Ordinary Meeting, 2003 November 29
held at The Geological Society, Burlington House, Piccadilly, London W1

Tom Boles, President

Ron Johnson, Nick Hewitt and Nick James, Secretaries

The second meeting of the 114th session was opened, and the minutes of the October meeting were read by Dr Hewitt before being approved by the audience. Mr Johnson announced the receipt of 53 books, kindly donated from the estate of the late Richard Kelly. Members expressed their gratitude to the donor. Mr James proceeded to announce that four papers had been accepted for Journal publication:

The star of Bethlehem and the comet of AD66, by Rod Jenkins
Visual and photoelectric photometry of 11 Parthenope from 1989 to 2002, by Richard Miles et al.
Jupiter in 2000/2001 - Part I: Visible wavelengths, by John Rogers et al.
Jupiter in 2000/2001 - Part III: The South Equatorial Disturbance, by John Rogers et al.

The President announced that the next meeting would be the Christmas Meeting, to be held at the Geological Society on January 10. The afternoon would include the Christmas Lecture, given this year by Prof Malcolm Longair of the Cavendish Laboratory, Cambridge, and Martin Mobberley's regular Sky Notes. Mr Boles proceeded to introduce the afternoon's opening speakers, Nigel Henbest and Heather Couper. Co-founders of a substantial production company specialising in the promotion of astronomy, Henbest and Couper were prolific broadcasters and writers, having authored a total of 66 books between them to date.

Mars, the Inside Story

Ms Couper expressed her delight at having been invited to address the Association, having previously held the Presidency 1984-6. As to her subject, there were many reasons for taking special interest in Mars at present, both for amateurs and professionals. The former group had, of course, been treated to an exceptional view of the red planet in recent months as it passed closer to the Earth than any previous approach of the two planets for many thousands of years. Furthermore, four space probes destined for Mars were due to arrive within a few months; firstly, the Japanese *Nazomi* probe, though this one seemed rather unlikely to perform well, as a series of crippling malfunctions in-flight, and solar flare damage from 2002 April, had forced substantial revision of the flight plan. Indeed, Nazomi had been intended to reach Mars in 1999, but a thrusting fault early in the mission had forced a new interplanetary trajectory to be devised, bringing it into Martian orbit in 2003. America had launched two twin landing rovers, *Spirit* and *Opportunity*, scheduled to arrive 2004 January, and Europe's *Mars Express,* scheduled to arrive at a similar time, was carrying the British-led *Beagle 2* landing probe. All these spacecraft appeared to have survived unscathed the radiation hazards posed by the intense solar storm activity of late 2003 October.

The speakers commenced their historical survey of observation of Mars in 1894, with Percival Lowell's industrious efforts from Arizona. Travelling south from Massachuchets to find clearer skies, Lowell had founded his own observatory shortly before the opposition of that year, using funds from his family fortune. Subsequently, he had concentrated his work almost exclusively upon Mars for a period no less than 15 years. He had famously claimed to find canals, and constructed elaborate theories to explain how an intelligent race had built these extensive systems of waterways to irrigate withering vegetation in the equatorial regions using water from the melting polar caps. He pictured Mars as a dying planet, and even after only his first night of observation, he already used the word 'desert' to describe what he saw. The speakers suggested that cultural influences such as the inauguration of the Suez Canal in 1869 may have biased Lowell's imagination at this time, as well as the desert surroundings of Arizona. Some inspiration was sure to have come from Schiaparelli's 1877 discovery of what he termed '*canali'* – translating either as 'canals' or 'rivers' – though Schiaparelli did not himself believe them to be anything other than natural phenomena. The speakers speculated that Lowell's use of aperture stops to reduce the brightness in the eyepiece may have introduced an anomalous sharpening of filamentary features, leading Lowell to over-interpret them.

Little more was learnt about the red planet until 1965, when NASA's *Mariner 4* flew past, becoming the first probe to obtain close-up images of any of the planets. Results returned by its instruments suggested the Martian atmosphere to be only 1% the thickness of that on Earth, and to be composed primarily of CO_2. Furthermore, Mariner found minimal magnetic field to protect the surface from the ionising particles of the solar wind. Bathed in such radiation, it would be rendered a particularly harsh environment for life.

This coming at the height of the Cold War era, the Soviets also worked strenuously on their own programme of spacecraft destined for Mars, though it was dogged by so many failures that the phenomenon became known as the 'Mars Curse'. The closest the Russian missions came to success were the *Mars 2-7* projects, launched in the early 1970s. These followed a series of at least eleven entirely fruitless attempts, most of which failed on launch. *Mars 2*

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and *3* were combined orbiters and landing modules, of which one lander failed 20 seconds after commencing data return; the other was destroyed at touchdown. The two orbiting modules returned data for no more than a few weeks. In 1973, the Russians launched four further missions, two orbiters, *Mars 4/5*, and two landers, *Mars 6/7*. The first failed to enter orbit, and only managed to return a few distant images of the planet. *Mars 5* failed 10 days after reaching its destination, and returned minimal data. *Mars 6*, a landing probe, returned data during decent, but failed on landing. Meanwhile, *Mars 7* entered solar orbit after missing its target completely.

The USSR would not attempt any further Mars missions until the 1988 launch of *Phobos 1* & *2*, both with considerable assistance from other European nations and communication support from NASA's Deep Space Network. These ambitious projects intended to examine Mars' moon Phobos, thought by some to be a captured asteroid. They would perform chemical tests on it by directing an intense laser beam onto the surface below, vapourising tiny samples. The spectrum of the resultant glow would be analysed in the hope of detecting emission features allowing identification of the rock composition. However, trajectory errors would lead both to miss their target.

The speakers reported that western missions to Mars had fared little better. For example, NASA's 1993 *Mars Observer* probe was lost three days prior to insertion into Martian orbit. In the absence of any information beyond a loss of radio contact, the failure remains unaccountable to this day, but a report into the incident found the most probable explanation to be a breach of the probe's propulsion system during an orbital insertion burn.

The final blow to Russia's programme was the loss of *Mars '96* in 1996, a massive spacecraft, weighing 6180kg at launch, and with both orbiting and landing probes. The latter sought to perform extensive tests on the soil, including penetrating below the top layers which are bathed in solar UV radiation. Sadly, however, the fourth stage of the launch vehicle failed to provide a crucial second burn to move the craft from Earth orbit onto an interplanetary trajectory, and a few orbits later, the payload crashed back to Earth.

In late 1999, the American programme suffered the twin failure of *Mars Climate Orbiter* (MCO) and *Mars Polar Lander* (MPL). MCO's loss was believed to be the result of confusion between imperial and metric units, which led to an incorrect orbital insertion burn. MPL failed on landing, and enquiries found the most likely cause to be a software bug in a control system programmed to cut-off the landing retrorockets upon feeling the jolt of touchdown. In the event, this was prematurely triggered by the jolt of the landing gear unfolding at an altitude of 1.5km.

The speakers moved on to discuss the notable success stories, starting with the memorable *Mars Pathfinder* mission of July-September 1997, which included the Sojourner rover. This had performed detailed surveys of rock chemistry around its landing site, finding results similar to those of the Viking mission of 1976-82. *Mars Global Surveyor* (MGS) arrived soon after, in November 1997, and continues to return data. The findings of these two missions have brought many past paradigms into question, in particular by returning evidence of geological processes at work in the recent past, suggesting that their present absence is a period of dormance, not extinction. Perhaps the most unexpected discovery of MGS was the identification of gullies and flow-like features, reminiscent of water-erosion seen on Earth. These appeared to imply the presence of water in the recent past.

Further evidence for recent activity had emerged from studies of lava flows in the vicinity of Olympus Mons. These appeared to be newly formed within a timescale of 10 million years; incompatible with previous ideas that Martian volcanism had ceased 100 million years ago. Though an issue of debate, many now argued Olympus Mons to be dormant, not extinct, and likely to erupt again in the future, this view being shared by Henbest and Couper.

The speakers concluded their talk by reviewing the evidence for life on Mars. The most important results in this regard came from the two *Viking* missions which landed in 1976. One experiment, termed *Labelled Release* (LR), sought to measure whether radioactively-tagged nutrients, when applied to soil samples, were subjected to respiratory reactions and released as gas, as would happen for samples containing terrestrial microbes. The results favoured the presence of respiring microbes. However, the results of another experiment, the *Gas Chromatograph – Mass Spectrometer* (GCMS), which measured the soil carbon abundance, had seemingly excluded the possibility of life. It reported a complete absence of organic molecules, and was influential in leading NASA to conclude that the evidence favoured a lifeless planet. A few researchers continued to advocate the presence of life, including Dr Gilbert Levin, who led the Viking LR experiment, and Henbest and Couper shared their conviction. The speakers explained that the inherent insensitivity and possible miscallibration of GCMS seemed a likely explanation for its negative results.

Further excitement had been raised in 1996 with the discovery of structures resembling fossilised bacteria in carbonate deposits within meteorite ALH84001, the Allan Hills meteorite, which was believed to be of Martian origin. The speakers eagerly awaited the results from *Beagle 2*, due to land in December, which, if successful, would perform extensive chemical tests seeking to resolve many of these questions.

To close, the speakers speculated about possibilities for future human colonisation. Following the applause, the speakers invited questions, and a lively debate ensued on many of the more controversial issues raised. With

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reference to the Allan Hills meteorite, Mr Nick James pointed out that many had discredited claims that the observed structures were fossils, because, at 100nm, they were around ten times smaller than anything comparable on Earth. However, the speakers felt that this scale-difference did not entirely refute a 'nanobacterial' interpretation. Mr James further wished to clarify the circumstances of the failure of MPL and MCO. He pointed out, with reference to the Young Report, that the failure of MPL was considerably less simple than had been implied earlier, and in particular, it had plunged only the final 40m to the surface with suicidal speed. With regard to the loss of MCO, the confusion of units was very subtle as compared to how it had been portrayed by the speakers. The error had occurred when ground-teams had modelled the small effect of the rotating angular momentum dump wheels on their thrust calculations. The effect was very small indeed, and some blame for the loss might be directed at the navigation teams who failed to identify the cause of a string of small trajectory errors earlier in the mission. The speakers disputed the details of Mr James' account.

With regard to the Viking experiments, Mr James argued that the speakers' account was rather selective. There had been a total of four soil experiments, three of which were incompatible with the presence of life. Even in the unlikely event that GCMS had failed, the results of two further experiments had to be explained. The combined evidence of these three experiments had led the majority of the community to believe Mars lifeless, especially since the LR results were themselves rather ambiguous and doubtful. The speakers disagreed, arguing that the LR results could not be ignored.

Moving on, the speakers were asked, in view of the low pressure of the Martian atmosphere, whether the formation of water-erosion features on Mars at the present epoch was plausible, as had been implied earlier, as water would surely boil too rapidly. Mr Henbest maintained that water might exist for long enough to cause erosion before vapourising.

Following a vote of thanks proposed by the President, the meeting broke for tea. After the break, Mr Martin Mobberley was welcomed back to present his latest Sky Notes.

The November Sky

The speaker took the opportunity to congratulate the President upon the discovery of his 58th supernova, only hours before the meeting, and the audience greeted this news with enthusiastic applause. Closer to home, the Sun had caught the attention of many observers of late, its surface intensely active at the present time. As well as flares, which the speaker illustrated with a number of Hα images, the activity had also resulted in enhanced auroral activity. Around the time of the October meeting, the Earth had been buffeted by an exceptional flare, and the speaker had seen clear images of the northern lights taken as far south as John Rogers' observatory in Cambridge on October 29.

A week later, November 8/9, a total lunar eclipse had been visible across the UK, although only the midlands had a window in the cloud at the appropriate time. This had been accompanied by a total solar eclipse at the following New Moon on November 23, though visible only across Antarctica. Whilst, perhaps unsurprisingly, few BAA members seemed to have made the trip, Michael Maunder had braved the elements, extending the length of totality by viewing from an aircraft window. The best still photographs of which Mr Mobberley was aware had been taken from the window of an Airbus A340 by William Whiddon and Dennis DiCicco using a Nikon digital SLR camera with 200mm lens. Another observing party, organised by Astronomical Tours, watched from the ground after chartering an Airbus A400 to fly from Cape Town to Novolazarevskaya Base, with tickets priced just over $13,000.

The speaker proceeded to tell the curious tale of asteroid Hermes, discovered in 1937, but soon lost and not recovered until Brian Skiff stumbled upon it on 2003 October 15. Whilst the 1937 approach had been to within 460 thousand miles, the present flyby was at a distant 4 million miles. In the meantime, it had followed a chaotic orbit with perihelion between the Earth and Venus, and of the intervening 31 orbits, four had come within 6 million miles, in 1942, 1954, 1974 and 1986. The 1942 approach came within 400 thousand miles, but was evidently missed. The 1986 approach should have been easily detectable by the Shoemakers, but the 18" Palomar Schmidt was temporarily down for maintenance at the time. It seemed that this remarkable object was not a single asteroid, but two disconnected rocks in a close orbit about one another.

The UK's supernova hunters had been hard at work, with a total of 22 discoveries between July 1 and November 28. Among the professional discoveries in the same period, SN2003iq in NGC772, discovered on October 26, was notable in that an earlier event, SN2003hl, had already been detected in the same host galaxy. This was only the tenth instance of multiple observed extragalactic supernova explosions within a single host galaxy to date.

Moving onto comets, the speaker displayed images of comet Encke, now fading after closest approach on November 17 at around mag 7, and heading towards perihelion on December 29. Encke's tail was an exceptionally diffuse and fan-shaped green smudge, and as a result it appeared as if it were several magnitudes brighter when viewed with a small aperture telescope of limited resolving power. Jonathan Shanklin had published a variety of magnitude estimates from various instruments. However, with Encke sinking fast through Ophiuchus into dusk,

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and moonlight becoming an increasing problem, Mr Mobberley thought the prospects for further observations were minimal.

Comets C/2001 Q4 (NEAT) and C/2002 T7 (LINEAR) remained exciting prospects for spring 2004, both expected to peak around mag 1 in mid-May in the northern and southern hemispheres respectively. The latter would be lost to northern observers around mid-February, by which time it would be around mag 6, and passing close by the south-eastern corner of the Square of Pegasus. More challenging targets would be 43P Wolf-Harrington and C/2001 HT50 (LINEAR-NEAT), which the speaker illustrated passing within ~5° of one another on January 17, whilst travelling in opposite east-west directions, about 3° south of the Square of Pegasus.

Mr Mobberley extended his congratulations to Vello Tabur, an Australian amateur comet hunter who had discovered C/2003 T3 near Telescopium on October 14 using a 140mm f/2.8 camera with CCD. The total magnitude was 11.7, and the coma 30" across. This added to his previous discoveries of two comets, a nova, and over 200 variable stars. Also notable was Juel's recovery of 157P/Tritton on October 6 using 0.12m f/5 refractor with CCD. Previously, this comet had been discovered and tracked for a month in 1978 before being lost. For asteroid-hunters, 4205 DavidHughes remained a realistic target at mag 15.4, presently around a degree from 51 Andromedae.

For planet watchers, Mars, whilst receding fast and appearing ever-smaller, was moving north to more favourable declinations. At the time of the meeting, it was crossing the Prime Meridian at 7pm, and had angular size 11"4, reducing to 8" by New Year. The speaker displayed an image taken semi-live by Damian Peach beside the Isaac Newton Telescope on La Palma during the filming of the BBC's *All Night Star Party*. In his previous Sky Notes, Mr Mobberley had challenged members to image the Martian moons, and he displayed one successful response by Maurice Gavin.

Jupiter and Saturn would both be visible in the UK skies in the New Year, transiting the Prime Meridian at 6.45am and 2.30am respectively at the time of the meeting. Though Jupiter was exclusively an early-morning sight at present, it would soon be visible earlier in the night. Among the most notable Saturn images of the past month, the speaker identified those by Jim Phillips (S. Carolina) of the occultation of a mag 8.9 star on November 15. As the background star passed behind the rings, it could clearly be discerned reappearing through the Cassini divide. Venus was shortly to become an evening planet, emerging over the south-western horizon into the evening twilight during December.

Finally, the speaker recommended two imminent meteor showers: the Geminids, December 7-16, and the Quadrantids, having a narrow peak on January 4. On both occasions, the lunar cycle was sub-optimal: the Geminids would share the sky with a waning Moon reaching its last quarter on December 16, and the Quadrantids a near-full Moon setting shortly before dawn, allowing perhaps a half-hour window of darkness. However, of all events in December, the speaker recommended watching the developments of the British-led *Beagle 2* probe, due to touch down on Mars on Christmas morning, after separating from host *Mars Express* on December 19. To close, the speaker showed Michael Maunder's excellent video footage of the November 23 Antarctic solar eclipse.

After the applause for Mr Mobberley's lively summary, the President called upon the afternoon's final speaker, Mr Geoffrey Johnstone.

Deep Sky Observation from Australia, July 2002

The speaker subtitled his talk *Confessions of an Astronomical Twitcher*, which he explained was a reference to the habit of travelling considerable distance, often with expensive equipment, to view elusive objects. In this instance, the habit had impelled Mr Johnston to relive the excitement of his youth in undertaking an off-road Landrover tour of Australia. It was explained that there were many attractions to this particular location: the southern sky could be viewed at reasonable altitude and comparatively cheaply, and without braving such inhospitable conditions as the Antarctic offered.

Mr Johnston's tour had started in Sydney, and whilst skyscrapers prohibited much practical observation here, there was at least one treat for the astronomer: the Sydney Observatory, which was home to a 19th century time-ball tower. Moving north, the forests of northern Queensland were also not good observing sites, but the tops of dividing mountain ranges provided clear open skies, and the speaker soon set about putting his Meade ETX to use. Driving conditions proved rather tricky in places, and the speaker illustrated a few of those feats of which he was most proud.

From a practical point-of-view, the speaker recommended to any future travellers that the southern sky should be learnt before setting out, as he had found it particularly difficult to navigate, with a vast array of very faint stars washed out by the dark skies. Mr Johnston had found a 35° south planisphere particularly invaluable in this respect. His targets were primarily open and globular clusters, as an ETX was not ideally suited to galaxy observation. Where possible, a description was written of each object, a magnitude estimated, and a Shapley classification assigned (1 = point-like, 12 = very loose). The results are recorded in table 1. The speaker commented that his classifications deviated quite considerably from some of the textbook values, but felt that

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writing such descriptions had been a highly educational experience.

Mr Johnston continued his observation programme from around Darwin, in the Northern Territory. Here, the seeing conditions are renown for being invariably excellent, and the speaker's visit passed without a cloud in sight. Of those objects he observed, the speaker gave special mention to 47 Tuc (NGC 104), the second brightest globular cluster in the sky, and Ω-Centauri (NGC 5139), the largest globular cluster in the Milky Way, and the sight of which had for him made the trip seem worthwhile in itself. With Sagittarius virtually overhead, the Lagoon Nebula (M8) was an easy binocular object. However, the real treats of the southern sky were the Megellanic Clouds, and the Galactic Centre in Sagittarius. Also worthy of mention was the naked-eye dark coal-sack nebula, obscuring a region of the Milky Way just south of Crux. The speaker closed his account with an image of the Moon, vertically flipped from its familiar northern hemisphere orientation, and a long-exposure star-trail image of the southern celestial pole.

Following the applause for Mr Johnston's lively account, the President thanked him, before adjourning the afternoon's proceedings until the Christmas Meeting, to be held at the same location on January 10.

Dominic Ford

References

[1] Binney, J., and Merrifield, M., *Galactic Astronomy*, Princeton (1998)

Name	Constel.	Textbook description	Speaker's comments	Class	Mag
NGC 4833	Musca	Bright large round globular cluster.	Easy globular cluster.	8	7.4
NGC 4372	Musca	Pretty faint large round globular cluster.	Mod. Large, mod. faint, Globular cluster.	12	7.8
NGC 3228	Vela	Large open cluster.	Very large, quite bright, open cluster.	I 1p*	6.0
NGC 104 / 47 Tuc	Toucana	Very large very bright extremely round.	Very large, very bright, Globular cluster.	3	4.0
NGC 3372	Carina	The Great η Carina Nebula.	Large bright nebula.		
NGC 2808	Carina	Very large, extremely, round globular cluster.	Small bright globular cluster.	1	6.3
NGC 3532	Carina	Extremely large round open cluster.	Very large open cluster.	II 1m*	3.0
NGC 6293	Ophiuchus	Small, quite bright, globular cluster	Small, quite bright, globular cluster.	4	8.2
NGC 6235	Ophiuchus	Pretty faint, large, round globular.	Mod. faint globular cluster.	4	8.2
NGC 6218 / M12	Ophiuchus	Very large, very bright globular	Bright globular cluster.	9	6.6
NGC 5139 / Ω-Centurai	Centaurus	Extremely large, bright, extremely round, globular cluster.	Fantastic.	8	3.7
NGC 6405 / M6	Scorpius	Large, irregular, round.	--	III 2p*	4.2
NGC 6475 / M7	Scorpius	Very bright.	--	II 2r*	3.3
NGC 6496	Scorpius	Pretty large, moderately extended globular cluster.	Small, quite faint, globular cluster.	12	9.2
NGC 6541	Scorpius	Mod. Large, very bright, globular cluster.	Bright round extremely compressed.	3	6.6
NGC 6388	Scorpius	Very bright, large, round globular cluster.	Small bright globular cluster.	3	6.9
NGC 6121 / M4	Scorpius	Mod. Large, very bright, globular cluster.	--	9	5.9
NGC 6144	Scorpius	Considerably large moderately compressed globular cluster.	Mod. large, mod. Faint globular cluster.	11	9.1
NGC 6093	Scorpius	Very bright, large globular cluster.	Fairly small, quite bright globular cluster.	2	7.2
NGC 6723	Sagittarius	Very large, very little extended globular cluster.	--	7	7.3
NGC 6715 / M54	Sagittarius	Very bright, large, round globular cluster.	--	3	7.7
NGC 6523 / M8	Sagittarius	Very bright, very large, irregular.	Lagoon Nebula.	--	5.0
NGC 6626 / M28	Sagittarius	Very bright, large round.	Small fairly faint globular cluster.	4	6.9
NGC 6656 / M22	Sagittarius	Very bright, very large, round compressed.	Small very bright globular cluster.	7	5.5
NGC 6809 / M55	Sagittarius	Pretty bright, large, round.	Very large bright globular cluster.	11	7.0

Table 1: Southern Hemisphere targets, mostly open/globular clusters, with standard textbook descriptions compared to Mr Johnston's own descriptions. Also listed are the speaker's magnitude estimates, and Shapley classifications. Asterisked classifications are according to Trumpler scheme (for explanation, see Binney and Merrifield pp. 378)[1]

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