THE COMET'S TALE

Newsletter of the Comet Section of the British Astronomical Association

Volume 10, No 2 (Issue 20), 2003 October

George Alcock Remembered

BAA-RAS Pro-am discussion meeting

Milton Keynes
2003 May 10

Around 80 astronomers gathered together on May 10 for a discussion meeting in the Open University Berrill Lecture Theatre in Milton Keynes. Although advertised as doors opening at 10:30, early arrivals had appeared by 9:30! Fortunately Tracey Moore from the OU was there ready to welcome visitors and the OU catering staff were already on hand to provide refreshments.

Several displays were available for inspection during the day, including comet drawings by George Alcock, samples of Libyan desert glass, cuttings from old journals and information on the Journal of the International Meteor Organisation.

Particular thanks are due to Tracey and the technical staff of the Open University for giving up their Saturday and interfacing all the various laptops to the display system, to Barrie Jones of the OU for arranging use of the facilities and to Simon Green and John Zarnecki for conducting the lunch time tours. Peter Hudson also supervised visits to the newly opened OU observatory.

The morning session was devoted to meteorites and meteors, with Monica Grady (Natural History Museum) having the unenviable task of setting the scene. The solar system formed in a region similar to the Orion Nebula, with asteroids being remnant fragments. Eros is an irregular object, well-battered over 4.6 billion years. Pieces of asteroids fall to earth as meteorites. Spectra of asteroids match those of meteorites and also the orbits of fireballs match those of asteroids. Meterorites are cool when the land, protected by a thin fusion crust. There are three types of meteorites - irons, stones and stoney-irons. Irons contain nickel and many other metals in trace amounts. Heat (from gravitational collapse and radioactive decay) allows reduction reactions similar to a blast furnace and metal accumulates in the centre of the asteroid. Iron meteorites tell us about core formation. Stoney-irons come from the boundary of core and mantle and are the most beautiful meteorites, with intermixed peridotite (olivine) and nickel-iron. Stones form the majority of meteorites. Their main components are chondrules and calcium-aluminium inclusions. The chondrules say something about asteroid formation. The CAIs formed 3 my before the chondrules, 4.568 by ago. Interstellar grains are also present as silicon carbide and diamonds. The silicon carbide has variable isotopic composition and therefore comes from different stars undergoing different reactions. At least 35 stars contributed material. Meteorites may also come from comets, the moon and mars. Deserts such as the Sahara and Antarctica are good places to hunt for meteorites. They come in various sizes - the Arizona meteorite crater was formed by an object 40 metres across and gave a 1 km diameter crater. The object that fell 65 my ago had significant effects on life on earth. On average one falls over the UK every 11 years. Falls are not predictable and the next one may be over Milton Keynes!

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Comet Section contacts

Director: Jonathan Shanklin, 11 City Road, CAMBRIDGE. CB1 1DP, England.
Phone: (+44) (0)1223 571250 (H) or (+44) (0)1223 221400 (W)
Fax: (+44) (0)1223 221279 (W) or (+44) (0) 1223 571250 (H)
E-Mail: JDS@AST.CAM.AC.UK or J.SHANKLIN@BAS.AC.UK
Antarctica: jdsh@south.nerc-bas.ac.uk
WWW page : http://www.ast.cam.ac.uk/~jds/

Assistant Director (Observations): (and also Editor of *The Astronomer* magazine) Guy Hurst, 16 Westminster Close, Kempshott Rise, BASINGSTOKE, Hampshire. RG22 4PP, England.
Phone & Fax: (+44) (0)1256 471074
E-Mail: GUY@TAHQ.DEMON.CO.UK *or* GMH@AST.STAR.RL.AC.UK

CCD Advisor: Nick James, 11 Tavistock Road, CHELMSFORD, Essex. CM1 5JL, England.
Phone: (+44) (0)1245 354366
E-mail: NDJ@BLUEYONDER.CO.UK

Photographic Advisor: Michael Hendrie, Overbury, 33 Lexden Road, West Bergholt, COLCHESTER, Essex, CO6 3BX, England
Phone: (+44) (0)1206 240021

Subscription to the Section newsletter costs £5 for two years, extended to three years for members who contribute to the work of the Section in any way, for example by submitting observations or articles. **Renewals should be sent to the Director and cheques made payable to the BAA.** Those due to renew should receive a reminder with this mailing.

Section News from the Director

Dear Section member,

The last six months have been heavily packed with meetings. First there was the Meeting on Asteroids and Comets in Europe in Mallorca quickly followed by the pro-am discussion meeting at Milton Keynes at the beginning of May. Next came the BAA Exhibition Meeting in June and at the close of the summer the observing workshop at the BAA Out of London meeting in York. Reports on the first two are elsewhere in this newsletter and reports on the latter two will appear in the Journal in due course. Next year there is another MACE meeting, however the main event is the International Workshop on Cometary Astronomy that will be held in Paris. Details of this are given in the box opposite and I would encourage all members to attend. The preliminary deadline for booking accommodation has already passed, however there is still plenty of time to book.

It is perhaps just as well that there have been few comets to observe as preparing for all the talks has taken up a lot of time. However things are beginning to change.

IWCA III

The third International Workshop on Cometary Astronomy will be held at Meudon and Paris Observatory, France from Friday 4th of June to Sunday 6th of June 2004. Its main objective is to promote cometary observations among amateur astronomers and optimise the benefit of these observations for the use by professional astronomers. It will be an opportunity for amateurs to meet professionals and exchange information about their techniques. It will be organized by the ICQ and Société Astronomique de France and sponsored by the Paris Observatory.

Topics to be discussed during the meeting include

- Cometary photometry (CCD, visual, light pollution effects, reference catalogs) and outgassing rates;
- Comet imaging with filters and Spectroscopy;
- Comet astrometry;
- Observation of trans-neptunians by amateurs;
- Comet discovery and automatic sky surveys;
- Space missions to comets;

Registration fee covering friday and saturday lunches, saturday reception, bus transportation, coffee breaks and welcoming package is 70 Euros per participant. Deadline: 31 December 2003 (80 Euros after).

Hotel room reservation fee for the 1st night is 52 Euros (Single) or 37 Euros each (shared double). The deadline was 20 September 2003 and the price is subject to change after this date. Full payment of the remainder can be made at the time of the meeting.

More details and registration forms are on the IWCA III web site. There is a link on the Comet Section web page.

Comet 2002 T7 (LINEAR) is brightening nicely and 2P/Encke should also reach binocular visibility in the autumn. The Section has observations of the latter comet going back over 50 years and I would like to encourage visual observers to continue the tradition as such long series can tell us much about the evolution of comets. Where possible try and use instrumentation that matches that of the past as this enhances their long term value. Next year several comets may attain naked eye brightness, however to see the rare spectacle of two naked eye comets at the same time you will have to head for the icy waters of the Southern Ocean in May. I will be visiting Antarctica yet again, however as last year I will be there in February and March, when they are still binocular objects. Hopefully the weather conditions will be somewhat more obliging than on my last visit, when the skies were unusually cloudy.

Whilst in Antarctica, I will be installing a new weather forecasting system at our Rothera station, though I suspect that the forecasts will be no more accurate than they are here! Colleagues will be installing a new permanent satellite link, so there is a chance that for once I will be able to maintain the web pages whilst I am away.

Conditions for comet observing in the UK are generally declining thanks to the widespread increase in light pollution. Maps on the Campaign for Dark Skies web site show that there is now nowhere in Cambridgeshire that has completely dark skies and such sites elsewhere in the country are rapidly declining. These maps are quite helpful in finding the best local sites and driving a short distance can make a significant difference to what you can see. Even in Antarctica light pollution is beginning to be a local problem, but it seems likely that regulation will be brought into the Antarctic Treaty system, thus combating light pollution on a whole continent. I hope that the report from the UK Select Committee due in early October will bring the promise of some regulation in this country.

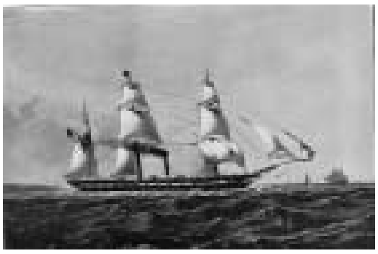
Since the last newsletter observations or contributions have been received from the following BAA members: Peter Birtwhistle, Werner Hasubick, Nick James, Gabriel Oksa, Jonathan Shanklin, and also from: Jose Aguiar, Alexandre Amorim, Alexander Baransky, Nicolas Biver, Jose Carvajal, Stephen Getliffe, JJ Gonzalez, Michael Jager, Andreas Kammerer, Heinz Kerner, Carlos Labordena, Martin Lehky, Rolando Ligustri, Michael Mattiazzo, Maciej Reszelski, Juan San Juan, Pepe Manteca, Jose Martinez, Stuart Rae, Tony Scarmato, and Seiichi Yoshida (apologies for any errors or omissions). Without these contributions it would be impossible to produce the comprehensive light curves that appear in each issue of *The Comet's Tale*. I would welcome observations from any groups which currently do not send observations to the BAA.

Comets under observation were: 29P/Schwassmann-Wachmann, 53P/Van Biesbroeck, 65P/Gunn, 66P/du Toit, 116P/Wild, 2000 SV74 (LINEAR), 2001 HT50 (LINEAR-NEAT), 2001 K5 (LINEAR), 2001 Q4 (NEAT), 2001 RX14 (LINEAR), 2002 O7 (LINEAR), 2002 T7 (LINEAR), 2002 Y1 (Juels-Holvorcem).

Jonathan Shanklin

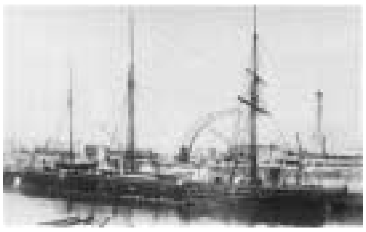
Tales from the Past

This section gives a few excerpts from past RAS Monthly Notices and BAA Journals.



The RMS Lady Joceyln

150 Years Ago: Observations of a comet [1853 G1] seen from HMS *Centaur* whilst at Buenos Ayres outer anchorage on 1853 April 30 and May 1 were reported in the June issue of Monthly Notices. The next month Lt Goodenough sent further observations and an apology for an error in the previous measurements, saying that he had 'worked out the degree of distance from Castor as 58° instead of 63°'. Other observations were reported from HM Sloop *Waterwitch* at Ascension Island, from the Cape and from the Royal Mail Steamer *Lady Jocelyn* on passage from the Cape to Mauritius.



HM Sloop Waterwitch

100 Years Ago: At a meeting Mr Crommelin said 'a paper had been received from Mr John Grigg recording observations of the comet Perrine [1902 R1] and this would be published in the Journal. Mr Grigg seemed to have re-discovered for himself what was very well known to observers, namely, the cross-bar micrometer. Although this, as he said, was well known, it was very creditable to Mr Grigg that he should have discovered it for himself in a place like New Zealand, where he was away from other observers. It was very satisfactory to know that he had now the power of recording accurately the place of any comet he might come across. Mr Grigg discovered a comet last July [26P/Grigg-Skjellerup], but his observations at that time were not sufficiently accurate for them to be able to get a reliable orbit, but now if he were fortunate enough to discover another they hoped his observations would be such that the comet's orbit would be fixed with accuracy.' The book reviews include one on "Comets and their Tails" by F G Shaw. The author advances the theory that comets' tails are merely optical appendages produced by refraction of light through the head, acting as a lens. The reviewer concludes 'while dissenting from many of his conclusions, we may welcome this evidence of increased zeal for cometary astronomy in our southern colonies'. The comet notes record the discovery of another comet [1903 H1] by 'Our energetic fellow member in New Zealand, Mr John Grigg'. It notes that Nature (May 7) stated that the comet was discovered from Mr Tebbutt's observatory in Windsor, NSW, when it was actually found from Thames, New Zealand. [*It seems clear that one hundred years ago the centre of the British Empire rather looked down on its far flung colonies!*] There was a paper in the June issue on "How I try to Realise a Comet's Orbit" by Edwin Holmes. In the annual report, the Director [E W Maunder] notes that the Section now numbers 18 Members, with 3 joining in the last year. He notes the half dozen comets that had been under observation during the year.

50 Years Ago:. The annual report notes that five comets had been observed by members of the Section during the sessional year. George Alcock had begun systematic comet searching in January and had so far logged a total of 34 hours in the five months to May.

Pro-am discussion meeting

Continued from page 1

Neil Bone, Director of the BAA Meteor Section introduced the work of the Section. The BAA is the largest UK organisation collecting amateur observations. Denning was an early Director and produced a catalogue of meteor shower radiants. Another Director, Prentice, was seconded to Jodrell Bank to correlate visual and radio observations. Harold Ridley and George Alcock both had long associations with the meteor section. Alcock in particular worked with Prentice on plotting tracks. Prentice was a solicitor and many of his observation reports have the wills of former clients on the reverse side! Today visual observers concentrate on rate information. A few observers using telescopes (or binoculars) still do plotting and there are also photographic surveys. Fireball reports come in at the rate of around one a week, mostly seen at 11pm whilst out walking the dog! Occasional bright events are seen widely, but the tracks often end over the sea. There may be possible fireball streams as there are some periods of enhanced activity, eg the end of June. Showers are listed in the BAA Handbook, however this year most showers are affected by moonlight. Neil has a portable observatory (a sun lounger), and showed his observing tools (several pencils and a red torch) and the standard observing form. A simple formula converts the observed rate into a zenithal hourly rate and for example Perseids observed at one a minute equates to a ZHR of 80. Observations give a profile of the ZHR and the Perseids showed an unexpected spike of activity in the early 1990s, which was still present as late as 1997. Such surprises show the value of visual observations. The profile of the Geminids has changed over the last couple of decades. Leonid storms have been observed over the last few years. Photography can be very pleasing and also scientifically useful. Trail photography and video work are very important. Spectra are being obtained by amateurs and could be analysed professionally. A few amateurs carry out radio work. Results are published in the Section newsletter and the BAA Journal.

Our next speaker was Iwan Williams of Queen Mary College, London, talking about meteor streams, their formation, evolution and observation. For a long time each aspect had been a separate discipline, for example comet specialists weren't interested in the bits once they had left the comet. We have known since the 1860s that a lot of meteor showers are associated with comets. Small ejected particles are blown away in the solar wind but large particles share the orbit with the comet. What happens next is highly mathematical, but results in the prediction of meteor storms etc. The sun vaporises ice in a comet and the resulting gas ejection speed is around 1 km/sec. Comets orbit the Sun at around 30 km/sec, so the particles must have a similar orbit to the comet as the difference in velocity is small, and it is possible to show possible changes in the orbital parameters. It is actually a 3-D problem, so the plane of the orbit can change, and with it the position of the nodes. The nodal position of a meteor is known very accurately (it is the time when it is seen), so the shift in nodal position between meteor and comet gives a measure of the out of plane ejection velocity. For the Leonids this amounts to around 20 m/s. Computer models can show the effect of differing ejection velocities, but it is also a function of where the ejection takes place, which makes the analysis more complex. Radar studies give us problems! They see very small meteors and lots of them - perhaps fragments of asteroids rather than comets. Recent TV results show evidence for hyperbolic orbits implying an interstellar origin if real. A third problem is that the density of meteors is generally quite high compared to that expected from comets, so there is either evolution of meteoroids or some of the theory is wrong!

Andrew Elliot concluded the morning session with a talk on how to video meteors. It is very easy if you have the right equipment. It can give good scientific results, with modern technology being a help. He had used an image intensifier system, with the intensifier being the most expensive item. A wide angle lens gives a 50° field and a similar limiting magnitude to the naked eye. The system needs an accurate time inserter and this can be manual, radio or GPS. Steve Evans does most of the analysis of the resulting videos, which form a permanent record. Single station work gives meteor rates, magnitude distributions, clustering information and radiant position. Two station work allows triangulation, particularly when combined with photography. It is possible to add spectroscopy, but this hasn't yet been done in the UK. Lunar impacts have also been recorded. A small number of cameras would cover the entire UK for a fireball survey. Photography gives 5" accuracy down to about 0^m, but video gives accuracy of a few minutes down to 5^{th} or 6^{th} magnitude. New software allows real time analysis of the data, whereas in the past it has often taken three times longer than the observations to reduce the data. Once an orbit is known software by Nick James can be used to visualise the orbit. Modern video cameras at prime focus on a 25-

cm telescope can reach 11^m stars, but are not yet quite as good for meteor work. Andrew then showed spectacular results from recent expeditions, including the 2001 Leonid storm over Arizona, the 2002 Leonid storm over Spain, and the 2003 Quadrantids.

Some of the speakers

Jonathan Shanklin started proceedings after lunch, giving a brief history of the BAA Comet Section and lamenting the fact that early observations had disappeared during World War II. Although George Alcock and Albert Jones had made visual discoveries of comets, but amateur visual comet discovery was probably now a thing of the past, thanks to asteroid search programmes such as LINEAR and spacecraft such as SOHO. However at the moment there was still a 'twilight zone' where amateurs stood a chance, particularly in the Southern Hemisphere. Visual observation of features in the coma and tail was also a thing of the past as CCDs now gave much more objective images. Amateurs could however make significant contributions by visual magnitude studies. Observations of 153P/Ikeya-Zhang showed variation across the course of the apparition, possibly reflecting the inhomogeneous comet nucleus loosing several metres as it rounded the Sun. Comet 2001 A2 (LINEAR) showed significant variation with a period of around a month, which might reflect precession of the nucleus. Comet 46P/Wirtanen had a relatively normal light curve, but by contrast 67P/Churyumov-Gerasimenko, the new Rosetta target, might be similar to 1999 K5 (LINEAR), which had a 'pathological' linear light curve, peaking some 73 days after perihelion. During questions David Hughes suggested that this might be due to a single active area becoming illuminated. Jonathan concluded by posing some questions: should observations be restricted to light pollution free areas (no, as this would eliminate most observations from the UK), do visual observers hallucinate (probably yes, as the brain often lets us see what we expect) and should light curves only be compiled from observations by experts (no, all observations are valuable).

David Hughes (Sheffield University) demonstrated how he used magnitude parameters derived from amateur visual observations. Short period comets (those with period less than 20 years) are seriously affected by Jupiter. Their median period is 7.2 years, however when perihelion is at 1 AU the period is 5.46 years and when at 3 AU the period is 8.3 years. This means that the shorter period object goes round more frequently and there must be plenty of short period comets with larger q (1.5 - 3 AU) still waiting to be discovered. We can measure the size of a comet either directly with the HST or via a light curve as the log of the radius is theoretically proportional to 0.2 H_{10}. This absolute magnitude can either be derived by assuming that the comet brightens as 10 log r (=> H_{10}) or by fitting to the light curve (=> H). David said that it would be helpful if light curves were plotted as a function of log(r) rather than r or time. Different molecular emissions may have different slopes. When he first plotted values from selected periodic comets he didn't get a very good fit, however revised values did better. There is still a lot of scatter, which implies different surface activity. Around 2 metres is lost from 1P/Halley each revolution, implying that it will last for around 250,000 years. One might expect that size and perihelion distance are correlated, given that comets with shorter period will loose more material. A paper by Lamy shows no such correlation, however David's interpretation of the data is that it doesn't disagree with the hypothesis. The average Jupiter family comet starts with a radius of around 3 km and slowly shrinks. The gradient of size versus perihelion distance will give a clue on the average age. There are no bright comets passing close to the Sun. The average comet has a radius of 1.4 km and perihelion distance of 1.8 AU. Short period comets are literally disappearing in front of our eyes and after 400 orbits (2,500 years) half will have gone. If we are in a steady state Jupiter must be throwing in more objects to the inner solar system.

Alan Fitzsimmons (Queen's Belfast) told us about some of the interesting things that he is doing at the moment under the title of Recent results in the ground based imaging of distant comets. He concentrated on three aspects: why we should study nuclei, snapshot surveys and dedicated observations. Spacecraft show that 1P/Halley is quite a large nucleus about 17 km long. Sublimation is seen on the surface giving jets of dust and gas. 19P/Borrelly shows that the nucleus is complex and has real geology, quite different from the theoretical construct of ground based observations. Nuclei were formed in the outer solar system, which was a wild and dangerous place at the time, and are collisional ejecta from the Kuiper belt. They are a repository of organic matter and are important for studies on the origin of life. The nucleus is the source of the coma and tail. Alan had run a survey programme to study bare nuclei, which observed 56 objects to get a size distribution. The William Herschel Telescope has a new prime focus camera with 2048x4100 pixels giving a resolution of 0.25" per pixel. 43P/Wolf-Harrington at 4.43 AU was magnitude 21.6 but still showed a slight dust coma. 143P/Kowal-Mrkos at 4.74 AU was brighter at 20.5, but showed a bare nucleus. Such objects are possibly bright enough for amateurs to image, so they could contribute to these studies. 1998 U4 (P/Spahr) was the most distant object imaged at 6.14 AU (beyond Jupiter) when it was 23.3. His team is now moving on to dedicated observations, looking at size, colour and rotation. 22P/Kopff was observed for a total of 3.6 hours and showed a dust trail behind the comet. The individual frames show a light curve with a period of about 6.15 hours. 6P/d'Arrest has a period of 7.20 hours with an amplitude of around 0.1. New planned studies include monitoring activity all round the orbit and a search for comet ice as no water has yet been detected on a nucleus. A search for comets near the Sun is planned to come on line in a few months with SuperWASP1 (Wide Angle Survey for Planets), a fully robotic telescope which will have a 247 square degree field and image down to 16^m in 30 seconds. The primary task is to search for planets round other stars at the opposition point, but they hope to try and search for SOHO like comets at 45° - 60° elongation from the Sun.

The session concluded with Nick James (BAA) describing CCD imaging by amateurs. Automated searches such as LINEAR find practically everything, however amateurs can carry out rapid follow up, observe structure near the nucleus, do photometry and monitor faint objects. CCDs also give pretty picture. Is astrometry worth doing? Yes, once you have the images. Astrometrica (commercial software) is fast and catalogues are good. It is particularly important for objects on the NEOCP. Peter Birtwhistle is getting down to 19.8. Photography didn't have enough dynamic range to show structure in the coma, but CCD processing can be used to bring out details. For example Hale-Bopp had apparently stationary jets prior to perihelion. A rotational gradient filter enhances radial features such as seen in 153P/Ikeya-Zhang. Photometry is difficult. What aperture should be used ? What comparison stars ? Are filters needed ? [See my review of the MACE 2003 meeting - Ed] Overall photometry is now seen as the most difficult area for amateurs. Specific targets for amateurs include the potential Rosetta target 67P/Churyumov-Gerasimenko, comets which have outbursts such as 29P/Schwassmann-Wachmann. Nick wasn't sure if spectroscopy was valuable [again see the MACE notes], however Maurice Gavin had obtained spectra of 2002 C1 and 2002 V1. Finally the amateur could take pretty pictures and there is nothing wrong with this. In addition wide field images do contain lots of structure. New CCD chips such as Kodak KAF1600 at 14x9mm and KAF1000 at 25x25 mm are becoming comparable to film, but expensive. Alternatively it is possible to mosaic smaller fields and these show considerable tail structure. Another technique is to use an ordinary camera lens with a CCD. Some digital cameras can record comets and more expensive digital SLRs are comparable to CCDs. Nick emphasised the need to use the standard naming convention when submitting images. Brian Marsden confirmed that astrometry and imaging were important to check if objects on the NEOCP where comets and that it was very important to submit results as quickly as possible. When LINEAR reports an object they have no idea if it is cometary or not.

Alan Fitzsimmons and Paul Murdin briefed the gathering on possible grants for scientific projects. The RAS has a small grants program open to fellows for peer reviewed proposals. There is a six month cycle, with £18,000 per year available distributed in grants ranging from £500 to £5000. They are normally awarded for purposes not funded by PPARC, for example travel, to teachers etc. Pro-am work would come within this remit, but proposals must come from fellows. Full details are posted on the RAS web pages. The Faulkes and Liverpool telescopes will be operational this summer and welcome proposals from amateurs, which can either be live or via email. The BAA has Ridley grants which are open to all astronomers. There is also the Shoemaker grant in the US which has 35,000$ per year.

During the tea break speakers and audience were photographed, which meant that we reassembled to hear Graeme Waddington speak on Random Meanderings by Jove slightly later than planned. Nothing much happened for 13.7 billion years, then along came Kepler and Newton. For a few body problem we need to consider solar attraction, planetary perturbations and relativity (ignore). Solar heating (radiation pressure, Poynting-Robertson effect, Yarkovsky effect) on comets gives outgassing. The Marsden non gravitational forces are A_I = g(r), where A_1 is the radial, A_2 transverse and A_3 the force normal to the plane. They only apply when the comet is closer than about 3 AU of the Sun. The forces can change with time, for example in 7P/Pons-Winnecke. In the real world outgassing is asymmetric on a peanut shaped nucleus and peaks after perihelion. It is also from discrete sources, which may not be continuously active. Observations of the light curve and inner coma may help to distinguish between interpretations of A_i. Initial orbital solutions for comet Ikeya-Zhang showed that the orbits of the comets of 1661 and 1532 were similar, but the comet was soon securely linked to that of 1661. The non-gravitational forces appear to have been quite different between the apparitions. Further back in 1273 there are two possible comets, the best is one in April which was seen for 21 days. 877 has an object in February and March seen from Europe, though Chinese records suggest May. Linking 877, 1661 and 2002 gives a time for perihelion between February 5 and 12 in 1273. If we assume the perihelion time for 2002 and 1661 and change A_1 (which is a function of A_2) gives several possible results and a return around 455, but implies a close passage near Jupiter. Is there a link to the comet of 1532? A 1 m/s split at one return would give a four year separation at the next return, so one or other fragment could easily make an encounter with Jupiter whose radius of influence is around 0.35 AU. As a trial we can again assume the perihelion times in 2002 and 1661, but set A_1 = 0, then vary the perihelion time to get a return in 1532. 2013 May 1 is a possible solution for a split in 77, though his preferred solution is a perturbation in 451 that will return in 200 years time, though this requires a return in 956, which was possibly seen. Essentially the orbit is chaotic and so prediction is very difficult.

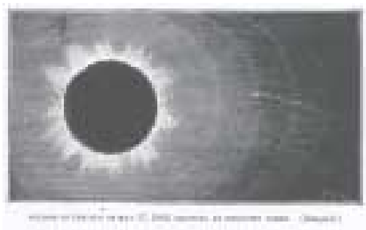
John, Guy, Brian, Kay and Nancy

Guy Hurst introduced John Alcock, brother of George, and Kay Williams George's biographer, before asking Brian Marsden to present the George Alcock Memorial Lecture. Brian first met George on August 28 1959, the day following George's discovery of 1959f, though the IAU circular wasn't issued until

September 1. This was the first UK discovery since Denning had found 1894 F1 [though Candy accidentally found 1960 Y1 Ed] It was only observed for a week and was not seen after perihelion. 1983d, which made the closest approach to the Earth of any comet in the 20th century was being observed exactly 20 years ago today. As well as making sketches on drawing card, George made copies on air letters. Brian had received a letter dated 1977 November 29, where George referred to a thin pencil like beam seen low in the sky on 1963 September 12, which may have been the comet discovered by Pereyra two days later. Ikeya-Seki was a great sungrazing comet as was the great September comet of 1882, when a fine drawing was made from Putney. The nucleus of this comet had fragmented and is possibly related to that of 1965, perhaps having split at a previous return early in the 12th century - there was a comet in 1106 that may match. Sekanina & Chodas (AJ, 2002) suggest that the fragmentation occurred 18 days after perihelion on 1106 February 13.5. Spectra of Ikeya-Seki showed many lines of iron. Other bright comets in 1843 and 1880 appear to be related, with a period of a few hundred years, and to force a relation would require the period to be 360 - 380 years, with a split in the late 15th century. The 1963 comet had a period of around 900 years and is perhaps another component of the 1106 breakup, although its orbit is clearly different. The exact orbit depends very much on where Jupiter is in its orbit; there are lots of possibilities, however Sekanina and Chodas suggest a link to the 1970 comet. In his original paper Brian had assumed a break-up at perihelion, however this is not necessarily the case. A comet seen on 1887 January 20 had a tail but no nuclear condensation and had perhaps passed through the Sun. A comet was seen in by du Toit (only) in 1945, then in 1970 came comet White-Ortiz-Bolelli. In 1981 the Central Bureau received reports from Solwind about a possible comet from 1979, which disappeared as it rounded the Sun. Since then SOHO has produced a multitude of objects. Eight Kreutz comets have been observed from the ground, 6 from Solwind, 10 from the Solar Maximum Mission and 465 from SOHO making a total of 489 as of May 1. There is quite a spread in the SOHO orbits, however they are only approximate and in many cases an orbit was only calculated because we know that the Kreutz group exists. For well known orbits L=282 and B=35. Brian wasn't sure if the spread in SOHO elements was real or not. Sekanina allows splitting well away from perihelion and finds pairs of comets coming in close together, which implies a separation velocity of mm/s, which doesn't match observed separation velocities [and often the elements of pairs appear different]. The problem is not solved yet. The comet of 371 BC is probably not connected with the Kreutz comets, but it makes a good story! We don't know the size of the progenitor. There should have been a bright comet in 1487, but no records have been found so far.

Kreutz group comet 1843 D1

Other SOHO comets also form a group. If they are periodic we have no idea what the period is. From the short arcs observed by SOHO it is impossible to tell the orientation of the orbit, and the groups were only recognised after further objects were found. A few comets pairs have been found in ground observed comets, but no groups. Why does only SOHO see them? The group is also associated with the Arietids, 96P/Machholz and the Quadrantids. The low inclination suggests that they might be short period objects. There are now 38 Meyer group objects, the Marsden group (similar to the Arietids) has 15 and the orbit passes close to the Earth today. The Kracht group has a further 16 members. Another group is 2000 Q1, Y6 and Y7. Excluding these groups leaves 35 comets that pass within 0.1 AU of the Sun of which 16 are from SOHO. Several of these did not survive perihelion, including all the SOHO objects. Those that survive did include 1680, 1962 Seki-Lines and 2002 V1 (NEAT).



Eclipse comet seen in 1882

A question asked about the boring names the majority of comets now received and would names be dropped? The new designation system introduced in 1995 is better than the old ones, but still has problems. On asked about whether interplanetary boulders might cause comet splitting, Brian thought it unlikely as comets were in any case so fragile.

Jonathan Shanklin

Professional Tales

The Populations of Comet-Like Bodies in the Solar system J. Horner (Oxford), N.W. Evans (Cambridge), M.E. Bailey (Armagh), D.J. Asher (Armagh), MNRAS

A new classification scheme is introduced for comet-like bodies in the Solar system. It covers the traditional comets as well as the Centaurs and Edgeworth-Kuiper belt objects. At low inclinations, close encounters with planets often result in near-constant perihelion or aphelion distances, or in perihelion-aphelion interchanges, so the minor bodies can be labelled according to the planets predominantly controlling them at perihelion and aphelion. For example, a JN object has a perihelion under the control of Jupiter and aphelion under the control of Neptune, and so on. This provides 20 dynamically distinct categories of outer Solar system objects in the Jovian and trans-Jovian regions. The Tisserand parameter with respect to the planet controlling perihelion is also often roughly constant under orbital evolution. So, each category can be further sub-divided according to the Tisserand parameter. The dynamical evolution of comets, however, is dominated not by the planets nearest at perihelion or aphelion, but by the more massive Jupiter. The comets are separated into four categories -- Encke-type, short-period, intermediate and long-period -- according to aphelion distance. The Tisserand parameter categories now roughly correspond to the well-known Jupiter-family comets, transition-types and Halley-types. In this way, the nomenclature for the Centaurs and Edgeworth-Kuiper belt objects is based on, and consistent with, that for comets.

MACE 2003

The 2003 Meeting on Asteroids and Comets in Europe was held on the holiday island of Mallorca. The weather wasn't quite as sunny as shown in the holiday brochures and it soon became clear to me that the vast majority of tourists get no further than the beach. Inland at the north end of the island is a spectacular range of limestone mountains, with steep ravines leading down to the sea, yet on walks through them I rarely saw another traveller. Although we were staying in a beach front hotel, 20 minutes walk down the road was the internationally renowned nature reserve of Albufera, full of wildflowers and birds. The meeting was held at the Observatorio Astronomico de Mallorca at Costitx near the centre of the island, which necessitated an exciting bus ride through narrow village streets several times each day. Here there is a very well equipped observatory, with a planetarium, and a wide range of telescopes, some under robotic control through the internet and others available for school teaching.

Each dome houses an LX200!

Here I generally describe only those talks relating to comets, however there was a good range of talks devoted to amateur studies of asteroids. These are summarised in a report in the BAA Journal and are also available as abstracts on the MACE web page at http://www.oam.es/oam/mace/abstracts2.htm. Many speakers used PowerPoint presentations, but only a few followed the best practice of using the pack and go option and the local laptop. Those that didn't often spent many minutes interfacing their own laptops to the host projector. This is a valuable lesson to learn if you plan on giving talks yourself.

Giovanni Valsecchi described close encounters between NEAs and the Earth. The mass distribution of these objects is approximately a power law. He described the keyhole theory where a close encounter at one return allows an even closer encounter at the following return. Each keyhole contains two collision possibilities. He estimates the error in calculations of future collisions done with the analytical theory of keyholes to be around 10%, mainly due to having disregarded various gravitational perturbations.

The dome of the robotic telescope

Mark Kidger updated us on the 2002/03 apparition of 67P/Churymov-Gerasimenko, the probable new target for the Rosetta spacecraft. It is a relatively new entrant to the inner solar system with the perihelion distance around 4 AU prior to 1840 and only going below 2.75 AU after 1959. The comet is fairly active, so it is a potentially risky encounter. The changes in perihelion distance drive the activity by increased sublimation blowing off crust. The Spanish language group "Observadores Cometas" have been observing it. 67P is much larger than 46P/Wirtanen at 2.5 km compared to 0.7 km radius. 67P/ apparently shows outbursts by about 1.5^m a few days before perihelion. 46P shows a consistent light curve, though a 3^m outburst reported in September 2002 and shown in a light curve from Seiichi Yoshida was not seen in his CCD data. Mark predicted another outburst for 67P in 2009 and is planning a campaign to observe it. His light curve suggests an outburst a few days before perihelion and a rapid change in slope at 1.85 AU on the way out, possibly related to H_2O sublimation switching off. A light curve by Seiichi Yoshida shows the same outburst, and also one at the previous apparition. [*Note that some sources use poorly calibrated CCD photometry, which frequently gives spurious effects* Ed.] He suggested that the coma became less condensed after perihelion. He showed examples of CCD images of the comet, which shows a prominent tail, even eight months after perihelion.

The planetarium projector

Jure Skvarc described astrovirtel and the search for trojans of the outer planets. The highlight of this talk was the Italian spaceguard representative who became very upset when it appeared that a possible NEO hadn't been reported to them.

Gerardo Avila reported on the spectra of comets. The Club of Amateurs in Optical Spectroscopy use a fibre optic linked spectrograph which has 1.5 Å resolution. They have obtained spectra of Hyakutake, Hale-Bopp and 1999 S4. They think that they recorded evolution in the Na-D lines in the spectra of Hyakutake that appeared during the apparition and also those in Hale-Bopp, which developed during March and April. Although raw spectra of 1999 S4 looked unpromising they do contain useful information. The group is developing an Echelle spectrograph which will have better resolution ($20{,}000\lambda/\Delta\lambda$) on the 0.6-m telescope, which will show spectra of a 6^m star with a 20 minute exposure.

Andrea Boattini described NEO search efforts. US programmes are not complete, particularly in the north, south and near the Sun. A Schmidt camera (roughly equivalent to the IOA Schmidt in Cambridge) was refurbished with a CCD camera. It can point to within 8° of the horizon. The best strategy was to observe at 50°-55° elongation down to 20^m.

Marcos Voelzke reviewed comets and their origin and evolution. What are comets? - the word comes from cometes or long haired star. They are a mix of dust and ice - we know about the nucleus of 1P/Halley from Giotto. We study comets to understand solar system evolution and the possible cataclysmic effects they may have on the Earth etc. Spectra show their composition. It is possible to show morphological evolution by subtracting image pairs taken a few hours apart, and this was illustrated by images of 1P/Halley. We can explain disconnection events in the tail by the nucleus passing through a magnetic field change, which accounts for about 70% of cases. Another theory suggests that the solar wind pressure varies, but this only explains 22% of cases. He wants to extend the theories to other comets and to use 3-D imaging.

Mark Kidger gave another talk, this time on 153P/Ikeya-Zhang. The previous longest return period was 35P/Herschel-Rigollet, which was seen in 1788 and 1939. 153P was the first comet with a confirmed period longer than 200 years as the proposed link to 1661 is secure. Previous returns, in 877 and 1273, are less secure [See the talk by Graeme Waddington at the Proam meeting]. It was discovered on 1661 February 3 in the morning sky, with a 6° tail. Shortly after discovery Hevelius reported it fainter than Altair. It was last seen on March 28, presumably with the naked eye. A rapid decrease in the degree of condensation was reported. In 1273 a comet was seen on February 5 in the evening and 17 in the morning. One was also seen two months later as a blue-white guest star in Auriga, however this can't be 153P if the first comet is. Waddington suggests that the second object is 153P as the track fits and gives the perihelion as March 27.5±1 day. However the latest IAU orbit suggests a perihelion in 1272 December. The Japanese record a comet on 877 February 11 in Pegasus and a comet was seen in the west from Europe in March. Nakano links these with 153P, however the European comet was in Libra, whereas the Nakano orbit puts it in Cygnus. It would not have been seen from Europe at sunset unless it was very bright. The orbit of 1532 R1 is similar to that of 1661. If the 1661 comet had a similar light curve to the present apparition it would have been better placed for observation before perihelion, and brighter, but there are no reports either in late December or in mid January. Possible explanations are an outburst at perihelion or an asymmetric light curve, but neither is credible. A possible explanation of the 1273 reports is an incorrectly transcribed date. There is a problem linking the expected magnitude to the suggested orbital fits. The observational evidence tends to favour the Waddington linkage in 1273. The Chinese reports suggest that the comet was blue and therefore it must have been bright to see colour, however the light curve gives a magnitude of 1.5 and fading even if the 1661 light curve is used. Alternatively the comet may show strong secular fading. This could be explained if the 1532 and 1661 objects are two fragments of a comet that split in the first century, with the 1532 body being the principle component. A smaller fragment might be expected to show secular fading. The orbit of 153P permits close encounters with Jupiter at the descending node. A split in 58 AD, followed by a close encounter with Jupiter in 485 should separate the components. This implies that the bright component will return at the end of this century.

Maria Teresa (Maite) Merino described the transformation of an old Baker-Nunn Camera from a military base at San Fernando in southern Spain. It will feature a new large format CCD camera and will be used in a robotic mode. It will be installed at Tossa d'Alp in the Catalan Pyrenees by the end of 2004 and might get down to 21^m, theoretically covering the northern sky in four or five days when used in survey mode. It will also be used for discovery and follow-up work for solar system objects, as well as other astronomical survey work which requires a quick response time.

Jure Skvarc described the Fitsblink software developed at Crni Vrh, which has image processing and objection detection facilities. It can't detect trails yet. It uses the USNO SA, Tycho 2 and will use USNO B catalogues for astrometry. It uses Tycho 2 and LONEOS (by Skiff) for photometry and will use the Landolt catalogue in future. There is an option for comet photometry, with automatic star exclusion, background subtraction and tail exclusion. It will produce a report directly in ICQ format and is designed to help beginners.

Herbert Raab & Bill Yeung

Herbert Raab, producer of the widely used Astrometrica software, described some new star catalogues. GSC 2.2, USNO B 1.0 and UCAC (USNO CCD Astrograph Catalog) V2 and compared them with the USNO A 2.0. USNO A is based on the POSS at 0.25" accuracy for 1957 with no proper motions. USNO B has 10^9 stars, relative proper motions (relative to the mean sky, rather than the fixed background of quasars) and is complete to 21^m. Positions are accurate to 0.2" at the current epoch. GSC 2.2 is 455 x 10^6 stars and has a limiting magnitude of 18.5 (R) and 19.5 (B), there is no proper motion and the accuracy is 0.2" in 1993. Version 2.3 is due in 2003 and this will include proper motions. UCAC 2 is based on recent CCD observations. At 50 x 10^6 stars in size it includes proper motion, stars from 8^m to 16^m at -90° to +45° declination to an accuracy of better than 0.1". The new catalogues are significantly better than USNO A. The UCAC is available on 3 CDs from USNO at ad.usno.navy.mil/ucac. USNO B is available on line as is GSC 2.2. The UCAC is good for photometry (approximating to a yellow-red filter [579 - 642 nm]) to around 0.3^m.

Herman Mikuz, well known for his CCD work, described the new 0.6-m robotic telescope at Crni Vrh observatory, which will reach 20^m with a 5 minute exposure. They discovered an NEO 2003 EM1 whilst imaging comet 2001 RX14 and confirmed 2003 H1, which was essentially stellar, but the image profile was slightly broader than that of a star. 2003 H2 was fainter, but clearly diffuse. You need to be very systematic in calibrating and focussing the telescope in order to get good results.

Korado Korlevic commented that comet 1998 VS24 (LINEAR) was discovered as a one night stand at Visnjan, but as they couldn't follow it up they lost the credit for it.

Konrad Dennerl spoke about the recent discovery of X-rays from comets. ROSAT observed comet 1996 B2 and detected X-rays, which was a big surprise. The team obtained 9 images which show a factor of four variation in brightness over a few hours. The peak of X-ray flux is offset in the solar direction. The X-ray coma is much larger than the optical one, and elongated perpendicular to the solar direction. They then looked at the archive data from the satellite and found several comets showing X-ray emission, including one prediscovery image, down to a visual magnitude around 12. All comets inside 2 AU and brighter than 12^m were seen. The X-rays are generally low energy. The X-rays don't follow the optical morphology and in particular don't follow the dust. There is a correlation between the X-ray and optical flux, but the X-rays are some 10^{-4} the intensity. Gassy comets are brighter in X-rays. Protons, electrons and helium nuclei form 99.9% of the solar wind, but the 0.1% of 'heavy' ions (eg C^{6+}, O^{6+}) are responsible for the X-rays by exchanging electrons from neutral H_2O in the coma giving emission at discrete X-ray energies, in particular at 568eV. Therefore the X-ray emission is more from the solar wind and this explains the crescent shaped emission profile on the sunward side. Comet observations therefore make a good probe of the solar wind. At high ecliptic latitude the wind is fast and steady, whilst at low latitude it is highly variable at solar minimum but more variable all round at solar maximum. Chandra and XMM-Newton have both observed comets. XMM observed 1999 T1 (McNaught-Hartley) and 2000 WM1 (LINEAR). 2000 WM1 didn't have any emission above 1 keV, but they recorded 10^6 X-ray photons. The profile is a function of 1/r. XMM can also measure spectra, thus identifying electron transitions. Chandra observed 2002 C1 on two nights, finding completely different X-ray morphology. CCD images or photographs taken on 2002 April 15 between 01:54 and 05:09 would help understand the reasons. The X-ray coma would perhaps be comparable to the Lyman alpha cloud in size if sufficient sensitivity could be used.

Richard Miles showed that the Sony CCD HAD chip is actually quite a close match to Hipparcos and so can be used without a filter if a simple transform is used. This assumes that the stars used have a similar B-V to the asteroid.

In his third talk Mark Kidger looked at amateur CCD photometry. The advent of the CCD has been the biggest revolution in cometary observation in the last 50 years. It provides both astrometry and photometry, however the photometry is generally unreliable with a scatter of perhaps 4^m. There is a need to standardise in a way that is simple, quick and adequate for the purpose. We must accept unfiltered photometry, and the fact that comets are not point sources, which makes life harder. The MPC list an N ($\equiv m_2$) or T ($\equiv m_1$) magnitude, however the m_2 reports tend not to be a bare nuclear magnitude. The Spanish method is to assume that unfiltered magnitudes approximate to R, for everyone to make the reductions with one package (eg Astrometrica), to use a standard aperture of 10" for nuclear magnitudes and to calibrate using USNO A2.0 R magnitudes (this is widely available, has many stars and there is nothing better at the moment). The catalogue is from 1950 POSS plates (or more recent) and is not a photometric catalogue. The B mags are too bright above 13^m so that $20^m \equiv 19.2$ but is generally close to the truth at 14^m. R is within 0.2^m from 11 - 19 (18 USNO ≡ 17.8) and the standard deviation is about 0.25^m. 60% of stars are within this and each field may have 100 stars, so outliers can be rejected (Astrometrica does this automatically). You should NEVER use single star calibrations. The error generally reduces as the square root of the number of stars used. The biggest single issue is actually sky subtraction. As an example using 2002 T7 the light curve scatter has ±0.2 mag. It is possible to improve things by using a range of fixed apertures, 10", 20" etc. They have developed a custom program (FASE3) to permit multi-aperture photometry and astrometry, and also give good sky subtraction.

Gyula Szabo introduced the idea of an Afrho database. It is difficult to do photometry on a diffuse comet coma. The observed length of tail or coma size depends on equipment and sky conditions. The coma brightness depends on aperture, the brightness of the nucleus depends on seeing, equipment, coma etc. Sunlight is scattered from dust in the coma towards the Earth, therefore the ratio of comet flux to solar flux is a measure of the dust in the coma. Dust is characterised by a function of the albedo and dust density (Afrho). He would like to create an archive of Afrho measurements supported by a helpful web page at cara.uai.it. AstroArt software includes tools for generating the information needed. As an example photographic data for 67P from Kitt Peak in the 1980s gives very similar results to recent Italian observations using CCD. He would welcome more observations. Mark Kidger suggested that the archive should do the calculation of Afrho from the input data.

Mike Kretlow concluded the papers with a talk on the splitting of comets. In the past 160 years we have seen about 35 split comets. There are two split comet families - the Kreutz group and the Marsden/Mayer/Kracht group. D/1993 F2 split as a result of tidal forces. High resolution imagery shows that fragments are sub kilometre in size. There are two types of fragmentation: A: two or three fragments leaving a primary body, a process which may recur and the fragments can survive for years. B: many fragments, with no primary (eg D/1993 F2, 1999 S4) with the parent completely destroyed. Backward integration generally doesn't give a satisfactory break-up point, which makes it tricky to link up fragments. Sekanina has published lots of papers on more than 30 comets over the last 25 years. This uses a simple 2-body model, which is not suitable for type B and even the 2-body model gives multiple solutions. The model implies that splits can occur anywhere along the orbit and the lifetime of fragments can be very variable, being weeks to years. The separation velocity is 0.1 to 15 m/s, but generally 0.3 - 4 m/s. The splitting rate is around 2%/century/object so that over the lifetime of a comet (10^7 years) about 1000 events may happen to a comet. If each fragment was 50-m in radius this sums to a parent 0.5 - 1 km in radius so it is an important mass loss factor. Splitting may be due to tidal forces, rotational forces, thermal stress, internal gas pressure or impact. The first known example is 3D/Biela, which split into 2 in 1845/6. It was seen again in 1852/3 and has been lost since then. 73P/Schwassmann-Wachmann split in 1995, with an outburst occurring just before the split and perihelion. 57P/du Toit-Neujman-Delporte split in many fragments in July 2002, although there was still one primary. Coma arc-lets or ring-lets as seen in image processed views of 2001 A2 may indicate breakup or may relate to outgassing. Amateurs need to monitor comets, both as a light curve and high resolution CCD images in order to detect break-up events closer in time to the actual event.

Several poster papers were on display in the foyer of the planetarium, which also housed an exhibition of meteorites. Mark Kidger had a poster on ‘Revealing the nucleus of long-period comets with Canaricam’. This is a mid-infrared imager planned to be installed on the Gran Telescopio Canarias, a 10 metre telescope which is due to start operation in 2005. By combining the infrared and visible photometry it will be possible to determine the albedo and diameter of distant comets.

The next MACE is planned for Frasso Sabino near Rome in 2004.

Jonathan Shanklin, with thanks to the speakers for corrections to my original notes

Springer Competition Winners

Thanks to the generosity of Springer-Verlag the comet Section was able to run a competition in the spring, with prizes being copies of the new book on *Observing Comets* by Nick James and Gerald North. The winning entries appear in this edition of *The Comet’s Tale* and the runners up will appear next time. A review of the book, by Guy Hurst, appeared in the August Journal and one by John Bortle appeared in the September issue of Sky and Telescope. The book is a valuable addition to the observers’ library and I can strongly recommend it.

Margaret Cullen submitted her drawing “Cat watching Hale-Bopp” to win the SPA Members division, Gabriel Oksa’s essay won the BAA division and Bill Ward’s essay won the open division. Congratulations to all these on their success.

Why I Observe Comets

Gabriel Oksa

I began with a systematic observing of comets in 1996 during my stay at the Loughborough University, Loughborough, England, where I received the Royal Society Fellowship in the field of parallel computing. At that time, the Internet was new to me and by means of it I established first contacts to the British Astronomical Association, especially to its Comet Section. From April 1996 onwards I am the only Slovak member of the BAA.

The year 1996 will be recalled as the year of Great Comet Hyakutake. I remember those foggy days in Loughborough when its finding was announced and the special BAA circular was issued with a map of comet's visibility. And then I remember the increasing frustration due to the 'English' weather when several weeks were totally clouded off with no sign of Sun, stars and comet. But exactly around the time of the comet's closest approach to the Earth, the weather changed and I vividly recall that evening in late March with the comet nearly overhead, having large coma and long tail - a stunning sight even from the middle of the city!

And then, of course, the Great Comet Hale-Bopp! My observations were split between England and Slovakia. The climax came in those cold evenings of April 1997, when I was able to record photographically the changing forms of its wavy plasma tail and to observe the brightening and lengthening of its dust tail and the famous dust envelopes around its pseudo-nucleus. Using even small binoculars, an amazing colour contrast between the blue plasma and yellowish dust was easily visible.

Since that time, seven years of the regular observing of comets have gone and my interest did not vanish. I observed, among many others, the famous comet 55P/Tempel-Tuttle rushing across the sky in January 1998, interesting changes in the tail and coma of the comet C/1999 S4 in spring and summer 2000 (the comet disintegrated in July 2000), the outburst of comet 41P/Tuttle-Giacobini-Kresak in December 2000 and a beautiful visual emission spectrum of the distinctly bluish pseudo-nucleus of comet 153P/Ikeya-Zhang in March 2002. Having used several observational techniques including the CCD camera, I am fascinated by wonderful cometary drawings of late Mr Alcock, so nowadays I am trying to reproduce some of my observations in this way.

To observe a comet, you must not be lazy. Sometimes you have to abandon your warm bed early in the morning - often too early for 'ordinary' people. Sometimes you have to change your evening plans suddenly when a beautiful transparent sky of a special blue colour appears following the passage of cold front. You have to know the sky well enough to find a comet. You have to remember that things completely change during an evening or morning twilight so that, in such circumstances, to find even a bright comet close to the horizon may be a challenge. You need a lot of patience in those cloudy nights when only a few holes of clear sky bring you some hope, and you firmly believe that one of them will reach a comet and stay there for a sufficiently long time to make an observation. You need all of these skills - and still, a successful observation is not guaranteed! Every time I go out to observe comets I am not sure what, if anything, I shall see. This uncertainty is a substantial part of my life with comets.

Cat watching Hale-Bopp - Margaret Cullen

So, why do I observe comets? It is a joy - every time a comet is in my eyepiece I feel lucky. It is a thrilling experience - just think of the depths of space and time, which a comet is coming from! It is a perception of beauty and very special order in the cosmos. It is a curiosity - how will a comet appear today? I would say that some sort of relationship arises between an observer and a comet, especially if a comet is observable for a longer time period. And it is a communication and sharing with a community of equally-minded people in the world.

Exciting days should be ahead for all cometary enthusiasts. Several space probes are planned to visit some comets and analyse their composition by 'in situ' measurements in near future. Unprecedented details will be added to the enigmatic nuclear images of comets 1P/Halley and 19P/Borrelly. But, regardless to the advances of science, the comets will remain delightful objects for amateur astronomers due to their intrinsic beauty, unpredictable behaviour and connection with the origin of our Solar system.

The Importance of Amateur Comet Observations

Bill Ward

Every comet is different with it's own story to tell and each one presents a new piece of information about the solar system. Comets by their very nature are varied and unpredictable. It is because of this that amateur astronomers can and do play an important part in cometary astronomy simply by the virtue of being "amateur". In this context amateur has nothing to do with the standard of workmanship only in the meaning of being un-waged and in conducting observations for the enjoyment to be found in it.

Amateur cometary astronomy is sometimes viewed as slightly quaint and reminiscent of the 18th and 19th centuries with their famous comet hunters. Nowadays there are relatively few professional cometary programmes with most solar system observing programmes dealing with other small bodies such as near earth asteroids and more recently trans Neptunian objects.

A great deal of time is required to conduct searches and carry out observations. From the discovery of a comet to its orbit back into the far reaches of the solar system may be months or years. As comets are unpredictable there is no way of scheduling observing time in advance as it is impossible to say when an interesting comet will appear or an unusual event will occur. The process by which telescope time is granted is highly competitive with large telescopes being over subscribed. This process tends to favour projects with a definite short-term goal and that will yield a scientific paper suitable for publication. Comet observations require a longer time scale. Major observatories simply cannot justify the expense of using major instruments for such work because of the restrictions placed upon them.

Considering this situation begins to reveal the importance of amateur comet observations. The key issue is one of flexibility, of being in the position to observe whatever and whenever without any other concerns or restrictions. A flexibility which professional observatories cannot match.

Another important element that is now fundamental to amateur comet observations is one of technology. The developments in detectors, that is the now ubiquitous CCD camera, allow the amateur to work at magnitudes that were impossible only a few years ago! Combined with the availability of powerful desktop computers, this allows real quantitative data to be produced to a high standard. Software is readily available and photometry and astrometry are now relatively simple tasks. Images of remarkable detail are now common place through the use of both modern film and CCD cameras. (A by-product of these spectacular images is to raise public awareness about astronomy in general. With the appearance of Comet Hyakutake in 1996 and Comet Hale-Bopp in 1997 coupled to the imminent appearance of two more possibly bright comets (Comet 2002 T7 and Comet 2001 Q4) a whole new generation of people have been (or shortly will be) exposed to comets and astronomy.)

Even with nothing more than ones eyes, there is a huge array of binoculars ranging from lightweight models to huge 150mm monsters which allow many comets to be followed visually. It should be noted that hand written visual observations are just as valuable as the "hi tech" CCD ones. One only has to consider historical observations to see this. Many comets would not have been found had it not been for those 18th and 19th century amateurs exploring the heavens and our understanding of comets would be poorer if it were not for these same people leaving us their notes. Properly recorded amateur comet observations constitute a major scientific archive.

Amateurs also have the advantage of numbers and coverage. With many eyes watching the skies there is the chance that any given event will be caught somewhere. Even casual observations are important too if a bit of care is taken. As astronomers we are plagued by the weather and you just might happen to be in the right place at the right time to get that critical observation, it could be cloudy elsewhere!

The importance of amateur comet observations cannot be underestimated as it is through the inherent flexibility, readily available technology and coverage that amateurs have which allows useful observations to be made in conjunction with professional research ultimately allowing us to know more about these fascinating objects.

Comet Prospects for 2004

2004 sees the return of 18 periodic comets. None are particularly bright and the best are likely to be 78P/Gehrels and 88P/Howell. Three long period comets are likely to put on good shows. 2001 Q4 (NEAT) reaches perihelion in May, when it could reach at least 3rd magnitude. Northern Hemisphere observers will first pick it up just after perihelion as it rapidly moves north. 2002 T7 (LINEAR) could also reach 3rd magnitude at closest approach in May, however Northern Hemisphere observers will have lost it as a binocular object in mid March. Observers at far southern latitudes may be able to see these two naked eye comets at the same time. 2003 K4 (LINEAR) could reach 6th magnitude as it brightens on its way to perihelion. Several other long-period comets discovered in previous years are still visible.

Theories on the structure of comets suggest that any comet could fragment at any time, so it is worth keeping an eye on some of the fainter periodic comets, which are often ignored. This would make a useful project for CCD observers. As an example 51P/Harrington was observed to fragment in 2001. Ephemerides for new and currently observable comets are published in the *Circulars*, Comet Section Newsletters and on the Section, CBAT and Seiichi Yoshida's web pages. Complete ephemerides and magnitude parameters for all comets predicted to be brighter than about 18^{m} are given in the International Comet Quarterly Handbook; details of subscription to the ICQ are available from the comet section Director. The updated section booklet on comet observing is available from the BAA office or the Director.

29P/Schwassmann-Wachmann is an annual comet that has frequent outbursts and seems to be more often active than not at the moment, though it rarely gets brighter than 12^{m}. It begins the year in Aquarius, but spends most of the year in Pisces, reaching opposition at the end of September. The comet is an ideal target for those equipped with CCDs and it should be observed at every opportunity. UK based observers should be able to follow it throughout the second half of the year.

43P/Wolf-Harrington is at its brightest (12th mag) at the beginning of the year, and slowly fades as its elongation in the evening sky decreases. This is the comet's tenth observed return. It is in a chaotic orbit, and made a close approach to Jupiter in 1936 which reduced its perihelion distance from 2.4 to 1.6 AU. It made an exceptionally close (0.003 AU) approach to Jupiter in 1841, which switched its previous perihelion distance into the new aphelion distance. It was discovered in 1924, then lost until 1951. Its next apparition, in 2010, will be unfavourable.

48P/Johnson was discovered by Ernest Johnson at the Union Observatory in South Africa in 1949, following a very close approach to Jupiter in 1931. It is now in a stable orbit between Mars and Jupiter and no close approaches are predicted for some centuries. At favourable apparitions, such as its first two returns, it reaches 13th magnitude. The next three returns were unfavourable, with the comet reported to reach only 18th magnitude. Returns are now improving, and at the last return, Werner Hasubick reported observing it at 13.5. It could reach a similar magnitude at this apparition, though it will be best seen from the Southern Hemisphere.

62P/Tsuchinshan The comet was discovered at Purple Mountain Observatory, Nanking, China in 1965, following a close approach to Jupiter in 1960, which reduced the perihelion distance from 2 to 1.5 AU. Unusually, the comet's name derives from that of the observatory rather than those of the discoverers. At a good apparition such as in 1985 it can reach 11^m and as the perihelion distance will continue to decrease future returns may be even better. At the last return the comet was recorded at around 13^{th} magnitude and this time it could do a magnitude or more better. It should be picked up as a 13^{th} magnitude object in the September morning sky, brightening throughout the rest of the year. It tracks from Gemini in September through into Leo at the end of the year, when it could be 11^{th} magnitude.

69P/Taylor A series of Jupiter encounters in the 19^{th} century reduced the perihelion distance from 3.1 to 1.6 AU and led to its discovery by Clement Taylor, with a 0.25-m reflector from Herschel View, Cape Town South Africa, in November 1915. It was quite bright, 9th magnitude at best, and shortly after perihelion, in 1916 February, E E Barnard found a double nucleus, each with a short tail. The secondary nucleus became brighter than the primary, but then rapidly faded and the primary also faded more rapidly than expected. The comet was then lost until 1977, when new orbital computations led to the recovery of the 'B' component by Charles Kowal with the Palomar Schmidt. The 'A' component was not found. The comet has had several encounters with Jupiter, the closest recent one being in 1925, and had very close (0.06 AU) encounters in 1807 and 1854. The comet was not expected to be brighter than 15^{th} magnitude at its last return, however it was discovered at around 12.5 in mid January 1998. The observations suggest that it suffered two outbursts. This makes it difficult to predict the likely brightness at this return, but if it maintains the level of activity it might reach 11^{th} magnitude at the end of the year. It will become visible in the late summer morning sky at perhaps 13^{th} magnitude and CCD observers should treat it as a priority object.

78P/Gehrels Tom Gehrels discovered this comet at Palomar in 1973. Its perihelion distance is slowly decreasing and is currently around the lowest for 200 years. The eccentricity is slowly increasing, with a marked jump in both following a moderately close approach to Jupiter in 1995. This return is extremely favourable, with the comet reaching opposition and perihelion within a fortnight of each other. At the last return the comet reached 12^{th} magnitude and it should do at least a magnitude better this time round. It should become within visual range of favourably placed observers by late spring, but UK observers will probably need to wait until July when it should be a 12^{th} magnitude object in the morning sky. It continues to brighten on its way to opposition and by October should be at 10^{th} magnitude. It spends most of the apparition in Aries, where it completes its retrograde loop in mid December, by which time it is fading towards 11^{th} magnitude.

88P/Howell Ellen Howell discovered the comet in 1981 with the 0.46-m Palomar Schmidt. It passed 0.6 AU from Jupiter in 1978, which reduced the perihelion distance, but the biggest change to its orbit occurred in 1585 when an encounter reduced q from 4.7 to 2.4 AU. The standard light curve was not a good fit to the observations at the last return and a better fit was obtained using a linear light curve that peaked 28 days after perihelion, thus confirming the view that the comet is brighter after perihelion. The comet was never well placed for viewing in the UK at the last return and will not be at this return either. Elsewhere it should be picked up at 12^{th} magnitude in January as it emerges from solar conjunction. The comet should be at its best in mid March when it could be 10^{th} magnitude.

95P/Chiron is an unusual comet in that it is also asteroid 2060. It will reach around 17^m when at opposition in July in Sagittarius. CCD V magnitudes of Chiron would be of particular interest as observations show that its absolute magnitude varies erratically; it is currently around 6. It began an outburst in 2000/01 though it is likely to be fading again in 2004. It was at perihelion in 1996 when it was 8.5 AU from the Sun and will be nearly 19 AU from the Sun at aphelion in around 40 year's time.

Two long period comets are likely to become naked eye objects. **C/2001 Q4 (NEAT)** was discovered at Palomar on 2001 August 24.40 when it was nearly three years from perihelion and over 10 AU from the Sun. It begins the year as a Southern Hemisphere binocular or easy telescopic object and remains at high Southern declination until it nears perihelion in May. By then it will have brightened considerably, and could be an easy naked eye object. Adopting a conservative magnitude equation predicts a peak of 3^{rd} magnitude as it emerges into the northern evening twilight in the second week of May, though it could be 1^{st} magnitude. Tail development is likely to be good, particularly in the first half of May, with a maximum length of 10° - 25°. Observing opportunities are best in the second week of May as the moon leaves the sky. It remains an evening object, becoming circumpolar in June, when it may still be just visible to the naked eye. It passes from binocular range by the end of July, but will remain visible to telescopic observers to the end of the year.

C/2002 T7 (LINEAR) reaches perihelion a few weeks before 2001 Q4, but will be at its best at around the same time, though only for Southern Hemisphere observers. It too begins the year as a binocular object, but at this time it is best placed for Northern Hemisphere observers. It remains a binocular object, dropping into the evening twilight in the first week of March. It emerges from solar conjunction as a naked eye object in mid April and continues brightening, even after perihelion, as the distance from earth decreases on the way to a moderately close approach at 0.27 AU in mid May. Equatorial observers get the best view as it emerges from conjunction, but at closest approach it is a Southern Hemisphere object of 3^{rd} or perhaps 1^{st} magnitude. The tail at this time could extend as much as 40°. Thereafter the comet fades, passing from binocular view in July and re-enters solar conjunction in August. It might be picked up again as a 13^{th} magnitude object at the end of October.

C/2003 K4 (LINEAR) reappears in 2004 February after solar conjunction and reaches binocular range in May. We will loose it into conjunction again at 6^m in 2004 September and it will pass through the SOHO LASCO fields as a 5^m object in 2004 October. Southern Hemisphere observers will pick it up at the end of the month and it should remain a naked eye object until 2005 January.

A few other long period comets will still be visible at the beginning of 2004. **2001 HT_{50} (LINEAR-NEAT)** will be fading from 12^{th} magnitude at the start of the year, but it is well placed in the evening sky in Pisces. It will be lost in the evening twilight by the end of February. **2002 O7 (LINEAR)** is fading from 11^{th} magnitude in Aquarius, but sinks into the twilight even more quickly and will be gone by the beginning of February. **2003 H1 (LINEAR)** is best placed for observation from the Southern Hemisphere and may reach 11^{th} magnitude in March.

Several other comets are at perihelion during 2004, however they are unlikely to become brighter than 13^{th} magnitude or are poorly placed. 40P/Vaisala, 42P/Neujmin and 121P/Shoemaker-Holt are 13^{th} magnitude or fainter but within range of larger amateur telescopes. 58P/Jackson-Neujmin, 103P/Hartley, 104P/Kowal and D/Haneda-Campos have unfavourable returns. 111P/Helin-Roman-Crockett, 120P/Mueller, 130P/McNaught-Hughes, 131P/Mueller, 1996 R2 (Lagerkvist), 2002 L9 (NEAT), 2003 E1 (NEAT), 2003 L2 (LINEAR), 2003 O1 (LINEAR) and 2003 S1 (P/NEAT) are intrinsically faint or distant comets and will not come within visual range. Ephemerides for these can be found on the CBAT WWW pages. D/Haneda-Campos has not been seen since its discovery in 1978.

Looking ahead to 2005, no bright comets are predicted to return. The best object for UK observers is likely to be 9P/Tempel, which will be a faint object in large binoculars from May to June. Several other periodic comets have favourable returns, but they will all be telescopic objects.

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Jonathan Shanklin

Comets reaching perihelion in 2004

Comet	T	q	P	N	H_1	K_1	Peak
58P/Jackson-Neujmin	Jan 10.0	1.39	8.27	5	11.0	15.0	15
D/Haneda-Campos	Jan 10.2	1.27	6.41	1	13.5	10.0	16
2003 L2 (LINEAR)	Jan 19.3	2.86			10.0	10.0	17
40P/Vaisala	Jan 22.9	1.80	10.83	6	8.9	15.0	13
2003 E1 (NEAT)	Feb 13.5	3.25	50.9		12.5	5.0	17
2003 H1 (LINEAR)	Feb 22.6	2.24			6.5	10.0	11
2003 O1 (LINEAR)	Mar 17.2	6.85			6.0	10.0	18
43P/Wolf-Harrington	Mar 17.9	1.58	6.45	9	9.9	5.8	12
2003 S1 (P/NEAT)	Mar 26.0	2.60	9.69	0	11.5	10.0	18
2002 L9 (NEAT)	Apr 6.2	7.03			8.5	5.0	17
88P/Howell	Apr 12.6	1.37	5.50	5	4.7	24.9	9
2002 T7 (LINEAR)	Apr 23.6	0.62			6.0	7.5	3
104P/Kowal	May 9.7	1.40	6.18	3	9.8	9.3	13
2001 Q4 (NEAT)	May 15.9	0.96			6.5	7.5	3
103P/Hartley	May 18.0	1.04	6.40	3	8.1	15.0	10
1996 R2 (P/Lagerkvist)	Jun 7.4	2.62	7.39	1	11.0	10.0	17
29P/Schwassmann-Wachmann	Jul 10.8	5.72	14.65	6	0.5	10.0	12
42P/Neujmin	Jul 15.9	2.01	10.70	4	9.5	15.0	14
121P/Shoemaker-Holt	Sep 1.7	2.65	8.01	2	4.5	15.0	13
120P/Mueller	Sep 30.2	2.75	8.43	2	12.0	10.0	18
48P/Johnson	Oct 12.0	2.31	6.96	8	5.6	15.0	12
2003 K4 (LINEAR)	Oct 13.8	1.02			3.5	10.0	5
130P/McNaught-Hughes	Oct 23.3	2.10	6.67	2	12.5	10.0	17
78P/Gehrels	Oct 27.1	2.01	7.22	4	7.1	10.0	10
69P/Taylor	Nov 30.4	1.94	6.95	5	8.9	15.0	10

62P/Tsuchinshan	Dec 7.9	1.49	6.63	6	8.0	15.0	11
131P/Mueller	Dec 17.6	2.42	7.07	2	13.0	10.0	18
111P/Helin-Roman-Crockett	Dec 27.1	3.47	8.12	2	5.0	20.0	18

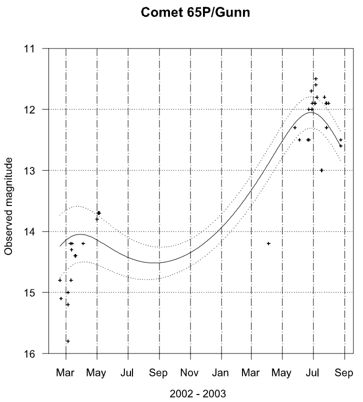
The date of perihelion (T), perihelion distance (q), period (P), the number of previously observed returns (N), the magnitude parameters H_1 and K_1 and the brightest magnitude are given for each comet. The brightest magnitude given for 29P and 69P is that typical of an outburst.

Note: $m_1 = H_1 + 5.0 * \log(d) + K_1 * \log(r)$

Review of comet observations for 2003 April - 2003 September

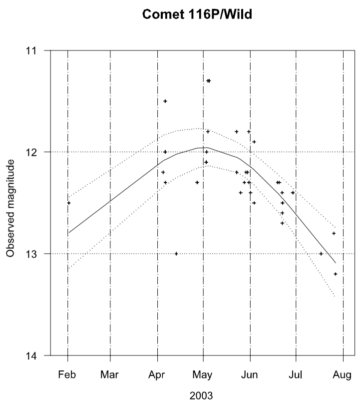
The information in this report is a synopsis of material gleaned from IAU circulars 8117 – 8212, The Astronomer (2003 May – 2003 September) and the Internet. Note that the figures quoted here are rounded off from their original published accuracy. Lightcurves for the brighter comets are from observations submitted to The Astronomer and the Director. A full report of the comets seen during the year will be published in the Journal in due course. I have used the convention of designating interesting asteroids by A/Designation (Discoverer) to clearly differentiate them from comets, though this is not the IAU convention.

65P/Gunn was relatively well observed by more southerly located observers, peaking at around 12th magnitude. The observations received so far give a magnitude equation of $m = 8.6 + 5 \log \Delta + 6.8 \log r$.



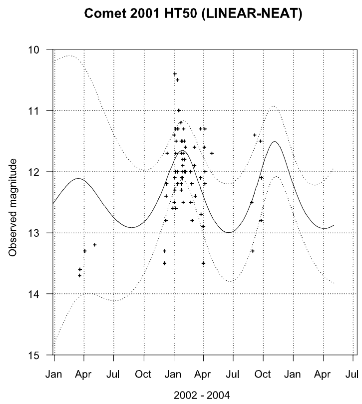
116P/Wild was also relatively well observed, peaking at a similar magnitude, however the observations do not allow a well constrained magnitude equation.

2000 QD_{101} (156P/Russell-LINEAR) IAUC 8118 (2003 April 19) announced the linkage of a comet discovered on UK Schmidt plates in September 1986, with an asteroid found at the end of August 2000 by LINEAR. Although it only appeared cometary in 1986, the identity is secure. Calculations by Kenji Muraoka show that the perihelion distance has been decreasing over the last 100 years, with significant changes around 1934 and 1970. The next significant change will be around 2017, when the perihelion distance will reduce to 1.33 AU from its present 1.60 AU.



R. H. McNaught, Siding Spring Observatory, reports observations of a comet found in Sept. 1986 by K. S. Russell on a 90-min exposure taken by F. G. Watson earlier that month with the U.K. Schmidt Telescope. Unsuccessful attempts were made by Russell, and later by McNaught, to locate the comet on the 30-min follow-up exposure by M. Hartley obtained on Sept. 25. T. B. Spahr, Minor Planet Center, has recently identified the comet with 2000 QD_{181}, an apparently asteroidal object observed by LINEAR on 2000 Aug. 31 and Sept. 5 (cf. MPS 18353), and itself linked by Spahr (MPO 9348) to another LINEAR discovery 2000 XV_{43} (observations Nov. 2000-Jan. 2001 on MPS 23109 and 25364), as well as to 1993 WU, recorded by C. S. Shoemaker et al. with the 0.46-m Palomar Schmidt telescope on 1993 Nov. 19 and 20 (MPS 397), the appearance again being evidently asteroidal. With the knowledge of the clearly cometary orbit, McNaught and M. A. Read have now located and measured the object on the Hartley follow-up plate. The 1986 observations were given the designation P/1986 R1. [IAUC 8118, 2003 April 19]

Comet P/2000 QD_{181} = 2000 XV_{43} = 1986 R1 = 1993 WU (Russell-LINEAR), announced on IAUC 8118, has been given the permanent number 156P (MPC 48317). [IAUC 8128, 2003 May 3]

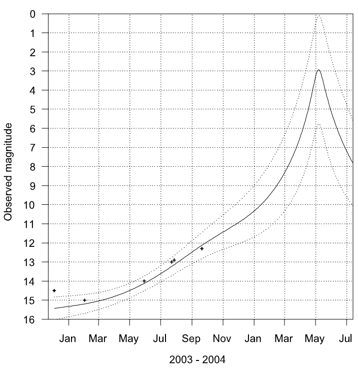


2001 HT_{50} (LINEAR-NEAT) could reach 11th mag at the second of its two oppositions in 2003. The light curve is not very well constrained by the observations made so far.

2001 Q4 (NEAT) was discovered when still over 10 AU from the Sun and will reach perihelion next May. Brian Marsden notes on MPEC 2003-R40 that the "original" and "future" barycentric values of 1/a are +0.000037 and -0.000708 (+/- 0.000003) AU**-1, respectively. [2003 September 9] The "original value of 1/a suggests that this is a new visitor from the Oort cloud. Michael Mattiazzo gives the dates of the orbital plane crossings as 2003 Oct 24, 2004 April 20 and 2004 October 23.

Observations in early September 2003 put the comet at around 12th magnitude. Alexandre Amorim, observing on September 20.31 with a 0.14-m reflector x80 estimated the comet at 12.3 with a 0.5' coma. The comet should be a bright object in May 2004. Adopting a conservative magnitude law (7.5 log r), suggests a peak of around 3rd magnitude, whereas the standard 10 log r gives around 0 magnitude. The observations made so far do not provide a good constraint on the likely peak brightness.

Comet 2001 Q4 (NEAT)

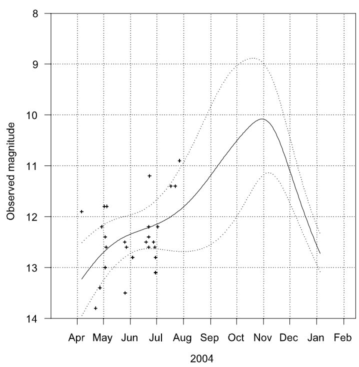


2002 CE$_{10}$ (P/LINEAR) As I suggested in issue 17 (2002 April) this object has turned out to be a comet. Observations made in mid August 2003 revealed the presence of a faint thin straight tail some 21" long, thus confirming the cometary nature of the object, although any coma was <6" in diameter. The further observations made since discovery confirm the perihelion date as June 22.1, perihelion distance at 2.05 AU and the period as 30.7 years. There have been no recent planetary encounters, though it approached to 0.6 AU from Jupiter in 1912 December.

N. Takato, T. Sekiguchi, and J. Watanabe, National Astronomical Observatory of Japan, obtained nine CCD images with the 8.2-m Subaru telescope of the apparently asteroidal object 2002 CE$_{10}$ (first reported by the LINEAR team, whose discovery observation is given below; originally announced on MPEC 2002-C83 and MPS 50101) on Aug. 22.4 UT that show a very faint, straight tail about 21" long in p.a. 212 deg; the tail is also present on shorter exposures from Aug. 21.5-21.6, when any coma as bright as the tail must have been < 6" in diameter. Recent astrometry, orbital elements (T = 2003 June 22, Peri. = 126 deg, Node = 147 deg, i = 145 deg, e = 0.79, P = 30.8 yr), and an ephemeris appear on MPEC 2003-R20. [IAUC 8193, 2003 September 3]

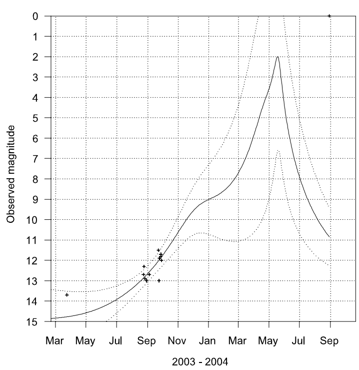
2002 O7 (LINEAR) did not reach perihelion until September 2003, however the last observations were made in late July and it has not been seen visually since. CCD observations by Michael Mattiazzo in late September show a faint diffuse cloud and it seems that it did not survive perihelion. The pre-perihelion light curve suggests a relatively slow rate of brightening, presaging things to come.

Comet 2002 O7 (LINEAR)



2002 T7 (LINEAR) will reach perihelion on 2004 April 23 at 0.61 AU. The comet could be an impressive object in the spring and early summer of 2004, however it will then be a southern hemisphere object. Making reasonable assumptions about the rate of brightening suggests a likely peak of 2nd magnitude in early May, giving the opportunity of viewing two naked eye comets at the same time [2001 Q4 should be around the same brightness].

Comet 2002 T7 (LINEAR)



Brian Marsden notes that the "original" and "future" barycentric values of 1/a are +0.000050 and -0.000590 (+/- 0.000003) AU**-1, respectively. [MPEC 2003-R42, 2003 September 9] The first value suggests that this is a "new" comet from the Oort cloud. Michael Mattiazzo gives the orbital plane crossings as 2003 December 25, 2004 December 25.

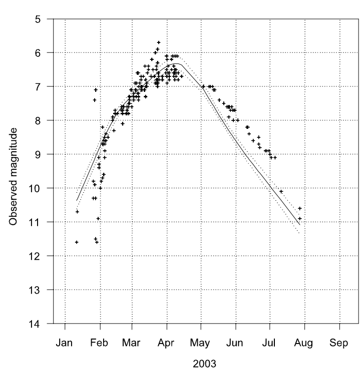
Observations made in 2003 August put the comet around 13th magnitude, brightening to 12th magnitude in September.

2002 VQ$_{94}$ (LINEAR) is another object first noted as asteroidal and identified as suspicious in the last issue. Observations made towards the end of August 2003 revealed a clear coma, thus confirming the cometary nature of the object.

An apparently asteroidal object reported by LINEAR (announced on MPEC 2002-V71, where B. G. Marsden noted "whether this object is a comet or not is inconclusive", and MPS 66506) has been found to have a prominent 10" coma with a fanlike morphology spanning p.a. 180-300 deg on images taken by D. Jewitt on Aug. 28.5 UT with the University of Hawaii 2.2-m telescope. Recent astrometry, the orbital elements below, and an ephemeris appear on MPEC 2003-R22. [IAUC 8194, 2003 September 3]

Brian Marsden notes on MPEC 2003-R43 [2003 September 9] that the "original" and "future" barycentric values of 1/a are +0.005297 and +0.005403 (+/- 0.000000) AU**-1, respectively, suggesting that this is not a "new" comet from the Oort cloud. The period is around 3000 years.

Comet 2002 Y1 (Juels-Holvorcem)



2002 Y1 (Juels-Holvorcem) faded rather more slowly than expected, but was a southern hemisphere object. The most recent observations are from Michael Mattiazzo who estimated it at approaching 11th magnitude at the end of July.

Although around 50 more **SOHO comets** have been discovered over the last six months, few have had their positions measured. At the moment there is no-one in the SOHO team responsible for making the measurements and it may be some time before designations are announced. There have been some problems with the spacecraft, which is past its design lifetime. The ground control team have so far kept it going through technical fixes, but its days may be numbered. A replacement for the spacecraft is not scheduled for launch before 2007. SOHO now has a total of 669 comets, with over 100 awaiting designation.

Meyer Group SOHO comets **2003 H5 SOHO, 2003 K5 SOHO** and **2003 K6 SOHO** were discovered with the SOHO LASCO coronographs and have not been observed elsewhere.

2003 F2 (P/NEAT) is a distant periodic comet discovered by NEAT on March 27.20. It has a perihelion distance of 2.9 AU, a period of 16 years and will fade. Syiuchi Nakano notes that the preliminary orbit is very similar to that of 2001 BB50 (P/LINEAR-NEAT) and that both objects were last at perihelion in late March 1987. Maik Meyer notes that based on the present orbits their separation was only 0.016 AU in July 1989. Further observations unfortunately remove the possibility of splitting at the last return, although retain the similarity of the orbits. Nakano also notes that the angular elements of the orbit are similar to those of C/1931 AN, which has a poorly defined orbit based on observations made over a few days.

An apparently asteroidal object of 20th magnitude, found by the NEAT project on March 27.20, and posted on the NEO Confirmation Page, has been reported as faintly cometary by a few observers. G. Masi reports that CCD observations in good conditions (0".9 seeing) with the Danish 1.54-m telescope at the European Southern Observatory on Mar. 28.3 and 29.1 UT show the object to be nonstellar, with a slight elongation toward p.a. 315 deg, such that a nuclear condensation appears on the southeast side of a coma that has size 5".5 along a southeast-northwest axis and 4" along a northeast-southwest axis. Images taken with the 1.06-m KLENOT telescope at Klet on Mar. 31.9 by M. Tichy and M. Kocer show the object as slightly diffuse with a coma diameter of 6". [IAUC 8104, 2003 April 1]

2003 G1 (LINEAR) was discovered by LINEAR on April 8.45. It has a perihelion distance of 4.9 AU. It was at perihelion in early February and will not brighten significantly from its current 15th magnitude.

An apparently asteroidal object of 17th magnitude, discovered by LINEAR on April 8.45, and posted on the NEO Confirmation Page, has been found to be cometary by several CCD observers, including L. Sarounova and P. Kusnirak (Ondrejov), A. Galad (Modra), P. Birtwhistle (Great Shefford, U.K.), G. Hug (Eskridge, KS), P. R. Holvorcem (0.81-m Tenagra II telescope; m_1 = 15.4 on Apr. 9.46 UT), and M. Tichy (Klet). The general description of the comet gives a coma of diameter 8"-15" and a straight tail about 40"-90" long in p.a. 210-225 deg during Apr. 9.1-10.0. The available astrometry, preliminary parabolic orbital elements (T = 2003 Feb. 7, q = 4.9 AU, i = 67 deg), and ephemeris appear on MPEC 2003-G56. [IAUC 8115, 2003 April 10]

Brian Marsden notes on MPEC 2003-P15 [2003 August 6] that the "original" and "future" barycentric values of 1/a are +0.000014 and -0.000372 (+/-0.000005) AU**-1, respectively, suggesting that this is a "new" comet from the Oort cloud.

2003 G2 (LINEAR) was discovered by LINEAR on April 8.38. It has a perihelion distance of 1.6 AU. It is near perihelion and will not brighten significantly from its current 17th magnitude.

L. Manguso, Lincoln Laboratory, Massachusetts Institute of Technology, reports the LINEAR discovery of a comet with a 13" coma visible on Apr. 9-10 (discovered on April 8.38 at 18th magnitude). Following posting on the NEO Confirmation Page, the object was also reported to have cometary appearance by G. Hug (Eskridge, KS, 0.3-m reflector; diffuse with m_1 = 16.6 on Apr. 9.4 UT and m_1 = 17.3 on Apr. 10.4) and by A. C. Gilmore and P. M. Kilmartin (Mt. John University Observatory, 0.6-m reflector; diffuse on Apr. 11.6). [IAUC 8116, 2003 April 11]

2003 G3 (SOHO) was a non group comet discovered by John Sachs in C3 and C2 images on April 4. The preferred retrograde orbit suggests that it was at around 30 degrees elongation from the Sun in late April and early May, but no observations were reported.

2003 H1 (LINEAR) was discovered by LINEAR on April 24.38. It reaches perihelion at 2.2 AU in late February 2004. It will slowly brighten from its current 15th magnitude, perhaps reaching visual range in the autumn and reaching 12th magnitude at its best.

An apparently asteroidal 17th magnitude object reported by LINEAR on April 24.38, and posted on the NEO Confirmation Page, has been reported to be cometary on Apr. 25 CCD frames taken by H. Mikuz (Crni Vrh, 0.60-m reflector + R filter; strongly condensed with coma diameter about 20" and m_1 = 15.9), P. Kusnirak (Ondrejov, 0.65-m reflector; "seems to be slightly diffuse"), and T. Spahr (Mount Hopkins, 1.2-m reflector; faint fan-shaped tail about 5" long toward the south). [IAUC 8122, 2003 April 25]

Brian Marsden notes on MPEC 2003-P16 [2003 August 6] that the "original" and "future" barycentric values of 1/a are +0.000745 and +0.000450 (+/-0.000008) AU**-1, respectively, suggesting that this is not a "new" comet from the Oort cloud.

2003 H2 (LINEAR) was discovered by LINEAR on April 24.40. It is near perihelion at 2.2 AU and will not brighten significantly from its current 17th magnitude. The orbit is a long period ellipse, with period around 240 years.

Another apparently asteroidal object of 19th magnitude reported by LINEAR on April 24.40, and posted on the NEO Confirmation Page, has also been reported to be cometary on CCD frames taken on Apr. 25 by Mikuz (diffuse with condensation and coma diameter about 20"), M. Tichy (Klet, 1.06-m reflector; diffuse with faint tail in p.a. 270 deg), and Kusnirak (coma diameter about 10"). [IAUC 8122, 2003 April 25]

Further to IAUC 8122, J. McGaha (Tucson, AZ) reports that six stacked 2-min CCD exposures taken on Apr. 25.3 UT (0.30-m reflector) show a 6" coma and a 10" tail in p.a. 50 deg. [IAUC 8125, 2003 April 30]

Brian Marsden notes on MPEC 2003-P17 [2003 August 6] that the "original" and "future" barycentric values of 1/a are +0.026849 and +0.026146 (+/- 0.000000) AU**-1, respectively, confirming that this is not a "new" comet from the Oort cloud.

2003 H3 (NEAT) was discovered by NEAT on April 30.45. It was near perihelion at 2.9 AU and will not brighten significantly from its present 16th magnitude.

S. H. Pravdo, Jet Propulsion Laboratory, reports the NEAT discovery on Haleakala images of a 17th magnitude comet on April 30.45 with a coma diameter of about 14" and an unresolved core of diameter about 4" or less. Following posting on the NEO Confirmation Page, other observers have also reported the cometary appearance from CCD images, including J. E. McGaha (0.30-m reflector, Tucson, AZ; fainter outer coma of diameter about 10" with a brighter core of diameter about 5"); J. Young (0.6-m reflector, Table Mountain; coma diameter about 8", and 16" tail in p.a. 250 deg, affected by cirrus clouds), and P. R. Holvorcem and M. Schwartz (Tenagra IV 0.36-m telescope, near Nogales, AZ; coma diameter 28" and m_1 = 15.4-15.7 on May 1.47). [IAUC 8126, 2003 May 1]

Brian Marsden notes on MPEC 2003-P18 [2003 August 6] that the "original" and "future" barycentric values of 1/a are +0.000438 and -0.000114 (+/- 0.000005) AU**-1, respectively, suggesting that this is not a "new" comet from the Oort cloud.

2003 H4 (P/LINEAR) was discovered by LINEAR on April 29.33. It is near perihelion at 1.70 AU and will not brighten significantly from its present 18th magnitude. The period is 6.1 years. The comet approached within 0.46 AU of Jupiter in December 2000 and approached the planet even closer at some previous returns. An encounter to within 0.02 AU in April 2012 will reduce the perihelion distance to 1.16 AU, though the subsequent two apparitions are not particularly favourable.

M. Bezpalko, Lincoln Laboratory, Massachusetts Institute of Technology, reports the discovery by LINEAR of a comet with a tail in p.a. 270 deg on images taken on Apr. 29.3 UT. Following posting on the NEO Confirmation Page, other CCD observers have also reported the object as cometary, including G. J. Garradd (Tamworth, N.S.W., 0.45-m reflector; slightly diffuse on most images taken on Apr. 30.6), J. E. McGaha (Tucson, AZ, 0.30-m reflector; faint coma of size 5" x 10" and m_1 = 17.7-17.9, aligned north-south, with uniform brightness and no apparent nuclear condensation or core on May 2.2), and J. G. Ries (McDonald Observatory, 0.76-m reflector; 20" tail pointing slightly south of west on May 2.3; m_1 = 17.7-18.0). [IAUC 8127, 2003 May 1]

Orbital elements on MPEC 2003-K34, indicate that this comet passed 0.07 AU from Jupiter in June 1929, before which q and P were larger. [IAUC 8135, 2003 May 24]

2003 H6 (SOHO) and 2003 H7 (SOHO) were non group comets discovered by Rainer Kracht in C2 images on April 30. They are clearly related to each other.

2003 HT15 (P/LINEAR) An apparently asteroidal object of 18th magnitude found by LINEAR on April 26.26 was found to be cometary by Carl Hergenrother on images taken with the Mount Hobkins 1.2-m telescope on June 24.3. The comet has perihelion at 2.7 AU and a period of 9.9 years. It passed 0.6 AU from Jupiter in 2001 March. It will fade.

An apparently asteroidal object reported by LINEAR (discovery observation published on MPS 78496; prediscovery LINEAR observations published on MPS 80247; orbital elements on MPO 48372) has been found cometary by C. Hergenrother, who reports a diffuse coma of diameter 15" (and mag 18.6 within an aperture of radius 8") and a broad tail 60" long in p.a. 115 deg on co-added 900-s R-band images taken on June 24.3 UT with the Mount Hopkins 1.2-m reflector. [IAUC 8156, 2003 June 25]

A/2003 HP32 (Kitt Peak) is an asteroid, of 21st magnitude, discovered by J A Larsen with the 0.9-m telescope at the Steward Observatory, Kitt Peak on 2003 April 26.31. It is in a 5.1 year orbit, with perihelion at 0.56 AU and an eccentricity of 0.81. It reaches perihelion at the end of August, but will remain near its current magnitude for the next few months. [MPEC 2003-H50, 2003 April 30, 4-day orbit] The orbit is typical of a Jupiter family comet. It can approach to within 0.3 AU of Jupiter and within 0.1 AU of the Earth.

2003 J1 (NEAT) was discovered by NEAT on May 13.59. Originally reported at 19.4, amateur CCD observations put it at around 17th magnitude. It reaches perihelion at 5.1 AU in October.

K. J. Lawrence, Jet Propulsion Laboratory, reports the discovery by NEAT of a comet on May 13.59. Following posting on the NEO Confirmation Page, other CCD observers reported the following total magnitudes and coma diameters: May 14.5 UT, m_1 = 16.4-17.0, 10" (P. Holvorcem, Tenagra II 0.81-m telescope; three co-added 120-s exposures); 15.5, 17.5, 8" (J. Young, Table Mountain, CA, 0.6-m reflector). [IAUC 8133, 2003 May 17]

Brian Marsden notes on MPEC 2003-O37 [2003 July 30] that the "original" and "future" barycentric values of 1/a are +0.001841 and +0.001804 (+/- 0.000077) AU**-1, respectively, suggesting that this is not a "new" comet from the Oort cloud.

A/2003 JC11 (Kitt Peak) is an asteroid, of 21st magnitude, discovered by J V Scotti with the 0.9-m telescope at the Steward Observatory, Kitt Peak on 2003 May 1.40. It is in a 5.3 year orbit, with perihelion at 1.35 AU and an eccentricity of 0.56. It was at perihelion at the end of November and will fade. [MPEC 2003-J35, 2003 May 6, 5-day orbit] The orbit is typical of a Jupiter family comet, though there have been no recent close approaches to either Jupiter or the Earth.

2003 K1 (Spacewatch) An object initially reported as asteroidal by Spacewatch has been found to be cometary by other observers, including some using the 0.41-m OAM relector at Costitx, Mallorca. It is past perihelion and will fade from 18th magnitude.

An object of 20th magnitude initially reported as asteroidal by J. A. Larsen on CCD images obtained with the 0.9-m Spacewatch reflector on May 23.38 was posted on the NEO Confirmation Page. CCD images taken by A. Lopez and R. Pacheco (Mallorca, 0.41-m reflector) on May 23.9 UT showed cometary appearance (and m_1 = 18.2-18.6). A. E. Gleason found the coma to be quite obvious on May 24.3 images taken with the 1.8-m Spacewatch II reflector at Kitt Peak, and Larsen found a 10" coma on Spacewatch I images taken on May 24.4. [IAUC 8135, 2003 May 24]

2003 K2 (P/Christensen) An object discovered by the Catalina sky survey on May 26.18 was quickly confirmed as cometary. It passed perihelion at 0.55 AU in April, but is intrinsically faint. It was visible on SWAN imagery and at brightest probably reached 10th magnitude; it seems likely that it was the object reported in SWAN imagery between April 5 to 19, but which was not confirmed visually due to low elevation and poor elongation from the Sun. It will fade from 14th magnitude. Its elongation remained relatively small and it was not very favourably placed for observation. As astrometric observation accumulated there was increasing evidence that it was a short period comet, with a period between 12 and 17 years and perihelion distance around 0.6 AU. These indications from orbits by Muraoka and others were confirmed on IAUC 8145 [2003 June 7] which gave an orbit with period of 6.5 years. Further orbit computations by Muraoka, Stoss and others have revised the orbit and the latest orbit gives P as 5.75 years and q at 0.55 AU. The comet passed 0.8 AU from Jupiter in 1996 January. There are no significant changes to the orbit at the next return.

Eric Christensen, Lunar and Planetary Laboratory, reports the discovery of a 15th magnitude comet on May 26.18 by the Catalina Sky Survey on CCD images taken with the 0.7-m Schmidt telescope. Following posting on the NEO Confirmation Page, many observers noted the obvious cometary nature of the object on CCD images taken during May 27.1-27.2 UT, including R. Elliot (Fall Creek, WI; coma diameter about 10"), P. R. Holvorcem and M. Schwartz (near Nogales, AZ; coma diameter about 35", with a 30" tail in p.a. 106 deg), J. Young (Table Mountain, CA; 10" coma and a very faint 40" tail in p.a. 115 deg with a slight curve halfway along its length to p.a. 130 deg), and J. McGaha (Tucson, AZ; coma diameter 12", with slight nuclear condensation and a 6" tail). [IAUC 8136, 2003 May 27]

It has been noted by numerous individuals that the preliminary orbital elements of comet C/2003 K2 (cf. IAUC 8136) place it close to the position of an unconfirmed object found on SWAN ultraviolet SOHO website images and reported to the Central Bureau on Apr. 14 by X.-m. Zhou (Bo-le, Xin-jiang, China). Measurements of the object on six dates, Apr. 5-19, were forwarded to the Central Bureau by Zhou (via D. H. Chen), by M. Mattiazzo, and by S. Hoenig; the positions differed considerably, due to the poor resolution of SWAN (uncertainty on the order of 1 degree). Two search ephemerides based on various positions were circulated by the Bureau to numerous visual and CCD observers in the hopes of optical confirmation, but the searches (undertaken during the last week of April by Zhou, A. Hale, Mattiazzo, Y. Kushida, and Y. Ezaki) revealed nothing to as faint as mag 14.5. The following improved parabolic orbital elements for C/2003 K2 (from MPEC 2003-K49) indicate that the search-ephemeris positions in late April for the SWAN object were no closer than about 2.5 degrees from C/2003 K2. The comet might be of short period. [IAUC 8138, 2003 May 30]

2003 K3 (SOHO) was a faint non group comet discovered by Heiner Otterstedt in C3 images on May 25. It appeared to be fading in images from late on May 28, although not due at perihelion until June 1. The preliminary orbit suggested that it would reach 25 degrees elongation from the Sun in mid June, but was not reported by ground based observers in the Southern Hemisphere. It was not favourably placed for discovery prior to perihelion.

2003 K4 (LINEAR) An apparently asteroidal object of 18th magnitude found by LINEAR on May 28.38 has been found to be cometary by other observers. The preliminary orbit suggests that it is a distant object with perihelion at 8.5 AU in September, however other, more interesting orbit solutions were possible according to Maik Meyer. New elements issued on MPEC 2003-L08 [2003 June 3] confirmed the more interesting orbit, and the latest put perihelion at 1.02 AU on 2004 October 13.8. The apparition circumstances are not particularly favourable, however the comet could reach 5th magnitude. By early August it had brightened to 16th magnitude (CCD). The comet may come within visual range from October this year and be visible until the end of the year when it enters conjunction.

An apparently asteroidal object found by the LINEAR survey on May 28.38, posted on the NEO Confirmation Page, has been found to show a round coma of diameter 5"-7" (m_1 = 17.5) on CCD images taken by J. Young on May 29.5 and 30.4 UT with the 0.6-m reflector at Table Mountain. J. McGaha, Tucson, AZ, reports that three stacked, 2-min CCD images, taken on May 29.4 with a 0.30-m reflector, show a 3" nuclear condensation and a 6" coma that is offset to the northeast. [IAUC 8139, 2003 May 30]

Brian Marsden notes on MPEC 2003-R44 [2003 September 9] that the "original" and "future" barycentric values of 1/a are +0.000020 and -0.000199 (+/-0.000014) AU**-1, respectively, suggesting that this is a "new" comet from the Oort cloud. Such comets often brighten relatively quickly at first, so that we should not necessarily expect a good display at perihelion.

2003 KV2 (P/LINEAR) An asteroidal object of 18th magnitude discovered by LINEAR on May 23.16 has been found to be cometary by other observers. It reaches perihelion on July 10 at 1.06 AU and has a period of 4.85 years, the third shortest amongst currently extant comets. It passed within 0.55 AU of Jupiter in February 2001, before which the perihelion distance was somewhat larger. It will not get much brighter than its present magnitude. The preliminary orbit given for the comet on MPEC 2003-K27 was not particularly cometary, whereas that for 2003 KU2 looked more promising.

Another apparently asteroidal LINEAR object found on May 23.16, announced on MPEC 2003-K27 as 2003 KV_2 (see also MPEC 2003-K38 and 2003-K47), has been found cometary on R-band images taken by C. Brinkworth and M. Burleigh on May 28.9 and 29.9 UT with the 1-m Jacobus Kapteyn Telescope on La Palma (communicated by A. Fitzsimmons), in which the object shows a tail about 4"-5" long in p.a. 125 deg and a small coma that is somewhat larger than the surrounding field stars. The preliminary orbit shows a passage 0.55 AU from Jupiter in Jan. 2001, before which the perihelion distance was somewhat larger. [IAUC 8139, 2003 May 30]

A/2003 KP2 (LINEAR) is an asteroid, of 19th magnitude, discovered by LINEAR on 2003 May 22.34. It is in a 4.53 year orbit, with perihelion at 0.82 AU and an eccentricity of 0.70. It will be at perihelion in mid October and will brighten a little. [MPEC 2003-R63, 2003 September 13] The orbit is typical of a Jupiter family comet, though there have been no recent close approaches to Jupiter. It will pass 0.18 AU from the Earth in early October.

A/2003 KU2 (Kitt Peak) is an asteroid, of 20th magnitude, discovered by A Tubbiolo with the 0.9-m telescope at the Steward Observatory, Kitt Peak on 2003 May 22.29. It is in a 4.6 year orbit, with perihelion at 0.80 AU and an eccentricity of 0.71. It will be at perihelion at the end of October and will brighten a little. [MPEC 2003-K26, 2003 May 24, 2-day orbit] The orbit is typical of a Jupiter family comet, though there have been no recent close approaches to either Jupiter or the Earth. It is a potentially hazardous asteroid passing 0.026 AU from Earth at the ascending node.

2003 L1 (P/Scotti) Jim Scotti discovered this faint comet in Spacewatch data. Further prediscovery images were found in Palomar NEAT data from 2002 April. The comet is three months past perihelion, which was at 5.0 AU. The period is 17.3 years. It will fade.

J. V. Scotti, Lunar and Planetary Laboratory, University of Arizona, reports the discovery of a 20th mag comet on CCD images taken with the Spacewatch 0.9-m f/3 reflector at Kitt Peak on June 4.21, showing a coma of diameter 6" and a faint tail about 0'.62 long in p.a. 273 deg. Images taken by A. S. Descour on June 5.3 UT with the 1.8-m f/2.7 Spacewatch reflector also show a tail, and June 7.2 images by Scotti with the larger instrument show the tail 0'.30 long in p.a. 273 deg. [IAUC 8145, 2003 June 7]

Clearly diffuse NEAT images of this comet, taken with the Palomar 1.2-m Schmidt telescope on three nights in 2002 April, were identified and measured by M. Meyer. Additional astrometry and the following orbital elements (MPEC 2003-M21) confirm the suspicion (cf. IAUC 8145) that this is a short-period comet. [IAUC 8153, 2003 June 19]

2003 L2 (LINEAR) was discovered by LINEAR on June 12.33. It will reach perihelion at 2.9 AU in mid January 2004 and will brighten a bit from its current 18th magnitude.

An apparently asteroidal object found by LINEAR, and posted on the NEO Confirmation Page, has been found to be cometary on CCD images taken by S. Sanchez, R. Stoss, and J. Nomen (Mallorca, 0.30-m f/9 reflector; 10" coma on June 12.95 UT) and by S. Gajdos (Modra, 0.6-m f/5.5 reflector; diffuse with coma diameter about 5" on June 13.97; m_1 = 18.0). [IAUC 8151, 2003 June 14]

Brian Marsden notes on MPEC 2003-R45 [2003 September 9] that the "original" and "future" barycentric values of 1/a are +0.006356 and +0.006809 (+/- 0.000011) AU**-1, respectively, and the eccentricity is 0.9814155 showing that this is not a "new" comet from the Oort cloud.

A/2003 MT (Kitt Peak) is an asteroid, of 19th magnitude, discovered by M T Read with the 0.9-m telescope at the Steward Observatory, Kitt Peak on 2003 June 23.20. It is in a 5.3 year orbit, with perihelion at 1.22 AU and an eccentricity of 0.60. It will be at perihelion in early August but will fade. [MPEC 2003-M42, 2003 June 24, 1-day orbit] The orbit is typical of a Jupiter family comet, though there have been no recent close approaches to either Jupiter or the Earth.

2003 O1 (LINEAR) An 18th magnitude comet was discovered by LINEAR on July 20.13. The provisional orbit (given to rather high accuracy for only a three day arc) suggested that it was a distant object some way from perihelion at 4.5 AU. Nick James reported imaging it on July 20.97 in a rather crowded field, with Peter Birtwhistle imaging it on July 20.95 and Stephen Laurie on July 20.96. Further observations confirmed the distant orbit, though with perihelion at 6.8 AU in March 2004.

An apparently asteroidal object reported by LINEAR, and posted on the NEO Confirmation Page, has been found to have cometary appearance on CCD images taken by P. Kusnirak (Ondrejov; 0.65-m f/3.6 reflector; well-condensed condensation and a faint 20" tail toward the southeast) and by P. Birtwhistle (Great Shefford, U.K.; nuclear condensation of diameter about 6" with a faint, short, broad tail about 15" long in p.a. 139 deg; mag 17.3-18.2). [IAUC 8170, 2003 July 30]

Brian Marsden notes on MPEC 2003-R09 [2003 September 2] that the "original" and "future" barycentric values of 1/a are +0.000225 and +0.000217 (+/- 0.000018) AU**-1, respectively, suggesting that this is probably not a "new" comet from the Oort cloud.

2003 O2 (P/LINEAR) A 19th magnitude comet was discovered by LINEAR on July 29.38, although other CCD observers estimate it at 17th magnitude. Peter Birtwistle imaged it on July 31.04. It showed a surprisingly long tail, perhaps suggesting a recent outburst. Further observations confirmed the short period nature of the orbit, with perihelion at 1.5 AU in early September and a period of 8.7 years. It has had no recent planetary encounters. It will not get much brighter than at present.

M. Bezpalko, Lincoln Laboratory, reports the LINEAR discovery of a comet, showing a tail approximately 42" long in p.a. 230 deg. Other CCD observers report mag 16.9-17.9 and a tail of up to 6' long in p.a. 245-250 deg on July 30-31 (including S. Sanchez, R. Stoss, and J. Nomen at Mallorca; R. Trentman and R. Frederick at Louisburg, KS; and P. Birtwhistle at Great Shefford, U.K., who also noted a 9" central condensation of mag 17.9, adding that the tail was very diffuse and wide). [IAUC 8172, 2003 July 31]

2003 O3 (P/LINEAR) A 19th magnitude comet was discovered by LINEAR on July 30.39, although other CCD observers estimate it at 18th magnitude. It was confirmed as cometary by Peter Birtwhistle amongst others. The comet reached perihelion at 1.25 AU in mid August and will fade. It passed 0.5 AU from Jupiter in 1956 July and the period is 5.5 years.

An apparently asteroidal object reported by LINEAR, and posted on the NEO Confirmation Page, has been found to be apparently cometary on CCD images taken by P. Birtwhistle (Great Shefford, U.K., 0.30-m reflector; very faint tail about 10" long in p.a. approximately 270-280 deg on July 31.10 and Aug. 2.08 UT; mag 18.1 and coma diameter about 5" on Aug. 2.08), by J. Ticha and M. Tichy (Klet, 1.06-m KLENOT telescope; diffuse with a wide tail in p.a. 260 deg on Aug. 3.01), and by J. McGaha (near Tucson, AZ; possible tail spike 5" long in p.a. 300 deg on Aug. 3.38 with a 0.30-m reflector; possible fan-shaped tail 5" long in p.a. 260 deg on Aug. 5.33 with a 0.62-m reflector). The preliminary orbital elements indicate that the comet passed 0.3 AU from Jupiter in Nov. 1979. [IAUC 8174, 2003 August 5]

2003 QX_{29} (P/NEAT) A 20th magnitude asteroid was discovered by NEAT on August 23.28. It was found to be cometary and some CCD observers estimate it a little brighter. The comet is nearly a year past perihelion and will fade. The perihelion distance is 4.3 AU and the period around 22 years. It passed 0.8 AU from Jupiter in 1911 May.

An apparently asteroidal object reported by NEAT (Palomar discovery observation originally posted on the NEO Confirmation Page, then assigned the designation 2003 QX_29 on MPEC 2003-Q33; observations on MPS 93475-93476) has been found to have cometary appearance on CCD images taken by I. Griffin and S. G. Huerta (Cerro Tololo 0.9-m reflector, Aug. 31.1 UT; visible coma of red mag 18.0-19.4 with FHWM = 2".3-2".6 in raw 300-s images, while stacked 10-exposure image shows a fan-shaped tail at least 17" long in p.a. 58 deg) and by J. Young (Table Mountain 0.6-m reflector, Sept. 1.2; 3" coma, slightly elongated in p.a. 260 deg, with a 16" curved tail starting in p.a. 243 deg; possible slight brightening in the tail at a point 4"-5" from the coma edge). J. Ticha subsequently reports that Klet images from Aug. 23.9 show the object to be slightly diffuse, while on Aug. 24.9 it exhibited a 8" coma. Astrometry, orbital elements (T = 2002 Oct. 17.3 TT, Peri. = 37.1 deg, Node = 264.9 deg, i = 11.4 deg, equinox 2000.0, e = 0.445, q = 4.311 AU, P = 21.6 yr), and an ephemeris appear on MPEC 2003-R14. [IAUC 8192, 2003 September 2]

2003 R1 (LINEAR) was discovered by LINEAR on September 2.37. It reached perihelion at 2.2 AU in early July. It will not brighten significantly from its current 19th magnitude.

An apparently asteroidal object reported by LINEAR, and posted on the NEO Confirmation Page, has been reported to have cometary appearance on CCD images obtained by J. Ticha and M. Tichy (Klet, 1.06-m KLENOT telescope; slightly diffuse object with a 6" coma on Sept. 5.08 UT, and asymmetric coma to the northwest on Sept. 6.05); and by J. E. McGaha (Tucson, AZ, 0.30-m f/10.0 Schmidt-Cassegrain reflector; 3" coma with a fan-shaped tail 8" long in p.a. 320 deg on Sept. 6.39). [IAUC 8195, 2003 September 6]

A/2003 RW_{11} (Table Mountain Observatory) is an asteroid, of 19th magnitude, discovered by J Young with the 0.6-m telescope at Table Mountain Observatory on 2003 September 15.47. It is in a 5.1 year orbit, with perihelion at 0.46 AU and an eccentricity of 0.84. It was at perihelion in mid June. [MPEC 2003-S03, 2003 September 16, 1-day orbit] The orbit is typical of a Jupiter family comet, and it can approach to within 0.5 AU of Jupiter and 0.08 AU of the Earth.

2003 S1 (P/NEAT) A 19th magnitude comet was discovered by NEAT on September 23.60, with some LINEAR prediscovery images found from September 4.3 and 20.3. Peter Birtwhistle was amongst those making confirming images. The comet reaches perihelion next March, though will remain near its present brightness. The perihelion distance is 2.6 AU and the period around 9.7 years. It passed 0.2 AU from Jupiter in 1972 October.

2003 S2 (P/NEAT) An 18th magnitude comet was discovered by NEAT on September 24.61, with some LINEAR prediscovery images found from September 19.36. Peter Birtwhistle was amongst those making confirming images. The comet reached perihelion in July and will fade. The perihelion distance is 2.3 AU and the period around 8.6 years. The preliminary orbit suggests that the comet passed 0.25 AU from Jupiter in January 1958. This is NEAT's 37th comet.

2003 S3 (LINEAR) was discovered by LINEAR on September 27.38. It is a distant object near perihelion at 8.2 AU. It will not brighten significantly from its current 19th magnitude.

2003 S4 (LINEAR) is LINEAR's 120th – a distant object.

For the latest information on discoveries and the brightness of comets see the Section www page: http://www.ast.cam.ac.uk/~jds or the CBAT headlines page at http://cfa-www.harvard.edu/cfa/ps/Headlines.html

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