TRANSIT

The Newsletter of

Cleveland & Darlington Astronomical Society

14th June, 2002. Julian Day 2452440

Editorial

May Meeting. Carole Haswell has taken up a new area of research with the Open University recently – Extra Solar Planets. She gave us a fresh and interesting introduction to this rapidly developing area of Astronomy. (see later for report).

June Meeting. On the 14th , for our last meeting of the 2001-2002 CaDAS year, Martin Dawson and Martin Whipp FRAS will visit us from York AS to give a talk and video presentation on " Astronomy in Yorkshire".

Membership. The latest figures from Ian Miles show CaDAS membership is now at 54. 33 members receive their Transit by post and 21 by email.

Planet line-up. Jack Youdale urged us all to observe the unusual linear positions of the major planets in the western sky. The next opportunity for such an unusual juxtaposition will be 2020.

John McCue Accident. We regret to have to report that John has broken his leg in a motor-cycling accident just before the May meeting. We wish him a speedy recovery and hope he will be able to attend our meetings again soon.

Comet Ikea Zhang was reported to be still visible May, in Draco, but fading fast.

Scarborough Star Party Weekend. Don't forget to put in your diaries the weekend August 9th to 12th, for the Star Party at a dark sky site in the North York Moors. Contact Scarborough AS at their website or the Editor for application forms. Booking in advance essential.

Planetarium. John McCue announces the formation of the brand new Film Club, specialising in Sci-Fi and Fantasy, at the Castle Eden Walkway Planetarium, near Thorpe Thewles, Stockton-on-Tees. The first meeting is on Friday, June 28th, at 7pm. (see later). If you would like details of membership and the forthcoming programme, please contact John or the Editor (see last page, Transit Tailpiece).

Next Issue. Transit is closing down for July and August, returning with the new season of meetings in September.

Astronomy and the Internet

from Rod Cuff

This is the second in a series of links 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, please e-mail me (Rod Cuff) – rod@wordandweb.co.uk.

On a personal note, I've just (28 May) taken delivery of a Meade ETX-125EC telescope, complete with the optional Autostar Controller that enables you to slew the telescope automatically to any of 30,000 objects (planets, asteroids, comets, earth satellites, nebulae, double stars, variable stars, galaxies …). So far I've had just 10 minutes' viewing on my first night before the clouds rolled in: but enough to let me see Jupiter's two biggest belts in poor seeing conditions. I'll have to wait until autumn for darker skies; but I wondered whether any other CaDAS member has a Meade ETX, and if so whether we could keep in touch via e-mail to swap experiences?

General

* Tonight's sky – www.earthsky.com/Features/Skywatching/today.html
* If you fancy a sky darker than hereabouts, and a few days away from it all with six telescopes laid on, try an astronomy holiday at Fieldview, North Norfolk – www.fieldview.uklinux.net
* But it will be warmer at COAA in the Algarve in Portugal – www.coaa.co.uk

Choosing a telescope

* There are extensive equipment reviews at Todd Gross' Weather and Astronomy Site – www.weatherman.com
* Meade Telescopes has its main site at www.meade.com
* Everything you could possibly want to know about ETX telescopes, contributed by people who use them, is at Weasner's Mighty ETX site – www.weasner.com/etx/menu.html

Extra-solar planets

*Carole Haswell, who spoke at May's meeting, is part of the Open University's Astronomical Research Group: her section of their website is at physics.open.ac.uk/~chaswell
* Carole discussed the star HD209458, and the detected transit of a planet across it. You can see more about this at astron.berkeley.edu/~gmarcy/transit.html
* California and Carnegie Planet Search – exoplanets.org
* Many general links about exoplanets are at etacha.as.arizona.edu/~eem/exo/links.html
* The Extrasolar Planets Encyclopaedia – cfa-www.harvard.edu/planets

*STARE (STellar Astrophysics & Research on Exoplanets) --
www.hao.ucar.edu/public/research/stare/stare.html
* The Astrobiology Web has loads of links to current and proposed exoplanet work – www.astrobiology.com/extrasolar.html
* And you'll find a news item about the two mission-architecture concepts that NASA has chosen for further study and technology development, aiming to look for exoplanets and the chemical signatures of life, at
http://www.spaceflightnow.com/news/n0205/11planetfinder

Brown dwarfs

*There's a good *Scientific American* article –
www.sciam.com/2000/0400issue/0400basri.html
* Brown Dwarfs Home Page – www.bahnhof.se/~davidgr/browndwf/bd_home.html

Postscript: More news on high-energy cosmic rays (discussed at April's meeting)
skyandtelescope.com/news/current/article_582_1.asp

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Planetarium and Observatory News
from John McCue

June 5: Trial run of the Mt. Wilson link-up from California with the 24-inch reflector. The telescope and CCD camera are controlled from the planetarium and the theme will be comet imaging and searching.
June 16, 2.30 pm: Concert in the planetarium with tenor and keyboard. Tickets £5, including a free planetarium show, raffle, and refreshments, available from John McCue.
June 28, 7 pm: The first of monthly meetings at the planetarium of the new Film Club dedicated to science-fiction movies. The first screening will be Battle Beyond The Stars. To cover copyright laws, screenings can only be attended by club members, but signing-up cam be done at the first meeting.

Observatory. Work is finally beginning on repairs to rain-damage in the observatory; and it is hoped to continue the construction of the 19-inch reflector prior to eventual installation. The telescope will lead the main future observatory project of comet and asteroid tracking. Regular Friday night observing will still go ahead from September onwards, 7.30 pm.

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Astronomy Basics

by Neil Haggath

No. 3: The Doppler Effect

Last month, I talked about how we measure the distances of stars and other astronomical objects. This month, I'll describe how we measure another very important property, the speeds at which they are moving. We can do this by means of a very simple, but amazingly useful, phenomenon, known as the *Doppler Effect*. It's named after the Austrian physicist Christian Doppler, who first explained it in 1842.

Imagine that you are standing at the side of a road, and an ambulance passes you at high speed, with its siren turned on. As it approaches you, the sound of the siren is high-pitched; as it passes you and moves away from you, the sound changes to a lower pitch. This is a classic demonstration of the Doppler Effect.

To understand it, we have to consider the nature of waves. Any wave motion – be it sound waves, the waves in the sea, or electromagnetic waves such as light or radio waves – can be described by two parameters. Its *frequency*, denoted by f, is the number of vibrations or cycles per second, or the number of wavefronts which pass a given point per second. Its *wavelength*, denoted by λ, is the length of each cycle of the wave, or the distance between successive wavefronts. Multiplying the frequency by the wavelength gives us the velocity at which the wave travels, which we call c, i.e.

$$f \lambda = c$$

To start with, let's think about sound waves, as in the example of the ambulance siren. The pitch of sound, as we perceive it, is related to the frequency of the sound waves; the higher the frequency (or the shorter the wavelength), the higher the pitch.

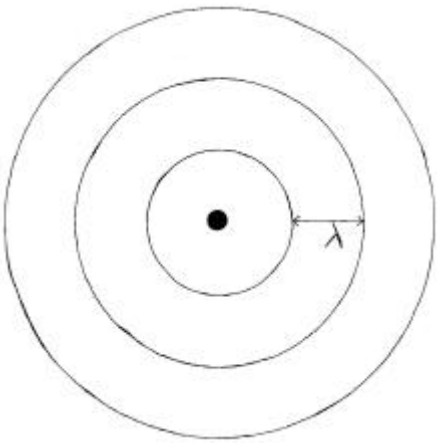


Fig. 1

Fig. 1 shows sound waves being emitted by a stationary source, represented by the black spot. The waves travel outwards as concentric circular wavefronts, like the ripples on a pond when you drop a stone into it. The three circles represent three successive

wavefronts; the biggest circle is the one emitted first, which has travelled the furthest. The distance between the circles is the wavelength, λ.

Now consider what happens if the source of the sound is moving.

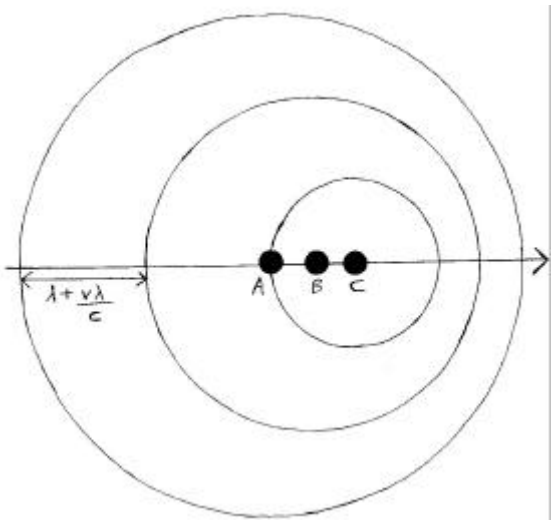


Fig. 2

In Fig. 2, the source is moving in the direction shown by the arrow, with a velocity which we'll call v. Now the wavefronts are no longer concentric; the three circles still represent three successive wavefronts, but they were emitted when the source was at positions A, B and C respectively. As you can see, the distance between the wavefronts is compressed in front of the moving source, and stretched out behind it. An observer to the right, with the source moving towards him, finds that the sound reaches his ears with a higher frequency, and shorter wavelength, than that with which it left the source. For an observer to the left, with the source moving away from him, the opposite happens; the sound arrives with a lower frequency and longer wavelength. That's why the ambulance siren changes in pitch as it passes you.

It's easy to calculate the change in the wavelength and frequency, which we call the *Doppler shift*. The time interval between the emission of successive wavefronts (the reciprocal of the frequency) is equal to the wavelength divided by the wave's velocity, i.e. λ / c. In that time, the source, moving with velocity v, travels a distance of $v \lambda / c$. So when the source is moving away from an observer, the distance between successive wavefronts, as they reach the observer, is increased by that amount. In other words, the observed wavelength, which we'll call λ', is given by

$$\lambda' = \lambda + v \lambda / c$$

or

$$\lambda' = \lambda (1 + v / c).$$

Of course, when the source is moving towards the observer, the observed wavelength is reduced by the same amount. Conventionally, we always use the above equation, with v measured positive if the source is receding, and negative if it's approaching.

Since the wavelength and frequency are inversely proportional, the observed frequency is found by dividing by the same factor, i.e.

$$f' = f / (1 + v / c).$$

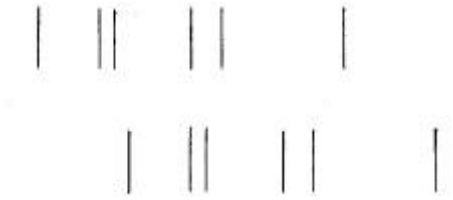
The above equations apply in the simplest case, where the source is moving directly towards or away from the observer. If its direction of motion is at an angle to our line of sight, then we simply replace v with the component of v in the direction of the line of sight, which is found by multiplying v by the cosine of the angle.

So far, I've been talking about sound waves. Since the velocity of sound is pretty small – a mere 338 m s^{-1} in air at sea level – the Doppler Effect is easily observable at everyday speeds, like the speeds of motor vehicles. But the same effect also applies to light and other electromagnetic radiation. Since the velocity of light is enormous – roughly 300000 km s^{-1} – the effect at everyday speeds is minute. But at much higher speeds, such as those of astronomical bodies, it becomes significant. We can measure the speeds of motion of stars and galaxies, by measuring the Doppler shifts in their spectra.

When a body is receding from us, its light is shifted to longer wavelengths, i.e. towards the red end of the spectrum, so we say it's *redshifted*. Conversely, a body approaching us is *blueshifted*.

Measuring the Doppler shifts of astronomical bodies is remarkably simple. If we use a prism or diffraction grating to spread out a star's light into a spectrum, we see that the "rainbow" pattern of colours contains lots of dark lines, called *Fraunhofer lines* or *absorption lines*. These are, in effect, "gaps" in the spectrum, where light of certain specific wavelengths is being absorbed by atoms of various elements in the star's atmosphere. Each line corresponds to a specific energy transition in an atom, and always occurs at precisely the same wavelength. Spectral lines can tell us a great deal about stars; which lines are present and which aren't, in a given star's spectrum, indicates the star's chemical composition. But I won't go into that here; stellar spectra will be discussed in a later article.

What matters here is that we can identify specific absorption lines, and we can reproduce them by heating various elements in a laboratory. By comparing a stellar spectrum with *reference spectra*, produced in the lab, we can measure the amount by which the absorption lines are red- or blueshifted, which then gives us the star's velocity along our line of sight.



Wavelength

Blue Red

Fig. 3 (above) shows a small part of a star's spectrum (bottom), compared with the same part of a lab spectrum (top). The absorption lines are shifted towards the red, showing that the star is moving away from us. We know the true wavelengths of the lines, so measuring their apparent wavelengths gives us the star's velocity.

Doppler shifts in stellar spectra are one of the most important tools in astrophysics, and we can deduce a remarkable amount of information from them. For example, by measuring the velocities of motion of stars within our Galaxy, astronomers are able to measure the rotation of the Galaxy, which in turn tells us a lot about its mass and its structure.

There are many binary stars whose separations are too small to be resolved, even with our biggest telescopes. But they can be identified by their spectra. As each component orbits around the system's centre of mass, it moves alternately towards us and away from us, so the lines in its spectrum are alternately blue- and redshifted. By measuring these alternating shifts over time, we can determine the orbital periods and velocities of these stars.

In recent years, the same technique has been used to detect planets of other stars, dozens of which have now been found. The presence of a planet causes a star to perform a very small "wobble" around the centre of mass, which shows up as an extremely tiny, but measurable, alternating Doppler shift in its spectrum. As these shifts are so minute, it's only in the last few years, by combining sophisticated telescopes and very sensitive spectrographs, that astronomers have been able to detect them. The first known extrasolar planet was discovered in 1995, and over 80 are now known.

But the most important use of the Doppler Effect is in cosmology; the study of the Doppler shifts of galaxies led to the discovery of the expansion of the Universe, and now allows us to measure its scale.

Early in the 20th Century, astronomers first realised that the "spiral nebulae", which we now call galaxies, were separate systems outside our own Milky Way. In 1912, V. M. Slipher studied the spectra of hundreds of galaxies, and discovered something remarkable. Almost *all* galaxies are redshifted, showing that they are moving away from our own. (The only exceptions are the few very nearest ones, which, as we now know, belong to our Local Group, and are gravitationally bound to each other.)

A few years later, astronomers found a way of measuring the distances of galaxies – the Cepheid variable method, which I described last month. In 1922, Edwin Hubble found that the speed of recession of a galaxy is directly proportional to its distance – the further away it is, the faster it's moving. A galaxy at distance d is receding from us at a velocity of

$$v = H_0 \, d,$$

where H_0 is *Hubble's Constant*. This equation is known as *Hubble's Law*. H_0 is measured in kilometres per second per megaparsec; a galaxy at a distance of d Mpsc is receding at a velocity of (H_0 d) km s^{-1}. Unfortunately, finding the value of H_0 has long been a major headache for astronomers; different methods of measuring it have produced embarrassingly different results over the years, ranging between about 50 and 100 km s^{-1} Mpsc^{-1}! Today, the favoured value is about 63. In fact, knowing H_0 is also very important

for another reason; knowing the rate of the expansion enables us to calculate the time since it began, i.e. the age of the Universe.

Having established Hubble's Law, we can use it the other way around; measuring the redshift of a galaxy enables us to calculate its distance. This is how astronomers calculate the distances of the most distant galaxies and quasars, which are too great to measure by any other method. Of course, this method is heavily dependent upon the controversial value of Hubble's Constant; cosmologists often evade that issue by simply referring to the *redshifts* of galaxies and quasars – e.g. "this galaxy lies at a redshift of 0.75" - as a measure of their *relative* distances.

A galaxy's redshift, denoted by z, is defined as the proportional amount by which its spectral lines are shifted in wavelength. If we call the shift in wavelength $\Delta\lambda$, then

$$\Delta\lambda = \lambda' - \lambda = v\,\lambda / c,$$

where c is the velocity of light. The proportional change, i.e. the redshift, is given by

$$z = \Delta\lambda / \lambda = v / c.$$

So by measuring z, we can easily determine v, which then gives us the galaxy's distance by Hubble's Law.

Actually, that simple formula only works when v is very much smaller than c. When v is a substantial fraction of c, which is the case for very distant galaxies, we have to consider relativistic effects, and have to use a more complex formula for z, which I won't bore you with here. In fact, many of the most distant galaxies and quasars have redshifts much greater than 1, which is impossible according to the above equation, but *is* possible when we use the relativistic version.

When Doppler first worked out his equation 160 years ago, he couldn't possibly have imagined how vital a tool it would become for astronomers. It's remarkable that such a simple phenomenon, familiar to us all through such things as ambulance sirens, proved to be the key to understanding the scale and structure of the entire Universe!

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The CaDAS Interview – Dave Graham

"One of our most experienced observers" was how Dave was described to me by Neil Haggath, "you must interview him". I knew that Dave was an early member of the Darlington Astronomical Society and had been a prime mover in bringing about the merger between the Darlington and Cleveland Astronomical Societies. I also knew he was Director of the BAA Saturn Section. CaDAS is blessed with so many prominent amateur astronomers – we are very lucky. Dave and I met in my house in Darlington, one Tuesday evening after his work, talking over a cup of tea and a piece of home-made cake. His job is in Darlington but he lives (and observes) in Ripon. He has a regular dinner date with his parents, who live nearby. The idea of a son making the effort to keep in touch with his parents appeals to me.

Do you prefer Dave or David? I don't mind, really. Just as it comes.

Tell me about how the Society merger came about. Well, Barry had started the Darlington end a couple of years before I joined in 1982; I was about 22 then. I enquired about Societies at the Library and they told me about it. We were only a few and it seemed that to join into a bigger grouping would spread the organising effort. In any case, Cleveland had an Observatory and a good observing site at Castle Eden Walkway. No – this all took place before the observatory which didn't open until 1994! I think both groups found that combining efforts made a better Society. I think the way that CaDAS has developed has justified the merger. Some of the Darlington people didn't make the move, they considered it too far to go. One of the other prominent members at the time was – and is – Chris Walker. You should interview Chris.

Were you interested in Astronomy before then? Yes. I was one of those 1960's kids who were in their formative years when the Space Race, Gemini, Apollo, Dr Who, Star Trek (the originals!) were all coming along and firing our enthusiasm and interest. I had been bought a 1 inch refractor for Christmas when I was about 8. Then I saved every penny I could from my newspaper round and amassed the amazing sum of £50 at about 16. I remember my Dad took me to a place up the North Road in Darlington that had a second-hand telescope. The proprietor opened this coffin-like wooden box and there was a wonderful 3 inch refractor and all the accessories. "How much do you want for that?". £50, he said – exactly right – and that was a wonderful boost to my astronomy career.

You are Director of the BAA Saturn Section. How do you become one of those?
It's by invitation. You have to be an active observer, of course, and contributing to the BAA specialty programme, which I was. I had been an enthusiastic observer since a family friend had made a 3 inch refractor and let me look through it at the Moon in about 1975. Then I got the 3 inch I told you about. In 1982 I got a 4 inch refractor and joined the Planetary section of the Junior Astronomical Society or the SPA as it became later. I eventually became Director of their Planetary Section, which covered all the planets, of course. In 1993, Alan Heath, the Director of the BAA asked me if I would take over as BAA Saturn Section Director and I agreed. You know you can see the planets in the day-time if you know where to look. Venus is fairly easy. Mercury is harder but has a higher altitude in the day.

What's involved in being the Director of a Section?
It amounts to the general running of the Section – formulating the observing programme, keeping in touch with all the members of the Group, co-ordinating and collecting all the observations that come in from the members, and writing the Annual Report for the BAA Journal. *Which means you get to know a wide range of active astronomers?* Yes, and not just from the UK. I have made a lot of contacts in the USA and Europe and keep in close contact with them. In these days of the Internet and e-mail, contact has been getting easier. The Saturn Section is one of the quieter ones, much less busy than the Variable Star Section for instance, which suits me.

You are rumoured to have spent some time observing at the Lick Observatory.

Yes. In the summer of 1995, mid August I think it was, I spent 7 clear nights on the trot looking through the eyepiece of the 36 inch refractor. It was arranged by Bill Sheehan, an American astronomical author. At the time the rings of Saturn were edge-on to the Earth – a sensational sight. We looked at all the Planets. *No CCDs or cameras in between?* No. Just as I love it to be. Eyeball at the end of the telescope, drawing what you see. It helps so much with training the eye to look properly.

You enjoy the direct contact? That is the essence of astronomy for me, the total observational experience. Looking directly with telescope or binoculars, or even the naked eye. Looking at the sky, wondering at it all. Being at one with the Universe, the immensity of it all, thinking about what is out there and how amazing it all is. It's a bit like when the starship Enterprise went into orbit round a new world. Its that sort of feeling, seeing new things. Then there is the aspect of being "in the nocturnal environment". Hearing and seeing owls and foxes through the quiet night hours. It's a bit like how the fishermen describe what they do. It's not just watching a float in the water. You are part of the river scene, part of the natural surroundings, feeling the wind, watching the water, thinking about it all.

Do you have an observatory at home? No, but Chris Walker, Malcolm Johnson and I set up an Observatory at Gilling West, in the sticks outside Richmond, with a 16 inch reflector. It's a dark site and it was not unusual to see the zodiacal light. We even saw it on a full Moon night! The trick was there was an eclipse on that night. You have to be in the right place at the right time – usually at the equinoxes. I saw it with the Hale-Bopp comet a few years ago.

What instruments do you have at home?
There is a 4 inch and a 6 inch refractor and a 6 inch and a 9 inch Maksutov- Cassegrain. They are not set up in a building. I just take them out when the opportunity presents itself. They are portable and don't take much setting up. I do a lot with binoculars, too. *Are they "goto" telescopes?* No. For me, part of the fun and pride in the skill of observing is finding the object you are looking for. Knowing the sky well enough to find even faint objects is part of the enjoyment for me. *Me too.* I haven't made any telescopes. I rely on professionally-made ones, made by Peter Drew, in Lancashire and get most of my accessories from him, too Although, I've brought a lot of stuff back from the USA, when I was visiting. You can buy stuff for the same number of dollars as it costs in pounds here.

Tell me about your upbringing and family.
I was brought up in Brompton-on-Swale. My two older brothers and I lived there in a normal, happy family, until we left school. They are not interested in astronomy – motor bikes are their enthusiasm. When they saw my first telescope they said "you'll never get to work on that!". After the local school, I went to secondary school in Richmond. When I left, at 16, I became an apprentice electrician. The rest of my education has been night school and College. *So many amateur astronomers are life long learners.* Well, in my case you have to keep up with the Electrical world. The subject is changing all the time.

As far as astronomy is concerned you just have to keep up with the changes.

What about your own family?
I am married with one little boy of eight months. *A 24-hour occupation.* Yes, the astronomy has had to take a back seat recently. What with moving house and lots of DIY as well. I'm enjoying family life.

A*re there any more characters you have met through astronomy?*
Oh, yes. As well as going to the Yerkes Observatory, I have been to Allegheny, Pittsburgh, and to Ohio to visit an American friend, Tom Dobbins. He has a number of private telescopes in clear sky sites, where you can rely on the weather. I used to go over every year until my little boy Matthew came along.
Another event I remember well was having dinner with Patrick Moore in Cambridge during a conference at the Institute of Astronomy. We went out to dinner and he had spare ribs – in the days before BSE – and the waitress took great delight in fitting him out with a big plastic bib. I wish I had a photo of that.
Then there was the Channel Four programme, of about 1990, called "Earth Calling Basingstoke". *Yes, I remember seeing that. Why Basingstoke?* Well Guy Hurst, currently President of the BAA, lived there and they filmed him at home. They also filmed me at home in Brompton and at our Gilling West Observatory. John McCue was in the programme, too along with John Nichol and Chris Walker. It was nerve-wracking when they were filming. It took several days. I was working at RAF Leeming at the time and they wanted to film me at work, needing special permission.
I also have some Italian connections and spent a week at the Paris Observatory in 1996. There was an professional conference on the Shoemaker-Levy comet and its collision with Jupiter. I remember being shown the 33 inch refracting telescope at the Meudon Observatory. Professor Dollfus is the top planetary man there; a real character. Rides round on a bike and wears a typical French beret.

Do you ever think about where your motivation and enthusiasm come from and whether they will ever go away?
Motivation? Its more a passion, a driving force. A reason for being. It continues through satisfaction or frustration. It's an inner voice, bringing a sense of identity, a continuity between past and future. It even continues through the upheaval of moving house!

You have clearly put a lot into the subject as well as getting something out.
I suppose so. I always think we amateur astronomers are a link with the general public – a better one than professional astronomers, who seem less accessible, more remote. We are normal individuals, who can relate to everyone else, and they to us. Even if you only invite your neighbour around to look through your telescope. *Have come across the idea that we amateurs could help schools to use access to the remote-controlled telescopes for schools?* You mean like the Liverpool Telescope? Yes, that would be a worthwhile thing we could contribute to. Did you know the Darlington Telescope, the 5 inch Cooke, is probably over at the Sixth Form College? Barry would know about that.

Final question – what makes a civilised society?

One that tolerates diverse attitudes to life. Sir Arnold Wolfendale said that a civilised society is one that takes an interest in Astronomy.

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Letter from New Zealand

from Frank Gibson

My wife and I have been living in New Zealand since 1989 and have no intention of living anywhere else. One of the many advantages to living here is the basic makeup and history of the society and people.

The modern history of this country dates from the early part of the nineteenth century when European emigrants began to arrive along with smaller numbers from China and other areas. A major driving force in this emigration was a wish to escape the squalor and short life expectance of industrial revolution Britain, famine struck Ireland and the enclosures of Scottish land. Understandably, the emigrants did their best not to bring these problems with them. The land they arrived in already had a thriving civilization which had not had its spiritual connections to the land and the rivers and the sky crushed by the need to make a profit for the master. In many ways what we see in New Zealand now is a country of people who are either trying to preserve their spiritual roots or redefine them.

The tribes (iwi) that have come to be known collectively as the Maori arrived in Aotearoa (Land of the long white cloud also known as New Zealand) between 800 and 1000 years ago. They arrived in large double-hulled sailing canoes and every self-respecting tribal leader can recite a whakapapa (ancestry), which goes back to these canoes and even back to the ancestral homelands. The canoes were more than just methods of transport; they were given names such as Aotea and Tokomaru and imbued with great mana (roughly meaning charisma, power, knowledge, wisdom - difficult to translate but you know when someone has mana and when they have not). The homeland was called Hawa iki. Nobody is certain now where that was but it was most likely in the Sandwich Island group.

Because of their voyages across huge areas of empty ocean they have been called the Vikings of the Pacific. However, the Vikings were largely coast huggers. Whichever direction you sail in the North Sea you will be very unlucky not to sight land within a day or two. The Maori voyagers were very skilled in the use of stars and the sun for navigation. They needed to be. If you are aiming for a speck of an island perhaps ten miles across in a thousand miles of empty sea and the next stop is Antarctica or South America there is little room for error. I am intending write a couple of articles on the astronomical methods of navigation used by these ancient mariners.

Ka puta a Matariki, ka rere a Whanui, ko te tohu o te tau
(Matariki (Pleiades) reappears, Whanui (Vega) starts it's flight)

This year, in the early morning of 12 June, the star cluster Matariki - or Pleiades - appears in our dawn skies signifying the start of Matariki. The Maori New Year begins with the first new moon after the first appearance of Matariki and this year the new moon also appears on 12 June. The bright star Puanga - or Rigel - emerges at about the same time, and for some iwi it is the appearance of Puanga rather than Matariki that has significance

and is celebrated. Festivities differ from iwi to iwi, but Matariki is, for most, a rich and meaningful celebration, marking the beginning of the plentiful season. It is a time for feasting, entertainment, and ceremony.
During the weeks of Matariki, all activities are tapu (another difficult word, books have been written about it's meaning, the nearest English word is probably sacred but it is more than that) and have great ritual importance. Crops are planted, and Rongo-ma-tane, the god of cultivated food. is appeased for a productive return. It's a good time to gather pikopiko (fern fronds) and a host of native berries. It's also the right time to cast fishing nets and lines into the deep waters of Tangaroa - god of the sea - to make the most of bountiful supplies of migrating fish.
The visual appearance of Matariki in the sky is vital. If the stars in the cluster are clear and bright, it is thought that the year ahead will be warm and productive. If they appear hazy and shimmering, a cold winter is in store for us, and all activities during the period of Matariki must take this into account.

I would suggest that anybody who manages to gaze at the heavens without some feeling of mystery has missed the point. I will conclude with the Maori explanation of why the day is the length it is

Maui often heard his brothers talking about how there was not enough sunlight during the day. No matter how early they got up, still there weren't enough hours of sunlight for all their village duties and for hunting and fishing. Maui thought about what he could do to solve their problem. Then he announced to his brothers that he had found a solution: "I think I can tame Te ra (the sun)".
" Maui, don't be so ridiculous! No one can tame te-ra. For a start, if you got anywhere near him you would be burnt to a cinder. There is no way of taming him. He's far too big and powerful." But Maui insisted. "Look, I can tame the Te ra. Get all the women of the tribe to go and cut as much flax as possible then I will show you how to make a net that will be strong enough to capture te ra. I will make sure that he won't go so quickly across the sky in future."
The brothers obeyed him and when they had collected mounds of flax Maui showed them how to plait it into strong ropes. He made long ropes and short ropes, and tied some of them together to make a net gigantic enough to catch and hold the fiery god. After many hours of plaiting they finally had enough rope and nets to please Maui.
Then he set off, equipped with his special axe, with his brothers and other men from the tribe. It took several days to reach the resting place of Tama-nui-te-ra in the east. After a short stop they started their preparations. They found the cave from which Te ra would be rising next morning and they quickly set to work covering the entrance with the net of plaited ropes. When they were sure they had done a really good job they camouflaged the ropes with leaves and branches. They also made clay walls as a protection against the Sun's fierce heat, and smeared the clay all over their bodies. Then they hid.
Maui crouched on one side of the cave and the rest of the men were on the other side. It wasn't long before they saw the first glimmer of light from the cave. Then they felt the scorching heat.

The men were shaking with fear, as the light grew more and more blinding and the heat more and more stifling. They were sure that Maui's plan would not work. Suddenly they heard a sharp shout from Maul, 'Pull! Pull the ropes as hard as you can.'
The net fell like a huge noose over the Te ra. Although the men were terrified that the Sun would kill them all, they pulled and strained as hard as they possibly could so that Te ra could not escape.
Tama-nui-te-ra, who was raging at being held captive, struggled and roared. Maui knew he had to do something more than just hold him in the net so he yelled to one of his brothers to take his end of the rope. He rushed out from the protection of his wall and, with his special axe raised high above his head, he ran towards Tama-nui-te-ra. Even though the heat was singeing his body and his hair, he started to attack him with his axe.
Tama-nui-te-ra roared even louder. "What are you doing? Are you trying to kill me?" he screamed.
"No I am not trying to kill you," answered Maui, "but you don't understand. You go too fast across the sky, and we are all unable to do our daily work. We need more hours of light in our days for hunting and fishing, for building and repairing our village houses."
"Well," said the Tama-nui-te-ra, "you have given me such a battering that I don't think I could speed across the sky now, even if I wanted to."
"If we release you" said Maui "will you promise to slow your journey down?"
"You have so weakened me that now I can only go slowly" answered Tama-nui-te-ra.
Maui made him solemnly promise to do what he had asked and then he released the ropes. Maui's brothers and the men of the tribe watched as Tama-nui-te-ra, slowly and stiffly, began to lift into the sky. They all smiled at Maui - they were proud of him.
To this day, Tama-nui-te-ra travels on his long lonely path across the sky at a very slow pace, giving us many more hours of sunlight than he used to do.

In England the sun (bel) was worshiped in many places. The name has been preserved in Place names such as Bellingham and possibly Billingham. Has something been lost?

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This Modern World is a Small Place.

from Ray Worthy

It has been quite amazing how my small mobile dome business has spread out its contacts across the world. When your business is the manufacture of inflatable domes, you very soon run out of customers if you confine your activities to these shores. The development of the Internet has made contact across the globe so easy. It would be no use putting an advert in the Gazette. It seems a long time ago now that I made contact with a Belgian planetarian whose English, whilst brilliant in the ordinary, everyday sense, did not quite come up to scratch when he wished to use it in a publication for English users. We English speakers are exceedingly lucky that our language has become the accepted international medium. It gives us a completely unjustified false sense of superiority. I was helping to start a European Internet magazine for planetarians when I came across the entry by a gentleman called Johan Gijsenbergs. He was trying to say that he had enjoyed the company of some folks in a visit to a particular American planetarium. He wrote that "They were a lovely bunch of gays". Strangely enough, it was only two weeks

later that I met Johan in London at the annual meeting of the British Association of Planetariums. In passing, I mentioned to him that he had not quite conveyed what he had in mind. After my explanation had produced a few giggles, he asked me to vet his English language output and so a collaboration and a deep friendship was born.
Later, I helped him with some work for his local committee for touristic development. One thing led to another and soon Josie, my wife and I were visiting Johan's home town, Genk and staying with his mother. Johan was the director of the "Europlanetarium" which gave shows in several languages. He escorted us around to see the various local sites and to meet some notable personalities. He also took us to sample the absolutely fantastic beer of the region.
One man we visited was an astronomical fanatic. He was also a weather fanatic. His house had been completely taken over by his hobbies. Most of his home was a fully equipped weather station. There was so little space for normal living that I felt distinctly sorry for his wife and daughter. Georges Meyen, for that is his name, gives talks on the local radio about the weather situation and also about astronomy. Amongst all his other paraphernalia, Georges had constructed a planetarium in its own dome inside his house. The most interesting aspect of the projector was that, apart from the necessary lenses and so forth, it was made of wood and cardboard. It was based on a dodecahedron design from an American kit. It had all the bells and whistles, sunrise and sunset, a display of the Aurora Borealis, meteor showers, the Milky Way. He had made everything himself, and what's more, they all worked.

Georges and his projector

It was the day after I met Georges, incidentally, that I discovered the old Spitz A1 projector which now graces our brand new planetarium. It was languishing in a cupboard below the large telescope at the Europlanetarium. That is only in passing because it does not concern the direction of this story.

Almost exactly a year ago, I was scanning the sci.planetarium newsgroup on the internet when I came across a plea for help from a young Mexican. Saul Grijalva, of Sonora State, wanted someone to advise him on the construction of a home made planetarium

projector. As long ago as 1985, I had constructed my own version of a projector and became an early member of what we called the "Home Made Planetarium Association". This was an international affair in which we discussed all the pros and cons of various ideas. I made the offer to help Saul and there was a constant stream of e-mails going back and forth across the Atlantic. He had set his heart on the construction of a dodecahedral starball, (they are called starballs no matter what the actual shape is. An Argentinean friend has actually made a cubic starball, and it works too). Because of his expressed desire, I sent Saul the pictures of the planetarium of Georges Meyen. "That is exactly what I had in mind!" he said.

However, I prevailed upon Saul to walk before he tried to run. I laid out before him all the various lines of attack and left it up to him as to which he chose. He tried such ideas as poking holes through aluminium sheeting with different sized needles, but in the end he opted for the photographic method. In this method, one draws the stars or whatever, black on white and takes a photograph. Then one uses the negative as the starball, through which the light from the pin-point bulb in the centre creates the image on the screen. Anyone familiar with "Starlab" will know what I mean. The simplest design for the starball is cylindrical, so that design was adopted for Saul's first attempt. I was expecting this to take forever, as Saul had a job in his fathers ship's chandler's shop. When I made mine, before the age of computers, I took three months to draw all the stars down to sixth magnitude.

Using a computer, Saul managed the task in an incredibly few days. He must be a workaholic because, in no time at all, he had constructed his first effort. Admittedly, there were a few rough edges mainly in the engineering, which I had to analyse and send a critique, but the overall result was very impressive.

In the State of Sonora, the local University is organising a scheme in which each of the cities of the area is to erect a small planetarium. They call it the "Constellation", or more correctly "Constelacion" Programme and, quite naturally, they are quite proud of it. Their domes will all have an outer structure of geodesic frames. These buildings will be somewhat like prefabricated buildings, but the exact extent I know not because I have not the Spanish to read the fine detail. It is silly, the rest of the world not speaking English! Why do they persist in this practice? If, by some chance you wish to know more about this scheme, you can look up the web site, the URL of which is http;//cosmos.astro.uson.mx/procons.htm

There is a chance, just a chance, that yours truly might be involved in providing a dome or two. The University people in charge of this scheme are very interested in Saul's new projector. Its performance seemed to impress them. Saul did not just lie back in satisfaction however. No; he saw this interest as a confidence booster and he immediately put in hand his plans to build a dodecahedron starball. Because of his lately-acquired knowledge from his first shot, he made the new starball from photographic

negatives, each pentagonal plate done separately. Using digital photography, he was able to include the Milky Way and several Messier objects, five I think. Saul did not realise a particular aspect at first and when I pointed it out he accepted the idea with alacrity. You see, with the photographic method, if you use a strong bulb, the dark part of the sky sometimes is not dark enough. One solution is to double up the negatives to increase the opacity between the stars. However, with the cylindrical configuration, you cannot use the same print one on top of the other. The different radii prevent the images coinciding correctly.
Now, with the new dodecahedron design, each of the plates is absolutely flat, so it is relatively easy to place one plate on top of another. Using this method, Saul can now use the same bulb as we use in our seven metre dome. The Milky Way and the Messier objects are intrinsically included in the plates and do not need separate secondary projectors.

This is all hot off the press. All so new that Saul has not thought about how much he ought to sell it for. One thing I am sure about and that he is on to a winner. Recently, I received an enquiry from someone who lives in Rostov-on-Don. Now I have the problem of trying to read a web site printed in Cyrillic script.
Anyone speak Russian?????????

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Book Review: The Photographic Atlas of the Stars by Arnold, Doherty and Moore

If you have the same problems as me in relating what you see on star maps and planispheres to what you actually see in the sky, this is the book for you. Looking for new objects is always a struggle. The angular distances are always a surprise and the shapes are never quite as expected, presumably because of the difficulty of representing the inverted bowl of the sky on a flat piece of paper. This book has a new approach. It is a collection of 45 photographs of the Constellations, all at the same scale. The exposures have been selected to show the magnitudes you would see through 7x50 binoculars – down to about 8th magnitude. This turned out to need ISO400 film in 10-minute exposures, with a 35mm lens covering 38 by 55 degrees of sky, taken over “a period of several years”.

The photographs are in colour and are stunning, having been taken in excellent seeing conditions, from very dark sites. As you would expect in a book with Patrick Moore involved, there is plenty of background information. Lists of interesting objects are similar to Norton's Star Atlas and each photograph has a diagram of the main stars in each constellation, placed opposite the photograph. Just now I've been looking at oCeti, delta Cephei and RZCas and can confirm they are on the photographs. I am not sure what they did about variable stars. It is a lovely book to leaf idly through and look at old favourites or find the ones you always meant to search out one night.
The book is published by the Institute of Physics. The softback version is £22.

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BAAVSS Meeting January 26th, 2002

The British Astronomical Association, Variable Star Section, met at the Institute of Astronomy in Cambridge on January 26th. These meeting seem to come round at about 6-monthly intervals. In fact this one was an RAS/BAA joint ProAm meeting, attended by many professional astronomers. Those who attended were treated to a packed day of talks in a very modern lecture theatre, with all the modern communication technology. Subjects ranged from following variable star observations over centuries, to the progress of the Liverpool and Faulkes Telescopes. The emphasis was on the role of amateur astronomers in Astronomy generally and the value of amateur observations. One talk of direct interest to us referred to "doing science with a biological detector" and the problems that can have. Not only the difficulties in estimating the magnitude of red stars (the dreaded Purkinje effect) but how to make the basic data, the sequence charts, Internationally agreed.
Many professional astronomers acknowledge the contribution made by painstaking observations over a long period of time, which only amateurs can give. The huge observing programme of variable and eclipsing binary stars, run by the BAAVSS, the American Association of Variable Stars Observers and many other associations around the World, means that these stars are kept under close surveillance by a wide network of amateurs. The question was what should amateurs concentrate on, as far as the professionals were concerned.
One talk mentioned the development of very sensitive, wide-angle telescopes expected to be available in the next decade or so. These instruments will be capable of scanning the whole sky about ten times a night, down to magnitude 15. They were not too clear on who would analyse what was seen, but the assumption is that robots will be also be developed to scan the pictures. They will be the ones who discover comets, brown dwarfs, supernovae and eruptive variables. What role can the amateur fulfill then? Answers on a post card, please.
Two lectures covered the progress on the Liverpool and Faulkes Telescopes. This year and next these three 2-metre instruments, of essentially the same design, will be commissioned. They are designed and built by Telescope Technologies Ltd, who seem to have taken over the mantle of British large telescope makers, vacated when Grubb-Parsons closed down. The telescopes are, all three, entirely robotic and unattended, costing £2.5 million each. The one for professionals will be on La Palma in the Canaries.

The other two are for the use of British schools and are a wonderful educational resource, provided by the generosity of the benefactor, the Faulkes Educational Trust. With one in Hawaii and the other at Siding Spring in Australia, accessible via the Internet, this will allow schools to use the telescopes in the day, when the schools are in session and it is night where the telescopes are. One interesting comment was that local Astronomical Societies could well provide a service to local Schools, who may need advice and assistance on running an interesting and inspiring programme.
There were many other attention-grabbing subjects during the day – such as why are there not more eclipsing dwarf novae? - but the best way to find out about these things is to attend. I hope I have whetted your appetite for the next meeting?

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May Meeting – "Exoplanets"

by Carole Haswell

At the last meeting of the Society we were treated to a fascinating talk on Extra-Solar Planets, from one of the hands-on researchers in the subject. Carole Haswell has recently taken up a new research post with the Open University. Using some excellent illustrations, she took us through the modern ideas from the beginning. Such as asking us the question "What defines a planet?". Our various attempts to answer this question were given quiet nods by the lecturer, who then added the crucial limitation "limited to less than 13 times the mass of Jupiter and not a brown dwarf".
Both the Greeks and early modern astronomers, such as Christian Huygens, had postulated the possibility of planets orbiting distant stars but there was no evidence then, of course. Nowadays, planet-forming discs or seen around most stars, which leads to the reasonable postulate that planets must be ubiquitous. Discs accrete into planets. Planets cause the parent star to wobble and this wobble has been detected in 65 stars, with 70 planets now known. The mass range is 0.16 to 11 Jupiter masses. They are in close circular or elliptical orbits ranging in size from 0.1 to 10 AU. By using eclipsing techniques, these planets have been shown to be gas giants – that is, the idea that planets near to parent stars must be rocky is not necessarily the case.
The speculation that life may be present on some Earth-like exo-planets is still speculation. For life to develop the conditions must be very special and stable for billions of years. There is now a wide angle search for planets using a 9x9 degree camera. All the bright stars will be checked and several thousand planets are expected to be found.

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STOP PRESS **CaDAS web pages are moving.** The pages are being combined with the Planetarium & Observatory website. They used to be on http://www.stocktonsfc/mccue/caseden.htm, but will soon be on http://www.planetarium.btinternet.co.uk . There may be a link to the new site from the old address.
The Society (or John McCue on behalf of the Society) can be contacted by e-mail on: planetarium@btopenworld.com

There will be a webmaster address for the website as soon as possible but, for the present, the webmaster will be Ed Restall, whose email addresses are
ed@nccs.fsbusiness.co.uk and ed@restall.freeserve.co.uk
When the page is fully in service, planned to be by the middle of June, incorporated on the Site will be down-loadable electronic versions (& back issues) of Transit, the Planetarium newsletter "Link-up" as well as general information about the Society.

Transit Tailpiece

Quote/Unquote

You that so wisely studious are
To measure and to trace each star
How swift they travaile and how far
Now number your celestial store
Sir William Davenant (1606 – 1668)

But if a man would be alone, let him look at the stars.
Ralph Waldo Emerson (1803 – 1882)

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.

14x100 Binoculars Would the member who has ordered binoculars from Glen Oliver, Custom Telescopes UK, please make contact with him - the telephone number he has for you is not working.

Custom Telescopes UK. For your telescopes, binoculars and accessories of all kinds, go to Glen Oliver, a long-time member of the Society. He operates from Hartlepool and has a website www.goliver.freeserve.co.uk. Glen also supplies Astronomy and Space books of all kinds. Don't forget to visit his website soon.

Sunderland AS Contact them at www.sunderlandastrosoc.com to see how they are progressing with the new Observatory at Washington Wildlife Centre. This thriving local society now has a membership of 48.

Post and Email If anyone wishes to change the way they receive their Transit, please let me know.

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). Copy deadline date is the 1st of each month.
