Meeting of the Deep Sky Section

held on 2005 March 5 at the Humfrey Rooms, Castilian Terrace, Northampton

The 2005 Deep Sky Section meeting was the first to be conducted by Dr Stewart Moore, who had taken over from Nick Hewitt as Section Director at the 2004 meeting. In his introductory talk, Dr Moore commented that 2004 could be called 'the year of variable nebulae', with the discovery of McNeil's nebula, a sudden brightening in Hind's Variable Nebula and the discovery of Persson's star on Digitized Sky Survey images. He showed some visual observations of Hind's Variable Nebula and also some CCD images of variable nebulae that had been submitted to the Section. Supernova discoveries were continuing apace: by the date of the meeting, BAA President Tom Boles had discovered 86 supernovae, Mark Armstrong had found 70 and Ron Arbour 15. Ron and Mark had also discovered novae in M31. As well as various images sent in by members, Dr Moore showed an image taken by Nick James that might just be the last image received by the Section to have been taken on Kodak TP2415. Production of this legendary astrophotography film had recently been discontinued by Kodak, in an age when digital photography is increasingly dominating the market.

The theme of this year's meeting was 'nebulae' and most of the talks focused on different aspects of this subject. The first main speaker of the day was Owen Brazell, who talked about the naming and numbering of nebulae in catalogues. Until the early twentieth century, deep-sky cataloguing was a relatively simple matter, all the known clusters and nebulae being covered by the Messier, NGC and IC catalogues. In recent times, as more objects have been discovered, a confusing multiplicity of catalogues has appeared, many of them covering the same objects. Dark nebulae, for example, were first catalogued by E. E. Barnard in the early twentieth century, from his wide-angle photographs of the Milky Way. However, this only included the larger nebulae and a more detailed catalogue of 1,800 nebulae, assembled from Palomar Observatory Sky Survey prints, was published by Lynd in 1962. This was later extended by Hartley and others into the southern hemisphere. The Barnard catalogue is still available as a reprint and on the Internet. The other main catalogues are available from the Strasbourg data centre through the SIMBAD website (http://simbad.u-strasbg.fr/Simbad).

More confusing are the catalogues of planetary nebulae. The first complete catalogue of these objects was published by Perek and Kohoutek in 1967. Its definition of what constituted a planetary nebula was very loose, however, and many objects in the catalogue were later found not to be planetaries, the most famous example being M1, the Crab Nebula supernova remnant. In 1992 Agnes Acker at Strasbourg published an updated planetary nebula catalogue, and then in 2000 Kohoutek published his General Catalogue of Planetary Nebulae, using his old numbering system from 1967. Nowadays one nebula can have up to seven different designations. Fortunately, SIMBAD relieves the confusion by listing all the known names of a planetary at a given position. Diffuse nebulae also have an array of specialist catalogues, such as those by Cederblad, Lynd and van den Bergh, as well as many small catalogues by astronomers in the former Soviet Union.

In the conclusion to his talk, Mr Brazell warned members to be wary of sky charting programs, which often use catalogue data that has not been checked for errors. He said that two of the better commercial packages currently available were *Guide* and *Sky Tools 2*, both of which had undergone some data checking.

The next speaker was Meteor Section Director Neil Bone, who is perhaps better known for his expertise on phenomena closer to home, but has many years' experience as a deep-sky observer and had recently published the *Philip's Deep Sky Observer's Guide*. His talk was titled 'observing nebulae with a small telescope'. By 'small telescope' Mr Bone meant an 80mm (3.1 inch) f/5 Celestron refractor, obtained for just £200, which he mounts on a camera tripod. This aperture may seem limited, but the telescope is surprisingly powerful, with many planetary nebulae, for example, being within its reach. Moreover, it is quick and easy to set up. This is an important consideration, for having to lug a big heavy instrument into the garden after a hard day's work can put many people off observing.

Mr Bone recommended observers to make their own sketches and descriptions of what they have seen, as this makes observing much more memorable and satisfying. He highly recommended the *Uranometria 2000.0* star atlas for finding objects with small telescopes by star-hopping. He noted that modern filters, especially the OIII filter produced by Lumicon, can make a big difference to views of deep-sky objects even in his 80mm refractor.

Mr Bone then showed some sketches and discussed examples of nebulae he has observed with the 80mm refractor. M42 shows improved contrast with the OIII filter, and even the much fainter nebulosity in M16 is visible with this aperture. The easiest planetary nebula to see is M27 in Vulpecula, an easy object even in binoculars. The Ring Nebula, M57, is a 'wow' object, the ring structure being easily visible and showing noticeably more detail with the OIII filter. The much fainter Messier planetaries M97 in Ursa Major and M76 in Perseus are still visible in the 80mm, though M76 appears to 'blink' at ×40, it being visible only when averted vision is used. NGC 3242 in Hydra, the 'Ghost of Jupiter', is very prominent with the OIII filter and can even be seen in binoculars if you know where to look. NGC 2392 in Gemini, the 'Eskimo Nebula', is also easily visible with this aperture, but it has a very small angular size and its proximity to a bright field star makes it easy to mistake for a double star at low powers. NGC 7293, the Helix Nebula in Aquarius, is often considered a difficult object for small instruments, but it is remarkably easy to see with the 80mm refractor and OIII filter.

Before lunch, Maurice Gavin spoke about 'understanding spectra and visual testing of nebula filters'. Mr Gavin has long been an enthusiast for amateur spectroscopy, making his own equipment from a variety of parts. He noted that even an ordinary compact disc can be used as a grating for a crude spectroscope, while a small prism placed in front of an eyepiece can identify planetary nebulae by isolating their emission lines. He demonstrated how a spectroscope can be made using a reflective grating, slit and camera lens. Such an instrument can do real science – for example, recording the spectra of stars, identifying the hydrogen-alpha emission line in novae and, very topically during the *Cassini-Huygens* mission, detecting the methane band in the atmosphere of Titan.

Recently, Mr Gavin built a spectroscope combining a grating and a prism to test the performance of various nebula filters supplied by Owen Brazell. Nebula filters work in two ways. Broadband filters for general deep-sky observing block emission lines from streetlights and thus increase the contrast of objects in light-polluted skies. Narrowband filters for observing emission nebulae, such as Lumicon's OIII, block *all* visible wavelengths except the emission lines produced by the nebulae. To be effective, filters must block or transmit exactly the correct range of wavelengths and have sharp cutoff points. Spectra of daylight imaged through the filters using Mr Gavin's test rig showed how well each filter performed. The results showed that while Lumicon filters of various vintages showed consistently high performance, the quality of some other filters on the market was more varied. For example, the transmission band of an OIII filter made by Thousand Oaks Optical cut off one of the two OIII emission lines, thus reducing its effectiveness by half. Even more surprisingly, OIII filters by the renowned US firm Tele Vue showed huge transmission bands with very blunt cut-off points, letting much light through in addi-

tion to OIII and confirming their disappointing performance at the eyepiece.

Lunch was an excellent ploughman's spread provided by the Northamptonshire Natural History Society, our hosts for the day. Straight afterwards, NNHS member Martin Morgan Taylor spoke briefly about the fight against light pollution. The Clean Neighbourhoods Bill, which declared light pollution a statutory nuisance, had just been passed by the House of Commons. However, the 'statutory nuisance' did not include light pollution from streetlights, and Mr Taylor urged members to write to their MPs as soon as possible to ask for the bill to be amended before it became law.

The first two talks of the afternoon session were both on CCD imaging of nebulae and were given by two well-known pioneers in this area. George Sallit spoke about high-resolution imaging of planetary nebulae, defining 'high-resolution' as 2.5 arcseconds or less – a resolution seldom achieved even in short-exposure solar system imaging before the digital age. Mr Sallit uses 250mm (10 inch) and 180mm (7 inch) Maksutov Cassegrain telescopes, which have long focal lengths. His Astro Physics 900 mount has a tracking error of just 2.5 arcseconds. He uses two CCD cameras, both made by Santa Barbara Instrument Group: an ST-2000 with a 1,600×1,200 pixel chip and a 1,500×1,000 pixel ST-8E.

Top-quality imaging demands a good signal-to-noise ratio, and this in turn demands exposure times of at least two hours, with three and four hours being not unusual. It is often necessary to split a long exposure into pieces, sometimes over several nights, due to interruptions from the British weather. Excellent guiding is required, and Mr Sallit recommended using a CCD with a built-in autoguider, like the ST-2000, rather than a guidescope or off-axis guider, as these can cause errors due to flexure between the guiding instrument and the main telescope. Only nights of excellent seeing are suitable for this type of imaging. Commercially-available adaptive optics systems can improve the seeing, though they are mainly useful for removing small guiding errors. Mr Sallit described some other techniques for improving the signal-to-noise ratio, such as 'dithering' – moving the camera very slightly – and taking at least 30 dark frames per image. This level of attention to detail paid off in the quality of Mr Sallit's images, some of which showed almost Hubble-like detail in nebulae such as the Ring Nebula M57, the Blue Snowball NGC 7662 and the Eskimo Nebula NGC 2392.

Adrian Catterall then gave a complementary talk on wide-angle imaging of gaseous nebulae with small telescopes. He commented that there were some 291 nebulae suitable for imaging north of declination –25°. A good small telescope can often be better than a large one for imaging the larger nebulae, because poor seeing does not show up as much as in a large instrument. For his nebula imaging, Mr Catterall uses a TMB 105mm (4 inch) refractor and a ST-8E CCD camera. This combination gives a true field of some 75×50 arcminutes. He showed some superb images taken with this setup, some of them taken while on holiday in South Africa. He then discussed imaging using H-alpha filters. One excellent aspect of H-alpha filters is that they eliminate light pollution very efficiently; one can do H-alpha deep-sky imaging from a London location or with a gibbous Moon in the sky. H-alpha images can be combined with standard red, green and blue images to create dramatic composites showing the red emission nebulae standing out very prominently. He finished his talk by showing some pictures taken by US amateur Russell Croman using a combination of exposures in H-alpha, oxygen III and hydrogen-beta light. Croman's image of the Eagle Nebula, M16 showed a striking resemblance to the famous Hubble Space Telescope 'pillars of creation' picture.

Following afternoon tea, Lee Macdonald returned to the visual side of deep-sky observing with the final talk of the day, on observing the Messier Objects. Mr Macdonald encouraged members to observe the Messier Objects because Messier's catalogue is a 'sampler' of nearly all classes of deep-sky objects – containing as it does 39 galaxies, 29 globular clusters, 27 open clusters, 6 diffuse nebulae, 4 planetary nebulae and even one supernova remnant. Moreover, all of them should be visible in a 90mm (3.5 inch) telescope under good conditions. All are in theory visible from British latitudes, though the southernmost ones culminate just a few degrees above the horizon in southern England and are very challenging to track down. Mr Macdonald described his technique for drawing deep-sky objects with his 222mm (8.75 inch) Dobsonian reflector, noting that drawings, unlike images, show objects exactly as they appear in the eyepiece. He illustrated his talk with a number of his own drawings, made at the eyepiece with an ordinary pencil and sketchbook and then scanned and converted into negative using image processing software, giving a realistic simulation of the appearance of objects in the eyepiece.

Stewart Moore then concluded the meeting with thanks to all the speakers for an excellent series of talks and also to Bob Marriott, Cyril Sampson and others in the Northamptonshire Natural History Society for all their work in providing the food and drink for this well-attended meeting.

Lee Macdonald