# TRANSIT

The Newsletter of

Cleveland & Darlington Astronomical Society

10th May, 2002. Julian Day 2452405

**Editorial**

**April Meeting.** We gave our usual enthusiastic and well-attended welcome to Dr Paula Chadwick, who had travelled directly from Bristol to be with us. Her subject was "Astronomy at the End of the Rainbow", an account of observations using the furthest reaches of the electromagnetic spectrum – the most energetic gamma rays.

**Planetarium.** John McCue announced that there have been at least 10 shows to date and there will now be regular public shows on Fridays at 7.30pm and Sundays at 3pm. The telephone number is 01740 630544. The electronic link from the Observatory to the planetarium is now working and being tested.

**Web Sites.** This month, Rod Cuff starts his regular series of recommended web sites of interest to CaDAS members. It would be very encouraging if you gave him some feedback, or suggestions for sites you have found interesting.

**May Meeting.** On the 10th , we welcome back Dr Carole Haswell, of the Open University, who was once a CaDAS member, I am told.

**Scarborough Star Party Weekend.** Here's another reminder about the weekend at a dark sky site in the North York Moors, August 9th to 12th, cost £15. Contact Scarborough AS or the Editor for application forms. Booking in advance essential.

**Ilkeston 21st Birthday Convention, 11th May.** Remember that on Saturday 11 May, the day after our May meeting, Ilkeston A.S. (near Derby) is hosting a convention for its 21st birthday. One of the speakers is our Secretary, Neil Haggath. Full details can be found at http://hometown.aol.com/idasastro/convention.htm

**Frank Gibson's Letter from New Zealand** tells us how he set up a CCD.

**Astronomy Basics.** I hope you enjoyed last month's 'Magnitudes'. This month Neil has written about Parallax, that intriguing technique for measuring stellar distances. Once again, Neil has not avoided the maths, I'm glad to say.

**Comet 2002 C1 (Ikeya Zhang).** Still near naked-eye visibility but fading rapidly. At the beginning of May it will be in Draco, then moves through Hercules, Corona Borealis and into Serpens.

**Occultation of Saturn by the Moon.** We have a report from David Graham on his observations of this event from Ripon. David is the Director of the British Astronomical Association Saturn Section. John McCue reports on viewing the occultation via the link from the Castle Eden telescope to the Planetarium.

**Hubble Space Telescope.** The very complex repairs and upgrades to the HST, intended to keep it going for many more years, were reported as completed successfully in early March. After tests and calibrations of the new equipment and camera, image publication on the website will be re-started in mid-May.

**A Good Look at the Moon.** Who solved the riddle set by Ray Worthy last month? A discussion at the next meeting would be interesting.

**Contributions.** The literary efforts of all members are always welcome and looked for.

---

## Astronomy Basics

by Neil Haggath

## No. 2: Parallax and Stellar Distances

In the early days of the telescope, when astronomers first realised that the stars were similar bodies to the Sun, it became clear that they must be an incredibly long way from us. So how could we hope to measure their great distances?

For the nearest of the stars, the answer was remarkably simple – at least in theory. But it proved extremely difficult in practice; though the method was thought of in the late 17th Century, it would be another century and a half before anyone succeeded in using it.

Stand at one side of a room, with your back to the wall. Hold your hand in front of you at arm's length, with one finger raised. Close one eye, and line up your finger with a reference point on the far wall. Now change to your other eye; your finger appears to move sideways, with respect to the reference point.

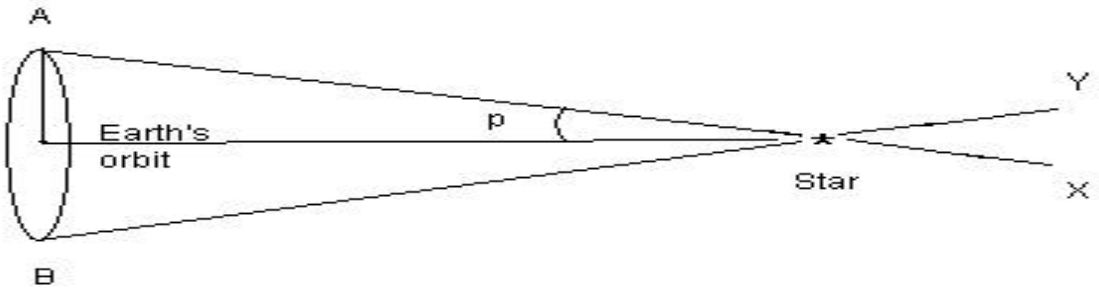
The reason, of course, is that you are viewing it from a slightly different angle. (With both eyes open, your brain fuses the two slightly different images, made from different viewing angles; this is what enables us to see in three dimensions and judge distances.) This is an example of *parallax* – the apparent shift in the position of a foreground object with respect to a more distant background, when observed from different vantage points. If we know the separation of the two vantage points, and measure the angle by which the object shifts, we can calculate its distance by simple trigonometry.

On a much bigger scale, the same thing happens with astronomical bodies. The distance of the Moon was first determined by measuring its apparent position in the sky, when observing it from different places on the Earth's surface. Similarly, we can measure the distance of a nearby star, by measuring its angular displacement, or *parallax angle*, with respect to the background of more distant stars.

As the stars are at immense distances, their parallax angles are tiny, so we need to use a much longer baseline to measure them. The longest baseline we can possibly use is the diameter of the Earth's orbit; if we observe a star on two dates six months apart, then we are seeing it from vantage points nearly 300 million kilometres apart. By very accurately

measuring its position with respect to background stars, we can then calculate its distance.

The diagram shows how it works. When we observe the star from points A and B, on opposite sides of the Earth's orbit, it appears at positions X and Y, respectively, against the sky background. (In fact, as the Earth moves around its orbit, the star traces a tiny ellipse on the sky.) The Earth, the Sun and the star form a very long, narrow triangle. ( In fact, it's vastly longer and narrower than I've drawn it here; if it was drawn to the correct scale, with the Earth's orbit the size shown, then even the nearest star would be about 400 metres away!) We know the radius of the Earth's orbit, which I'll denote by a, and we can measure the parallax angle, which we call P.




The diagram shows the simplest case, where the Earth, Sun and star form a right-angled triangle; in this case, P is simply equal to the angle p in the diagram. Generally, of course, this isn't the case; we also have to account for the angle between the Sun's direction and that of the star. If we call this angle $\theta$, then it can be shown that p and P are related by

$$p = P \sin \theta.$$

( Take my word for it; I don't want to bore you with too much maths! )

Then the star's distance d is simply given by

$$\sin P = a / d.$$

Since P is a very small angle, sin P is very nearly equal to P, if P is expressed in radians, so we can simplify the above equation to

$$P = a / d,$$

or

$$P = 206265\ a / d$$

if P is expressed in arc seconds. (An arc second is 1/60 of 1/60, or 1/3600 of a degree; approximately 206265 arc seconds are equivalent to one radian).

As I said, it's very simple in theory, but very difficult in practice, as the parallax angles are so tiny. Even for the very nearest star, Proxima Centauri, the parallax angle is less than one arc second! So the position measurements have to be made with incredible accuracy.

One of the first astronomers to attempt to measure stellar parallaxes was John Flamsteed, the first Astronomer Royal, in the late 17th Century. He devoted a great deal of time and effort to the task, building special telescopes for the purposes, but sadly failed. Many others tried and failed during the next 150 years or so, including Sir William Herschel, perhaps the greatest observer who ever lived. The required accuracy of measurement was simply beyond the capability of any telescopes and instruments of the 17th or 18th Centuries.

The breakthrough came early in the 19th Century, with the development of much better telescopes and accurate clock drives, pioneered by Fraunhofer. The first to triumph was Friedrich Bessel in 1838, who successfully measured the parallax of 61 Cygni. Soon afterwards, other people succeeded with several other stars.

By the way, you may wonder how they decided which stars were likely to be nearer than others. Easy! All stars exhibit varying degrees of *proper motion*, i.e. their actual motion across the sky, with respect to other stars. It was assumed - correctly – that as a general rule, those with the biggest proper motions were probably the closest to us. It was also a reasonable assumption that binary stars with wide separations were generally closer to us than narrower ones. Bessel chose 61 Cygni because it has a big proper motion, *and* it's a wide binary!

The parallax angle of 61 Cygni turned out to be minute, a mere 0.3 arc second. Bessel deduced that its distance was a staggering *98 million million* kilometres! Today, we would describe this distance as 10.3 light years. 61 Cygni's distance is now accepted as 10.8 light years, so Bessel did remarkably well for a first effort!

Naturally, stellar distances are far too great to express them in familiar units such as miles or kilometres; we'd be overwhelmed by huge numbers, with enough zeros to attack Pearl Harbour! (Sorry for that awful joke; I nicked it from Clive James.) There are two different units which astronomers use to express them more conveniently. The first is the *light year*, which is simply the distance which light travels in a year. The speed of light is an amazing 300,000 kilometres per second, so a light year is roughly $9.5 \times 10^{12}$ km.

The other is that strange unit, the *parsec*, which I mentioned in last month's article. The word parsec is short for *parallax second*; it's the distance at which a star would exhibit a parallax angle of one arc second, and is equal to 3.26 light years.The parsec is beloved of cosmologists, who express the distances of galaxies in *megaparsecs*, or millions of parsecs.

The closest other star to the Sun, Proxima Centauri, lies at a distance of 4.2 light years, or 1.3 parsecs.

By definition, the parallax method only works for stars which are, astronomically speaking, very close to us. We can only use it to measure distances of up to about 100 parsecs; beyond that, the parallax angles are too tiny for even today's instruments to measure reliably. So how can we measure the distances of more distant stars?

Fortunately, there are several thousand stars within 100 parsecs of us. After the distances of a few thousand had been found by parallax, various other properties of those stars could be measured, which then enabled us to determine their distances by other methods.

Last month, I explained how a star's apparent magnitude, or observed brightness, is related to its absolute magnitude, or true brightness, and its distance. So if we can find an independent way of determining a star's true brightness, then it's easy to calculate its distance. Fortunately, there are ways of doing exactly that.

One of the most important tools in astrophysics is the Hertzsprung-Russell Diagram, which will be the subject of a later article in this series. Early in the 20th Century, Hertzsprung and Russell discovered that the absolute magnitude, or intrinsic luminosity, of a star is related to its colour. A star's colour is related to its temperature; blue stars are the hottest, red the coolest, with white, yellow and orange in between. Though "colour" might seem a pretty vague term, we can in fact define it in precise terms. We measure a star's apparent magnitude at a number of specific wavelengths of light; the difference between these magnitudes gives us its *colour index*, which is a direct indication of its temperature. Its temperature is in turn related to its mass, as is its luminosity; therefore, there is a direct relationship between colour index and luminosity.

The H-R Diagram is a graph of colour index against luminosity; the latter can of course be calculated for those nearby stars whose distances have been found by parallax. All "normal" stars - i.e. those which are in the "steady" part of their life cycles, before they do strange things like turn into red giants – lie in a narrow band on the graph, known as the *Main Sequence*. So for any "normal" star, simply measuring its colour index tells us its luminosity, or absolute magnitude; comparing this with its apparent magnitude then gives us its distance.

This method can be used to measure stellar distances of many thousands of light years. It's particularly effective when applied to clusters of stars, like the Pleiades. There, we have several hundred stars, all at roughly the same distance, so that their apparent and absolute magnitudes are directly related. If we plot a graph of the apparent magnitude and colour index of each star in the cluster, we obtain a "mini Main Sequence"; comparing it with the standard Main Sequence allows us to accurately determine the cluster's distance.

Another important method of measuring distances involves a class of variable stars known as Cepheids. These are very bright, and can therefore be seen at great distances; they also have a very useful property.

In 1912, Henrietta Leavitt studied a large number of Cepheids in the Small Magellanic Cloud, one of the small satellite galaxies of the Milky Way. At that time, no-one knew the exact distance of the SMC, but it was known to be pretty big; we now know that it's about 220000 light years. So for any practical purpose, we can assume that all the stars in it are at roughly the same distance from us ( as we could say that London, Plymouth and Edinburgh are all at roughly the same distance from Tokyo ) – which means that once again, their apparent and absolute magnitudes are directly related.

Leavitt found that there was a direct relationship between the brightness of Cepheids and their period of variation; the brighter the star, the longer the period – though she didn't know why. This meant that, if we could measure the distances of a few of them, then we could directly relate their periods to their luminosities, and then the distances of

others could be deduced from their periods. Unfortunately, no Cepheids are close enough to us for their distances to be measured by parallax, so it wasn't possible to deduce their true brightness.

But then Harlow Shapley realised why Cepheids vary in brightness; they actually pulsate in and out, and thus vary in size. He showed that their periods of pulsation must be related to their masses; the bigger the star, the longer the period. He was therefore able to work out the mass of a given Cepheid from its period; its absolute magnitude then followed from the H-R Diagram, enabling its distance to be determined.

Cepheids are so bright – about 100 times brighter than the Sun on average – that they can be identified even in other galaxies, at distances of several million light years. Shapley used them to measure the distances of globular clusters, and therefore to map the shape and size of our own Galaxy. They were later used to determine the distances of the nearest other galaxies, such as the Andromeda Galaxy.

Looking even further afield, there are several other methods of determining the distances of more distant galaxies, which I won't go into here.

To summarise, there are numerous methods of determining progressively greater cosmic distances; each method depends upon known properties of objects whose distances have been measured by earlier methods. But parallax remains the only way in which we can measure stellar distances *directly*, and therefore forms the foundation stone of the entire distance scale.

■ ≈ ■ ≈ ■ ≈ ■ ≈ ■ ≈ ■ ≈ ■ ≈ ■ ≈ ■ ≈ ■ ≈ ■ ≈ ■ ≈ ■ ≈ ■ ≈ ■ ≈ ■ ≈ ■ ≈ ■ ≈ ■ ≈ ■ ≈ ■ ≈

## The CaDAS Interview – Ian Miles

*I confess to not knowing Ian very well. He pays my expenses for producing and posting Transit very promptly, so I like him for that. His association with CaDAS goes back a long way, to the formation from the very original John McCue Society for Schools, back in the 1980's. The Interview was a good way to get to know better the man we trust with the running of our finances. It turns out he is in the mould of the Interview's previous subjects – an astronomy enthusiast who also does all sorts of other interesting things.*

*How and when did you become treasurer - are you an accountant, perhaps?* No, I'm not an accountant and unfortunately I am surrounded by them at work! I became treasurer in 1988. I don't remember how this came about, but safe to say I was nobbled by John. We had a balance of £65 at the time which has now swelled to £600+. I'm happy to say that subs have stayed at the current levels since 1991.

*Tell me about your own family.* I got divorced some 3-4 years ago and since then having to vacate my rented flat in Eaglesclifffe, Kathy & I hunted around the Yarm/Eaglescliffe area, but due to a lack of suitable houses, ended up in Middleton St. George. My two lads, Paul & Steven spend their time between their mum (Eaglescliffe) and Kathy & I. So it's still not too far to travel. We only moved last bonfire night, so I've only seen the place in the dark so far !

*When did you first get interested in Astronomy?* I first got interested at an early age at school. The key event which got me going on a serious footing was the first National

Astronomy Week (1980 ?). It was then that I (and others such as Neil and Michael, I think) first came into contact with CASS (Cleveland Astronomical Society for Schools). Meetings were held at Marton College and in those early days had attendances of 100+. I've got my original Greenkat 60mm refractor (with a novel mirror flip arrangement to divert the light path up to a finder eyepiece), a portable 8" f4 reflector and a rather large 8.75" f8 reflector (through a fork !). The latter unfortunately is in bits spread between about three houses at the moment. With all the goings on of the move & oodles of DIY, my observing has nose-dived of late (it had been on a low for a while anyway). I was a member of the JAS (SPA as was). I also was a founder member (I sponsored a brick !) of the AAC, located between Todmorden and Bacup.

*Do you specialise at all?* I've got no specialist area in the hobby. I've dabbled in everything from construction to astrophotography. The attractive thing about astronomy is that it is of interest to all ages, it's universal (pardon the pun) and it's free for everyone. I do like a drive up over the back of Osmotherly for nice, dark, clear skies ! Have you "done" all the Messier objects? No, but I've got the book if that counts for anything ?!

*Have you done any telescope making?* In my teens I attended a mirror making class at Billingham (not sure if this was run by Jack ?). I remember riding up there from the far side of Stockton with two 2" thick Monax blanks and various grades of grit in my pannier bags. Any reasonable bump in the road resulted in a wheelie due to the weight at the back ! I then helped John Nichol (ex-original member of the Society & now lives next-door but one from John) make mirrors….an apprentice so to speak. Before he moved, he had a double length garage which was devoted to mirror making (at least three grinding machines from what I remember). I've ground, polished, tested and figured in my time. Both my 8" mirrors are home grown. Both the mounts of my main scopes were joint efforts by John & myself. Very enjoyable times.

*What is good about the Society and what would you change?* It's full of interesting, dedicated people. I'm not sure what other societies get up to around the country, but with our observatory and planetarium exploits, plus the national officials past & present, surely we must be up there with the top ? I think it's time we had another summer trip out somewhere. I've been to Edinburgh Observatory and Jodrell Bank with the Society, both were great fun. I particularly remember the tour guide at Jodrell Bank explaining the vast control console and all its complexities to our group, only for Michael to shout out "Oh look, there's a squirrel !" as he looked out of the dish viewing window. (I take it they're a rarity in Brotton ?).
Where have all the juniors gone ?! I know as they hit middle teens the lads discover women and disappear, but we seem to be devoid of young uns at the moment.
Washing up ! I hate washing up ! Please, please, please rinse your cup and dry it after a cuppa !

*What was your educational route?* I went to Teesside Poly (as it was then). Got an HND in Computing and left the Advanced Diploma part-way through for employment. Up to that point, I kept being turned down for lack of experience, so the first offer I went for! I started my IT career programming an IBM mainframe in COBOL. *So my question about*

*being computer literate is superfluous?* As IT Manager for Stockton Council I hope so ! Unfortunately, despite popular belief, I do not know the detailed inner workings of a PC, so don't quiz me about your home PC problems! Unfortunately, PCs are not yet fully matured consumer items like TVs or videos. I'm not into formal learning any more. I did ok, but was never that good at it….boredom sets in if the lecturer isn't fired up and the subject a bit naff. Music? – well I learned the trombone at school, but I'm not at all arty.

*Where were you born and brought up?* Born in Darlington, but moved to Stockton as a toddler. Spent all my life until last year living within the boundaries of Stockton. Now back in Darlington area….seems a bit strange to not be in Stockton! My Mum always said they're a funny lot south of the river, so at least I've managed to stick to the correct side! (Apologies to members in M'bro, Thornaby etc. etc.). I have one sister.

*Tell me about the memorable characters you have met in the astronomical world.*
David Sinden (who gave a talk to us recently) and Jack. Full of enthusiasm and have a unique way of putting it across to others. I can listen for hours… *Any heroes?*
I looked this up in the Microsoft Word Thesaurus and it came up with: Brave man, superman, champion, conqueror, idol. No is the answer.

*Do you have time for any other interests and hobbies?* I am a fully licenced radio amateur (call-sign G0CNN). As well as passing a City & Guilds exam, I had to take a morse test at the Royal Navy testing centre at Cullercoats. I once tracked the Challenger space shuttle with one of my 144MHz beams and listened to one of the astronauts who was also a radio amateur. I've got it on tape somewhere. This is a hobby in storage, as I haven't participated in anger since about 1990 (Note: John is now into this as well). My current interest other than astronomy is sea fishing (from the shore). I got back into this about 2 years ago having dabbled as a teenager. As most is done in the dark, I can spend 3-4 hours visual observing at the same time as well as giving impromptu astronomy lessons to fellow anglers! I am also into a specialist branch of sea angling, which is tournament casting. This is done over a grass court and it's got all the disciplines of say javelin throwing, but involves the use of specialist tournament rods & reels for casting. There are regional, national and international tournaments. I'm proud of my current official PB of 229 yards (not bad after one year). I know all of this will sound odd to the majority, even to a lot of sea anglers!!! Imagine the discipline of perfecting a professional golf swing, plus the added complication of a 150g/5oz lead flying around the back of your head and you get an idea of the techniques and skill involved….or not! It does have a practical application, as being able to cast past the majority of anglers who'll be in the 70 - 100 yard range can have a distinct advantage on the beach.

*What is your most satisfying astronomical achievement to date?* Being part of the team getting the observatory and planetarium off the ground. Observing two big aurora in the 80's.

*Do we do enough as individuals, as a Society, to combat light pollution. What should we do to protect the Observatory for example?* I think Councils now comply with a national standard on street lighting. However, you still see new private developments with those

useless globe lights on poles. As for the observatory, I think as long as there's no major housing developments nearby, it's as good/bad as it's going to get. The site is a good balance between convenience of the public and darker skies.

*Do you think about motivation and enthusiasm, or just get on with it?*
I think you're either generally self motivated (see Jack & John as good examples), or you're not. There may be the odd lull now and then, but it never goes away.

*If you were World dictator, what measure(s) would you introduce?*
Nothing deep and meaningful has immediately sprung to mind, so I won't spend more time thinking about this one. Hang on, here's one, a ban on weak grey tea, the sort of stuff that's had a tea bag swung over the cup (take note John !). *And a civilised society?*
Decent tea !

☓ ❍ ☓ ❍ ☓ ❍ ☓ ❍ ☓ ❍ ☓ ❍ ☓ ❍ ☓ ❍ ☓ ❍ ☓ ❍ ☓ ❍ ☓ ❍ ☓ ❍ ☓ ❍ ☓ ❍ ☓

## Letter from New Zealand

from Frank Gibson

Last month I told you about building my observatory. I will now give you a run down on the observing gear and how it was set up

But first an embarrassing admission. I have not seen a comet since Hale-Bopp, which was easily visible to the naked eye. So, when Comet Ikeya-Zhang was forecast, I thought I would try to find it. According to the news it should have been too low to see from here but I thought I would look anyway. I used my binoculars to scan the northwest horizon just after sunset and yes, there it was. I called my wife to look which she did and said "This comet spotting is too easy these days, somebody has put a flashing light on this one!" Yes, it was a distant high flying aircraft.

I originally intended to build my own telescope on the basis that I could afford a very large mirror blank and that building the tube and mount would be an interesting challenge. I then cast my mind back to the hours spent by John McCue figuring a six-inch reflector mirror when I was at school with him. I figured that the time required to fine polish a mirror probably increases as the square of the aperture. I also contacted a supplier of mirror blanks in Australia, who pointed out that the majority of mirror polishing projects finish up as doorstops. Patience never having been one of my virtues, I decided not to follow this path, especially as I had just come into some money.

I scoured the adverts and weighed one against the other against my budget. I eventually decided upon a Celestron CM 1100, which was being offered a bit cheaper because it was the previous years stock (I have never been over fashion conscious). I imported it through a company in Christchurch. This is a 300mm Schmidt Cassegrain on an equatorial mount with electric drives on both axes. This may seem like overkill but part of the long term plan is computer controlled long exposure CCD photography. The setting up was interesting. Like most things astronomical, it is assumed that you live in the northern hemisphere. This meant that the electric drive turns the telescope in the

opposite direction to the sky (because your telescopes are all upside down). This was corrected by opening the control panel and reversing some switches. To set up the axis, Celestron provides you with a small telescope with a specially modified crosshair, which sits on the mount and you line it up with Polaris - great except of course you cannot see Polaris from here. This was a problem because the usual method of finding south here is to sight along the line of the long axis of Crux until you come to a star called Achernar in Eridanus and then estimate two thirds along this line. This is fine to make sure you don't get lost taking the dogs for a walk but not much use for accurate setting of a telescope. I decided to be devious. I borrowed an accurate magnetic compass from my school laboratory and then using this website (http://www.ngdc.noaa.gov/cgi-bin/seg/gmag/fldsnth1.pl) and knowing my latitude and longitude I found the magnetic deviation. From this I was able to offset the axis from the compass. It required a bit of minor tweaking using guide stars but it was a good start.

My observatory is on top of a hill and this caused an unseen problem. I am unable to satisfactorily view down to the horizon. This made setting the spotting scope difficult. I got around this by setting up a dressing table mirror in front of the telescope and angling it down so that I could use a power pole about a mile away to line up the spotting scope with the main telescope.

So I was ready to start observing and of course we have had one of the cloudiest summers on record, although it has picked up recently. Finding the most comfortable position for using the telescope has proved a challenge on occasions. Looking at objects up to about 60 degrees above the horizon is fine but the best seeing is of course overhead. Using the main telescope is no problem with a stool and a diagonal but it requires an interesting act of contortion to use the spotting scope for objects high in the sky. However, I believe I have solved the problem. The answer is a hammock. Using expansion bolts I have fixed a number of strong hooks into the concrete walls of the observatory and made a hammock from two lengths of climbing rope and wooden slats between them. It is stabilised using two vertical slats to prevent it tipping. With a piece of foam rubber to lie on, I find I can adjust it to the correct height and observe the zenith in fair comfort. I also find this a good position for simply roaming the heavens using binoculars.

The next addition to the setup was a CCD camera and here I got really lucky. To run a CCD camera you need a computer. I have a computer and my wife also uses one but finances would not really stretch at this point to a camera and another computer. I toyed with ideas of building a trolley so that I could wheel my computer up to the observatory and back each time I used it. I did not like this idea and I am fairly sure the computer would not have liked it for long either. Then fate smiled.

Our power comes overland through cables on power poles. At the bottom of the driveway is a power pole with a step down transformer on it which serves us and the two houses within a kilometre of our house. One Saturday afternoon the transformer was struck by lightning. This sent a spike up the line which fried everything in my computer except the hard drive and the CD drive. The cost of a replacement would have been about NZ$4000 but we are well insured and for the cost of $150 excess the insurance company

provided a computer which was significantly more advanced than the wrecked one. I also kept the monitor and keyboard from the old one as they were undamaged. We added a few dollars, bought a laptop for the wife and dedicated her old machine to the observatory.

The CCD camera is a Starlite Xpress MX5 with STAR tracking. I have found that the most important tool in the development of skills in using a CCD is patience and the realization that the camera is just the start. However, with some perseverance the results are worth the trouble. I am now just beginning to get results that look vaguely like pictures. I started by sighting an object, removing the eyepiece, inserting the camera and expecting to get a perfect pin sharp image. For your sanity omit this step.

When you buy your camera, buy at the same time (or if you are handy make) a flip mirror device and preferably an illuminated eyepiece (Meade sell an excellent one with different chip sizes on it). You then need to set aside several hours of darkness to set it up. You cannot do it in daylight because even dim daylight is far too intense for the sensitive chip and you simply get a white frame. I suggest you use a stationary target (i.e. not a star) to set it up as motion just compounds the problems. Because of my problem with seeing down to the horizon from the observatory I borrowed my wife's laptop as an image getter, telephoned a neighbour across the valley to leave a porch light on as a target, rested the telescope on wooden blocks on a table on the deck, adjusted it until it was pointing at the porch light, poured myself a large glass of Te Mata Cabernet Sauvignon Merlot (New Zealand reds are the best in the world) and set myself to the painstaking task of setting up the CCD.

The first task is to find a focus and it is important to get this as sharp as you can. Having done this you parfocalise the illuminated eyepiece and finally you adjust the flip mirror until what you see through the eyepiece is what the camera sees through the telescope. This may sound straight forward but altering one of these parameters usually slightly alters others, so you sort of sidle your way to a conclusion. Having done this however (and you will need to repeat the process occasionally), you have an instrument which has the potential to be as sensitive to light (though without the acuity) of an instrument many times larger of only thirty years ago.

♐ ♑ ♐ ♑ ♐ ♑ ♐ ♑ ♐ ♑ ♐ ♑ ♐ ♑ ♐ ♑ ♐ ♑ ♐ ♑ ♐ ♑ ♐ ♑ ♐ ♑ ♐

## Report on the occultation of Saturn by the Moon as observed from Ripon on 2002 April 16

from David Graham

The evening observation was made with a 150mm f15 Maksutov-Cassegrain telescope and a 25mm Plossl eyepiece in conjunction with a 2X Barlow Lens providing a magnification of X120. The sky was clear though a slight haze was present and the seeing was judged to be III on Antoniadi's scale. The observing station was the west facing aspect of our home at Ripon, North Yorkshire.

This was a spectacular event, all the more so given the nature of the 4 day old Moon with earthshine. On contact with the dark limb of the Moon, Saturn appeared to be quickly swallowed. Likewise the reappearance at the bright limb seemed equally rapid. Before and after, the proximity of Saturn to the Moon was a splendid spectacle to the naked eye, with various binoculars and seen through the telescope. In the deepening twilight, the arrangement of Venus, Mars, Moon, Saturn and Jupiter gave the almost three-dimensional aspect of 'seeing' the plane of the ecliptic.

The four stages of the occultation were timed using a Quartz wristwatch checked against a radio-controlled clock on our kitchen wall. No serious attempt was made to obtain precise times and the following are of casual interest only:

1st Contact……20h 50m 00s UT
2nd Contact……20h 52m 30s UT
3rd Contact…….21h 25m 30s UT
4th Contact…….21h 27m 00s UT

Turning to Jupiter from time to time, Io and shadow were seen to be in transit across the disk and a transit estimate was made for the centre of the RSH at 21h 49m UT, the system 2 longitude being 77°·8.

♎ ♑ ♎ ♑ ♎ ♑ ♎ ♑ ♎ ♑ ♎ ♑ ♎ ♑ ♎ ♑ ♎ ♑ ♎ ♑ ♎ ♑ ♎ ♑ ♎ ♑ ♎

## Planetarium Report

from John McCue

The first test of the link-up between the observatory and the planetarium at the Castle Eden Walkway took place on April 16th, during the occultation of Saturn. Since it wasn't due for another 22 years, we thought we should hurry with the first stage of the link (there is still a lot of work left to do). We attached our standard CCTV camera to the eight-inch refractor and linked through the underground conduit via BNC connectors to the data projector in the planetarium - and it worked! The occultation was viewed on the planetarium dome by members of the society from the comfort of cinema seats, while I was perched on top of the steps in the observatory nervously keeping Saturn on the monitor!

The overall size of the image was about ten arcminutes. Clouds hampered viewing, hence the image of Saturn was poor, but at least we just got the disappearance on video tape for the record. I later estimated the time for disappearance at about 1m.20s., which, if the motion of the observer caused by the rotation of the earth is ignored, (not too large an error, since the moon and Saturn were low in the sky) gives an overall diameter of the ring system of 190,000 miles, by a ratio calculation. The true figure is nearer 170,000. My VCR at home would not play the tape from the planetarium, so I have been delayed while machines were swapped around!

The Lunar image grabbed on the same night showed the main crater Janssen, with the Rheita Valley shown nearby, a feature that would stretch from London to Birmingham,

but which is not really a valley more a crater chain. The crater Rheita itself, at the lower end of the "valley" in this orientation, is about 40 miles across with walls rising to 14,000 feet. (Sirek of Rheita was a Czech optician who made Kepler's telescope.)

Good observing, John McCue.

♐ ☽ ♍ ♐ ☽ ♍ ♐ ☽ ♍ ♐ ☽ ♍ ♐ ☽ ♍ ♐ ☽ ♍ ♐ ☽ ♍ ♐ ☽ ♍ ♐ ☽ ♍

## In The Teesdale Mercury of Yesteryear

from Barry Hetherington

1869 November 10 p5 - A meteor of extraordinary magnificence was observed at Barnard Castle at seven o'clock on Saturday night shooting from a few degrees east of the zenith towards the west. It disappeared about 13 degrees above the horizon, and left a broad trail of light visible for 20 minutes. The ball of fire was of intense brilliancy and changing colour, bursting after five minutes duration.

1870 November 16 p 5 - Mr Jacob Readshaw, of Roseberry Cottage, [Middleton in Teesdale] has recently constructed a six feet reflecting telescope, which is certainly a wonderful instrument. Stars, quite invisible to the naked eye, may easily be seen and examined by its assistance. The moons of Jupiter appear very distinctly, and an object resembling a comet is at present making its appearance to the S.E. of this planet, which is about 400 million miles distant from the earth.

(So, the Mercury was reporting Astronomical items, even in the 19th Century. The first report must surely express a certain poetic, or newspaper reporter, licence? Presumably the six feet (in the second piece) refers to the focal length, not the mirror diameter, otherwise it would have been a remarkable instrument indeed. – Ed)

♌ ♒ ♌ ♒ ♌ ♒ ♌ ♒ ♌ ♒ ♌ ♒ ♌ ♒ ♌ ♒ ♌ ♒ ♌ ♒ ♌ ♒ ♌ ♒ ♌ ♒ ♌

## Astronomy and the Internet

from Rod Cuff

The Internet is crammed with wonderful sites to interest the amateur astronomer, whether you want a quick overview of a topic, to browse in an online encyclopaedia, to look at amazing (and/or very recent) photographs or to burrow into the depths of a particular subject.

I hope to include in each issue of Transit a guide to some of the sites that may be of particular interest to CaDAS members either because of current astronomical events or because they relate to what's been discussed at a recent meeting. If you have any particular areas that you'd like me to tackle for a future issue, do please e-mail me (Rod Cuff) - rod@wordandweb.co.uk.

Here's a start on things to show you what's around - get clicking ...

**General**

* British Astronomical Association -- www.ast.cam.ac.uk/~baa/index.html
* Astronomy resources -- www.mpe.mpg.de/AstR (links to everything!)

* Astronomy Net -- http://www.astronomy.net (more links to everything!)
* Astronomy picture of the day -- antwrp.gsfc.nasa.gov/apod/astropix.html (every day a different image or photograph)
* Astronomy Now magazine online -- www.astronomynow.com/

**Comet Ikeya-Zhang**

* Comet observation home page -- encke.jpl.nasa.gov (a site jointly run by the Jet Propulsion Lab (JPL) in Pasadena, California, and NASA site. There are excellent images of Ikeya-Zhang and many links to other comet information)
* Comet Ikeya-Zhang photo gallery -- science.nasa.gov/spaceweather/comets/gallery_iz.html
* Gary W. Kronk's cometography page for this comet -- cometography.com/lcomets/2002c1.html (everything you could want to know about it, with great photos)

**Lunar occultations**

*The International Occultation Timing Association -- www.lunar-occultations.com/iota/iotandx.htm (a master index and information site for lunar occultations & grazes)
*The Society for Popular Astronomy, lunar occultations page -- www.popastro.com/sections/occ/table1.htm
*The February 20 occultation of Saturn -- www.space.com/spacewatch/occult_pics_020221.html

**Gamma-ray astronomy**

*The history of gamma-ray astronomy -- imagine.gsfc.nasa.gov/docs/science/know_l1/history_gamma.html (from NASA)
*The home page of the Gamma-Ray Astrophysics Team of the (US) National Space Science and Technology Center -- www.batse.msfc.nasa.gov
*The University of Durham gamma-ray group -- www.dur.ac.uk/~dph0www4

❒ ♍ ❒ ♍ ❒ ♍ ❒ ♍ ❒ ♍ ❒ ♍ ❒ ♍ ❒ ♍ ❒ ♍ ❒ ♍ ❒ ♍ ❒ ♍ ❒ ♍ ❒ ♍ ❒ ♍ ❒ ♍

## Creationism and Evolution

by John Crowther

Recently there has been a media furore about creationism being taught at the Christian Foundation of Emmanuel College, Gateshead. The teaching of this subject the old science and religion debate, especially as a Christian business man had put £2 million into the College.

It was a good media story and it was given more publicity by Professor Richard Dawkins, who is in charge of the Understanding of Science at Oxford University, for he said that the College was teaching “ludicrous falsehood”.

Ever since Darwin expounded his theory of evolution, theologians have tended to criticise scientists and vice versa. In these days of intense specialisation, experts in either field need to be careful before they air their views. For when Genesis was written, well before the birth of Christ, science and theology were combined, as was astrology and astronomy. Nowadays, science usually asks the “how”, why theology attempts the “why”.

The Genesis creation stories are not seen as scientific accounts nowadays, even if they were taken as such by most people until the mid nineteenth century. We mustn't interpret them as being scientific, even though the order of events isn't far from the modern view. The first chapter has these in the following order; light from darkness, water and sky, sea and land, plant types, the time measurers which are Sun, Moon and Stars, birds, animals, man and woman. Rather like a chorus, the words 'and God saw that it was good' are used with 'and God saw that it was very good' at the end. So with man and woman being in charge, those words may express gratitude for our 'free lunch', the creation of the Universe.

The author of this chapter has tried to inspire feelings of awe and wonder. With faith, he was attempting to find the truth way back in the iron age. That is still what scientists today are aiming for. Professor Dawkins was described by the Times newspaper as someone who "articulates the views of many liberal atheists in science". But perhaps he isn't all that liberal. As we all know, religious fundamentalism is a threat but a growth of scientific fundamentalism could also be a problem.

Students, along with the rest of us, need to be offered different viewpoints, so that we may argue and reason before accepting what may be a step on the way to the truth.

Personally, I have doubts about the reality of Oort's cloud of comets and also about whether just a planetoid strike finished off the dinosaurs.

St. Augustine uttered the words of wisdom" I believe in order that I may understand".

I am grateful to Erik, the vicar of St. Barabas Church, Middlesbrough, for some of the views and facts given in this article. His long letter in their magazine was entitled "In the Beginning".

♐ ♍ ♐ ♍ ♐ ♍ ♐ ♍ ♐ ♍ ♐ ♍ ♐ ♍ ♐ ♍ ♐ ♍ ♐ ♍ ♐ ♍ ♐ ♍ ♐ ♍ ♐

## Book Review: Timothy Ferris - The Whole Shebang

Published in 1997, this "State of the Universes Report" is an erudite and easily-read exposition of the situation in modern astronomy, cosmology and cosmogony. More than 300 pages of entertaining and very informative reading are backed up by notes on each chapter and a glossary of terms. It is written for the general reader but has some challenging ideas and thinking, without being a text book. It starts with an explanation of the standard Big Bang Model, tracing how an expanding Universe came from the Greeks, via Keplar and Einstein, among many others. Chapter headings such as "The Shape of Space" stretch the imagination in discussing an infinite but unbounded Universe. The origin of the chemical elements, the problem of dark matter and the large-scale structure of the Universe are all illuminated by this author's clear writing. The mysteries of inflation and the multi-Universe hypotheses lead on to the weirdness of quantum theory and how it affects cosmology. At the very end, Ferris gives his fascinating views on the relationship of theology and modern astronomy.

This is a book to be recommended to everyone, and certainly to anyone interested in astronomy.

♏ ♎ ♏ ♎ ♏ ♎ ♏ ♎ ♏ ♎ ♏ ♎ ♏ ♎ ♏ ♎ ♏ ♎ ♏ ♎ ♏ ♎ ♏ ♎ ♏ ♎ ♏

## Transit Tailpiece

### Quote/Unquote

Great indeed are the things which, in this brief treatise I propose for observation and consideration by all students of nature. I say great because of the excellence of the subject itself the entirely unexpected and novel character of these things and finally because of the instrument by means of which they have been revealed to our senses.
*Galileo Galilei (1546-1642) Siderius Nuncius 1610*

What once was "Heaven" is "Zenith" now.
Where I proposed to go,
When Time's masquerade was done,
Is mapped and charted, too.
*Emily Dickenson (1830-86)*

Astronomy Mags The May meeting is the last chance to pick up some past editions for free from Gareth. He says he is in grave danger of severe male-type injury carrying them to and from the Hall.

---

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.

---

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. Support local businessmen! Glen tells me that he now has an Astronomy and Space books page on his website.

---

CaDAS Website Don't forget to visit our very own website and give John McCue your comments (www.stocktonsfc.ac.uk./mccue/caseden.htm).

---

Sunderland Astro Soc Website If you get withdrawal symptoms and want to go to meetings between CaDAS monthlies, visit www.sunderlandastrosoc.com to see what they are doing.

---

Articles Please send contributions for the Newsletter to Alex Menarry, 23, Abbey Road, Darlington, DL3 7RD, 01325 482597 (a.menarry@virgin.net) or to John McCue, 01642 892446 (john.mccue@ntlworld.com).