th and the eclipse the day after provides an ideal opportunity to locate the planet. See the finder map which covers a field of view roughly equal to that seen through a pair of 10x50 binoculars. Neptune's position is plotted monthly from the 1st of August until the 31st of October. A distinguishing feature of Neptune normally noted in textbooks is its colour - it has a bluish tinge to it but this isn't always seen as it is quite a delicate shade. In a similar way Uranus shows a pastel green shade under good seeing conditions. This effect is often the confirmation that what you're observing is actually a planet rather than a background star.



The path of Neptune from August 1 to October 31. The Moon is also shown at the time of maximum eclipse.

Meteors

August is always a very good month for observing meteors as five showers reach their respective peaks;

- On the 2nd the alpha **Capricornids** are at a favourable maximum. Expect poor rates of around 5 per hour.
- Slightly better is the iota **Aquarids** on the 6th with a rate of 10 per hour.
- A day later the delta **Aquarids** peak, also with a rate of 10 per hour.
- The highlight of the month is the **Perseid** shower with a high rate of around 80 per hour. The shower peaks on the 12th/13th but unfortunately the 11 day-old Moon hanging around best part of the night makes this year's maximum an unfavourable one.
- Finally, the alpha **Aurigids** are favourable on the 28th with a rate of around 10 per hour.

Occultations

There are no bright events this month.

Deep Sky

M57 The Ring Nebula R.A. 18h 54m Dec 33°2' mag 9.5 - This tiny smoke ring in the sky is easily found with a small telescope between Sulafat and Sheliak, the bottom two stars in Lyra. A planetary nebula is the last display of a star similar in size to our Sun. As the star runs out of fuel the outer layers are blown off and the remaining core shrinks to become a white dwarf. The intense ultra violet radiation from the white dwarf causes the surrounding gas to glow as it slowly dissipates into space. In stellar life times this is just a fleeting moment. The ring nebula formed approximately 20,000 years ago.

M27 The Dumbbell Nebula R.A. 19h 59m Dec 22° 44' mag 7.5 - The summer sky's show piece planetary nebula can easily be seen as a rectangular patch of light bluish grey nebulosity with 10x50 binoculars. It is quite a large object; almost half the diameter of the full moon. A small telescope will show some detail, and some users of large telescopes even claim to be able to see traces of colour. The nebula consists of multiple gas shells moving away from the central star some moving at speeds of 30km/s.

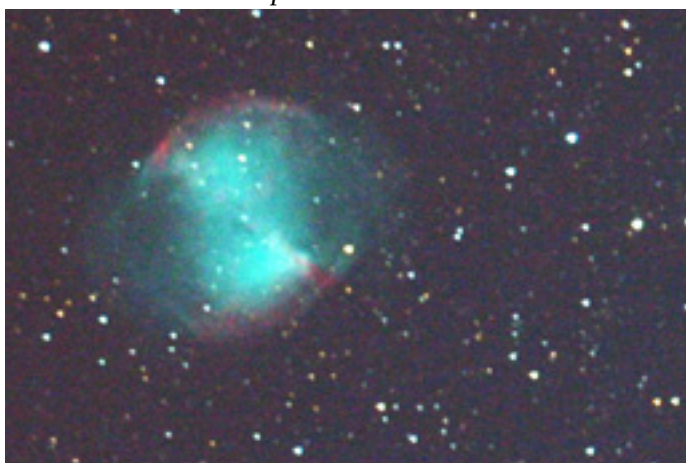
M39 Open Cluster R.A.21h 32m Dec 48° 32' mag 5.5 - The Milky Way is full of star clusters, many are dimmed by intervening dusts or are so surrounded by other stars that it can be difficult to identify them. M39 can be spotted with the naked eye under good conditions, it is large, about the size of the full moon, so binoculars or a rich field telescope are the best instruments to use to observe this cluster.

Peter Burgess

Member's Photos

This month we have some great pictures of M27 from Glyn Salmon. All taken with Canon EOS 350D through a 10 inch Newtonian telescope. Processed using IRIS freeware software and Photoshop.

Exposure = 3 min

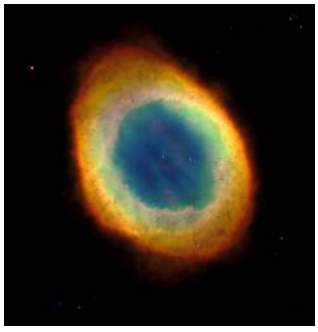


Exposure = 2.5 min

Exposure = 2 min

Glyn Salmon

July's Sky



NASA image of M57, the Ring Nebula, taken from English Wikipedia.
Image Credit: NASA and The Hubble Heritage Team (STScI/AURA) [1]
Object: Planetary nebula M57, the Ring Nebula, in Lyra constellation
Image info: The colour image was assembled from three black-and-white photos taken through different colour filters with the Hubble telescope's Wide Field Planetary Camera 2
Details:
* Blue isolates emission from very hot helium, which is located primarily close to the hot central star.
* Green represents ionized oxygen, which is located farther from the star.
* Red shows ionized nitrogen, which is radiated from the coolest gas, located farthest from the star.
The gradations of colour illustrate how the gas glows because it is bathed in ultraviolet radiation from the remnant central star (hot white dwarf), whose surface temperature is a white-hot 120,000 degrees Celsius.

Dawn Sighting

Wide awake at 3.15 am on Friday 4 July Margaret and I got up to make a drink as one does in these circumstances. Dawn was approaching so we glanced out of the window to see if it was a colourful one and, lo and behold, there in the north-eastern sky was a lovely display of Noctilucent Clouds.

Last time we saw these was after sunset in the north-western sky about 10 years ago and we weren't prepared to see the phenomenon in the dawn sky - anyone else done so? I do know that this display was seen by a Boscombe Down meteorologist at 3.30 that morning but then, these weather persons keep weirder hours than astro folk.

I nipped outside to see if I could capture the scene. Now - 1. I'm no astro photographer, 2. The camera was a basic LCD device and hand held, 3. I was in my dressing gown and 4. It was 3.28 am for goodness sake. However, although the photo is not as bright as the real thing, it does give a reasonably faithful reproduction of the nature and extent of the noctilucent clouds. Those I saw previously were considerably more filamentary in nature but these were the curved forms, known as 'billows' or 'whirls'.

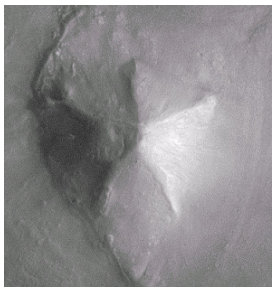
N-clouds are formed when traces of water vapour are carried to great heights in summer by an upwelling of cold air from the lower atmosphere in the polar regions. This is believed to condense around particles deposited by volcanoes or meteors and form extremely tenuous clouds in thin sheets at heights of 80km or more.

They become visible by light reflected when the Sun is from 6 to 16 degrees below the horizon and mostly at latitudes of 60 to 80 degrees, so we are fortunate to get occasional sightings from our relatively low latitude. Still, we're luckier than most in the Southern hemisphere, where there's almost no land in the equivalent latitude band, and USA residents stand no chance, unless they're in Alaska and can stand the mosquitoes.

PS. As this was a morning appearance, perhaps it should be called dielucent cloud! (Latin: dies=day)?

Bert Paice (aka Sleepless in Wootton)

The Cydonia Riddle (*Part 1 of 3*)

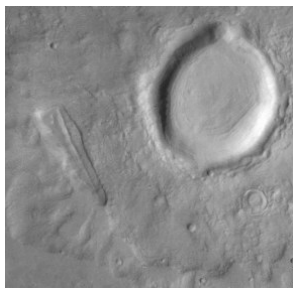


In terms of controversy, "the D&M Pyramid," a structure located in a small Martian region known as Cydonia, has rivalled the "Face on Mars" as potential evidence of extraterrestrial engineering. The problems of explaining a symmetrical, five-side pyramid object, on a planetary surface, as the result of being wind-blown raises questions; how does the wind change direction every few years around the apex of the pyramid? Wouldn't wind smooth one side while sculpting another?

When NASA's Mars Odyssey probe's visible-wavelength THEMIS camera captured this pyramidal form in unprecedented resolution (April 2002) - an apparently 5-sided and, despite extensive damage, highly bi-symmetrical enormous feature (dwarfing the Egyptian Great Pyramid) less than 20 km from the Face - researchers were startled by the appearance of a "new", previously unnoticed diamond-shaped facet emerging from the D&M's northwest quadrant. The structure appeared more bisymmetrical than originally thought - the D&M was named after its original discoverers, Goddard Spaceflight Center digital imaging engineers Vincent DiPietro and Gregory Molenaar in 1979. The discovery of the previously hidden corner forced reconstructions of the D&M's "floor plan" to "morph" into an elongated highly symmetrical, enormous faceted "arrowhead" like appearance.

Earlier high resolution photos have shown that the sides of the D&M - in particular the western facet - reveal extensive erosion, with the northeast and southeast quadrants (assuming they were once intact) almost wholly ravaged, a finding consistent with earlier observations. Subtle details on the D&M Pyramid recall ancient terrestrial architecture - the Pyramids "bottom" triangular facet is bracketed by two somewhat rectilinear formations that may have served as buttresses. Another seemingly structural detail is also revealed on the "buttressed" facet, a shallow, meandering crack which, although could be windblown material peeling away from the southern facet, it is virtually identical to the ruined brick casing seen on the (smaller scale) pyramids in Egypt. While it is unlikely that the D&M represents architecture of an Ancient Egyptian-level civilization (if artificial), this superficial detail suggests some sort of protective veneer which has apparently begun to crumble away, leaving the scrape-like feature seen in the images. It would be absurd to expect smooth, polished surfaces when dealing with objects possibly hundreds of thousands of years old, or more! Any artificial structure left deserted in a Mars-like erosive environment would necessarily be coated in dust and smoothed by meteoric rain, dust, and possibly flowing water - mounting evidence suggests that the Face and related features once protruded from a shallow lake.

Three-sided forms are not unknown in geology, but the formations in Cydonia, being close together and displaying more sophisticated morphology lend themselves more easily to an architectural interpretation. So far, there three bilaterally symmetrical five-sided formations clustered around the Face have been detected. For example, how common are symmetrical five-sided "pyramids" elsewhere on Mars? To date, none have been found. Are they the result of wind-faceting? If so, what are the chances of such faceting producing three uncannily similar shapes in the immediate vicinity of the Face? As the saying goes: "Once is happenstance; twice is coincidence; the third time it's enemy action." But in this case does "enemy action" equate to "intelligent design"? What are the chances of two highly symmetrical anomalies (the D&M and the Face) forming naturally in such close proximity, especially as the features' respective morphologies are so different? While the Face has a generally rounded topology, the D&M is composed of hard angles that belie a simple wind-erosion model.



Another anomaly in the vicinity, recently photographed in visible light by the Mars Odyssey's THEMIS camera is what has been christened "the Cliff". There is no readily explainable way a feature like this could have formed naturally as it sits atop the ejecta blanket of an adjacent "splash"-style crater, sharing alignment with the nearby Face. This type of crater occurs on Mars when an asteroid or comet strikes ground that is saturated with water/ice causing a great out-rush of water/melted water and shattered rock. If the Cliff has existed prior to the impact, it should show obvious signs of damage. although there is plain evidence of ejecta material from the crater on either side of the Cliff - which lies well within the perimeter of the crater's ejecta blanket - none of it seems to have dammed up against this obvious obstacle or come to rest on top of it. Since the Cliff, with its remarkably straight "wall" sited on top, appears unscathed, then it implies it was assembled AFTER the impact - lack of blast-shadow beyond this formation tends to support this observation. This interpretation is supported by a network of shallow grooves extending from the eastern edge of the Cliff to the lip of the crater. These may be remnants of a quarry/construction site utilizing ejecta rubble for the Cliff's tapered base. It is therefore a vital formation in our potential understanding of the Cydonia Mensae region and the role intelligence may have played in shaping it, and is the first look at this anomalous formation in its entirety since the Viking mission took its low-resolution scan of Cydonia in the 1970s.

Our own planet is littered with asymmetric artificial formations that could easily pass for natural hills and mesas if not for extensive aerial and on-site analysis - with such structures appearing deceptively natural until viewed in a cultural/artistic context. Paradoxically, Mars boasts features that, despite appearing quite unnatural, are excluded from archaeological consideration because of the inconvenient fact that they exist on another planet - resulting in disciplined planetary SETI being confined to the scientific fringe. Fortunately, unlike the endless pontificating that surrounds the issue of extraterrestrial intelligence, the reality of Cydonia is readily testable. But until NASA/JPL engages the media in a forthcoming dialogue, we'll only see a perpetuation of the contemporary "conspiracy" mythos. Of course, one must concede that perhaps there really is a conspiracy to down play evidence of former intelligent life on Mars. The admission of life probably wouldn't benefit the career geologists at NASA's JPL, who controls the US' robotic presence on Mars. And if the "Face on Mars" represents a form of non human intelligence, suddenly it would invite uncomfortable questions, most beyond the scope of established authority.

Related links

THEMIS visible-light image-strip showing the D&M pyramid towards the bottom of the image (you will have to look at this image upside down to see the amazing bilateral symmetry of this feature):
http://themis.asu.edu/zoom-20020413a.html

THEMIS visible-light image-strip showing the "Cliff" upper-right-hand side of image (released October 2002):
http://themis.asu.edu/zoom-20021009a.html

Any thoughts to New Zenith or, I can be e-mailed at: alan.matthews3@jobcentreplus.gsi.gov.uk

Alan Matthews

Riddle

I recently received this riddle as a text message from my sister and thought I would share it with rest of the VAS. (*although its probably a bit easy for our membership!*)

- I live above a star, but never burn.
- I have 11 neighbours but they never turn.
- My initials are p q and r and sometimes s.
- What am I?

Answer next month

Stephen Taylor

Observatory 10 Years On

Back in the distant past, there was a grubby patch of grass in the Newchurch Recreation Field that was doing no harm to anyone. Little did it know that great plans were afoot and the schemes of men (the mice just couldn't be bothered!) decreed that a wondrous new building was to be placed exactly where that lowly patch of grass prospered.

And it came to pass that those who worshipped the heavens and the stars therein did toil mightily all through that year, and much wailing and gnashing of teeth ensued: yea, even when the promised funding proved to be allied to the Devil himself in that it had to be grasped with the bare hands when proffered by the counting houses and not turned away in a prodigal manner. And the committee looked at the works progress and saw that it was good.

A minaret dome was forthcoming from far across the ocean and it needed much in the way of refurbishment. After great wringing of hands and application of paint brushes, the mighty dome proudly sat in its allotted position on the roof of the astronomical temple. And Lo! It was seen to rotate at the whim of man in both directions and Yea, the shutter did elevate to reveal the skies to the gaze of the worshippers below. And the committee saw that it was good.

And yet, in this time of success, an instrument to study the heavens was needed and the committee did wail and gnash their choppers in grief. And it came to pass that an angel did say that there would be an instrument if only enough faith could be displayed. A messenger from the distant land of Forest Road came forth saying verily, a temple such as this one was nothing without the means to bring the stars forth to the very eyes of the assembled brethren. And the messenger did announce to the multitude therein, that he would perform a miracle and Lo! there was seen to be a remarkable device fit to be used for surveying the heavens, and it was installed beneath the dome. And the committee and the assembled worshippers did agree that it was good. Thus all the toil and troubles came to an end and a great priest from over the ocean came to bless the temple and its children and all was well in Newchurch.

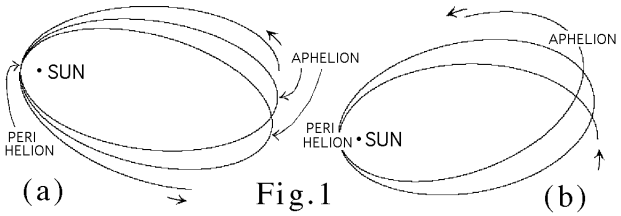
Which, in other words, was how the Observatory came to be built in 1998, on time and on budget, thanks to John Smith (MBE) and his stalwart team of toilers. It was on September 28th 1998 that Dr John Mason did us the honour of officially opening the Observatory. Ten years have now passed and it would seem a pity if we did not mark the anniversary. In which case you are all invited to a grand afternoon shindig at the Newchurch Pavilion (next door to the Observatory) on Sunday 28th September. We hope to celebrate in fitting style so get the date firmly fixed in your diaries. *More details in next month's New Zenith.*

John Langley

From Pioneer Spacecraft to Mercury's Precession

In "The Pioneer Anomaly and the Potter's Wheel" (June NZ) which proposed an annulus to explain the anomaly, we said, "We can't have an annulus dense enough to upset the perihelion movement of Mercury which fits in with general relativity. Our annulus must have a central hole."

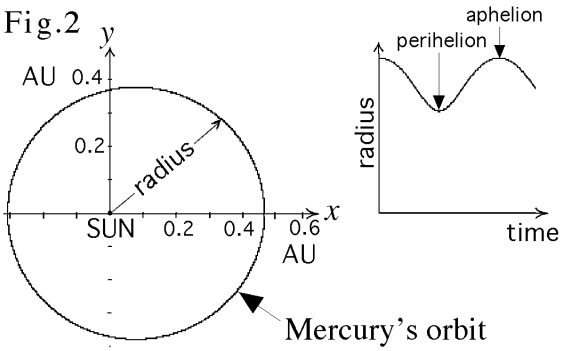
Since science involves triple checking, we decided to check that our hypothesized annulus would have no significant effect upon the orbit of Mercury. We should have said "aphelion" - it precesses by the same angle as the perihelion, but being the furthest point in the orbit from the Sun, its movement shows up more in diagrams like Fig.1. Mercury precesses in the same direction as the orbit, Fig.1(b), but this picture is exaggerated. In reality the orbit with eccentricity close to 0.2 has the appearance of an off-centre circle as in Fig.2. The precession of the orbit is like the movement of a hoop around the body of a gymnast but making only one gyration per three million years. Einstein and Infeld[1] describe how the precession was explained using general relativity. The precession per cycle is 0.1 arc second - the angular size of a six inch grapefruit atop the Eiffel Tower spotted from a glider flying over the Isle of Wight - not a lot!



Detecting this amount of precession in crude computer orbit modelling would be like trying to catch a wood louse in a lobster basket - and we are looking to confirm a smaller precession caused by our hypothetical annulus. Suppose the annulus caused exactly 0.1 arc second per orbit - now that would spell trouble! - we needed to check it out, so how would we do it?

One of us travelled by Greyhound bus with a folding bike around the USA and Canada, with Goldstein's *Mechanics*[2] in a backpack to read at night in the woods. Equations - if you can get them - would be more accurate than computing. Now it's time to give the book another go - what's this? - tucked at the end of a chapter, the student is invited to calculate the effect of dust in the solar system on orbit precession - huh! But one piece of mechanics we don't follow. So we'll try it our way...

If Mercury is sitting in a hole within a very large annulus, we want data on the gravitational effects of the annulus in the hole. Ah, but the Sun rotates, so if the Sun is slightly oblate, this would cause a departure from the inverse square relation near to the Sun and also cause precession of Mercury's elliptical orbit. The maths is tricky, so we go for the simple question first - which way? Does an internal or external annulus to Mercury's orbit give precession in the same direction or counter to the orbit? A squashed Sun would approximate to an annulus internal to Mercury's orbit, added to a perfect solar sphere. Our computer modelling gives Fig.1(a) for an internal annulus, and (b) for a planet orbiting in a hole inside an external annulus. Since Mercury's aphelion goes in the same direction as its orbit, we shelve the maths of an oblate Sun.



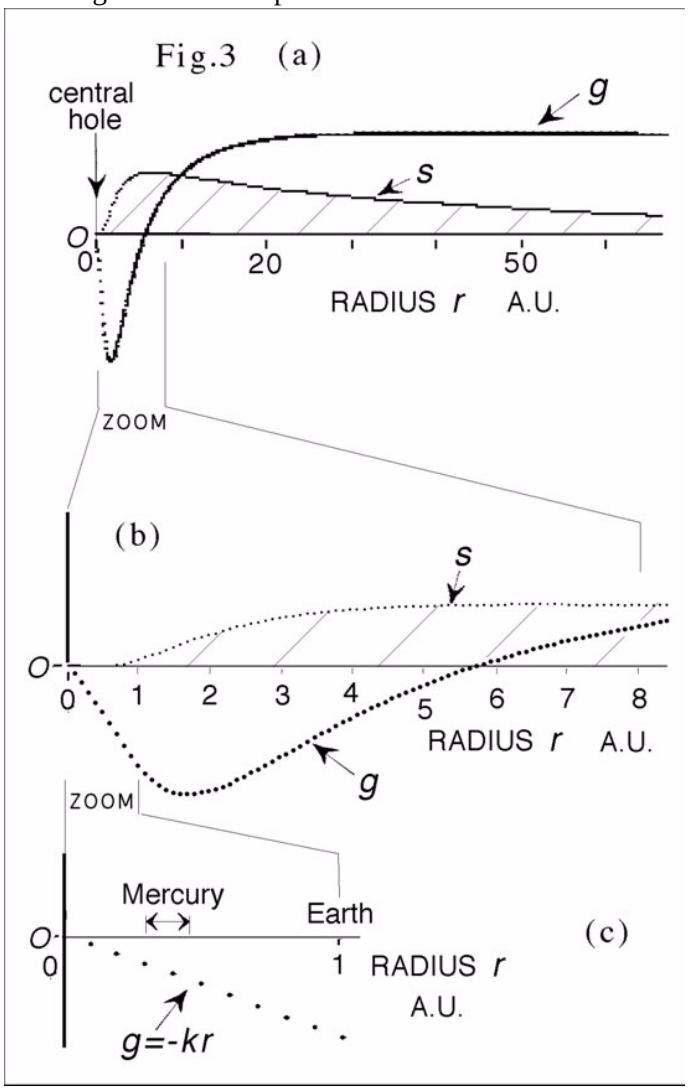
If someone said of our Potter's Wheel article - "all very clever, but the Pioneer engineers would have noticed the spacecraft getting drawn outwards by such an annulus before the constant g regime took over" - we would say "what about launching uncertainties and mid-course corrections, wouldn't these hide the effect of an initially outward acting gravity from an external annulus, superimposed on solar gravity?" Mercury is well inside the hole of our proposed annulus, but the further Mercury travels out from the Sun, the more it would be slightly attracted to such an annulus, giving it precession. We need the data, preferably an equation for annular gravity, then we can model Mercury's orbit, without having to compute individually the effects of all the particles of our annular model.

Fig.3 (a) is a copy of part of Fig.2 of the Potter's wheel article, *s* is area density.

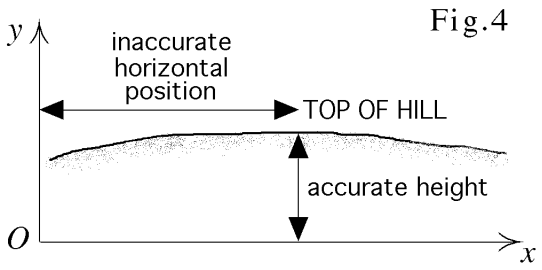
Zooming in, Fig.3(b) gives more data on the computed gravity inside the hole. Zooming in again, Fig.3(c), between the Sun and the Earth's orbit (at 1 A.U.) outward gravitation due to the annulus very conveniently approximates to the linear relation $g = -kr$ (1).

Combining solar and annular gravity gives the net gravitation $g=GS/r^2 - kr$ (2), valid from the Sun out to the Earth's orbit, enabling us to model Mercury's behaviour. G is Newton's gravitational constant, S the mass of the Sun, and k comes to 5.22×10^{-21} m/s^2 per metre (units simplify to s^{-2}). We set up an orbit to scale representing Mercury, and tested the effect of various values of k on the precession.

But now we reach the problem we call "where's the top of the hill?" In Fig.4 the height of the top of the hill can be measured accurately, but the horizontal position to the hilltop is much less certain. In orbit computations, the angular position of the aphelion is required, which means detecting the angle where maximum radius occurs and using that to tell us the angle. This might sound simple, but when computing the orbit in steps, at every step, we get a radius value to 9 decimal places and the last figures can wander, sometimes randomly, so several maxima can appear in the region required. Intriguing computing problems hide here which we haven't fully solved, depending upon how exactly we perform our algorithm to implement Newton's law of gravitation, updating the computed position of Mercury step by step. But we know how to get around this problem.



In our simple program, we model the motion of Mercury to scale on our computer screen, doing a computation for every 50 seconds real motion of Mercury. Our program can do the calculation in about one millisecond, so we're going around the orbit in our model 50,000 times faster than Mercury. Since the orbital period of Mercury is (nearly) 88 days, divide that by 50,000, gives 2.5 minutes for one circuit on screen.



We multiply *k* in equation (2) by one million, and see what precession we get. We can detect reliably down to 15 arc minutes precession, and we find that our orbit has precessed 4 degrees. We establish that the precession angle and *k* are directly proportional to each other, and assuming this linear relation physically holds down to zero, then our hypothetical annulus would give a precession of Mercury's orbit of one millionth of 4 degrees per cycle, or 0.014 arc seconds.

This computed precession is one seventh of the 0.1 arc second per orbit cycle attributable to general relativity. Perhaps this is negligible, or perhaps it's cancelled out by the effect of solar oblateness, or perhaps our proposed annulus should have less of a hole, filling it in would reduce outward acting gravity near Mercury. So, we're fairly happy that our proposed annulus wouldn't have much effect on Mercury, but then we began to ask - what happens if the outer planets themselves are included as a part of such an annulus? We were puzzled because our modelling suggested their effect would be substantial, so, by then, something was looking wrong. The answer came as a surprise to us.

The precession attributable to general relativity of "43 arc seconds per century" to quote one modern book, is less than one tenth, of its *total precession*. Looking into history[3], Newcomb found that of Mercury's total precession of 579.16 arc seconds per century, he could account only for 537.62 arc seconds using Newton's laws, leaving the difference for Einstein to explain. Yet the picture we got from Einstein and Infeld was one of precession entirely caused by general relativity! Is their text oversimplified, or didn't they know? - we wonder.

References

[1]A.Einstein & L.Infeld, *The Evolution of Physics* Simon & Schuster NY 1938, p239.

[2]H.Goldstein *Classical Mechanics* Addison Wesley, New York,1980, problem 13, p122.

[3]Captain Ellison Hawks *Astronomy* T.C.& E.C. Jack Ltd, London, 1922, p90.

Dr. Guy & Dr Richard Moore

A Few Facts

Light Year

A light-year or light year (symbol: ly) is a unit of length, equal to just under ten trillion kilometres. As defined by the International Astronomical Union (which is the body which has the jurisdictional authority to promulgate the definition), a light-year is the distance that light travels in a vacuum in one Julian year.

A light-year is equal to:

- exactly 9,460,730,472,580.8 km (about 10 Pm)
- about 5,878,625,373,183.61 international miles
- about 63,241 astronomical units
- about 0.3066 parsecs

The figures above are based on a Julian year (not Gregorian year) of exactly 365.25 days (each of exactly 86,400 SI seconds, totalling 31,557,600 seconds) as defined by the IAU.

The light-year is often used to measure distances to stars. In astronomy, the preferred unit of measurement for such distances is the parsec, which is defined as the distance at which an object will appear to move one arcsecond of parallax when the observer moves one astronomical unit perpendicular to the line of sight to the observer. This is equal to approximately 3.26 light-years. The parsec is preferred because it can be more easily derived from, and compared with, observational data. However, outside scientific circles, the term light-year is more widely used.

Astronomical Units

The astronomical unit (AU or au or a.u. or sometimes ua) is a unit of length of approximately 150 million kilometres, and is based on the distance from the Earth to the Sun. The precise value of the AU is currently accepted as 149,597,870,691 ± 30 metres (nearly 150 million kilometres or 93 million miles).

The symbol ua is recommended by the Bureau International des Poids et Mesures but in anglophone countries the reverse - au - is more common. The International Astronomical Union recommends au and international standard ISO 31-1 uses AU. In general, capital letters are only used for the symbols of units which are named after individual scientists, while au or a.u. can also mean atomic unit or even arbitrary unit; however, the use of AU to refer to the astronomical unit is widespread.

Originally, the AU was defined as the length of the semi-major axis of the Earth's elliptical orbit around the Sun. In 1976, the International Astronomical Union revised the definition of the AU for greater precision, defining it as the distance from the centre of the Sun at which a particle of negligible mass, in an unperturbed circular orbit, would have an orbital period of 365.2568983 days (one Gaussian year). This definition gives a value that is slightly less than the mean Earth-Sun distance. An alternative way of stating the definition is that an AU is the distance at which the heliocentric gravitational constant (the product GM?) is equal to $(0.017\ 202\ 098\ 95)^2$ AU^3/d^2

Examples

The distances are approximate mean distances. It has to be taken into consideration that the distances between celestial bodies change in time due to their orbits and other factors.

- The Earth is 1.00 ± 0.02 AU from the Sun.
- The Moon is 0.0026 ± 0.0001 AU from the Earth.
- Mars is 1.52 ± 0.14 AU from the Sun.
- Jupiter is 5.20 ± 0.05 AU from the Sun.
- Pluto is 39.5 ± 9.8 AU from the Sun.
- The Kuiper Belt begins at roughly 35 AU
- Beginning of Scattered disk at 45 AU (10 AU overlap with Kuiper Belt)
- Ending of Kuiper Belt at 50-55 AU
- 90377 Sedna's orbit ranges between 76 and 942 AU from the Sun; Sedna is currently (as of 2006) about 90 AU from the Sun.
- 94 AU: Termination shock between Solar winds/ Interstellar winds/Interstellar medium.
- 100 AU: Heliosheath
- 105 AU: As of February 2008, Voyager 1 is the furthest of any human-made objects from the Sun.
- 100-150 AU: Ending of Scattered Disk
- 500-3000 AU: Beginning of Hills cloud “Inner Oort Cloud”
- 20,000 AU: Ending of Hills Cloud “Inner Oort Cloud”, beginning of “Outer Oort Cloud”
- 50,000 AU: possible closest estimate of the “Outer Oort Cloud” limits (0.8 ly)
- 100,000 AU: possible farthest estimate of the “Outer Oort Cloud” limits (1.6 ly).
- 125,000 AU: maximum extent of influence of the Sun's gravitational field (Hill/Roche sphere). beyond this is true interstellar space. This distance is roughly 1.8-2.0 light-years.
- Proxima Centauri (the nearest star to Earth, excluding our own Sun) is ~268 000 AU away from the Sun.
- The mean diameter of Betelgeuse is 2.57 AU.
- The distance from the Sun to the centre of the Milky Way is approximately 1.7×109 AU

THE BACK PAGE

LINKS, COMMENTS AND OBSERVATIONS

News From Around the Web

Future of Jodrell Bank Secured - 10 July 2008

The University of Manchester has reached an agreement with the Science and Technology Facilities Council (STFC) that should secure the medium and long term future of the famous Jodrell Bank Observatory in Cheshire.

The STFC has confirmed to the University its intention to contribute to the operating costs for the e-MERLIN radio-astronomy facility at Jodrell Bank. The deal guarantees full funding at current levels for the next two years, during which time the development phase of e-MERLIN will be completed, with scientific project funding made available thereafter.

The long term future of Jodrell Bank will be secured by the commitment of the STFC to invest in the development of the next generation facility in radio astronomy, the Square Kilometre Array, which will be led by The University of Manchester from the Jodrell Bank Observatory, working with Oxford and Cambridge universities.

Commenting on the agreement, Professor Alan Gilbert, President and Vice-Chancellor of The University of Manchester, said: "We are delighted that the STFC has recognised the scientific importance of e-MERLIN and the Square Kilometre Array, and that they have provided a commitment to fund these important projects, which will guarantee the future of Jodrell Bank."

http://www.jb.man.ac.uk/

Pheonix Lander News - 11 July 2008

The delivery of Martian water ice to the Phoenix lander's organic chemistry instrument remains the highest priority for the mission, although efforts have been slowed by the ice's toughness. Phoenix has had trouble trying to scrape enough ice off the extremely hard ice layer near the spacecraft. Once a significant ice sample has been acquired, "bake and sniff" tests will be made for spectrometer analysis of any evidence in the melt water that the ice possibly preserved organics.

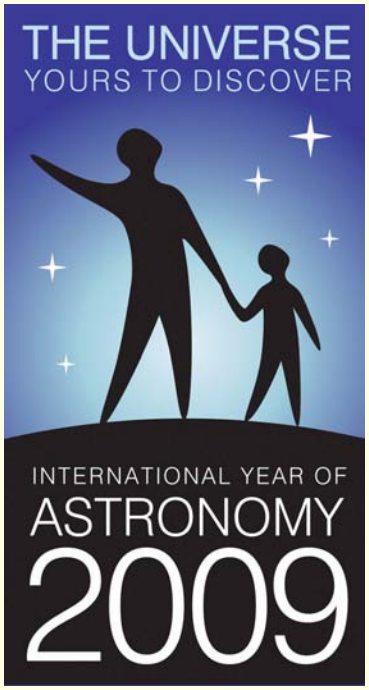
Plans for the ice test were slowed when researchers found that not even the tungsten carbide hard blade on the robotic arm scoop could scrape enough shavings off the ice layer. Scraping produced piles of scrapings at the bottom of a trench on July 7, but did not get the material into its scoop. The scrapings were smaller than previous piles dug by Phoenix, making it difficult to collect samples.

"It's like trying to pick up dust with a dustpan, but without a broom," said Richard Volpe, from NASA's Jet Propulsion Laboratory, Pasadena, Calif.

The teams are now focusing on use of the drill-like motorized rasp within the scoop to access the hard icy soil and ice deposits. They are also conducting tests on Phoenix's engineering model in the Payload Interoperability Testbed in Tucson to find the optimum ways to rasp the hard surfaces and collect samples.

Once shavings are collected, the next challenge will be moving the arm fast enough to reach the TEGA before the ice sublimates back into the tenuous Martian atmosphere.

http://www.nasa.gov/mission_pages/phoenix/main/index.html



Cool!

"The Cern Laboratory, home of the Large Hadron Collider, is fast becoming one of the coolest places in the Universe. According to news.bbc.co.uk, the Large Hadron Collider is entering the final stages of being lowered to 1.9 Kelvin (-271C; -456F) - colder than deep space. The LHC aims to re-create the conditions just after the Big Bang and continue the search for the Higgs boson."

Observatory

For your own safety when visiting the VAS observatory, please remember to bring a torch. Also, please make sure you close the car park gate if you are the last to leave.

Articles Needed

New Zenith welcomes letters, articles or pictures related to all aspects of astronomy.
Please send contributions to the Editor at the email or postal address on the front page.