TRANSIT

The April 2012 Newsletter of

NEXT TWO MEETINGS at Wynyard Planetarium

Friday 13 April 2012, *7.15 for 7.30 pm*

The minor planets

Paul Money, FRAS FBIS

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Friday 11 May 2012, *7.15 for 7.30 pm*

What's in a name?

Neil Haggath, FRAS *CaDAS*

Contents

Editorial

Rod Cuff

First, welcome to new members Ian Riach and the Maddison family – it's good to have you in our circle. Also a grateful wave to CaDAS's good friend Dani Corredor from Moonfish, who we're delighted to add to our distribution list.

I 'm glad to have Rob Peeling back in *Transit* again, and to know he's being as helpful to the locals around him as he was when he lived in the CaDAS region. Bet you miss the dark of the NY Moors, though, Rob …

Keith Johnson has this month photographed seemily everything that moves in the sky (notably the ISS) and a good portion of what doesn't, *and* keeps being on TV too. I know from personal experience he cooks a mean breakfast as well. Sigh.

Neil Haggath has been in fine writing form lately, and after his recent two-issue scene-setter about the Transit of Venus he turns to examining and explaining aspects of our calendar in another two-part series. I can't believe that I've never really thought about why the number of days in each month are the weird set they are; Neil's article this time reveals a historical complexity that I'd never suspected.

Astronomical/cosmological history is also the theme of articles from both Ray Worthy and John Crowther – Ray's concerning an early-20th-century meteorogist and mathematician who deserves to be better known, and John's concerning James Cook's voyage that, among other things, proved the worth of the newly developed Harrison chronometer, which transformed maritime navigation. Good tales both.

And the quiz is back …

Many thanks to this month's contributors, and if you're not one, please consider writing in. The deadline for *Transit*'s May edition is **Sunday 29 April**.

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Letters

Who needs Damart anyway?

from Rob Peeling

As you'll gather from reading my Skylights article below, I've just completed a successful campaign of galaxy hunting in Ursa Major. I have also realised that I've made it through the winter and done a reasonable amount of observing without needing to dig out my thermal underwear! Conditions on the most recent few nights here in Berkshire have been remarkably clement.

During the weekend of 9–10 March, Reading AS participated in Reading Science Week and joined Reading University to arrange public observing at the Museum of English Rural Life. Newbury AS came along too. Friday night was clouded out, so a range of activities and displays were set up, including a series of speakers. I did half an hour on what's up in the spring sky, based on the leaflet I wrote for the Planetarium a few years back. A reasonable sprinkling of people came through.

Saturday was much better. The site was not promising, as it is slap in the middle of Reading. The museum has a large grassy area behind it, fairly enclosed by buildings but with a good view west. The first success was finding Venus before the Sun set (public observing starts early here at 6 pm) and, a little later, Jupiter. We had six telescopes set up in all and the event was well supported, with something in the region of 120–150 people attending. After Venus and Jupiter, clouds intervened for a while before it became completely clear for a couple of hours.

The surprising thing was how much could be shown to people despite the city location. I was able to show people M81 & M82, M42 and various clusters such as M44. I even found M1 (though I couldn't persuade any of the public there was anything in the field of view!). Mars appeared from behind the museum as well. Round about 9 pm the sky thickened and the stars gradually disappeared. Most people had gone so we packed up too.

All the best – Rob

Sky at Night appearances

Keith Johnson

Just after March's *Sky at Night*: programme was shown for the first time, Jürgen, Peter Vasey and I had this note from its producer, Jane Fletcher:

> *Dear Jurgen, Keith and Peter,*
>
> *I am holding onto the three films we shot last autumn for a special this year about back garden observatories. They are all great little films and to squeeze them into this weekend's programme would have meant hacking them to bits, which would have been a waste.*
>
> *Instead, I am going to hold onto them for a special programme we are making about back-garden observatories. It's later this year and I will let you know when they are going out.*
>
> *I hope this is not too disappointing for you. Your images, and some sneaky shots of you at Kielder, are in this weekend's programme for family and friends to spot!*
>
> *Best – Jane*

Skylights – April 2012

Rob Peeling

The Moon

6 April	13 April	21 April	29 April
Full Moon	Last Quarter	New Moon	First Quarter

The planets

Venus will dominate the western sky in the evening throughout the month. On 3 April the planet will be just within the Pleiades and it should be a wonderful view through binoculars or a low-power eyepiece. Venus's apparent diameter and brightness increases through the month as it approaches closer to Earth, although the phase becomes an increasingly narrow crescent.

Jupiter switched places in the sky with Venus during the close conjunction in March (wasn't it a great sight?) and is now preceding the Evening Star to the horizon, setting by the middle of the evening (10 to 9 pm). Use the early part of the evening for a last look at the belts and moons. The clarity of the view will of course degrade the lower Jupiter gets towards the horizon.

Mars will be gradually receding during April but is well placed in the southern sky below the main part of Leo. Earlier in the month will therefore be the best opportunity to pick out the north polar cap if you are planning to attempt *The Sky at Night* 55, Moore Marathon[1] that the BBC is promoting for April. There are some interesting targets suggested in that, by the way – see later in this article.

Saturn is starting to rise in the early evening, so April should offer good opportunities to see the rings and the many moons. Titan is obvious with its slight orange tinge even in binoculars. Up to seven other moons are accessible with amateur instruments, and with time and patience. Another nice thing to observe is the dark gap caused by Saturn's shadow as the rings pass behind the planet.

Meteors

The **Virginids** shower provides a few meteors per hour from several radiants in Virgo, mostly through the first half of the month. There isn't really a clear maximum.

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[1] *[I emailed everyone on the* Transit *list about this on 13 March. I commented,"You can download the forms (the detailed one would probably appeal to most CaDAS observers) at www.skyatnightmagazine.com/news/sky-night-55-moore-marathon. If you fancy writing a narrative of your observing sessions for* Transit*, do please send it in! Also, it would be good to have a 'CaDAS tally' of who's managed what -- let me encourage you to email me a copy of the Quick Form (which is just a set of tick-boxes) with your ticks on it. If at least a few people do that, I'll feature it in the May issue of* Transit*. – Ed.]*

The **Lyrids** meteor shower lasts between 16 and 25 April with a maximum on the 21st/22nd at up to 20 per hour. The radiant is in Lyra and the meteor stream is derived from comet Thatcher.

Deep sky

Here are some of my spring favourites. I've mentioned them before – no apologies for doing so again, because they're well worth it!

Markarian's Chain

Markarian's Chain is a 1.5°-long arc of galaxies that all belong to the Virgo Cluster, although some of the members are in fact in the constellation Coma Berenices. It was first described by the Armenian astronomer B E Markarian (1913–85) in December 1961. A paper in 1983 by Litzroth supports the idea that seven of the eight do indeed seem to be moving away from us at the same velocity – i.e. as a group.

This area of sky is rich with galaxies. Photos easily pick out 14 galaxies along the original arc from **M84** to **NGC 4477**. To the observer the chain appears to logically extend an extra degree further northeast to **M88**, drawing in a further four potential members.

To find Markarian's Chain, first find the wonderfully named star **Vindimiatrix or epsilon (ε) Virginis**. This is a naked-eye star, so it should be fairly easy to set your finder on. Now scan westwards (right) from Vindimiatrix to find a simple asterism of four stars with rho (ρ) Virginis in the centre. I call this the 'Space Rocket' because it reminds me of Thunderbird 3. Scan way up and to the right of the Space Rocket to find the next star as bright as ρ Vir. This should be 6 Com. Imagine a line between the rocket and 6 Com and start searching with a low-power lens just over halfway up to 6 Com. M84 and **M86** should show up together in the same field, which is how you know you are in the right place. Now work slowly first to the east (left) and you should pick up the first pair of galaxies. Continue east to some (very) faint stars, and the next two galaxies are between them. Now work north (up) to pick up two more quite separate galaxies. Then a biggish step north for one more, and finally sweep eastwards to see if you can finish on M88.

Melotte 111, Coma Berenices star cluster

This cluster is impressively large and bright, filling the binocular view. It is the third-nearest star cluster to our Sun and only about 260 light years away. It is thought to be about 400 million years old, and because the force of gravity is so weak between its stars it is considered likely to disperse completely in the relatively near future – a few tens of millions of years! Scan your binoculars along a line between **Denebola** and **Cor Coroli** to find Melotte 111. It is somewhat closer to Cor Coroli than to Denebola. Unusually, the best views of Melotte 111 are with binoculars and not with telescopes. This is because the cluster covers so much sky.

The Whale

Another nice galaxy to try for is **NGC 4631**, nicknamed the Whale, in Canes Venatici. It is indeed a huge galaxy, and bright (for a galaxy at any rate). It is also fairly straightforward to locate. Use Melotte 111, the Coma Berenices open star cluster, as a starting point. This is an easy naked-eye object. The stars in the cluster appear to indicate a direction northwards; follow this to a wide pair of 6th-magnitude stars and scan south-eastwards with a low-power

lens and you should catch your whale. There is no obvious core to this sprawl of stars but there is a fairly well-defined bright band along the middle of its length.

Figure 1. The Whale Galaxy

The Sky at Night 55 – Moore Marathon

One suggestion in particular in this observing list has caught my eye. This is the **Cheshire Cat asterism**, which I have not heard of before. This lies south-west of **M38** in Auriga. The open cluster forms one end of the smile. It appears to involve part of the **Leaping Minnows asterism** in the same constellation. It's a binocular object – it's far too large to frame in a telescope field. Have a look for it and see what you find.

Herschel 400 objects in Ursa Major

Finally, I have long been interested in the Herschel 400 list of objects, ever since my son gave me a copy of Stephen O'Meara's *Herschel 400 Observing Guide*. With the galaxy-spotting season for Virgo and Coma upon us, how about considering Ursa Major for a change? With three clear nights on 11, 12 and 14 March, I was able to see the grand total of 45 galaxies. This included **all five Messier galaxies in Ursa Major**, and some galaxies not in the Herschel 400 but conveniently nearby. A couple of them were in Camelopardalis and three in Canes Venatici (**M106**, **M51** and its companion **NGC 5195**). These were mostly around or under the bowl of the Plough.

March's astrophotography

Keith Johnson

It's been an interesting and varied month – here are just some of the things that have kept me busy recently!

Orion and the ISS

After looking at Heavens Above one evening, I suddenly realised that the International Space Station was going to make a flyover. After putting the co-ordinates into SkyMap Pro, I saw it fly underneath the conjunction (of Venus and Jupiter) and through Orion. Figure 2 shows one of the pics I took (which I hope will come out visibly here!)[2]

Equipment:

Canon 300D DSLR camera, with 18–55mm lens, captured at ISO 800 using a basic tripod.

Figure 2. Jupiter, Venus, the ISS and the Moon

[2] *[I've brightened it a bit in Photoshop, in hope! – Ed.]*

Mars at opposition

Figure 3, with a hint of surface detail, is my latest attempt at capturing Mars. The right-hand image is a simulated view of the red planet, using Mars Previewer II, at the time of the capture. The image on the left is my result, which incidentally is true to scale, using a 2.5× Powermate *and* a 4× ImageMate *combined* on my C9.25" f/10 OTA, giving an overall focal length of f/65 !!

At such a magnification the tracking has to very, very accurate, as there is only just enough room to fit the planet on the CCD chip. Moreover, the seeing must be better than average. Sadly, in this case and indeed over the last few weeks leading up to and beyond Mars at opposition, the seeing wasn't very good.

Saturn is now coming into view at a more comfortable time of the night and I would hope to use this opportunity to gather together and help any CaDAS members who would like to image this beautiful planet.

On the same subject, there's an excellent website called Processing planetary images, which will be very useful for CaDAS astrophotographers.

Equipment used:

Hardware:	**Software**:
C9.25" OTA EQ6 Pro mount Computer-controlled focuser ToUCam Pro II camera (+ infra-red blocking filter)	Image capture: AVI-IO Image processing: Registax version 5. Telescope Go-To and control using SkyMap Pro.9. Adobe Photoshop used only for creating the text and combining both the Mars Previewer II and my image capture

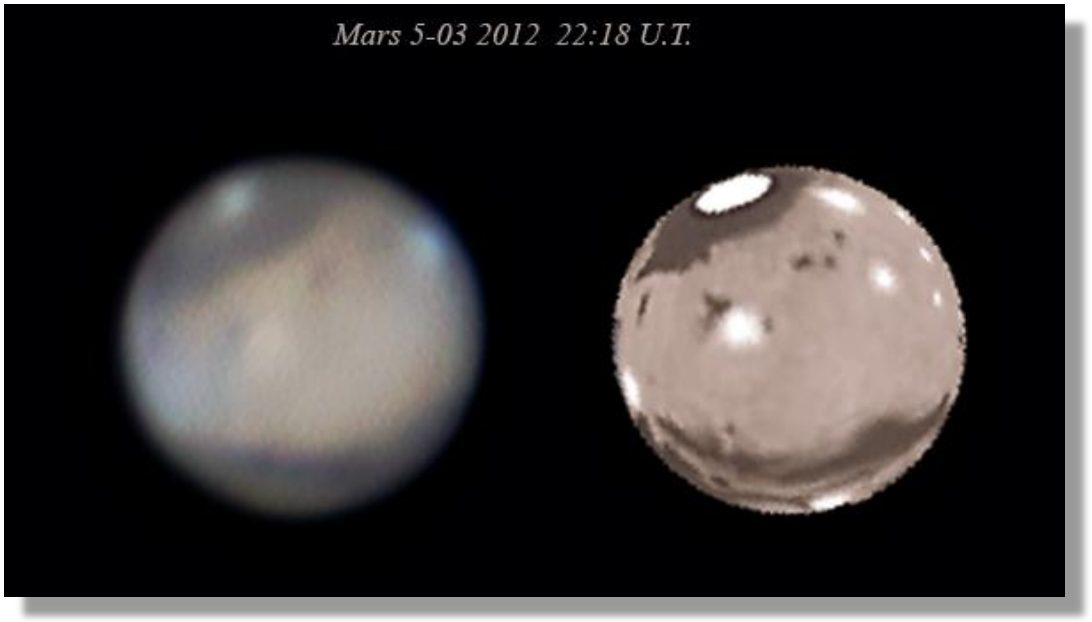


Figure 3. Mars – Keith's image (left) and Mars Previewer graphic

Kielder Star Camp weekend, 23–25 March

The long weekend could not have gone any better. At around 10 am on the Friday morning, I drove my car up to collect George Gargett from his house 2 miles away before we set off in my motorhome just before lunch time. In the bright, warm, sunny weather, both of us were excited by knowing that we would get at least one clear night out of the three we were staying. Arriving at the campsite at around 2 pm, we were greeted by a couple of Sunderland Astronomical Society members who showed us to our pitch, which turned out to be the same one I'd used last autumn.

George then helped me get the motorhome sorted, including levelling the vehicle, erecting the awning, setting up the two telescopes and positioning the satellite dish, which was invaluable in keeping us informed about the latest weather forecasts and the Formula 1 Grand Prix.

The set-up for the weekend's visual observing comprised my C9.25" attached to the HEQ5 Pro mount, and with 2" eyepieces. George decided to piggy-back his camera on the mount for some long-exposure constellation shots.

The photographic set-up included my Meade 127mm triplet refractor with a side dual-dovetail bar that also held my William Optics ZS66. The Meade was to be my imaging OTA, with the ZS66 acting as the guide scope together with an LVI autoguider. Image capturing was carried out using a modified Canon 1000D.

We then decided (reluctantly) to go to the nearby pub to get something to eat and have a few pints (this turned out to be many!). In the pub we got chatting to a father and son who were there for the weekend and after a few more pints I invited them back to my motorhome for – you guessed it – a few more pints! As the sky wasn't very clear, we stayed in the motorhome watching TV and chatting.

I awoke the next morning with a thumping headache (must have been something I ate) but was looking forward to meeting up with an old friend, Alan Clitheroe from Scotland, who I first met during one of my visits to Patrick Moore's home in Selsey. Alan arrived in the late afternoon and soon set up his equipment, mainly a 10" Schmidt-Newtonian and an Atik imaging camera. Alan and I were hoping to obtain some good shots of M95, as a supernova had been detected in it a few days previously.

The darkness soon approached and it looked like we were in for a reasonable night of viewing and imaging. As soon as darkness fell, we started taking our images. A brief look at Alan's laptop screen indicated that he was going to obtain some good data, and I wasn't doing too badly either.

As Alan would be heading home early the next day, we called it a night at around 2 am. After a few drinks and bit of a chat, all three of us got out heads down for a good night's sleep.

Next morning, while I was making a good old English breakfast of bacon, eggs, mushrooms, tomatoes bread buns and a cuppa, Alan set up his solar telescope, which gave us some amazing views of solar prominences. It was sad to see Alan leave at lunchtime, but I'll be meeting up with him four weeks after the Kielder weekend and at a different venue – but more about that in a later edition of *Transit*!

Saturday night was a mixed bag with fairly clear skies – but Sunday was a truly amazing experience, as the skies could not have been any better if we had wished.

George and I decided to have a go at creating a wide-screen time-lapse movie of the constellations rising in the east, recorded as a set of 40-second exposures with a 10-second gap between them. We captured 6 hours of footage and have put a movie of it on YouTube. We would surely have struggled if it had not been for the kind loan of a mini-tripod from Joe Gordon. We simply left the camera to capture all night long, once a brief inspection of one of the frames had shown it was going to be something special!

My imaging targets for the night were **M108** and **NGC 4565** and I would have been imaging all night long, but my autoguiding setup started to misbehave so I decided to call a halt to the night earlier than I'd intended.

M108 (Figure 4) is one of my favourite Messier objects, similar in appearance to another of my favourites, NGC 4631 (the Whale Galaxy).

Figure 4. M108 in Ursa Major

I then turned my attention to NGC 4565 (the Needle Galaxy), an edge-on galaxy with dark dust lanes running through the centre (Figure 5). However, this was where the problems started to arise with the autoguider, so I didn't capture as many light frames of this object as I would have wished.

Figure 5. NGC 4565 (the Needle Galaxy) in Coma Berenices

The morning of our final day was spent putting all the gear away before setting off on our journey back home at lunchtime. We arrived back very tired, but pleased that the weather had been kind to us all. I'm already counting the days down to my next trip to Kielder next spring, when I'll have a much better imaging camera and will be using a more reliable method of autoguiding with my DMK mono camera and PHD software.

Equipment used:

Imaging: Meade 127mm triplet refractor OTA Modified Canon 1000D DSLR camera EQ6 Pro mount. **Processing**: DeepSkyStacker Adobe Photoshop CS2	**Guiding**: William Optics ZS66 OTA LVI stand-alone autoguider 10 light frames 10 flat frames No dark frames **Image processing by John Gargett**

Leap years and calendar quirks – Part 1

Neil Haggath

Thirty days hath September,
April, June and November.
All the rest have thirty-one,
Excepting February alone,
Which has but twenty-eight days clear,
And twenty-nine in each leap year.

We all learned that rhyme when we were kids, didn't we?

Obviously, the awkward number of days in a year dictates that we need to have months with varying numbers of days – but why is this done in such a bizarre and apparently haphazard manner, such that we need to teach children a rhyme to remember the sequence? Well, we can blame the Romans for that – but before I explain why, we need a little background.

A year, as we all know, is the period of the Earth's orbit around the Sun. Astronomers use several different definitions of a year, with slightly different lengths, but that's beyond the scope of this article. The orbital period is very close to 365¼ days – which is of course why we insert a leap day in every fourth year (more on that next month), to keep the calendar year in step with the physical one.

Ancient cultures, of course, didn't know that the Earth orbits the Sun; they defined a year as the time which the Sun takes to apparently move all the way around the sky with respect to the constellations – which is the same thing. But the number of days in a calendar year, 365, is a pretty horrible number to work with, as it can't be divided up in any convenient way! In fact, it's the product of two prime numbers, 5 and 73, so it doesn't divide by anything else. So *any* system of dividing up the year was always going to cause problems.

The arbitrary division of the year into twelve months dates back thousands of years.

The Sumerians, around 4000 years ago, defined a year as 360 days – a number that can be neatly divided up in several ways. This is why we have 360 degrees in a circle; a degree is very nearly equal to the angle through which the Sun appears to move in the sky per day. They divided their year into twelve months, each of 30 days.

The Egyptians later realised that the length of a year was in fact roughly 365 days. They kept the twelve 30-day months, and simply tacked the extra five days onto the end of the year – and invented an elaborate myth to explain why one of their goddesses had added those extra days.

Now we come to the Romans. They established the system of months, with equivalent Latin names, which we still use, and used months of varying lengths to account for those troublesome five days. Initially, their system was pretty neat; their calendar had alternating months of 31 and 30 days, except for February, which had 29. That's because six 31's and six 30's add up to 366 – one day too many – so one day had to be removed somewhere. Why February? Because March, not January, was the first month of their calendar, and February the last – so it was logical to remove that day at the end of the year. So March, May, July, September, November and January each had 31 days; April, June, August, October and December each had 30, and February 29.

(The fact that the Roman calendar began with March is still apparent in our calendar today; the names of *Sept*ember, *Oct*ober, *Nov*ember and *Dec*ember indicate that they were originally the seventh, eighth, ninth and tenth months.)

Later, as is well known, the Romans were the first to introduce the concept of leap years.

They realised that the physical year is actually 365¼ days, so the Emperor Julius Caesar, acting on the advice of an astronomer named Sosigenes, introduced the system of adding an extra day in every fourth year. Once again, it was logical to add this extra day at the end of the year, and to the one month which was shorter than any other – so February came to have 30 days in leap years, and 29 otherwise.

(Actually, the Egyptians knew about the quarter-day much earlier – but strangely, they never bothered to correct for it. They simply accepted that their calendar moved out of step with the seasons at the rate of a day per four years, coming back into step after a very long cycle of four times 365¼ or 1461 years.)

So far, so good; the system was as neat and logical as it could be. But as always, you could rely on the politicians to stick their oar in and cock it up… In 45 BC, the Roman Senate decided to honour Caesar for his reform of the calendar, by naming a month after him. The fifth month, previously called Quintilis, was renamed Julius – from which we get the name July. I don't know why they chose that particular month to name after him, but they decided that it had to be one of the long ones with 31 days. Sadly, Caesar wasn't able to enjoy this honour for very long, as he was murdered the following March.

That amendment was no big deal – but the next one was! In 30 BC, after the Emperor Augustus won the civil war against Mark Antony, the Senate decreed that he should also have a month named in his honour. The chosen month was the sixth, known as Sextillus, because Augustus had returned triumphantly to Rome during this month, and a couple of other events of great importance to the Empire had also occurred in the same month. So the month after Julius became known as Augustus.

But now there was a problem. Julius' month had 31 days, but that of Augustus had only 30. Not wanting to give the impression that the latter emperor was being fobbed off with an 'inferior' month, the Senate decreed that his month must also have 31 days! Naturally, this meant that a day had to be removed from somewhere else to compensate; once again, it was taken from the end of the year. So that's how February came to have only 28 days, and 29 in leap years.

Now things were becoming a bit messy! The addition of an extra day to August meant that there were now three successive months – July, August and September – with 31 days. So the numbers of days in the next four months – September to December – were swapped around, resulting in the illogical sequence which we're stuck with to this day! We have two instances of two successive 31-day months – July and August, December and January – but never three.

Not surprisingly, several later emperors also tried to have months named after themselves – but thankfully, their names didn't catch on. The Julian Calendar, in the form at which we've arrived here, remained in use throughout Europe until 1582, when Pope Gregory XIII made further reforms, and changed the rules on leap years.

Next month, I'll explain the subtleties of the Gregorian Calendar, and why deciding which years are leap years isn't quite so simple.

To boldly go – 1914 style

Ray Worthy

When one reads history at school or college, it is always in the context of a syllabus. The student has to study an event or a person's life and place it in the context of the overall situation. It is my belief that sometimes the latest technology such as the internet, or the computer itself, gets in the way of the full understanding of how people in the past made their decisions. History could be viewed as the continual flow of the effect of people's decisions. It is so easy to view events that happened years ago through modern eyes with the twenty-twenty vision of hindsight.

What I want you to consider and use as the background to this story is the growing awareness in the early twentieth century of the atmosphere above us.

Hot-air balloons and hydrogen balloons had lifted men and women into the air since the time of the Napoleonic wars, but it was always appreciated that there was a limiting lack of control. However, in 1903 the very first controlled heavier-than-air machine had taken flight on a North Carolina beach. Wilbur and Orville Wright had built a flimsy machine of bicycle parts and flown a controlled flight over several hundred yards. They were only the first of the vanguard. All over the western world, similar flimsy machines were being coaxed into the air. The technology grew apace, and only five years later an intrepid Frenchman, Louis Bleriot, took off from the white cliffs of Dover, flew in a more or less straight line across the 21 miles of the Channel and landed in a field in France.

The First World War began only six years after that cross-Channel flight. The development of aircraft design was tremendously accelerated as a result, and within a year after the Armistice the first successful transatlantic flight took place. It was during this period that scientists began to realise they really did not know very much about the atmosphere above

them. Now that humanity was venturing into this new dimension, it became obvious that something should be done to rectify this prevailing ignorance.

Earlier, way up north in the city of St Petersburg, a romance had developed between a beautiful concert pianist and a virile, handsome ballet dancer. This romance progressed as these things do. The pair were married and, in the course of time, in 1888 a baby was born. This boy grew up to be recognised as a mathematical genius. He shot through school and college. His passion was typical of the young men of his day; his mind was fixed on aircraft, both balloons and the heavier-than-air variety.

In early 1914, he attended a German university to study meteorology under the acknowledged world leader in the subject at that time. From here he made several balloon flights in the course of his studies. Once it became obvious that his country might soon be at war with Germany, he made his way home. Once there, his talents were appreciated to such a degree that, in a short time, he became a bomber pilot, a balloonist and a university lecturer in aeronautics and meteorology. His mathematical ability, it seems, could be turned to many applications and his time was sought by more than one university department.

Conditions in Russia after the war were fantastically chaotic. The Revolution was followed by the capitulation of the Russian Army. When the Germans were defeated in 1918, the Red Army was still fighting for its very existence against the so called White Army, backed by elements in the West. With millions starving, it cannot have been easy for any academic to carry on a normal life. Be that as it may, this young man seemed to thrive. His studies in meteorology took him up in balloons, higher and higher, until in July 1925 he broke the world altitude record. Unfortunately for the world in general, and science in particular, only two months later this brilliant man died of typhoid fever after a visit to the Crimea.

Figure 6. Alexander Friedmann (1888–1925)

Now, why am I writing about this young daredevil in a magazine devoted to astronomy and cosmology? Oh yes! The young man's name was Alexander Friedmann. Does that mean anything to you? It doesn't to most people. When I was preparing the article of two or three months ago on the subject of the scientists who were 'forgotten' by Hubble when he should have acknowledged their efforts, I got the impression that it was like peeling an onion. When I discovered someone who deserved to be on the list, there always seemed to be another candidate in the offing.

You may remember that the Belgian priest genius Lemaître disclosed to Einstein that he, Lemaître, had been following the logic of Einstein's equations and had come to the conclusion that Einstein was wrong and the Universe was not static but expanding. The two of them met at a gathering of scientists in Holland. They were walking up and down in a Leiden park, going at it hammer and tongs.

Einstein was glaring at this young upstart. He said something to the effect, 'Your mathematics is excellent, but your physics is atrocious.'

They separated unreconciled, but not before Einstein had a parting shot.

'You are not the first, you know,' he said.

'What do you mean?' Lemaître queried.

'There's a young man in Russia who beat you to that idea by at least two years. His name is Alexander Friedmann.'

And so it proved. In all that chaos that followed the Kaiser's war, Friedmann had discovered the works of Albert Einstein from which he had been isolated during the conflict, and had assimilated the revolutionary concepts. Then, in an apparent intellectual holiday from his normal work, he had developed the equations and worked out at least three conclusions. His solutions to Einstein's equations allowed that the Universe could be shrinking or expanding. He even followed up the logic of the expanding option to calculate the age of the Universe.

Figure 7. Arthur Geoffrey Walker (1909–2001)

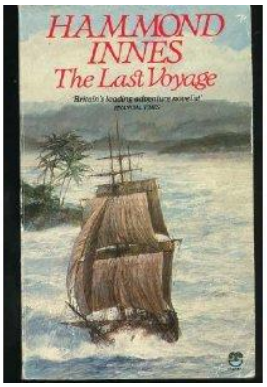
Unfortunately for his record in posterity, Friedmann chose to publish his 1922 and 1925 papers in an obscure German scientific magazine devoted to rather obscure mathematical concepts and it was filed away as an exercise in relativity theory. The impact on cosmology was not appreciated by the specialist readers, and the mainstream scientists never got wind of it.

If you would like to have a go with this peeling onion idea, take a look at Arthur Geoffrey Walker, from Watford of all places. His name is coupled with the further development of the ideas of Friedmann and Lemaître. I warn you, though, the maths is a bit like a barbed-wire fence.

Not an 'Open Night' talk

John Crowther

CaDAS's programme for the 2012 Open Night was provided with speakers well before the event – the first time this has happened. I had considered offering a talk, but things turned out for the best as I was unable to attend anyway. However, here's the material I'd intended to use. It's about the astronomy of Captain Cook's last voyage, and is based on Hammond Innes' book *The Last Voyage* (Pan, 1978).



The book is a fictitious account, yet the author's skill, his knowledge of the man and his careful research have enabled him to persuade us that it is Captain Cook who has written it. The fiction is that it is a confidential piece of writing from a diary written between 22 July 1776 and 13 February 1779. The book opens with these words:

This manuscript, which only recently came to light in the cellars of the Old St James Club, is such an extraordinary document that I feel some explanation is essential. It appears to be in Cook's hand and style and covers his third voyage up to the time of his death, and to some extent it overlaps his official Journal.

A real-life link to this is that some years ago in the attic of the Merchant Seamen's Hospital Houses in Church Street, Whitby, the muster rolls[3] of at least one of Cook's voyages turned up. The sailors, as might be expected, mostly came from the Whitby area, but with one at least as far away as Pinchinthorpe.

So here is a precis[4] of astronomical excerpts from Hammond Innes' book, all factual items being taken from Cook's official journal.

Monday after Noon, 22 July 1776

Cook was present while the 'Watch Machine' was wound up and the time entered into the Observations Book, along with the measurement of latitude at noon. He lists the instruments on his two ships:

> *2 Astronomical Clocks, one with an Alarum, an Astronomical Quadrant, a Hadley's Sextant by Ramsden and another by Dolland, an Acromatic Tellescope [sic] with a treble Object Glass 46 inches Focus, a Reflecting Tellescope, a 4 feet hand perspective with large Aperture, a Marine dipping Needle with Six Magnetic Steel Bars, 2 Small Variation Compasses, an Azimuth Compass with spare Card, a Theodolite and Gunters chain, a pocket Pinchbeck Watch and Mr Bayly the Astronomer on board of the* Discovery *and I have a small Hadleys Sextant by Ramsden as well as logarithms and a variation chart.*

23 July

Cook had taken four duplicates of Harrison's recently developed H4 chronometer, three made by Arnold and one by Kendall, as ordered by the Board of Longitude. The Kendall instrument had proved 'a most excellent timekeeper' throughout the voyage, and it was then delivered to 'Mr Maskelyne the Astronomer Royal' at Greenwich for checking. Cook commented:

> *Testing the accuracy of all the equipment, using at times portable observatories, had taken up a great deal of our time during the Voyage.*

Figure 8. H4 chronometer made by John Harrison (1693–1776)

25 July

Cook's team passed Cape Finisterre, and used the chronometer and 'the mean of 41 lunar observations. To determine its longitude as 9° 19' 12" W [the actual is 9° 8'].

31 July

They observed a total lunar eclipse through the 'Night Telescope' and used ephemeris tables to calculate their

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[3] *[An exhibition based on the 8000 muster rolls found during renovation work is on at the Whitby Museum until 7 May. – Ed.]*

[4] *[John supplied extensive verbatim passages from Innes' book, but this is still in copyright and alas it would not be legal to quote large chunks here from the book itself. I've summarised/reworded some of them, and only quoted explicitly a handful of sentences and a list of items, which I'm pretty sure Innes would have taken directly from Cook's journal. – Ed.]*

longitude as 15° 35' 30"; an independent calculation using the chronometer gave 15° 26' 45". Much of the time, especially at the beginning and end of totality, clouds hid the Moon, compromising the observations.[5]

A French frigate was near them, captained by a fine navigator named Bourdat. Helped by a Spaniard on shore, Bourdat compared his on-board watches with a clock on shore at noon each day, and also passed the results to Cook:

> *The result was the same longitude within a few seconds, conforming that our Watch had not materially altered its rate of going. This is something that affords me considerable satisfaction for where we are bound on this voyage we shall have much need of an accurate timekeeper and no means of checking it.*

28 November

By this time they were at the Cape of Good Hope, where their tents and observatory were blown away. Nevertheless, after 15 days' observation they found that the chronometer as the sole basis for timekeeping gave a mean error in the true longitude of no more than 8' 25". Cook declared that clearly the watch had gone well during its voyage from England and had led to a more accurate longitude result than any other timepiece had ever given him. He ended his entry:

> *This is of great importance for the determining of currents, as off the coast of Brazil where from 2°N 25°W to 13°S 30'W in the space of 4 days we had an error in the Ships reckoning of 115 miles SWbyW the cause of which I now take to be a strong current setting in that direction.*

CaDAS AND OTHER NEWS

York AS celebrates

York Astronomical Society invites us to join them in the celebration of their 40th Anniversary at the Priory Street Centre, off Micklegate in York, YO1 6ET. You can get more for your Money through them too:

Friday, 4 May: Meeting starts at 20:00

Images of the Space Shuttle by **Paul Money**, one of England's best-loved astronomical speakers. YAS members £1, visitors £2.

Saturday, 5 May: Doors open at 09:30. Lectures to be presented by:

- Dr Monica Grady – Mineralogy and meteorite specialist, The Open University
- Nik Syzmanek – One of the UK's leading astrophotographers
- Dr Allan Chapman – Astronomical historian, Wadham College, Oxford
- Dame Professor Jocelyn Bell-Burnell – Fellow of the Royal Society and co-discoverer of pulsars

[5] *[A pity we don't know which value was the more accurate. I think I'd put my money on Harrison. – Ed.]*

There will also be a short presentation by York AS members, plus trade stands and exhibitions. Refreshments will be available morning & afternoon. Lunch can be obtained in cafes etc locally, or bring your own.

Entry £10, concessions & YAS members £5. No booking arrangements.

There is no parking at the Priory Street Centre, or in the streets nearby.
The nearest Pay & Display car park is in Nunnery Lane (postcode YO23 1AA).

For further information, visit www.yorkastro.org.uk or phone 01347 821 849.

Tour of the Moon

There's a truly excellent video 'Tour of the Moon', put together by NASA Goddard Space Flight Center, at http://lunarscience.nasa.gov/articles/video-a-tour-of-the-moon. To quote the site: it 'takes viewers on a breathtaking journey across the moon's surface. Several interesting locations include: Orientale Basin, Shackleton crater, South Pole-Aitken Basin, Tycho crater, Aristarchus Plateau, Mare Serenitatis, Compton-Belkovich volcano, Jackson crater and Tsiolkovsky crater. … This video was made in honor of the NASA Lunar Reconnaissance Orbiter's (LRO) first 1,000 days in orbit.'

Telescope for sale

Dave Lewis, who looks after CaDAS's hardware, especially telescopes, has been contacted to see if the Society or any individual is interested in a telescope that's on offer. The enquirer says (edited):

> Five years ago I had a fit of (what I believe is termed) 'aperture fever' and purchased a 12" Meade LightBridge telescope. This has for the most part sat in the house gathering dust (though I have the mirror covered...). Would anyone in your Society be willing to take it off my hands?
>
> My hope is that someone could take it to try for a month or so and then, if it proves useful, make an offer. Along with the scope and eyepiece that came with it, I bought a couple of accessories that will go with it: a 9×50 spotter scope (which I actually found a bit heavy for the LightBridge – beyond a certain angle it would pull the scope down!) and a laser collimator for setting up the mirrors. It was £600 when I bought it 5 years ago, so with depreciation, £200 all told seems a reasonable target; I don't want to bankrupt anyone!

To preserve the enquirer's privacy, all enquiries or requests for contact should go through Dave (01429 276332 or mdavidlewis03@googlemail.co).

APRIL'S QUIZ

1. What's the connection between M16, IC 5070 and M97?

2. And what about the connection between M40, M109 and M97?

3. And Albireo (β Cyg), Almach (γ And) and Rasalgethi (α Her)?

4. What are M65, M66 and NGC 3627 collectively known as?

5. When Jupiter is at its closest to us, how many light-minutes/hours away is it?

   (a) 3 mins (b) 33 mins (c) 3 hrs (d) 333 mins

6. Which astronomer does this describe, and what are his enduring legacies? His father was the Danish Minister for War and the Navy; he worked for Lord Rosse and directed the Armagh Observatory; and he produced a 15-volume edition of the works of Tycho Brahe.

7. An O III filter excludes other than what kind of light? And what objects can be particularly well viewed through it?

8. In a typical diffuse nebula, how much space would a kilogram of dust grains occupy?

   (a) 1 cubic km (b) 1000 cubic km (c) a million cubic km (d) a cubic light-year

9. What are Bok globules?

10. Where in our Galaxy would you be most likely to find OB associations, and what are they?