TRANSIT

The Newsletter of

Cleveland & Darlington Astronomical Society

5 January 2006. Julian Day 2453740

Hon Sec Neil with Charlie Duke, Lunar Module Pilot, Apollo 16

Editorial

Apollo Astronaut Visits WYAS.

In November a number of CaDAS members traveled to the West Yorkshire AS meeting in Pontefract to meet Charles Duke, the 12th Man on the Moon. Charlie was the Lunar Module Pilot on Apollo 16 and straight man to Mission Commander John Young's sense of humour. Charlie demonstrated his own sense of humour throughout his presentation, it was more like a South Carolina down-home chit-chat. He showed previously unpublicized video footage of Apollo 16 that added to the uniqueness of the occasion. He also proved his heroic stature by signing autographs for over an hour. A memorable coup for WYAS and the > 600 person audience.

December 2005meeting - A Story of Time.

Martin Lunn gave a fascinating view into the development of Time from early days as both a useful tool to man and his occasional scourge. He described a number of fascinating time-telling mechanisms as well as providing an insight into the cultures of those who developed them.

January 2006 Meeting – Members Night

Do you have a subject you could share with the Members in a 20 minute slot. Contact Neil on neil.haggath@ntlworld.com or give me a call on 01642 324939.

Happy New Year – 2006

To those staid, conservative and sober-sided readers of the Transit I apologise for the inclusion of frivolous humour in this issue. For the rest of you Hey! its 2006 and we haven't been hit on the head yet by an NEO, lets have a bit of humour (but only this once).

Q. How many astronomers does it take to change a light bulb?

A. Two. One to change the bulb and one to complain about the light pollution.

Copernicus' parents - "Copernicus, young man, when are you going to come to terms with the fact that the world does not revolve around you?"

The CaDAS Interview – Alex Menarry

The ace astro interviewer is finally interviewed Alex has conducted a number of great interviews over the years providing an insight into member's lives which, to be honest, most of us never imagined that those quiet persons who pop into the Parish Hall every month have so much going for them, not just in astronomy but in interesting and often exciting lives. Alex falls into this category with a full family, academic and athletic life. Yet another fascinating CaDAS member.

Where were you born and bred?

I'm a Lancashire lad. Born in Liverpool in 1932 but my very sensible father moved us into the country four years later, before the 1939-45 war broke out, to Burscough, outside Liverpool, where I lived the life of a country boy until it was time to go to University. In those early days the countryside was really dark but with all my other interests I regret not once looking up into the night skies, a missed chance.

Do you have any brothers or sisters?

I have a brother seven years younger. He is doing very well in his chosen profession in the Government Health and Safety Executive.

What is your academic background?

After grammar school in Ormskirk, I went to Manchester University to study Physics. I was very lucky in the very practical Physics courses introduced by Professor Lipson at UMIST. They stood me in very good stead when I entered Industry. I spent 6 years at UMIST, staying on to present a thesis for a PhD. My research area was X-ray crystallography, a field which allowed me to meet Crick of DNA fame, who used similar X-ray techniques in his own research.

And after University?

I joined a Consortium involved in designing and building Nuclear Power Stations for the electricity supply industry. The very first project was Calder Hall, built and operated by UKAEA, where I spent a year training. My speciality became reactor commissioning, which was an entirely new subject at the time. My career in the nuclear industry has taken me around the UK, starting at on of the very early magnox stations at Bradwell, in Essex. The next two years were at Latina, in Italy, south of Rome, one of the very few exports the UK managed to make. After commissioning stations at Oldbury on the Severn and Hunterston in Ayrshire, I eventually came to Hartlepool Nuclear Power Station. I spent ten years there before my retirement and then commenced a very hectic and active post-working life.

Do you have children?

Nita and I have two girls and one boy, all living happy and busy lives. We have an annual get-together in Darlington for my birthday every December, which includes the whole family and our four grandchildren.

What are your interests as well as astronomy?

At about the age of forty, I took up running. It was to get fit for an expedition to Iceland with some younger friends. I didn't want to be left behind! In the event, I was fitter than they were. I have been a cyclist for many years and have taken up cycling touring again, since retiring. My cycling takes me to the mountainous regions of France to follow sections of the Tour de France along with my similarly-aged friends, As a group we also tour in the UK – England Coast to Coast, across Scotland, Ireland south to north – that sort of thing. Our future plans include Italy, Switzerland and following the pilgrimage route in Northern Spain to Santiago de Compostella. We have just finished an exciting ride up the middle of Wales in horrendous weather. Robert Stevenson's Britannia Bridge over the Menai Straits makes very exciting riding in high winds!

My running is more in the traditions of Fell running. I'm a member of a running club in Edinburgh and we have had regular annual journey-running holidays on high mountain routes in Norway, Iceland, France and Spain, as well as the mountains of Scotland. I learned my interviewing techniques on these runs for the Carnethy Club magazine. My wife Nita is a keen walker and between us we keep very fit and healthy. I've done a lot of racing over the last couple of years, since the Fell Runners Association introduced a championship for the over-70s. When we travel to a race, Nita has a long walk, while I do the running business. We are both very keen on ballroom dancing, going out at last once a week and sometimes twice or three times. Other interests include playing the guitar and plan to take up the piano again soon.

How did you develop your interest in astronomy?

As I mentioned earlier it is a great regret that I missed the opportunity of using a telescope my parents bought me in the wonderful dark skies of my country youth. The clear skies of southern Italy, with a flat roof on our house and the pleasant warmth of the nights, encouraged my looking up at the heavens. My interest continued on returning to UK. I joined CaDAS soon after moving to Darlington. My observing has included night-long sessions on eclipsing binaries. I eventually became involved in the BAA Variable Star section and today I am helping to convert their vast amount of hand-written records into a digital format. I started grinding a 6 inch mirror but this is still an ongoing project.

Are you happy with the present CaDAS, anything you would like to change?

The lecture series are outstanding - they are such high quality for such a small group. Producing Transit magazine has been a great pleasure. A newsletter, which reaches every member, is an excellent way of giving a sense of being in touch. I am impressed with the

development of the Planetarium and Observatory through the imagination and efforts of those involved, both in the original construction and subsequent development. I would like to see the Society having events outside the monthly Parish Hall meetings, to enable us to get to know one another a bit better. However, I appreciate that members appear to be quite happy with the present arrangements.

As an ongoing life-long learner are you interested in the latest theories in astronomy?

I am still involved with the University of Central Lancashire astronomy and cosmology courses. They serve as a wonderful knowledge base in understanding the latest astronomical and cosmological discoveries. My present astronomical involvement is more in 'knowing' than actually 'seeing'. I hope to change that in the near future by becoming involved in observing with the incredibly sensitive modern, small TV cameras which are becoming available. The hope is to adapt the cameras to observing the magnitudes of eclipsing binaries. Estimating magnitudes by eye needs a lot of experience and I am not very good. I find astronomy a wonderful springboard into other scientific disciplines, it seems to touch many fascinating fields.

Who are your heroes in the field of science?

They must include Sir Bernard Lovell whom I met in Manchester University, feisty Richard Feynman and Richard Dawkins. My heroes in the fell-running world you won't have heard of - fantastic athletes like Joss Naylor, Helene Diamantides and Angela Mudge, whose mountain running feats are beyond belief.

What books are you reading?

I have just finished the "Life of Pi"; a friend talked me into trying novels for a change. "The Number One Ladies Detective Agency" and "Last Lovers" are both lovely, gentle reads, which I recommend. However, my preference is for non-fiction, geology, evolution, astronomy, physics and maths. Anything by Feynman or Dawkins makes one (to quote Hercule Poirot) 'furiously to think'.

What is your motivation, what keeps up your enthusiasm in your many interests?

My theory of motivation and enthusiasm, both cerebral and physical, is that it comes from contact with other enthusiastic people. It is a sort of re-cycling process, whereby we pass enthusiasm around from person to person. I have been very lucky with my friends and associates and I hope my enthusiasms will never leave me.

Who has influenced you the most in life?

This must be my father. Although he died when I was young, his influence and good-sense decisions, such as moving to the countryside, have greatly influenced me in my life. He spent his early working life in the Merchant Navy and pointed out the

constellations when I was very young. He was a great advocate of education and learning, as well as respect for others.

Do you enjoy the use of computers?

Yes, I derive a great deal of pleasure and entertainment from my home network. It gives instant access to vast amounts of information as well as the chance of buying things on-line. I use e-bay regularly and book air and train tickets that way. Producing Transit Magazine and doing the BAA Variable Star records would be impossible without the computer.

What is your definition of a civilised society?

As a lifelong socialist, I consider that in a civilised society, the strong support the weak.

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Q How many astronomers does it take to change a bulb?

A. Three, plus or minus seventy five according to observational errors.

Q. How many astronomers does it take to change a bulb?

A. 10^8, because astronomers love really big numbers !

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Double, Binary and Variable

from Alex Menarry

How's about this for one of those "I don't believe it" facts:- 50% of the stars we see in the sky are doubles and the vast majority are binary stars' i.e. 2/3rds of the stars in the sky are members of binary pairs. Some people even suspect that the Sun may be one member of a binary pair. Optical doubles are merely the product of coincidences of line of sight. A genuine, Bedouine binary is a gravitationally bound pair, each rotating in an ellipse about the other. The distance between the pair determines whether they can be

seen either a) visually or b) by spectroscopic means or c) by astrometric wobbles or d) the characteristic light curves of eclipsing binaries.

Eclipsing binaries bridge the gap between double stars, which are extrinsic variables and true variable stars, those varying for intrinsic reasons. As well as binary pairs, there are multiple systems of great complexity, for example the Trapezium in Orion. The mixture of binary systems is at least as varied as you or I can imagine. The catalogues give combinations of star and star (similar and different types), star and white dwarf, variable star and non-variable star, star and black hole, star and pulsar. The classical catalogue, a publication of great fascination, is the Aitken Double Star Catalogue, with its ADS numbers. Norton's Star Atlas also has lots of information on doubles in the 'interesting objects' sections before each map – look for the EA, EB or EW designation (explained below) of eclipsing binaries.

Theories of the formation of these systems have varied from the spontaneous fission of single stars to capture of one star by another or the postulation of collisions similar to that produced by the Earth-Moon system. The favourite at present, using modern knowledge of the interstellar medium (ISM), is the formation of multiple systems by accretion or the collision of giant molecular clouds (GMC) at various speeds. Using the appropriate physics equations, computer simulations have made "visible" the production of doubles, triples and more complex systems. They are not all stable and many evolve into binary systems. It seems that the binary pair is the most stable configuration.

As for the history of the discovery of binaries, surely variable stars must have been noticed by the Greek and Arabian astronomers? Maybe the religious requirement of the day, that the sky is pure and unchanging, inhibited reports of variables. The first recorded variable star was Algol, recognised in 1669 by Geminiano Montanari. It is now known that the magnitude variation is from 2.1 to 3.4 in about 2.9 days. The idea that doubles may be gravitationally bound and eclipsing one another came from the deaf and dumb John Goodricke in 1782. What an incredible idea. I find these out-of-the-blue, outrageous ideas fascinating. Where do they come from? Would I have thought of it? No! Large numbers of doubles were catalogued by F. W. Herschel and his son, John in the early 1800's. FW recognised them as gravitationally bound and moving with the same proper motion.

Visual binaries have been instrumental in measuring the masses of stars, leading to the relation between mass and luminosity. Careful observation of the size and period of the orbit gives the sum of the masses using Newton's form of Kepler's Third Law. The velocities, from Doppler shift in the spectral lines, give the ratio of masses. Hence the mass of each component of the binary can be calculated. The periods of binaries vary widely. Distant ones (separation up to 100AU) have periods of hundreds or even thousands of years. Close ones, with separations of only 0.01 to 0.1 AU, have periods of days or even less than a day. Imagine that situation!! Sit and think about what is happening out there; two star-sized objects whizzing round one another in less than a day.

Spectral binaries also come in several flavours. A double-line binary indicates that the stars' spectra are similar and the lines sometimes "double" as the radial velocities vary towards and away from us. Single line binaries, with only one set of dark lines showing Doppler shift, indicate that a companion can be inferred, although invisible. A composite spectrum binary shows the components are different types of star. It still surprises me what it is possible to infer from star spectra – a few photons reaching us here on Earth from many light years away.

Eclipsing binaries pass in front of one another in our line of sight to produce the characteristic, periodic light curves for different types. They are of necessity very close to one another, with periods of days. Those that are a few star diameters apart are called detached. Any closer and one of the pair becomes distorted by the gravitational pull, filling the Roche lobes and possibly depositing mass on the other star, through the mutual Lagrangian point. It is thought that this type of binary is evolving by mass transfer and tidal effects from semi-detached to contact, then over-contact, leading to totally combined, or common envelope, binaries. The amazing symbiotic stars exhibit spectral lines indicating the binary as a red super-giant (surface 3,000K) and a dwarf B star (surface 20,000K), exchanging mass through an accretion disc and called an interacting binary.

Classic types of eclipsing binary for amateur observation are beta Persei (Algol) (EA), beta Lyrae (EB) and W Ursa Majoris (EW), each with a characteristic light curve. Observe them at the right times and see the variation in magnitude for yourself, by naked eye or binoculars. One method for estimating magnitudes is that of the BAA Variable Star Section, which compares the variable with nearby, so-called "sequence stars". A more difficult method is the decimal steps of Pogson – the man who invented the magnitude system we use today. Try it with beta Lyrae, which varies quite a lot over a few nights. I was very excited to be able to see the variation, thinking it was only for professionals or very advanced amateurs with special equipment.

One way of boning up on the technical terms in this piece is to refer to one of the Dictionaries of Astronomy, for example the Oxford. By following the references to other entries, the story of the binary evolves as you read. I enjoy just reading my dictionary, flicking over the pages. All sorts of wonders are revealed - the subject for another time?

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Q. How many astronomers does it take to change a light bulb?

A. None, astronomers prefer to use standard candles.

NASA'S MARS ROVERS CONTINUE TO EXPLORE & AMAZE

from Ray Worthy and NASA

NASA's durable twin Mars rovers have successfully explored the surface of the mysterious red planet for a full Martian year (687 Earth days). Opportunity starts its second Martian year Dec. 11; Spirit started a new year three weeks ago. The rovers' original mission was scheduled for only three months.

"The rovers went through all of the Martian seasons and are back to late summer," said Dr. John Callas of NASA's Jet Propulsion Laboratory, Pasadena, Calif. He is deputy rover project manager. "We're preparing for the challenge of surviving another Martian winter."

Both rovers keep finding new variations of bedrock in areas they are exploring on opposite sides of Mars. The geological information they have collected increased evidence about ancient Martian environments including periods of wet, possibly habitable conditions.

Spirit is descending from the top of "Husband Hill" to examine a platform-like structure seen from the summit. It will then hurry south to another hill in time to position itself for maximum solar-cell output during the winter.

"Our speed of travel is driven as much by survival as by discovery, though the geology of Husband Hill continues to fascinate, surprise, puzzle and delight us," said Dr. Steve Squyres of Cornell University, Ithaca, N.Y., principal investigator for the rover's science instruments. "We've got this dramatic topography covered with sand and loose boulders, then, every so often, a little window into the bedrock underneath."

From the composition and texture of more than six different types of rock inspected, scientists deduced what this part of Mars was like long ago. "It was a hot, violent place with volcanic explosions and impacts," Squyres said. "Water was around, perhaps localized hot springs in some cases and trace amounts of water in other cases.

Aided by a good power supply from Spirit's solar cells, researchers have been using the rover at night for astronomical observations. One experiment watched the sky during a meteor shower as Mars passed through the debris trail left by a passage of Halley's comet. "We're taking advantage of a unique opportunity to do some bonus science we never anticipated we would be able to do," Said Cornell's Dr. Jim Bell, lead scientist for the rovers' panoramic cameras.

Opportunity is examining bedrock exposures along a route between Endurance and Victoria craters. It recently reached what appears to be a younger layer of bedrock than examined inside Endurance. In Endurance, the lowest layers of bedrock were deposited as windblown dunes. Some of the upper layers were deposited as underwater sediments, indicating a change from drier to wetter conditions over time.

The bedrock Opportunity began seeing about two-thirds of the way to Victoria appears to lie higher than the upper layers at Endurance, but its texture is more like the lowest layer, petrified sand dunes. This suggests the change from drier to wetter environmental conditions may have been cyclical.
Iron-rich granules are abundant in all the layers at Endurance but are much smaller in the younger bedrock. These granules were formed by effects of water soaking the rocks. One possibility for why they are smaller is these layers spent less time wet. Another is the material in these layers had a different chemistry to begin with.

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Seeing

From Alan McRobert, S&T magazine

Amateurs have long recorded the seeing quality in their observing logbooks on a rather subjective scale of 1 to 10, with 1 hopeless and 10 perfect. People's ideas of what the numbers mean are likely to differ. In the interest of uniformity, here is the scale in its early form as described by Harvard Observatory's William H. Pickering (1858-1938). Pickering used a 5-inch refractor. His comments about diffraction disks and rings will have to be modified for larger or smaller instruments, but they're a starting point:

1. Star image is usually about twice the diameter of the third diffraction ring if the ring could be seen; star image 13" in diameter.

2. Image occasionally twice the diameter of the third ring (13").

3. Image about the same diameter as the third ring (6.7"), and brighter at the center.

4. The central Airy diffraction disk often visible; arcs of diffraction rings sometimes seen on brighter stars.

5. Airy disk always visible; arcs frequently seen on brighter stars.

6. Airy disk always visible; short arcs constantly seen.

7. Disk sometimes sharply defined; diffraction rings seen as long arcs or complete circles.

8. Disk always sharply defined; rings seen as long arcs or complete circles, but always in motion.

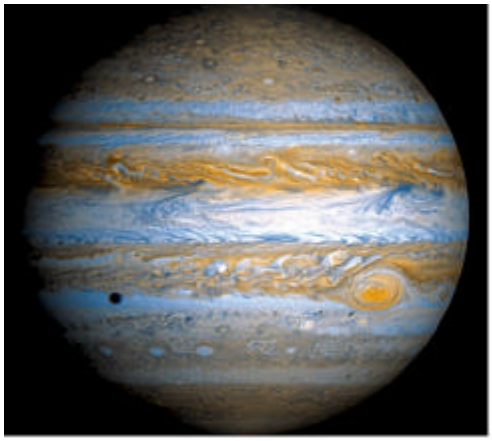
9. The inner diffraction ring is stationary. Outer rings momentarily stationary.

10. The complete diffraction pattern is stationary.

On this scale 1 to 3 is considered very bad, 4 to 5 poor, 6 to 7 good, and 8 to 10 excellent.

Juno, the next mission to Jupiter

From NASA/Goddard Space Centre



Following the spectacularly successful Galileo mission from 1995 to 2003, the scientific community yearns for a return to Jupiter. The Southwest Research Institute (SwRI) and NASA's Jet Propulsion Laboratory have issued a joint proposal for a new Jupiter probe called Juno.
Juno would be NASA's second probe in the New Frontiers series of medium-cost explorers and launch no later than 2010. According to SwRI's Bill Gibson, Juno is "very simple as planetary missions go, so we can keep the cost down. … Juno uses conventional propulsion. And we've limited our study to Jupiter. It's a plenty big target!"

Data returned from observations made by Galileo's orbiter and probe left many questions: Why is there so little water in Jupiter's clouds when models predicted otherwise? Is the structure at the probe's entry site typical of other locations on Jupiter? What is the planet's core made of, and how extensive is it? What is the nature of the polar regions, especially as it relates to Jupiter's immense magnetic field?

Equipped with a plasma physics suite of instruments, Juno will improve on Galileo's atmospheric science. "The Galileo probe was a single-point measurement," says Gibson. "Some results were ambiguous. With Juno, we can study the Jovian atmosphere and magnetosphere over a year, and do it planet-wide."

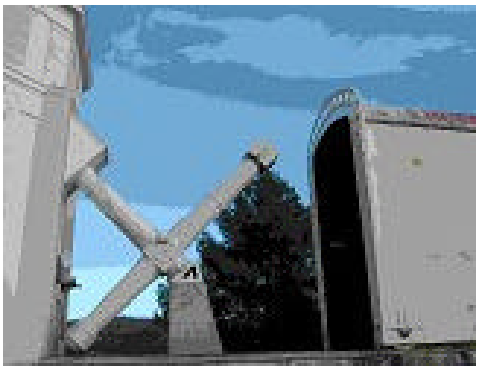
Juno's co-investigator, NASA/Goddard's Jack Connerey, explains, "Juno's orbit puts us right at the cloud tops with a series of well-timed passes, so that we can make a grid around Jupiter. We'll map the [magnetic] field precisely."
Juno's elliptical orbit will range from just 2,796 miles (4,500 kilometers) above the cloud tops to 40 Jupiter radii (roughly 2,856,000 km). Flight engineers will chart Juno's orbit and map Jupiter's gravity. As the craft changes speed, the Doppler shift in its signals will reveal the subtle tug of Jupiter's gravity on Juno. These measurements will be the most accurate to date, enabling researchers to determine the mass and size of Jupiter's core.

Visit to Nice Observatoire – 9th Nov 2005

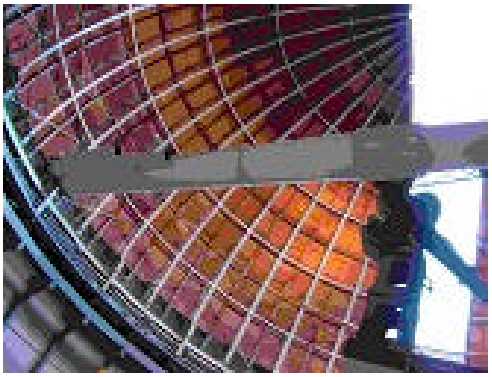
From David Blower

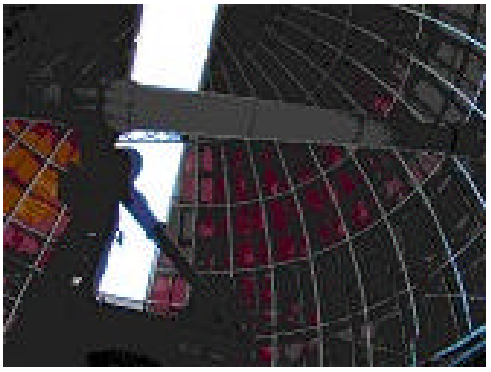
There is currently a twice weekly public visit on Wednesday & Saturday afternoons which last two hours and costs 5 euros. If your're going to Nice it's well worth a visit. The only drawback is that the guide only speaks a little English and the talk is generally in French. The site has three scopes on the site.

Le Petite Equatorial



L'Equatorial Coude'





Le Grande Equatorial

The biggest one is a 19m refractor and is housed in a huge dome which dominates the hillside above Nice. The site is also used for research and local Astronomy groups. It has been an observatory site since 1881, Charles Garnier was responsible for its establishment and the famous Astronomer Raphael Bischoffsheim discovered many deep sky objects. Interestingly early refractors were referred to as la lunettes.
For further info see www.obs-nice.fr

How Many Colours of the Rainbow?

from Neil Haggath

Everyone knows that there are seven colours of the rainbow – red, orange, yellow, green, blue, indigo and violet. Children are taught to remember the sequence, by means of mnemonics such as "Richard of York gave battles in vain". It's common knowledge, and something we all take for granted – right?

(A digression here; many people probably don't realise that a rainbow is always accompanied by a *secondary bow*, outside and concentric with the primary, in which the order of the colours is reversed. This is produced by light taking a different path through the water droplets, which includes an extra reflection – hence the colour reversal. The secondary bow is always there, but it's usually too faint to notice; just occasionally, it becomes obvious, when a particularly bright rainbow is seen is a very clear sky. I've seen it a few times.)

But wait a minute – look again at the sixth colour in the list. What the hell is *indigo*? When have you ever heard that word used, in any context other then listing the colours of the rainbow? More than likely, the answer is never! (Actually, I do know of one example where it's used in a play on words. Café Indi-Go is an Indian restaurant in Stockton – and a very good one too, despite the hideous purple colour of the frontage.)

In reality, of course, there are an infinity of colours in the rainbow or spectrum. Colour is simply the way our eyes and brains perceive light of different wavelengths; what we see as white light is composed of a continuum of wavelengths, and therefore of colours. But we naturally divide the spectrum into bands, named for familiar colours, for convenience. Dividing it into red, orange, yellow, green, blue and violet is natural and obvious, as those are colours which we use in everyday speech – though most of us would tend to say "purple", rather than "violet". But why "indigo"? Why such an obscure name? (It was originally the name of a specific deep blue dye, extracted from plants, which was used for dyeing cloth.) And why is it necessary at all, to insert an arbitrary "extra" colour between blue and violet? It seems completely artificial, illogical and unnecessary – and indeed it is!

To explain it, we have to go back three centuries, to good old Sir Isaac Newton. Newton, of course, did a great deal of pioneering work on light and optics; his book *Opticks*, published in 1704, is his second best known work, after the *Principia*.

Others before Newton had shown that white light could be split into colours by a prism, and had explained the rainbow in terms of water droplets acting as natural prisms. But they didn't understand *why* it happened; they believed that white light was "pure", and that colours were produced when it "decayed" in some way. Newton, however, was the first to show that by using a second identical prism, turned the other way around, the colours could be recombined, producing white light again. He therefore showed that colour is an intrinsic property of light, and went some way towards explaining it.

Newton wrongly believed that light was composed of streams of particles, and that the colours of the spectrum consisted of particles of different sizes, which were refracted through a prism at different angles. We now know, of course, that light is an electromagnetic wave, and that colours correspond to light of different wavelengths. On the other hand, modern quantum physics tells us that it behaves as both waves *and* particles, exhibiting the properties of a wave in some situations, and those of a stream of particles in others. Though it travels in the form of a wave, it consists of discrete "packets" of energy, called photons; the energy of a photon is proportional to the frequency of the wave, or inversely proportional to the wavelength. So Newton's idea wasn't really all that far wrong, after all!

It was Newton who established the convention of dividing the spectrum into the aforementioned seven colours – but why did he arbitrarily include that obscure term "indigo"? Well, Sir Isaac, despite his genius, was a very strange and eccentric character. No-one disputes that he was one of the greatest mathematicians and physicists who have ever lived – but at the same time, he dabbled in "the occult", and believed in various kinds of mysticism - some connected with religion, and some with pure superstition and ancient beliefs. For example, he experimented in such totally unfounded fields as alchemy, and wrote a number of papers on such subjects, which were completely worthless and embarrassing.

He also believed, as had some ancient cultures, that the number seven had some great mystical significance. For example, the ancients said that there were seven "planets"; they regarded the Sun and Moon as "planets", as well as the five actual planets which they knew – i.e. from Mercury to Saturn – while not realising that the Earth is one. And the fact that there are seven days of the week is based on the Biblical Creation story – "On the seventh day, God rested." (I suspect that this connection actually arose the other way around – i.e. the seven-day week was invented as a natural subdivision of a lunar month, the convention established of giving workers a weekly "day of rest", and the Biblical "seventh day" story was made up as a consequence.) For this reason, he decided that there ought to be seven colours, rather than six.

Newton also correctly concluded that the colour of light was analogous to the pitch of sound – which is, of course, our perception of sound of different wavelengths. It has been said that he chose seven colours as a direct analogy with the seven notes of the musical scale – which are equally arbitrary, though he seems to have believed otherwise.

So while we rightly revere Sir Isaac as a scientific and mathematical genius, it's strange to think that something which everyone knows, and which has become part of our language – the colour sequence of the rainbow – arose from his most *un*scientific eccentricities!

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Major Meteor Showers in 2006

from Wes Stone http://skytour.homestead.com/met2006.html

The 2005 meteor year was dominated by the Moon, with the Perseids being the lone exception among major showers. Beyond the traditional major showers, a predicted increase in the incidence of Taurid fireballs did occur and was well-reported in the news media. The October Draconids (Giacobinids) produced a modest and poorly-observed outburst of faint meteors for Eastern Europe and Asia.

In 2006, the Moon will have a severe impact on the Perseids, but all of the other major showers will fare better. Novice meteor observers should enjoy the Geminids, and select regions may see a Leonid outburst. In general, this should be a great year for meteor observing!

Don't forget to consider the effect of radiant elevation when planning an observing session. Even if a shower is near its activity peak, you won't see a thing from it if the radiant is below your local horizon. In the case of a strong shower, you may expect a (very) few long "earthgrazing" meteors when the radiant is near the horizon, but even when the radiant has reached an elevation of 30 degrees you will only see half as many meteors as you would if it were at your local zenith. Most shower radiants are highest during local morning hours, often just before twilight begins. That's usually when you want to observe, although occasionally a rising Moon or a sharp activity peak will suggest an earlier time. Best viewing windows are suggested for each shower.

Vagaries of meteor activity, your personal ability to perceive meteors, and local sky conditions may all dramatically affect the rates you observe. Sky conditions to consider include weather and light pollution. If you can't see the summer Milky Way in Cygnus on a moonless night when this region of the sky is overhead, you probably won't see much from even the strongest annual showers. Clear, dark skies are essential for observing meteors. More shower meteors are visible from a dark site, and sporadic (random) meteor rates are enhanced greatly.

QUADRANTIDS (maximum January 3, 18h UT

Moon: Waxing Crescent (no interference)

Best viewing window: Evening watching will be most attractive to those in Northern Europe this year, as the predicted peak occurs during their local evening hours.

Recommended for: Adventurous meteor observers who are lucky enough to have clear skies. Quadrantid rates are rather unpredictable. Observers who catch the peak from a dark site might see 60-100 Quadrantids per hour
Quadrantids are medium-velocity meteors, and some bright ones are often visible at maximum activity. The radiant is in a rather blank area surrounded by the constellation figures of Bootes, Hercules, Draco and Ursa Major (see radiant drift map). Off-

maximum nights only produce a few shower members; the shower has a very short duration from about January 1-5.

LYRIDS (maximum April 22, ~16hUT])

Moon: Waning Crescent (minor interference)

Best viewing window: **Saturday morning, April 22, from roughly 12:30am local daylight time until morning twilight gets too bright (roughly 4:45 local daylight time at 40 degrees N**

Recommended for: Anyone interested in serious meteor observing. Maximum rates are 10-20 per hour. The time of maximum is rather variable, as is the shower's full width at half of maximum strength.
Lyrids produce fairly fast meteors with a reputation for being faint on average. Nights adjacent to the peak usually aren't worth watching, but observations on the morning of April 23 would be valuable to determine this year's activity profile.

ETA AQUARIDS (maximum May 6 [broad])

Moon: First Quarter to Waxing Gibbous (minor to no interference)

Best viewing window: **Saturday morning, May 6** (adjacent mornings may be just as good at the same local times). Focus on the last hour or so before twilight gets really bright (depends on your latitude and also on your longitude with respect to the center of your time zone).

Recommended for: Southern observers; also northerners who want a challenge. The Eta Aquarids would produce maximum rates of >50 per hour if we could see them with the radiant high in a dark sky. In the northern temperate latitudes, we don't get close to that. We get just a small taste of them in an intricate dance just before dawn. The low radiant elevation means that the earliest ETAs you see will be "earthgrazers": long, relatively slow and often tracing paths along the horizon. Bright earthgrazers are spectacular.

SOUTH DELTA AQUARIDS (maximum July 29 [broad])

Moon: Waxing Crescent (no interference)

Best viewing window: **Any morning between July 28-31 (Friday through Monday mornings)**. 1:00-4:00am local daylight time would probably be the best hours.

Recommended for: Anyone with a dark site and a desire to see some meteors.

The South Delta Aquarids are barely a major shower from 40 degrees N. They are part of a complex of radiants in Aquarius, Capricornus and Piscis Austrinus, all of which combine with sporadic and early Perseid activity to provide a nice display of meteors on

moonless mornings in late July. The stream normally produces about 5-10 meteors/hour, with overall activity of about 30/hour under good conditions.

The South Delta Aquarids are medium-speed meteors, and tend to be faint on average. .

PERSEIDS (maximum August 12, 23h UT

Moon: Waning Gibbous (major interference)

Best viewing window: **Saturday evening, August 12, from the end of evening twilight through Sunday morning, August 13**.

Recommended for: Anyone interested in meteors; just remember that the Moon will detract from the show.

The Perseids are probably the most-watched annual meteor shower. The shower has a very long duration, from about July 15 through August 25. The shower is most interesting around its peak on August 12 or 13. This year, the waning gibbous Moon will be a big nuisance, riding high in the sky during the morning hours when the Perseid radiant is high.

Rates for most observers will probably top out at around 15-30 Perseids per hour, with a few sporadic and minor shower meteors added to the mix.
Perseids are fast meteors and tend to be fairly bright on average. An occasional fireball is seen, but these seem to depend on the luck of the draw.

ORIONIDS (maximum October 21 [broad and irregular])

Moon: New (no interference)

Best viewing windows: Friday, Saturday, and/or Sunday morning, October 20-22. 1am - 6pm local daylight time are the best hours. Other mornings in the period of October 17-25 may also be productive.

Recommended for: Anyone interested in meteors.

The Orionids are capable of producing interesting activity from October 17-25. Maximum rates seen from a dark site may reach 20-25 per hour, but sometimes there are lulls even around the traditional maximum of October 21. Clear mornings during the activity period are always good times to look for meteors from dark sites.

The Orionids are fast meteors, perhaps a bit faint on average but capable of producing fireballs. Note that the radiant is north of Betelgeuse and not right in the middle of Orion.

LEONIDS (maximum November 19; 4:45 UT

Moon: New (no interference)

Best viewing window: European observers should have the best view, during the predawn hours of Sunday, November 19.

Recommended for: Anyone interested in meteor observing; just keep in mind uncertainties in predictions and don't expect to see any Leonids if you're watching before the radiant rises (11pm-midnight for most mid-northern locations).

Some years ago, when the teams of David Asher and Robert McNaught were making their groundbreaking predictions of Leonid storms and outbursts for the years 1999-2002, they also noted a possible outburst for 2006. This November, we'll find out whether that prediction comes true. On November 19, the Earth is due to pass through a trail of debris left by the Leonids' parent comet on one of its previous returns. A sharp peak of perhaps 100 Leonids/hour is expected, although there is a bit of uncertainty. If it occurs very near the predicted time of 4:45 UT, Europe and Western Africa will see the display during the favored morning hours.

The Leonids are very fast meteors. Most of the meteors seen during this outburst are expected to be faint, so dark skies will be very helpful. Even if you miss the November 19 outburst, the shower is active at a low "background" level for about a week from November 14-21.

GEMINIDS (maximum December 14, ~11h UT)

Moon: Waning Crescent (moderate interference)

Best viewing windows: **The entire night of December 13/14 (Wednesday evening through Thursday morning).** Begin viewing around 9pm on Tuesday evening.

Recommended for: Anybody with clear skies on maximum night!

The Geminids are a beautiful, prolific and reliable shower. While December nights can be bone-chilling, for many areas sky transparency is better than it is during the August Perseids. . The radiant is highest in the sky at around 2am, but from mid-northern latitudes it is at a decent elevation from around 9pm until the beginning of morning twilight.

The Geminids can produce observed rates of up to 100/hour at maximum. Even if those numbers are a bit optimistic for this year, this will be a shower that just about anyone can enjoy if the weather cooperates. Decent numbers of sporadic meteors (~10-15/hour from dark sites) will add to the display. The shower often shows a plateau-like maximum, with near-maximum rates being sustained for many hours before dropping off rather sharply.

Geminids are medium-speed meteors. Most of them don't leave glowing trains, but the brighter ones are often colored (yellow, green and blue are most common). The

proportion of bright meteors and fireballs is higher during and after maximum than on pre-maximum nights. The shower is active from December 7-17; observations before the peak night will be impeded by a bright Moon this year, although December 12/13 is worth a shot. December 14/15 may be worth watching as well, although as stated above activity tends to fall off sharply after the peak.

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Q. How many astronomers does it take to change a light bulb?

A. Ten! One to change the bulb, and nine to argue how their own bulb gives a better spectral resolution than his.

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A Sadder State of Affairs

from John Crowther

I noticed this passage in a book review in the Daily Telegraph of April 3rd, 2005.

"But then perhaps we expect too much of our real-life heroes, especially when fiction and Hollywood have set our sights impossibly high. There's a telling moment here when the veteran American broadcaster, Walter Cronkite, recalls commentating on the occasion when the Gemini 8 rocket got into trouble and appeared about to explode in a ball of flame. The station switchboard was jammed with viewers' calls – not expressing concern for the astronauts' welfare but complaining that the extended news coverage was interrupting an episode of *Lost in Space"*.

This reminds me of the public panic caused by the 1930's broadcast of H.G.Well's "War of the Worlds" in New York State. Then fiction was taken as fact. Surely fiction being preferred to fact is a sadder state of affairs?

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Q. How many astronomers does it take to change a light bulb?

A. If the Universe continues to expand and accelerate, apparently an infinite number.

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The Green Flash

Picture the scene. You're on holiday, watching the sun set in cloudless skies with a cool drink. As the sun slips below the horizon the top edge of it briefly 'flashes' green. You quickly look at your drink - you don't remember ordering absinthe - but rest assured, the chances are you have been lucky enough to see the elusive 'green flash'

What causes it?
As light passes from the vacuum of space into the atmosphere, which acts like a prism, it slows down by 0.03%. This causes the light to bend or refract towards the surface of the earth. The white from the sun is made up of many different colours of light, all of which have a different wavelength. The wavelength (or colour) of light affects how much it is refracted on entering the atmosphere, with red light refracted the most and blue least (as in rainbows).
Light from the 'red image' will be refracted more than that from the green and blue.

Imagine the image of the sun as being made up of red, green and blue images. Light from the 'red image' will be refracted more than that from the green and blue. So, the 'red image' will appear lower than the green, which will similarly appear lower than the blue. At sunset, or sunrise, this effect is intensified as light travels through a slightly thicker atmosphere. As the sun disappears below the horizon, the 'red image' will disappear first and the blue last.

The atmosphere causes blue light to be scattered more than red or green - the reason why the sky appears blue - so light from the 'green image' - the 'green flash' - will normally be the last thing you see as the sun disappears below the horizon.
On very rare occasions, the atmosphere may be clear enough to allow some of the blue light to reach us and cause a 'blue flash' as the sun sets.

Why don't you see a green flash every time the sun sets?
The phenomenon lasts only a fraction of a second, so unless you know where to look and when, the chances of seeing one are very slim indeed. Viewing conditions need to be just right too.

Optimal viewing conditions
Watching the sun set over an ocean horizon on a clear evening will be a good start, as you will have an uninterrupted view through clear unpolluted air. Your line of sight should be almost parallel to the horizon and you need to really concentrate at the top edge of the sun as it is about 98% set. If you are lucky, you will see the top edge of the sun turn green for a brief moment, before disappearing below the horizon.
In one of its guides, the National Trust recommends looking for the green flash from Zennor Head in south west Cornwall, probably because atmospheric conditions are likely to be better here than in other areas in the UK.

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Eclipse Hunter

An astronomer is on an expedition to Darkest Africa to observe a total eclipse of the Sun when he is captured by cannibals. The eclipse is due the next day around noon. To gain his freedom he plans to pose as a god and threaten to extinguish the sun if he's not released but the timing has to be just right. So, in the few words of the cannibals' primitive tongue he knows he asks his guard what time they plan to kill him.

The guard's says - "Tradition has it that captives are to be killed when the sun reaches the highest point in the sky on the day after their capture so that they may be cooked and ready to be served for the evening meal".

"Great", says the astronomer.

The guard continues - "But because everyone's so excited about it, in your case we're going to wait until after the eclipse."

Q. How many astronomers does it take to change a light bulb ?

A. Just one, if he can shoot straight.

Q. How many astrono mers does it take to change a light bulb?

A. None, they wouldn't change it because it ruins their night vision.

The New York Times, among other papers, recently published a new Hubble photograph of distant galaxies colliding. Of course, astronomers have had pictures of colliding galaxies for quite some time now, but with the vastly improved resolution provided by the Hubble Space Telescope, you can actually see lawyers rushing to the scene...

A seminar on Time Travel will be held two weeks ago

A Black Hole is a tunnel at the end of light

Entropy isn't what it used to be

Transit Tailpieces

Malcolm Bannister has sent the following the attention of the videocam imaging guys "While poking around on the web I came up with this site: - http://www.astrosurf.com/astrobond/ebrawe.htm
A guy has found an easy way of modifying the firmware inside Philips and Logitech webcams to improve the images, reduce noise and also the capability to output image streams in RAW format. The mods are non-destructive and the firmware can be easily restored at any time."

Custom Telescopes UK. Glen Oliver, a long-time member of the Society, can supply telescopes and accessories of all kinds. He operates from Hartlepool and has a website www.goliver.freeserve.co.uk, e-mail glen.oliover@ntlworld.com.
Support local businessmen! Glen tells me that he now has an Astronomy and Space books page on his website

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Transit Adverts If you wish to let members know what you want to sell or what you are looking for, please send an advert for the magazine.

CaDAS Website Don't forget to visit our very own website at www.**wynyard-planetarium**.net.

For sale – Helios 240mm reflector with tripod, eyepieces, Barlow etc. Sensible offers considered. Please contact Graham Johnson at the Carlton Outdoor Centre on 01642 712229

Articles Please send contributions for the newsletter to Bob Mullen, 18 Chandlers Ridge, Nunthorpe, Middlesbrough, TS7 0JL, 01642 324939 (b2mullen@hotmail.com) or to Dr John McCue (john.mccue@ntlworld.com). Copy deadline date is the 25th of each month.

And finally, the last of the humour :-

Q: How far can you see on a clear day?
A: 93 Million miles...From here to the Sun.

NASA just disclosed details why the Rover wouldn't accept any commands. They took a picture of the Rover's built-in display which showed a Windows screen and the on-screen text, "press any key to continue".

Alex Menarry – Transit Interviewee

Ray Worthy, our NASA correspondent

David Blower, our French correspondent