TRANSIT

The Newsletter of

Cleveland & Darlington Astronomical Society

13th June 2003. Julian Day 2452804

Front page picture Keith Johnson has been recording some wonderful images recently and here is one example, showing an amazing prominence on the Sun.

Editorial

May meeting. Jack Youdale entertained us with his annual Presidential lecture, "The Measure of all Things" from micro-millimetres to light years and parsecs. Another new subject, after 24 years of delivering the lecture.

The Society Book Project. An informal meeting in the Vane Arms, after the May meeting, moved the project forward. Please read the article later in Transit and don't think "oh, this is for someone else" – it is for us all.

The Transit of Mercury. Several members have emailed reports of their observations of the transit on 7th May, several with pictures. A summary of the reports received will appear in the next issue (space is tight this month – again!). See later for Keith Johnson's offer of a video of the event.

Mount Stromlo. A report in the May 24 New Scientist indicates that the observatory could be operational again within 3 years. However, because of light pollution from the urban sprawl around Canberra, the big telescopes may be built on another site.

Next meeting will be held on 13th June 2003, in Thorpe Thewles village hall, when Barry Hetherington, Chairman of CaDAS, will talk on "Observatories through the Ages".

♋ ❍ ♋ ❍ ♋ ❍ ♋ ❍ ♋ ❍ ♋ ❍ ❍ ♋ ❍ ♋ ❍ ♋ ❍ ♋ ❍ ♋ ❍ ♋ ❍ ♋ ❍

A Video created by CADAS members for CADAS members

From Keith Johnson

(Keith is making a fantastic offer to all members and I hope there will be a huge response. The offer will also be publicised at the next meeting. Ed.)

Hi, everyone, I'm making good progress with the single frame captures from the video - then I had a thought.... using the video footage, wouldn't it be a good idea to make a "CADAS Mercury Transit 2003" video, with all of the proceeds going to the society?
We have the main ingredients, which is the video footage. Someone could put a dubbing over the top of it (Jack's superb "velvety" voice springs to mind) explaining first of all the safety aspect of viewing the Sun, with details about the filters that were used, facts about the transit, including such phenomena as the "teardrop effect". This is visible on egress on the footage, which also includes prominences, sunspots and other structures clearly visible on the disc of the Sun.
There are a couple of people who would be pretty good at making video covers (John and George). Single frames from the footage could be displayed on the front and back cover along with text. It would be interesting to get some feedback for owning a copy of it from all of the members.
Incidentally there is currently discussion and ideas about a book, so why not a video?
The edited version lasts for 45 minutes and a tape could be filled further with footage I have of Comet C2002 V1 NEAT, the Moon and planets.

& ♑ & ♑ & ♑ & ♑ & ♑ & ♑ & ♑ & ♑ & ♑ & ♑ & ♑ & ♑ & ♑ & ♑ & ♑ & ♑ & ♑ &

The Society Book Project, May 2003

After the May lecture evening, some informal discussion was held to progress the production of the Society Book. A sizeable number of people turned up and discussed their contribution or were approached to contribute something. If you have read the previous articles in Transit, you will know the general outline of the proposals. One very good idea which arose was to include a dedicated section which ensures that high quality pictures are reproduced with sufficient fidelity, even if the text is reproduced by photocopying.

A random selection from those at the meeting already offering to write something are Malcolm Bannister, Darren Summerfield, Neil Haggath, Pat Duggan, Julia McBride, Mark Rice and many others – and you can probably guess "the usual suspects" who were not there but will be producing something. Some people are writing on their particular field of expertise – deep sky, planets, space art, imaging, making telescopes, eclipses – and one member is already thinking about more general subjects – a crossword, a wordsearch, sundials, what astronomy means to me. We have such a wide range of talent in the Society that we can cover more or less any subject in astronomy. One article has been received already and another is in a very advanced state of production. Can you guess who the authors are?

As you will know from previous articles, one major principle of the Project is to elicit contributions from as many members as possible. If you are thinking of writing something but are reticent in any way, please ring me for a chat and I will try to answer any questions you may have and encourage you to have a go. Several people, when approached, have said something like "oh, I can't write, and anyway it wouldn't be of a sufficient standard". Please remember that all contributions will be welcome on any subject remotely connected with astronomy. Cast your eye over the subjects suggested in previous Transits. Remember that there is a wide range of knowledge and lots of reasons for being in the Society and it would be very satisfying if we could cover the whole range. This idea also indicates the technical level at which the articles should be pitched. It may have been said before but it is worth repeating, again and again – complete success would be to have something from every member. It is a Society project.

Pictures or drawings are welcome. The suggested maximum size of any one contribution is about 2000 words. Depending on what you are writing about this may not be enough, in which case ignore it and we can discuss it later, when the size of the book becomes clearer. If any author wishes to contribute on several subjects, that's fine. Team efforts may be easier in some cases. The aim is for contributions to reach me by the end of September but this is flexible, too. The end of the year should be possible for everyone. The danger is that if the "deadline" is moved back, so does the date on which authors really get stuck into the task! For anyone connected with the editing and layout, it would be excellent to have an idea by the end of September of the sort of contributions to be expected.

The aim is to publish, in a form which depends to some extent on the contributions and has yet to be decided, in time for the Jubilee of the foundation of the original Society – ie by the end of 2004. You will appreciate that there will be a lot of work and some difficult decisions to be made, when all contributions have been received and assessed. From final assembly of the material to the book appearing in print may take some months.

So far, nearly half the membership has either volunteered to produce something, or have been approached with an invitation to do so. There will be regular articles from now on, to inform everyone of progress and to harass, gently.

Editor

++

Two short pieces from John Crowther:-

Was Thomas Hardy a Stellar Observer?

Some years ago I remember John McCue reading from the classic novel "Far from the Madding Crowd", by Thomas Hardy. It was the passage describing the shepherd using the night sky to tell the time from the stars.

In the Daily Telegraph of December 16th, 2002, Trevor McDonald chose Thomas Hardy's poem "Shut out that Moon". Stellar observers would fully agree with verse two.

"Step not forth on the dew-dashed lawn
To view the Lady's Chair,
Immense Orion's glittering form,
The Less and Greater Bear;
Stay in: to such sights we were drawn
When faded ones were fair."

Astrothink

Astrothink isn't in the dictionary. It's a similar word to one in George Orwell's novel '1984', "Duckspeak". This was political jargon, which couldn't be faulted by the Communist regime portrayed in that book.

I recently did a bit of astrothink. In an enclosed garden in a Sheffield hospital, is a piece of modern sculpture. To me it was a woman surveying the sky through a large pair of binoculars. But then as I moved round, I saw that the woman apparently had two heads. Then the truth dawned. I was in the maternity wing of the hospital. The pair of binoculars was a chunky child, which the woman had swung up above her head. The binocular tubes were its legs and the lenses its feet.

How wrong can observers be, sometimes!

♂ ♍ ♂ ♍ ♂ ♍ ♂ ♍ ♂ ♍ ♂ ♍ ♂ ♍ ♂ ♍ ♂

Castle Eden Planetarium - One year on

From John McCue

Opened in April, 2002, the planetarium is an extension of the popular observatory, which was built in 1994. The planetarium's main function is the delivery of educational presentations to schools and colleges in the north-east under the guidance of John McCue and the invaluable help of volunteers. Under full-time supervision, the observatory also now has the opportunity of re-examining its objectives, and the major change has been the construction of a new type of telescope, a 475 mm reflector named the Millennium Telescope.

Planetarium shows were launched full-time in April, 2002, with the American Spitz A1 planetarium projector donated by the Europlanetarium at Genk, Belgium. The Spitz is 50 years old however, and when, in August, the opportunity arose to acquire a newer projector, a 1970's Japanese Goto E5 projector, which was surplus to requirements at Glasgow University, it was grasped immediately. The Goto is more reliable and has more accessory projectors, but it was designed for a 5m. dome. The Castle Eden Planetarium dome is 7 m. however , which makes the stars images more diffuse than the pinpoint-sharp ideally required for a realistic night-sky. Nonetheless the overall sky effect is visually impressive, and the slightly larger star images make the constellations easy to see, which is especially advantageous for young children, and older people in public shows. The planetarium also has a full range of audio-visual facilities: computer displays, video sequences and television broadcasts through the data projector, colour slides shown with twin Braun projectors (fade facility) and a sound system with mini-disc, CD, and a mixer desk. The last mentioned enables a radio microphone to be used for the live shows accompanied by a musical background for a professional feel to the presentations. A radio station has been set up with the help of an Awards for All grant.

In all, 78 schools have visited the planetarium from all age groups. There are naturally more visits from primary schools as there are more schools of this type in all authorities. Earth and its place in the Universe is on the National Curriculum at all key stages of education, and consequently each school planetarium presentation contains as much instruction as possible towards the attainment targets specified by the syllabus and being pursued by the teachers. So far we are encouraged by the response of the teachers, and the immediate reaction of children, to the whole planetarium experience.

The show itself normally describes the stars, constellations and planets visible in the current night sky (to encourage children to observe the real sky for themselves). Constellation outlines are projected from a hand-held device; this helps to define the constellation pattern. Accessory projectors on the Goto, such as the sun and moon projector, planet projector, altitude projector, and the combined equator/ecliptic projector, are used where appropriate. There then follows an audio-visual presentation, covering scientific aspects of the universe at large, and putting factual knowledge in the hands of the children and students. The planetarium has a large resource of colour slides: video films and computer projections are also well used. Finally, a question and answer is held, giving the children an opportunity to follow up the presentation with their own enquiries. It is always the case that the younger the audience, the more profound and enthusiastic are the questions!

During the summer of 2002, the planetarium gave shows for the public on Sunday afternoons, which attracted modest audiences of around 20 in number. Themes were written for the shows, such as Life on Mars, The Stars from Down Under, and What's Up this Month. During autumn and winter the shows reverted to Friday evenings fortnightly, alternating with public observing sessions at the observatory using the new Millennium Telescope. At the beginning of January, 2003, good press publicity launched the public shows on a popular phase, with the new theme being The Big Bang. Shows were, and are, sold out for the first four months of the year.

The most frequent community group visitors are scout and guide groups, who attend for evening shows. On clear nights the visitors appreciate views of the real night sky through the portable telescopes owned by the planetarium, which are taken out onto the paved area outside the building (the security lights being turned off!). In total, 150 shows have been presented of this nature.

It's appropriate now to look back and thank again all those who made this possible. The original organising committee comprised Ron Peacock, whose overall design and supervision of the planetarium building (not to mention crucial renovation work on the original Spitz A1) was pivotal, Jack Youdale (thanks for the landscape artwork and important help with the new reflector in the observatory), Ray Worthy, who scouted the world and found the Spitz, and helped to renovate it (not to mention his construction of the fabric dome), Ian Miles (thanks for the painstaking document preparations), Ed Restall (who masterminded the electrical and electronic networks), and Martin Jenkins, who was largely responsible for raising the bulk of funds needed. Thanks also to the team of society helpers who came, saw, and conquered when the interior was being fitted out: Pat and Paul Duggan, Charles Rees, Dave Lewis, John Coulthard, Mark and Linda Rice, and anyone I've missed (for which, apologies, and thanks).

Now under way, the planetarium/observatory could not have offered the wide range of technical activities so soon without the help of volunteers dedicated to the vision of the project. Mr. Bob Mullen and Dr. Ed Restall help on a near full-time basis. Bob is a communications expert who has advised on, and constructed, the radio station, as well as completing innumerable technical tasks, both innovative and maintainable. Ed has continued and developed his electrical work, especially installing a computer network in the planetarium and observatory: he has also written and regularly updates the web-site. Mr. Jack Youdale provides invaluable publicity in his radio and TV broadcasts, and Mr. Ray Worthy offers regular help and advice based on his long experience of portable planetarium shows. Mr. Ron Peacock, the project designer, keeps contact with the planetarium offering help and advice, particularly on musical concerts in the planetarium. At the moment all shows are presented by John McCue, but for the 2003 summer shows it is hoped to return to the technique of scripts recorded on mini-disc, and for volunteers to become familiar with, and execute the required visual accompaniments for a full show.

What of the future? Members may be pleased to learn that plans are afoot for bringing back the Russian cosmonauts, last seen in 1998. Alexandre Martynov, the rocket engineer, will this time bring Alexandre Alexandrov, space veteran of Russian missions on Mir and Salyut. They'll touch down in October. Watch this space!

Praise for the Chairman of CaDAS

by Barry Hetherington

While working on the Internet I came across an article entitled "1000 Years of Missing Astronomy" by Dr. Salah Zaimeche, B.A., M.A., PhD. In this article the author criticises "western" historians of science, and astronomy in particular, for ignoring the period 500AD to 1500AD as being a dark age in science, when there was little progress being made. However, buried in the article is the following: "To have a very thorough picture of the contribution of various ethnic groups to astronomy in general, [and] the Chinese, above all, [there is] no better work than Sarton, of course, but also the more recent excellent work by Hetherington "A Chronicle of Pre-Telescopic Astronomy". In it the author surveys each and every single achievement in the science, and every event of importance, year by year, from the very ancient times until our times. Hetherington, to his credit, not leaving the thousand years from 500 to 1500 blank as is customary with others. The full article can be found at
www.muslimheritage.com/features/defauly.cfm?ArticleID=233
<http://www.muslimheritage.com/features/defauly.cfm?ArticleID=233>

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

The President's Address 9th May, 2003
"The Measure of All Things"

How does one trace the development of and the search for absolute standards of length and time? Jack managed to do it and entertain us in his own special way as well. He emphasised that this 2500 year long human endeavour has been essential to science and technology, enabling complete interchangeability of mechanical components in the modern world. The talk started with the ancient Greeks, with units of length based on the human body. Eratosthenes and Hipparchus were concerned with the size of the Earth and the distance of the Moon and the Sun, which they deduced with remarkable accuracy. But measurement of all sorts of commercial products, including the length of cloth, became very important in medieval times. At that time there were all sorts of different standards, which could be – and were – lost. In more modern times, France, England and the USA were turning their minds to the development of World standards. The French revolution gave a great impetus to the development of the metric system. Important names in this time were Borda, Lelande and Delambre. The metre was based on the dimensions of the Earth, which the Greeks had been so keen to measure, with a standard maintained in controlled conditions in Paris. An attempt was made to use the pendulum as a standard for time but this failed because of the variation of gravity in different parts of the World.
Meanwhile, astronomers were getting to grips with the size of the Solar system and the Universe. The distance ladder stared to grow, from the size of the orbit of the Earth, to the distance of the stars by parallax using that orbit as the baseline. Bessel was the first to be successful with that measurement. The parsec was another unit, based on the parallax technique, developed to measure the immense distances between the stars

In modern times, the unit of length is based on the wavelength of a krypton 83 spectral line, using the concept of the metre and its divisions. Time, while measured in units based on a fraction of the Earth's rotation time, is defined by a number of vibrations of atoms in atomic clocks of staggering accuracy.
We all enjoyed this journey through the development of a key part of human thought, which generated plenty of questions at the end of the lecture. A vote of thanks from Barry enabled us all to show our appreciation to Jack Youdale for another fascinating talk.

Astronomy and the Internet

by Rod Cuff

This month we look back at images of May's transit and eclipses, and give some jumping-off points for exploring the theme of measurement from Jack Youdale's talk last month. And you, too, can get your name on a comet …

If you have any particular areas that you'd like me to tackle for a future issue, please e-mail me (rod@wordandweb.co.uk).

Pictures of May's astronomical events

- Many excellent photographs and videos of the Mercury transit can be reached from http://science.nasa.gov/spaceweather/planets/gallery_07may03.html
- There's a gallery of pictures from the lunar eclipse at www.spaceweather.com/eclipses/gallery_15may03_page2.html
- I'm writing this before the annular solar eclipse, but if you visit http://skyandtelescope.com/observing/objects/eclipses/article_80_1.asp you'll probably find photos linked from there, and will certainly find a list of solar and lunar eclipses for this year and next.

Measuring the Earth and sky

If your appetite was whetted by Jack's talk last month about schemes of measurement, there are a number of sites that could take you further in various directions. For instance:

- A history of old measures (why is a hundredweight not 100 pounds?) is at www.du.edu/~jcalvert/tech/oldleng.htm
- A time-line for the various ways in which the standard metre has been defined is at www.mel.nist.gov/div821/museum/timeline.htm
- A review of *The Measure of All Things*, the book about the French scientists who set out to define the metre, and which so enthused Jack, is at http://books.guardian.co.uk/Print/0,3858,4515954,00.html
- And an excellent guide to no less than 26 ways of determining the distance of objects beyond the Solar System is at www.astro.ucla.edu/~wright/distance.htm

News

- The deepest visible-light image ever made of the sky was published in May. You can read about this Hubble 84-hour exposure and see parts of the image at http://skyandtelescope.com/news/article_949_1.asp and http://spaceflightnow.com/news/n0305/07deepview/. You might want to view or download more and bigger images from the Hubble's press site at http://hubblesite.org/newscenter/archive/2003/15/

General

- On 4 July 2005, NASA's Deep Impact mission will slam a probe into the body of comet Tempel 1. As well as things scientific, the probe will contain a CD-ROM with hundreds of thousands of names recorded in it. You can add yours free by visiting http://deepimpact.jpl.nasa.gov/. How could you resist? (I couldn't!)

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

The CaDAS Interview – Ed Restall

Ed has done, and still does, an immense amount of work for the Observatory, the Planetarium and the Society generally. On first approaching him for an interview, last year, he thought there were more important people to be interviewed. This was taken as "Yes" and now the time has come. We chatted in the Planetarium – in the Director's office to be exact, taking advantage of his absence – which had a certain aptness, since Ed made such a major contribution to its construction and completion. This was the first topic I wanted to explore.

Before we start, I have to say that I don't remember agreeing to do this interview. Well, if a victim doesn't actually say "No, definitely not, under no circumstances what-so-ever, go away", this is the result.

You are involved in the running and improvement of the buildings here and as web-master for the Society's web page. Did you volunteer for these jobs or are you one of those people who can't say no? Well, I do have difficulty saying No but its all voluntary, really. I had been a member of the society since the early 1990's and involved in the observatory for quite some time, helping John to sort things out, getting cameras connected up and network connections for using cameras on telescopes overseas. We would like to remote control our new telescope, along the lines of the sort of thing that Mark Rice does and so on but what you can do all depends on funding.

How did you get involved in the Planetarium? I'd been doing voluntary work teaching A-level physics tutorials and helping out with the technical side of the computer network at Stockton Sixth Form College, when John taught there – that's when he originally mentioned the whole Planetarium idea, but I didn't get really involved until Ron Peacock asked for volunteers. Are you a physicist? Yes, my degree was in physics and computer science and my research was in physics.

Tell me about the construction of the Planetarium from your point of view. Forgive me if I ramble a bit here, as I'm prone to do, but we'll get to the point eventually. I'd heard about the early moves, such as getting hold of funding and the early design work by Ron Peacock, but I was too busy with my PhD thesis to think about becoming involved. John used to teach me at the Sixth Form College and I remember Ray Worthy coming along with one of his inflatable planetariums, which made a big impression on me. I didn't know whether I wanted to do physics or computer science at University, so I went to do a double degree in both at York. The PhD was in diffractive optics at Heriot-Watt University in Edinburgh, involving optical computing and holography.

Can you elaborate upon your research a little? The main area of my work was diffractive optics, which was essentially the theoretical modelling and fabrication of holograms on the microscopic scale. This was applied to optical computing and communication systems that use light (laser) beams instead of electrical wires to connect parts of the systems together. In essence you can direct or steer thin beams of light by making small holograms (or arrays of holograms) of things like lenses and mirrors to create the sort of complex connections you would find on an electronic circuit board, but in three-dimensional space. The benefit of this, and the primary reason for doing it, is that beams of light can pass through one another without being affected whereas electrical signals are subject to all kinds of interference, so you can cram many more connections in a very small space making a faster and more complex computer or communications network.

When was this? I finished my three years of research at Edinburgh in 1991 and was employed as a research associate in the physics department but went down with a mystery illness, which turned out to be ME. I don't like to talk about it too much, because its still a condition which the medical world don't know how to deal with. I'm always in two minds as to whether to crusade and inform people to dispel misconceptions or to just keep it to myself and get on with life. It does still place limitations on my lifestyle but I feel that it's best to emphasise the positive in life. A distinct advantage it brought was that there was plenty of time, while recovering, to improve my incomplete PhD thesis and develop optical theories that there wouldn't have been time for otherwise. I completed my thesis in 1997.

So you got involved with the planetarium with Ron, John and Ray? When volunteers were called for I was quite busy with some classic car projects I dabbled in but I thought I would have a go. My first big, hands-on job was helping to get the roof on to close the building and make it vandal proof, which was very necessary. My involvement spiralled from there because we were so far behind due to many problems – foot and mouth being a major delay in 2001. We were so far behind schedule that construction work had to be concentrated on during the day and the vast majority of the electrical work had to be done on an evening by me. The whole thing has been a great team project though with an awful lot of people who responded to the call and put lots of time and effort into it, such as Dave Lewis, Colin Chatto, Peter Kent, Charles Rees, John Coulthard, Paul and Pat Duggan, Mark Rice, Ken Stuart and Ian Miles. They have never had the acknowledgement from the Society in general for the work they did and if I've left

anyone out through my absent mindedness I apologise. Like the Forth Rail Bridge though it appears to be a continual project, even when we opened we had not finished the building and constant additions and improvements have been taking shape along the way with large amounts of work being carried out by Bob Mullen (I can't over-stress how much you should interview him). Last summer John, Bob and I revamped the Observatory, with the huge input of Terry Waugh and his NACRO team, principally to accommodate the new telescope but also to stop the wet-rot before it fell down – there's quite a bit of detail about this on the web-site.

You mentioned you have an interest in classic cars. Oh yes, you may have seen my rather shabby Triumph Herald kicking about. It's my main runabout and has taken a lot of work to consolidate the chassis and rebuild the engine – the bodywork needs attention but until I have the money to respray it, it'll probably stay that way a while longer. Older cars seem to have more style and something of a soul than your modern euro-box. Buying the Herald got me involved with a few other classic car projects that kept me busy for a while. I'm a bit of a Triumph nut and bemoan the passing of the mark to British Leyland where things went down hill rapidly. My favourites are the TR series and my automotive aspiration is to own a TR4A – obviously in much better condition than my Herald!

It sounds to me as if the Society Book Project would be an ideal forum to write a full history of the Planetarium. Yes, I think it should be recorded somewhere what a big effort was necessary by a lot of people. The electrics, for example needed a full recabling to the Visitor Centre, new trenches and cables to meet the new loading requirements as well as the CCTV, network and other communications cables. That again was a pressure job, because the cables had to go in and be covered all in a day to prevent vandalism – which is quite a big problem on the site. The NACRO teams and our own people were great. As with many of the other construction jobs some of us were here until 10 and 11 at night.

You run the Society web site, which I think is an enormous asset as an archive as well as for general information and links to other places. Thanks, it's kind of you to say so. It started in 2002, when the Planetarium was nominally finished. Originally it was hosted by Stockton Sixth Form College with our own Society pages, but that wasn't going to last with John moving from there to the Planetarium. I'd done website design before, so it seemed natural to pick up that job as well. Are people using it? To be honest, I haven't put in a "hit-counter", I'd rather not know to that level of detail and I think they look a bit tacky – we get plenty of feedback via e-mail and a bit when people take the trouble to sign the guestbook on the site. I'd encourage anyone who looks at the site to sign it please. It's far from perfect though and really needs a lot more development. The ISP we have at the moment means quite a small capacity and we could do with more space, they also limit the use of interactive components, which is why we can't get a bulletin board up and running at the moment. The ideal would be to host it ourselves, we have our own server but more telecommunications infrastructure is needed and all these ideas need money. The equipment in the planetarium and the observatory comes from a combination of Council funds, donation and sponsorship.

Are you a local lad, born, bred and educated in the North-East? Yes, I was born in Middlesbrough in 1966 and was brought up in Norton, where I still live. My girlfriend, Helen, lives around the corner and she's very supportive and understanding of my involvement with the planetarium – she loves to watch the stars too. My parents live behind Sparks Bakery in Stockton, my father is retired, he has MS and is confined to a wheelchair, my mother is his constant carer. My Dad has just published a book on local history called "Just a Lad from the Village", he opened local history month for Stockton Borough Council by signing copies in the Billingham Art Gallery on May 1st. I have a brother and two sisters. My youngest sister is studying English and Politics in Glasgow. My other sister is a secondary school physics teacher in Sunderland and my brother (who's also trained as a physicist) is a primary school science and technology teacher in Newcastle. We are all still in close touch with Mum and Dad. I suppose I ought to mention I am a Magpie, not a Boro, fan.

Have you travelled much? Before I became ill, I went lecturing on my PhD research to the USA and had a week's skiing in Salt Lake City. As an undergraduate I went hitch-hiking around France for a month with a friend of mine. I remember many happy family holidays in Italy, Spain, Norway, Tunisia, Austria and France.

Have you ever made a telescope? Not an entire one, but I have been building the societies new Millennium scope with Bob and John. I have a lot of experience in optical design but the hands-on practical side is more at the microscopic level.

When did you first start astronomy? Oh, it started as a child. In Tunisia the skies were clear and totally different, with new constellations. It was a spontaneous interest brought about by seeing such wonderful skies. It was so interesting I just delved further and further. While at York we would stagger back from the pub and marvel at the sky. In Edinburgh in 1989, when Mars was at closest approach we resurrected an old 8 inch reflector and roamed the skies from the roof of the weather station in the physics department. The other thing was that the teaching of gravity at school and at the Sixth Form College didn't make sense – it raised lots of questions, which of course makes you want to inquire more. So we had lots of extra-curricular debates with the maths and physics teachers. We discovered relativity ourselves – with a bit of help from John.

Who are the people who have influenced you most? My parents - my Dad's approach to life, his interest in computers and his work ethic, I guess. He used to be an electrician and took me out on jobs, teaching me all sorts of practical skills as well as trying to bump me off with electric shocks every once in a while! I served a full apprenticeship with him from an early age which stood me in good stead for the future. My mum has always been supportive and encouraging.

What are you reading at the moment? I tend not to read the stuff, which I have studied formally, like physics and computers. My current book is 'Nemisis' by Bill Napier, of Armagh Observatory, who spoke to us a few months ago about threats from outside the Earth. In a vague attempt to broaden my education I've read lots of classics – D. H.

Lawrence, Shakespeare, the Brontes, Flaubert and the like, but not Dickens – I find him hard to read and prefer to watch dramatisations of his stories. I prefer to read light stuff, for entertainment. Thrillers are quite entertaining with John le Carre and Philip Kerr taking a lot of beating, but my favourite read for quite some time now has been the Harry Potter series. Occasionally factual stuff by Dawkins and Hawking.

Are you a musician? Yes, I can read music, but I can't sight read at any speed and I write the odd song. I taught myself to play the guitar and play classical guitar very badly. Everyone does. I'm no mad axe-man lead guitarist – I don't have the talent, but I can ham away with the best of them at old standards that everyone can sing along to and really like playing good rock guitar songs by the Eagles and Elvis Costello. Dancing is a big enjoyment as well – ballroom, latin, ceroc. I used to go with a group of friends to the Dolphin Centre in Darlington and Redcar Bowl, for the ballroom stuff. It all started when I was best man at a wedding and had to do a waltz with the chief bridesmaid. It was a crash course.

And now the daft questions. The World Dictator one. I'd ban fluorescent lights, they have such a bad effect on my eyes and brain. The expert on this sort of visual stress is Arnold Wilkins and I tried to contact him about the problem, but to no avail – I fear the only solution to this problem is for me to go on the rampage with a large hammer and smash the lot! You may have noticed that the Planetarium is a fluorescent free zone.

In one sentence, what makes a civilised society? I have to agree with all the answers given by others on this. I would add "Don't judge others" – oh and no fluorescent lights.

Whom should I interview next? Bob Mullen, Dave Lewis and Mark Rice are all interesting guys whose story should be told, but we didn't really get a hand-over interview from the old Transit editor to the new and so I think John should be interviewing you very soon – I know he's up for it.

ℳ ❒ ℳ ❒ ℳ ❒ ℳ ❒ ℳ ❒ ℳ ❒ ℳ ❒ ℳ ❒ ℳ ❒ ℳ ❒ ℳ ❒ ℳ ❒ ℳ ❒ ℳ ❒ ℳ ❒ ℳ ❒

Astronomy Not-So-Basics

by Neil Haggath

No. 13: Black Holes

Sorry about the facetious title, folks. Well, an article on black holes is going a little beyond what you could class as "basics"! However, the subject does follow on quite naturally from my last two articles on stellar evolution – so I thought I should give it a go…

We usually think of black holes as being at the forefront of modern astrophysics research – but the concept is much older than you might think. As long ago as 1796, Pierre-Simon de Laplace suggested that there could, in theory, be a star so massive that its *escape velocity* – the velocity which an object requires to overcome its gravity and escape from orbit around it – would exceed the velocity of light. Such a star would be

invisible, as not even its light would be able to escape from it. (This idea implicitly assumed that light has mass, more than a century before Einstein showed that it *does*!)

Laplace calculated that such a star would have to have the mass of several million Suns; of course, we know that there are no stars anywhere near that size, so no-one paid much attention to his idea.

Then Karl Schwarzschild, around the time of the First World War, developed the idea further. Since an object's escape velocity depends on its radius as well as on its mass, he realised that an escape velocity greater than that of light could result from a star of ordinary mass being compressed into an extremely compact and dense state – though he didn't know how such a thing could happen!

For a body of mass M and radius R, it can be shown that the escape velocity v_e from its surface is given by

$$v_e^2 = 2GM / R$$

where G is the *gravitational constant*, equal to 6.67×10^{-11} Nm^2kg^{-2}. So for v_e to be equal to the velocity of light (denoted by c), a body of mass M would have to be compressed to a radius of

$$R_s = 2GM / c^2$$

We call this radius the *Schwarzschild radius*, denoted by R_s.

As c is a huge number – its value is 2.998×10^8 ms^{-1} – we can see that R_s is extremely small for objects of any "normal" mass. For the mass of the Sun, R_s is about three kilometres; for the Earth, it's all of one centimetre! Obviously, there's no way that the Sun or Earth *could* be compressed to such densities, as they are not massive enough – but those figures give you an idea of the incredible densities we're talking about. Imagine the mass of the Earth compressed into a radius of one centimetre!

A few years earlier, Albert Einstein, in his Special Theory of Relativity, had shown that photons of light do indeed have a mass (even though their *rest mass* is zero), and therefore that light could be prevented from escaping from an object of immense gravity. At about the same time as Schwarzschild's work, Einstein published his General Theory of Relativity, which deals with gravity and the curvature of "space-time". Among other things, General Relativity predicts the existence of Schwarzschild's hypothetical objects – what we now call black holes. (The term *black hole* was coined by John Wheeler in the 1960's). But please don't ask me to explain General Relativity, as I don't pretend for a minute to understand it! Special Relativity is relatively easy (no pun intended), but the General kind is something else entirely, and way beyond me!

Today, of course, we *do* know how objects of such immense density can be produced – by the gravitational collapse of very massive stars, after they have exploded as supernovae. As I explained last month, when the core which remains after a supernova is bigger than three solar masses, its gravity is powerful enough to overcome even neutron degeneracy pressure, the effect which "holds up" a neutron star. Then there is absolutely nothing which can halt its collapse; it crushes itself into a *singularity* – a point mass of zero dimensions and infinite density. General Relativity tells us that gravity is basically a

distortion of space-time in the vicinity of a mass; we can think of a black hole as a "bottomless pit" of gravity, such that nothing which falls into it can ever escape.

Strictly speaking, a black hole isn't really "an object". A black hole and a singularity are not quite the same thing; the former actually consists of a region of space surrounding the singularity. While the singularity is a point of zero size, the black hole *does* have a finite size; its radius is the Schwarzschild radius.

At a distance of R_s from the singularity, the escape velocity becomes equal to the velocity of light; closer in than that, it exceeds it. So the singularity is surrounded by a spherical volume of space of radius R_s, from which nothing – no matter, no radiation, no information of any kind – can escape to the outside Universe. The "interior" of this spherical region is the black hole; its "surface" is called the *event horizon*, because any event occurring inside it is forever hidden from the rest of the Universe (Fig. 1).

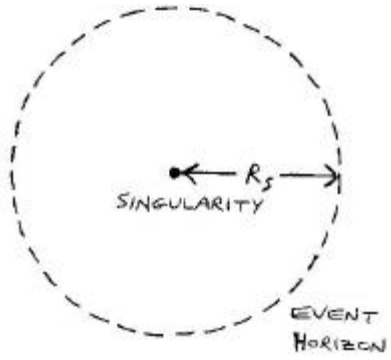


Fig. 1

Obviously, we have no way of knowing what conditions are like inside the event horizon, but we believe that the normal laws of physics, as we know them, break down under such extreme conditions. General Relativity tells us that strange things happen in a very strong gravitational field, one of them being that time slows down. If a spacecraft approached a black hole, a clock aboard it would run slow, compared with a clock a safe distance away; the closer it approached, the slower the clock would run.

It's believed that at the event horizon, time slows down to an infinite degree; you could say that time "stands still". So it's possible that the zero-sized singularity doesn't actually exist; that the collapsing stellar remnant never becomes smaller than its Schwarzschild radius, because it would take an infinite time for this to happen!

Suppose a spacecraft, at a safe distance from a black hole, launches a probe on a trajectory which will take it close to the black hole, and the astronauts watch what happens as the probe gets sucked in. They will observe some bizarre effects!

First, as the probe approaches the event horizon, it changes shape; it becomes longer and thinner, stretched out in the direction towards the black hole. This is because, as the black hole's gravity is so intense, the probe suffers a "tidal" effect; gravity at one end of it is significantly stronger than at the other, so it's gradually stretched into a long thin string – a process known by the corny name of *spaghettification.*

At the same time, the frequency of the probe's radio signal becomes steadily lower as it gets closer to the event horizon. This is a consequence of the slowing down of time, known as *gravitational redshift*.

Although the probe – or what's left of it! - is steadily accelerating towards the black hole, the observers aboard the spacecraft see it "falling" ever more slowly – again due to the slowing down of time. They will never actually see it "disappear" into the black hole; when it reaches the event horizon, it stops falling, and appears to hang there forever – because time, as experienced by the probe, has now stopped!

For some years, there was a great deal of controversy as to whether black holes really existed; in 1970, a leading cosmologist, speaking at an international conference, wrote on a blackboard "Black hole = naughty word"! But today, most astronomers are certain that they *do* exist, and we know of a number of objects which are almost certainly black holes.

So how do we detect them? By definition, we can never observe a black hole directly, but we can infer its presence from its gravitational influence on nearby objects. Consider a black hole which is part of a binary system, i.e. it's in a mutual orbit around an ordinary star. This isn't a particularly uncommon situation, since about two thirds of all stars are found in binary pairs; if the two stars are of different masses, then the bigger one dies first, and suffers gravitational collapse, while its smaller companion continues to shine merrily.

In such a system, the black hole's immense gravity distorts its companion star, and pulls material off it. This material doesn't immediately fall into the black hole; as it approaches it at high speeds, it goes into orbit around it, gradually spiralling inwards until it succumbs to gravity and disappears beyond the event horizon. So the black hole is surrounded by a flat disc of material, with each particle spiralling around as it "waits its turn" to be swallowed by the black hole. This is known as an *accretion disc* (Fig. 2).

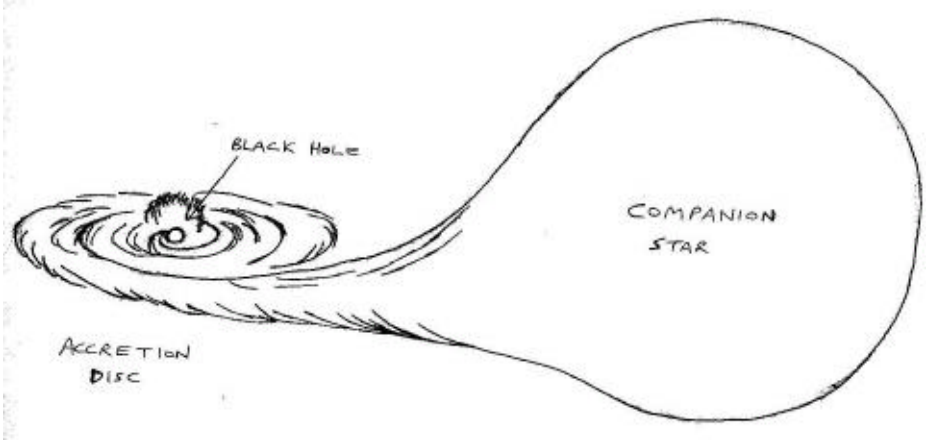


Fig. 2

(N.B. Fig. 2 proved a little beyond my very limited drawing skill, and was kindly drawn by John McCue.)

So while we can't observe the black hole itself, we can observe what is going on around it, just outside its event horizon. The spiralling gas in the accretion disc is heated by friction to a very high temperature, and emits copious amounts of radiation, mainly in the form of X-rays. This emission can be detected by X-ray telescopes - which have to be in orbit, as X-rays can't penetrate the Earth's atmosphere.

If we detect an X-ray source closely associated with an ordinary star, it isn't necessary a black hole; a neutron star can also disrupt its companion star and form an accretion

disc. Indeed, most such X-ray sources which have been discovered are neutron stars; they give themselves away by also emitting periodic radio pulses, i.e. they are pulsars. (See last month's article.)

If such an X-ray source doesn't pulse, then it could simply be a neutron star whose magnetic axis points in the wrong direction for us to detect its radio emission – or it could be a black hole. So how can we tell which? It's quite simple; by studying the spectrum of the visible star, we can deduce its mass from the Hertzsprung-Russell Diagram (see Astronomy Basics No. 10). Then, by measuring the speed of its orbital motion by means of its Doppler shift (see Astronomy Basics No. 3), we can also deduce the mass of its invisible companion. If the latter is greater than three solar masses, then the object must be a black hole.

The first promising black hole candidate to be identified was the X-ray source Cygnus X-1, discovered by the Uhuru X-ray satellite in the early 1970's. The visible star is a blue supergiant of about 20 solar masses; its dark companion was found to weigh in at 10 solar masses – far beyond the limit for a neutron star.

Since then, a number of similar objects have been identified, whose properties can only be reasonably explained by the presence of black holes – so the evidence for their existence is steadily accumulating.

If the concept of stellar-mass black holes isn't sufficiently mind-boggling, then try to imagine a "monster" one, with the mass of many millions of Suns! As incredible and frightening as that may seem, we now believe that such a thing exists - in the centre of every galaxy!

Firstly, in any galaxy, stars are much more closely packed near the centre, in what we call its nucleus. Secondly, whenever two stars further out in the galaxy's disc pass close to each other, their mutual gravity flings them off in different directions – one is thrown outwards, and the other inwards towards the galactic centre. Over time, after millions of such encounters, a great number of stars accumulate within a relatively small volume of space in the galactic centre. They are accompanied by a huge mass of gas and dust, as friction in interstellar material also flings particles into the centre. As this huge agglomerate of stars and other material increases in size, its mutual gravity draws everything together to form a single enormous object, whose immense gravity makes it collapse into a gigantic black hole.

It's now thought that every galaxy – apart from maybe the smallest "dwarf" ones – contains such a "supermassive" black hole at its heart, with the mass of up to a billion Suns. It sucks in everything from a considerable volume of space around it – including entire stars! – and is therefore surrounded by an enormous accretion disc. These central "monsters", at various stages in their evolution, are believed to be the "powerhouses" of what we call "active galaxies" – Seyfert galaxies and quasars. The latter are the most energetic and luminous objects in the Universe, and hence the ones which we can detect at the greatest distances.

A typical quasar is a galaxy with an incredibly bright nucleus; a region in its centre, only one light year or so across, emits as much light and other radiation as 100 or so "ordinary" galaxies! This astonishing luminosity is thought to come from the accretion disc around the billion-solar-mass black hole at the galaxy's centre.

Quasars are *only* seen at immense distances, usually measured in billions of light years. This means that they are very old objects, as their light has taken billions of years to

reach us. It's therefore thought that they represent a phase which many galaxies go through relatively early in their evolution, and that the activity of their central "monsters" later quietens down.

Finally, an even more bizarre thought. We always say that nothing can ever escape from a black hole – but that isn't *quite* true! Stephen Hawking has shown that a strange effect of quantum physics actually allows particles of matter, very occasionally, to leave the black hole and "pop back into existence" outside the event horizon. This is known as *Hawking radiation*; it effectively means that, over a *very* long period of time, a black hole will "evaporate" and cease to exist. We're talking here about truly unimaginable timescales, vastly longer than the current age of the Universe; the time taken for a stellar-mass black hole to evaporate is of the order of 10^{100} *years*!

So that concludes my attempt to describe black holes. As weird and unlikely as they may seem – they are real.

Once again, my thanks to John McCue, for his invaluable assistance in writing this article.

■ ♒ ■

The Apollo Hoax 6

It's time to call an end to this series of extracts from a typical web site on the subject. After six months there are only two more points to be covered:- (24) Can the Moon rockets be faked? and (25) Is unmanned retrieval of Moon rocks possible? There is then a list of associated websites. No doubt you can guess the answers to the two questions and, if you wish, you can visit the original website, www.appollohoax.com.

Two people have made contact with reactions to the series. Neil Haggath is scathing and dismissive about any movement which calls into question the fact of the Apollo missions. His thoughtful repost to it all will be published in a future edition. John McCue was worried for our reputation as serious astronomers, fearing no doubt that the presentation of the material in our newsletter implied we may be sympathetic to the wrong conclusions.

In the introduction to the first extract, the hope was expressed that you would all be interested in the points raised in the argument and in seeing the evidence. No doubt you have developed your own ideas on how to answer the questions raised, perhaps forming an opinion on whether it is possible to prove that the Apollo missions were not faked. The unstated intent of running the series was to give an example of a subject which I assume interests us all – the principles of Science. How does one approach The Truth? Is there A Truth to be found in how the Universe operates? If so, how do we reach it? Heady stuff!

There was an article in this month's "Astronomy Now", discussing the very question of the Apollo hoax theory, by a journalist who covered the missions, Reginald Turnhill. His argument is that of a non-scientist - how could such a hoax, involving thousands of people, be kept out of the public domain, hidden from his profession, the "media"? Another way of approaching The Truth, I suppose, but definitely not Science.

■ ♋ ♦ ♋ ■ ♋ ♦ ♋ ■ ♋ ♦ ♋ ■ ♋ ♦ ♋ ■ ♋ ♦ ♋ ■ ♋ ♦ ♋ ■ ♋ ♦ ♋ ■ ♋ ♦ ♋ ■

A History of the Cleveland and Darlington Astronomical Society

Part 6

This month, the extract from Barry's History of the Society gives a summary of our prominent members. Reading this section makes one realise how many eminent personalities from the Astronomy world we are lucky enough to have as members of our Society.

+ +

President

Jack Youdale is a native of Billingham. After his formal schooling had finished he did an engineering apprenticeship at ICI, and he served his National Service with the Royal Navy.

An interest in astronomy began when he was 11 years of age when a neighbour showed him he moon through his two-inch refractor. He joined the British Astronomical Association in 1948 and decided to specialise in meteors and the planet Mars, joining these sections of the BAA. At about the same time he met David Sinden, also from Billingham, who was to become one of the best professional telescope makers in the world, achieving the position of Chief Optical Engineer for Grub Parsons of Newcastle; their friendship continues to the present day. Jack's interest in telescope making stayed with him thereafter. Shortly after joining the BAA he bought a 6-inch mirror and built his own telescope from scratch. Later he taught astronomy for the Workers Educational Association and progressed to teaching telescope making.

In 1958 he was one of the first British amateurs to build a Maksutov telescope, and, with the help of David Sinden, constructed meteor cameras using surplus aircraft reconnaissance lenses. He also built Dall-Kirkham telescopes and a solar prominence telescope. In 1973, during his career with ICI, he invented an 'inspectoscope' for the inspection of inaccessible petro-chemical structures.

The Cleveland Astronomical Society was formed in 1979 by two local teachers, John McCue and John Nichol, who persuaded Jack to be their Patron; later President.

Jack was the main driving force behind the Castle Eden Observatory. He won funding from Cleveland County Council, and local training enterprises helped to build the telescope and observatory. In 1995, for his services to telescope making, he was awarded the Horace Dall Medal and Gift by the British Astronomical Association.

He also found time to present a monthly local radio programme for BBC Radio Cleveland called *The Sky over Cleveland,* which started in 1971 and is still going strong. On the first Wednesday of each month, at 10:30am, he gives a 20-minute talk about what

is happening in the sky for that month. The radio station also produces his monthly star charts which the listeners can apply for.

Vice President

In 2001 John received the highest level of professional recognition for his CCD observations of asteroids and comets – currently C/2000wm1(LINEAR) – and is now qualified as an accredited observer. The Minor Planet Centre, based at the Smithsonian Astrophysical Institute, USA, designated his Bradbury Observatory, Norton, as IAU 937. There are only about 1000 observatories, amateur and professional, around the world with this accreditation.

Chairman

Barry Hetherington was born at West Hartlepool in 1945, and moved to Darlington in 1966. He joined the British Astronomical Association in that year, and founded the Darlington Astronomical Society in 1980. With the merger of the Cleveland Society with that of Darlington he became chairman of the newly formed society.

At various times since 1977 he has been a part-time lecturer on astronomy for the Workers Educational Association in Darlington and North Yorkshire.

In 1985 he was invited by Edward Bowell of the Lowell Observatory, Flagstaff, Arizona, to name five asteroids discovered by his team at the observatory, the names chosen being of British astronomers (the numbers are the asteroid numbers):- (2633) Bishop, (2634) James Bradley, (2635) Huggins, (2636) Lassell, (3041) Webb; In 1986 he named seven more asteroids for Mr. Bowell:- (3061) Cook, (3062) Wren, (3077) Henderson, (3078) Horrocks, (3115) Baily, (3116) Hay, (3131) Mason-Dixon; all of these names being accepted by the International Astronomical Union and are the official names of these planets.

Several articles by Barry on historical subjects have been published in the Journal of the British Astronomical Association, including one on Thomas Wright of Durham (J.B.A.A. vol 84, p16, 1973). He has also contributed an annual list of astronomical centenaries to the journal for a number of years. A booklet on *The Darlington Telescope; a Documentary History* was published by him in 1986, and a major piece of historical research entitled *A Chronicle of Pre-Telescopic Astronomy* was published in 1996.

Secretary

Neil Haggath was born in 1961 in Middlesbrough and obtained an Honours degree in Physics with Astrophysics at Leeds University. By profession he is a software engineer. He joined the Cleveland Astronomical Society in 1981 and was appointed Secretary in 1989. His extensive astronomical knowledge, together with his vast network of astronomical friends throughout the country, enables him to produce a programme of excellent speakers year after year.

At the age of 16 he joined the Royal Naval Reserve, eventually becoming a Radio Supervisor. He has visited 27 countries on five continents.

Neil also organises the North-East's own national conference – *Cosmos North-East*, the first being in 1988 and held every four years thereafter.

David Graham

David became Planetary Director of the national Junior Astronomical Society, and in 1993 became Saturn Section Director of the main national amateur astronomical institution, the British Astronomical Association. His equipment consists of a 4-inch refractor, a 6-inch refractor, a 6-inch and a 9-inch Maksutov-Cassegrain system.

In the summer of 1995 David journeyed to California to use the 36-inch refractor of the Lick Observatory to observe the planet Saturn as the earth crossed the plain of its ring system. He was allowed seven clear nights looking through the eyepiece of this magnificent telescope. Later he went to India to observe the total solar eclipse of the 24th October 1995.

Ray Worthy

Ray was born in Middlesbrough and went to Acklam Hall School, enjoying a grammar school education. After serving his National Service in the army he studied for his A-levels at Constantine College in Middlesbrough. Thereafter he then spent six years working for ICI as an Experimental Officer in nylon research but then decided that he wanted to go into teaching. He then went to Teacher Training College in Weymouth where he obtained his qualification. Later he went to Newcastle University to do an advanced education diploma. Ray taught Biology and other sciences at Billingham Campus for 30 years.

He brought students to the Castle Eden Walkway Country Park so that they could do their practical for O-level astronomy. As the weather was not always kind to them Ray built his own planetarium projector and dome. While still teaching he took his portable dome and planetarium all over the country, to whoever requested a show – the first person to do so.

By February 1994, just after he had retired, he and his wife Josie made a better inflatable dome to a higher standard of design. Being very successful at dome making, they found that they was soon making them for other users in this country, and, as their reputation increased, orders came in from abroad.

Ray has developed his skills in planetarium construction to such an extent that he now gives advice to budding planetaria makers worldwide, via the WWW. His knowledge and connections have been invaluable to our planetarium project.

Carole Haswell

Carole was a member of our society in the early 1980's as a sixth-form student. After graduating from Oxford University she undertook her Ph.D. research at the McDonald Observatory of the University of Texas. She then moved on to the Space Telescope Science Institute in Baltimore before returning to the UK. She is now teaching and doing research with the Open University. Carole became an honorary member of the society in 2002.

David Weldrake

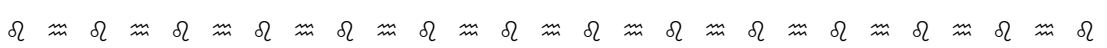
David graduated from University with a First in Astrophysics and is now doing his Ph.D. research at Mount Stromlo Observatory in Australia. His status as an ordinary member of our society was upgraded in 2002 when he was made an honorary member.

Ordinary Members

Although many of our members are casual or 'armchair' astronomers, we also have several dedicated and expert observers among our ranks, two of whom hold important posts in the British Astronomical Association as observing section co-ordinators.

Many of our members own telescopes, and several have built impressive private observatories. Chris Walker, Malcolm Johnson and Dave Graham have an observatory with a 16-inch reflector at a dark-sky sight at Gilling West in North Yorkshire, while John Borrett has a magnificent multi-instrument observatory in Nunthorpe. Dave Blenkinsop has several home-made telescopes, which he uses to introduce members of the public to the sky.

Don Martin, is now a veteran of four solar eclipse expeditions to diverse parts of the world, and he also went to Australia to see Halleys Comet in 1986.



Did you know?

From New Scientist

Astronomers have spotted 12 more moons orbiting Jupiter, bringing the total to 52 – the most for any planet. The new satellites, each between 2 and 4 kilometres across, orbit the gas giant every 500 to 980 days, at distances up to 25 million kilometres. All were captured by Jupiter in the distant past and may be fragments of larger captured bodies, says David Jewitt, who discovered the satellites with colleague Scott Sheppard using the 8-metre Subaru telescope at the University of Hawaii. So far only 27 have been named and at least one other has been seen and then lost, says Brian Marsden of the Harvard-Smithsonian Center for Astrophysics, who calculated the new moons' orbits.

Transit Tailpiece

Quote/Unquote

And thou, mysterious guest of the night,
Red traveller of immensity!
James Hogg (1777 - 1853)

Then assuredly the world was made, not in time, but simultaneous with time. For that which is made in time is made both after and before some time – after that which is past and before that which is future. But none could then be past for there was no creature by whose movements its duration could be measured. But simultaneously with time the world was made.
St Augustine

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.

CaDAS Website Now at www.planetarium.btinternet.co.uk and the society email address is planetarium@btopenworld.com . Everyone is encouraged to visit the site and tell your friends about it.

Sunderland AS Contact them at www.sunderlandastrosoc.com to see how they are progressing with the new Observatory at Washington Wildlife Centre. If you wish to attend their meetings you are assured of a friendly welcome.

York AS have a website at www.yorkastro.freeserve.co.uk and an excellent programme of lectures, if you wish to go along.

Post and Email If anyone wishes to change the way they receive their Transit, please let me know. If any member is not receiving a copy, 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

The Back Page Picture

Another of Keith Johnson's pictures of the Sun showing a group of sunspots. Unfortunately, reproductions in Transit never give pictures their full impact. However, by supporting Keith's initiative for a CaDAS video (see article page 3), you will be able to see them in their full glory