TRANSIT

The June 2010 Newsletter of

Cleveland & Darlington Astronomical Society

NEXT MEETING *(last of the season)*

11 June 2010, *7.15 pm for a 7.30 pm start*

Wynyard Woodland Park Planetarium

Presidential address: Beginners' astronomy

Jack Youdale FRAS *Hon. President of CaDAS*

Contents

Editorial

Rod Cuff

This month's issue illustrates more than most the variety of astronomical activities and backgrounds that CaDAS members have. We have articles and letters relating to university research, astrophotography targeting Saturn and the Sun, observations of double stars and over the internet, astrotourism of different kinds in Cambridgeshire and the Canaries and Holland, the difficulties of setting up a telescope, and acid comments on the folly of astrology. That's in addition, of course, to Rob's regular and stimulating Sky Notes. Another regular item, the quiz, is replaced this month by a crossword, just for variety. Alas, no one seems to want to buy or sell anything this month (and no one bought my pop-up tent advertised in May – boo!).

But I'd like to make a special mention of Andy Flemings's AstronomyQuest blog, which he writes in conjunction with his son David. His article on this on page 18 is self-explanatory, but what it doesn't tell you is that their blog recently received the accolade of being featured on what is rapidly becoming *the* primary website for astronomical news, Portal to the Universe. This aims to be "a global, one-stop portal for online astronomy content, serving as an index and aggregator for astronomy content for laypeople, press, educators, decision-makers, scientists and more". Andy & David's regularly updated blog is an impressive pleasure to read, and deserves its success. Andy's article is immediately followed by an example of his writing, to whet your appetite.

Many thanks to all contributors. The copy deadline for the next issue is **Saturday 26 June**.

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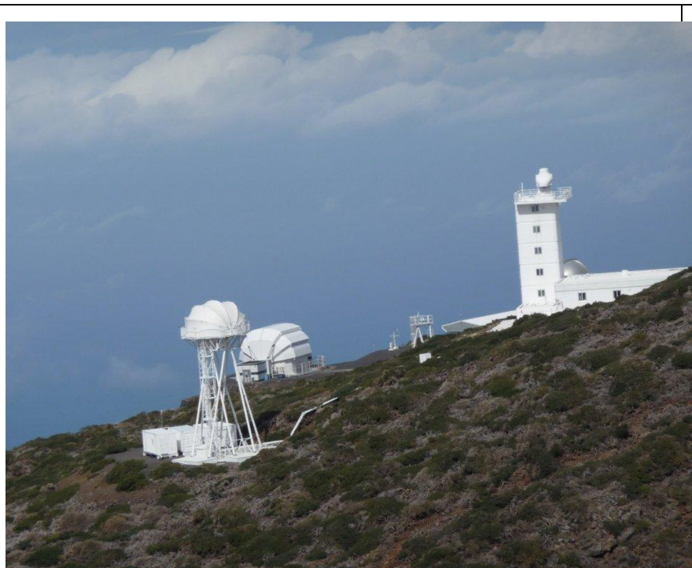
Letters

Telescopes on La Palma, Canary Islands — *Ray Brown*

In the spring, Mrs B and I had a couple of weeks walking on La Palma and of course had to take a look at the observatory. Here's a sample[1] of some photos I snapped whenever the clouds parted. I hope I've identified the telescopes correctly (*see next page*).

[1] *[Ray supplied about a dozen photographs – there are a lot of different scopes up there! – so this is just a selection. – Ed.]*



From top left, clockwise: **Swedish Solar & Dutch Open; Gran Telescopio Canarias; William Herschel; Magic2.**

The La Palma telescopes are listed, with links, at http://en.wikipedia.org/wiki/La_Palma#Observatories

Scientists in Holland

From Neil Haggath

I've just spent a long weekend in Amsterdam. During my sightseeing on foot, I photographed something of astronomical interest. I first came across it during my previous visit to the city years ago, and remembered where to find it.

On the wall of an old house in Leidsestraat, which is now a major shopping street, is this mosaic picture (*see next page*) commemorating the great Dutch astronomer, Christiaan Huygens (1629–95).

Huygens was, in fact, something of a polymath – astronomer, mathematician and instrument maker. As well as being an accomplished observer (we know him best for discovering the nature of Saturn's rings), he built his own telescopes and invented a type of eyepiece that's named after him. He also invented the pendulum clock; curiously, this memorial honours him for that distinction, rather than as an astronomer.

I don't know the significance, if any, of the memorial's location. It wasn't Huygens' birthplace – he was born in The Hague – but the house might date back to his era (I don't know enough about architecture to say, but there are many surviving 17th-century houses in Amsterdam), so perhaps he lived there at some time. I'll have to see if Allan Chapman knows, next time I see him. Today, it looks somewhat out of place; the ground floor of the building is now a fashion shop, while next door is a Ben and Jerry's ice cream parlour!

Not far away from the memorial is a street named after Huygens' father Constantijn, who was a well-known poet and composer – but I'm not aware of one named after Christiaan himself.

During the same trip, I came across a connection with another, more recent, Dutch scientist. I visited the Afsluitdijk ('enclosing dyke') – the huge 20-mile-long dyke, built between 1927 and 1932, that closed off the Zuider Zee and turned it into what's now the Ijsselmeer. Before the dyke was built, the vital calculations pertaining to the tides were done by the famous physicist Hendrik Lorentz, of Lorentz Equation fame. He formulated the equations of time dilation and linear contraction 20 years before Einstein explained the phenomena with the Special Theory of Relativity.

OBSERVATION REPORTS AND PLANNING

Skylights – June 2010

Rob Peeling

The Moon

4 June	12 June	19 June	26 June
Last Quarter	New Moon	First Quarter	Full Moon

Planets

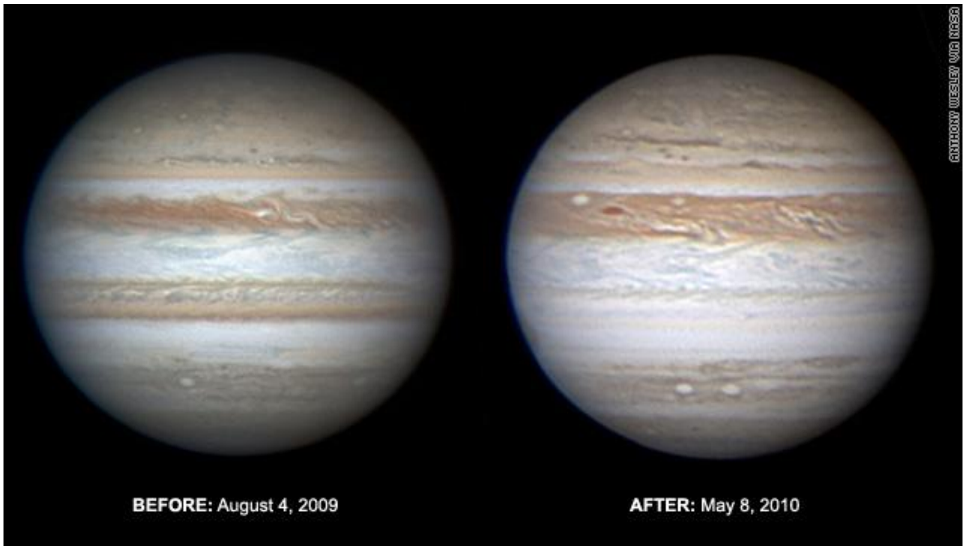
Saturn is visible towards the west in the late evening when it gets dark enough to pick it out. It is in Virgo, about halfway along a line from Regulus to Spica.

Mars is lower and further west. It starts the month to the west of Regulus (very close indeed around 6/7 June) and continues moving east as if trying to catch Saturn.

Venus starts the month in Gemini and by the end of June is almost where Mars was on 1 June. **It should be quite a dramatic display of orbital mechanics from these three planets.** Naked-eye only should be sufficient, and perhaps even the best way to enjoy the show.

Jupiter is very much an early morning object in June, spending the month in Pisces. On 6 June it will mark out Uranus beautifully, with Uranus showing as a 6th-magnitude star just above the brightness of Jupiter. You won't miss it with binoculars or your telescope finder, because it's the brightest 'star' anywhere in the close vicinity of Jupiter. Further west you'll find **Neptune** 1½^{o} to the northwest of iota Aquarii.

If you're familiar with Jupiter through a telescope, you may be surprised this month. The South Equatorial Belt, one of the two dark belts normally easily seen with a telescope, has faded.



Deep sky

The constellation of **Ophiuchus** is well placed to the south at 23:00 in the middle of June. The star **Rasalhague** (α Orphiuchi) is bright and prominent and thus easily found below and to the west of Vega in the sky. Use Rasalhague as a guide to three bright open clusters that I always seek out in Ophiuchus. The first is so large and bright that it is a very easy binocular object. This is **IC 4665**. IC stands for Index Catalogue and was Dreyer's extension to his original NGC (New General Catalogue). IC 4665 can be found by sweeping down to the horizon from Rasalhague to the next bright star, which is β Ophiuchi. As seen with binoculars, the cluster is a little above and to the left of β.

The other two clusters are similarly bright and lie to the east of IC 4665. They can be seen with binoculars but are probably best seen with a telescope at low power. Look up and to the east of β Ophiuchi for the wide, bright pair of **71 & 72 Ophiuchi**, which lie one over the other. Now scan down and further east amongst brightish stars. The nearest cluster to 71 & 72 is **NGC 6633** and a little further on is **IC 4756** (which is actually in Serpens Cauda).

If you fancy a little challenge, then how about tracking down **Barnard's Star**? It is near 66 Ophiuchi, which itself is close by and east of β Ophiuchi. This red dwarf is neither bright nor impressive; however, it is the second-nearest stellar system to our Sun and shows the greatest proper motion of all stars. It moves across the sky so fast that you'll need a star chart showing its exact position for this year – otherwise you won't be able to tell which one of the several faint stars in the field of view is actually Barnard's Star.

Go back to Rasalhague and look for a nearby brightish star to the west of it. This is **α Herculis** or **Rasalgethi** and is an excellent colour-contrasting double. Moderate power is enough to split it and see the orange primary and the much dimmer greenish or bluish (depending on how your eyes work) secondary. The orange star is a red supergiant with a stellar diameter greater than the diameter of the orbit of Mars.

Almost overhead, you will find the famous **Keystone asterism**, which represents the body of Hercules. Most of you will already know how to find the fantastic globular cluster **M13**, halfway up the western side of the asterism. This is easily the best globular cluster visible from Teesside. From a really dark site, M13 is a naked-eye object. I have seen it with my naked eye just once; can you see it too? Less well known is the faint galaxy **NGC 6207** nearby. You'll need a dark night to find this galaxy with a telescope.

A second prominent globular in Hercules is **M92**. Take the midpoint of the northern edge of the Keystone and look further north (towards the head of Draco) for a moderately bright, wide pair of stars. Use these as pointers to guide you a bit further north. M92 should be picked up as a fuzzy blob in your finder or binoculars.

There is a third globular in Hercules, **NGC 6229**. It is not bright and is also tricky to find – but have a go!

Public observing at Wynyard Planetarium, 30 April 2010

Rob Peeling[2]

Friday 30 April was the last public observing night of the current season at Wynyard Planetarium. There were about a dozen people around, mostly CaDAS members but at least a couple of other visitors too. Despite the nearly complete cloud cover, we still managed a good 2½ hours of quality observing. This was thanks to Global Astronomy Month and Gianluca Masi at the Virtual Telescope.

The Virtual Telescope (VT) is a 14" SCT on a robotic mount with a SBIG CCD imager attached. It is at the Bellatrix Observatory at Ceccano in Italy and run by Gianluca Masi.[3] To celebrate Global Astronomy Month, Gianluca has been hosting live internet observing sessions using the VT. The closing session, entitled 'Cosmic Depths', was on 30 April. Ed logged into the live session and projected it onto the planetarium dome. We could also hear Gianluca as he described the objects he targeted with the VT and explained how he was getting the images he obtained and displayed to us all. On these sessions there is also an internet chat room, which enables people following the sessions to share comments with each other and with Gianluca, and so we could also hear his replies to some of the comments from literally around the world.

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[2] With grateful thanks to Ed Restall for processing some of the images in this article.

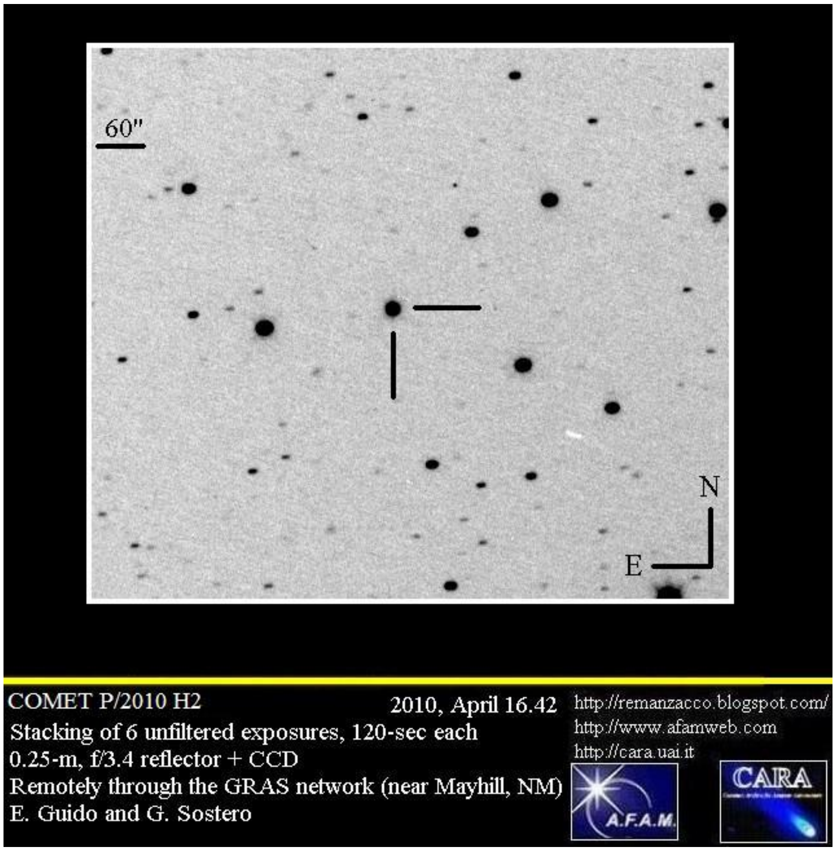
[3] *[See also last month's* Transit. *– Ed.]*

As we joined in, so too did people from the USA, Argentina, Sri Lanka and many other countries.

Gianluca started us off in the Solar System with **Saturn**. Oddly enough, as sometimes happens, this was perhaps the least impressive sight we saw from the VT that night. The rings were clearly visible, but, sadly, no moons appeared in the images. This just proved that the show really was live – you simply can't expect to get high-quality images every time from a real object.

Gianluca moved on to show his worldwide audience an **asteroid**. I was surprised to hear him airily pick an asteroid pretty much at random, it seemed, from the Minor Planets website and aim the telescope at that. I expected either Vesta or Pallas, as they're well positioned at the moment. Instead he went for an asteroid with the rather forgettable name of 152931 2000 EA 107, which is about 2 AU from the Sun. However, he is a good showman and teased us by taking a short-duration exposure to show us how to match the star images to his star chart. Then he took a longer exposure (3 mins) to pick up the asteroid itself, and invited us to find it for ourselves in the resulting image. Sure enough, you couldn't miss the little track of the asteroid against the sharp images of the stars that the telescope was tracking – clear evidence that something was moving against the background. Then he set up the telescope to track the asteroid itself. Reassuringly, his image showed a point of light that was 152931 2000 EA 107, while all the stars were now streaks.

The next target was a comet, and again we were given something a little unusual. The target was **Comet P/2010 H2 (Vales)** discovered two weeks earlier by a Slovenian astronomer, Jan Vales. He found it in an area of sky imaged the previous night by the Catalina Sky Survey, which had not detected anything new. This means that in only 24 hours the comet had brightened by ~200 times.



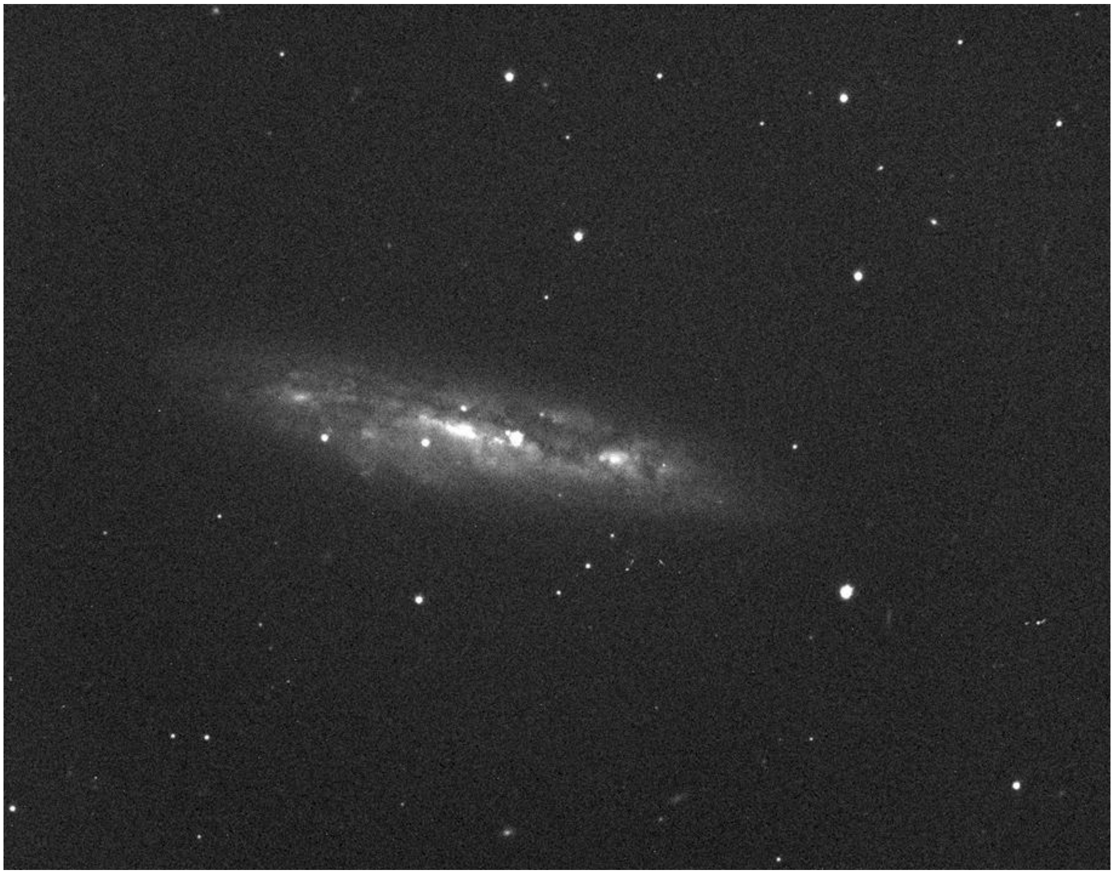
The comet has continued to brighten as it undergoes an outburst somewhat like the memorable outburst of Comet 17/P Holmes in 2007. The image from the VT clearly showed us a bright coma surrounded by a near-circular cloud of dust.

Now it was time to leave the Solar System. The first extra-solar target was **M97, the Owl Nebula**. This is one of the four planetary nebulae in the Messier list and was given its name by Lord Rosse in the 19th century when he observed it with his 6-foot reflector at Birr Castle in Ireland. Gianluca's image caught the two holes that give this planetary its owlish appearance. M97 is in Ursa Major, just beneath the bowl of the Big Dipper. We were now ~1600 light years from home.

M97 from Virtual Telescope on 30 April 2010

We didn't move far for the next object, which was **M108**, a galaxy less than a degree north of the Owl Nebula. The distance was now much greater, as M108 is 46 million light years away. M108 is a highly inclined (near to edge-on) spiral galaxy. The detail in the image from the VT without any processing made my jaw drop. Gianluca pointed out some much smaller and much more remote galaxies in the same image.

Staying in the constellation of Ursa Major and now 55 million light years away, we were now treated to a view of **M109**. This galaxy is a barred spiral and the bar stood out beautifully in the image we saw.

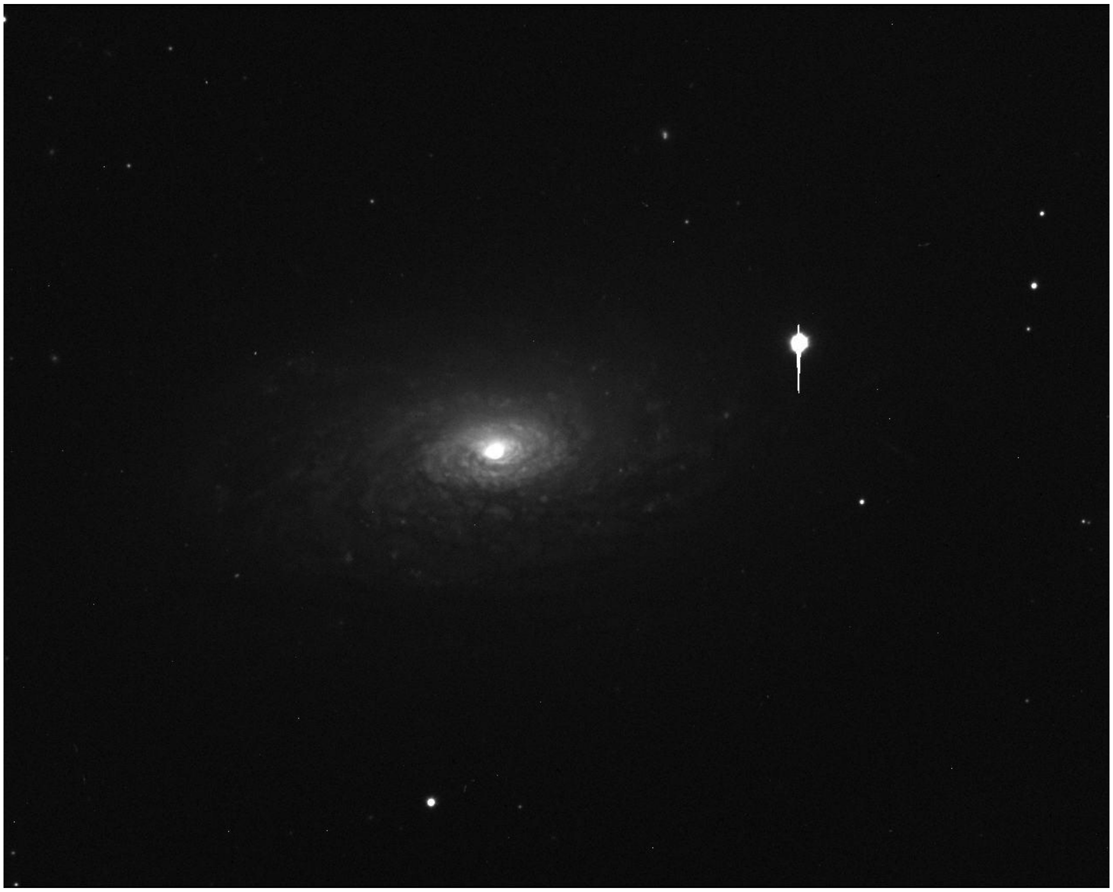


M108 from Virtual Telescope on 30 April 2010

M109 from NOAO/AURA/NSF

Next and much closer to home, at only 15 million light years, was **M51** with its companion **NGC 5195**. This is in Canes Venatici under the handle of the Big Dipper and was famously the galaxy in which spiral structure was first seen by Lord Rosse.

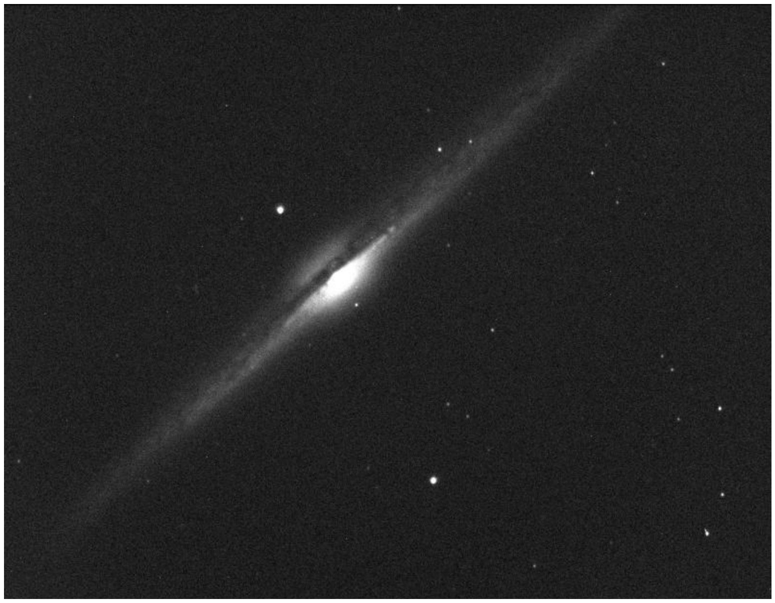
The next object was a flocculent spiral galaxy, **M63, the Sunflower Galaxy**, which is also in Canes Venatici.



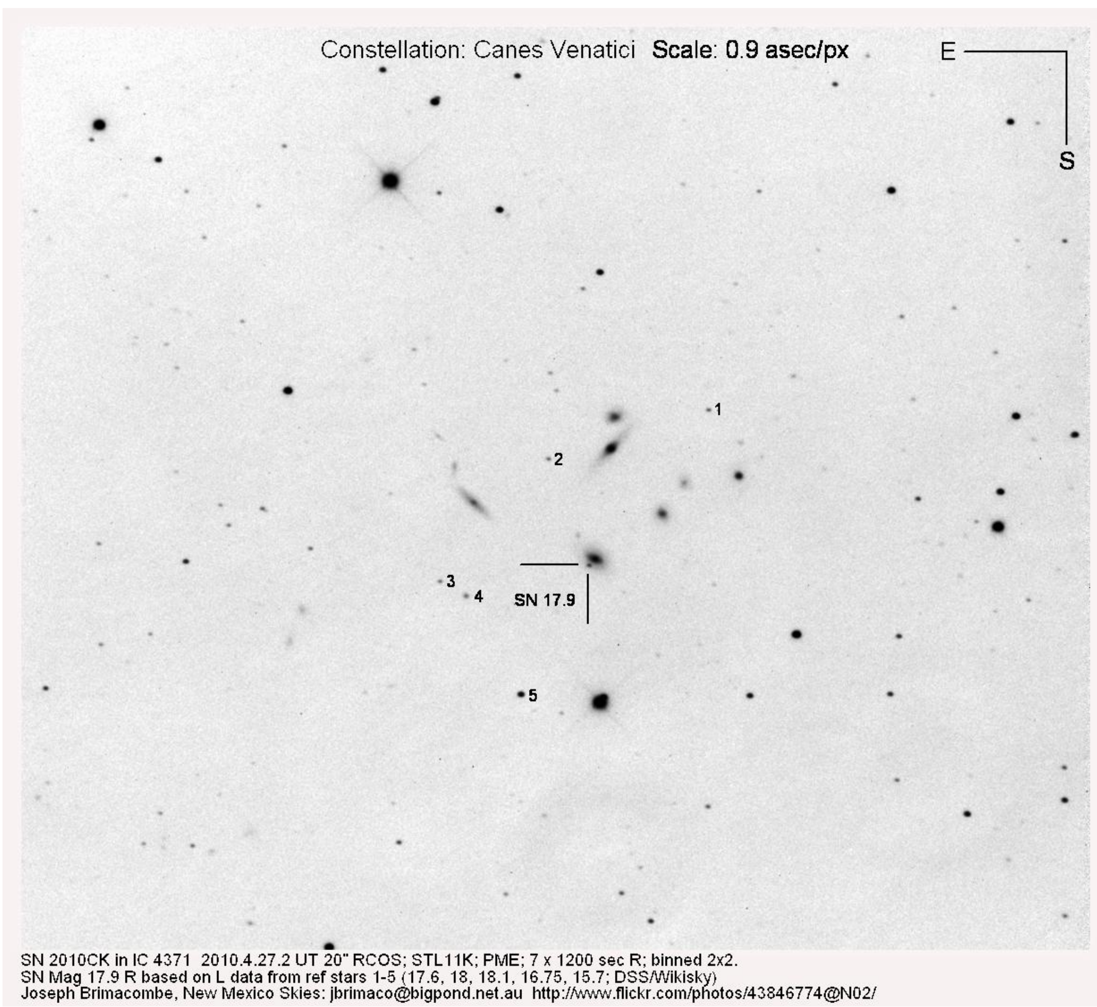
M63 from Virtual Telescope on 30 April 2010

We then moved on to Coma Berenices to see a lovely edge-on spiral galaxy, **NGC 4565** (*see page 11*).

The final object from the VT that we saw at the Planetarium was **IC 4371**, a galaxy in a group called Hickson Compact Group 70. With this galaxy, Gianluca had another surprise for us as he pointed out **supernova** SN 2010ck, discovered just 5 days earlier by Tim Puckett and Jack Newton in North America.



NGC 4565 from Virtual Telescope on 30 April 2010



Some double stars in Boötes

Dave Blenkinsop

Welcome to the wonderful world of double stars. If the night sky is clear, I get out my *Norton's Star Atlas* and *Celestial Objects for Common Telescopes* by TW Webb. I have a street lamp just outside my back yard, so I place a large plywood screen up on my shed to hide behind, as otherwise the yard is floodlit. If *I* can see the stars, you can.

(On May 3 in twilight I had a look at Saturn with my 6-inch Dobsonian and 70mm refractor. With the Dob at 80×, I could see Titan and Rhea. On 10 May I could see Titan, Rhea and Dione. With the 70mm Titan was faint, but I could see the rings' shadow on the planet. But back to doubles in the constellation of Boötes.)

Epsilon (ε): I can just resolve it at 140× with the 70mm. In a larger telescope it's a wonderful yellow and blue double.

Pi (π): With the 6-inch two white stars can be seen, one a little brighter than its companion. The 70mm splits it at 50×.

Xi (ξ): the Purple Star. It's a Sun-like star with a red dwarf companion, rather like Eta (η) Cassiopeiae. The latter's companion looks red, while ξ Boötis' companion looks purple. Don't let the season go by without a look at this one. It resolves at 60× with the Dob and at 50× with the refractor, which also at 17× shows a nice star-field.

Kappa (κ) and **Iota (ι):** Wide, easy doubles in the refractor at 35×.

Σ1825: This pair is just above Arcturus. Both stars are white, but the companion is faint. In the Dobsonian it resolves at 120× but is better at higher power. Both can be seen in the 70mm at 140×.

Σ1835: About 10° south of Arcturus, a tight line of three stars run north to south; Σ1835 is the topmost one. In the Dobsonian it resolves at 60×, showing a white primary and a fainter yellow companion. With high power it looks like a miniature Cor Caroli (the brightest star in Canes Venatici). In the 70mm at 35×, all three of the lined-up stars fit in the field of view; and at 50× I can still see two stars, white and yellow.

Σ1838: This pair is about 3° up from Σ1835. The refractor shows two stars at 35×, though it's dim.

Mu$^{2/1}$ (μ$^{2/1}$): To find this Boötes pair, start at α Coronae Borealis (Alphekka), then move up to Theta (θ) CrB, and finally to the target pair. Two stars can be seen in the 6-inch at low power, but with higher power it can be seen that one of them is a double. They are sunlike stars 100 light-years away and 1.2 and 0.7 times as bright as the Sun. Alas, they're too faint and close for the smaller telescope.

Finally, moving out of Boötes to **Zeta (ζ)** and **Sigma (σ)**[4] **Coronae Borealis**: These are east of our last previous target and can be found, resolved, in the same field of view at 50×. And there is more: Webb lists ζ as green. So what did I see with the Dobsonian? Well, maybe green – a definite maybe… Do tell me what *you* see!

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[4] *[Although Dave specifies Sigma in his manuscript, the* Cambridge Double Star Atlas *shows it as about 10° east of Zeta. I suspect he means Σ1964, which* would *be in the same low-power field as Zeta. – Ed.]*

Some 'en-darkened' planning at last

Rob Peeling

Recently I stayed for three nights at a hotel in a village called Cambourne, about 8 miles west of Cambridge. Every building in the village looks recently built, and with a little research I found out that the place didn't exist before about 2004, when the whole area was a farm.

On my first night I quickly realised that all the street lights (including in the hotel cark park) were full cut-off types. This has to be the result of a specific requirement set for the area's developers by South Cambridgeshire Council. The night sky was, however, determinedly cloudy. Late the following afternoon, I happened to find the local office of the Wildlife Trusts and found that all the land between the various housing estates in Cambourne has been laid out as nature reserves – with no lighting at all. Here's further evidence of some forward thinking at South Cambridgeshire Council. Cambourne turned out to be a rather pleasant location, albeit an entirely man-made environment.

On my last night the sky was clear and I took the opportunity to walk 200 yards or so into the nature reserve with a pair of 15×70 binoculars. The benefits of the full cut-off lighting policy were immediate and dramatic. I could easily see the Milky Way without waiting for night adaptation. However, the most impressive thing to me was the number of galaxies I could find with my binoculars. Within a short observing session of about 30 minutes, I saw eight. **M81** and **M82** are easy, but the view in Cambourne was crisp and clear. **M51** is also straightforward, but less usually for a developed area I could also see the companion **NGC 5195** with my binoculars.

The next target was a real surprise for me; I could easily see **M101** with direct vision. This is a notoriously difficult object in any of the built-up parts of Teesside, including my own garden. I could clearly see a circular, nebulous patch with a distinct core. My next target was the **Cocoon Galaxy**, NGC 4490 in Canes Venatici. This is a long-standing favourite of mine that I know can be reached with binoculars in good conditions. I wasn't disappointed; it was easy to spot with averted vision. I then tried **NGC 2403** in Camelopardalis (west from M81) and found that too with averted vision. My final galaxy was **M66** in Leo, which I could just see with averted vision (but not M65).

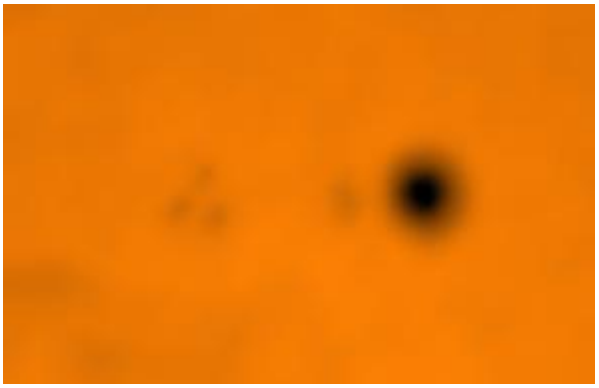
I think that's pretty good going for observing from the middle of a modern housing development. I am convinced that the obvious controlled lighting policy for the area made all the difference. Well done to the developers at Cambourne and South Cambridgeshire Council!

Sunspot group 1072

Rod Cuff

Recently I disinterred the Meade ETX-125 telescope that I used before I acquired an LX90. I always had trouble getting it to track properly, though I've just now retrained the motors and am keeping my fingers crossed.

The reason I brought it out of storage is because I wanted to try photographing sunspots, and the ETX has a full-aperture, screw-on solar filter. However, even though solar cycle 24 is clearly under way and sunspots have been appearing for a few months, there's not been a large one that I could use to build up some experience in focusing and capturing. Recently, though, sunspot group 1072 provided a moderately decent target, so here is my first attempt.



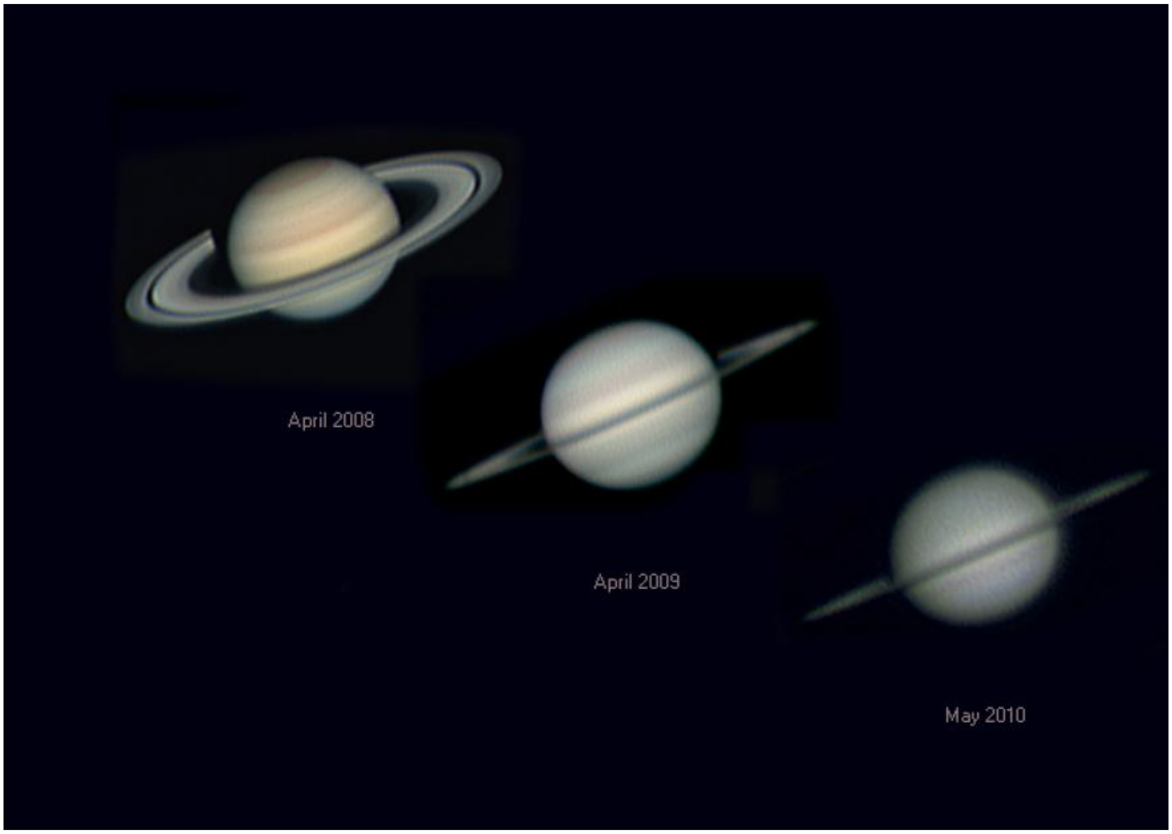
I'm not sure how genuine the background mottling is – it may be an artefact of subsequent image processing – but the leading large spot (umbra + penumbra), following smaller spot and trailing mini-group of three are genuine enough (http://stargazerslounge.com/imaging-solar/104792-sunspot-1072-a.html has someone else's picture taken 5–6 hours later). I'll keep at it!

Equipment used: ETX-125 (5" SCT), Meade full-aperture white-light solar filter, ToUCam Pro II webcam, approx 380 frames at 10 fps, exposure 1/50 sec (I think – I failed to make a note of it). Post-processed with Registax 5, Photoshop 9 and Neat Image noise reduction.

Changes in Saturn's appearance

Keith Johnson

Here are a few images of Saturn taken over a three-year period, showing how much the rings have tilted during that time. I took the most recent image on the evening of 3 May 2010.



Using a German equatorial mount:

Part 2 – Experiences in setting up

Alex Menarry

Writing all this fulfils two functions. One is to check whether I understand what I am doing. The second is to see how it compares with others' experiences and methods of setting up. The EQ5 mount (and tripod, which I no longer use because I have a fixed post in the garden) was originally bought for use with a six-inch, standard Newtonian. However, an ordinary Newtonian telescope tube needs to be rotated in the clamps to allow the eyepiece to be in a reasonable observing position, so I gave up.

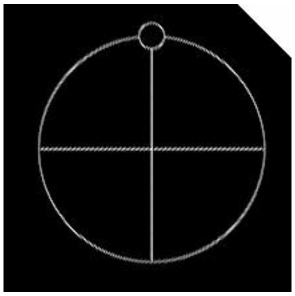
Because I was rubbish at star hopping using an equatorial, I fitted the motors of the Eclipse GoToStar system to the EQ5 mount and switched to using photography with a DSLR Pentax 100D. By mounting the camera and a sighting telescope together on a little table with a dovetail (*left*), it was easy to take reasonable astro-pictures. The whole assembly is very light and doesn't need a balance weight.

This project was partially successful, and by using RAW pictures with the software package AIP4Win, I was able to do some photometry to measure the magnitudes of variable stars and eclipsing binaries, rather than estimate them by eye (see February's *Transit* for the eyeball estimation method). One big advantage of photometry with a DSLR is that the image does not need to be in focus – in fact it is better out of focus. Des Loughney, the Eclipsing Binary Secretary of the BAAVSS, has developed the technique so that he can measure to about 0.01 magnitude and for some stars detect the dip in light output when a planet passes in front!

However, the bad light pollution from sodium street lights around my house was too limiting, so I gave that up. Frustrated, I became an armchair and binocular astronomer for a while, until the CaDAS Expedition to the North Pole came along, inspiring me to buy a Celestron C8 and giving me the enthusiasm to eyeball fascinating objects in the sky with a telescope again. It was at this point that problems of slewing accuracy became obvious. With the camera, using a 5×5° field, great accuracy was not needed. However, I was noticing that the accuracy of the Eclipse GoToStar and EQ5 combination was no better than 1° and sometimes much worse. This was nowhere near as good as other people's experiences I heard about, which indicated that an accuracy of better than 10 arcmins should be routine.

And so we come to the central subject of this article. How does one set up an equatorial mount accurately enough? After discussions with, and generously-given advice from, several members of the Society, including Keith Johnson, John Gargett, George Gargett, Jürgen Schmoll, Ed Restall, Mike Gregory and others, what follows is the routine I now follow to set up before an observing session. In addition, I discovered that the worm drives of the EQ5 had excessive mechanical play in them, which explained the previously unacceptable inaccuracy of the GoTo system. Jürgen showed me the adjustments available on the worm drives (which are very clever!) and reduced the play to negligible proportions. It is now possible to achieve an accuracy of better than 30 arcmins, which drops the object required into the field of view of a 25mm eyepiece with my C8.

Typical fields of view for my Celestron C8 are: polar scope 5.5°, sighting scope 6.7°, 40mm eyepiece 60 arcmins, 25mm eyepiece 35 arcmins, 12.5 mm eyepiece 15 arcmins and 9mm eyepiece 10 arcmins.



The first thing to do with an equatorial mount (after checking for and eliminating mechanical play in the head, of course!) is to ensure that the polar axis sighting scope is at the axis of rotation of the RA drive. My polar axis scope has an eyepiece with cross-hairs and two circles inscribed (*left*).

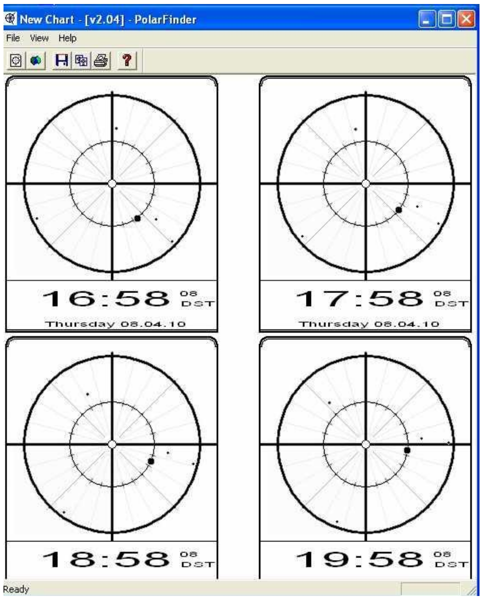
The large circle is just under 1° in radius, which is the offset from the centre (the North Celestial Pole – NCP) where Polaris must be when the RA axis is accurately aligned to the Pole – as discussed later. The smaller circle is designed so that, when in the correct angular position and with Polaris in the little circle, the polar scope will be pointing at the NCP.

There is a facility on equatorial mounts for rotating the Dec axis so that a hole in the axle comes into position to allow sighting through the polar alignment scope (*right*).

For adjusting and checking that the polar scope axis is parallel to the RA axis, I usually adjust the RA axis to be almost horizontal and then sight on an easily recognised fixed point (a mark on a wall or on a TV aerial, something like that) in the daytime. When the RA axis is rotated through 180°, does the centre of the cross move around or not? If it is describing a circle around the selected fixed point, the polar scope is not aligned with the RA axis. The method of adjustment is to fiddle with the three adjustment screws of the polar scope and, by trial and error, make the centre of the cross stay on the selected fixed point when the RA axis is rotated through 180°. I call it a fiddle because it really is a fiddle. The photo on the left shows two of the three adjusting screws.

The method of adjustment with three screws is not a good idea, since it always takes adjustment of at least two of them to move the direction of the scope axis, which throws the other directions out. Maybe better-quality polar scopes have a properly designed and engineered adjustment system? After about a quarter of an hour I usually say, “Well, that’s as near as I can get it”, even if it isn't perfect.

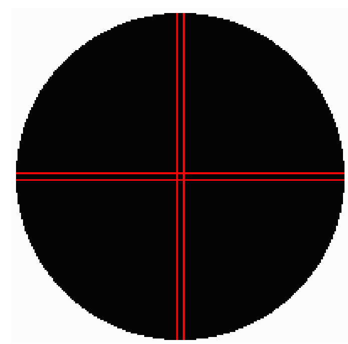
The next check on this polar alignment axis comes when setting up on the Pole Star. The view through the polar alignment scope must have the NCP at the centre of the cross-hairs. By adjusting the azimuth and elevation settings on the head (see Part 1 in May's *Transit*), Polaris must then be on the (larger) circle – but where on the circle? That depends on the date and time, since Polaris describes a circle about the NCP. There is a method, using the scales on the EQ5 head, for setting the little circle at the correct angular position, but it is much easier to use a free-download program called Polar Finder. This shows the position of Polaris at the date and



time of setting, as seen through a (reversing) polar sighting scope; clever, eh? Here (*left*) is a typical screen presentation.

Using the picture with the correct date and time, the azimuth and elevation are adjusted to put Polaris in the place indicated by Polar Finder on the '1 degree' circle. The 180° rotation method, as used in the original adjustment setting of the polar alignment scope, will confirm that Polaris rotates on the circle, if all is well. Using the RA and Dec locks (see diagram in Part 1), the telescope dovetail slot can then be returned to the 'Park' position and the telescope fitted.

But just a moment, I hear you say: the position of the telescope in RA and Dec is a pure guess, as near as to the Park position as you can estimate to make the telescope line up with at the starting point – the NCP. The GoToStar electronics/computer are at the start position, by definition, when the system is powered up, and the computer moves the RA and Dec motors the correct amounts from there. The telescope may or may not be pointing at the NCP – there is no way of knowing. One guess that might be one step better (?) is to adjust the axes, using the locks, so that the sighting telescope of the main telescope has Polaris in roughly the same place as the Polar Alignment scope – but it's still a guess. Another strategy might be just to let the computer make the corrections necessary, after a three-star alignment using the GoToStar instructions.



A third possibility is to use the GoToStar three-star alignment procedure but, on the first star, use the head-setting locks to set the chosen star at the centre of the field of view. Now the telescope is pointing in the correct direction and the three-star alignment can proceed, using the handset to centre the other two stars, as in the instructions. To ensure accurate positioning on the chosen star, I now use a 12.5mm eyepiece with an illuminated reticule (*right*). This eyepiece gives the most accurate method I know of centring the alignment stars.

There will still be inaccuracies, of course, with their origins in the polar scope setting, the NCP setting and the mechanical errors in the mounting head itself – for example, errors in the alignment of the RA and Dec axes and whether they are at right angles and whether the worm drives are accurate or have backlash. I'm told there is a method of correcting for backlash in the electronics of the drives, but I haven't clocked that yet. The correspondence between the RA optical axis and the mechanical RA axis is taken care of by the polar scope alignment procedure described above.

After the setting-up procedure I have described, I can see no more accurate method of approaching the job. I should be most grateful if our experienced observers would comment on the procedure I've adopted. I have to confess ignorance of how the electronics and computer in the handset send the correct RA and Dec to the driving motors. Jürgen told me that for objects within the triangle of the three-star alignment, the software interpolates and for outside that triangle it extrapolates – which makes all sorts of sense. Others have told me that, following a three-star alignment, the electronics corrects for all sorts of errors, so accurate polar alignment etc is not really necessary. One principle has come home firmly to me – the engineering quality of the head must be paramount. Do I need to buy an HEQ 5 Pro, like this beauty, I ask myself?

The AstronomyQuest blog

Andy Fleming

News, views, features and podcasts about astronomy, astrophysics and cosmology PLUS an online ASTRONOMY SUPERSTORE

With the light nights well and truly with us, an amateur astronomer's attention naturally turns to... well... other areas of our science that, unlike observing, are unaffected by our so-called summer.

For many years on cloudy, rainy nights and weekends, I have had my nose firmly ensconced between the pages of a plethora of astronomy, astrophysics, cosmology and planetary science text books. One by one, through sheer determination, interest and enthusiasm, the various theoretical aspects of our hobby that I never expected to be able to understand, such as Newtonian mechanics, special and general relativity, quantum mechanics and particle physics have been, at least in their basic forms, cracked. This is not to mention my self-education in subjects such as planetary science, geology and astrobiology, which are, to say the least, fascinating.

One of the joys of education is being able to share your newly found knowledge with others, and so my mind turned to public-science literacy and education, and inflicting Lorenz transformations, quantum chromodynamics, the Pauli exclusion principle, Chandrasekhar masses, tectonic plate subduction and impact ejecta on a whole new gamut of unsuspecting readers in the form of a weblog, or 'blog'!

To be cool, you have to join the 'blogosphere' these days – I love writing, I love astronomy, and I love explaining astronomy to others (I'll leave it to them to describe just how effectively I manage these things!), and so I launched the AstronomyQuest blog in March this year. Truth be told, although I had published websites in the past, I didn't really have a clue what a blog was or what it could be used for. I had a notion that blogs were written by movie or sports stars, or politicians with over-inflated egos and opinions of themselves.

It turns out that a blog is just a frequently updated news webpage with outgoing feeds or channels (such as RSS or Atom) that communicate with other related blogs and blog directories, thus effectively broadcasting your posts around the blogosphere and ultimately the internet.

AstronomyQuest's stated aim is "to provide an educational resource for the public in new developments and discoveries in astronomy and cosmology. It also includes media reviews and tips on amateur observing and explanations of various astronomical phenomena, and scientific theories pertaining to astronomy." To this end, the blog aggregates the latest hot news and press releases from a smorgasbord of astronomy and space-related organisations such as NASA, JPL, the Royal Astronomical Society, ESA, CERN, JAXA, major observatories and university research facilities. As the blog's target audience is both amateur astronomers and interested members of the general worldwide public, such press releases are then edited into shorter reader-friendly news items and posts.

AstronomyQuest's content doesn't stop with cutting-edge news, however. There are weekly podcast reviews and downloads, such as 'Planetary Radio' from the Planetary Society, ABC's 'Star Stuff', the SETI Institute's 'Are We Alone?', and the superb video podcast 'This Week In Space' with CNN's Miles O'Brien.

There are also plenty of exciting in-house home-grown features on subjects as diverse as backyard observing and the evolution of stars, or the personalities behind the 1960s Soviet space programme. The blog also sports the AstronomyQuest monthly podcast, available for download either on iTunes or by using the site's embedded podcast player. This 25-minute programme, which has already amassed 800 subscribers from around the globe, includes the latest space and astronomy news, a feature, a media review and a 'What's up in the night sky' segment.

If all of this up-to-date content is not enough to whet your appetite, the AstronomyQuest blog also includes its own Amazon Astronomy Superstore, with pages of telescopes, binoculars, astronomy books and DVDs all at highly competitive prices and at a quality you would associate with the world's premier online retailer.

So stay local and keep informed about the latest news in astronomy and cutting-edge space science by regularly visiting:

http://astronomyquest.blogspot.com/

Leave some comments, and don't forget to tell your friends!

A medieval crater on the Moon?

Andy Fleming

The intriguing case of Giordano Bruno crater

If you take a look through binoculars at the lunar surface on any moonlit night, you will be immediately reminded of the routine planetary violence that has created the surface that we see today. Over billions of years, our Moon (and for that matter, the Earth) has been pummelled by countless asteroids, comets and meteorites, principally throughout the Period of Heavy Bombardment about 3.9 billion years ago, but also right up to the present epoch. Unlike the Earth, however, the Moon has no plate tectonics, vulcanism or weathering, and its surface provides a pristine record of its impact history. Moreover, its recent history includes supplementary written records of events on the lunar surface.

In 1178, the chronicler Gervaise of Canterbury took down the depositions of five monks who had claimed to have seen a strange spectacle on the lunar surface:

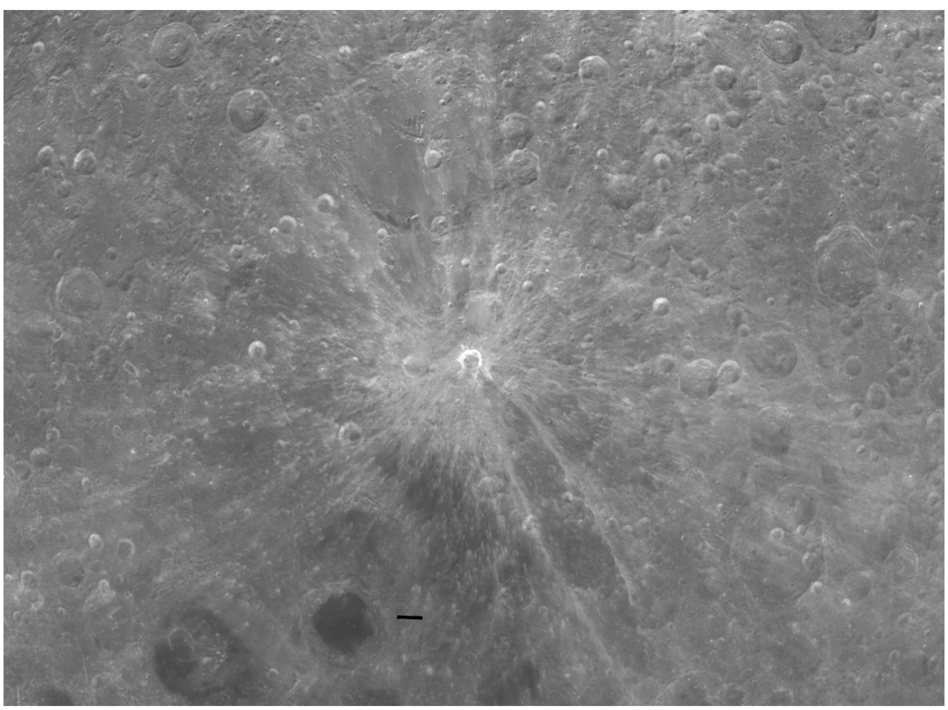
This year on the 18th of June, when the Moon, a slim crescent, first became visible, a marvellous phenomenon was seen by several men who were watching it. Suddenly, the upper horn of the crescent was split in two. From the midpoint of the division, a flaming torch sprang up, spewing out over a considerable distance fire, hot coals and sparks. The body of the Moon which was below writhed like a wounded snake. This happened a dozen times or more, and when the Moon returned to normal, the whole crescent took on a blackish appearance.

In 1976, in the journal *Meteoritics*, an astronomer from the State University of New York, Jack Hartung, investigated the claim, eventually putting forward the hypothesis that what the monks had witnessed was a meteor impacting the Moon. Indeed, Gervaise's account, if true, is unique. There is no other account either in antiquity or during modern times of such a large lunar impact and resultant explosion. Sure, there are frequent Transient Lunar Phenomena, even witnessed during the NASA's Apollo programme – the result of possible outgassing, small impacts or electrostatic effects.

Indeed, there is a fascinating account from NASA's Marshall Space Flight Centre (MSFC) of an impact in December 2005. This was possibly a Taurid meteor. There is also spectacular MSFC video footage of another small impact in June 2006

That the monks of Canterbury witnessed something is fairly certain, and Gervaise was clear that they were prepared to place their reputations 'on the line'. Certainly, on the date in question the Moon was in the sky, revealing itself as a thin crescent.

Hartung's hypothesis can be tested. Scientists have calculated that, given the naked-eye description of the event, a crater of at least 10 kilometres in diameter would have resulted, along with ejecta rays emanating up to 100 kilometres from the impact site. Its position would be near latitude 45° north and longitude 90° east.



A candidate crater was soon found in the form of Giordano Bruno (*left*), named after the 16th-century astronomer and philosopher. Amateur astronomers can observe this crater with telescopes during periods of exceptionally favourable libration in the far north-east of the Moon's disc; however, it is usually on the far side. In October 1959 the Soviet Lunik III Mission photographed the crater, and found its diameter to be approximately 20 kilometres, with a ray system to rival that of Tycho's (this is despite the crater rim diameter being only one fifth that of Tycho).

So is Giordano Bruno crater 832 years old? Interestingly, no one is certain about its age. The usual dating method of surveying subsequent craters both within it and on its ejecta blanket certainly suggests this is a young crater. But by 'young' these results imply an age of anywhere between one and ten million years. However, if these subsequent small craters turn out to be secondary cratering from the main impact event that formed Giordano Bruno, then its age is once again thrown into doubt... it could be much younger.

There are, however, further objections to Hartung's hypothesis. Such an impact on the Moon should have showered the Earth with secondary meteorites in a fantastic firework display. And yet there are no records in European, Chinese or Arab chronicles of such a ferocious and stunning meteor storm. In 2008, a further survey by scientists analysing high-resolution images of the crater and its surrounding area, acquired by the Terrain Camera on board the Japanese lunar orbiter SELENE (Kaguya), estimated that it formed more than one million years ago; but again this discounts secondary cratering.

The controversy will finally be put to rest when radiometric age-dating of impact-melt rocks at the crater is returned by the next generation of lunar explorers. Whatever the monks of Canterbury saw on that warm summer June evening in 1178, whether it was an impact on the Moon, or a meteor exploding in the Earth's upper atmosphere, it certainly was a spectacular sight.

Why does Venus spin backwards?

John McCue

All the planets in our solar system seem to have a regular spin, but what is 'regular'? You might say that it means the spin axis is more or less upright, and the time of spin is about the same as our own Earth's day. If you look closely, though, strange things emerge.

Mercury, for instance, is most odd because of its proximity to the powerful pull of gravity of the Sun. If you were able to stand on Mercury's surface, the Sun would rise, set, and rise again while the planet itself went around the Sun twice, so making a solar day on Mercury twice as long as its year. The Sun's gravity has locked Mercury into this resonance.

Mars behaves itself and spins very much like Earth (which will feel like home when we finally get there), but what about the gas giants, Jupiter, Saturn, Uranus and Neptune? They, on average, spin about twice as fast as Earth – that's not too much of a difference from us – but look at Uranus. Its spin axis is tilted right over at 98°, so imagine watching it: it would roll round the Sun. The accepted idea is that Uranus suffered a major collision in its early history that knocked it over.

Venus also is unusual. It spins backwards, taking about 243 days to do so. In the early 1980s, when my supervisor Dr John Dormand and I started working on this problem at Teesside University, there was no consensus on the cause of this peculiarity and very few astronomers were working on it. John, incidentally, was just coming to the end of 25 years' work, in partnership with Prof. Michael Woolfson of York University, on an idea about the origin of the Solar System, an idea they called the Capture Theory. In a nutshell, it proposes that our young Sun pulled from a nearby proto-star cool material, which clumped into the planets as it swung into orbit around our Sun. The more widely accepted theory, outlined in all popular astronomy books, of gradual accretion, like rolling snowballs, of a disk of left-over material into the planets, has serious flaws. "It's been dead for years", he would report. True, disks of material have been seen round other stars, but that doesn't mean our planets started like that. There may well be two or three different ways in which planets can be formed.

But back to Venus. The Sun exerts a gravitational tidal force on Venus (just as it does on the oceans of Earth) but in a dual way: tidal forces are raised on the body of Venus and on its atmosphere. The second tidal force is significant because Venus has a very thick, heavy atmosphere composed almost entirely of carbon dioxide. In the early 1980s astronomers were divided as to whether these tidal forces could have been responsible for slowing down and reversing Venus from a so-called initial regular spin, so that we see the planet in its present state. Some said they could, some said they couldn't. If they couldn't, maybe Venus started life spinning backwards. But why so, if all the other planets had started spinning normally? Thinking about Uranus, I talked to John about the possibility that Venus was hit by a large object and knocked backwards, after which the spin was modified by tidal forces until it arrived at its present-day value.

We worked on this for seven years and I presented a PhD thesis on this very topic in 1990. I was disappointed, though, that the theory sank without trace for nearly ten years. Even when it was finally cited in a scientific paper, it was not exactly welcomed with open arms. Meanwhile, the Planetarium was launched in 2002 and I worked there for nearly four years. During that time, I bought a new educational package of short films called Space Files. I was astonished that the Venus film included the collision theory, and it has been popping up on the web ever since. Only this week an OU student posted on the S196 forum a link to a website that had the theory there in a popular article about Venus' unusual spin. I'm so chuffed to have finally played a part, even though no credits are given in any of the articles I've seen. Now I'm happy to be accused of trumpet-blowing, and I know that some will do so. You though, my friends, can do me a favour by telling people you know the bloke behind this theory.

Astrology uses the election to give misleading information

John Crowther

In the *Sunday Express* of 2 May, which of course was three days before the election, the centre-page spread had the title 'Will Moon land Cameron a win?'. Lori Reid, the *Express*'s resident astrologer, had supplied this eye-catching title; just as medieval monarchs employed a court jester, so 21st-century newspapers seem to need to employ an astrologer.

But on Election Day the Moon wasn't involved in any way with astrology, and so the Moon couldn't perform – but perhaps Mercury could, although the astrological definition of retrograde doesn't seem the same as the astronomical one (and can't we squeeze *four* orbits of Mercury into our year?):

> *What we do have on polling day (and have had since April 18) is a retrograde Mercury, a planetary period notorious for hitches and hassles, miscommunication and mistakes. When this phenomenon happens (and it occurs three times every year) we can expect slow-downs*

and delays, sluggishness and strikes, machinery malfunction and generally spanners in the works.

Uranus also is mentioned in the article, along with Saturn. In pre-telescopic times, Saturn, at the then known boundary of the Solar System, was seen as a pale, slow-moving old man. When William Herschel discovered Uranus, it was clearly the harbinger of a new order; yet it is much slower and paler than Saturn. So the adjectives used by the astrologer, describing the planet as the bringer of fresh ideas and reform, should be applied instead to Herschel and his fellow astronomers and have nothing to do with Uranus. And here we have the caricature of the retrograde:

There is a mighty planetary challenge taking place in the sky. On one side there's Uranus, planet of the new order, reformation and fresh ideas. Diametrically opposite in their orbits stands Saturn: solid, cautious, planet of the status quo.

Nothing is straightforward with Uranus. As soon as it has thrown us into disarray by moving into Aries, this planet of upsets and surprises then promptly turns tail and by early July scuttles right back into Pisces, the sign it came from.

So how about part of the Planetarium wall being reserved for head-banging?

THE *TRANSIT* QUIZ

Answers to May's quiz

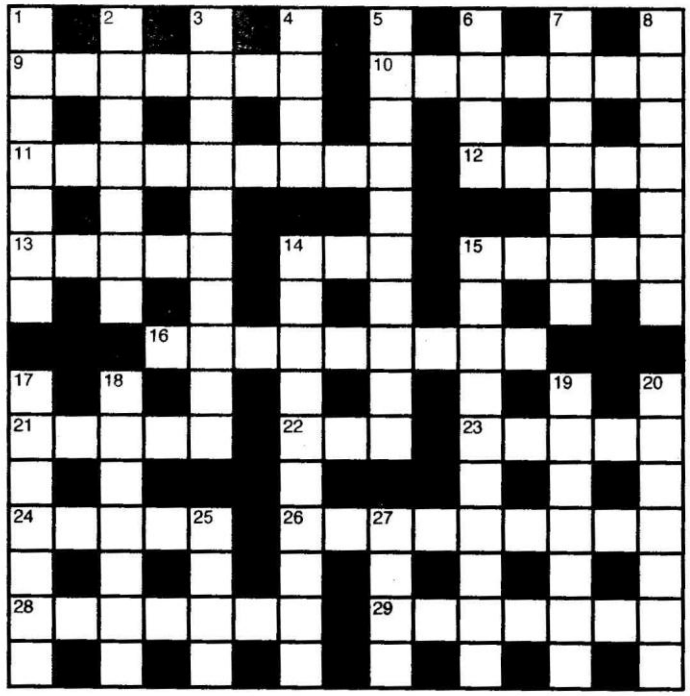
You were asked to fill in the gaps – the answers are shown here in blue.

1. The absolute magnitude is the apparent magnitude that a star would have if it were observed from a standard distance of **10 parsecs.**
2. The apparent magnitude of the Sun is about **–27**.
3. The sidereal day is the mean interval between successive culminations (transits of the meridian) of the same star, and to the nearest second is **23h 56m 4s**.
4. The Earth's escape velocity, to the nearest km/sec, is **11 km/sec.**
5. **Sirius** is the brightest star in our skies, and **Regulus** is the least bright first-magnitude star.
6. Of all the 21 first-magnitude stars, **Canopus** has the brightest absolute magnitude, and **α Centauri** the least.
7. The Earth/Moon system, or indeed any two-body system, has **five** Lagrangian points.
8. The first star to be discovered to vary in a periodic manner was **Mira**.
9. Because of precession, the celestial pole describes a complete circle around the pole of the ecliptic in about **25,800** years.
10. The first quasar to be identified, and optically the brightest, is designated as **3C 273** in Virgo.

June's crossword

Fairly easy; the clues are all factual and non-cryptic. They can be a bit whimsical occasionally, though ….

You will, I think, get most satisfaction out of it by first seeing how many clues you can solve without any reference aid; then using reference books (if you have any) to fill in some more; and only then, if necessary, looking things up on the internet. Drop me an email if you succeed and/or if you enjoyed it or were irritated by it – it would be good to have some feedback!



ACROSS

9. Adobe program that enables you to see this crossword on your computer (7)
10. Belonging to the constellation of the River (7)
11. Constellation containing M32 (9)
12. A division in Saturn's rings (5)
13. What matter does before collapsing to form a star (5)
14. Greek letter χ (3)
15. The largest constellation (5)
16. First syllable of M33, plus the last syllable of one of Enceladus's most famous features (a suitable clue?) (3-6)
21. Constellation containing M42 (5)
22. What probably broke the Mars Phoenix lander, we learned this month (3)
23. Greeting for visitors to the Keck Observatory? (5)
24. Alternative alignment to alt-az (5)
26. Newton's great work (9)
28. Current mission to Saturn (7)
29. Dennis Tito was the first in space (7)

DOWN

1. An English name for the only zodiacal constellation representing an inanimate object (7)
2. Heavens Above tells you when to expect a flare from one of these satellites (7)
3. Cause of dark spectral lines (10)
4. Used in the Apollo programme – DuPont called it Teflon (4)
5. Zubeneschamali or Zubenelchemale (4, 6)
6. Pair of interacting galaxies in Coma Berenices (4)
7. Kemble has one in Camelopardalis (7)
8. One of three people chasing a sight in the sky 2100 years ago? (4,3)
14. Constellation containing M52 (10)
15. Discoverer of the precession of the equinoxes (10)
17. Central attribute of a MACHO (7)
18. Describes the Moon's atmosphere (7)
19. English name for the constellation between Pegasus and Aquila (7)
20. Pertaining to the Milky Way (7)
25. The Huygens probe found that methane does this on Titan (4)
27. The brightest star in the Sword (4)