TRANSIT

The January 2010 Newsletter of

Cleveland & Darlington Astronomical Society

NEXT MEETING

15 January 2010, *7.15 pm for a 7.30 pm start*

Wynyard Woodland Park Planetarium

Enjoying the Night Sky

Rob Peeling (CaDAS)

Contents

Editorial

Rod Cuff

I hope you all had a fine Christmas with at least one special astronomical item in your stocking. This month's *Transit* is a rich pudding stuffed with silver thruppenny bits – for many, Dave Weldrake's climactic article on the Lupus exoplanet project will be a highlight, to judge from comments received on his earlier articles. But there are other crackers; indeed, I hope there's something for everyone this month.

Rob surveys the January sky and also continues the 'Expedition to the North Pole' theme of recent *Transits* (if you've been scanning that area of sky recently, do please tell us about it). There are three opinion/questioning pieces, by Michael Roe, John Crowther and Alex Menarry: if positive or negative comments about them rise to your mental lips, why not send me a letter/email for next month's issue? A heart-warming piece by Ray Stapleton and Ed Restall reveals a British/Spanish personal friendship that has been doing wonders for CaDAS as well. There are new pictures from Keith Johnson and a pointer from me to free downloadable Open University astronomy course material. A happy New Year's reading to all!

Many thanks again to the much-appreciated contributors to this issue. It would be good to kick off one or two new series – how about writing a short piece about your approach to observing, or what your most-visited sites in the sky are, or what your astronomical plans for the coming year are, or what you've read lately … how about a review of one of the books or pieces of kit you may have been fortunate enough to get as Christmas presents? Some pieces along those lines are already on the stocks for February's issue – do please add to them! The copy deadline for the next issue is **Friday 29 January**.

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OBSERVATION REPORTS AND PLANNING

Skylights – January 2010

Rob Peeling

The Moon

7 Jan	15 Jan	23 Jan	30 Jan
Last Quarter	New Moon	First Quarter	Full Moon

There will be a lunar occultation of the Pleiades on Wednesday 7 January between about 16:00 and 20:00. So the event will have begun as it gets dark. The Moon's glare may make it difficult to see the Pleiades with the naked eye but you should be able to see the brighter stars with binoculars.

Planets

Mars is the principal planetary interest this month. Although this is not an especially close opposition this year, the disk of the planet ought to be large enough to see some surface details. This will require good seeing, but the north polar cap is the easiest detail to pick out. If you can see dark markings, then why not roughly sketch what you can see? Record the date and time of the observation. Next you will need to find the longitude of the central meridian of Mars, in other words which bit of the planet was facing you when you made your observation. Here is a table to help you, taken from the 2010 *BAA Handbook*..

Longitude (in degrees) of the central meridian of Mars at 00:00

1 Jan	2 Jan	3 Jan	4 Jan	5 Jan	6 Jan	7 Jan	8 Jan	9 Jan	10 Jan	11 Jan
294	285	276	267	258	249	240	231	223	214	205
12 Jan	**13 Jan**	**14 Jan**	**15 Jan**	**16 Jan**	**17 Jan**	**18 Jan**	**19 Jan**	**20 Jan**	**21 Jan**	**22 Jan**
196	187	178	170	161	152	143	135	126	117	108
23 Jan	**24 Jan**	**25 Jan**	**26 Jan**	**27 Jan**	**28 Jan**	**29 Jan**	**30 Jan**	**31 Jan**		
100	91	82	73	65	56	47	39	30		

Finally, find a map of Mars and, given the longitude of the centre of the disk facing you, see if you can put names to the markings you've seen. Use a low-resolution map such as the one in *Philip's Atlas of the Universe* (Patrick Moore). The high-resolution maps from the Mars orbiters will overwhelm you with detail and it will be difficult to identify features.

Look out for Syrtis Major, a prominent dark feature at longitude 280^{o}.

Here is a sketch I made on 19 October 2005 with a 150mm f/5 Newtonian. The area sticking out at the bottom is Syrtis Major. The parallel features are Tyrrhenum and Cimmerium.

Saturn is an early morning object in Virgo throughout January.

Meteors

The **Quadrantids** are the principal shower for January, lasting from 28 December to 7 January with the maximum on 3 January. According to David Levy, in a dark sky this shower yields 40–200 meteors per hour and they tend to be bluish. Stockton skies will yield a much lower rate.

Deep sky

M42, the **Great Orion Nebula**, can be seen as a fuzzy star with the naked eye. However, it is more easily seen with almost any pair of binoculars. Through a telescope, M42 is a great testing ground for whatever equipment you have. Try several eyepieces each of a different power, and nebular filters if you have them, and see how much detail you can pick out. With a low-power lens, look for the faint splodge around a single bright star away from the Trapezium. This is **de Mairan's Nebula** or **M43**. It is prominent in good observing conditions from all locations. Above and to the north of M42 is an open star cluster, **NGC 1981**, which should be clearly visible with binoculars. If you have a larger telescope (8"+) and nebula filters, then it is worth trying for the nebula **NGC 1973/75/77** around the stars lying between NGC 1981 and M42. Imagers should attempt to obtain a clear image of the "running man". Also look at the bright star **ι (iota) Orionis** below M42 in the sky. On a good night it is possible to see a faint arc of nebulosity stretching all the way from M42 down to this star.

Also in Orion is a small, bright open cluster, **NGC 2169**, which completes a triangle with and below ξ and ν Orionis lying way out along Orion's up stretched arm to the north-east of Betelgeuse. It is personal favourite of mine for the whimsical way in which the stars in the cluster appear to write "37" in the sky.

β Monocerotis is a lovely triple of white stars (use a high power). To the north-east of β lie the **Rosette (NGC 2239) and Cone (NGC 2264) nebulae**. These are worth a look in order to see the associated open clusters, but the nebulae themselves are very difficult to see. 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.

An expedition to the North Pole

A CaDAS project to celebrate the International Year of Astronomy 2009
by collecting observations, sketches, images and *any* kind of information about any object with a J2000 declination ≥70 degrees.

Send your reports, lists, or whatever to Rod, Alex or Rob (contact info for all three is at www.cadas-astro.org.uk/contacts.html) or, if you prefer, bring them along to a CaDAS meeting.

Five asterisms around the North Pole — *Rob Peeling*

[*This is the third and final part – see the November and December issues of* Transit *for parts 1 & 2 – of a comprehensive report by Rob on 'North Pole' observations from the past couple of years. Here Rob describes various* **asterisms** *that he has found out about and/or seen in 'our area of sky'. – Ed.*]

On 11 October I was searching for some of the deep-sky objects in the original list I put together (*see the September 2009 issue*) for the Expedition to the North Pole Project. I noticed an object called Kemble 2, apparently an open cluster, marked in my copy of *Uranometria*. I thought I'd have a go at finding it.

Kemble 2

- 20:37 UT 11 October 2009, from Eaglescliffe with 12" f/5 Newtonian, 8×50 finder & 15x70 monocular. Kemble 2 found. This is close to the east of χ or 44 Draconis and φ or 43 Draconis. This is a bright object in the 32mm lens. I think I've heard Dave Blenkinsop talking about this as 'the baby Cassiopeia'. It has a definite W shape to it. Through the 8×50 finder you can see the W structure. It is a bright, clear object in a 15×70 monocular. This is definitely a binocular object.

Indoors the following day, I googled Kemble 2 and found an impressive listing of other asterisms (www.deep-sky.co.uk/asterisms.htm), including a further four in the area >70° Dec. Here is the list (including a further entry for Kemble 2), together with some notes from observations I made from Eaglescliffe on 17 October between 18:23 and 18:43 UT. From darker locations it will become possible to see these asterisms with smaller instruments.

Name	*RA*	*DEC*	*Constell'n*	*Size*	*Description*
7 Sisters of the Pole	00h 00.0'	86˚45'	CEP	4˚× 2˚	Pleiades pattern of 6th-mag. stars NW of cluster NGC 188. Larger in area than the real Pleiades.

- The 7 Sisters of the Pole asterism between Polaris and NGC 188 is clearly visible in 8×40 binoculars. The Pleiades shape of the asterism is quite obvious. The field of view of the 15×70 monocular is too small to show this asterism at its best. Viewing this with a telescope is therefore likely to be a bit disappointing.

Diamond Ring	02h 32.0'	89˚00'	UMI	45'	Also known as the Engagement Ring, with Polaris the diamond. Visually better than any image.

- The Diamond Ring asterism involving Polaris is not visible with 8×40 bins. More light-gathering power is required from this observing location. With the 15×70 monocular the Diamond Ring around Polaris is quite obvious and pretty. (*See photo below.)*

Kemble's Kite	03h 28.0'	72˚00'	CAS	1.5˚× 0.5˚	Diamond-shaped kite with tail.

- Not looked for on 17 October. From maps, I think it will probably show up with a 15×70 monocular or with a small telescope.

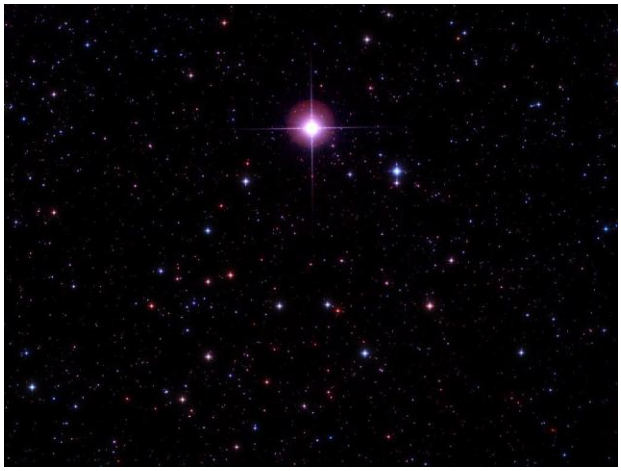
Mini-Coathanger	16h 29.0'	80˚13'	UMI	15'	Fainter copy of the original in Vulpecula.

- I scanned the indicated area of Ursa Minor with 8×40 binoculars and saw a couple of possible targets. Thin cloud and haze spreading from north and east. I checked later with star atlases and I think this object will need a small telescope (3" minimum?) with a low-power eyepiece to be seen satisfactorily.

Little Queen (Kemble 2)	18h 35.0'	72˚25'	DRA	20' × 10'	Mini Cassiopeia – surprisingly similar W shape. Kemble's Cassiopeia?

- Initially 3 or 4 stars in the Little Queen picked up with 8×40 binoculars. The full W shape is just outside the edge of visual detection. With the sky a little darker, the full asterism is just seen. (*See photo below.)*

- Kemble 2 seems to be included as Draconis 102 in Johann Bode's *Vorstellung der Gestirne* of 1782. It may even be a naked-eye object from a dark site.



Diamond Ring asterism

Kemble 2 asterism

Images: David Ratledge from www.deep-sky.co.uk/asterisms.htm

GENERAL ARTICLES

The Lupus Project: Looking for transiting Hot Jupiter planets

Dave Weldrake

Part 3: What we found, and how we found it

In part 1 of this series, I described the typical process for setting up, applying for and carrying out a large-scale survey for transiting extrasolar planets in a previously unstudied part of the southern skies. **In part 2**, I described the typical process of how to analyse the resulting large amount of telescope image data for this purpose. We covered how the **light curves** (for more than a hundred thousand stars in our case) are typically extracted from the images, and prepared for further study. **This month**, I'll describe how the transit (and variable star) search was undertaken on these light curves. I'll detail what we ultimately found in our 0.66 square degree field of view, and how we went about proving it to the rest of the astronomical community.

Transit detection algorithm

The very first part of our search is to select those stars for which our measurements have suitable accuracy to detect a planet. For Hot Jupiter planets, we must have better than 1% accuracy per data-point in our light curves. The brighter stars in our database (those stars brighter than magnitude 18) fulfil this requirement, and number around 30,000. The rest (down to magnitude 22.5), although not measured accurately enough for a planet search, are

surveyed for variability, leading to the detection of hundreds of previously unknown variable stars: pulsating stars and eclipsing binaries.

Clearly, having tens of thousands of light curves to search through for the tiny signal of a transiting planet is a very tedious task. To do so manually would take weeks of careful scrutiny, looking for a tiny periodic dip in brightness at a random period and occurring at any random place in the data. Finding the statistical significance of any detection (or non-detection) would be all but impossible if we used only our eyes. **Computerising and assigning a mathematical significance** was hence the first major task of the process.

To do this, a new method of transit detection was developed, which involved comparing each light curve in turn against a database of tens of millions of feasible transit signals, which occur randomly in time as well as in period, with varying depths and durations. Each model, when compared to the light curve, has a 'best fit' statistic assigned to it, based on whether any of the data seem to mimic the transit model. If a transit is present in the data, a high significance 'detection' is flagged. By producing tens of thousands of fake signals and comparing it with the model, we can determine what threshold to set our algorithm, thereby guaranteeing that it recovers a large fraction of the injected signals, while making sure it doesn't find a transit signal in every star it analyses.

This search process is repeated for all 30,000 stars, taking about 24 hours of computer time to complete. In the end, we are left with a couple of dozen transit candidates, which are then studied by eye to see if they look reasonable to flag as possible planets. This algorithm took a few months to develop and test, ultimately being published in a research paper for the community at large to use after our project was complete.

Transit candidates

By looking at the candidates individually, those that are random statistical transit-like signals could easily be rejected, as they typically have the same common features. We were left with six candidates for further study, which we named **Lupus-TR-1 through Lupus-TR-6**. We then undertook detailed further examination of these candidates, to see if any were suitable for follow-up observations to prove them as new planets. All six of these can be seen in **Figure 1**, which shows them in order with the transit clearly visible in the centre. The different types of dot indicate which year the data was taken: open circles for 2005 and black circles for 2006.

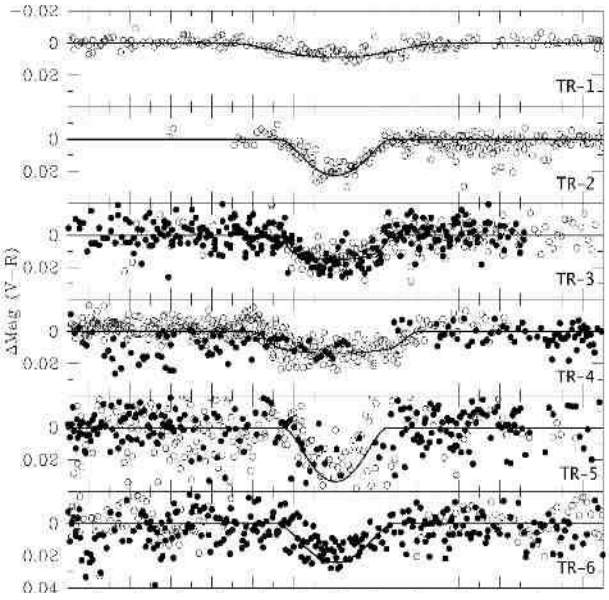


Figure 1

Lupus-TR-1, the first candidate found, had a very shallow depth and long duration. If a planet, it would have to be orbiting a star with a radius around twice that of the Sun, and the planet would be small compared to this – about the size of Jupiter. It would also have to have a very short period (just over a day). It would be one of the shortest-period planets known, if indeed it was one at all.

We can test this theory by looking at a spectrum of the star, allowing us to calculate its radius directly, based on its spectral type and apparent brightness. The spectrum tells us this star is solar-like, with a solar-like radius. Hence this candidate is unlikely to be a planet. Further examination of the images shows that the 'star' is actually two stars very close to each other. Almost certainly this candidate is the result of one of these stars being an eclipsing binary, with us only able to measure the residual bled-over signal from this binary, a very common occurrence known as a **blend**.

Lupus-TR-2 produces a very different transit shape, one far more V-shaped. If a planet, it must have an orbit that takes it close to the edge of its star, and would have to be rather large and orbiting a star smaller than the Sun. The data taken in 2006 clearly shows a deep secondary eclipse, missed in the 2005 data owing to bad weather. This candidate is a very obvious eclipsing binary and can be scrubbed from the list of possible planets.

Lupus-TR-3 shows a very classical, perfect planet-like transit shape, with a period of 3.9 days and a depth typical of a planet with a radius approximately the same as Jupiter. The transit is well-sampled and regular, and the star is single and isolated on the images. The spectrum shows that this star is a K-dwarf, being a little cooler and a little smaller than the Sun, perfectly in agreement with the shape and duration of the transit. This candidate is our prime candidate for a transiting planet, and will be further observed with a large-aperture telescope to determine its true nature. At magnitude 17.4, we must use an 8m telescope to measure it further.

Lupus-TR-4 is worthy of mention because it has such a long and flat transit, again suitable for a planet orbiting a star larger than the Sun. Additional observation revealed this to also be an eclipsing binary, with a Sirius-like A-type primary star orbited by an M-dwarf companion.

The other candidates, **TR-5 and TR-6**, were both determined to be purely artificial, caused by blemishes on the CCD image, perfectly mimicking the appearance of a planet. I left them in because they are good examples of why great care must be taken when taking astronomical data.

Variable stars

Before further study of Lupus-TR-3, the entire dataset was searched for the presence of variable stars. Out of 110,000 stars, 450 were found to be variable, including more than 200 **eclipsing binaries** and more than 100 **pulsating stars** (RR Lyrae and red giant pulsators). Although not the main targets of the project, they are of great importance to people studying stellar evolution. They were separately catalogued and published in a research paper*.

All 450 were new discoveries, and **Figure 2** shows 25 of them as an example. I have plotted each example in turn, with the name assigned to each and the period in days marked. Examples of contact binaries (IE V26), semi-detached binaries (IE V 37), detached eclipsing binaries (IE V41), RR Lyraes (IE V32) and pulsating stars (IE V31) are shown. All of these were found in a patch of sky only as big as the full moon. Clearly the sheer number of variable stars waiting to be discovered across the whole sky is simply staggering.

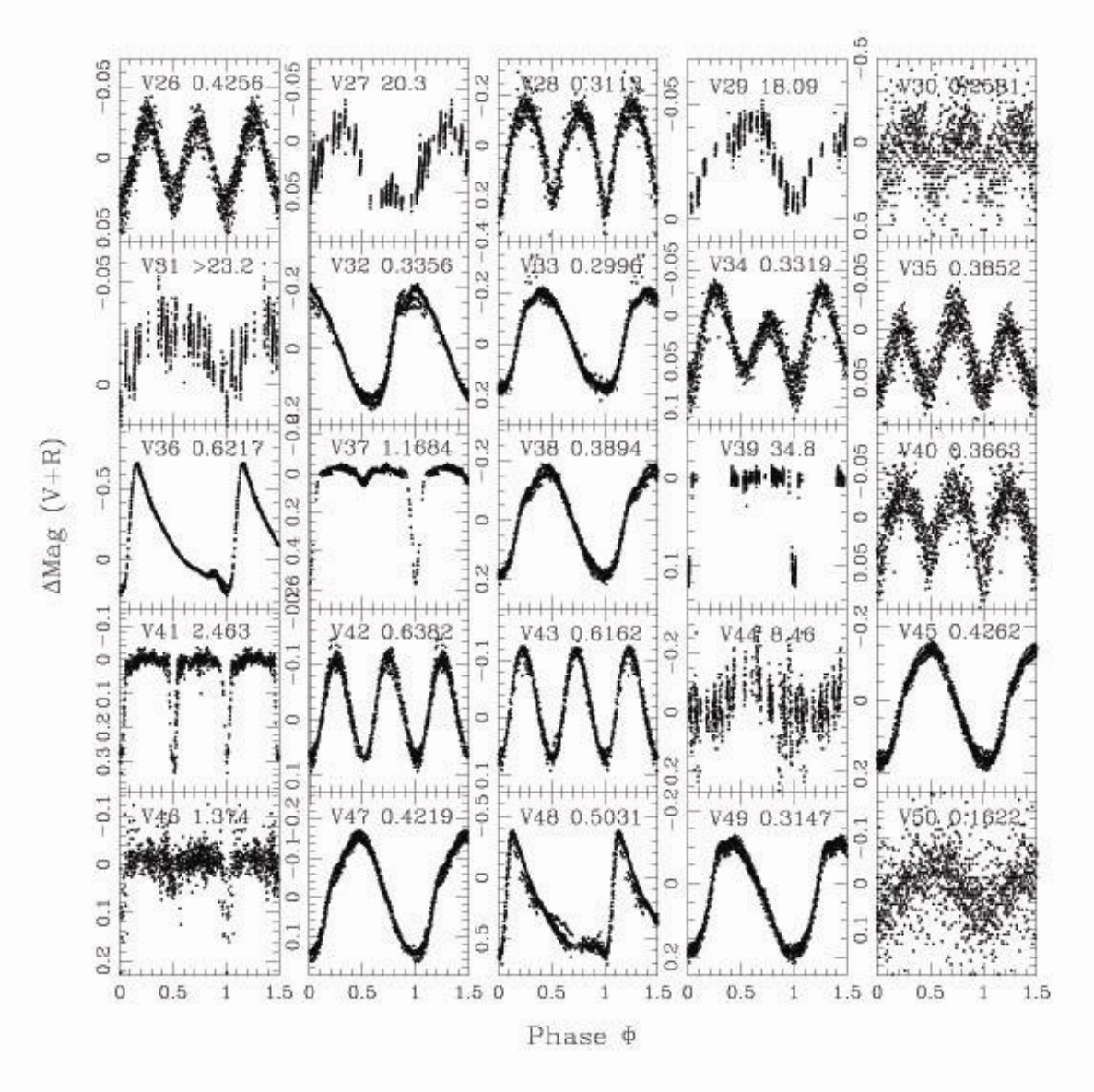


Figure 2

Lupus-TR-3

As our third candidate, Lupus-TR-3, was so promising as a new planet, we put in a proposal to use the 8m Magellan telescope in Chile to measure its spectrum over the course of four nights with unprecedented accuracy. This was for two reasons: firstly, to measure the **stellar radius** as accurately as possible; and secondly, to try to observe the stellar wobble, or **radial velocity**, of the host star as caused by the gravity of the orbiting object. This would allow us, via Newton's laws, to directly and accurately measure the mass of the orbiting body. This would be the final confirmation that we had observed a new planet. Clearly, at magnitude 17.4, accurate measurements were needed.

We had very good luck during the four nights that we captured our data on this object, with extremely stable conditions (with seeing consistently below half an arcsecond), and our data was superb.

From careful analysis, we did indeed observe a radial velocity in the spectrum of the star, amounting to a change in stellar velocity of 110 m/s over the course of our four nights (co-incidentally the same amount of time as a complete orbit of the candidate). This radial velocity can be seen in **Figure 3**. The black points indicate the observed velocity variation of the host star, with the best-fitting variation overplotted. The blue dots indicate the variation of two comparison stars, to show that the velocity was indeed varying in-phase with the transit signal, exactly as expected if a planet was present.

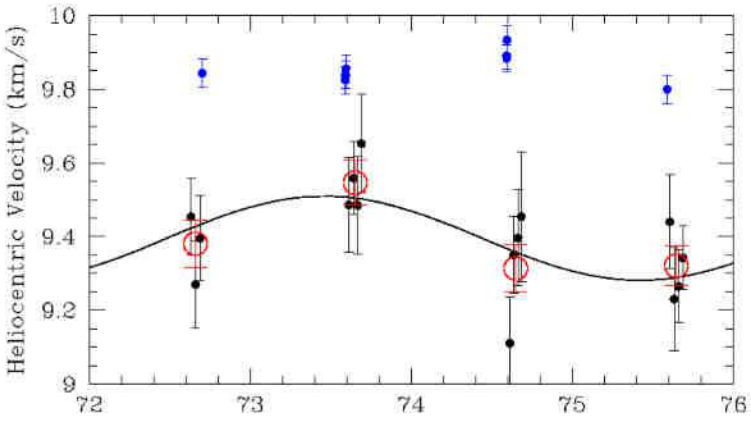


Figure 3

The star was indeed a K-dwarf, with a mass around 0.8 times that of the Sun (with a radius coincidentally also of 0.8 times solar). By applying Newton's laws, it meant our orbiting body had to have a mass of 0.8 times that of Jupiter. From the transit depth, the object has a radius of 0.9 times that of Jupiter. Clearly this meant we had indeed discovered a new distant transiting Hot Jupiter planet, which we named, with great pride, 'Lupus-TR-3b'.

From the apparent brightness of the host star, our planet is around 9000 light years distant, located in the next spiral arm in towards the centre of the Galaxy. It's amazing to think we could find such a distant object with 'only' a 1m telescope, and we had chosen our field of view perfectly: if the telescope had been pointed a mere few arcminutes away in any direction, we would have missed it. With an orbital period of only 3.9 days, this planet must have an atmospheric temperature of around 1500 degrees, with winds of thousands of miles per hour racking its atmosphere. The sub-stellar point on the atmosphere would be blasted with intense radiation, making the whole planet glow like an ember floating from a fire. Clearly it's not a pleasant place to visit.

The announcement of this new planet was published in a research paper* in November 2007, and shows the sheer potential of discovering transiting planets if great care is taken when planning, executing and analysing the results of large-scale surveys. Lupus-TR-3b remains the faintest ground-based detection of a transiting planet, and the first ever found from Australia.

More than 350 extrasolar planets are now known, with an ever-increasing number being found via transit surveys. As for Lupus-TR-3b, the light we detected set out from the star thousands of years before Stonehenge was built. It will continue to orbit its star as regular as clockwork, orbiting once every 3.9 days for tens of billions of years to come. It's not going anywhere, and has more than enough time to wait for someone to go and see it in person.

[** For readers interested in looking at the work and results of Dave and his colleagues on the Lupus project in more detail, there are at least nine papers available on the internet in PDF form, listed at http://tinyurl.com/CaDAS100102 – Ed.]*

Why did the Moon landings end?

Michael Roe

Why did the Apollo Moon landings end? It's now more than 40 years since the first one. It's a question that has haunted me ever since.

I was born in 1961, and my generation grew up with the Space Age. I first found out about an actual mission in 1968 – the Apollo 8 trip around the Moon. Before then, I knew that rockets and astronauts existed, probably learning that from books and television, watching Dr Who and Thunderbirds. I watched all the Apollo flights on television and found them amazing and exciting. I knew little of why men went to the Moon, or how rockets worked; I just loved it and wanted more Moon landings.

Then in late 1972, after three glorious years, it stopped! All the Moon walks from Apollo 11 to Apollo 17 just ended. I couldn't understand why. I was just 11 years old, and in those days getting information on space travel was difficult. I got a few space books with actual photographs of the Apollo landings, but that was all.

In 1973 the Skylab space station was launched. It was a space mission all right, but it just went around the Earth – a backward step in my opinion. Still, I thought, it's just a matter of time – surely in just a few years, men will go back to the Moon.

I waited and waited, year after year. I did start to get more information on the Moon landings, though: President Kennedy's promise just before I was born; the space race against the Russians; even what had been discovered. In 1976 the Viking Lander landed on Mars – this was fascinating, but no men went there, although there was speculation at the time that a man would land on Mars probably around the year 2000.

In 1981, after years of delay, the Space Shuttle finally flew. I was grown up by then. I also followed the Soviet space programme and the Salyut space station, but still no one went to the Moon. There was more speculation that the Russians planned to send a man to Mars in 1992 or even 2000. I listened to Radio Moscow for clues, but it all came to nothing.

The frustration was terrible. In the years afterwards, an almost endless stream of Shuttle flights took place and several Salyut missions; and then the Mir space station orbited the Earth. The Soviet Union crumbled along with its communist ideals and its once-mighty space programme, although the latter eventually recovered by cooperating with the former enemy, the USA. There was also the 1986 *Challenger* explosion that killed seven astronauts, and the incredible Voyager probe to the outer planets.

Then in 1985 the first President Bush announced a new space programme to send humans back to the Moon, then on to Mars and beyond. It vanished without trace. I read later about the NASA Office for space exploration beyond Earth orbit. It had a couple of staff in a small office, although they hoped a part-time student would join them! How the mighty had fallen!

After Apollo 11, something else had happened. Within days of Armstrong and Aldrin's historic steps on the Moon, President Nixon had looked at the Apollo applications programme, a hugely ambitious list of more Apollo flights (up to Apollo 20), Moon bases and a Mars landing

mission, with Space Shuttles to supply all this. Nixon didn't like the cost and decided that Apollo 17 would be the last Moon landing, to be followed by Skylab and Space Shuttles only!

Afterwards, interest in space flight faded. The present media have little interest in science. News is politics, war, violence and scandal, with little else. And of course there are the poor deluded fools who say that men didn't land on the Moon at all.

In 2004 the son of the first President Bush announced a new programme to send people to the Moon, Mars and beyond. The 'Mars and beyond' part was soon conveniently forgotten, but some progress *has* been achieved, with a new Ares rocket ready on its launch pad for a test flight. So why am I not dancing with joy?

Well, the Orion Project, as it is called, is still uncertain. The public considered the $24billion that the Apollo programme cost and didn't like it, despite the fact that such a sum would keep a pointless war going for only a few months (the Vietnam war was raging while the Apollo missions took place, and I understand that it was costing a great deal more).

The new Orion spacecraft should be reasonably cheap. Most of Apollo's massive cost was on research, on finding out how to build a Moon spacecraft. All that information is still in existence, so I do wonder why Saturn V rockets and Apollo spacecraft with moon-lander modules or similar couldn't be built, instead of the planned small rockets to get them into orbit and larger rockets to form the main spacecraft, launched separately for the Orion Project.

Photo 1. Mock-up of Orion capsule on display at the Kennedy Space Center visitors' complex (photo: NASA)

Orion is still uncertain and could easily be cancelled even now. There has also been almost no coverage of the Orion Project on TV, cutting off any public interest.

Many years ago people believed that science fiction was a prediction of the future: the space travel parts, anyway. Now I realise that it was indeed fiction, and that SF is no more a prediction of the future than, say, Robin Hood is how medieval England was. I was lucky enough recently to meet Charlie Duke, one of the Apollo 16 astronauts; for those of us who saw the Apollo landings, it's a bitter thing to see such great achievements as his cut short in our lifetimes, when just $30 a year for each American could revive exploration of the Moon, which is visible on many nights and ought to be investigated if we are to count ourselves as an intelligent and civilised species!

Sadly, even if Project Orion goes ahead it will take until 2020 or later to achieve a manned landing. Interestingly, no one set foot on Antarctica from 1840 to 1898, a similar time span of 58 years. This is likely to be beyond my lifespan, and if any other nation goes to the Moon instead then the wait could be even longer. There are rumours about China going to the Moon, but we know what rumours are like! I hope that some younger readers may see new Moon landings, but we older ones will have to be content with videos and DVDs of Apollo landings, I'm afraid!

The lost legacy

(Some thoughts on Neil's essay *Mankind's pinnacle* in the 12/09 issue)

John Crowther

I haven't always agreed with Neil and I remember that Bob used health warnings to introduce some of his articles. But his essay last month struck a chord and I fully agree with what he wrote. Please excuse the lack of astronomy in what follows!

Along with "Let us fight on the beaches …", Winston Churchill is also reported as repeating the phrase "Keep b-----ing on", which was not one that was repeated in print during the 1940s.

The spirit of Churchill needs to be adopted by scientists, and especially by astronomers, in a society where young people are largely ignorant of past achievements. For if the past is not known, its mistakes may well be repeated with even more serious consequences. For us to make progress, we need to be confident and with a destination before us.

I see a link between Neil's letter in the November issue and what he wrote last month. The fact that 19% of people still can be said to be pre-Copernican is tragic, especially when the flat-earthers are no more. But a current television advert isn't helpful: British Gas portrays a family happy on its own isolated little world with the Sun and Moon rotating around them. These objects are 180° apart, so a permanent full moon would be seen. This is not too different from the calendar I bought a few years ago that had a full moon each month on the same day.

It's true that, in this age of instant knowledge and communication without computers, we are all in our own separate little worlds: in our rooms or walking about plugged into mobile phones, for instance. Music and knowledge is all around us, yet wisdom seems to be largely absent.

I wonder what percentage of people exchange eye contact in our towns and cities? Yet walking alone in the countryside we still usually speak to strangers and get a pleasant reply.

When visiting the Health Centre, people sometimes say in one breath, "How are you all right?". I'd be tempted to say, "No, I'm dying on my feet."

In a supermarket some time ago, I heard the woman operating the checkout saying to every customer, "And there you go." So when it was my turn, I said, "Here I come!" Her amazed look seemed to say, "He's as nutty as two of those fruitcakes." But she still dismissed me with a "There you go".

Neil mentioned GCEs. I took mine in the final year in which they appeared – so you educational experts can work out how old this old git is. But my O and A certificates are more colourful, larger and on better-quality vellum than those of our three children. The fly-on-the-wall TV series that recreated a class of the 1950s showed that present-day youngsters know more than we did, yet they got "*sic"* written more often after words in their essays.

But it's perhaps too easy to criticise the ignorance of those who do not follow our interest. We are very likely to be ignorant about what *they* are keen on.

Neil encourages and comforts us by ending on a hopeful note. There is always a ‘Faithful Remnant’ (I hope I will be excused for employing words first used to describe a part of the Israel of the Old Testament). The light at the end of the tunnel isn’t always from a locomotive bearing down on us with its carriages full of ignoramuses. There are a lot of young people like David Fleming about.

The only true astronomers

Alex Menarry

Now here's a rebellious thought, which I’d like to try out on the rebels out there. It was sparked off by reading an article somewhere, maybe in *New Scientist*, about today's modern professional astronomers: data miners, I think was the phrase used. It described how the modern thrust is about massive telescopes, searching the boundaries of the observable universe, looking for dark matter, worrying about lithium, exploring the Big Problems, asking god-like questions, contemplating an infinity of universes. Needless to say, the Big Telescopes don't have an eyeball at an eyepiece.

How jealous I was, years ago, hearing about professional astronomers bogging off to places like the Pic du Midi, Mont Blanc, the Alps, the Pyrenees, Mount Wilson, Hawaii, Chile and other glorious places for mountaineers. Off they went on a summer holiday pretending to work. Work! And getting paid for it! Oh, for the opportunity to spend a few weeks looking down (or is it up?) the world's best telescopes.

Ah, but not now. It's all done over the internet. Send in your observing plan; the local technicians ensure that the scope, instruments and CCD cameras are in working order; receive your results by email; and sit looking at your computer screen. Not even a trip into space to sit at the eyepiece of the Hubble Telescope.

You see, it's all about the data. Never mind the wonder of the heavens. None of your actual searching, recognising patterns of stars and star-hopping to objects of interest. No careful sketching or taking your own astro-images with your own camera and fancy gear, which you just love and polish every day. No sitting in an armchair in the garden, with a pair of binoculars and a coffee, trying to find that elusive variable star. No armchair astronomy, no reading for distance-learning courses. No struggling with cosmology and how supernovae work and what's a Hewlett-Packard diagram, or whatever it's called. All of which we amateurs take for granted. Think of the sheer dedication of BAAVSS and AAVSO observers sending in magnitude estimates for communal databases, the multi-computer-controlled-telescope supernovae patrollers flashing messages to all and sundry when they find one, the comet seekers scanning the sky, night after night. These are the people we need to keep astronomy real.

So the thought I put to you, for agreement or derision, is this: we, the amateurs, are the true guardians of real astronomy, as it is meant to be done. We preserve the childish excitement in wondering what's out there and what it's all about. Only *we* find our mind's eye being drawn into the telescope and travelling into deep space, being overwhelmed by the sheer size and complexity of it all, the beauty of it all, the wonder of it all.

Or have I lost the plot? Has it all been too much for me?

Moonfish and me

Ray Stapleton
(topped & tailed by Ed Restall)

For those of you who aren't completely aware of our generous benefactors, Dani Corredor and Ray Stapleton (né Hauxwell; he's a very modern man), this article explains some of the history behind their friendship.

Dani is co-founder and proprietor of Moonfish Group: http://moonfishgroup.com. He's responsible for the Spanish arm, while his colleague Ric Capucho-Paulo looks after the operation out of Switzerland. Moonfish are probably known to most of our Society's members, but if you're not aware of their reputation for extremely high-quality astronomical optics for unbelievable value, then please visit their website. They can't be recommended highly enough!

Dani, his wife Nuri and their two children Jan and Ariadna operate the company from their home on the outskirts of Barcelona. As you would expect, Dani is an enthusiastic amateur astronomer as well as an extremely proficient and generous purveyor of astronomical equipment. Like all enthusiasts, he has his own observatory, but this one is at a rather special dark site, shared by other amateurs with their own observatories, over 120km to the west of his home, in Ager.

Photo 2. Roll-off observatories at Ager

Over the past few years, Dani has been generously donating equipment to help the Society, as has Ray. The following is Ray's account of how he got to know Dani and how their friendship developed into support for CaDAS:

> My first encounter with Dani was after I had seen an advert in *Astronomy Now* magazine in 2003, for the now-famed 30mm ultra-wide (80° field of view) 2" eyepiece. At the time, it was selling for £65, so I thought I would treat myself. Within 20 minutes of my order I had a personal email from Dani thanking me for my order and telling me I should expect delivery in 6 days. After 6 days there was no eyepiece, so I emailed Dani, who assured me it would be with me soon. He also gave me his personal MSN address so I could log-in and chat. Ric, the other half of Moonfish based in Switzerland, also sent me a personal email, promising me the eyepiece would arrive the next day, and it did. I was extremely impressed and promptly logged-on to MSN to communicate to Dani how delighted I was with the service and the product. From then on we started to chat most days.

For those who aren't aware of it, I broke my back whilst serving in the army and now have lots of spare time, as the army categorised me as unemployable; let's face it, there isn't much call for knackered second-hand machine gunners, is there? Our friendship grew from that point, really. We found we had a lot of things in common; Dani also has a damaged back from a car accident. We would chat about anything and everything and I would proofread the English section of the Moonfish Group website for him.

Eventually Dani invited my wife Mandy and me over,t and we took him up on the offer in March 2004, albeit for only 2 nights (he might have been an axe murderer … hee hee). Dani and Nuri (his then girlfriend) were there to meet us at Barcelona airport. What followed was a mad but hugely enjoyable two days: a whistle-stop tour of some of the finest sites on day one, including the Camp Nou and the Olympic Village, while day two was a long, slow walk down Las Ramblas with Dani and me doing most of the shopping. Nuri and Mandy got on just as famously as Dani and I did. Alas, the third day was travel-home day, but not before Dani had shown me how the Moonfish operation worked from his then cramped flat in Cerdanyola del Vallès. Just before we left to go to the site where his new house (and current home) was being constructed, he presented me with a set of *Burnham's Celestial Handbook*. To say I was shocked doesn't come close. The new house was coming on wonderfully when we saw it; it was designed using software I had sourced for Dani, so I was impressed.

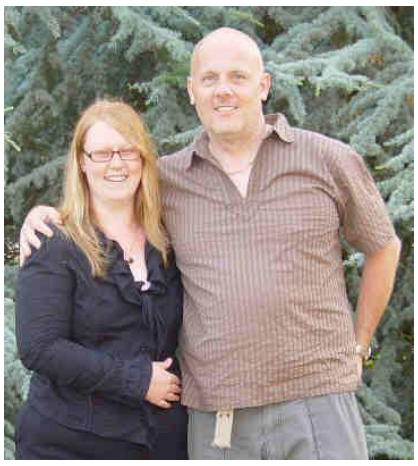


Photo 3. Mandy and Ray

We arrived home with gifts from Nuri and Dani for my one-year-old twins (Abi and Jack) and son (Jed), nearly seven; their generosity was astounding.

Over the months, various packages went backwards and forwards to Barcelona via DHL. There was the odd sample from Dani and also some DVDs. In return we sent lots of stuff from Amazon, as they don't have it in Spain, and also Nesquick banana milkshake which Dani has a weakness for, and is again not available in Spain.

Dani and Nuri invited us to their wedding, which we were honoured to accept, although unfortunately we had to cancel at the last minute. Despite that they sent us their wedding DVD and pictures along with our cigars, place cards etc.

That July, Mandy ordered me a 2" Barlow for my birthday (now on loan to the Society).

Photo 4. Nuri and Dani

The following year they came to the UK and stayed with us for my 40th birthday. On the morning of my birthday, a DHL delivery van arrived and presented me with a huge box. inside was a Moonfish 80ED apochromatic refractor together with a 2" diagonal. I was almost in tears; it was probably the best present I have ever received and it took a long time to sink in. Dani also gave me a Crayford 2" focuser for my SkyWatcher 8" Newtonian reflector (which Jürgen Schmoll has kindly fitted for me). We had such a good week with our friends visiting Whitby and the Lake District; it was so hot that they felt right at home. The week just flew by.

During the CaDAS funding crisis a few years ago, I discussed the situation with Dani, who was very supportive. He told me to leave it to him. This was a very busy time for him, as the family were moving twice in 6 months: first to Sabadell, then into the new and almost completed house in Matadepera. Dani still took the time to make good his promise and donated a binoviewer, which became a raffle prize across a couple of Society meetings.

Now fast-forward to November 2008 when I flew to Barcelona for a week, mainly to rest my back, which is getting steadily worse. I had a great time and felt that I was treated as a family member. On my last day Dani handed me five boxes, inside which were five 30mm ultra-wide 2" eyepieces. I thought he was pulling my leg, but he explained that he wouldn't sell them as they had some very minor faults – e.g. a small fleck of paint between the elements of glass. He told me they were for the Society to use, raffle, auction or dispose of as they wanted, a hugely generous donation!

In May 2009 Dani came to stay with us for a week's short break. Ed very kindly gave him a tour of the facilities at Wynyard Woodland Park, with a Planetarium show thrown in. Dani gave me a 2" dielectric star diagonal, which enabled me to loan my old one to CaDAS. We also went to the Durham AS meeting at Redwood Lodge – that and the customary visit to the pub (The Court) with DAS members both went down well.

In July 2009 my family and I had 2 weeks at Dani's house and all had a great time. While I was there I bought a new 2" ED Barlow – I had to forcibly give him the money because as usual he wanted to make a present of it. He then gave me two 15mm 2" ultra-wide eyepieces and I asked if it was OK to give one to CaDAS, to which he said "Of course – no problem".

As a footnote, I am off to Dani's in February 2010 for a week of rest and relaxation (honest). I'm hoping to get up to his observatory for a night or two and try my hand at imaging through his 12" LX200.

As well as donating numerous raffle prizes (including the binoviewer), Ray & Dani have now loaned and donated: five 30mm ultra-wide 2" eyepieces, one 15mm ultra-wide 2" eyepiece, a 2" ED Barlow lens, a 2" star diagonal and a copy of Wil Tirion's *Sky Atlas 2000*.

Personally and professionally I've been overwhelmed by the support, kindness and generosity of both these guys. If you ever use any CaDAS 2" optics, then they've probably been donated or loaned by either Dani or Ray and if you enjoy using them and are considering buying new optics yourself, then please visit Moonfish, because you won't be disappointed with quality, service or price!

MISCELLANY

Picture gallery

Keith Johnson

[*On the next page are a couple of Keith's recent photos. I'd be delighted to publish others that members may take of astronomical objects (or of equipment, observing areas and so forth). Don't think you have to match Keith's standard! – Ed.]*

Picture 1: Transit on Jupiter: Io and its shadow

On 12 September I became aware that Io and its shadow would be transiting and that the Great Red Spot (GRS) would be appearing too. The GRS was already just past the meridian, so I had to be quick about re-polar-aligning the mount after its previous outing at Dalby.

The seeing was very turbulent, but I put this down to having only recently set up the optical tube assembly (OTA) outside, so thermal equilibrium had not yet been reached. After 15 minutes or so, the seeing started to improve slightly, and with the camera settings and focus set as accurately as I could get, I captured the first set of AVIs. But after 3 × 90-second AVIs the seeing was so bad that I drew a halt to the night's proceedings.

The first AVI result shows quite a lot of activity on the Northern Equatorial Belt (NEB) and more interestingly what might have been another spot beginning to form next to the GRS.

Io's shadow can be clearly seen just right of centre. The moon itself can just be seen in transit on the first image, and separating from the planet's limb on the second.

Equipment details:

C9.25" Celestron
EQ6 Pro mount
ToUCam Pro.2 840K webcam
UV/IR blocking filter
2.5 × Tele Vue Powermate

Capture details:

Capture software: AVI-IO
Processing : Registax 5
90-second AVI captured at 10 frames per second

Picture 2: M42 and NGC 1977

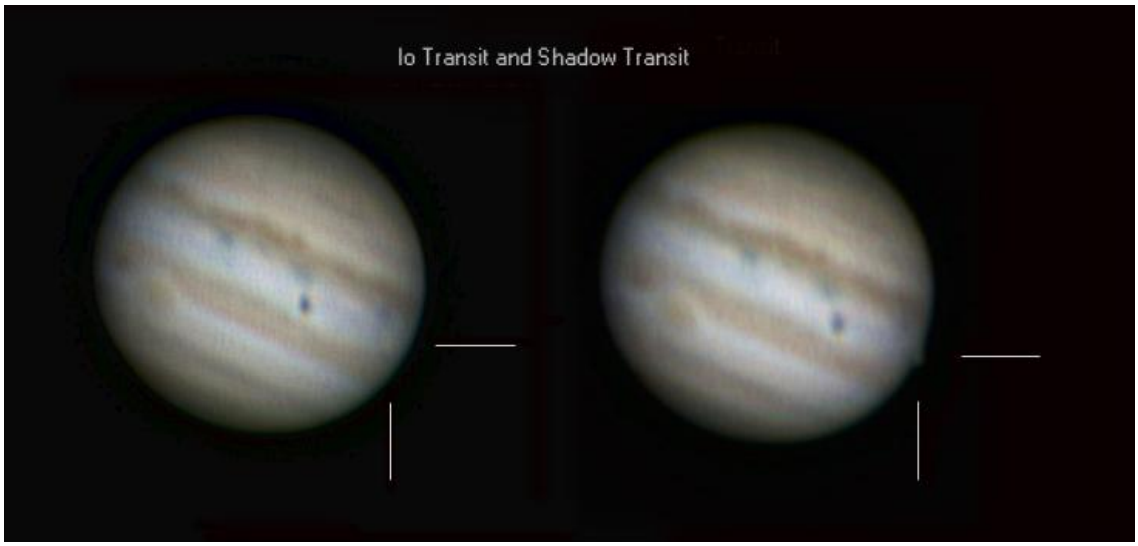
Equipment details:

Astrotrac TT 320X
William Optics ZS 66
Unmodified Canon 1000D
Astronomik CLS filter (light pollution)

Capture details:

Between 03:30 and 05:30, 18/10/09
8 × 2 min. exposures
4 × 30 sec. exposures
Horrendous light-polluted skies

Image captured by Keith and processed by John Gargett.



M42 (Great Orion Nebula) below, and NGC 1977 (the Running Man Nebula) above

Open University astronomy course material – free of charge!

Rod Cuff

For many years now I've been taking distance-learning courses in astronomy, mostly from the University of Central Lancashire (www.studyastronomy.com). It's a very rewarding process, but I know that most people interested in the subject won't want to commit to spending scores of hours a year (and an associated course fee) on both working through the material AND completing 3 or 4 assignments to be sent off to be marked and commented on.

But increasingly there are whole sets of course material (on all sorts of subjects, not just astronomy) appearing on the internet for free downloading, where you have the same material that enrolled students receive, but don't have to concern yourself with submitting assignments for grading. In the UK, the Open University (OU) has been making more and more of its excellent sets of course material available that way. I've recently visited its OpenLearn website (www.open.ac.uk/openlearn/home.php) to see what's available. Here are some quotations from the site, and basic information about the astronomy courses that are there at the moment.

> *OpenLearn will … become the hub for all OU materials that are freely available to the public, including videos, podcasts and lots more interactive content … you'll find hundreds of free study units, each with a discussion forum. Study independently at your own pace or join a group and use the free learning tools to work with others.*
>
> *OpenLearn has seen over 6.5 million people take advantage of free education since we launched in October 2006. We know there are millions more out there who want access to free educational materials but they may not have heard of us yet.*

To access a course directly, go to http://openlearn.open.ac.uk/course/view.php?id=xxxx, where xxxx is the 'Id' value given in the table below. The course level is Introductory, Intermediate or Advanced. The time given is the suggested number of hours to work through and absorb the material fully, but of course you can skim and skip as much as you like – no one's checking up on you! If you try any of the material out, drop me a few lines of review so that other CaDAS members can learn from your experience.

Name	*Id*	*Level*	*Time (hrs)*
The evolving Universe	**2382**	**Introductory**	**12**
This unit explores origins of the Universe by looking in detail at events immediately following the Big Bang. Starting with looking at the cooling of the very early Universe, the unit then moves on to the inflation era, the quark-lepton and the hadron era. Then the unit looks at how fundamental particles began to synthesise to form nuclei, and from here it discusses the development of larger structures like stars and galaxies. By examining closely the forces in play and the interactions of fundamental particles in these very early stages of the Universe we can begin to understand how it turned into the Universe that we live in now.			

The Moon	3504	Introductory	6
This unit deals with the Moon, the only planetary body that everyone is familiar with seeing in the sky. You will learn about the nearest planetary body to Earth, the long record of cratering on its surface, and about the ancient eruptions that flooded many low-lying areas. If possible, it would be helpful to get a look at the Moon's surface before studying this unit (even if you have no optical aid available), but don't worry if you are unable to do this.			
The Sun	**2453**	**Introductory**	**8**
For astronomers, the Sun is fascinating because it is our nearest star. By studying the Sun, they can gain an insight into the workings of the other millions of stars that are visible in the night sky. Learning that the Sun is a star can be a little surprising. After all, the Sun is a brightly glowing, yellow object – so bright that it is dangerous to look at it directly, and so hot that we can feel its radiation warming the whole Earth. Stars, on the other hand, are mere silvery pinpoints of light that are visible only against the darkness of the night sky and with no discernible heating effect on Earth. How can they possibly be the same sort of object? The key to the answer lies in their *distances*. In astronomical terms, the Sun is relatively close, being only about 150 million kilometres (93 million miles) from Earth. The stars that are visible at night are much further away: the nearest is about 40 *million million* kilometres from Earth, and most are much more distant than that. Imagine looking at a glowing light bulb first from very close up and then from a much greater distance. Close up, you would see the shape of the bulb but, from far away, it would be just a point of light.			
Jupiter and its moons	**3686**	**Introductory**	**12**
The core of this unit is Chapter 9 of *Teach Yourself Planets*, by David Rothery, which is found in Section 1 of this unit page by page, followed by a guided discussion and questions in Sections 2 through 4. Note that all references in Chapter 9 of *Teach Yourself Planets* to other chapters, are to other chapters of *Teach Yourself Planets* – these references are not to other sections of this unit. Four of Jupiter's large family of satellites these are much more substantial than any asteroid and can justifiably be regarded as worlds in their own rights.			
Comparing stars	**2796**	**Intermediate**	**16**
We can study the individual properties of individual stars, such as photospheric temperature, luminosity, radius, composition and mass. If we wish to understand more about stars and obtain some insight into their evolution, we need to look at the overall distribution of stellar properties. We would like to know the answers to such questions as 'Can stars have any combination of these properties?' and 'How many stars are there of each type?' We can potentially learn a lot more about the stars if we compare them, but what should be the basis of our comparison? We certainly want to use intrinsic properties, such as luminosity, and not properties that depend on the distance to the star, such as the flux density received on Earth. Also, as an initial step, we want to avoid properties that are well removed from what we actually observe. In this unit we			

look at probably the most important diagram in stellar astronomy, the Hertzsprung–Russell diagram, and how it is used to identify the main classes of stars.

Introduction to active galaxies	**3610**	**Intermediate**	**20**

Active galaxies provide a prime example of high-energy processes operating in the Universe. This unit introduces the evidence for activity from the spectra of some galaxies, and the concept of a compact active galactic nucleus as a unifying model for the observed features of several types of active galaxy. It also develops the key skill of applying arithmetic and simple algebra to solving scientific problems.

Icy bodies: Europa and elsewhere	**2758**	**Intermediate**	**17**

Until the 1980s, the icy satellites of the outer planets were scarcely thought of as places where life could ever have existed. Few could have imagined that one of them, Europa, would within 20 years have become the rival of Mars as a priority for astro-biological study. This unit recounts the history of our changing perceptions of the icy satellites, examines the available evidence for their internal structures, and considers the niches offered for life to begin and to be sustained. In this context, the 'habitable zone' embraces settings devoid of both sunlight and an atmosphere. These are areas where life could survive on the energy from chemical reactions made possible by the discharge of hot chemically enriched fluids through vents on the floor of an ocean capped by a thick layer of ice. Note that 'ice' does not necessarily mean just frozen water. In the outer Solar System, although H_2O is usually the dominant component, ice can incorporate other frozen volatiles such as NH_3, CO_2, CO, CH_4 and N_2.

The Big Bang	**3639**	**Advanced**	**20**

In this unit, we present the three main lines of experimental evidence pointing to the Big Bang origin of the Universe: (i) the recession of the galaxies; (ii) the microwave remnant of the early fireball; and (iii) the comparison between the calculated primordial nuclear abundances and the present-day composition of matter in the Universe.

An overview of active galaxies	**3922**	**Advanced**	**15**

This unit begins by studying evidence leading to our basic hypothesis that active galactic nuclei (AGN) are accreting, supermassive black holes. It also covers some physics of radiation which you will need to be able to interpret the observed emission of AGN, and includes an examination of AGN.

You'll be studying a young subject with fundamental issues which are still being vigorously debated by experts and are subject to current research activity; so it is not possible to give clear definitive explanations of all aspects of the subject.

You may already have become accustomed to reading unfamiliar words and phrases. In this unit, you will not only encounter new and specialised vocabulary, you will meet ideas which are currently being shaped and tested. Do not be dismayed if you fail to immediately grasp the underlying principles behind some of the material you will read: it is possible no-one has yet elucidated them!

THE *TRANSIT* QUIZ

Answers to December's quiz

Last month I quoted material ripped from the July 2009 edition of the BAA Journal *and challenged you to say what it related to, or to add the missing words. How did you get on?*

Q1. "Cycle 24 has been reluctant to show its hand."

A1. Cycle 24 is the new sunspot cycle, whose first sunspot appeared in January 2008, But 2008 was the fourth least spotty year since records began, with 266 spotless days – the record was 311 in 1931.) There's a nice website at http://solarcycle24.com.

Q2. "He is now the leading discoverer of supernovae worldwide (including all individuals, whether professional or amateur, who have personally searched for those objects but excluding those discovered by automatic surveys)."

A2. Tom Boles, former President of the BAA. At the time of writing, Tom has discovered 127 supernovae (http://myweb.tiscali.co.uk/tomboles).

Q3. "It was discovered by Anthony Wesley, on a freezing winter's night at his home in the mountains of New South Wales."

A3. Wesley observed and photographed a new impact site on Jupiter (see http://tinyurl.com/CaDAS0908-1) on 19 July. CaDAS's Keith Johnson also photographed it a few days later – see *Transit*, August 2009.

Q4. "Having been laid down over numerous returns of 1P/Halley, the *?* stream is quite spread out."

A4. "Orionid" [meteor]. See http://meteorshowersonline.com/orionids.html.

Q5. "*?* (1835–1910) was the leading observer of Mars of the late nineteenth century."

A5. "G. V. Schiaparelli". See www.daviddarling.info/encyclopedia/S/Schiaparelli.html.

Q6. "Prof. Tom Ray … spoke on 'Hubble's successor: the *? ? ?* Telescope'."

A6. "James Webb Space". See www.jwst.nasa.gov.

Q7. "The session saw the celebration of the 400th anniversary of the invention of the *?*."

A7. "telescope". See http://tinyurl.com/CaDAS100101.

Q8. "*? ?* came to fame when it was the first [star] to have a planet detected around it in 1995."

A8. "51 Pegasi". See http://en.wikipedia.org/wiki/51_Pegasi.

Q9. "The prolonged period of solar inactivity has resulted in an almost complete absence of the *?* from British skies …"

A9. "aurora". See www.dcs.lancs.ac.uk/iono/aurorawatch.

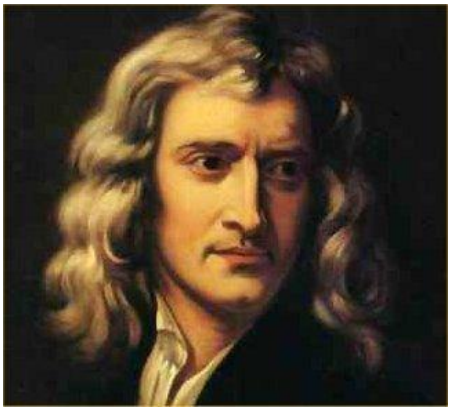
Q10. "During this session Bob Marriot stood down as Double Star Adviser and was replaced by *? ? ?*."

A10. "Dr John McCue", CaDAS's founder and Honorary Vice-President. See www.britastro.org/jbaa/pdf/118-4letters.pdf.

Picture quiz for January

Who are these famous names in astronomy? Answers in next month's issue.

A



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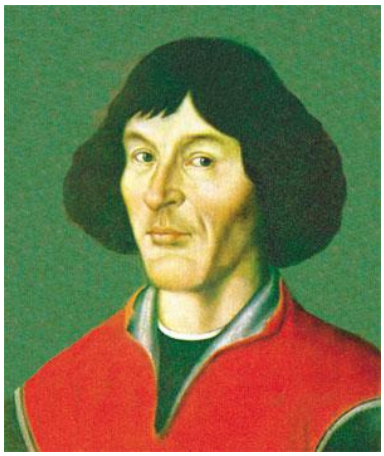

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