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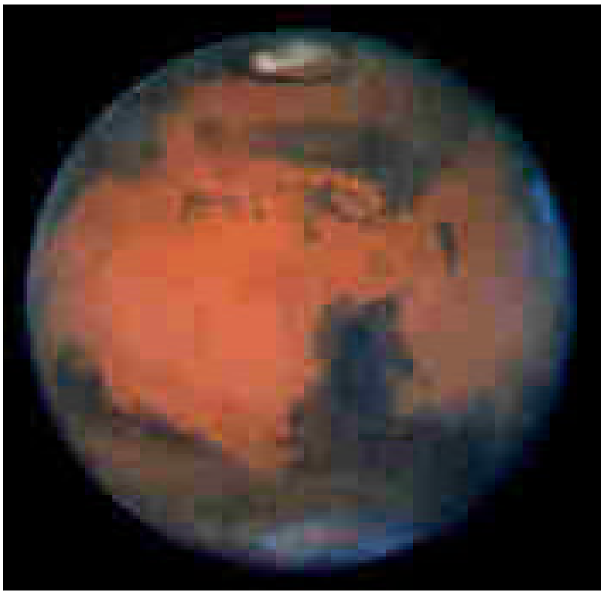
The Newsletter of

Cleveland & Darlington Astronomical Society

9th May 2003. Julian Day 2452769



The Front page picture this month is a reminder that Beagle 2 will be launched from Baikonur on its way to Mars in June of this year, due to arrive on the surface in December, 2003.

Editorial

April meeting. David Graham's subject for the April talk was "Cassini's Planet". The report on the meeting is by Barry Hetherington.

Light pollution. The Science and Technology Select Committee begins its examination of the problems and solutions to light pollution next month. Many people are now campaigning on this subject and an article by radio presenter Libby Purves appears later.

The Society Book Project. Hopefully, everyone is now busily writing their contribution to the Book Project. Member's opinions on the scheme of things outlined in last month's issue would help the project along.

Next meeting will be held on 9th May 2003, in Thorpe Thewles village hall.

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Meeting Report – 11th April 2003.

from Barry Hetherington

The main event of the meeting was a talk given by David Graham of Ripon. David joined our society shortly after its formation and is one of this country's leading planetary observers. He is the Director of the Saturn Section of the BAA, and for his talk he chose to tell us about Saturn:

Cassini's Planet

By David Graham

The title refers to the Cassini spacecraft which is currently on its way to make a prolonged study of this planetary system. Saturn is one of the naked eye planets and as such its history is linked with Classical Mythology; he was the Italian god of agriculture, and was also regarded as the father of the gods.

The first telescopic observations indicated that the planet had an unusual shape, or a strange configuration. The matter was resolved by Christiaan Huygens in 1659 when he announced that the planet was surrounded by a ring which nowhere touches the planet. Huygens also discovered its largest satellite Titan in 1655.

The next discoveries came from the Paris Observatory when it's Director, the Italian born G. D. Cassini, discovered the satellites Iapetus in 1671 and Rhea in 1672. A gap in the ring system was discovered by him in 1675, and is known as the Cassini Division. Cassini also went on to discover two more satellites in 1684 – Tethys and Dione.

The German born William Herschel started his career in England as a professional musician and then became a professional astronomer. He discovered two new satellites in 1789 – Mimas and Enceladus. Herschel also gave a value for the rotation period of the ring and of the planet, which he said was about 10 hours 30 minutes, very close to the current value.

In 1837 J. F. Encke, Director of the Berlin Observatory, discovered a gap in ring A which is known as the Encke Division.

William Lassell, a brewer by profession, discovered the satellite Hyperion in 1848, but subsequent intelligence from America announced that its discovery had been made two days earlier by William C. Bond, Director of the Harvard College Observatory. Bond also went on to discover the Crêpe Ring in 1850 which was independently discovered in England a week or so later by William Rutter Dawes.

Not only were telescopic observations uncovering information about the planet but theoretical work was making its contribution. The University of Cambridge offered the Adams Prize to anyone discovering the true nature of the ring system. This was won by James Clerk Maxwell in 1857 when he demonstrated that the rings had to be made up of small particles each in an independent orbit around the planet.

The French mathematician Edouard Roche had worked out a theory, known as Roche's Limit, to account for the origin of the ring system. He stated that any large solid object coming within 2½ times the radius of Saturn would be gravitationally disrupted, and that the rings were the result of a large satellite in a tight orbit suffering in this way.

The American astronomer Daniel Kirkwood had worked out a theory to explain gaps in the asteroid belt. When applied to the satellites of Saturn he discovered that the orbits of some of them were disrupting particles at a certain distance from the planet and that this disruption corresponded to the Cassini division.

So far, no conspicuous bright spots had been observed on the planet's surface which would enable the planet's rotation period to be determined with any accuracy. This position changed in 1876 when Asaph Hall, using the 26-inch Washington refractor, observed a bright white spot in the equatorial zone which remained visible for several weeks and a total of 67 revolutions. Using his own results, and those of fellow American astronomers, he produced a rotation period of 10h 14m 23,8s.

The application of the spectroscope to the telescope produced a valuable tool to investigate the chemical composition and the motions of celestial objects. In 1895 James Edward Keeler, at the Allegheny Observatory of Pittsburgh, observed the Doppler shift in the spectral lines of the of the planet and ring system. The results proved that the rings did not rotate as a solid body but move slower at the outer edge than in the middle.

Hugh Seeliger, Director of the Munich Observatory, pointed out that the brightness of the rings varied depending on the angle which they presented to the observer. This was a further verification of the particle theory of their composition.

The value of experience in observing the planet was demonstrated by the British amateur astronomer William Frederick Denning who consistently recorded fine detail with his 10-inch reflector which the professionals, with their larger instruments, did not record.

The Stockton born amateur astronomer, William (Will) Thompson Hay, became a famous Music Hall, radio and screen entertainer. He was also a competent observer with his 12½inch Newtonian reflector and 6-inch Cooke refractor. It was with his refractor that in 1933 he discovered the great white spot on Saturn, which his status ensured received more publicity than would normally have been given to such a discovery.

The best current observer of the Saturn system is David Gray of Spennymoor who searches out the planet when at its most difficult aspects. His contributions to the Saturn Section of the BAA are of great value.

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.

Visits to the planet began when the Pioneer 11 space probe encountered the system in 1979 and sent back photos of the event. The second encounter was made by Voyager 1 in 1980, followed closely by Voyager 2 the following year. These two spacecraft sent back a tremendous amount of data, including pictures of the planet, the ring system, and the satellites.

The Cassini space mission was launched in 1997 and is expected to arrive at Saturn on the 1st July 2004 to start a four-year investigation of the system. The spacecraft caries the Huygens probe which will be released onto Titan, the largest of Saturn's satellites.

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Dark Skies and Light Pollution

Written submissions to the Science and Technology Select Committee were due by Wednesday, 30 April 2003. I hope the information given in the last issue helped those who wished to make a contribution. Oral evidence will be heard in May.
The British Astronomical Association's Campaign for Dark Skies is gathering more and more supporters in all walks of life. John Crowther spotted this article by Libby Purves, who reveals her interest in astronomy in a recent Saga magazine.

Wishing for the Stars

"We are all in the gutter", said Oscar Wilde, "but some of us are looking at the stars". He died in 1900, in an age of gas lamps. He was never blinded to the night sky by neon and sodium, headlamps and electric hoardings and garish reindeers and Santas. The cities did not glare angrily up at the heavens in winter 1900, or even on 1950: they twinkled faintly. Even at the heart of those cities, a late-night reveller sodden with drink and sin might, like the man in Wilde's imagination, glance up and glimpse eternity.

Another late Victorian writer, George Macdonald, touchingly wrote about a vagrant child looking up from the London streets on a cold night and seeing the Moon. ". . . .here was a cloud, all crapey and fluffy, trying to drown the beautiful creature. But the Moon was so round, just like a whole plate, that the cloud couldn't stick to her. She shook it off and shone pout clearer and brighter than ever. But up came a thicker cloud and "You shan't" said the Moon and "I will" said the cloud but it couldn't. Out shone the moon quite laughing at its impudence. I knew her ways, for I've always been used to watch her. She's the only thing worth looking at in our street at night".

Well, on a very bright city night, a child might still see the Moon. But the stars, pinpricks of cold majesty in the black velvet mantle of the night, are strangers to more and more of them. We have sabotaged the very night. Look at the satellite pictures of Europe and the problem becomes clear. Populous areas – most of Britain, especially in the Southeast - glare up at the sky, with motorways and street lighting throwing as much light upwards as downwards.

One of the most powerful arguments for the National Parks, I always think, is the fact that on the UK map you can see the boundaries of some of them – notably the Peak District – absolutely clearly as black holes in the sea of light. For what the satellite sees as a black hole is, on earth, one of the increasingly rare places from which you can see the night sky. Even in comparatively open country it is blanked out by road lighting, insensitive suburban lights in villages and horrible security lights on private houses (which actually do very little good, experts say; they create corridors of deeper darkness alongside their beam, up which the burglar creeps, rejoicing).

But the sky is our heritage, the most magical part of the natural environment. It has been an inspiration down the centuries and a mysterious source of comfort to short-lived, restless grieving humankind. Even before we knew from physicists about the immense distances and unthinkable energy of the Universe, human beings divined that the night sky held secrets; it was worshipped. You need not be a pagan moon-worshipper, though, to use the jewelled sky for meditation and private exaltation.

But you need to be able to se it. At sea, a clear night means you nearly always can. Those of us who sail small boats offshore have stored up many happy memories of the swaying shapes of tall sails, moving against familiar stars. My best days ever were heading west for the Caribbean in my twenties as crew on a 50ft yacht and using the belt of the constellation of Orion to steer by, moving it across the wire rigging as night went on. But on land, stargazing is increasingly hard and has become – so says the British Astronomical Association – very much harder during the past 40 years. They call it light pollution and it is a curse that has sneaked up on us unawares.

I am lucky where I live. Apart from Sizewell B nuclear power station, lights which have been dimmed since their glaring hey-day while the second station was built, there is not much extraneous lighting. We have a night sky. A few years ago comet Hale-Bopp drew us out into the garden every night to see its long shining tail, a celestial peacock hurtling over the garden shed. The Perseid showers of shooting stars this summer were a marvel. Even the occasional satellite, creeping shinily across the sky, is a reminder of the greatness of human achievement and how tint it still remains, next to Nature's.

One of my best memories is of sitting with a Japanese visitor after supper and gazing at the Milky Way. She thought our name for it was ugly: "We call it Sky River". Most people can't see the Milky Way except on holidays abroad. They could, though. It isn't impossible to cure skyglow. The British Astronomical Association's Campaign for Dark Skies lobbies for better-designed lights on roads, buildings and sports stadiums to sine the necessary beams downwards, not upwards.

It should be obvious: as one campaigner said, “The light from the rest of the Universe takes hundreds, thousands or millions of years to reach our eyes. What a pity to lose it on the last millisecond of its journey”.

But it isn’t yet obvious to a lot of councils, architects and authorities. Which is why people like me go on and on about it. Young and old, town and country, winter and summer, we all should have the right to look up on a clear night – and gasp.

* *

Junior Astronomy

From John Crowther

John writes that he took a class at Ing’s Farm School, where his daughter teaches. He received a letter from three of the lads he spoke to. “Dear Michael’s, Ben’s and Lewis’s Favourite Astronomer Mr Crowther, We are really grateful you had come in to help us create a new version of Astronomy. Thanks for your help this book has changed history!, From Michael, Lewis and Ben.” The letter was accompanied by three poems. Notice that these young people already know the names and the order of the planets.

Space Spot by Max Fatchen

Twinkle, twinkle little star
Up there I the blue. How
I wonder what you are
Are you Doctor Who?

Humpty Dumpty went to the Moon by Lewis

Humpty Dumpty went to the Moon
On a supersonic spoon
He took some porridge and a tent
But when he landed
The spoon got bent
Humpty said he didn’t care
And for all I know
He’s still up there

Astronomy by Michael Harbison

The sun is one of the stars
To describe it,
It’s much bigger than Mars

Mercury is closest to the Sun
But it weighs a tonne!

Venus is scorching hot
Some are cold
But this one's not!

Earth, but is best of all
To other planets not
But to us quite tall

Mars is back
And ready to attack
But needed to be wound back!

Jupiter is king of kings
If only he had wings!

Saturn has a lot of rings
You wouldn't believe what it brings

Uranus is bright blue
It would totally shock you!

Neptune is king of the sea
Better swimmer than you and me!

Pluto's really cold
Well, at least, that's what I'm told!

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Astronomy and the Internet

by Rod Cuff

This month there's a fair bit on the solar system, one way or another, but also a few deep-space spectaculars as well.

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).

Huge events a long way away

- On April 4 the nearest and probably optically brightest gamma-ray burst yet detected excited a lot of attention around the world. Amateur astronomers played a large part in studying its rapid changes – see http://skyandtelescope.com/news/current/article_932_1.asp
- There are some beautiful recent images of highly excited nebulae at www.eso.org/outreach/press-rel/pr-2003/pr-08-03.html, taken by the Very Large Telescope in Chile.

Future planet activity

- The transit of Mercury across the face of the Sun in the morning of May 7 is covered at many places on the Web, including the European Southern Observatory at www.eso.org/outreach/eduoff/vt-2004/mt-2003/mt-display.html, where you can watch the transit in real time if British clouds get in the way.
- The planetary astronomer's attention in August will turn to Mars, then at its closest to Earth for 60,000 years. The text about it at http://skyandtelescope.com/observing/objects/planets/article_929_3.asp# includes a link to an online Mars Profiler program that will help you focus on what to look for, by telling you which part of the planet is facing Earth at any particular date and time.
- And if your appetite is whetted by the Mercury transit, then prepare for the biggy on June 8 next year – a transit of Venus, something no one living today has ever seen. There's a website devoted to it at www.venus-transit.de

News

- The history of the discovery of Neptune may need rewriting, according to http://skyandtelescope.com/news/current/article_932_1.asp – it looks as though the Frenchman Jean Le Verrier has a much better claim on it than the Englishman John Couch Adams, despite what's been written before.
- "Astronomers have found a way to harness clouds of gas in space to make a natural 'telescope' … able to resolve details about 10 microarcseconds across – equivalent to seeing a sugar cube on the Moon, from Earth… ten thousand times better than the Hubble Space Telescope can do." If you're intrigued, visit http://spaceflightnow.com/news/n0304/21gascloud

General

- There's a chatty and sensible review page for astronomy books, mostly practical and aimed at small-telescope users, at www.weasner.com/etx/book_reviews.html
- An intriguing and inexpensive device for observing sunspots, transits etc. is advertised at www.lighttec.fr/pages/solarscopeenglish.htm, projecting a 115 mm (about 4.5 inches) image of the sun entirely safely without requiring a telescope.

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Astronomy Basics

by Neil Haggath

No. 12: The Life and Death of Stars – Part 2

Last month, we looked at how stars are born, how they generate their energy during the main part of their lives, and how average, Sun-like stars die. We saw how, after a star has exhausted its energy source, it finally loses the battle against gravity, and collapses into a small, incredibly dense white dwarf, with the mass of the Sun packed into an object the size of the Earth.

But stars much bigger and hotter than the Sun end their lives in far more spectacular fashion; their deaths, and the bizarre objects which result, are the subject of this article.

As we saw last month, a white dwarf "holds itself up", and is prevented from being gravitationally compressed any further, by means of electron degeneracy pressure, the "resistance" of electrons to being forced beyond their lowest allowed energy levels within atoms. But there's a limit to the size of a white dwarf. If the mass of the star – or rather, what's left of it, after it has blown off its outer layers during its red giant phase – is greater than 1.4 solar masses, then its gravity is so powerful that it overcomes even electron degeneracy pressure, and it's compressed to an even denser state. This limiting mass is called the *Chandrasekhar Limit*, after its discoverer.

When a star whose mass exceeds the Chandrasekhar Limit collapses, the end result is something even weirder than a white dwarf. I should point out here that normal matter – even solid matter – consists mainly of empty space! The nucleus of an atom is an incredibly small and dense object, whose diameter is a tiny fraction of that of the whole atom, with its orbiting electrons. But when a big star's gravity overcomes electron degeneracy, the electrons in each atom are forced into the nucleus, where they combine with protons to turn them into neutrons. Separate atomic nuclei, now consisting entirely of neutrons, are forced vastly closer together than is possible in normal matter, resulting in an object a thousand times denser even than a white dwarf!

This bizarre object is called – not surprisingly – a *neutron star*, since it consists mainly of a mass of neutrons and not much else! Its density – now comparable to that of a gigantic atomic nucleus – is truly staggering; for a star whose mass just exceeds the Chandrasekhar Limit, the resultant neutron star has a radius of only about *ten kilometres*. A cubic centimetre of it weighs *100 million tons*!

So what finally halts the collapse of a neutron star? Well, neutrons also exhibit a kind of quantum behaviour which prevents them being forced too close together; as a white dwarf is "held up" by electron degeneracy pressure, so a neutron star is "held up" by *neutron degeneracy pressure*. The existence of neutron stars was predicted by theoretical physicists in the 1930's, three decades before the first ones were actually discovered.

Those who know their physics will realise that as a stellar remnant is compressed in size, its rate of rotation increases, due to conservation of angular momentum. (Cue that clichéd comparison about an ice skater spinning faster as she pulls her arms in to her sides.) So neutron stars spin *very* quickly; many have rotation periods of less than a second. Due to some properties of their strange material, which I don't pretend to understand, they also generate immensely powerful magnetic fields. This results in intense radio waves being emitted, in a narrow beam along the direction of the star's magnetic axis, which is tilted with respect to its rotational axis.

In some cases, as a neutron star spins, this radio beam sweeps across our line of sight, like the beam of a lighthouse, so we detect it as a *pulsar* – a regular series of radio pulses, whose separation equals the star's rotation period. Studies of pulsars have enabled astronomers to deduce a lot about the structure of neutron stars.

A star whose mass is a few times greater than that of the Sun suffers similar "death throes" to that of a Sun-like star, as described last month – except that its end product is a neutron star instead of a white dwarf. But the biggest and hottest stars – the *blue supergiants* of spectral classes O and B, with masses of about eight or more solar masses – end their lives in much more dramatic fashion. They go out not with a whimper, but with a very big bang indeed. In fact, you could say that they commit a spectacular suicide; the demise of such a star is marked by one of the most violent events in the Universe, a *supernova*.

More accurately, the event I'm about to describe is called a *Type II supernova*. A *Type I supernova* is a completely different kind of stellar explosion, which is equally dramatic, but unrelated to the death of a blue supergiant.

The term "supernova" is actually a pretty silly and misleading one, but unfortunately, we're stuck with it! Firstly, as I've just said, we use the same word to describe two totally different and unrelated phenomena. Secondly, the word is derived from *nova*, which is itself short for *nova stella*, or "new star". A "classical" nova is a stellar eruption on a much smaller scale, which causes a star's brightness to increase greatly for a time; it's so called because it sometimes results in a normally faint star temporarily becoming visible to the naked eye, giving the appearance of a new star having suddenly appeared in the sky. The word "supernova", as you can imagine, was invented to mean something much more powerful than an "ordinary" nova; however, we now know that novae and supernovae are also totally different and unrelated phenomena!

Such adjectives as "spectacular" and "dramatic" are really not adequate to describe a supernova. When a massive star explodes in this manner, its brightness suddenly increases by a factor of *a billion* or more; for a very brief time – usually just a few days – the star can outshine the rest of the entire galaxy in which it is situated. In fact, almost all our knowledge of supernovae comes from observing them in galaxies other than our own; they are so bright that they can be detected at distances of hundreds of millions of light years.

Supernovae are very rare events; within any given galaxy, they occur at an average rate of just one every couple of centuries. By sheer bad luck, none have occurred in our own Galaxy since the invention of the telescope; in fact, in a remarkable example of cosmic Sod's Law, the last one occurred in 1604, just five years before Galileo first turned a telescope to the sky! Luckily, in 1987, astronomers were blessed with the next best thing – Supernova 1987A exploded in the Large Magellanic Cloud, our Galaxy's nearest neighbour. Apart from that one, we have only been able to study them in distant galaxies, many millions of light years away.

So what causes a supernova? Well, it's an inevitable consequence of nuclear physics. Last month, I explained how a star generates its energy, during the main part of its life, by the nuclear fusion of hydrogen into helium. This is an exothermic reaction - it releases more energy than that which is required to trigger it – and it provides the steady supply of energy which prevents the star collapsing under its own gravity. The helium produced, being denser than hydrogen, sinks into the centre of the star's core, where gravitational compression heats it further, so that the helium is able to fuse into heavier elements, carbon and oxygen. It's this phase of helium burning which causes a Sun-like star to swell into a red giant - the beginning of its death throes.

But in more massive stars, things don't stop there. The greater the star's mass, the higher the temperature which is produced in its core by the infalling of denser elements – and the higher the temperature, the further the process of nuclear fusion can go. The carbon and oxygen sink into the centre, where they are heated to even greater temperatures; then they fuse into neon, and next to silicon. So now the star's core consists of a series of concentric spherical shells, each sustaining a particular fusion reaction. The outermost shell still consists of hydrogen; inside that is a denser and hotter shell of helium, then further shells of carbon, oxygen, neon, and finally silicon in the centre. (Other elements are also produced, but those are the ones which dominate in each of the shells.) Remember that the early Universe, soon after the Big Bang, contained only hydrogen and helium; all elements heavier than helium have been produced by fusion in the cores of stars.

Remember that such a big star is short-lived; as it has had to consume its hydrogen fuel at an extravagant rate to counteract its huge gravity, it has taken only a few tens of millions of years to reach this state.

Finally, if the star's mass is eight or more solar masses, its centre reaches a temperature – several *billion* degrees! - at which silicon nuclei can fuse to form iron – and when *that* happens, it spells disaster for the star! Up to now, all of the fusion reactions have been exothermic, and have therefore continued to provide a supply of energy to "hold the star up" against gravity. But iron has the most stable nucleus of any element. Fusion of iron into any heavier element is no longer exothermic, but endothermic; the energy required to trigger the reaction is greater than the amount released. This is the *only* process in the Universe which can produce nuclei heavier than iron; every existing atom of lead, gold, uranium and all other heavy elements was produced in the core of a supergiant star, in the final moments of its life.

This abrupt transition from exothermic to endothermic reactions has fatal and dramatic consequences; it means that, almost instantaneously, the star loses its energy source, and loses the battle against gravity. While a supernova is commonly described as a stellar explosion, it actually begins with an *implosion*; the star's core suddenly collapses inwards *within a few seconds*, heating itself in the process to a staggering temperature of about 50 billion degrees. Then, due to this intense heating, the infalling material "bounces" outwards again, and the star blows itself apart in a colossal explosion. For a few days, it shines more brilliantly than an entire galaxy – then it gradually fades over a period of months or years.

What remains of the star's core now collapses under gravity to become a neutron star. Meanwhile, the material which was blown off from its outer layers continues to expand at a rate of thousands of kilometres per second. This expanding shell of incandescent gas can be seen from thousands of light years away, and remains visible to astronomers for thousands of years, as it gradually cools and fades. There are many examples, in our own Galaxy, of these *supernova remnants* – glowing gas clouds with neutron stars (some of which we detect as pulsars) at their centres. Some of these are the remains of stars which exploded many millennia ago.

During recorded human history, in the pre-telescopic era, we know of eight supernovae which occurred in our Galaxy, between AD 185 and 1604. More accurately, the historians of various cultures recorded the appearance of very bright "new stars" in the sky, and their descriptions are consistent with supernovae. For some of these, where the position of the phenomenon was recorded with sufficient accuracy, astronomers have been able to identify the corresponding remnant.

The best known example is the supernova which was seen in AD 1054; it was recorded by Chinese astronomers, who called it a "guest star", and left very detailed descriptions of its position, its brightness and the time over which it remained visible. At its peak, it was so bright as to be visible in daylight!

The remnant of this event is the famous Crab Nebula in Taurus, about 6500 light years away. (Of course, AD 1054 was the year in which the light from the supernova reached the Earth; the explosion actually occurred 6500 years earlier.) The glowing shell of gas is now about 14 light years across; it shines partly because it's still hot, and partly because it's excited by radiation from the neutron star at its heart. The latter was one of the first known pulsars, and is by far the most studied.

The Crab Nebula is regarded by astrophysicists as one of the most important objects in the sky. As well as being one of the closest supernova remnants, it's also one of the very few for which we know precisely when the explosion occurred; studying the structure of the remnant, and knowing exactly how old it is, can tell us a lot about how it has evolved.

One of my University lecturers, who taught us "High-Energy Astrophysics", was madly in love with the Crab Nebula; I don't think he ever got through a lecture without mentioning it. In fact, it has been said – with a little exaggeration – that "modern astrophysics can be divided into two parts - the Crab Nebula and everything else"!

I said earlier that what remains of the star's core after the explosion collapses to form a neutron star. That is usually the case, but not always. The mass of this remaining core is only a fraction of the giant star's initial mass, but it can still be equal to several Suns. If its mass is greater than about three solar masses, then its immense gravity will overcome even neutron degeneracy pressure – and then there is absolutely nothing which can halt its collapse. In this case, the end product is one of the most bizarre objects in the Universe – a *black hole*.

A black hole represents the ultimate state of gravitational collapse – an object which has literally crushed itself out of existence. In theory, it shrinks to what we call a *singularity* – a point mass of zero dimensions and infinite density. In reality, we have no way of knowing what happens inside a black hole, because its gravity is so great that not even light can escape from it. That's why we call it a black hole; it's like a bottomless pit of gravity, from which absolutely nothing can escape. We can't observe its interior, because no information of any kind can reach us from it. We also believe that the "normal" laws of physics, as we know them, break down under such extreme conditions.

The existence of black holes is predicted by Einstein's General Theory of Relativity (which I don't pretend for a moment to understand!). We are now pretty certain that they do exist, but actually finding them isn't easy. By definition, we can't observe them directly, so we can only detect their presence by their gravitational influence on nearby objects. There are now many known astronomical objects which are believed, with a high degree of confidence, to contain black holes.

We also believe that black holes exist of another kind – enormous ones, with the mass of millions of stars, at the centres of galaxies – but that's another story entirely.

I'm not going to describe black holes in any more detail here, as that could easily fill an entire article of this length! Indeed, I'll devote my next article to them – but I'll have to enlist John's help in writing that one!

Now, you might think that supernovae are distant events in space, and that, fascinating though they are, they are not of any importance to us here on Earth. But they are, in fact, of vital importance to us; indeed, we owe our very existence to them!

Think about it. As I said earlier, the early Universe was made of only hydrogen and helium; all other elements have been synthesised in the cores of stars, and all the elements heavier than iron can *only* be produced in supernovae. When a massive star explodes as a supernova, it disperses those heavy elements into the surrounding region of interstellar space, where they will form part of the material from which later generations of stars will form.

Some of the oldest stars which now exist – the smallest red dwarfs – are “first generation” ones; they have been around since the galaxies themselves first formed, and are made of only hydrogen and helium. But all stars bigger than a fraction of a solar mass are at least second generation; they formed from clouds of gas and dust which had been enriched with heavy elements from the debris of earlier supernovae. That’s why those stars themselves contain heavy elements, and why rocky planets are able to form around them.

Had an ancient supernova not occurred in our region of the Galaxy, sometime before the birth of our Sun, then the iron, nickel, silicon and oxygen of which the Earth is mostly composed would not have existed. Our planet itself, and everything on it – including ourselves – is made of atoms which were created long ago in the core of a massive star, and flung out into space when that star met its violent end.

We are, quite literally, made of stardust.

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The Apollo Hoax 5

As these extracts have unfolded, it has become clearer that the author may well be part of the supporters of the conspiracy theory.

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(17) The radiation hazards facing the missions.
From www.aulis.com/nasa6.htm "According to an expert at DERA in the UK: Radiation is the biggest show stopper affecting mankinds exploration of the universe. As far as the probability of encountering SPEs or solar flares went, the thin-walled Apollo craft (from 8 through to 12) travelled during a solar maximum period, a time when there was a likelyhood of three or four severe flares per mission. The ability to predict solar flare activity was, and still is, very poor indeed. The CSM did not have any shielding against such an event. Neither did the LMs, nor did the spacesuits." Even NASA admits that should there have been a severe flare while astronauts were on the Moon the likelyhood would have been a fatal dose of radiation. There is no comparison with the international spacestation which does have shielding and which orbits inside the protection of the Earth’s Van Allen bands as well. Now here's what is typically said in response to questions about the problem of radiation: from: www.clavius.org/envsun.html
"A major solar event doesn't just cut loose without warning. It is possible to observe the "weather" on the Sun and predict when a major event will occur. And this is what was done on the Apollo missions. To be sure, the missions were planned months in advance and the forecasting was not that farsighted. But they would have had enough warning to call off the mission should a solar event have started boiling up from the depths of the sun." That's not quite right. It takes millions of years for anything to "boil up" from the depths of the Sun and it's just not possible to accurately predict when a solar flare will

occur. About the best you can do is say they correlate with high sunspot numbers but the Sun can have high sunspot numbers for months on end!

From www.lunaranomalies.com/fake-moon.htm "As to the issue of solar flares and the danger they presented, there simply weren't any major ones during any of the Apollo missions. So the biggest reason that none of the astronauts died from their radiation exposure was that they simply did not get a bad dose to speak of.". That's right, they gambled with the astronaut's lives. When the chance of encountering severe solar flares was 3 or 4 per mission, any single flare of which could have proven fatal they just went ahead anyway. However the NASA plan wasn't all bad. NASA had a "Sun" watch going by the name of SPAN, the solar particle alert network. This was a network of telescopes that monitored the Sun day and night for flares. It was known that electromagnetic radiation, the gamma and radio bursts for example would reach the Moon (and Earth) well ahead of the solar particles that were thought to be more dangerous. This might have bought anywhere from 10 to 100 minutes time for the astronauts to find shielding from the deadly particle stream. NASA says the astronauts would have been ordered to leave the Moon and fly back up to the safety of the command module. But the command module didn't have the sheilding to protect against a severe flare. Oops! Another NASA clanger.

Another potentially serious radiation hazard (not for Apollo) are the Van Allen belts or zones. They are regions in space near the Earth where the Earth's own magnetic field traps and "concentrates" radiation from the Sun. The most damaging form of radiation that we need worry about are the solar wind particles that the Sun continuously emits and which is prevented from reaching the Earth's surface by the Earths magnetic field. Whilst we are protected from this radiation on the Earth just above us at a range of approximately 500 to 20 thousand miles the radiation is concentrated and transit times through these regions must be kept to a minimum. It is not thought that any of the Apollo mission astronauts will have spent sufficient time in the Van Allen belts for it to have been a worry. The International space station however must keep clear and thus orbits underneath the Van Allen zones and whilst keeping away (most of the time) from a related problem known as the South Atlantic Anomaly.

(18) The lunar surface brightness misconception.

It is sometimes argued that the surface of the Moon is so bright that it counts for all the so called fill-in lighting that critics of the Apollo record claim has been used. For example it has been argued that, "One celebrated picture shows an astronaut with the sun behind him, and the lunar lander and American flag reflected in his visor. According to critics, the astronaut should have been merely a silhouette. And so he should, if he weren't surrounded by brightly-lit ground. If the full Moon can brightly illuminate the earth from 250,000 miles away, just imagine what it can do to an astronaut standing on it". That argument is about as wrong as it can get. Here's what NASA has to say about the Moons surface brightness.

See: http://liftoff.msfc.nasa.gov/Academy/UNIVERSE/MOON.HTML

"Next to the sun, the full Moon is the brightest object in the heavens. However, its surface is rough and brownish and reflects light very poorly. In fact, the Moon is about the poorest reflector in the solar system. The amount of light reflected by a celestial object is called the albedo (Latin: albus, white). The Moon reflects only 7% of the sunlight that falls upon it, so the albedo is 0.07". The reflectance of grey paper is 18% and the Moon (close up) is brown with a reflectance of only 7%. You know now that close up, on the Moon things are going to look pretty gloomy over all because the ground is brown and the sky is black. From a distance the Moon might be a raging beacon of light (comparatively) but it's not that way close up.

(19) Photographic anomalies, heiligenschein and perspective.
Note, all the images referred to here use the same file name as that used in the NASA online archive and are easily located with Google <filename> or alternatively at the following websites:
http://lunar.arc.nasa.gov/archives/images/USA/Apollo_11/Spacecraft/medres/
http://lunar.arc.nasa.gov/archives/images/USA/
www.hq.nasa.gov/office/pao/History/ap11ann/kippsphotos/apollo.html

The following images all contain "photographic" anomalies or inconsistencies. In aS11-40-5903.jpg there is a strong hot spot very near the subject and the brightness of the ground fades rapidly into the distance to nothing. The hot spot is indicative of spot lighting and will not be caused by the Sun which illuminates all the ground equally and that is in spite of what they say on the badastronomy dot com website. Any "heiligenschein" effect in the above image should be invisible as the Sun is way off to the right. You can tell that because the astronauts shadow is to the left. Here's what badastronomy says about the heiligenschein effect; "The lunar dust has a peculiar property: it tends to reflect light back in the direction from where it came. So if you were to stand on the Moon and shine a flashlight at the surface, you would see a very bright spot where the light hits the ground, but, oddly, someone standing a bit to the side would hardly see it at all. The light is preferentially reflected back toward the flashlight (and therefore you), and not the person on the side". So, take a look at the image and see for yourself. They must have used a spotlight to take that photograph because the hotspot cannot have been caused by the heiligenschein effect.
Some of the shaded areas of the astronauts suit is brighter than the lunar ground which, if it is the only source of fill in (light reflecting from the ground acting as fill in light), is not possible. Why is the brightness of the astronauts suit (his right ankle/calf) so bright near the ground? There should
be much less reflected light reaching him down there and yet the brightness is the same as it is at the top of his suit. Try looking at as11-40-5902.jpg for all the same anomalous features and inconsistencies. What about the following images, 10075741.jpg and 10075742.jpg. In these images Mt Hadley is the back drop but with a small change in viewing position and a slight increase in camera height of a couple of feet the top of Mt Hadley has completely changed it's angle relative to the horizontal. Mt Hadley is 3 miles in back so a small shift of a few feet in camera position ought not to produce such a large shift of perspective at the top of Hadley.
Many images look like the background is dropped in to the foreground and some are obviously air brushed just like 10075841.jpg. There are many more examples of images that are not right and which may be described as fakes. In some NASA film footage included in the late Jim Collier's video "Was it only a paper Moon?" Young and Duke of

Apollo 16 can be seen against exactly the same backdrop on two different EVA's (EVA1 and EVA2), which were on different days at alleged
different places and in different directions from the LM base camp. On EVA2 Young describes the scene as "absolutely unreal". On another EVA to and from a site near Hadley Young makes a similar remark about the scenery being unreal during the return journey when exactly the same backdrop (which should have been laterally reversed with respect to the origin but which was not) was displayed as that used in the forward (to) journey.
Of course the whole debacle is explained away as human error in the editing room by the NASA supporters. What can I say, "It's absolutely unreal".

(20) What still film was used?
www.aulis.com/nasa6.htm "It was actually ordinary Ektachrome film emulsion. However, it is now claimed by the Enterprise Mission (post justification) that there was a special transparency film created for these missions under a NASA contract. Called XRC, apparently this was a specially extended range color slide film that allowed the astronauts to take perfect National Geographic-quality pictures. So you might ask how does the agency justify the fact that according to Kodak in 1969 and confirmed again in 1997 the film was just ordinary 160 ASA high speed Ektachrome?". www.empusa.clara.net/lunar/lunar1.htm "Ordinary ektachrome slide film will shatter at -4F". So what kept the inside of the cameras warm? They had a silver case presumably to reflect solar heat to keep them cool.

(21) In a vacuum there is no heat?

"So it may be +200F in the lunar sunlight and -200F in the shade, but in a vacuum there is no heat". Wrong. There is plenty of heat in the vacuum and especially close in to a star. Heat is energy and there is plenty of it in the "vacuum" of space in the form of an energy flux. The sun pours out massive amounts of heat energy and other radiation. At the distance of the Earth (and this goes for the Moon too) the amount of heat energy in the "vacuum" of space amounts to 1.36Kw per square metre also known as the solar irradiance. Both the Earth and the Moon receive this amount of energy from the Sun but at the Earths surface you can sometimes subtract about 30% from the solar irradiance figure due to reflection by clouds in the atmosphere.
There is also no such thing as a completely empty vacuum with no energy in it. There is a virtual partical flux throughout the whole of space and there is a base level of energy associated with that flux. It's called the zero point of energy. It's not zero energy but a baseline of energy below which we cannot go.

(22) The noon day temperature misconception.

It is often said or implied that it takes 14 days for temperatures to reach +200F on the lunar surface. This is plainly wrong. Claims that astronauts landed on the Moon during the "lunar morning" in order to "avoid noon day heat" are ridiculous. They might say they landed at that time but it would not have helped them to avoid any heating problem that they will have faced. Heating to +200F or more can happen in less than 24 hours of exposure to sunlight on the Moon's surface. Here's how; surface temperatures (not the regular air temperature measurements) may reach 200 degrees Fahrenheit on Earth in places like deserts and so forth. If we consider that during the night the temperature may in all probability have dropped to freezing (-32F) or near freezing then we may note that the Sun's energy in a matter of only a few hours (less than 12 hours) will have brought about a temperature rise of around 200 degrees Fahrenheit and that is after the additional cooling effects of atmospheric convection which are not found on the Moon have done their worst. If we remove atmospheric cooling then the ground will heat up much faster because there will be no convective heat losses caused by the presence of the atmosphere which are far more severe than the radiative losses and the final temperature may even be more than 200F.

Now, hypothesizing a world where the minimum starting temperature is -200F (that's what the surface temperatures on the Moon can cool off to during the night and in the shade) those same 12 hours of sunlight would also bring a RISE in temperature of more than 200F. If we add the two solar exposures and take out the night time, that makes things nearer to conditions on the Moon where the Sun can shine for 14 whole days at a time because that is how long the lunar day

is, then we can see that temperatures starting from -200F may easily rise to more than +200F in 24 hours or less. If we take the best case of the 24 hour period centred on lunar midday when more time is spent by the Sun overhead presenting the optimum angle of incidence to the ground then the temperature rise on horizontal ground will be fastest of all during that period. However for surfaces that present normal (head on) or nearly normal angles of incidence to the Sun's rays no matter whether it be lunar midday or morning then they too may rapidly heat up to more than +200F in less than 24 hours.

It is fairly obvious from this that surface temperatures on the Moon can rapidly heat to more than +200F in much less than 24 hours of sunlight depending on angle of incidence. For a recently landed lunar module standing vertically on the ground and presenting a surface that is perpendicular to the Sun's rays (which it will be during the lunar morning) the heating effect will be rapid and similar to that for level ground at midday.

The same applies to astronauts standing on the lunar ground. They too will present a perpendicular side to the rays from an early morning Sun.

(23) How much insulation does it take to keep an astronaut warm?

Not much. The biggest problem is in keeping him cool. However, in order to maintain a normal temperature (37C) the human body (naked) would have to radiate about 800 watts of heat to the cold sky of space. With an average layer of clothing the losses can be considerably reduced to around 200 watts but the average daily calorific intake is only sufficient to support losses of around

100 watts. Therefore a little more clothing on top will suffice to stay warm under a cold sky and losses would then be at the normal 80 to 100 watt level which is easily sustained given proper calorific input.

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A History of the Cleveland and Darlington Astronomical Society

Part 5

This extract from Barry's history describes recent events in the development of the Society. Some comments and corrections on previous parts have been received and the invitation to send any comments to Barry or the editor is still open.

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On the 15th December 2001 York Astronomical Society and Durham Astronomical Society came to Thorpe Thewles to do battle for the Thomas Wright Trophy. Our speaker for the evening, Paul Money, acted as question setter and question master. Neil Haggath, Michael Roe and Darren Summerfield came out winners for CaDAS.

An occultation of Saturn by the moon was observed from Ripon by David Graham on the 16th April 2002. The moon was four days old with the dark side showing earthshine. This event was also used as the first linkup between our observatory and the planetarium. Using a standard CCTV camera attached to the 8-inch refractor society members viewed the event in the planetarium while John McCue was at the telescope tracking the event.

The First Telescopes

During the late 1980's a visit to the South Tyneside College of Education by John McCue and John Nichol resulted in the reporting of the existence of part of a telescope mount; a large equatorial head. Much of the original mount was missing. It seems that during the 19th century a large telescope and mounting had been bequeathed to the college by a Mr John Martin.

Letters were exchanged between our society and the Principal of the South Tyneside College as to the possibility of obtaining the equatorial head for a telescope project we had in mind. Agreement was reached by the end of 1990 and arrangements were made for the transfer of the equatorial head to Billingham

Jack Youdale produced detailed engineering drawings of the missing parts of the mounting. He then arranged a meeting with the manager of ASTRA Employment Training of Billingham as to the possibility of refurbishing the mounting as a training project. This was agreed and the work was undertaken during 1991.

The first telescope to be placed on the mounting in the workshop was a 6-inch refractor which had been acquired by John McCue and refurbished by Jack. At the time the mounting was being worked on, Malcolm Bannister presented Jack with an 8-inch diameter lens which, on closer inspection, turned out to be a cemented object glass of two elements of long focal length (f/20). It appeared that the lens was a war surplus item which had been the object lens of a submarine periscope. This 8-inch cemented doublet had some surface scratches and would require reworking to a more suitable focal length and the surfaces repolished.

Jack separated the crown and flint components of the lens and the exact curves were determined. New curves were calculated to give a focal ratio of f/15, and the Sinden Optical Company of Newcastle undertook the required grinding and polishing. David Sinden took charge of the all important colour correction. Jack took it upon himself to oversee the making of the telescope parts – cell, tube, baffles, and focusing unit. The completed refractor was mounted on the equatorial mount in the workshop at Billingham by the end of 1991.

In the April of 1992 an article appeared in the astronomical magazine *Popular Astronomy* describing the completed 8-inch refractor and the proposed building of an observatory. The article carries a picture of Jack being dwarfed by the completed refractor.

During 1991, while Jack was busy working on the large refractor, he also found time to build a telescope for observing prominences on the edge of the sun – a "Promscope". On the 17th June an article describing the instrument appeared in the *Daily Telegraph*, on page 12, together with a photograph of Jack and John McCue, with the telescope, in Jack's observatory. The article also mentioned the building of the 8-inch refractor and its proposed observatory. The notion of observing the sun by the general public was included in the thinking behind the observatory at this time. This was to become another facility.

In August 1997 we acquired an Ultima 1¼" eyepiece with a 42mm focal length giving an apparent field of 36 degrees; this was paid for by Barry Hetherington. Also in 1997 the telescope was completely refurbished by John McCue, Ian Miles and Jack Youdale.

The operation of the telescope was extended into daylight hours by the purchase of a Solar Filter for 'white-light' observations of the sun, and a Hydrogen Alpha Filter (1½ angstrom) for observing solar prominences with the 8-inch aperture stopped down. These filters were purchased by the County Council and proved to be invaluable during open days.

The New Telescope

A former society member, John Nichol, who now operates under the name of Nichol Optical, figured a new 19-inch Newtonian f/4 reflector mirror and offered it to the society in May 2001 at a price that we couldn't refuse. Its coating was applied by David Sinden of Sinden Optical, Newcastle. Nichol Optical also provided the 4-inch minor axis secondary elliptical flat mirror. The mirror and flat were placed into a new aluminium tube made by Hendersons (Teesside). The building of the main telescope tube and mounts were undertaken by Bob Mullen and John McCue, Jack Youdale built the primary mirror cell, and Ed Restall provided the secondary mirror mount and spider. The new reflector was placed on our original mount and will be used for minor planet observations imaged by a new CCD camera.

At the present time the 8-inch refracting telescope is in storage – the intention being to eventually shorten its length by folding its light path and mount it alongside the reflector

The Observatory

On the completion of the 8-inch refracting telescope it was very clear to all concerned that the new instrument would require a permanent building on a suitable observing site. Plans had been drawn up as to the type of observatory building we would like, as well as ideas as to where it might be sighted. A meeting was arranged to which Councillor Mauren Taylor would attend, along with other interested parties within the Cleveland County Council. This took place on the 27th August 1991 when the parties endorsed the idea of a public observatory to be sited on the Castle Eden Walkway Country Park, Thorpe Thewles – the home of the new observatory.

Letters were exchanged and meetings arranged with the Architects Department of the County Council with regard to the best observatory design. It was decided that the observatory dome be purchased from Ash Domes in the USA, and the supporting structure built by a local work training programme. Archon 2000, a Stockton training provider, funded by the Training & Enterprise Council, undertook the work

The *Northern Echo* of the 15th October 1992 carried an article to the effect that a plan for the observatory at Castle Eden Walkway Nature Reserve had been sent to Stockton Borough Council. This was subsequently approved.

The construction of the building consists of a circular ash framework on which is mounted the dome. The ash framework was clad on both sides with marine-plywood and then the outer brick walls were added for weatherproofing.

The observatory was completed by the end of 1993 and the official opening ceremony was performed by Professor Sir Arnold Wolfendale, the Astronomer Royal, of Durham University, and Councilor Ted Wood, Chairman of Cleveland County Council, on the 9th February 1994.

Throughout the early years in the observatory it was clear that the structure of the building was not completely waterproofed. During heavy rains water was seeping into the building and standing on the floor. This standing water was doing damage to the main wooden supports under the dome.

On the 2nd July 2002 a major refurbishment of the observatory started. The 8-inch refractor was removed from its mount and put into storage. Terry Waugh and his NACRO team carried out the lion's share of the building's reconstruction work. The damaged timbers were all removed and replaced with a concrete wall, and a new damp course was added to the building.

The opportunity was also taken to prepare the observatory for our new telescope. Because our new 19-inch Millennium reflecting telescope is much shorter than the refractor a new false floor was constructed some five feet above the base. An internal staircase was constructed to reach the new level. To the top of the staircase is fitted two trap doors which can be lowered to enable all of the floor space to be used without the risk of anyone falling through. The space under the floor is to be used for storage. Because of the raised floor, observers can now look through the slit in the dome and see the horizon.

The Planetarium

Proposals to build a Planetarium at our observatory site were first formalised in the spring of 1996 when John McCue, Jack Youdale, Ray Worthy and Ian Miles produced a document which was presented to the councillors who were behind the original observatory scheme. This received a boost when, in November 1997, a friend of Ray Worthy, Johan Gijsenbergs, Director of the Europlanetarium in Genk, Belgium, offered us a Spitz A1 planetarium projector - free of charge.

In 1998 we received a grant of £5,000 from the Ropner Trust. On the 28th February 1999 Suzannah Clarke, principal soprano of the English National Orchestra, and Kate Wilson, virtuoso harpist and accompanist to Tom Jones, under the title of *Angles of the North*, gave an afternoon concert in Stockton Parish Church, which raised £613 for the Planetarium fund. On the 1st-3rd June 1999 Jill Kears, Tom Ripley, Dave Dods and John McCue did a sponsored coast-to-coast cycle ride which brought in £218. On the 12th November 1999 a grant of £1000 was received from the Community Development Committee which we earmarked for a sound system. By the beginning of the year 2000 a grant of £30,000 was received from the European Community European Social Fund; this brought our total funding to £42,000.

The site for the building was finally agreed on in February 2000. The Stockton Training Employment Services provided the labour force. Although this would mean that the building would be “cost free” we would not have exclusive use of the workforce as they had other commitments with the council, so it would be impossible to give a definite completion date. The steel frame was built by Structures (Teesside) Ltd. and was ready to be put in place as soon as the foundations had been laid.

Members of the Planetarium Committee attended the British Association of Planetaria AGM held at Jodrell Bank on the 8th April 2000. The purpose was to establish contacts and benefit from the experience of others in the field of planetarium operation from across the country.

Work began on site on the 17th April 2000. A major hold-up occurred in 2001 with the outbreak of Foot-and-Mouth disease, when access to the site was prohibited for most of the year.

The possibility of a full-time salaried planetarium operator was first put forward in October 1999. On the 6th June 2000 an approach was made to John Bennett, Chief Executive of the Tees Valley TEC, and to Stanley Bradford, Director of Education of Stockton Borough Council, about the possibility of funding a full-time Planetarium Director. In August we were awarded a grant from the Tees Valley TEC of £10,000 as a contribution towards the salary of a suitable employee, subject to the continued employment of the Director in subsequent years by the Borough Council.

The sound system for the planetarium was ordered in October 2000.

The original projector for the planetarium, a Spitz A1, was discovered languishing in a cupboard below the large telescope at the Europlanetarium in Belgium by Ray Worthy. In February 2001 Ray commenced to overhaul the projector, including all the electrical circuits. Also at this time a trench to take electronic cables was commenced to connect the observatory to the planetarium with the view of permitting us to project on the dome live views seen through the telescope via a CCD camera.

The Planetarium’s 70 tilt plush seats came from the former Odeon Cinema, Middlesbrough.

Dr. Alan Chapman of Wadham College, Oxford University, officially opened the Planetarium building on the 9th November 2001. After unveiling a commemorative plaque he treated the audience to a lecture on *Astronomers of the Northeast*. The “Public Opening” of the building, in the presence of VIPs, Councillors, a local choir, and a return visit of the *Angles of the North*, took place on the 26th February 2002. The facility opened full-time on the 8th April.

The alignment of Jupiter, Saturn, Mars, Venus and Mercury in April and May 2002 brought BBC Radio Cleveland to the Planetarium on the morning of the 19th April, and, later that day, the TV Look North camera crew filmed presenter Tony Baker asking Jack Youdale, live on air, what was happening.

A film club was formed where members can come to the Planetarium once a month to watch classic and modern Science Fiction and Fantasy films. The first meeting was on the 28th June 2002.

In the summer of 2002 the British Association of Planetaria held their annual meeting in Glasgow, attended by Ray Worthy. Professor John Brown, Astronomer Royal for Scotland, heard from Ray about our planetarium and said that his department had an “Eros” Goto Planetarium projector, model E5, going spare. It arrived at our planetarium for the princely sum of £10 where it replaced the Spitz A1 projector.

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Did you recognise anyone?

Last month's picture of the teacher and his enthralled students appeared in the local newspaper at the time What year was the picture taken? 1968. Where was it taken ? Whinney Banks School – the Astronomical Society with visitors from other schools. How many can you name? David Bayliss is pointing to the heavens; John McCue is kneeling on the left and next to him is Frank Gibson, who is now teaching in New Zealand. What caption would you add to the picture?" My attempt – "And that big yellow orb is the Sun".

Transit Tailpiece

Quote/Unquote is from John Crowther, who suggests that these are relevent words for a telescope maker or sky watcher :-

A man who looks on glass, On it may stay his eye
Or if he pleaseth through it pass, and the heavens espy.

From a hymn by George Herbert

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.

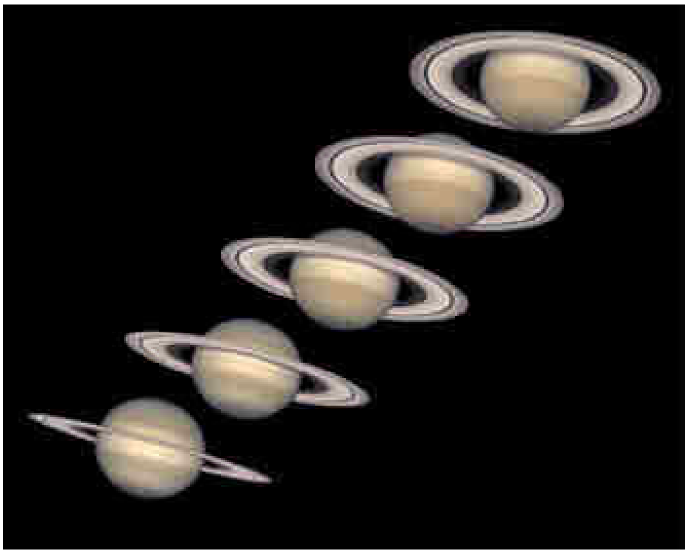
Sunderland AS Contact them at www.sunderlandastrosoc.com to see how they are progressing with the new Observatory at Washington Wildlife Centre. If you wish to attend their meetings you are assured of a friendly welcome.

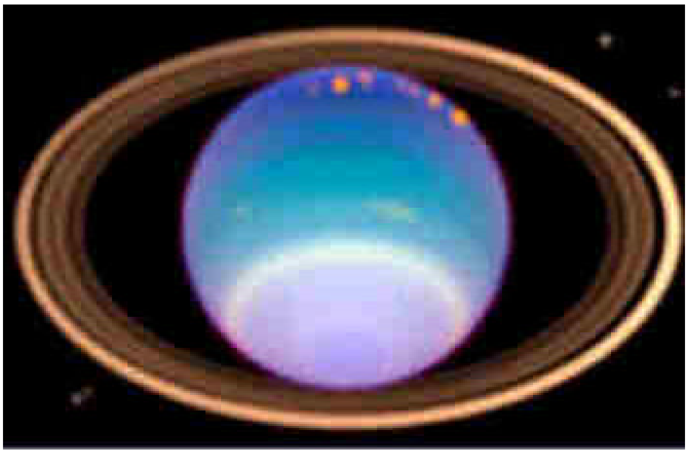
York AS have a website at www.yorkastro.freeserve.co.uk and an excellent programme of lectures, if you wish to go along.

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 Pictures





To complement the view of Mars on the front page, two more planet images from the Hubble collection. In this image, the rings of Uranus rival those of Saturn