TRANSIT

The September 2009 Newsletter of

Cleveland & Darlington Astronomical Society

NEXT MEETING

11 September 2009, *7.15pm for a 7.30 pm start*

Wynyard Woodland Park Planetarium

400 years of the telescope

Dr Jürgen Schmoll (Durham University and CaDAS)

Contents

Editorial

Rod Cuff

Another bumper issue entirely made up of members' contributions – many thanks to everyone, and I hope the twisted arms have reset by now. Let me especially draw your attention to two items.

There's the first of what promises to be a great new series of articles by Keith Johnson on aspects of astrophotography – Keith starts off on page 8 with part one of a beginner's guide to capturing images of objects in our solar system.

And Rob Keeling has fleshed out what strikes the committee as a great idea for a CaDAS-wide observing activity that everyone can get involved in at whatever level suits them, with or without involvement with others in the Society – see page 4.

Speaking of involvement with others: I've recently come back from my first-ever Dalby Forest Starfest – two or three days and nights in a dark site near PIckering, accompanied by five other CaDAS members (Keith again, John & George Gargett, Dave Lewis and Jürgen Schmoll) and about 150 other enthusiasts, from beginners to serious players. The skies were splendidly clear for the Friday night, though only partly so for the Saturday, and the astronomical *craic* was great, both through sharing views at the telescope and in simply talking about the subject that enthuses us. And the beer and 'whale & chips' in the Royal Oak was good at Saturday lunchtime, too (thanks, Dave!). For me, it was a great way of forming or building on friendships with other CaDAS people – it's been all too easy to go to our monthly meetings and never get to know anyone properly. This sort of activity is Good News – even if I'm never going to be one of life's enthusiastic campers. I'm dead keen on Keith's and the Gargetts' Astrotents, though (*see photo and* [*http://tinyurl.com/CaDAS003*](http://tinyurl.com/CaDAS003)) – more expense to come <sigh> ...

Many thanks to those who send kind reactions to my first *Transit* last month. I hope you and others enjoy this one too.

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

Skylights – September 2009

Rob Peeling

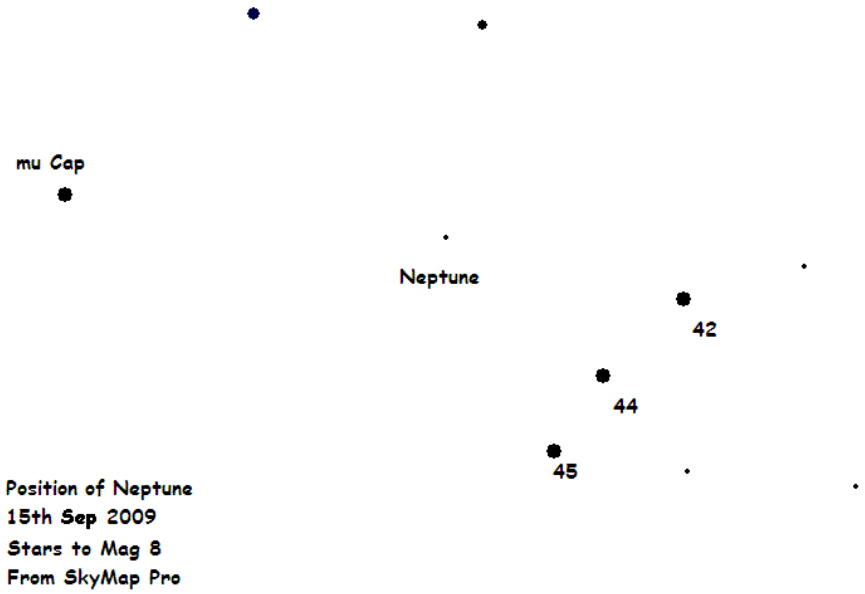
The Moon

4 Sep	12 Sep	18 Sep	26 Sep
Full Moon	Last Quarter	New Moon	First Quarter

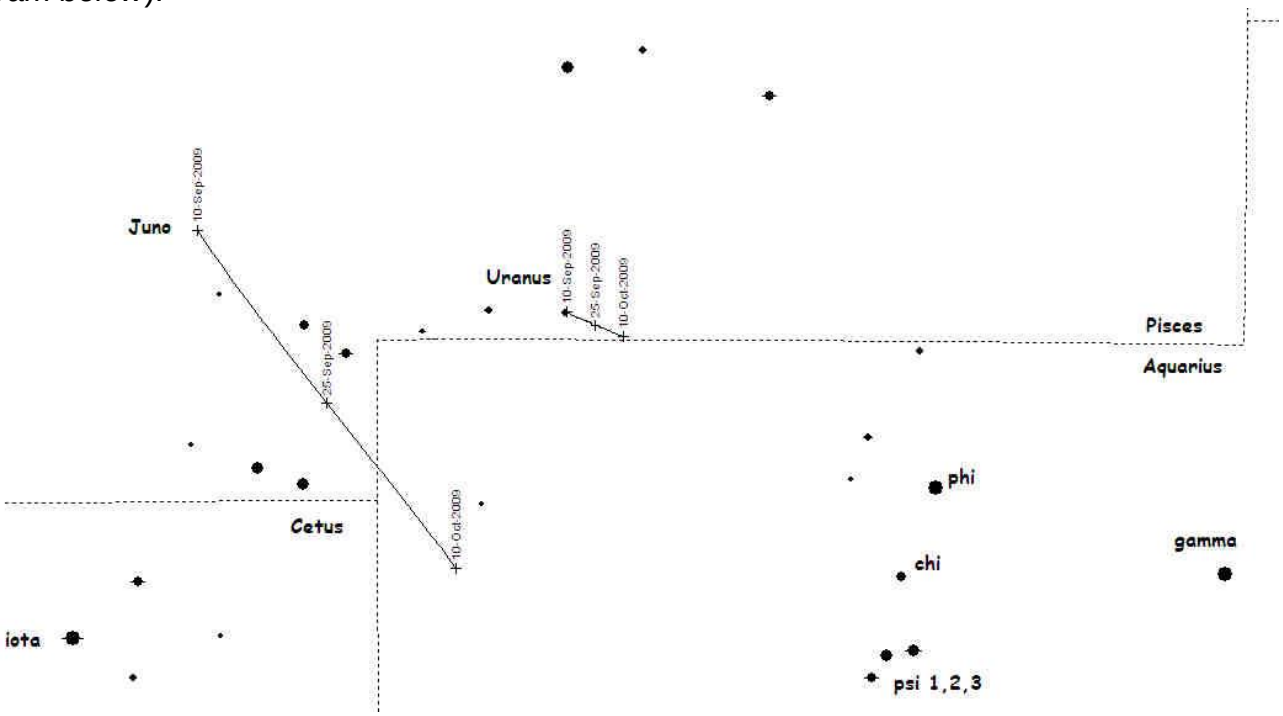
Planets

Jupiter is still the most conspicuous planet in the sky in September. It will be lying low in the sky to the south-east as it gets dark. I expect it will be difficult to get good views of details in the cloud belts with the planet at low altitude in the sky. The four Galilean moons will be clearly visible with good binoculars. If you're using a telescope, then check the moons at least a couple of times in a night – about 2 hours apart. Their orbital movements, particularly those of Io and Europa, are quick enough to be noticeable within one evening.

Neptune is fairly easy to track down because Jupiter, although it has now moved well away, remains a very clear marker for which part of the sky to search. Sweep to the east and slightly upwards along the ecliptic with binoculars or your telescope finder and look for the obvious row of three 6th-magnitude stars 42, 44 and 45 Capricornii (the brighter, 5th-magnitude mu Cap is a bit further east in the same binocular field). Neptune will look like an 8th-magnitude star between the stars mentioned (*see the diagram below*). A medium-power telescope eyepiece should be enough to allow you to see the planet as a disk and confirm your sighting. Can you detect any colour in the disk?



Uranus reaches opposition during September. It lies a good way east of Neptune, beneath the circlet asterism of Pisces. It is an easy binocular object, and once again a medium-power lens in any telescope should show the disk. Is it the same colour as Neptune, or different? As a bonus, the asteroid **Juno** passes fairly close by during September. Juno is of a similar brightness to Neptune. If you've found Neptune, you should be able to see Juno (*see the diagram below*).



Mars remains an early-morning object for September.

An expedition to the North Pole

A Cleveland and Darlington AS project to celebrate the International Year of Astronomy 2009

Rob Peeling

It would be a shame if our Society didn't do something special to mark IYA 2009. It would also be good if our project could be designed to involve as many of the Society's members as possible.

This means that it needs to be something different from a public observing session or scientific observation of a specific object. ***CaDAS therefore invites all its members to join in an expedition to the North Pole!*** Meaning the celestial North Pole, to be exact.

The idea behind the rather corny title is to collect observations, sketches, images and *any* kind of information about any object with a J2000 declination ≥70 degrees.

This is the circular area of sky centred around Polaris and stretching out slightly beyond the two Guardians of the Pole, Kochab and Phekad at the other 'end' of Ursa Minor. Most of it lies in one of four constellations: Ursa Minor, Cepheus, Camelopardalis and Draco. There are also a couple of small strips taken from Ursa Major and Cassiopeia.

The area around the pole is a patch of sky not that frequently visited by amateurs, but that doesn't mean there's nothing interesting to find. There are no Messier objects (M81 and M82 are *just* outside the 70^{o} Dec limit), but this area does contain the first two Caldwell objects, which of course come with Sir Patrick's personal recommendation. There are plenty of other deep-sky objects to find, lots of double stars and many variables as well. Some are easy to see; some will be seriously challenging.

The Society would like to collect reports from as many members as possible covering absolutely anything to do with this area of sky. As the project is to celebrate the International Year of Astronomy, so observations from the remaining four months of 2009 are our priority. However, the plan is to leave the 'book' open indefinitely, and any observations after 2009 will still be welcome.

Your contribution could be images, sketches or detailed reports on the different types of objects, or simply a list of the objects you've seen. How about trying something you haven't done before – perhaps a magnitude estimate on a variable star?

If you haven't got a telescope, then how about observing with your naked eyes and seeing how many stars you can see in the area? If enough people did this, it would give us all an idea of exactly how much light pollution there is in our area and where the best (and worst) spots are. There is a chart in *Norton's Star Atlas* that's very helpful for anyone trying this.

If you prefer to stay in the warm, then how about researching some of the objects in books or on the internet? Who discovered them and when? Are there any interesting scientific facts or findings about them? Where did the names of the stars and constellations around the pole come from? How about a list of good sources of data on the internet?

We plan to list at least the nature of all contributions in the issue of *Transit* following their receipt, and possibly more detailed accounts – the submitter's comments, photos, drawings, results of internet study etc. – as often as possible. It would be great if, for a couple of months at least, the Expedition results were a major part of each issue.

Send your reports, lists, or whatever to Rod, Alex Menarry 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. We will also be happy to help put people interested in similar types of observing or research in touch with each other or try to find someone to help explain how to do something: for instance, how to estimate the magnitude of a star. More than anything ***that's*** the point: to get us all doing something and talking to each other about what we're doing.

To repeat: ***anything at all is welcome***. It can be just a scribbled list of objects seen, complete with authentic coffee stains, or anything up to a full-blown scientific thesis. The only thing that really matters is joining in.

To get you started, here are some objects with declination $\geq 70^{o}$.

DEEP SKY: Not all these will be easy!

Object	*Comments*	*Constellation*	*Object type*	*R.A.*		*Dec.*	
				Hour	*Min*	*Deg*	*Min*
NGC 40		Cepheus	Planetary Nebula	0	13	72	32
NGC 188		Cepheus	Open Cluster	0	44.4	85	20
Cr 463		Cassiopeia	Open Cluster	1	48.3	71	57
Palomar 1		Cepheus	Globular Cluster	3	33.4	79	35
Cr 464		Camelopardalis	Open Cluster	5	22	73	0
NGC 2655		Camelopardalis	Galaxy	8	55.6	78	13
NGC 2985		Ursa Major	Galaxy	9	50.3	72	17
NGC 3147		Draco	Galaxy	10	16.9	73	25
IC 3568	Theoretician's Nebula	Camelopardalis	Planetary Nebula	12	33.1	82	34
NGC 6217		Ursa Minor	Galaxy	16	32.6	78	12
NGC 6503	Lost-in-Space Galaxy	Draco	Galaxy	17	49.4	70	9
NGC 3173	Polarissima Borealis	Ursa Minor	Galaxy	11	50	89	7
IC 1454		Cepheus	Planetary Nebula	22	42.6	80	27

DOUBLE / MULTIPLE STARS

Star	*Constellation/name*	*R.A.*	*Dec.*	*Separation [arc sec]*	*mag1*	*mag2*
Σ93	Polaris	02 31	+89 16	18.5	2.1	9.1
Sh136	Cam	12 10	+81 43	65.1	6.15	8.25
OΣ28/OΣΣ14	Cep	01 19	+80 52	130.9	7.56	6.69
Σ1972	π^1 Umi	15 29	+80 27	31.1	6.64	7.3
Σ1625	Cam	12 16	+80 07	15.4	7.24	7.78
Σ2308	40/41 Dra	18 00	+80 00	220.2	5.7	8.34
HN122	A = YZ Cas = 21 Cas	00 46	+74 59	36.1	var	9.4
Σ1193	UMa	08 21	+72 24	43.1	6.1	9.1
Σ2241	ψ^1 Dra	17 42	+72 09	30.3	4.9	6.1
Σ2675	κ Cep	20 09	+77 43	7.4	4.4	8.4
Σ2806	β Cep = Alfirk	21 29	+70.34	13.3	3.2	7.9
h2200	γ Cam	03 50	+71 20	106	4.6	8.5
Σ973	Cam	07 04	+75 14	13	7.2	8.2
Σ1362	Dra	09 38	+73 05	5	7	7.2
Σ1415	UMa	10 18	+71 04	16	6.7	7.3
OΣΣ143	UMi	16 05	+70 16	47	6.7	9.3

Ku1=Hu917	UMi	16 43	+77 31	2.9	6.1	9.4
Σ2452	Dra	18 54	+75 47	6	6.5	7.4
Σ2603	ε Dra	19 48	+70 16	3	4	6.9
β pm	75 Dra	20 28	+81 25	197	5.5	6.7
Σ2923	Cep	22 33	+70 22	10	6.3	9.2
OΣ481	Cep	22 44	+78 31	2.4	7.5	9.3

VARIABLE STARS

BAAVSS Binocular Programme extract

(charts downloadable/printable from BAAVSS website at www.britastro.org/vss)

Star	*Const*	*RA(2000)*	*Dec*	*Type*	*Min mag*	*Max mag*	*Period (days)*	*Chart*
V391	Cas	01 57	+70 12	Lb	7.6	8.4		1978May15
V393	Cas	02 03	+71 18	SRa	7	8	393	1978May15
RU	Cep	01 21	+85 08	SRd	8.2	9.8	109	1985May06
SS	Cep	03 50	+80 19	SRb	6.7	7.8	90	315.01
Ar	Cep	22 52	+85 03	SRb	7	7.9		1985May06
DM	Cep	22 08	+72 46	Lb	6.9	8.6		Undated
UX	Dra	19 22	+76 34	SRa?	5.9	7.1	168	1982Nov07
VW	UMa	10 59	+69 59!	SR	6.9	7.7	610	226.01
V	UMi	13 39	+74 19	SRb	7.2	9.1	72	101.01
S	Cep	21 35	+78 37	Mira	7.4	12.9	487	

ECLIPSING BINARIES

Star		*RA (2000)*	*Dec*	*Max*	*Min II*	*Min I*	*Period (days)*	*Chart*
RZ	Cas	02 49	+ 69 38	6.2	6.3	7.7	1.2	236.01
AB	Cas	02 38	+71 18	10.1	10.3	11.9	1.37	1986Jul05
U	Cep	01 02	+81 03	6.8	6.9	9.4	2.49	279.01
VW	Cep	20 37	+75 36	7.2	7.6	7.7	0.28	1972Mar21
EG	Cep	20 16	+76 49	9.3	9.6	10.2	0.54	1986Jul05
EI	Cep	21 29	+76 24	7.5	8	8.1	8.44	1972Mar21
GK	Cep	21 31	+70 49	6.9	7.4	7.4	0.94	1971Dec02
Z	Dra	11 46	+72 15	10.8	11	14.1	1.36	1993Jan10

Predictions available from BAAVSS

A beginner's guide to imaging solar system objects

Keith Johnson

Part one: First things first

I'm sure that most if not all of our Society's members have seen the glorious images of various solar system objects taken by amateur astronomers and displayed in astronomy magazines and wondered how they can achieve such amazing detail.

For those of you interested in imaging objects in our solar system, *Transit* will be publishing a series of tutorials over the coming months to assist you.

You don't need to own expensive optical equipment or even a motorised telescope mount to achieve amazing results. All that is needed is spending a few pounds on a web camera, and bucketfuls of patience!

Partial solar eclipse, 29th March 2006.

Capture details:

Philips Vesta Pro Web camera using a Pentax-type Carl Zeiss 135mm camera lens, a Baader white-light filter and a non-motorised camera tripod.

Proof that you don't need to be the proud owner of expensive optical equipment!

A few very important factors will have great bearing on how good your images will turn out to be. Most of these factors are ones you can resolve yourself; but, frustratingly, others are down to issues that are out of our hands.

At this point I'm not going to explain in great depth why the following five factors are so important, but I'll nevertheless touch upon them slightly:

1. Collimation
2. Seeing conditions
3. Focus
4. Thermal equilibrium
5. Dew.

Factor 1: Collimation

To achieve the best possible view from a telescope, or in our case imaging from the telescope, it is essential that the optical components are aligned as accurately as possible to obtain the best image possible.

The two types of instruments that often require collimating are Newtonian and catadioptric telescopes.

Refractor telescopes mostly have fixed optics, though some instruments do allow the user to make adjustments – but be warned: any attempt at adjusting the lenses of refractors should only be carried out by someone who knows exactly what they are doing.

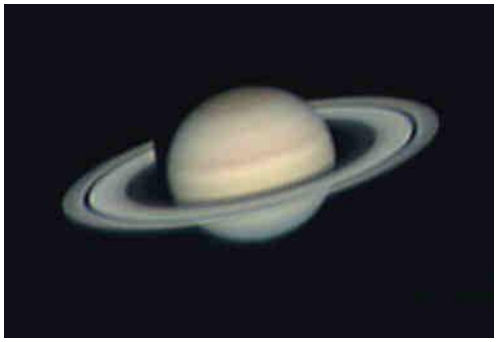
Factor 2: Seeing conditions

“Seeing” is the term that astronomers use to describe the atmospheric conditions of the sky. The atmosphere is constantly changing owing to variations in temperature and air currents.

Poor seeing conditions are more noticeable when observing or imaging solar system objects; on nights of poor seeing, the object being viewed will “boil” before your very eyes.

Sadly, there is nothing one can do about it other than wait to see if the seeing settles down. If it does not, one can only put up with it – or put the telescope away.

There are, however, very rare occasions when “good seeing” occurs, and when this happens I would recommend that you spend a short time observing at the eyepiece before commencing work with your web camera. There is nothing more appealing to the amateur astronomer's eye than observing Jupiter or Saturn at high power when there is good seeing to be had. My good friend and CaDAS member George Gargett and I witnessed this beautiful but rare occurrence with Jupiter many years ago – an event we talk about to this very day!



Saturn captured under “good seeing” conditions on April 14th 2007

Factor 3: Focus

Before you begin any imaging session, pay great care and attention to detail on the object while you are focusing. If you skimp on this, you'll waste precious time, especially if the seeing conditions are very good.

A very useful tip to achieve good focus when imaging a planet that has moons is to adjust the camera's shutter-speed settings so that the planet itself is over-exposed and then concentrate focusing on any of the planetary moons until its image is star-like.

Factor 4: Thermal equilibrium

To avoid getting overcomplicated, I’ll keep this simple!

Basically, for a telescope to operate efficiently and effectively it is essential that the interior of the optical tube assembly (OTA) is thermally balanced with the exterior. If it isn’t, the object will have the same appearance through the telescope as when seeing is poor.

To ensure that the telescope is in thermal equilibrium, it should be placed outside for an hour before you start to do any imaging.

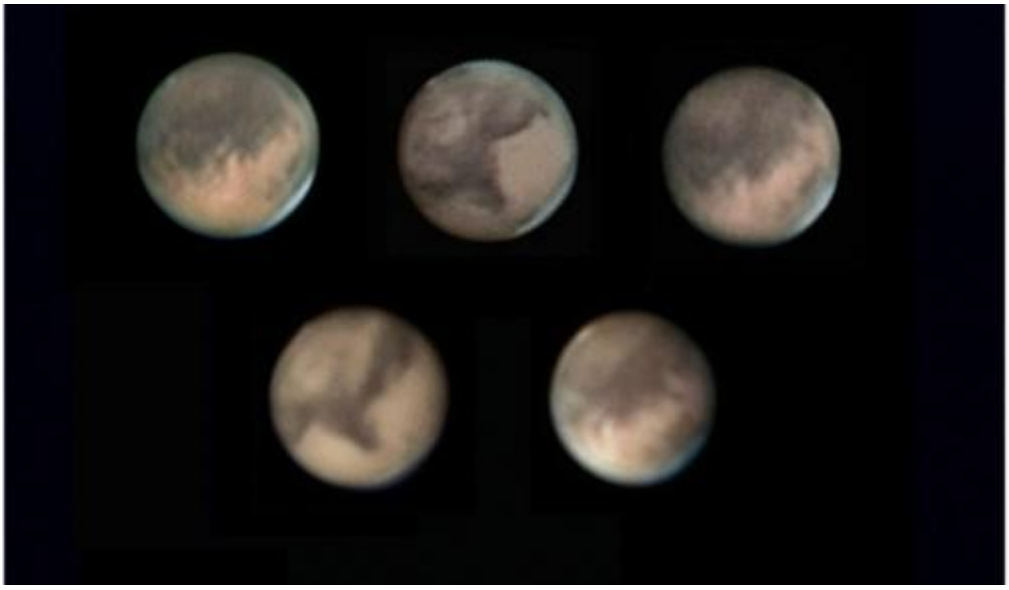
Factor 5: Dew

After coping with light pollution and clouds, the next problem that observers come up against is dew building up on the telescope's corrector plate, mirror or objective lens.

There a number of ways to help prevent this, and some are better than others. A good dew shield should be used on refractors and catadioptric instruments, and hair dryers can further help keep dew at bay; but to stop it in its tracks, a dew-heater strap is the best solution.

The dew strap creates just enough heat to keep the dew from forming. It is essential to have the strap heat set correctly using a dew-strap controller, as too little heat will still allow dew to form and too much will create thermal currents that cause the image to "boil".

I hope that these small but very important factors that I have touched upon will give you a better insight into how to prepare for an imaging session. If you handle well all of the factors outlined above, you'll have the ingredients for capturing amazing results.



Mars captured in 2005 on various dates, showing amazing surface detail.

Equipment:

9.25" Schmidt-Cassegrain telescope, motorised Vixen GP mount, 3x Barlow lens, Philips ToUCam Pro 2 web camera.

Next month's tutorial

The hardware essentials: Telescopes, web cameras, adaptors, filters and Barlow lenses

... And one beginner's experience of webcam imaging

Rod Cuff

Earlier this year, I decided to stop being intimidated by the high standard that Keith and others routinely achieve in webcam astrophotography, and have a go myself. Armed with advice and encouragement from Keith, and after partially reading a good book on the subject*, I started last April with Saturn, before the rings closed up completely and before the nights got too short.

My basic equipment was an 8" Meade LX90 (a catadioptric), an inexpensive but well-recommended webcam, the Philips ToUCam Pro 2, and a laptop computer. I also added an infrared blocking filter and a 2.5x Powermate (a superior kind of Barlow lens) – Keith will be explaining the value of these in his article in the October *Transit*.

I'm not going to anticipate the explanation that Keith will give in later articles concerning how to use a webcam to record a video of a solar system object, or the post-processing that turns it into a single finished picture – perhaps I'll add a note to a later article, with details of how some of the pictures below were produced. For now, I'll just include the first-ever, fuzzy but recognisable, image of Saturn that came from my 4 April session.

Not exactly the same quality as the one in Keith's article, is it?! Nevertheless, it does show the flattening of the planetary disk; evidence of banding on the planet; the rings; and the gap between the rings and the planet. For a first-off, I certainly felt encouraged.

Saturn has disappeared behind the Sun now, and Jupiter is up in the southern skies at a reasonable hour of the night – it's not very high, which means that there's a lot of atmosphere to get in the way, but it made a good target for my next 'first attempt', on the night of 7–8 August. As it happened, the seeing was poor, transparency was good initially, later only medium, with thin high cloud, and there was a 96% full moon not far away – hardly ideal (but a built-in excuse if the results were dreadful!).

Still, I'm pleased at how they turned out – see the next page. North is up.

Using a 2.5x Powermate, taken at UT 2342

With no Barlow or Powermate, taken at UT 0009: top is the original result, bottom is stretched to 2x2 size

Using a 2x Barlow, taken at UT 0020

I knew that Jupiter rotated fast, in under 10 hours, but was still surprised at how far the Great Red Spot (GRS) had moved in the 38 minutes between the first and last images above.

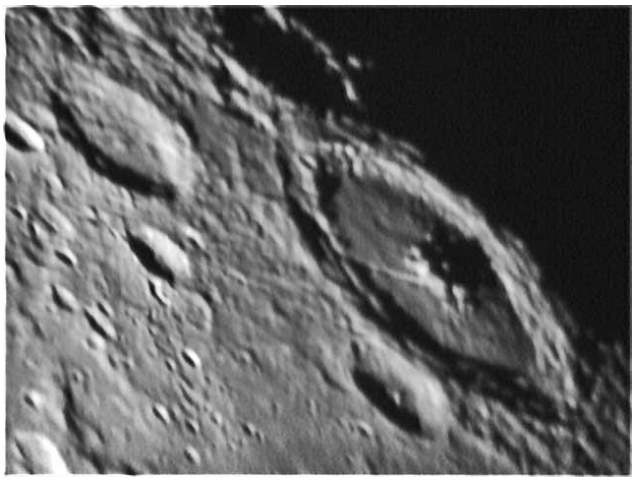
In all three the complex Northern Equatorial Belt (NEB) structure shows well, along with many bands; there's a dark, thick linear smudge trailing the GRS at the S edge of the SEB; and a white spot and bracketing but separated dark smudges on the S edge of the NEB. If I can find time at some stage, I'll try to find out more about all that for my own education, if nothing else!

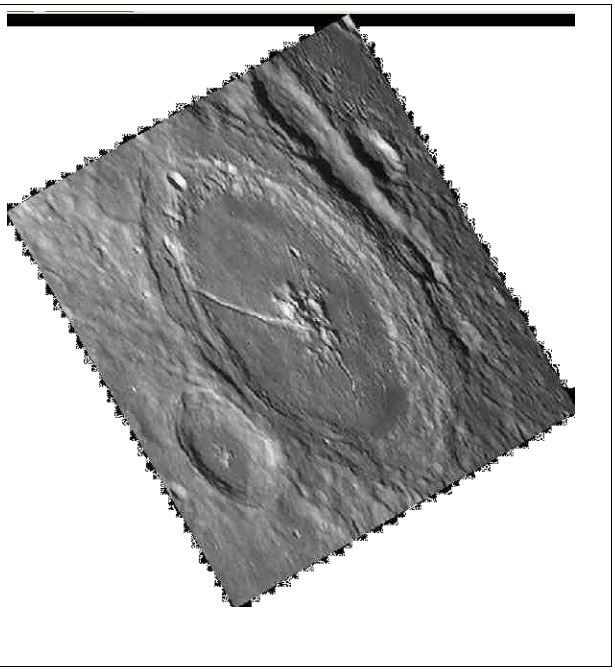
Keith's article above stresses the importance of focusing, which indeed is tricky (you're focusing the image as seen on your laptop), and I was experimenting throughout this session. For the middle image above, I focused on the moons Io and Europa, both of which were fairly close to the planet; for the image on the right, I turned up the 'gain' on the webcam to get the over-exposed edge of Jupiter as sharp as I could, and then turned down the gain to take the video sequence (otherwise it would have been horribly overexposed).

Once I could no longer hide the Moon behind the trees, and Jupiter started being obscured by high cloud, I decided to finish the session with a few quick shots of the just-past-full Moon. The seeing through the telescope was by then pretty bad, and it later dawned on me that a large

part of that problem was that the Moon was then over a neighbouring house, with its rising air currents.

Anyway, for historical interest here is one of the resulting pictures: of the area round the crater Petavius, near the south-east lunar rim. Next to it I've put one of the pictures of Petavius, suitably rotated, from the high-quality Lazarotti photographs downloaded from the wonderful (and free) Virtual Moon Atlas (www.ap-i.net/avl/en/start).





The point I want to emphasise is that, given the basic equipment, most of which you probably have already or can purchase for modest cost, it's possible to get personally satisfying results very early on in this game. I hope to improve considerably on these first efforts, of course, with more experience both at the telescope and with the post-processing software, with the already generous advice from other astrophotographers, and of course with better sky conditions.

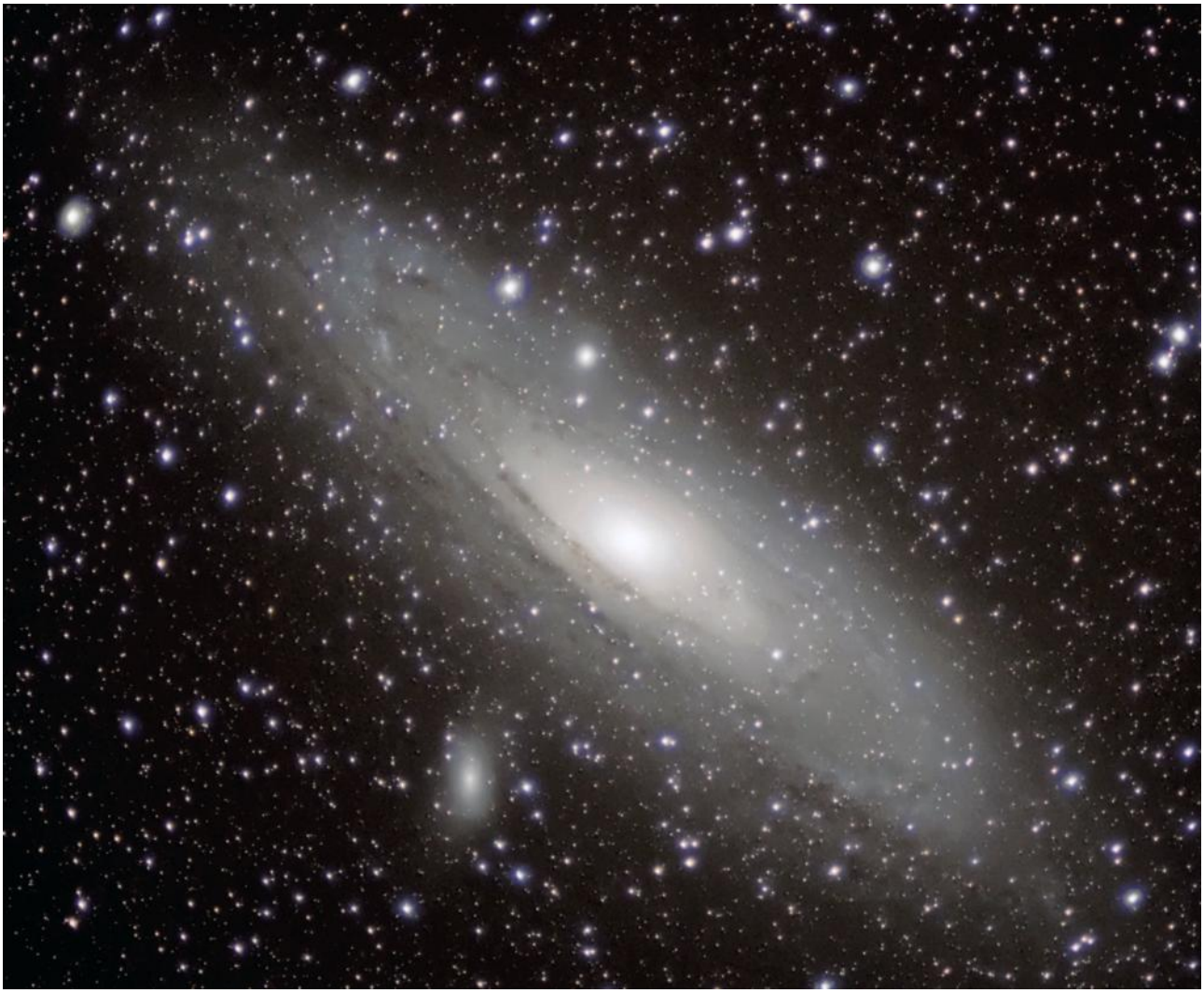
**Lunar and Planetary Webcam User's Guide*, by Martin Mobberley, published by Springer in Patrick Moore's Practical Astronomy Series, 2006. Available from Amazon at £18.99, postage free.

Oh, and there's all that deep-sky stuff too...

Keith Johnson

[Ed.: The technical details are for the more advanced astrophotographers in CaDAS – wait until later in Keith's series to find out more about what some of them mean!]

The photograph of the Andromeda Galaxy (M31) on the next page is my first serious attempt at capturing a deep-sky object of any kind from a truly dark site – at Dalby Starfest 2009, using an Astrotrac tracking platform (www.astrotrac.com) and a Canon 1000D non- modified DSLR with a Chinon 200mm fixed lens @ f/3.5.



I took 13 x 5-minute frames @ ISO 800 and 3 x 5-minute dark frames aligned and stacked in DeepSkyStacker (http://deepskystacker.free.fr/english), with curves, levels and colour-balance adjustments in Adobe Photoshop CS2.

There's obviously a fault with blooming on the stars, but by this time next year I'll have invested in better kit to eliminate that problem ☺ ...

GENERAL ARTICLES

Fireball!

Dave Lewis

This happened some time ago, so I can't tell you the exact date, but I do remember that it was around June –July of 1961.

I was on my first trip as a junior engineer with Overseas Tankships, on the *Caltex Auckland*, a wartime T2 tanker of about 20,000 tons. As she was a US-built ship (Sun Shipyard, Philadelphia, 1944), the fuel

and water measuring instruments were calibrated in US gallons. At the end of each watch, the engine room log had to be filled in by the junior engineer, and things such as average fuel consumption per knot, fuel used per watch, and water made by evaporators and used by boilers all had to be calculated in US gallons and then converted to Imperial. Remember, this was 1961 – there were no handheld calculators other than slide rules, so all calculations had to be done using logarithms. I wasn't good at arithmetic and haven't got better with age.

Because the temperature in the engine rooms of these old ships when sailing through places such as the Arabian Gulf would typically be 35–40°C, and over 50°C in the boiler room, the best place to write up the log was out on the deck where there was usually a cooling breeze, as the ship would be steaming at 13 knots or so.

On the night in question, I'd come off watch at midnight and was getting myself as comfortable as possible on a steel deck in sweat-soaked overalls with this massive log book in my lap and my logarithm book and pen at hand, when suddenly the whole area around us was lit up by blue- white light. The light was the first thing I remember that got me moving to the ship's rail; there was an awning over where I was sitting, so I had to get to the side to see up to the sky. We were at this time passing through the narrow neck of the entrance to the Gulf, moving through some islands known as 'The Quoins'. Suddenly, from the previous complete darkness, I could now see all the islands around us and the mainland too as if in broad daylight. Looking up I saw the meteor or whatever it was that was creating the brilliant light, traveling in the same direction as the ship but somewhat faster. It was leaving a trail in the sky something like a jet's contrail or a smoke trail. If after all these years I was asked how wide the trail was, I would say about the width of two fingers at arm's length.

But that's not the thing that's etched in my memory the most. The most memorable aspect was the sound. I will never forget that: the ear-splitting, silk-tearing, supersonic sound. The whole episode probably took no more than ten seconds, maybe even less; there must have been a sonic boom, but if there was I don't remember it. I have no idea in which direction it was heading, but it seemed to be going parallel to the surface of the Earth and, as we were going round the corner, so to speak, it would end up in the desert of Saudi Arabia, the water of the Gulf or somewhere in Iran.

The Quoins are still there – see http://tinyurl.com/CaDAS001. This all happened 48 years ago, but I remember it as if it were yesterday.

COMMITTEE NEWS AND INFORMATION

Thomas Wright Trophy

This year, the annual Thomas Wright Trophy quiz competition, usually contested by teams of three from CaDAS, York AS and Durham AS, will be hosted by Durham at their meeting on Friday 16 October. Alas, this year York AS has had to withdraw because of a clash of dates. However, ideas for a third team are being followed up, and we'll keep you informed of progress. Neil Haggath (fiendish question-setter) will be in the chair, and of course strictly neutral on this and other such occasions.

The venue is Redwood Lodge, School Lane, Durham (off Church Street) – see http://tinyurl.com/CaDAS002 for a map. Do please come along and cheer raucously....

The *TRANSIT* QUIZ FOR SEPTEMBER

Q 1. Which constellation:

(a) is the only one split across two areas of the sky?
(b) is a cup?
(c) is a table?
(d) has a teapot?
(e) *[for extra points!]* has a carafe?

Q 2. What's the astronomical significance of midday on 1 January 4713 BC?

Q 3. What do these kinds of graphics illustrate:

(a) a Hertzsprung–Russell diagram?
(b) a butterfly diagram?
(c) the Wilkins–Moore map?

Q 4. If you double the aperture of a telescope (the clear diameter of the main mirror or lens), what happens to the resolving power (the width in arc seconds of the finest detail that it will show)? By how much does the limiting magnitude (the faintest star that can be seen by eye through the telescope) increase?

Q 5. What might observers use these things for:

(a) a Bahtinov mask?
(b) a Stoneyhurst disk?
(c) a Zürich grid?
(d) Wratten 8?

Answers in next month's issue