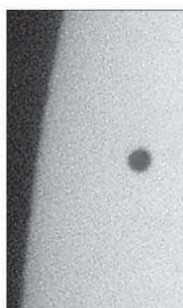
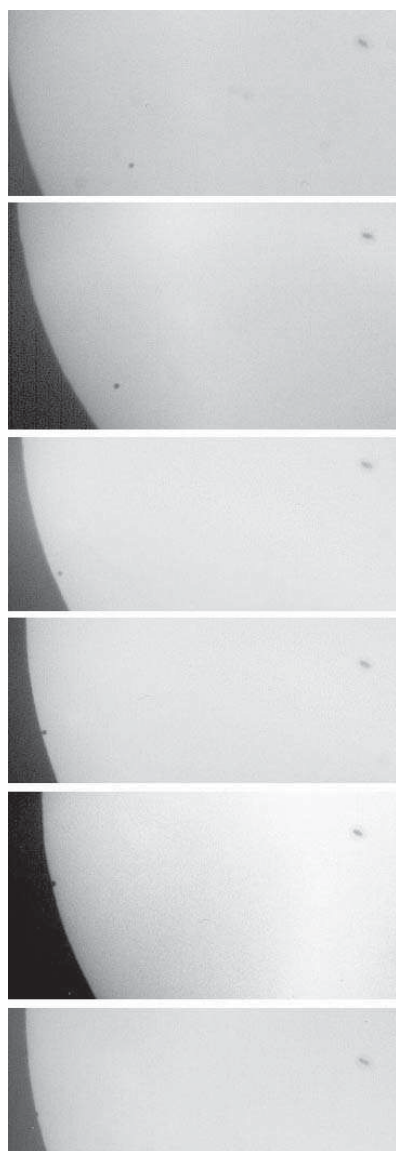
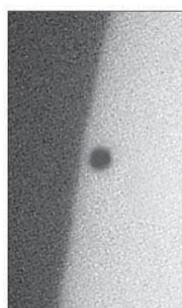




The transit of Mercury, 2003 May 7



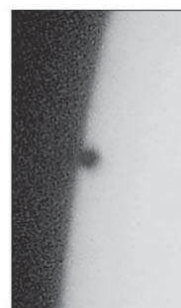
10.12 UT



10.27 UT



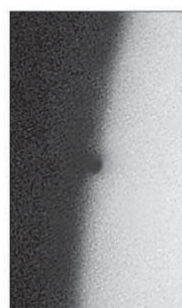
10.28 UT



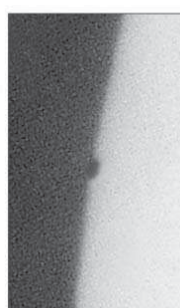
10.29 UT



10.30 UT



10.30.30 UT



10.31 UT



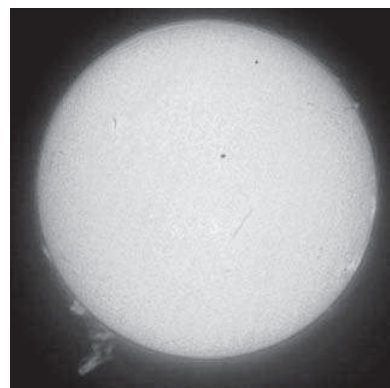
10.31.30 UT

Above: Sequence of images of the egress by Peter Paice, Belfast, using a 152mm refractor at f/12, $\times 2$ Barlow, Baader film filter and afocal coupling to an Olympus 2040Z digital camera.

Left: Sequence by Gerald North. From top to bottom: 09.06 UT; 09.58; 10.25; 10.29; 10.30; 10.31.

Right: Ray Emery's combination of a visible light and h-alpha image captures the tiny planet in transit (top right), with a large sunspot and several filaments on the disk, and a huge eruptive prominence at bottom left.

Below right: Image by Martin Mobberley at 09.46 UT. ETX 125 SCT with ND5 filter, Nikon Coolpix 5700 digital camera.



BAA Picture of the Week

Since August 2002 the BAA Website www.britastro.org has featured a regular Picture of the Week, edited by the Picture Editor, Callum Potter. Criteria for appearance include observational interest, topicality and visual effect. All members are encouraged to send in images, pictures, or drawings for consideration. So far these have all been sent by e-mail, but if you have a photograph, 35mm transparency or drawing to send and don't have scanning facilities, please get in touch with the Picture Editor who can arrange this.

From time to time the *Journal* will include some of the best of these, but please note that due to printing processes images that reproduce well on a computer monitor may not be suitable for publication.

You can get in touch with the Picture Editor by e-mail [picture@britastro.com] or by post to Callum Potter, The Cottage, Bredons Hardwick, Tewkesbury, Glos. GL20 7EE





Variations in the brightness of Uranus in 2002

In an earlier *Journal*¹ I presented the results of an analysis of visual observations of Uranus and Neptune taken over many years. In this paper I noted not only apparent variations over periods of years but also some short-term fades with durations measured in weeks or months.

Recently I have been carrying out CCD imaging using a Starlight Xpress camera

unfiltered. The camera uses a Sony chip, which is intended for use in colour video cameras and hence has a pseudo-visual response window cutting out the extended red response of many CCD chips, and gives visual magnitudes for B-V stars/planets between about 0.0 and 1.2.

Photometric analysis of the images obtained in late 2002 using AIP4WIN software showed a fade that was of short duration (less than six months). Here I present the plot of magnitudes corrected to a standard distance that supports the visual results presented in the paper.

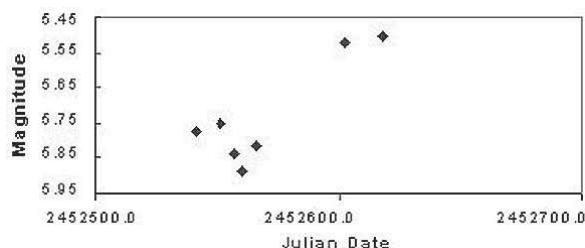
I am aware that sceptics believed that the conclusions

presented in the paper were not necessarily valid due to the inherent errors of visual observers and hence scatter in their estimates. This series, being taken by CCD, should be free from the errors and bias of visual observation and as such confirms global variations within the atmosphere of Uranus over a timescale of a few months.

Uranus is now easily visible in the night sky. Observers are encouraged to look and estimate the magnitude using the chart in the *BAA Handbook* or on page 238 of this *Journal*. Those with larger telescopes could try making disk drawings – less accessible than nearby Mars but rewarding none the less.

Andrew J. Hollis, *Director, Asteroids & Remote Planets Section*

¹ Hollis, A. J., *J. Brit. Astron. Assoc.*, **110**(6), 330 (2000)



CCD measurements of the brightness of Uranus in autumn and winter 2002.

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The annular solar eclipse of 2003 May 31

This interesting eclipse was annular at sunrise in the far north of Scotland, and also in Iceland a few degrees from the horizon. For details and circumstances see Peter Macdonald, *JBA* 112(1), 29 (2002 February). The remainder of the British Isles experienced a deep partial eclipse at dawn. Most places later enjoyed a magnificent warm spring day, but visibility of the eclipse itself was widely affected by dawn cloud and mist. A selection of images received is presented here.



Composite of images by John Rogers, recorded at Cawdor Castle on the coast of Nairn. The mist-enshrouded foreground encapsulates the experience of most observers of this event.



Tony Rickwood had a good view of the partial phase as the Sun rose above the mist at Drumcree. He used a 4.5-inch Newtonian and a Fuji Finepix digital camera.



Above: Douglas Arnold obtained these images of annularity from the north coast of Iceland, using a Nikon 1400mm lens at f/16 and Agfa RSXII Professional film. Left: 04.06.46 UT; right: 04.04.16 UT.

Right: Photograph taken at North Bay, Scarborough by Melvyn Taylor.

Below: Martin Mobberley travelled as far as his Essex bedroom window to take this image of the rising eclipsed Sun at 03.55 UT, using a Nikon Coolpix digital camera at 280mm.





Ordinary Meeting, 2002 November 30

held at the Scientific Societies' Lecture Theatre, 23 Savile Row, London W1

Guy Hurst, President

Ron Johnson and Nick Hewitt, Secretaries

The President opened the second Ordinary Meeting of the 113th session. The minutes of the October meeting were read by Dr Hewitt, approved by the audience and duly signed. Mr Johnson said that there were no presents to report. Mr Hurst said that 26 new members had been proposed, and that their names would be displayed in the library. The audience approved the election of the 32 new members proposed at the previous meeting.

The President announced on behalf of Mr James, who was absent, that no papers had been approved that day by Council. Mr Hurst went on to comment upon a recent article¹ in the *Independent* newspaper, which had reported government plans to levy rent charges on the occupants of Burlington House. This would affect the Royal Astronomical Society, which allows the BAA to occupy rooms in its premises. Council were aware of this matter, however the President did not wish to comment further in view of the possibility of legal action. Members were assured that these proposals, even if approved, would not be realised for several years.

The President regretted that the current meeting would be our last at Savile Row after 32 years. Dr Richard McKim had reliably informed him that the first meeting held here by the BAA was on 1970 January 28. The Christmas meeting on 4th January would be held at a new venue, the St Bride Institute on Fleet Street. Peter Hingley would be speaking on *Astronomers and Oddities – the RAS and its library*, and Prof Joseph Silk would give the Christmas Lecture on the topic of *The Big Bang*.

Mr Hurst then welcomed Prof Robert Hutchison to deliver the afternoon's first talk. Prof Hutchison's highly respected work on meteorites had earned him the Gold Medal of the RAS in 2001.

What do chondrite meteorites tell us about the origin of Solar System planets?

Prof Hutchison explained that looking at the Earth's crust was not a very useful way to investigate the formation of the Earth, since it was continuously evolving. For this reason, it was necessary to look elsewhere, and the

analysis of meteorites had proved particularly fruitful. When a meteor hits the Earth's atmosphere, it typically exceeds escape velocity. The resultant friction generates a great deal of heat, and melts the surface layer of the object, but the core remains very cold. Most meteorites are categorised as chondrites. They are also labelled, usually with the name of the locality where they land, though in some cases only with a number. The latter is the case for oceanic meteors, for example.

The speaker went on to describe the technique of radioactive dating, which had first been accurately used by Clive Patterson in the 1950s. Two different isotopes of uranium decay to form lead with different halflives, and thus by measuring the proportions of the various species in a sample, and comparing with natural abundances, an age estimate can be made. Dating of basalt in the Earth's crust yielded an age of 4–5 billion years, in close correlation with meteorite data. Prof Hutchison discussed the typical microstructure of meteorites, explaining that the mixture of isotope species present indicated that the material forming the Earth had previously been processed in as many as 35–40 separate stars.

Prof Hutchison then discussed a 31g object which had caused a great deal of debate around 1980. It appeared to be of Martian origin, although the suggestion of a sample escaping the Martian gravitational field and travelling to Earth appeared incredibly unlikely. The escape velocity of the Moon is considerably smaller than that of Mars, and its closer proximity suggested that if one meteor could travel from Mars, great numbers should have travelled from the Moon. This is not observed. However, landing probes sent to Mars had shown that the Martian atmosphere matched gas samples in pockets of the meteorite, showing that it was almost certainly of Martian origin.

The speaker proceeded to describe a 3.7 tonne meteorite that had been found in western Australia by John Carlisle. Transporting it across the desert had proven a considerable challenge, with crowbars having to be lashed to the underside of a truck to support the weight. The team had had seventeen punctures on their 43km journey, and Prof Hutchison admired their resourcefulness.

Ratios of ²⁷Al (aluminium) and ²⁶Mg (magnesium) abundances in certain samples indicated an age of around 4570 million years, which led the speaker to suggest that such meteors had formed within 2 million

years of the birth of the solar system. However, other evidence indicated that they had formed in the violent collision of two planetary bodies of considerable size, and Jupiter appeared to be the only planet fitting this criterion. Prof Hutchison postulated that this was evidence that Jupiter was present in the solar system within two million years of its formation. It seemed unlikely that such a vast body could grow in such a short time, so he argued that it may have been gravitationally captured by the Sun after its formation.

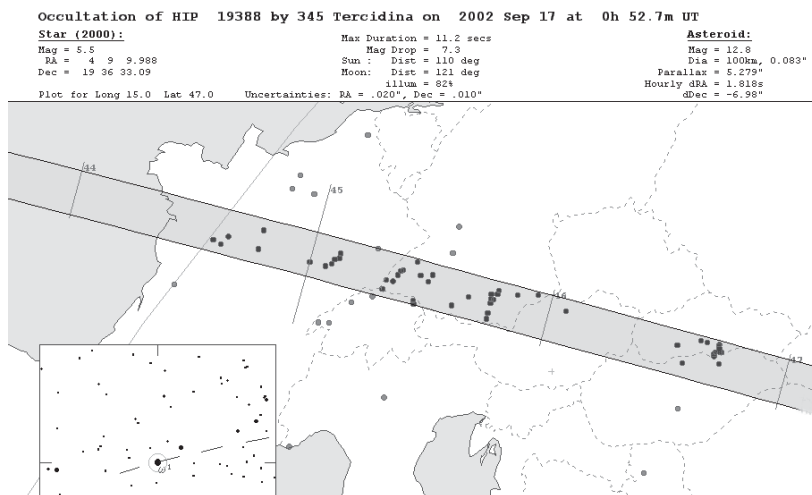
This idea was backed up by considering the dynamics of the disc of material surrounding the Sun in the early solar system. Jupiter-sized objects would be most likely to form only in the inner regions of this disc, from material with low angular momentum. Such a theory was supported by observations of extra-solar planets, where it was found that the majority of Jupiter-sized objects were in close orbits to their parent star. It therefore seemed unlikely that Jupiter had formed in the solar system. Prof Hutchison also cited the 7.2° inclination of Jupiter's orbit to the solar rotation axis as evidence for an unusual history. He pointed out that the idea of the capture of such an object was not as ridiculous as it might appear, since free-floating Jupiter-sized objects had been detected in Orion. Finally, he speculated that the fluke capture of Jupiter 2 million years after the formation of the Sun might have made life possible on Earth. If this was the case, Prof Hutchison believed that whilst our solar system might not be unique, there could not be many other systems like it.

In response to a question as to whether any observable features on Jupiter would confirm the age difference, the speaker was sceptical. He pointed out that radioactive dating methods are typically accurate to within two million years, and this is equal to the predicted delay between the formation of the solar system and Jupiter's capture into it.

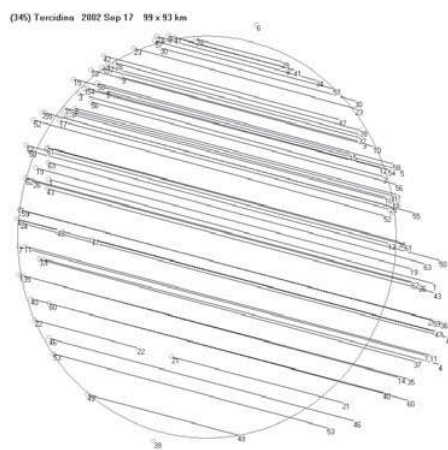
The President thanked Prof Hutchison for his comprehensive talk, before adjourning the meeting for tea. After the break, Dr Nick Hewitt, Meetings Secretary, made a



Colin Powell (left) accepts gifts from Dr Nick Hewitt in recognition of his help at Savile Row over many years of meetings there.



The track across northern France and central Europe of the visibility of the occultation of HIP 19388 by 345 Tercidina on 2002 September 17. Black dots indicate positive observations, grey dots negative reports. *European Asteroïdal Occultation Network*.



Measured timings of the Tercidina occultation provided over 60 chords across the diameter of the asteroid. *EAON*

presentation on behalf of the Association to Mr Colin Powell of the Royal Society of Chemistry. Mr Powell had given tremendous support to the organisation of meetings at Savile Row, for which Dr Hewitt was deeply grateful. The President then invited Mr Martin Mobberley to present his Sky Notes.

The December sky

Mr Mobberley opened with a report of the occultation of a mag 5 star, HIP 19388, by minor planet 345 Tercidina on 2002 September 17. The speaker illustrated the location of amateurs who had contributed observations from across central Europe, and hailed it as the second most observed occultation of its kind – the first being a US

event. These observations had placed more than 60 chords across the object, and refined its size to 99km by 93km. Mr Mobberley remarked that professionals would have been unable to obtain such accurate data without the use of a costly space probe.

During 2002, there had been an unusual clustering of four nova events in Sagittarius, one of which had peaked at mag 5. The speaker showed Mike Jäger's images of the second event, V4742 Sgr, which was tucked just south of the Trifid and Lagoon nebulae. The nova showed a striking red colour, and Maurice Gavin had reported spectral measurements of a strong H α line. A light curve constructed by Guy Hurst showed a three magnitude fall within a few days of the peak at 8.5 around 17 September. The third Sgr event, V4743 Sgr, had been discovered by Katsumi Haseda on September 20 at mag 5.

A GRB on the evening of October 4 had been the first ever to have been successfully observed by amateur astronomers, including some in the UK.² The object, GRB021004, appeared beside the Eastern side of the square of Pegasus. Nick James had achieved the first UK images at twilight, followed by several others. A robotic telescope had obtained images of the optical transient associated with the event within minutes of its discovery.

The speaker congratulated Tom Boles on a spate of supernova discoveries, starting with 2002gc. Three further discoveries had come within a week, including 2002hl and 2002hm, which had received consecutive labels from the IAU.

Moving onto planetary observation, Mr Mobberley showed superb images by Ed

Grafton from Houston and Damian Peach from Tenerife. A notable white spot in the South Temperate Zone of Saturn had caught the attention of both on September 27. More generally, recent images had revealed a greenish tint to Saturn's southern polar region, and a greyish tint had also been reported in the A ring.

Recent images suggested Jupiter's Great Red Spot to be a little more orange than usual. An exquisite stacked image of the post-spot turbulence by Ed Grafton was shown. The inclination of Jupiter's orbit was particularly favourable for so-called 'Mutual Galilean Events' in the coming month. These are events where two moons occult one another. There would also be occasions when two moons would cast simultaneous shadows onto the Jovian surface.

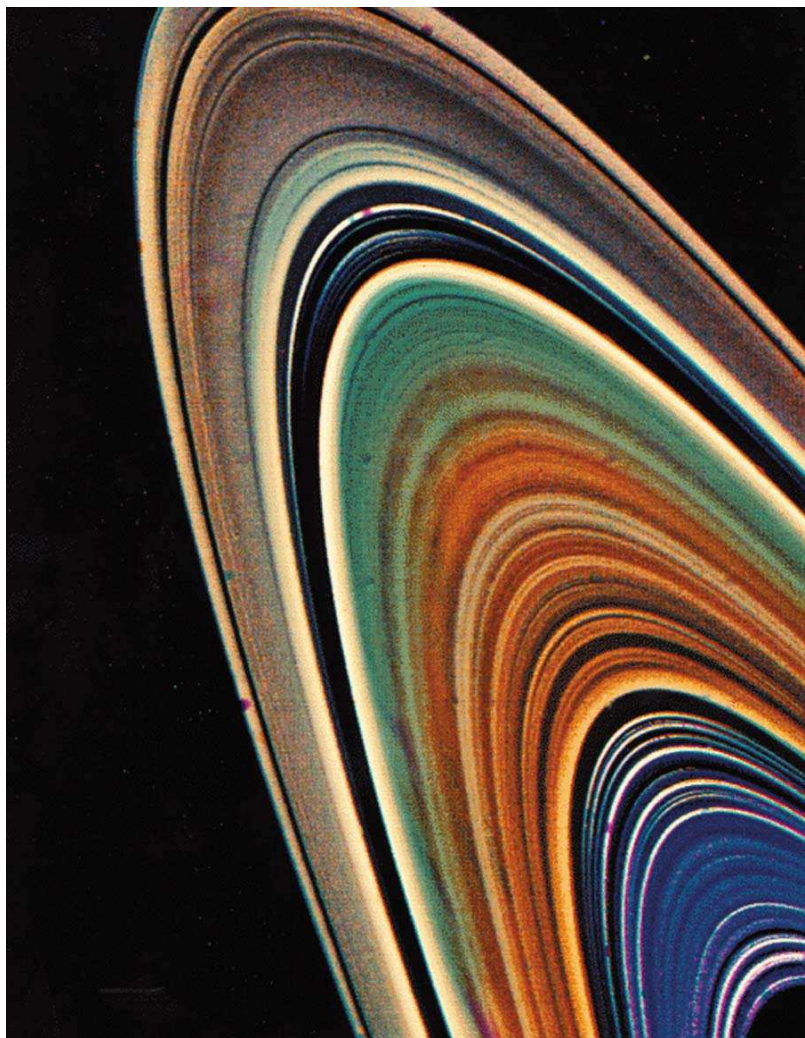
Mr Mobberley opened his discussion of the comet scene with superb images of 2002 O4 (Hoenig) and 46P (Wirtanen) by Ed Grafton. The speaker illustrated the paths of several comets which were expected to be observable with amateur telescopes in the next few months.

The speaker closed his summary with mention of the total solar eclipse of December 4, which would be visible across southern Africa and Australia. Many BAA members not present at the afternoon's meeting were on their way to this event, although totality would last only 26 seconds for Australian observers. Mr Mobberley then handed over to Neil Bone, who would summarise the results from the recent 2002 Leonid meteor shower.

The 2002 Leonids

Mr Bone had received floods of observation reports since the shower of 2002 November 18/19. Weather had proved problematic for many observers, although those in Scotland and on the Chilterns had had a good view. In other areas, cloud and fog had hindered observation. Preliminary reports suggested that the near-full Moon had limited observers to mag 4 at best.

Referring back to the Asher-McNaught models outlined in his preview at the previous meeting, the speaker suggested that the estimated 03h56m UT peak had come a little later than expected, just after 04h. Mr Bone pointed out that a 10–15 minute error in such predictions was to be expected, and they remain remarkably accurate. At maximum, rates of around 15 meteors per minute had been reported. On average the meteors had been brighter than usual, although there had not been a significant excess of fireballs. One such event at 04h09m had caught the attention of a number of observers, however, and was reported to have left a 20–30 second train.³



A *Voyager 2* false-colour image of Saturn's rings, taken from a distance of 8.9 million km on 1981 August 17. Subtle colour variations due to differences in surface composition of the particles making up the rings are enhanced in this image produced by combining ultraviolet, clear, and orange frames. (NASA/*Voyager 2*, P-23953)

Relatively few observations had been received for the 03h region of the distribution, although it appeared that rates had soared at around 03h45m before peaking at an EZHR of about 1500. On the tail of the distribution, rates had remained high at 04h30m, and had reduced to 2–3 meteors per minute by 05h.

The speaker urged observers to take a look at the Geminid shower on December 14, which he believed to be the next best shower after the Leonids. The peak would be at 04h UT, although observation from 01h until dawn was recommended. Mr Bone believed that a good show would be guaranteed, since the shower had frequently reached 120 EZHR in recent years. It was undergoing a period of evolution, and good rates were to be expected for the next decade or so. Early morning observations were likely to be the most fruitful on this occasion due to the late-setting Moon.

Looking further ahead, the speaker also recommended observation of the Quadrantids, due to peak on the night of 2003 January 3–4. The radiant would be low at peak, although activity might outstrip even the Perseids.

Following the applause for Mr Bone's thorough summary, the President welcomed Mr Jerry Workman to report on the progress of the *Cassini* mission to Saturn.

The *Cassini* mission to Saturn

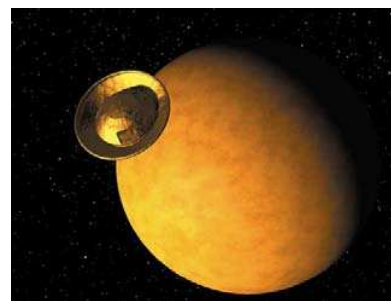
Mr Workman believed many amateurs might be asking why there was a need to send a new probe to Saturn when amateurs such as Damian Peach were obtaining such superb

images from Earth. The ring structure is of course the most eye-catching feature for amateurs. Early observations had recorded the rings as a triple planet, and they had first been correctly identified in 1655 by Christiaan Huygens. Two decades later in 1675, Giovanni Cassini resolved the planet sufficiently well to see a gap between two apparently separate rings – the gap we now call the Cassini division. The Berlin observatory identified another sub-gap within the A ring in 1837, but it was decided that it was sufficiently hard to resolve that it did not warrant naming as a further division.

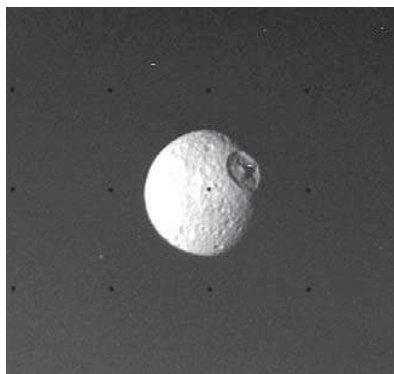
In contrast, the *Voyager* missions had revealed unexpected character on the surface of the planet itself. Its tremendous size dominates the dynamics of its gaseous surface. There is little large-scale structure comparable to the Great Red Spot on Jupiter, but there is rich fine structure, with an average wind velocity in excess of 1000mph. These are the fastest winds in the solar system, and their energy source remains a mystery.

The *Voyager* probes had also overturned our previous picture of the rings. For example, they revealed that the Cassini Division was an area of low density, not a complete gap. There are actually over 4000 closely-packed rings, not just four large structures as had previously been thought. The rings are believed to be composed of water ice and small pieces of rock, which range from the size of a sugar-lump to that of this lecture theatre. We had learnt from *Voyager* that rings are not the rare phenomenon once thought, but in fact all four gas giants exhibit them to some extent. Both Neptune and Jupiter have faint ring structures around them.

Further out in the Saturn system, the satellites had produced numerous puzzles when *Voyager* resolved the first surface detail ever seen on them. The landscape of Mimas was dominated by an 80-mile crater. This was indicative of a particularly violent history, as the formation of such a crater in an object of 240-mile diameter would have brought it close to total destruction. In contrast, Enceladus had a bright surface of water ice which was



Mockup of the *Huygens* spacecraft seen against a *Voyager 2* image of Titan. The satellite is completely shrouded in a thick atmosphere of nitrogen and methane. (ESA/NASA)



Voyager 1 image of Saturn's satellite Mimas, showing the huge crater Herschel at upper right. The 100km diameter crater is about a quarter the diameter of Mimas itself. *NASA/Voyager 1, 34933.50*)

virtually uncratered, begging the question of where the craters had gone.

Diomine is believed to be composed of an inner rock core, surrounded by water ice. Overall the moon is rather lightweight – only twice the density of water. A curious feature of the surface is a number of white wisps and speckles, centred around the crater Amata. It is believed that the impact that created Amata also blew a large amount of liquid water melt off the surface. This subsequently resolidified in the vacuum of space before returning to the surface. Similar wisps are also seen on Rhea, a moon which the *Cassini* probe would spend some time imaging. It was the aim of the *Cassini* probe to orbit within the system for four years, rather than just fly past the system, as the *Voyager* probes had done.

Finally, the speaker described the satellite that is commonly thought of as the king of Saturn's retinue: Titan. The atmosphere is 94% nitrogen, and it appears likely that the surface is liquid ethane or methane. Conditions in the atmosphere are ideal for liquefaction of such hydrocarbons. Infrared HST images hint that light-coloured regions might be continents of solid hydrocarbon, although this remains an area of active research.

The *Cassini* mission would be in two parts: an orbiter, and the *Huygens* landing probe, which is destined for the atmosphere of Titan. The orbiter is exceptionally large – as high as a single-storey building – and weighs six tonnes. Sadly an atmospheric probe had not been included due to space constraints. *Cassini* was launched in 1997 as a NASA/European collaboration.⁴ A recent encounter with Jupiter had been used to test the camera, which appeared to be working well. It would finally reach Saturn in 2004 July.

The first priority would be to obtain a stable orbit. Then, in 2005 January, the *Huygens* probe would be released into the atmosphere of Titan, marking the start of scientific investigation. A slight technical hitch had

recently been identified with *Huygens*, although engineers were confident that the control software could be suitably modified. It was hoped that after penetrating the atmosphere, the probe would continue to function for around half an hour on the surface, and take two or three images of the landing site. A particularly interesting question would be whether *Huygens* would splat down on a solid surface or splash down into liquid.

It was hoped that the orbiter would complete around 80 orbits of Saturn, half of which would be close passes of Titan. Some questions of interest included the nature of the magnetic field, the composition of the ring particles, the atmospheric composition, as well as the many puzzling features of the satellites. Between 2005 and 2008 around eight billion images would be taken. Depending upon the status of the mission in 2008, it could potentially extend until 2010.

The President thanked Mr Workman for his detailed report of an enthralling subject, before welcoming the afternoon's final speaker, Mr Chris Lintott, to speak about recent developments in cosmology.

The age of precision cosmology?

Mr Lintott opened by expressing his honour to be the final BAA speaker at the Savile Row venue. He believed that in recent years humanity had reached a consistent and plausible cosmological model for the first time, and this explained the title of his talk.

Historically, philosophers had preferred the idea of an infinite static universe, in accordance with the cosmological principle that neither our position nor time in the universe is special. This was believed primarily out of modesty, but the static universe had numerous problems. In both classical and general relativistic physics, such a model turned out to be unstable to small perturbations from uniformity, as was pointed out by Richard Bentley as early as 1691, in correspondence with Newton. Furthermore, the blazing sky paradox – often falsely attributed to Olbers – showed that the sky in such a universe would be as bright as the Sun in all directions, since every line of sight would eventually end on the surface of a star. Such was Einstein's faith in this cosmology that when he discovered its incompatibility with general relativity in 1917, he introduced the famous cosmological constant Λ to counteract the instability.

In 1929, however, Hubble published the remarkable observation that distant galaxies were receding from us. From this it was inferred that the universe was expanding. An obvious question to ask in light of this observed expansion was at what time, if we

extrapolate back, did all points in space coincide? For the first time, we had scientific evidence that the universe may have started at some finite time in the past, in a giant primordial explosion.

Mathematically, such expansion was explained within the framework of general relativity by Alexander Friedman. He constructed a model whereby the universe emerged from a primordial 'Big Bang', and then expanded to a maximum size, before recollapsing in a 'Big Crunch'. It was later shown that two further possible models were a universe which tended asymptotically to a maximum size, or one which continued to expand for eternity.

When confronted with this evidence, Einstein retracted Λ , branding it as the 'biggest blunder of his life'. Some believe that the idea of such a constant was a 'fudge factor', whilst others point out that it arises naturally as a constant of integration in relativity and hence discarding it was perhaps rather premature.

The Friedman models were resisted by some, most notably Sir Fred Hoyle, who proposed a steady-state model in which new galaxies formed in the voids between pre-existing ones as the universe expanded. Such models were largely discredited in 1967, however, with the discovery of the Cosmic Microwave Background Radiation (CMBR) by Penzias and Wilson of Bell Labs. This radiation is near equal in all directions, which implies it is not associated with either our solar system or indeed the Milky Way galaxy. Instead, it is believed to have formed and filled the universe when it was 500,000 years old, at a time known as recombination. It has the characteristic spectrum of a body cooling and expanding, as a big bang universe would have been.

In recent years, observation of the CMBR by observatories including the COBE satellite had shown several surprising features, including a striking uniformity to one part in a hundred thousand. Calculations show that regions of the CMBR separated by more than a degree or so would not have had time to have any influence over one another between the big bang and the epoch of recombination. The global uniformity is therefore surprising: how do the various regions know how to make themselves similar to one another? This philosophical issue has led cosmologists to favour an idea known as inflation – a rapid period of expansion immediately following the Big Bang. This allows the various regions of the CMBR time to synchronise themselves.

The speaker finally discussed the distance-ladder method of estimating the distance of objects to ever-increasing redshifts. He pointed out that the use of Type Ia supernovae as 'standard candles' had produced evidence suggesting that the



Observing Comets

by Nick James and Gerald North

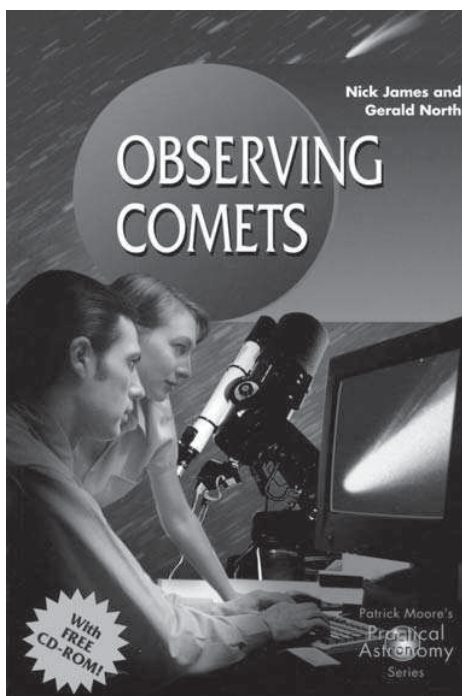
Springer-Verlag, 2003. ISBN 1-85233-557-2. Pp x + 234 + CD ROM, £26.00 (pbk)

This book is intended primarily for those observers who wish to progress from the basics of comet observing and to maximise their results, hopefully ensuring they are of real scientific value. For this reason, whilst there are sections describing visual observing and reporting formats, greater emphasis is placed on exploring the various techniques of imaging these objects.

The introductory chapter briefly covers the historical observation of comets and the way in which many people feared them, which still persists to this day in some cases. The question of nomenclature is tackled which, like variable stars, has been through great complexity. The result is that the same comet is referred to in the literature in different ways. The notes on the pre-1995 scheme suggest the final designation was based on year of discovery (with a number for perihelion passage) whereas the reviewer's understanding is that the year also related to that of perihelion passage.

Chapter two entitled 'Comets Unveiled' provides details of the physical characteristics of comets. This section provides a useful message to the observer who merely sends in a magnitude estimate and does not report the intricate detail seen in some comets. Drawings by Robert Bullen illustrate just how much detail could be seen in the jets of Comet Hale-Bopp but which were missed by many observers.

The next section on 'Comets in Vision' contains a lengthy and valuable discussion concerning image brightness and advice on magnification and telescope aperture. The



difficulty here is that each comet's appearance is quite different and the reviewer has found some large comets visible in binoculars are virtually invisible in telescopes regardless of aperture. The chapter acknowledges the value of binoculars and correctly suggests caution in purchasing large binoculars because of weight considerations.

The 'Visual Practices' in the next chapter balance this book well since it is acknowledged that much pleasure can be gained from direct visual sighting of comets, especially those just discovered. An in-depth discussion follows on the important subject of locating comets, which many find quite a difficult task. It may have been

useful to mention the excellent finder charts placed on the WWW by Reinder Bouma of The Netherlands which also contain reliable magnitudes for comparison stars. (<http://www.shopplaza.nl/astro/>)

Even the variety of magnitude estimating methods can cause confusion for observers. To the reviewer's knowledge, the Sidgwick method remains the most popular rather than the Bobrovnikoff method as stated in the book, which tends to be difficult to use for diffuse and faint comets.

The chapter on 'Comets in Camera' still makes a case for the use of photography for comets, which is very welcome given the impression given in some books that only digital imaging can be useful. As the authors state, second-hand SLR cameras can now be obtained quite cheaply, lowering the setup costs of starting out in the comet imaging field. The chapter's discussion then covers the use of

CCDs and how this compares with photography.

Discussion follows on the increasing use of computers to analyse comet orbits and produce ephemerides. The current speed of the home PC brings all this into the domain of the amateur and is a fascinating area of enjoyment for some.

The following chapters cover imaging with CCDs in more detail and it is clearly in this area that those who wish to advance their observing techniques can make great strides. The notes on the processing of images are particularly valuable for those trying these techniques for the first time. Images in this book of the central region of Comet Hale-Bopp show the amazing amount of detail which can be obtained by careful processing.

The section on 'Advanced Research' options has many tempting projects. This includes astrometry, still in great demand by professionals especially for newly-discovered comets. Photometry and spectroscopy are discussed, which until now have only been seriously attempted by comparatively few observers around the world, but which surely will be explored by many more amateurs in the future.

Comet discovery covers only a few pages as the authors point out that the domination of professional surveys is making the traditional visual discovery by amateur astronomers more difficult. Despite the authors' comments, the back ▶

>The age of precision cosmology? ...meeting report continued

outer regions of the universe were expanding more slowly than predicted by Hubble expansion. This supported a non-zero cosmological constant, and reopened the debate as to whether Λ was a necessary component of our cosmological models. Such a constant could be interpreted as an intrinsic energy of empty space (vacuum), which led particle physicists to attribute it to quantum fluctuations associated with the creation of pairs of particles and anti-particles. However such an association resulted in estimates of Λ which were 10^{120} times greater than the maximum limit

allowed by astronomical observation. The speaker closed by expressing his interest in hearing the resolution of this inconsistency.

The President thanked Mr Lintott for his enlightening talk, before adjourning the meeting until 2003 January 4 at the St Bride Institute on Fleet Street.

Dominic Ford

- 1 *The Independent*, 2002 November 25
- 2 *J. Brit. Astron. Assoc.*, **112**(6), 308 (2002)
- 3 *J. Brit. Astron. Assoc.*, **113**(1), 4 (2003)
- 4 *J. Brit. Astron. Assoc.*, **107**(6), 338 (1997)



Asteroids III

by William F. Bottke Jr., Alberto Cellino, Paolo Paolicchi & Richard P. Binzel (Eds)

The University of Arizona Press, 2002. ISBN 0-8165-2281-2. Pp xviii + 785, \$110.00 (hbk).

It has finally arrived: the latest landmark publication in the Space Science Series from the University of Arizona Press. It is almost 14 years since its predecessor, *Asteroids II* appeared and a great deal has happened since that time to revolutionise this subject.

This book, made possible by contributions from 150 collaborating authors, brings together the latest information obtained by spacecraft, combined with astronomical observations and theoretical modelling, to present our best current understanding of asteroids and the clues they reveal for the origin and evolution of the Solar System. It builds on the fine tradition established by the previous two generations of this book, and sets out to become the definitive source on asteroids for the next decade.

Although it is now more than two centuries since Piazzi discovered Ceres, the first asteroid, the last decade or so has marked a rapid acceleration in our

knowledge of these distant tiny worlds. We now know of many examples of binary asteroids, and of objects that spin with periods of a few minutes, which by their very nature must be monolithic. Instead of always being seen as remote near-point sources of light, radar observations of near-Earth objects (NEOs) have been so refined that Arecibo now achieves a spatial resolution as small as 15 metres, and spacecraft missions, including the highly-successful *NEAR-Shoemaker* probe to Eros, have provided us with wonderful close-up imagery. New insights are being gained into asteroid-meteorite connections and into the relationships with comets and even with meteoroid streams. Tremendous advances have been made in determining orbital characteristics and this work has permitted the hazards posed by asteroids colliding with the Earth to be quantified with unprecedented accuracy. Ground-based surveys have become highly automated enhancing the discovery rate for new objects especially in the search for NEOs.

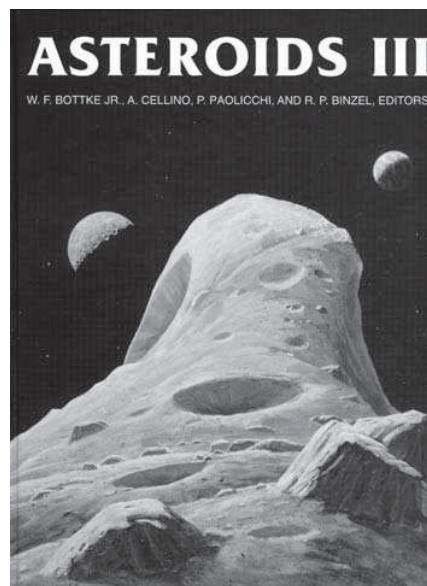
Asteroids III is a large book: it has to be, to be able to bring together so much information in one volume. It contains 8 colour plates, 52 halftones and 247 line illustrations embedded in an 8.5" × 11" format weighing over 2kg. Reproduction is on archival-quality paper in a cloth binding with a resilient hard-backed cover illustrated front and back, and clearly intended to last the test of time.

The book is a compilation of 51 articles, the large majority of which are multi-authored. What I particularly liked is the way in which each of these articles reviews the past history of its topic before going on to describe current advances as well as providing masses of references (including their titles) thus making the entire volume an invaluable resource. There is no need to have access to the two forerunner volumes, this is indeed a stand-alone text. There is even an article dedicated to the dawning of the subject, the so-called problem of the 'missing planet' and the discovery of Ceres, from a historical perspective.

Given that our understanding of asteroids has progressed dramatically in recent years, it has now been possible for many of the articles to draw on the comparisons between asteroids and meteorites, comets and interplanetary dust. Indeed, one article describes the way in which comets may evolve to become dormant or extinct comet candidates among the asteroid population. We also now have a detailed understanding of the chronology

of asteroid formation, and of the way in which collisions have aged the population to where it is today. Asteroids can now be classified in upwards of 50 families based on their orbital characteristics. Many of these families and even specific asteroids can be reliably associated with certain meteorite groups. So although this book is unambiguous in its title, if you want to know more about the links between asteroids, comets and meteorites then this book is for you also.

There is no CD associated with the book but the last article is on the subject of data archiving and gives a description of the NASA Planetary Data System, which includes a section devoted to small bodies including asteroids and comets. Reference



► cover of the book, presumably written by the publishers, states 'most comets are first discovered by amateur astronomers', which is sadly no longer true.

The concluding chapter covers the two comets which have promoted this area of observing in recent years, Comets Hyakutake and Hale-Bopp. Last but not least, the CD ROM offers a considerable bonus to those with computers and a Web browser, containing both comet software and an excellent set of images, mainly of comets from 1995 onwards.

Overall this book succeeds in the authors' quest to encourage the comet observer, who is already familiar with the basics, to progress to more detailed results. I have no hesitation in highly recommending it and believe it will enhance the overall contribution levels on comets to the BAA Comet Section and other organisations.

Guy M. Hurst

Guy Hurst is President of the Association and Editor of *The Astronomer*. He gives regular lectures to schools, societies and at adult education sessions. He is assistant director of the BAA Comet Section and an active observer of comets and novae.

is also made to other important asteroid archives available via the World Wide Web.

Although the contributions come from virtually all of the recognised international authorities on the subject around the world, the quality of the writing is exceptionally good, being accurate and making full use of the English language. Indeed, I commend the editors for their achievement in assembling such a marvellous book, which from my reading so far appears to be error free. Given the immense collection this book represents, I still have many happy hours ahead of me exploring its contents further.

Richard Miles

Dr Richard Miles has followed this topic for many years, having served as Assistant Director of the Asteroids and Remote Planets Section of the BAA since 1984



Meeting of the Deep Sky Section

held at the Humfrey Rooms, Castilian Terrace, Northampton on 2003 March 8

March 8 saw the return of an annual feature of the BAA calendar – the Deep Sky Section meeting. Held at a convenient, central location in Northampton, the meeting always attracts a good turnout, and this year's was no exception. In his introductory remarks, Section Director Nick Hewitt reported on another busy year for the Section. Many excellent CCD images had been received (the Director showed some examples), along with some double star measures and observations of active galactic nuclei. On the supernova-hunting front, Mark Armstrong and Tom Boles were now neck-and-neck, with about 40 discoveries each – all of them made since 1996. A notable new development was the detection by amateurs of the visible-light component of a gamma-ray burst. The electronic scanning of the Section's archive of visual observations, in progress at the last Section meeting (see *Journal*, 2002 October), was now complete.

Nick Hewitt gave the first of the main talks, on the subject of double stars, a field perhaps neglected by amateur astronomers in recent years. Double stars make good recreational observing, as they often show attractive colours. A more challenging task for the amateur is to measure their separations and position angles. This is difficult to do visually, but it is somewhat easier using photography, as photographs can be measured at the

desk rather than in the field. Many of the most interesting double stars are just a few arcseconds apart and ordinary prime focus photography gives too small an image scale for useful measurements. The best photographic method to use is eyepiece projection, the same as for planetary photography. It is important accurately to calculate the effective focal length of your projection system, in order to get a correct image scale for making measurements. Exposures of only a few seconds are necessary – in fact, overexposure will reduce the accuracy of your measurements. Photography seems to show that the colours of double stars are real and not just psychological effects. Nick Hewitt concluded by noting that measuring binary stars (i.e. double stars in orbit around one another) is scientifically useful, as large numbers of pairs have not been measured for many years.

The next speaker was Martin Nicholson,



Martin Nicholson in his runoff roof observatory at Daventry.

who continued the double star theme with the story of his remarkable work at the Daventry Observatory. The observatory is, in fact, a shed with a run-off roof in Mr Nicholson's back garden. His observing site is quite light-polluted, which is one reason why he took up the study of double stars,

as they are less affected by light pollution than other deep-sky objects. His approach to double star work is two-pronged. He began by making measurements of known doubles. Of the 90,000 or so pairs in the Washington Catalogue of double stars, nearly

half have only been measured once and nearly one-third were last measured more than 50 years ago. His second line of enquiry was to look for new double stars in images and published data.

His equipment for measuring double stars is high-tech: a 12-inch Meade LX200 and an SBIG ST-7E CCD, plus a battery of software, including the AIP image processing program, which has a module specifically for double star work. Measuring the separation and position angle of a double star is easy with this software, once the scale and orientation of the CCD image have been worked out. Using this setup he has measured more than 1,100 doubles since April 2002.

Mr Nicholson also began discovering many new double stars. Before he began his programme, just 18 new doubles were discovered in 2000 and 2001 by all astronomers, amateur and professional. But in 2002, Mr Nicholson alone found 85 new systems. He then came up with a new discovery technique. Rather than use his own images, he began looking in the Hubble Guide Star Catalogue for pairs less than 10 arcseconds apart in right ascension and declination. He used software techniques to isolate pairs of stars with the required coordinates, and then confirmed that they were doubles using images from the Digitized Sky Survey. Since October 2002 he has discovered a staggering 27,000 new pairs in this way. His future plans include searching the open clusters in the Messier and NGC catalogues for new double stars down to magnitude 18. It will also be important to measure his new discoveries at the telescope over time to determine whether they are true binary stars or just pairs of widely-separated stars that happen to lie in the same line of sight.

After an excellent cheese and wine lunch provided by our hosts, the Northamptonshire Natural History Society, this year's professional speaker, Dr Paul Crowther of University College, London, gave a talk on 'the birth, life and death of very massive stars'. The vast majority of stars in the Milky Way Galaxy are relatively light-weight objects like the Sun. Stars of more than eight times the Sun's mass are relatively rare. These massive stars burn up their energy quickly and have lifetimes of only a few million years – about one-thousandth that of Sun-like stars. They are also very luminous, with absolute magnitudes up to one million times that of the Sun.

Astronomers believe that massive stars are born in giant molecular clouds – nebulae

New Honorary Members

Congratulations to the following who, with the start of the 2003–2004 Session, have achieved 50 years continuous membership of the Association and are therefore designated Honorary Members:

	<i>Date elected</i>
Charles Chilton	1952 Dec 31
Edward Ellis	1952 Nov 26
Leslie Green	1953 May 27
David Harris	1953 Jun 24
Alan Heath	1953 Feb 25
Neil Macnaughtan	1952 Nov 27
Dr Philip Message	1952 Dec 31
Peter Morris	1952 Nov 26
Colin Munford	1953 Jan 26
John Perdrix	1953 Jun 09

much larger than the one from which the Sun formed. Precisely how they are created is still a subject for controversy. They may form by accretion of nebular material by gravity, as do normal stars, but they could also form as a result of collisions between mid-mass stars in the dense cores of the molecular clouds. Many young high-mass stars are shrouded by dust and so are invisible in visual wavelengths, but they show up strongly in the infrared and radio.

After they have exhausted the hydrogen in their cores, massive stars start to vary in brightness and pass through a phase when they are known as 'luminous blue variables'. This period only lasts for about 20,000 years – a very brief time in the life cycle of a star. Luminous blue variables rapidly change their spectral type as they vary in brightness. Dr Crowther noted that these stars are regularly monitored by amateur astronomers, as only they have the telescope time to monitor them continuously over a long period.

One particularly interesting class of massive stars is the Wolf-Rayet type. In addition to being very massive, they are also very hot, shining with more than 100,000 times the Sun's luminosity. They have lifetimes of just 3 to 6 million years and Dr Crowther noted that Wolf-Rayet stars seen in other galaxies are already dead, because they have ended their lives long before their light has reached the Earth. Only 230 Wolf-Rayet stars have been found in our Galaxy.

At the end of their hydrogen-burning phase, stars of more than 15 solar masses expand to become 'red supergiants', fusing successively heavier elements up to iron in the periodic table. They then end their lives as type II supernovae – or, in the case of the most massive stars, type Ib or Ic supernovae. One unsolved mystery, however, is supernova 1987A in the Large Magellanic Cloud, a type II whose progenitor star was a *blue* supergiant.

Bob Marriot then resumed the double star theme with a history of double star observing. Systematic observation of double stars was begun by William Herschel, who observed stars at intervals of 20 years in an attempt to determine their parallaxes. During the course of his observations he discovered many double stars and found that some of them were orbiting binaries. His observational measurements proved that Newton's gravitational laws applied outside the Solar System. The first comprehensive survey of double stars was begun in 1823 by Wilhelm Struve, using the 9-inch (228mm) refractor at Dorpat (Tartu) Observatory in what is now Estonia. Systematic observations of double stars in the southern sky were begun around the same time by James Dunlop and during the

following decade William Herschel's son, Sir John Herschel, observed over 2,000 southern doubles from the Cape of Good Hope.



The 9-inch Fraunhofer refractor at Dorpat, used by Wilhelm Struve for his study of double stars.



New members

The British Astronomical Association cordially welcomes the following new members:

Elected 2003 March 19

Anderson Robin, Milnthorpe, Cumbria
Gear Alistair Bryn James, London NW1
Metcalf Val, London NW1
Pacult Zbigniew Alojzy, Rodington, Shropshire
Parkin Kenneth Stanley, Smalley, Derbys.

Elected 2003 May 21

Alexander Maxwell, London, N7
Allen Kevin Peter, Luton, Beds.
Anderson Stephen, Durrus, Kincardineshire
Asplin Eamon, Peterborough, Cambs.
Austin Arthur Edward, Paignton, Devon
Austin Kenneth William, Binfield, Berks.
Barker Derek Paul, Great Bar, Birmingham
Barnes Katie, Heysham, Lancashire
Barrett Derek James, Banbury, Oxfordshire
Bate Ryan, Warrington, Cheshire
Bell Edna, Roadhead, Cumbria
Bell Leslie Charles, Heston, Middx.
Bellinger Barry, Thatcham, Berkshire
Bennington David, Ruislip, Middx.
Berry Andrew Christopher, Knutsford, Ches.
Blake Robert John, Ulverston, Cumbria

Blamey Claire, Gorleston, Norfolk
Boethe Charles David, Harrow, Middx.
Bolton Roger, Ruthin, Denbighshire
Bradley Leonard, Warrington, Cheshire
Brady Kevin Anthony, Orpington, Kent
Branston David Arthur, Arnold, Notts.
Broad Graham Leslie, Rayleigh, Essex
Brooks Ben Lester, London, SE12
Brooks Stephen Derek, Welling, Kent
Brown Christopher, Cosham, Hampshire
Brown Christopher, Long Eaton, Notts.
Brydon Derek, Norwich, Norfolk
Bryson Chris, Redhill, Surrey
Buck Alan Gene, Douglas, Isle of Man
Bull Jason Paul, Wednesbury, West Midlands
Burgess Ken, Newport, Shropshire
Burton Stephen, Stoke-on-Trent, Staffs.
Calvert Ralph, Helston, Cornwall
Cantillon Richard John, Whitton, Middx.
Carter Andrew, Croydon, Surrey
Cassidy Joseph, Wylam, Northumberland
Ceaton Christine, Garndiffaith, Pontypool
Champness Helen Eileen, Long Eaton, Notts.
Chapman Paul, Sheffield, South Yorks.
Cheetham Stephen Robert, Oakham, Rutland
Clarke Paul, Sundridge, Kent
Clough Kathy, Abingdon, Oxfordshire

Collins Timothy Charles, Chellaston, Derbys.
Coote Jennifer Anne, South Godstone, Surrey
Corrigan Terence, Basingstoke, Hampshire
Corsi Gianfranco, Sunderland, Tyne & Wear
Cottis Brian Philip, Walton-on-the-Naze, Essex
Coxon Paul David, Horwich, Lancashire
Creed Steve, Okehampton, Devon
Cummings Julian, London, N2
Dallimore Peter Robert, St Leonards on Sea, E.Sussex
Davies Eric Howard, Llansamlet, Swansea
Dickens Leslie Allan, Cheltenham, Glos.
Dimond Annette, Horwich, Bolton
Dobson Michael John, Greenford, Middx.
Drysdale Robert, Glenrothes, Fife
Dunn Francis, Folkestone, Kent
Dutkowskij Michael, Dundee
Dyer John, Lingdale, Cleveland
Earnshaw Julie, Huddersfield, Yorkshire
Easton Craig Anthony Samuel, Royston, Herts.
Edwards Leslie Lewis, Tring, Herts.
Edwards Richard, London, N10
Elsmore Martin, Lixwm, Holywell
Eyrie Dennis George, Wokingham, Berks.
Finn Charles William, Ashford, Kent
Finney Roger, Middlewich, Cheshire
Finnigan David Thomas, Halesowen, Worcs.



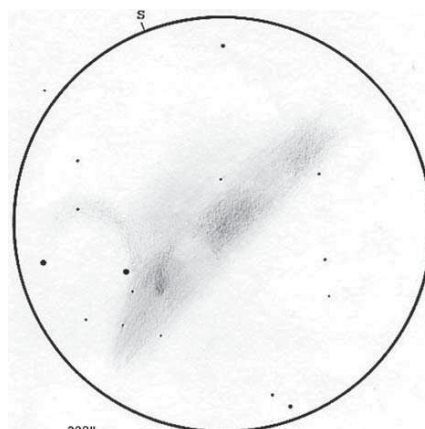
From the earliest days of double star observation, separations were measured using a micrometer, which consisted of a very precise grid of fine wires in the field of a telescope eyepiece, often made from spiders' webs. The invention of the Barlow lens in the mid-nineteenth century was a considerable boon to double star observing, as it increased the telescope's magnification without increasing the size of the micrometer wires, as would be the case if a higher-power eyepiece were employed. The British amateur W. R. Dawes made many measures of double stars with this new lens and established the 'Dawes Limit' – the resolution limit for double stars with a given telescope aperture.

Two other well-known observers during this period were Admiral W. H. Smyth and the Reverend T. W. Webb, but both concentrated on visual descriptions of the colours of the stars rather than measurements. One of the greatest of all double star observers was the American S. W. Burnham, an amateur astronomer who spent his entire life measuring double stars. His *General Catalogue*, published in 1906, contained 16,000 measurements. In the twentieth century, further important work was done by Robert Jonckheere and R. G. Aitken. Paul Couteau, a professional astronomer, continued making visual

measurements into modern times.

Following afternoon tea, Campaign for Dark Skies director Bob Mizon gave a talk entitled 'Piercing the Veil', on how to observe deep-sky objects in light-polluted skies. Bob Mizon is very much a visual observer and prefers to hunt for deep-sky objects manually. He described using Go To telescopes as 'like fishing with a hand grenade'. The key to successful deep-sky observing from urban locations is to wait for good sky transparency, as the effects of light pollution are then at their minimum. From his location near Poole in Dorset, Mr Mizon has made many successful observations of galaxies, and has even seen detail in M33 in Triangulum with his trusty 8½-inch (216mm) Charles Frank telescope.

Mr Mizon noted that while many major roads now have sky-friendly lighting, sports lighting is becoming the worst pollution offender. The flood of lottery and millennium funding in recent years has resulted in many sports complexes being built, many of them choosing poor-quality lights that shine sideways instead of downwards. There is, however, cause for hope. The well-known DIY retailer B & Q have been persuaded to sell environmentally-friendly security lights and a Parliamentary



Drawing by Lee Macdonald of the 6th magnitude emission nebula M17. 222mm reflector ×90 and ×232, 1993 July 12.

Select Committee on light pollution had recently been set up.

The final speaker of the day was Lee Macdonald, who spoke on 'Drawing the Deep Sky'. Drawing deep-sky objects may seem archaic in our electronic age, but it still has much to be said for it. Making drawings trains your eye to look for detail, thus improving your observing. It is much cheaper than CCD imaging or photography

New members ... continued ...

Fitz-Simon Charles Thomas, Winwick, Ches.
Fletcher Glynn Robert, Horsham, W.Sussex
Flett James, London, SE9
Flower Stephen William, Blackpool, Lancs.
Ford Martin Carl, London, E1
Fowell, Loughton, Essex
Freestone Alan, Sawston, Cambridgeshire
Frost Ernest George, Gosport, Hampshire
Fry Michael, Maidenhead, Berkshire
Gallear Mike, Wombourne, West Midlands
Gallon Peter John, Tunbridge Wells, Kent
Gibson Jacky, Kirk Hallam, Derbyshire
Gillies Ken, Solihull, West Midlands
Girvan David, Muirkirk, Ayrshire
Grace David, Cardigan
Graham Alan, West Kilbride, Ayrshire
Green Richard, Scarborough, Yorkshire
Griffin Andrew, Loughborough, Leics.
Griffiths Adrian, Long Eaton, Notts.
Gunawardena Nagoda, Kalutara, Sri Lanka
Habibi James, Prestbury, Macclesfield
Hadley William, Rochester, Kent
Halpin Marylynn, Tarleton, Preston
Hanson David James, Winsford, Cheshire
Hanson Robert, Toffean, S. Wales
Harrison Raymond, York
Harvey John Michael, Porthleven, Cornwall
Heath Robert, Macclesfield, Cheshire
Highton John, Keswick, Cumbria
Hilton David Stewart, Oldham, Lancashire

Hilton Trevor, Southwick, West Sussex
Hodgson Christopher, Bakewell, Derbyshire
Holdsworth Frank, Bingley, West Yorkshire
Holland Gary, Walsall, West Midlands
Hume Keith, Yateley, Hampshire
Humphrys Mark, Stalham, Norfolk
Ireland Anthony John, Skipton, N.Yorkshire
Jones Robert, Rossendale, Lancashire
Keen Colin, Sible Hedingham, Essex
Kemp Geoffrey Gordon, Waterlooville, Hants.
Kensett Janet, Kingsthorpe, Northampton
Kenyon Ronald Cooder, Llantwit Major
Khan Sonny, St Albans, Herts.
Kidner Christopher, Llanelli, Carmar.
Kourdi Thomas, Kettering, Northants.
Lang Robert, Cambuslang, Glasgow
Langley Lindsay, Huntingdon, Cambs.
Lawrence Oliver, Ashford, Kent
Lawson Alan, Berkhamsted, Herts.
Lawson Ronald, Hebburn, Tyne & Wear
Lee David Egbert, Barnsley, South Yorkshire
Lever Richard, Wilmslow, Cheshire
Lewis Alan Ivor, Uplands, Swansea
Lewis Leonard, Cwmavon, Port Talbot
Linton Barry, Southend-on-Sea, Essex
Lloyd Graham Charles, Boston, Lincs.
Longstaff Alan, London, W10
Mackie David, Carlisle, Lanarkshire
Mahoney Helen, Nunthorpe, Middlesbrough
Mallin-Jones Andrew, Northwich, Cheshire

Mann Feona, Dundee
Manning Ronald Edward, Peterhead, Aberdeen
Marchant Paul, Headingley, Leeds
Marler Jeremy Peter, Coulsden, Surrey
Marshall Kevin Patrick, Lavenham, Suffolk
Martin Stanley, Leeds
Matthews David, Southsea, Hampshire
Mattinson Fred, Syston, Leicestershire
Mayhew-Sanders John Reynolds, Umberleigh, Devon
McCarthy Kevin, London, SE19
McGregor William Wood, Kirkliston, West Lothian
Millais Anthony James, Stevenage, Herts.
Mitchell David Barry, Hempton, Norfolk
Mitchell David George, Cheltenham, Glos.
Mitchell John, Presteigne, Powys
Mitchell Penelope, Burton-on-Trent, Staffs.
Morley Brian George, London, SE15
Morris Raymond, Kidderminster, Worcs.
Mumford Alan, Culloden, Inverness
Nash Laurence, Hounslow, Middx.
Nash Lee David, Bideford, Devon
Naylor Brian James, Welwyn Garden City, Herts.
Newman Terence, Richmond, Surrey
Newsom Brian George, Llanymynech, Powys
Nicol Colin, Broughton, Cheshire
Nimmo Steven, Plymouth, Devon
Northcott William Charles, Par, Cornwall
O'Flaherty Francis Thomas, St Ives, Cornwall

and represents objects *exactly* as they appear in the eyepiece, with no over-exposure or bias towards the red end of the spectrum. Drawings also have considerable historical value, allowing us to appreciate what observers like Sir John Herschel or Lord Rosse might have seen through their telescopes.

In addition to your telescope, the basic equipment for drawing deep-sky objects is a bound sketchbook with smooth cartridge paper, a pencil of grade B or HB, an eraser and a dim red torch. You should only carry one pencil at the eyepiece, as they are only too easy to lose in the dark. Choose a magnification high enough to show detail in the object, but low enough for some background sky to surround it. Begin by marking the object's position in the centre of the field and then plot the brightest stars by estimating their distances from the centre to the edge of the field. Draw the object itself, making its centre dark and sketching the outer parts in successively fainter bands, and then carefully smudge it with your forefinger to reproduce its nebulous appearance. Finally, fill in the details in the object itself and the fainter field stars. Later on, make finished copies of your drawings for display or sending to organisations such as the BAA Deep Sky Section.

Nick Hewitt concluded the meeting by thanking all the speakers for such a

wonderful variety of talks, showing both what the amateur can do and the latest developments in professional research. He also thanked the Northamptonshire Natural

History Society for their hard work in providing the food and refreshments.

Lee Macdonald

Prestigious award for BAA member

It has been announced that BAA member Mario Frassati of Crescentino (VC), Italy, Coordinator of the Mercury programme of the Planetary Section of the Unione Astrofili Italiani (UAI), is the 2003 recipient of the Walter H. Haas Award of the Association of Lunar and Planetary Observers (ALPO) (USA).

The award, instituted in 1986 by Walter Haas who founded ALPO in 1947, is given solely for amateur astronomy and takes the form of an engraved plaque. It is bestowed for excellence in observational studies of solar system objects. Theoretical contributions, and work done as part of an observer's professional duties, are excluded. The awardee need not be an active observer at the present time, nor does he or she need to be still alive. Also, a professional astronomer can be recognised for work done when he or she was an amateur.

Mario was chosen on the basis of his long continued direct visual examination of the

albedo appearance of Mercury. His results are encapsulated in a new optical map of the regolith albedo of the planet (*JBAA* 112(3), 125-129, 2002), a work now recognised by professional workers. Currently he is seeking to correlate the white spots reported by visual observers of the planet, with the ejecta blankets of bright rayed craters (*JBAA* 112(4), 158-159, 2002)).

We extend our warm congratulations to Mario. His contributions highlight the very principle upon which the BAA was founded. It is also worthy of notice that it was a countryman of his, Giovanni Virginio Schiaparelli (1835-1910), who in 1889 became the first to map Mercury, though on a false premise. Previous recipients of the Haas Award include Charles Capen, Thomas Cave, Dr Jean Dragesco, Dr Donald Parker and Alan W. Heath, former Director of the BAA Saturn Section.

Richard Baum

New members ... continued ...

Offord Neville Edward, Bury St Edmunds, Suffolk
Oliver Annette Elfriede Rosalie, Rangeworthy, Bristol
Ord-Smith Norah Christine, Grange-over-Sands, Lancs.
Parker Greg, Brockenhurst, Hampshire
Parker William Joseph, Adstock, Bucks.
Parkin Leonard, Harrow, Middx.
Partridge, London, SE23
Penfold, Gateshead, Tyne & Wear
Penston Margaret Joan, Barton, Cambridge
Peters Raymond Wallace, Rustington, W. Sussex
Pittock June Irene, Maldon, Essex
Powell (Rassington) Roy, London, SW8
Power Matthew Richard, Camborne, Cornwall
Price Huw John, Pontypool, Monmouthshire
Purves Ian, Southampton, Hampshire
Putland David Eric, Little Bookham, Surrey
Raine Margaret, Newtownabbey, N. Ireland
Rattenbury Justin, Birchington, Kent
Reddish Wilson, Codicote, Herts.
Relf Graham Thomas, Newcastle-upon-Tyne
Rice Lily Alice Elisabeth, Walton-on-Thames, Surrey
Richards Stuart, Bury, Lancashire
Rickard Keith Robert, Erith, Kent
Rowe David Alister, Hurst, Berkshire
Ruff Jonathan, Horley, Surrey
Rumble Angela, Walsall, West Midlands

Rushton Anthony, Sale, Cheshire
Rutherford David, Havant, Hampshire
Sanger Malcolm Ernest, Swanage, Dorset
Savage, Fareham, Hampshire
Sellar, Purley, Surrey
Sharpe Ellis Paul, Loughton, Essex
Sheldon Christine, Pershore, Worcs.
Sheldon Kenneth, Pershore, Worcs.
Silverstone Norman Mark, St Davids, Pembs.
Simkins Colin, Great Missenden, Bucks.
Singleton Donald William, Matlock, Derbys.
Skinner Roderick, Tynemouth, Tyne & Wear
Smith Mathew, Bexley, Kent
Smith Michael Anthony, Barr Hill, Cambridge
Smith Walter, Killimster, Wick
Spink Hugh Michael, London SE3
Storey Antony Thomas, Grimsby, Lincs.
Tanner Joseph Russell, Bruton, Somerset
Tasselli Andrea, Wolverhampton, Staffs.
Taylor Ian Michael, Wallingford, Oxfordshire
Taylor Robert Ian, Hoole, Chester
Teague Jeffrey, Chandlers Ford, Hampshire
Teasdale Brian, Consett, Co. Durham
Thomas David Paramor, Sevenoaks, Kent
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Walker Simon Anthony, Ashton-under-Lyme, Lancs.
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Wilkinson Gordon, Nelson, Lancs.
Wilkinson Keith, Runcorn, Cheshire
Wilkinson Mark, Blackburn, Lancs.
Wilkinson Thomas, Rainworth, Notts.
Williams David, Chaddesden, Derbyshire
Williams Patrick, Stechford, Birmingham
Williamson Malcolm John, Scarborough, N. Yorkshire
Wilson Brian James Patrick, Swadlincote, Derbyshire
Winfield Henry William, St Ives, Cornwall
Wrack Dennis Michael, Scunthorpe, Lincs. ■

Sky notes

by Neil Bone

2003 August & September

Sun and Moon

Sunspot cycle 23 continues its slow decline from the double maximum of 2000–2001. On most days, observers viewing the solar disk by the safe means of projection should find at least a few sizeable spot groups (active areas).

The Sun is now heading southwards along the ecliptic, cutting south of the celestial equator at 10h 47m Universal Time (UT; BST minus 1 hour) on September 23 – the moment of the autumnal equinox. From then on, the hours of darkness will exceed those of daylight, ushering in the main night-time observing season.

The Moon is New on August 27 and September 26, placing the best dark skies in the first and last weeks of the month in this interval. Full Moon falls on August 12 and September 10. August's Full Moon couldn't be worse timed for meteor observers, who will find the Perseid maximum swamped by its glare.

Early autumn is a good time for viewing the waning gibbous to last quarter Moon, as it rises comparatively early in the night. For several nights after Full, retardation – the difference in rising time from night to night – is only about 20 minutes in August and September. Although the Moon moves eastwards along its orbit (more or less in the ecliptic plane) by about 13° from one night to the next, the shallow angle of the ecliptic to the eastern/northeastern horizon at this time means that it continues to rise early. Even as much as ten days after Full, the broad waning crescent can be up before midnight on an August or September night.

These early risings give observers the opportunity to observe lunar features under their sunset illumination at a convenient time of night. For example, the crater chain of Theophilus, Cyrillus and Catherina (on the southern 'shore' of Mare Nectaris) will be on the terminator – day-night line – around August 15 and September 13. These are easy to observe in small telescopes when the Moon is a waxing crescent in the spring evening sky: do they appear any different as the Sun sets on them?

The planets

Mercury is technically an evening object in early August, reaching greatest elongation 27° east of the Sun on Aug 14. Setting less than an hour after the Sun, however, it is not likely to be visible. Inferior conjunction between Sun and Earth is reached on September 11,

then Mercury pulls out to a favourable morning elongation west of the Sun, reaching its maximum (18°) on September 26 when it will be rising over 90 minutes before sunrise, among the stars of Leo.

Venus has languished low in the morning sky for the past several months, and finally reaches superior conjunction (on the far side of the Sun from Earth) on August 18. Thereafter moving into the evening sky, Venus will remain too close to the Sun to be visible until almost the end of the year.

The centre of attention in this interval will, of course, be Mars. Reaching opposition (180° from the Sun in Earth's sky) on August 28, the Red Planet will, by a small fraction, be closer to us than at any time in recorded history a day earlier. The marked eccentricity of Mars' orbit means that not all oppositions are equally favourable: when opposition comes with Mars at aphelion – farthest from the Sun in its orbit – the planet is distant and presents a small apparent disk. This time, however, we enjoy a perihelic opposition, with Mars reaching a maximum angular diameter of just over 25 arcseconds – large enough to reveal surface features in telescopes of 75mm aperture and upwards.

Perihelic oppositions of Mars have a couple of potential downsides. First of all, they come with Mars at a southerly declination on the ecliptic, meaning that the planet is never very high in the sky from the UK and our view is, of necessity, through a thick 'wedge' of unsteady air: poor seeing may restrict the amount of detail which can be resolved even in large telescopes. Also, the time close to perihelion is often when dust storms break out in Mars' southern hemisphere, obscuring the view over much of the planet's surface.

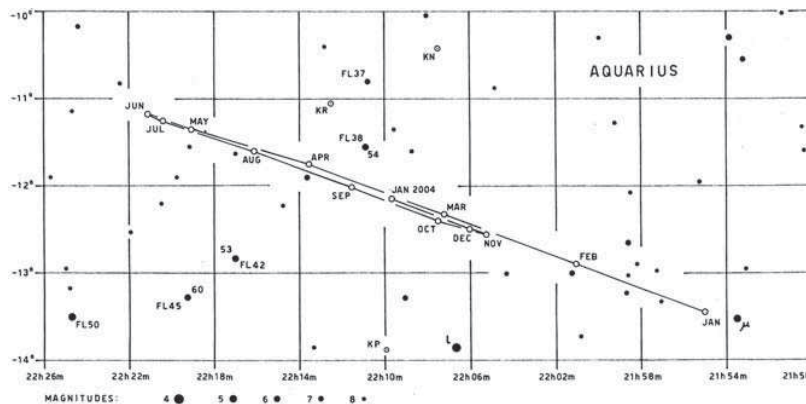
These potential problems notwithstanding,

amateur astronomers across the world will be taking an eager interest in Mars this summer. Mars, among the stars of Aquarius, will reach a maximum 24° above the horizon from southern England at midnight when close to opposition. Shining at magnitude –2.9, Mars will be the brightest object in late August's night sky (the Moon being close to the Sun at this time) and will be unmistakable in any case by virtue of its pronounced red-ochre colour.

The most obvious features for telescopic observers will be the bright south polar cap (retreating as summer advances in Mars' southern hemisphere), the light Hellas basin and dark markings. The prominent 'V'-shaped Syrtis Major is turned towards Earth on evenings in late August, and again about a month later. Mars rotates on its axis once every 24h 37m, and the aspect presented will change markedly over the course of an observing session lasting a few hours. Drawings and images will be welcomed by Mars Section Director, Dr Richard McKim.

Jupiter reaches conjunction beyond the Sun on August 22, and will not be visible in this period. Saturn, now among the stars of Gemini, has re-emerged into the early morning sky and by mid-September will be rising around midnight. At mag. 0, Saturn remains prominent, and the ring system is still essentially wide open towards us – a magnificent sight in any telescope.

The binocular-visible outer planets Uranus and Neptune are at their best in this interval. Uranus, at mag +5.7, is the easier target, in western Aquarius, reaching opposition on August 24. Neptune, mag +7.8, reaches opposition a couple of degrees west (to the right in the northern hemisphere) of 4th-magnitude Theta Capricorni on August 4. Finder charts for Uranus and Nep-



Finder chart for Uranus in 2003. (BAA Handbook)



NGC 7009, the 'Saturn' nebula in Aquarius, imaged by David Briggs & John Lewis.

tune are given on pp76–77 of the *BAA Handbook*, and that for Uranus is reproduced here.

Meteors

Perseid maximum on August 12–13 is usually a dependable highlight for meteor observers, with rates up to 60–70 meteors/hr on occasion. This year, sadly, Full Moon wrecks the spectacle, and only the brightest 20% or so of the crop will cut through the glare. Useful observations will be possible during the run-up towards maximum in the first week of August, when rates should certainly be reasonable, augmented by activity from the Delta Aquarid and Alpha Capricornid radiants low to the south below the Square of Pegasus.

By the time the Moon is out of the way, in the latter parts of August, the Perseids are over: next year will provide a much better view of the shower.

Dedicated meteor observers find September a productive month with random background sporadic activity at its highest for the year, producing rates up to 8–10 meteors/hr. Also in evidence throughout the month are the Piscids, a steady trickle of slow meteors from radiants close to the ecliptic plane.

Variable stars

With Cassiopeia well placed high in the north-eastern sky on autumn evenings, this is a good time to keep an eye on a couple of its variable stars. Gamma Cassiopeiae – the central star of the 'W' – is prone to slow, prolonged brightenings, as happened in the 1930s when it rose to mag +1.6. In more recent times, Gamma Cas has been around mag +2.2 to +2.4, but another brightening could occur at any time, and it is well worth making brightness estimates every few nights. Suitable comparisons are Alpha Andromedae (mag +2.1) and Delta Cassiopeiae (+2.6). Gamma Cas is a rapidly-rotating young B-class giant star, which occasionally throws

off material. A similar object, Delta Scorpii, has brightened markedly in the past couple of years.

On the basis of spectroscopic observations, astronomers believe that Rho Cassiopeiae may imminently enter a phase of increased activity. Located a few degrees west (right) of the 'W', Rho Cas is usually around fifth magnitude, but has been observed in the past to undergo rapid brightening by perhaps half a magnitude or more, following which fades occurred, taking Rho below naked eye visibility into binocular range. The star is an unstable yellow supergiant which could potentially go supernova within a few tens of thousands of years. Brightening is equated with rapid 'collapse' of the extended atmosphere onto the star's surface, following which there is a period of matter-ejection and cooling. Rho Cas bears nightly watching in the closing months of 2003. A chart showing suitable comparison stars can be found on the BAA website at: <http://www.britastro.org/vss/charts.html>

Eclipsing binary Algol (Beta Persei) has favourable minima on the nights of Aug 29–30, Sept 1, 18–19 and 21–22. During eclipse, the star fades from mag +2.1 to +3.4, a difference which is quite noticeable to the naked eye.

Deep sky

With all eyes on Mars in the constellation of Aquarius, perhaps this would be a good time to take in some of that constellation's many deep sky attractions. Although made up of mainly dim stars, Aquarius encompasses some interesting objects within its boundaries. To the naked eye, the most obvious feature is probably the inverted 'Y' of third- and fourth-magnitude stars making up the Water Jar asterism southwest of the Square of Pegasus. Mars at opposition will lie midway between the Water Jar and Fomalhaut (Alpha Piscis Austrini, a lonely first-magnitude star deep in the south of our early autumn sky).

Brightest of Aquarius' deep sky objects, about 8° west of the Water Jar and a few degrees north of (above) mag +3.8 Beta Aquarii is M2, a bright globular cluster. At mag +6.4, this is easy in binoculars. Small telescopes show a fairly large hazy spot with a condensed core.

About 15° to the southwest is a fainter, more challenging globu-

lar, M72. At an overall mag +9.3, this is probably beyond reach in binoculars, low in a hazy autumn sky. My small (80mm aperture, f/5) wide-field spotter telescope shows it as a compact object with a near-stellar nucleus, just west from a mag +8.5 star.

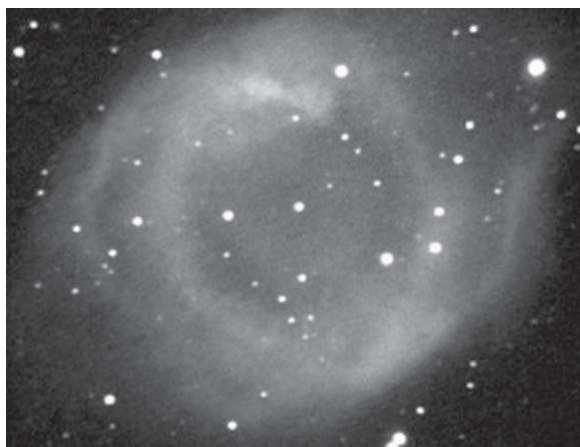
One of Messier's more bizarre catalogue inclusions – like the M40 stellar pair in Ursa Major, an asterism rather than a cluster or nebula – is M73, which lies a little to the east on the same parallel of declination as M72, and will drift into the field of an undriven telescope within a couple of minutes. This object is actually a collection of four faint stars in a 'Y'-shaped pattern, the most southerly (lowest) being the brightest at mag +8. Nicely resolved at ×80, this does, admittedly, appear slightly 'nebulous' at lower powers.

Also in this vicinity is NGC 7009, the Saturn Nebula – a planetary nebula of mag +8.3, best seen in larger aperture instruments. The nebula takes its name from ring-like extensions – 'ansae' – to either side of the main body.

By far the most difficult of Aquarius' treasures is the celebrated Helix Nebula, NGC 7293 some 20° due south of the Water Jar and therefore always low in British skies. This extended planetary nebula is one of the closest to the Solar System, and spreads its overall mag +7.3 over a wide area, almost a third the size of the Moon, making for low contrast with the sky background. Contrast-enhancing OIII filters coupled to large apertures (250mm and upwards) and the clearest, darkest skies will be needed to detect this object.

While bereft of bright stars, Aquarius certainly has much to offer, and it is well worth taking some time out from observing Mars while in the neighbourhood during the dark of the Moon at the close of August and September.

Neil Bone



Diffuse planetary nebula the 'Helix', NGC 7273, is always low and difficult in British skies. CCD image by Nik Szymanek.



Notice board

Meetings diary

2003 August 1–30

Ilkeston, Derbyshire. Exhibition of photographs and drawings for National Astronomy Week by the Ilkeston & District Astronomical Society, at the Erewash Museum, Ilkeston. **Saturday August 30**, an **Open Day** in the grounds of the Museum, with Society telescopes and members' own equipment, and an astronomical treasure hunt for the children. Details from the Society website at <http://hometown.aol.com/idasastro/index.htm>, or Mary McNulty, 01298 78234.

2003 August 16

Meeting of the Instruments and Imaging Section, The Humfrey Rooms, Northampton. 11.00 am to 6.00 pm. Speaker details and map on the Section Web page, www.britaastro.org/iandi/meetings

2003 August 23 to September 13

A public exhibition on Astronomy at the Library, Campus West, Welwyn Garden City, Herts. Admission free. Opening and an introduction to the exhibition at 2:00 pm on

23 August, and there will be two free multimedia presentations: 30 August, 2:00 pm: A Tour of the Universe; 13 September, 2:00 pm: The Amateur Astronomer. For further information, contact the organiser, Jerry Stone at spaceflight_uk@yahoo.co.uk or the Library on 01438 737333

2003 September 5–7

BAA Out of London Weekend, at the Priory Centre, York. Incorporating the third BAA Observers' Workshop. See adjacent notice and the BAA Web page, www.britaastro.org/meetings

2003 September 12–14

Horncastle Astronomy Weekend. Details from Paul Money, 18 College Park, Horncastle, Lincs. LN9 6RE. Tel. 01507-524037.

2003 October 10–12

The Astronomer Annual General Meeting: a residential weekend at the Alston Hall, Preston. Details from the *TA* website www.theastronomer.org or from Guy Hurst, 16 Westminster Close, Kempshott Rise, Basingstoke RG22 4PP.

2003 October 29

BAA Annual General Meeting, 17.30 hrs., The Geological Society, Burlington House, Piccadilly, London W1. The pro-

gramme will include the Presidential Address, given by Guy Hurst on the topic of **'Pro-Am collaborations in astronomy'**.

2003 November 8

Leeds Astronomical Society Astromeeet 2003, at the Brunswick Building, Leeds Metropolitan University, Merriam Way. Doors open at 9am onwards for a 10am start. Speakers include Prof. David Hughes, Allan Chapman, Michael Clark, Robert Walsh & Prof. Carlos Frenk. More details on the Leeds AS Website, www.leedsastronomy.org.uk

Items for this diary should be sent to the *Journal* Editor [hazelmccgee@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.

BBC TV: Request for contributors

BBC Television is planning a 90 minute live broadcast at the end of August 2003 from Jodrell Bank Radio Observatory in Cheshire and La Palma in the Canary Islands. Timed to coincide with the close opposition of Mars and the beginning of National Astronomy Week, this will be the biggest mass sky-watching event ever mounted for television, a nationwide celebration of Britain's amazing discoveries in space and astronomy.

BBC viewers will be able to use the Isaac Newton Telescope on La Palma, Jodrell Bank's Lovell Radio Telescope as well as other telescopes around the world to see for themselves the full splendour of the Universe – live as it happens.

We are still looking for people to contribute to the programme and would like to hear from anyone who has a 'special' reason for wanting to use these powerful telescopes to target an object of their choice. All you need to do is tell us what you want to see and more importantly why.

From all the requests we receive, we'll be selecting the most interesting ones and offering ten lucky people the chance to attend this late-night astronomy extravaganza, with the possibility that they may be asked to appear on the programme.

Karen Keith, Assistant Producer

Phone: 0870 010 4425
(calls charged at national rate)

E-mail: starparty@bbc.co.uk

**Address: Rm. 4430, BBC White City
201 Wood Lane, London, W12 7TS**

Small advertisements

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

Small adverts must be typed or printed clearly and sent with the correct remittance in sterling, payable to the British Astronomical Association, to the BAA office at Burlington House, Piccadilly, London W1J 0DU, England.

Members' private sales and wants

One advertisement of up to 35 words per member per issue is accepted FREE OF CHARGE, at the discretion of the Editor. This offer is not available for business advertisements or to non-members.

Notice

Readers are advised that the British Astronomical Association cannot be held responsible for the accuracy of any descriptive statements or for the quality of goods or services advertised.

Wanted

Wanted, for private/educational observatory and library: BAA *Journals*, Vol. 1–14, 16–18, 27–35, 41–45, 49; BAA *Memoirs* Vol. 1–4, 9–15, 18, 22, 24, 25, 28, 31; *Astronomical Registers* Nos. 1–28, 94–97, 115, 133–156, 175, 177, 186, 202, 203, 209, 211, 214, 220, 224–288; Smyth *Sidereal Chromatics*; A. S. Williams, *Zeno. Fragments 1 & 2*; Franklin–Adams *Charts 140–206 (+30–+90)*; Ross/Calvert, *Atlas of the Northern Milky Way*. Complete libraries, books, periodicals, notebooks, charts, atlases and medals related to observational work. Also wanted, old brass telescopes, eyepieces, spectroscopes etc. by Cooke, Dollond, Tulley, Wray etc.; large binoculars by Zeiss; modern Zeiss boxed set eyepieces. Please contact: Andy Stephens, 01242 675719 (Cheltenham); e-mail nighthawk@glasseyes.fsnet.co.uk

For sale

Meade 2080 8" SCT, wedge and tripod; offers invited. Tel. 0115 937 6333 (Nottingham) or e-mail rockvision@freeuk.com

The next BAA meeting

2003 September 5 to September 7

BAA weekend in York

at the Priory Street Centre, 15 Priory Street, York

Paul Roche: 'Impacts from Space' (Friday 7.30 pm)

Dr John Mason: 'TV documentaries on Astronomy: an insider's view' (Sat. 7.30 pm)

and featuring the third

BAA Observers' Workshop (Saturday, all day)

Guy Hurst	Nova patrolling
Jonathan Shanklin	Visual observations of comets
Melvyn Taylor	Observing variable stars with binoculars
Dave Gavine	Auroral forms and how to report them
Richard McKim	Drawing and imaging Mars
Steve Evans	Photographic measures of meteors
Andrew Elliott	Video recording of occultations

Admission is free to all events. You may visit for some or all of the talks and lectures, as you wish. For a map of the venue and travel details see the York AS web site, www.yorkastro.freemove.co.uk

Last-minute accommodation details may be obtained from the BAA office.

Annual subscriptions

May we remind members that the annual subscription for the 2003-2004 Session became due on August 1. Only those who have paid their subscription will receive the 2003 October *Journal* and the 2004 *Handbook*. If you have mislaid your renewal form please contact the office for a replacement: Tel. 020 7734 4145 or e-mail office@baahq.demon.co.uk.

Patricia Barber, Assistant Secretary

Your vote for Council

You will find the Balloting List for the BAA Council enclosed with this issue of the *Journal*. Please take a few minutes to vote and return the Balloting List no later than 2003 October 22 in the envelope provided.

When returning the Balloting List please make sure that **nothing else** is enclosed in the envelope. These envelopes are not opened until after October 22, so any subscriptions enclosed would not be processed until after the end of October, and your October *Journal* and the *Handbook* would be received very late.

Ron Johnson, Business Secretary

Please note that the BAA Office will be closed for the Bank Holiday on Monday and Tuesday August 25/26.

Publications for sale from the BAA Office

The following are for sale **post free** (inland and overseas surface mail) from the BAA office at Burlington House, Piccadilly, London W1J 0DU. Please send cheque with order, or credit card no. with expiry date. If airmail required please fax or e-mail first for cost: Fax no. (+44) 20 7439 4629; e-mail office@baahq.demon.co.uk. (Payment must be made in sterling or US dollars).

<i>The BAA Observing Guide</i> (revised 2002)	£2.50	<i>BAA Memoirs</i>	
<i>Comet Section Guide for Comet Observers</i> (new 2002)	£3.50	<i>Jupiter 1973-1977, The Pioneer Years</i>	£3.00
<i>Deep Sky Section Deep Sky Observing Catalogue</i>	£2.25	<i>Jupiter 1977-1981, The Voyager Years</i>	£3.00
<i>Deep Sky Section Messier Catalogue</i>	£2.25	<i>Both Jupiter Memoirs</i> (set)	£5.00
<i>Small map of the Moon</i>	£0.50	<i>Halley's Comet: the 1986 Apparition</i>	£3.50
<i>Lunar quadrant maps</i> (set of 4 detailed maps, 58×68cm)	£9.50	<i>BAA: The Second Fifty Years</i>	£4.50
<i>Mars map</i> (99×102cm)	£6.50	<i>Telescopic Martian Dust storms</i> (members)	£10.50
<i>Night view of the Earth poster</i>	£7.50		(non-members) £15.00
<i>Solar eclipse poster</i>	£7.50	<i>BAA Journal</i> , Vol.1 No.1 (Reprint)	£1.25
<i>BAA Chart of the Heavens</i>	£2.00	<i>BAA Journals</i> , 2002 or earlier, per issue	£1.50
<i>Philips Planisphere</i> (large) 51° 5N	£5.50	<i>Index to BAA Journal</i> , Vols. 51-100	£4.00
<i>Philips Planisphere</i> (small) 51° 5N	£3.50	<i>1927: a British eclipse</i>	£3.50
<i>Southern sky Planisphere</i> , 35°S	£9.00	<i>CD-ROM: The 1999 August 11 Eclipse</i>	£7.50
<i>Messier Objects laminated observing chart</i>	£3.00	<i>CD-ROM: 2002 Perth conf. Mesospheric Clouds</i> (mem)	£6.00
<i>Caldwell Objects laminated observing chart</i>	£3.00		(non-mem) £10.50



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Secretary (Business): Ron Johnson, 53 Manor Drive, Ewell, Surrey KT19 0EU. Tel. (020) 8393 0679. E-mail: 113457.1736@compuserve.com

Secretary (Papers): Nick James, 11 Tavistock Road, Chelmsford, Essex CM1 6JL. Tel. (01245) 354366. Fax: (01245) 602081. E-mail: ndj@blueyonder.co.uk

Secretary (Meetings): Dr Nick Hewitt, The Manor House, Toot Baldon, Oxford OX44 9NG. Tel. (01865) 343398. E-mail: Nick_Hewitt@compuserve.com

Other elected members of Council

Roger Dymock, Richard Flux, Dominic Ford, Maurice Gavin, Peter Hudson, Geoffrey Johnstone, Dr John Mason, Dr Richard Miles, Callum Potter.

Directors of Sections

Solar: Geoff Elston, 32 Alma Road, Chesham, Bucks. HP5 3HD. Tel. (01494) 786232. E-mail: geoff_elston@solarobserver.freemove.co.uk

Lunar: Alan Wells, 135 Elmdon Lane, Marston Green, Birmingham B37 7DN. Tel. (0121) 779 5082. E-mail: awells@citycol.ac.uk

Mercury & Venus (Acting): Edward Ellis, 64 Marshal's Drive, St. Albans, Herts, AL1 4RE. Tel. (01727) 856250. E-mail: edwardellis@btopenworld.com
Transits Coordinator: Peter Macdonald, 46 Vista Way, Harrow, Middx HA3 0SL. Tel. (020) 8907 8669.

Mars: Dr Richard McKim, Cherry Tree Cottage, 16 Upper Main St., Upper Benefield, PE8 5AN. Tel. (01832) 205387. E-mail: RMcKim5374@aol.com

Asteroids and Remote Planets: Dr Andrew Hollis, 35 Millmead, Rode Heath, Cheshire ST7 3RX. Tel. (01270) 883304. E-mail: A.J.Hollis@open.ac.uk

Jupiter: Dr John Rogers, 10 The Woodlands, Linton, Cambridge CB1 6UF. Tel. (01223) 893758. E-mail: jhr11@cam.ac.uk

Saturn: David Graham, 95 Hillshaw Parkway, Ripon, N. Yorks. HG4 1JU. Tel. (01765) 608517. E-mail: davgram@ic24.net

Comet: Jonathan Shanklin, 11 City Road, Cambridge CB1 1DP. Tel. (01223) 571250. E-mail: jds@ast.cam.ac.uk

Meteor: Neil Bone, 'The Harepath', Mile End Lane, Apuldrum, Chichester, West Sussex PO20 7DZ. Tel. (01243) 782679. E-mail: bafb4@central.sussex.ac.uk

Aurora: Ron Livesey, Flat 1/2 East Parkside, Edinburgh EH16 5XJ. Tel. (0131) 662 4220. Section E-mail: web@baa-aurora.fsnet.co.uk

Variable Star: Roger Pickard, 3 The Birches, Shobdon, Leominster, HR6 9NG. Tel. (01568) 708136. E-mail: rdp@star.ukc.ac.uk

Deep Sky: Dr Nick Hewitt, The Manor House, Toot Baldon, Oxford OX44 9NG. Tel. (01865) 343398. E-mail: Nick_Hewitt@compuserve.com

Instruments and Imaging: Bob Marriott, 24 Thirlestane Road, Far Cotton, Northampton NN4 8HD. Tel. (01604) 765190. E-mail: ram@hamal.demon.co.uk

Computing: Gordon Taylor, 20 Badgers Walk, Deanland Wood Park, Golden Cross, Hailsham, East Sussex BN27 3UT. Tel. (01825) 873153. E-mail: mp2603@talk21.com

Historical: Anthony Kinder, 16 Atkinson House, Catesby Street, London SE17 1QU. Tel. (020) 7701 0626. E-mail: anthony_kinder@hotmail.com

Reporting of fireballs and other transient or unusual phenomena: Howard Miles, Lane Park, Pityme, St Minver, Wadebridge, Cornwall PL27 6PN. Tel. (01208) 863153. E-mail: HowardMiles1@compuserve.com

Other officers

Journal Editor: Hazel McGee, Starfield, Dedswell Drive, West Clandon, Guildford, Surrey GU4 7TQ. Tel. (01483) 222791. E-mail: hazelmgee@compuserve.com

Journal Advertising Manager: Richard Flux, 29 Kite Hill, Wootton Bridge, Ryde, PO33 4LA. Tel. (01983) 883062. Fax: (01983) 883062.

Circulars Editor: Don Miles, 96 Marmion Road, Southsea, Hants. PO5 2BB. Tel. (02392) 591146. Fax: (02392) 862466. E-mail: donmiles@webbsoc.demon.co.uk

Public Relations Officer: Dr John Mason, 51 Orchard Way, Barnham, West Sussex PO22 0HX. Tel. (01243) 554331. Fax: (01243) 554272. E-mail: docjohn@dircon.co.uk

Librarian: Anthony Kinder, as above [Historical Section].

Curator of Instruments: Bob Marriott, as above [Instruments and Imaging Section]

Radio Astronomy Coordinator: Peter King, 38 St Bede's Gardens, Cambridge CB1 3UF. E-mail: pdk@eng.cam.ac.uk

Coordinator, Program and Data Library, Computing Section: Robert Watkins, 7 Shirehampton Close, Webheath, Redditch, Worcs. B97 5PF. Tel. (01527) 404419. E-mail: robert_r_watkins@hotmail.com

Coordinator, Campaign for Dark Skies: Bob Mizon, 38 The Vineries, Colehill, Wimborne, Dorset BH21 2PX. Tel. (01202) 887084. E-mail: bob@mizar-astro.freemove.co.uk. Web page: <http://www.dark-skies.org>

Coordinator, Education Committee: Dr Anne Urquhart-Potts, Tanyard Farm, Somerford Booths, Congleton, Cheshire CW12 2JT. Tel. (01260) 224332. E-mail: anne-cohen@lineone.net

Coordinator, UK Nova/Supernova Patrol: Guy Hurst, 16 Westminster Close, Kempshott Rise, Basingstoke, Hants. RG22 4PP. Tel. (01256) 471074. E-mail: guy@tahq.demon.co.uk

World Wide Web site manager: Richard Miles, Grange Cottage, Golden Hill, Stourton Caundle, Dorset DT10 2JP. Tel. (01963) 364651. E-mail: rmiles@baa.u-net.com

Assistant Secretary: Patricia Barber, Burlington House, Piccadilly, London W1J 0DU. Tel. (020) 7734 4145. Fax (020) 7439 4629. E-mail: office@baahq.demon.co.uk

The New South Wales Branch

President: Elizabeth Budek, 7/59 O'Brien Street, Bondi, NSW 2026, Australia. E-mail: elizabeth.budek.109313@navy.gov.au

Secretary: Elizabeth Cocking, PO Box 138, Randwick, NSW 2031. Tel. (+61 2) 9398 9705

Treasurer: Monty Leventhal, 69 Mons Ave., Maroubra, NSW2035. Tel. (+61 2) 9344 5601. E-mail: monro@ozemail.com.au