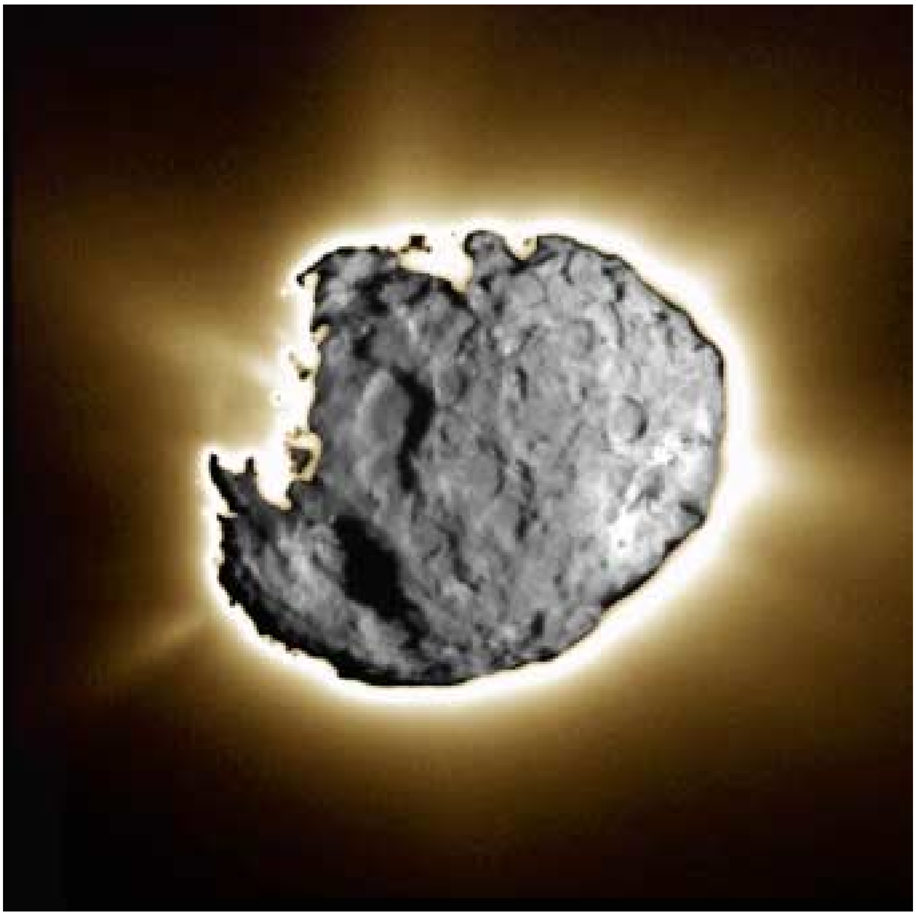
THE COMET'S TALE

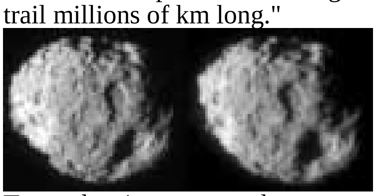
Newsletter of the Comet Section of the British Astronomical Association

Volume 11, No 1 (Issue 21), 2004 April

Stardust encounters comet 81P/Wild

On 2004 January 2, NASA's Stardust spacecraft successfully survived flying through the coma surrounding comet 81P/Wild; captured thousands of fresh cometary dust particles released from the surface just hours before, and is now on its way home for Earth return set for January 2006. During the flyby, the highest resolution images ever taken of a comet's nucleus were obtained and have been the subject of intense study since the flyby. A short exposure image showing tremendous surface detail was overlain on a long exposure image taken just 10 seconds later showing jets. "This spectacular composite image shows a surface feature unlike any other planetary surface see to date in our solar system", says Prof Donald Brownlee, the Stardust Principal Investigator from the University of Washington. "Other than our sun, this is currently the most active planetary surface in our solar system, jetting dust and gas streams into space and leaving a trail millions of km long."





Two other images are shown as a stereo pair and also as a red/green stereo anaglyph (below).

"The overall shape of the nucleus resembles a thick hamburger patty with a few bites taken out", says Thomas Duxbury, the Stardust Project Manager from JPL. "The surface has significant relief on top of this overall shape that reflects billions of years of resurfacing from crater impacts and out gassing".

The composite image (above) was taken by the navigation camera during the close approach phase of Stardust's flyby of comet 81P/Wild. Several large depressed regions can be seen. The comet is about five kilometers in diameter. To create the image, a short exposure image showing tremendous surface detail was overlain on a long exposure image taken just 10 seconds later showing jets. Together, the images show an intensely active surface, jetting dust and gas streams into space and leaving a trail millions of kilometers long.

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The Section newsletter is now free to all BAA Members who make contributions to the work of the Section. The cost for other subscribers is £5 for two years, extended to three years for those 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,

I am very pleased to announce that the BAA Council have agreed to make all Section newsletters free to BAA Members who contribute observations or other material to their Section. This means that if you are a BAA Member who contributes comet observations or other material to me you will no longer have to pay a subscription for this newsletter. If you are not yet a BAA Member it has never been easier to join, and it is now possible to pay on line using a credit card from the main BAA web page at http://www.britastro.org.

The main meeting this year is the International Workshop on Cometary Astronomy that will be held in Paris. Details of this are given in the box and I would encourage all members to attend. The preliminary deadline for booking accommodation has already passed; however late bookings are very welcome. There is a raffle associated with the meeting and this includes prizes of a Meade ETX telescope and a copy of Volume 2 of Gary Kronk's Cometography, which has just been published. This

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 80 Euros per participant.

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.

massive tome contains details of all comets observed between 1800 and 1899 and I think I can safely say that we will never see its like again.

My visit to Antarctic went very well and the workstation that I installed for the forecaster has already paid for itself. I could even set it up to give detailed predictions of likely cloud conditions, which was a big benefit both for myself for astronomy and for a colleague making lidar observations of the atmosphere at the height of noctilucent clouds. Our permanent satellite link was in operation, though generally we were stopped from browsing the Internet beyond the local domain of the British Antarctic Survey. This was however sufficient to allow me to maintain the Section web pages, so you should have found them reasonably up to date over the last few months.

Weather conditions were a bit more favourable than on my last visit, particularly once I arrived in the Falkland Islands on the way north. From here I was able to glimpse comet 2001 Q4 with the naked eye and I am looking forward to seeing it again in May when it should be a prominent object in the evening sky. If it is sufficiently bright it would be interesting to get some high speed photometry of it, as rapid variation in nuclear brightness has often been reported in bright comets in the past. The very transparent skies of the Southern Hemisphere allowed me to make a somewhat unexpected observation of 2003 H1, which at magnitude 11.5 would normally be regarded as well below the limit for my 9-cm refractor. This shows the difference that getting to a really dark site can make, though even in Antarctica light pollution is beginning to be an issue. We are putting a discussion paper to the next Antarctic Treaty meeting on the subject in the hope that Antarctica will be declared a light pollution free continent.

Since my return I have been doing a fair amount of travelling and this has prevented me from completing this edition of the newsletter in time for its nominal publication date. At least the delay has given me the chance to include some details of comet Bradfield. This discovery nicely demonstrates my suggestion that the ‘twilight zone’ is where amateurs should search for comets. I hope this discovery, in combination with the article in this edition will encourage observers to continue hunting.

Geoffrey Johnstone, one of our members, has a copy of the IHW printed archive to go to a good home. If any readers are interested in obtaining this, particularly if you are from eastern Europe, please contact me.

The ICQ has proposed a project for visual and CCD observers to observe some selected Deep Sky objects which resemble comets. This would serve several roles: investigating observer and instrumentation effects, training for beginners and to better determine extinction effects at low altitude. The objects to observe are M1, M3, M15, M32, M60, M65, M77, M83, M84, M86, M87, M104, NGC 936, NGC 2068, NGC 3031, NGC 3344, NGC 3485, NGC 3627, NGC 3640, NGC 4147, NGC 5024, NGC 6356, NGC 6384, NGC 6426, NGC 6712, NGC 6760, NGC 6781, NGC 6934 and UGC 5373. Observations should be submitted in the standard BAA or ICQ format, including estimates of diameter and DC. There are no set comparison stars, so just choose suitable ones close to the object, or alternatively always use the north polar sequence.

Since the last newsletter observations or contributions have been received from BAA members: James Abbott, Sally Beaumont, Peter Birtwhistle, Len Entwisle, John Fletcher, Maurice Gavin, Werner Hasubick, Guy Hurst, Nick James, Martin Mobberley, Gabriel Oksa, Roy Panther, Jonathan Shanklin, David Storey, David Strange, Alex Vincent and also from: Jose Aguiar, Alexandre Amorim, Alexander Baransky, Sandro Baroni, Mike Begbie, Nicolas Biver, Reinder Bouma, Jose Carvajal, Tim Cooper, Matyas Csukas, Haakon Dahle, Mike Feist, Stephen Getliffe, JJ Gonzalez, Bjorn Granslo, Michael Jager, Andreas Kammerer, Paul Kemp, Heinz Kerner, Atilla Kosa-Kiss, Carlos Labordena, Martin Lehky, Rolando Ligustri, Michael Mattiazzo, Maik Meyer, Maciej Reszelski, Juan San Juan, Pepe Manteca, Jose Martinez, Andrew Pearce, Stuart Rae, Walter Robledo, Andras Sajtz, Tony Scarmato, Giovanni Sostero, Willian de Souza, 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: 2P/Encke, 29P/Schwassmann-Wachmann, 43P/Wolf-Harrington, 65P/Gunn, 88P/Howell, 123P/West-Hartley, 2001 HT50 (LINEAR-NEAT), 2001 Q4 (NEAT), 2002 T7 (LINEAR), 2003 H1 (LINEAR), 2003 K4 (LINEAR), 2003 T3 (Tabur), 2004 F4 (Bradfield).

Jonathan Shanklin

Tales from the Past

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

150 Years Ago: Volume 14 of Monthly Notices begins with several reports of comet 1853 G1, including observations from Thomas Maclear at the Royal Observatory, Cape of Good Hope, from A G Constable who was a passenger on board ship between Melbourne and Callao, from Monsieur Bosquet the Government Meteorological Observer at Port Louis, Mauritius, from Lieut John Parish commanding HMS Sharpshooter in Rio de Janeiro and from Captain King at Paramatta, NSW. [*Many more details are given in Volume 2 of Cometography*]. These reports were followed by an account of a daylight observation of 1853 L1 by John Hartnup in Liverpool. A report on the work of Professor James Challis and the Cambridge Observatory notes that he observed three comets (2P/Encke, 3D/Biela and 20/Westphal) during the course of 1852 with the Northumberland refractor. [*As an* *aside this prompted me to check on what observations Professor Challis had made in earlier years. In Cometography he first appears in 1843 with observations of 4P/Faye, however the Northumberland was first used in 1838 and as it was designed for astrometry, I thought that there should be earlier records. On checking in the library of the Cambridge Observatory there are indeed earlier observations recorded in both the annual reports and the volumes of Cambridge Observations. For example on 1838 November 7 at 11^h the assistant, Mr Glaisher noted that 2P/Encke was reasonably bright and certainly visible to the naked eye, appearing about two-thirds of the size of the Pleiades. On November 9 at 8^h Professor Challis observed the comet with the Northumberland and noted "the comet tonight appeared decidedly not circular, but fan shaped. The brightest part was that side which followed in right ascension". On 1840 March 7 he observed comet 1840 B1 (Galle) and noted: "A well defined nucleus distinctly visible, as bright as a star of 8th magnitude". I suspect that there may be many more observations made on this side of the Atlantic which Gary did not have access to.*]

In a Note on Comet III 1853 by M C Rumker the following appeared: The phenomenon attending the setting of the comet of Klinkerfues, witnessed September 2, 1853, at Liverpool, Durham, Markree, in America, throughout Denmark, Sweden, and several parts of Germany, brings to recollection the appearance of the great comet of 1843. The tail of that comet first attracted the attention of European observers, some of whom never saw the nucleus; but the tail remained for several evenings visible; and on or about the 25th of March, after its setting in the south-west, a luminous appearance was observed above the western horizon and called a zodiacal light, the name of Aurora occidentalis being deemed objectionable. On the 2nd of September, 1853, at 9h 15m, or two hours after the setting of the comet of Klinkerfues, I observed at Hamburg, a little to the north of west, an appearance resembling that of the tail of a comet, slightly curved, with the concave side to the north. But as the phenomenon, which appeared at first immovable, was a quarter of an hour afterwards seen to the south of Arcturus, when clouds prevented further observations, and as several observers have attributed it to the effects of the comet, I propose to investigate how far this supposition can be justified by theory and reconciled with the coindicence of the alleged tail with the star Arcturus. He then goes into some detailed calculations, and concludes: But, notwithstanding, the phenomenon might have been an atmospherical one caused by the tail of the comet, as there are perihelia [sic] round the sun and halos round the moon, rainbows, etc etc which expand and contract, and are generated in the atmosphere. And although there have been observed more aurorae boreales than comets, there certainly also exist more comets than those that have been discovered; and it has already been remarked by others, that our earth may often have been enveloped in the tail of a comet without our having been aware of it. *[Guide shows that a tail along the radius vector would have been on the horizon, but a curved tail could have extended below Arcturus]*

This is followed by an extract of a letter from Professor C Piazzi Smyth relative to Cometary Physics: It is generally believed that the tails of comets are only put on near the perihelion point of their orbits; that they are produced by the intensity of the sun's rays there, and are dissipated on either side. Now I maintain that this is the reverse of what actually takes place…. Moreover, it is now found that all comets, large and small, invariably become not only smaller, but more compressed and concentrated, as they approach the sun; and so far from a dissipation of solid matter, there is a bringing together of it, and a consequent brightening. The tail, indeed, shuts up like a many-draw telescope as it nears the perihelion, and opens out again as it leaves it. The amount of such concentration appears to vary in a proportion not yet accurately ascertained with the length of the radius vector or distance of the comet from the sun. So that, with such comets as Encke's and Biela's, where the difference of perihelion and aphelion distances is not very great, the amount of concentration is never considerable, and they are never seen but as faint, vaporous, telescopic bodies. He goes on to say: I may further remark that, in consequence of the concentration of matter which ensues as the comet approaches the perihelion, much confusion arises from speaking of the length of a comet's tail without a qualifying note of the part of the comet's orbit at the time. The same reasoning applies to every other part of the comet, for it is all vaporous, but the nucleoid centre. Here, if anywhere, is the solid body, but it is infinitely small. The old writers do, indeed, talk of very large nuclei in former comets, upwards of 9000 miles in diameter, but that was not the nucleus, it was only the head round about it...

Later the editor writes some notes on Hooke's observations of the Comets of 1680 and 1682, which he said compared favourably with later observations of other comets. In particular Hooke gave a description of a stream of light which was seen issuing from the nucleus "in the manner of a sudden spouting of water out of an engine". He goes on to describe observations of nuclear jets and halos and draws an analogy with lighting, mentioning that he had been told by "some antient men" who had seen the great comet of 1618, that it did perfectly sparkle and shoot fire.

The annual report of the RAS notes that five comets had been discovered in the previous twelve months, of which two had become unusually conspicuous. Julius Schmidt had observed 1853 L1 during daylight on each day from August 30 to September 4. Further reports of this comet followed, including an extract of a letter from Captain Drury of HMS Pandora to Rear-Admiral Sir Francis Beaufort [*of wind fame*]. Another bright comet was discovered on March 29th, with R C Carrington in Durham and E J Lowe of Highfield House Observatory Nottingham sending discovery reports.

A letter from Monsieur Otto Struve to the Astronomer Royal on 1854 January 17 sets out the conditions for an essay prize on the motion of 3D/Biela. "The memoirs for the competition may be written in Russian, Latin, French, German or English. They are to be addressed anonymously to "The Imperial Academy of Sciences of St Petersburg", but furnished with a motto. A sealed packet annexed bearing the same motto as the memoir will contain the name and address of the author. The memoir crowned will be published by the Academy, and the author will have fifty copies placed at his disposal. The packets of the unsuccessful memoirs will be burned, and the memoirs will be placed at the disposal of the authors. The prize is fixed at 300 ducats of Holland. There will be besides an accessit of 150 ducats of Holland.

100 Years Ago: At the November meeting Mr Maunder showed some photographs of comet 1903 M1 (Borelly), taken at the Greenwich Observatory. One of the comets of the year was discovered by a Member of the Association, Mr John Grigg. Another Member Mr John Tebutt followed its movements and determined its position, whilst a third Member, Mr Merfield, computed the elements of the comet from the observations which Mr Tebbutt had supplied, so the Association could regard that comet as entirely their own (applause). The Section report lists five comets discovered between 1902 October 1 and 1903 September 30 and contributions from 18 Members. It then goes into detail with descriptions of all the comets. Comet Notes taken from the January Observatory give forecasts for three periodic comets due to return in 1904. A letter from A M du Celliee Muller of Nymegen, Holland draws attention to the phenomenon of "cometary refraction" when a bright comet passed close to a star and suggested that this was a way of computing a comet's mass. An ephemeris was given for 2P/Encke [*which had an apparition that was very similar to that of last year*].

A note taken from A.R., No. 53 reads: At the 75th meeting of the German Scientists and Doctors in Cassel, Dr Harperath gave an address on some recent discoveries in astronomy. From the fact that the spectrum of a comet changes from that of carburetted hydrogen to hydrogen, and then to sodium as the comet approaches perihelion and reverses the series as the comet retires, he deduced that these substances are set free in the order stated. The deduction is supported by the statement that a frozen mass of enormous dimensions consisting of petroleum and common salt would undergo similar changes under influences corresponding to those acting on a comet. On first coming under the influence of the heat and electricity of the sun the petroleum would become gaseous, and the spectrum of carburetted hydrogen would appear. Under the electrical influences the salt would be decomposed by the separation of some of the chlorine. Further reactions between these substances and the carburetted hydrogen would lead to the formation of chloroform and free hydrogen with the consequent appearance of the spectrum of the latter. The tail of the comet is formed at this stage, owing to the tension between the electro-positive hydrogen gas and the similarly electrified sun's atmosphere, the former giving rise to the cometary atmosphere and the tail-like mass. A closer approach would lead to the decomposition of the Na_2Cl into sodium and chlorine, and we get the sodium of the nucleus which the spectroscope reveals. These actions and results are reversed as the comet recedes from the sun.

50 Years Ago: Dr E L Cunningham had set a new record by photographing 2P/Encke with the 100-inch reflector at Mt Wilson ten months before perihelion. The 48-inch Schmidt at Palomar was continuing to discover faint comets during the course of the National Geographic Sky Survey and had so far discovered eight. At the November meeting, Dr Waterfield showed some slides of comet 12P/Pons-Brooks that he had taken that autumn and noted that it was variable in brightness. In December, Dr Merton gave an account of recent comets, bemoaning the fact that there had been no spectacular ones since those of 1947 and 48, which were both Southern Hemisphere objects. On the other hand members of the Computing Section were successful in predicting returns of short period comets. Harold Ridley showed a model of the orbit of 12P/Pons-Brooks, using a 10" gramophone record to represent the Earth's orbit and this would have required a 14-foot long section to represent the comet orbit if he had shown it all. George Alcock, in a rare visit, reported an observation made on Christmas night. The death of Frederick Richard Cripps was announced at the February meeting – he had been a great "computer" and had assisted Cowell and Crommelin in tracing back Halley's comet to 240 BC. He received the Walter Goodacre Medal and Gift in 1950. In March it was reported that Miss Elizabeth Roemer, a student at Lick Observatory, had recovered 19P/Borrelly.

Can Comet Hunters Survive ?

Toshimi Taki and Shigeki Murakami

Shigeki Murakami, co-discoverer of comet 2002 E2 (Snyder-Murakami), published an article on the impact of SWAN and NEO sky surveys on amateur comet hunting in "Tenkai (The Heavens)" (the bulletin of Oriental Astronomical Association). When Murakami's article appeared in 2003, Toshimi Taki was conducting a simulation of comet hunting competition between amateurs and NEO sky surveys. Taki sent an e-mail to Murakami to ask him to help in the study. This article is the result of the collaboration..

Toshimi Taki made a presentation on the simulation of comet hunting competition at the 34th Comet Conference held on March 6-7, 2004 in Azumino, Japan. The following is the English version of the presentation [*which I have edited slightly to improve the English - Ed*].

1. Introduction

Since Charles Messier's era, visual comet hunting has been a fascinating field for amateur astronomers. Dedicated comet hunters win honour and feel a sense of achievement for comet discoveries. However, in the late 1990s, automated sky survey programs for Near Earth Objects (NEOs) started routine operations and discovered many comets as well as asteroids (Sky &

Telescope, December 2000, p. 32). Amateur comet discovery has seemed to decline since then.

The situation looked especially serious in the northern hemisphere; many comet seekers stopped hunting in Japan discouraged by the NEOs. One of the authors, Murakami, also quit hunting once. However, he resumed it with a large aperture telescope and luckily enough he found a new comet, C/2002 E2 (Snyder-Murakami.

Incredibly, five comets were visually discovered in the northern hemisphere in that year, 2002. In the same year a new kind of shock was given by Masayuki Suzuki's discovery of comet 2002 O6 (SWAN) from the SWAN (Solar Wind ANisotropies) images which are open to the public on the web site. Most comet observers thought faint comets could be found in SWAN images before amateur comet hunters' discovery.

Among serious Japanese comet observers, there were hot discussions on whether comet hunting could survive under the threats of NEOs and SWAN. Is it an accidental occurrence that five comets were visually discovered in 2002? Can you actually detect all the comets from the SWAN images that could be visually discoverable? What will become of visual discovery?

To answer those questions we conducted an objective evaluation on comet discoveries. This study owes much to the discussions we had with Japanese amateurs.

2. Threat of SWAN

Syogo Utsunomiya, the most successful comet hunter in recent years, emailed one of the authors Murakami in October 2002; "I am worried myself about Masayuki Suzuki's discovery of comet 2002 O6 (SWAN) in the SWAN images. Can we comet hunters survive?"

Utsunomiya was dismayed to read the Japanese astronomical magazines which said that all comets brighter than about 11th magnitude would be found by SWAN. However, he thought fainter comets could still be detectable visually using a large aperture telescope like Murakami's, though Utsunomiya's 15 cm binoculars were too small for this purpose. Utsunomiya could not stand the uncertainty any more and consulted Murakami about using large apertures.

Murakami did not worry much about SWAN because few comets were discovered by SWAN before the finding of C/2002 O6. However, he was anxious about it after receiving the email and decided to inspect the SWAN images to confirm if they could have detected visually discovered comets prior to the actual discoveries.

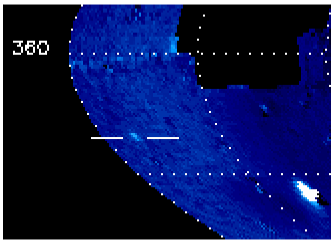

Figure 1. SWAN image of Comet 153P/Ikeya-Zhang. Two weeks before the discovery

The result was unexpected: only one comet, 153P/Ikeya-Zhang, out of six visually discovered in 2001 and 2002 could be discoverable from the SWAN images by his eye. One reason is that the SWAN images were not open to the public at the time of the discovery and/or a new comet was near the Sun and out of SWAN's coverage. Another is much more fundamental: many Japanese comet observers claimed that they could find pre-discovered comet pictures on the SWAN images because they knew the position of the comets. These images are very faint and dim, look like a stain or ghost, and therefore you cannot detect them unless you know the positions. To observe a known comet is one thing and to find a new comet is another. This holds true whatever you use; a picture, a CCD, the SWAN images and visual observation.

Murakami concluded "no need to worry about SWAN" and emailed this result to Utsunomiya. He replied, "Your analysis is a great comfort to me. Some people might say, 'Oh! You still continue to comet hunt? You are a living fossil.' It is true that the chance of discovering a new comet may have reduced but you cannot claim that it is impossible. I will go on comet seeking relying on my eyes and instrument."

3. Threat of NEO Sky Survey

We evaluated the threat of NEO sky surveys in two ways, actual comet discovery statistics and simulation of comet discovery. The simulation enables us to study each element which affects the comet discovery.

3.1 Analysis of Actual Comet Discovery

The analysis here is based on the data in Tenmon Nenkan (Astronomical Almanac) published annually by Seibundo-Shinkosha, Tokyo, Japan. Tenmon Nenkan lists dates of discovery, orbital elements and magnitude at discovery for all the new comets found in the previous year. Comet discovery data from November 1986 to December 2002 are studied below. Comets with very long period and parabolic/hyperbolic orbit (eccentricity > 0.93) are studied.

The first figure shows the trend in discovery. From 1998, discovery of comets with larger perihelion distance increased abruptly. This corresponds to full operation of LINEAR (Lincoln Near Earth Asteroid Research) project. The trend began in early 1996 when NEAT (Near-Earth Asteroid Tracking) program began to operate. Thus, we can identify two periods, "Before NEO Sky Survey" and "After NEO Survey". "Before NEO Survey" ended in December 1995 and "After NEO Sky Survey" started from March 1998. From January 1996 to February 1998 is a transition period.

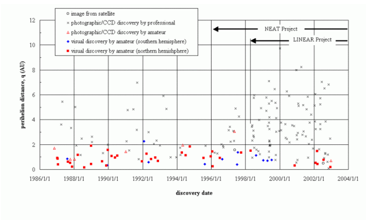

Figure 2. Comet discovery trend

The second figure shows a comparison of comet discovery per year between the two periods. The difference is very clear. Professional comet discovery increased 6 times and visual comet discovery by amateurs in the northern hemisphere decreased to half after NEO sky survey. Amateur discovery from southern hemisphere does not decrease though.

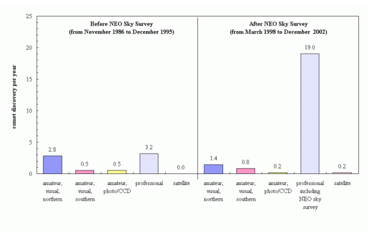

Figure 3. Comet discovery statistics for "Before NEO Sky Survey" and "After NEO Sky Survey"

This figure does not include discoveries by the SOHO (Solar Observation and Heliospheric Observatory) satellite except by SWAN which is one of the instruments boarded on SOHO.

The position of each comet at its discovery was calculated using the orbital elements and the discovery time. Further analysis reveals more interesting facts.

3.1.1 Absolute Magnitude Distribution

The absolute magnitude of a comet is defined by the following equation.

$$M = H10 + 5 \log_{10} \Delta + 10 \log_{10} r$$

where,
m: Magnitude of comet
H10: Absolute magnitude
Δ: Distance of the comet from the Earth
r: Distance of comet from the Sun

The absolute magnitude of each comet was calculated from the comet magnitude and its position at the discovery. The relationship between absolute magnitude and perihelion distance are shown in the figures below for both before and after NEO survey. Amateur visual discovery is limited to the comets with small perihelion distance, q < 2. NEO sky survey extends the limiting perihelion distance further. It is interesting that there is no amateur comet discovery brighter than 6.0 in absolute magnitude after NEO survey, though the number of samples is small. We will discuss this trend later using simulation.

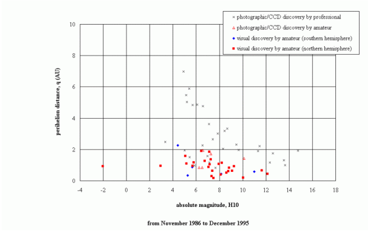

Figure 4. Absolute magnitude and perihelion distance plot for "Before NEO Sky Survey"

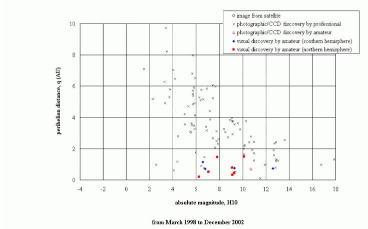

Figure 5. Absolute magnitude and perihelion distance plot for "After NEO Sky Survey"

3.1.2 Comet Position at Discovery

Comet positions at discovery are plotted in the figures below. The positions are expressed in ecliptic coordinates and longitude difference between comet and the Sun. A line of elongation of 80° is also plotted in the figures. Visual discovery before NEO sky survey mostly occurred in the region within 80° elongation. On the contrary, almost all the professional discovery occurred in the region beyond 80° elongation. Tsutomu Seki, the co-discoverer of the famous Comet Ikeya-Seki, pointed out that the sky coverage of the automated sky surveys is limited beyond 80° from the Sun and there is a good chance to discover comets visually in the sky near the Sun.

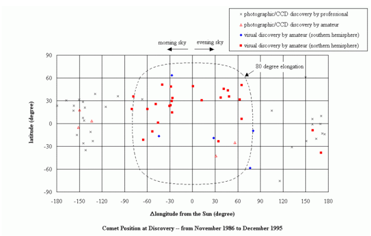

Figure 6. Comet position at discovery for "Before NEO Sky Survey"

Note that discovery in the morning sky is more than discovery in the evening sky.

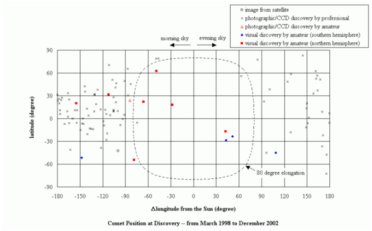

Figure 7. Comet position at discovery for "After NEO Sky Survey"

3.2 Simulation of Comet Discovery

This is a comet hunting competition in a computer. Who is the first discoverer of the comet that is randomly generated in the computer, amateur comet hunters or NEO sky surveys? The author (Taki) was an enthusiastic reader of Scientific American column "Computer Recreations" by A. K Dewdney in the 1980s. The column inspired him to perform the simulation.

The Monte-Carlo method is used in the analysis. 3,000 virtual comets are generated in a computer. Visual comet hunters in the northern and the southern hemispheres and NEO sky survey in northern hemisphere are also assumed in a computer. A calculation is performed to find when the comets become bright enough to be discovered by them. Effect of atmospheric absorption is considered in the analysis.

3.2.1 Assumptions

(1) Distribution of Comets
Comets with parabolic orbits are assumed in the simulation. Distributions of the orbital elements are assumed as follows.

a. Time of passage in perihelion distributes uniformly in 25 years, from 2003 to 2027. This assumption was put in order to consider the effect of the position of the Moon and the Sun.
b. Perihelion distance distributes uniformly from 0 astronomical unit (AU) to 10 AU.
c. Longitude of ascending node and argument of the perihelion distribute uniformly from 0° to 360°.
d. Triangular distribution is assumed for inclination, no comets at 0° and 180° and the peak of the distribution is at 90°. This distribution is derived from the same comet discovery data

described above.
e. Distribution of absolute magnitude H10 of comet is assumed to be a normal distribution with mean value of 11.0 and standard deviation of 4.0. The distribution is based on detailed analysis of the comet discovery data.

(2) Amateur Comet Hunters
a. Sky Coverage
- Lower limit of altitude at the beginning or end of twilight: 5°
- The Moon should be below the horizon when the illumination fraction k is greater than 0.2.

b. Location
- Comet hunter in the northern hemisphere: Longitude 0°, Latitude 35° North
- Comet hunter in the southern hemisphere: Longitude 0°, Latitude 35° South

c. Limiting Magnitude: 10.0 and 12.0 are considered.

(3) NEO Sky Survey
a. Sky Coverage of LINEAR Program
- We consider LINEAR is a major threat to amateur comet hunters because the sky coverage of LINEAR is the widest in the NEO sky surveys. Analyzing the sky coverage plots published in LINEAR program and the Minor Planet Center home pages, the author derived the sky coverage pattern of LINEAR as follows.
- LINEAR observes declination from -30 to +80°.
- In the near full moon period (illuminated fraction, k >= 0.9), LINEAR does not work.
- For 0.9 > k > 0.8, LINEAR observes declination from +60 to +80°.
- Limitation of right ascension is limited by altitude at the beginning or the end of twilight as follows.

$$h = 25° \sin(2(\delta + 10°)) + 45°$$

where,
h: altitude
δ: declination

b. Location: Longitude 106° E, Latitude 32° N
c. Limiting Magnitude: 18.0

3.2.2 Result of Simulation

The result of the simulation is plotted in the figures in the same manner as the actual comet discovery data. In the figures, the simulation assumes a limiting magnitude of amateur discovery of 10.0. Readers will be surprised with the resemblance between the simulation and the actual data. All the observations made for the actual discovery data are consistent with the result of the simulation. A big difference is that the actual discovery by amateurs in the southern hemisphere is much fewer than that in the simulation. This means that amateur comet hunters in the southern hemisphere have been missing the chance of comet discovery.

After NEO survey period the number of comets visually discoverable with an absolute magnitude brighter than 8 reduces in the northern hemisphere. This trend, the reduction of bright comet discovery on the basis of absolute magnitude in the northern hemisphere, corresponds to the actual one as mentioned above.

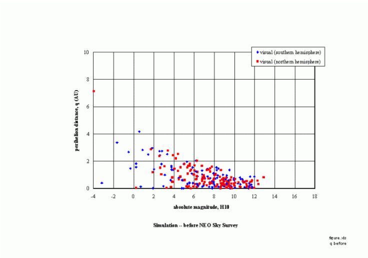

Figure 8. Absolute magnitude and perihelion distance plot for "Before NEO Sky Survey" by simulation - visual limit magnitude 10.0

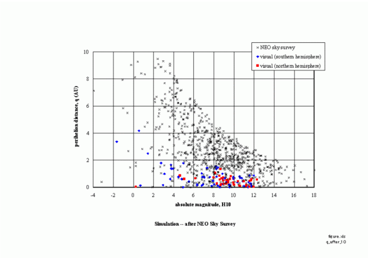

Figure 9. Absolute magnitude and perihelion distance plot for "After NEO Sky Survey" by simulation - visual limit magnitude 10.0

The explanation of this finding is as follows. The comets with brighter absolute magnitude enter the coverage of the NEO surveys when they are far away from the Sun and not bright enough for the amateur comet hunters' reach. Some of the comets with fainter absolute magnitude and small perihelion distance increase brightness up to the limiting magnitude for the amateur comet hunters, when they approach the Sun without entering the coverage of the NEO surveys. The plot of discovery position for after NEO sky survey obtained by the simulation suggests where to search.

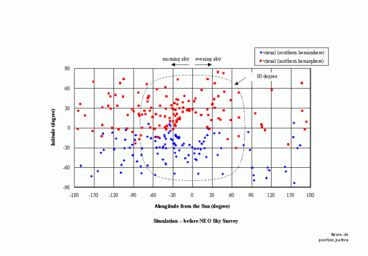

Figure 10. Comet position at discovery for "Before NEO Sky Survey" by simulation - visual limit magnitude 10.0

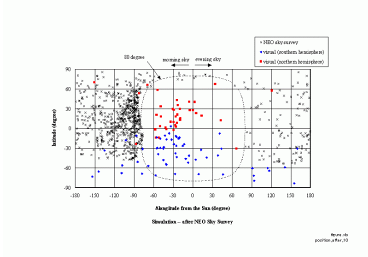

Figure 11. Comet position at discovery for "After NEO Sky Survey" by simulation - visual limit magnitude 10.0

The figure below shows comet discovery rate per year obtained from the simulation. The comet discovery rate of NEO sky survey is assumed to be the same value as the actual data, 19.0. Again, the simulation is consistent with the actual data except for the discovery rate of amateur comet hunters in the southern hemisphere. Amateur discovery rate from the northern hemisphere after NEO sky survey becomes one third of before NEO sky survey. The impact of NEO survey to amateur comet hunters in southern hemisphere is much less.

In the both hemispheres, if you make the limiting magnitude of your telescope darker from 10 to 12, it would increase the chance of discovery by 50%. While this requires a 2.5 times larger aperture telescope this gives an increased magnification, which narrows the actual field of view. Thus, your search area per unit time is reduced and you do not know whether the large aperture is effective or not. It seems that there is no best telescope for comet hunting.

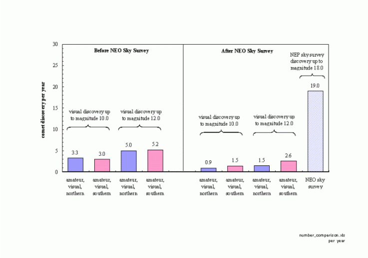

Figure 12. Comet discovery rate comparison by simulation

3.2.3 Competition and Cooperation for Near Earth Comet Discovery

The following two figures show how severe the competition is.

500 near earth comets with perihelion distance smaller than 1.0 are considered here. The square with black solid line shows numbers of comets which can be discovered by the NEO sky survey if amateur comet hunters do not work. The square with blue solid line shows numbers of comets which can be discovered by the amateur comet hunters in the northern hemisphere if the amateurs in the southern hemisphere and the NEO sky survey do not operate. The square with red solid line shows numbers of comets which can be discovered by the amateur comet hunters in the southern hemisphere if the amateurs in the northern hemisphere and the NEO sky survey do not operate. Number of comets in each block enclosed by solid lines is shown in the figures.

Competition occurs where the squares overlap. Overlap between the NEO sky survey and the amateur comet hunters is large and the NEO sky survey has an advantage over the amateur comet hunters in the overlapped area.

The NEO sky survey and the amateur comet hunters can discover 68% to 76% of the near earth comets (perihelion distance, q<1.0). Most of the undiscovered comets are small ones with faint absolute magnitude. Note that the NEO sky survey misses many near earth comets. Without the amateur comet hunters, the discovery rate of near earth comets will decrease to 60%. The amateur comet hunters compete with the NEO sky survey, and also complement it.

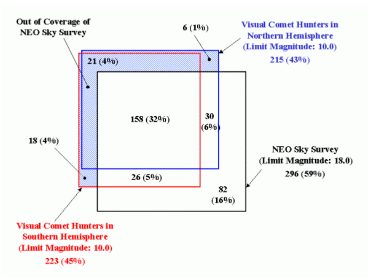

Figure 13. Discovery rate of near earth comets by simulation - visual limit magnitude 10.0

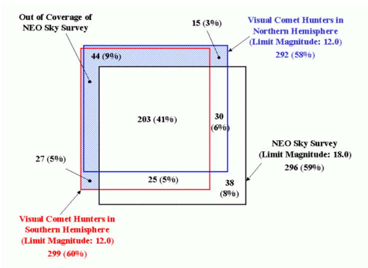

Figure 14. Discovery rate of near earth comets by simulation - visual limit magnitude 12.0

4. Conclusion

Comet hunters can survive for the time being, though the discovery rate reduced to one third in the northern hemisphere after NEO sky survey. In the southern hemisphere if amateur search becomes active a higher discovery rate is expected than the statistics to date.

When Kaoru Ikeya discovered his 6th comet 153P/Ikeya-Zhang, 35 years had past since his last discovery (Sky & Telescope, July 2002, p.70-73). Shigehisa Fujikawa has spent 24 years to find his 5th comet, C/2002 X5 Kudo-Fujikawa. Both of them continued comet hunting for decades without hesitation. Tsutomu Seki emphasizes importance of self-confidence and dedication; "Strong rivals exist at any era and only comet hunters who fight bravely and attack openly are crowned with victory".

Unless complete sky coverage of the NEO sky surveys is realized, amateur comet hunters can survive but they have to swim with the sharks. Comet hunting goes on.

5. References

[1] "The Searches for Near-Earth Objects," Sky & Telescope, December 2000, p. 32.
[2] "The Comet Master", Sky & Telescope, July 2002, p. 70-73.
[3] Jean Meeus, "Astronomical Algorithms," Willmann-Bell, Inc., 1991.

About the Authors

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Shigeki Murakami is a forest hydrologist and a snow scientist of the Japanese National Institute, Forestry and Forest Products Research Institute. He is a discoverer of C/2002 E2 Snyder-Murakami and also a member of OAA. You can contact him at cometsm@nifty.com.

Note that the illustrations were reduced in size for publication here, but can be found full size at http://www.asahi-net.or.jp/~zs3t-tk/index.htm

Professional Tales

Astronomers Suggest Comet To Blame For 6th Century "Nuclear Winter" [Press release from Cardiff University, 2004 February 3]

Scientists at Cardiff University, UK, believe they have discovered the cause of crop failures and summer frosts some 1,500 years ago - a comet colliding with Earth. The team has been studying evidence from tree rings, which suggests that the Earth underwent a series of very cold summers around 536-540 AD, indicating an effect rather like a nuclear winter. The scientists in the School of Physics and Astronomy believe this was caused by a comet hitting the earth and exploding in the upper atmosphere. The debris from this giant explosion was such that it enveloped the earth in soot and ash, blocking out the sunlight and causing the very cold weather. This effect is known as a plume and is similar to that which was seen when comet Shoemaker-Levy-9 hit Jupiter in 1995. Historical references from this period - known as the Dark Ages – are sparse, but what records there are, tell of crop failures and summer frosts. The work was carried out by two Cardiff undergraduate students, Emma Rigby and Mel Symonds, as part of their student project work under the supervision of Dr Derek Ward-Thompson. Their findings are reported in the February issue of Astronomy and Geophysics, the in-house magazine of the Royal Astronomical Society.

The surprising result of the new work is just how small a comet is needed to cause such dramatic effects. The scientists calculate that a comet not much more than half a kilometre across could cause a global nuclear winter effect. This is significantly smaller than was previously thought.

Dr. Ward-Thompson said: "One of the exciting aspects of this work is that we have re-classified the size of comet that represents a global threat. This work shows that even a comet of only half a kilometre in size could have global consequences. Previously nothing less than a kilometre across was counted as a global threat. If such an event happened again today, then once again a large fraction of the earth's population could face starvation."

The comet impact caused crop failures and wide-spread starvation among the sixth century population. The timing coincides with the Justinian Plague, widely believed to be the first appearance of the Black Death in Europe. It is possible that the plague was so rampant and took hold so quickly because the population was already weakened by starvation.

[Several other explanations have been proposed, including volcanoes, droughts, a nearby super-nova or that information about the period is lacking.]

Optical observations of water in Leonid meteor trails Asta Pellinen-Wannberg, Urban Brandstrom, Carl-Fredrik Enell, Edmond Murad, Bjorn Gustavsson, Christopher Roth, Iwan P. Williams, Ake Steen. Geophysical Research Letters paper 10.1029/2003GL018785, 2004.

Researchers have used a finely tuned imaging system to record the first direct observations of water in meteors entering Earth's atmosphere. Pellinen-Wannberg et al. adjusted two filters in the ALIS auroral imaging network during the 2002 Leonid meteor shower and present optical identification of water in the meteor tails as they entered the Earth's atmosphere. The authors tracked one of the meteors from the time it entered the upper atmosphere at high speed until it evaporated from frictional heating. The findings were unexpected, since it had been thought that meteoroids tended to lose their vapor content before entering Earth's atmosphere. The researchers set the auroral imaging system for specific elements, however, specifically sodium and combined iron/calcium atoms, the latter of which is indicative of meltwater that originated on the comet that initiated the Leonid meteors. They also confirmed that the Leonid meteors were relatively young, having passed by the Sun only a few times.

Did a comet create the biomorphic swirl on the Moon known as Reiner Gamma? Robert Burnham

In western Oceanus Procellarum on the Moon lies a curious feature named Reiner Gamma. Its light-colored, semi-symmetrical swirls look mysterious enough to startle any backyard lunar astronomer who stumbles across it unawares.

The feature, measuring about 20 by 40 miles (30 by 60 km), has been ascribed to many causes. The most widely mentioned cause is that buried and magnetized material that has created a magnetic field - in effect, a micro-magnetosphere - that shields the mare surface from weathering (darkening) by the impact of ionized particles from the Sun. Supporters of this theory point to the site's strong magnetic anomaly, which was first mapped during the Apollo 15 and 16 missions in the early 1970s.

Patrick Pinet (CNRS/University of Toulouse, France) and a group of coworkers used Clementine imagery to derive the photometric properties of the top-most lunar surface across the southern half of the feature. These data, they report, demonstrate that the feature is "optically immature," meaning that its properties appear to have been exposed to solar darkening for only a geologically brief time, perhaps 10 million years.

This apparent newness of the feature led the researchers to suggest it was caused by the impact of a collection of icy fragments - a comet, in other words. According to Pinet, the best candidate is a comet nucleus that had been disrupted by Earth's gravity, much as Jupiter's gravity broke up Comet Shoemaker-Levy 9 a decade ago. In any case, Pinet says, the impacting object was made of a cloud of small particles. This could have produced swirls on the Moon's surface when the impacting gas and dust interacted with the uppermost layer of lunar soil, affecting only its uppermost layer. The magnetization might have resulted from compression of the comet's magnetic field, he suggests.

But where is the crater? Pinet says the impacting fragments were small and fluffy, and detecting any craters will call for sharper images than what has been achieved so far. "We are planning to use high-resolution images taken by the SMART-1 spacecraft when it reaches the Moon early in 2005," he says. These images will let the researchers examine the surface of Reiner Gamma closely and perhaps reveal details that will tell an unambiguous story of the feature's origin. There are two Japanese missions headed for the Moon as well, Lunar-A (to be launched this summer) and Selene (slated for 2006). Imagers and other instruments on these spacecraft also may make observations that will help settle the question.

"This is a puzzling problem that hasn't yet been solved," Pinet concludes. "And its solution will be applicable to all bodies with airless surfaces that have developed a regolith." Besides the Moon, he points to Mercury and asteroids. © 2004, Astronomy.com

Springer Competition Runners-Up

Thanks to the generosity of Springer-Verlag the comet Section was able to run a competition last spring, with prizes being copies of the new book on *Observing Comets* by Nick James and Gerald North. The winning entries appeared in the last edition of *The Comet's Tale* and this time we feature the runners up. 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. The following essay and illustration were runners up in the competition.

The importance of amateur comet observations

C.L. Hall

I cannot tell why some things hold for me
A sense of unplumbed marvels to befall…

These were the sights that shaped my childhood dreams.
Such treasures, left from times of cautious leaven,
Cannot but loose the hold of flimsier wraiths
That flit with shifting ways and muddle faiths
Across the changeless walls of earth and heaven….

… from "Fungi from Yuggoth" by H.P. Lovecraft

Comets are the harbingers of doom for many, a cause of wonder for the masses, and an unending source of fascination for those astronomers – amateur and professional alike – who study wanderers into our region of space.

People over the years have recorded comet observations in many ways. Ancient literature talked of comets. Paintings and drawings showed us comets long before our photographic and CCD imaging techniques were even dreamed of. Learned men from ancient times recorded information on comets in terms of what they understood – using such terms as hairy stars and dragons in the sky.

Since the time of the first comet discovery using a telescope, observations have taken a mighty leap. Could Gottfried Kirch on November 14th, 1680, have imagined what wealth of information could now be gleaned by comet observers? I expect so. Based on observations of Kirch's comet, Georg Doerffel first described parabolic orbits for comets. Kirch's comet went on to dominate the list of bright comets – and opened the eyes of many astronomers to this fascinating field of study.

Many of the contributions to the science of comets were made by professional observers, or observers humbly trained who went on to assume positions with observatories around the world.

However, many amateur astronomers also started making observations. Thankfully, many of these were relayed to the scientific community. What would science have done without the contributions of observers such as Dirk Klinkenberg? Today we know his comet as the exquisite 6-tailed comet of 1744 – "de Cheseaux's". Klinkenberg found the comet first… he was an amateur.

In our lifetime, amateur observers used to have modest telescopes and equipment. Many of us grew up with telescope making. Grind your own mirror, probably a 6 or 8 inch, and put together an equatorial pipe-mounted Newtonian – or perhaps a nice wooden yoke mounted reflector. We learned the sky from the ground up, so to speak. We taught ourselves how to navigate the skies using Norton's and Vehrenberg atlases. We learned our constellations well, from the Arabic star names to the deep sky splendours. We did modest visual observations of comets, and most of us had to get information on what was visible from the comet circulars mailed to us. Most of us did not own even a basic computer. The technical observations of comets, the good data, were primarily gleaned by professional astronomers.

Nowadays, technology is everything – or so the world tells us. The beginning amateur telescope these days is probably an 8 or 10 inch reflector on a Dobsonian mount. The tech version for a more serious amateur is probably a computer controlled Schmidt-Cassegrain or Maksutov with complete go-to capability, outfitted with CCD camera, autoguider, and travelling laptop. For those with observatories in their backyards, the equipment often verges on professional. Amateurs are now in a golden age. They can contribute extremely useful information, at levels approaching the pros.

So, are amateur comet observations relevant today? Yes – and no. For those amateur comet observers fortunate enough to have good equipment, dark skies, and suitably available observing time – yes. It is going to be that fortunate handful who will make the most useful observations. This data will complement the research of the professionals, and help extend the global coverage of comet studies. We need this data – and we all respect the dedication and effort of those observers.

So, why would observations not be relevant? There is a vast untapped reservoir of observers out there… sort of an Oort Cloud of receptive observers needing a bit of encouragement from the scientific community.

These are not observers to be coddled – far from it. These are people who are educated, knowledgeable about comets, and enthusiastic. However, they may be a bit intimidated by all the recent technological advances and the impact of those advances on amateur observing techniques. Increased emphasis on communication between professionals and amateurs would help guide these potential observers towards types of comet observations that they are capable of – and that are scientifically useful.

This increased pro-am cooperation would vastly increase the importance of amateur comet observations. How should the professionals get the message across? Amateurs, like the pros, are scattered all over the globe. Written information on observing technique and equipment is vital – in book form and on websites, and even articles in the popular magazines. Email discussion groups are valuable for queries, as are contacts in the professional community who are willing to field serious questions. Some serious amateurs may be able to afford to attend conferences, but many are not.

What information do we amateurs need? We need to know how we, with the equipment we have – be it modest or all the latest tech – can contribute something to the scientific study of comets. Obviously, those with more advanced equipment will be able to gather different types of data than those of us with more modest telescopes. All of us would like to make worthwhile contributions though. We need guidance in determining the most efficient use of our equipment and resources.

Comet 153P/Ikeya-Zhang photographed on 2002 March 25 by Malcolm Gibb from near Callendar, Scotland. The mountain is Ben Ledi. 75 second exposure with Olympus OM1 + 50mm lens on 400 ASA Kodak Elite Chrome film, hand guided on a Scotch mount.

Amateur comet observations are important. They were important hundreds of years ago, and they will continue to be important in the future. Time may have changed the observing tools, and the knowledge base on which we now build. However, the comets are still out there, waiting to be discovered. The comets that we have found are still taunting us with new and exciting knowledge to be gleaned.

There are more than enough comets to go around – and precious few dedicated comet observers on this planet. Our scientific community does indeed need all the amateur comet observations that it can get.

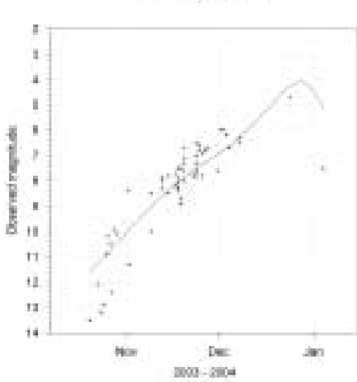
L. M. Woodney, University of Central Florida; and T. C. Owen

Review of comet observations for 2003 October - 2004 April

The information in this report is a synopsis of material gleaned from IAU circulars 8213 – 83xx, The Astronomer (2003 October – 2004 April) 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.

2P/Encke The comet was picked up visually at the 2003 return in October, however it was initially very diffuse and significantly fainter than expected. In the Northumberland 0.30-m refractor x230 I estimated it 12.9 on October 24.89 with a 0.8', DC1 coma. It was half a magnitude brighter a couple of nights later. Following reports on the comet mailing list that it was significantly brighter in binoculars, I visited a dark sky site on October 27.94 and found it at 9.9 in 20x80B with a 4.5' DC3 coma. It was a very easy object in 25x100B. On November 16.81 I estimated it at 7.7 in 20x80B, with a 10' diameter DC2 coma. On November 26.73 it was 6.8 in 10x50B with a 13' DC3 coma. Many observers comment on the pronounced fan of material coming from a stellar nucleus. Most observers lost it in early December, but Juan José González Suárez was able to view it from a mountain location on December 24.28, estimating it as a stellar object of approx 4.7 in 25x100B.

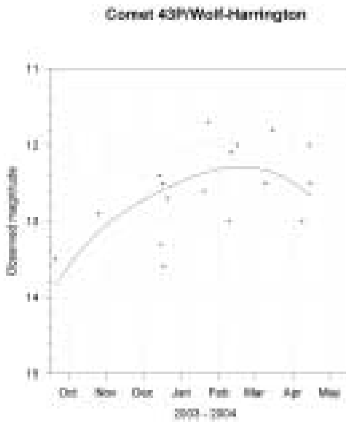
For the 2003 return 59 observations give a preliminary corrected light curve of 10.7 + 5 log d + 12.3 log r.



and Y. R. Fernandez, University of Hawaii, report the detection of HCN from comet 2P/Encke. The HCN J(4-3) transition was observed during Nov 9-11 UT at the James Clerk Maxwell Telescope. The line had a FWHM of 1.4 km/s and an integrated line strength of 0.057 +/- 0.011 K km/s. Assuming a rotational temperature of 43 K, and using a Haser model, a production rate of Q(HCN) = 9.8 x 10**23 molecules/s was derived. [IAUC 8239, 2003 November 17]

F. Bensch, Harvard Smithsonian Center for Astrophysics (CfA); E. Bergin, University of Michigan; and G. Melnick, CfA, write: "We have monitored the 1(10)-1(01) emission of water vapor at 556.936 GHz toward comet 2P using the Submillimeter Wave Astronomy Satellite (SWAS). Between Nov. 7.04 and 15.21 UT, the line- integrated antenna temperature within the 3'.2 x 4'.5 elliptical SWAS beam varied between I < 0.252 (3-sigma upper limit for observations on Nov. 7.04-7.99) and I = 0.98 K km/s (Nov. 12.03- 12.99). The average line-integrated intensity for this period is I = 0.55 +/- 0.03 K km/s. The water-production rate, Q(H_2O), is derived using a spherical outflow model (Haser model) with a water photo-destruction rate of 1.366 x 10**-5 s**-1 and an assumed ortho-para ratio of 3. The uncertainty in the resulting Q(H_2O) is governed by the finite S/N ratio of the observations and the uncertainty in the electron abundance in the coma. (In addition to infrared fluorescence and H_2O-H_2O collisions, H_2O-electron collisions provide a significant contribution to the 1(10)-1(01) line excitation; our modeling of the electron abundance uses the same parameterization as Biver et al. 1999, A.J. 118, 1850). For observations made between Nov. 9.06 and 9.96 (I = 0.53 +/- 0.07 K km/s), we derive Q(H_2O) = (2.9 +/- 0.4) x 10**27 s**-1 for an electron abundance similar to those derived by in-situ measurements in the coma of 1P/Halley, and Q(H_2O) = (4.0 +/- 0.5) x 10**27 s**-1 for an electron abundance reduced by a factor of 0.2. Previous studies of this transition toward several other comets by SWAS and by the (sub)millimeter-wavelength satellite Odin have indicated that the electron density in cometary comae might be smaller by a factor of about 0.2, compared to the electron density in 1P/Halley (Biver, private communication, based on data from Lecacheux et al. 2003, A.Ap. 402, L55)." [IAUC 8249, 2003 December 4]

43P/Wolf-Harrington was at its brightest (12th mag) in February and March, though observers recovered it as early as September. This was the tenth observed return of the comet, which was discovered in 1924, then lost until 1951. The comet 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.



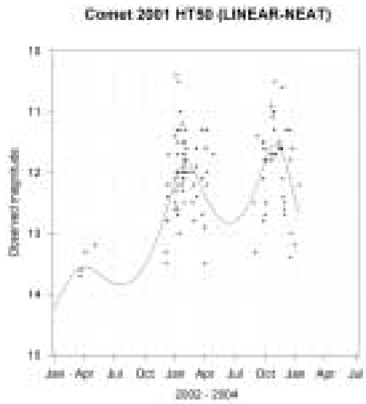
For the 2003 - 2004 return 17 observations give a preliminary corrected light curve of 6.5 + 5 log d + 16.2 log r.

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.

Standard predictions suggested that the comet should be at its best in mid April and observers found it at 11^{th} magnitude in late March into April. However it had brightened to 10^{th} magnitude by early May, suggesting that the linear fit still holds good.

SOHO comets. Over 90 more SOHO comets have been discovered over the last six months. The majority of these were Kreutz group members. Four have been given designations: **2003 T5**, **T6** and **T7**, which were all Kreutz group comets and **2004 G2** which was a Meyer group comet. Quite a few comets from the first half of 2003 have also received designations and there are now 653 SOHO comets with designations and a total of 763 confirmed discoveries.

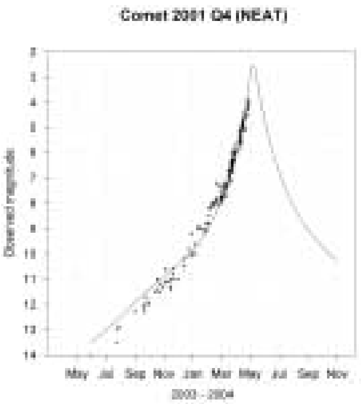
2001 HT50 (LINEAR-NEAT) emerged from solar conjunction in the late summer. Observations in September and October show a small diffuse coma, with the comet around 11th magnitude. By December the comet was clearly fading and was around 13th magnitude in the Northumberland refractor.



123 observations give a preliminary light curve of 5.2 + 5 log d + [7.5] log r

2001 Q4 (NEAT) 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. Observing with 20x80B in mid January Alexandre made the comet 8.9. By early February he was reporting it at 8th magnitude. I observed the comet from Stanley, Falkland Islands on February 19.03, where it was 40 degrees altitude and estimated it at 7.2 with a 9' coma. I flew to Rothera in the Antarctic the next day. On February 26.14 I was able to observe it in rather bright skies (sun 12 degrees below the horizon) and with a little cloud interference estimated it at 7.3 in 10x50B. On March 5.12 I had another view and made it a fraction brighter at 7.2. We then had a lengthy spell of cloudy weather, but with a forecast of clearing skies I arranged for an early morning call and made another observation on March 16.28. The comet was significantly brighter and I made it 6.9, with a 10' diameter coma. I left Rothera on March 19 and was able to make a couple more observations on the voyage to the Falkland Islands. We berthed at FIPASS just outside Stanley and from there is a short walk over a hill to dark skies. From here on March 25.00 I estimated the comet at 6.6 in 10x50B, with a 9' coma and 40' tail, and was also able to glimpse it with the naked eye at 6.0. The available observations so far extrapolate to a peak of around 2nd magnitude in early May. It should be a naked eye object for suitably placed observers from April to June. UK observers should be able to pick it up from around May 6 to 8. Initially the tail will be nearly parallel to the horizon, but the comet quickly gains altitude in the evening sky.

Michael Mattiazzo gives the dates of the orbital plane crossings as 2004 April 20 and 2004 October 23.



235 observations give a preliminary corrected light curve of 5.0 + 5 log d + 6.0 log r

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, however it will then be a southern hemisphere object. The observations to date suggest a likely peak of around 2nd magnitude in mid May, giving the opportunity of viewing two naked eye comets at the same time [2001 Q4 will probably be similar].

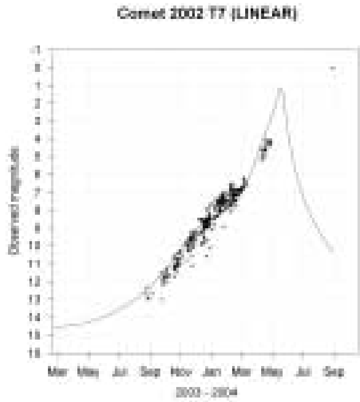
From the UK, it was lost from view in the evening sky in early March, when it had reached 6th magnitude. It is essentially a southern hemisphere object when at its best this month.

Michael Mattiazzo gives the orbital plane crossings as 2002 December 26, 2003 June 27, 2003 December 25, 2004 December 25.

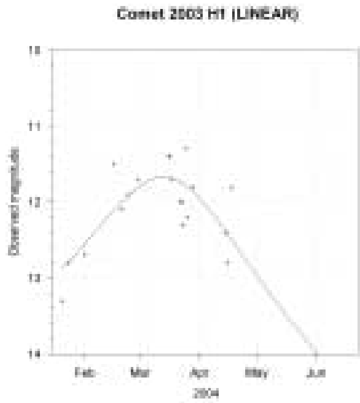
Brian Marsden notes that the "original" and "future" barycentric values of 1/a are +0.000050 and -0.000590 (+/- 0.000003) AU**-1, respectively. [MPEC 2003-R42, 2003 September 9] The first value suggests that this is a "new" comet from the Oort cloud.

Image by Martin Mobberley taken on 2004 February 25

Observations made in 2003 August put the comet around 13th magnitude. I observed the comet on September 29.1, estimating it at 11.7 in the N'land refractor x170. The comet appeared significantly brighter than a week earlier. By October 27.03 the comet had brightened to 10.7, with a small 0.7' DC6 coma. It was visible in 25x100B on October 27.95, appearing nearly stellar at mag 11.1 (TK). On November 17.09 it was visible in 25x100B at mag 9.9, with a 1.3' DC5 coma. Several reports in early December put it at around 8.5 with a 2' or larger coma. By mid December observers were reporting significant tail development, unusual in such a distant comet. In mid January I observed the comet in 20x80B making it 7.6, with a 9' diameter coma. By early February the comet had brightened to 7th magnitude, with observers reporting a tail of between 20'and 60'. By early March observers were putting it a little brighter than 7th magnitude, but clearly the rate of brightening had slackened off a little.



394 observations give a preliminary corrected light curve of 4.5 + 5 log d + 7.3 log r The light curve appears smooth with no outbursts, however there are slower variations and the comet is currently a magnitude fainter than the mean curve. This suggests a likely peak brightness of 2nd magnitude in mid May 2004.

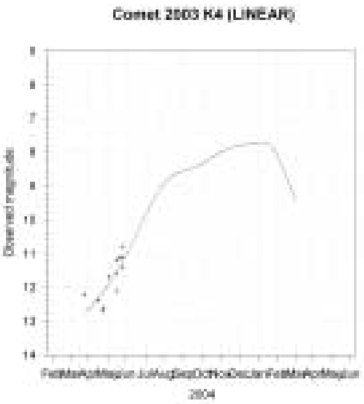


2003 H1 (LINEAR) was discovered by LINEAR on April 24.38. It reached perihelion at 2.2 AU in late February 2004. It came into visual range in January, but is now past its best. I was able to glimpse it under transparent Antarctic skies on March 16.31 estimating it at 11.4:, with a 1.3', DC2 coma in my 9cm f5.6 refractor x40. The wind had been 15 - 20 knots, but dropped to 5 knots at the time of the observation, with an air temperature of -2 Celcius. A quarter moon, only slightly brightened the sky. Under very clear skies, just outside Stanley, Falkland Islands I made another observation, recording the comet at 11.3 with a 2.4' diameter coma in the 0.09-m refractor. The main difficulty of observing was wind, but conditions were OK in the lee of some rocks.

20 observations give a preliminary corrected light curve of 6.5 + 5 log d + [10] log r.

2003 K4 (LINEAR) the latest orbit puts perihelion at 1.02 AU on 2004 October 13.7. The apparition circumstances are not particularly favourable, however the comet could reach 7th magnitude.

The first visual observations were made in February 2004. It may reach binocular range in May. We will loose it into conjunction at 7^m in 2004 September and it will pass through the SOHO LASCO fields as a 7^m object from 2004 September 28 to 2004 October 12. Southern Hemisphere observers will pick it up at the end of the month and it should remain a binocular object until 2005 January.



13 observations give a preliminary corrected light curve of 4.6 + 5 log d + [7.5] log r.

P/2003 SQ215 (NEAT-LONEOS) An object originally reported as stellar by NEAT and LONEOS has been found to show a coma by Alan Fitzsimmons et al. The period is nearly 13 years and it reaches perihelion at 2.30 AU in late March 2004.

A/2003 SB220 (LINEAR) is an asteroid, of 18th magnitude, discovered by LINEAR on 2003 September 28.12. It is in a 5.8 year orbit, with perihelion at 1.32 AU and an eccentricity of 0.59. It was at perihelion in early September. [MPEC 2003-S89, 2003 September 30, 2-day orbit] The orbit is typical of a Jupiter family comet, and it can approach Jupiter to within 0.4 AU.

2003 T1 (157P/Tritton) D/1978 was recovered in outburst at around 12th magnitude. P Holvorcem reported that C Juels had found a fast moving cometary object and this was confirmed by other observers. Following suggestions from Sebastian Hoenig, based on computations by Maik Meyer, Brian Marsden was able to confirm the identity with comet D/1978 (Tritton) that had been observed for a month in 1978. The linkage shows that the period estimated from the 1978 apparition was incorrect. The original prediction was for a return in early March, based on a period of 6.32 years, however the actual perihelion was on September 24 and the period is 6.45 years. The current brightness suggests that the object is in outburst and its future brightness is uncertain.

Keith Tritton provides the following information about the original discovery: I'm amazed (and delighted) it's been recovered. It's quite a story - it was very faint on discovery in 1978 (I think it may even have been the faintest comet ever discovered at that time), when I was working on the Southern UK Schmidt Sky Survey. The orbit was observed over only a very short arc. The first return was very unfavourable, so it couldn't be seen, and the orbital inaccuracy was so large that the predictions for the second return had huge uncertainties. Nevertheless I got some plates taken at the Schmidt (this was about 1990) and sent to me in Cambridge for searching. But I never got them, they were lost in transit from Australia! So I never expected to hear anything more about it. It must be rather rare to pick up a lost comet on its fourth return, mustn't it?

P. Holvorcem, Campinas, Brazil, has reported that the co- addition of three 45-s unfiltered CCD images of a fast-moving object found by C. Juels, Fountain Hills, AZ, with a 0.12-m f/5 refractor and a 0.5-m f/4.8 reflector on October 6.44 show a coma of diameter 2' and a hint of a 1'.5 tail at p.a. roughly 257 deg. Following posting on the NEO Confirmation Page, additional CCD observers noted the object's cometary appearance, including R. Trentman (Louisburg, KS, 0.75-m reflector; mag 13.1 and very faint evidence of a tail approximately 10" long in p.a. approximately 280 deg on Oct. 7.4 UT), D. T. Durig (Sewanee, TN, 0.30-m f/5.86 reflector; teardrop-shaped coma of mag 10.1 with a tail at least 2'-2'.5 long in p.a. about 285 deg on Oct. 7.4), and J. Young (Table Mountain, CA, 0.6-m reflector; 36" coma elongated to 48", with a 3' tail in p.a. 289 deg with a very straight and extremely thin jet of length about 1'.5 in its center on Oct. 7.5).

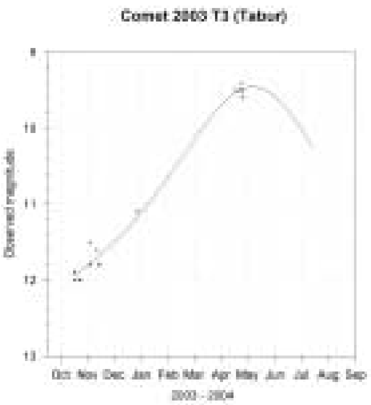
Following a suggestion by S. Hoenig (Dossenheim, Germany) from orbital computations by M. Meyer (Kelkheim, Germany), B. G. Marsden (Smithsonian Astrophysical Observatory) has shown that this comet is identical to the lost comet 1978d = 1977 XIII = D/1978 C2 (Tritton), which was observed for only a month (cf. IAUC 3175, 3186, 3194, 3198). The available astrometry, including Sept. 22 prediscovery observations, and the orbital elements by Marsden appear on MPEC 2003-T37. [IAUC 8215, 2003 October 7]

2003 T2 (LINEAR) LINEAR discovered an 18th mag object on Oct 13.44 which was found to be cometary by other observers and possibly as bright as 15th magnitude. It reached perihelion at 1.79 AU in mid November, but no visual observations were reported.

An apparently asteroidal object reported by LINEAR on October 13.44, and posted on the NEO Confirmation Page, has been found to show cometary appearance by several CCD astrometric observers, including R. Apitzsch (Wildberg, Germany, 0.24-m reflector; Oct. 14.0 UT, diffuse coma of diameter about 10"), J. E. McGaha (Tucson, AZ, 0.62-m reflector; Oct. 14.4, bright compact coma of diameter 4" with a fainter outer coma of diameter 10" and a broad tail 20" long in p.a. 30 deg), G. R. Jones (Tucson, AZ, 0.32-m reflector; Oct. 14.4, coma diameter about 6" and a possible tail at p.a. 35 deg), P. R. Holvorcem and M. Schwartz (Tenagra 0.81-m reflector at Nogales, AZ; Oct. 14.5, co-addition of three 120-s exposures shows a coma of diameter about 15" and total mag 15.1-15.6), and A. Knoefel and T. Payer (Essen, Germany, 0.32-m reflector; Oct. 14.9, short tail). [IAUC 8222, 2003 October 14]

Brian Marsden notes on MPEC 2004-A07 [2004 January 3] that the "original" and "future" barycentric values of 1/a are -0.000065 and +0.000653 (+/- 0.000024) AU**-1, respectively, suggesting that this is a "new" comet from the Oort cloud.

2003 T3 (Tabur) Vello Tabur discovered a somewhat condensed comet of 12th magnitude on October 14.57, which was posted on the NEO confirmation page. It was confirmed the next day by Terry Lovejoy and other Australian observers and announced on IAUC 8223. This circular also announced the recovery of the only named but un-numbered and lost minor planet, Hermes after 31 revolutions.



Vello Tabur, Australian Capital Territory, reports his discovery of a somewhat-condensed comet with a 30" coma on unfiltered CCD images taken with a 140-mm f/2.8 camera lens on Oct. 14.481 UT. T. Lovejoy (Thornlands, Queensland, 0.16-m reflector) reports that a CCD exposure taken on Oct. 15.5 shows a 0'.7 coma of total mag 11.6 and a fan-shaped tail about 1' long in p.a. 90 deg. [IAUC 8223, 2003 October15]

The latest MPEC and orbits by Hirohisa Sato give perihelion at 1.48 AU at the end of April 2004. The comet passed through the SOHO C3 coronagraph field between 2004 February 20 and 2004 March 25, but was not convincingly observed. It emerged from solar conjunction as a 9th magnitude object in late April and will slowly fade through to the end of year.

Brian Marsden notes on MPEC 2004-A08 [2004 January 3] that the "original" and "future" barycentric values of 1/a are +0.000176 and +0.000878 (+/- 0.000043) AU**-1, respectively, suggesting that this is probably not a "new" comet from the Oort cloud.

17 observations give a preliminary corrected light curve of 5.7 + 5 log d + 6.9 log r.

2003 T4 (LINEAR) LINEAR discovered an 20th mag object on Oct 13.45 which was found to be cometary by other observers. From the initial orbit it appeared to be a distant object near perihelion, however Sebastian Hoenig computed a rather more interesting orbit, which gave perihelion at 0.75 AU in March 2005. The MPECs confirm this rather more interesting orbit, with perihelion at 0.85 AU in early April 2005. The indications are that the comet could reach 6th magnitude. The comet could come within visual range in 2004 September and reach binocular visibility in 2005 February. We will loose it in March at 6th magnitude and it will be a southern hemisphere object after perihelion.

An apparently asteroidal object reported by LINEAR on October 13.45, and posted on the NEO Confirmation Page, has been found to show cometary appearance by several CCD astrometric observers, including J. E. McGaha (Tucson, AZ, 0.62-m reflector; Oct. 14.4 UT, coma diameter 6" with a fan-shaped tail 12" long in p.a. 75 deg), P. R. Holvorcem and M. Schwartz (Tenagra 0.81-m reflector at Nogales, AZ; Oct. 14.4 and 15.4, co-addition of three 180-s exposures on each night shows a coma of diameter about 5" and total mag 17.7-18.3), G. R. Jones (Tucson, AZ, 0.32-m reflector; Oct. 15.4, coma diameter 2", slightly elongated toward p.a. 40 deg), and J. Young (Table Mountain, CA, 0.6-m reflector; Oct. 15.5, 6" diffuse coma surrounding a very small central core). [IAUC 8224, 2003 October 15]

Brian Marsden notes on MPEC 2004-A09 [2004 January 3] that the "original" and "future" barycentric values of 1/a are +0.000169 and -0.000827 (+/- 0.000069) AU**-1, respectively, suggesting that this is probably not a "new" comet from the Oort cloud.

2003 U1 (LINEAR) LINEAR discovered an 18th mag object with halo on Oct 19.38 which was confirmed to be cometary by other observers. It was at perihelion at 1.8 AU in early November and will fade from 17th magnitude. Orbits by Sato and Marsden show that it is a periodic comet, with period around 109 years.

L. Manguso and H. Stange, Lincoln Laboratory, Massachusetts Institute of Technology, report the discovery of a comet with a definite halo but no tail on LINEAR images on October 19.38. Following posting on the NEO Confirmation Page, two other CCD observers have also commented on the cometary appearance: J. E. McGaha (Tucson, AZ, 0.30-m reflector; faint 10" coma elongated in p.a. 240 deg on Oct. 20.3 UT) and J. Young (Table Mountain, CA, 0.6-m reflector; coma of diameter 6" and mag 17.5 with a tail about 16" long in p.a. 276 deg). [IAUC 8227, 2003 October 20]

2003 U2 (P/LINEAR) LINEAR discovered an 18th mag comet on October 19.09 which was confirmed to be cometary by other observers. Prediscovery images back to September 19 were also found. It is at perihelion in early December at 1.7 AU and has a period of 9.6 years. It will fade from 18th magnitude.

F. Shelly, Lincoln Laboratory, Massachusetts Institute of Technology, reports the discovery of a comet with a diffuse coma and a very wide, fan-shaped tail in p.a. 85 deg on LINEAR images on October 19.09. Following posting on the NEO Confirmation Page, other CCD observers have also commented on the cometary appearance on Oct. 21.1-21.2 UT, including J. Young at Table Mountain (0.6-m reflector; 5" coma without central condensation and with a fan-shaped tail about 25" long spanning p.a. 70-95 deg) and R. Fredrick and T. Medlock at Louisburg, KS (0.75-m reflector; 30" tail in p.a. 80 deg). [IAUC 8229, 2003 October 21]

2003 U3 (P/NEAT) NEAT discovered an 19th mag comet on October 22.29. It is past perihelion at 2.5 AU in late April and has a period around 11.5 years. It will fade from 18th magnitude.

K. Lawrence, Jet Propulsion Laboratory, reports the discovery by the NEAT project of a 19th magnitude comet on 2003 October 22.29. Observations by J. Young at Table Mountain on Oct. 23.2 UT show a 3" coma with a short, broad, fan-shaped tail about 8" long spanning p.a. 255-285 deg. [IAUC 8230, 2003 October 23]

2003 UD16 (159P/LONEOS) LONEOS discovered an 19th mag asteroid on October 16.40. Subsequent images taken by Carl Hergenrother with the Mt Hopkins 1.2 m reflector on November 30.21 showed cometary features. It will reach perihelion in early March at 3.65 AU and has a period of 14.3 years. It will not get any brighter.

An apparently asteroidal object with not-unusual motion, found by LONEOS on October 16.40 (the discovery observation together with other astrometry appeared on MPS 88336, 90581, and 91035 with the designation 2003 UD_16; initial orbit on MPO 53844), has been found by C. W. Hergenrother to show a circular, condensed 11" coma and no tail on co-added 900-s R-band CCD exposures taken on Nov. 30 with the Mt. Hopkins 1.2-m reflector (astrometry below measured by T. B. Spahr). [IAUC 8248, 2003 December 3]

Maik Meyer found images of the comet on Palomar plates taken in 1989 and 1991, thus allowing a secure orbit to be determined. The comet was therefore numbered 159P.

2003 UY275 (P/LINEAR) LINEAR discovered an 18th mag asteroid on October 29.32. Subsequent images taken by Carl Hergenrother with the Mt Hopkins 1.2 m reflector on November 30.25 showed cometary features and these were confirmed by other observers. Prediscovery images back to October 5 were also found. It was at perihelion in early July at 1.8 AU and has a period around 7.2 years. It will fade from 18th magnitude.

An apparently asteroidal object discovered by the LINEAR project on 2003 October 29.32 has been found to show cometary appearance on CCD images taken with the Mt. Hopkins 1.2-m reflector on Nov. 30.25 UT by C. W. Hergenrother; his co-added 1200-s R-band exposures show a highly condensed 16" coma and a narrow tail 100" long in p.a. 280 deg (mag 18.5 determined by T. B. Spahr). Also, R. S. McMillan noted the object as diffuse in Spacewatch incidental observations made on Nov. 30.4. [IAUC 8247, 2003 December 2]

A/2003 UO12 (Spacewatch) is an asteroid, of 21st magnitude, discovered with the Spacewatch II telescope on 2003 October 21.26. It is in a 5.5 year orbit, with perihelion at 0.94 AU and an eccentricity of 0.70. It is at perihelion in mid December. [MPEC 2003-U44, 2003 October 22, 1-day orbit] The orbit is typical of a Jupiter family comet, and it can approach to within 0.1 AU of Jupiter and 0.05 AU of the Earth.

A/2003 UY283 (Spacewatch) The discovery of an unusual asteroid, found by Spacewatch on October 18.36 was announced on MPEC 2003 V58 [2003 November 14]. The 21st magnitude object is in a 195 year periodic orbit with perihelion at 3.51 AU and has just passed perihelion. Aphelion is at 64 AU.

2003 V1 (LINEAR) LINEAR discovered an 18th mag comet with tail on November 4.47 which was confirmed by other observers. It is past perihelion, which was at 1.78 AU in mid March and will fade from 16th magnitude. The comet could have reached 13th magnitude near perihelion but was then in solar conjunction. It could potentially have been discovered by a Southern Hemisphere search programme in 2002, or found in the 'twilight zone' not searched by LINEAR by amateur CCD observers located in the tropics or southern hemisphere during November to January, or by northern observers from late August onwards.

A. Milner, Lincoln Laboratory, Massachusetts Institute of Technology, reports the LINEAR discovery of a comet with a tail in p.a. 330 deg on 2003 November 4.47. Following posting on the NEOCP, other CCD observers recognized the object as a comet, reporting additional physical data: Nov. 5.2 UT, 12" coma (mag 16.5) and 40" tail (A. Knoefel, Essen, Germany, 0.32-m reflector); Nov. 5.5, 7" coma (mag 16.5) with a broad tail a little more than 70" long spanning p.a. 290-310 deg, including two or three streamers, the brightest of which is 30" long in p.a. 295 deg (J. Young, Table Mtn., CA, 0.6-m reflector); Nov. 5.5, coma diameter about 10", with 10" tail in p.a. 310 deg (P. R. Holvorcem and M. Schwartz, Nogales, AZ, 0.81-m reflector; three 180-s exposures); Nov. 6.4, soft coma of diameter 6", broad tail 9" long in p.a. 310 deg (J. E. McGaha, Tucson, AZ, 0.30-m reflector). [IAUC 8236, 2003 November 6]

Brian Marsden notes on MPEC 2004-B51 [2004 January 26] that the "original" and "future" barycentric values of 1/a are +0.001411 and +0.002242 (+/- 0.000035) AU^-1, respectively, suggesting that this is not a "new" comet from the Oort cloud.

Sedna (2003 VB12) This object is the first member of the inner Oort cloud to be discovered. With a perihelion distance of 75.8 AU, aphelion at nearly 1000 AU and an orbital period of 12,000 years it is the most distant member of the solar system to be found. At several hundred kilometres in diameter it is smaller in size than Pluto and would be a substantial comet if ever made it into the inner solar system. It is currently just under 90 AU from the Sun, moving in towards perihelion, which is in about 70 years time.

2003 W1 (LINEAR) LINEAR discovered an 18th mag object on November 16.08 which was found to be cometary by other observers. Hirohiso Sato noted that the early observations were also fitted quite well by a periodic orbit with a period of 9.3 years. This would be rather unusual in a comet with an orbital inclination of around 75 degrees. However as more observations accumulated, orbits published in the MPECs were given as elliptical. The comet has a periodic orbit of 126 years, inclination 78 degrees and perihelion in early November at 1.65 AU. It will fade.

An apparently asteroidal object reported by LINEAR on 2003

November 16.08 was posted on the NEO Confirmation Page and has been found to show cometary appearance by several CCD observers, including J. Young (Table Mountain, CA, 0.6-m reflector; Nov. 17.1 UT, very round coma of diameter 8" and mag 17.5 with a faint, featureless tail 50" long in p.a. 42 deg), R. Fredrick and R. Trentman (Louisburg, KS, 0.75-m reflector; Nov. 17.1, very diffuse tail approximately 4" long in p.a. 20 deg), J. E. Rogers (Camarillo, CA, 0.30-m reflector; Nov. 17.1, diffuse), and J. Lacruz (Madrid, Spain, 0.30-m reflector; Nov. 17.8, diffuse coma extending some 50" to the north). [IAUC 8239, 2003 November 17]

2003 WC7 (LINEAR-Catalina) LINEAR discovered a 20th mag object on November 18.14 which was observed on two nights. It was independently discovered by the Catalina Sky Survey on January 31.14 and posted on the NEO confirmation page. Other observers then noted a coma and tail. The object is in 11.8 year orbit with perihelion at 1.65 AU in early February.

A/2003 WM7 (NEAT) is an asteroid, of 19th magnitude, discovered by Palomar NEAT on 2003 November 18.21. It is in a 4.6 year orbit, with perihelion at 0.27 AU and an eccentricity of 0.90. It reaches perihelion in mid March 2004. [MPEC 2002-W21, 2003 November 20, 2-day orbit] The orbit is typical of a Jupiter family comet and it can approach within 0.4 AU of Jupiter. It can approach within 0.1 AU of our planet. If it shows cometary activity it could reach 9th magnitude at perihelion and it will pass within the LASCO C3 field from March 14 to 20. At its last return in August 1999 it would only have reached 14th magnitude.

A/2003 WB8 (LINEAR) is an asteroid, of 19th magnitude, discovered by LINEAR on 2003 November 18.14, but linked to 1987 FJ1. It is in a 5.9 year orbit, with perihelion at 1.46 AU and an eccentricity of 0.55. It reaches perihelion in late June 2004. [MPEC 2003-W27, 2003 November 20] The orbit is typical of a Jupiter family comet, and it can approach Jupiter to within 0.2 AU.

A/2003 WY25 (Catalina) is an asteroid, of 18th magnitude, discovered by the Catalina Sky Survey on 2003 November 22.15. It is in a 5.3 year orbit, with perihelion at 1.00 AU and an eccentricity of 0.67. It reaches perihelion in mid December. [MPEC 2003-W41, 2003 November 22, 28-day orbit] The orbit is typical of a Jupiter family comet, and it can approach Jupiter to within 0.2 AU, approaching it to 0.4 AU in 1995. It is also a PHA, approaching earth to 0.005 AU at the ascending node. It will approach to 0.025 AU in mid December, when it will reach 15th mag.

A/2003 WE42 (Haut Provence) is an asteroid, of 18th magnitude, identified with asteroid 1982 YA, which was discovered at Haut Provence observatory. It is in a 6.92 year orbit, with perihelion at 1.10 AU and an eccentricity of 0.67. It reached perihelion in mid October 2003. [MPEC 2004-D48, 2004 February 28] The orbit is typical of a Jupiter family comet, and it can approach Jupiter to within 1 AU, and the Earth to within 0.2 AU.

2003 WT42 (LINEAR) was first identified as an unusual asteroid, of 18th magnitude, discovered by LINEAR on 2003 November 19.26. The initial elements gave a 13,000 year orbit, with perihelion at 5.23 AU and an eccentricity of 0.991, with perihelion in April 2006. [MPEC 2003-W48, 2003 November 24, 28-day orbit]

Observations in mid January 2004 demonstrated the presence of a coma, confirming the object as a comet. The latest orbit is hyperbolic, but perihelion remains a distant one at 5.19 AU in mid April 2006.

Brian Marsden notes on MPEC 2004-E05 [2004 March 1] that the "original" and "future" barycentric values of 1/a are +0.000207 and +0.000362 (+/- 0.000120) AU^-1, respectively, suggesting that this could be a "new" comet from the Oort cloud.

A/2003 WG166 (LINEAR) is an unusual asteroid, of 19th magnitude, discovered by LINEAR on 2003 November 30.26. It is in a 11.7 year, high inclination orbit, with perihelion at 1.84 AU and an eccentricity of 0.64. It reaches perihelion at the end of December. [MPEC 2003-X24, 2003 December 4, 4-day orbit] There have been no recent close approaches to Jupiter or the Earth, largely thanks to the high inclination orbit.

A/2003 WN188 (Catalina) is an asteroid, of 19th magnitude, discovered by the Catalina Sky Survey on 2003 November 29.41. It is in a 55 year orbit, with perihelion at 2.22 AU and an eccentricity of 0.85. It reaches perihelion in early April 2004. [MPEC 2003-Y43, 2003 December 22, 28-day orbit] The orbit is typical of a comet, though there have been no recent approaches to Jupiter or Saturn closer than 3 AU.

2003 XD10 (P/LINEAR-NEAT) LINEAR discovered an 19th mag asteroid on December 4.34. NEAT independently discovered the object on December 14.43 and reported it as cometary. It was posted on the NEO confirmation page on cometary activity was noted by Peter Birtwhistle amongst others. Prediscovery images were made by LINEAR on November 20. The preliminary elliptic orbit of 6.1 years puts it at perihelion in mid September at 1.88 AU. It will fade.

A/2003 XM (LINEAR) is an asteroid, of 19th magnitude, discovered by LINEAR on 2003 December 3.33. It is in a 5.4 year orbit, with perihelion at 0.99 AU and an eccentricity of 0.68. It reaches perihelion in early February 2004. [MPEC 2003-X26, 2003 December 4, 1-day orbit] The orbit is typical of a Jupiter family comet, and it can approach Jupiter to within 0.1 AU, approaching this distance in 1974. It is also a PHA, approaching to 0.012 AU of the Earth at the descending node.

2004 A1 Brian Skiff discovered a faint comet on LONEOS images taken by himself. Although the object appeared stellar, he requested additional images from other observers because of the motion of the object. These showed a slight coma. The comet is not due to reach perihelion until late August 2004, but it is a distant periodic comet with period of 22.2 years and perihelion at 5.46 AU and it will initially fade.

A/2004 AE9 (LONEOS) is an asteroid, of 19th magnitude, discovered by LONEOS on 2004 January 13.19. It is in a 11.65 year orbit, with perihelion at 1.83 AU and an eccentricity of 0.64. It was at perihelion in early January and will fade. [MPEC 2004-B11, 2004 January 18, 1-month orbit] The orbit is typical of a Jupiter family comet and it can approach within 0.2 AU of Jupiter.

2004 B1 (LINEAR) On January 29.16 LINEAR discovered a faint distant comet. It is not due to reach perihelion at 1.60 AU until early February 2006. It could reach 13th magnitude, although it will be a southern hemisphere object at perihelion. Post perihelion it may be visible from the UK at 13th magnitude in May and June.

A/2004 BC103 (LINEAR) is an asteroid, of 19th magnitude, discovered by LINEAR on 2004 January 31.47. It is in a 5.9 year orbit, with perihelion at 1.5 AU and an eccentricity of 0.55. It was at perihelion in early January and will not get significantly brighter. [MPEC 2004-C11, 2004 February 2, 2-day orbit] The orbit is typical of a Jupiter family comet, but its orbital inclination of 28 degrees keeps it well away from Jupiter.

A/2004 BG121 (Scotti) is an asteroid, of 22nd magnitude, discovered by Jim Scotti with the 0.9-m reflector at the Steward Observatory, Kitt Peak on 2004 January 30.28. It is in a 6.3 year orbit, with perihelion at 0.78 AU and an eccentricity of 0.77. It was at perihelion in August 2003 and will fade. [MPEC 2004-C38, 2004 February 11, 11-day orbit] The orbit is typical of a Jupiter family comet, but its orbital inclination of 29 degrees keeps it well away from Jupiter. It is a potentially hazardous asteroid and the orbit is 0.008 AU from the earth's at its descending node. There have been no recent close approaches.

2004 C1 (Larsen) Jim Larsen discovered a 20th mag comet in Spacewatch images taken on February 12.42 The preliminary orbit suggested that it would reach perihelion at 8.0 AU in November 2004. The latest orbit is elliptical, with a period of 40 years and perihelion distance of 4.4 AU, which it passed in mid March 2003.

2004 CB (LINEAR) An apparently asteroidal object of 18th magnitude discovered by LINEAR on February 3.40 has turned out to show a tail. The original orbit given on MPEC 2004-C16 on February 5 and based on an arc of 2 days had a period of 4.1 years and a perihelion distance of 0.90 AU. The latest orbit has a period of 5.03 years and a perihelion distance of 0.91 AU and it reached this point on April 2. It will fade.

A/2004 CK9 (Catalina) is an asteroid, of 20th magnitude, discovered by the Catalina Sky Survey on 2004 February 14.23. It is in a 8.8 year orbit, with perihelion at 0.32 AU and an eccentricity of 0.92. It will reach perihelion in early May. [MPEC 2004-C63, 2004 February 15, 1-day orbit] The orbit is typical of a Jupiter family comet and it can approach within 0.1 AU of the Earth.

A/2004 CM111 (Kitt Peak) is an asteroid, of 22nd magnitude, discovered with the 0.9-m reflector at the Steward Observatory, Kitt Peak, on 2004 February 13.41. It is in a 190 year orbit, with perihelion at 4.94 AU and an eccentricity of 0.85. It was at perihelion in early July 2003 and will fade. [MPEC 2004-D37, 2004 February 25, 9-day orbit] The orbit is more typical of a long period comet and it can approach within 0.4 AU of Jupiter.

2004 D1 (NEAT) An apparently asteroidal object found by NEAT on February 17.12 has been found to show a coma by Peter Birtwhistle and others. Currently around 20th magnitude it doesn't reach perihelion until February 2006, but with a perihelion distance of 5 AU it will not reach visual range.

2004 DO29 (Spacewatch-LINEAR) was initially reported as an asteroid, of 20th magnitude, discovered with the 0.9-m reflector at the Steward Observatory, Kitt Peak on 2004 February 17.22. It is in a 20 year orbit, with perihelion at 4.1 AU and an eccentricity of 0.45. It reaches perihelion in mid October and will fade as the distance from Earth is increasing. [discovery on MPEC 2004-D45, 2004 Feruary 28] The orbit is more typical of an intermediate period comet and it can approach within 0.7 AU of Jupiter.

Subsequent observations with the 2.2-m reflector of the University of Hawaii showed it to have a coma, thus confirming its true cometary nature.

2004 DZ61 (Catalina-LINEAR) was first reported as an asteroid, of 19th magnitude, discovered by LINEAR on 2004 February 19.37. It is in a 300 year orbit, with perihelion at 2.01 AU and an eccentricity of 0.96. It reaches perihelion in late May and will fade as the distance from Earth is increasing. [MPEC 2004-E02, 2004 March 1, 12-day orbit] The orbit is more typical of a long period comet and subsequent observations with the University of Hawaii 2.2-m reflector showed a coma and tail. Further astrometry has confirmed the long period orbit, with perihelion in late May at 2.01 AU.

A/2004 DA62 (LINEAR) is an asteroid, of 20th magnitude, discovered by LINEAR on 2004 February 25.38. It is in a 23 year orbit, with perihelion at 4.17 AU and an eccentricity of 0.48. It reaches perihelion in late March and will brighten a little [MPEC 2004-E03, 2004 March 1, 4-day orbit] The orbit is more typical of an intermediate period comet and although the orbit crosses that of Jupiter the high inclination keeps it away from the planet.

2004 EW38 (Catalina-LINEAR) is another object, initially reported as asteroidal by the two survey teams that has been found to show cometary activity by other observers. This object is in a short period orbit of 6.8 years, with perihelion at 1.79 AU in mid November 2003.

2004 F1 (NEAT) NEAT discovered a faint comet on March 18.31. Prediscovery observations have been found back to 2003 December 1 and these show that the comet is in a 9.45 year periodic orbit, with perihelion in mid October 2003 at 2.45 AU. It will fade from 20th magnitude.

2004 F2 (LINEAR) On March 25.44 LINEAR discovered an 18th magnitude comet. It was at perihelion in late December 2003 at 1.43 AU and will fade.

2004 F3 (P/NEAT) On March 28.54 NEAT discovered at 17th magnitude comet. The observations show that it is in a periodic orbit of 8.1 years and that it passed within 0.37 AU of Jupiter in July 2001, which reduced the perihelion distance. It will reach perihelion at 2.87 AU in early January 2005. It will remain near 16th magnitude visually.

2004 F4 (Bradfield) The veteran Australian observer, Bill Bradfield, has done it again! He has beaten all the professional search teams and found a relatively bright comet, though at the moment it is too close to the Sun for observation. Although he made the initial discovery with his 0.25-m reflector on March 23.43, it took several weeks to get full confirmatory observations. On discovery it was 8th magnitude, but had brightened to 5th magnitude by the time it was confirmed on April 8. Bill had been hunting for comets in the twilight sky in the hope of finding a bright sungrazer, and whilst this one isn't a member of the Kreutz group, it will be impressive as it passes through the SOHO field later this week.

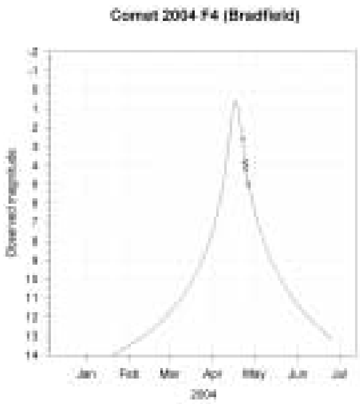
Image by Tony Scarmato taken on 2004 April 28

The preliminary orbit, which puts perihelion at 0.17 AU on April 17, suggests that it should have been a relatively bright object during the winter and well placed in northern skies, so it is a little surprising that no-one picked it up. Perhaps it will be found in archival images, which should lead to an immediate improvement in the orbit. Alternatively the comet may have undergone an outburst, in which case its future behaviour becomes uncertain.

It entered the C3 coronagraph field on April 16 and left it on April 20; during the passage it brightened significantly, perhaps reaching -2 with a tail over 9 degrees long. Its elongation from the Sun rapidly increases and it will soon be visible in a dark sky. It remains a binocular object in the morning sky until June, passing through Pisces and Andromeda and is close to M31 in the second week of May.

Image by Rolando Ligustri taken on 2004 April 28

I was able to recover the comet on April 23.14, estimating it at 2.6: in 20x80B in strong twilight. The comet was nearly stellar with hints of a tail. I made a second observation on April 26.1 by which time it had faded to 4.9, but had a 3° tail which filled most of the field of my 20x80B.



8 observations give a preliminary corrected light curve of 9.9 + 5 log d + 12.7 log r. Such a faint absolute magnitude makes its survival through perihelion highly unusual according to John Bortle's formula, however it clearly has! The light curve also suggests that the comet should have been found by one of the search teams prior to its discovery by Bradfield. It would have been well placed at opposition in November, when it was around 18th magnitude. By the time it reached quadrature in January it may have been 16th magnitude, well within range of amateur CCDs and perhaps 14th magnitude by the time it left UK skies.

2004 G1 (LINEAR) On April 9.36 LINEAR discovered a 19th magnitude comet. The preliminary orbit suggests that it will reach perihelion in early June at 1.2 AU, however it will not be well placed and will fade.

2004 H1 (LINEAR) A 19th magnitude suspicious object found by LINEAR on April 16.13 and put on the NEOCP has been found to show cometary activity. It was at perihelion in mid January at 2.08 AU.

2004 H2 (P/Larsen) Jim Larsen discovered a 20th magnitude comet in Spacewatch images of April 19.41. The preliminary orbit based on five days of observations suggests that it is in a 10 year elliptical orbit and will not brighten significantly. It was at perihelion in mid April at 2.6 AU.

2004 H3 (P/Larsen) Jim Larsen discovered a 19th magnitude comet in Spacewatch images of April 22.33 preliminary orbit based on two days of observations suggests that it is in an elliptical orbit and will fade.

2004 HC18 (LINEAR) An apparently asteroidal object of 19th magnitude discovered by LINEAR on April 17.35 has turned out to show a tail. The orbit has a period of 6.55 years and a perihelion distance of 1.71 AU and it reached this point on June 18. It will fade.

A/2004 HV60 (Spacewatch) is an asteroid, of 21st magnitude, discovered by Spacewatch on 2004 April 25.35. It is in a 1400 year orbit, with perihelion at 3.1 AU and an eccentricity of 0.98. It is past perihelion and near its brightest. [MPEC 2004-H91, 2004 April 30, 5-day orbit] The orbit is more typical of a long period comet.

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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