TRANSIT

The June 2011 Newsletter of

NEXT MEETING

10 June 2011, *7.15 pm for a 7.30 pm start*
Wynyard Planetarium

The Dark Side of the Universe
Prof. Christine Done, *Durham University*

Contents

Editorial

Rod Cuff

First of all, I'd like to welcome five recently joined members – Deborah Britton (from Norton), Josh Duncan (Thornaby), Ged & Jan Flanagan (Stockton) and Alan Mark (Acklam). We're very pleased to have you as members, and I hope you enjoy *Transit* among other aspects of the Society – I welcome letters and articles from both new and experienced members, by the way! We've had many other new members earlier in the season too; apologies for not welcoming you all by name in *Transit* at the time – will do better, will do better.

May's issue was slanted towards observational reports; this one has more general articles for a change. Rob Peeling has had a pressured month and was unable to supply his usual excellent review of the June sky. Instead, I've taken deep-sky material from Rob's *Skylights* of June 2009 and added coverage of solar system events for the month ahead.

As promised last month, this issue contains a fully illustrated how-I-did-it guide by Keith Johnson on building a robust yet inexpensive pier system. This could be *your* summer project …

Many thanks to all contributors. The copy deadline for the May issue is **Tuesday 28 June**.

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

Astronomy lecture series in Liverpool

[*This is probably a bit far away for most CaDAS members, but if you're in or near Liverpool later this month, the opening lecture of this series sounds well worth your time. For others in the series, keep an eye on www.astro.ljmu.ac.uk/news.]*

There is a new, free **Public Lectures in Astronomy** series organised by the Astrophysics Research Institute at Liverpool John Moores University and made possible through the generous support of Paul and Leslie Murdin. Here are details of the first lecture in the series.

Title: **Hubble in Orbit: Two decades and counting**

Speaker: **Dr Bob Fosbury** (*former director of the Space Telescope – European Coordinating Facility in Garching*)

Date: Thursday 23 June at 7:30 pm

Venue: Art and Design Academy, Johnson Foundation Auditorium, Liverpool John Moores University (see Art & Design Academy, L3 5YD: www.ljmu.ac.uk/conferences/86077.htm)

Free and unticketed – just show up. Suitable for all!

Abstract: During May 2009, the Hubble Space Telescope was subject to the most intense overhaul of its life, with astronauts from the Space Shuttle *Atlantis* performing engineering feats far beyond what was originally envisaged for orbital servicing. Instruments were repaired and replaced during the most complex human process that had yet been performed in space. The telescope is now some hundred times more powerful than when it was launched in 1990. This is

the story of Hubble, looking back on the revolution in astrophysics that it has achieved and forward to what it is achieving now, from probing into the early history of the universe to the study of the atmospheres of extrasolar planets.

OBSERVATION REPORTS AND PLANNING

Skylights – June 2011

Rob Peeling[1]

The Moon

1 June	9 June	15 June	23 June
New Moon	First Quarter	Full Moon	Last Quarter

On 15 June a **total lunar eclipse** is visible from our area, but the Moon rises while totality is already under way. Moonrise at this latitude is about 21:32 BST, and totality ends at 22:03 BST (21:03 GMT) with the Moon only a few degrees above the south-eastern horizon – so you'll need an unobstructed view in that direction to get the best sighting and a spectacular photo opportunity if you're lucky (please send your pictures to the Editor!).

The Moon then moves into the penumbra, the lighter part of the Earth's shadow, gradually moving from browny-orange (probably) to a more yellowish cast. The penumbral phase comes to an end at 00:02 BST on 16 June (23:02 GMT on 15 June).

Earth's atmosphere

The next few months provide the best time to look for the appearance of **noctilucent clouds**. These appear at a height of about 82 km and are visible when the Sun is 6–16° below the horizon. There's an excellent website about them at www.kersland.plus.com.You may well be able to capture a good image of them with a digital camera on automatic exposure, or you could experiment with setting exposures manually to see what gives best results. Again, please send your pictures to the Editor!

The planets

Mercury, **Venus** and **Mars** are still visible before sunrise early this month, provided that you have a clear view to the eastern horizon. Binoculars would come in handy when looking for Mercury and Mars.

By the end of June, **Jupiter** rises at around 01:30 BST, about three hours before sunrise. Unless you're an insomniac or on shift work, though, it will be better to wait to get it in your telescopic sights until later in the year – for instance, by the end of September it will be rising at around 19:30 BST.

At mid-month, you can see both **Porrima** (gamma Virginis) and **Saturn** in the same telescopic field of view. They're 15 arcmin apart on 11 June. Porrima is a fine object to observe in its own

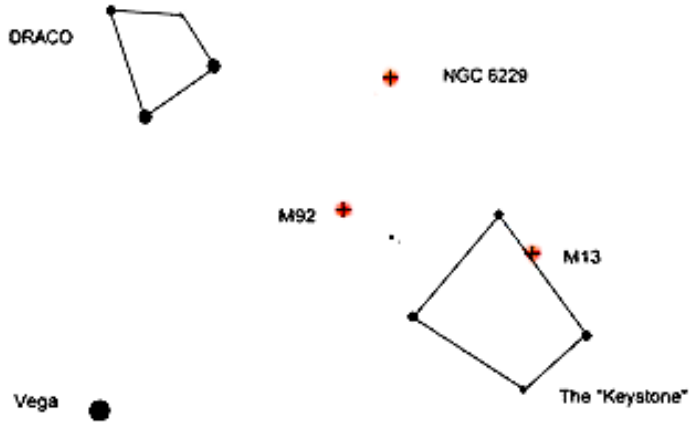
[1] *[See my editorial on p.2. – Ed.]*

right. It's a double star and 4–5 years ago its components were too close together to resolve in most telescopes. Their current separation is 1.7 arcsec, enough to resolve in most telescopes on a steady night.

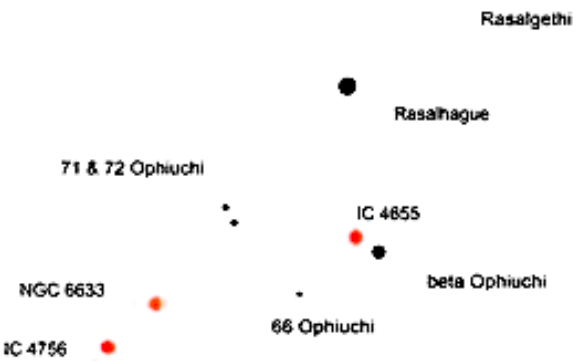
Deep sky

Orphiuchus

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



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



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

Hercules

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

Almost overhead, you will find the famous **Keystone asterism** which represents the body of Hercules. Most of you will already know how to find the fantastic **globular cluster M13**, halfway up the western side of the asterism. This is easily the best globular cluster visible from Teesside. Less well known is the faint galaxy **NGC 6207** nearby. You'll need a dark night to find this one.

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

A third globular in Hercules is **NGC 6229**. This isn't bright and can be tricky to find – but have a go!

Still moving up the learning ladder

Rod Cuff

In the May issue I showed the first open cluster, M37, that I'd captured with my Meade DSI IIIc astrocamera. Gradually hauling myself up the ladder of experience and ambition, on 1 May from about 22:00 UT I tackled my first galaxy. They don't come much more spectacular than **M51 in Ursa Major**, even if it was neck-craningly high in the sky, so that's what I went for.

I'm trying to see how far I can get with astrophotography without fundamentally adding to my current kit. I don't have an equatorial mounting or a wedge, relying instead on the excellent tracking of the LX90 in alt-azimuth mode. As a further result of that, I'm not guiding the exposures either automatically or by hand.

Necessarily, this involves shorter individual exposures ('subs') than more experienced and well-equipped astrophotographers (You Know Who I Mean) use routinely. There are two reasons for the shorter exposures.

The first is conservatism about the departures from perfect tracking that will inevitably occur. Visually, the LX90 will keep an object in the field of view (FOV) for hours, but there is an inevitable very slow drift. My judgement is that the tracking is accurate enough to permit 2-minute subs in good conditions, and one day I may experiment to test that out. However, I decided to restrict each exposure to at most 60 seconds to be on the safe side.

The second reason is that, because the mount is not equatorial – in other words, the scope isn't rotating around the North Celestial Pole – the FOV rotates. The rectangular image captured on the CCD chip appears to rotate around its centre even if tracking is perfect. Exposures have to be short enough that star images don't blur as a result. The maximum exposure recommended

depends on how high the object is in the local sky (high is bad) and whether it's roughly on an east/west (good) or north/south line (bad) at the time.[2] At the date and time I was observing, M51 was in about the worst possible place, and by experiment I found that 60-second subs produced noticeable star trails and 30-second subs didn't.

Even then, an irritating random breeze spoiled all but 30 of the 103 subs. Next day I stacked the good ones, 'derotated' them using Nebulosity software (you identify the same two stars on each image, and the software rotates the images to overlay the instances of each star). It was very pleasing to see the well-known spiral shape of the main galaxy, NGC 5194, and the interaction with the more modest NGC 5195, gradually appearing from faint wisps in the individual stackable images as post-processing proceeded in fits and starts. The best I could do with the result is shown below. Pity about the unwanted glow at top right, though.

[2] There are good discussions of this on the internet – e.g., www.allaboutastro.com/Articlepages/fieldrotation.html and http://autostarsuite.net/forums/storage/19/4981/Field%20Rotation%20V3.pdf

Equipment:

Meade LX90 8" SCT, alt-az mounting
0.63× reducer/field-flattener, giving a focal ratio of f/6.3
DSI IIIc camera (30 × 30 sec) with an IR filter
Captured with Nebulosity software
Post-processed with Nebulosity, FITS Liberator and Photoshop CS2

GENERAL ARTICLES

Happy birthday, Neptune!

Michael Roe[3]

So why am I wishing Neptune, the eighth planet, a happy birthday? Surely it's as old as the other planets – thousands of millions of years – and an exact date would be impossible to calculate!

Yes, but I'm talking about the date of its discovery by humanity, and the number of Neptunian years – one – that have passed.

Neptune was discovered using calculations by Urbain le Verrier on the orbit of Uranus, which by the 1830s was 30 arcseconds from its theoretically calculated position. Le Verrier must have been a genius to calculate the position of an unknown planet from this slight perturbation of Uranus.

Le Verrier was French, and in England another mathematician, John Couch Adams, made similar calculations. In 1845 a search began, and on 23 September 1846 Johann Galle and Heinrich Louis d'Arrest, using a 9-inch refracting telescope in Berlin, found the new planet just 55 arcminutes from where Le Verrier had calculated it should be on this date.

With Neptune's orbital period (its year) being 164 years and 289 days of Earth time, its 'discovery birthday' in our calendar is 9 July 2011, according to my calculations. So – happy birthday, Neptune!

And if you can spot Neptune on or near this date, it is roughly where Galle and d'Arrest discovered it in 1846.

As for other planets: Uranus would have had its first birthday in March 1865, and Pluto will have its anniversary in 2178.

Building a telescope pier

Keith Johnson

Recently I decided to upgrade my telescope pier with something a bit more substantial and sturdy. Here's how it all went.

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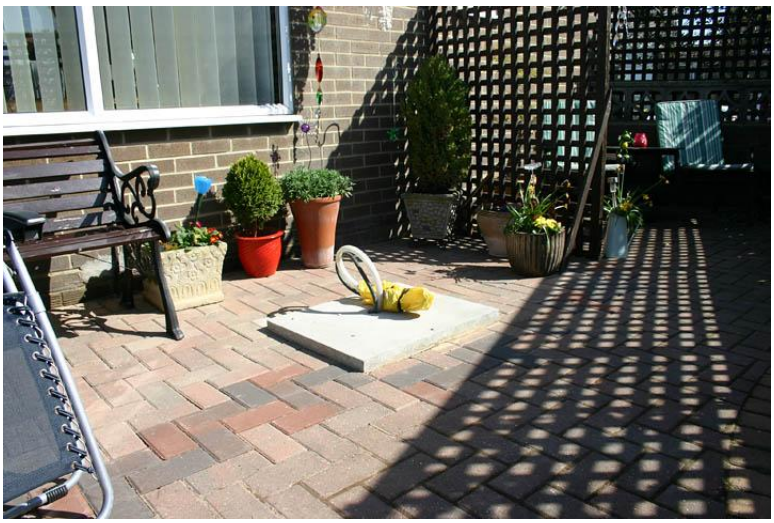
[3] *[Apologies to Michael and to John Crowther, both of whom I photographed after the last CaDAS meeting in order to bring their filed images up to date. My new (camera) phone had to be reset and then eventually sent back, and I lost the pictures on it. – Ed.]*

First of all I had to make sure the base was capable of taking the weight of a very heavy pier together with the mount/telescope and counterbalance weights. So, underneath the concrete paving slab is a concrete foundation 28” square and over two feet deep.

Five cables (2 USBs, plus single cables for video signals, computerised telescope control and autoguiding) were fed out of the imaging room, into protective plastic piping down the outer wall, under the block paving and out of a hole drilled in the paving slab.

The cables can be seen below protruding out of the concrete slab, and will later be fed into the bottom of the pier's central column.



In the next picture, the pier is in place, bolted firmly into three holes drilled into the concrete.

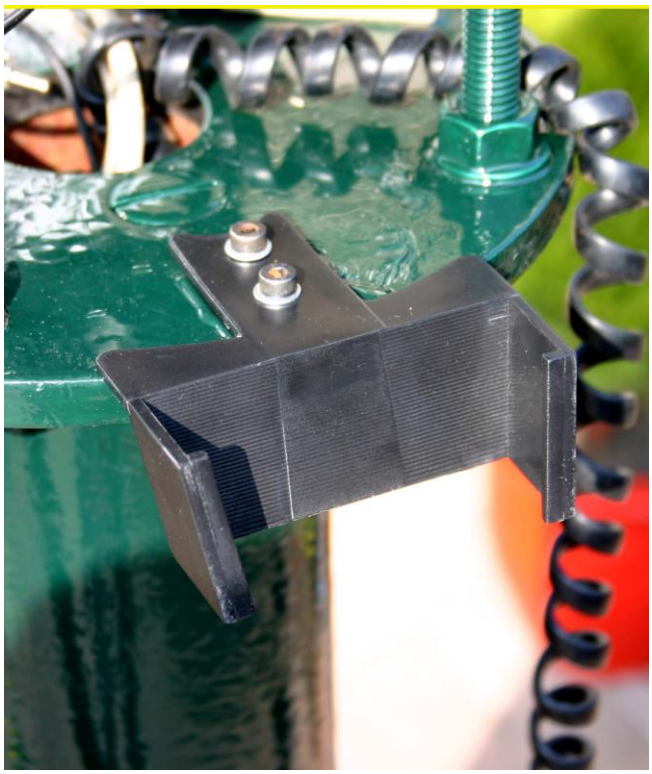
I then painted the pier and the base and top plate. Notice also (see next page) that the cables have been fed up inside the centre column and are now protruding out of the top plate. (Thanks to George Gargett for helping to lift and feed the cables through the pier.)

The next step was to make sure that the pier was level. This was carried out very precisely by adjusting the four nuts situated underneath the top plate, fully tightening them only when the spirit-level bubble was centred:

The next picture shows the drilled and tapped top plate with the drilled phosphor-bronze adaptor and EQ6 mount attached. (Thanks to Dr Jürgen Schmoll for carrying out the drilling and tapping.)

One remaining issue that required attention was where to place the hand-control holder and, more importantly – what holder to use?

Fortunately I have both an EQ6 Pro.and a HEQ5 Pro.mount, so I decided to use a hand-controller holder from one of the tripods. The photos on the next page show the holder attached (*left*) and the controller resting within it (*right*).



In the right-hand picture, the coiled cable on the left is connected from the controller to the mount to allow telescope control when I'm physically next to the telescope, and the coiled cable on the right is for controlling the mount via the computer, using SkyMap Pro.

The flat, dark cable shown above the controller is for autoguiding. It plugs into the autoguiding port on the mount, allowing me to have full autoguiding control at the computer.

The two USB extension sockets attached to the base plate are for either webcam/video-camera imaging or using the Canon EOS utility software that allows full remote DSLR computer control.

Finally, at the end of this article are two photos of the completed project. All that remains is for the top plate to be painted and for an observatory to cover it!

All items were zero cost apart from work carried out to make a base and top plate, an M12 threaded bar, 16 M12 nuts and washers, and a tin of Hammerite paint – costing £65 in total.

What should have been the most expensive items – the pier and the EQ6 phosphor-bronze adaptor – were actually from my previous workplace and cost nothing.

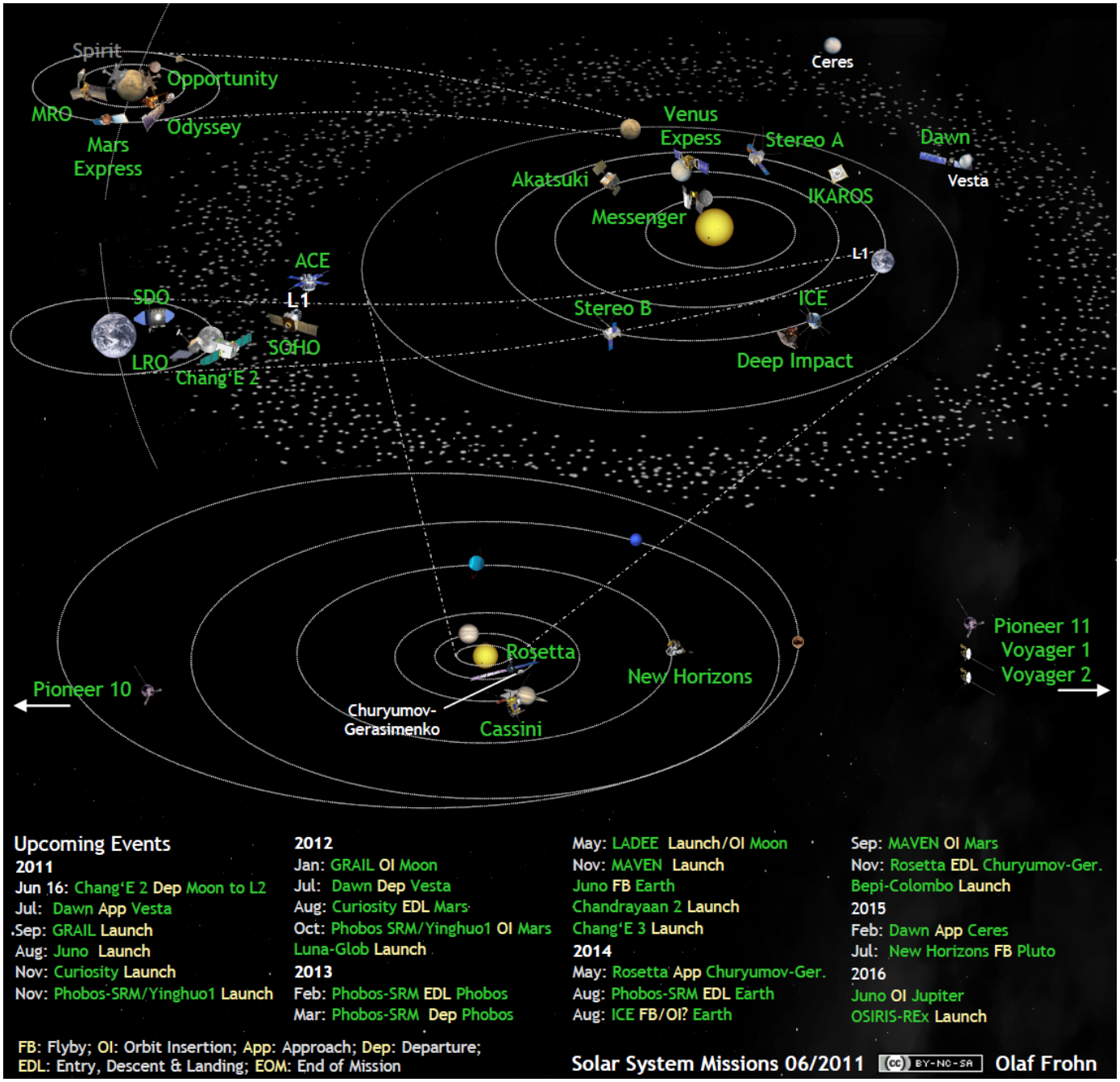
Any member considering attempting a similar project is welcome to get in touch if they require advice or assistance.

Where are they now?

Rod Cuff

While doing a bit of research for *Skylights* this month, I came across the wonderful graphic shown in the next page, courtesy of Olaf Frohn, of where all the current and near-future exploratory vehicles are in our solar system.

A full write-up, with descriptions and links to all the active missions, can be found in Emily Lakdawalla's excellent *Planetary Society Blog*, at http://planetary.org/blog/article/00003050. Andy Fleming has recommended this blog (not least in his talk to a CaDAS meeting earlier this year) as essential regular reading, and I concur entirely.


Spirit
Opportunity
MRO
Odyssey
Mars Express
Ceres
Venus Expess
Stereo A
Dawn
Vesta
Akatsuki
IKAROS
Messenger
L1
ACE
SDO
L1
Stereo B
ICE
SOHO
LRO
Chang'E 2
Deep Impact
Rosetta
New Horizons
Pioneer 11
Voyager 1
Voyager 2
Pioneer 10
Churyumov-Gerasimenko
Cassini
Upcoming Events
2011
Jun 16: Chang'E 2 Dep Moon to L2
Jul: Dawn App Vesta
Sep: GRAIL Launch
Aug: Juno Launch
Nov: Curiosity Launch
Nov: Phobos-SRM/Yinghuo1 Launch
2012
Jan: GRAIL OI Moon
Jul: Dawn Dep Vesta
Aug: Curiosity EDL Mars
Oct: Phobos SRM/Yinghuo1 OI Mars
Luna-Glob Launch
2013
Feb: Phobos-SRM EDL Phobos
Mar: Phobos-SRM Dep Phobos
May: LADEE Launch/OI Moon
Nov: MAVEN Launch
Juno FB Earth
Chandrayaan 2 Launch
Chang'E 3 Launch
2014
May: Rosetta App Churyumov-Ger.
Aug: Phobos-SRM EDL Earth
Aug: ICE FB/OI? Earth
Sep: MAVEN OI Mars
Nov: Rosetta EDL Churyumov-Ger.
Bepi-Colombo Launch
2015
Feb: Dawn App Ceres
Jul: New Horizons FB Pluto
2016
Juno OI Jupiter
OSIRIS-REx Launch
FB: Flyby; OI: Orbit Insertion; App: Approach; Dep: Departure;
EDL: Entry, Descent & Landing; EOM: End of Mission
Solar System Missions 06/2011
BY-NC-SA
Olaf Frohn

Memories from a single cinema seat

John Crowther[4]

Recently I watched *Destination Moon*, showing one afternoon on Channel 4, seeing all but the first half-hour. The film was released in 1950, so it was first screened when I was a teenager. I saw it at the Waterloo in Whitby – a cinema with double seats at the back for courting couples.

My memory was at fault in thinking that the film had been made in black and white, but colour wasn't needed for the lunar scenery, which came out blueish. Only the sleek silver of the unadorned spaceship balanced on its huge fins in a crater, cracked like a dried-up mud puddle, and the white diver-style helmets and coloured suits of the four crew members provided some colour.

Our knowledge of the first Moon landing nineteen years later has made differences noticeable, but I clocked only one error. Fashion and technology in 1950 gave us men in braces, fountain pens, a walkie-talkie label, a porthole, black and white TV and a wall clock.

The wife of one of the crew was the only female in the film. The fourth crew member was from Brooklyn, supplying humour, bravery, music from his mouth organ and a lack of space knowledge. He did the countdown from 'forty', with 'thoyteen' being prominent.

Acceleration effects were shown through facial expressions and by hands strugggling to reach the controls. The crew took pills to combat space sickness caused by being weightless. A rear view of Earth showed it with few clouds and with North America clearly seen. Extravehicular activity was needed to free a frozen radar aerial. Despite wearing magnetic boots, a crew member became detached from the spaceship. He was rescued by another crew member with a safety rope, who used blasts from an oxygen container to propel himself and rescue his friend.

Television helped them land onto a crater floor, where the distant Earth shone amidst many stars of the same magnitude with no recognisable patterns. The crew then climbed down rungs at the side of the rocket, with an ordinary ladder for the final stage between its huge fins.

The Moon was claimed for mankind by the United States, though no flag was raised. Washington was spoken to, with the three-second timelag being commented on. Then the crew explored the crater and used a geiger counter to detect the presence of uranium.

Tension mounts towards the end of the film because the rocket is too heavy and has to be lightened if it is to return to Earth. It is emptied of many movable objects, but is still not light enough; so the crew member from Brooklyn offers to stay behind. Fortunately this turns out not to be necessary – the solution, worthy of Heath Robinson, involves a length of cord and a hole drilled through the airlock door.

The problem of a safe landing back on Earth was not addressed, as a sudden THE END appeared on the screen. Perhaps the landing was to be left to the individual's imagination. How about wings being extended when the atmosphere was entered? Or a skimming solution, losing speed with a winged rocket like those in the Chesley Bonestell paintings, also of 1950s vintage?

Now another sudden THE END …

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[4] *[See footnote on page 7. – Ed.]*

FOR SALE

Jürgen Schmoll (jurgen.schmoll@durham.ac.uk) has news of a scope for sale:

I have a friend who is selling a **Skywatcher ED80** *refractor on an HEQ5 mount (not the pro version). A photo of it is shown here.*

He is looking for about £400 pounds for it – I'm not sure what accessories are included in the price.

If you're interested, please contact me by email or on my home phone number – 01740 655631.

Jürgen

[There is a full spec of the ED80 at, for instance, www.telescope-service.com/Skywatcher/ED_refractors/ED-refractors.html#sked80 – Ed.]

THE TRANSIT QUIZ

Answers to May's quiz

[The questions were based on end-of-chapter summaries in Universe (6th edn), by Roger Freedman & William Kaufmann III (WH Freeman and Co., New York, 2001.]

1. **Jupiter** has the shortest rotation period of any solar system planet.

2. The ecliptic is inclined to the celestial equator by about **23½ °**.

3. The plane of the Moon's orbit is tilted by about **5 °** from the plane of the Earth's orbit.

4. Wien's law states that the dominant wavelength at which a blackbody (which a star more or less is) emits electromagnetic radiation is inversely proportional to its **temperature**.

5. **Chromatic aberration** is an optical defect whereby light of different wavelengths is bent in different amounts by a lens.

6. The atmosphere is transparent chiefly in two wavelength ranges known as the optical window and the **radio** window.

7. **Seven** large planetary satellites (one of which is the Moon) are comparable in size to the planet Mercury. In order of decreasing size, they are **Ganymede, Titan, Callisto, Io, the Moon, Europa and Triton**.

8. Spacecraft measurements reveal that 96.5% of the Venusian atmosphere is c**arbon dioxide.**

9. The orbital periods of the three innermost Galilean satellites of Jupiter are in the ratio **1:2:4**.

10. Most of Saturn's rings exist inside the planet's **Roche** limit, where disruptive tidal forces are stronger than the gravitational forces attracting the ring particles to each other.

May's quiz

Here are some more blanks to fill in, based on end-of-chapter summaries in Universe*.*

1. All clouds on Uranus and Neptune are composed of _____, which absorbs light and gives these planets their greenish-blue colour.

2. Resonances from Jupiter's gravity cause empty regions, called _____ gaps, in the asteroid belt.

3. As a comet approaches the Sun, an ion tail and a dust tail form, pushed out by the _____ and _____ respectively.

4. Comets are thought to originate from two regions, the _____ belt and the _____ cloud.

5. _____ is the study of how the Sun vibrates.

6. The absolute magnitude of a star is the apparent magnitude it would have if viewed from a distance of _____.

7. The Sun has been a main-sequence star for about 4.6 billion years and should remain one for another _____ years.

8. When the central temperature of a red giant reaches about 100 million K, _____ begins in the core.

9. _____ variables are high-mass pulsating variables, with a direct relationship between period of pulsation and luminosity.

10. More than 99% of the energy from a Type II supernova (a collapsing high-mass star) is emitted in the form of _____.