Centenaries for 2006

Barry Hetherington

806 Abû Yahyâ al–Batrîq died; an astronomer at the court of Baghdad.

Al–Fazârî died; a Muslim scientist and astronomer at the court of Baghdad.

1006 A new star appeared in Scorpio from May to August with an unusual magnitude, 'brilliant in appearance and striking to the eye.'

1106 Ibn Badja born; a Hispano–Muslim philosopher and scientist; constructed a planetary system based on eccentric circles but not epicycles.

1306 Ibn al–Shâtir born; a Syrian astronomer and instrument maker; constructed a splendid sundial for the Umayyad Mosque in Damascus.

1406 Abdallah ibn Khalil al–Maridini died; an Iraqian mathematician; wrote works on astronomical tables and the sine quadrant.

1606 On 4th December Jupiter was occulted by Mars, seen from China.

Edmund Gunter invented an instrument called the Sector.

The Umayyad Mosque, Damascus

Christopher Schissler of Augsburg died; an 'astronomical master mechanic'; instrument maker.

1706 Giuseppe Asclepi born at Macerata; an Italian Jesuit astronomer and physicist.

Pierre Bayle died; published a *Letter on Comets*; claimed that comets do not cause calamities.

John Dollond born; an English optician and instrument maker; improved the refracting telescope by making the objective out of two pieces of glass.

Jean Baptiste Duhamel died; a French astronomer; claimed that all comets are celestial bodies.

Roger Cotes appointed Plumian professor of astronomy at Cambridge.

Solar prominences discovered by Captain Stannyan during a total eclipse.

A 72lb meteorite fell at Larissa, Macedonia, in January.

1806 Benjamin Banneker died; an American astronomer; wrote *Ephemerides*.

Francisco Jose de Caldas put to death; Director of Santa Fé de Bogota Observatory.

Antonio Colla born; Director of Parma Observatory; received a gold medal from the King of Denmark for discovering a comet.

Eduard Heis born; a German astronomer; observer of variable stars.

Petr Borisovich Inokhodtsev died; a Russian astronomer.

Christian August Friedrich Peters born; a German astronomer; Director of the Königsberg observatory; computed the orbit of Sirius B.

John Russell died; made a crayon drawing of the Moon, measuring 4 feet 11 inches by 5 feet, in 1795.

Tadao Shizuki died; proposed a nebular explanation for the origin of the solar system.

The large proper motion of 61 Cygni determined and published by Giuseppe Piazzi.

A fall of meteorites at Alais, France on the 15th March.

The first modern transit circle constructed by Edward Troughton for Stephen Groombridge.

The Dorpat Observatory acquired a 7-foot Herschel-type reflector and a Dollond 8-foot transit instrument.

Historical researches on the astronomical observations of the ancients by Christian Ludwig Ideler.

1906 Hans Albrecht Bethe born on the 2nd July; studied atomic and solar theory.

Raphael Louis Bischoffsheim died; patron of astronomy; founded the Nice Observatory.

Bart Jan Bok born on the 28th April; researched on interstellar matter and galactic structure.

Joseph Francois Bossert died; published a star catalogue.

Emily Hughes Boyce born; studied variable stars.

Thomas George Cowling born; studied the structure of the stars.

Laszlo Detre born; a Hungarian astronomer; Director of the Konkoly Observatory; studied variable stars.

Bengt Edlen born; Swedish physicist; studied solar spectroscopy.

Joseph Gledhill died; assistant at the Bermerside Observatory, Halifax.

Caroline Winifred Herschel born; great-great-grand-daughter of Sir William Herschel and the last member of the family to be born with the Herschel name; Patron of the Herschel Astronomical Society and the William Herschel Society.

Johannes Hoppe born; professor of astronomy at the University of Jena; studied meteors.

Charles Jasper Joly died; Astronomer Royal for Ireland 1897–1906.

Kojiro Komaki born; founder and Director of the Kii Astronomical Society, 1943, and the Japan Meteor Society in 1968.

Evgenij Leonidovich Krinov born; a Soviet meteoriticist.

Pierre Lacroute born; director of Strasbourg Observatory; pioneer of astronomy from space.

Jean Ph. Lagrula born; Director of the Algiers Observatory.

Samuel Pierpont Langley died; an American astronomer; director of the Allegheny Observatory; devised the bolometer.

Frantisek Link born; a Czech astrophysicist; director of Ondrejov Astrophysicial Observatory.

Dmitrii Yakovlevich Martynov born; a Soviet astrophysicist; Director of the V. P. Éngelgardt Astronomical Observatory.

Nicholas Ulrich Mayall born; an American astronomer; studied galaxies and globular clusters.

Jeffrey Charles Percy Miller born; mathematical astronomer; studied stellar structure.

Peter MacKenzie Millman born; a Canadian astronomer; studied comets, meteors and the planets.

William Wilson Morgan born; an American astronomer; co-discoverer of the spiral structure of the Milky Way.

Kiyoshi Mori born; a computer of asteroid and cometary orbits.

Pavel Petrovich Parenago born; founder of the Moscow school of stellar astronomy; studied variable stars.

Richard S. Perkin born; co-founder of the Perkin–Elmer Corporation which makes astronomical instruments.

Robert Methven Petrie born; studied galactic structure and stellar motions.

George Antoine Pons Rayet died; director of the Floirac Observatory; co-discoverer of Wolf–Rayet stars.

Heinrich Siedentopf born; Director of the observatories in Jena 1933–'45 and Tübingen 1949–'63; studied stellar atmospheres.

Pol F. Swings born; a Belgian astrophysicist; studied cometary physics and stellar spectroscopy.

The Variable Star Section – news of the Mentoring scheme

by Karen Holland

From the Section Director

Recently the BAA Council has been considering ways to help new members and particularly new observers to get started in their chosen area. To this same end, the Variable Star Section has been running a 'mentoring' scheme for a few years now, and the following article by Karen Holland is a description of how it operates and how useful 'mentees' (and in some cases, mentors!) have found it.

Whilst setting up such a project is extremely simple and straightforward, the Variable Star Section would be very happy to advise other Sections who might wish to initiate similar schemes. Similarly, it is hoped that new observers will consider asking their Director for help in the manner described below.

Roger Pickard, *Director, Variable Star Section*

Introduction

The Variable Star Section Mentoring scheme was set up in late 2002,[1,2] with the intention of providing much-needed support and guidance to new visual observers, or to those who might wish to try their hands at variable star observing, perhaps coming from another field. The point of the scheme was for the mentor to provide support and guidance with any difficulties or areas of uncertainty that the observer might have during the early stages of observing.

No specific format or guidelines were set up for the form that the assistance should take, as observers' requirements vary widely; it was also felt that a light-touch approach was the most appropriate for such a scheme. In some cases, observers who were already capable of making good visual estimates, simply wanted some reassurance regarding the quality of their observations before they started submitting them to the database, and in this case, the encouragement required from the mentor was likely to be relatively simple, and the mentor/mentee arrangement short-lived. On the other hand, some observers wanted a great deal more advice regarding target selection and observing techniques, and might need instruction over a longer period of time before they felt confident regarding the quality of their observations.

The administration of the project involved finding a number of experienced observers who were willing to volunteer to act as mentors to newcomers; then as observers requested help, they were allocated a mentor, and encouraged to make contact with them.

Some mentors agreed to advise by telephone, or email only, whilst others offered real observing sessions, if the mentee lived nearby, or was willing to travel. In practice, unless an observer specifically requested a particular mentor (which has happened in a number of cases), then an effort was always made to choose pairs who lived as close as possible to each other. However, because the geographical distribution of mentors is not ideal, this was not always possible.

Progress and growth of the scheme

The scheme really got under way in 2002 with a total of 15 visual mentors willing to help. We found that experienced VS observers were always very keen to assist new observers, and as a result, we have, to date, always had more mentors offering assistance than mentees for the visual scheme, as seen in the graph in Figure 1. The number of observers seeking a visual mentor grew rapidly over the first couple of years.

It became apparent that the visual scheme was a success, in that a substantial fraction of the mentor/mentee pairs were reporting positive results from the arrangement. We decided that, as a number of key observers were becoming proficient at CCD photometry, we should extend the scheme to provide CCD mentors, which we did in 2004 December.[4] The aim was to provide newcomers to CCD photometry with the help that they needed to learn the basic techniques for good photometry, guided by a more experienced observer, who might not know the answers to all questions, but who might be more confident at establishing good practice.

For the CCD mentoring scheme, however, there are slightly more mentees than mentors, meaning that one or two mentors are assisting more than one person.

Figure 1 charts the growth of participation in the scheme. It should be noted

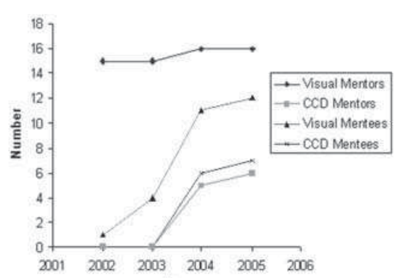

Figure 1. The growth in numbers of mentors and mentees since the scheme began in 2002.

Centenaries for 2006... continued

Con Tenukest born; an Australian planetary observer and telescope maker.

Clyde William Tombaugh born; an American astronomer; discovered the planet Pluto in 1930.

Johann Wempe born; astronomer at the Astrophysical Observatory at Potsdam; worked at the Heidelberg–Königstuhl Observatory.

Fred Lawrence Whipple born; Director of the Smithsonian Astrophysical Observatory; studied the smaller bodies of the solar system.

Richard van der Riet Woolley born; director of the Mount Stromlo Observatory; eleventh Astronomer Royal.

Achilles (Asteroid 588) discovered on the 22nd February by Max Wolf.

X Leonis discovered variable by Metcalf.

Walter Sydney Adams undertook a systematic study of the Sun's rotation by the spectroscopic method.

The 60-inch reflector on Mount Wilson came into operation.

A vertical solar tower with a 12-inch objective erected on Mount Wilson.

The removal of the Hamburg Municipal Observatory to Bergedorf began.

The Aldershot Observatory built, housing an 8-inch refractor by Grubb, with funds given by Mr P. Y. Alexander.

John D. Hooker presented $45,000 to the Carnegie Institution of Washington to purchase a glass disk 100 inches in diameter.

A General Catalogue of Double Stars within 121° of the North Pole by S. W. Burnham.

Barry Hetherington, 22 George Street, Darlington DL1 5DW

that although the Section asks that potential mentees request a mentor through the scheme co-ordinator, Karen Holland, many more informal mentor/mentee relationships have been set up since the scheme began. As the only reason for having a central coordinator was to maintain records to monitor the success of the scheme, and to attempt to collect feedback in an effort to improve the service, the Section has been happy to encourage such informal relationships to flourish, without necessarily adding them to the list; hence it is believed (though impossible to prove) that the scheme has encouraged many more pairs to be formed than is evident in Figure 1.

Another reason for asking for mentee/mentor relationships to be set up through the co-ordinator, was to try to distribute mentees evenly, so that no single mentor ended up with too many observers. Again, the informal relationships that seem to have been encouraged since the scheme began are self-regulating, in that no mentor will take on more mentees than can be maintained, although it does mean that some mentors have not yet been allocated a mentee, whilst others have more than one.

Feedback and results

One of the first new observers to be allocated a mentor was Janet Simpson (pictured), who became my student in 2003. Janet began observing initially with binoculars, and after a quieter period during her house move to Scotland, where she now runs a B&B, she is actively observing again, and setting up an observatory for a telescope. Figure 2 shows how competent an observer Janet has become in a short period.

Janet has written an article[3] describing some of her experiences and thoughts regarding the scheme. She concludes: *'I feel the VSS Mentor system has given me direction, and the means and encouragement, which gave me the confidence to get started and a way of checking my results are on track; and a friend.'* I certainly feel that I, personally, have gained a great deal from acting as a mentor.

Des Loughney initially joined the scheme after requesting a CCD mentor, but after further investigation, decided that he was not currently in a position to obtain a good CCD camera. Through mentoring by Gary Poyner he managed to stretch his visual magnitude limit substantially. He comments: *'Following Gary's advice, I bought a Radian eyepiece. I used to think that, with an 8-inch reflector, I could only see stars down to a magnitude of 12.5 in suburban skies. Following Gary's recommendations, I have already been able to get down to magnitude 13.2 observing W Lyrae using AAVSO chart 1811+36d; I managed to see the star marked 132 on the chart, but not its faint companion, which Starrynight Pro gives as magnitude 13.85. This observation was made during the light summer months, and in the new season just starting, I am optimistic that I will be able to see down to 14. This will allow me to do much more. I will be able to tackle binaries such as RW Tauri with more confidence.'*

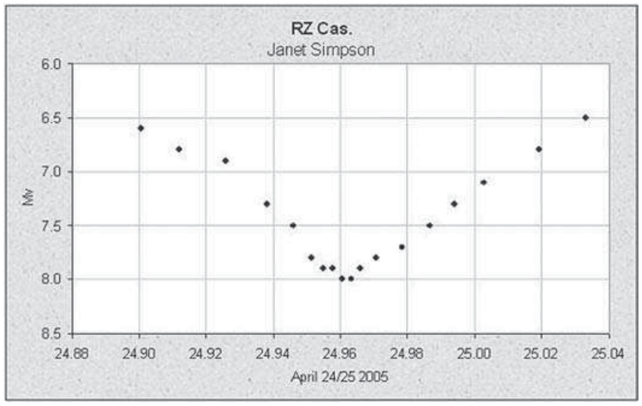

Figure 2. Janet Simpson's visual observations of an eclipse of RZ Cas.

Jeremy Shears received much useful advice from several sources whilst becoming quite expert at CCD photometry and imaging. He comments: '*I had some experience of CCD imaging of deep sky objects for pleasure, but I wanted to achieve some more scientifically useful results from my work. Having attended the BAA Pro-Am symposium on CCD photometry at Northampton in 2004 May, I was stimulated to investigate variable star photometry. I made my first attempts in the autumn of 2004 and have been climbing the learning curve ever since. Throughout this period I have received copious technical advice, both on photometric techniques and general variable star science, as well as encouragement from many members of the BAA Variable Star Section. This support has been invaluable in learning the ropes and I would especially like to thank Roger Pickard, Gary Poyner, Richard Miles and Guy Hurst. Many others have been generous with their advice and time along the way. There is indeed a lot to learn when starting in CCD photometry, but it's certainly very helpful to be able to tap into such a vast pool of expertise – without this the learning phase would have been much more painful!'*

The plot in Figure 3 demonstrates the quality of data that Jeremy has achieved, little more than a year after beginning CCD imaging. Figure 4 shows one of Jeremy's images taken for the Recurrents Objects Programme.

Comments that I have received regarding the scheme, indicate that mentors feel that their mentees have benefited from the scheme, and that they too have made good friends, and benefited in the process. Meanwhile Dave Storey, on the Isle of Man, has taken the brave step of adopting five local observers as his visual mentees, and we eagerly await news of their progress!

John Howarth (a visual mentor), commented: *'I feel the mentoring scheme is look-*

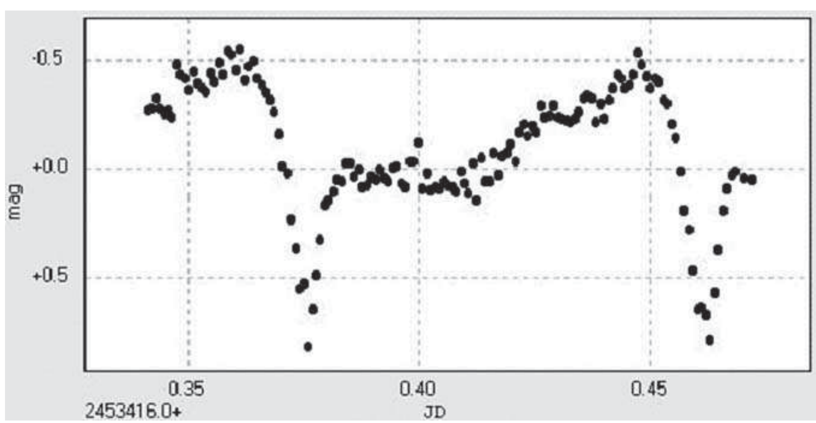

Figure 3. CCD photometry of the deeply eclipsing dwarf nova DV UMa, 2005 Feb 14, 20:10 to 23:19 UT. Two eclipses can be seen during which the brightness dropped from about mag 14.2 to 15.5. Takahashi FS102 102mm refractor, Starlight Xpress MX716 CCD camera, unfiltered. Each data point represents photometry on a single 1 min CCD exposure. *Jeremy Shears*

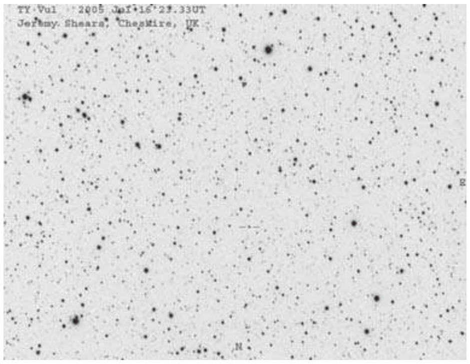

Figure 4. Outburst of TY Vulpeculae on 2005 July 16, 23:33UT, unfiltered 2 min CCD exposure (equipment as Figure 3). The field is 25' by 19'. TY Vul is a dwarf nova on the BAA VSS Recurrent Objects Programme. Photometry showed it to be at mag. 15.10C. *Jeremy Shears*

ing good, and well worth doing for both mentee and mentor. It has got me interested in types of observation that I had either not tried before or given up on.'

Gary Poyner (a visual mentor) had the following comment regarding the scheme: *'I think for a scheme like this to work to its full potential, both need to live quite close to each other. It's important to be with the person to pass on any comments/suggestions whilst you are observing. I know this happens a lot in the AAVSO, where a similar scheme has been very successful for years. E-mail is OK, but it's just not very personal. It's impossible to show someone how to do something over the ether!'*

Future plans: the analysis of VS observations

John Howarth, who is well known for his articles on the analysis of variable star observations, has suggested the scheme be extended to mentoring others who are possibly more interested in this aspect than in observing. Therefore, if there are any members who feel they would like to know more about this they should contact either Karen Holland or the Director. In addition, those who feel they could help by becoming mentors themselves should also contact either of the above.

Conclusion

The scheme was originally set up in response to a valid criticism made by a Section officer (Tony Markham) that we were not doing enough to help new observers. It seems that the scheme has been very successful in this respect and much valuable assistance is being made available to those who are willing to accept it.

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References

1 *J. Brit. Astron. Assoc.,* **113**(2), 115 (2003)
2 VSS *Circular,* **114**, 13 (2002)
3 *ibid.*, **120**, 10 (2004)
4 *ibid.*, **122**, 25 (2004)

BAA Awards and Medals for 2006

Early in the new year Council will consider nominations for the Association's Medals and Awards for 2006. If any members wish to nominate a fellow member for some notable contribution, please send a suitably worded citation to the Business Secretary no later than 2006 February 10. All nominations must be in writing and signed by two sponsors. Please try to confine citations to one side of an A4 sheet of paper. Thank you.

Conditions relating to each award are given below. Members are requested to read the conditions carefully and to ensure that citations comply with the conditions for the relative award. A list of previous recipients of the awards may be obtained from the Business Secretary.

The Walter Goodacre Medal and Gift

'This award ... is the senior award made by the Association. ...Normally awarded at intervals of not less than two years and not more than four years since the last award.

'The award shall be given in recognition of the recipient's contribution to the progress of astronomy over many years, special regard being had to his or her work communicated to the Association, this work being communicated in any form, and not necessarily in writing, provided that the recipient is a member of at least five years standing in the Association at the date of the Annual General Meeting in the year of the award.'

Merlin Medal and Gift

'This award shall ordinarily be made not more than once in any year and not less often than once every five years... It shall be made in recognition of a notable contribution to the advancement of astronomy. If two or more persons have been jointly concerned in any particular work, a joint award may be made, in which case each recipient shall receive a medal and gift.'

Lydia Brown Medal and Gift

'This award shall be made at the discretion of the Council. [It] shall be in recognition of meritorious service to the Association in an honorary capacity over many years on grounds which would not qualify a nominee for either the Walter Goodacre or Merlin Awards. If two or more persons have been jointly concerned in any particular work, a joint award may be made, in which case each recipient shall receive a medal and gift.'

Steavenson Award

'This award shall be made at the discretion of the Council. It shall be awarded to a member who has made an outstanding contribution to observational astronomy.'

Horace Dall Medal and Gift

'The award shall be made at the discretion of the Council but not more than once in any calendar year. It shall be made to a person, whether or not a member of the Association, who has shown marked ability in the making of Astronomical Instruments. If two or more people have been jointly concerned in a particular work then each person may receive a medal and gift.'

Ron Johnson, *Business Secretary*

Meetings

Ordinary Meeting, 2005 January 26

held at the Geological Society, Burlington House, Piccadilly, London W1

Tom Boles, *President*
Ron Johnson, Nick Hewitt and Nick James, *Secretaries*

The President opened the fourth Ordinary Meeting of the 115th session, inviting Dr Nick Hewitt to read the minutes of the previous meeting. After these were approved, Mr Boles thanked Guy Hurst, who had chaired the latter part of the proceedings in his absence. Forty-nine new members were proposed for election, meanwhile the audience approved the twenty-five who had been proposed at the previous meeting. Mr James said that two papers had been approved for *Journal* publication:

The Zeeman Effect observed with a spectroheliosope, by Fredrick Veio
A discussion of the duration of central transits as seen from Earth, by Darren Beard

The next Ordinary Meeting would be held, with a Special General Meeting, on March 30, at the present venue. In the meantime, however, there would be an experimental *Back to Basics* workshop in Chichester on January 29, the sixth in the Association's successful series of *Observers Workshops* at the Open University in Milton Keynes on February 26, and a Section Meeting of the Deep Sky Section in Northampton on March 5. Finally, in accordance with traditional practice at this point in a President's tenure, Mr Boles announced his personal nomination for his successor, due to take office at the start of the following session. He was pleased to recommend Dr Richard Miles for the post, and offered him his warmest congratulations should he be elected.

Mr Boles then proceeded to welcome the evening's first speaker, Dr David Boyd, Vice-President of Newbury Astronomical Society, a BAA Council member, and an active member of the Variable Star Section.

Clocking a spinning white dwarf

Dr Boyd described his observations of the variable star DO Draconis (DO Dra) during its outburst of 2004 January. He opened by explaining that this system was a member of a class of cataclysmic variables known as *intermediate polars*. Such systems consisted of a pair of stars, orbiting about their common centre of gravity, where the more massive star had exhausted its fuel and become a white dwarf, while its less massive companion continued to burn hydrogen. Upon reaching the red giant phase of its life, the smaller secondary star would expand, pushing its outer layers towards its companion, such that some of its outer envelope entered the strong gravitational field surrounding the white dwarf – a process called *Roche-lobe overflow*. This gas, having no escape from the white dwarf, would spiral in towards it, forming an *accretion disc*.

From his CCD observations of the variations in the brightness of DO Dra in outburst, the speaker said that he had found it possible to measure what he believed to be the spin rate of the white dwarf in the system. He added that this was possible as a consequence of the behaviour of the inner edge of the accretion disc. It was well established that white dwarfs were surrounded by intense magnetic fields, essentially the result of compressing the magnetic field of an entire star into the tiny volume of such an object – comparable to that of the Earth. This was relevant, as the material falling onto the accretion disc would rapidly become ionised, a result of the tremendous temperatures generated by viscous friction within the disc, fuelled by the acceleration of material to velocities of several thousand km/s upon falling in towards the white dwarf. However, such ionised material was known to follow the direction of magnetic fields, and so the strong field in the vicinity of the white dwarf would be expected to alter the dynamics of the inner parts of the accretion disc, drawing material out of its plane, along the field lines emanating from the star's magnetic poles, and ultimately onto the surface of these poles.

However, the speaker explained that there was no reason why the white dwarf's magnetic poles should be aligned with its rotation axis, and so as it spun, the magnetic poles would rotate, and the geometry of the inflow onto them changed with respect to our line of sight. The result would be some periodic modulation of the observed brightness of the system, typically with two brightenings per rotation, on account of seeing both poles alternately crossing its disc.

As a historical note, Dr Boyd added that DO Dra had not been identified as an intermediate polar until it was realised to be a significant source of X-ray radiation, suggestive that accretion onto a compact object was involved in its variability. Prior to this, in 1934, an eclipsing binary, catalogued YY Dra, had been identified very close nearby, though it was apparently no longer observable. Recent literature argued that it seemed likely that this was a case of misclassification, and both were in fact the same object.

Previous observations taken over the course of the 1990s by *ROSAT* in X-rays, and by the Faint Object Spectrograph (FOS) aboard the Hubble Space Telescope (HST) in the ultraviolet, had identified two periodic variations in the brightness of DO Dra, with periods of 530s and 265s, interpreted as being due to the spin period of the white dwarf and its first harmonic respectively. The detection of brightness modulation at the first harmonic of the spin period fitted well with the suggestion that there should be two brightenings per rotation, corresponding to accretion onto each of the two magnetic poles. Previous observations in the V-band (visible light), yielded a marginal detection of the 530s modulation, but no detection of its first harmonic.

Moving on to discuss his own observations, the speaker said that these had been made during the outburst of 2004 January. Normally DO Dra varied in the range mag 15–15.5, but on 2004 January 23, Mike Simonsen had reported that it appeared brighter in his images, around mag 14.5. The subsequent brightening was rapid, and the speaker's photometry the following night found it closer to mag 11.5. During the course of the night of January 24/25, he had set his CCD to take automatic 30s integrations over a period of 7.5 hours. In each of the resulting frames he had later been able to use a reference star in the same field to estimate the brightness of DO Dra. He had repeated the same procedure with a second reference star to estimate the error in his photometry. More details of the data analysis can be found in his paper, Boyd (2005).[1]

When the frequency spectrum of the brightness variations over the night was calculated, significant modulation with a period of 527.8±1.8s was identified, though the first harmonic, at half this period, was not observed. This value was compatible with the best professionally measured value of the spin period of the white dwarf from the HST, of 529.42±0.1s. In conclusion, the speaker believed he had measured the spin rate of a white dwarf using only a 250mm aperture amateur telescope – he found this rare opportunity to plot his personal observations alongside HST data rather satisfying. In addition, he had uncovered something of a mystery: why had he detected only one brightening in the V-band on each rotation, as previous observations in that band had also hinted, and yet two brightenings per rotation were observed in X-rays and the ultraviolet. More observations would be required to answer this question, and the speaker felt concurrent monitoring in both the V-band and at shorter wavelengths would be valuable to ensure that the explanation did not simply lie in a change in the behaviour of the object between the observations at different wavelengths.

Following applause, the President congratulated Dr Boyd on undertaking observations of genuine scientific value, and expressed his hope that his success might encourage other amateurs to pursue similar projects. A member asked why the speaker had chosen to observe in the V-band, using a green filter, rather than observing in white light with an unfiltered CCD. The speaker explained that this made it easier to compare his results with those of others, as the wavelength response of unfiltered CCDs varied considerably. A member asked if Dr Boyd would be willing to speculate as to what physical mechanism caused the difference between his V-band observations and those at shorter wavelengths. The speaker replied that he was reluctant to do so, as he was not aware of any well-established explanation having appeared in the professional literature.

Finally, Mrs Hazel McGee asked whether the earlier X-ray/UV observations had been taken at times of quiescence or outburst, whether the speaker had made any V-band observations during quiescence, and whether any discrepancy here might account for the different behaviour of the object. The speaker replied that the previous observations had mostly been taken during quiescence, but his own attempts to make V-band observations at such times had been plagued by large error-bars, a result of the object's faintness.[2]

The President then welcomed the next two speakers, who together would be discussing a new design of telescope optics. Mr Peter Wise, the telescope-maker behind the idea, would explain the design of the instrument, whilst Mr Martin Morgan–Taylor would be presenting some of his results obtained using a telescope with such optics.

New movements in imaging technologies: Telescopic imaging with digital SLR cameras

Mr Wise explained that his optical design, which he called *Newise*, employed a spherical primary mirror, with two subsequent lenses used to correct for the spherical aberration before rays were brought to focus. The first of these, a negative (diverging) doublet, was placed in front of the focal plane of the primary, and brought the converging rays from it into a near-parallel configuration. As with the Newtonian design, rays were then deflected through 90° by a small flat mirror, leaving the side of the instrument. Here, a positive (converging) doublet brought them to focus.

The speaker saw a number of advantages to this design. The distance between the primary mirror and the secondary optics was shorter than that of most comparable instruments. The result was a compact telescope, which was more readily transportable than an instrument of comparable aperture using more conventional optics. The optics were also comparatively fast – the speaker showed the audience an easily-portable 200mm f/6 prototype, explaining that he had also made a 400mm f/3 instrument. The usable fields of these were 1.5° and 0.9° respectively, making them ideally suited to wide-field work. He added that he had hopes to make a 600mm version within the coming year, if the cost was not too great.

In addition, Mr Wise explained that the distance between the last lens of the system and the focal plane was comparatively large, making it straightforward to take images simply by placing a standard camera in front of the eyepiece, without the need for a transfer lens, as was so often the case with other designs. Finally, to reassure the sceptics, he added that the instrument exhibited 'no chromatic aberration', despite the use of lenses.

Mr Morgan–Taylor then explained that he would be presenting a series of images, comparing the results from a conventional CCD with those from a consumer digital SLR camera. In the process, he hoped to demonstrate what imaging was possible with some of the newer cameras on the market and, in addition, what it had been possible to achieve using a telescope of Mr Wise's new design. All of the images in his talk had been taken from a location three miles outside Leicester. He had used a so-called 'deep sky' filter, about which he regretted he had been unable to find any technical specification, either from the retailer or from his own research. However, in practice it appeared to add a blue tint to colour images, excluding much of the red end of the spectrum, and with it much of the sodium light pollution. Whilst not ideal for colour imaging, the filter seemed a useful tool if the results were grey-scaled.

The advantages of CCDs as imaging sensors were, the speaker was sure, very familiar to many in his audience. They gave a penetrating view of the sky, often less affected by light pollution than traditional film. In addition, they were typically more sensitive, and free of the reciprocity failure suffered by so many film emulsions when used with long exposure times. Digital SLR cameras themselves brought further advantages: an LCD display on the back, allowing the focusing to be checked quickly prior to taking long exposures, and relatively large chips, the speaker's being 20×16mm. However, the downside was that the CCD arrays in such cameras were usually based on CMOS semiconductors, which astronomers had tended to shy away from in the past on account of their being cheap and invariably rather noisy. Whilst they performed well for daylight shots, long astronomical exposures had historically been rendered impossible by the build-up of noise.

Starting with the Orion Nebula, Mr Morgan–Taylor first showed results obtained directly from the eyepiece, with no flat-fielding or stacking. His first reaction had been that they were exceptionally pleasing images, which perhaps one might normally have expected to have come from a telephoto lens rather than a telescope. In view of this, it seemed that technology had finally arrived which allowed wide-field imaging to be straightforwardly undertaken with an autoguided instrument. Moving on to the Pleiades, a similar raw image from the eyepiece provided a good view of the cluster, while minimal processing in Adobe *Photoshop* was required to bring the surrounding nebulosity into view.

An animation of Comet Machholz, composed of two-minute exposures taken every three-and-a-half minutes on January 8 revealed another advantage of the use of digital SLR cameras: their ability to be driven by a digital cable release. In this case, the speaker had been able to program such a release to take a series of exposures of his chosen length, before retiring into the warm.

In conclusion, the speaker felt that there had been great advances in the quality of CMOS CCD detectors in recent years, to the point where they were now useful tools for astrophotography. In response to a question concerning the temperature-dependence of the noise in the CCD, the speaker replied that he had found images taken at sub-zero temperatures to be greatly superior to those taken when the camera had been warmer. Following applause for Messrs Wise and Morgan–Taylor's presentation, the President welcomed Mr Nick James to speak on a similar theme.

Wide field astrophotography

Mr James recalled that in the past he had been something of a sceptic regarding digital cameras: they had seemed relatively insensitive, and to have rather small fields. He was one of many who had chosen instead to dedicate his attention to following the development of new types of film, each supposedly giving superior performance to its predecessors for long exposures. However, he proceeded to show an image which had caused him to think again: a wide-angle image of the Milky Way, which Nigel Evans had taken during their expedition to Sharm-el-Sheikh in Egypt in 2004 June to view the transit of Venus. The quality of this image, taken with an 8mm aperture lens and digital SLR camera, had convinced him that technology had moved on, and because of this he had since bought his own camera. The speaker remarked that he had often heard the question asked whether 'film was dead', and in contrast with his previous opinions, he was now convinced that digital technology had reached a stage where it was challenging even the final remaining strengths of film.

The speaker's own camera was a *Canon 10D*, already an obsolete model, though he noted it had a consumer counterpart, the *Canon 300D*, which was essentially the same, except that it was packaged in a more compact and somewhat less sturdy case. Essential for astrophotography was a very high-quality lens, as it was relatively difficult to focus stars into point sources without appreciable spreading of the light. Mr James recommended the eBay website as a good source, remarking that he had himself found a very good lens there, priced at £160. The trend seemed to be towards increasing popular demand for zoom lenses, and so the fixed-focus variety could often be found quite cheaply.

The CMOS sensor array in the Canon 10D was found to have quite a low noise-level, and without any cooling, exposures of up to five minutes were possible before it began to become an issue. The chip itself contained 7.4ì m-square pixels in a 3,072 by 2,048 array, measuring 15.1mm by 22.7mm in total.

Mr James remarked that whereas CCD users needed to carry a laptop with them to drive their cameras, digital camera users had no such need, as the body of the camera itself read and stored the data from the sensor, whilst at the same time being somewhat less bulky to carry around. The capacity of consumer flash memory cards was growing incredibly fast, so that a card with plentiful storage for a night's observing was now available at reasonable cost. The control of the speaker's camera was very similar to that of a standard SLR – for example it had a 'bulb' setting for long exposures. By default the camera returned images in JPEG format, though it also supported the return of raw data directly from the sensor. The speaker reminded members that the latter option was essential for astrophotography, as it allowed tasks such as flat-fielding and the removal of hot pixels to be undertaken on the images. These were not possible after the image had been compressed into JPEG format, as information from each of the individual detector elements was blurred together.

The speaker had found the LCD display on the back of his camera to be remarkably useful as a focusing aid since it could display the image at a very high magnification. Whereas older SLR cameras had usually provided a split prism in the viewfinder to aid in reaching sharp focus, their modern counterparts tended to lack such niceties on the assumption that automatic focusing was always used. In addition, it appeared that the focusing wheels of all Canon lenses could now be turned beyond infinity, which meant that it was no longer possible to simply turn them to the end stop when doing astrophotography.

Mr James commented that the 10D, along with many similar cameras, had an ISO setting, allowing the user to make the sensor simulate the behaviour of film of a given speed. He remarked that for astrophotography one might intuitively choose to use a high-sensitivity setting. However, he explained that this was actually not a good choice. When images were read in raw format, each pixel directly returned a 12-bit number (4096 quantisation levels), giving the number of quantised units of brightness detected. The ISO setting increased the gain between the CMOS sensor and the sampler, but beyond a certain setting there was no benefit, since the image noise was already covering several quantisation levels. In fact higher ISO merely had the effect of reducing the dynamic range available and restricting the maximum exposure time in light polluted environments. Thus, best results were obtained by configuring the camera to a relatively low ISO setting (200), and taking a longer exposure.

The 10D supported the use of a programmable digital cable release, which made it straightforward to schedule the exposure of a series of images at given intervals. The speaker noted, however, that photographers who were happy with old-fashioned push button releases would have to pay £30 for the digital equivalent. This seemed an extortionate price, though Mr Maurice Gavin had reportedly soldered together such a device himself, with minimal cost or effort involved.

Moving onto software, the speaker recommended the use of a package called *Iris*, which was freely available online.[3] For newcomers to the field of image processing, there was an extensive online tutorial at the same website. The software supported the input of images in the raw data formats used by both Canon and Nikon cameras. As an example, Mr James demonstrated what he had been able to achieve with a single 180s exposure of Comet Machholz. The raw image from the camera suffered a significant transverse gradient as a result of shadowing caused by the reflex mirror mechanism, as well as a few blotches caused by dust on the sensor. To counter these blemishes, he had taken an image of the flattest field he could find, by directing the camera at a blank region of the sky in twilight. The comet image was then divided by this, and any residual background variation was identifed by letting *Iris* fit a polynomial to the result. The calibrated image was then divided by this smoothed flat, and both the dust and ion tails were then clearly visible, despite their brightnesses being a mere ~1% of that of the sky background. That the 10D was able to obtain such detail from a sub-optimal suburban location seemed an impressive feat.

To conclude, the speaker mentioned one disadvantage of the 10D. Although CMOS image sensors were typically quite sensitive well into the infrared part of the spectrum, the 10D incorporated a filter in front of the sensor, which blocked much of this light. The reason for having such a filter was that the focal length of the optics differed with wavelength, and so if infrared light were detected, it would not be in focus when visible light was, causing a blurring of the image. However, the filter's cutoff was around 20nm shortwards of the Hα line at 656nm, making it a poor tool for imaging hydrogen emission. To give an example, the Horsehead Nebula in Orion would be virtually invisible. However, the speaker concluded that on balance the Canon 10D was an outstanding imaging tool for £700. Given how unimaginable its capabilities would have been only a very few years previously, he wondered what technology might become available to amateur imagers in years to come.

Following applause, a member asked Mr James how easy the sensor was to clean. He replied that Canon's official advice was that it should be returned to them for cleaning, but that as this seemed somewhat impractical, he had personally chosen to use a blower brush to blow air over it, without any physical contact. This procedure had seemed adequate so far. Whilst researching what others had done, he had found various accounts on the internet, describing the passing of various cleaning fluids over the sensor, though he did not envisage he would be risking this himself. He also remarked that he had read similar accounts of people dismantling the camera to remove the infrared filter – though this idea also failed to entice him.

The President then introduced the evening's final speaker, Dr Nick Lomb, former Vice-President of the Association's New South Wales Branch in Australia, and currently Curator of Astronomy at the Sydney Observatory.

The historic Sydney Observatory

Dr Lomb opened by asking how many members of the audience had visited the Sydney Observatory, and found that a considerable number had done so. He explained that historically, it had been founded in 1858, built next to Sydney harbour with the principal aim being that a time-ball should be placed on its roof, from where it would be visible to all shipping across the harbour. To this day, the panoramic view across the harbour from the top of the time-ball tower remained an exceptional sight. This foundation date was – the speaker added – very old by Australian standards, and placed it as the country's oldest observatory.

An impression of the Observatory from the late 1860s showed that, at this time, it had had a single observatory dome, with an attached residence for the Government Astronomer. In these early days, the principle telescope had been a transit instrument, though various other instruments were soon added to the collection, most notably the Schroeder 11.4-inch refractor, procured in 1872 by the then Government Astronomer, Mr Henry Russell. This telescope, now the oldest working instrument in the country, remained at the Observatory, and was still in regular use for public observing nights.

The speaker added that Russell had dedicated a great deal of attention to the transits of Venus of 1874 and 1882, and published his observations in a book in 1892. To commemorate this, the speaker showed the scene from the recent transit of 2004 June 8, which he added had attracted a great deal of interest, even though only the early stages had been visible from Australia. He remarked that it was curious that the black drop effect was clearly observed from Sydney, although many UK observers had not seen it. Given that the Sun was low in the sky at the time of ingress in Sydney, this seemed to support the suggestion that it was predominately a seeing-related effect due to the Earth's atmosphere, rather than one due to the atmosphere of Venus or the Sun.

Moving on to the Observatory's present day activities, Dr Lomb described these as including the organisation of exhibitions and displays concerning its history, running workshops for local school groups and adult education programmes. In addition, there were frequent telescopic viewing sessions, which combined the use of the historic Schroeder instrument with a recently acquired 400mm Meade. However, the speaker regretted to report that the Association's New South Wales Branch had had a dwindling membership in recent years and, as a result, had decided that its name was excessively antiquated. Under its new name, the *Sydney City Sky Watchers*, it continued to hold monthly meetings at the Observatory. Dr Lomb also remarked that there was also a group based at the Observatory who were working to combat light pollution, and which was actively campaigning against any planning proposals which it was thought might significantly change the lighting conditions of the city.

To close, the speaker extended an invitation to all members to visit the Observatory, adding that they would be particularly welcome to join the Sydney City Sky Watchers' meetings on the evenings of the first Monday of each month. Concerning the light pollution issues raised in the talk, a member asked how Australian legislation in this regard compared with that in the UK. The speaker replied that Sydney was split into several municipal regions, and the situation varied between them. However, in the city centre, planning restrictions on lighting were comparatively favourable, though not all proposals complied with them.

The President then adjourned the Meeting until March 30, at the present venue.

Dominic Ford

1 Boyd D., 'Detection and measurement in the V-band of the white dwarf spin period in the January 2004 outburst of DO (YY) Draconis', *J. Brit. Astron. Assoc.*, **115**(1), 25 (2005)

NGC 7331 and Stephan's Quintet

High overhead on autumn evenings and still well displayed as darkness falls in December, is the constellation of Pegasus. Pegasus is home to only one Messier object, the globular cluster M15, although there is a fine galaxy that Messier and his colleagues missed, the close coiled spiral NGC 7331 discovered by William Herschel in 1784. This Sbc galaxy is visible in large binoculars and particularly impressive in a 300mm or larger telescope when it appears about 8×2 arcminutes in size, with a bright oval core and faint stellar nucleus. Photographers and imagers will also be able to capture hints of the tight spiral structure.

Deep Sky Section member Jeremy Shears imaged the galaxy from Bunbury, Cheshire with his Takahashi FS102 refractor and Starlight Xpress SXV-M7 CCD camera. Also shown on Jeremy's image are some of the companion galaxies to NGC 7331. The brightest of these, NGC 7335, is magnitude 14.7 and will probably need a 400–500mm telescope to be detected visually from typical UK dark skies.

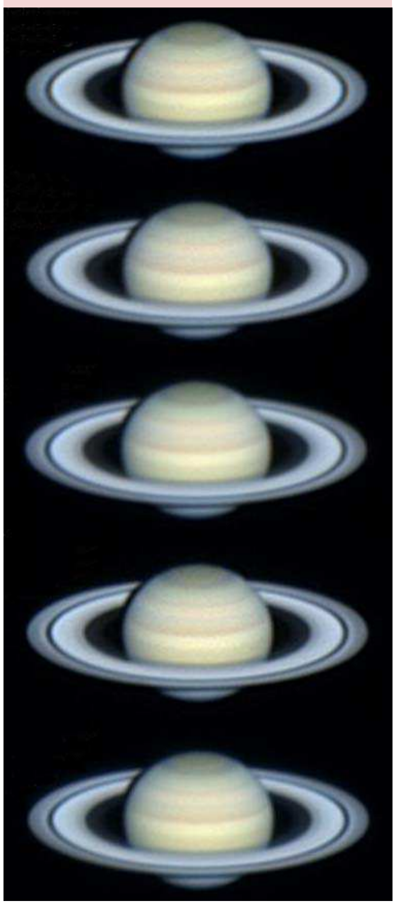
For those people without 'go-to' telescopes, NGC 7331 is traditionally the jumping off point for star-hopping to Stephan's Quintet, the cluster of 5 faint galaxies discovered visually by Jean Marie Stephan with the 40cm refractor at Marseilles Observatory in 1877 – the first compact group of galaxies discovered. They are all challenging objects visually, needing dark skies and a large aperture. I have observed them from my previous location in Fleet, Hampshire, using a 355mm Dobsonian, but there was a tendency for all the galaxies to merge into one. The galaxies, NGC 7317, 7318A, 7318B, 7319 and 7320 all lie within a circle just over 3.5 arcminutes across, so high magnification and averted vision will be needed to separate them clearly.

The group is also known as Hickson 92 in Paul Hickson's listing of compact galaxy groups, and Arp 319 in Halton Arp's listing of galaxies which appear gravitationally connected but in which there are discordant redshifts. The brightest member of the group, NGC 7320, has a visual magnitude of 12.6 and a lower redshift. It is now believed that this galaxy is much closer to us than the rest of the group and its apparent connection with the other galaxies is a line of sight effect. Jeremy's image of the

Bright galaxy NGC 7331 imaged by Jeremy Shears, Bunbury, Cheshire with a Takahashi FS102 f/8 refractor and Starlight Xpress SXV-M7 CCD camera, 8 min. exposure. North is at the top and west to the right.

The new apparition of Saturn begins

This sequence of five images of Saturn was taken by Toshihiko Ikemura, a resident of Nagoya City, Japan on 2005 September 18 between 19:30:02 and 20:10:38 UT, using a 310mm Newtonian with an ATK-2C electronic camera and IR blocker. Taken early in the 2005–'06 apparition of Saturn, the sequence shows regions of the planet north of the rings becoming visible for the first time in a number of years, as the latter begin to close. The newly exposed regions appear to have a blue cast. *Communicated by David Graham, Saturn Section.*



group shown here is a 15 minute exposure using the same equipment as for NGC7331.

I would be delighted to receive further images of all the galaxies mentioned here and visual reports, both successes and failures, would be particularly welcome. When sending in observations please remember to include all instrument and exposure details along with field orientation, field size, date, time and observing conditions.

Stephan's Quintet, also imaged by Jeremy Shears.

Stewart L. Moore,
Director, Deep Sky Section

Continued from page 310

Comet prospects for 2006

[45P/Honda–Mrkos–Pajdusakova] can approach quite closely to the Earth and will do so in 2011 (0.06 AU) and 2017 (0.09 AU). At present the Minor Planet Center only lists eight approaches closer than 0.06 AU out of 20 passes by any comet closer than 0.102 AU, and five of these are by periodic comets. It can also pass close to Venus and does so on June 4, when it passes at 0.083 AU. It was well observed in 1995/'96, when it reached 7th magnitude, but in 2001 it was fading from 9th magnitude. This is not a favourable return for UK observers, but it may be seen from further south during May and June when it is a morning object on its way in to perihelion.

52P/Harrington–Abell was discovered on a plate taken for the Palomar Sky Survey by Robert G. Harrington and George O. Abell. This is the eighth observed return of the comet since its discovery in 1955 and it never became brighter than 17th magnitude until 1998. It was not expected to get brighter than mag 15 at that return, however it was found in outburst at 12th magnitude, seven magnitudes brighter than expected, in 1998 July. After the outburst it faded, and it is unclear how bright it will get this time around. In any case, this is not a favourable return and is poorly placed for observation from the UK.

71P/Clark: Michael Clark of Mount John Observatory, New Zealand discovered this comet on a variable star patrol plate in June 1973. At discovery the magnitude reached 13, but alternate returns are unfavourable and it is then 5 magnitudes fainter, though it hasn't been missed. An encounter with Jupiter in 1954 put it into its present orbit, which is such that it can approach quite closely to Mars, passing within 0.09 AU in 1978. This is the comet's 7th return since discovery and it could reach 10th magnitude. It is best seen from the southern hemisphere and will not be visible from the UK.

73P/Schwassmann–Wachmann: Prof Arnold Schwassmann and Artur A. Wachmann of Hamburg Observatory discovered their third periodic comet on minor planet patrol plates taken on 1930 May 2. Initially of magnitude 9.5 it brightened to nearly mag 6, thanks to a very close approach to Earth (0.062 AU) on June 1. The initial orbit was a little uncertain and the comet wasn't found at the next or succeeding apparitions until 1979. The comet passed within 0.9 AU of Jupiter in 1953, and 0.25 AU in 1965. In August 1979, Michael Candy reported the discovery of a comet on a plate taken by J. Johnston and M. Buhagiar while searching for minor planets; this had the motion expected for 73P/Schwassmann-Wachmann, but with perihelion 34 days later than in a prediction by Brian Marsden. Missed again at the next return, it has been seen at the last three returns. At the 1995 return the comet underwent a major outburst near perihelion, reaching 5th magnitude when it was only expected to be mag 12. Subsequently four components were observed, though calculations by Sekanina suggested that the fragmentation occurred after the outburst. Three fragments were recovered in 2001, but only a few visual observations were reported as the comet was poorly placed and the absolute magnitude had clearly faded a little from the previous return. The components have now separated in the date of perihelion by roughly a day.

The comet's 1930 approach to Earth is currently ninth on the list of well-determined cometary approaches to our planet. In May the fragments will make another close approach, when the brightest one could again reach mag 7 or brighter, possibly even becoming visible to the naked eye. The encounter circumstances are favourable for the UK. At closest approach the fragments will be racing across the sky at around 4.5° a day, though they are separated by around ten degrees from each other. Their exact paths across the sky will only be determined after recovery due to uncertainties in the non-gravitational parameters for each fragment and the extremely close approach. The main fragment (C) is currently predicted to pass at 0.073 AU on May 13.22 when it is in Vulpecula. The other fragments (B and E) will follow it, approach closer and be further north in the sky (May 14.60, 0.065 AU; May 17.32, 0.052 AU); the pass of fragment E will replace the 1930 pass as the 9th closest cometary encounter and the other two will be 12th and 14th closest. After the encounter they rapidly head south and will be difficult to observe a week later.

With the orbit approaching so closely to the Earth, an associated meteor shower might be expected, and the comet has been linked to the Tau Herculid shower, though the radiant now lies in the Bootes–Serpens region. Strong activity was reported in 1930 by a lone Japanese observer, but little has been seen since then. It is likely that any future activity would be in the form of a short-lived outburst, confined to years when the comet is at perihelion.

There are several close cometary approaches in the 2nd decade of the 21st century. Three feature comets at perihelion this year, with 41P/ approaching to 0.135 AU in 2017, in addition to the approaches of 45P/ already mentioned. There are five others, with 2000 G1 passing at only 0.032 AU in 2016 (4th closest) and 2004 CB passing at 0.051 AU in 2014 (9th closest). The brightest pass is that of 46P/Wirtanen, which may be a circumpolar object of 3rd magnitude over Christmas 2018, when it passes 0.076 AU at mid-month.

76P/West–Kohoutek–Ikemura was discovered in 1975 following a very close encounter with Jupiter in 1972 which produced one of the largest reductions of perihelion distance on record, reducing q from 5.0 to 1.4 AU. Lubos Kohoutek was actually taking a confirmation plate for a second comet (75P/Kohoutek) discovered 18 days earlier and then lost. Although 12th magnitude at the discovery apparition, this is another comet that has not done so well on subsequent returns and it may not trouble visual observers this time round.

80P/Peters–Hartley: This will be the fifth observed return of this comet, which was discovered in 1846, then lost until it was accidentally recovered in 1982. At its first apparition the comet was quite bright, mag 8–9, which suggests that its absolute magnitude may have faded over the past 150 years. No visual observations were reported at the last return when it was expected to reach 13th magnitude, though it was observed in 1990.

102P/Shoemaker was discovered at a very favourable return in 1984, following a close

Comets reaching perihelion in 2006

Comet	*T*	*q*	*P*	*N*	H_1	K_1	*Peak mag*
3D/Biela	Jan 23	0.8	6.7	6	8.1?	10.0	?
170P/Christensen (2005 M1)	Jan 26.8	2.93	8.63	1	12.0	10.0	18
LINEAR (2002 VQ94)	Feb 6.7	6.80	3000	0	9.5	5.0	18
LINEAR (2004 B1)	Feb 7.9	1.60		0	10.5	5.0	13
NEAT (2004 D1)	Feb 10.8	4.97		0	11.5	5.0	18
132P/Helin–Roman–Alu	Feb 15.0	1.92	8.28	2	10.1	10.0	15
P/Catalina (2005 JY126)	Feb 21.3	2.13	7.27	0	11.5	10.0	17
McNaught (2005 E2)	Feb 23.5	1.52		0	5.5	10.0	9
Christensen (2005 B1)	Feb 23.6	3.20		0	6.5	10.0	14
LINEAR (2005 G1)	Feb 27.3	4.96		0	8.0	10.0	18
98P/Takamizawa	Mar 6.5	1.66	7.40	3	11.5	15.0	16
83P/Russell	Apr 7.7	2.17	7.62	2	12.0	10.0	16
LINEAR (2003 WT42)	Apr 10.8	5.19		0	9.2	5.0	16
P/LONEOS (1999 RO28)	May 11.8	1.23	6.61	1	18.0	5.0	20
71P/Clark	June 7.2	1.56	5.52	6	8.6	15.0	10
102P/Shoemaker	June 7.3	1.97	7.23	3	8.0	15.0	14
73P/Schwassmann–Wachmann (C)	June 7.4	0.94	5.36	5	5.5?	7.0	?
73P/Schwassmann–Wachmann (B)	June 8.2	0.94	5.36	1	5.5?	7.0	?
73P/Schwassmann–Wachmann (E)	June 9.6	0.94	5.36	1	5.5?	7.0	?
41P/Tuttle–Giacobini–Kresak	June 11.3	1.05	5.42	9	7.0	15.0	7
45P/Honda–Mrkos–Pajdusakova	June 29.8	0.53	5.25	10	11.0	11.1	9
5D/Brorsen	July 6	0.6	5.7	5	9.3?	10.0	?
P/Hug-Bell (1999 X1)	July 6.7	1.95	7.06	1	13.5	10.0	18
84P/Giclas	Aug 7.5	1.85	6.97	5	9.5	20.0	16
SOHO	Aug 8	0.05	3.93	1	14?	5.0	7 ?
52P/Harrington–Abell	Aug 14.8	1.76	7.54	7	6.8	15.0	13
D/Skiff–Kosai (1977 C1)	Aug 31	2.80	7.47	1	8.5	15.0	?
114P/Wiseman–Skiff	Sep 13.2	1.58	6.68	3	11.5	15.0	16
80P/Peters–Hartley	Sep 25.8	1.63	8.14	4	8.5	15.0	13
112P/Urata–Niijima	Oct 29.6	1.46	6.67	3	14.0	15.0	15
P/Hergenrother (2000 C1)	Nov 6.9	2.09	6.62	1	14.0	10.0	19
D/Lovas (1986 W1)	Nov 23	1.40	6.61	1	10.0	10.0	?
4P/Faye	Nov 15.5	1.67	7.55	19	6.0	20.4	10
P/Shoemaker–Levy (1991 V1)	Nov 17.0	1.13	7.53	1	10.5	10.0	11
76P/West–Kohoutek–Ikemura	Nov 19.6	1.60	6.48	4	8.0	30.0	14
P/LINEAR (2000 R2)	Dec 15.1	1.46	6.13	1	18.0	10.0	21

The date of perihelion (T), perihelion distance (q), period (P), the number of previously observed returns (N), the magnitude parameters H_1 and K_1 and the brightest magnitude are given for each comet. The date of return of 3D/Biela and 5D/Brorsen must be regarded as highly uncertain, whilst both D/Skiff–Kosai and D/Lovas have only been seen once and missed at several returns. *Note:* $m_1 = H_1 + 5.0 * \log(d) + K_1 * \log(r)$

approach to Jupiter in 1980 which reduced the perihelion distance from 3.8 to 2.0 AU. In 1984 it reached 11th magnitude, however no further visual observations have been reported to the Section. This apparition is a little better than the last one, but it will probably not be until the next apparition, which is similar to that of the discovery, that we will visually observe it again.

1991 V1 (P/Shoemaker-Levy) was discovered by the Shoemaker-Levy team with the Palomar Schmidt on 1991 November 7 at photographic magnitude 13. Prior to discovery it was at high southern declinations and could potentially have been discovered by amateur comet seekers. It wasn't seen last time round, but the circumstances this time are similar to that of discovery. It will initially be a southern hemisphere object, but moves north after perihelion, so that UK observers may pick it up in late November. It could be 11th magnitude, but many one-apparition comets disappoint the next time they are recovered.

Comet **2005 E2 (McNaught)** was discovered by BAA member Rob McNaught at Siding Spring on 2005 March 12.75 with the 0.5m Uppsala Schmidt, during the course of the Siding Spring Survey. It reaches perihelion at 1.52 AU in late February 2006, when it could reach 9th magnitude. It should become visible to UK observers in December and will remain visible at mag 9–10 until April, when it enters solar conjunction. Next best of recently discovered objects is comet **2004 B1 (LINEAR)**, which may reach 13th magnitude. Sebastian Hoenig has predicted that **2002 R5 (SOHO)** may return in August. If his prediction holds, the object could become visible to southern hemisphere observers prior to perihelion, but is unlikely to be brighter than 12th magnitude.

Several other periodic and parabolic comets are at perihelion during 2006, however they are unlikely to become brighter than 13th magnitude or are poorly placed. Ephemerides for these can be found on the CBAT WWW pages. 3D/Biela, and 5D/Brorsen have not been seen since the 19th century, whilst D/Skiff–Kosai and D/Lovas were only seen once, and for all four the likely perihelion dates and magnitudes are extremely uncertain.

Looking ahead to 2007, the two brightest comets are 2P/Encke and 96P/Machholz, and there may be more than two dozen fainter ones. 2P/Encke puts on a brief showing in the evening sky just before perihelion, when it may be a binocular object. After perihelion it may be visible in the SOHO LASCO coronagraph field or that of its successor. 96P/Machholz is also best seen in the coronagraph field, when it reaches 2nd magnitude. UK observers may pick it up after perihelion, but it will be a fading telescopic object. 8P/Tuttle is really a comet for 2008, however it could be a binocular or even naked eye object at the close of 2007 as it makes a close pass of the Earth at 0.25 AU at the beginning of the new year.

Jonathan Shanklin, *Director, Comet Section*

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Letters

Seasonal terrestrial optical effects

From Dr David Airey

Bill Livingston's recent interesting paper on 'Colour and light in nature' [*JBAA* vol.**115**(5) p.247] prompted me to offer two of my own photographs that may be of interest to members.

Figure 1. The longest legs on the (near) shortest day, 2003.

Figure 1 concerns the effects of bright, low angle Sun and terrain geometry on shadows. The image was taken during a walk in the New Forest on 2003 December 21 at 13:59 UT. The image is a shadow self-photograph of me and my walking stick. The Sun was at near winter-minimum mid-day altitude which results in long shadows. The shadow length is amplified by the initial downwards slope of the path in front of me, but the path slope rises again to horizontal in the region of my torso and head. The effect is compounded by the reducing image angle subtended at the camera lens with increasing object (shadow) distance. So, the overall effect on the image is that I have very long (fat) legs and an apparently foreshortened body, with a 'pin sized' head around 1/10th the width of my near-field leg.

Figure 2 demonstrates the reflective nature of some animals' eyes when fully dark-adapted (maximum iris aperture). The fox was imaged with camera 'flash' in the road, outside of my front gate, in the early snow of 2004 January 28 at 18:48 UT. This animal, I suspect, is one of the family that killed my baby bantams earlier in 2003. Nonetheless, the natural response of its eyes to the incoming 'flash' rays is to partially negate that input by reflection, in an attempt to preserve its night vision. Rabbits' eyes, on the other hand, do not seem to react in this way; only a red reflection photographic image ('red-eye'?) is seen. Following the encounter, the fox nonchalantly sloped off having decided that no dinner was available that night from number 29.

Figure 2. Fox in the snow with 'headlights'.

David Airey

'Argosy', 29 Fairview Drive, Hythe, Southampton SO45 5GX. [dave@aireyassociates.co.uk]

The total solar eclipse of 2006 March 29

From Mr Peter Macdonald

The track of totality on 2006 March 29 crosses central and north Africa, Turkey and central Asia, the greatest duration of 4m 07s taking place in southern Libya, close to the border with Chad. The eclipse belongs to the same series as that of 2186 July 16 which has the longest duration of any known total eclipse.

In the British Isles a partial eclipse is visible during the morning, the magnitude ranging from 0.14 in the Outer Hebrides to 0.30 on the Kent coast. The Table gives some local circumstances. The angle P is measured from the north point of the Sun's disk through east while the angle V is reckoned anticlockwise from the vertex.

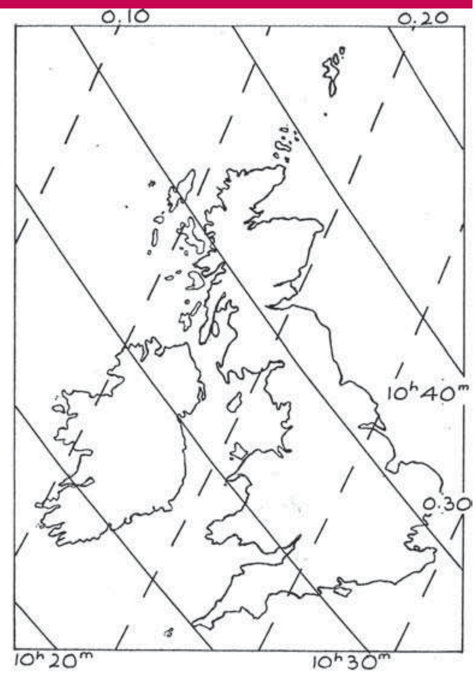
The penumbra over the British Isles is illustrated in the Figure, from which may be obtained the time and magnitude of greatest eclipse for any location.

Peter Macdonald

46 Vista Way, Harrow, Middlesex, HA3 OSL

Local circumstances in the British Isles for the partial solar eclipse of 2006 March 29

	Begins			*Middle*		*Ends*		
	UT *h m*	*P (°)*	*V (°)*	*UT* *h m*	*Mag*	*UT* *h m*	*P (°)*	*V (°)*
Edinburgh	09 55	179	202	10 36	0.20	11 17	106	117
Greenwich	09 45	185	211	10 33	0.28	11 22	98	107
Liverpool	09 49	181	206	10 32	0.22	11 16	104	115
Plymouth	09 42	182	211	10 27	0.24	11 13	101	116



Blackout

From Mr David Frydman

On 2005 August 29/30 there was a major power cut at my address and in the surrounding area from 23:33 UT to 24:29 UT, and also later a second cut.

I was observing with binoculars and it instantaneously became dark. The sky was cloudless with fair transparency. The sky background became five to ten times darker, but obviously the whole of London was not affected. The extent of the cut was to 2,375 properties plus all street lights, a high voltage fault restored by switching. I estimate that just under one square mile was blacked out. This is one thousandth the area of London. Normally I suffer serious light pollution.

The limiting stellar magnitude was about 0.4m better. More stars were visible but not enormously so. Alcor was easy with the naked eye and distance glasses, although fairly low in a hazy area. However, I can see Alcor even with the normal light pollution.

What was dramatic was that I could not see anything in my flat and had to feel the walls until I could find a torch. I do not recall that happening previously in London. I could see nothing in my room until I was 15 minutes dark adapted, then I could see a glimmer of light leaking from the top of the drawn curtains. I do not know the limit of human vision, but it was less than my luxmeter which reads to 0.1 lux.

It would be wonderful if there were a power cut every night for two hours from midnight, but unfortunately they are very rare.

David Frydman

6 Berkeley Court, Ravenscroft Avenue, London NW11 8BG

Extreme declinations of the Moon in 2006

From Dr Darren Beard

The sidereal period of the Moon is about 27.32 days on average. During this period, the Moon has a maximum northerly declination, followed about 14 days later by a maximum southerly declination. However, the orbit of the Moon is very complicated and is affected by the influence of the Sun, the planets and even by the asteroids. Due to these effects, the extreme declinations of the Moon are not the same every month. There is a cycle of 18.61 years during which the extreme declinations range from about ±18.2° to ±28.7°. The maximum declinations occur when the ascending node of the Moon's orbit coincides with the vernal equinox.

During the year 2006, the Moon will reach an extreme southerly declination of –28° 43′ 23" on March 22 at 16:54 UT. The Moon has not had such an extreme southerly declination since 1950 September 19. It will not be further south in the sky until 2025 March 22.

The extreme northerly declinations immediately before and after March 22 are not the most extreme for the year 2006. The most extreme northerly declination of the Moon will occur on 2006 September 15 at 01:27 UT (Meeus J., personal communication). The Moon will then be at declination +28° 43′ 22". The Moon has not been further north in the sky since 1969 March 25.

When will the Moon next be further north in the sky? Not for many hundreds of years! One of the factors affecting the extreme positions of the Moon is changes in the orbit of the Earth around the Sun. The secular decrease of the obliquity of the ecliptic is gradually making the extreme declinations of the Moon less extreme as time passes (Meeus J., *Mathematical Astronomy Morsels*, Willmann–Bell, 1997). The result is that the extreme northerly declination of the Moon in 2006 September will not be exceeded for at least 800 years and probably much longer. Likewise, the extreme southerly declination in 2025 March will not be exceeded for at least 800 years and probably much longer.

Darren Beard

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Great observatories of the world

by Serge Brunier & Anne-Marie Lagrange

Firefly Books, 2005. ISBN 1-55407-055-4. Pp 240, £35.00 (hbk)

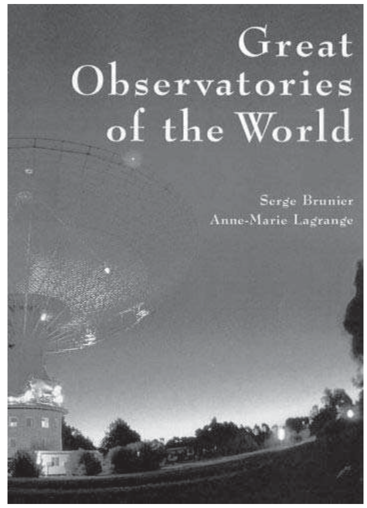
This is an exciting book describing nearly 60 observatories worldwide and some off-world too. Optical observatories dominate, but the whole spectrum from gamma to radio wavelengths is covered. Collectively the book provides a convenient reference to a mass of information that even the dedicated Internet user would be hard pressed to match.

The book, translated from French, has a few typos and minor factual errors of no great consequence. The period from Galileo's first telescopic observations [1609] to Palomar's 5m Hale is condensed into the first nine pages. The great refractors like Lick and Yerkes and historic observatories like Greenwich or Meudon get scant mention. The book's emphasis is on cutting-edge astronomy and the observatories that support these goals.

French observatories, despite their modest instrumentation, get initial billing. Coverage then spirals outwards through Europe including the Canaries to north and south America – the former includes Hawaii's Mauna Kea whilst Australia's Siding Spring concludes the optical section. Both optical and radio observatories are covered equally in each continent. The final third of the book describes space telescopes from gamma and X-ray through to infrared, and concludes with telescope plans for the future, both space and ground-based. For the latter ESO's 100m aperture OWL (OverWhelmingly Large) optical telescope is destined for Chile – looking like a radio dish but presumably with a surface precision orders of magnitude better to work at optical wavelengths.

At regular intervals throughout the book, sections describe how telescopes operate and collect data. These are brief but lucid and cover many topics like atmospheric turbulence, adaptive optics and detectors, astrometry, interferometry and spectroscopy, data reduction and analysis. Classic hemispherical domes are no longer in vogue – their modern counterparts are shed-like and often completely open at night to allow the free flow of air to minimise the effects of atmospheric turbulence. Each telescope description includes the working parameters of resolution against designed waveband and limiting magnitudes for a given exposure via quantum efficient CCD detectors.

Many of these great observatories will be familiar to the reader from popular journals, but some less so. It is interesting to read of the former secret US Air Force Starfire base in New Mexico that pioneered laser ranging and adaptive optics in the 1980s as part of the 'Star Wars' initiative – this technology has now migrated to major astronomical observatories. An unusual design is the 10m Hobby–Eberly at Mt Locke in Texas and its counterpart at Sutherland in South Africa. Both huge telescopes point to a fixed elevation but can rotate in azimuth to cover 70% of the sky throughout the seasons. The telescopes are exclusively used for spectroscopy, reaching mag 23 in two hours' exposure – the limit for moving the gantry across the static telescope's field of view. However, this compromise reduces the project cost to about 15% of that of a fully-tracked giant like Keck.



The appendices are comprehensive with a map showing observatories worldwide and the URL for the 100 largest. A page shows graphically the 50 largest optical mirrors from 10m Keck to 2.4m Hubble – the UK's 4.2m William Herschel on La Palma trails in 20th place. The largest optical mirrors are mosaiced from smaller hexagonal sections to form huge collecting surfaces, much like a radio dish. Keck's 10m is the current limit whilst this reduces to 8m for monolithic mirrors – they assume a paraboloidal shape whilst spuncast in a furnace prior to cooling and final figuring. In October 2005 the consortium for the Giant Magellan Telescope announced a 25m aperture multi-mirror telescope of seven mirrors brought to a common focus with the outer six mirrors spuncast as off-axis parabolas.

In summary this is a stunning book profusely illustrated in full colour on quality paper. The double page Sagittarius starfield alone, showing thousands of pinpricks of light, is jaw dropping even for non-astronomical friends. If your forthcoming seasonal presents don't set you alight then buy this volume for yourself – you will not be disappointed.

Maurice Gavin

Maurice Gavin is a BAA past president and retired architect with a passion for observation and spectroscopy, often under his homebuilt dome.

Robert Hooke and the English Renaissance

by Paul Kent & Allan Chapman (Eds.)

Gracewing Publishing, Leominster, 2005. ISBN 0-85244-587-3. Pp xii + 191, 15.99 (hbk).

The tragedy of Robert Hooke is that he lived at the same time as Isaac Newton, who has cast a shadow over all others of his time. Hooke had to wait for over 250 years before becoming the subject of a biography (Margaret Espinasse's *Robert Hooke: New Studies,* 1956, reviewed in the *Journal* vol. 67), and with one exception in the 1980s, almost another 50 years passed before he attracted more.

The tercentenary of his death in 2003 has led to the appearance of a number of volumes devoted to Hooke and his work. Hooke was without doubt one of the most important figures of his time, and even under the shadow of Newton he was and still is one of the giants of science during the late 17th century. It is therefore very difficult to imagine how so much detail could be packed into such a small number of pages, as has been achieved by the authors of the book now under review. Written (and, almost as importantly for a multi-authored work, edited) in a clear and succinct style, well illustrated and presented, the fact that the various chapters complement each other with little duplication is a clear indication of the careful and expert editing that has gone into this work. This book is probably the best (a comment which given the quality of the other works, is not easily made) of those on the subject that I have read.

The book is divided into nine chapters, each dealing with an aspect of Hooke's interests, and with only one exception, free of mathematics. Each chapter is written by a specialist in their field; the authors include Allan Chapman, Sir John Enderby (Physical Secretary of the Royal Society), Ellen T. Drake, Gerard L. E. Turner, Edmund C. Hambly (former president of the Royal Academy of Engineering), M. A. R. Cooper,

A. A. Mills and P. W. Kent, with a preface by Sir Arnold Wolfendale, the former Astronomer Royal. Naturally, as an astronomer, I found the chapter by Allan Chapman on Hooke's astronomical work of particular interest, but equally the other chapters, covering his life as a whole (also by Allan Chapman), his early life in Oxford, his relationship with the Royal Society, his ideas on the Earth in space, his work with the microscope and the writing of his *Micrographia*, his inventiveness and mechanical ability and finally his role in the rebuilding of London after the Great Fire, were all as engrossing. What is brought out very clearly is the complex nature of Hooke's character, and why he acquired a reputation for rarely completing projects, due to the sheer volume of work he undertook.

The book is well referenced and illustrated throughout, and although no known likeness of Hooke exists, a conjectured likeness using descriptions of him by his contemporaries (drawn by Rachel Chapman) appears opposite the title page. I can thoroughly recommend this book, and at the price stated it is without doubt value for money.

Anthony Kinder

Tony Kinder is Director of the BAA Historical Section.

Sky notes

by Neil Bone

2005 December & 2006 January

Sun, Earth and Moon

The northern hemisphere winter solstice occurs on December 21 when, at 18h 35m Universal Time (UT, equivalent to GMT), the Sun reaches its most southerly position for the year. Around this date, the days are at their shortest, and during the few hours when it is above the horizon the Sun cuts a low arc across the southern sky. The Solstice is taken calendrically to mark the start of winter, but astronomers are probably more inclined to follow meteorological convention, wherein the season starts at the beginning of December.

The short hours of daylight limit opportunities for solar observing – indeed many of us may only see the Sun at weekends as the season of dark mornings and dark evenings for the daily commute is here. Those who can continue daily monitoring of the solar disk (projection remains the recommended safe method) will find a relative dearth of sunspot activity. Solar minimum is expected during 2006, and after a remarkably active 'tail' with several large, complex active regions up to 2005 September, sunspot cycle 23 is now winding down. Spotless days have become more common of late.

Experienced observers are on alert for the appearance of the first spots of cycle 24, which should be starting to break out at higher solar latitudes, while the last few of the current cycle are close to the Sun's equator.

The Moon is New on December 1 and 31, and on January 29: dark skies will usher in 2006! Full Moon, high against the stars of Gemini in December and Cancer in January will swamp all but the brighter stars on December 15 and January 14: faint-object observation will be restricted for several days to either side of these dates.

Earth reaches perihelion, the closest point to the Sun in its elliptical orbit, on January 4.

The planets

Early risers have a good opportunity to view Mercury during the opening half of December. The planet reaches its greatest elongation 21° west of the Sun on December 12, and for several mornings to either side of this date will be rising almost two hours ahead of the Sun. At magnitude –0.5, Mercury will be reasonably prominent as a 'spark' low in the southeastern sky. By late December, Mercury becomes lost in the near-solar glare, and the planet eventually reaches superior conjunction on the Sun's far side on January 26.

Having been rather poorly placed for much of 2005, Venus finally comes to real prominence as an 'evening star' in early December. Setting 3h 30m after the Sun, Venus shines as a brilliant mag. –4.5 beacon in the early-darkening west/southwest sky. Greatest elongation was reached early in November, but Venus remains quite far east from the Sun until mid-December. Around Christmas, though, the planet begins to close back in towards the Sun by a degree per day, and the apparition comes to an abrupt end in early January. During the latter stages of the visibility period, Venus will show a large but slender crescent phase – similar to that of the young Moon a few days after New. The phase should be discernable even in 10×50 binoculars.

Venus reaches inferior conjunction between the Earth and Sun on January 13, emerging rapidly thereafter into the morning sky. By late January, Venus will be rising around 06h local time, almost two hours ahead of the Sun. At this time its crescent phase (now resembling the Moon just before New) will again be easily seen in binoculars and small telescopes.

Following early November's opposition, Mars rapidly becomes less favourable for observation during December. Earth's orbital motion carries us quickly away from the Red Planet, with the result that the apparent disk diameter diminishes from 17 arcseconds at the beginning of December to 12 arcseconds at the close of 2005. Those with larger telescopes – 200 mm aperture upwards – should still be able to pick out some surface detail, but Mars will be less rewarding for observers with more modest equipment. In addition to showing a reduced apparent disk, Mars fades from mag. –1.5 in early December to mag. 0 in late January, becoming much less conspicuous as it moves eastwards against the star background from Aries into Taurus, west (right) of the Pleiades.

Jupiter is an early morning object in December, relatively poorly placed low down against the stars of Libra in the southeastern sky during the last couple of hours of the night. Even in late January, the mag. –2 giant planet won't be up until about 02h UT, and most observers will wait until spring for more convenient viewing opportunities.

Saturn, in Cancer close to the Praesepe open cluster M44, – an attractive pairing for binocular viewing – is well-placed, reaching opposition on January 27. With the planet a little further south in the sky, the presentation of the rings is noticeably less open than it was a year ago: Saturn's north polar region is no longer hidden behind the rings. The rings are still sufficiently well open that they can be easily resolved in small amateur telescopes in the 60–80mm aperture bracket. Larger instruments will reveal some of the subtly-shaded cloud features on the globe of the planet itself.

Magnitude +8 Titan, Saturn's largest satellite, can be found due west of the planet at a distance of about three ring-spans on December 5 and 21, and January 6 and 22; Titan will be due east of Saturn eight days after these dates.

Minor planets

Two of the larger, brighter asteroids come to opposition in this interval, and will be in range for binocular observation. (3) Juno, a shade brighter than mag. +8, can be found a little west of Orion's Belt, slowly moving retrograde (westwards) against the star background from night to night. Juno is at opposition on December 12.

(4) Vesta is an easier binocular target, at mag. +6, reaching opposition against the stars of western Gemini on January 5.

Meteors

The Geminids, active from December 7–15, are poorly-placed in 2005, with the Moon only a couple of days from Full at the shower's normally-prolific Dec 13–14 maximum.

Darker skies prevail for the Ursids, a poorly-observed shower which normally produces fairly modest activity (perhaps 5 meteors/hr) between December 17 and 25. Maximum falls on Dec 22–23, and evening observations at this time will be unaffected by moonlight. The shower radiant, near the bowl of Ursa Minor's 'dipper', is circumpolar. The Ursids have produced outbursts of unexpectedly high activity in the past, and this much-neglected shower really merits more careful attention.

The Quadrantids open 2006 with a reasonably favourable return. Active between January 1–6, the shower has a very narrow maximum, with the highest rates in a six-hour interval on Jan 3–4. Peak in 2006 is expected close to Jan 3d 17h UT, as night falls in western Europe. At this time, the radiant (in northern Boötes) is sinking in the northwestern sky, and although circumpolar, it will remain low for observers at the latitudes of the British Isles until the early hours. Watches on the evening of Jan 3–4 should still be productive, and later on the numbers of bright Quadrantids, particularly, could make for rewarding viewing.

Following the Quadrantids, meteor activity in January–February slumps to its lowest for the year, with only very minor shower and low sporadic rates in evidence.

Variable stars

Algol (Beta Persei) can be caught at minimum early on the evening of December 2, and on the nights of Dec 19–20 and 22–23. Further opportunities come on Jan 8–9 and 11–12, and the evening of January 14. This famous eclipsing binary system fades from maximum magnitude +2.1 (where it spends much of its time) to mag. +3.4 at minimum, the decline and recovery each taking five hours; long, dark midwinter nights offer the determined observer a chance to follow entire eclipse cycles. Brightness estimates can be made using Alpha Andromedae (mag. +2.1) and Kappa Persei (mag. +3.8) as comparisons, at intervals of 15–20 minutes. Plotted as a light curve, the estimates, requiring no more equipment than the naked eye, can be used to establish the time of mid-eclipse with reasonable accuracy.

Among winter's other prominent variable stars is Rho Persei, a close neighbour in the constellation to Algol. Rho is a pulsating orange-red giant star, showing several overlapping cycles of variation over an extreme range from mag. +3.3 to 4.0: in any one observing season, the maximum range is more usually a few tenths of a magnitude. Rho Per varies quite slowly, and naked-eye estimates at weekly intervals suffice to keep the star covered. Good comparisons include Eta Aurigae (mag. +3.2), 41 Arietis (mag. +3.6) and Iota Persei (mag. +4.1).

Deep sky

The northern winter Milky Way is rather wan in comparison with its bright summer counterpart. On a good, clear moonless December/January night, however, the faint band of our galaxy can be seen extending from Cassiopeia and Perseus high overhead, into Auriga, clipping the feet of Gemini, and on to Orion's east through the star-sparse constellation Monoceros, before reaching the southern horizon via Canis Major and Puppis. Along this span, formed by a spiral arm lying beyond ours in the direction of the Galaxy's rim, are found a number of excellent open star clusters. On the best nights, it can be a rewarding experience to lie back in a garden recliner and sweep from the zenith downwards along the Milky Way using a pair of 7×50 or 10×50 binoculars. Tucked between Cassiopeia's 'W' and the northern end of Perseus, the 'Double Cluster' NGC 869 and 884 is the first of many fine objects which will be swept up; on a good night, this pairing is visible to the naked eye as an elongated hazy patch. Binoculars will show a coarse scattering of stars over an are three Moon-widths across, while a small telescope reveals maybe a couple of hundred stars in each cluster, and will bring out the colour of the numerous evolved red giants intermingled here.

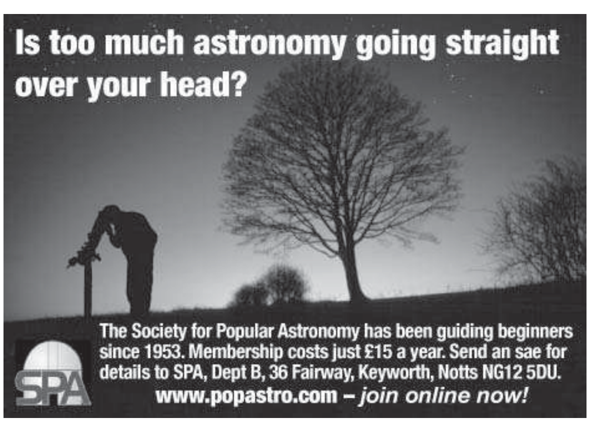
Continuing the sweep southeastwards in the direction of Auriga brings the fine trio of M38 (NGC 1912), M36 (NGC 1960) and M37 (NGC 2099) into view: these are 'knots' in the Milky Way as seen in binoculars, and in a small telescope each reveals a subtly different character. All three are packed with faint stars.

Further on, at the northwest (upper right) corner of Gemini, M35 (NGC 2168) is a real winter showpiece. Under the very best conditions, this is visible with the naked eye as a fifth-magnitude fuzzy spot. In binoculars, M35 becomes a circular haze comprising a couple of faint (mag. +8 to +9) stars in a 30 arcminute wide area – about the same apparent size as the Moon. Any small telescope will resolve it better still, while instruments of 150mm aperture upwards will reveal the compact NGC 2158 near M35's southwestern edge. NGC 2158 is a much more remote cluster in the same line of sight, at a distance of 16,000 light years compared with 2800 light years for M35.

South from Gemini into Monoceros, the sparse but bright NGC 2244 – the cluster at the heart of the visually-elusive Rosette Nebula – is always attractive at low magnifications. Also in Monoceros, M50 (NGC 2323) is a coarse scattering of fainter stars in an area about 15 arcminutes across, located one-third of the way from Sirius on the line connecting the Dog Star and Procyon.

Many, many more less conspicuous clusters populate the winter Milky Way, and despite its comparative faintness, this really is a rich hunting ground for deep sky observers.

Neil Bone



Notice board

Meetings diary

2005 December 17
BAA Christmas Meeting. 14:30–18:00, English Heritage Lecture Theatre, Savile Row, London W1. Featuring the Christmas Lecture, Prof Don Kurtz, 'It's about time,' and Mr Rod Jenkins, 'The star of Bethlehem'.

2006 January 21
3rd BAA 'Back to Basics' workshop, Canterbury, Kent. See adjacent notice.

2006 January 25
BAA Ordinary Meeting. King's College, Guy's Hospital, London SE1 9RT (see map opposite). Chris Lintott, 'Cosmology for the terrified', Martin Mobberley, 'Winter sky notes'.

2006 February 25
BAA Observers' Workshop. Berrill Lecture Theatre, Open University, Milton Keynes. Solar and lunar observing – full details in the February *Journal*.

2006 March 4
Deep Sky Section meeting at the Humfrey Rooms, Castilian Terrace, Northampton. Full details in the February *Journal*.

2006 March 22
BAA Ordinary Meeting. King's College, Guy's Hospital, London SE1 9RT.

2006 April 7–9
BAA Winchester Weekend, at King Alfred College, Winchester, Hants.

2006 April 21–23
BAA weekend meeting, Liverpool.

2006 May 20
Ilkeston & District Astronomical Society Silver Jubilee Convention, Heanor, Derbyshire, 10:00 a.m.–4:00 p.m. Guest speakers, trade stands, refreshments. Quality raffle. Parking on site and public car park next door. Close to town centre, convenient for public transport. Further details from Mary McNulty, 0129 878234.

Items for this diary should be sent to the *Journal* Editor [hazelmcgee@compuserve.com] as soon as dates and locations are known. Details of all astronomical meetings of regional or national interest are welcome. The Editor's decision on inclusion or otherwise of any meeting in this listing is final.

Are you new to Astronomy?

Then the 3rd BAA Back to Basics Workshop is for YOU

Saturday 2006 Jan 21, at the University of Kent, Canterbury

The aim of this event is to help everyone who has recently become interested in astronomy to learn some of the basic techniques and develop the interest to its full potential. Speakers include Mike Foulkes, Guy Hurst, Bob Marriott, Martin Morgan–Taylor, Kevin Smith. Practical sessions by BC&F Ltd., solar observing, equipment demonstrations.

The cost is only £10 per person, including lunch and refreshments. Bookings and remittance must be sent to the BAA office by 2006 January 6. For further details see the booking form enclosed with this Journal.

Erratum

Martin Male was inadvertently omitted from the list of Campaign for Dark Skies committee members on page 267 of the October *Journal*. Apologies from Bob Mizon.

Learn more about the BAA Campaign for Dark Skies at ***www.dark-skies.org***

Office closure

Members are advised that the BAA offices in Burlington House will be closed for Christmas and the New Year from Friday Dec 23 to Monday 2006 January 2 inclusive. The Officers, Council and office staff wish all members the very best for the festive season, and clear skies and good observing in 2006.

BAA Membership

The subscription rates for the 2005–2006 session are as follows:

Junior Members (under 18 years of age on 1st August) £14.50
Intermediate Members (18 or over and under 22) £17.50
Ordinary Members (22–64) £37.00
Senior Members (65 or over) £25.50

Affiliated Societies £37.00

Members of 50 or more years' standing no charge

Family Membership:
Where both Members are under 65 on 1st August £40.50
Where one or both Members are 65 or over £27.50
Family Membership is available for couples living at the same address. Only one *Journal* and *Handbook* will be sent although both may use the Library, attend meetings and have a vote.
Associate Membership £10.00

Associate Membership is open to all, including societies, but especially to educators and those under 18. Associate Members will receive the BAA *Handbook*, and may use the Library and attend meetings. They do not have a vote.

Circulars (if required):
UK and Europe £4.00
Outside Europe £9.00

Postage:
Overseas postage by surface mail for the *Journals* and *Handbook* is included in the above rates. To avoid postal delays and losses use of airmail is strongly recommended. Please add the following for airmail:

Europe (including the Canary Islands and Turkey) £9.25
Near and Middle East, the Americas, Africa, India, Malaysia, Singapore and Hong Kong £16.00
Australia, China, Japan, New Zealand, Taiwan and the Pacific Islands £17.70

Payment may be made in Sterling, US$ or Aus$, or by credit card using the BAA's secure website **www.britastro.org**. UK members are particularly requested to save administrative costs and time by paying their subscriptions by Direct Debit.

New members joining between August and January will be sent the publications of the current session. New members (regardless of age) joining between February and June may pay the reduced rate of *either* £21.00 for the February, April and June *Journals* plus the current *Handbook* or £14.00 for the above *Journals* without the *Handbook*.

Gift Aid

UK Income Tax payers are urged to complete a Gift Aid certificate for their subscriptions and other donations. Please request a Gift Aid form from the Office if you have not previously completed one. The BAA can claim a tax refund at any time during the year.

The next BAA meetings:

2005 December 17, 14:30 hrs at the English Heritage Lecture Theatre, 23 Savile Row, London W1

The Christmas Lecture

Prof. Don Kurtz – It's about time

and **Rod Jenkins – The star of Bethlehem**
Martin Mobberley – Sky notes

Tea or coffee will be served before the meeting, but we regret that a Christmas Lunch is not available this year.

Wednesday 2006 January 25, 17:30 hrs

Ordinary Meeting

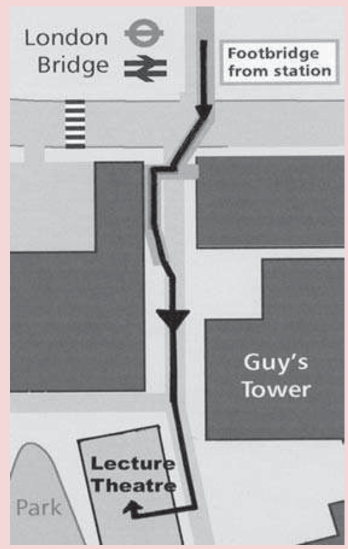
at Lecture Theatre 2, New Hunt's House, King's College, Guy's Hospital, St Thomas Street, London SE1 9RT

PLEASE NOTE NEW VENUE: SEE MAP

Chris Lintott – Cosmology: into the unknown

Martin Mobberley – Winter sky notes

and other speakers TBA



Small advertisements

25p per word, minimum £5.00. Box number 40p extra.

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