# Ordinary Meeting, 2006 December 16
## held at New Hunts House, Guys Hospital, London Bridge, London SE1

**Richard Miles**, President

**Ron Johnson, Hazel Collett and Nick James**, Secretaries

The President opened the third meeting of the 117th Session and invited Dr Nick Hewitt to read the minutes of the previous meeting, which were approved by the audience and duly signed. He announced that 26 new members were proposed for election; those 61 who had been proposed at the previous meeting were approved and declared elected. Mr Nick James, Papers Secretary, explained that he had papers from two months to announce, since he had made no announcement at the previous meeting. In total, three papers had been approved for *Journal* publication:

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The President gave details of a forthcoming joint venture between the Campaign for Dark Skies (CfDS) and the Campaign to Protect Rural England (CPRE) to map light pollution across the UK. On the moonless evenings of December 20-24, between 20h00 and midnight GMT, members of the public were invited to conduct naked-eye star counts in the rectangle of sky in Orion enclosed at its four corners by the feet, shoulders and head of the Hunter – i.e. by the stars Betelgeuse, Bellatrix, Rigel and Saiph. Even from the most heavily light-polluted areas, some stars would be visible, but from dark skies many more would be discernable. Observations could be submitted via the BAA website. In case these nights were clouded out, the exercise would be repeated around the time of the following New Moon, on the evenings of January 14-21.

The President went on to announce that the next Association meeting would be a *Back to Basics* workshop on January 20 in Ipswich, including a talk by Dr Laurence Newell marking the first appearance of the Radio Astronomy Group (RAG) in the series. The next Ordinary Meeting would take place at the present venue on January 31.

Finally, before moving onto the afternoon's talks, the President expressed his gratitude on the behalf of the Association to Jean Felles, Office Manager, and her husband, for having worked beyond the call of duty in their oversight of the Office's relocation from Burlington House to its temporary accommodation on Hallum Street. Both were presented with a token of the Association's thanks, to which members applauded.

The President then proceeded to introduce the afternoon's first speaker, Mr Doug Ellison, host of the spaceflight imaging community website *unmannedspaceflight.com.*

## Farce and Fortuity in the Exploration of Space

Mr Ellison explained that his talk would outline a few of the turns of fortune which had affected the history of spaceflight. His first example was the *Cassini-Huygens* mission; he recalled how, after launch, its engineers had realised that they had over-looked the Doppler shift in the telemetry between the *Huygens* lander and the *Cassini* orbiter which resulted from their relative velocity. It had then been too late to change the frequencies to which the telemetric hardware was tuned, but with a stroke of genius, the ground team had re-designed the orbital trajectories of the two probes to minimise their relative velocities to within tolerable limits.

This had not been the only technical hitch in that mission; Mr Ellison further recalled how all of the data from one of the two communications channels between *Huygens* and *Cassini* had been lost as a result of a software bug on *Cassini*; the relevant receiver had never been turned on.

He turned next to the Jovian *Galileo* probe; he recalled its long history, having been designed by NASA in the 1970s, built in the 1980s, and launched after a delay in 1989; it had finally reached Jupiter in 1995. He recalled that its primary antenna, rather like an umbrella, had failed to unfold. The leading theory as to the cause was that grease from the antenna joints had shaken out during its many journeys between Florida and NASA Jet Propulsion Laboratory (JPL) in Pasadena, CA, making it too stiff to open.

Without this antenna, *Galileo* had been seriously crippled: its functional low-gain antenna could transmit only 10 bits/second; the lost antenna would have transmitted 138 kbit/sec. Mr Ellison explained that once again, engineers had devised ingenious work-arounds. By upgrading ground-based antennae and improving the data compression software used on the spacecraft, they had achieved a final communication rate of 120 bits/sec. Whilst many of the mission's planned activities had had to be cancelled, *Galileo* had still achieved many of its original aims.

Mr Ellison turned next to the *NEAR Shoemaker* probe, sent to asteroid *433 Eros*. He recalled how, on its final

approach to the asteroid in 1998, a 15-minute orbital-insertion burn had failed and *NEAR* had subsequently gone radio-silent for 27 hours. Upon realising the situation, the engineers had had little time to redesign the mission, yet they had been able to take data during a fly-by of *Eros* three days later, and then achieve orbital insertion upon its next close approach in 2000. The speaker noted that the subsequent mission had been a resounding success, ending in touchdown onto the surface of *Eros* in 2001.

He then turned to discuss the many turns of fortune which had affected missions to Mars. He recalled that the failure of *Mars Observer* (1992), three days prior to orbital insertion, had led to a feeling that NASA should not have risked all of its instruments on one spacecraft, but should instead have sent a larger number of cheaper probes. This philosophy had now grown to be known by the motto 'faster, better, cheaper'. It had had some early success with the fruitful missions of *Mars Pathfinder* and *Mars Global Surveyor* (1996), but less luck with *Mars Climate Orbiter* (MCO) and *Mars Polar Lander* (MPL) in 1998, both of which had been sunk by design flaws. He noted, however, that these had both had second lives: much of the technology from MCO had been reused in *Mars Odyssey* (2001), meanwhile *Phoenix* (scheduled 2007) would be similar to MPL.

In 2003, NASA had made the daring decision to send two identical rovers to Mars – achieving complete redundancy against spurious failure, but also risking the combined failure of both in the event of design failings. These, the *Spirit* and *Opportunity* rovers, had been tremendously successful: both remained to this day fully operational. Before launch, however, their mission had seemed in great doubt; 15 months beforehand, tests had revealed serious problems with both their parachutes and airbags; furthermore, the suitability of the chosen landing sites had been questioned. As in previous cases, Mr Ellison explained that mission engineers had effected a miracle in rectifying these issues within the time available.

He recalled that these had not been the only problems for the mission. Early in *Spirit*'s explorations, an issue with its memory filing system had left it crippled for several days; more seriously, *Opportunity*'s arm joint heater had always been jammed in the 'on' state, forcing engineers to power the rover down into a 'deep sleep' mode each night. In consequence, *Opportunity*'s hardware was frequently exposed to temperatures well below its minimum rated tolerance; how it had survived this treatment remained something of a mystery.

The speaker closed by posing the open question of whether the space industry had learnt from these brushes with fortune, but praised the engineers for their often-ingenious fixes to problems.

Following the applause, the meeting broke for tea. The President then introduced the afternoon's second speaker, Prof John Brown, who would be presenting this year's Christmas Lecture. Prof Brown held a Regius Professorship in Astronomy at the University of Glasgow, and was also the current Astronomer Royal for Scotland.

## Abra Cad Astra

Prof Brown explained that the theme of his Christmas Lecture would be 'Christmas Crackers'; he presented descriptions of astrophysical explosions on scales ranging from the Big Bang, through the collision of Comet *Shoemaker-Levy 9* with Jupiter, to that of lightning strikes on Earth. These, he interleaved with a show of magic tricks.

He remarked that many of his serious-minded academic colleagues might find his passion for magic somewhat flippant. He thought, however, that there was much of relevance to science which could be learnt from the art – about observation and reasoning, for example. He had observed when performing tricks how much sharper young children's apparently unconditioned eyes could be, as compared to those of adults. He added that he also tried to weave stories around magic tricks to illustrate aspects of physics. By so doing, he could produce memorable analogies to effects such as relativistic length contraction, which could never be demonstrated for real.

Following the applause for Prof Brown's lively and festively-themed mix of astrophysics and magic, the President proceeded to present a brief Sky Notes for the month.

## The December Sky

Dr Miles opened with an update on Nova Cygni 2006 (aka. V2362 Cygni), which had flared in early April. At the last meeting, an anomalous brightening had been reported; Dr Arne Henden, Director of the AAVSO, had then predicted that the light-curve would plateau for a time, but fade within 2-3 weeks. Observations by a number of BAA members had since confirmed this prediction.

The speaker turned to report that Peter Birtwhistle, an active near-Earth asteroid observer, had discovered four new main-belt asteroids within the past month. This brought the total number of his discoveries to 62.

Turning to meteor showers, Dr Miles reported that the Ursid maximum would be on December 22. Though this shower normally yielded rates of only around 10 ZHR, Esko Lyytinen and Markku Nissinen had published predictions of an enhanced rate of up to 35 ZHR this year, resulting from the Earth's orbit intersecting a stream of

dust laid down by the shower's parent, Comet 8P/Tuttle, 75 orbits ago, in AD 996. The enhanced rate would likely peak at around 19h27 UT, though it might extend from 18h10 to 20h50 UT. The speaker noted that the observing conditions were forecast to be good: the evening of maximum would be Moon-free this year, and the radiant of this shower was at high altitude in the UK sky.

Dr Miles closed by mentioning an exciting comet prospect for early January: 2006 P1 (McNaught), discovered in August. Currently at around mag 5 and 14° from the Sun, it would reach perihelion on January 12, passing within Mercury's orbit and skimming a mere 0.17 AU from the Sun. On the evenings of January 7-9 it would be briefly visible in evening twilight shortly after sunset at around 5pm, positioned vertically above the azimuth where the sun had set, at a similar altitude to Venus, which lay 20° away in azimuth. Given its close approach to the Sun, this could be a spectacular object despite the necessity of twilight observing.

After January 9, the nucleus itself would be too close to the Sun for observation, though it would appear within the field of the LASCO camera on the SOHO satellite. If it grew a substantial tail, however, this might be visible stretching above the western horizon after sunset.

The President then welcomed Dr Stewart Moore, Director of the Deep Sky Section, to present the meeting's final talk.

## The Winter Deep Sky

Dr Moore began by defining the 'winter sky'. Though constellations normally associated with summer were still visible in the west at dusk, and those associated with spring were already visible in the east at dawn, he would concentrate upon those which presently transited at around midnight, such as Orion, Gemini and Taurus. Reading the popular literature, one might be forgiven for concluding that the Orion Nebula (**M42**) was the only deep sky object among these constellations. Dr Moore argued that there were, in fact, many other beautiful but widely-neglected objects on offer; given that he would say nothing further about M42, he conceded that his title should perhaps have been 'The *Alternative* Winter Deep Sky'.

The sword of **ORION** contained an often-ignored string of nebulae apart from M42. Immediately north of M42, and physically associated with it, was **M43** – a complex of emission/reflection nebulosity which repaid detailed study. A little further north still, one came to another cluster of nebulae: **NGC 1973**, **1975** and **1977**. These were likewise associated with M42 and actually formed a single continuous whole; Dr Moore explained that the small-field telescopes used in the compilation of the NGC had often hindered the identification of large-scale nebulosity. At the northern end of the sword lay **NGC 1981** – a beautiful open cluster.

Turning to more challenging targets in Orion, Dr Moore mentioned planetary nebula **Abell 12** – easy to find on account of being a mere 1.2' from mag 4 star μ-Ori, but very tricky to distinguish from its glare. This nebula was more accessible to CCDs than to visual observers, but in both cases an OIII filter was essential; the speaker showed a recent CCD image by Andrea Tasselli. Despite its fame, the Horsehead Nebula (**B33**) often disappointed. It too was a highly challenging target, requiring a large aperture – minimum 14" for visual work – good transparency, and Hβ filter. As with Abell 12, it had become much easier to image since the advent of CCDs.

Further north lay **M78** – a comet-shaped region of both emission and reflection nebulosity, appearing to have two nuclei. It repaid both filtered and unfiltered observation to reveal its emission and reflection components respectively. It had achieved brief fame in 2004 as the site of McNeil's Nebula, though this had now faded from sight. Dr Moore urged members to keep watching this sky region; McNeil's Nebula had previously been seen in 1966-7, and so might recur. He concluded his tour of Orion by briefly mentioning two further bright objects: planetary nebula **NGC 2022** and open cluster **NGC 2169**.

He then moved south to **LEPUS**, a constellation seemingly ignored by many UK amateurs. Though it lay south of Orion, its centre still culminated at 20° altitude, making it accessible from all but the most light-polluted areas. Dr Moore started his tour with **M79**, a bright globular cluster; at 9' across it was an ideal binocular target. It was midway in concentration and had a bright central condensation.

The Spirograph Nebula (**IC 418**) was a visually easy planetary nebula. Through a 6" aperture, a disk of 12" diameter was visible; through a 24" aperture, signs of mottling began to appear within this. At high power, it was possible to resolve the mag 10 star which lay at its centre. Using an OIII filter, an outer ring was also discernable.

Finally, Dr Moore gave mention to open cluster **NGC 2017** and carbon star **R Leporis**, which Hind had described as "the most intense crimson, resembling a blood-drop on the black background of the sky". It was a long-period Mira-type variable star, and its colour varied from deep crimson at minimum to a more coppery hue at maximum.

He then turned to **GEMINI**. The most famous globular cluster here was **M35**, in which more than 150 stars could be counted within a 1° diameter. But the speaker urged members to look also at **NGC 2158**, less than 30' away, and much more compact on account of being six times more distant. Two open clusters also lay nearby: **IC 2157** and **NGC 2129**; a little further afield was **NGC 2266**.

Gemini offered two easy planetary nebulae. The Eskimo Nebula (**NGC 2392**) was well known, but the double object **NGC 2371-2** less so. Measuring 55" across, this latter object was larger than Jupiter; it had a bipolar appearance, especially apparent through an OIII filter. The Medusa Nebula (**Abell 21**) was much more of a challenge; through the speaker's 14" it was discernable but not bright. A final challenge for Gemini was supernova remnant **IC 443**.

Dr Moore then turned to **MONOCEROUS** – not a widely known constellation, probably on account of its complete lack of bright stars. It could be found immediately to the east of Orion. Its most famous deep sky offering was the Rosette Nebula (**NGC 2237, 2238, 2239, 2246**), a vast swath of emission nebulosity, in the centre of which lay open star cluster **NGC 2244**; this was a site of very recent star formation. Its most appealing open cluster was **M50**, a grouping of 50+ stars within a 15" diameter. Visually, it appeared arrow shaped. Monocerous was also home to Hubble's Variable Nebula (**NGC 2261**), a bright and easy patch of emission/reflection nebulosity, varying in both brightness and structure on timescales of months.

The speaker concluded his talk with **TAURUS** – home to **M1** and **M45**, but also to some lesser-known objects. The Hyades (**Mel 25**) were an appealing sight through binoculars – more so than through a telescope – it was nice to see this large cluster with its surrounding field.

Dr Moore closed by remarking that December 14 had been the 200th birthday of the Revd Thomas William Webb (1806–1885); Webb had been one of the first popularisers of astronomy, and it was in his honour that the modern-day Webb Society was named.

Following the applause, the President adjourned the meeting until 2007 January 31 at the present venue.

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Dominic Ford