BAA

I & I News

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It has been some time since *I&I News* was last produced. Previous issues – none of them in colour, and some as lengthy as ten pages – were sent to around 150 members, thereby involving the printing, collation, stapling, enveloping, and posting of 1,500 pages. Now, however, publications such as this can be produced in colour and can be distributed much more widely via e-mail. I would be pleased to hear from anyone who would like to contribute short articles, notes about observatories and equipment, observing techniques, photometry, astrometry, spectroscopy... or anything related to practical astronomy. Many amateurs are now using sophisticated equipment to produce superb results which were inconceivable only twenty years ago; but it should not be forgotten that even a small Newtonian reflector on an altazimuth mount can reveal 'the wonders of the heavens' – not only to produce scientific results, but also for the pleasures of contemplation: the night air... the glint of moonlight on rime frost... the piercing intensity and colours of bright double stars... a faint smudge of light on the edge of vision... the stark contrasts of the lunar terrain... Aesthetic appreciation is important, and visual observation engenders a sense of immediacy which cannot be reproduced on a computer monitor. Whatever might be your especial interests and methods of observation, never forget to look through the eyepiece, even if only occasionally. The following is from Robert Frost's poem, 'The Star-Splitter':

Often he bid me come and have a look
Up the brass barrel, velvet black inside,
At a star quaking in the other end.
I recollect a night of broken clouds
And underfoot snow melted down to ice,
And melting further in the wind to mud.
Bradford and I had out the telescope.
We spread our two legs as it spread its three,
Pointed our thoughts the way we pointed it,
And standing at our leisure till the day broke,
Said some of the best things we ever said.

Bob Marriott, *Director*

8-inch f/15 Cooke refractor, Cambridge
The Thorrowgood refractor

7-inch f/11 Calver reflector, Worcestershire
BAA Instrument No. 150

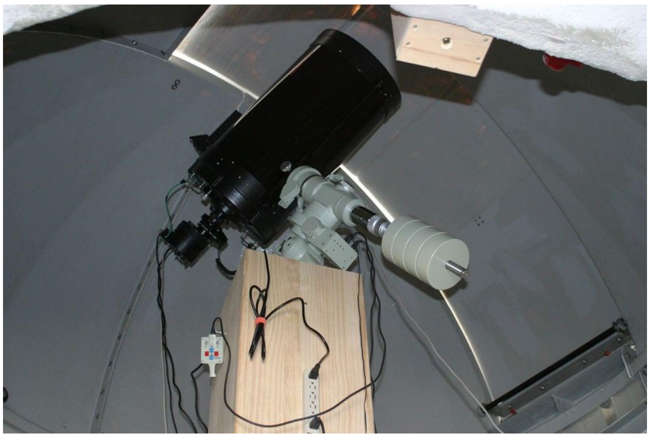
12-inch (formerly 11¾-inch) Northumberland refractor, Cambridge
The Dawes observing chair

8-inch f/15 Grubb refractor, Aldershot

Director: Bob Marriott | ram@hamal.demon.co.uk | 01604 765190 | http://britastro.org/iandi

Imaging from Spain

Paul Downing



When I and my wife Liz returned to Europe from Texas in 2003 we ensured that we would be able to continue our hobby. I had been President of a major astronomy club in Houston and a regular attendee at the Texas Star Party, and when we returned to England I particularly wanted to continue with astrophotography. However, we did not want to operate from 52º N, so we purchased an old farmhouse in the Alpujarra region of southern Spain, at 37º N, and converted it into an observatory. The property, which has its own power (solar) and water (spring) supplies, stands in idyllic surroundings – and the skies are very dark.

The telescope permanently installed in the dome is a Celestron C14 SCT. During installation I seriously considered buying a Paramount ME, but the Takahashi NJP mount I had brought from Houston was working perfectly, the base mounting of the ME required a different pier termination from the flat plate which had been installed, and I decided to retain what I had. The benefit of having a mount permanently installed and settled is that it is more stable in use than it would be if it were moved and set up on each occasion, and results have been very good. The fibreglass dome was supplied by Pulsar Domes – though I chose not to install the optional sidereal motors, and instead move the dome by hand.

I have two CCD cameras: an SBIG ST8-XE and an SBIG ST10-XME. The ST10 is the camera of choice for the C14, and almost all of my deep-sky imaging is carried out with this set-up, in combination with a Meade f/6.3 focal reducer and JMI focuser. The one major limitation is that guiding is enabled using the SBIG built-in guide chip, requiring a guide star to be available somewhere near the object being imaged. This also means that low-transmission filters such as Hα cannot be used, thus limiting the work that can be accomplished.

I have considered incorporating a separate guide-scope and camera, but there are several factors inhibiting these changes. First, the additional weight of a second telescope and a second CCD camera would probably overload the mount, leading to a need to upgrade. Second, the Pulsar dome has only a limited slit-width, and in some orientations it would not be possible for both instruments to clear the slit edges. As most of my work involves galaxies (especially Arp galaxies) and planetary nebulae, I decided not to change anything until I had exhausted the number of objects to image using the existing set-up – possibly over the next 50 years!

I believe that it is important to decide what types of object will be imaged – lunar, planetary, deep sky, and so on – and to adhere to that discipline. I specialise in galaxy imaging [see next page]; but planetary imaging, for example, requires a very different approach, and although I have tried my hand at this, using a Phillips ProCam webcam and Registax, there are many others who produce far better results than I ever could. Whatever might be the choice, once good-quality data are acquired, the secret of producing high-quality images lies in the methods by which the data are processed. Over the years I have had a considerable amount of help from individuals such as Jay McNeil (of McNeil's nebula) and Jan Rek, and I am now able to extract the best out of the data available.

Liz and I also have a Takahashi FSQ-106 refractor, which we have used for wide-field imaging (but which has not been used for two years, while I complete my Arp galaxy catalogue images), a 16-inch truss-tube Newtonian which Liz uses for visual observing, and a 4-inch Myauchi fluorite binocular which produces stunningly sharp wide-field views.

NGC 5907 – the Spindle – in Draco

NGC 4565 – the Needle – in Coma Berenices

Imaging the Moon with a webcam

Bob Marriott

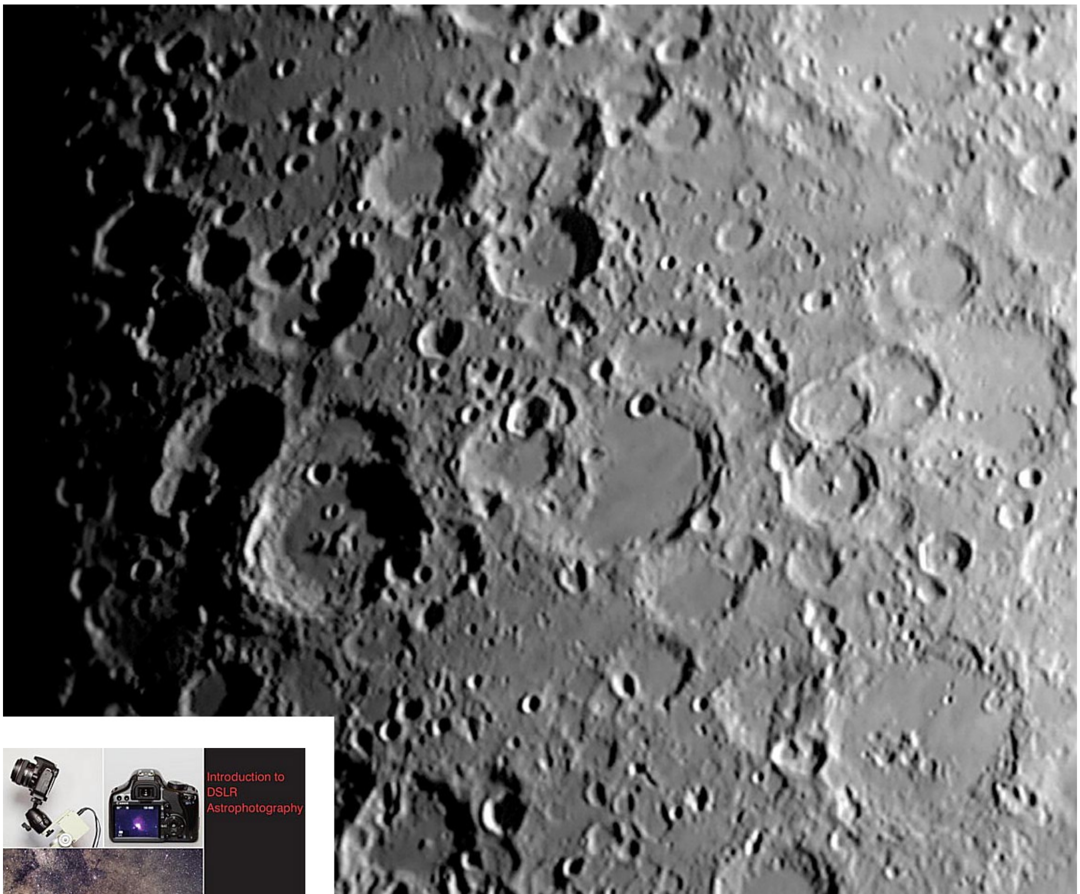
This brief note is not intended as a guide to lunar imaging. It simply shows what can be achieved with a low-cost webcam and no other electrical or electronic device except a laptop.

The equipment consists of a Philips ToUcam attached to an equatorially mounted 10-inch f/7.2 With–Browning reflector (vintage 1875) without a drive. Tracking on individual features can be accomplished with a manual slow-motion; but with the telescope fixed, the entire disc of the Moon can be captured in 20 minutes. Registax software – which is now commonly used for processing AVI video files – tracks the deviation of position, dependent upon the quality of seeing, of a feature in each frame; but it also tracks features moving across the frames. Therefore, the telescope can be fixed, and the Moon can be recorded on video, in overlapping strips, as it drifts across the field.

Sections of the AVI file containing the same feature are then selected for processing, and although the stacked images are sometimes inferior towards the edges, they can be cropped. The resultant images are processed with other software and then stitched together, and chosen regions are extracted. The image below, with the prominent crater Maurolycus, is extracted from the image at right, which itself is part of a larger image. Both of these images have been resampled smaller (chiefly to minimise the file-size of this PDF), and are therefore of lower resolution than the originals. These images negate the belief (and occasional assertion) that nineteenth-century mirrors are inferior.

This technique and procedure demonstrates that computer-driven telescopes and expensive mounts and drives are not a necessity for successful imaging – though I could, of course, obtain far better results with this telescope if it were driven, and also equipped with a more expensive webcam.

I have not experimented with an instrument on an altazimuth mount, but there is no reason why it should not be attempted, as relatively short exposure times and average seeing would probably override any adverse affects of image rotation. Whatever might be the results, there is at least a sense of effort and achievement.



Introduction to DSLR Astrophotography

The Association has recently published a booklet, written by Tony Morris, entitled *Introduction to DSLR Astrophotography* (price £7.50). It describes several projects which can be carried out with DSLR cameras and lenses, small refractors, and a portable tracking mount, without the requirement of an expensive telescope. For details, see the BAA website at http://britastro.org, and follow the ‘Shop’ link.

Seeing

This article, by W. H. Steavenson, is extracted from the report of the Ordinary Meeting of 24 February 1960 (*Journal*, **70** (5), 204, June 1960). The talk led to a discussion in which participants included Frank Holborn, Bertrand Peek, Horace Dall, Alfred Curtis, Gilbert Fielder, David Hinds, and Jim Hysom. At that time, the 'common telescope' for the amateur was the Newtonian reflector – many of them home-made – and the emphasis on this type of instrument is apparent in Steavenson's discussion concerning tube currents, where there is no reference to closed systems such as Schmidt–Cassegrains and Maksutovs, although he notes that refractors are 'not immune'. The quality of seeing is an important factor, and observers – visual and otherwise – should always be aware of its nature, causes, and effects.

With regard to the word 'seeing' itself; seeing has nothing to do with a star's brightness, but refers to definition. The apparent brightness of a star is a measure of transparency, and is entirely different from seeing, though often confused with it. Leaving aside telescopic faults, it may be said that poor definition is due to atmospheric disturbances. These disturbances come under six headings. Bad definition can in fact be diagnosed, and it is always desirable to find out just why seeing is bad instead of simply accepting it. I want, therefore, to deal mainly with the diagnosis of bad seeing conditions. Let us take the six headings as follows:

1. *High* This type of bad seeing is due to air currents at heights of, say, 20,000–40,000 feet.
2. *Low* Disturbances originating at heights up to a few hundreds of feet.
3. *Ground* Disturbances caused by radiation from the ground upon which the telescope is standing.
4. *Shutter/observatory currents* Of course, these affect only the observer who has a dome.
5. *Tube currents* These affect reflectors particularly, but refractors are not immune.
6. *Mirror currents* These become troublesome only with larger reflectors, say above 18 inches aperture.

The way to diagnose the cause of bad seeing is to take a bright star, such as Capella or Vega, use a high-power eyepiece, and rack out. If the trouble is *high*, you will see parallel lines, like telegraph wires, moving straight across the field in one particular direction – the direction of the wind high in the atmosphere. These were first observed by Douglass in 1893 or 1894; they were described in *Popular Astronomy* and later in *Amateur Telescope Making*. I once had the curiosity to try to find out what they were, so I used a Thornton-Pickard shutter, exposure 1/20 second. I saw moving bright and dark patches; you would see five or six at a time, for instance, with a 20-inch aperture. Since then they have been photographed with the Palomar 200-inch reflector. They are caused by the fact that two layers of air at different temperatures create an 'optical surface' between them: there is an analogy with what happens in the case of a stream of water in contact with the air. You also get roughly similar effects just before totality in a solar eclipse (shadow bands). This, then, explains the moving lines; they are produced by the different densities and temperatures of atmospheric layers, and they move at 100–200 mph. The 'line' appearance is due to persistence of vision. The effect on a star is to fuzz it, and give it an apparent diameter of perhaps 2–3 seconds of arc. Things may be even worse than this. At the Cape, which can produce the worst seeing in the world, I have seen Arcturus looking like Mars. (I have heard it said that there are three kinds of seeing: good, bad, and Cape!) When this trouble is experienced, nothing can be done about it. Neither can it be regarded as 'local' in any spot in a small country such as England. For instance, we cannot claim that the seeing at, say, Scarborough is generally better or worse than at Wolverhampton. The cause is due to alternations of weather systems such as cyclones and anticyclones, which produce changes of pressure and therefore of density. So if you want to avoid the trouble, do not change your *altitude*. Change your *latitude* instead. W. H. Pickering first pointed this out, and it was probably the most important thing he ever said. Near the equator, of course, pressure is more constant.

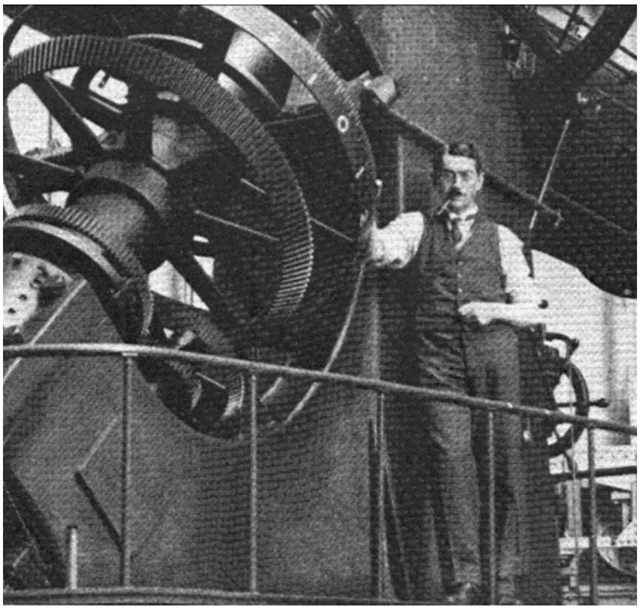
Next we come to *low* seeing. This really is more or less local, and some parts of England are worse than others. For instance, you would be more bothered with it on the lee side of a city such as Birmingham. It may be recognised by the presence of large waves moving slowly across the field. The waves move so slowly that they may take as much as one second each to cross the field, and with a telescope up to 3 inches in aperture a wave may occupy the whole aperture for a fraction of a second. This gives a flickering effect, and you may get periodical flashes of good seeing. You can avoid the worst of it simply by moving away from areas that are particularly badly affected.

Ground seeing is very important to solar observers. When a telescope is in the open, the surrounding ground is heated, and during the daytime hot waves of air upset the seeing. The only real remedy is to use a 'tower' telescope, as has been done at Mount Wilson. However, do not put your telescope on stone or concrete – as has been done at Herstmonceux, where they have done their best to ensure the worst possible seeing by surrounding all the instruments with slabs of stone. Instead, put your dome on grass, or green stuff of some kind. The trouble is worst near midday, but may continue for at least half an hour after sunset.

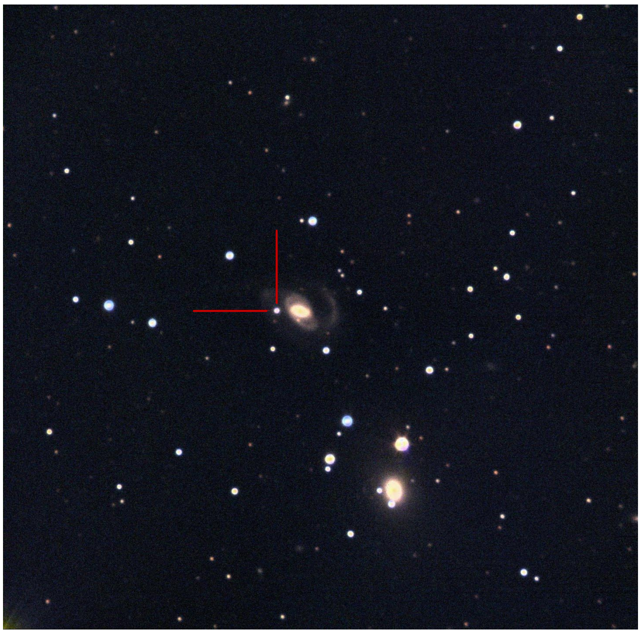
Now for *shutter* currents. The remedy is to avoid too narrow a shutter – and do not have too many hot people inside the dome at the same time. I know what has happened at Cambridge, when I have had as many as twenty people in my dome at once, all hot and all talking. You can diagnose the trouble by putting the aperture across the edge of the shutter; a wide shutter more or less cures it. When the 6.75-inch Sheepshanks telescope was set up at Greenwich about 1837, it was given only a 9-inch diameter shutter, and bad currents were experienced, but this sort of thing is not done nowadays. Shutter currents are not serious, but *tube* currents are very serious indeed. Reflectors are worst affected, but as I have said, refractors are not immune. A few things may be done to reduce the trouble. First, do not have a metal tube. As heat is radiated off, cold, dense air falls to the bottom of the tube, and currents are produced. Unfortunately, telescope-makers tend to be conservative; most old telescopes had cylindrical metal tubes, and the practice still goes on. At any rate, do not have a cylindrical tube, whether it be made of metal, cork, asbestos, or anything else. Square tubes are better, since the currents tend to go out of the top. With a cylindrical tube, the currents hit the side and produce gyrations reminding one of spiral nebulae. Every cylindrical tube does this – even if it is not made of metal, though metal tubes are naturally the worst. Sensible people therefore use lattice tubes, and the lattice should go right down to the mirror. It is wrong to have a closed-in section close to the mirror, and indeed this is just where you do not want it. A mistake was made here with the 72-inch Victoria telescope, but the 100-inch and 200-inch reflectors are really well designed. The best plan is to have a skeleton structure all the way down, and this may be either cylindrical or square. If you are bothered with tube currents, install a fan to suck the air down (not blow it up).

This helps very considerably. Note that tube currents go round and round, irregularly, and this gives a means of diagnosis. If the disturbance is irregular, it originates inside the tube. If it takes the form of straight waves crossing the field, the trouble lies outside. Refractors are not immune from tube currents, though they are less affected than reflectors. Dawes noted this, many years ago, when he described an occasional triangular deformation of the star image. The worst time is during daylight, for observations such as last year's occultation of Regulus by Venus. (You do not get the same effect in solar work, since the Sun is not shining on the side of the tube.)

Mirror currents affect only users of large telescopes. A metal mirror will cool quickly, and a glass mirror up to, say, 12 inches aperture, takes generally less than an hour. However, a 20-inch glass mirror takes five to six hours, and a larger one does not really cool down entirely even after a complete night. Consequently you get a 'boundary layer', with numerous small 'flames' not unlike the solar chromosphere. A fan is no good in dealing with these crawling, maggot-like things, which adhere closely to the surface of the mirror. One method of testing is to take a bicycle pump, and plough a furrow through them! The result of the trouble is, of course, a fuzzy image. I have proved this often at Cambridge. Under good seeing conditions I have had poor results with my 30-inch reflector and excellent ones with the 25-inch Newall refractor on the same night. The moral is, of course, never to do visual work with large glass reflectors, unless you can afford an elaborate building or a refrigeration system.



W. H. Steavenson standing at the RA circle of the 40-inch refractor at Yerkes Observatory, accompanied by the instrument (at bottom left) that he afterwards referred to as his 'Great 1-inch Refractor'. The Association's Steavenson Award recognises members who have made 'an outstanding contribution to observational astronomy.' As succinctly expressed by Dr David Dewhirst in his obituary of 'Steave' (1894–1975): '... for above all he was an observer, and his skill as an observer was remarkable.'



Robotic Telescope Project

The Robotic Telescope Project allows BAA members access to remote telescopes and imaging systems at attractive rates. Members are able to use the service at half the commercial rate up to a limit, then at full rate, and are provided with access to a wide range of equipment beyond a private budget. It also allows users to benefit from observing from a location with a better climate than Britain's, including access to telescopes in the southern hemisphere. This project is not part of the Instruments and Imaging Section and is managed independently of the Observing Sections, and all enquiries should be directed to the Robotic Telescope Coordinator, Peter Meadows. For details and an application form, see the RTP website, which includes a selection of results obtained by members. The example here is an image of NGC 4319 (80 million light-years) and Markarian 205 (~1,200 million light-years), obtained by Mike Foylan, using one of the Sierra Stars instruments, on 2010 August 5.

Peter Meadows	robotscope@britastro.org
RTP website	http://britastro.org/robotscope

Observing Sections

Solar	Lyn Smith	marlyn@marlynsmith.wanadoo.co.uk	http://britastro.org/~solar
Lunar	Bill Leatherbarrow	w.leatherbarrow1@btinternet.com	http://baalunarsection.org.uk
Mercury and Venus	Dr Richard McKim	richardmckim@btinternet.com	http://britastro.org/mercuryandvenus
Mars	Dr Richard McKim	richardmckim@btinternet.com	http://britastro.org/mars
Asteroids and Remote Planets	Dr Richard Miles	rmiles.btee@btinternet.com	http://britastro.org/asteroids
Jupiter	Dr John Rogers	jhr11@cam.ac.uk	http://britastro.org/jupiter
Saturn	Mike Foulkes	mike.foulkes@btinternet.com	http://www.britastro.org/saturn
Comet	Jonathan Shanklin	jds@ast.cam.ac.uk	http://www.ast.cam.ac.uk/~jds
Meteor	Dr John Mason	docjohn@dircon.co.uk	http://britastro.org/meteor
Aurora	Ken Kennedy	ken.kennedy42@btinternet.com	http://britastro.org/aurora
Variable Star	Roger Pickard	roger.pickard@sky.com	http://britastro.org/vss
Deep Sky	Dr Stewart Moore	sigarro@btinternet.com	http://britastro.org/dss
Radio Astronomy Group	Paul Hyde	g4csd@yahoo.co.uk	http://britastro.org/radio