Ordinary Meeting, 2002 March 16
held at the Scientific Societies' Lecture Theatre, 23 Savile Row, London W1

Mr Guy Hurst, President

Ron Johnson and Nick James, Secretaries

The President welcomed members to the fifth meeting of the 112th session. The minutes of the previous meeting of 2002 February 23 were read and approved. Mr. Johnson stated that no presents had been received. The President announced that thirty new members had been proposed for election, and the ten new members proposed at the previous meeting were approved for election by the members present. He invited any new members who had not already introduced themselves to meet him for a chat during the break. Mr. James reported that four papers had been accepted by Council to appear in the Journal:

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The President informed the meeting that forthcoming events included the Winchester weekend of March 22-24, including a vast array of speakers, and the next Ordinary Meeting, to be held at the University of Cardiff. In other news, he welcomed Ann Davies who would shortly join the Society's office as Assistant Secretary. The President wished her well, and hoped her arrival would reduce the workload on the existing staff, and the audience applauded Ms. Davies.

The President announced that Council had made a number of awards as follows:

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It was commented that Mark Armstrong's award was particularly well-earned in light of his discovery of three supernovae in the week preceding the meeting. This was particularly relevant to the meeting's first speaker, Prof. Peter Meikle of Imperial College, London, who is a pioneer of the infrared study of supernovae. The President welcomed him to speak on Supernova Secrets; Infrared Insights.

Supernova Secrets; Infrared Insights

To open, Prof. Meikle showed a number of images of supernovae, illustrating that their intensity could outshine even the brightest of foreground stars. With reference to 1987A, it was demonstrated that the spectra of such objects show a number of broad peaks, indicating very substantial temperatures. The speaker also demonstrated that supernovae show much more structure when imaged in the radio band. SN1993J was used to illustrate how a featureless expansion in the optical region showed complex structure at radio wavelength.

The speaker moved on to ask why some stars explode in this way. The speaker estimated the energy release of such events to be of the order of 10^{44}J, which can be visualised as 10^{28} megatons of TNT or 200 times the rest mass energy of the Earth. Main sequence stars do not explode as they have negative specific heat and are consequently gravitationally bound. White dwarf stars differ in that they are composed of a degenerate state of matter. This is a quantum mechanical state, which can be visualised by modelling the star as a finite potential well. Only a discrete set of bound states are allowed, and as electrons are fermions, the Pauli exclusion principle limits the occupation of each state to two electrons. Consequently, in a dense white dwarf the highest energy electrons are in relatively high energy states since all lower energy states are occupied. These fast moving energetic electrons create a pressure known as degeneracy pressure which is sufficient to support the white dwarf against its own gravitational attraction.

It has been shown, however, that at the critical Chandresehkar mass, 1.4 solar masses, relativistic effects involving the variation of electron mass with velocity limit the degeneracy pressure to be weaker than the gravitational attraction. The speaker suggested that the result would be the collapse of the iron-rich core of the star from the size of the Earth to that of a lemon in around 100ms, raising the temperature to 8×10^{9}K. The collapse would at this point be abruptly halted and bounced by neutrinos trapped in the core. These neutrinos are formed by the particle interaction:

$p + e^- \rightarrow n + \nu_e$

Although neutrinos only interact via the nuclear weak force and are renown for their lack of interaction, in the dense core of such a collapsed star interactions would be plentiful. The speaker demonstrated this bounce effect by dropping two spheres on top of each other, and the upper one rebounded to the ceiling. This also demonstrated Prof. Meikle's next point concerning the rebounding material surging out of the core. The speaker suggested that in essence the same would happen as had happened in the lecture theatre – the material hits the outer stellar gas

which acts as a ceiling. A number of computerised models of increasing complexity have been proposed, initially one dimensional, and now two dimensional, and the speaker showed such a model in action. Such theoretical models predicted that fingers of iron would be observed in supernova remnants, and the speaker suggested that were these to be observed, it would provide a strong indication of the validity of the theory. Furthermore, he suggested that such fingers had already been seen in 1987A.

Not all supernovae, however, form by this mechanism. The speaker went on to describe Type 1A supernovae, which are formed by the accretion of matter onto a white dwarf from a binary partner. Such accretion could push the white dwarf above the critical Chandresehkar limit. In this case, the core collapse would cause sufficient temperature rise for carbon and oxygen in the core to undergo nuclear fusion to form ^{56}Ni. The energy released could surpass 200 times the rest mass energy of Earth.

The speaker commented that supernovae are unlike other explosions in that they take a long period of time to fade. The typical light-curve for a supernova rises to maximum brightness within hours, but takes many months to fade. The speaker proposed that plentiful supplies of ^{56}Ni would form in a Type 1A supernova, and this undergoes radioactive γ decay to ^{56}Co and then ^{56}Fe. The halflife is 77 days, and so could explain the afterglow, but only in the γ region of the spectrum, not optical photons. The speaker suggested the existence of complex mechanisms for the interconversion of γ and optical photons, including the absorption of γ radiation by excited gas and subsequent reemission at optical wavelength. Estimates for the cobalt/iron mass ratio from the spectrum of 1987A closely matched theoretical predictions from this model, but matched more closely if the slower ^{57}Ni decay route was also taken into account.

Moving onto the ongoing puzzles, Prof. Meikle showed an image of SN1987A which has two outer rings which remain unexplained. For SN1998S, the speaker explained that the light curve had remained brighter for much longer than any current theory predicted – another mystery. The spectrum is interesting as it appears to contain a 1200K blackbody, possibly indicating dust particles. If verified, supernovae could explain the origin of the dust in the universe, another puzzle. Examination of supernovae in the Hubble deep field has revealed curious anomalies in their magnitudes, supporting the need for Einstein's serendipitous cosmological constant. Finally, the speaker referred to type 1C supernovae, which are thought to be a source of the curious phenomenon of gamma ray bursts.

To close, Prof. Meikle thanked all of the amateur astronomers in the audience who had helped search for supernovae, as this is a field where professional resources are very limited indeed. Following the applause for Prof. Meikle's highly informative talk, the President adjourned the meeting for tea, after which Mr. Martin Mobberley returned in lively style to give his Sky Notes.

Sky Notes

Mr. Mobberley opened by looking at GK Per, the remnant of a supernova explosion discovered by Revd Anderson on 1901 February 21 – the first supernova discovery of the 20th century. Since 1966 this remnant has behaved as a dwarf nova type cataclysmic variable, rising from mag 13 to mag 10 every few years. Since early 2002 March such brightening had been observed, and Hazel McGee reported an estimate of mag 10.5 for 2002 March 15.

The speaker reported that the next planetary occultation would be that of Saturn on April 16, which would be at the sociable hour of 2100-2128. The Moon would not be full for this occultation as had been the case in other recent events. There would also be a daylight occultation on May 14 which it would probably not be possible to observe.

Moving onto supernovae discoveries, the speaker gave tribute to Mark Armstrong's work. In the week preceding the meeting, Mr. Armstrong had discovered 2002bl, 2002bn and 2002br – all of which were very subtle on their discovery plates. The speaker was stunned that since 1995 June, Mr. Armstrong had reported observations on 871 nights, amassing a total of 194,610 images. The speaker showed a light curve for 2002ap, making particular reference to a recent observation which suggested it to be flattening out. The President called for observations to confirm this. Moving onto Jupiter, the speaker was pleased to announce Damian Peach's presence at the meeting, and invited him to talk about his superb planetary images.

Mr. Peach first showed his superb image of Jupiter from 2002 February 15, highlighting the passage of the anticyclonic storm BA past the Great Red Spot. Some had anticipated this would be a dramatic event, but in the event BA passed the GRS with no effect other than a few streaks ahead of it. Mr. Peach also showed an image of Saturn from February 15 and commented that the planet was visible through the Cassini divide. Mars was now very small, but high in the sky. Mr Peach reported that the dust storm that had been observed at last summer's opposition had now subsided, and surface details could be resolved. He also displayed a superb image of the Jovian moon Ganymede with surface features including Nicholson resolved.

Mr. Mobberley thanked Mr. Peach for showing his impressive images before discussing the comet scene. Ikeya-Zhang was now an impressive object, two days off perihelion, and the speaker reported seeing some superb images from both Schmidt cameras and telephoto lenses. The ion tail was undoubtedly the best since Hale-Bopp. Maurice Gavin reported spectral observation of three emission lines in the blue/green, suggesting the comet was doing

something rather more interesting than just reflecting sunlight. The speaker reported that although the comet will fade after perihelion, it will become 2.5 times closer to Earth in April, and so will continue to give an impressive show for some time yet. He anticipated it would feature in the dawn sky peaking at 62° declination. Finally before closing, the speaker called for observation of 2002WM-Linear which peaked at mag 3 in the southern hemisphere and was expected to remain at mag 7 in the north.

Following much applause for Mr Mobberley's talk, the President welcomed Mr. Owen Brazell, editor of The Deep Sky Observer, to review the British deep sky scene.

The British Deep Sky Scene: A Review

Mr. Brazell described his talk as a review of deep sky observation over the past 15 years with the aim of asking the audience where it might be going. He opened by describing the main UK deep sky observing groups: the Webb Society, formed in 1967, and the BAA Deep Sky Section, formed in 1981. The Webb Society publishes quarterly journals, as well as handbooks which are intended to be self contained guides to a specific area of deep sky observation, although sadly many of these are now out of print. The speaker also thought the website was an especially important component for communicating up-to-date information.

The speaker observed that the BAA's Deep Sky Section focussed more on scientific and project-based work, an area in which he thought it had had much success, although he admitted he saw deep sky is more of a fun pursuit than a scientific field. His opinion was that the DSS' publicity and website could do with more frequent updates. The speaker suggested that a greater amount of cooperation between the Webb society and the DSS would allow currently overstretched resources in a relatively minority area of astronomy to be better utilised. He was concerned that with increased sales of large instruments, there was not a corresponding increase in observers, and suggested that the two societies should have a higher profile.

Mr. Brazell suggested that a more aggressive presence would involve communicating some of the best images from the archives to show newcomers what is achievable, and he suggested that people are often put off when they see poor quality images. He referred to Mr. Philip Perkin's recent talk at the meeting of 2002 January 5 and congratulated Mr. Perkins on his work.

To close, Mr. Brazell showed a 3-dimensional animation of the Orion Nebula which had been produced using a volume visualisation technique. This had been constructed using HST images and distances to construct a scientifically accurate model of the nebula in 3-dimensions.

Following the applause for Mr. Brazell's thought-provoking talk, the President welcomed Dr. Nick Hewitt, director of the BAA's Deep Sky section to give a second opinion on the deep sky scene.

The Visual Archive of the Deep Sky Section

Dr. Hewitt opened by agreeing with much of Mr. Brazell's previous talk, specifically he suggested the visual archive of the DSS needed to be better utilised. Dr. Hewitt inherited the archive in 1992 from Bernard Abrams, and said that much of it still needed organising. The archive contains over 600 drawings from the 1980s with at least 51 contributors. The speaker reported that so far he had scanned 178 of these to digital format, and hoped that Bob Marriot's help would speed the process. The drawings were usually cropped from the report form and inverted to give an eyepiece view, as opposed to black objects on white paper.

Dr. Hewitt reported that the majority of the archive were not scientific observations, with the only exception being Alan Kane's near miss at being the first British supernova discoverer with SN1989B. Unfortunately Mr. Kane delayed reporting his observation, and was beaten to it. The speaker went on to demonstrate the quality of some of the images in the archive, showing a selection of his favourites. He compared these with the all time benchmark images of the 19th century including Sir John Herschel's famous drawing of the Orion nebula. Dr. Hewitt commented that many past observers had never anticipated that one day their work might be scanned, and had often folded their masterpieces or written on the back of them such that the writing shows through the paper.

The speaker intended to work on the visual archive in the immediate future and hoped to produce a joint CD or DVD with the Webb Society, as well as a paper publication. The photographic archive was also in need of attention, and the speaker hoped this would be worked on after the visual archive had been scanned.

In response to a question from Stewart Moore, the speaker agreed that the journal could benefit from more popularist papers, such as "The Top Ten Deep Sky Objects". Both Hazel McGee, editor of the Journal, and Nick James, paper secretary, agreed that such papers would be well received.

Following the applause for Dr. Hewitt's superb and well-illustrated talk, the President personally welcomed the afternoon's discussion of visual deep sky work since such a high proportion of observers are visual. He suggested

that deep sky work was a good way to learn to get as much detail as possible from the eyepiece. He then adjourned the meeting until 2002 April 27 at the University of Cardiff.

Dominic Ford