TRANSIT

The Newsletter of

Cleveland & Darlington Astronomical Society

14th March 2003. Julian Day 2452713

Editorial

February meeting A large audience was addressed by Jurgen Schmoll, of Durham University on the subject of "Astrophotography". His extensive and varied selection of slides from his collection were evidence indeed of the success he has in taking pictures, both in his native Austria and at Esh Winning.

John Tasker, the brother of the climber Joe Tasker who died near the summit of Everest, has presented some stunning pictures to Jack Youdale. They were taken in Namibia, using half-hour exposures with a Nikon camera and are truly wonderful. Jack would be pleased to show them to you, by prior arrangement. The Tasker family has been resident in Middlesbrough for many years.

Annual subscriptions for 2003 are now overdue and should be sent immediately to Ian Miles, to ensure you remain a member and continue to receive the newsletter "Transit". Ian's financial statement for last year is included in this month's edition.

Scarborough Star Party. Neil has reminded us that the dark sky site in Dalby Forest will again be the venue for the annual weekend event. The dates are August 1st to 4th, 2003. Application should be made to Scarborough AS or enquiries to me.

Light pollution. Submissions can be made to the Select Committee of the House of Commons now considering the problems caused to astronomy by badly designed lighting. Please see the article later in these pages. Here is our chance to make our voices heard and have something done about this 20th Century scourge to our subject.

The Society Book Project. Please see the article later in this issue, which develops Jack Youdale's idea further from his suggestion last month. You are invited to comment or to submit an article for inclusion in the Book. I have volunteered to be the collection point and standardising editor, but would gladly hand over to someone else – probably better qualified – who would like to take on this job.

Society website. Ed Restall has sent a notice on the development of the site.

NEAT Comet. This is still visible low down in Pegasus and its progress is being recorded by Keith Johnson, using his TV camera.

Book Reviews. If anyone has a favourite astronomy book you think we would all enjoy, please send a review or recommendation. I am sure we are all on the lookout for that special volume. This month's is from an outside source.

Colour pictures We hope you liked the images in last month's issue and hope to continue the idea. If anyone has a favorite image they would like to include, please send it to me with a caption.

Next meeting will be held on 14th March, 2003, in Thorpe Thewles village hall, when Dr Nigel Bannister of Leicester University will speak on "The International Space Station and Lobster All-Sky Telescope".

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Society Website

Ed Restall, the Society's webmaster, writes :

Some people at the last meeting were discussing the idea of a Bulletin Board on the website as a contact point, where seasoned society members can answer peoples' questions and queries. It's a good idea but can't be done at the moment because of limited webspace with our Internet Service Provider and the fact that they don't allow third party cgi scripts to be run on our allocated webspace. Longer term we have plans to host the website from our own internet file server, which would allow us to do what we want with shed-loads of storage space.

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Light Pollution Issues

Barry Hetherington wanted to publicise this notice from the British Astronomical Association. Submissions can be made by individuals or by the Society in its role as the representative of the amateur astronomers in the Cleveland and Darlington District. Please note the latest submission date of the end of April, 2003.

Dear BAA Members,

Many of you will have heard of the committee formed to look at the effects of light pollution and its impact on UK Astronomy. Bob Mizon is already preparing a technical presentation to them and I also have a draft document to consider for submission on behalf of the Association as a whole. However, I would encourage local societies and any other members to submit their thoughts direct to this committee, as there must be many examples of local difficulties, which have created an impact on observing. I am repeating the message we received below and please note the various websites, which should be viewed before sending your submissions.

LIGHT POLLUTION AND ASTRONOMY

The Science and Technology Committee is to conduct an inquiry into light pollution and astronomy, with the following terms of reference: To examine the effectiveness of measures taken to reduce the impact of light pollution on astronomy and to consider what further steps, if any, are required.

The Committee will consider the following specific questions:

1. What has been the impact of light pollution on UK astronomy?
2. Are current planning guidelines strong enough to protect against light pollution?
3. Are planning guidelines being applied and enforced effectively?
4. Is light measurable in such a way as to make legally enforceable regulatory controls feasible?
5. Are further controls on the design of lighting necessary?

The Committee would welcome written evidence from interested organisations and individuals addressing these points. Evidence should be submitted by Wednesday 30 April 2003. Oral evidence will be heard in May. Evidence should be sent in hard copy to the Clerk of the Science and Technology Committee, 7 Millbank, London SW1P 3JA. Please send an electronic version also, in Word format, via e-mail to *scitechcom@parliament.uk* or on disk.

Guidance on the submission of evidence can be found at :-
www.parliament.uk/commons/selcom/witguide.htm

Further information on the work of the Committee can be obtained from Committee staff on telephone number 020 7219 2793/4.

Previous press notices and publications are available on the Committee's homepage: *www.parliament.uk/parliamentary_committees/science_and_technology_committee.cfm*

Membership of the Committee is as follows:
Dr Ian Gibson (Chairman) (Lab, Norwich North)
Mr Parmjit Dhanda (Lab, Gloucester)
Mr Tom Harris (Lab, Glasgow Cathcart)
Mr David Heath (Lib Dem, Somerton and Frome)
Dr Brian Iddon (Lab, Bolton South East)
Mr Robert Key (Con, Salisbury)
Mr Tony McWalter (Lab, Hemel Hempstead)
Dr Andrew Murrison (Con, Westbury)
Geraldine Smith (Lab, Morecambe and Lunesdale)
Bob Spink (Con, Castle Point)
Dr Desmond Turner (Lab, Brighton Kemptown)

Kind regards,
Guy M Hurst
BAA President

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Planetariums and Dolphins

From Ray Worthy

I am about to make a connection between planetariums and dolphins; yes, I do mean dolphins. And one day, it could involve some of you. It comes about like this. There exists a considerable worldwide body of belief that dolphins can exert some sort of benign influence over human beings, which can be utilised in the healing processes, especially for so-called psychosomatic disorders. It has been shown that dolphins can play a part in the therapy for autism and similar disabilities. How this works, I personally do not know and cannot offer any opinion. Suffice to say that people, whose opinions I have come to respect, are entirely convinced. There is such a strong belief abroad, that organisations have sprung up in various parts of the world to send affected children (and adults) thousands of miles to dolphin centres.

This, naturally, costs a lot of money. However, certain practitioners have discovered that if a "Dolphin ambience" is created by the use of film, video, sound and anything else that comes to mind, then measurable improvements can be effected. These improvements have been monitored by hospital staff, and by departments of the Universities of Swansea and Cambridge. The search is now on to discover exactly what it is that does the trick. Experiments are being planned to investigate this.

Before such an experiment can proceed, there is a requirement for a controlled environment with a surrounding screen on to which carefully chosen images can be projected. This environment needs to be light tight, air vented and be supplied with speakers and projectors. If you have read this far, you will realise that I am describing the attributes of a planetarium.

In the past few days, I was approached with a view to providing a transportable dome in which to conduct some of these experiments. The gentleman who visited me is Dr. Horace Dobbs, the author of a dozen or so books on dolphins. In case you think that we are straying into mysticism, let me tell you that his PhD is in nuclear chemistry. He is "One of us" as it were. Horace and I spent the morning finding out what could, and just as importantly, could not, be done with an inflatable dome. In the afternoon, I took him along to the rural site of the Castle Eden Walkway Planetarium, to show him our seven metre negative pressure fabric dome .

The planetarium has been up and running for some time now, with public shows and burgeoning school visits. What is surprising is that the total expenditure has been ninety thousand pounds. Although I say this myself, this place is succeeding beyond all expectations. It has a cosy, warm feeling about it which is very inviting. We have even had a wedding there. In the short time since the visit, word has raced round the dolphin world and it has been decided to hold the next committee meeting there in January next year with a view to explore just how such a facility can be utilised.

There is no point in me giving a lot of detail hereabout this dolphin business. You can get it all at two web sites
www.idw.org <http://www.idw.org> and www.dilo-dolphin-dome.org <http://www.dilo-dolphin-dome.org>

" There are more things in Heaven and Earth than are dreamed of in your philosophy" Hamlet.

Shakespeare wrote the last two lines. I wrote the rest.
Ray Worthy.

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A Society Project

Last month's note on "The CaDAS Book of Amateur Astronomy" introduced the idea from our President and it has been developed further. The following concrete suggestions are for comment and discussion. It is hoped that all members of the Society will take part in this project, to proclaim whom we are, what we do and what motivates us.

Objectives

- To write and publish an illustrated book on Astronomy by our Society.
- To invite members of the Society to be involved and contribute to the book.
- To aim for a contribution, no matter how large or small, from every member of the Society.
- To appoint an Editor to ensure a common style and consistent format.

Content

The following is a list of suggested "chapter" headings. Each chapter or section of a chapter could be written by an individual or by a team sharing the authorship. Comments are invited on the contents and the order of the list.

- Preface
- Introduction
- A Brief History of Astronomy
- A History of Cleveland and Darlington Astronomical Society
- The Celestial Sphere
- The Sky Month by Month
- Making a Telescope
- Observing (Techniques and Results)
    1. The Atmosphere
    2. Aurorae
    3. The Moon and its Eclipses
    4. The Sun and its Eclipses
    5. The Planets
    6. The Minor Planets
    7. Comets and Meteors
    8. Variable Stars
    9. The Deep Sky
    10. The Messier Objects
    11. Neolithic Astronomy
- Astronomical Imaging Techniques
    1. Photography
    2. Charge Coupled Detector s
    3. TV Cameras
- Building an Amateur Observatory
    1. In the Garden
    2. The CaDAS Observatory
- Planetariums and Teaching Astronomy
    1. Our Planetarium
    2. Portable Planetariums
    3. Planetaria I have visited
    4. Teaching with Planetaria
- Drawing at the Telescope and Space Art
- The Exploration of Space
- Terrestrial and Orbiting Telescopes
- Astronomical Miscellany
    1. Tell the Time from the Sky
    2. Make a Planisphere
    3. Make a Sun Dial
    4. Measure Sidereal Time

- Favourite Astronomical Quotations
- Officers of the Society
- List of Members
- Constitution of the Society
- Index

An invitation to a prominent member of the Astronomical community – Dr Allan Chapman has been closely associated with the Society - to write the Preface would add to the interest of the publication.
All Members are invited to select a subject to work on, individually or collectively with friends and colleagues. Because the Society has a wide range of interests, it is important that articles are pitched at an amateur audience with some knowledge of the subject but not necessarily a deep academic knowledge. We believe it is important that this Project is inclusive and not exclusive or elitist in any way.
Photographs and drawings are probably essential and in any case would add to the interest of any article. Members' sketches could be scanned as they are or converted into computer graphics, as required.
As to length of articles, it is suggested that 5,000 to 10,000 words should be regarded as a maximum. This may need to be revised when the total size of the publication becomes clearer. The Editor would need to discuss this with authors as we go along. A maximum size for the book, and hence the cost, needs discussion. To encourage everyone to contribute, there is no suggested minimum size of article.

CLEVELAND & DARLINGTON ASTRONOMICAL SOCIETY
2002 FINANCIAL SUMMARY

	Expenditure	Income	Balance
2002 Opening Balance			471.11
Room Hire	91.00		
Speaker Expenses	235.00		
Copying & Mailing Expenses	156.33		
FAS Subscription	22.50		
Projector Bulb	4.50		
Signing-in Book	3.99		
Planetarium Grant*	3440.00		
Subscriptions (48 Adult/2 Family/0 Junior)		308.00	
Entry Fees, Tea & Raffle Proceeds		70.67	
Bank Interest		1.58	
Planetarium Grant*		3440.00	
2002 Closing Balance			338.04

* Planetarium Project funds transferred to a dedicated account.

I.Miles, CaDAS Treasurer, 5th February 2003

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Astronomy Basics

by Neil Haggath

No. 10: The Hertzsprung-Russell Diagram

Last month, I wrote about stellar spectra, and the wealth of information which they can tell us about stars. This time, we'll look at the relationships between some of the properties of stars – their temperatures, luminosities, colours and spectral classes – and how they give rise to one of the most important tools of astrophysics, the Hertzsprung-Russell Diagram.

By the early 20th Century, the Harvard Classification system for stellar spectra had been established, and astronomers had begun to understand how the colours and spectra of stars were related to their temperatures. The distances of many nearby stars had also been measured by the parallax method (described in Astronomy Basics No. 2), so that their intrinsic luminosities, or absolute magnitudes, could be calculated from their distances and apparent magnitudes (see Astronomy Basics No. 1).

By the way, whenever I refer to "temperature" throughout this article, I mean *surface* temperature. The temperature of a star's core is measured in millions of degrees, but that of its surface in mere thousands, ranging from about 3000 to 30000°C. A star's surface temperature determines its colour and spectral class.

In 1913, Henry Norris Russell, often called "the father of modern astrophysics", discovered that there was an important correlation between the temperatures and luminosities of stars. He studied many of the stars whose distances were than known, and found that stars of any given spectral class only existed within a fairly narrow range of luminosities. For example, yellow G-type stars, of which the Sun is one, always had luminosities between a few times less and a few times greater than that of the Sun. Hot blue and white stars were nearly always tens to hundreds of times more luminous than the Sun. And cool red stars of type M could be either very bright – hundreds of times more luminous than the Sun – or very faint – hundreds to thousands of times fainter than the Sun – but nowhere in between.

Russell plotted stars on a graph of temperature (or spectral class) against luminosity, and found that about 90% of them lay within a narrow diagonal band, with hotter stars being more luminous; we now call this band the *Main Sequence*. Most of the remainder fell within two other distinct regions, above and below the Main Sequence (Fig. 1).

In fact, the Danish astronomer Ejnar Hertzsprung had reached the same conclusions a couple of years earlier, but had published his results only in one obscure journal, so his work was unknown to Russell and most others. Today, we honour them both; their graphs have evolved into what we now call the *Hertzsprung-Russell Diagram*, or *H-R Diagram* for short. It's also sometimes referred to as a *colour-magnitude diagram.*

The horizontal axis of the diagram can be labelled with spectral class, temperature or *colour index*. The latter is a way of quantitatively defining a star's colour; it's the difference between values of the star's magnitude, measured at two specific wavelengths of light. Not surprisingly, pure white stars, of type A, have a colour index of zero; blue stars have negative colour indices, and yellow, orange and red ones have increasingly positive indices. These three properties are all directly related, so in Fig. 1, I've labelled

the axis with all three. The diagram is always drawn with temperature decreasing from left to right.

The vertical axis can be labelled with either luminosity or absolute magnitude, which again are directly related. You may remember, from Astronomy Basics No. 1, that a star's absolute magnitude is defined as what its magnitude would be, if it was observed from a standard distance of 10 parsecs. Again, I've labelled the axis with both.

Note that the luminosity scale is logarithmic, as the luminosities of stars cover a vast range. The absolute magnitude values run linearly, as the magnitude scale is itself defined logarithmically; a difference of five magnitudes represents a factor of 100 in brightness. Luminosity is usually expressed in terms of the Sun; the Sun's luminosity is defined as 1, a value of 100 means that the star is 100 times as bright as the Sun, etc.

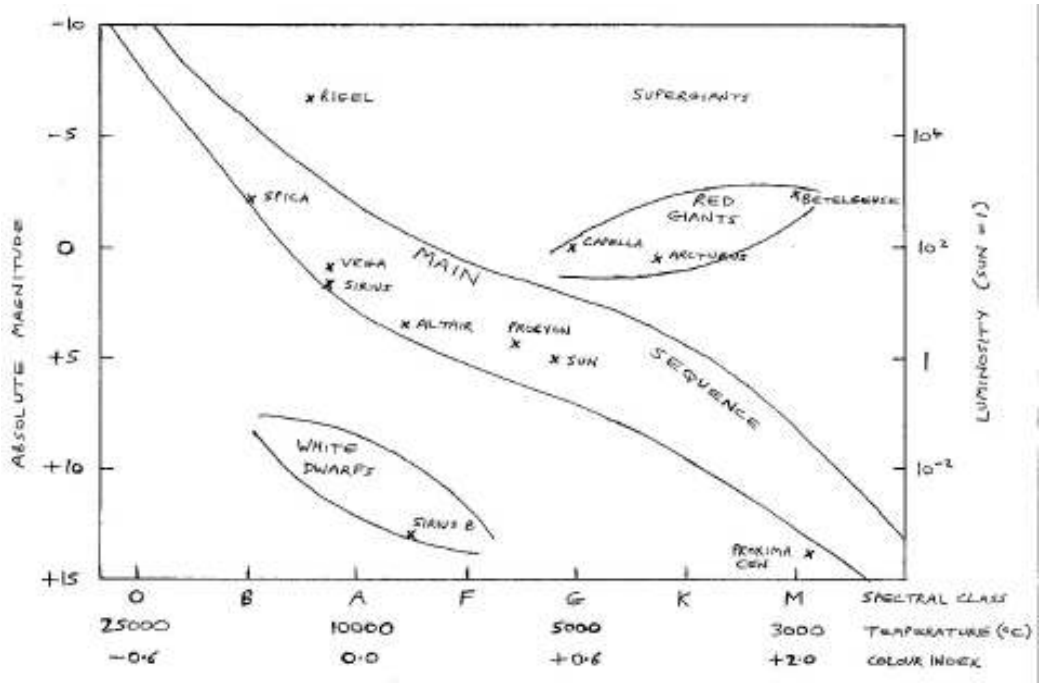

Fig. 1

We see that the Main Sequence runs diagonally from top left to bottom right; hotter and bluer stars are the most luminous, and the coolest red stars are the least luminous. Of the 10% or so of stars which *don't* lie on the Main Sequence, most lie within the two regions marked "Red Giants" and "White Dwarfs"; their significance will become clear later.

I've marked the positions of a few well-known stars in the diagram. It shows us, more clearly than anything else, that there's nothing whatsoever special about our Sun; it's a decidedly average, common or garden star, if ever there was one!

The H-R Diagram is useful in many ways. First, it provides us with a simple way of measuring the distances of stars which are too far away for their parallax to be measured. (Remember that the first diagrams were produced using only those stars whose distances were known.) For any "ordinary" Main Sequence star, simply measuring its colour index enables us to determine its luminosity or absolute magnitude; comparing this with its apparent magnitude then gives us its distance.

This method isn't fantastically accurate; because the Main Sequence is a band of finite width, rather than just a line, there's a significant uncertainty in any given star's luminosity, and hence in its distance. But what we *can* do, with remarkable accuracy, is measure the distances of star clusters.

Consider a big galactic cluster, such as the Hyades or Pleiades, with hundreds of stars – or a globular cluster with thousands. In each case, we have a large number of stars, all at roughly the same distance from us. We can plot an H-R Diagram for the stars in the cluster, labelling the vertical axis with their apparent, rather than absolute, magnitudes. Most of those stars will, naturally, form their own "mini Main Sequence". We then superimpose this diagram onto a standard H-R diagram, and see how far we need to move it vertically, to make the mini Main Sequence line up with the standard Main Sequence. This tells us, directly, the difference between the apparent and absolute magnitudes of the stars in the cluster, and therefore their distance.

This method, called *Main Sequence fitting*, was used to measure the distances of many galactic and globular clusters, enabling astronomers to determine the size and shape of our Galaxy.

Now what about those stars which don't lie on the Main Sequence? It was from the H-R Diagram that the concepts of red giants and white dwarfs were discovered. As I said earlier, red stars can be either very faint or very bright. The faint ones, at the bottom right end of the Main Sequence, are the commonest type of stars – small and relatively cool ones, with around a thousandth of the Sun's output, or even less. They are by far the longest lived stars, as they don't burn their fuel at anything like the extravagant rates of their hot blue and white cousins. A typical example is the Sun's nearest neighbour, Proxima Centauri.

Now consider those stars in the region to the upper right of the Main Sequence, which is known as the *Giant Branch*. These can be up to a million times as luminous as Proxima and its ilk, yet their colour, spectral classes and temperatures are the same. How come?

Well, a star's luminosity depends not only on its temperature, but also on its size. Stefan's Law says that the amount of energy radiated per unit area of a star's surface is proportional to the fourth power of its temperature. So its total power output – its luminosity – is proportional to the fourth power of its temperature multiplied by its surface area – the latter, of course, being proportional to the square of its radius. Therefore, if two stars have the same surface temperature, but different luminosities, the more luminous one must be bigger in radius.

Now look at Proxima Centauri and Betelgeuse in Fig. 1. They have roughly the same temperature, but Betelgeuse is about a million times more luminous. From Stefan's Law, it follows that its radius must be about a thousand times that of Proxima. Betelgeuse is indeed a huge star; its radius is of the order of the Earth's distance from the Sun! It's a fine example of a class of star known as a *red giant*.

By similar logic, we can see that the very faint white stars to the lower left of the diagram must be very small in radius; hence they are known as *white dwarfs*. In fact, they are incredibly small, with diameters of the order of that of the Earth! The first white dwarf to be discovered was the companion of Sirius.

We now know that both red giants and white dwarfs represent late stages in the evolution of "normal" stars like the Sun. In fact, all stars occupy different places in the H-R Diagram at different stages of their life cycles; indeed, the Diagram is closely related to

stellar evolution. Since 90% of stars lie on the Main Sequence, it's pretty obvious that that must be where they spend the major part of their lives; relatively few red giants and white dwarfs are found, because those stages are relatively short-lived.

When a star first forms from a contracting cloud of gas, and thermonuclear reactions ignite in its core, it takes up a position on the Main Sequence; exactly where depends on its mass. (It's hardly surprising that a star's temperature is related to its mass – the more massive, the hotter. The more massive it is, the more powerful its gravity, and so the more energy it needs to generate, to counteract gravity and prevent itself collapsing). There it remains, a "normal" and well-behaved star, for around 90% of its lifetime – which is also heavily dependent on its mass; the bigger the star, the shorter its life.

But eventually, as it uses up its supply of fuel, things start to go wrong. First, for reasons which I won't go into here, its outer layers expand to a massive, bloated size, becoming cooler and much less dense. The star moves off the Main Sequence and along the Giant Branch; it becomes a red giant.

After a relatively short time, it blows away its tenuous outer layers, leaving a shrunken core. As the remaining core exhausts its supply of nuclear fuel, it finally loses the fight against gravity, and collapses into a very dense and hot object, with the mass of the Sun compressed into a sphere the size of the Earth. This is a white dwarf. The star ends its life in the bottom left region of the Diagram; slowly, over many millions of years, it fades and dies.

Exactly *how* all this happens – and the more exotic and bizarre fates which befall more massive stars – will be explained over the next couple of months.

Finally, there's one more thing which we can learn from the H-R Diagram. I said earlier that we can produce a Diagram for the stars in a cluster, and use it to calculate the cluster's distance. But in the case of a globular cluster, we can also deduce something else – its age.

As I said earlier, the lifetime of a star is heavily dependent on its mass. Massive blue or white stars burn their fuel at an extravagant rate, and live for only a few tens or hundreds of millions of years. Stars of the Sun's mass are much more conservative, with lifetimes of around ten billion years; cool red ones last much longer still.

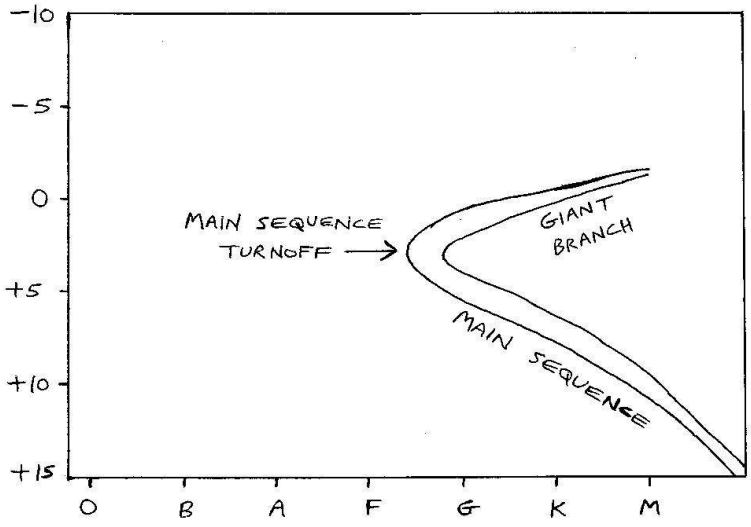

Fig. 2

Globular clusters – those spherical swarms of stars which form a huge halo around our Galaxy – are very old; they formed during an early stage of the formation of the Galaxy itself, over ten billion years ago. And most of the stars in a given cluster are of more or less identical age. So the H-R Diagram of a globular cluster looks quite different from the standard Diagram; the upper left end of the Main Sequence is missing (Fig. 2). Globulars don't contain any massive blue or white stars, as they have all long since burned themselves out, and suffered their spectacular fates. There are also many more stars to be found in the Giant Branch, since many of the "average" stars of around solar mass are now nearing the end of their lives, and have entered their red giant phase.

Any given globular cluster has a limiting point on its Main Sequence, to the left of which no stars are found. At this point, the distribution of stars turns away from the Main Sequence, upwards and to the right – showing that stars of a particular temperature (and therefore of a particular mass) are currently in the process of leaving the Main Sequence and beginning their evolution into red giants. The location of this *Main Sequence turnoff* is a pretty reliable indication of the cluster's age.

As I said earlier, the H-R Diagram has played a vital part in our understanding of the life cycle and evolution of stars. The birth, life and death of stars will be the subject of my next two articles.

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The CaDAS Interview – David Bayliss

David has been a member of the Society from its very beginnings. In a sense, as you will see from one of his answers, he was a spiritual member before the Society was actually formed! He tells me he has photographic evidence that our Vice President once wore short trousers. As I am finding over and over again in these interviews, we seem to be a group of people with certain constant characteristics. I detect not only a fascination with astronomy and a capacity to feel awe when looking at the night sky, but also a thirst for knowledge for its own sake, a propensity for life-long learning. I sometimes detect a compulsion to learn as much as one can and enjoy it at the same time.

Where were you born and brought up? Until the age of 7 I lived in Piercebridge. Then we moved to Norton until I was 11 and after that in Stockton. Did you have brothers and sisters? No. I was an only child.

Have you moved around the country a lot? No. I've stayed mainly in the North of England and mostly in the Northeast. I worked in Stockton first of all, then Middlesbrough, Darlington, Wakefield and Thornaby. I'm scientist and an electrical Engineer by training.

Tell me about your own family. The Bayliss family are originally from Buckland in Gloucestershire. They were in the agriculture and coal business. They moved to Birmingham, Rotherham and then Teesside. On the paternal side, I have a background of service in the Police. My grandfather was a sergeant, my father was a policeman and I followed the family tradition by serving as a spare-time special constable. My full time

jobs have been in Local Government, then with ICI in engineering before becoming a Science Teacher and Head of Department. In between I served in the Royal Observer Corps as Group Officer.

When did you first get interested in Astronomy? I was interested from the first time I looked up at the heavens, without any instruments at all. When I acquired a pair of ex-army field glasses the whole subject opened up for me. In the main I observe from near my home. I guess you could call me a back-yard astronomer. *What is your favourite type of astronomy?* I don't think I have a favourite. The general phenomena interest me. I suppose if there were a specialist interest, it would be meteorites.

Have you done any mirror grinding or telescope making? Oh, yes. With an engineering background, I guess one has to have a try. I ground and figured a 4" mirror and constructed a telescope. Working in the engineering industry and with British Steel handy, the materials were all easily available. I even had a go at making a refracting telescope from ex-WD lenses. I was rather pleased with both telescopes.

What is your most satisfying astronomical achievement, to date? I was very pleased to finish the construction of the telescopes successfully. As far as observation is concerned, the big moments were seeing the last total solar eclipse in 1999 and monitoring and photographing Comet Hale-Bopp in 1997.

What is good about the Society and what is bad? I think it is a first-class society with a good magazine. *(There was a smile on David's face when he said this – Ed).* Perhaps I am biassed, having seen it grow from small beginnings, even from when Dr John McCue was a schoolboy. *What would you change?* I wouldn't change anything but let it grow naturally. There are a lot of very fine people and astronomers in the membership and they seem to do the right things at the right time. The Planetarium is a wonderful asset to the Society and the whole district. I think we all know that it could be improved by the addition of toilets and cooking facilities but these will come when the funds are available.

What was your educational route? In Darlington I went to Dodmire Infant School, then moved on to Norton and Stockton Richard Hind Central School. After leaving school, I continued at night school for a National Certificate in Electrical Engineering then at Constantine Technical College for the Higher National. I did HNC Mathematics but I wouldn't say I was a mathematician. My Teaching career started after studying at Freckleton Teacher Training College, in Lancashire. My 3rd year Science Teacher training was at Exeter University followed by a year doing an Med course at Durham. T the present I'm in the 2nd year of an Archaeology degree, externally from Leeds University. *Aha! You and Michael Roe should get together!* Did you enjoy your education? Oh, yes. I've enjoyed education generally, both being educated and educating others.

You are a scientist and engineer – are you computer literate? Despite many courses and some application, I have to confess I regard myself as computer illiterate. It is difficult to teach an old dog new tricks. The computer has always antagonised me. I find the things

infuriating and boring, while at the same time realising their advantages. Even the daft addresses with www and dots set me on edge. I like simplification.

Do you like travelling? Yes, indeed, but bodily frailties are beginning to tell. *Have you a favourite place?* I love the Lakes and Norway is my favourite foreign country. I watch the skies wherever I go but have not been on any specifically astronomical holidays. It would be a good idea if I could persuade my wife but I am a man under authority.

What is the essence of astronomy for you? The constant revelation of the wonders of the heavens. As the palmist wrote circa 1000 BC in Psalm 8, verse 3

> When I consider the heavens
> The work of Your fingers, the Moon
> And the stars, which You have ordained
> What is man that You are mindful of him
> And the son of man that You visit him.

It is interesting that the word consider is made up of two Latin words – con – together and sider – sidereal – the stars. Psalm 8 could be called the astronomer's psalm.

Tell me about the memorable characters you have met in the astronomical world.
The three most eminent people I remember meeting were the Astronomer Royal, an Astronomical Historian and a Space Man. Sir Arnold Wolfendale was former president of the Royal Astronomical Society, Emeritus Professor of Physics at Durham University, an expert on cosmic rays, a believer in God like myself and a humble man. The historian is the best lecturer around, Dr Allan Chapman of Oxford University. Commander Alexandre Volkov, Hero of the Soviet Union, spent over a year in space and is now Director of the Russian Space Programme. He said "When you see the Earth from way up there, you understand there is no difference between countries or peoples". And I mustn't forget our own Jack Youdale, the practical astronomer plus.

Do you have time for any other interests and hobbies? Numerous – I have a butterfly mind, rich in variety. Walking, running, cycling, swimming, sailing, archaeology, steam trains and models. I used to pilot a glider with the Yorkshire Gliding Club. I am very active in the Christian community I belong to.

Where does your motivation and enthusiasm come from? I think a lively mind provides ample motivation and enthusiasm follows.

If you were World dictator, what measures would you introduce? If . . . . ; its a good job it is "if". I would try to introduce an economy which would give fair shares in food materials and opportunities for all peoples. Unfortunately, man being man, it would all be messed up as previous history shows.

In a short sentence, what is your definition of a civilised society? A society where man deals with his fellow men as he would like to be dealt with himself. In other words “do unto others as you would be done by”.

Whom should I interview next? Yourself?

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The Apollo Hoax 3

This third extract from the website article gives the author’s answers to the second six of the 26 questions listed in last month’s article. The rest will follow in future editions. Sometimes it is difficult to tell which side of the argument this author is on. The series will nevertheless be continued, since it covers most of the points of dispute.

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(7) Where are the flames from the landers engines?
Some websites like bad astronomy dot com make the claim that the engine didn't produce any visible exhaust or flame because the fuel mixture that was used just doesn't do that they say. However it is known that the LM engine and the space shuttle orbiter both use hypergolic fuel engines of the same type and same fuel and yet the space shuttle orbiter does produce a visible exhaust flame and the LM somehow did not.
The flame from the orbiter is plainly visible in the image at this website: http://internet.ocii.com/~dpwozney/apollo1.htm
but the badastronomy website would have you believe that no flame is produced. The Titan2 rocket used exactly the same fuel and oxidizer mix as the LM and yet it produced copious amounts of highly visible flame but the LM somehow does not NASA and its supporters claim.
Images of a Titan2 launch and also a very misleading side by side comparison of an "LM" type of engine and a solid fuel rocket engine in a direct luminosity comparison. I say it's flawed because the exhaust bell in the "LM" type image is nothing like the real thing. The one in the picture flares out at 45 degrees thus diluting the luminosity of the exhaust flame greatly. Even so it is still visible even against what appears to be a bright background. Note that it would have been greatly inefficient to waste fuel and thrust with such a flared exhaust and that it would not have been allowed to happen on a real engine. The solid fuelled engine used for comparison is against a darker background though it is not clear if this is as a result of under exposure in the photography. Note here that in the case of the solid fuelled engine the exhaust is properly formed unlike in the other picture. You'd be right to think that they were comparing "apples" with "oranges" in this comparison. The only usefull information to come out of this comparison is that the "LM" type engine did produce a luminous exhaust flame and that if a real exhaust bell had been used then the flame would have been much brighter and thus easily visible against a dark background like the lunar sky.

(8) What about the shape of the exhaust and its effects?
The badastronomy website claims "In a vacuum, no air means the exhaust spreads out even more, lowering the pressure. That's why there's no blast crater! Three thousand

pounds of thrust sounds like a lot, but it was so spread out it was actually rather gentle". Take a look at the photograph at the url http://internet.ocii.com/~dpwozney/apollo1.htm and see how much the flame spreads. It spreads only a little. Also the exhaust bell on the LM will have been only a couple of feet above ground as the LM touched down and given that the bell was five feet in diameter the ground just below will have felt the full effects of the engine as it set down. Therefore we can forget about the badastronomy claim as it is not a significant factor.

(9) Was the Lunar Module (LM) tested on Earth?
Basically, no. The Lunar Module was the vehicle that was supposed to take the astronauts down to the Moons surface and allow them to take off again back up to rendezvous with the command module. The LM just wasn't designed for reuse and for flight in Earths gravity where it's weight would have been six times what it would have been on the Moon. That's why they developed simulator vehicles for training. NASA had Lunar Module "simulators" built for astronaut training but four out of the five training/research vehicles crashed. NASA is still to this day having trouble with vertical take off and landing rockets. The last known attempt ended in a crashed landing in 1996. NASA claims that the LM underwent successfull "testing and manouvers" out in space and in orbit around the Moon.
The simulators or training vehicles were actually called LLRV's and LLTV's - lunar landing research vehicles and lunar landing training vehicles but they were nothing like the LM.
See here: www.astronautix.com/craft/apoollrv.htm
People often cite the Harrier jump jet as an example of a machine with vertical takeoff and landing capability as a comparison. While that is true the Harrier has 4 powerfull turbofan driven thrusters for load balancing. The LM would have had to balance on one engine output only. The LM also had 16 small (110 pound) thrusters for attitude control and translation complicating matters considerably and which the Harrier does not have. The Harrier is much flatter and with a much lower centre of gravity than the LM resulting in a more stable configuration as well. It can be seen that the Harrier jump jet and the LM are two different kettle of fish entirely.

(10) Where's the blast crater?
The Moon is covered in powdered rock and rubble. The dust has a consistency described as being like corn flour. The blast emitted by the descent engine of 3000 or so pounds thrust and averaged out over the exit area of the exhaust "bell" came to about 1.5 pounds per square inch. That's some draft. If the dust layer on the lunar ground was only an inch or two deep then conceivably there would not be much of a crater or hollow etched out by the blast, however NASA claims that the regolith (the powdered rock and rubble) that covers the Moon is 5 to 15 metres deep. Instead we see a fairly smooth surface with a few light brush marks underneath the bell.
See this image: as11-40-5921.jpg. It's not a blast crater, it's more like someone swept up with a broom just underneath the bell. The main engine was not extinguished until after touch down on some missions, NASA say, yet all the landing sites (the ground beneath and around the LM) look the same, that is relatively undisturbed. There should have been a star burst pattern extending out beyond the footpads.

(11) Dust kicked up by the Rover wheels acts strange.
Yes it does. Let's examine the claim on the badastronomy dot com website that says; "you will see dust thrown up by the wheels of the rover. The dust goes up in a perfect parabolic arc and falls back down to the surface. Again, the Moon isn't the Earth! If this were filmed on the Earth, which has air, the dust would have billowed up around the wheel and floated over the surface. This clearly does not happen in the video clips; the dust goes up and right back down. It's actually a beautiful demonstration of ballistic flight in a vacuum". So, badastronomy dot com tells us how it is supposed to be, what is supposed to happen on the Moons surface, however frames from NASA's own footage of the lunar rover show us a very different picture. It reveals the presence of atmosphere.
In parts of the rover footage "vertical walls" or "curtain" formations of dust are seen to form in the wake of the dust kicked up by the rear wheels. Jim Colliers video shows this effect nicely. Small particles of dust encountering atmosphere will have their ballistic flight path impeded to the point where sideways velocity drops to zero. The particles can then only fall vertically and look as if they had come up against a wall. That would only happen if the dust encountered atmosphere.
See also this image at http://www.empusa.clara.net/lunar/lunar6.jpg and notice that clouds of dust form behind the rover's wheels. It looks just like there is an atmosphere! Also it's just not good enough to ascribe the cloud like appearance of the dust kicked up by the rover to "random motions". You would only get random motions like that when factors due to atmosphere come in to play. Close in to the wheels the geometric planes in which the dust move are all basically parallel and are not randomly aligned.
Last point, don't let the fact that some of the dirt kicked up by the rover's wheels fall in a parabolic arc require it was done in a vacuum because it means no such thing. If you drive the wheels over coarse sand you will see the same thing.

(12) Radio telemetry proves man went to the Moon right?
Jodrell Bank and sundry government scientists might have pointed their antennae at the Moon but none of that will prove man set foot on the Moon. Sending unmanned packages to the Moon for orbit and deployment on the lunar surface is child's play in comparison to safely landing and returning astronauts from the Moon.

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A History of the Cleveland and Darlington Astronomical Society

Part 3

The third extract of Barry Hetherington's history of the Society covers part of the period after the combination of The Cleveland and Darlington Societies. Any comments or additional material, which could be included in the final version, should be sent to the Editor (see Transit Tailpiece) or directly to Barry himself.

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Cleveland and Darlington Astronomical Society

The inaugural meeting of the combined society, named the Cleveland and Darlington Astronomical Society, took place at the Cleveland Scientific Institute, Corporation Road, Middlesbrough, on the 12th January 1990. Initially the combined society alternated its meetings between Middlesbrough and Stockton. The member's subscription rate was £4 for adults and £2 for those in full time education; non-members were charged a rate of 80p and 40p respectively per meeting.

While observing the total lunar eclipse on the night of 9th February 1990, David Graham, Chris Walker and Malcolm Johnson observed a strong display of the zodiacal light, describing it as bright as the Milky Way. A week later, on the 15th February, Malcolm Johnson and Chris Walker again observed the zodiacal light, which was followed later in the evening by a display of the aurora borealis. Two days later Chris, Malcolm and David made another observation of the zodiacal light.

Five of our members travelled halfway around the world, to Hawaii, to see the total eclipse of the sun of 11th July 1991. They were Jack and Pat Youdale, Don Martin, Dave Graham and Neil Haggath. Observing from a desolate lava field the rather surprising result was that they all saw the clouds go dark – no sign of the eclipse. As a consolation prize they journeyed back via California and visited some of the famous observatories in that region.

While at our meeting of the 8th June 1990 at the Sixth Form College John Nichol has his car broken into. This was one of the reasons that prompted us to look around for another venue. In September 1990 we moved to the Elmwood Youth and Community Centre, Hartburn, Stockton.

The annual Thomas Wright Trophy Quiz was held on the 7th December 1990 between South Shields, Durham and ourselves, when we came out winners.

At the meeting of the 12th April 1991 Dr John K. Davies of the Royal Observatory, Edinburgh, spoke about "Cosmic Impact". He brought along copies of his book of the same title, which he signed for those purchasing them.

On the 3rd August 1991 Barry Hetherington, Neil Haggath and David Graham attended the Federation of Astronomical Societies Northern Convention, held at Trevelyan College, Durham University. At 10am the president of the Federation, Rosemary Naylor, welcomed us and introduced the first speaker, all of whom are from the University. He was Dr. Carlos Frenk who spoke on "Dark matter in the Universe". He said that dark matter accounts for about 99% of the mass of the universe.

After a short break Dr. Richard Ellis spoke on "Formation and Evolution of Galaxies". Lunch was provided by the Durham Astronomical Society, after which we heard Dr. John V. Major speak on "Martini - Sharpening of star images". He was working

on a system to eliminate atmospheric turbulence from the telescopic image of stars by altering the light path so that the image remained stationary. The next speaker was Dr. Stephen Rayner who spoke about "Very high energy gamma ray astronomy". He said that the Durham group was the only one in this country who is working in this field, and that there were only about a dozen other groups in the world working at this time.
Dr. F. Richard Stephenson then spoke on "Modern uses of early astronomical records". From an analysis of ancient eclipse records he said that the slowing down of the earths rotation cannot be totally explained by tidal effects alone. The final speaker was Dr. Nigel Metcalfe, whose talk "Galaxy counts at the edge of the observable universe" included a slide of a recent CCD image which showed objects (Galaxies?) as faint as magnitude 28. The numbers attending were about 45 in total, a very disappointing result, especially since they expected 150, and catered for 100.

The future of the 5-inch Cooke refracting telescope in Darlington was discussed in the *Northern Echo* on the 12th January 1992. This was prompted by a rumour that a housing development was being considered for the site of the Observatory in Abbey Road, Darlington. The article carried a picture of Barry Hetherington cleaning the 5-inch objective.

Cosmos II was held on the 25th April 1992 in the same venue as last time - Teesside Polytechnic, Middlesbrough. The speakers were Professor Arnold Wolfendale of Durham University, who was the Astronomer Royal at that time - *The New Astronomies*; our own David Graham - *An Observer's Guide to the Planets*; Dr. Allan Chapman - *A World in the Moon - 17th Century Ideas about Spaceflight*; Peter Rea - *This New Ocean - A Review of Project Apollo*; and Dr. David Malin, the world's greatest astro-photographer, from the Anglo-Australian Observatory, in Australia - *Things to See and Do in the Dark*. The admission charge this time was £5.

This year, on the 3rd December 1992, the contest for the Thomas Wright Trophy was held at South Shields Technical College between teams from South Shields, Durham and Cleveland. Neil Haggath, Jack Youdale and Brian Sutton brought the trophy back to Cleveland.

With the opening of our observatory in 1994 the venue for our meetings changed to the Station House Visitor Centre at the Castle Eden Walkway Country Park, close to the observatory. Despite the fact that this venue was off the beaten track we always seemed to have more people than could comfortably be accommodated in the room.

Durham Astronomical Society was host for the Thomas Wright Trophy competition held on the 7th December 1994 when the societies of South Shields, Durham and Cleveland did battle. The winning team was Cleveland and Darlington, represented by Neil Haggath, David Weldrake and John McCue.

On the 7th December 1995 South Shields Astronomical Society were hosts for the annual Thomas Wright Trophy where teams from South Shields, Durham, Hartlepool and Cleveland & Darlington competed. The event was organised by the

Northern Area Group of Astronomical Societies and the former Astronomer Royal, Sir Arnold Wolfendale, was there to hand over the trophy to the winning team of Neil Haggath and David Weldrake from the Cleveland & Darlington society.

It was reported in the January 1996 edition of our Newsletter that John Borrett of Nunthorpe, and Chris Walker of Richmond were both making observations with the new technology of the CCD camera. The article carried a picture of the Horsehead Nebula by John Borrett.

After 20 years of study, Barry Hetherington's researches into the early history of astronomy were published on the 2nd February 1996 by John Wiley & Sons Ltd. Entitled *A Chronicle of Pre-Telescopic Astronomy*, the book covers the study of the stars from the Big Bang, 15 thousand million years ago, to the year 1609, the first year from which we have observations with a telescope. The book not only contains observations of eclipses, planets, comets, meteors, aurora, sunspots and other phenomena, but also the calendar, star maps and globes, and the science of optics. All of the well-known astronomers are featured as well as many obscure ones, together with their observatories and publications. Unfortunately the price of £50 a copy puts it beyond the reach of most of our members.

Helen Sharman, Britain's first astronaut, has paid us a visit, and Heather Couper, the professional astronomer and TV personality, visited us on the 19th March 1996 as part of our contribution to National Science Week. She was presented with a framed print of our observatory.

On 1996 June 6 our President, Jack Youdale, appeared on Tyne Tees television local news at 6:30pm to discuss with presenter Cathy Secker his views on extra- terrestrial life.

In 1996 *Cosmos III* was held on the 30th November at the University of Teesside – the former Teesside Polytechnic. The programme was Dr. John Mason – *Latest Results from the Hubble Space Telescope*; Dr. Victor Clube – *Giant Comets and Civilisation;* Dr. Fiona Vincent – *Astrometry – Measuring the Sky*; Peter Rea – *The Early Exploration of the Moon*; and our own David Graham – *A Week on Mount Wilson*. The price of admission was £7.

Because of the limited accommodation at the Station House Visitor Centre we decided to move to Grindon Parish Hall, Thorpe Thewles, which is about half a mile from the observatory. Our first meeting there was on the 9th May 1997when Paul Money spoke to us about *Jovian Encounters*

In 1997 David Weldrake, of Ingleby Barwick, was voted Observer of the Year by the national Society for Popular Astronomy. This year he started an astronomical degree course at Hertfordshire University.

On the 10th October 1997, a Friday "open" night at the observatory, George Hardy, David Weldrake, Darren Bushnall and David Blenkinsopp, together with a few

members of the public, observed a brief [about ten minutes] glimpse of the aurora above the northern horizon.

David Graham, observing from Gilling West on the 1st December 1997 observed a fireball moving from the southeast to the northeast across the eastern sky. At 20h 25m UT the bright object, brighter than Venus but not as bright as the full moon, sparked its way across 35º of sky. It had a slightly elongated visible disk about half the apparent diameter of the full moon. Chris Walker also observed the event from Richmond.

For the meeting on the 5th December 1997 we were accommodated on the replica of H.M. Bark Endeavour [the original took a local lad, James Cook, around the world in 1768-71], at Castlegate Quay, Stockton. This was a joint meeting of the Castlegate Quay Trust and ourselves. The speaker was Dr. Allan Chapman of Oxford University who gave a talk on *A History of Astronomy in the North-East*.

For the meeting of the 20th November 1998 we joined the students of the Stockton Sixth Form College to hear a talk given by the Russian Cosmonaut Alexander Volkov, a veteran of three space missions totalling over a year in space, and rocket scientist Alexandre Martynov (interpreting for Volkov) as part of their tour of the country.

After a meeting of the planetarium committee at the home of Ray Worthy at Hartlepool on the 13th January 1999, Ian Miles and John McCue made their way home towards the A19, John keeping his eyes open for any aurora which had been predicted for that evening. Suspecting some activity they turned off at the Greatham turn-off and stopped in a light-free area and witnessed a spectacular display. After 15 or 20 minutes watching a colourful animated curtain spanning the northern horizon the cold wind forced them back into the car. By the time they reached home the display had ceased.

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Book Review

This one was sent to me by Ray Worthy, taken from an internet site. Regrettably, I have lost the name of the reviewer! Has anyone read the book and is prepared to recommend it?

“I never thought a book about astrobiology could be depressing, but when I put down The Life and Death of Planet Earth by Peter D. Ward and Donald Brownlee, I couldn't help but feel kind of glum. Over the course of nearly 300 pages, Ward and Brownlee take a look at our planet and its inhabitants. They chart the Earth's formation, the catastrophic events that shaped its history, and the rise of life, and finally the evolution of higher life forms. This is familiar territory that they covered in more depth in their previous book, Rare Earth. If you stopped reading here, it would be a happy book.

But there's lots more to read. They then go on to predict what the future holds for our planet. Whether it will end in fire or ice? Apparently both... and worse. In case you didn't

know, we're probably enjoying a warm siesta between severe ice ages. And while there are cold times ahead they will eventually end. Our Sun is steadily increasing in temperature - and as the temperatures rise, the biologic diversity on Earth will shrink (it's possible that we've already gone past the height of life's diversity and we're already on the slide down). Eventually higher life forms won't be able to survive, then the plants will go, and finally, hardy heat-loving bacteria living in the highest mountains at the Poles will be driven to extinction and the Earth will be a lifeless, dead world. Then the Sun will enter the final stages of its life, balloon out past the orbit of the Earth, and consume our planet in a fiery afterthought.

Like I said, depressing. But don't worry, we've got a few hundred million years left to enjoy our planet before we're driven off it as a species. Ward and Brownlee tell an engaging story, and I was pretty hooked from beginning to end. There's lots of scientific terminology, but it's always well explained - easy reading for almost anyone. At each point they stop to describe our future world, they step away from the science and just tell you what you'd see if you looked around. It was very easy to imagine what it must be like to stand on a sun-parched landscape and see our descendants struggling to survive. The Life and Death of Planet Earth isn't without hope, though. There are plans afoot to change the Earth's orbit by engineering near misses by asteroids – hopefully this could set our planet on an outward spiral that always keeps us in the right distance to enjoy a temperate environment. They encourage ongoing research into space exploration as a way to avoid our ultimate fate.

I'm hoping Ward and Brownlee will continue on this path for another book, and maybe paint a portrait of how the Universe will end. After all the galaxies have drifted apart; after all the stars have decayed and turned into white dwarfs or black holes; after black holes have consumed all the matter there is; and after the black holes themselves have evaporated, leaving us with a Universe of elementary particles accelerating away from each other into the darkness."

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Astrocat

Sent by John Crowther

John's caption to this picture from Radio Times is
"The Star Gazing or Bird watching Cat"

Transit Tailpiece

Quote/Unquote

If you find yourself arguing with an idiot, the chances are he's doing just the same thing.

Eternity is very long – especially towards the end.
Woody Allen

Man is related inextricably to all reality, known and unknowable. Plankton, a shimmering phosphorescence on the sea, the spinning planets and an expanding Universe all bound together by the elastic string of time. It is advisable to look from the tide pool to the stars and then back to the tide pool again.
John Steinbeck, The Log from the Sea of Cortez.

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.

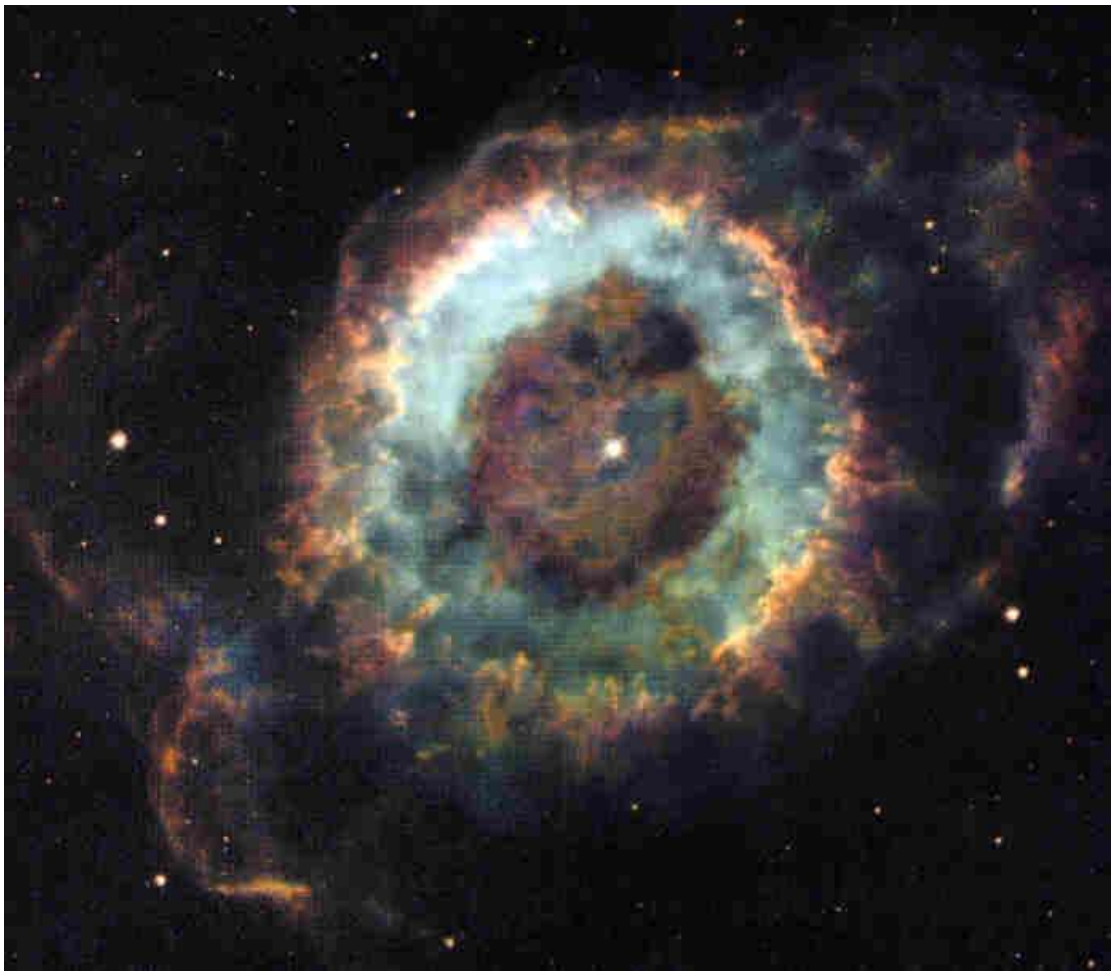
Sunderland AS Contact them at www.sunderlandastrosoc.com to see how they are progressing with the new Observatory at Washington Wildlife Centre. If you wish to attend their meetings you are assured of a friendly welcome.

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



One of the Hubble Space Telescope's photographs with the Wide Field Planetary Camera, from NASA and the Hubble Heritage Team. "The Little Ghost Nebula", NGC 6369 in Ophiuchus, is illuminated by the dying star at the centre. A flood of ultraviolet light is emitted into the surrounding gas, causing it to glow. The blue represents oxygen, green the hydrogen and red the nitrogen.
No prizes for naming the front page picture!