

FEBRUARY 2013

TRANSIT

The journal of the Cleveland and Darlington Astronomical Society

**CADAS Member receives
2013 Fowler Award**

Sharing the P, B and J

Visit the Seven Sisters

CONTENTS

	Page
Editorial with guest editor, Andy Fleming.....	3
Letters from John Crowther and Neil Haggath.....	4
Society News.....	6
Skylights by Rob Peeling.....	7
Sharing the P, B and J by Andy Fleming.....	9
Knowledge, Certainty and the Road to Auschwitz by Andy Fleming.....	13
Astronomy for Everyone: Visit the Seven Sisters by Andy Fleming.....	18
Those Magnificent Men in Their Moon Machines by Andy Fleming.....	20
The Light-Not-So-Fantastic by Andy Fleming.....	21
Astronomy for Everyone: Look Again at the Plough by Andy Fleming!.....	23
Transit Quiz:Where in the Universe Challenge (including answers for January).....	25

NEXT MEETING



Friday 8 February 2013, 7.15 for 7.30 pm at Wynyard Planetarium
CaDAS Annual General Meeting followed by Members' Night
Presentations

COVER PHOTOGRAPH

M33, the Triangulum Galaxy imaged at Dalby Starfest, August 20, 2012, courtesy KEITH JOHNSON.



OPINION

with Guest Editor, ANDY FLEMING



Welcome along to February's issue of your *Transit* magazine in which I'm honoured once again to have been asked to be guest editor. Once again your journal is packed with astronomy news, features and ideas and targets for amateur observing in the night sky. Your regular editor, Rod Cuff invited me as always to 'do my own thing' so for a complete change we're out of the regular magazine visual format (for this month only) with not only my creative writing skills at test, but my artistic ones too!

The year has started on a high for UK amateur astronomy, thanks mainly to the BBC, despite us all still reeling from the sad loss of Sir Patrick Moore, covered so well in the previous issue of *Transit* by Neil Haggath. The popularisation of science and astronomy in particular has never been higher up the media's agenda and BBC2's [Stargazing LIVE](#) is becoming somewhat of an annual national institution. The passion for the subject as portrayed by Dr Brian Cox and Dara O'Brien is truly infectious with even local newspapers becoming inspired to publish articles about our hobby.

Many of you will have been involved in various *Stargazing LIVE* initiatives, particularly outreach activities with the general public. For example, I was involved at a star party at RSPB Saltholme organised by CaDAS member and founder Dr John McCue in conjunction with the RSPB. With a portable planetarium, several telescopes and volunteers, the attendees were treated to a fine evening of shows, videos and stunning views through the eyepiece. Many of these members of the public were keen ornithologists and hence already interested in science and nature, but nonetheless looked in awe and wonder at the sight of objects such as Jupiter and its Galilean moons or the Orion Nebula through a telescope. They saw Betelgeuse on-screen on BBC2... it was even better in full High Definition through a telescope!



And showing friends, family and the public the beauty of the night sky and explaining to them their place in space and time is a profoundly moving experience. To me it's a wonderful, spiritually uplifting facet of our science. I thus urge all of you to participate in sharing your interest, your astro-images, your equipment and knowledge with the wider world. You'll be following in the footsteps of some of the true popularisers of science, typified in the broadcast media by Jacob Bronowski, Sir Patrick Moore, Dr Carl Sagan and latterly by Dr Brian Cox in the UK and PBS's Dr Neil deGrasse Tyson, Director of New York's Hayden Planetarium in the US.

My article on page nine documents my own attempts to raise the profile of amateur astronomy locally both in the broadcast, digital and printed media, and ideas of how you can get involved in helping inspire others into amateur astronomy. Ultimately, there is of course

a hidden benefit in popularising astronomy and science, and one that was all too apparent to the late Dr Sagan, even as he was criticised by some of the scientific temple's high priests for engaging with the public. For it is the self same public who by and large pay the taxes to fund astronomical research, space exploration and science in general. To get the public on side regarding science and astronomy, whether it's Brian Cox inspiring via the BBC or yourself down at the pub doesn't really matter. But strong public support and interest is vital because it means at a time when state budgets are being cut nationally, reducing science funding will be much less attractive to politicians, especially when the ballot box looms! Good luck with inspiring and engaging friends, colleagues and the public!

Many thanks to this month's contributors, Rob Peeling, John Crowther and Neil Haggath. The deadline for *Transit's* March edition, when Rod will be back in this seat (contact details are below), is **Wednesday 27 February, 2013.**

Please send items for March's issue to Rod Cuff: info@cadastastro.org.uk; 1 Farndale Drive, Guisborough TS14 8JD (01287 638154, mobile 07775 527530)

LETTERS

From JOHN CROWTHER



Although I haven't been able to get to the last few meetings, I greatly enjoyed the last magazine. Long may they continue. Thanks to the contributors and to Rod. May someone step forward to be our new editor.

Neil wrote a good appreciation of Sir Patrick and his work. Unfair criticisms in the media show up their compilers. They are either publicity seekers or are small-minded, being jealous of another's achievements and talents. Probably a bit of both.

Unfortunately there are a number of them around. They may make money when they write about those who in our eyes have been courageous and successful. So our memories are spoiled when they attack such people as Captain Cook or Scott of the Antarctic. A text says that "their works do follow them" This applies both to those whose evil lives have been revealed and to those who have been brave, talented and good, as Sir Patrick was.

Further on we had Ray's article which took up six pages. It was probably the longest yet in *Transit*, and very interesting, especially for older members who have young grandchildren.

Peter and Ray met through Peter's grandfather and so the skilled teacher and the young prodigy were the right people in the right place, at the right time.

The second story about Bobby was a negative one. It described a boy suffering from dyslexia. Nothing much could be done to help because of the shortage of money in a large rural county in the south west.

The two cartoons in Ray's article had two lookalike academics, one in a white coat with masses of evidence and one with just the Book of Genesis.

But it wasn't really fair to those long go writing about their ideas on creation. For the two creation stories at the beginning form a magnificent attempt by a Bronze Age civilisation to explain the world as it appeared to them.

For all of us "stand on the shoulders of giants". Perhaps the artist realised this because the faces and figures are almost identical. The scientist though has long hair and moustache whilst the creationist has cranium bumps and less hair for "grass does not grow on busy streets".

Archbishop Usher's dates, as to the day, hour and year of creation seem to reflect he mind set behind the centuries which passed before the Roman Catholic Church apologised for its treatment of Galileo and finally took his writings off its list of prohibitive reading for its members.

Fairy tale science: Definitely not astronomy although I'm finally mentioning it. The children didn't need Enid Blyton books but Robert Louis Stevenson's, "a child's garden of verse" where the sun tells the moon off for coming out during the day.

Years ago I heard a primary school teacher explain why summer is hotter than winter. "It's because the Sun is closer to us in summer and further away in winter".

"Wot no almost circular orbit and more importantly no 23.5 degree tilt of the Earth's axis?"

For she was a misguided as the Evening Gazette which last year had its picture entitled "Sunset over Saltburn" showing that it didn't know east from west.

Thanks Ray for your article and for getting me stirred up, and keep them coming.

From NEIL HAGGATH



Ray Worthy's article in the January issue was a fascinating read. I would like to add another factor which can hamper people's ability to learn – their preconceived ideas. Sometimes, it seems, if someone has a false preconceived notion engrained deeply enough in their mind, nothing that anyone says to the contrary will ever get through to them.

A case in point. In 1990, during one of the UK's National Astronomy Weeks, the Dark Skies 2000 Campaign was launched, with the aim of educating the public – and the Government and councils – about light pollution. Inevitably, some people completely misunderstood it, and thought that astronomers wanted to "turn all the lights out", or to get rid of streetlights altogether.

Of course, the organisers knew that most of the public wouldn't care about preserving the night sky for astronomy, so when talking to non-astronomers, it was important to emphasise the financial and environmental aspects of light pollution. Wasted light means wasted electrical energy, which in turn means wasted public money. It also means wasted fossil fuels, which in turn increases the more familiar kind of pollution.

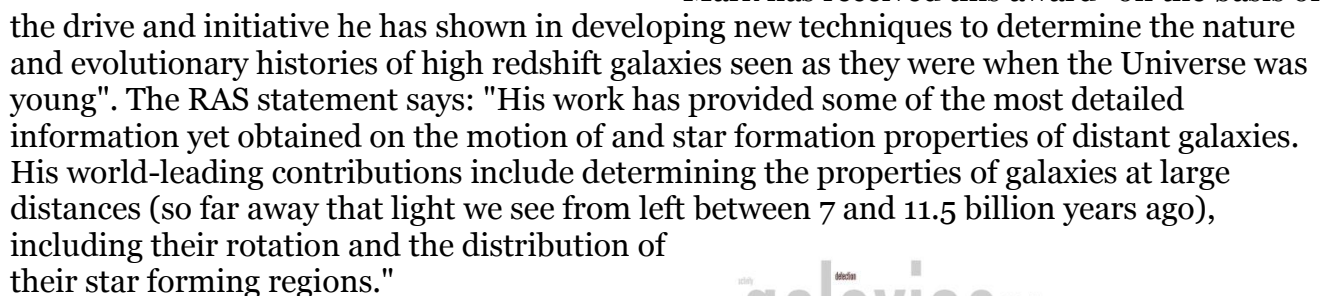
During that NAW, CaDAS had a public display in a Stockton shopping centre, with the hope of attracting new members. We were also publicising the Dark Skies 2000 Campaign, and giving out leaflets.

While I was manning the display, one chap who was passing noticed the Dark Skies 2000 poster, and came and asked me what it was about. His manner of asking bordered on confrontational, indicating that he had already made up his mind about the "astronomers

To this day, I can remember the exact words which I used to conclude my argument; I said that if streetlights were designed efficiently, “you could achieve the same level of illumination on the ground, with half the electrical power!”

He replied, “But then how would we see where we were going?”

via NEIL HAGGATH

[illegible]

Skylights - February 2013

By Rob Peeling

Hours of Darkness

GMT	Astronomical Twilight
1 st February	18:54 to 05:53
28 th February	19:42 to 05:04

The Moon

	3 Feb	10 Feb	17 Feb	25 Feb
	Last Quarter	New Moon	First Quarter	Full Moon
Rise	00:46	06:57	09:59	17:37
Set	10:17	17:51	00:54 (18 th)	06:14 (26 th)

Planets

Jupiter is between the Hyades and Pleaides making this part of the sky together with Orion the main focus for attention in February. Look out on the 18th Feb when the 1st quarter moon is close by.

Here is a list of convenient transit times for the Great Red Spot. You will need steady seeing and high power.

Feb 1	20:59 UT	Feb 16	18:26UT
Feb 3	22:37	Feb 18	20:05
Feb 4	18:29	Feb 20	21:43
Feb 6	20:07	Feb 22	23:22
Feb 8	21:46	Feb 23	19:14
Feb 10	23:25	Feb 25	20:53
Feb 11	19:17	Feb 27	22:32
Feb 13	20:55	Feb 28	18:23
Feb 15	22:34		

Saturn rises at 1 am at the start of the month and getting up earlier as the month progresses to rise at 23:30 at the end. You might be able to catch the end of an occultation of a faint (mag +11.5) star as Saturn rises on the morning of 26th Feb with emergence from behind the rings. The ring angle is now wider so it ought to be possible to pick out the planet's shadow on the rings as they pass behind. So far this year I've only glimpsed Saturn on a few early mornings as I have got up early for business trips.

Deep Sky



Beta monocerotis is a lovely triple of white stars (use high power). To the north-east of beta lie the Rosette (NGC 2239) and Cone (NGC 2264) nebulae. These are worth a look to see the associated open clusters but the nebulae themselves are very difficult to see. Something like a CLS or UHC filter will be needed I think. The star 15 Monocerotis marks the base of the Christmas Tree cluster. Where the fairy should be on the top of the tree is the tip of the eponymous Cone nebula. You will need some sort of star atlas to help you navigate in this region of sky. Below NGC 2264 in the sky is NGC 2261, Hubble's Variable Nebula (*in the Hubble image to the left*). This is a tiny arrow-shaped wisp emerging from the star R Monocerotis. Regular observations of this object will be welcomed by the BAA or SPA to provide a record of the light variations from the nebula. Variations occur on a timescale of a few weeks.

If you are up for a bit of a hunt, then try the open cluster NGC 2301 further to the east. This is a lovely bright little cluster.

Use Sirius and beta Canis Majoris to its right as pointers to sweep eastwards (left) with binoculars or your finder to find first M47 and then M46 lying within 2 degrees of each other in the constellation of Puppis. Both are open clusters. M46 is a personal favourite because lying within the cluster is a planetary nebula, NGC 2438. Since the cluster is low in the sky from Stockton you will almost certainly need a nebula or OIII filter to find this planetary for the first time. The planetary nebula is probably not associated with M46 itself but it is not yet clear whether it lies in front of or behind M46. The problem is the lack of an accurate method of measuring the distance to a planetary nebula.



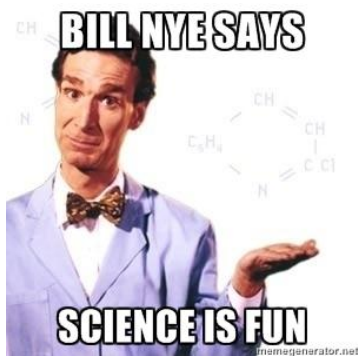
M46: Credit & Copyright: Roth Ritter (Dark Atmospheres)

SHARING THE P, B AND J

by ANDY FLEMING



[BBC2's Stargazing Live](#) presenters: Brian Cox and Dara O Briain. Photograph courtesy of the BBC

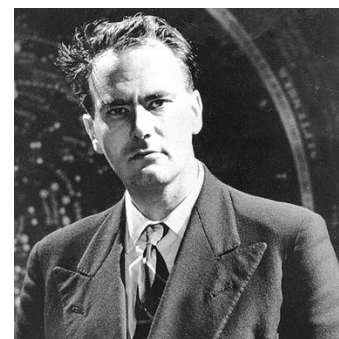


The late NASA astronomer and science populariser [Dr Carl Sagan](#) once wrote about his passion for science stating that when you're in love with someone or something, you want to tell the world. And he was in love with science and astronomy.

To socialise is a strong human trait, we are after all perhaps the most social of animals; hence the popularity of internet social media such as Facebook and Twitter. And such media are a potent tool when it comes to inspiring others to become involved with our own interests and hobbies. It's what the Chief Executive Officer of the Pasadena, California-based [Planetary Society](#), the [Science and](#)

[Planetary Guy Bill Nye](#) calls sharing the P, B and J; the Passion, Beauty and Joy of astronomy and space exploration.

So who inspired you into the subject of astronomy, space exploration and science? Was it one of the pioneering popularisers of the twentieth century using broadcast media to convey their interest and passion and to help inspire you into the hobby or perhaps scientific career? Perhaps it was [Jacob Bronowski](#), [David Attenborough](#), [Carl Sagan](#) or [Sir Patrick Moore](#). Or perhaps it was one of the contemporary popularisers of science such as [Dr Brian Cox](#) or [Dr Neil deGrasse Tyson](#). It could have been reading up on the lives and thoughts of the early Ancient Greek natural philosophers



or indeed perhaps discovering the paradigm-shifting discoveries of Copernicus, Kepler, Galileo, Newton, Einstein or Hubble. Or it could have been a friend or family member who shared and inspired you into their passion, perhaps even throwing in some optical equipment such as a pair of binoculars or a telescope!

Whoever it was, why not give something back to the subject and spread the word of science? If you're enthralled by astronomy and have experienced the spiritual uplift of realising your place in space and time you quite possibly have a yearning to share your interest and lobby to support initiatives in science and space exploration. You're obviously a member of your local astronomical society, but you're

possibly wondering what else can you do to promote your passion and hobby?

In the twenty first century there's much you can do without even leaving the comfort of your own home. For starters, why not join an astronomy forum, or even better, join the blogosphere. You'll soon be publishing by registering free for a service such as [Google Blogger](#), or start a traditional website at one of the free web hosts such as <http://www.webs.com/>. If you can find objects in the night sky through a telescope and know how to switch a computer "on", you'll find publishing on the internet easier than A,B,C!



If you're into astro-imaging then this is a great place to upload and showcase your images, videos or sketches. Alternatively you can publish your own astronomy posts on subjects of your choice. These may include your observing notes, articles and news from the world of astronomy and cosmology that you may wish to publicise. In addition to your own articles, guest bloggers can be engaged and of course press releases and photographs can be reproduced without royalties from organisations such as [NASA](#), [JPL](#), [ESA](#), the [European Southern Observatory](#), the [W M Keck Observatory](#) on Mauna Kea, Hawaii and indeed virtually every other astronomical research establishment in the world! Publicising your posts



for free on social media and bookmarking sites such as [Reddit](#), [Stumbleupon](#), [Facebook](#) or [Twitter](#) will mean your blog will soon be attracting thousands of readers and

subscribers, along with all of their comments (which you can moderate!). My astronomy blog [Andromeda Child – Our Amazing Universe](#) that I started in February 2011 has to date accrued over 210,000 hits!



Two of CaDAS member Keith Johnson's superb astro-images as showcased in September 2012's Transit magazine. They are M31, the stunning Andromeda Galaxy (left) and M27 the Dumbbell Nebula in Vulpecula (right).

In addition to the internet there's also this CaDAS *Transit* monthly magazine where you can share your experiences with other astro-folk. Or perhaps you could share your passion by producing a CaDAS meeting presentation on a subject of your choice for 2013/14 meeting programme. If so see Neil Haggath at the next meeting! Of course, there's also helping at a star party, perhaps at the Wynyard Planetarium or, as I have done recently in connection with [BBC2's Stargazing LIVE](#) at another venue such as the RSPB's superb centre at Saltholme near Port Clarence.



If you have connections with the media then network and utilise your contacts and skills. Local newspaper editors particularly like ready-made articles about astronomy, cosmology and science in general. This particularly the case now as competition from the internet and new media means many newspaper groups no longer have the funds to employ dedicated science correspondents. Well-written press releases with succinct information and contact details are much appreciated. An example of what can be achieved is illustrated by a recent interview I had with Stuart Arnold at the *Northern Echo*. My

input was part of a story that again was being published to celebrate BBC2's *Stargazing LIVE* entitled [Fresh Focus on the Night Sky](#).

Of course if one's work and passion for astronomy can be included in the free-to-air broadcast media then a real sense of fulfilment can be achieved and you can literally have the attention of thousands of viewers or listeners for maximum impact! Juergen Schmoll and Keith Johnson have both had their superb astrophotography regularly featured on the BBC1's very popular [Sky at Night](#) programme, and indeed have both been interviewed with their equipment for the programme. An inspiration indeed for all budding astro-imagers!



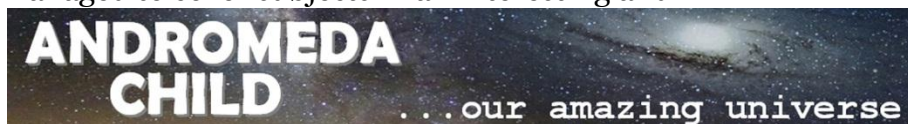
I've managed to dovetail my lifelong interest in radio, music and astronomy into a weekly five minute slot at approximately 1425h CET each Sunday on my four-hour Solid Gold Sunday show on [102.4 Radio Hartlepool](#). The show can be listened to live on 102.4MHz in Hartlepool and surrounding areas and live online at [www.radiohartlepool.co.uk](#). Once again, Jason Anderson, Radio Hartlepool's Managing Director was quite literally "over the moon" to incorporate an astronomy strand into the station's output and was well aware of the popularity of astronomy due in part to the success of [Dr Brian Cox's numerous BBC television series](#).



Recordings of the weekly segment have been edited and stored as a podcast download on my [audio archive page on my Andromeda Child blog](#). Each weekly feature has been tailored to be of inspiration and interest to the general public. Of course one is always open to the accusation of 'dumbing down' the subject, but since April, 2012 I've managed to cover subjects in an interesting and

inspirational style as diverse as black holes, exoplanets orbiting Alpha Centauri B, astrophysics, numerous constellations, SETI

along with a monthly 'What's Up?' segment. It's amazing what you can communicate in a few minutes on the radio, and hopefully through my sound bites, the seeds are being sown in the minds of some of our listeners to explore the subject further.



Popularising astronomy either via star parties and outreach or via the media is a very rewarding past time and one I can certainly recommend to all CaDAS members. [Carl Sagan](#) said many times that it is the birth-rite of every child to know their true co-ordinates in space and time, and by now you may think you can help in and enjoy the task of enlightening the public.

Your involvement will also bring one further massive benefit for astronomy and science I haven't mentioned: the public are the ones who pay the bill via their taxes for much astronomical research and exploration either solely in the UK or as collaborative efforts with other countries via projects such as the [European Space Agency](#) or the [Large Hadron Collider](#). It's vitally important that amateur astronomers get as many of the public interested in science as possible to bring pressure to bear on elected politicians to save funding for science. When politicians and the electorate are confronted by cost-saving measures, it's another field that's cut rather than the scientific seed corn upon which our future technology, economy and ultimately the UK's future success will be built.

Who knows, something may even be done about light pollution... now that would be a real result!!

Knowledge, Certainty and the Road to Auschwitz



Left: It's August 20 1977 and the NASA/JPL Voyager 2 spacecraft launches atop a Titan IIIIE/Centaur heavy lift booster from the NASA Kennedy Space Centre at Cape Canaveral, Florida. It's trajectory, that encompassed the famed 'grand tour' of the planets of the outer solar system, their rings and moons was planned to exquisite levels of accuracy using the centuries-old Newtonian Laws of Motion and Universal Gravitation. At non-relativistic speeds or in the absence of strong gravitational fields they are still perfectly adequate. Credit: NASA Marshall Space Flight Center (NASA-Marshall Spaceflight Centre).

January 27 was [Holocaust Remembrance Day](#).

In tribute to its victims, ANDY FLEMING investigates knowledge and certainty, and how a society that dispenses with scientific scepticism inevitably ends in tragedy...

All of my life I've been fascinated by science, and although I'm not a scientist (although I was a laboratory analyst at ICI for many years, and I'm an amateur astronomer!) I still consider science to be the best human method for explaining how we, and the entire cosmos came to be. Unlike other areas of human endeavour such as religion or politics, our scientific theories, although only approximate descriptions of reality, are testable, falsifiable and most importantly, can be verified by peer review. This cannot be said of the other enterprises mentioned, as instead of logical, rational thought, they rely on each individual's belief systems and their hypotheses are hence not testable in the real world.

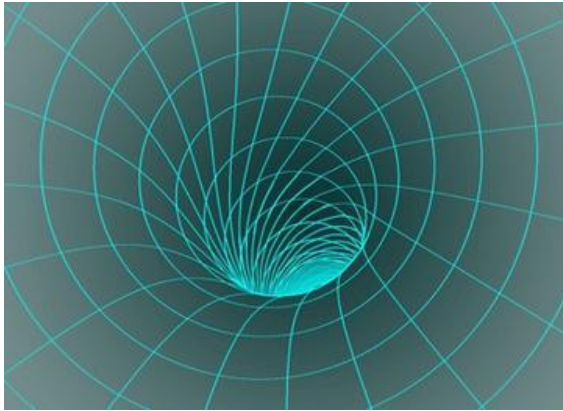
Humankind's scientific theories are however, at best only approximations of reality, albeit often exquisitely accurate approximations. Over decades and centuries they have been developed and amended in the light of better data and evidence. For example Newton's Laws of Motion and Universal Gravitation were perfectly adequate up to 1915, and indeed are still used in determining a spacecraft's trajectory. Such an example is NASA/JPL's's New Horizons probe to Pluto, due to arrive with perfect accuracy to the nearest second at that distant dwarf planet in 2015. However, Sir Isaac Newton cannot be placed in the driver's seat in very strong gravitational fields or at relativistic velocities (speeds approaching that of light), due to effects including time dilation and Lorentz length contractions. It is in such situations that Einstein's Theory of General Relativity, developed from the edifice of Newton's work must be engaged.



Isaac Newton in 1689 (left). His Laws of Motion are perfectly adequate for launching spacecraft to the stars. Albert Einstein as a young man in the early twentieth century (right). His Theory of General Relativity builds on Newton's work at relativistic speeds and in regions of strong gravitational force, and is a requirement when adjusting clocks in GPS deep space systems due to even miniscule amounts of time dilation as a result of the varying strength of the Earth's gravitational field both on the planet's surface and in orbit.

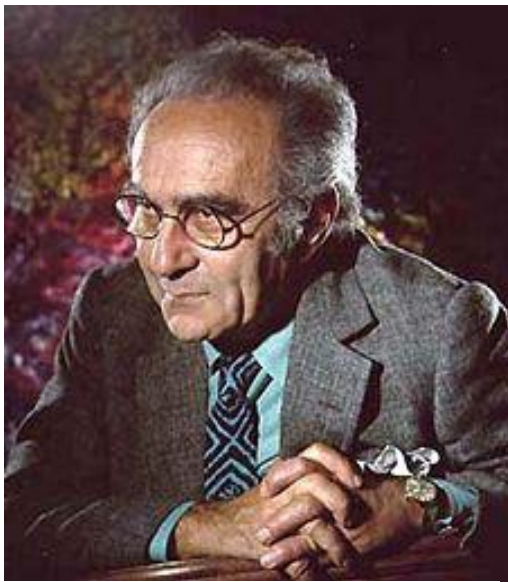
Through science's language of mathematics and its empirical research and practical experimentation, the two pillars of modern physics (seemingly bizarre in their verified predictions to both the public and scientists alike) – Quantum Mechanics and General Relativity are supremely accurate descriptive approximations of physical reality. Most

importantly for our civilisation, and unlike the revelations, myths and prophecies of pseudo science and religion, they bring home the bacon, witnessed by the presence in our lives of television sets, computers, the internet, the Global Positioning Satellite (GPS) system, telecommunications, nuclear power – the list is seemingly endless.



Spacetime being dragged and contorted in the bottomless infinite gravity well of a black hole (left). Einstein's Theory of General Relativity, his 'theory of gravity'... forecast these bizarre objects decades before their discovery and fully accounts for their effects on the surrounding cosmos. In General Relativity Einstein also merges spacial and temporal dimensions into one: space-time, and introduces the equivalence of indistinguishability of acceleration and gravity.

However, despite all the enormous benefits that the scientific enterprise has brought to human kind – life-saving vaccines, medicines and medical procedures, electronics, technology... even the manned and robotic exploration of our Solar System, there remains a concerning mistrust within the general population of science and scientists. As explained above, science and its theories, as a human activity is never perfect. Scientists are not infallible, possessing the same vulnerabilities, frailties, prejudices and personal agendas as each and every one of us. And let's face it... science and mathematics are difficult subjects... such accurate models and descriptions of reality based on evidence and calculation are never going to be instantly decipherable to the layperson without at least some scientific education.



The late Dr Jacob Bronowski, responsible for the epic 1973 BBC Television documentary series, "The Ascent of Man". (Image courtesy of the BBC).

When it comes to the general public understanding of science, there is also the issue of public science education (or lack of it) in the West. As Sagan (1994) pointed out, we have conspired to produce a situation where our societies and economies totally depend on science and its offspring, technology. And yet virtually nobody knows anything about science. With scientific decisions being taken over important issues such as climate change, energy supply, atomic power, atomic weapons and stem cell research by largely scientifically illiterate members of the public and their elected representatives, it's a policy that's likely to blow up in our faces... indeed we are lucky to have come this far.

However, I think that the distrust and suspicion of science has another reason all together, and this can be found in some of humanity's darkest moments and activities. I'm talking about the misuse of science, especially by political authorities, exemplified in weapons of mass destruction, the holocaust in Nazi Germany in which eight million people were murdered, and the fact that in the 1960s over half of the world's top scientists were involved in some respect in the atomic

arms race between the former Soviet Union and the United States. The battle lines were

drawn through the very heart of the scientific establishment, the further development of Robert Oppenheimer's Manhattan Project 'bomb' being simultaneously propounded by Edward Teller, and yet vehemently opposed by that greatest of all scientists... the genius Albert Einstein.

All of the above historical abuse and misuse of science are emphatically not, however, the fault of science itself. As that brilliant polymath Dr Jacob Bronowski (1973) explains in his fabulous chronology of the development of the scientific method, and how science works, [*"The Ascent of Man"*](#), it is what happens when human leaders aspire to the power of gods and believe they have absolute knowledge and certainty. It is also, as Sagan (1995) states what happens when the population at large indulges in a philosophy of ignorance stemming from a high degree of scientific illiteracy and an absolute lack of healthy scepticism. It is the epitome of Bronowski's "push button society" complete with a total absence of any check in reality, the very cornerstone of true science.

The very bedrock of the scientific enterprise is testability, repeatability, falsifiability and verifiability by peer group. No other area of human endeavour is so unsympathetic to an individual's challenging new hypotheses. Indeed, scientists still compete for a Nobel Prize to be the first to discover cracks in Einstein's greatest achievement... his Theory of General Relativity, despite the fact that it is nearly one hundred years old. And certainly at some point in the future, someone somewhere will nail down a flaw in Einstein's edifice. And therein lies another unique facet of science... unlike politics or religion there are no "authorities" in the subject... no "high priests".



Anyone can make an astonishing discovery and propound a new theory, but it must be falsifiable, verifiable and testable. After all, Einstein was slow to learn to talk, a difficult pupil at school (which he left early), held an ordinary position as a patents clerk in Berne, Switzerland, and yet went on to be the most famous scientist of the twentieth century. His concise and humbly titled 1905 paper "On the Electrodynamics of Moving Bodies" ushered in the paradigm-changing concept of special relativity and the age of modern physics.

To be successful in science one needs imagination and scepticism both. Regarding the former, there is no greater example than Einstein's strides in relativity, all derived from one amazing imaginative thought... what would the world look like if one rode on a beam of light? What an amazing thought for a sixteen year old child. Little did he know it at the time, but this single thought would lead inexorably to nothing less than a total revolution in our concepts of space, time and energy. But imagination is not enough... scepticism is particularly important in the ability to distinguish fact from speculation.

I hope that by now I've explained adequately how all of our science, indeed all of our knowledge is never absolute, never certain. The pursuit of the truth may set you free, but through science you'll never acquire the absolute truth about the construction of reality.

But what happens when an individual or nation confuses its imperfect knowledge available through science with the unattainable ideals of certainty or absolute knowledge, and aspires

to the latter? Such aspiration, with no test in reality inevitably leads to the gates of Dachau, Buchenwald and Auschwitz. It results in the dispensing of scepticism by a whole people who are mindlessly prepared to allow their evil leaders to mislead and manipulate them.

In 1973, BBC Television first broadcast "[The Ascent of Man](#)", widely regarded still as one of the best documentary series ever made. The expensive sets, on-location filming around the globe, huge production values and the sheer enthusiasm of its presenter Dr J Bronowski were all attributes that would ensure its success. One such location was the pond outside the crematorium at the Auschwitz concentration camp in Poland, into which the ashes of millions of holocaust victims, including those of the relatives of Dr Bronowski were poured.

With certainty, but without any evidence in reality whatsoever, the Nazis believed all their victims to be inferior or sub-human. This despicable genocide was not perpetrated by science, or even by gas, it was committed by individuals defaulting to a push button society, individuals who were not prepared to confront their own ignorance, prejudice and arrogance.

Bronowski's ten minute clip at Auschwitz is regarded by many as the most poignant and moving moment in the history of broadcasting. As Bronowski scoops up the pond's sedimentary ashes, he is seen to have tears in his eyes as he logically explains how humanity allowed itself to stoop so low. He describes the unthinking, non-sceptical, non scientific push button society that was Hitler's Third Reich. Scooping up the ashes of a generation of people, he movingly states that,

"There is no absolute knowledge. And those who claim it, whether they are scientists or dogmatists, open the door to tragedy. All information is imperfect. We have to treat it with humility. That is the human condition; and that is what quantum physics says. I mean that literally."



Holding the ashes of Holocaust victims in the mud, Bronowski's entreaty to all humanity is that:

"We have to cure ourselves of the itch for absolute knowledge and power. We have to close the distance between the push-button order and the human act. We have to touch people."

Now please, if you have an internet connection click the following link and watch Dr Bronowski's clip filmed at Auschwitz and edited from my DVD collection of this wonderful documentary series. It is an excerpt from "The Ascent of Man", Episode 11, "Knowledge or Certainty", at the crematorium and pond at Auschwitz.

<http://youtu.be/dkgkook5jro>

Bibliography:

Bronowski, J., "*The Ascent of Man*", British Broadcasting Corporation Books, 1973. ISBN: 978-0563104988.

Sagan, C., "*The Demon-Haunted World: Science as a Candle in the Dark*", Ballantine Books, 1995, ISBN: 978-0345409461.

Astronomy for Everyone: Visit the Seven Sisters!

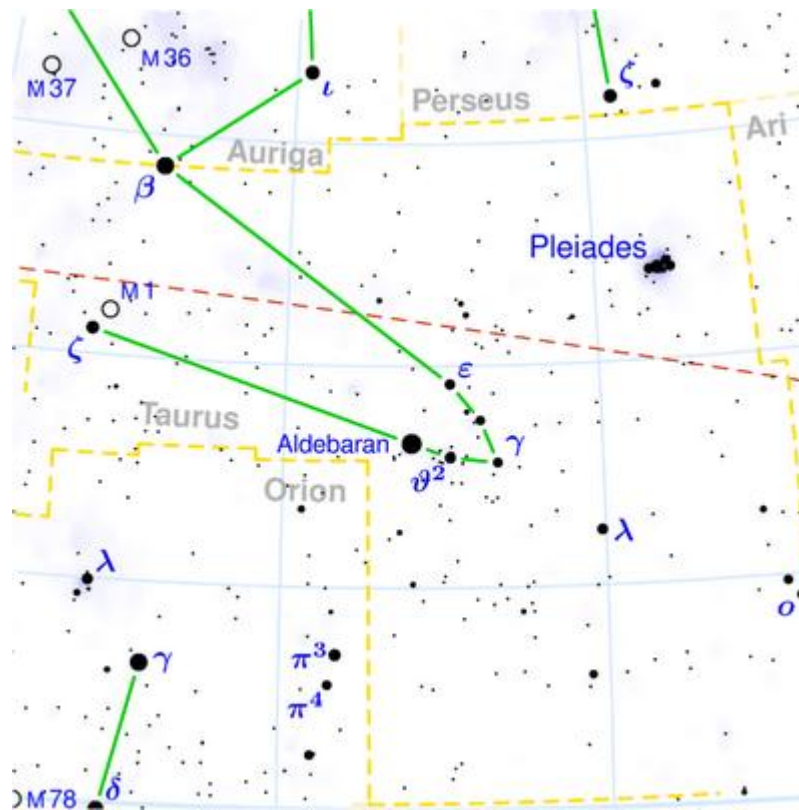


The beautiful Seven Sisters or Pleiades star cluster in the constellation of Taurus, complete with labels marking the main stars visible to the naked eye. Credit: Anglo-Australian Observatory/Royal Observatory, Edinburgh.

There are certain objects in the night sky that paradoxically and almost counter-intuitively appear much better with the naked eyes or with ordinary common or garden binoculars rather than expensive telescopes. One such object that also defies even the most appalling city and urban light pollution is the Seven Sisters or Pleiades open star cluster. With a prominent place in ancient mythology, it's perhaps one of the most popular astronomical targets for the beginner... after all most youngsters are either taught about this beautiful cluster of stars at home or at school. Some may also be familiar with the constellation from its appearance on the badge on the bonnet of Japanese Subaru cars: the manufacturer was named after the constellation.

In fact, The Pleiades cluster, otherwise known as Messier 45 far from containing the six or seven stars seen with the unaided eye actually contains hundreds, with many more becoming

visible through binoculars. For those in the northern hemisphere, the cluster is above and to the right of Orion the Hunter as one faces south in the constellation of Taurus the Bull, and it reaches its highest point in the sky, midway between rising and setting at around 4am in September, midnight in November, and 8pm in January.



Location of The Pleiades, M45. Look for the constellation of Orion the Hunter with his distinctive belt, and in the Northern Hemisphere, M45 is to the right and above.

The stars in the Pleiades are thought to have formed together around 100 million years ago, making them one fiftieth the age of our sun, and they are also close in astronomical terms to the Earth... just 425 light years away. They're very hot and hence blue in colour and indeed from a dark site strands and wisps of the star forming nebula of hydrogen gas from which the stars originated can still be seen.

The main stars have delightful names too emanating from Greek mythology, and being the seven daughters of Atlas and of Pleione, the daughter of Oceanus. Their names were Electra, Maia, Taygete, Alcyone, Celaeno, Sterope, and Merope. According to some versions of the myth, they committed suicide from grief at the fate of their father, Atlas, or at the death of their sisters, the Hyades. Other versions made them the attendants of Artemis, goddess of wildlife and of hunting, who were pursued by the giant hunter Orion, but were rescued by the gods and changed into doves. After their death, or metamorphosis, they were transformed into stars, but are still pursued across the sky by the constellation Orion to this day.

Finally, you may still be wondering why I recommended the naked eye or especially binoculars when looking at the Pleiades. The reason is quite simple: to gain the full effect of observing this beautiful 'open' star cluster you need to be able to see it all in the same field of view. The onus is on the word 'open', as M45 covers quite a large area of sky. The typical 4.5 or 5 degree field of view provided by 10x50 binoculars is just perfect. The limited field of view

provided by a telescope is disappointing as you won't see the beauty of the group in its entirety. You will however see more stars of course, and from a dark site, possible nebulosity.

Those Magnificent Men in Their Moon Machines



ANDY FLEMING reviews a superb documentary that reveals the gargantuan engineering task that faced NASA and its contractors in meeting President Kennedy's challenge of putting a man on the Moon by the end of the 1960s.

The Moon landings are often regarded as mankind's finest achievement, and this 2008 Discovery Science Channel miniseries certainly gives an in-depth account of why. At its peak in the 1960s, NASA's Project Apollo employed nearly 400,000 people, and this series is a tribute to the scientists, engineers and astronauts who made Kennedy's audacious dream come true.

Moon Machines is a series of six forty-five minute programmes, each focussing on a particular piece of essential hardware developed specifically to place an American on the Moon by the end of 1969. It includes episodes concentrating on the Saturn V

rocket, the Command Module, the Lunar Module, the Lunar Module's Guidance Computer, the Apollo Spacesuits and the Lunar Rover.

Using hours of original historic footage from NASA and its contractors, and interviews of the surviving engineers and scientists Moon Machines records those brief years in the sixties when (regarding spaceflight at least), anything seemed possible and when if materials or components didn't pre-exist, they were almost magically developed and created by NASA and its engineers.

Everything about the Apollo program was gargantuan in size, from its budget to its workforce to the hardware itself. The first episode for example, about the development of the Saturn V launch vehicle, a monster at nearly three hundred and fifty feet tall and mankind's largest ever flying machine, reveals how the three stages of the booster were designed by an army of engineers and employees at three different companies: Boeing, North American Aviation, and the Douglas Aircraft Company. Of the hundreds of thousands of components developed and

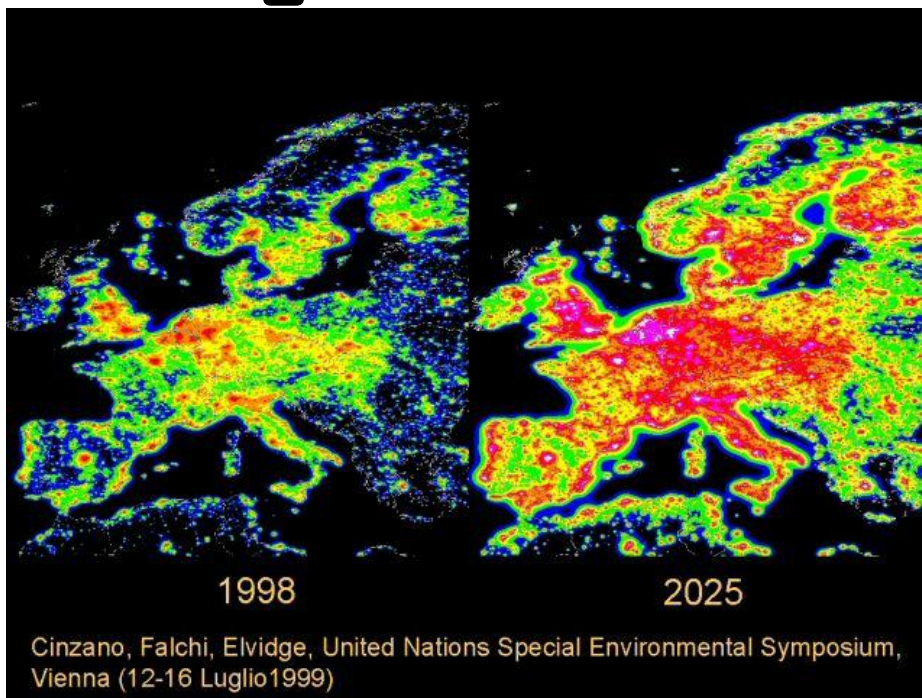
manufactured, all had to work together... perfectly. And all of this under the watchful eye of Wernher Von Braun and his German colleagues who worked on the V-2, from which the Saturn rockets were ultimately derived.

The series encompasses the setbacks such as the Apollo I launchpad fire when NASA lost three astronauts, caused by inherent problems with the Command Module, the oxygen tank explosion on board the Service Module of Apollo XIII when the Grumman-built Lunar Module Aquarius was used as a lifeboat boat to bring Jim Lovell and his crew home, and the numerous failures of launch vehicle stages on the test launch pad.

Every single employee interviewed in the series has a real glint of justifiable pride in their eyes for the problems overcome and the triumphs, whether it was their work on the MIT-developed guidance computer with its hand-wound copper wire memory, the women who laboriously worked on the spacesuits, the Grumman engineers who produced the first ever true spacecraft and the untestable lunar ascent engine, or the Douglas Aircraft Company whose S-IVB Saturn V third stage worked perfectly on each mission and without which Trans-Lunar Injection and Lunar landings would not have been possible.

I love this series, probably because it bravely goes further than a mere entry-level introduction to NASA's Apollo Program. It delves much deeper into its history, and the design and engineering of much of the fantastic hardware involved. Ultimately, it is a tribute to man's greatest ever voyage of discovery, and the amazing men and women who built the Moon Machines that allowed it to happen.

The Light-Not-So-Fantastic!



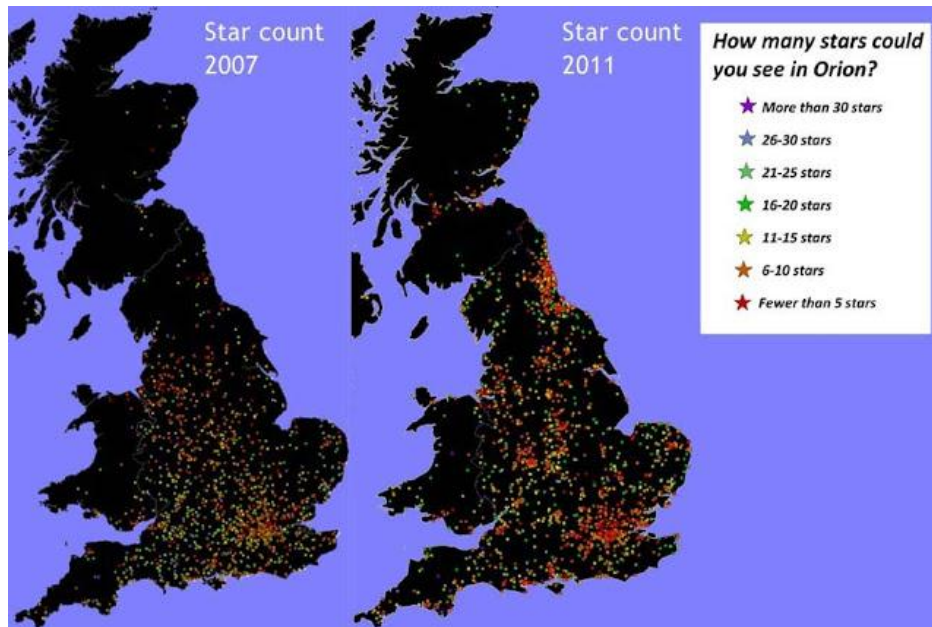
The projected increase in light pollution is all too apparent in the graphics to the left.

ANDY FLEMING
takes a look at one of the scourges of the twenty first century: light pollution, and looks at the health and environmental problems it causes.

Take a look at the above graphic. It shows

something that is having a profound and adverse effect on the Earth's wildlife and natural habitats and come to that, human life and sleep patterns too. The chart on the left shows the

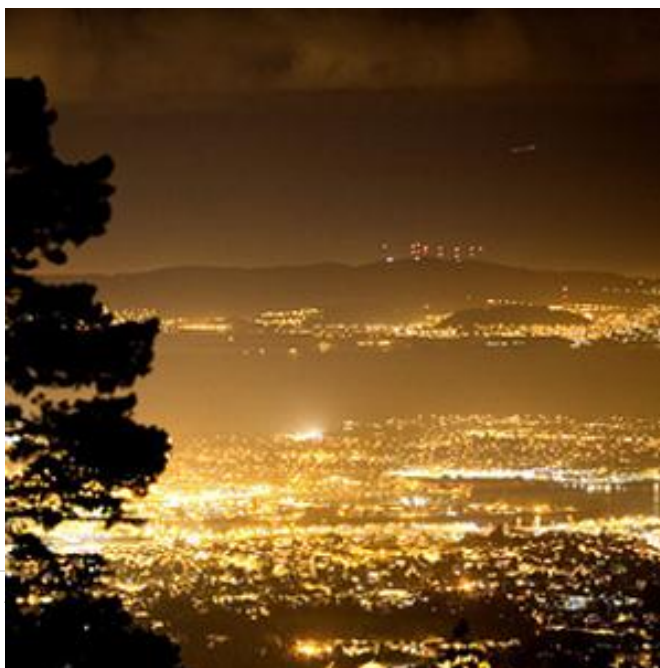
measured light pollution, the wasted light and hence electricity being lost to space in 1998. The worst pollution is represented by the pink and red areas, the least light pollution emanating from the areas marked in blue. Move on to the situation for 2025, just fourteen years hence, and see how the situation has deteriorated.



Getting worse: the growing threat to amateur astronomy is detailed in the [Campaign for the Protection of Rural England's Dark Skies project](#) whereby members of the public were invited to report how many stars they could see within the well known constellation of Orion, The Hunter. (Credit: CPRE).

Light pollution is defined as stray or wasted light that results from ill-fitted

street lights, security lights, industrial lighting and public lighting around shopping malls, showrooms and public buildings. Light pollution despoils one of the greatest of natural wonders that I remember from my childhood, and available now in only a handful of remote rural locations such as north west Scotland, Dumfries and Galloway and Kielder Forest. It's bad news for children who are denied the educational value and beauty of the night sky and it's bad news too for amateur astronomers throughout urban Europe and the USA who are denied the stunning views of galaxies, nebulae and other deep sky objects. The enjoyment of star spotting pales into insignificance however compared to the serious health and environmental implications of light pollution. Like many forms of pollution its true negative effects are only just becoming apparent in terms of the affect on the disorientation and hibernation of animal and bird life and the disruption to human sleep patterns and rhythm, with all the implications for stress and ill-health that it brings.



The photograph to the left graphically illustrates the well lit streets of San Francisco, but this appalling example of urban light pollution means that only a handful of stars, planets and the Moon will be visible in the city's skies.

To any rational person, it seems incredible that simultaneously to the major G7 economies such as the UK, US, Germany and Japan facing a growing serious energy shortage, government, private and commercial institutions and individuals should be wasting expensive electrical power in such a profligate manner. Because make

no mistake: the horrible orange sky-glow now present in all urban areas is a waste of electricity, is costing a fortune and contributing to the ever growing concentration of carbon dioxide in the Earth's atmosphere. Put simply, wasted photons (particles of light) equal wasted electricity which means predominantly wasted scarce fossil fuels and more greenhouse gases pumped into the atmosphere.

Perhaps if we turned some of the lights off we wouldn't have to consider building more power stations or wind farms. It's really not rocket science.

Useful Links for Campaigning Groups:

[The British Astronomical Association's Campaign for Dark Skies](#)

[Campaign to Protect Rural England - Dark Skies](#)

[International Dark Sky Association](#)

Astronomy for Everyone: Look Again at the Plough or Big Dipper!



The beauty of the night sky... the Big Dipper or Plough, an asterism that is part of Ursa Major, the Great Bear.

ANDY FLEMING casts his binoculars at a naked eye asterism everyone knows: The Plough or Big Dipper, part of the Constellation of the Great Bear or Ursa Major

If there's one constellation in the Northern Hemisphere that most living there learnt as a child, it's The Plough, or Big Dipper. Truth be told, it's not actually a constellation at all, it's called an asterism -- a pattern of stars seen in Earth's sky which is not an official constellation. Like constellations, they are composed of stars which, while they are in the

same general direction, are not physically related, often being at significantly different distances from Earth. The Big Dipper (named after the huge soup ladle farmers' wives would use to serve up to the farm hands at the end of a busy day's work), is actually part of a sprawling constellation called Ursa Major, home to wonders aplenty in terms of deep sky objects.

Here though, we're going to just concentrate on the Big Dipper itself. To those in North America, Europe and Asia, both it, and indeed Ursa Major itself, is a circumpolar constellation, meaning it is visible every night throughout the year -- its stars never set.

And so to a tour of the stars of this asterism, all visible with the naked eye, in all but the most appalling light pollution. Binoculars will start to reveal its true beauty, and a small telescope will give superb details of the multiple star members.

Starting in the top right hand corner of the bowl of the ladle, Dubhe (Alpha Ursae Majoris (α UMa / α Ursae Majoris)) is the second-brightest star in the constellation of Ursa Major, and is about 124 light years away. It is typical of a red giant, an evolved helium-burning star. It is also a multiple star, orbited by a main sequence companion, Dubhe B, at a distance of about 23 astronomical units (AU), as well as a close pair, Dubhe C, at a distance of about 8000 AU.

Journeying anticlockwise, we come to Merak (Beta Ursae Majoris (β UMa / β Ursae Majoris)). Both it and Dubhe are familiar to northern hemisphere observers as the "pointer stars" in the Big Dipper, and a line connecting them and moving north extends to Polaris, located at the north Celestial Pole in this epoch. Merak is fairly typical for a main sequence star of its type, although being slightly hotter and larger than our own Sun, it shines several times brighter. The star is surrounded by a cooling disk of dust, much like those discovered around Fomalhaut and most notably Vega. No planets have been discovered orbiting Merak, but the presence of the dust indicates they may exist or be in the process of forming.

Moving to the left of the bowl we come to Phad or Phecda (Gamma Ursae Majoris (γ UMa / γ Ursae Majoris)). It is an average main sequence star not unlike our Sun, although somewhat hotter, brighter and larger.

At the top left of the bowl is Megrez (Delta Ursae Majoris (δ UMa / δ Ursae Majoris)). Megrez has an apparent magnitude of +3.32 making it the dimmest of the seven stars in the Big Dipper. Located 81 light years away, it is a bluish-white main sequence star. It has two faint companions, the 11th magnitude Delta Ursae Majoris B, 190 arcseconds away, and the 10th magnitude Delta Ursae Majoris C, 186 arcseconds away.

Moving to the left, we first come to Alioth (Epsilon Ursae Majoris (ϵ UMa / ϵ Ursae Majoris)). It is the brightest star in the entire constellation of Ursa Major, at magnitude +1.76. It is the star in the tail of the bear closest to its body, and thus the star in the handle of the Big Dipper closest to the bowl. Historically, the star was frequently used in celestial navigation in the maritime trade, because it is listed as one of the 57 navigational stars.

Further out along the handle of the Big Dipper, we arrive at Mizar (ζ UMa / ζ Ursae Majoris), 78 light years away. It is a quadruplet system of two binary stars, with an apparent magnitude is +2.23. Its name comes from the Arabic mĀzar, meaning a waistband or girdle.

With normal eyesight one can make out a faint companion just to the east, named Alcor, or 80 Ursae Majoris, at magnitude 3.99. Mizar and Alcor together are sometimes called the "Horse and Rider," and the ability to resolve the two stars with the naked eye is often quoted as a test of eyesight, although even people with quite poor eyesight can see the two stars. The two stars lie three light-years apart, and though their proper motions show they move

together, it was long believed they do not form a true binary star system, but simply a double star. New data reveals Alcor actually is itself a binary, consisting of Alcor A and Alcor B, and that this binary system is most likely gravitationally bound to Mizar, bringing the full count of stars in this complex system to six.

Lying at the end of the handle is Alkaid (Eta Ursae Majoris (η UMa / η Ursae Majoris)). It has apparent magnitude +1.9, and is a young bluish-white main sequence star, and burning at 20,000 kelvins it is one of the hotter stars visible with the naked eye.

So go and enjoy the Big Dipper, arm yourself with some 10x50 binoculars, and see how many double stars you can resolve in this lovely asterism!

TRANSIT QUIZ

Answers to January's quiz

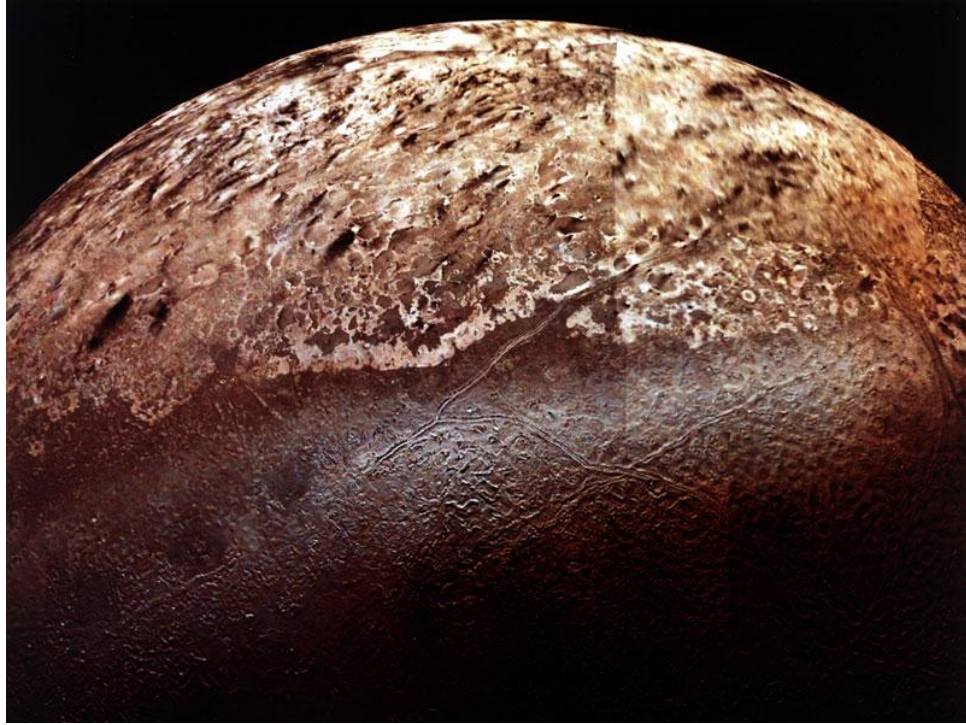
Every answer to the descriptions below starts with the letter 'B'. The first five are objects in the sky; the second five are the names of astronomers (did you know more than their surnames?). Each sub-section is in rough order of obscurity.

1. Another name for Praesepe (M44), the bright open cluster in the constellation of Cancer. **Beehive.**
2. Another name for Gamma Orionis, derived from a Latin term for 'the female warrior'. **Bellatrix.**
3. Another name for M64, a spiral galaxy in the constellation of Coma Berenices. **Black Eye Galaxy.**
4. Another name for M46, an open cluster in the constellation of Scorpius. **Butterfly Cluster.**
5. Another name for T Coronae Borealis, the brightest-known recurrent nova. **Blaze Star.**
6. The inventor of a lens that many of us use, and that can be used in conjunction with a standard eyepiece to increase the magnification, usually by 2–4 times. **Peter Barlow (1776–1872).**
7. The first person to measure stellar parallax (of the fast-moving star 61 Cygni). **Friedrich Wilhelm Bessel (1784–1846).**
8. The first person to resolve stars in the Andromeda Galaxy, and to discover that there are two populations of Cepheid variables. **Walter Baade (1893–1960).**
9. The discoverer of the last planetary satellite to be found without the aid of photography, and also the discoverer of dark nebulae. **Edward Emerson Barnard (1857–1923).**
10. The first person to photograph a star (Vega, in 1850) and the first to image a double star (Mizar, in 1857). **George Phillips Bond (1825–65).**

Where in the Universe Challenge

We're looking at five stunning views this month from various places in our fabulous universe. All you have to do is simply decide the locations. The February quiz is Google-free because, according to Galaxy Zoo, humans are better at recognising images and than computers!!!

1.



2.



3.



4.



5.



All images used in this month's quiz are used courtesy of NASA.

TRANSIT EGRESS

Astronomy can be a spiritually uplifting and romantic hobby. But not all of it! Don't forget Valentine's Day on Thursday February 14!

