THE COMET'S TALE

Newsletter of the Comet Section of the British Astronomical Association

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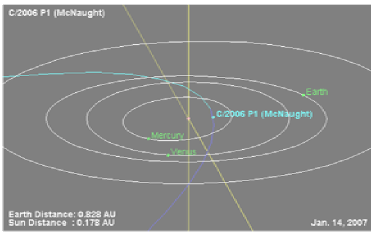
2006 P1 (McNaught) – a Great Comet ?

Once the orbit of comet 2006 P1 (McNaught) became reasonably well known, the speculation as to its likely brightness commenced. The initial indications were not that favourable, with the available CCD magnitudes indicating an absolute magnitude on the limits of survivability for the comet's relatively close pass to the Sun. However, it is often the case that CCD magnitudes are closer to the nuclear or m_2 magnitude, than they are to the visual or m_1 magnitude. Would this be the case for this comet?



As the comet drew closer, visual observations were attempted and it became evident that the comet was significantly brighter than indicated by the CCD observations. As the arc of observation increased it appeared that the comet was brightening fairly rapidly, perhaps as 15 log(r). A simple linear extrapolation then suggested that we could have a daylight comet in January. I hinted that this might be the case on the Section web page and in a BAA e-circular, but it is well known that many comets appear to brighten more slowly as they approach closer to the Sun, in which case the extrapolation would be a long way out. In many cases this is just an appearance, caused by a change in aperture and magnification as the comet becomes brighter, and there is often little substantial change in the light curve.

2006 P1 image by Nick James on Jan 4

By the time the comet was lost in the twilight in mid November it had brightened to around 9th magnitude, and showed no sign of slowing down its rate of increase in brightness. The indications were however that it might be recoverable in twilight at the end of the year, and I gave predictions on the Section web page. As I write these have been borne out and at the beginning of 2007 the comet appears to be around 2nd magnitude, a little fainter than the simple extrapolation. Being optimistic, the indications are that the comet could be as bright as Venus, and perhaps brighter if there is significant forward scattering when it reaches a large phase angle close to the time of perihelion. The scattering angle is less than 40° from January 13 to 15, which could give a 10 fold (2 magnitude) increase in brightness.

I hope that by the time you receive your copy of the Comet's Tale you will have seen a Great Comet in the evening twilight with a long tail, and perhaps even have witnessed it during the daytime. I hope that readers will submit suitable illustrations for the next issue, including sketches as well as images.

Comet 2006 P1 (McNaught) imaged by Haakon Dahle on January 3

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Comet Section contacts

Director:	Jonathan Shanklin, 11 City Road, CAMBRIDGE. CB1 1DP, England. Phone: (+44) (0)1223 571250 (H) or (+44) (0)1223 221482 (W) Fax: (+44) (0)1223 221279 (W) E-Mail: JDS@AST.CAM.AC.UK or J.SHANKLIN@BAS.AC.UK WWW page : http://www.ast.cam.ac.uk/~jds/
Assistant Director (Observations): (and also Editor of *The Astronomer* magazine)	Guy Hurst, 16 Westminster Close, Kempshott Rise, BASINGSTOKE, Hampshire. RG22 4PP, England. Phone & Fax: (+44) (0)1256 471074 E-Mail: GUY@TAHQ.DEMON.CO.UK *or* GMH@AST.STAR.RL.AC.UK
Assistant Director (CCD):	Nick James, 11 Tavistock Road, CHELMSFORD, Essex. CM1 5JL, England. Phone: (+44) (0)1245 354366 E-mail: NDJ@BLUEYONDER.CO.UK
Photographic Advisor:	Michael Hendrie, Overbury, 33 Lexden Road, West Bergholt, COLCHESTER, Essex, CO6 3BX, England Phone: (+44) (0)1206 240021

The Section newsletter is now free to all BAA Members who make contributions to the work of the Section. The cost for other postal subscribers is £5 for three years, extended to four 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. You can also download the newsletter (in colour) from the Section web page.

Section News from the Director

Dear Section member,

Having decided to move to an annual publication schedule for *The Comet's Tale* time seems to have flown past and I'm now late in preparing the January edition. I have highlighted 2006 P1 on the front of this issue, as it promises to be an exciting object. There are some things to beware of: it is all to easy to see what you expect to see, to see what you want to see, and to misidentify something that you can see. This evening (January 4) after cloud cleared from the north, with some still near the horizon, I saw a bright star-like point, low down in the west, roughly where I was expecting to see comet McNaught. I couldn't see a tail, but internet reports suggested it was DC9, and it seemed roughly the right magnitude. The problem came when I tried to reduce the observation. My magnitude estimates, made over 20 minutes didn't tie together if I had seen the comet and also the object seemed too high above the horizon as shown by a planetarium program. It looks as if I observed λ Aquilae. I hope no-one else has made the same mistake! Something for the imagers to watch is making clear on submitted or posted images what the scale and orientation of the image is. Several that I've seen on the internet give no information at all, which effectively makes them useless. Images from people such as Martin Mobberley or Giovanni Sostero are good examples to follow.

When submitting observations it is very helpful if you can use **exactly** the right format. Sadly many observers, both visual and CCD use nearly, but not quite the approved format. This makes for a lot of extra work in editing them for further use. Visual observers please double check that you are correctly using the ICQ format by looking at the observations file http://www.ast.cam.ac.uk/~jds/2006obs.obs on the Section web page [At the moment there are no 2007 observations] and comparing your format with what is used here. Note that I delete leading zeroes from the day and month, however they are preferred by the ICQ. Imagers please use the standard name format, for example 2006p1_20070103_observer.jpg. DO NOT use c2006p1 as the comet name, DO NOT give the date as 07Jan03, DO NOT use DSCN0003.jpg and finally DO add your name. The image should include details of the identity of the comet, time of observation, exposure, telescope etc.

The debate on the status of Pluto came to a reasonably logical conclusion that it is not a major planet, however sadly it is not a comet. There is still room for debate on the precise meaning of clearing its zone of influence (I would suggest that should be the largest body in its zone of influence by an order of magnitude). As I was elected a member of the IAU at the meeting, I can reflect any views that I receive and would welcome comments relating to the minor bodies of the solar system.

It has been a very busy period for comet observing, particularly with 2006 M4 and I would like to thank everyone for their contributions, including: James Abbott, Jose Aguiar, Alexandre Amorim, David Arditti, John Ball, Alexander Baransky, Cédric Bemer, Peter Birtwhistle, Nicolas Biver, Reinder Bouma, Jean-Gabriel Bosch, Jose Carvajal, Matyas Csukas, Roger Dymock, Mike Feist, John Fletcher, Maurice Gavin, Stephen Getliffe, Antonio Giambersio, Michael Glenny, JJ Gonzalez, Bjorn Granslo, Peter Grego, Werner Hasubick, Guy Hurst, Michael Jager, Nick James, Ron Johnson, Geoffrey Johnstone, Andreas Kammerer, Carlos Labordena, James Lancashire, Pete Lawrence, Robin Leadbeater, Rolando Ligustri, Christopher Low, Pepe Manteca, Jose Martinez, Michael Mattiazzo, Alastair McBeath, Martin McKenna, Frank Melillo, Cliff Meredith, Richard Miles, Martin Mobberley, Fabrizio Montanucci, Stuart Moore, Martin Nelson, Bob Neville, Maciej Reszelski, Walter Robledo, Hirohisa Sato, Robin Scagell, Tony Scarmato, Jonathan Shanklin, Jeremy Shears, Giovanni Sostero, David Storey, David Strange, Melvyn Taylor, Vince Tuboly, Alex Vincent, Paul Yates and Seiichi Yoshida (apologies for any errors or omissions) for submitting observations or contributions since the last newsletter. Without these contributions it would be impossible to produce the comprehensive light curves that appear in each issue of *The Comet's Tale*. Observations from groups that currently do not send observations to the BAA would be much appreciated as they make a valuable addition to the analyses.

Comets under observation included: 2P/Encke, 4P/Faye, 29P/Schwassmann-Wachmann, 41P/Tuttle-Giacobini-Kresak, 71P/Clark, 73P/Schwassmann-Wachmann, 76P/West-Kohoutek-Ikemura, 84P/Giclas, 87P/Bus, 102P/Shoemaker, 117P/Helin-Roman-Alu, 177P/Barnard, 2003 WT42 (LINEAR), 2004 B1 (LINEAR), 2005 E2 (McNaught), 2005 YW (LINEAR), 2006 A1 (Pojmanski), 2006 HR30 (P/Siding Spring), 2006 L1 (Garradd), 2006 L2 (McNaught), 2006 M4 (SWAN), 2006 P1 (McNaught), 2006 T1 (Levy), 2006 U1 (LINEAR).

Best wishes for the New Year,

Jonathan Shanklin

Tales from the Past

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

150 Years Ago: For once there were no interesting reports in Monthly Notices!

100 Years Ago: A report from John Grigg of Thames, New Zealand dated 1906 March 22 records how he had found 2P/Encke & 1905 X1 (Giacobini). He commented that it would be useful to have the time of perihelion of the next return of a comet published in the Journal once the present return was over, as the news of recoveries published in the Journal always arrived too late. On March 19 he had found a new comet 1906 F1 (Ross), however it was noted by the Director that this had been discovered by Ross a day earlier than Grigg [*both were members of the Comet Section*]. A letter from David Ross dated March 21 records "It is gratifying to me to know that I have discovered another comet. What concerns me now is to know whether it is a new one or not, as there are several expected this year. Alongside this is one from Grigg dated April 12 which sends a further position and notes that he was informed of a previous sighting in Sculptor. Some observations of 1905 X1 by Fermor Rendell at the Natal Observatory, Durban are unusual for the time as they give magnitude estimates with respect to stars BD-12 201 and BD-11 221 on February 20 & 21. A paper by Edwin Holmes on "Notes and Queries Incidental to Mr Maunder's Research" discusses comet's tails, in particular that of 1680, where the tail changed direction by 180° in 18 hours. There appears to have been something of an argument between the two gentlemen judging by the meeting report! Further tail studies were reported from a paper by Herr Jagermann of Moscow in Astronomiche Nachtrichen. A paper on the structure of comets by Mr Thos Ranham was read by Mr Hardcastle. This explained comet tails by light pressure on very minute particles. He describes a flying sandbank model. At the May meeting Mr W T Lynn read a paper on 17P/Holmes, which had the least eccentric orbit of any of the comets [*Since then many even less eccentric comets have been discovered, including 29P/Schwassmann-Wachmann and 158P/Kowal-LINEAR which both have eccentricities less than 0.1*]. Mr Lynn commented that at the time of discovery it must have undergone a remarkable increase in brightness. The Section report for the BAA year (to the end of August) notes eight comets had been discovered. All were faint and few observations were made, though Mr Longbottom had photographed 1905 W1 (Schaer). At a New South Wales branch meeting in Sydney in June Mr H A Lencham, Acting State Astronomer, contributed an exhaustive paper on the "History of Comets" illustrated with many fine lantern slides. On page 353 appears a chart showing the path of 1P/Halley for January – August 1910, prepared by C Grover, who noted that there was increasing interest in the return. At the RAS December meeting Mr Crommelin drew attention to the serious discrepancy between predictions for the return of Halley's comet. Dr Angstrom gave 1910.08, whilst the Comte de Pontecoulant gave 1913.37. He suggested someone should make an independent computation. By January he, together with Mr Cowell had found that perihelion would probably be in May 1910, perhaps a fortnight earlier that Pontecoulant's prediction [*which suggests a typo in the date given as 1913.37*].

50 Years Ago: As noted in the last issue, at the March meeting Dr Merton opened a discussion on the observation of comets. George Alcock contributed a couple of tips: Observe from under a coat in order to maintain your dark adaptation. Cycle everywhere in bare hands, even in the coldest weather (he was now able to observe without gloves for some time with the air temperature 6° below freezing). [*If you have any tips that would help improve comet observing do let me know and I'll publish them in the next issue.*] Photographs of comets taken by Michael Hendrie, and drawings made by Roy Panther were shown at the Exhibition Meeting, which was held in April. The annual report notes that eight comets were observed during the session, with only 1955 O1 (Honda) being seen with the naked eye (by Michael Hendrie on August 17). The December comet notes highlight the discovery of 1956 R1 (Arend-Roland), which the Director hoped might reach 0^m in April, although he drew a note of caution. [*It was indeed an impressive object, as is recounted in the paper by Michael Hendrie in BAAJ 106 (6)*]. 27P/Crommelin had been recovered by Ludmilla Pajdusakova at Skalnate Pleso and by Michael Hendrie. The comet is named for a former Director of the Section who succeeded in linking comets found by Forbes (1928 W1), Pons (1818 D1) and Coggia and Winnecke (1873 V1). Comet 13P/Olbers had reached 6^m.

Meeting on Asteroids and Comets in Europe MACE 2006

Roger Dymock, Director Asteroids and Remote Planets Section

This year's three day meeting was held at the Kuffner Observatory on the outskirts of the Austrian capital, Vienna from 12th to 14th May. The seventy plus attendees (professionals and amateurs) from nineteen countries included three from the UK; Peter Birtwhistle, Richard Miles and Roger Dymock and two ex-pats; Matt Dawson (Luxembourg) and Robin Lauryssen-Mitchell (Czech Republic). The timing of the lectures allowed for travelling at civilised times to and from Heathrow. Very heavy traffic was encountered on leaving Vienna airport due road closures and the necessary policing to cater for high-level European and South American diplomats attending a summit meeting in Vienna - or was it for us ?!? The Kuffner Observatory was half an hours walk from our hotel - fifteen minutes on the flat to prepare one for the steep climb to follow.

The lectures were by both professional and amateur astronomers. A selection of presentations relating to comets is described here. A fuller account has been published in 'Impact' the newsletter of the Asteroids and Remote Planets Section and a short summary was also published in The Journal of the British Astronomical Association. The MACE web site is at; http://www.minorplanets.org/

Hermann Mucke (Austria), the 'Voice of astronomy in Vienna', presented 'Austrian monographs on comets and minor planets' describing the work of two Austrian observers, Michael 'Kometan' Jager and Erich Meyer. The monographs were freely available to attendees. Jager discovered comet 1998 U3 Jager and asteroid 78391 is named after him. He started observing comets in 1982 using binoculars and a 20cm Celestron Schmidt Camera. From photographs he extracted and documented data including; apparent total magnitudes, coma dimensions and densities and forms and lengths of tails. His monograph 'KOMETENBEOBACHTUNGEN 1982 TO 1995' describes 157 comets over that period. He has continued his work with Gerald Rhemann. Meyer using similar instruments but CCD imaging has replaced the earlier photography. Erich Meyer, who focussed on asteroid astrometry, had discovered 30 asteroids up to the end of 2003.

C Cremaschini (Italy) described an observing program to find comets in the asteroid population. This program will target objects with a Tisserand parameter wrt Jupiter of less than three on the assumption that all such bodies are comets rather than asteroids. Software has been written to search the MPCORB database and extract all asteroids with a similar Tisserand parameter. This program is described in full at http://asteroidi.uai.it/t3.htm If cometary features are not obvious in an image the FWHM of the potential comet is measured using Astrometrica. If this is 25% greater than neighbouring stars the object may well be a comet. Confirmation of the cometary nature of the object may then be sought from professional observatories.

G Sostero (Italy) shared 'Some thoughts about cometary CCD photometry'. He described a number problems associated with imaging comets; what size photometric aperture to use for measuring images (eg equivalent to 100,000 km at the distance of the comet), determining where the coma ends and the sky background begins, stacking of frames to obtain a reasonable SNR, the need to provide suitable reference star sequences, the use of different approaches for different targets and the lack of a standardized approach. Filters, to isolate strong emission lines, are required to determine Afrho which is a measure of the amount of dust produced by the comet and thus cometary activity. The CARA (Cometary Archive for Amateur Astronomers) web site can be found at http://cara.uai.it/

R Lauryssen-Mitchell (Czech Republic, British ex-pat) summarised the growing number of robotic telescopes which can be accessed via the internet by amateurs. These include; Slooh online Observatory (http://www.slooh.com), Bradford Robotic Telescope (http://www.Telescope.org), Faulkes Telescopes (http://faulkes-telescops.com), RAS Observatory (http://ras-observatory.org) and Red Mountain (a technology demonstrator rather than a real telescope). In general terms; an object is selected, a job request submitted, the images are taken at the appointed time and then the user downloads the images on to his own computer. Some telescopes give free time to amateurs whilst others charge by the hour. Alan Cahill is running a project for the ARPS to assess the suitability of such telescopes for the needs of Section members.

A Milani (Italy), in his usual robust manner, gave us a 'New Definition of Discovery for Solar System Objects'. Assigning discovery credit is difficult and a little controversial at times involving, as it does; observer(s), measurer(s) and orbit computer(s). The speaker's view was that all involved in a discovery deserved some credit. When claiming a discovery the observations used should normally allow its orbit to be calculated accurately enough to define its position in the Solar System eg; NEO, Main Belt or Edgeworth-Kuiper Belt. Potential discoveries of comets must include enough observational data to prove the presence of cometary activity and astrometry. Where professional sources (eg; SOHO) are used by amateurs to claim discoveries then the source should get some of the credit for the discovery. Rules for claiming discoveries of asteroids and comets are different and can lead to confusion and controversy when it is difficult to define the exact nature of the object. This definition was submitted to the IAU General Assembly held in Prague, 14th - 25th August 2006.

C Koebert (Austria) spoke on 'Meteorite impact cratering on Earth: Geological and biological consequences'. Many bodies; the inner planets, planetary satellites, asteroids and comets eg; 9P/Tempel and 19P/Borrelly, show a history of impacts stretching back over 3 to 4 billion years. Crater chains may be evidence of impacts by comets that have previously broken up. Presence of an atmosphere and plate tectonics will reduce the number of craters formed by impacts and their longevity respectively. Discriminating between impact craters and other similar structures requires an understanding of the structures; morphology, geophysics, mineralogy and geodensity. Large impact craters on Earth are believed to have caused environmental changes leading to mass extinctions. Significant volcanic action can be triggered by impacts dramatically changing the climate for millions of years after the initial event.

During the weekend we were kept up to date on the **disintegration of comet 73P/Schwassmann-Wachmann by G Sostero and E Guido**. A Spitzer space telescope image showed a Shoemaker-Levy 9 like train of 80 fragments. A movie compiled from Hubble images showed the expansion of small fragments away from the major components. Peter Birtwhistle's images showed that some fragments brightened significantly before fading. As with the Hubble images small fragments can be clearly seen moving away from the larger ones.

In addition to the lectures several visits had been arranged for participants. These included; Kuffner Observatory, Vienna University Observatory and one of the world's largest meteorite collections at the Vienna Natural History Museum. Most enjoyable was the evening meal at a typical Viennese Heuringen (restaurant), "10er Marie".

Herb Raab (of Astrometrica fame) and his organising committee are to be congratulated on an extremely well organised and very pleasant meeting.

Professional Tales

Many of the scientific magazines have articles about comets in them and this regular feature is intended to help you find the ones you've missed.

Photometry of cometary nuclei: Rotation rates, colours and a comparison with Kuiper Belt Objects; *Colin Snodgrass, Stephen C. Lowry, Alan Fitzsimmons* Mon. Not. Roy. Astron. Soc. 373 (2006)

We present time-series data on Jupiter Family Comets (JFCs) 17P/Holmes, 47P/Ashbrook-Jackson and 137P/Shoemaker-Levy. In addition we also present results from `snap-shot' observations of comets 43P/Wolf-Harrington, 44P/Reinmuth, 103P/Hartley and 104P/Kowal taken during the same run. The comets were at heliocentric distances of between 3 and 7 AU at this time. We present measurements of size and activity levels for the snap-shot targets. The time-series data allow us to constrain rotation periods and shapes, and thus bulk densities. We also measure colour indices (V-R) and (R-I) and reliable radii for these comets. We compare all of our findings to date with similar results for other comets and Kuiper Belt Objects (KBOs). We find that the rotational properties of nuclei and KBOs are very similar, that there is evidence for a cut-off in bulk densities at ~ 0.6 g cm^{-3} in both populations, and the colours of the two populations show similar correlations. For JFCs there is no observational evidence for the optical colours being dependant on either position in the orbit or on orbital parameters.

Constraints on the Formation Regions of Comets from their D:H Ratios *Jonathan Horner, Olivier Mousis and Franck Hersant* (To appear in: Earth, Moon and Planets)

Studies of the D:H ratio in H_2O within the Solar nebula provide a relationship between the degree of enrichment of deuterium and the distance from the young Sun. In the context of cometary formation, such models suggest that comets which formed in different regions of the Solar nebula should have measurably different D:H ratios. We aim to illustrate how the observed comets can give information about the formation regions of the reservoirs in which they originated. After a discussion of the current understanding of the regions in which comets formed, simple models of plausible formation regions for two different cometary reservoirs (the Edgeworth-Kuiper belt and the Oort Cloud) are convolved with a deuterium-enrichment profile for the pre-solar nebula. This allows us to illustrate how different formation regions for these objects can lead to great variations in the deuterium enrichment distributions that we would observe in comets today. We also provide an illustrative example of how variations in the population within a source region can modify the resulting observational profile. The convolution of a deuterium-enrichment profile with examples of proto-cometary populations gives a feel for how observations could be used to draw conclusions on the formation region of comets which are currently fed into the inner Solar system from at least two reservoirs. Such observations have, to date, been carried out on only three comets, but future work with instruments such as ALMA and Herschel should vastly improve the dataset, leading to a clearer consensus on the formation of the Oort cloud and Edgeworth-Kuiper belt.

UM Proposal for Deep Impact Extended Mission Clears Major Hurdle *UM press release.*

A University of Maryland proposal to send the Deep Impact spacecraft on an extended mission to get a close-up look at comet

85P/Boethin has cleared the biggest step in a two-step NASA approval process. On October 30 the space agency announced that two proposals to use the Deep Impact's flyby spacecraft for new missions were among the three "missions of opportunity" proposals chosen to provide detailed concept studies that NASA will use in the final selection process.

The proposed Deep Impact follow-on missions are called DIXI and EPOCh. The Maryland-led Deep Impact eXtended Investigation (DIXI) seeks to use the surviving Deep Impact spacecraft and its three working instruments (two color cameras and an IR spectrometer) for an extended flyby of 85P/Boethin. The Extrasolar Planet Observations and Characterization (EPOCh) mission would use the high resolution camera on the Deep Impact flyby craft to search for Earth-sized planets around other stars.

Mission DIXI

The University of Maryland-led team that produced the spectacular Deep Impact mission, which smashed an impactor into Comet 9P/Tempel in July 2005, hopes new information gathered from 85P/Boethin will help coalesce the vast array of new cometary information into solid ideas about the nature of comets, how they formed and evolved and if they have played a role in the emergence of life on Earth.

"As we try to interpret the larger meaning for all comets of our results from Deep Impact at 9P/Tempel, we have realized more and more how important is the variation from comet to comet," said Deep Impact leader and University of Maryland astronomer Michael A'Hearn. "Deep Impact's flyby spacecraft and payload are still healthy. We propose to direct the spacecraft for a flyby of Comet Boethin in December, 2008, to investigate whether the results found at 9P/Tempel are unique or are also found on other comets," he said. "This mission is a very cost effective way to provide new results that can be directly compared to the landmark Deep Impact findings as well as with the results of Deep Space 1 and Stardust and the earlier results from the numerous missions to Comet Halley." 85P/Boethin [*which wasn't observed at its last return*] is now inbound to the sun from its most distant point that is nearly out to the orbit of Saturn, A'Hearn says. "At encounter, 85P/Boethin will be just outside Earth's orbit, closer to the sun than was 9P/Tempel (at the orbit of Mars) but about the same distance from Earth."

Like Deep Impact, DIXI will be a partnership between the University of Maryland, NASA's Jet Propulsion Laboratory (JPL), and Ball Aerospace & Technologies Corporation. "One of the great surprises of comet explorations has been the wide diversity among the different cometary surfaces imaged to date," said A'Hearn, who will be principal investigator for DIXI. "Even on 9P/Tempel, the comet we've imaged the best, there is shocking variability in its surface. The comet's different surface types clearly have undergone different histories." A'Hearn says the data obtained from DIXI will also will help scientists determine which characteristics of comet structure and composition are primordial, reflecting conditions and processes that existed 4.5 billion years ago when the solar system formed, and which are the result of evolutionary forces (heating and cooling, impacts, etc.) that have acted on comets since that time.

"Data from comets can help us to better understand the origin of the solar system, as well as what role, if any, comets may have played in the emergence of life on Earth," said Jessica Sunshine, a member of the Deep Impact science team, who will be deputy principal investigator on DIXI. "However, we first must know which cometary characteristics are due to evolution and which are primordial."

Deep Impact Surprises

Deep Impact was the first large scale experiment ever conducted on a comet. The Deep Impact flyby spacecraft made many surprising discoveries on approach to 9P/Tempel. These include an extremely fluffy composition that largely insulates the interior from heat experienced by the surface; frequent, natural outbursts; major differences in the distribution of carbon dioxide and water; craters and other surprising geological features; demonstration that the ice below the surface must be evaporating (subliming) to water vapor, and the first detection of ice (a very small amount) on a cometary nucleus.

"Since half the discoveries at 9P/Tempel were from the flyby data taken before impact, DIXI can return half the science of Deep Impact for much less than 10 percent of the cost of Deep Impact," A'Hearn said. "From the point of view of cost effective science, an extended mission such as DIXI is unbeatable."

Stardust Results *Jon Shanklin*
Science, 2006 December 15.

Initial results from the Stardust mission to 81P/Wild are presented in a special section in Science for December 15. Perspectives by Mike A'Hearn and Don Burnett accompany seven research papers.

It is clear that 81P is a very different object to 9P/Tempel, perhaps reflecting different origins or different subsequent histories. Interestingly all three Jupiter Family Comets (9P, 19P/Borrelly & 81P) show signs of layering, most obvious in 9P. The size distribution of grains in 81P is quite different to that of 1P/Halley or 9P. The surprise from the analysis of captured particles from 81P is that all are mineral assemblages, with crystalline silicates such as olivine and pyroxene, along with troilite the most common. This is more akin to meteoritic composition than the amorphous material expected for comets, which was rare to non-existent. The isotopic abundances suggest that most material formed in the inner solar system, though some pre-solar grains are present. One grain matches the Calcium-Aluminium rich inclusions (CAI) found in meteorites, suggesting that there must have been mixing of material formed near the Sun with material as far out as the Kuiper Belt. The range of olivine and low calcium pyroxene compositions requires a wide range of formation conditions across the proto-planetary disk. CHON grains are very rare, however organic material is present. No hydrous silicates or carbonates were detected. The mean elemental composition is similar to CI meteoritic composition.

The Cambridge-Conference Network (CCNet)

CCNet was an electronic network devoted to catastrophism, but which included occasional information on comets. Over the last year or so it has become increasingly devoted to greenhouse warming scepticism, however there have been a few comet related items. To subscribe, contact the moderator Benny J Peiser at <b.j.peiser@livjm.ac.uk>. The electronic archive of the CCNet can be found at http://abob.libs.uga.edu/bobk/cccmenu.html

Clandestine comets found in main asteroid belt *Kimm Groshong*, NewScientist.com news service

You do not have to look to the outer edges of the solar system, or even out beyond Neptune to observe a reservoir of comets. A bevy of the ice-containing bodies lies disguised as main-belt asteroids between Mars and Jupiter, claim astronomers from the University of Hawaii, US. David Jewitt and Henry Hsieh have dubbed the new population "main belt comets". They describe three objects with near circular, flat orbits in the asteroid belt that stream volatile materials, producing an observable tail for weeks and months at a time.

The finding backs a theory that ice-bearing asteroids - or "comets" - from this much closer region may have played an important role in forming the Earth's oceans. Scientists once believed the icy comets from the outer regions of the solar system were the most likely source of the water that transformed the early Earth from a dry, barren world. But chemical analyses of comet water - carried out from a distance - ruled out the possibility. Another possibility was asteroids. But it had seemed impossible to study the water content of asteroids since most of their water appears to have dissipated or is now buried too deeply to observe.

Now Jewitt says this new population within the asteroid belt may provide a way to sample the chemicals in water on or near the surface of these objects. And he says the main-belt comets hold promise for future study as components of the protoplanetary disc that surrounded the Sun - the disc from which the planets formed. "They're a window to some early epoch, back when objects were accreting," he says. The new study underscores the increasingly hazy distinction between comets and asteroids. "There are different definitions of comet used by different people at different times," Jewitt told New Scientist. The two traditionally recognised comet reservoirs are the Kuiper Belt, a frigid region beyond Neptune's orbit, and the even more distant Oort Cloud. One definition describes a comet as an object following a highly elliptical, often inclined orbit with origins in one of these two reservoirs.

Carbonaceous covering

But another definition involves what an observer sees either with the naked eye or through a telescope - a comet's streaming gassy tail as it loses ice and other volatile materials through being warmed by the Sun. Jewitt says based on their nearly circular, stable orbits, the main belt comets are "completely asteroidal". You would never guess that they were anything but asteroids." But in terms of appearance, with their long-lasting tails, he says "they're definitely comets". The team believes in order to survive at such proximity to the Sun, the volatiles in the main belt comets would have to be covered by a layer of possibly carbonaceous material. They say an impact event could then uncover some of the volatiles, allowing the Sun's heat to trigger the observed outgassing.

Activated asteroids

Asteroid expert Richard Binzel at MIT questions the need for the new classification. "I prefer to think of them as activated asteroids," he told New Scientist. "It's no surprise if some asteroids have some water content, particularly in the outer asteroid belt." He says volatiles have been measured to make up about 10% of some carbonaceous meteorites that are thought to come from the region. Jewitt says potentially tens of thousands of main belt objects contain ice and have simply not been observed during their active period. In order to be seen spewing dust, the objects would have to have been hit by a meteor size boulder within the last thousand years or so, he adds.

The comets' tale: maybe the dirty snowball theory is wrong *David L. Chandler*, The Boston Globe

Three fly-by missions since 2001 have confounded almost everything astronomers thought they knew about the makeup of comets. Then, two weeks ago, University of Hawaii researchers announced the discovery of a whole new family of close-in comets -- which might help explain how the early Earth got its water. Our lack of knowledge could have dire consequences, scientists warn, because -- unlike asteroids, whose paths can be predicted years in advance -- comets could strike Earth with little warning. The missions have proven that we don't know enough about these dazzling lumps of ice and dirt to know how to respond.

But now, one astronomer has come up with a theory that might tie some of the loose ends together. Instead of the conventional view of a comet's nucleus as a solid, several-miles-wide rubble pile or dirty snowball, Michael Belton, a lead scientist for last year's Deep Impact comet mission, suggests that the nucleus may be more like a lump of papier mache -- built up from a random assortment of irregular sheets of varying thickness. "The presence of layers is ubiquitous" in the nuclei seen so far, Belton said, "and may be an essential element of their internal structure." In his view, the nuclei were built up gradually as hundreds of smaller bodies smashed together over time, each flattening out and sticking to the growing body, forming one layer after another.

Astronomers were startled and confused by the dramatic and unexpected differences between the nuclei of 9P/Tempel (seen by last year's Deep Impact mission), 81P/Wild (as seen by the Stardust mission in 2004) and 19P/Borrelly (seen by Deep Space 1 in 2001). Belton's new theory, which he outlined at a conference in Houston last month, identifies all the varied and unexplained features seen on these comets -- including supposed craters on 81P/Wild, mesa-like plateaus on 19P/Borrelly, and distinctly different, overlapping surface textures on 9P/Tempel - as different aspects of the layered model he nicknamed Talps (for "splat" spelled backwards).

Clark Chapman, a specialist in asteroids and comets at the Southwest Research Institute in Boulder, Colo., agrees with Belton that "it looks like comets have layers in them," but he said the theory is still untested. "It's a first step toward trying to understand comets differently." The new model would have significant implications for the life cycle of comets and for how we might attack a comet headed for Earth. Pushing aside a solid ball with a huge rocket or nuclear blast might make sense, but using the same approach against a ball of many layers might cause the comet to splinter and could magnify the damage rather than avert it, Belton suggests.

The find of a new type of comet -- the third known -- adds a lot of new questions to comet research and possibly helps answer a longstanding mystery: How the Earth has so much water when models suggest it shouldn't. As the solar system's inner planets coalesced from the cloud of gas and dust swirling around the sun, the sun's heat caused water to evaporate. The new discovery suggests that Earth's water supply might have been replenished by some comets or asteroids that initially formed just a bit farther out and so might have retained their ice as they hurtled around the sun and eventually smashed into our planet.

Astronomers Henry Hsieh and David Jewitt of the University of Hawaii announced late last month that they have found comets with asteroid-like orbits -- circling the sun as planets do, between Mars and Jupiter, instead of the very elongated orbits characteristic of all previously known comets. Finding comets like these suggests that there could be icy asteroids or comets that formed much closer to the sun than previously thought. They would have replenished Earth's water supply when they crashed into its surface. "I think it's very significant," Jewitt said, to find such a fundamentally different group of comets, which must have formed separately from all the others. But it will take more study to figure out how this new population will compare to the others and what kind of structure they might have. Being born in a hotter region of the growing solar system, for example, might have produced a different kind of layering, if any.

Belton, president of Belton Space Exploration Initiatives in Tucson, said he'd like to have a chance to prove his model by getting a closer look at some of these comets, particularly with a radar analysis -- which past missions couldn't perform -- that could clearly show whether the orb is layered deep down. It may be a while before he gets that wish, but the European Space Agency's Rosetta mission will provide close-up views in 2014 of another comet nucleus and will use microwaves to probe its inner structure. Other comet missions have been proposed. "The reconnaissance is over," Belton said. "It's time to get into the detailed exploration phase."

A comparision of an islamic contemporary comet reference and the anglo-saxon chronicle contemporary comet reference to halley's comet of 1066 ad. *A. A. Mardon*

The following are two different contemporary written references to Halley's Comet of 1066A.D. one from England and one from the Islamic world. Other comparisions between the Anglo-Saxon Chronicles records of cometary sightings give the substantiation that the ASC has historical veracity.

From the Islamic Medieval source Ibn al-Jawzi: "in the first tenth of Jumada I if this year a great comet with a long tail appeared in the east. Its width was around three yards and it stretched to the middle of the sky. It stayed until the twenty seventh and then disappeared. Then there appeared at the end of the same month at sun-set a heavenly body with light that surrounded it like that of the moon. People were frightened. When the night fell, the heavenly body developed a tail pointing south. It stayed for ten days and then disappeared"

From the Anglo-Saxon Chronicle: "Then was over all England such a token seen as no man ever saw before. Some men said that it was the comet-star, which others denominate the long-hair'd star. It appeared first on the eve called "Litania major", that is, on the eighth before the calends of May; and so shone all the week."

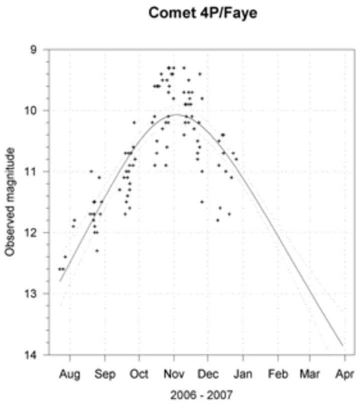
Review of comet observations for 2006 May - 2006 December

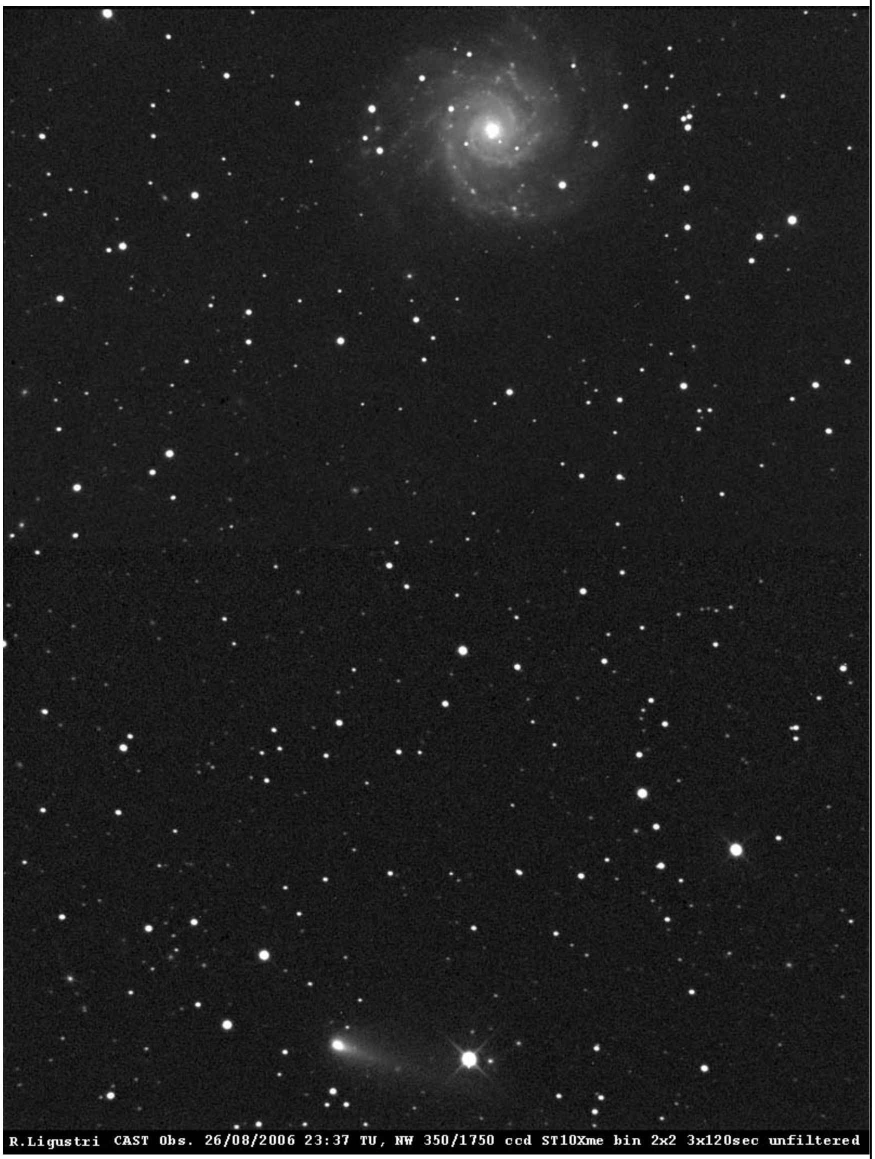
The information in this report is a synopsis of material gleaned from IAU circulars 8712 – 8787, The Astronomer (2006 May – 2006 November) and the Internet. Note that the figures quoted here are rounded off from their original published accuracy. Lightcurves for the brighter comets are from observations 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.

Information that used to be published in the Observing Supplement can be found on the Section web pages and in the BAA Guide to Observing Comets. Reminders of the observing circumstances of forthcoming comets will however continue to appear in these pages.

Comet **4P/Faye** behaved much as predicted and was at its brightest in late October at just brighter than 10th magnitude. The first observations put it at around magnitude 12.5 in late July, although the more southerly observers should have been able to pick it up earlier. It was brighter nearer the time of opposition than perihelion, suggesting that a phase factor may be needed in the light curve. There is some evidence for an outburst around Christmas.

The 104 observations received so far give an uncorrected preliminary light curve of $m = 8.0 + 5 \log d + 12.8 \log r$. The comet was markedly more condensed prior to perihelion than after. It will slowly fade, but should be observable into March.

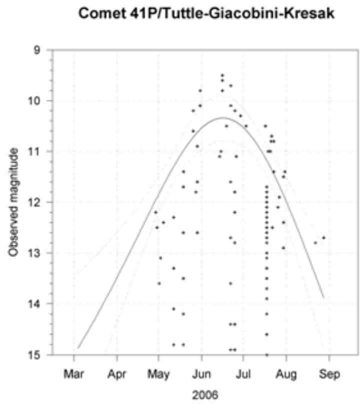


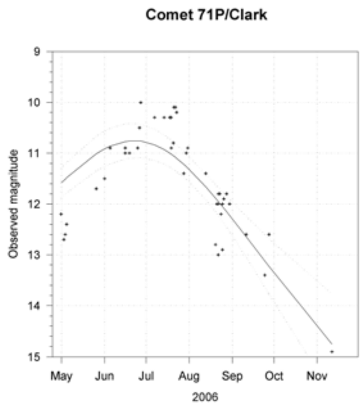


Comet Faye near M74 on August 26. Rolando Ligustri.

The annual comet **29P/Schwassmann-Wachmann** has frequent outbursts and over the past few years seems to be more often active than not, though it rarely gets brighter than 12m. It reached opposition in late November on the borders of Taurus and Perseus. It remains well placed and UK based observers should be able to follow it until the end of March, and it should be possible to recover it again in July. The comet was reported in outburst at around 13th magnitude in mid July 2006 and seems to have been brighter than 14th magnitude for most of the last six months. An image taken by Martin Mobberley on December 16.8 showed the comet at around 12th magnitude.

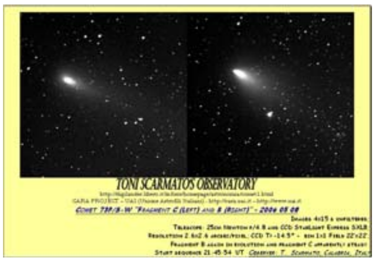
This was a good return for comet **41P/Tuttle-Giacobini-Kresak**, however relatively few observers covered it, perhaps concentrating on the more spectacular 73P. The CBAT prediction proved closer to the truth than mine, with the comet reaching just brighter than 10th magnitude. There were no signs of an outburst, unlike in the 1973 return. If it follows a similar light curve in 2017, when it has a close approach to the earth, it will be a naked eye object in March and April. The illustrated light curve includes CCD observations, which greatly contribute to the scatter. A series of studies by Toni Scarmato show the need for matching the magnitude reduction to the coma diameter as seen by visual observers – using too small a diameter results in a significant underestimate of the magnitude. The preliminary light curve from the 40 observations received so far is m = 9.4 + 5 log d + 17.2 log r.

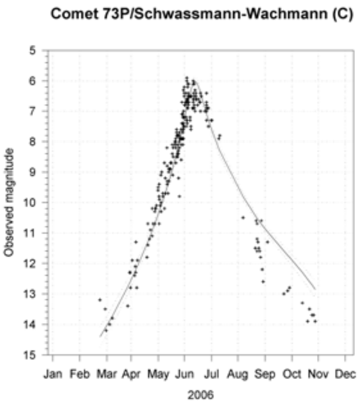




Comet **71P/Clark** was a southern hemisphere object, but was relatively well covered. It performed much as expected, just reaching 10th magnitude at its brightest. A standard light curve does not fit the data very well, and a better fit is obtained with a linear light curve, peaking 35 days after perihelion of $m = 6.0 + 5.0 * \log(\Delta) + 0.0400 * abs(t – T - 34.5)$

By early May, component C of comet **73P/Schwassmann-Wachmann** was being reported as visible to the naked eye; it was well condensed with a short tail and an easy object in binoculars. Component B changed in appearance from day to day, but was generally more diffuse. Observations showed a major outburst around May 8, making the fragment an easy object under light polluted skies. It showed quite an extreme aperture effect, being faintly visible to the naked eye, yet nearly two magnitudes fainter in 20x80B. After this the fragments rapidly headed south and were gone from UK skies after mid month. Further south, observers were able to continue following B until July and C until September. Observations received so far for component C (249) give an aperture corrected preliminary light curve of m = 11.3 + 5 log d + 5.5 log r, with a somewhat smaller aperture coefficient than normal, being 0.021 rather than 0.033.





Comet **76P/West-Kohoutek-Ikemura** was discovered in 1975 following a very close encounter with Jupiter in 1972 which produced one of the largest reductions of perihelion distance on record, reducing q from 5.0 to 1.4 AU. Lubos Kohoutek was actually taking a confirmation plate for a second comet (75P/Kohoutek) discovered 18 days earlier and then lost. Although 12m at the discovery apparition, it is another comet that has not done so well on subsequent returns and it did not trouble visual observers at its 2006 return. The comet was recovered by Peter Birtwhistle (station J95) in late August 2006. An image taken by Martin Mobberley on December 16.8 shows the comet at around 15th magnitude.

Comet **84P/Giclas** This is the comet's fourth observed return since its discovery in 1978 by Henry Giclas of the Lowell Observatory. The perihelion distance is fairly constant at present and Jupiter encounters only make significant changes to the angular elements. However around 2300, a low velocity close encounter with Jupiter will transfer the comet to an orbit outside that of the planet. Only one observation has come in so far, with Seiichi Yoshida estimating the comet at 14.1 on December 23 and it will continue to fade.

Peter Birtwhistle recovered comet **102P/Shoemaker** at the 2006 return, allowing an improved orbit to be computed, that includes non-gravitational parameters and links the 1991 and 2000 returns. It was not observed visually.

The distant comet **117P/Helin-Roman-Alu** was discovered in 1989 and can be observed most of the way round its orbit. An encounter with Jupiter in May 2002 reduced the perihelion distance from 3.7 to 3.0 AU. This has brought it into visual range, and a few observers estimated it at between 13th and 14th magnitude from August to September.

Meyer Group SOHO comets 2006 F6, 2006 J5, 2006 R3, 2006 U10 were discovered with the SOHO LASCO coronographs and have not been observed elsewhere.

SOHO Kreutz group comets 1998 J5, 1999 V5, 2003 B3, 2003 G5, 2006 D5, 2006 D6, 2006 E3, 2006 E4, 2006 F5, 2006 F6, 2006 F8, 2006 G2, 2006 G3, 2006 H2, 2006 H3, 2006 H4, 2006 H5, 2006 H6, 2006 J1, 2006 J2, 2006 J3, 2006 J4, 2006 J6, 2006 J7, 2006 J8, 2006 J9, 2006 J10, 2006 J11, 2006 J12, 2006 K6, 2006 K7, 2006 K8, 2006 K9, 2006 K10, 2006 K11, 2006 K12, 2006 K13, 2006 K14, 2006 K15, 2006 K16, 2006 K17, 2006 K18, 2006 K19, 2006 K20, 2006 K21, 2006 L3, 2006 L4, 2006 L5, 2006 L6, 2006 L7, 2006 L8, 2006 M5, 2006 M6, 2006 M7, 2006 M8, 2006 M9, 2006 N1, 2006 N2, 2006 N3, 2006 O3, 2006 O4, 2006 O5, 2006 O6, 2006 O7, 2006 O8, 2006 P2, 2006 P3, 2006 P4, 2006 P5, 2006 P6, 2006 P7, 2006 R4, 2006 S7, 2006 S8, 2006 S9, 2006 S10, 2006 S11, 2006 S12, 2006 S13, 2006 T2, 2006 T3, 2006 T4, 2006 T5, 2006 T7, 2006 T8, 2006 T9, 2006 T10, 2006 U8, 2006 U9, 2006 U11, 2006 U12, 2006 U13 were discovered with the SOHO LASCO coronographs and have not been observed elsewhere.

1999 X3 (SOHO) This was a non-group comet discovered in archival C2 images by Hua Su in May 2006.

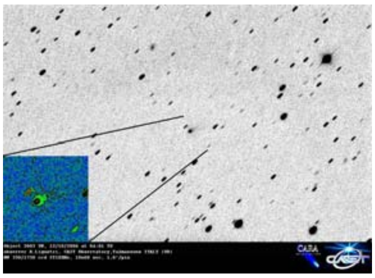
1999 RE_{70} (176P/LINEAR = 118401) Whilst monitoring members of the Themis familly of asteroids for signs of cometary activity H H Hsieh and Dave Jewitt of the University of Hawaii imaged asteroid 118401. Images taken on 2005 November 26 with the Gemini North telescope showed a tail 7" long, and confirming images were taken in December. The asteroid was found by LINEAR. In June 2006 the Committee on Small Bodies Nomenclature agreed to name and number the comet, although the asteroidal designation will be used for archiving any astrometry.

2000 EC_{98} (174P/Echeclus = 60558) Observations made since December 2005 appear to indicate that the main source of activity is a secondary body moving independently of the primary, possibly on a hyperbolic orbit. The object was at maximum elongation from the primary around February 25. It may be an escaped satellite or a debris fragment.

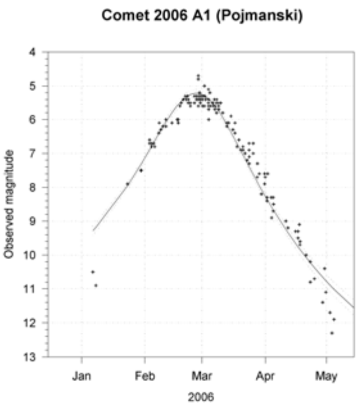
A/2000 KD_{41} [LONEOS] This unusual asteroid, currently of 20th magnitude, was discovered by LONEOS with the 0.59m Schmidt on 2000 May 26.2. [MPEC 2000-K39, 2000 May 31] It has a period of 6.2 years, with perihelion at 1.39 AU in mid December 2006. Its orbit is typical of a Jupiter family comet, and it can pass within 0.25 AU of the giant planet, last doing so in 1979. It is estimated at around 3km in diameter.

2005 YW (LINEAR) was originally identified as an unusual asteroid, of 20th magnitude. It was discovered by LINEAR with the 1.0-m reflector on December 21st. Currently 4 AU from the Sun, it reached perihelion at 2 AU in December 2006 and has a period of over 1000 years. At aphelion it is 190 AU from the

Sun. [MPEC 2005-Y43, 2005 December 27, 6-day orbit]. It was classed as a scattered disc object or cubewano and has a diameter of around 15 km. It was predicted to reach magnitude 17.5 at the end of 2006, but is then heading towards high southern declination.



In October 2006, L Buzzi and other Italian amateur observers including Ernesto Guido, Giovanni Sostero, Rolando Ligustri and Sergio Foglia reported that the object had a coma and tail, and was around 15th magnitude. The comet may brighten by a further magnitude towards perihelion. Brian Marsden notes on MPEC 2006-T62 [2006 October 12] that The "original" and "future" barycentric values of 1/a are +0.005508 and +0.006832 (+/- 0.000006) AU^-1, respectively. The size of the "original" value suggests that this comet has made a previous visit to the inner solar system.



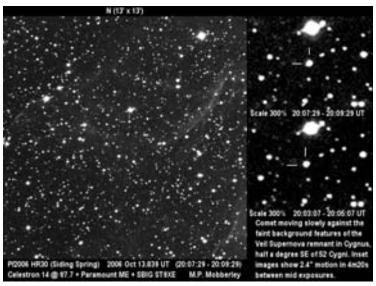
2006 A1 (Pojmanski) Observations in May suggest that more rapid fading occurred as the comet was around 12th magnitude and it wasn't seen after the end of the month. The preliminary light curve from the 143 observations received so far is m = 7.7 + 5 log d + 8.3 log r.

A/2006 BF_{208} [Catalina] This unusual asteroid, of 20th magnitude, was discovered by the Catalina Sky Survey with the 0.68m Schmidt on January 31. The orbit has a period of 15 years with perihelion at 3.08 AU in 2006 December. It does not currently approach close to Jupiter.

A/2006 FV_4 [Catalina] This unusual asteroid, of 19th magnitude, was discovered by the Catalina Sky Survey with the 0.68m Schmidt in March. [MPEC 2006-H28, 2006 April 22] It has a period of 36 years, with perihelion at 3.3 AU in early December. There have been no significant encounters with Jupiter.

2006 GZ_2 Spacewatch This object, of 20th magnitude, was discovered from the Steward Observatory with the 0.9m reflector on April 7.18 and was initially classed as an asteroid. It was in a retrograde orbit and was suspected as being diffuse on follow up images from Klet. It was confirmed as cometary following closer inspection of the Spacewatch images. It was due at perihelion at 3.3 AU in late August.

2006 HR_{30} (Siding Spring) This object, of 19th magnitude, was discovered during the Siding Spring Survey with the 0.5m Uppsala Schmidt on April 20.78 and initially classed as an asteroid. It has a period of 22 years and perihelion is at 1.23 AU in early January 2007. It can approach to within 0.6 AU of Jupiter and a similar distance from the Earth. Subsequent observations have confirmed my suggestion that this was a possible cometary candidate. Observations by S Lowry and Alan Fitzsimmons with the ESO 3.5m NTT telescope and by M Hicks and K Lawrence with the 5m Palomar telescope both show a coma. The cometary characteristics seem to have been fleeting, and the object reverted to essentially asteroidal nature. Images by Martin Mobberley in December show it at around 14th magnitude.



2006 HW_{51} (Siding Spring) This unusual object, of 18th magnitude, was discovered during the Siding Spring Survey with the 0.5m Uppsala Schmidt on April 23.49. Initially it was classed as a scattered disk object or cubewano on account of its long period orbit, with an estimated diameter of 18km. Perhaps as expected subsequent observations with a large telescope revealed a faint coma. Alan Fitzsimmons observing with the 2.0-m Faulkes North telescope on June 4.3 noted a 3" coma. The new orbit is parabolic, but still with perihelion at 2.3 AU in late September. Brian Marsden notes on MPEC 2006-N10 [2006 July 7] that *The "original" and "future" barycentric values of 1/a are +0.000015 and +0.000058 (+/- 0.000019) AU^-1, respectively*. The small "original" value suggests that this is a "new" comet from the Oort cloud.

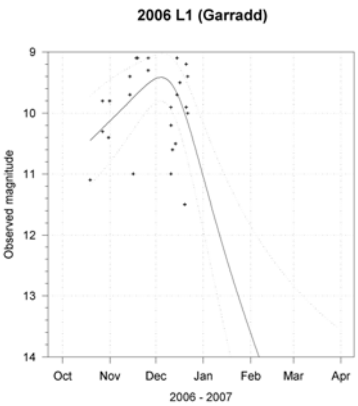
2006 K1 (McNaught) Rob McNaught discovered another comet during the course of the Siding Spring Survey on May 17.72. The object was 18th magnitude. Further observations changed the preliminary orbit completely and the new estimate is for perihelion at 4.4 AU in July 2007. Brian Marsden notes on MPEC 2006-P39 [2006 August 11] that *The "original" and "future" barycentric values of 1/a are +0.000016 and +0.001057 (+/- 0.000019) AU^-1, respectively*. The small "original" value suggests that this is a "new" comet from the Oort cloud.

2006 K2 (P/McNaught) Rob McNaught discovered another comet during the course of the Siding Spring Survey on May 22.16. The object is 18th magnitude and near opposition. It reached perihelion at 2.1 AU in late June 2006 and has a period of 7.1 years.

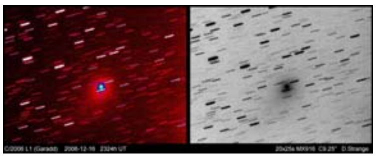
2006 K3 (McNaught) Rob McNaught discovered a second comet the same night, during the course of the Siding Spring Survey on May 22.34. The object is 18th magnitude and reaches perihelion at 2.5 AU in mid March 2007. It might reach 14th magnitude. Brian Marsden notes on MPEC 2006-S43 [2006 September 22] that *The "original" and "future" barycentric values of 1/a are +0.000005 and -0.000178 (+/- 0.000025) AU^-1,* *respectively.* The small "original" value suggests that this is a "new" comet from the Oort cloud.

2006 K4 (NEAT) NEAT discovered their 52nd comet on May 18.45. The 20th magnitude object reaches perihelion at 3.2 AU in late November 2007. It had reached 17th magnitude by August 2006. Brian Marsden notes on MPEC 2006-Q46 [2006 August 29] that *The "original" and "future" barycentric values of 1/a are +0.000927 and +0.000889 (+/- 0.000050) AU^-1, respectively.* The large "original" value suggests that the comet has previously visited the inner solar system.

2006 K5 (SOHO) This was a non-group comet discovered in C3 images by Hua Su in May 2006.

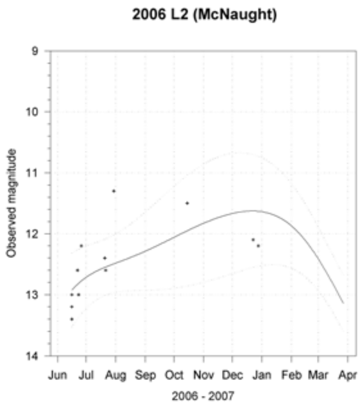


2006 L1 (Garradd) Gordon Garradd discovered his first comet during the course of the Siding Spring Survey on June 4.38. The object was 18th magnitude at discovery. It reached perihelion at 1.5 AU in October 2006. The comet has proven brighter than expected and is now visible to northern hemisphere observers at around 9th magnitude. It will continue to brighten a little into early December. The preliminary light curve from the 28 observations received so far is m = 5.7 + 5 log d + 20.8 log r



2006 L1 imaged by David Strange on December 16

2006 L2 (McNaught) Rob McNaught discovered another comet during the course of the Siding Spring Survey on June 14.52. The object is 14th magnitude. It reached perihelion at 2.0 AU in late November 2006. The IAUC announcing the discovery suggested that it seems to be undergoing rapid brightness variation, changing by a magnitude in as little as ten minutes. Subsequent comments suggest that this was due to the object's low altitude and was not real. The comet should become visible to northern hemisphere observers as a 12th magnitude object in December. It rapidly becomes circumpolar and will slowly fade. Astrometric measurements in early August suggested a magnitude around 15.

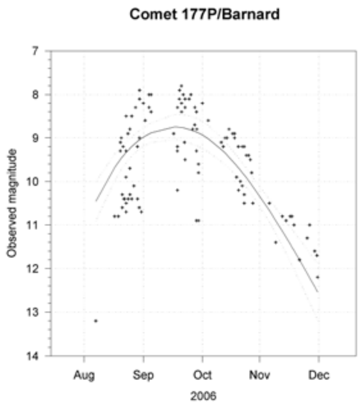


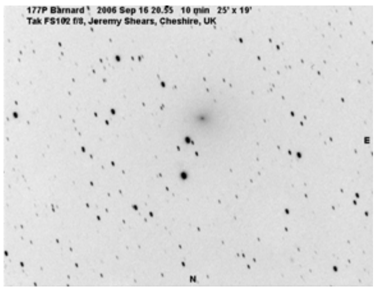
Brian Marsden notes on MPEC 2006-Q47 [2006 August 29] that *The "original" and "future" barycentric values of 1/a are +0.000052 and -0.000057 (+/- 0.000018) AU^-1, respectively.* The small "original" value suggests that the comet has not previously visited the inner solar system. The preliminary light curve from the 13 observations received so far is m = 5.1 + 5 log d + 14.8 log r.

A/2006 LM_1 [Mt Lemon] This unusual asteroid, of 21st magnitude, was discovered by the Mt Lemon Survey with the 1.5m reflector on June 3.42. It is in a retrograde orbit with a period of over 200 years and perihelion is at 3.7 AU in September. [MPEC 2006-L38, 2006 June 8, 2-day orbit].

2006 M1 (LINEAR) LINEAR discovered an 18th magnitude comet on June 18.32. Originally noted as asteroidal, it was confirmed as showing cometary features by Peter Birtwhistle and others. The comet is at perihelion at 3.6 AU in 2007 February and moves in a long period orbit of around 2000 years. Brian Marsden notes on MPEC 2006-P16 [2006 August 4] that *The "original" and "future" barycentric values of 1/a are +0.006872 and +0.006441 (+/- 0.000004) AU^-1, respectively.* The large "original" value suggests that this is not a "new" comet from the Oort cloud.

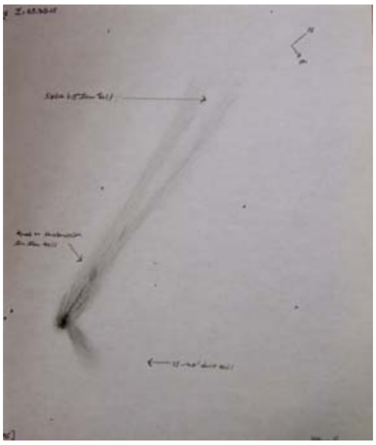
2006 M2 (Spacewatch) Spacewatch discovered a 21st magnitude object on June 19.31, that was found to show weak coma following posting on the NEOCP. The preliminary parabolic orbit is retrograde with perihelion at 5.2 AU in 2005 November.





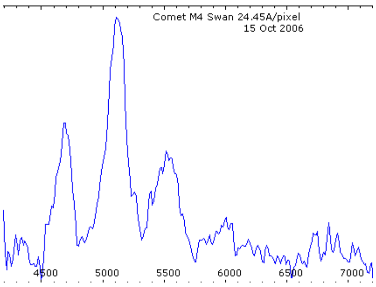
2006 M3 (177P/Barnard) A 17th magnitude asteroidal object found by LINEAR on June 23.26 was shown to have cometary characteristics following posting on the NEOCP. Dan Green suggested that it might be a return of comet 1889 M1 (P/Barnard) and Brian Marsden confirmed the identification. At this return the comet has a period of 120 years. Despite a favourable return it seemed unlikely to exceed 14th magnitude given the initial magnitude estimates. As is often the case, early magnitude estimates by CCD observers were approximating to m_2 rather than the published m_1 and by mid July the comet was reported at around 10th magnitude. It was however very diffuse, so much harder to see than the magnitude suggests.

It seems to have peaked at around 8th magnitude in August and then faded rapidly. The preliminary aperture corrected light curve from the 104 observations received so far is m = 9.1 + 5 log d + 16.8 log r.



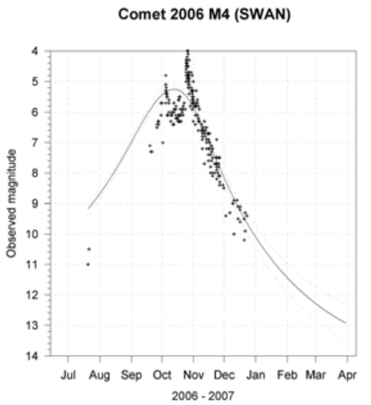
Sketch by Martin McKenna on October 4

2006 M4 (SWAN) Michael Mattiazzo and Rob Matson found an object in SWAN images from late June, which was found on images taken by Terry Lovejoy on June 30. The comet was confirmed with images taken by Rob McNaught with the Uppsala Schmidt on July 12. It passed through the SOHO LASCO coronagraph field between August 11 and the end of the month, but was barely visible. It emerged from conjunction in mid September as an 8th magnitude object in the morning sky. The comet reached perihelion in late September at 0.8 AU.



Spectrum by Robin Leadbeater

David Storey recovered the comet from the Isle of Man on September 15. His image showed the comet close to the predicted track, well condensed and about 8th magnitude. Martin McKenna observing from Northern Ireland on September 26 reported a naked eye observation, and a 30' tail in binoculars during a morning observing session. Observing with 20x80B from near Dorchester in Oxfordshire on October 4.80 I noted the comet as 5th magnitude, appearing much like a globular cluster. This appears to have been a short lived outburst as a few nights later it was back to 6th magnitude. A second outburst occurred around October 24, and that evening I was surprised to find it at around mag 4.5 with a short tail. Infra-red observations on November 7, made with the MMT suggest the presence of a secondary condensation, perhaps originating in the October 24 outburst.



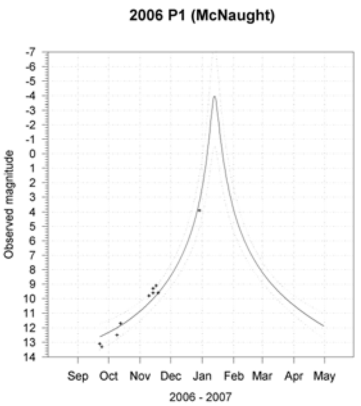
Comet C/2006 M4 (SWAN) and M13. 2006 October 26. 30x30s. 1842-1900UT. Canon EOS 10D. 100mm, f/2 lens at f/2.5, ISO 200. FOV 6.3 x 4.7 degrees, N up. Nick James.

Brian Marsden notes on MPEC 2006-S89 [2006 September 29] that *The "original" and "future" barycentric values of 1/a are +0.000106 and +0.000658 (+/- 0.000072) AU^-1, respectively.* The small "original" value suggests that this is a "new" comet from the Oort cloud on its first pass through the inner solar system. The preliminary light curve from the 267 observations received so far is m = 5.8 + 5 log d + 9.1 log r

2006 O1 (178P/Hug-Bell) D Tibbets and Gary Hug recovered comet 1999 X1 (Hug-Bell) on July 16.40 with the 0.7-m reflector at the Farpoint Observatory Eskridge, Kansas. The correction to the perihelion time predicted on MPC 48383 was -0.12 day. Following recovery it was numbered 178P.

2006 O2 (Garradd) Gordon Garradd discovered his second comet during the course of the Siding Spring Survey on July 30.39. The object is 17th magnitude and it reached perihelion at 1.6 AU in early October 2006.

2006 OF_2 (Broughton) This object, of 18th magnitude, was discovered by John Broughton with his 50-cm reflector at Reedy Creek on July 17.66. It was in a highly eccentric orbit and was 7.6 AU from the Sun. This suggested that it might in fact be a comet and as I suggested the object eventually grew a coma, which was detected by Carl Hergenrother on CCD frames taken with the 1.54m reflector at Catalina on 2006 September 20.11. The latest orbit is slightly hyperbolic with perihelion at 2.4 AU in 2008 September. It should emerge from solar conjunction in 2008 June as a 12th magnitude object and peak at 11th magnitude in November. It is circumpolar for northern hemisphere observers when brightest during the autumn of 2008 and will remain visible until 2009 May. Brian Marsden notes on MPEC 2006-S91 [2006 September 29] that *The "original" and "future" barycentric values of 1/a are -0.000063 and -0.000749 (+/- 0.000071) AU^-1, respectively.* The small "original" value suggests that this is a "new" comet from the Oort cloud on its first pass through the inner solar system.



2006 P1 imaged by Michael Jaeger on November 15

2006 P1 (McNaught) Rob McNaught discovered another comet, during the course of the Siding Spring Survey, on August 7.51. The object was 17th magnitude and reaches perihelion at 0.17 AU in mid January 2007. The orbit suggested that it would be a bright object in the SOHO (& STEREO) fields when it reached perihelion. It will fade rapidly after perihelion and will not be visible from the Northern Hemisphere. It came within visual range in September, with visual observations continuing into November, by which time it had reached 9th magnitude. Some observers imaged the comet in early December, although the posted images give no scale or orientation, making interpretation difficult. [**As an aside it is very important that all images should include indication of the scale and orientation, with observers such as Martin Mobberley or Giovanni Sostero providing good examples of possible styles to follow**]. Michael Jaeger imaged the comet

Comet 2006 M4 near M13 on October 27. Rolando Ligustri

in late December, and Bjorn Granslo obtained a visual observation on December 29, estimating it at 3.9. Following perihelion it will be visible in the SOHO LASCO C3 field from January 12 to 15. The preliminary light curve from the 10 observations received so far is m = 5.3 + 5 log d + 11.3 log r which suggests that it could reach -4. Brian Marsden notes on MPEC 2006-V20 [2006 November 8] that *The "original" and "future" barycentric values of 1/a are +0.000059 and +0.000518 (+/- 0.000048) AU^-1, respectively.* The small "original" value suggests that this is a "new" comet from the Oort cloud on its first pass through the inner solar system. Such comets often brighten more slowly when they approach closer to the Sun, however it could still be a negative magnitude object for Southern Hemisphere observers when it emerges from solar conjunction.

2006 Q1 (McNaught) Rob McNaught discovered his 32nd comet, during the course of the Siding Spring Survey, on August 20.74. The object is 18th magnitude and still over 6 AU from the Sun. The comet will reach perihelion at 2.8 AU in early July 2008. This implies that it will come into visual range for southern hemisphere observers late in 2007 and peak at around 11th magnitude. Northern observers may pick it up at 13th magnitude late in 2008. Rob now equals the record for individually named comet discoveries with the Shoemakers. Brian Marsden notes on MPEC 2006-V21 [2006 November 8] that *The "original" and "future" barycentric values of 1/a are -0.000002 and +0.000657 (+/- 0.000048) AU^-1, respectively.* The small "original" value suggests that this is a "new" comet from the Oort cloud on its first pass through the inner solar system.

2006 Q2 (P/LONEOS) A 19th magnitude asteroid was discovered by LONEOS on August 29.27 and when posted on the NEOCP was found to show a coma and tail by Peter Birtwhistle and others. The object was at perihelion at 1.3 AU in early September and has a period of 6.0 years. It was near its brightest and will fade after mid September.

A/2006 QL_{39} [LONEOS] This unusual asteroid, of 19th magnitude, was discovered by LONEOS with the 0.59m Schmidt on August 19. [MPEC 2006-Q44, 2006 August 29] It has a period of 11.6 years, with perihelion at 2.04 AU in 2007 February. Its orbit is at the long end of those for Jupiter family comets, but it can pass within 0.5 AU of the giant planet, although it has not done so recently.

A/2006 QM_{111} [Siding Spring] This asteroid, of 16th magnitude at discovery, was discovered during the Siding Spring Survey with the 0.5m Uppsala Schmidt on August 31.54. It has a period of 4.7 years and perihelion was at 0.69 AU in mid October. [MPEC 2006-Q68, 2006 August 31, 3-hour orbit]. The object passed very close to the Earth on August 31, with an MOID of 0.0011 AU. It can pass within 0.5 AU of Jupiter and is a potential comet candidate.

2006 R1 (Siding Spring) This object, of 18th magnitude, was discovered during the Siding Spring Survey with the 0.5m Uppsala Schmidt on September 1.49. The comet was near perihelion at 1.7 AU and will fade. It has a period of 13 years and moves in a retrograde orbit. Rob McNaught comments on the discovery *Donna Burton is being trained as a new observer for the Siding Spring Survey, initially as a replacement for Gordon Garradd who is on 2 months sick leave following a cycling accident. Sep 01 was Donna's first time alone at the telescope. When she found 6R6F4D3 she phoned me so I went to the telescope to check on the detection and show how to schedule follow up. The first follow up was involved with a star, but the next was good. All the data was submitted. It was only with a second call later in the night with her detection of 6R6F50C that I noticed that some of the 6R6F4D3 images looked a bit soft and checking back through the other images confirmed that all images had the same appearance of diffuseness. This was confirmed for certain on images taken the following night. Thus Donna discovered the object and I noted that it was a comet, hence "Siding Spring".* Brian Marsden commented on MPEC 2006-R41 [2006 September 10] It is still possible that the orbital period P is somewhat longer than the best-fit value of 16 years (which would be the shortest for a comet having a retrograde orbit). Further observations confirmed the short period, with the latest value being 13.3 years.

2006 R2 (P/Christensen) Eric Christensen discovered a 17th magnitude comet on September 14.32 during the course of the Catalina Sky Survey with the 0.68-m Schmidt telescope. It was at perihelion at 3.0 AU in mid June and has a period of 8.5 years. It will fade.

A/2006 RG$_1$ [Siding Spring] This asteroid, of 19th magnitude at discovery, was found during the Siding Spring Survey with the 0.5m Uppsala Schmidt on September 1.70. It is in a retrograde orbit and has a period of 48 years with perihelion at 2.0 AU at the end of November. [MPEC 2006-R36, 2006 September 9, 4-day orbit].

A/2006 RG$_2$ [Catalina] This unusual asteroid, of 19th magnitude, was discovered by the Catalina Sky Survey on September 14.46. [MPEC 2006-S02, 2006 September 16, 2-day orbit] It has a period of 8.7 years and perihelion was at 1.0 AU in mid December. Whilst a possible JFC it only passes within 0.6 AU of Jupiter and 0.1 AU of the Earth.

A/2006 RJ$_2$ [Catalina] This unusual asteroid, of 19th magnitude, was discovered by the Catalina Sky Survey on September 14.40. [MPEC 2006-R51, 2006 September 15, 1-day orbit] It is in a retrograde orbit with a period of 58 years and perihelion was at 2.4 AU in mid August.

A/2006 RY$_{102}$ [NEAT] This unusual asteroid, of 19th magnitude, was discovered by NEAT on September 14.37. [MPEC 2006-T33, 2006 October 5] It has a period of 15.8 years and perihelion is at 4.56 AU in early January 2009. Whilst a possible JFC it only passes within 0.7 AU of Jupiter.

2006 S1 (P/Christensen) Eric Christensen discovered another 17th magnitude comet on September 16.25 during the course of the Catalina Sky Survey with the 0.68-m Schmidt telescope. It was at perihelion at 1.4 AU at the end of August and has a period of 6.5 years. It will fade.

2006 S2 (LINEAR) LINEAR discovered a 19th magnitude object on September 17.17. Originally noted as asteroidal, it was confirmed as showing cometary features by J Young at Table Mountain Observatory. The comet is at perihelion at 3.2 AU in 2007 May.

2006 S3 (LONEOS) A 19th magnitude comet was discovered by LONEOS on September 19.32 and when posted on the NEOCP was confirmed as cometary by Peter Birtwhistle, Richard Miles and others. Perihelion is near 5.2 AU in 2012 April. The orbit suggests that it could reach 12th magnitude near the time of perihelion.

2006 S4 (P/Christensen) Eric Christensen discovered another 17th magnitude comet on September 22.37 during the course of the Catalina Sky Survey with the 0.68-m Schmidt telescope. It was at perihelion at 3.1 AU in early 2006 June, and will fade. It has a period of 16 years.

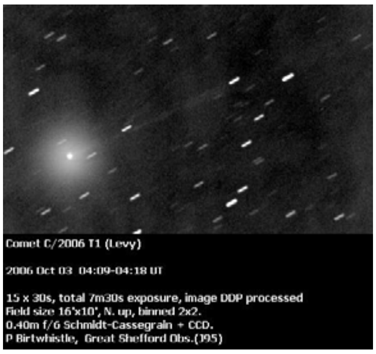
2006 S5 (Hill) BAA Member, Rik Hill discovered an 18th magnitude comet on September 28.28 during the course of the Catalina Sky Survey with the 0.68-m Schmidt telescope. It will be at perihelion at 2.6 AU in 2007 December, and could reach 13th magnitude around the time of perihelion. Brian Marsden notes on MPEC 2006-V22 [2006 November 8] that *The "original" and "future" barycentric values of 1/a are +0.009930 and +0.010421 (+/- 0.000165) AU^-1, respectively.* The large "original" value suggests that this is not a "new" comet and has made a previous pass through the inner solar system.

2006 S6 (P/Hill) Rik Hill discovered a second comet on the same night, also of 18th magnitude. This one was found on September 28.40. It was at perihelion at 2.4 AU in mid 2006 October, and has a period of 8.5 years. It will not brighten significantly.

A/2006 SH$_7$ [Catalina] This unusual asteroid, of 20th magnitude, was discovered by the Catalina Sky Survey on September 18.34. [MPEC 2006-S24, 2006 September 19, 1-day orbit] It is in an orbit with a period of 7.9 years and perihelion is at 1.1 AU in early November. It can pass within 0.2 AU of Jupiter and 0.13 AU of the Earth, and is a JFC candidate.

A/2006 SO$_{134}$ [Steward] This unusual asteroid, of 21st magnitude, was discovered from the Steward Observatory with the 0.9m reflector on September 19.27. It has a period of 93 years and perihelion was at 3.3 AU in mid July 2006. [MPEC 2006-S79, 2006 September 28, 13-day orbit]. It can approach to within 1 AU of Jupiter. Aphelion is at 38 AU. Given that it is well past perihelion it is unlikely to show cometary activity.

A/2006 SK$_{198}$ [Catalina] This unusual asteroid, of 20th magnitude, was discovered by the Catalina Sky Survey on September 28.40. [MPEC 2006-S102, 2006 September 30, 2-day orbit] It is in an orbit with a period of 6.8 years and perihelion is at 0.2 AU in 2007 April. There have been no recent close approaches to Jupiter but it can pass within 0.11 AU of the Earth.



2006 T1 (P/Levy) David Levy made a visual discovery of a comet on October 2.50. Observing near Saturn with his 0.41-m reflector he noted a diffuse object of magnitude 10.5. The cometary nature of the object was confirmed by Peter Birtwhistle and Richard Miles amongst others. The Japanese comet hunter Shigheki Murakami made an independent discovery of the comet on October 4, but by this time the object had been placed on the NEOCP and an IAUC issued. Calculations by Hirohisa Sato suggested a periodic orbit, and an MPEC was issued on October 7 confirming this. The period is 5.2 years, which perhaps suggests that it was discovered in outburst. The comet was at perihelion at 1.0 AU on October 7 and faded. Several people, including Cédric Bemer, have suggested the possibility of a meteor shower from the comet around December 31/January 1. The orbit is however still a little uncertain, so it is not clear how much meteoric material is likely to be present. At its next return in 2011 the comet makes a close approach to the Earth. Calculations by Andrew Lowe suggest an approach to 0.024 AU, with the comet perhaps visible to the naked eye. If the comet is fragmenting it may be more likely to have a significant dust trail present. Initial visual and CCD observations suggested that the comet was perhaps a magnitude brighter than the discovery magnitude.

2006 T6 (SOHO) This was a non-group comet discovered in C3 and C2 images by Bo Zhou on October 10 2006. Superficially the track appeared similar to that of the Meyer group comets.

2006 U1 (P/LINEAR) An apparently asteroidal object of 17th magnitude, discovered by LINEAR on October 19.40 has been found to be cometary by other observers. It has the short period of 4.6 years, and was at perihelion at 0.5 AU at the end of August. It will fade.

2006 U2 (179P/Jedicke) J V Scotti recovered comet 1995 A1 (P/Jedicke) with the Spacewatch II telescope at Kitt Peak on October 22.19. The comet was nearly stellar at magnitude 21. The indicated correction to the prediction on MPC 51823 is Delta(T) = -1.0 day.

2006 U3 (180P/NEAT) J. L. Ortiz and A. Mora recovered comet 2001 K1 (P/NEAT) on CCD images obtained with the 2.5-m Isaac Newton Telescope at La Palma. The images were measured by Reiner Stoss. The comet was essentially stellar and magnitude 22. The indicated correction to the prediction on MPC 54169 is Delta(T) = -0.4 day. This confirms a tentative identification made by Reiner of the comet on Palomar Sky Survey plates from 1955.

2006 U4 (181P/Shoemaker-Levy) Rob McNaught and D Burton recovered comet 1991 V1 (P/Shoemaker-Levy) on October 26.47 with the 0.5m Uppsala Schmidt at Siding Spring. The comet was 18th magnitude and the indicated correction to the elements on MPC 48384 is Delta(T) = +8.0 days. The comet is a month from perihelion and substantially fainter than expected. Predictions based on the last return suggest that it should be 11th magnitude, so unless the light-curve is unusual it will not come within visual range.

2006 U5 (Christensen) Eric Christensen discovered an 18th magnitude comet on October 27.39 during the course of the Catalina Sky Survey with the 0.68-m Schmidt telescope. It will brighten a little. Calculations by Kenji Muraoka suggested that it was a periodic comet, with perihelion at 2.4 AU in late 2006 November and period 7.8 years. Further observations refined the period to 6.6 years, with perihelion at 2.3 AU in mid 2007 January.

2006 U6 (Spacewatch) Spacewatch discovered a 20th magnitude asteroidal object on October 19.13, that was found to show weak coma following posting on the NEOCP. The latest parabolic orbit gives perihelion at 2.5 AU in 2008 June. It could reach 14th magnitude around the time of perihelion.

2006 U7 (Gibbs) Alex Gibbs discovered a 21st magnitude comet on October 28.30 during the course of the Mt Lemon survey with the 1.5-m reflector. An orbit determination by Hirohisa Sato suggested that the orbit might be periodic, with period around 40 years. This was confirmed by a new orbit published on MPEC 2006-W18, and the latest orbit gives perihelion at 4.4 AU in 2007 March.

A/2006 UO [Steward] This unusual asteroid, of 21st magnitude, was discovered from the Steward Observatory with the 0.9m reflector on October 17.48. It has a period of 5.6 years and perihelion is at 0.9 AU in mid December 2006. [MPEC 2006-U12, 2006 October 18, 1-day orbit]. It can approach to within 0.2 AU of Jupiter and 0.03 AU of the Earth. The orbit is typical of a Jupiter-family comet.

A/2006 UN$_{216}$ [Catalina] This unusual asteroid, of 19th magnitude, was discovered by the Catalina Sky Survey on October 28.37. [MPEC 2006-U94, 2006 October 30, 2-day orbit] It is in an orbit with a period of 6.1 years and perihelion is at 1.2 AU in late December. It can pass within 0.1 AU of Jupiter (most recently around 1948) and 0.24 AU of the Earth (in December), and is a JFC candidate.

2006 V1 (Catalina) An 18th magnitude comet was discovered with the 0.68-m Schmidt telescope during the course of the Catalina Sky Survey on November 11.49. The latest orbit places it at perihelion at 2.7 AU in 2007 November.

2006 VZ_{13} (LINEAR) This unusual asteroid, initially classed as an Amor, of 20th magnitude, was discovered by LINEAR on November 13.13. With a period of 40 years, a retrograde orbit and perihelion at 1.33 AU in 2007 September it seemed a likely cometary candidate. Richard Miles noted that his astrometric images appeared slightly softer than stellar images and this was confirmed by Carl Hergenrother using the University of Arizona's 1.54-m Kuiper reflector at the Catalina station on December 1st and 2nd. The new orbit is parabolic, with perihelion at 1.02 AU in mid August 2007. The comet could come into visual range in June and reach 10th magnitude in July.

2006 W1 (P/Gibbs) Alex Gibbs discovered a 19th magnitude comet on November 16.41 during the course of the Catalina Sky Survey with the 0.68-m Schmidt. The latest elliptical orbit giving a period of 14 years suggests that perihelion was at 1.7 AU in 2006 March.

2006 W2 (182P/LONEOS) Eric Christensen has recovered comet 2001 WF_2 (P/LONEOS) with the Catalina Sky Survey 0.68-m Schmidt. The comet was 20th magnitude and the indicated correction to the elements on MPC 51822 is Delta(T) = -0.05 day.

2006 W3 (Christensen) Eric Christensen discovered an 18th magnitude comet on November 18.40 during the course of the Catalina Sky Survey with the 0.68-m Schmidt telescope. Peter Birtwhistle was amongst those making confirming observations. The latest orbit gives perihelion at 3.1 AU in 2009 July.

2006 W4 (P/Hill) Rik Hill discovered a 19th magnitude comet during the course of the Catalina Sky Survey on November 22.34. Peter Birtwhistle was one of the observers providing confirming images. It will be at perihelion at 4.4 AU in January 2009, and has a period of 17 years.

A/2006 WZ_2 [Catalina] This unusual asteroid, of 20th magnitude, was discovered by the Catalina Sky Survey on November 17.51. [MPEC 2006-W45, 2006 November 21, 4-day orbit] It is in an orbit with a period of 21 years and perihelion was at 1.6 AU in early October. It can pass within 0.7 AU of Jupiter and 0.9 AU of Saturn, and is a JFC candidate.

A/2006 WR_3 [Catalina] This unusual asteroid, of 19th magnitude, was discovered by the Catalina Sky Survey on November 20.34. [MPEC 2006-W60, 2006 November 22, 2-day orbit] It is in an orbit with a period of 7.0 years and perihelion was at 2.1 AU in early November. It can pass within 0.3 AU of Jupiter and is a JFC candidate.

A/2006 WS_3 [Catalina] This unusual asteroid, of 18th magnitude, was discovered by the Catalina Sky Survey on November 21. It is in an orbit with a period of 6.5 years and perihelion was at 1.6 AU in early December. It does not currently approach close to Jupiter.

A/2006 WD_4 [Mt Lemon] This unusual asteroid, of 20th magnitude, was discovered by the Mt Lemon Survey with the 1.5m reflector on November 20.33. [MPEC 2006-W61, 2006 November 22, 2-day orbit]. It is in a retrograde orbit with a period of over 300 years and perihelion is at 0.5 AU in April 2007. Aphelion is near 100 AU.

2006 X1 (LINEAR) An apparently asteroidal object of 19th magnitude, discovered by LINEAR on December 11.12 has been found to be cometary by Peter Birtwhistle and other observers. It is a distant object with perihelion at 6.1 AU in 2006 March.

A/2006 XH_1 [Catalina] This unusual asteroid, of 20th magnitude, was discovered by the Catalina Sky Survey on December 11.35. [MPEC 2006-X36, 2006 December 11, 0.5-day orbit] It is in an orbit with a period of 7.6 years and perihelion was at 1.2 AU in mid November. It can pass within 0.3 AU of Jupiter and is a JFC candidate.

A/2006 XL_5 [NEAT] This unusual asteroid, of 19th magnitude, was discovered by NEAT on December 5.44. [MPEC 2006-Y29, 2006 December 21] It has a period of 7.2 years and perihelion was at 1.82 AU in late November. It is a possible JFC and can pass within 0.2 AU of Jupiter.

2006 YC (Catalina-Christensen) Almost simultaneous observations of an object were made by the Catalina Sky Survey (December 16.42) and the Mount Lemon Survey (December 16.49), with Eric Christensen of the latter noting that it showed a coma and tail. A high inclination orbit was published on MPEC 2006-Y15, however at that time the MPC wasn't aware of the additional information. The object is around 20th magnitude. The preliminary orbit gives perihelion at 4.2 AU in 2007 September. Calculations by Hirohisa Sato show that an elliptical orbit with the comet near perihelion at 4.7 and a period of 72 years is also fitted by the available observations. Further observations suggest a parabolic orbit, with perihelion at 5.0 AU in 2006 September.

2006 Y1 (P/Korlevic-Juric) Eric Christensen recovered 1999 DN_3 (P/Korlevic-Juric) with the Mt Lemon 1.5-m on December 16.36. The comet was 20th magnitude, and the indicated correction to the prediction on MPC 54168 is Delta(T) = -2.0 days. Perihelion is at 3.9 AU in May 2008 and the comet has a period of 9.6 years.

2006 Y2 (Gibbs) Alex Gibbs discovered a 18th magnitude comet on December 26.49 during the course of the Catalina Sky Survey with the 0.68-m Schmidt. The comet is near perihelion at 1.4 AU, and may be of short period.

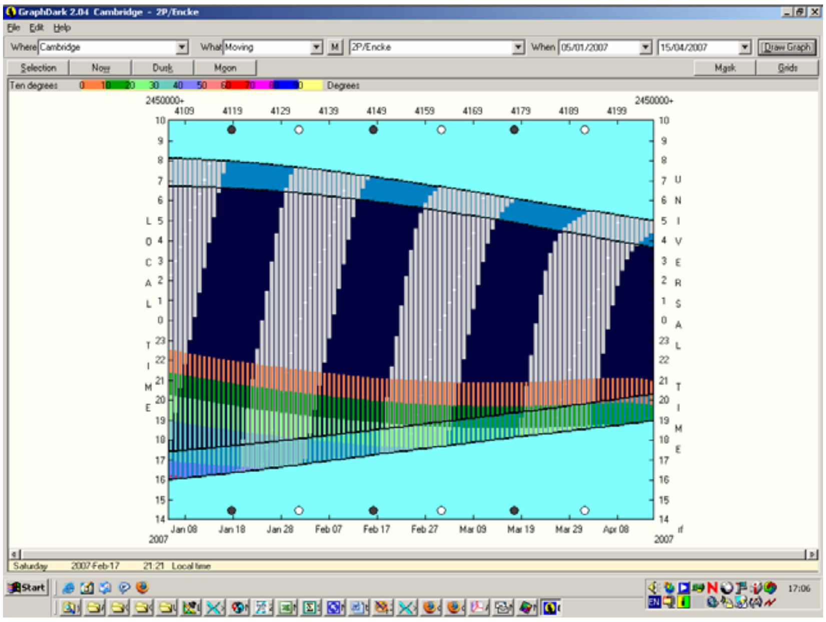
For the latest information on discoveries and the brightness of comets see the Section www page: http://www.ast.cam.ac.uk/~jds or the CBAT headlines page at http://cfa-www.harvard.edu/cfa/ps/Headlines.html

Comet Prospects for 2007

2007 is a poor year for returning comets and whilst it sees the possible return of 30 periodic comets only a few of these are likely to come within range of visual observation with moderate apertures. 8P/Tuttle may reach binocular brightness at the end of the year, though strictly it belongs with the comets of 2008. The highlight will be comet 2006 P1 (McNaught), although it will be a difficult object from the UK prior to perihelion.

Theories on the structure of comets suggest that any comet could fragment at any time, so it is worth keeping an eye on some of the fainter periodic comets, which are often ignored. This would make a useful project for CCD observers. As an example 51P/Harrington was observed to fragment in 2001. Ephemerides for new and currently observable comets are published in the *Circulars*, Comet Section Newsletters and on the Section, CBAT and Seiichi Yoshida's web pages. Complete ephemerides and magnitude parameters for all comets predicted to be brighter than about 21^{m} are given in the International Comet Quarterly Handbook; details of subscription to the ICQ are available on the internet. The section booklet on comet observing is available from the BAA Office. The version of Comet Prospects given here is slightly revised from that which appeared in the December Journal.

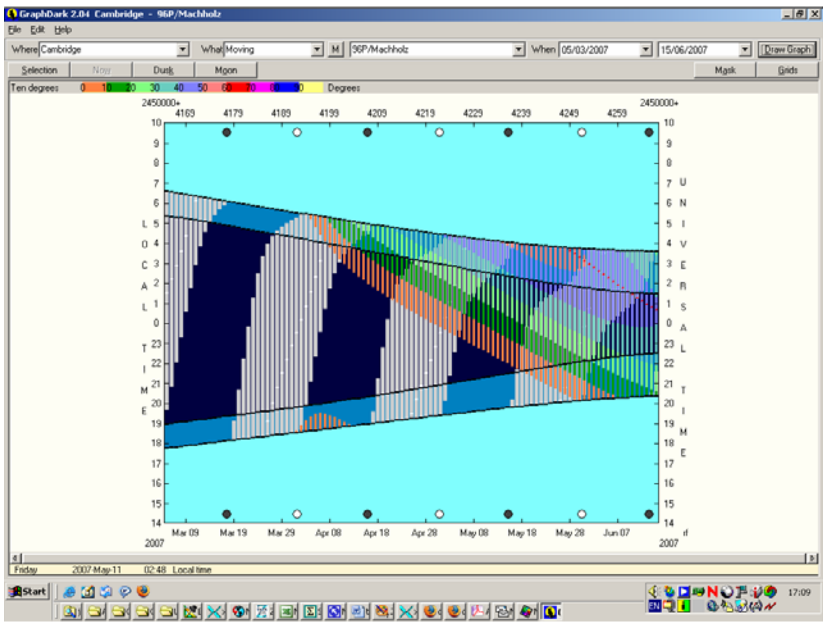
2P/Encke puts on a brief showing in the UK evening sky in late March and early April just before perihelion, when it may be a binocular object in Pisces and Aries. After perihelion it will be visible passing through the SOHO LASCO field and that of its successors, the twin STEREO satellites. This is comet **Encke's** 60th observed return to perihelion since its discovery by Mechain in 1786. The orbit is quite stable, and with a period of 3.3 years apparitions repeat on a 10-year cycle. This year the comet is briefly seen from the Northern Hemisphere prior to perihelion, with rather better views from the Southern Hemisphere after perihelion, when the comet is often brighter. BAA Members have been observing the comet for over 50 years and there is little evidence for a secular fading. The comet is the progenitor of the Taurid meteor complex and may be associated with several Apollo asteroids.



UK observing circumstances for 2P/Encke from January 5 to April 15

29P/Schwassmann-Wachmann is an annual comet that has outbursts, which in recent years seem to have become more frequent and were more or less continuous in 2004. At many recent outbursts it has reached 12^{m}. It spends the first quarter of the year in Taurus before sinking into solar conjunction. It emerges into the morning sky of Auriga in August, reaching opposition there at the end of the year. The comet is an ideal target for those equipped with CCDs and it should be observed at every opportunity. It is again well placed this year and UK based observers should be able to follow it for much of the year.

96P/Machholz should reach 2nd magnitude as it passes through the satellite coronagraph field at perihelion in early April, however it will be 9th magnitude by the



UK observing circumstances for 96P/Machholz from March1 to June 17

Comets reaching perihelion in 2007	T	q	P	N	H_1	K_1	Peak mag
P/Siding Spring (2006 HR30)	Jan 2.3	1.23	21.8	1 ?	10.0	10.0	10
McNaught (2006 P1)	Jan 12.9	0.17			5.0	10.0	-4 ?
99P/Kowal	Jan 15.7	4.72	15.1	2	4.5	15.0	17
P/Christensen (2006 U5)	Jan 20.3	2.32	6.61	1	12.0	10.0	16
182P/LONEOS (2006 W2)	Feb 6.1	0.98	5.02	2	18.0	10.0	15
LINEAR (2006 M1)	Feb 13.9	3.56			8.5	10.0	17
P/Petriew (2001 Q2)	Feb 24.6	0.94	5.47	1	11.0	10.0	12
LONEOS (2005 EL173)	Mar 6.1	3.90			11.5	5.0	17
McNaught (2006 K3)	Mar 13.4	2.50			8.0	10.0	14
P/Gibbs (2006 U7)	Mar 27.7	4.43	41.4	1	10.0	10.0	19
106P/Schuster	Apr 2.2	1.56	7.31	3	10.0	15.0	15
96P/Machholz	Apr 4.6	0.12	5.24	4	13.0	12.0	2
2P/Encke	Apr 19.3	0.34	3.30	59	10.5	15.0	3
17P/Holmes	May 4.5	2.05	6.88	9	10.0	15.0	17
LINEAR (2006 S2)	May 7.3	3.16			10.0	10.0	17
P/LONEOS-Tucker (1998 QP54)	May 12.2	1.88	8.60	1	9.7	15.0	16
135P/Shoemaker-Levy	May 31.0	2.71	7.48	2	6.5	20.0	16
128P/Shoemaker-Holt (A)	Jun 13.6	3.07	9.59	2	4.6	15.0	14
128P/Shoemaker-Holt (B)	Jun 13.7	3.07	9.59	1	4.6	15.0	?
156P/Russell-LINEAR	Jun 17.4	1.59	6.83	3	13.0	15.0	18
133P/(7968) Elst-Pizarro	Jun 29.4	2.64	5.61	4	12.0	10.0	17
87P/Bus	Jul 7.2	2.17	6.51	4	10.0	15.0	16
P/Mueller (1998 U2)	Jul 7.9	2.03	8.73	1	11.0	15.0	17
108P/Ciffreo	Jul 18.0	1.72	7.26	3	9.2	15.0	15
McNaught (2006 K1)	Jul 20.6	4.43			7.5	10.0	17
P/NEAT (2002 O5)	Jul 26.3	1.17	4.98	1	19.0	10.0	16
125P/Spacewatch	Aug 10.7	1.52	5.53	3	15.5	10.0	18
LINEAR (2006 VZ13)	Aug 10.9	1.02			10.5	10.0	10
P/Hoenig (2003 R5)	Sep 11.3	0.05	3.99	2	12.5	5.0	6?
D/Schorr (1918 W1)	Sep 26.4	2.85	8.51	1	10.0	15.0	18
70P/Kojima	Oct 5.9	2.01	7.06	5	11.0	15.0	17
136P/Mueller	Oct 22.2	2.96	8.57	2	11.0	10.0	17
50P/Arend	Nov 1.2	1.92	8.26	7	9.5	15.0	14
75D/Kohoutek	Nov 3.3	1.80	6.70	3	10.5	10.0	13?
D/Blanpain (1819 W1)	Nov 3.4	0.94	5.16	1	10.5	10.0	?
Catalina (2006 V1)	Nov 26.1	2.82			8.0	10.0	15
NEAT (2006 K4)	Nov 29.4	3.19			6.0	10.0	13
179P/Jedicke (2006 U2)	Dec 3.0	4.09	14.3	2	9.5	10.0	18
D/Denning (1894 F1)	Dec 4.3	1.63	9.69	1	10.5	15.0	14?
Hill (2006 S5)	Dec 9.7	2.63			8.0	10.0	13
P/Shoemaker-Levy (1990 V1)	Dec 12.9	1.46	16.4	1	10.5	10.0	13
P/LINEAR-Mueller (1998 S1)	Dec 16.1	2.55	9.13	1	5.6	15.0	13
93P/Lovas	Dec 17.3	1.70	9.20	3	10.1	10.7	12

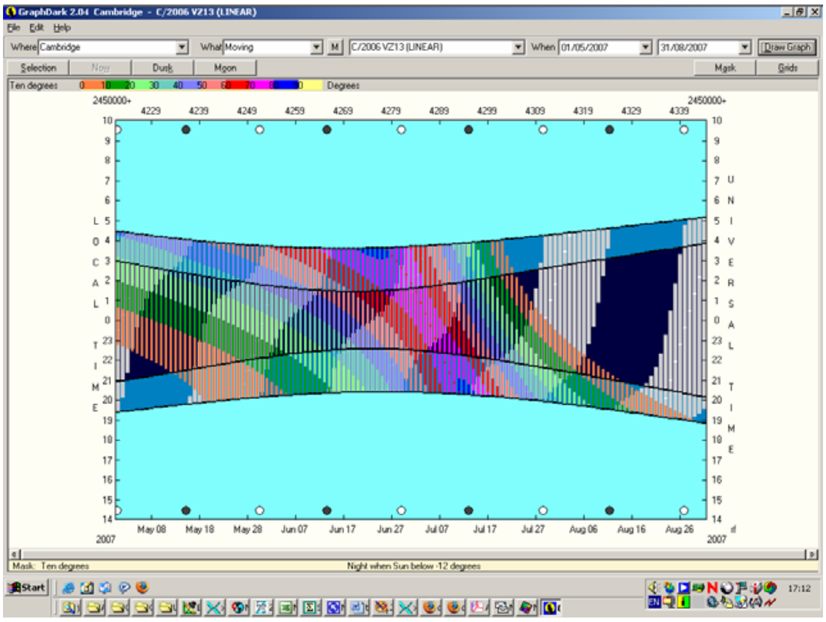
The date of perihelion (T), perihelion distance (q), period (P), the number of previously observed returns (N), the magnitude parameters H_1 and K_1 and the brightest magnitude are given for each comet. The date of return of D/Schorr and D/Denning must be regarded as highly uncertain, whilst 75D/Kohoutek was missed at the last two returns. If there is an identity between D/Blanpain and 2003 WY25 (P/Catalina) it will not return in 2007.

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

time its elongation increases sufficiently for ground based observation in late April. UK observers may pick it up in the morning sky, but it will be a fading telescopic object. The orbit is very unusual, with the smallest perihelion distance of any proven short period comet (0.13 AU), which is decreasing further with time, a high eccentricity (0.96) and a high inclination (60°). Studies by Sekanina suggest it has only one active area, which is situated close to the rotation pole and becomes active close to perihelion. The comet may be the parent of the Quadrantid meteor shower.

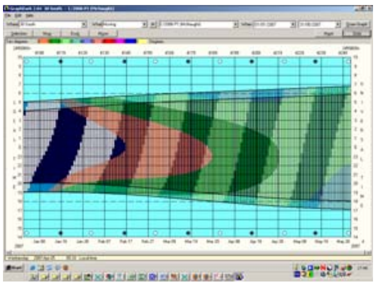
Although **8P/Tuttle** doesn't reach perihelion until 2008, it is likely to be one of the brighter objects for visual observers in 2007. It could be a binocular or even naked eye object at the close of 2007 as it makes a close pass of the Earth at 0.25 AU at the beginning of the New Year.

2006 HR_{30} (P/Siding Spring) was discovered during the Siding Spring Survey with the 0.5m Uppsala Schmidt on 2006 April 20.78. With a period of 22 years and perihelion at 1.23 AU it seemed a likely cometary candidate and this was finally demonstrated in early August, however its cometary appearance seems to have been short lived. Reaching perihelion in early January 2007 the comet could reach 10th magnitude around this time if cometary activity resumes, however it was a stellar 14th magnitude in December. It can approach to within 0.6 AU of Jupiter and a similar distance from the Earth.



UK observing circumstances for2006 VZ13(LINEAR) from May1 to August 31

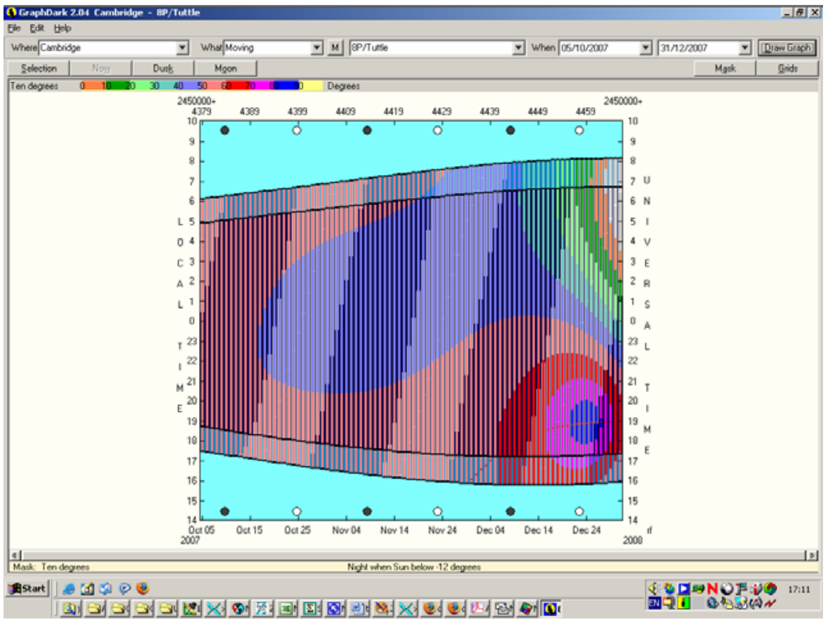
Southern Hemisphere observers will get a good view of comet **2006 P1 (McNaught)**, but it will not be visible in a dark sky from the UK. It too will pass through the fields of the satellite coronagraphs and could be an impressive negative magnitude object in mid January. Prior to perihelion, UK observers may see it in the twilight during the first 10 days of the month. It emerges from conjunction fairly rapidly and it could be visible from mid January, perhaps initially as a negative magnitude object. It fades rapidly and by the end of the month will be 4th magnitude, but should remain a binocular object into March.



Observing circumstances for 2006 P1 (McNaught) for 30° South from January 1 to May 31.

2006 VZ$_{13}$ was originally identified as an asteroid, but its unusual retrograde orbit suggested a likely cometary nature and this was duly confirmed. It should come in to visual range in May and will be brightest in mid July, before perihelion. At high northern declination at the beginning of the month, it rapidly heads south and will be lost to UK observers by the end of the month.

The other periodic and parabolic comets that are at perihelion during 2007 are unlikely to become brighter than 13th magnitude or are poorly placed. Ephemerides for these can be found on the CBAT WWW pages. Three were only seen once and have not been seen since their discovery, whilst D/Kohoutek has not been seen for two returns, and for all four the likely perihelion dates and magnitudes are extremely uncertain.



UK observing circumstances for8P/Tuttle from October 5 to December 31

Looking ahead to 2008, the brightest comets are 6P/d'Arrest (10th mag), 8P/Tuttle and 85P/Boethin (8th mag) and there may be more than 40 fainter ones.

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Jonathan Shanklin

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