TRANSIT

The September 2010 Newsletter of

NEXT MEETING *(first of the season)*

10 September 2010, *7.15 pm for a 7.30 pm start*
Wynyard Woodland Park Planetarium

The Big Universe
Gary Fildes FRAS *Kielder Observatory A.S.*

Take a walk through the various scientific methods used throughout history to understand and test how we have formed a picture of our evolving Universe. From Galileo to Einstein, celestial spheres to quantum theory and general relativity. I hope to deliver the talk in my usual enthusiastic manner using modern theory to expose and confirm what we think we know about the Universe around us!! And How!

(note the change of title from that in the Summer Newsletter)

Contents

Editorial

Rod Cuff

We mourn the sad loss of one of our long-time members, Paul Duggan, to whose wife Pat (also of course a CaDAS member) we offer our sincere condolences. Paul will be missed in a much wider circle than among his astronomical friends, but we hope to publish an appreciation with particular emphais on his CaDAS life in next month's *Transit.*

CaDAS's programme of monthly meetings and talks from Neil's collection of always-excellent speakers kicks off this month with Gary Fildes of the Kielder Observatory on Friday 10 September – see the cover page (alas, I'll be abroad for this one). Don't forget the new 'informal workshops' initiative beginning with a Messier Bingo session on Wednesday 29 September – see the article starting on page 15.

I've enthused in previous issues about the blog that Andy Fleming created, with a wealth of interesting articles about things astronomical. Sadly, despite hard work and good-quality material, it couldn't gain the readers it deserved, and Andy has now closed it down. However, his loss is CaDAS's gain, since much of his material will now appear in *Transit* – he's already supplied enough to see us through until next summer, and his first article appears on page 6.

Sue Barnes and her family have been travelling, like many people, over the summer, and she's kept an eye open for things of potential interest to CaDAS members – resulting in the report this month on page 12. This is very much the kind of article that could lead to other members following it up – if *you* have been to somewhere with an astronomical connection, especially recently, that you'd like to write up, do please send it over. (I have one of my own to be written for the next issue.)

The copy deadline for the October issue is **Sunday 26 September**.

Rod Cuff, info@cadas-astro.org.uk*,1 Farndale Drive, Guisborough TS14 8JD (01287 638154)*

Letters

Podcasts

from Ray Worthy

Living in the world of sound as I now do, I am very appreciative of the *Astronomy Cast* podcast, to be found on iTunes. It is weekly and usually lasts about an hour.There are many back numbers available.

Jupiter

from Keith Johnson

The weather forecast for the evening of Friday 20 August looked promising, so I decided to have a go at capturing Jupiter, this being the first capture of this season.

Seeing was average. so I decided to wait to see if it would improve – but sadly the clouds drifted in from the east and I managed to capture only four AVIs. The seeing was improving as time went on, and the image here is from the last AVI capture of the session.

If the clouds had stayed away, I'm confident that seeing would have improved a lot more and would have resulted in much better images.[1]

Capture details:

C9.25" Schmitt Cassegrain O.T.A.
ToUCam Pro II camera
EQ6 Pro mount
Telescope control via Skymap Pro
AVI capture software : AVI-IO
Image processing: Registax 5
90-second AVI captured at 10 frames per sec.

OBSERVATION REPORTS AND PLANNING

Skylights – September 2010

Rob Peeling

The Moon

1 September	8 September	15 September	23 September
Last Quarter	New Moon	First Quarter	Full Moon

Planets

Jupiter, **Uranus & Neptune** are all well placed to observe through September. Both Jupiter and Uranus are in retrograde motion (moving west against the stars). However, Jupiter moves faster because it is nearer to the Sun, and around the middle of the month it will catch up and pass Uranus. This will make **Uranus** particularly easy to spot as a 5th-magnitude object to the north of the giant planet and easily within the same low-power field of view in a telescope (*see Figure 1*). It should be quite a view with the equatorial stripe (not stripeS at the moment!) on Jupiter, the four Galilean moons and Uranus all in sight at the same time.

[1] Keith has subsequently sent more Jupiter pictures, and very good they are – no more room in this issue, alas, but *next* time … *Ed.*

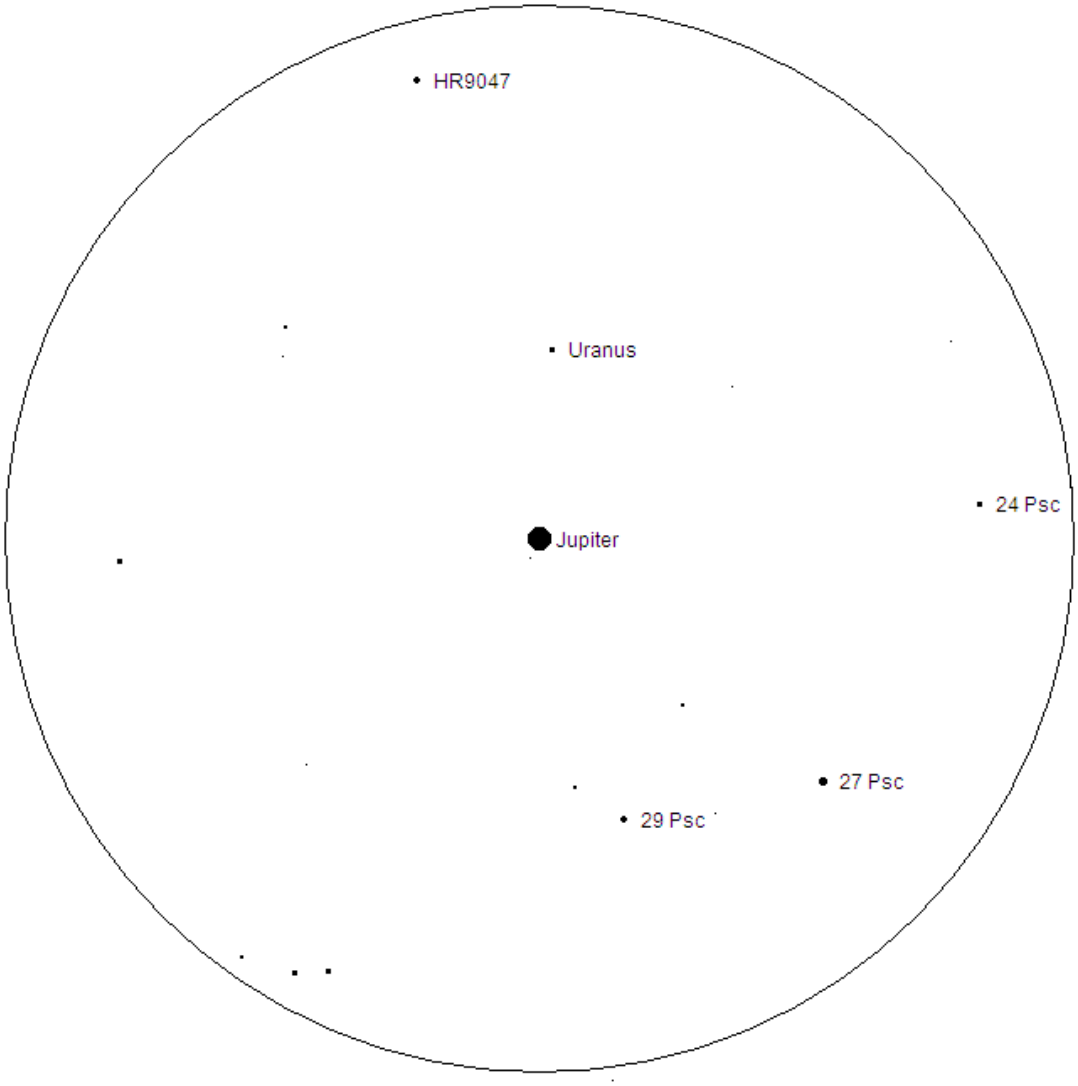


Figure 1. Positions of Jupiter & Uranus on 15/09/2010. Field of View is 5°. Stars to 8th mag.

Neptune is fairly well marked out in September by the 5th-mag star μ Cap. Look for 3rd-mag δ Cap and scan north-east (up and left) about 3° to find μ Cap. With μ Cap centred, Neptune will be in the field as an 8th-magnitude object to the north-east (*see Figure 2*).

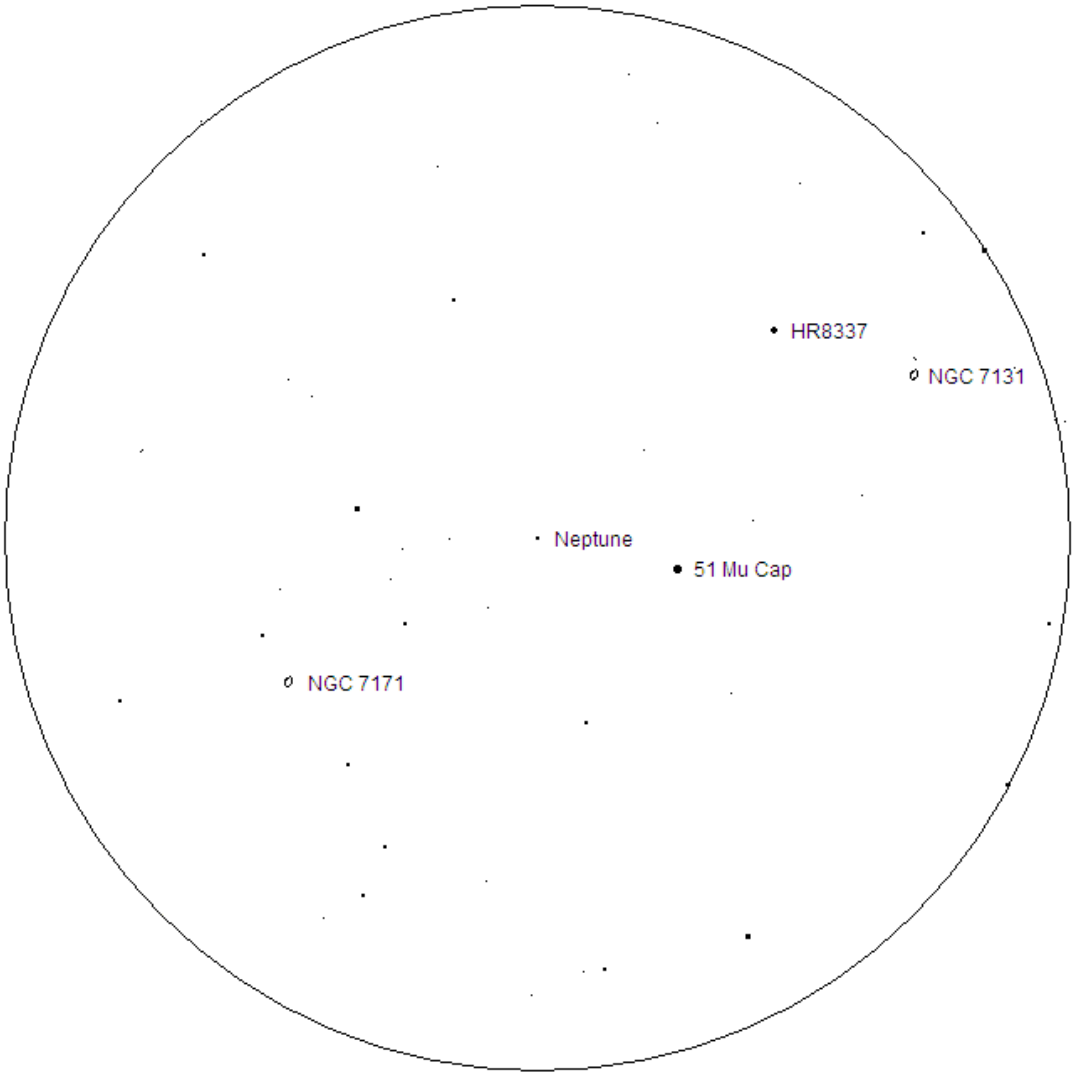


Figure 2. Position of Neptune on 15/09/2010. Field of View is 5°. Stars to 9th mag.

Deep-sky objects

The following piece is borrowed from Glenn Chaple of the Amateur Astronomical Society of Rhode Island, who wrote it in September 2009. I've chosen this because it's something a little different to try.

Epsilon Pegasi: The Pendulum Star

This month, we're going to pay a visit to epsilon Pegasi (Enif), the 'Pendulum Star'. It's an optical double star comprised of magnitude 2.5 and 8.7 component stars separated by 144 seconds of arc. Pairs this wide usually don't merit much consideration, but wait! Epsilon Pegasi has a surprise for us.

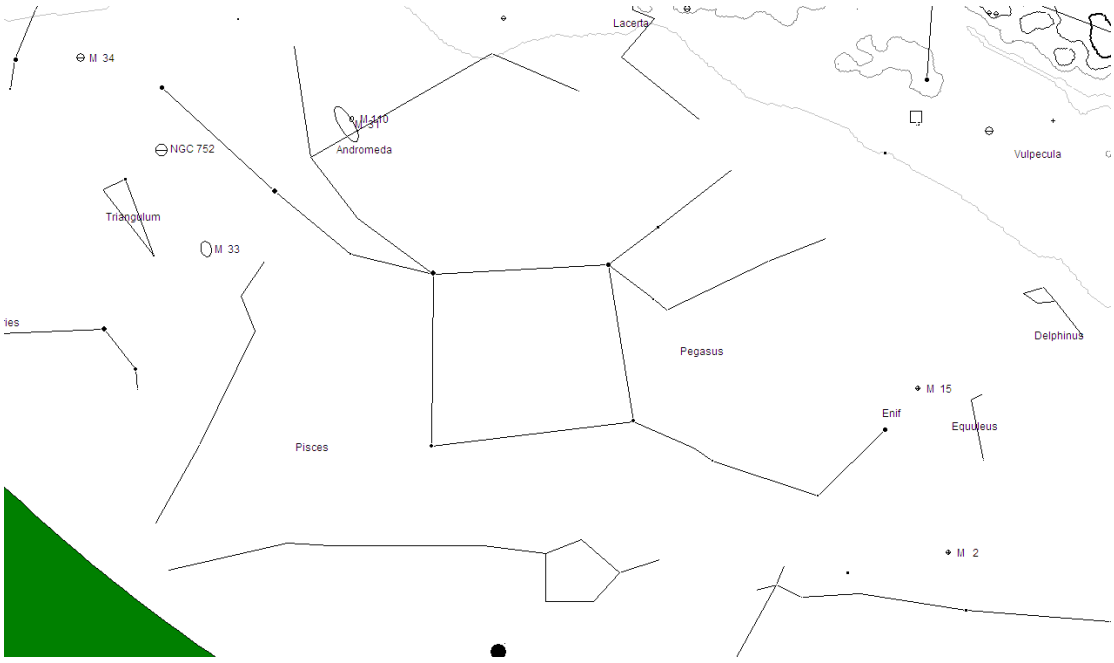
After centring this pair in the eyepiece field (60–100× is the recommended magnification), mentally trace a line between them. While keeping your eye at the eyepiece, gently jiggle the telescope back and forth so that the two stars move at right angles to the imaginary line. While the golden yellow primary (a K-type star) travels serenely back and forth, the little companion

seems to swing wildly to and fro, like a clock pendulum. It's one of the most amazing telescopic optical illusions you'll ever witness.

What's happening? According to Sir John Herschel, who was among the first to describe the 'Pendulum Star', the oscillations are due to the longer time it takes light from the faint star to affect the retina. We detect the motion of the primary a split second earlier, so the companion seems to lag behind. Rapid back and forth movement of the telescope generates the illusion of pendulum-like motion.

The Pendulum Star received plenty of recognition in astronomy guidebooks written in the late 19th and early 20th centuries – a time when double stars enjoyed tremendous popularity. Nowadays, with attention directed towards nebulae, clusters and galaxies, epsilon Pegasi receives scant notice.

The finder chart shows the location of epsilon Pegasi. If you hunt down deep-sky objects by the star-hop method, you may recognize it as a pointer (with nearby theta Pegasi) to the globular cluster M15. Next time you plan to visit M15, take a moment to check out epsilon Pegasi. This star will put on a show that's sure to dazzle!



GENERAL ARTICLES

Children of the stars

Andy Fleming

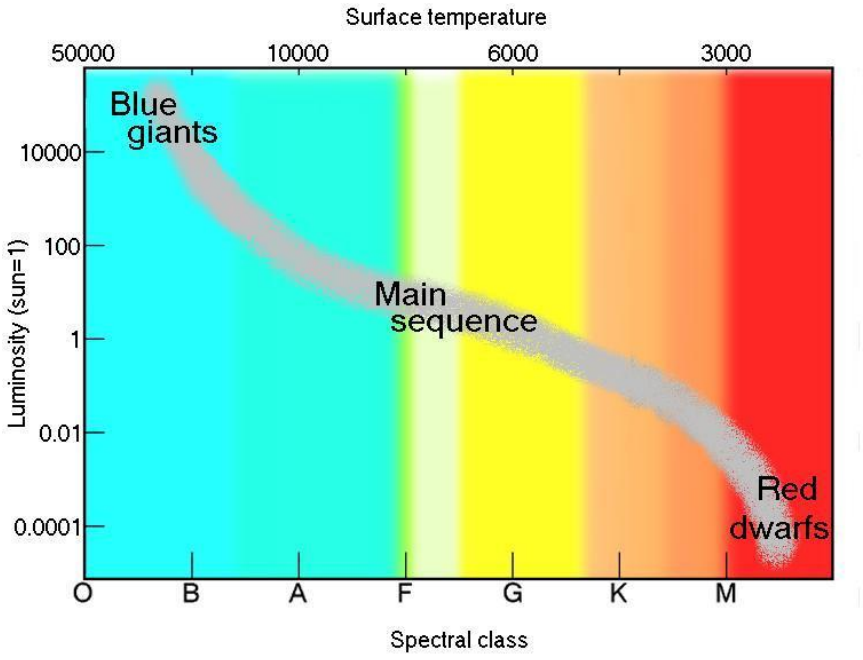
It's the story of how we, and all of the creatures with whom we share the Earth came to be. It's an epic tale to rival the best Shakespearean tragedy or our best works of literature. It's the story of how we and everything we see was literally 'made in heaven', and it confidently predicts what our fate may be...

Stars do not live forever, and our Sun will one day die, and with it all life on Earth. Five billion years from now, when our planet has been incinerated to a crisp, our local star will have run out of the fuel that powers its nuclear fusion. Its hydrogen depleted and all consumed, it will have metamorphosed from the relatively stable yellow dwarf star that we see today into a bloated angry red giant, its outer layers and atmosphere occupying most of the inner solar system.

Indeed, the Sun is already imperceptibly increasing in temperature – it's 20 per cent hotter now than when the Earth coalesced out of the Sun's proto-planetary disk 4½ billion years ago, and within a couple of hundred million years the Earth will become uninhabitable. This chain of events is inevitable and, over different time periods, happens to all stars.

Stars coalesce by gravity out of clouds of interstellar gas, made up largely of the original constituent elements of the universe: about 75% hydrogen and 25% helium, plus trace amounts of lithium – the latter two termed 'metals' in the unorthodox nomenclature of astronomy.

The force of gravity contracts the proto-star to the point where pressure and temperature dictate that nuclear fusion starts and it begins to shine. The star is then said to gain membership of the 'main sequence' (*see below*), and will spend the vast majority of its life undergoing the nuclear fusion of hydrogen into helium. A small amount of mass is converted in the process into energy



(under $E = mc^2$, mass is equivalent to energy). A hydrostatic equilibrium is achieved whereby the gravity of the star is counterbalanced by the energy, in the form of photon and radiation pressure from the nuclear reactions within its core.

At this stage, the star gives the appearance of stability in terms of shape and size. In truth, however, it is a magnetically contorted and tortured object, erupting frequently and spewing out solar flares, charged particles such as protons, and coronal mass ejections. Stars the mass of our Sun will be in this hydrostatic equilibrium for about 10 billion years, but all the while, the concentration of helium in their cores continues to increase. As it does so, the star begins to contract to maintain hydrostatic equilibrium, and temperatures in the core gradually increase over billions of years.

Finally, when the star's nuclear fuel is exhausted, gravity exceeds radiation pressure and the core contracts much further, until spiralling temperatures and pressures succeed in igniting helium, which is then fused and transmuted into carbon via the triple-alpha process. The loosely gravitationally bound outer layers are puffed out, and the star becomes a red giant.

Gravity has won -- the progenitor star, having had insufficient initial mass to fuse heavier elements, ends its life as a white dwarf, within which, owing to a quantum effect (the Pauli exclusion principle), the repulsive negative electric charge of tightly bound electrons in the star is sufficient to resist further collapse. These sub-atomic particles are not morally reprehensible, but this energy has the unfortunate title of 'electron degeneracy pressure'!

A white dwarf is a truly bizarre, object – a star of diamond, a dense hot carbon star the size of the Earth, but with the mass of the Sun. It puffs off its outer layers to interstellar space as a beautiful planetary nebula, and over billions of years it will cool off to become a black dwarf.

Larger blue giant hot stars, however, with a mass range between a couple and one hundred solar masses, burn through their fuel at a much more prodigious rate. They live fast and die young: they are the James Deans of the star family, with life-spans in millions rather than billions of years. One such well-known star is Rigel in the constellation of Orion the Hunter.

Neither does the nuclear fusion process within the core of such a star terminate at the element carbon. With its high mass and thus much higher gravity, the result is a much more compact stellar core with higher temperatures and pressures, thus ensuring the nucleosynthesis of ever heavier elements.

The process only stops with the exceedingly stable atomic nucleus of element number 26, iron. Up to this point, the fusion process in all stars has been exothermic, i.e. during nuclear fusion energy has been constantly released as elements have been transmuted via $E = mc^2$. However, the dying star is about to undergo one of the most spectacular phenomena in the cosmos.

At this point, one may ask, just as the great British astronomer and astrophysicist Fred Hoyle did, how are the remaining natural chemical elements formed – those most essential for life, from cobalt at atomic number 27, right up to uranium with atomic number 92? The answer is: with an event of gargantuan violence – a Type II supernova.

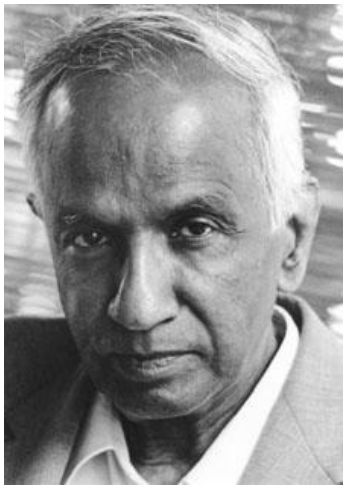
The contorted, twisted iron star collapses under its own gravity, and detonates and explodes with a shockwave and explosion of gargantuan proportions. The awesome energy released fuses the heavier elements in a final endothermic nuclear fusion reaction, and these elements are then vomited back into space, enriching the clouds of gas and dust that in the future will coalesce to form another generation of stars. In this manner, successive generations of stars become ever richer in heavier elements from nitrogen to iron, and then right up the periodic table to uranium.

The process that follows this cataclysmic event is intrinsically bound up with the mass of the progenitor star. If this was less than ten solar masses, it collapses into a neutron star, a hideous and fascinating object so dense that it resembles a giant atomic nucleus with a diameter of 20 kilometres, about the size of Greater London. Stabilised by neutron degeneracy pressure and with insufficient gravity, this neutron star can collapse no further. However, its huge angular momentum from energy produced by its gravitational collapse ensures that it spins as a pulsar, often at near-relativistic speeds (speeds approaching that of light), with intense jets of charged particles emanating from its poles due to intense magnetic fields generated in the star.

The frequency of the pulsar's spin is constant over human timescales, and varies in value depending on the size of the neutron star and the mass of its progenitor. It can range from a few seconds to milliseconds. Pulsars are in effect Nature's successful attempts at exquisitely accurate timepieces – outclassed only by our modern atomic clocks. When first detected by Anthony Hewish and Jocelyn Burnell at Cambridge University in 1967, the radio signature of the first pulsar stellar remnant was thought to be artificial in original... and was duly labelled on the computer print out as 'LGM', standing for Little Green Men! Well-known pulsars include that in the centre of the Crab Nebula (M1), resulting from a supernova witnessed by Chinese astronomers in 1054 AD, and the Vela Pulsar.

Finally, progenitor stars with masses of between 10 and 100 solar masses end their lives as probably the most bizarre object known, one that is the subject of endless speculation and folk-lore: a black hole. For a star to become a black hole, its mass, and hence gravity, must be large enough to ensure that its final contraction overcomes neutron degeneracy pressure, the stellar remnant collapsing into a singularity, a point of infinite density. Its gravity is so great that its escape velocity is more than the speed of light. This point surrounding the singularity, beyond which no light or indeed any electromagnetic radiation can escape, is termed its 'event horizon'.

One final type of important star detonation that must be mentioned is a Type Ia supernova. The mechanism for its explosion is very different from that of a Type II event. A Type Ia supernova occurs when one of the stars in a closely bound binary system is a dense white dwarf. Its immense gravity-well draws material from the atmosphere and outer layer of its companion main sequence star, and deposits it onto the surface of the white dwarf.



When the mass of the white dwarf finally equals approximately 1.4 solar masses (the so-called Chandrasekhar Limit, named after the brilliant Indian American Nobel Prize-winning astrophysicist Subrahmanyan Chandrasekhar – *see left*), it will collapse under its own gravity and detonate as a Type Ia supernova, again spewing heavy elements into the interstellar medium.

In addition, such exploding stars are of immense importance to cosmologists – they always detonate at the same mass and have approximately the same intrinsic brightness. As such they can be used as 'standard candles' for measuring cosmic distances over inter-galactic scales.

It is truly astounding that some of the most awesomely powerful and destructive phenomena in the heavens are simultaneously responsible for creating a habitable universe. For if it were not for massive stars that ended their brief lives as supernovae, there would be no Milky Way, no solar system, no Earth, and no homo sapiens. Everything from which we are made, from the iron in our blood to the calcium in our bones, can all be directly traced back to the fiery cores of long-dead stars.

You see, you are a child of the stars. You were quite literally 'made in heaven'. As the late NASA astronomer and astrobiologist Carl Sagan so eloquently stated, 'You are the cosmos with consciousness, a way for the cosmos to know itself, star stuff harvesting starlight'. There can be no more profound or spiritually uplifting a thought than that.

The cowboy apprentice

Ray Worthy

Those among us of, let us say, more mature years may remember when our region offered jobs, particularly in industry. They may recall that the apprentices, when they first started, were practised upon. That is to say, they became the butts of practical jokes, sometimes funny, more often crude. A sixteen-year-old would be sent to the factory store for a 'long stand', would be told by the storekeeper to 'Wait there, young man', and a hour or so later would be told that he had had his long stand. I remember that when I joined the Forestry Commission, so long ago, I was part of a gang planting young trees on the Yorkshire Moors. We each had a bag slung around our shoulders, rather like a paper-boy's bag but full of young conifers. On my first morning at this job, I was puzzled to find that my bag, instead of becoming lighter as the trees were planted, seemed to become rather heavier.

It was only at lunchtime, when I was seated and beginning my sandwiches, that I discovered that the bottom of the bag was full of tiny pebbles, which had been gradually added as the morning went by. Upon my shout of discovery, one of my workmates jumped up in triumph, shouting 'It's me! I've won!'. The b***ers were running a sweep on the timing.

The cowboy story below comes by courtesy of a friend and planetarium operator who took me around schools in Florida. His name is Vic Stryker and he calls himself 'The Old Stargeezer'. Vic, bless him, is the same age as I am, though he still has his sight and now lives somewhere in South America.

Vic was born and brought up in the Texas Panhandle, where his father was a rancher with thousands of cattle. Before he achieved the age of fourteen, just after the Second World War ended, his mother absolutely refused to allow the lad permission to go on the annual drive to the railhead, and the young Vic looked upon the day when he would finally be allowed to go on the drive as his transition to manhood.

His mother took the view that the goings-on when the hands let off steam at the railhead, a scene so often pictured in cowboy films, were totally unsuitable for her darling boy to witness.

Came the day, soon after his fourteenth birthday, when Vic at last received permission to go on the drive. He was a man at last. In the early part of the trip he was cosseted, but he tried to insist that he should be allowed to do the work like everyone else. Of course, he had grown up surrounded by horses and cattle, so there was nothing new there. After the first three nights, however, he realised that he had been allowed to sleep all night around the fire, whereas each of the others had done his stint as sentinel, staying awake in case of trouble.

Vic wanted to do it all and persuaded his father that he be allowed to do his full part. One thing puzzled the young lad, however, and that was, 'How do the men tell the time during the night when not one of them carries any timepiece?'.

He was assured that the answer would be made plain to him when the time came.

So it transpired that, at the appointed hour, the young lad was shaken awake and was immediately made aware of the astonishing panorama of the sky at an hour when he, until that moment, had always been tucked up and fast asleep. To say he was astonished would have been too mild. He was flabbergasted.

'So, how do I tell the time, then?' he asked the cowhand who had woken him.

'Well, you see, son,' the cowhand drawled, 'we've each got our own star, and when that star disappears below the horizon, we wake up the next man.'

'Great', said Vic. 'Which is *your* star, then?'

The cowhand took a stick and pointed to the western horizon.

'You see that one there, that bright one?'

'Yes', said Vic eagerly.

'Well, when it goes down out of sight, I can go to bed.'

'Which one was Charlie's star, then?' asked Vic.

'Don't be silly. You won't see his star again until tomorrow night. It's already gone down two hours ago'.

'Oh, sorry. Of course,' said the young Vic, ' sure thing. Which is mine, then? I have to wake Hank.'

'OK, then. Pay close attention', and the cowhand showed him his star and how he could always find it by tracing a particular curve of stars.

'Have you got it, son?'

'Yes.'

'You sure?'

'Yeah, yeah,' answered Vic impatiently. 'Go to bed. I can do it.'

So that's how the young lad finally became a man of the world. He could brag with the rest of his friends when school started again.

He stood up every now and again or took a short walk on his rounds to check all was well. Every so often he checked 'his star'.

'No. It hasn't reached the horizon yet ', he thought.

After some more time had elapsed, he began to feel very sleepy – very sleepy indeed. He was really struggling when he realised that dawn was beginning to break in the east.

At breakfast that morning, the others gathered around him.

'That was a lovely star, that, son', said Hank.

Vic was beginning to suspect something was afoot.

'Yup! ' he said, ' Sure was.'

Charlie leaned over. 'Scientists call it Alpha Ursae Minoris.' Then, after a short pause, he went on, 'Others call it "Polaris"'.

Vic muttered an inward curse, but from that moment on, he began to study astronomy.

The William Herschel Museum

Sue Barnes

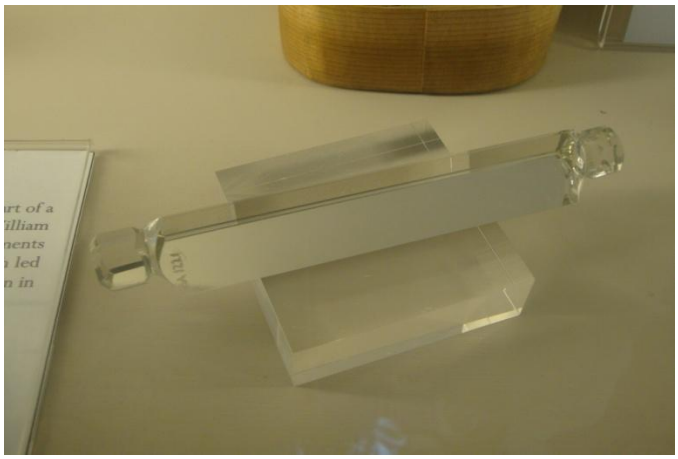
Whilst holidaying with my family in Ross-on-Wye this summer, we decided to spend the day in Bath. We naturally went to see the Roman Baths, but I persuaded everyone else that we definitely needed to include a visit to the William Herschel museum at 19, New King Street. This proved quite a challenge to find but was well worth the visit. It was from the back garden of this house that Herschel discovered Uranus in 1781.

The house is a middle-grade Georgian town house that has been decorated in the style of that era, since it was not possible to replicate the décor owing to a lack of records. It felt quite a modest house, and from the descriptions available it was easy to imagine it busy with activity, combining musical lessons with a real passion for astronomy, although the music often took a back seat. I sympathised with the despair in his sister Caroline's writing about how almost every room in the house was turned into a workshop, as my son Thomas would also do this, given half a chance!

In the reception room of the museum is a replica of the seven-foot Newtonian reflecting telescope, the original of which Herschel had been using when he discovered Uranus. There is also a scale model of the forty-foot telescope that he famously used but that failed to live up to expectations. In the music room upstairs I was delighted to find an early photograph (*see right*) that his son John had taken of the telescope. It was rather faint but recognisable. The dark wooden frame was reputed to be made from some of the salvaged wood from the original telescope when it was dismantled.

The drawing room had various interesting artefacts on display, including a number of letters and some of the mirrors and eyepieces made by Herschel. Also on display was the glass prism (*see next page*) that was once part of a chandelier that Herschel had experimented with and that ultimately let him to discover infrared radiation.

One of the most interesting rooms was the workshop on the lower ground floor (*see below left*). For the most part, only replica equipment was on display but you were encouraged to pick items up and try them out. This included a replica of Herschel's lens-polishing machine, which I had a quick go on. It is said he would spend up to 16 hours polishing lenses on one of these, and at times Caroline fed him whilst he continued to polish, to ensure he ate a meal! There was also a replica furnace and a number of different tools he would have used. The cracks in the stone floor were partly due to a large spill of molten speculum metal! The original treadle lathe that had been given to Herschel by George III was on display. He would have used this for turning small items such as eyepieces for his telescopes.



One of the cellar vaults at the base of the house had been converted into a very small 'cinema' where you could view a short documentary narrated by Sir Patrick Moore about the Herschels and their contribution to astronomy.

We ended up being at the house for about 2 hours, but I really enjoyed the visit. It was clear that William Herschel was a very genuine, well-liked individual whose enthusiasm for astronomy was willingly shared with anyone who showed an interest.

So if you are ever in Bath, make time to visit the place, as it is well worth it…but don't ask me for directions!

Links with August's *Transit*

John Crowther

Short, cloudy nights and non-astronomical holidays – these made for the slimmer *Transits* of July and August[2]. Yet the articles we had were as fascinating as ever.

Julia's piece about the total solar eclipse will have brought back happy memories to those who have seen earlier ones; and the history of that small, remote island, greatly altered by man, reminds us that the rest of our planet must be cherished. Easter Island is a warning to us all.

[2] And September! – *Ed*.

We can also make links with Neil's article, as not planning for the future and an ignorance of our history can lead us to disaster. Again I agree with Neil, although my views are more moderate – we are unsure of the size of his 'majority of young people' who care little about their health or their education.

Why is peer pressure so strong? Do fashions have to be strictly followed? Yet nothing is new. In medieval times the pointed shoes were so long that they were fastened to the knees with cords. Nowadays it's women's fashions, and the showing of unsuitable bits, that will appear ridiculous to future generations.

But back to the fashion of ignoring anything that is educational. Perhaps the World Wide Web has made knowledge *too* easy to obtain? Before the coming of computers, we had to get to a reference library, be it near or far. And the harder a qualification or a material object is to obtain, the more it is valued.

To buy a second-hand bike in the 1940s was difficult, as petrol for private transport was unobtainable. Cars had been cocooned for the duration. My father and I took a bus, dull grey and fuelled by a gas-bag on its roof. Then we had a long walk to a farm, bought the bike and returned home by train. The bike was too big, so wooden blocks were fastened to the pedals. Stabilisers were unknown, so my Dad had to hold the saddle and run behind until I got my balance, and I got off by falling off. So I remembered and valued that bike.

At primary school we were occasionally allowed to look at a multi-volume encyclopaedia. It had just one coloured frontispiece, but with luck I sometimes got the book that dealt with astronomy.

Perhaps the future isn't as bleak as is sometimes forecast. For George Orwell's *1984* (written in 1948) seems to have come close to reality only in Communist North Korea and in the theocracy of Iran – though we were in a similar situation over 300 years ago under Cromwell's Puritan Protectorate.

Now, at last here's a fragment of astronomy! In *1984*, O'Brien, a representative of the original and terrifying Big Brother, has Winston Smith in the torture chamber of Room 101, where he is forced to accept what he did not believe in. Like Hitler with his hollow-Earth idea, Big Brother tried to shrink the cosmos so that The Party could seem to be in complete control. The extract of bad astronomy below is similar to the views of the creationists who rightly irritate scientists such as Professor Richard Dawkins – for extreme political views and extreme religious ones are equally dangerous.

> *'Unimportant. We shall conquer them when it suits us. And if we did not, what difference would it make? We can shut them out of existence. Oceania is the world.'*
>
> *'But the world itself is only a speck of dust. And man is tiny – helpless! How long has he been in existence? For millions of years the earth was uninhabited.'*
>
> *'Nonsense. The earth is as old as we are, no older. How could it be older? Nothing exists except through human consciousness.'*
>
> *'But the rocks are full of the bones of extinct animals – mammoths and mastodons and enormous reptiles which lived here long before man was ever heard of.'*
>
> *'Have you ever seen those bones, Winston? Of course not. Nineteenth-century biologists invented them. Before man there was nothing. After man, if he could come to an end, there would be nothing. Outside man there is nothing.'*
>
> *'But the whole universe is outside us. Look at the stars! Some of them are a million light-*

years away. They are out of our reach for ever.'

'What are the stars?' said O'Brien indifferently. 'They are bits of fire a few kilometres away. We could reach them if we wanted to. Or we could blot them out. The earth is the centre of the universe. The sun and the stars go round it.'

Winston made another convulsive movement. This time he did not say anything. O'Brien continued as though answering a spoken objection:

'For certain purposes, of course, that is not true. When we navigate the ocean, or when we predict an eclipse, we often find it convenient to assume that the earth goes round the sun and that the stars are millions upon millions of kilometres away. But what of it? Do you suppose it is beyond us to produce a dual system of astronomy? The stars can be near or distant, according as we need them. Do you suppose our mathematicians are unequal to that? Have you forgotten doublethink?'

Three sayings underline the view that Neil and I have:

- There's none so blind as those who won't see.
- You can take a horse to water but you can't make it drink.
- *(From a psalm attacking idol worship – and making a link with the Easter Island statues!)* They have eyes yet see not.

CaDAS NEWS

The Alternative CaDAS Meetings / Workshops

A reminder of our first informal workshop – a Messier Bingo Evening, on Wednesday, 29 September at 19:30 at the Planetarium, to be organised by Ed Restall and Rob Peeling.

Messier Bingo was fully described in August's *Transit*, but here's a brief summary again.

Each person is given a sheet of paper modelled on a traditional bingo card, containing ten or so images of objects from Charles Messier's famous catalogue of 110 celestial objects, each labelled with its catalogue number.

The workshop leader then randomly chooses objects one by one (by computer, random number stabbing or whatever), and you mark your card if that object is on it. The first person to have a fully marked card calls out 'Messier!' or whatever, and is acclaimed the winner.

This is of course an excuse to talk about the objects on the way – what kind of objects they are, perhaps something of their observational history, whereabouts in the sky and at what time of year you can see them, whether you've personally observed them, etc. By the end of the evening, everyone should know much more about these objects and others like them, and no doubt other aspects of astronomy too.

Other workshop ideas

Last month we suggested some other ideas for workshops and invited you to say (among other things) what you think of them, which appeal to you personally, and any other topics you would like to see added to the list. Alex is away on holiday as I write this, so I can't check whether he received any input on this – but I certainly haven't. I hope it's because everyone has been

sunning themselves on the Med or beyond during August and not because no one has an opinion. Do please let me (info@cadas-astro.org.uk) know your views.

THE *TRANSIT* QUIZ

Answer to August's quiz

In which countries would you find these observatories or telescopes? For ones in the USA, in which state?

1. Kitt Peak: *Arizona, USA*
2. Arecibo: *Puerto Rico*
3. Roque de las Muchachos: *Spain (on the island of La Palma)*
4. Chacaltaya Astrophysical Observatory: *Bolivia*
5. Apache Point: *New Mexico, USA*
6. Foggy Bottom: *New York, USA*
7. Yerkes: *Wisconsin, USA*
8. Isaac Newton group of telescopes: *Spain (La Palma again)*
9. Submillimetre Array: *Hawaii, USA*
10. Siding Spring: *Australia*

September's quiz

Here are some literal translations of star names. Each is the 'alpha' star within its constellation. Which stars in which constellations?

1. Ear of grain
2. Rival of Mars
3. Tail of the hen
4. Head of the kneeling one
5. Scorching
6. Bear-guard
7. Before the dog
8. End of the river
9. Flying one
10. The horse