THE COMET'S TALE

Newsletter of the Comet Section of the British Astronomical Association

Number 28, 2008 December

The Missing Comets

Several long lost comets have recently been re-discovered. Just over 30 years ago Richard Buckley published a paper in the Journal discussing "The Missing Comets" [JBAA, 87, 3 pp226 - 239]. One of these (69P/Taylor) was recovered whilst the article was in proof, and half of the other ten have now been found. It seems clear that in many cases the comets undergo occasional outbursts, and it is the timing of these that governs the possibility of recovery. His selection of comets that might be refound was Denning (1881 T1), Barnard (1884 O1), Brooks (1886 K1), Spitaler (1890 W1), Barnard (1892 T1), Denning (1894 F1), Swift (1895 Q1), Giacobini (1896 R2), Metcalf (1906 V2), Taylor (1915 W1) and Schorr (1918 W1).

72P/Denning-Fujikawa. An 11^{th} magnitude comet found by Shigehisa Fujikawa in October 1978 was linked with P/Denning (1881 T1), but it has not been seen on following returns and is again considered lost. It faded rapidly in 1978, so it may have been found in outburst.

97P/Metcalf-Brewington. Howard J Brewington of Cloudcroft, New Mexico discovered a comet of magnitude 9.8 with his 0.41-m reflector on 1991 January 7.18. This was subsequently found to be the first observed return of P/Metcalf (1906 V2) which had been lost since 1907. A prediscovery image on January 5.5 showed the comet at about 15^{th} magnitude suggesting that it was found during an outburst. A close approach to Jupiter in 1993 drastically altered the orbit and q is now 2.6 AU, but it was observed in 2001.

113P/Spitaler. On 1993 October 24.3 James Scotti found a 17^m comet with the SWT moving west on the borders of Pisces and Aries. He suggested that it might be P/Spitaler, which had not been seen since its discovery apparition in 1890. Syuichi Nakano had predicted that it might return to perihelion on October 4.0 and the comet was close to the line of variation for $\Delta T = +108.7$ days. At its discovery the comet reached 12^m in a very favourable apparition, however the recovery magnitude suggests that it may have been in outburst in 1890.

205P/Giacobini. Koichi Itagaki and Hiroshi Kaneda discovered a 13^{th} magnitude comet on unfiltered CCD patrol frames taken on 2008 September 10.56 UT using a 0.21-m f/3 reflector. Maik Meyer, suggested that the comet was identical to comet 1896 R2 (D/Giacobini), which had not been seen since January 1897 The identity was confirmed by Nakano, who noted that the comet had made 17 revolutions and passed only 0.51 AU from the earth on 1962 September 9 and 0.81 AU from Jupiter on 1992 January 14. The fact that the comet was not recovered on previous occasions, and that it was past its brightest for this return, suggests that the comet might have been found in outburst. The discovery of two fragments, which appear to have separated from the parent in the last decade may present another reason for its brightness at this return.

206P/Barnard-Boattini. Andrea Boattini discovered a 17^{th} magnitude comet in a dense part of the Milky Way during the course of the Catalina Sky Survey with the 0.68-m Schmidt on 2008 October 7.22. Maik Meyer suggested an identity with D/1892 T1 (Barnard) and Gareth Williams then re-reduced the published observations of that comet. Williams and Nakano then computed a linked orbit which showed that the comet made 20 revolutions between 1892 and 2008, passing about 0.3-0.4 AU of Jupiter in 1922 October, 1934 August, and 2005 August.

A lost comet not considered by Buckley was 11P/Tempel-Swift-LINEAR, which was found by LINEAR as a 20^{th} magnitude object on 2001 December 7.1.

Two other long lost comets are 1783 W1 (D/Piggott) and 1819 W1 (D/Blanpain), which may be identical with 2003 A1 (P/LINEAR) and 2003 WY_{25} (P/Catalina) respectively. They may be recovered in 2009 and the longer arc should allow confirmation of the identities.

It seems likely that some of the remaining comets will also be recovered, particularly once deep search programmes such as Pan-Starrs begin operation.

Jonathan Shanklin

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The Section newsletter is now free to all BAA Members who make contributions to the work of the Section. The cost for other 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 and in future this will be the only option for non BAA subscribers.

Section News from the Director

Dear Section member,

There have been some notable recoveries of lost comets over the last twelve months, and I have given details of these and some possibilities to come on the front cover. It will be very interesting to see how many remain lost in twelve months time.

I seem to be forever repeating requests to get the format of observations right, and it does seem to be possibly even more difficult for observers to do this than it is for them to observe the comet in the first place. Please use exactly the format given for both visual observations and images – there are examples on the Section web page to help you if you are not quite sure.

I also seem to be forever criticising professional astronomers for not using the MPC/CBAT form for comet names. This is a case of “stills”. Those in the military will know that after the Falklands War, the troops called the islanders “bennies” on account of the hats they wore, which were very similar to those of a TV comedy character. The CO ticked off the troops, and said that they were not to use this term again. Some time later he overheard them referring to the islanders as “stills”. When asked why, he was told “because they are still bennies”. In “The Comet’s Tale” I have edited some professional abstracts to more closely follow the standard format.

The Association is setting up a new observing initiative, which will allow Members access to a robotic telescope. This could be an excellent opportunity for Section members to try imaging some of the fainter comets that are not regularly monitored. Objectives could include checking on possible outbursts, extending light curves, or attempting to recover periodic comets. It is very clear from recent observations that many comet can vary significantly in brightness from one apparition to the next, so regular patrolling of unlikely targets is important. It is hoped that the scheme will formally be announced early in 2009.

I’ve tried to use at least one image from all contributors in this issue, even though there may be better images from other contributors, so my apologies if you haven’t been included or if I haven’t used your superior images. All will be downloaded into the Section archive. There are a variety of styles in use, and it is worth considering which conveys the best information when reproduced. I think that the style used by Martin Mobberley does come over very clearly and is a good model to follow. The negative images used by Jeremy Shears are also very clear.

There was an intention that the Association would hold an observers workshop on Comets, Asteroids and Meteors in February, however due to a combination of circumstances this has had to be postponed. A new date will be announced in due course, and hopefully it will be in 2009. Although many observers submit images, relatively few do any reduction on their images to provide magnitudes in the standard ICQ format. This is perhaps a subject that we need to cover in the workshop.

There are two International Workshops on Cometary Astronomy being planned – one in China following the total eclipse in July and the other in Rio de Janeiro in August. Further details of these can be found from links on the Section web page.

A new comet book has been published: David Seargent "The Greatest Comets in History: Broom Stars and Celestial Scimitars" Springer | 2008-11-13 | ISBN: 0387095128 | 260 pages | It is also available as a PDF download, though you get a lot of undesirable advertisments in the process.

I regret to report the death of Peter Wroath. Peter joined the Association in 1955 and was one of its Senior Members. He did not carry out very much comet observing, and the most recent object for which he sent in photographs was comet 1995 O1 (Hale-Bopp).

I made good progress with the reports on the comets of 1999 and 2000 and these have been submitted and have been refereed. All I need to do now is incorporate the referees comments and submit the finished reports. I look forward to seeing them in the BAA Journal some time in the next 12 months. I had intended to start on the report for 2001 over the Christmas holidays, but haven't managed to do yet, although my objective is to complete it before the middle of 2009. With any luck I will begin to catch up on the back-log of reports, though there are many more to report on than when I joined the Association in 1971.

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: The annual report notes that 8 comets had been discovered during the session. It gives a brief précis of each, which included D/Brorsen, 6P/D'Arrest and 8P/Tuttle. There was still some uncertainty of the orbit of 8P, which was linked to the 2nd comet of 1790. It notes expected returns of three comets and finishes by discussing the investigations of M Hoek of the Leyden Observatory. He had looked at the orbits of the comets of 1276 and 1556 and decided that they could not be the same object. A short note from S M Drach, Esq in the April Notices describes a Law of Contraction of the Nebulosity in Encke's Comet as given by M Arago. He suggests that the diameter of the coma as given in Arago's table varies as the +5/2 power of r. Dr Donati discovered a comet on the 2nd June. He noted that the comet was very faint. In the July Notices there is a letter from Professor Encke about his comet. He begins by congratulating Mr Maclear on the quality of his 1855 observations of Pons's comet, to which the editor adds a footnote "Usually called Encke's comet". He notes that this is the first time that observations from the Southern Hemisphere have matched those made in Europe. He goes on to say that the comet deviated from the ephemeris, but this was entirely due to the time of perihelion, which was 0.15 days early. Thanks to Maclear's observations he was able to deduce an ephemeris for the 1858 apparition and had recovered the comet, although he had only applied perturbations by Jupiter. He asked that an ephemeris should be distributed to English observers, which it duly was. Mr Hodgson observed the comet on August 14, noting that it appeared large - perhaps larger than Jupiter, but not 8' or 10' as it is said to be. He added that whoever wants to see it must rise early and search with nothing less than a 10cm refractor. By now the comet found by Donati was no longer faint and the editor noted as a footnote to some astrometry "This splendid comet has been visible to the naked eye for the last month, and that further observations would appear in the next number of MN". Professor Encke reported the recovery of Faye's comet and also noted that "The observations of Pons's comet (2P/Encke) go on quietly; it is now so bright that it cannot escape notice even with inferior instruments". He also comments on remarks made at the Paris Academy, with relation to the hypothesis of a resisting medium, and said that he had written a memoir on the subject in its favour. A report on this memoir appeared in the December MN. His argument was "the anomaly appeared to consist solely in a gradual increase of the mean motion of the comet, which was explicable by a force continually acting in the direction of a tangent to the orbit; and this again was in exact accordance with the effect which would be produced by a resisting medium.

Table Mountain and the Lion's Head
Emiliano Homrich (Internet)

The November MN reports many (about 18 pages!) physical observations of Donati's comet. At the Royal Observatory, Airy had found that the light of the comet was polarised in the plane of the comet's tail. On October 2nd the comet's head was much brighter than Arcturus. Through the Sheepshanks refractor parabolic envelopes were visible. By October 5 it was no longer as bright as Arcturus. Professor Challis observed the comet with the Northumberland refractor at Cambridge, using a power of 166. He notes that the tail was 33 degrees long to the naked eye on October 2. Admiral Smythe had been asked how "The Donati" compared to the comet of 1811, he thought that the comet of 1811 was more splendid, but said that "the Donati" was one of the most beautiful objects I have ever seen in the heavens." He concluded ".. its physical interest is increased by segments of light and a dark hollow, giving the aspect a resemblance to the gaslight called a bat's-wing. This dark line, or space down the centre of the brilliant phenomenon, not only had the direct tendency to strengthen the luminosity of the jets of light, in the manner observable in the burning of a wax taper, but also, on a fuller scrutiny of this singular characteristic, to recall its striking resemblance to the similar structure seen in water-spouts, and in the pillars raised in sand-storms which I have witnessed in North Africa". In December MN, Maclear reports an observation of 6P/D'Arrest and notes "It was a very faint object, partly owing, perhaps, to the line of sight being through the Kloop that separates the Lion's Head from the Table Mountain".

100 Years Ago: The January Journal has an article by A C D Crommelin on Daniel's comet 1907 L2, which included reproductions of several photographs and a drawing. It was sufficiently bright that several observers reported spectroscopic observations. Further studies by Cowell and Crommelin on the orbit of comet 1P/Halley confirmed the identification with the comet seen in 1301. Following on from this they showed that the comet of 1223 was not that of Halley, but confirmed the return in 1066. A paper published in May took the comet back to 760. In a note from MN, Dr Wolf pointed out that whilst visual observers reported a minimum of luminous radiation around the axis of the tail in the region turned away from the sun, photographs show the brightest tails near the axis.

Mr Crommelin spoke about Encke's comet at the April meeting. Although Dr Wolf had reported its recovery from Heidelberg in early January, the position was off that expected for the comet and it showed the wrong rate of motion. It was obvious that this wasn't comet Encke, and that it hadn't yet been recovered. After perihelion it would be a Southern Hemisphere object, so he had sent a note to Mr Grigg of New Zealand on the subject. The object observed was a new comet, that was thought to have the largest perihelion on record, saving that of the comet of 1729. Further notes appeared about the nature of the objects in subsequent months.

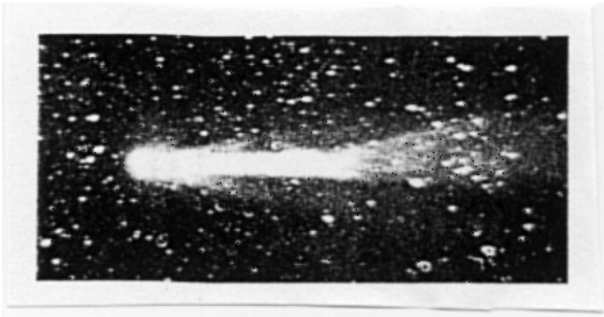
A paper on comet Daniel read at the New South Wales Branch meeting in March tells of disagreement in the magnitude estimates made during August. Several observers suggested a fading between August 5 and 11, but it was much brighter between August 17 and 20. Mr Tebbutt explained it by the standard formula, but when pointed out that this didn't fit the observations he said that the observations must be wrong. A note from AN points out the confusion between observations reported to be of Encke's comet in 1832 and that of 1832 O1. Another note reports investigations of the eclipse comet of May 1882, and the circumstances under which a comet might remain invisible.

At the May ,meeting Mr W T Lynn read a paper on Encke's Comet, which elaborated further on Mr Crommelin's earlier remarks and the note in AN, and covered the history of the comet. He concluded with a description of the brightness of the comet at recent returns. Mr Crommelin commented that he expected it to be a difficult object at this return. Curiously the best conditions for observing this comet were not when it was nearest to the earth. The best return was when the perihelion came in winter. In the 1894 return his impression was that the object was distinctly visible to the naked eye, although Mr Lynn put it down at only eighth magnitude; it was certainly very curious that a comet which had been coming round at such short intervals and had been sending out a tail at each perihelion passage would seem to have lost so little substance in the course of a century as this comet had done. By singular coincidence the comet was recovered at the Royal Observatory, Cape of Good Hope, the very next day.

At the July meeting Mr G F Chambers read a paper on Halley's comet in 1456 and the Pope. Popular legend had it that the comet had been excommunicated by Pope Calixtus III, however research into the papal documents of the time showed that whilst he had excommunicated the Turks, the comet was not mentioned. Later authors had embellished Platina's "Vitae Pontificum" with their own thoughts about what the pope might have said.

A note taken from A.S.P records that Prof Leuschner had protested against the assumption that cometary orbits which cannot be distinctly proved to be elliptic must be parabolic. He found little evidence for parabolic orbits for comets that had been observed for more than 240 days.

The annual report of the comet section noted that "The opportunities for observational work have been very restricted during the last year." Mr Crommelin noted that he had now been able to trace the orbit of Halley's comet with certainty back to 87 BC. He had been particularly helped by several BAA Members in the course of the computations. As a postscript he noted that a large number of Members were now observing comet 1908 R1 (Morehouse), which was visible to the naked eye.



Comet 1908 R1 photographed by Mr Longbottom on 1908 October 12. From Liverpool AS web site.

After the presidential address at the AGM, Mr Crommelin exhibited a number of slides of the comet which had been taken by Mr F W Longbottom. It was not a very interesting comet visually, but photographically it exhibited remarkably rapid changes, with some tail knots showing a velocity of over 80,000 miles an hour. On the night of October 3, the main tail had disappeared, which meant a temporary pause in the emissive action from the head. [*Today we would probably describe this as a tail disconnection event*] On October 15 a remarkably bend was photographed in the tail, and confirmed visually. The bend was seen to be moving outwards rapidly which overturned a previous theory that it had been caused by some physical obstruction - prophetically he said that if there was it must have been a moving obstruction. All the photographs were between 5 and 10 minute exposures. Several Members recounted their recent observations of the comet. Mr Longbottom wrote a report on his photographs, which appeared in the same issue, along with reproductions of several of the photographs.

A report abstracted from AN notes an investigation of whether comet Donati might have been a return of the comet of 69 BC. The conclusion was that it could not, though an association with the comet of 147 BC was considered possible. This might have been the comet described by Seneca as "large as the Sun, red like fire, giving sufficient light to dispel the darkness of night until it gradually faded away and disappeared, after being visible for a period of 32 days". A report abstract from ApJ notes spectrographic studies of 1907 L2 (Daniel) made a Lick Observatory with the 36" equatorial. Sixty one bright lines were catalogued between 385.5 and 563.4nm. Studies made at Juvisy using an objective prism were reported from Comptes Rendue. This method had advantages [*not noted*!], and the authors commented on the marked difference in the spectra of comets 1907 L2 and 1908 R1 (Morehouse).

Further photographs of 1908 R1 were shown at the November meeting. During extensive discussion it was noted that the excellent series of photographs that had been taken opened a new chapter in the history of comet observations. They suggested a regular variability of the tails of comets and that the comet was going through a fairly regular cycle of phases: it was perplexing how that could arise. Was the variation in the tail due to some periodic change in the nucleus, or was it due to different qualities in the regions of space that it was passing through? Mr Crommelin had had an idea to explain the apparent rotation seen in some tails - if the comet's head was rotating in a period which was long compared with the time the tail matter took to go out, then obviously the tail would simulate rotation although the particles of the tail themselves were not rotating. Mr Ellis wondered whether the reason that the comet was more impressive photographically than visually was because the emission was almost entirely from cyanogen (which has an ultra-violet emission). A remark from Mr Walter Heath suggests that the idea of a solid nucleus was not quite the modern one - if a comet 100,000 km in diameter could be brought into a laboratory, it could be condensed and packed away in a pill-box and comfortably carried around in one's pocket. Mr Ainslie commented that the envelopes in front of the nucleus struck him as having an extraordinary resemblance to the waves formed in front of the bows of a ship at high speed. Mt Thwaites said he thought that they appeared more like the beautiful photographs taken by Prof Boys showing the progress of bullets in the air. Several Members commented on the appearance of "dark rays" in the tail.

At the December meeting Mr Crommelin reported on further studies of the orbit by Dr Smart, and others by Mr Cowell and himself. There was general agreement that perihelion would be in mid April. He noted that it was rather disappointing that the comet would not be better placed for observation in this country, for throughout the time of its greatest brightness it would be south of the sun. Those in South Africa, Australia and Tasmania should have a magnificent sight in early May. It was remarked that the return would be approximately similar to that of 1066. Two other cometary papers were given at the meeting - one by Mr Hardcastle on the Shape and Motion of Comets' Tails and the other by Mr Lynn on Comets and possible Ultra-Neptunian Planets, which Mr Hardcastle then expanded upon. Several more reports appeared about comet 1908 R1 (Morehouse), including a photograph taken by R C Johnson on November 15 from West Kirby.

50 Years Ago: Mr M P Candy (recently appointed Assistant Director of the Section by the Council), reported on comets 1957 U1 (Latyshev-Wild-Burnham) and 1957 P1 (Mrkos) at the meeting held on 1958 January 1. He noted that 1957 U1 might be picked up in a few weeks time after perihelion [it wasn't, and probably faded rapidly]. He then went on to describe 1957 P1 (Mrkos), which had been independently discovered by a young BAA Member - Clive Hare [Applause]. He was at the meeting and reported that he had been observing meteors when he spotted the comet. He had got his father out of bed and they had tried to communicate with the Royal Observatory by telephone, but unfortunately nobody was there! He sent a wire the following morning, but this does not seem to have been acted upon. The President, Dr Hunter commenting "Well, as everybody knows from the national Press, the Observatory works a five-day week. It was not that nobody was there, however: Mr Hare's message did not get through to anybody who appreciated the importance of his observation." This has now been put right and we can guarantee that anybody's telegram about novae or comets will get proper and immediate attention." Mr Granger showed some photographs of the comet, as did Mr E A Whitaker. In comet notes the discrepancy between a visual estimate of 1958 D1 (Burnham) by the discoverer at 9^m and the photographic confirmation by Dr Elizabeth Roemer at 15^m was remarked upon. George Alcock had observed 2P/Encke at the end of September, estimating it at 8.3. The Director, Gerald Merton, reported on a paper by Dr Liisi Oterma on her comet 39P/Oterma, which traced the comet's orbit. It had come into its present orbit in a long encounter with Jupiter, remaining within 0.5 AU between 1936 January and 1939 August. In a coming encounter it would approach the planet to 0.095 AU in 1963 April, which would dramatically change the orbit again. He concluded by noting that he had resigned as Director after 12 years in the post and would be succeeded by Michael Candy [*this was in fact announced at the March meeting, the details of which appeared in the July Journal, although the note appeared in the April Journal*]. Albert Jones [*who is still observing comets*] was appointed as Assistant to the Director

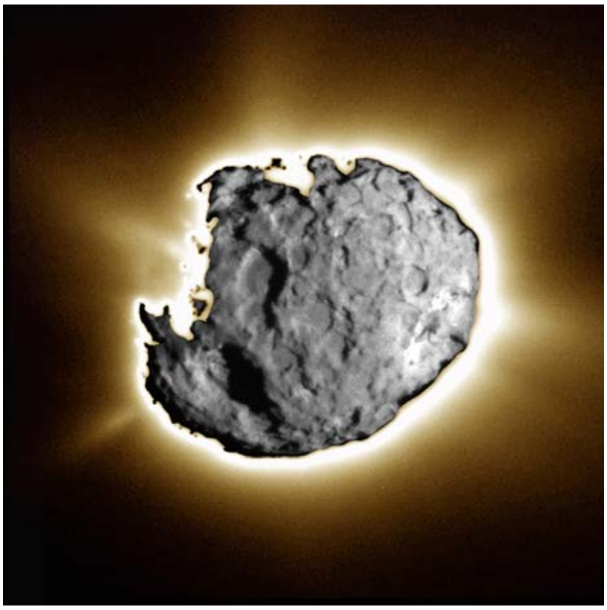
The Thorrowgood telescope

At the May meeting Mr S Archer described the construction of simple photometer, which could be constructed for around £20 (or £1 if a secondhand photocell was used), and which could be used to measure comet magnitudes to 0.01. It was used on the 20cm Thorrowgood telescope at the Cambridge Observatories to measure the light curves of some eclipsing binaries, but there are no subsequent reports of cometary magnitudes.

The annual report notes the transfer of Directorship, and that three comets had been under observation. Half a dozen of the observers making observations then are still active members of the BAA. Many photographs of comets were displayed at the Exhibition Meeting, and also a painting of 1956 R1 (Arend-Roland) by David Early.

Miss Cicely M Botley had an historical note on two cometary centenaries in the October Journal. 1758 was the year that comet Halley had been recovered on its first predicted return, and in 1858 comet Donati was on view. She notes an extract from a letter written by Richard Wagner in Venice "I chose it with a certain haughty defiance for my star. I could see in it nothing but the unaccustomed, the dazzling, the marvellous. Am I such a comet myself? Have I brought misfortune? Was that *my* fault?" When he returned to Venice in 1882 to die, another great comet 1882 R2 shone over the city.

RAS Discussion Meeting "Comets after Stardust"



81P/Wild imaged by Stardust

On 2008 October 10th, the Royal Astronomical Society held a discussion meeting on "Comets after Stardust". The meeting was organised by Mark Burchell of the University of Kent, and Anton Kearsley of the Natural History Museum. These are my notes from the meeting, amplified in some cases by the abstracts from the speakers. As such they reflect what I heard the speaker say, and may not accurately reflect what was intended. I've added a few comments and these are in square brackets [....]. I've used the standard form of cometary nomenclature, rather than the conservative designations often used by the speakers. Many talks involved complex mineralogy, stretching my memory of undergraduate courses, and I've added a few explanations.

Morning talks

Anny-Chantel Levasseur-Regourd (Paris). *Cometary dust: significance and bulk properties.* She started by showing pictures of recent comets – 17P/Holmes, where the dust tail was hidden by the coma, and which had a heterogeneous inner coma. 2006 P1 (McNaught) was a great comet. 1995 O1 (Hale-Bopp) had well separated dust and gas tails. Spacecraft missions show dust on the nucleus and the question is - is it pristine, regolith or crust. We also see dust in cometary trails along the orbital path, and in the zodiacal light. We need to understand its physical and chemical properties in order to understand the origin of comets and also to plan for spacecraft missions. Rosetta will provide much information on 67P/Churyumov-Gerasimenko [which few speakers could pronounce!]

Vega 1 and Giotto showed a 50% mix of silicate and CHON in 1P/Halley, and there were also signs of PAH (poly-aromatic hydrocarbons) and POM (poly-oxy methylene). Particles are of low density (100 Kg m^{-3}), low albedo (4%) and fragment. The mass distribution is approximately $m^{-0.53}$, though it differs between comets. IR observations show the presence of amorphous and crystalline silicates, which was confirmed by Stardust. Polarimetry, which gives information on dust properties (bees use polarimetry for navigation) and on the scattering medium, suggests irregular particles which are bigger than a few microns. The technique showed a change in the properties of the dust in the coma arcs of

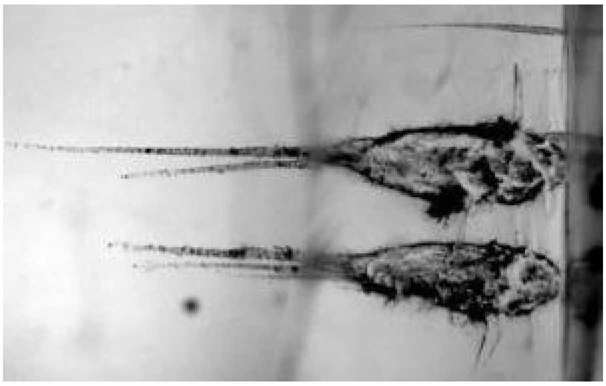
1995 O1, which implies evolution in the particles. Studies suggest that there are two or three classes of comets, those with low polarisation maxima or high polarisation maxima (with silicate emission) and 1995 O1. (In answer to a question – there is no significant difference between the orbits of the groups, but it is possibly related to age). Laboratory and numerical simulations suggest that the particles are a good match for fluffy magnesium and iron silicates and carbon aggregates with some compact grains (granular like salt grains). The studies suggest a fit for 1995 O1 of 0.1 to 20 micron particles composed of 40% silicates and 60% organics (although this could 65/35 if the organics mantled a silicate core). There are similar results for 1P/Halley and 153P/Ikeya-Zhang. Stardust confirms the presence of compact particles and aggregates. The nucleus may have a high micro-porosity, which implies the potential survival of organics after passage through the Earth's atmosphere.

Single scattering occurs at distances greater than 1000km from the nucleus. Circular polarisation is low, but measured in some comets, but is not caused by multiple scattering. Polarisation amount reduces with distance from the Sun, implying degradation of organics.

Anton Kearsley (Natural History Museum). *Stardust after 2 years.* Stardust does not provide the key to identifying cometary material in existing museum collections. Several JFC (Jupiter Family Comets) have been visited. There are many questions that could be answered by spacecraft missions.

9P/Tempel has lots of olivine and pyroxene and possible carbonates. Stardust aimed to collect cometary and interstellar dust particles (IDP), though it isn't clear if the latter were found. As well as the aerogel it had impact shields that collected particles. There were some large impacts in the aerogel. Many groups worked on the material, which was quickly distributed after return to Earth. Because the orbits were known, the collection conditions could be replicated in laboratories, so it is possible to calibrate and model the observations. There were 256 impacts of particles greater than 100 microns. There are several types – carrot shaped with terminal particles, and bulbous varieties representing aggregates. The aluminium foil shows smaller particles, however there is a calibration problem at very small sizes less than 10 microns. Some aerogel cells have lots of small tracks of secondary origin. There are some complex impacts. Coarse grains account for more than 90% of the collected mass.

X-ray fluorescence shows that particles disintegrate along the track. Particles are very diverse. Most effort so far has been spent on looking at the larger particles. For example one olivine grain was more or less pure forsterite [olivine is a magnesium-iron silicate $FeMgSiO_4$, with forsterite pure magnesium silicate and fayalite pure iron silicate]. There are possibly fragments of chondrules [suggesting a link with meteorites]. There is evidence that sulphides behave badly during hyper-velocity impacts through reactions with the impact material, so it is not possible to say much about them, or iron. There are some strange CAI (calcium-aluminium rich inclusions) type impacts, which implies that there was migration of material from the inner solar nebula through the central plane of the solar system when comets were borne.



Stardust impact trails

Many minerals have been found. Only three pre-solar grains in this comet have been found in impact craters. The finer material is close to carbonaceous chondrite composition. GEMS (Glass with Embedded Metal and Sulphides) were not found. The nitrogen isotope ratio is close to that of the Tagish Lake meteorite. It doesn't look like a pile of primitive dust, more like a dusty mixture of chondritic meteorite material.

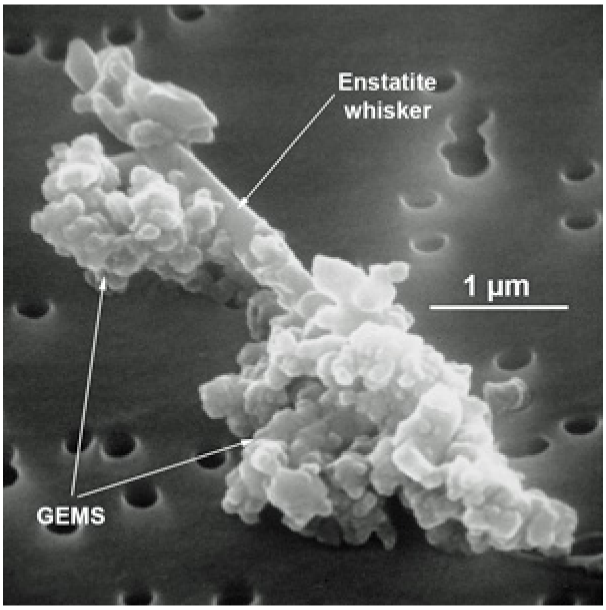
John Bridges (Leicester). *Fe-oxide, Fe-Ti-oxide and Fe-Cr oxide in comet 81P/Wild: Affinities to Carbonaceous Chondrites.* Bridges compared IDP and chondrites. Stardust samples suggest that iron oxides are present, but are they cometary or formed during capture? Stardust material is closest to anhydrous, porous IDP. The UK consortium used a variety of analysis techniques. The Diamond Light synchrotron at the Rutherford-Appleton Laboratory near Harlow, Oxfordshire makes detailed analysis possible as it has a fine 3 micron beam. This shows a heterogeneous mineral assemblage. Track 41 shows a mixture of magnetite and haematite, another track shows iron sulphide. The haematite may have formed by oxidation of magnetite. Chromite [$FeCr_2O_4$] is present – both IDP and CI chondrites contain it.

Hugues Leroux (Lille). *Mineralogy of the 81P/Wild particles as studied by transmission electron microscopy.* Grains were sliced into 100 nm frames for analysis. Track 69 shows pigeonite [a member of the pyroxene family which are iron-magnesium-calcium silicates $FeMgCaSi_2O_6$], with olivine grains and chromite inclusions. Another fragment was enstatite [another pyroxene $MgSiO_3$] and diopside [yet another pyroxene $CaMgSi_2O_6$] with pigeonite exosolution, implying an igneous melt. Track 32 has two enstatite particles which have different thermal histories. Some particles have an iron core with a sulphide rim. There is quite varied elemental distribution in some grains. The ternary diagram of Fe/Mg/S clusters around CI chondrite composition. They are likely to have originated from fine grained material and there is indication of nebular mixing.

Nicholas Foster (Kent). *Magnesium rich silicates in Stardust detected by Raman spectroscopy.* Stardust will go on to 9P/Tempel, and hopefully we will see exactly what effect the Deep Impact impactor had, and also if any other changes have occurred. There is a wide range of olivines from fosterite to fayalite. They carried out laboratory studies using a flight spare aluminium foil and aerogel. Raman spectra give a clear fingerprint of minerals. They used a range of olivines, but it turned out that the standard samples that they were provided with weren't as standard as they were supposed to be. All samples show a shift towards iron after impact.

Nigel Park (AWE, Aldermaston). *Hypervelocity impact cratering using molecular dynamics: A starting point to simulate the nanoscale features observed on Stardust aluminium foils.* He had been carrying out hydrodynamic computer simulation of 6 – 20 nm particle impacts. For simulations the impact box needs to be 10 times the size of the particle. Boundaries give problems. The crater ejecta rim and shape depends on the crystal structure. There is damage and plasticity. The projectile to crater diameter ratio is not the same as at larger scales.

Stephen Coulson (Cardiff). *Modelling the deceleration of cometary particles captured in aerogel and the Earth's atmosphere.* The Stardust impacts at 6.1 km s^{-1} give heating of over 1000 K for 0.1 – 10 µs. The aerogel has a linearly variable density. The Earth's atmosphere also acts as a collector and particles are roughly 60% cometary and 40% asteroidal, with <1% interstellar. There are faster impact speeds at 11 – 72 km s^{-1}, but lower decelerations. Particles are difficult to model due to their irregular shape, and the aerogel is also difficult. He uses a simple model, but there are no results yet. He hopes to explain the formation of the turnip type tracks.



Henner Busemann (Open University). *Ultra-primitive dust from comet 26P/Grigg-Skjellerup.* Some IDP collected from the Earth's atmosphere might be from comet 26P/Grigg-Skjellerup. IDP had been collected from the stratosphere, from Antarctic ice and from spacecraft solar panels. Theory suggests that there should be extra particles as the trail from 26P/ passes across the Earth between April 22 and 24. Samples collected then seem to show a greater concentration of pre-solar grains and are fresh. GEMS like particles include carbonate, chlorite, talc and amphibole [all hydrated minerals] and extremely D/N^{15} rich organics. A pre-solar grain enhanced in O^{17} implies origin in the atmosphere of a red giant star. If they are from 26P/ there are some similarities with 81P/. Sampling bias could explain some of the differences. We expect water related phases in JFC and this implies that there was widespread liquid water in JFC. Other explanations do exist, for example shock formation of phylosilicates, or dry condensation.

Lunchtime posters

Hitesh Changela (Leicester). *Characterisation of Stardust track 134 using the Diamond synchrotron.* He has used the Diamond source for X-ray absorption spectroscopy. One interesting conclusion from looking at the mineralogy along the track is that oxidised features mid-track may be evidence of capture heating.

Mark Burchell (Kent). *Stardust craters: An overview (Calibration, Classification and particle size).* 56% of craters are from composite particles of olivine, pyroxene and iron sulphide, 36% are mono-mineralic particles of the same phases. They are experimenting at simulating the composites using glued together aggregates in their laboratory gas gun.

Yan Le Gac (Natural History Museum). *Are CI chondrites cometary samples ?* CI chondrites may derive from cometary nuclei. Hydrated minerals are generally absent in Stardust samples, probably because they don't survive capture. He is therefore looking at olivine crystals in meteorites, but it is still work in progress.

Max Wallis (Cardiff). *Melt structures in comets.* He sees evidence for a) early central melting due to radionucleides, b) impact melts, c) subcrustal melting due to solar heating. He sees frozen lakes in 9P/Tempel. The flat craters in 81P/ could be a remnant internal shell. He thinks a comet could maintain a liquid layer for 10 My.

Mark Burchell (Kent). *Stardust: Where are the specific organics?* Laboratory experiments show thin layers of organics would be lost at hypervelocity impact speeds.

Yano (Japan). There are Japanese plans for followups to the Hyabusa mission, going first to a C-type asteroid (1999 JU3) and then a D-type dormant comet. The latter is scheduled for around 2030. They could collaborate with Europe over use of launch vehicle and data exchange.

Afternoon talks

Andy Morse (Open University). *Isotope measurements of a comet by the Ptolemy instrument on Rosetta.* The Ptolemy instrument on the Rosetta lander is a gas chromatograph to measure light element isotope ratios to 1%. It can drill to 30cm depth and has 26 ovens on a carousel. It will operate during the Lutetia flyby. It is in good shape for the 2014 landing.

Iwan Williams (Queen Mary College, London). *The CONSERT experiment on Rosetta, where are we now?* The CONSERT experiment uses radar to probe the comet. The change of target from 46P/ to 67P/ may be a problem. The orbiter transmits, the lander receives and re-transmits the signal, which the orbiter receives. It is therefore possible to probe the comet interior. The experiment only measures the time delay and loss of power. The time delay is a function of both the different path and the different speed through the comet. The maximum reasonable length for the antenna was 20m, so the frequency is 90 MHz. They can't deploy the antenna until after the landing, so there is no possibility of testing to see if it all works. The travel time is around 10^{-4} s, and the delay 100 ns. 67P/ is not spherical (46P/ was) and is much bigger at around 5 x 3 km, compared to 1.2 x 1.1 km. Another problem is that the loss of power on reflection is around 20 dB, which is comparable to the transmission loss for the larger comet. They therefore need to do more modelling. A similar concept worked on Mars, and they have also tested it on an alpine glacier.

Lionel Wilson (Lancaster). *Cryovolcanic origin of smooth terrain on comet 9P/Tempel?* There are irregular surfaces on comets, including impact craters. Pits show the inhomogeneous release of material. 9P/ has smooth patches, which have a distinct scarp face about 20m high, possibly formed under the control of gravity. These are similar to pyroclastic density current deposits on Earth. The scale is quite different, but when allowing for gravity they are quite similar (20m on 9P/ would equate to 6cm on Earth). Does sublimation of ice fluidise clasts ? It is reasonable enough to support particles up to cm size, depending on the ice fraction. [I wonder if these features are perhaps a relict from past outbursts on the comet.]

Pan-Starrs test image of 17P/Holmes taken early in 2008

Geraint Jones (MSSL, University College, London). *Dust, neutrals and ions in a near-sun comet: Observations of C/2006 P1 (McNaught).* The comet showed prominent dust tail striae in observations from SOHO and STEREO. Wavelet analysis clearly delineates the striae, which originate from active areas on the rotating nucleus passing into and out of sunlight. Particles fragment after a finite delay of around 1.2 days, so that they break up at the same time. Mass fractionation takes place along the striae. Something happened in the case of 2006 P1 that caused interleaving of the striae. A CME (Coronal Mass Ejection) from the Sun hit the comet, so perhaps electrical charging plays a part. The comet crossed the current sheet on January 13, which would reverse the Lorenz force. This ties in exactly with when the interleaving occurs. The sodium tail is also visible in LASCO images.

Bob Barber (University College, London). *Observations of H_2O emission lines previously unrecorded in cometary spectra require an alternative molecular excitation mechanism.* Newly discovered H_2O lines require a different excitation mechanism. Water molecules show rotational and vibrational oscillation. Solar pumping can excite these states, which in the outer coma have time to decay. The population level indicates temperature, and changes in the spectra can measure 15 K changes in temperature over a few weeks. New lines were found in 8P/Tuttle, which he calls stochastic heating lines. There are several possible mechanisms – excitation by electrons, recombination of H_3O^+ or collisional excitation by $O(^1D)$.

Alan Fitzsimmons (Queen's University, Belfast). *Comets in the era of the E-ELT.* The European Extremely Large Telescope is a 42m aperture telescope, which is hoped to be operational in 2018, though he thinks it will be later. It will operate at wavelengths of 8 microns and longer, however there are molecular emission lines at these wavelengths. It could potentially detect Kg s^{-1} release rates from objects in the inner solar system. Imaging dust round distant objects should detect a level of 10^{-6} Kg s^{-1}, possibly detecting individual active areas. It may also be able to resolve nuclei in the K or J bands for nearby (< 0.1 AU) comets. Pan-Starrs begins operation in a couple of months. The LSST follows and these will generate many targets for the E-ELT.

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.

Nearby Star May Be Swarming With Comets *New Scientist*

A giant ring of debris around a nearby star appears to be a much bigger version of our solar system's Kuiper belt, the region of ice-rich objects beyond Neptune that is thought to be a source of comets. A team of astronomers used the orbiting Spitzer Space Telescope and the Gemini South telescope in Chile to study infrared light from the disc around HD 181327, which lies about 150 light years from Earth. They saw a peak in brightness at a wavelength of around 63 micrometres, which is characteristic of water ice which is evidence that the composition is similar to our Kuiper belt. The disc has a radius of about 12 billion kilometres, roughly twice the size of the Kuiper belt. It is also exceptionally bright, suggesting that it holds a lot of material - so the system may be swarming with comets.

The Extremely Anomalous Molecular Abundances of Comet 96P/Machholz from Narrowband Photometry *David G. Schleicher* The Astronomical Journal, 136 (2008)

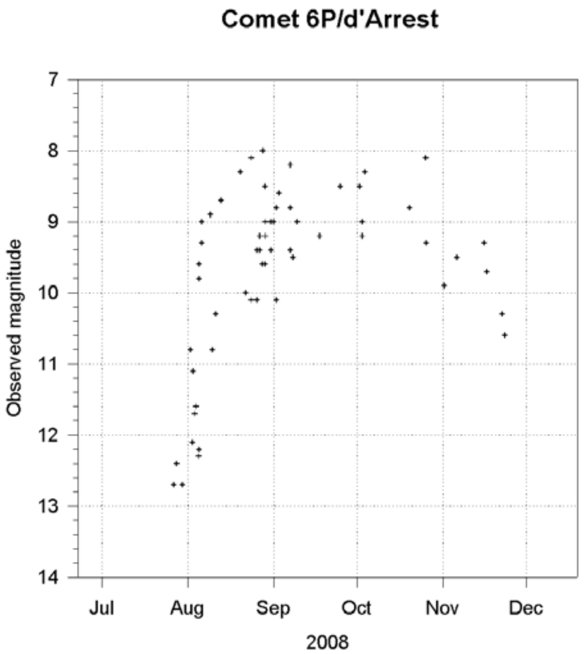
Narrowband-filter photometry of Comet 96P/Machholz was obtained at Lowell Observatory during the comet's

2007 apparition. Production rates of OH, CN, C_2, C_3, and NH were derived from these data sets, and the quantity $A(\theta)f\rho$—a proxy measure of the dust production—was also calculated. Relative abundances, expressed as ratios of production rates with respect to OH (a measure of the water abundance), were compared to those measured in other comets. Comet 96P/Machholz is shown to be depleted of CN by about a factor of 72 from average, while C_2 and C_3 are also low, but "only" by factors of 8 and 19, respectively, from "typical" composition (based on an update to the classifications by A'Hearn et al.). In contrast, NH is near the mid-to-upper end of its normal range. This extremely low CN-to-OH ratio for 96P indicates that it is either compositionally associated with comet 1988 Y1 (Yanaka), which was strongly depleted in CN and C_2, but not NH_2, or represents a new compositional class of comets, since 1988 Y1 had a much greater depletion of C_2 (>100×) than did 96P (8×). Evidence strongly suggests that the extremely anomalous compositions of these two comets are primordial rather than from recent thermal processing. It remains unclear whether these comets formed at a location in our solar system with unusual conditions and a low probability of being gravitationally perturbed into the inner solar system, or if one or both objects are interstellar interlopers.

Review of comet observations for 2008 January - 2008 December

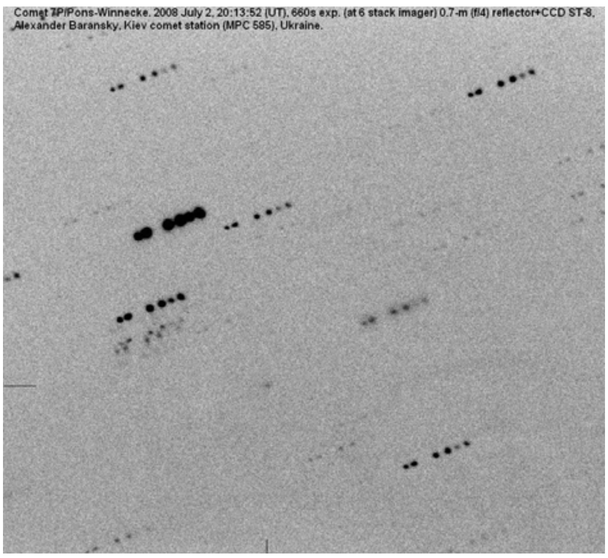
The information in this report is a synopsis of material gleaned from IAU circulars 8903 – 9009, The Astronomer (2007 December – 2008 November) and the Internet. Note that the figures quoted here are rounded off from their original published accuracy. Lightcurves for the brighter comets are mostly from observations submitted to the Director. A full report of the comets seen during the year, including observations published in The Astronomer will be produced for 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.



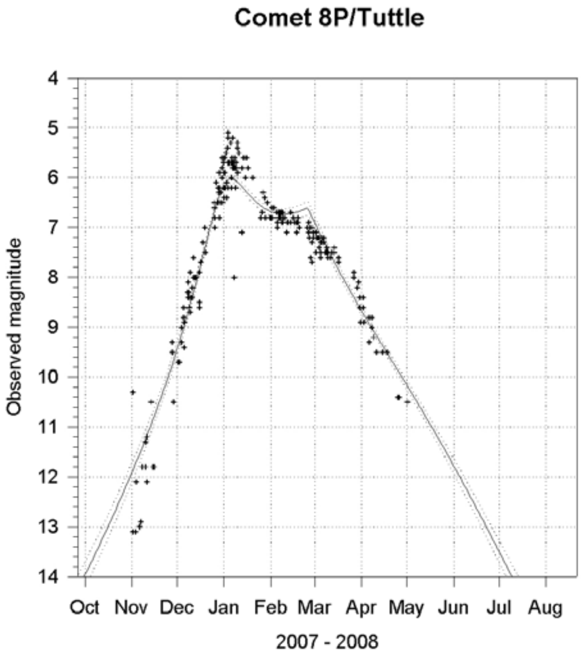
6P/d'Arrest made its 19th observed return in 2008. The comet was recovered in late April by observers at Lowell Observatory's Anderson Mesa Station and Kachina Observatory, Flagstaff. It was around 19th magnitude. It was expected to be brightest at arbout 10th magnitude around the time of perihelion in mid August. It appears to have undergone something of an outburst just before then, and no satisfactory equation for the light curve can be fitted. It was poorly placed for observation from the UK after perihelion.

7P/Pons-Winnecke



The comet was discovered by Jean Louis Pons with a 0.12-m refractor at Marseilles in 1819, but was then lost until rediscovered by Friedrich August Theodor Winnecke with a 0.11-m refractor in Bonn in 1858. He demonstrated the identity and recovered the comet in 1869. The perihelion distance has slowly been increasing since the early 1800s. It can make close approaches to the Earth and did so in 1927 (0.04 AU), 1939 (0.11), 1892 (0.12), 1819 (0.13) and 1921 (0.14).

An outburst of the meteor shower associated with the comet, the June Bootids, occurred on 1998 June 27.6. The comet was at perihelion in late September. It was not expected to be within visual range at this return, however a few observations in the late summer put it at 12th magnitude.

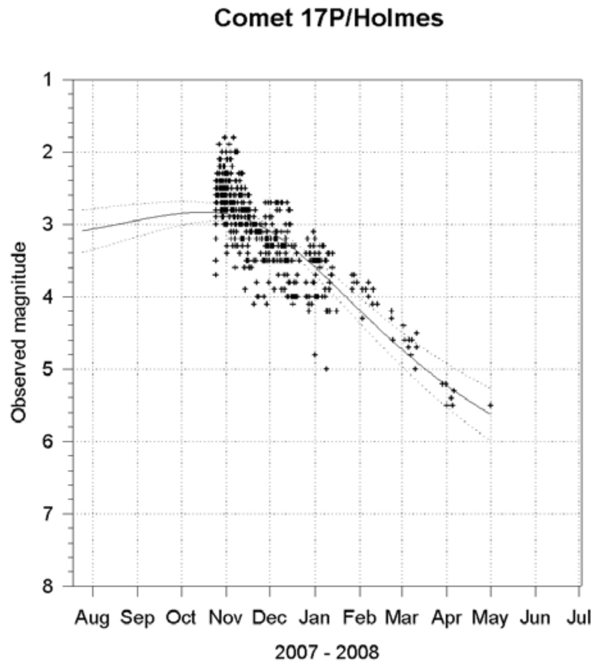


Comet 8P (Tuttle)and M33 – 2007 December 30
Image 2x90 s with 8cm refractor f/5 and Canon 10D;
Start sequence 21:48:02 U.T.– Observer: T. Scarmato, Calabria, Italy

8P/Tuttle was recovered in April 2007, and by the end of the year was readily visible in binoculars. It peaked early in January, with most observers making it 6th magnitude. Observers in good conditions were able to see it with the naked eye, and reported a coma diameter of between 20 and 30’. It began to fade shortly after the closest approach to the Earth, but there was something of a slowdown after the comet had passed perihelion. It had headed south after closest approach, but fortunately so had I, and I was able to observe it from the Antarctic in late February. It remained a Southern Hemisphere object, and the last observation was made in early May, when it was 10.5 according to Stuart Rae. A standard light curve is not a particularly good fit to the observations and it seems that the comet was intrinsically brightest about a month after perihelion.

15P/Finlay William Henry Finlay discovered this comet from the Cape Observatory on 1886 September 26, with an 18cm refractor. It was around 11th magnitude at this and the following return. In 1906 it passed 0.3 AU from the Earth and reached 6th magnitude. Jupiter perturbations in 1910 gave an unfavourable return in 1913, but a good one in 1919, though they were unfavourable after that until 1953, when it was recovered. It has been observed at every return since 1953, and this is its 14th return. It is an intrinsicaly faint object and there are usually few visual observations. A September perihelion would give favourable observing circumstances, under which the comet could reach 5th magnitude.

Although only expected to reach 13th magnitude, observations suggest that it faded from 9th magnitude in early July and had faded to 11 by early August.



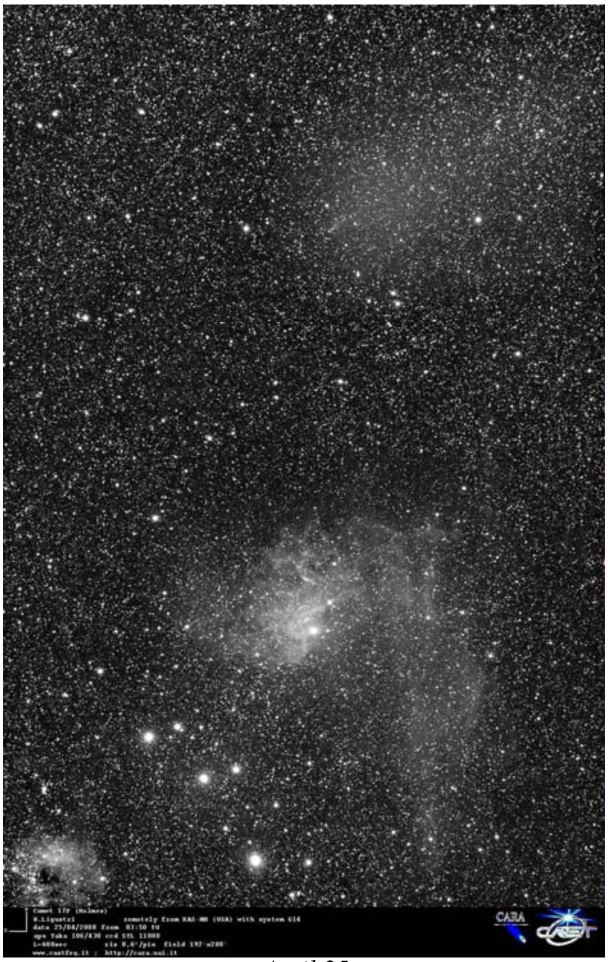
Nick James – January 5

17P/Holmes continued to grow and faded extremely slowly, although it became steadily harder to see. The last visual observations were made at the end of April, by which time it was around 5.5. A full report on the extraordinary spectacle will appear in due course. Although the light curve suggested that the comet would still be a bright object when it emerged from conjunction, in practice the coma diameter had expanded to such a size that, like the Cheshire Cat, it had become invisible, apart from the nucleus, which was visible to CCD observers.

March 8

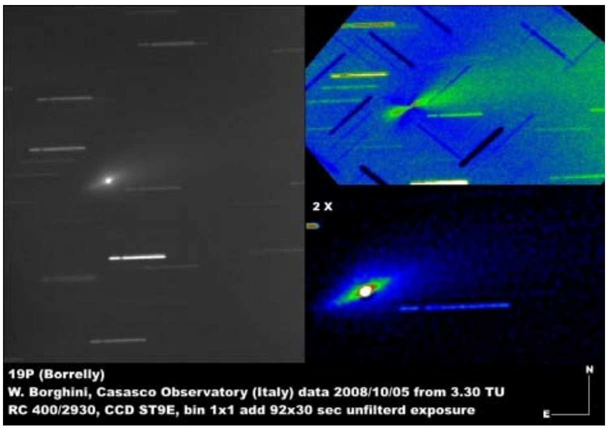
Richard Miles has suggested an interesting explanation for the outburst, which involves the explosive decomposition of a solution of hydrogen peroxide that had formed under the comet's crust.

Comet 17P/Holmes
2008 November 06 (14:03-14:58 UT)
The comet has now reached visual magnitude 20, seen here traversing a faint cluster of galaxies in Cancer. The brightest galaxy near the image centre is 19th magnitude. About 100 galaxies down to magnitude 24 are visible in the field of view of 3.1' x 2.4'. Motion-compensated stack of 16 x 164-sec exposures (total time = 44 min), 2.0-m Faulkes Telescope North + Sloan-r' filter R. Miles



April 25

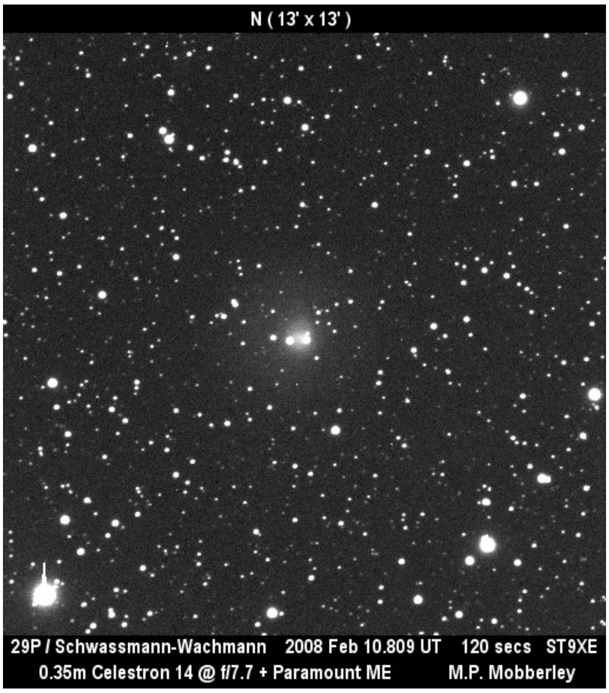
19P/Borrelly remained close to the Sun until perihelion. It slowly emerged into the morning sky, and observations of the comet commenced in July, with the comet a surprisingly bright 9th magnitude. It slowly faded and had reached 13m by the end of November.



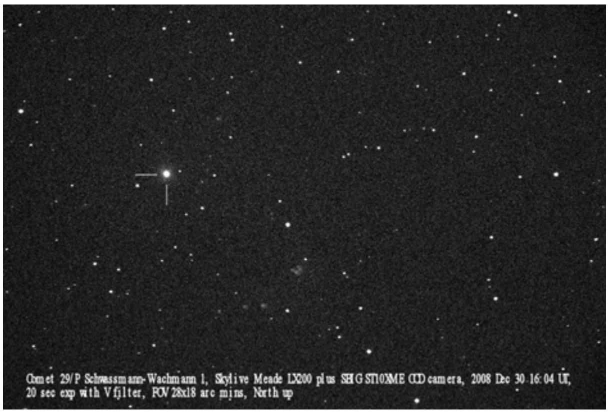
26P/Grigg-Skjellerup was another comet that was not expected to be readily observable in small apertures. Two observations in April put it at around 11th magnitude.

On 2008 June 12 NASA resulted a news bulletin announcing the discovery of a new mineral in dust particles captured in the Earth's atmosphere, which were possibly from 26P.

29P/Schwassmann-Wachmann This annual comet has frequent outbursts and over the past few years seems to be more often active than not, though it rarely gets brighter than 12m. This year it seems to have been in more or less continuous activity and it seems to have spent most of the year within visual range. A major outburst occurred in January and it reached 11th magnitude mid-month. A further outburst occurred in mid September, when it again reached 11th magnitude. Another outburst commenced around December 18.

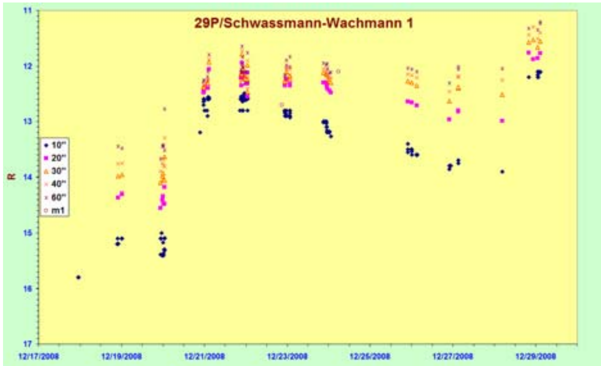


Guy Hurst notes in a TA Circular: Mark Kidger (Herschel Science Centre, European Space Agency European Space Astronomy Centre) reports that 29P/Schwassmann-Wachmann seems to be passing a phase of extremely high activity. After a long period of quiescence since the exceptional outburst in late September, no less than three outbursts have been observed by members of the "Observadores_cometas" Group in 11 days between 2008 December 18/19 and December 28/29.

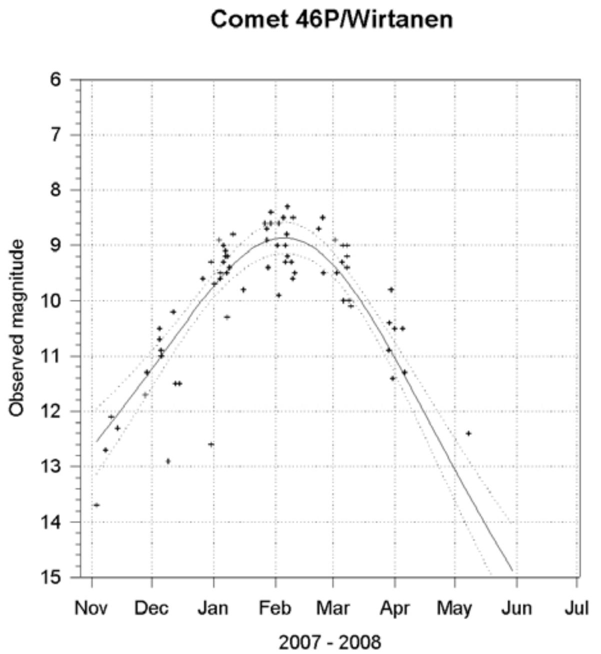


A small, initial outburst of amplitude 0.7 magnitudes to R=15.1 (10" square aperture), detected on December 18.9 by Toni Climent (MPC J97) and Josep Ayamami (MPC B20) was followed by a large outburst to R=12.6, registered by Rolando Ligustri (MPC 235) on December 20.9 and by Ramón Naves and Montse Campàs (MPC 213) on December 21.0. A third outburst, to R=12.15 followed, first detected by Faustino García (MPC J38) on December 28.85 and confirmed by many observers including César Piret (MPC J46), José Ramón Vidal (MPC 945) and Gustavo Muler (MPC J47).

The two most recent outbursts are the 6th and 7th largest of this comet observed since regular monitoring by the group began in 2001. During 2008, the activity of 29P has been exceptional compared to any other period since 2001, with the two largest outbursts that the group has observed, occurring in mid-January and late September, followed by this recent activity. In other words, four of the seven largest outbursts observed in the last eight years have occurred within the last 12 months.

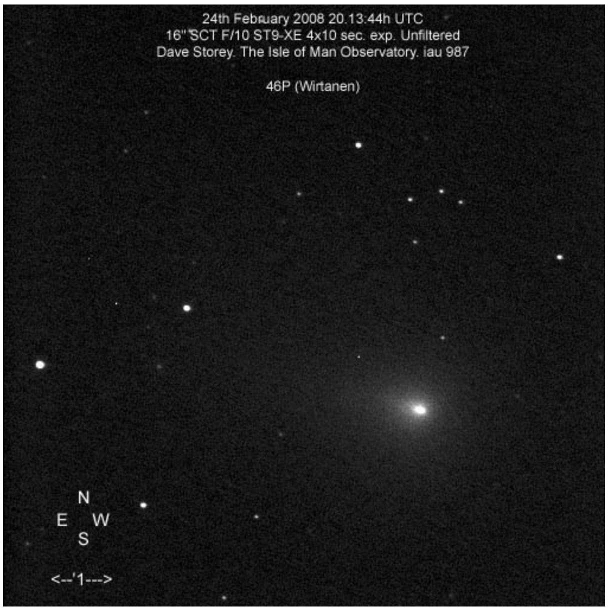


Further light curves of recent activity can be found at the url: http://www.astrosurf.com/comets/cometas/29p/



46P/Wirtanen behaved much as expected and peaked at around 9th magnitude near its February perihelion.

47P/Ashbrook-Jackson was discovered in 1948 following an approach to Jupiter in 1945, which reduced the perihelion distance from 3.8 to 2.3 AU. Although intrinsically relatively bright, the large perihelion distance keeps it faint. Alternate returns are favourable, but this is not one of them, as the comet was still some way from perihelion when it reached opposition in August. A couple of observations at this time suggest that it was then around 15th magnitude.



46P/Wirtanen

51P/Harrington was recovered on 2008 July 28.43 by the Catalina Sky Survey, with delta T of 0.98d. Further observations were made in October 2008, when the comet was around 17th magnitude. Visual observations suggest that the comet may have been brighter, with estimates of 14 – 15 in late summer.

61P/Shajn-Schaldach Ernesto Guido & Giovanni Sostero recovered the comet at its 2008 return on June 6.4, using a remotely controlled telescope in New Mexico. Visual observations suggest that it reached 14th magnitude in November.

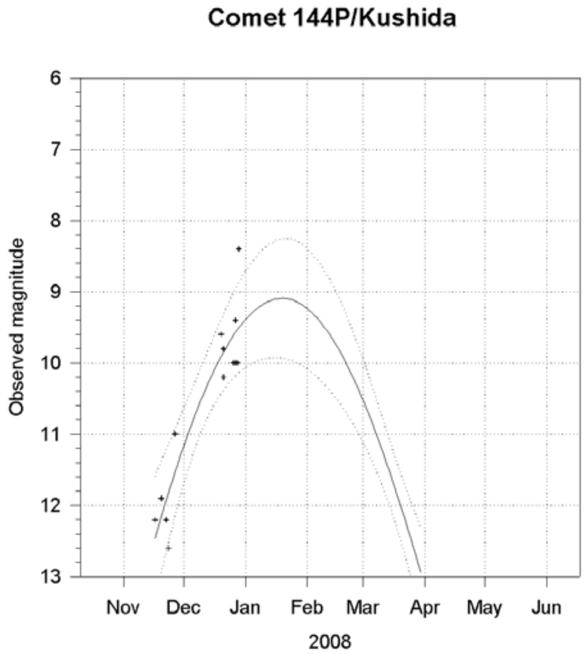
67P/Churyumov-Gerasimenko was recovered by Gustavo Mueller at Observatorio Nazaret with a 0.30m Schmidt-Cassegrain on 2008 June 1.12, when it was 19th magnitude. It is not well placed for observation, but the few observations suggest that it had brightened to 12th magnitude by the end of the year.

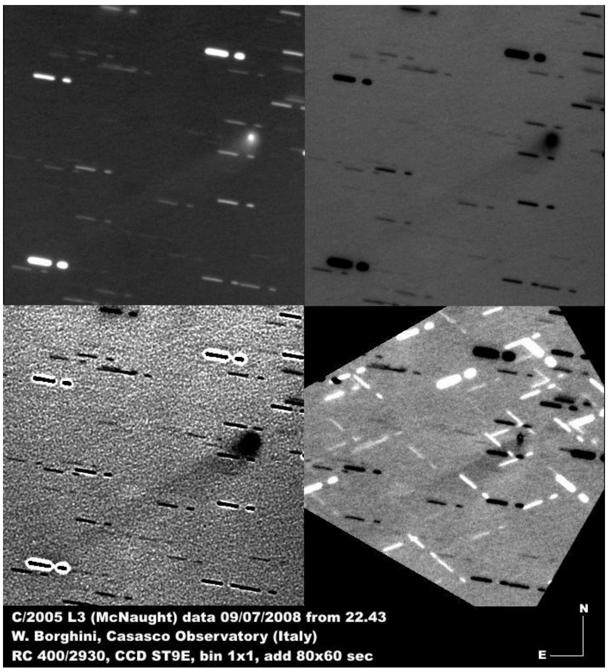
85P/Boethin still has not been recovered, so it seems likely that the suggestions for its demise are correct, unless the determined period is substantially out. This remains a slight possibility as it has made a couple of close approaches to Jupiter since it was last observed in 1986. It came within 0.63 AU in August 1995 and 0.44 AU in June 2007.

93P/Lovas was well placed for observation during the first quarter of 2008, and still within visual range, however most observers neglected it and only a couple more observations were received. It was fading from 13th magnitude.

116P/Wild was observed once, with an estimate of 14.5 at the beginning of November. This is about as expected for this return, and it should now be around 13th magnitude.

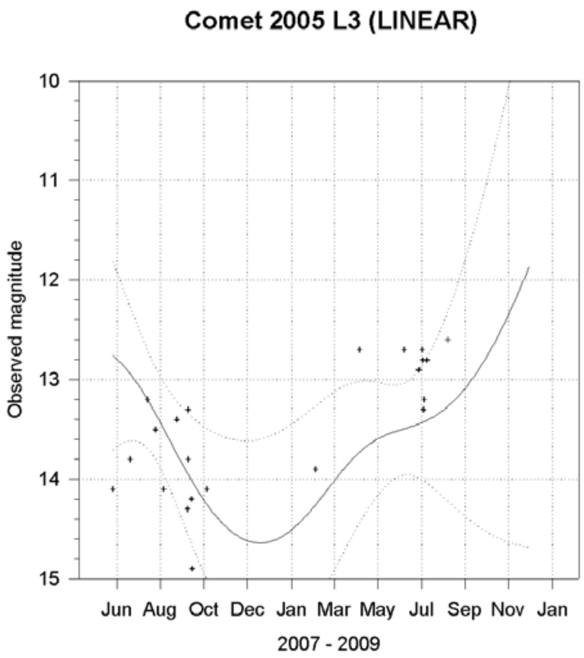
144P/Kushida is significantly brighter than expected, and can be seen in large binoculars. It is however likely to fade rapidly. [See also 2009 predictions.]

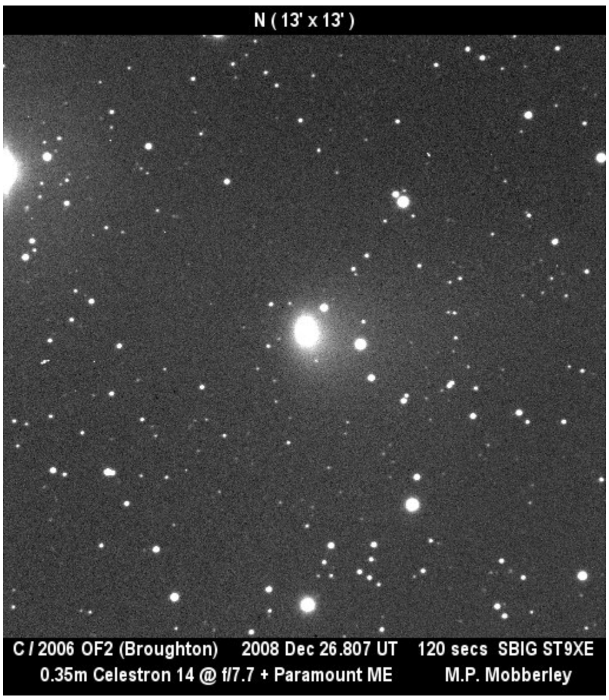




192P/Shoemaker-Levy was observed a few times in January and February, with the observers making it 13th – 14th magnitude.

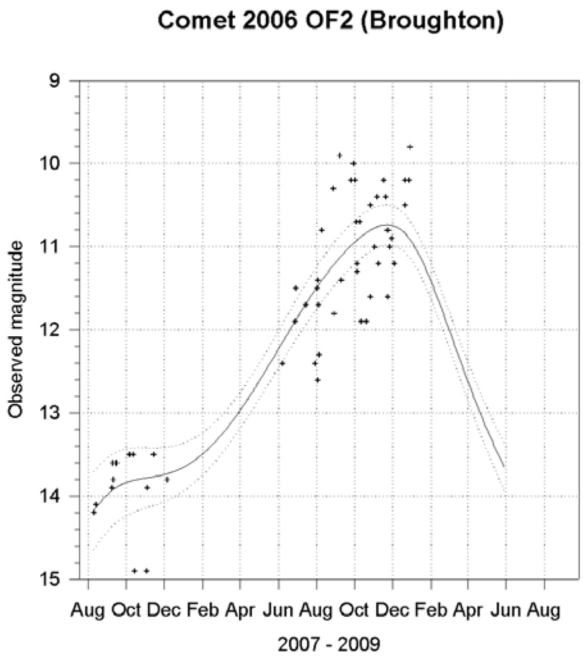
2005 L3 (McNaught) reached perihelion at 5.6 AU in January 2008. As it was a distant object it has been observable over two oppositions. The light curve (fitted using the standard form of magnitude equation) shows that it was brighter at the second opposition, which is physically unrealistic unless the absolute magnitude has brightened with time. Being at such a great distance it may be subject to similar behaviour to that shown by 29P/Schwassmann-Wachmann, in which case it could still be visible now that it has emerged from conjunction, although a more normal light curve would suggest that it should be fainter than 14th magnitude.



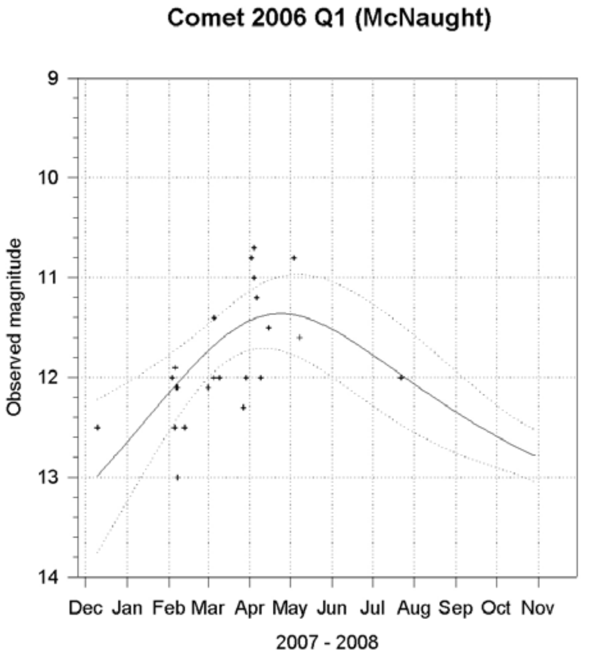


C / 2006 OF2 (Broughton) 2008 Dec 26.807 UT 120 secs SBIG ST9XE
0.35m Celestron 14 @ f/7.7 + Paramount ME M.P. Mobberley

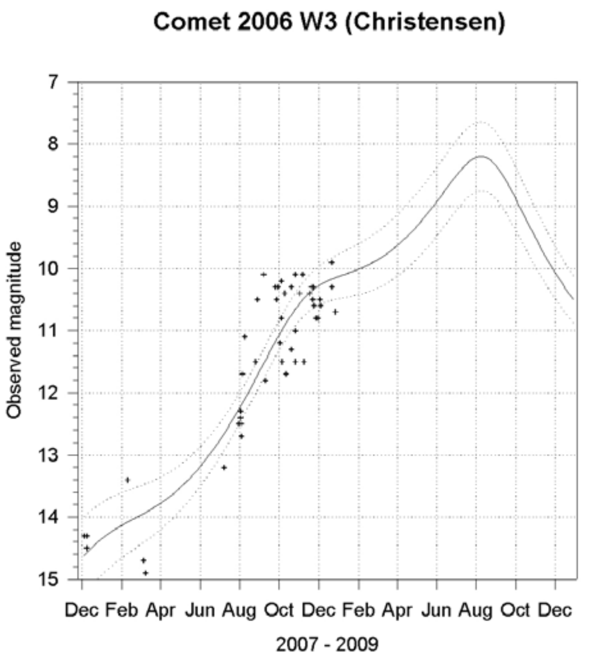
2006 OF$_2$ (Broughton) emerged from solar conjunction in 2008 June as a 12th magnitude object and peaked at 10th magnitude in November. It will remain visible until 2009 May.



2006 Q1 (McNaught) reached perihelion at 2.8 AU in early July 2008, when it was around 12th magnitude. It passed through solar conjunction in October, but I have not yet received further observations. The light curve seems fairly normal, so it could still be 13 – 14 magnitude.

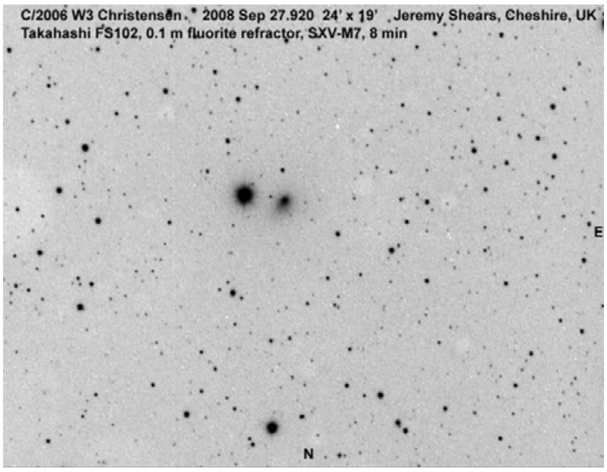


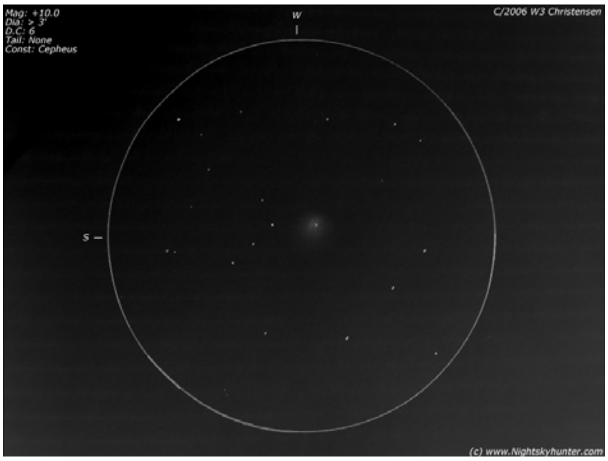
2006 S5 (Hill) was at perihelion at 2.6 AU in 2007 December. A few observations show that it faded from 13th magnitude in 2007 November and had reached 14th magnitude by early March.



2006 W3 (Christensen) is a small well condensed object, and is currently well placed for UK observers. I was able to observe it on October 22.8, estimating it at 10.7 in my 0.33-m Dobsonian x45. It has somewhat stagnated over the last couple of months as its distance from us has increased, but it should begin brightening again.

48 observations received so far suggest an uncorrected preliminary light curve of m = -1.7 + 5 log d + 16.1 log r. If this light curve holds (and the absolute magnitude is unusually bright), it could reach 8th magnitude in 2009.

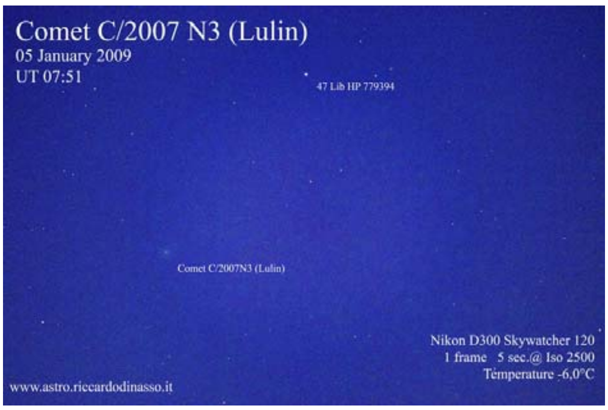




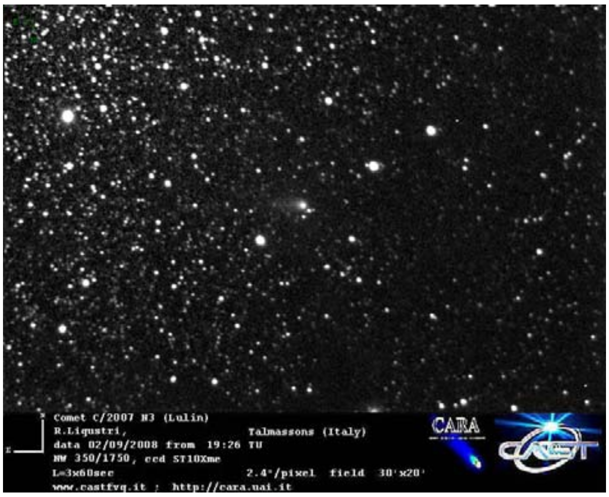
2007 B2 (Skiff) was a distant comet, but was within visual range during the first half of the year, with observers suggesting that it brightened from 14th to 13th magnitude.

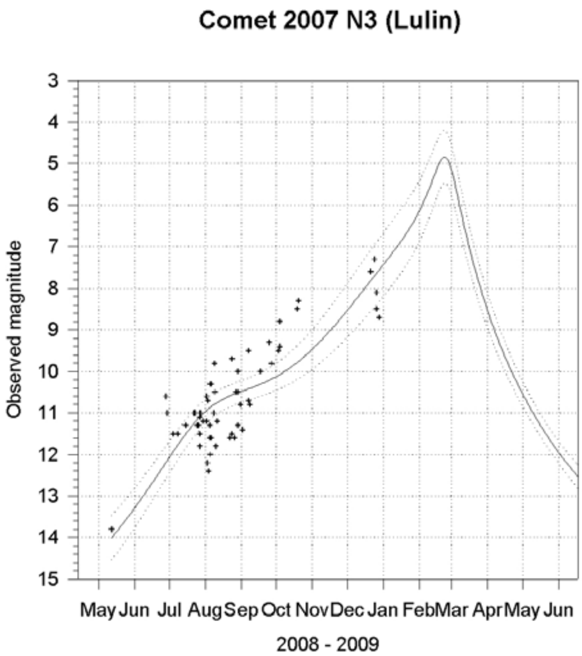
2007 G1 (LINEAR) was observed from May to August, brightening from 13th to 11th magnitude. It is now a Southern Hemisphere object, but should still be visible, fading from 12th magnitude.

2007 K3 (Siding Spring) The comet reached perihelion at 2.05 AU in April 2008. It was predicted to reach 14th magnitude around the time of perihelion, however no visual observations have been reported to the BAA.



2007 N3 (Lulin) emerged from conjunction for near equatorial observers around December 15 and rapidly moved into the morning sky. The comet should become visible to UK observers in early 2009, and may be a naked eye object in 2009 February. It will remain visible until early May, although it fades rapidly.



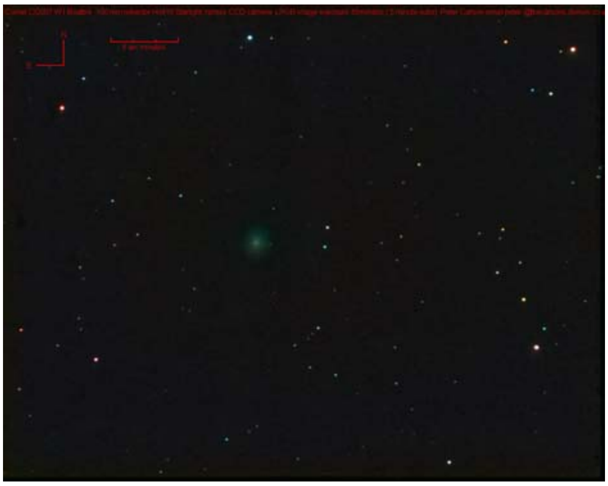


The comet passed through the SOHO C3 field between November 17 and December 4. It should have been around 7th magnitude to visual observers, but was clearly fainter than this. However Michael Mattiazzo did locate the 9th magnitude nuclear condensation in C3 images from December 1. An observation by Juan Jose Gonzalez Suarez on December 21.3 made it 7.6 in 25x100B, rather fainter than expected from the pre conjunction light curve.

2007 U1 (LINEAR) reached perihelion at 3.3 AU in 2008 August. A few observations made during the autumn suggest that it reached 14th magnitude.

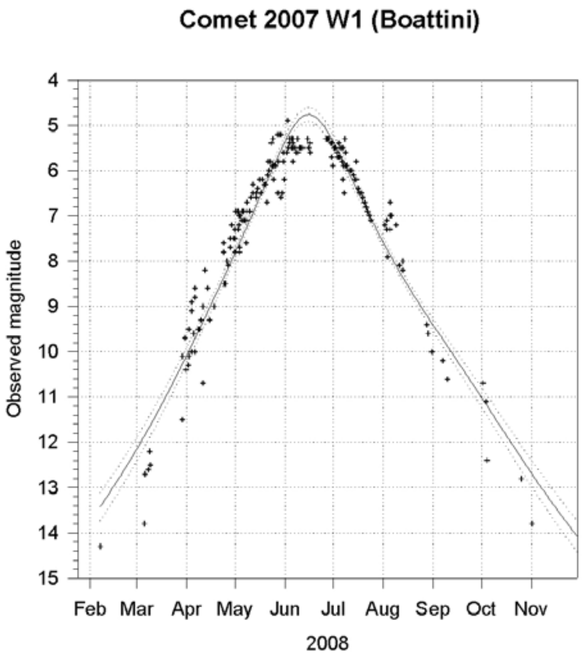
Visual observers estimated **2007 T1 (McNaught)** at around 9th magnitude in early January. It was not well placed for observation from the UK.

2007 W1 (Boattini) brightened rapidly and came within general visual range in early March 2008. It reached binocular visibility in late April, but few UK observations were made as the comet was rather far south, and very diffuse. Southern Hemisphere observers had a better view, and were able to view it through perihelion. The brightening seemed to slow down during May, with many observers reporting it at around 6th magnitude, for example Alexandre Amorim reporting it at 5.9 in 10x50B on May 24.92. It peaked at around 5th magnitude near the time of perihelion in late June.



It moved into view from the UK after perihelion and was imaged on July 25 by Peter Carson, from Leigh on Sea, Essex. It was visible as a weakly condensed binocular object in August. It had faded to around 10th magnitude by early September and had become quite diffuse, but then went into a steep decline, with CCD observations suggesting that it was 18th magnitude by late October.

Cedric Bemer pointed out the possibility of a meteor shower from the comet. The miss distance for the orbits is 0.0178 AU and the earth passed this point 27.5 days later. Maximum was likely on August 21.9 or 27.6, with a radiant of 168° -14°, however no unusual activity was reported.



SOHO Comets. Altogether 170 SOHO comets and 7 STEREO comets were discovered during the year. Some still await orbits. A further 3 SOHO comets have so far been discovered in 2009.

Meyer Group SOHO comets 2008 D6, F1, H4, J10, J12, K7, L11, L15, X5 were discovered with the SOHO LASCO coronographs and have not been observed elsewhere.

Kracht Group SOHO comets 2008 E4, G6, L6, L7, N4, R7 were discovered with the SOHO LASCO coronographs and have not been observed elsewhere.

Brian Marsden noted in MPEC 2008-F33 [2008 March 26]: R. Kracht suggested the identity of the Kracht group comets C/2002 Q8 and C/2008 E4 on the basis of the MPEC 2002-Q46 measurements of the former and his own measurements of the latter. He gave the previous perihelion date T = 1997 Feb. 14.9 but was unable to locate the comet on C2 images from that time. A linked orbit was computed by Brian Marsden and gives a period of 5.52 years.

Brian Marsden noted in MPEC 2008-L29 [2008 June 6]: R. Kracht suggests that the Kracht-group comet C/2008 G6 is a return of comet C/2002 S11 (cf. MPEC 2002-T75). Rainer Kracht also suggests that a comet he discovered on June 11 may be linked to 2002 R5, with a previous return on 1996 November 25.

Brian Marsden noted in MPEC 2008-O23 [2008 July 24]: Comets C/2008 L6 and L7 appear to be members of the "Kracht 2" Group, and R. Kracht suggests that they represent a return of comet C/2002 R5 (cf. MPEC 2002-S35). The 15-deg shift in the line of nodes actually supports the likely correctness of this linkage, as it is consistent with the comet's passage within 1.1 AU of Jupiter in January 2007. Zdenek Sekanina suggested on IAUC 8983 [2008 September 28] that 2002 R5 split 2 - 10 weeks prior to perihelion, and the fragments separated with low velocity that shows no sign of outgassing effects.

Brian Marsden noted in MPEC 2008-P60 [2008 August 12]: R. Kracht suggests that the Kracht-group comet C/2008 N4 is a return of C/2002 S7, principally on the assumption that C/2002 S7 was itself a return of one of C/1996 S5, C/1996 S4 or C/1996 S3 (see MPEC 2006-C49). The derived orbit links C/2002 S7 and C/2008 N4. This gravitational linkage leads to a previous perihelion time of T = 1996 Dec. 6.00, earlier by a few hours than the values for the aforementioned 1996 comets. This possibly suggests the presence of non-gravitational effects, which would confirm the cometary nature of these objects.

Brian Marsden noted in MPEC 2008-S67 [2008 September 26]: The Kracht-group comet C/2008 R7 is likely to be a return of one of the members of September 2002. R. Kracht himself suggests identity with C/2002 S5. Identity with C/2002 S11 is a distinct possibility, although this comet was associated with C/2008 G6 on MPEC 2008-L29. The published orbit links C/2008 R7 with C/2002 S4.

Marsden Group SOHO comets 2008 A3, X6 were discovered with the SOHO LASCO coronographs and were not observed elsewhere.

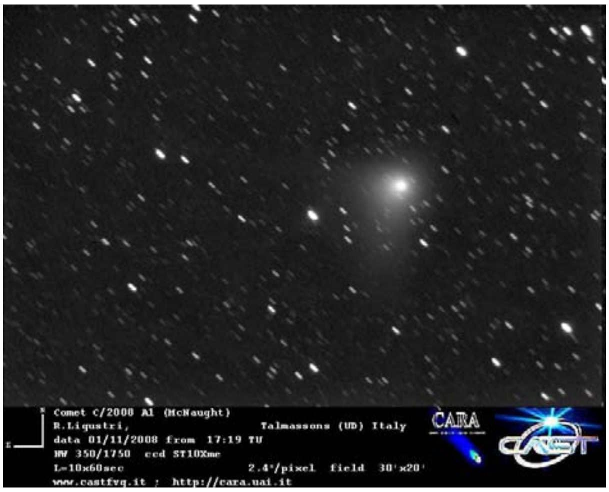
Brian Marsden noted in MPEC 2008-B61 [2008 January 29]: R. Kracht has suggested the identity of the Marsden-group comet C/2008 A3 with C/2002 R1 (cf. MPEC 2002-R57). The linkage (all the observations having been made with the C2 coronagraph), by Brian Marsden, yields for the previous perihelion passage T = 1997 Apr. 19.0.

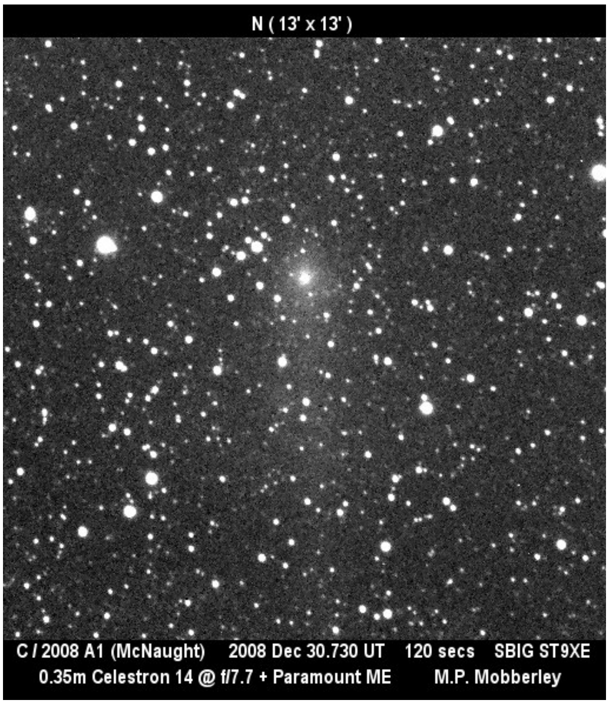
SOHO Kreutz group comets 2008 B1, B2, B3, B4, C4, C5, C6, C7, C8, D1, D2, D3, D4, D5, D7, D8, D9, E5, E6, E8, E9, G3, G4, G5, H2, H3, H5, H6, H7, H8, H9, J7, J8, J9, J11, J13, J14, J15, J16, K1, K2, K3, K4, K5, K6, K8, K9, K11, L4, L5, L8, L9, L10, L12, L13, L14, M1, M2, M3, M4, M5, M6, M7, N2, N3, N5, N6, N7, N8, N9, N11, O1, O5, P2, P3, P4, P5, P6, R5, R9, R10, R11, R12, R13, S4, S5, S6, S7, S8 were discovered with the SOHO LASCO coronographs and have not been observed elsewhere. They were sungrazing comets of the Kreutz group and were not expected to survive perihelion. Some of these comets show no tail at all and it is possible that some supposed observations of Vulcan were actually tiny Kreutz group comets. 1298 SOHO and STEREO members of the group have now been discovered. SOHO and STEREO have discovered 1591 confirmed comets, though some more await orbit determination.

Brian Marsden noted on MPEC 2008-E58 [2008 March 6] that the parabolic orbit for C/2008 D3 satisfies 52 (10 from HI1-A, 12 from COR2-A and 30 from COR2-B spanning Feb. 20.66-22.21 UT, during which time the comet's heliocentric distance decreased from 0.154 to 0.032 AU) of the 97 observations shown with residuals no more than 15" in either coordinate. T and q are good to the quoted precision, while the uncertainties in the angular elements are substantially less than 0.1 deg.

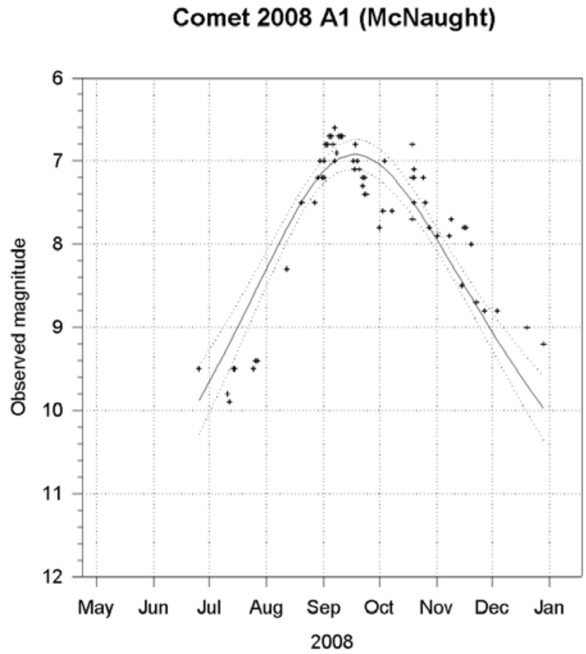
Elliptical orbit computations give e = 0.9998 and 120 < P < 180 years, results that are likely to be somewhat too small for a member of the Kreutz group. The STEREO-A and STEREO-B spacecraft were respectively 0.38 and 0.41 AU from the earth, the line between them subtending an angle of 155 deg at the earth.

2008 O1 (SOHO) was visible in the total eclipse image taken by Miloslav Druckmuller (Brno University of Technology), Peter Aniol and Vojtech Rusin. Professor Druckmuller also provides a spectacular false colour image with frames taken 20 minutes apart in Novosibirsk (10:45) and Mongolia (11:04). The earlier image appears distinctly non-stellar. This is the first ground based imaging of one of the SOHO Kreutz comets.





2008 A1 (McNaught) Rob McNaught discovered a 15th magnitude comet on January 10.57 on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring Observatory. The comet reached perihelion at 1.1 AU in 2008 September, when it reached 7th magnitude. It moved into view for UK observers in October, and although initially well condensed it was a difficult object due to its low altitude. I was able to locate it on October 22.8, when it 7.8 in 20x80B. It has remained low down in the evening twilight, but is now emerging into the morning sky, where it will become better placed.



Brian Marsden notes on MPEC 2008-F02 [2008 March 17] that the "original" and "future" barycentric values of 1/a are +0.000105 and +0.000374 (+/- 0.000016) AU^-1, respectively. The moderate "original" value suggests that this comet may have made a previous visit to the inner solar system.

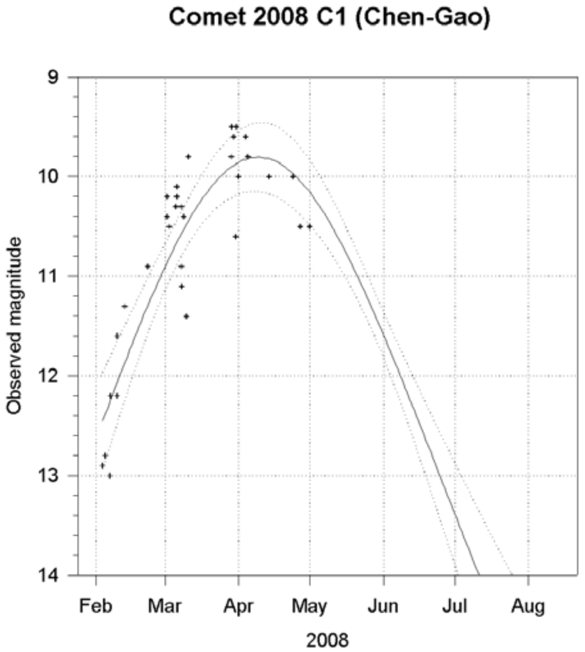
2008 A2 (P/LINEAR) An apparently asteroidal object of 20th magnitude discovered by LINEAR on January 13.22 was found to show a coma after posting on the NEOCP. The comet has a period of about 5.7 years and perihelion is at 1.3 AU in June.

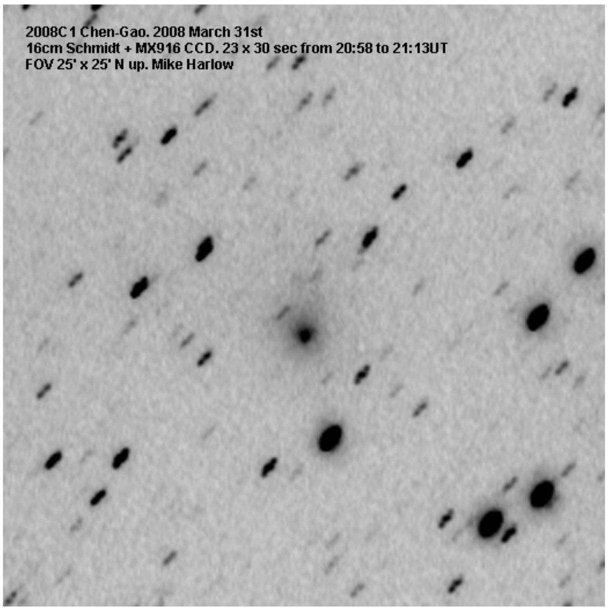
A/2008 BN_{18} [Spacewatch] This unusual asteroid was discovered by Spacewatch with the 1.8m reflector on January 30. 19th magnitude at discovery it has a period of around 100 years and perihelion is at 2.6 AU in June [MPEC 2008-C91, 2008 February 13, 14-day orbit]. The orbit is comparable to those of long period comets, and it will be interesting to see if it develops cometary activity as it approaches perihelion.

2008 C1 (Chen-Gao) Tao Chen (Suzhou City, Jiangsu province, China) discovered a comet on a CCD image taken on February 1.67 by Xing Gao (Urumqi, Xinjiang province) with a wide-field 7-cm, 200-mm-f.l., f/2.8 camera lens (+ Canon 350D camera) at Gao's Xingming Observatory, Mt. Nanshan, in the course of a nova survey. He then found images of the comet on earlier exposures taken by Gao on January 30 (when the comet appeared at mag 14.0) and January 31 (mag 13.5). Gao obtained confirming images on February 2 (showing that its brightness increase had continued to mag 12.0). The discovery was confirmed by numerous observers following posting on the NEOCP, and announced in IAUC 8915 [2008 February 3].

Brian Marsden notes on MPEC 2008-H03 [2008 April 17] that The "original" and "future" barycentric values of 1/a are +0.000017 and +0.000481 (+/- 0.000061)

AU^-1, respectively. The small "original" value suggests that this comet has not made a previous visit to the inner solar system and is a "new" comet from the Oort cloud.





The rapid rise in brightness described by the discoverers was not entirely consistent with the preliminary orbit. Subsequently published discovery magnitudes were however fainter, and visual observations suggest that the comet was around 13th magnitude. The comet reached perihelion in mid April at 1.3 AU. Visual observations in March suggested that the comet was around 10th magnitude, but was quite large and diffuse. By late April it had become poorly placed for easy observation from the UK and faded rapidly.

2008 C2 (196P/Tichy) M. Tichy and J. Ticha, Klet Observatory, recovered comet P/2000 U6 (cf. IAUC 7515) on CCD images obtained on February 3rd with the 1.06-m KLENOT Telescope. They subsequently identified earlier images from January 11. The indicated correction to the prediction on MPC 54167 is Delta(T) = -0.16 day.

2008 C3 (SOHO)(IAUC) This was a non-group comet discovered in C2 images by Rainer Kracht on 2008 February 3.

2008 C9 (SOHO)(IAUC 8953, 2008 June 14) This was a non-group comet discovered in C2 images by Rainer Kracht on 2008 February 15.

A/2008 DS_{83} [Steward] This unusual asteroid was discovered at the Steward Observatory, Kitt Peak with the 0.9m reflector on February 24.40. 20th magnitude at discovery it has a period of 5.8 years and perihelion is at 1.38 AU in early August [MPEC 2008-K42, 2008 May 27]. The object can pass within 0.2 AU of Jupiter and 0.4 AU of the earth. This type of orbit is typical of Jupiter family comets.

2008 E1 (Catalina) An apparently asteroidal object of 19th magnitude discovered during the Catalina Sky Survey with the 0.68-m Schmidt on March 2.14 was found to show a coma after posting on the NEOCP. Numerous observers, including Peter Birtwhistle, remarking on the cometary appearance.

Further observations showed that the comet has a period of around 35 years, reaching perihelion at 4.8 AU in August.

2008 E2 (197P/LINEAR) After posting an asteroidal object discovered by the Catalina Sky Survey on the NEOCP Sergio Foglia suggested an identity with comet 2003 KV2 (LINEAR), indicating a correction of Delta(T) = +0.8 day to the prediction by Nakano on MPC 56801.

2008 E3 (Garradd) Gordon Garradd discovered an 18th magnitude comet on images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on March 5.78, the object being diffuse and 20" in diameter on images from Mar. 7.8 UT. The comet reached perihelion at 5.5 AU in August.

Brian Marsden notes on MPEC 2008-K06 [2008 May 17] that the "original" and "future" barycentric values of 1/a are +0.000253 and +0.000852 (+/- 0.000049) AU^-1, respectively. The moderate "original" value suggests that this comet has made a previous visit to the inner solar system.

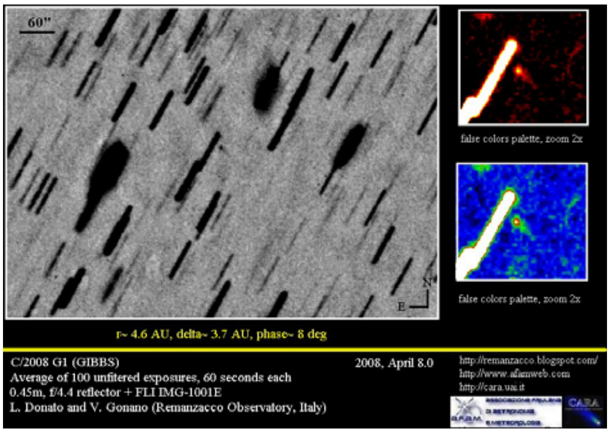
2008 E7 (SOHO)(IAUC 8956, 2008 June 20) This was a non-group comet discovered in C2 images by Hua Su on 2008 March 5. The inclination of the orbit is similar to Kreutz group comets but perihelion is at 0.055 AU.

A/2008 ED_{69} [Catalina] This unusual asteroid was discovered by the Catalina Sky Survey with the 0.68m Schmidt on March 11.50. 20th magnitude at discovery it has a period of around 5 years and perihelion is at 0.72 AU in early July [MPEC 2008-E105, 2008 March 12 & MPCORB, 18-day orbit]. The object can pass within 0.2 AU of Jupiter and 0.3 AU of the earth. This type of orbit is typical of Jupiter family comets.

Peter Jenniskens suggests that it may be a major fragment of the object that formed the kappa Cygnids meteor shower. Work with Jeremey Vaubaillon suggests a formation date for the shower between 4000 and 1600 BC.

2008 FK$_{75}$ (Lemmon-Siding Spring) The Mt Lemmon survey discovered a 19th magnitude asteroidal object on March 31.40 that was designated 2008 FK$_{75}$. Siding Spring discovered a 19th magnitude object on July 1.43 and it was posted on the NEOCP before the identity was found. Other observers noted a slight coma. The comet reaches perihelion at 4.52 AU in 2010 September.

A/2008 FF$_5$ [Mt Lemmon] This unusual asteroid was discovered from Mt Lemmon with the 1.5m reflector on March 28.32. It has a period of 3.3 years and perihelion was at 0.08 AU in mid February 2008. [MPEC 2008-F50, 2008 March 29 & MPCORB, 2-day orbit]. In the current orbit it can approach to 0.008 AU of the Earth. The object is small, with an absolute magnitude of 23.



2008 G1 (Gibbs) Alex Gibbs discovered a 19th magnitude comet on images taken with the Mt. Lemmon 1.5-m reflector on April 7.36. It was soon confirmed by astrometric observers following posting on the NEOCP. It will reach perihelion at 4.0 AU in 2009 January. The orbit is a long period ellipse.

2008 G2 (P/Shoemaker) Whilst examining single-night observations of minor planets from April 10 reported by the Catalina Sky Survey to the Minor Planet Center, T. B. Spahr identified a candidate for comet P/1994 J3 = 1994k = 1994 XXVIII (Shoemaker, a.k.a. Shoemaker 4; cf. IAUC 5991, 5998, etc.). Brian Marsden then identified a corresponding candidate in the Catalina data from April 1. In each case the observer was R. A. Kowalski, and nothing was reported about the object's appearance. The indicated correction to the prediction on MPC 56803 (ephemeris on MPC 60734) is -1.7 days. [From CBET 1347, 2008 April 22]. This was again first announced in a CBET. The comet was around 19th magnitude at recovery and is near its brightest for this opposition. It reaches perihelion in 2009 April.

Spanish CCD observers reported the comet in outburst in early August, and this was confirmed by other CCD observers. Juan Jose Gonzalez Suarez made a visual observation on August 4.92, estimating it as a nearly stellar object of magnitude 14.4.

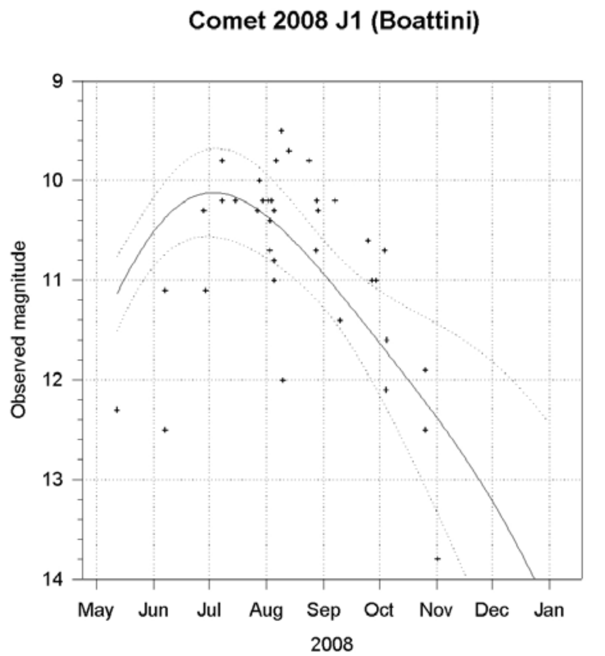
2008 H1 (LINEAR) An apparently asteroidal object of 18th magnitude discovered by LINEAR on April 18.35 was found to show a coma and tail after posting on the NEOCP. The comet was at perihelion at 2.76 AU in mid March. Unusually the discovery was first announced in a Central Bureau Electronic Telegram (1343) rather than in an IAUC.

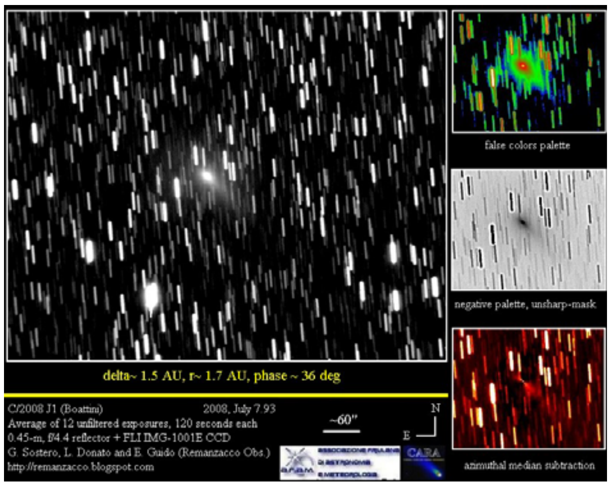
Early orbit computations by Hirohisa Sato allowed the possibility of an elliptic orbit, with a period of around 200 years and this was subsequently confirmed, the latest orbit having an eccentricity of 0.95 and a period of around 350 years.

2008 J1 (Boattini) Andrea Boattini discovered a 14th magnitude comet during the course of the Catalina Sky Survey with the 0.68-m Schmidt on May 2.46. It was confirmed by many other CCD observers. The comet reached perihelion at 1.72 AU in mid July, and brightened to 10th magnitude.

Orbit computation by Hirohisa Sato suggested that the orbit was a long period ellipse, and the latest orbit gives a period of around 2000 years.

Brian Marsden notes on MPEC 2008-N38 [2008 July 15] that the "original" and "future" barycentric values of 1/a are +0.006961 and +0.006426 (+/- 0.000017) AU^-1, respectively. The large "original" value suggests that this comet has made a previous visit to the inner solar system.





2008 J2 (P/Beshore) Ed Beshore discovered a 14th magnitude comet with the Mt Lemmon 1.5-m reflector on May 6.47. It was confirmed by many other CCD observers.

Orbit computation by Hirohisa Sato suggested that the orbit was of short period. The comet was at perihelion at 2.41 AU in late March and has a period of 6.5 years. It will fade. It is a member of the "Main Belt Comet" family.

A few observations were made in May and July, with observers giving a brightness of around 12.5.

2008 J3 (P/McNaught) Rob McNaught discovered an 18th magnitude comet on May 10.69 on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring Observatory. The comet is at perihelion at 2.29 AU in mid March 2009 and has a period of 7.7 years.

2008 J4 (McNaught) Rob McNaught discovered another comet on May 10.79, of 17th magnitude on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring Observatory. The comet was at perihelion at 0.44 AU in mid June. Although the comet could have brightened to 11th magnitude around the time of perihelion, it was both intrinsically very faint and poorly placed for observation.

Images obtained by Michal Jaeger on May 28 showed the comet as a large, faint patch without central condensation. He suggests that the comet may have disintegrated. The most recent astrometric observations are from May 25. A single visual observation made by Juan Jose Gonzalez Suarez on June 7.1 put the very diffuse comet at 11.7.

2008 J5 (Garradd) Gordon Garradd discovered a 17th magnitude comet on May 13.73 on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring Observatory. The comet was at perihelion in early April at 1.96 AU. The orbit is a long period ellipse of around 600 years.

Brian Marsden notes on MPEC 2008-N41 [2008 July 15] that the "original" and "future" barycentric values of 1/a are +0.014802 and +0.014657 (+/- 0.000076) AU^-1, respectively. The large "original" value suggests that this comet has made a previous visit to the inner solar system.

2008 J6 (Hill) Rik Hill discovered a 15th magnitude comet during the course of the Catalina Sky Survey with the 0.68-m Schmidt on May 14.46. It was confirmed by many other CCD observers. The comet was at perihelion in mid April at 2.00 AU.

Brian Marsden notes on MPEC 2008-N42 [2008 July 15] that the "original" and "future" barycentric values of 1/a are +0.000031 and -0.000474 (+/- 0.000050) AU^-1, respectively. The small "original" value suggests that this comet has not made a previous visit to the inner solar system, and is a "new" comet from the Oort cloud.

A/2003 JC_{11} [Kitt Peak] is an asteroid, of 21st magnitude, discovered by J V Scotti with the 0.9-m telescope at the Steward Observatory, Kitt Peak on 2003 May 1.40. It is in a 5.3 year orbit, with perihelion at 1.35 AU and an eccentricity of 0.56. It was at perihelion at the end of November and will fade. [MPEC 2003-J35, 2003 May 6, 5-day orbit] The orbit is typical of a Jupiter family comet, though there have been no recent close approaches to either Jupiter or the Earth.

It was refound as 2008 JL_{14}, also at Kitt Peak. The linked orbit has a period of 5.0 years, with perihelion at 1.28 AU in mid December 2007. The earth MOID is 0.46 AU. [MPEC 2008-O29, 2008 July 26]

A/2008 JS_{14} [Siding Spring] This unusual asteroid was discovered during the Siding Spring Survey with the 0.5m Uppsala Schmidt on May 6.78. It has a period of 40 years and perihelion was at 3.0 AU in mid June 2008. [MPEC 2008-O30, 2008 July 26, 80-day orbit].

2008 K10 (P/SOHO) [IAUC 8982, 2008 September 26] was a non-group comet discovered in C2 images by Rainer Kracht on 2008 May 31. The original orbit on MPEC 2008-O16 [2008 July 22], gave a retrograde orbit. On the basis of an identification by Rainer Kracht, Brian Marsden has computed a linked orbit with 2004 E2 and 1999 X3, which has a period of 4.2 years and a low inclination. Brian Marsden comments on MPEC 2008-S49 [2008 September 24] The identification is by R. Kracht. The observations, all obtained with the LASCO C2 coronagraph, are on MPEC 2006-L20, 2004-M42 and 2008-O16. The object passed 0.058 AU from the earth on 2000 Jan. 13, 0.032 AU from Mars on 2004 May 19 and 1.17 AU from Jupiter on 2003 Feb. 1.

A/2008 KB_{12} [Andrushivka] This unusual asteroid was discovered from the Andrushivka Astronomical Observatory with the 0.6m reflector on May 29.95. It has a period of 5.1 years and perihelion was at 1.17 AU in mid May 2008. [MPEC 2008-L01, 2008 June 1, 2-day orbit]. The object can pass within 0.5 AU of Jupiter and 0.2 AU of the earth. This type of orbit is typical of Jupiter family comets. The object is small, with an absolute magnitude of 21.

A/2008 KV_{42} [Mauna Kea] This unusual asteroid was discovered from Mauna Kea with the 3.5m Canada-France-Hawaii reflector on May 31.35. It is in a retrograde orbit with a period of around 300 years and perihelion is at 20 AU in 2034. [MPEC 2008-O02, 2008 July 16, 39-day orbit]. The object is cometary sized, with an absolute magnitude of 9.

2008 L1 (200P/Larsen) J. V. Scotti recovered comet P/1997 V1 (Larsen) with the Spacewatch 1.8-m f/2.7 reflector at Kitt Peak on June 9.44. The indicated correction to the prediction on MPC 54170 is Delta T = -2.0 days. This is the 200th comet to be numbered, although several SOHO comets have been observed to return and not numbered.

2008 L2 (P/Hill) Rik Hill discovered an 18th magnitude comet on CCD images taken with the 0.68-m Catalina Schmidt telescope on June 12.44. It will brighten a little towards perihelion. Hirohisa Sato suggested a short period orbit. This is confirmed by the latest orbit, which gives the period as 15 years, with perihelion at 2.3 AU in mid August. A couple of visual observations in the autumn suggest that the comet was around 15th magnitude.

2008 L3 (Hill) Rik Hill discovered another comet the following night, on CCD images taken with the 0.68-m Catalina Schmidt telescope on June 13.28. It was 19th magnitude. The latest orbit gives perihelion at 2.0 AU in late 2008 April.

A/2008 MR_1 [LINEAR] This unusual asteroid was discovered by LINEAR with the 1.0m reflector on June 30.39. 20th magnitude at discovery it has a period of 7.6 years and perihelion is at 1.23 AU in late August [MPEC 2008-N04, 2008 July 1, 1-day orbit]. The object can pass within 0.2 AU of Jupiter (at both nodes) and 0.25 AU of the earth. This type of orbit is typical of Jupiter family comets.

2008 N1 (Holmes) An apparently asteroidal object of 20th magnitude discovered on July 1.33 by amateur astronmer, Robert Holmes of Charleston, Illinois with a 0.40-m f5.8 Schmidt-Cassegrain reflector was found to show a slightly elongated coma by other observers, including Peter Birtwhistle. The comet is due to reach perihelion at 2.8 AU in 2009 September.

Brian Marsden notes on MPEC 2008-R70 [2008 September 15] that the "original" and "future" barycentric values of 1/a are +0.001193 and +0.001252 (+/- 0.000033) AU^-1, respectively. The large "original" value suggests that this comet has made a previous visit to the inner solar system.

2008 N10 (SOHO)(IAUC) was a non-group comet discovered in C2 images by Rainer Kracht on 2008 July 11.

2008 O2 (P/McNaught) Rob McNaught discovered an 18th magnitude comet on July 28.69 on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring Observatory. Although the initial parabolic orbit looked promising for visual observation, as more observations accumulated it became clear that it was a periodic comet with perihelion at 3.8 AU in 2009 April. The period is around 9.5 years.

Brian Marsden notes on MPEC 2008-Q07 [2008 August 18] that the orbit indicates a very close approach to Jupiter (to 0.1 AU) in 2003 and that the previous perihelion distance was around 5.8 AU.

2008 O3 (P/Boattini) Andrea Boattini discovered a 19th magnitude comet during the course of the Mt Lemmon Survey with the 1.5m reflector on July 29.46. The comet reached perihelion at 2.5 AU in early June and has a period of around 24 years.

2008 O4 (SOHO)(IAUC 8985, 2008 September 30) was a non-group comet discovered in C2 images by Michal Kusiak on 2008 July 25.

2008 O6 (SOHO)(IAUC 8987, 2008 October 2) was a non-group comet discovered in C3 images by Hua Su on 2008 July 17.

2008 O7 (SOHO)(IAUC) was a non-group comet discovered in C2 images by Bo Zhou on 2008 July 18.

A/2008 OB_9 [Mt Lemmon] This unusual asteroid was discovered from Mt Lemmon with the 1.5m reflector on July 29.34. It has a period of 6.6 years and perihelion is at 0.76 AU in late January 2009. [MPEC 2008-O64, 2008 July 31, 2-day orbit]. It can pass 0.7 AU from Jupiter.

2008 P1 (Garradd) Gordon Garradd discovered a 17th magnitude comet on images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on August 13.72. The comet reaches perihelion at 3.9 AU in July 2009.

Brian Marsden notes on MPEC 2008-U16 [2008 October 20] that the "original" and "future" barycentric values of 1/a are +0.000132 and +0.000222 (+/- 0.000047) AU^-1, respectively. The moderate "original" value suggests that this comet may have made a previous visit to the inner solar system.

A/2008 PJ_3 [Siding Spring] This unusual asteroid was discovered during the Siding Spring Survey with the 0.5m Uppsala Schmidt on August 3.79. It has a period of 4.6 years and perihelion is at 0.39 AU in early October 2008. [MPEC 2008-P27, 2008 August 5, 1-day orbit]. The object can pass within 0.5 AU of Jupiter and 0.21 AU of the earth. This type of orbit is typical of Jupiter family comets.

2008 Q1 (Maticic) An 18th magnitude moving object of stellar appearance discovered by Stanislav Maticic on four 40-s R-band CCD images taken with the 60-cm f/3.3 Cichocki robotic telescope in strong moonlight in the course of the Comet and Asteroid Search Program at Crni Vrh Observatory was found by other observers to show cometary appearance. The comet reaches perihelion at 3.0 AU in 2008 December.

Brian Marsden notes on MPEC 2008-U17 [2008 October 20] that the "original" and "future" barycentric values of 1/a are +0.001786 and +0.001851 (+/- 0.000023) AU^-1, respectively. The large "original" value suggests that this comet has made a previous visit to the inner solar system.

2008 Q2 (P/Ory) An 18th magnitude apparently asteroidal object discovered by Michel Ory of Delemont, Switzerland, on CCD images obtained with a 0.61-m f/3.9 reflector at Vicques has been found to show cometary characteristics after posting on the NEOCP. The comet has a period of 5.8 years with perihelion at 1.4 AU in mid October. It has a perihelic opposition and reached around 14th magnitude.

Michel Ory is a Swiss amateur astronomer and president of the Société jurassienne d'astronomie, which has a well equipped observatory in the foothills of the Jura.

The comet passed 0.3 AU from Jupiter in November 2005, before which the perihelion distance was a little larger.

2008 Q3 (Garradd) Gordon Garradd discovered a 19th magnitude comet on images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on August 27.63. The comet reaches perihelion at 1.8 AU in June 2009.

Brian Marsden notes on MPEC 2008-U19 [2008 October 20] that the "original" and "future" barycentric values of 1/a are +0.000676 and +0.001137 (+/- 0.000129) AU^-1, respectively. The large "original" value suggests that this comet has made a previous visit to the inner solar system.

2008 Q4 (201P/LONEOS) Comet 2001 R1 (P/LONEOS) was recovered by Michael Jaeger from Stixendorf, Austria on August 31.09 as a 17th magnitude object. It was confirmed by Giovanni Sostero and team from the Skylive Observatory, Catania, Italy the following night. The comet is a month past perihelion and will fade. Following posting of the recovery on the comet-ml Maik Meyer located NEAT images on frames from 2001 August. The indicated correction to the prediction on MPC 54169 is Delta T = -0.42 day.

2008 QP_{20} (P/LINEAR-Hill) Rik Hill discovered an 18th magnitude comet on CCD images taken with the 0.68-m Catalina Schmidt telescope on September 23.63, which was confirmed as cometary by many observers following posting on the NEOCP. K Smalley of the MPC then identified the comet with an asteroidal object found by LINEAR on August 25.40. The comet is at perihelion at 1.7 AU in early November and has a period of 6.5 years.

2008 R1 (P/Garradd) Gordon Garradd discovered a 19th magnitude comet on images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on September 2.50. It will remain a faint object.

Few observations of the comet are being made, but those available suggest a periodic orbit of 4.5 years, with perihelion at 1.8 AU in July.

Akimasa Nakamura notes that it has the smallest aphelion distance (3.7 AU) of any comet and Carl Hergenrother notes: *P/2008 R1 (Garradd) is the latest example of a 'Main-Belt Comet' or an 'Activated Asteroid'.*

Current theory suggests that traditional comets formed between 5 AU and the edge of the proto-solar disk. Most of these proto-comets were absorbed into the rapidly growing outer planets. As the outer planets migrated, the remainder of the proto-comet population was either thrown out of the solar system, thrown into the Oort Cloud, or trapped in the Kuiper Belt / Scattered Disk Population. These populations now give us our usual assortment of comets, the Jupiter-Family Comets, Halley-types and Long-Period Comets.

The Main-Belt Comets are volatile-rich bodies that either formed in the asteroid belt or were trapped there during the era of planet migration. One theory, the Nice theory, suggests that all carbonaceous asteroids (C,B,D,F,G type asteroids) in the Main Belt and Jupiter Trojan population originally formed between 5 AU and the outer edge of the Kuiper Belt. This means that objects such as Ceres and Pallas are related to Kuiper Belt Objects and were trapped in stable orbits much closer to the Sun.

There are at least 5 known Main Belt Comets: 133P/Elst-Pizarro 176P/LINEAR P/2005 U1 (Read) P/2008 J2 (Beshore) P/2008 R1 (Garradd)

It is possible that many asteroids in the outer part of the Main Belt are capable of occasional cometary activity. There are also objects on Near-Earth asteroid orbits that more likely originated in the Main Belt rather than from the Kuiper Belt or Oort Cloud, such as: 2P/Encke 107P/Wilson-Harrington (3200) Phaethon

The main point is there may no longer be a clear cut boundary between comets and asteroids. Many objects in the solar system have moved a long way from where they originally formed.

Henry Hsieh's research really expanded our knowledge of these objects. He has a good website devoted to his work.

2008 R2 (202P/Scotti) Jim Scotti recovered his comet (P/2001 X2) on Spacewatch images taken with the 1.8-m reflector at Kitt Peak on September 5.43 as a 21st magnitude object. The indicated correction to the prediction on MPC 56802 is Delta(T) = -0.15 day. Pre-recovery images were found on Mt Lemmon frames from 2007 September and October, and Spacewatch from 2008 August. The comet passed 0.67 AU from Jupiter on 1960 March 24.

An orbit by Syuichi Nakano, published in 2004, linked the comet with asteroid 1929 WW, however some of the 1929 positions were unsatisfactory. These have now been re-measured, and the identification confirmed, indeed the 1929 object does appear cometary on closer examination. Perihelion was on 1930 January 8.7.

2008 R3 (LINEAR) A 19th magnitude asteroidal object discovered by LINEAR on September 7.13 was found to show cometary characteristics after posting on the NEOCP. The comet is due to reach perihelion at 1.9 AU in November. It is periodic, with a period of around 80 years.

2008 R4 (203P/Korlevic) Gareth Williams identified images of 1999 WJ7 in incidental astrometry taken with the 0.9-m Spacewatch telescope on September 3.24. The comet was 20th magnitude, with perihelion in 2010 February. The indicated correction to the prediction on MPC 59598 is Delta(T) = -0.3 day.

2008 R5 (204P/LINEAR-NEAT) Gareth Williams has also identified images of 2001 TU80 in incidental astrometry taken with the 1.8-m Spacewatch telescope on September 8.43. The comet is at perihelion in December. The indicated correction to the prediction on MPC 54171 is Delta(T) = -0.3 day.

2008 R6 (205P/Giacobini) Koichi Itagaki (Teppo-cho, Yamagata) and Hiroshi Kaneda (Minami-ku, Sapporo) discovered a 13th magnitude comet on unfiltered CCD patrol frames taken on September 10.56 UT using a 0.21-m f/3 reflector. A confirming unfiltered CCD image was taken subsequently with a 0.60-m f/5.7 reflector at Yamagata, where the comet was diffuse with strong condensation, with a coma diameter of about 25" and a 2' tail toward the east-southeast.

Maik Meyer, Limburg, Germany, suggested that the comet was identical to comet 1896 R2 (D/Giacobini), which had not been seen since January 1897 and for which a prediction by Nakano gave T = 2008 September 9.89. This prediction was included in the BAA listing for the comets expected in 2008. Richard Buckley made a prediction for its return in 1975, which was published in the Journal in 1977. The identity has been confirmed by Nakano, who notes that the comet has made 17 revolutions and passed only 0.51 AU from the earth on 1962 September 9 and 0.81 AU from Jupiter on 1992 January 14. The linked orbit shows that the comet was at perihelion on September 10.08.

The fact that the comet was not recovered on previous occasions, and that it is now past its brightest for this return, suggests that the comet might have been found in outburst, although it was expected to reach 11th magnitude based on the discovery apparition. Further confirmation of this suggestion was made when Douglas T. Durig and K. N. Hatchett, Cordell-Lorenz Observatory, Sewanee, Tennassee, USA reported observations of two additional components, which have perihelion times differing by Delta(T) = +0.014 and +0.133 day.

Several visual observers reported magnitudes, with the comet being 12 – 13th magnitude through the autumn.

2008 R8 (SOHO)(IAUC) was a non-group comet discovered in C2 images by Rainer Kracht on 2008 September 4.

2008 S1 (P/Catalina-McNaught) Rob McNaught discovered a 17th magnitude comet on September 17.41 on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring Observatory. Brian Marsden subsequently linked the comet to asteroid 2008 JK, discovered during the Catalina Sky Survey on May 2.34. The comet was therefore renamed from McNaught to Catalina-McNaught. The improved orbit shows that the comet approached to 0.18 AU from Jupiter in 1990 August, before which its perihelion distance was 1.5 AU. The comet was near perihelion at 1.2 AU and has a period of 6.7 years.

2008 S2 (P/SOHO)(IAUC) Rainer Kracht noted that the non group SOHO comet discovered in C2 images from 2008 September 17 by him the following day may be linked to 2004 X7 (SOHO). He also suggested a linkage to 2001 D1 (SOHO). If so this would be another very short period comet, with a period of around 3.8 years. Sebastian Hoenig suggests it may be a member of the group with 1:3 resonance with Jupiter.

Brian Marsden published a linked orbit on MPEC 2008-S82 [2008 September 27] and noted: The object passed 1.29 AU from Jupiter on 2003 October 14.

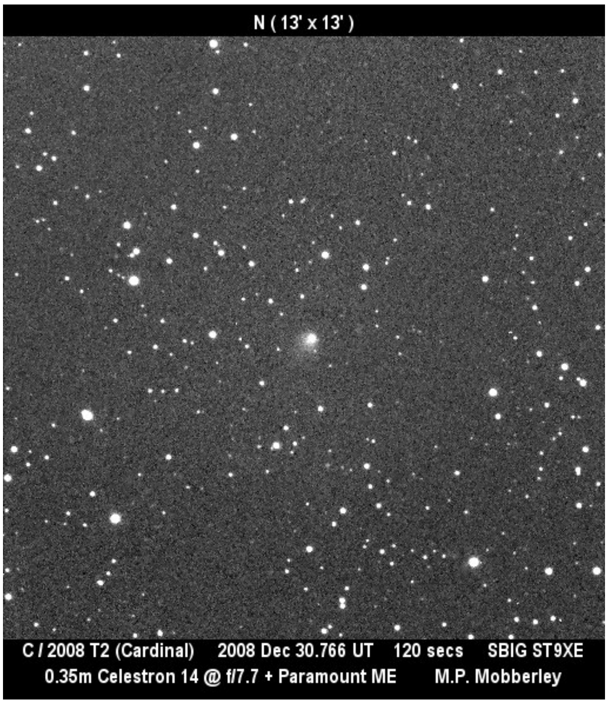
2008 S3 (Boattini) Andrea Boattini discovered an 18th magnitude comet during the course of the Catalina Sky Survey with the 0.68-m Schmidt on September 29.49. The comet will reach perihelion at 8.0 AU in June 2011. At discovery it was a distant object around 9.9 AU from the Sun. The current orbit is strongly hyperbolic.

Brian Marsden notes on MPEC 2008-X59 [2008 December 8] that the "original" and "future" barycentric values of 1/a are -0.000501 and -0.000490 (+/- 0.000507) AU^-1, respectively. The "original" value suggests that this comet is weakly tied to the solar system, but membership of the Oort cloud is not ruled out.

A/2008 SB_{85} [Steward] This unusual asteroid was discovered at the Steward Observatory, Kitt Peak, with the 0.9m reflector on September 26.31. It has a period of 6.6 years and perihelion was at 2.1 AU in late July 2008. It has an inclination of 75 degrees. [MPEC 2008-S86, 2008 September 29, 3-day orbit]. The object can pass within 0.75 AU of Jupiter.

A/2008 SO_{218} [Mt Lemmon] This unusual asteroid was discovered with the Mt Lemmon 1.5m reflector on September 30.43. It has a retrograde orbit with a period of 23 years and perihelion is at 3.5 AU in early January 2010. It has an inclination of 170 degrees. [MPEC 2008-T84, 2008 October 7, & MPCORB 8-day orbit]. Aphelion is at 12.1 AU and it can pass within 0.6 AU of Saturn and 0.8 AU of Jupiter. It is currently 4.6 AU from the Sun, so may show cometary activity as it nears perihelion.

2008 T1 (P/Boattini) Andrea Boattini discovered an 18th magnitude comet with the Mt Lemmon 1.5-m reflector on October 1.35. Several observers confirmed the cometary nature, including Peter Birtwhistle and Rolando Ligustri Prediscovery Spacewatch images were found from September 2 and 21. The comet was at perihelion at 3.0 AU in late February and has a period of 8.7 years. Brian Marsden notes that the comet made a close approach to Jupiter in April 2003, with a minimum distance 0.03 AU. Further calculations by Hirohisa Sato show that it approached to 0.0191 AU of Jupiter on April 8, 2003. Prior to the encounter the comet had perihelion at 6.2 AU and a period of 22 years.



2008 T2 (Cardinal) An apparently asteroidal object of 16th magnitude found by Rob Cardinal of the Rothney Astrophysical Observatory, with the University of Calgary 0.50-m f/1.0 reflector at Priddis on 2008 October 1.16 was found to show cometary characteristics by other observers after posting on the NEPCP. The comet reaches perihelion at 1.20 AU in mid June 2009. It could be a binocular object for UK observers in April and May, but is then moving south and becomes lost in the summer twilight. Only a few observations have so far been received, and these suggest that the comet is fainter than expected from the discovery magnitude.

Brian Marsden notes on MPEC 2008-X60 [2008 December 8] that the "original" and "future" barycentric values of 1/a are -0.000018 and +0.000245 (+/- 0.000043) AU^-1, respectively. The small "original" value suggests that this comet is on its first visit to the inner solar system.

2008 T3 (206P/Barnard-Boattini) Andrea Boattini discovered a 17th magnitude comet in a dense part of the Milky Way during the course of the Catalina Sky Survey with the 0.68-m Schmidt on October 7.22. Maik Meyer suggested an identity with D/1892 T1 (Barnard) and Gareth Williams then re-reduced the published observations. Williams and Nakano then computed a linked orbit which shows that the comet made 20 revolutions between 1892 and 2008, passing about 0.3-0.4 AU of Jupiter in 1922 October, 1934 August, and 2005 August. The comet is at perihelion at 1.15 AU in late October and has a period of 5.8 years.

The comet was the first one to be discovered photographically, by E E Barnard from the Mount Wilson Observatory on 1892 October 12. It was very faint and only followed until December 8. The apparition was not a particularly favourable one and the comet was last observed a few days before perihelion. The calculated orbit suggested that no favourable returns were likely for some years and the comet was lost. Richard Buckley published a paper on missing comets in the BAA Journal in 1977 (BAAJ, 87, No3) and gave a prediction for a return in 1976.

2008 T4 (P/Hill) Rik Hill discovered an 18th magnitude comet on CCD images taken with the 0.68-m Catalina Schmidt telescope on October 8.39. The latest orbit gives a period of 9.4 years with perihelion at 2.51 AU in late December.

2008 T5 (207P/NEAT) Ken-ichi Kadota, Ageo, Saitama-ken, Japan recovered comet 2001 J1 (P/NEAT) on CCD images obtained with his 0.25-m f/6 reflector on October 15.78. Confirming observations were also made by H. Abe (Yatsuka-cho, Shimane-ken, Japan, 0.26-m reflector). The indicated correction to the prediction on MPC 54170 is Delta(T) = -0.6 day.

2008 U1 (208P/McMillan) Robert McMillan discovered a 19th magnitude comet with the Spacewatch 1.8-m reflector on October 19.20. Further prediscovery images back to September 20 were found in Spacewatch imagery. The comet has a period of 8.1 years and was at perihelion at 2.5 AU in mid May.
In December, S Nakano linked the comet with previously unreported observations of an 18th magnitude object obtained by LONEOS in September and October 2000. This return is now designated 2000 S7. The new orbit shows that the comet passed 0.18 AU from Jupiter on 2004 July 8.

A/2008 VU_4 [Catalina] This unusual asteroid was discovered by the Catalina Sky Survey with the 0.68m Schmidt on November 7.40. 18th magnitude at discovery it has a period of 5.1 years and perihelion was at 0.54 AU in early September [MPEC 2008-V43, 2008 November 8]. The object can pass within 0.4 AU of Jupiter and 0.19 AU of the earth. This type of orbit is typical of Jupiter family comets.

A/2008 VH_{14} [Mt Lemmon] This unusual asteroid was discovered with the Mt Lemmon 1.5m reflector on November 8.22. It has a period of 4.9 years and perihelion is at 1.00 AU in late December. [MPEC 2008-V49, 2008 November 10]. It can pass within 0.5 AU of Jupiter and 0.03 AU of the Earth.

A/2008 WJ_{14} [Mt Lemmon] This unusual asteroid was discovered with the Mt Lemmon 1.5m reflector on November 21.36. It has a period of 7.6 years and perihelion was at 1.05 AU in mid November. [MPEC 2008-W39, 2008 November 21]. It can pass within 0.4 AU of Jupiter.

2008 X1 = 2003 F6 (P/Hill) Rik Hill discovered a 17th magnitude comet on CCD images taken with the 0.68-m Catalina Schmidt telescope on December 4.34. The comet reaches perihelion at 1.6 in May 2009.

Calculations by Hirohisa Sato allow for the possibility of an elliptic orbit of period 11 years and perihelion at 2.0 AU in early June 2009. This was confirmed by subsequent orbits, which give a period of 6.7 years and perihelion 2.4 AU in 2009 May.

With an improved orbit, Maik Meyer subsequently found previously unidentified images of the comet on frames taken by NEAT on 2003 March 24 and LONEOS on 2003 April 1. The comet was given the designation 2003 F6 at this return, which had perihelion on 2002 August 19.1.

2008 X2 (209P/LINEAR) Gary Hug recovered 2004 CB (P/LINEAR) on December 4.39 as an essentially stellar object of 20th magnitude. The indicated correction to the prediction on MPC 56803 is Delta(T) = +0.16 day.

2008 X3 (LINEAR) An 18th magnitude asteroidal object discovered by LINEAR on December 4.45 was found to show cometary characteristics after posting on the NEOCP. The comet was at perihelion in October at 1.9 AU.

2008 X4 (P/Christensen) Alan Watson found a 10th magnitude comet on SECCHI HI1-B images taken on December 8.24 Rainer Kracht made measurements of the object's position and computed a parabolic orbit, from which Maik Meyer suggested identity with comet P/2003 K2. The indicated correction to the prediction on MPC 56802 is Delta(T) = -22 days.

Rob Matson reports that the comet was visible in SWAN imagery from December 4, but was moving slowly in a location close to the occulting region. If anyone took an image of the planetary conjunction of Venus and Jupiter in early December it is just possible that they might have captured the comet, although for UK observers it would be very close to the horizon.

The comet passed through the SOHO LASCO C3 field between December 20 and 26, but at 9th magnitude would probably not have been detectable. However Piotr Guzik pointed out that the geometry is strongly forward scattering and the magnitude could be enhanced by 5 - 6 magnitudes around December 23. Joe Marcus suggested that the forward scattering could be sufficiently strong to enhance the brightness by as much as 6.5 magnitudes, making it a prominent object in the SOHO fields. On December 21.8 it was easily visible in the C3 field at about 8.2, along with two Kreutz comets. The comet will emerge into the morning sky for UK observers around January 10, by which time it will have faded to around 10.5.

A few favourably placed observers have already reported observations: Juan Jose Gonzalez Suarez (Leon, Spain) saw it on January 4.26, estimating it at 10.1, and Marco Goiato (Araçatuba, Brazil) observed it in the morning of January 6 and 7, when it was around 10.5. These observations suggest that it is a little fainter than suggested above.

A/2008 XE_2 [Catalina] This unusual asteroid was discovered by the Catalina Sky Survey with the 0.68m Schmidt on December 4.38. 19th magnitude at discovery it has a period of around 6.7 years and perihelion was at 1.3 AU in late November [MPEC 2008-X46, 2008 December 5, 1-day orbit]. The object can pass within 0.3 AU of Jupiter and 0.33 AU of the earth. This type of orbit is typical of Jupiter family comets.

2008 Y1 (Boattini) Andrea Boattini discovered an 18th magnitude comet during the Catalina Sky Survey with the 0.68m Schmidt on December 22.09. Several observers confirmed the cometary nature. The comet will reach perihelion at 1.4 AU in February and will brighten a little.

An orbit computation by Hirohisa Sato suggests that it has an elliptical orbit with period of around 30 years.

2008 Y2 (P/Gibbs) Alex Gibbs discovered an 18th magnitude comet during the Catalina Sky Survey with the 0.68m Schmidt on December 31.37. Several observers confirmed the cometary nature. The comet will reach perihelion at 1.6 AU in January and has a period of 6.8 years.

2008 Y3 (P/McNaught) Rob McNaught discovered a 16th magnitude comet on December 31.64 on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring Observatory.. The latest orbits give perihelion at 4.4 AU in mid January 2009 and a period of around 20 - 25 years.

A/2008 YB3 [Siding Spring] This unusual asteroid was discovered during the Siding Spring Survey with the 0.5m Uppsala Schmidt on December 18.61. It has a period of around 80 years, a retrograde orbit and perihelion is at 5.5 AU in February 2011. [MPEC 2008-Y38, 2008 December 22, 4-day orbit].

A/2008 YD29 [Steward] This unusual asteroid was discovered at the Steward Observatory, Kitt Peak, with the 0.9m reflector on December 30.08. It has a period of 5.7 years and perihelion is at 1.2 AU in 2009 January. [MPEC 2008-Y78, 2008 December 30, 1-day orbit]. The object can pass within 0.25 AU of the Earth and 0.4 AU of Jupiter.

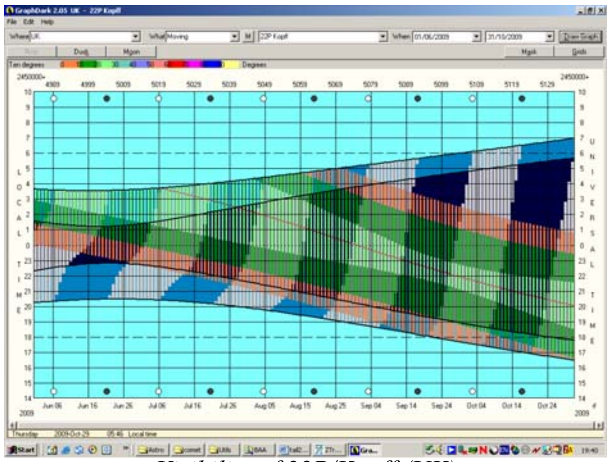
For the latest information on discoveries and the brightness of comets see the Section www page: http://www.ast.cam.ac.uk/~jds or the CBAT headlines page at http://cfa-www.harvard.edu/cfa/ps/Headlines.html

Comet Prospects for 2009

2009 is a fairly good year with several comets likely to come within binocular range. The best is a long period comet discovered in 2007, which could be within naked eye range in February. There are several other comets that should be within visual range for larger telescopes and many more for the CCD observers.

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. Perhaps the most spectacular example of such fragmentation is 73P/Schwassmann-Wachmann, which exhibited a debris string of over 60 components as it passed close to the Earth in May 2006. Another unheralded example of sudden change was the phenomenal outburst of 17P/Holmes. 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. A section booklet on comet observing is available from the BAA Office.

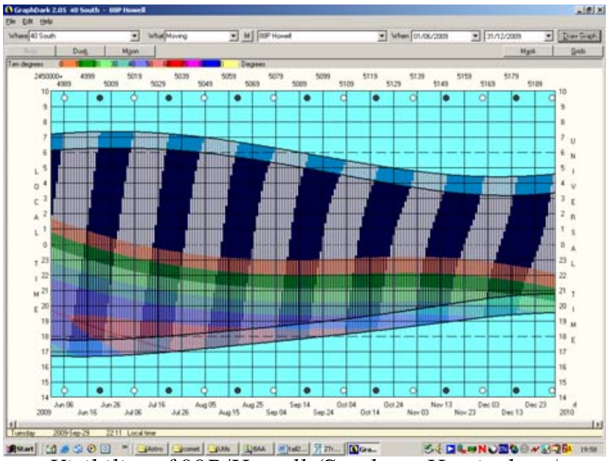
22P/Kopff was discovered photographically by A Kopff at Konigstuhl Observatory in 1906, when it was around 11^m. The next return was unfavourable, but it has been seen at every return since then. Following an encounter with Jupiter in 1942/43 its period was reduced and the perihelion distance decreased to 1.5 AU. The following return was one of its best and it reached 8^m. The next return was unusual, in that it was 3^m fainter than predicted until perihelion, when it brightened by 2^m. It suffered another encounter with Jupiter in 1954, but this made significant changes only to the angular elements. 1964 was another good return and the comet reached 9^m. This will be another good return with the comet brighter than 13^m all year, although as the comet is at Southern declination, it will be best seen from the Southern Hemisphere. UK observers should pick it up as a binocular object of around 9^m in June, when it is at its brightest. It slowly fades, remaining in Aquarius, and will be around 12th magnitude in November when it sinks into the evening twilight for northern observers.



Visibility of 22P/Kopff (UK)

67P/Churymov-Gerasimenko was discovered in 1969 September, by Klim Churyumov and Svetlana Gerasimenko on a plate taken for 32P/Comas Sola at Alma Ata observatory. It reached its present orbit after a very close encounter (0.05 AU) with Jupiter in 1959, which reduced the perihelion distance from 2.74 to 1.28 AU. At a good apparition, such as in 1982, when it approached the Earth to 0.4 AU and was well observed by the comet section, it can reach 9th magnitude. This is not a particularly good apparition, as the comet remains at a relatively small elongation from the sun. There is however a short observing window in the early evening sky and it might be seen at around 12th magnitude for the first few months of the year.

85P/Boethin had a favourable perihelion in mid December, however it has not yet been recovered and may have disintegrated. If recovered it will fade, but remains favourably placed for observation. Its magnitude must be regarded as uncertain.



Visibility of 88P/Howell (Southern Hemisphere)

Ellen Howell discovered **88P/Howell** in 1981 with the 0.46-m Palomar Schmidt. It passed 0.6 AU from Jupiter in 1978, which reduced the perihelion distance, but the biggest change to its orbit occurred in 1585 when an encounter reduced q from 4.7 to 2.4 AU. The standard light curve is not a good fit to the observations and a better fit is obtained using a linear light curve that peaks a few weeks after perihelion, thus confirming the view that the comet is intrinsically brighter after perihelion. This return may see the comet reach 10th magnitude in late October, when it is on the borders of Scorpius and Ophiuchus.

116P/Wild was discovered on 1990 January 21.98 by Paul Wild with the 0.40-m Schmidt at the Zimmerwald station of the Berne Astronomical Institute at a photographic magnitude of 13.5. The comet was perturbed into its present orbit after a close approach to Jupiter in mid 1987. This time round the comet is quite well placed prior to perihelion, and may reach 11th magnitude.

144P/Kushida has a favourable apparition and was expected to be at its brightest at 11th magnitude at the beginning of the year. Observations received so far show that it has reached 9th magnitude and may fade quickly, fading past 13th magnitude in April.

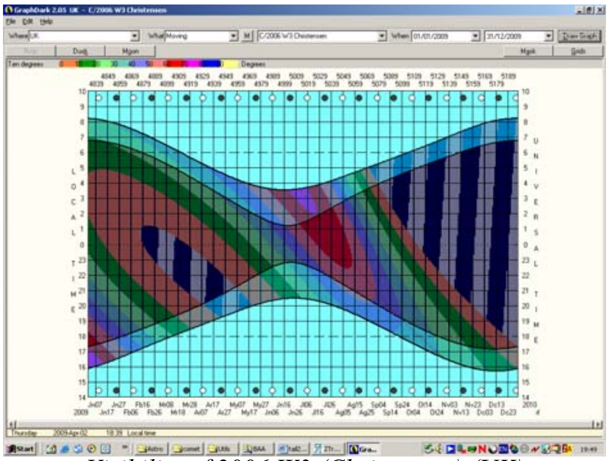
169P/NEAT An asteroidal object discovered by NEAT on 2002 March 15.27 was found to show a tail in late July 2005 by two independent groups of observers. It had not shown a tail when observed two months earlier. The comet was linked to observations made by Spacewatch in 1998 and the DSS in 1989, and it was then numbered. How it will behave at this return is unknown, and in addition it is not particularly well placed during 2009. It becomes better placed in early 2010, but is then in southern skies.

210P/Christensen (2008 X4 = 2003 K2) was recovered on STEREO images in December, arriving at perihelion several weeks earlier than predicted, which explains the delay in recovery. It emerges from conjunction around January 9 at around 11th magnitude and will quickly fade.

2001 MD7 (P/LINEAR) has a reasonably favourable return and could reach 12th magnitude near the time of perihelion, coming into view for UK observers in August.

Following the discovery of **2003 A1 (P/LINEAR)** Brian Marsden noted that the object was probably of short period, and that its orbit was rather similar to that of comet D/1783 W1 (Pigott). Orbital calculations by Maik Meyer tended to confirm the identity of the object with D/1783 W1 and Nakano has computed a linked orbit, although the number of revolutions that it has made is uncertain. This apparition should help to confirm the identity. The comet could be 12th magnitude when it emerges into the morning sky in August and will slowly fade.

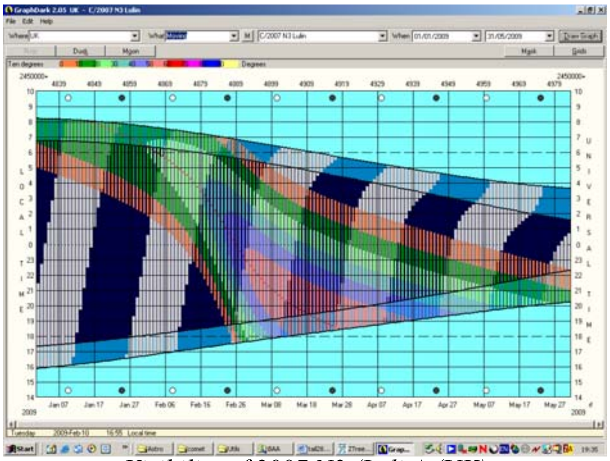
2006 OF_2 (Broughton) was at perihelion in the autumn of 2008 and slowly fades from 11th magnitude at the beginning of the year. Initially it is circumpolar for Northern Hemisphere observers and remains well placed in the evening sky, but will have faded to 13th magnitude by the end of March.



Visibility of 2006 W3 (Christensen) (UK)

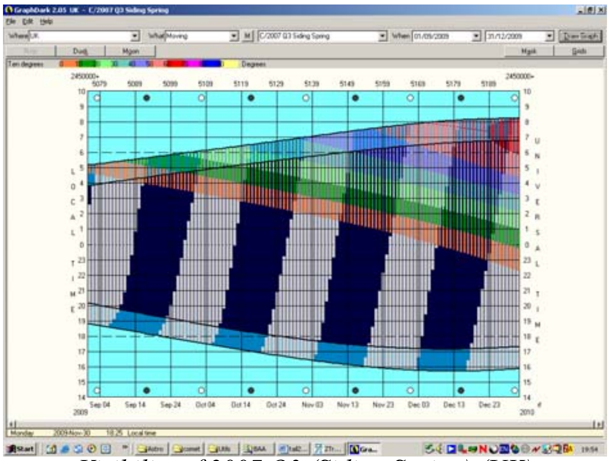
2006 W3 (Christensen) Eric Christensen discovered an 18th magnitude comet on November 18.40 during the course of the Catalina Sky Survey with the 0.68-m Schmidt telescope. Peter Birtwhistle was amongst those making confirming observations. It is a distant comet, but reaches perihelion near opposition. It has brightened quite rapidly during 2008 and may reach 7th magnitude over the summer if this rate of brightening continues. It starts the year in Lacerta, when it may be 10th magnitude. By the summer it is passing south through Cygnus and Vulpecula, so well placed for observation. UK observers will loose it in early December.

2007 G1 (LINEAR) was at perihelion at 2.7 AU in mid November 2008. The comet will start the year at 12th magnitude, but with a high southern declination will remain invisible from the UK. Southern Hemisphere observers will be able to follow it for several months as it slowly fades.



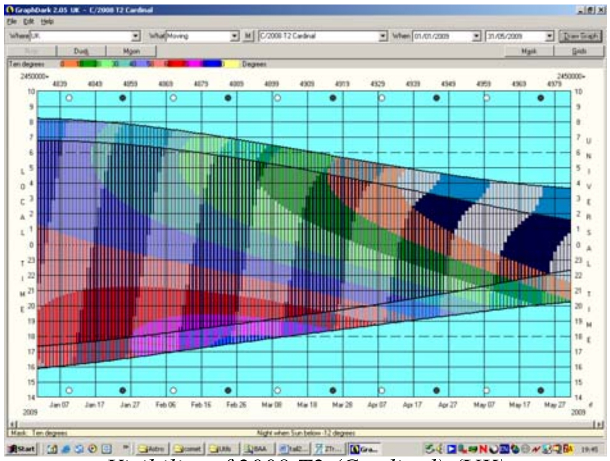
Visibility of 2007 N3 (Lulin) (UK)

2007 N3 (Lulin) reaches perihelion early in 2009, and will start the year at around 8th magnitude. It quickly brightens and becomes better placed for viewing in the morning sky. It reaches its brightest of around 4th magnitude in late February when in Virgo, rapidly becoming visible in the evening sky. It remains well placed and is lost into the evening twilight in early May, by which time it has faded to 11th magnitude.



Visibility of 2007 Q3 (Siding Spring) (UK)

2007 Q3 (Siding Spring) was discovered during the Siding Spring Survey in August. For the first half of the year the comet is a Southern Hemisphere object, and just within visual range. After solar conjunction the comet will become visible to Northern Hemisphere observers in October and could reach 10th magnitude towards the end of the year.



Visibility of 2008 T2 (Cardinal) (UK)

2008 T2 (Cardinal) was expected to be around 12th magnitude at the close of 2008, however the few observations available suggest that it is about a magnitude fainter. The comet should be observable into May, by which time it could be 8th magnitude. It starts the year at high northern declination, and moving south reaches Gemini in May, so it will be well placed for UK observation.

The other periodic and parabolic comets that are at perihelion during 2009 are unlikely to become brighter than 13th magnitude or are poorly placed. Ephemerides for these can be found on the CBAT WWW pages. 18D/Perrine-Mrkos has not been seen since 1968. Searches at favourable returns in the intervening period have failed to reveal the comet and it is possible that it is no longer active.

Looking ahead to 2010 several comets will be visible. The highlight is the return of **103P/Hartley**, which makes a close approach to the Earth and could reach naked eye brightness. **81P/Wild** should become visible in binoculars at around 9th magnitude, whilst **2P/Encke** reaches 4th magnitude as it passes through the SOHO or STEREO fields.

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Comet	T	q	P	N	H_1	K_1	Peak mag
210P/Christensen (2008 X4)	(Dec 20.0)	0.53	5.66	1	13.5	10.0	9
P/LINEAR (2002 CW_{134})	Jan 5.9	1.84	6.85	1	13.0	10.0	16
Lulin (2007 N3)	Jan 10.7	1.21			3.5	15.0	4

Comet	T	q	P	N	H_1	K_1	Peak mag
Gibbs (2008 G1)	Jan 12.1	3.99			9.5	10.0	19
P/McNaught (2008 Y3)	Jan 15.1	4.45	22.9	0	8.5	10.0	18
68P/Klemola	Jan 21.0	1.76	10.8	4	6.8	15.0	13
195P/Hill (2006 W4)	Jan 21.1	4.44	16.5	1	8.5	10.0	18
P/Gibbs (2008 Y2)	Jan 22.5	1.64			16.0	10.0	18
P/LINEAR (2002 JN_{16})	Jan 25.1	1.78	6.49	1	14.5	10.0	19
144P/Kushida	Jan 26.9	1.44	7.60	2	10.0	15.0	11
P/LINEAR (2003 O3)	Jan 30.0	1.25	5.47	1	18.0	10.0	21
47P/Ashbrook-Jackson	Feb 1.0	2.80	8.34	8	5.0	15.0	14
202P/Scotti (2008 R2)	Feb 7.0	2.53	7.34	1	13.5	10.0	19
Boattini (2008 Y1)	Feb 16.8	1.41	6.80	0	15.0	10.0	17
14P/Wolf	Feb 27.3	2.72	8.74	15	10.0	15.0	19
67P/Churyumov-Gerasimenko	Feb 28.4	1.25	6.45	6	9.5	10.0	12
59P/Kearns-Kwee	Mar 7.7	2.36	9.51	5	7.5	20.0	16
P/McNaught (2008 J3)	Mar 10.7	2.29	7.68	0	12.0	10.0	18
P/Van Ness (2002 Q1)	Mar 21.0	1.55	6.71	1	13.0	10.0	17
145P/Shoemaker-Levy	Mar 26.6	1.89	8.39	2	13.0	10.0	18
199P/Shoemaker (2008 G2)	Apr 9.8	2.94	14.6	1	10.0	10.0	16
209P/LINEAR (2008 X2)	Apr 16.0	0.91	5.03	1	17.0	5.0	14
18D/Perrine-Mrkos	Apr 17.3	1.64	7.83	5	11.5	20.0	??
P/McNaught (2008 O2)	Apr 24.4	3.80	9.56		9.0	10.0	17
P/Hill (2008 X1)	May 7.8	2.36	6.75	0	12.5	10.0	17
137P/Shoemaker-Levy	May 13.6	1.92	9.55	2	14.5	10.0	19
22P/Kopff	May 25.4	1.58	6.44	15	6.6	12.5	9
143P/Kowal-Mrkos	Jun 12.2	2.54	8.92	2	14.0	5.0	17
Cardinal (2008 T2)	Jun 13.2	1.20			6.0	10.0	8
64P/Swift-Gehrels	Jun 14.3	1.38	9.34	5	9.0	20.0	13
P/LINEAR (2003 A1)	Jun 16.0	1.92	7.50	2?	6.0	15.0	12
P/LINEAR (2003 H4)	Jun 22.4	1.70	6.10	1	16.0	10.0	18
Garradd (2008 Q3)	Jun 23.5	1.81			10.0	10.0	13
Garradd (2008 P1)	Jul 2.6	3.64			7.0	10.0	15
Christensen (2006 W3)	Jul 6.5	3.13			-4.2	19.7	7
77P/Longmore	Jul 7.8	2.31	6.83	5	7.0	20.0	15
116P/Wild	Jul 19.0	2.17	6.49	3	1.2	25.3	11
P/LINEAR (1999 XB_{69})	Jul 25.9	1.65	9.47	1	17.5	5.0	21
74P/Smirnova-Chernykh	Jul 30.3	3.56	8.53	5	5.0	15.0	15
24P/Schaumasse	Aug 9.6	1.21	8.29	10	7.6	24.2	11
89P/Russell	Aug 17.2	2.28	7.40	4	10.0	15.0	16
P/LINEAR (2002 T1)	Aug 25.5	1.31	6.96	1	18.0	10.0	19
P/LINEAR (2004 X1)	Sep 3.3	0.78	4.84	1	17.5	10.0	13
P/LINEAR (2001 MD_7)	Sep 9.0	1.22	7.83	1	12.0	10.0	12
Holmes (2008 N1)	Sep 25.3	2.78			9.0	10.0	16
Siding Spring (2007 Q3)	Oct 7.3	2.25			4.5	10.0	10
88P/Howell	Oct 12.5	1.36	5.49	6	4.7	24.9	9
127P/Holt-Olmstead	Oct 21.4	2.20	6.39	3	14.0	10.0	18
54P/de Vico-Swift-NEAT	Nov 28.4	2.17	7.37	4	10.0	15.0	16
169P/NEAT	Nov 30.3	0.61	4.21	4	16.0	5.0	12
100P/Hartley	Dec 6.1	1.98	6.30	4	8.9	15.0	16
P/McNaught (2004 K2)	Dec 15.5	1.55	5.50	1	15.0	10.0	19
P/Catalina (2005 JQ_5)	Dec 28.8	0.82	4.42	1	17.5	10.0	18

The date of perihelion (T), perihelion distance (q), period (P), the number of previously observed returns (N), the magnitude parameters H_1 and K_1 and the brightest magnitude (which must be regarded as uncertain) are given for each comet. 18D/Perrine-Mrkos has not been seen since 1968. P/LINEAR (2003 A1) may be linked to P/Pigott, but this is not yet confirmed. A linear light curve for 88P/Howell, peaking several weeks after perihelion is a better fit to the observations, but the conventional parameters are given here. Note: $m_1 = H_1 + 5.0 * \log(d) + K_1 * \log(r)$

The Comet's Tale is produced by Jonathan Shanklin, with thanks to the British Antarctic Survey and the Institute of Astronomy, Cambridge for the use of computing facilities. E&OE.