THE COMET'S TALE

Newsletter of the Comet Section of the British Astronomical Association

Number 30, 2011 January

Brian Marsden (1937 August 5 - 2010 November 18)

Brian Geoffrey Marsden was born on 1937 August 5 in Cambridge, England. His father, Thomas, was the senior mathematics teacher at a local high school. It was his mother, Eileen (nee West), however, who introduced him to the study of astronomy, when he returned home on the Thursday during his first week in primary school in 1942 and found her sitting in the back yard watching an eclipse of the sun. Using now frowned-upon candle-smoked glass, they sat watching the changing bite out of the sun. What most impressed the budding astronomer, however, was not that the eclipse could be seen, but the fact that it had been predicted in advance, and it was the idea that one could make successful predictions of events in the sky that eventually led him to his career.

John Alcock, Guy Hurst, Brian Marsden, Kay Williams and Nancy Marsden at the BAA/RAS meeting in Milton Keynes on 2003 May 10

When, at the agxe of 11, he entered the Perse School in Cambridge he was developing primitive methods for calculating the positions of the planets. He soon realized that earlier astronomers had come up with more accurate procedures for doing this over the centuries, and during the next couple of years this led to his introduction to the library of the Cambridge University Observatories and his study of how eclipses, for example, could be precisely computed. Together with a couple of other students he formed a school Astronomical Society, of which he served as the secretary. At the age of 16 he joined and began regularly attending the monthly London meetings of the British Astronomical Association. He quickly became involved with the Association's Computing Section, which was known specifically for making astronomical predictions other than those that were routinely being prepared by professional astronomers for publication in almanacs around the world. Under the watchful eyes of the director and assistant director of the Computing Section, this led him to prepare and publish predictions of the occasions when one of Jupiter's moons could be seen to pass directly in front of another. He also calculated the gravitational effects of the planets on the dates and sky positions of the returns of some periodic comets. He carried out these computations using seven-place logarithms. After all, this was long before pocket calculators had been invented, and the construction of large electronic computers was still then very much in its infancy. He always maintained that making such computations by primitive means significantly increased one's understanding of the science involved. During his last year of high school he also became a junior member of the Royal Astronomical Society.

He was an undergraduate at New College, University of Oxford. In his first year there he persuaded the British Astronomical Association to lend him a mechanical calculating machine, allowing him thereby to increase his computational productivity. By the time he received his undergraduate degree, in mathematics, he had already developed somewhat of an international reputation for the computation of orbits of comets, including new discoveries. He spent part of his first two undergraduate summer vacations working at the British Nautical Almanac Office. He also responded to an inquiry from Dorothy L. Sayers involving the ancient Roman poet Lucan. Incensed by what she perceived as grossly unfair criticism of Lucan by A. E. Housman and Robert Graves, she elicited his assistance during the last year of her life to support her view that Lucan's understanding of astronomy and geography was reasonably valid. Dr. Sayers' extensive correspondence in the course of this study is included in the last volume of her collected letters.

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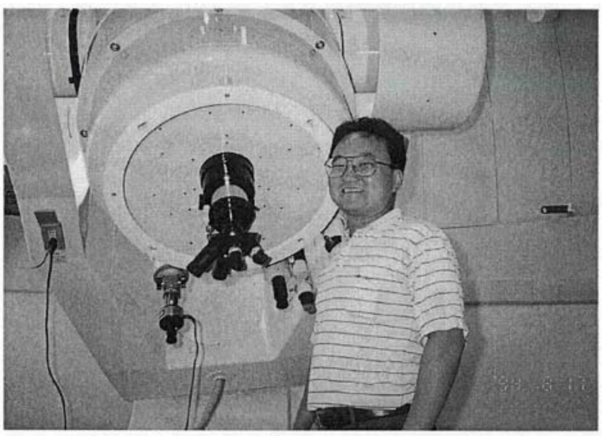
Section News from the Director

Dear Section member,

It was with some shock that I read of the death of Brian Marsden on November 18. He had contributed to the BAA and the Comet Section since the early 1950s. Although not known as a visual observer of comets, he did make a few observations of naked eye comets over 40 years [running from 1956 R1 (Arend-Roland) to 1996 B2 (Hale-Bopp)] and also observed 1958 D1 (Burnham) with the Northumberland refractor in Cambridge. His main contributions however were in the areas he was best known: the computation of comet orbits, particularly for the BAA Handbook, and in supporting amateur observers. He will be sorely missed.



M. Muraoka (60cmL. Kajigamori)

Another death that I'm sorry to have to report is that of Kenji Muraoka. He was also well known as a computer of comet orbits and compiled the comet Handbooks published by the Comet Section of the Oriental Astronomical Association.

Many recently published orbits appear to be highly precise, the angular elements for example being given to 5dp. The problem is that when the orbital arc is extended with further astrometry, the elements change significantly, often in the first decimal, or even by degrees. As a physicist I would like to see orbits published with a precision that actually reflects the certainty with which they are known. This could easily be done by assigning error bars to the available positions, rather than assuming that they are precise and then making several orbital determinations to see what the variance is. As an example the initial MPEC orbits for 2010 X1 (Elenin) had a perihelion distance that changed from 5.1516487 on December 12 to 0.4479489 on December 18 and 0.4420298 on December 24.

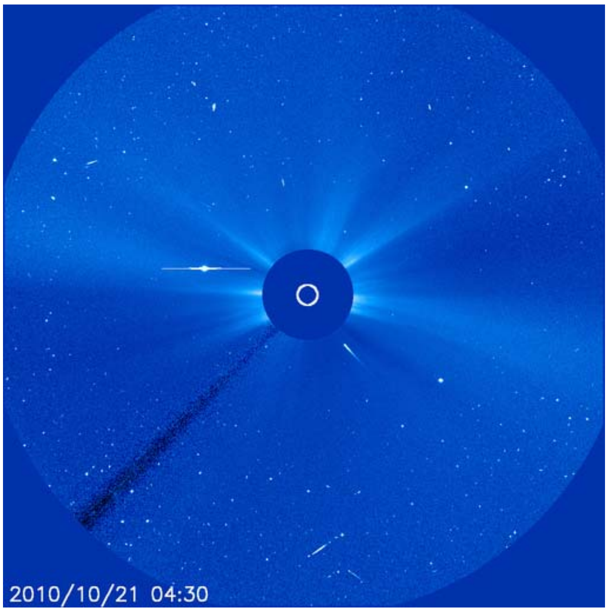
Many of you who submit observations will have rarely received a reply, because keeping the web pages up to date, producing the comet entry for the Handbook, writing material for the Journal, producing this newsletter and making a few observations leaves little time for anything else. I am therefore very pleased that Denis Buczynski has volunteered to take on some secretarial duties. Please send all images to him, and he will rename them in the correct format (as only a few people manage to get this right) and place them on the BAA server. I will then download them to the Section archive for use in publications etc. It is preferable to send an image rather than a url, as we cannot guarantee to trawl the internet looking for usable images. Please continue to send me visual observations, but copy them to Denis if you want a reply.

I've also approached Richard Miles to lead on some technical projects linking comets and asteroids, where imaging with robotic telescopes will play a big part. There have been several asteroidal comets discovered, most recently the main-belt asteroid (596) Scheila, so this will be an excellent link between the BAA Comet and Asteroid Sections.

Several new books on comets have appeared recently, or are about to appear. David Seargent's book "The Greatest Comets in History" was published in 2009. The fourth volume of Gary Kronk's Cometography was also published in 2009, the fifth is just out and another volume is on its way. The format has not changed, despite several reviewers recommending the inclusion of illustrations, but it is THE compendium of comets. Richard Schmude has written a volume in the Springer series of Astronomer's Observing Guides. I have reviewed this for The Observatory, and my view is that whilst the book has much worthwhile content it would have benefited from a more stringent assessment before publication. All points could easily be resolved with a second edition. Finally Martin Mobberley's "Hunting and Imaging Comets" is due out in 2011.

NASA press releases are quite notorious in the scientific community for many reasons. There was the rather premature announcement of life in meteorites, and recently of new types of chemistry in extremophiles. Their press releases sometimes report "new" discoveries that have already previously been reported. The EPOXI spacecraft has produced some spectacular images of 103P/Hartley, but the NASA web pages and press releases highlight their use of obsolete comet nomenclature. Unfortunately many Journals just parrot the press releases and so NASA bad practice is propagated. The IAU Comet Catalogue gives the approved nomenclature, and editors sadly need to take the time to refer to this, rather than relying on the reports that they receive being correct.

The SOHO spacecraft has been a very successful collaboration between ESA and NASA. Designed for a nominal two year life, it was launched on 1995 December 2. As something of a by-product of its monitoring solar activity it has become the leading comet discoverer of all time. The 2000th discovery, the vast majority made by amateur astronomers, was clocked up on December 26th.



SOHO-1932 (lower right centre, showing a long tail)

It has been some time since there was a formal Section meeting, though many members attended the BAA Observers Workshop in September. I generally share the view that a meeting for the sake of having a meeting is not a good idea, so a Section meeting should have a specific purpose. One possibility might be to discuss observing strategies for 2009 P1 (Garradd) and perhaps review those of 2010 X1 (Elenin), in which case a meeting in the autumn might be worthwhile, as by then the comet will be well-placed for viewing and may be an easy binocular object. I would appreciate hearing your views.

This is the final edition of the Section newsletter that will be distributed in printed form. In future the newsletter will be produced in pdf format for download in colour from the Section web page. A few printed copies will be produced for library use and for the few life Members of the Association who do not have access to computer facilities. If you are a life Member, and not able to access it in this format please let me know.

Best wishes,

Jonathan Shanklin

Tales from the Past

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

150 Years Ago: Professor Challis at Cambridge University noted that "Comets are still observed with the Northumberland equatoreal [sic]" [A statement still true today! Ed] Sir Thomas Maclear presented a report on observations of Donati's comet [1858 L1], which had been made at the Cape between 1858 October 11 and 1859 March 4 [The last position used in the orbital determination]. The prelude begins "Rain fell on the forenoon of the 11th, after which the clouds dispersed, and as the evening twilight closed in, there is no exaggeration in the statement that the westward view from the observatory was magnificent beyond description. Venus in full splendour, the young moon, and the comet, presenting an imposing display of celestial objects rarely witnessed, while the feelings were rendered more sensitive to the sublime and the beautiful by one of the serene evenings so delicious in the Cape climate when the atmosphere is calm and moist." A report on the comet discovered at Olinda on 1860 February 26 [1860 D1], published in the original French notes "La grande nebulosite de la comete offrait le singulier aspect de deux nebulosites visibles a la fois dans le meme champ". Reports on a recently discovered comet (1860 M1) visible in late June note that it was more readily visible to the naked eye than Donati's comet during the first few nights of its appearance. A subsequent note suggests that it was first seen by Professor Caswell from the deck of the steamship Arabia on June 20 while on his voyage to England. Mr H P Tuttle saw it on June 21. The comet was also observed from Ascension Island in July [from where I have also observed a comet]. In December R C Carrington presented a paper suggesting that the distribution of the perihelia of parabolic comets might be used to determine the direction of motion of the solar system through space. He found an asymmetry in the perihelion directions (61/72) in the supposed hemispheres that the Earth was moving, however thought that this wasn't enough to be convincing, particularly given the "unequal distribution of discoverers of comets in the northern and southern hemispheres of the earth".

100 Years Ago: There are extensive reports on 1910 A1 and 1P/Halley during the year, from around the globe. These extracts generally cover curiosities and matters of more peripheral interest.

The January meeting began with a report by Mr Crommelin on the great "daylight" comet [1910 A1]. This was the brightest since 1882 and was discovered in the southern hemisphere. At first the name of "Drake" was attached to it, but they now heard that there was no Mr. Drake, and that "Drake" was a mere telephonic corruption from the word "great". Apparently it was seen in the Orange River Colony two or three days before they received the telegraphic announcement [by some railwaymen]; however the first sighting was from the Premier Mine in the Transvaal on the 13th and reported by Mr J T Garvie who had mounted to the highest part of the gear and saw the comet which was "like an ordinary star, with a tail about a metre long, and little to the right of the point where the Sun rises". He had plotted a diagram showing the track of the comet relative to the sun, which was handed round. Mr Hinks of Cambridge saw it 15 or 20 minutes before sunset on January 19. Considering the poor weather he had received an astonishingly large number of observations from Members. There was some debate about the exact orbit and he noted "that they had got out an orbit at Cambridge, although they had not yet published the details". For himself he would rather that the comet had not come in Halley's year, for they were already pretty full of work in observing Halley's comet and making computations about it, and the appearance would necessarily take off some of the interest in Halley's comet, although he thought it quite likely that it would hold its own as a spectacle - at all events, as seen from this country. One piece of advice which the new comet emphasised was that those who wanted to see Halley's comet at its best must leave London. There had been an almost constant pall of haze and cloud over the west horizon from Greenwich, and they should go to some elevated station where there was no great town to the west of them. Mr Chambers commented that speaking from a purely commercial standpoint the new comet had already had a beneficial effect on the book trade. Several people noted the yellow colour of the comet, and attributed this to sodium. Mr Hinks in Cambridge had used the 30-cm Sheepshanks and said there was a blue-green band which might have been a hydrocarbon band. [This lens was a photovisual triplet, which was later transferred to the Northumberland telescope, where it remained until replaced with a doublet for its 150th birthday. By then the centre component of the triplet had begun to crystallise, significantly reducing the contrast of objects viewed through the telescope.]. Mr Crommelin also gave a report on recent observations of Halley's comet, including discussion about the possible transit across the Sun, which concluded with a note from Mr Tebutt "I think Halley's comet is fitful in brightness". Mr D Ross was congratulated on having been the first to observe Halley's comet from Australia, on November 18, with a 30cm reflector.

A note from Miss C O Stevens discusses comets and meteors, and points out that the Bielid meteors must pre-date the visible disruption of the comet in 1845-46.

At the February meeting Mr G F Chambers described several notable comets. He said that Donati's comet was probably the most beautiful of them all, but that of 1843 [1843 D1] was perhaps the most striking. This had been seen at Blackheath and pictured in the Illustrated London News in 1843. In 1843 there was not so much smoke in London as now, and that was perhaps, a reason why the comet appeared so clear to the observer. He was queried as to what might happen if the Earth went through the tail of Halley's comet in May. He recounted the following: "The great comet of 1861 [1861 J1] was so circumstanced that the Earth passed through the tail, and the fact was not known for some days afterwards. There was an incident, which was recorded by Mr Edward Lowe, a well-known meteorologist at that time. Mr Lowe was at a church in Nottinghamshire, and, although the Sun was shining during the evening, the vicar, before going to the pulpit, insisted on having the candles lighted because he felt a sensation of gloom; and Mr Lowe also noted something foggy inside the church, although he could not imagine what it was. Some days afterwards it was ascertained that the Earth had passed through the tail of the comet, but, except so far as it led to a little fog in a church, nothing happened. Much excitement also arose in 1832, when Encke's comet was thought likely to strike the Earth, and the French astronomer Arago sent out a letter warning the French people to disregard stories put forward as to the bad results of the contact. One lady had written to him, asking as Halley's comet was composed of cyanogen gas, therefore was not this particular tail going to be seriously dangerous. He could only say that it was a thing about which no sensible people need trouble their heads." Mr Holmes commenting on Donati's comet, which he had a perfect recollection of, said that the two straight rays, if they were there at all, were enormously exaggerated in the picture that had been shown. The picture was based on one put forth by Mr G P Bond, of Cambridge, Mass.

Mr M E J Gheury observing comet 1910 A1 complained of the glare of a row of arc lamps just below the comet. He then had to leave off his observations while cycling amongst the multitude of lamps hung along the Well Hall Road, where the work for the laying of the electric tram line had just begun. Mr E G Bird from Saskatchewan likened the comet to "a ray of light from the Sun or a burning straw-pile, such as we have scattered over the prairies". There are many other notes both on this comet and 1P/Halley, including one on "How to make a Model of the orbit of comet 1910 A1". Another corrects the view that Johann Georg Palitzsch (who recovered Halley's comet in 1758) was a "rustic stargazer", when in fact he was a noted amateur astronomer, a zealous botanist with a museum and botanical garden on his estate and had constructed the first lightning conductor in Saxony.

A note taken from the January H und E, tells how Herschell knocked together his sister's comet seeker "between breakfast and dinner out of odds and ends, including an old mopstick. This comet seeker stood for forty-seven years without requiring any repairs, and with it Caroline Herschel discovered five of the eight comets which are recorded in her name."

The March meeting was told that Professor Wolf had seen Halley's comet with the naked eye on February 11. Mr Denning wrote a note on Comet Seeking, in which he observed that comparatively few successes had been recorded to English observers. More speculation about the likely effects of the tail passage appeared: The passage of the Earth through the comet's tail may cause some deflection of the latter and also the excitement of our atmosphere may cause unusual auroral displays. Dr Allen suggested in Nature that it would be worth trying to fill a large exhausted chamber with air during the passage of the tail, and subsequently analysing this to see if any unusual gases could be detected. Monsieur Guillaume on the other hand suggested the liquefaction of a large volume of air, followed by fractional distillation. Liquefaction measurements were made by Monsieur Georges Claude at Boulogne-sur-Seine with apparatus capable of liquefying 350,000 litres of air per hour and failed to find any residue greater than probable errors of observation.

Comet Donati (1858 L1) drawn by Edmund Weiss of Stuttgart

In April Mr Henkel read a paper on a Theory of Cometary Phenomena, which he said were due to the combined influence of gravitation, solar heat and in some cases a repulsive force, on a fluid mass. Edwin Holmes was critical pointing out several errors and noting "there is more in the article which calls for inquiry and comment, but I refrain." Further reports on comet Halley were given, including Mr Crommelin raising some doubts as to whether the tail would reach the Earth, and he commented that "It looked as if the two persons who had committed suicide rather than be killed by the tail might have given themselves the benefit of the doubt. (Laughter)." Some of the discussion on magnitude estimates show that they were using the standard techniques of today "you put a second-magnitude star out of focus until the disc is as large as the head". In response to a question Mr Crommelin said that whilst micrometer measurements put the comet as comparable to the Earth in size, he thought that there must be a much smaller inner kernel. An article reported from Astronomische Nachrichten, suggests that the acceleration of the mean motion of Encke's comet must have change abruptly at certain times, one of which was close to 1895 January 18 and collision with a meteor swarm was suggested as an explanation. The paper also notes that the comet is always fainter after perihelion than before, and that since its first observation in 1819 it cannot have decreased in brightness by as much as a single magnitude.

Mr Maunder gave the report on Halley's comet at the May meeting, and commented that most Londoners looked upon it as a distinct fraud, but that was really the fault of London's geographic position. Mr Goatcher used much ingenuity to construct a drive for an altazimuth telescope to photograph the comet. "The tangent screw was one of the patent keys from a banjo head, and the Hooke's joint was constructed from a Lee-Metford cartridge case. .... It was not easy to lengthen the exposure, owing to the strain of continually guiding with each hand in the two motions in azimuth and altitude." An extract from Ralph Thoresby's diary [Thoresby was a celebrated historian and antiquary] is given, which describes Halley's comet in 1682. He observed it with friends who "came to see the comet upon our turret". Another friend, John Evelyn, noted "What this comet may portend God only knows; but such another phenomenon I remember to have seen in 1640, about the trial of the great Earl of Strafford preceding our bloody rebellion. I pray God avert His judgements! We have had of late several comets, which, though I believe appear from natural causes and operate not, yet I cannot despise them. They may be warnings from God, as they commonly are fore-runners of His animadversions."

An excerpt from Monthly Notices draws attention to Professor Fowler's investigations into the spectra of comets. By experimentally introducing gasses into a vacuum tube he deduced that carbon dioxide or carbon monoxide were present in the tail of comets Daniel (1907 L2) and Morehouse (1908 R1), probably the latter.

In June the negative results of the attempt at monitoring the transit of Halley's comet across the Sun at Kodaikanal were reported. Analysis suggested that the head must be composed of particles less than 60km in diameter, and more probably fine dust. Comet Notes suggest that some observers ascribe the prevalence of haloes, Bishop's Ring, &c to finely divided matter in our upper air, introduced by the tail. Some observers in Trinidad describe a curious effect on the landscape, everything appearing out of focus, and as if seen through cobwebs. [Too much rum perhaps ?]. Magnetic records from Kew for May 19 and 20 showed that there was disturbance but no storm; the conclusions drawn from them would probably depend somewhat on the temperament of the inquirer!

The Section annual report presented in October stated that it had been an unusually busy year for the Section!

The October comet notes report that observations of comet Halley were still coming in. The writer notes that some halos seen at Yerkes and elsewhere might be connected with the passage through the tail. Professor Forbes considered that the luminous edges of clouds were also connected with the passage. [I rather suspect that this is a case of astronomers looking at the daylight sky and seeing phenomena that meteorologists would consider common.] It notes that the comet discarded its tail on June 6 and formed a new one in a different direction. [Presumably a tail disconnection event.] Professor Holetschek noted that the absolute magnitude of the comet had not changed significantly at the last five returns (since 1607).

There was more debate as to whether or not the Earth had passed through the comet's tail at the November meeting, and as to whether the atmospheric phenomena were caused by cometary material. Observations with a new selenium photometer were reported [from Astrophysical Journal], which made the greatest brightness second magnitude, and was so sensitive that it could detect the secondary minimum of Algol. Mr Maunder noted that according to calculations by Bredikhine, the great southern comet of 1880 [1880 C1] had a tail that was composed of an element about four times as heavy as iron. Somewhat fortuitously comet 4P/Faye had been recovered by accident, as no one had remembered that it was due to return and no search was made for it. It was noted that Halley's comet had emerged from solar conjunction and that more observations might be secured before its disappearance till August 1985. A postscript notes that the comet was re-observed. Mr Beatie from near Sydney, NSW had observed the tail in May and concluded that its peculiar visibility was due to its being a fan in the plane of the comet's orbit [which is the likely explanation]

50 Years Ago: The January comet notes (the first for a while) remark on the two discoveries by George Alcock in 1959 August [1959 Q1 and Q2]. The second comet was not recovered after solar conjunction, and must have faded by at least 5 magnitudes.

At the April meeting, Michael Candy reported on observations of comet Burnham 1959 Y1, which was then a naked eye object. Observers included Albert Jones and Michael Hendrie, the latter making photographic observations with Harold Ridley at Dr Waterfield's observatory that included one of 70 minutes duration and showed a tail extending over 10 degrees. George Alcock said that "if you take the trouble you can see almost as much through the telescope as with the camera, if you know your instrument. People say that a camera is much better, but that is not really so.". A pair of papers by M Kamienski attempts to link comets reported by Lubieniecki in 2008 BC, 1930 BC, 1770 BC with Halley's comet. [The identity has not been substantiated by subsequent research.]

Observations from 40 visual observers, and 16 photographic ones were received during the year according to the annual report. Brian Marsden had computed orbits for four comets using the IBM 650 at Yale; previous computations had been by hand. Candy's comet seeker and photographs of 1959 Y1 by Ridley and Hendrie were shown at the June Exhibition Meeting.

Brian Marsden

(Cont from page 1) After Oxford, he took up an invitation to cross the pond and work at the Yale University Observatory. He had originally planned to spend just a year there carrying out research on orbital mechanics, but on his arrival in 1959 he was also enrolled as a Yale graduate student. With the ready availability of the university's IBM 650 computer in the observatory building, he had soon programmed it to compute the orbits of comets. Recalling his earlier interest in Jupiter's moons, he completed the requirements for his Ph.D. degree with a thesis on "The Motions of the Galilean Satellites of Jupiter".

At the invitation of director Fred Whipple, he joined the staff of the Smithsonian Astrophysical Observatory in Cambridge (MA) in 1965. Dr. Whipple was probably best known for devising the "dirty snowball" model for the nucleus of a comet a decade and a half earlier. At that time there was only rather limited evidence that the motion of a comet was affected by forces over and above those of gravitation (limited because of the need to compute the orbit by hand), and the Whipple model had it that those forces were due to the comet's reaction to vaporization of the cometary snow or ice by solar radiation. Dr. Marsden therefore developed a way to incorporate such forces directly into the equations that governed the motion of a comet. Application of a computer program that included these non-gravitational effects to several comets soon gave results that were nicely compatible with Dr. Whipple's original idea. Continued refinement of the non-gravitational terms, much of it done in collaboration with Zdenek Sekanina, a Czech astronomer and friend of Dr. Marsden whom he and Dr. Whipple succeeded in bringing to the U.S. as a refugee following the Soviet invasion of Prague in 1968, resulted in a wealth of improved computations of cometary orbits by the time Dr. Sekanina moved to California in 1980. It is noteworthy that the procedure devised and developed by Dr. Marsden is still widely used to compute the non-gravitational effects of comets, with relatively little further modification by other astronomers.

The involvement of the Smithsonian Astrophysical Observatory with comets had been given a boost, shortly before Dr. Marsden's arrival there, by the transfer there from Copenhagen of the office of the Central Bureau for Astronomical Telegrams, a quaintly named organization that was established by the International Astronomical Union soon after its founding in 1920. The CBAT is responsible for disseminating information worldwide about the discoveries of comets, novae, supernovae and other objects of generally transient astronomical interest. It is the CBAT that actually names the comets (generally for their discoverers), and it has also been a repository for the observations of comets to which orbit computations need to be fitted. Dr. Marsden succeeded Dr. Owen Gingerich as the CBAT director in 1968. He was joined by Daniel Green as a student assistant a decade later, and Dr. Green took over as CBAT director in 2000. Until the early 1980s the Bureau really did receive and disseminate the discovery information by telegram (with dissemination also by postcard Circular), although e-mail announcements then understandably began to take over. The last time the CBAT received a telegram was when Thomas Bopp sent word of his discovery of a comet in 1995. Since word of this same discovery had already been received from Alan Hale a few hours earlier by e-mail, the object was very nearly just named Comet Hale, rather than the famous Comet Hale-Bopp that beautifully graced the world's skies for several weeks two years later.

The comet prediction of which he was most proud was of the return of comet Swift-Tuttle, which is the comet associated with the Perseid meteors each August. It had been discovered in 1862, and the conventional wisdom was that it would return around 1981. He followed that line for much of a paper he published on the subject in 1973. He had a strong suspicion, however, that the 1862 comet was identical with one seen in 1737, and this assumption allowed him to predict that Swift-Tuttle would not return until late-1992. This prediction proved to be correct, and this comet has the longest orbital period of all the comets whose returns have been successfully predicted.

Although the CBAT also traditionally made announcements of the discoveries of asteroids that came close to the earth, the official organization for attending to discoveries of asteroids (more than 99% of which are located in a belt between Mars and Jupiter) is the Minor Planet Center. Also operated by the International Astronomical Union, the MPC was located until 1978 at the Cincinnati Observatory. In that year the director, Dr. Paul Herget, was retiring, and it was necessary for the Center to find a new home. Accordingly, the IAU asked Dr. Marsden also to take over the direction of the MPC. Thanks to the transfer of associate director Conrad Bardwell with the MPC records from Cincinnati, this task was rendered easier. While the CBAT and the MPC still maintained their separate entities, there was a lot of common ground between them. Dr. Marsden was therefore able to introduce some efficiencies into their combined operation. On Mr. Bardwell's retirement at the end of 1989, Gareth Williams joined the MPC staff and later became associate director.

The advances in electronic communication during the 1990s also permitted improvements in MPC operation. Perhaps the most important of these was the development, in 1996, of the Internet "Near-Earth Object Confirmation Page". This draws attention to candidate earth-approaching objects in need of follow-up observations as soon as they have been reported to the MPC, following the derivation by Dr. Marsden of a particularly ingenious method for estimating the uncertainty of the prediction by automatically computing a series of orbits that represent just the first and the last observations. In 1998 he developed a certain amount of notoriety by suggesting that an object called 1997 XF_{11} could collide with the earth. He did this as a last-ditch effort to encourage the acquisition of further observations, including searches for possible data from several years earlier. The recognition of some observations from 1990 made it quite clear that there could be no collision with 1997 XF_{11} during the foreseeable future. Without those 1990 observations, however, the object's orbit would have become very uncertain following a close to moderate approach to the earth in 2028; indeed, Dr. Marsden correctly demonstrated that there was the possibility of an earth impact in 2040 and in several neighbouring years. He was thereby able eventually to persuade his principal critics routinely to perform similar uncertainty computations for all near-earth objects as they were announced. Again, as more data accrue, it is almost certain to happen that all possible impacts with moderately large objects (i.e., those at least several hundred feet across) during the next century, say, will disappear. While the production of such computations was directly due to his encouragement, it was always with some amusement that he saw cases where further data forced his former critics sheepishly to withdraw their earlier frightening statements about a potentially dangerous object.

Dr. Marsden was particularly fascinated by the appearance of a group of comets that passed close to the sun. Known as members of the Kreutz group, after a German astronomer who studied them in the late nineteenth century, the discovery of three more of these sungrazing comets in the mid-twentieth century led him to undertake a detailed examination of how the individual comets may have evolved from each other. He published this examination in 1967, following it up with a further study in 1989 involving a more recent bright Kreutz comet, as well as several much fainter objects that had been detected from sun-observing coronagraphs out in space. Beginning in 1996, these were being found by the SOHO coronagraphs at rates ranging from a few dozen to more than one hundred per year. Unfortunately, the faintness of the comets and the poor accuracy with which they could be measured made it difficult to establish their orbits as satisfactorily as Dr. Marsden would have liked. More significantly, however, he was able to recognize that the SOHO data also contained another group of comets with similar orbits, these comets now known as members of the "Marsden group". Unlike the individual Kreutz comets, which have orbital periods of several centuries, it seems that the Marsden comets have orbital periods of only five or six years, leading him to try and recognize the same object at different passages near the sun and thereby predict future returns. Two other well-populated groups have also been detected in the SOHO data.

Another series of astronomical discoveries that greatly interested him were what he always called the "transneptunian objects", although many of his colleagues have insisted on calling them "objects in the Kuiper Belt". When what those same colleagues considered to be the first of these was discovered in 1992, Dr. Marsden immediately remarked that this was untrue, because Pluto, discovered in 1930 and admittedly somewhat larger in size, had to be the first. More specifically, he was the first to suggest, correctly, that three further transneptunian objects discovered in 1993 were exactly like Pluto in the sense that they all orbit the sun twice while Neptune orbits it thrice. This particular recognition set him firmly on the quest to "demote" Pluto. Success required the discovery of transneptunian objects more comparable to Pluto in size, something that finally happened in 2005 with the discovery of the object that came to be known as Eris. At its triennial meeting in 2006 in Prague, the IAU voted to designate these objects, together with two further transneptunian objects now known as Makemake and Haumea, as well as the largest asteroid, Ceres, members of a new class of "dwarf planet".

It was also at the IAU meeting in Prague that Dr. Marsden stepped down as MPC director, and he was quite entertained by the thought that both he and Pluto had been retired on the same day. While he remained working at the MPC (and also the CBAT) in an emeritus capacity, the directorship was passed to Dr. Timothy Spahr, whom he had brought to the MPC in 2000.

Dr. Marsden served as an associate director of the Harvard-Smithsonian Center for Astrophysics (the combination of the Smithsonian Astrophysical Observatory and the Harvard College Observatory) for 15.75 years from the beginning of 1987 (the longest tenure for any of the Center's associate directors). He was chair of the Division of Dynamical Astronomy of the American Astronomical Society during 1976-1978 and president of the IAU commissions that oversaw the operation of the minor Planet Center (1976-1979) and the Central Bureau for Astronomical Telegrams (2000-2003). He continued to serve subsequently on the two solar-system nomenclature committees of the IAU, being the perennial secretary of the one that decides on names for asteroids. He also continued to publish a "Catalogue of Cometary Orbits", the first of these having appeared in 1972 and its successors roughly at intervals of two years.

Among the various awards he received from the U.S., the U.K. and a handful of other European countries, the ones he particularly appreciated were the 1995 Dirk Brouwer Award (named for his mentor at Yale) of the AAS Division on Dynamical Astronomy and the 1989 Van Biesbroeck Award (named for an old friend and observer of comets and double stars), then presented by the University of Arizona, now by the AAS, for service to astronomy.

Dr. Marsden married Nancy Lou Zissell, of Trumbull, Connecticut, on 1964 December 26, and fathered Cynthia (who is married to Gareth Williams, still MPC associate director), of Arlington, Massachusetts; and Jonathan, of San Mateo, California. There are three Californian grandchildren, Nikhilas, Nathaniel and Neena. A sister, Sylvia Custerson, continues to reside in Cambridge, England.

This obituary was written by Brian Marsden some years ago and was updated by Gareth Williams and Cynthia Marsden. It appeared on MPEC 2010-W10 on 2010 November 18.

BAA Observers Workshop on Asteroids, Comets and Meteors
held in Burlington House on 2010 September 25th

A full report on the meeting will appear in the BAA Journal in due course. The report will include my summary given here, and a shorter version of Roger’s presentation, which is given in full here.

The Comet Section
Jonathan Shanklin

I introduced the comet Section, outlining its history from its institution in 1891 to the present. Overall the section has around 40,000 observations of about 500 comets, including returns of over 100 comets. The Section has a frequently updated web page, produces reviews for the Journal and an annual newsletter. First steps in producing a revised observing guide are underway.

Discovery prospects for amateur observers were decreasing thanks to professional all sky surveys, both from the ground and space, although a Spanish group of amateurs had just picked up another comet. I highlighted one spacecraft discovery, 2006 M4 (SWAN), which had a couple of major outbursts around the time of perihelion, as an example of unexpected comet behaviour. Such outbursts made it worth monitoring faint comets in case they were brighter than predicted.

Having made a potential discovery, follow up observations were needed, both to identify any cometary characteristics and to compute an orbit in order to allow others to follow the object. Peter Birtwhistle was a noted contributor of responsive observations to objects posted on the Near Earth Object Confirmation Page (NEOCP).

Visual observations were still of value, as the consistent derivation of the absolute magnitude of comets provided some form of proxy for cometary size distributions used by professional astronomers. Aspects of visual observation included measuring the brightness, which was done in a similar manner to variable stars, but in order to compare like with like needed out of focus stars, which made life much harder. The coma diameter and degree of condensation were slightly subjective or condition dependent, but could be measured by comparison. The tail of a comet depended very much on its degree of activity and geometry, and one such as 2006 P1 (McNaught), which displayed multiple striae is a rare event.

Comet photometry
Roger Dymock

Introduction
The presentation covered;
- potential targets
- use of the Sierra Stars Observatory Network (SSON) robotic telescope
- photometry, the Spanish method
- observations of comet 103P/Hartley

You may well be asking ‘Why is this person writing about comets when he is an asteroid observer?’ That was true until recently but, after putting what I and quite a few other people know about asteroids into a book ‘Asteroids and Dwarf Planets and How to Observe Them’ to be published by Springer at the end of 2010, I felt I needed a change.

Targets
Compared with asteroids there aren’t that many comets visible at any one time – those that can be observed visually or imaged with a CCD camera and modest amateur equipment that is. Lists of observable comets can be found on the following websites;
- the BAA Comet Section
- JPL ‘What’s Observable’
- the Minor Planet Center’s (MPC’s) List of Observable Comets

While a few bright comets may be all too obvious to the naked eye, for the fainter ones, use of the latest orbital elements to position ones telescope is essential. These can be obtained from the MPC's Minor Planet and Comet Ephemeris Service website.

Robotic telescopes
There are a growing number of robotic telescopes which are available to amateurs via an internet connection. BAA members can recoup 50% of the cost of using a robotic telescope via the Instruments and Imaging Sections' Robotic Telescope Project providing that a project proposal is first submitted and approved. At this time SSON costs approximately 50p/min and the other two telescopes half that amount (with the BAA discount). There is also a half-price special offer available for first time users. The two modes of operation most often employed are what might be called;
- 'real time', that is you have to be at your computer and operate the telescope and take images as you would with your own,
- 'fire and forget' where you input your requirements and go to bed/work/whatever – SSON operates in this way.

The data used in this presentation is extracted from images of 103P/Hartley obtained using the SSON's 0.61 metre telescope located in Alpine county, California, USA. I have found this system simple to use, one only pays for imaging time – no set up time being charged and there are no quibbles as to refunds if images are not of acceptable quality. The two telescopes situated in the USA, SSON and Rigel, are shortly to be joined by another located in Grove Creek, New South Wales, Australia giving northern hemisphere observers access to the southern skies.

Photometric methods
As some of you will no doubt be aware astrometry and photometry of asteroids is a fairly simple matter thanks to Herbert Raab's *Astrometrica* software. Knowing that comet photometry might not be quite so simple I sought help from the Comet Section's Assistant Director (CCD), Nick James. His response was 'It's quite a thorny subject, certainly not as simple as photometry of asteroids!' and pointed me in the direction of different methods which were presented by Giovanni Sostero (the Italian method) and Mark Kidger (the Spanish method) at the Comet Section's workshop held in Cambridge in 2005.

In brief, the Italian method, developed by the Cometary Archive For Amateur Astronomers Group (CARA), uses narrowband filters centred on 647 or 650 nm (unless the comet is fainter than mag 11.5 when a broadband Bessel or Cousins R or I filter is recommended). The size of the aperture used to determine the magnitude of the comet is defined as 100,000 km at the distance of the asteroid. For example on 2010 March 14 30P/Reinmuth was 241,500,000 km from the Earth and thus the angle subtended by the aforementioned aperture is 85 arc secs.

The Spanish method
Castanets are not required nor is a knowledge of bullfighting but beware of the inquisition if you make a mistake !!! This method was developed after analysis of the MPC comet database by one of Mark Kidger's students showed that the photometric data was of little use as the methods used for imaging and data reduction were inconsistent. The resultant measures had a scatter equal to or greater then 4 magnitudes – photometry received by Mark from Spanish amateurs was similarly inconsistent. The quite simple method developed by the Spanish Group requires the use of *Astrometrica* and their own *FoCAs II* software. This method differs from that developed by the CARA group in that unfiltered images are used and the comet magnitude is defined in terms of a number of fixed apertures – 10×10 to 60×60 arc secs in steps of 10 arc secs hence the 'Multibox' terminology. Actually the terminology refers to earlier version where square apertures were used – current versions use circular apertures with diameters of; 10, 20, 30 ,40, 50, 60 arc secs.

Imaging
When using a distant robotic telescope a planisphere for the relevant latitude can help to determine the region of the sky visible at a particular time (some locations do have an all-sky camera which can serve a similar purpose). If you do choose an object that is not presently observable SSON will advise you of this. The presence of even a full moon need not be a problem – SSON advise that a minimum of 30º separation between object and moon should result in satisfactory images being obtained. Note that this applies to asteroids and comets – I have not tried to image other objects, e.g. deep sky, so cannot comment on its applicability in such cases.

To obtain images with SSON (having first purchased some time of course);
- log in (you can operate your own account and one via the BAA scheme),
- enter project title an observer name in the Project Information screen,
- choose an object from the lists provided (or enter RA and Dec coordinates). For this project comet 103P/Hartley was selected from the Current comets list,
- you can choose a specific date or time but, if you do so and your job doesn't run, you will have to delete and resubmit that job. As I don't mind if my job is delayed I do not do this and then the job is rerun at the first opportunity,
- select Telescope, Filter (or Clear if using the Spanish method of measuring magnitude as described below), Duration of exposure, Number of exposures, Time Delay between exposures and Payment Choice,
- submit job. SSON responds with a job ID and your updated credit position. You will also receive an email confirming that the job has been accepted,
- on successful completion of your job you will receive an email confirming that your images (calibrated and in zipped format) are available for download. If the job was not run or there were problems with some of the images you will be informed by email and credited appropriately.

Image processing the Spanish way
Mention needs to be made of some key *Astrometrica* settings;
- ensure Time in File Header (Start, Middle or End of Exposure) matches that in the image FITS header
- set the CCD Chip/Saturation to 50000 to avoid using bright stars that have saturated the CCD's pixels,
- set the Colour Band to Red(R),
- set Object Detection/Aperture Radius to 2 × FWHM (obtainable from *Astrometrica's* Object Verification window),

- set Star Catalog/Lower Limit to 14.0 or lower to improve photometric accuracy ensuring such a setting produces enough comparison stars (20) for *FoCAs II*

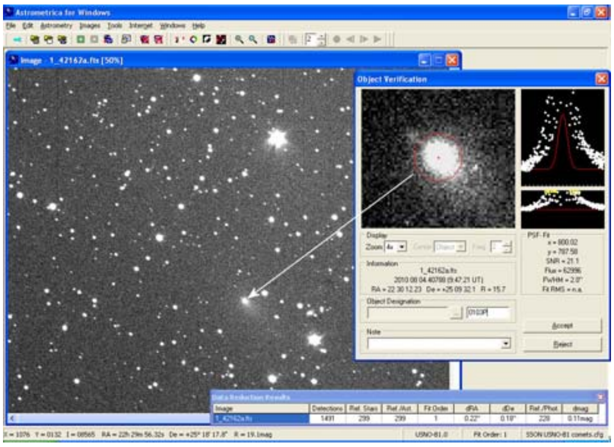


Figure 1. Astrometry and photometry using *Astrometrica*.

Using *Astrometrica* one measures the images first with UCAC 2 or USNO-B1.0 (for astrometry) and then with USNO-A2.0 or CMC-14 (for photometry) in that order or *FoCAs II* will not accept the *Astrometrica* data. The procedure is the same for any of the catalogues;
- open the images to be measured,
- click on the Astrometric Data Reduction button,
- align the reference stars, select the object to be measured and the Object Verification window opens, Figure 1. The number of reference stars used is shown in the box at the bottom right of the figure. Do not use the control key when placing the cursor over the target but allow *Astrometrica* to do the centering or an erroneous magnitude measurement will result.
- enter the comet ID, in this case 0103P, and Accept the data,
- repeat for all images using the astrometric catalogue and again using the photometric catalogue

It is worth checking the *Astrometrica* MPC report to verify that the RA and Dec measurements are evenly spaced (assuming similar delays between images) and that the magnitudes are similar. As they should be unless you were fortunate to witness an outburst.

Having run *Astrometrica* open *FoCAs II*. The images processed with *Astrometrica* will be listed, select these and then click on 'Process' - the results are shown in Figure 2. The positions and magnitudes are listed and shown in graphical format – astrometry, top right and photometry, bottom right. The plots should not deviate significantly from a straight line – if they do check your processing as they may, or may not be, in error. It is also worth visiting the Cometas website before submitting results to check that yours are in line with those previously submitted. If they are significantly different again recheck your results. It doesn't necessarily mean you have made a mistake but a check is worthwhile. If you are still concerned as to the accuracy of your measurements then pose a question to the Cometas Yahoo Group (make sure you select the correct language for your message). Although most of the messages are in Spanish the Google translation feature seems to make reasonable sense of them.

Should you not wish to use all the results, then I would recommend rerunning both *Astrometrica* and *FoCAs II* using only the 'good' images. The reason for this is that the 10×10 aperture value in the Multibox report is an average of the values listed at the top left of Figure 2 irrespective of which of the lines you select. An erroneous value of magnitude, even if not selected, can lead to an error in the multibox values. The Multibox report also includes; errors (+/-), Signal to Noise Ratio (SNR), the number of images (N), Sky brightness measured over 1 square arc sec (SB), Full Width Half Maximum (FWHM), MPC code (COD) and catalogue used for photometry (CAT).

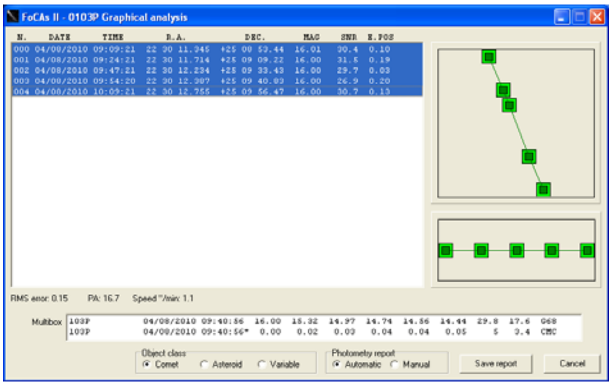


Figure 2. Screenshot showing results of *FoCAs II* analysis with all observations selected.

Reporting

FoCAs II produces both a standard MPC report and a Multibox report which I distribute, having setup that distribution as shown in Figure 3, as listed below;
- BAA Comet Section via Guy Hurst who published them in 'The Astronomer' (MPC and Multibox reports plus images),
- MPC (MPC report),
- the Spanish group via Yahoo (MPC and Multibox reports plus images).

MPC report

```
COD G68
OBS R.Dymock
MEA R.Dymock
TEL 0.61-m f/10 reflector + CCD
AC2 roger.dymock@ntlworld.com
ACK G68_2010_08_05-1
COM CMC-14 used for photometry

NET USNO-B1.0

0103P         C2010 08 04.38149 22 30 11.24 +25
08 52.7          16.0 N       G68
0103P         C2010 08 04.39191 22 30 11.63 +25
09 07.9          16.0 N       G68
0103P         C2010 08 04.40788 22 30 12.13 +25
09 32.8          16.0 N       G68
0103P         C2010 08 04.41273 22 30 12.38 +25
09 40.8          16.0 N       G68
0103P         C2010 08 04.42316 22 30 12.70 +25
09 55.1          16.0 N       G68
```

An extra COM line has been added to the MPC report to indicate which catalogue has been used for photometry.

Multibox report

```
COD G68
OBS R.Dymock
CATALOG: USNO A2.0 / CMC-14 - BAND: R
```

```
                      10x10  20x20  30x30
40x40  50x50  60x60   SNR   SB   COD
OBJECT DATE       TIME        +/-    +/-    +/-
+/-    +/-    +/-      N  FWHM  CAT
------ ---------- --------  -----  -----  -----
-----  -----  -----  ----  ----  ---
103P   04/08/2010 09:40:56  15.99  15.29  14.94
14.71  14.54  14.42  19.3  17.6  G68
103P   04/08/2010 09:40:56*  0.01   0.02   0.03
0.03   0.04   0.05     5   3.4  CMC

FoCAs II - 17/03/2010
www.astrosurf.com/cometas-obs
es.groups.yahoo.com/group/Cometas_Obs
```

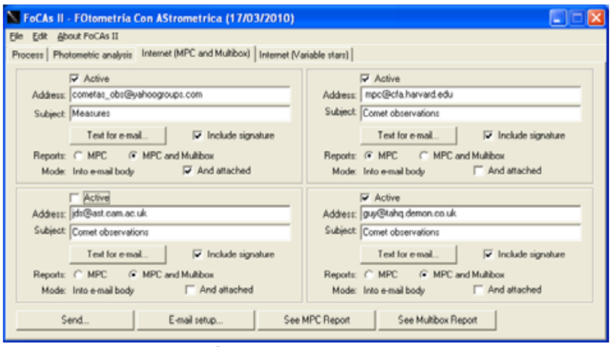


Figure 3. *FoCAs II* email setup.

Images are sent to the BAA Comet Section and the Spanish Group. Figure 4 shows an image of 103P/Hartley obtained with the SSON robotic telescope. The data shown at the bottom of the images may differ slightly from observer to observer but the format of the file name, in this case 103p_20100914_0810_dymock.jpg, must be adhered to or you will be subjected to the Shanklin inquisition which is infinitely worse than the Spanish version !!! (see the Comet Section website for details of this format).

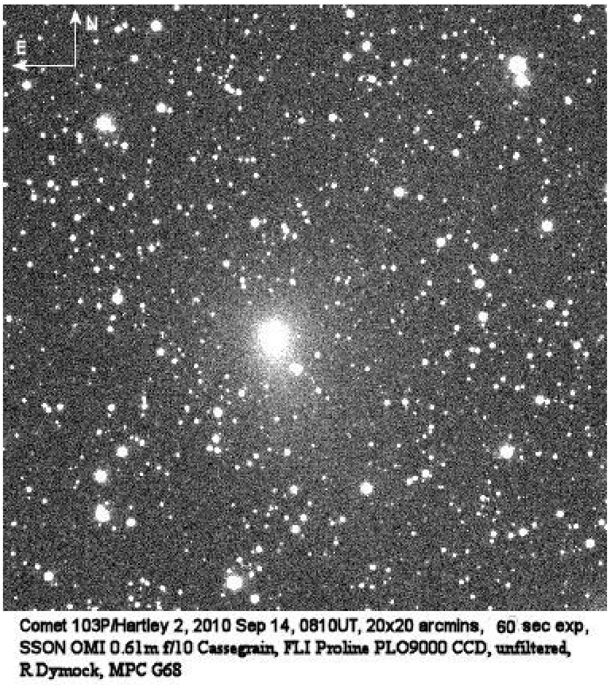


Figure 4. Comet 103P/Hartley

Having gone to the trouble to pass on your data it is always good to see it published for example in;

- The Journal of the British Astronomical Association e.g. 'The comets of YYYY',
- The Astronomer,
- MPC – on-line MPECs 'Observations of comets',
- the Spanish Cometas_obs website and Yahoo group.

Comet 103P/Hartley

Observing this particular comet was suggested by one of the reviewers when I applied for a robotic telescope grant. This comet was predicted to become as bright as magnitude 4 and would be thus suitable for CCD imaging and visual observation. The EPOXI spacecraft, previously known as Deep Impact which visited 9P/Tempel in 2006, was scheduled to fly by this comet on 2010 November 4 – Figure 5. 103P/Hartley is a Jupiter family comet. These have orbital periods of less than 20 years and are thought to originate in the Edgeworth-Kuiper belt.

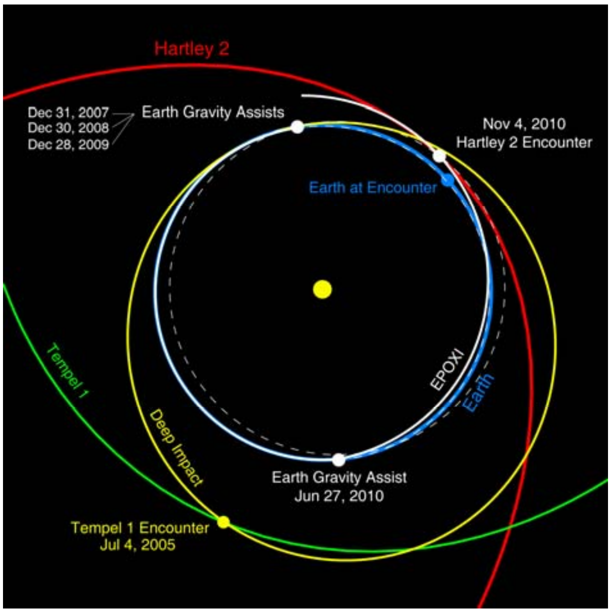


Figure 5. EPOXI spacecraft, comet 103P/Hartley encounter. Credit: NASA/JPL-Caltech/UMD/GSFC/Tony Farnham

I started imaging this comet in 2010 June, when it was a magnitude 18 object 1.39 AU from Earth, using the SSON robotic telescope – see above and Figure 4 and plan to follow it for as long as possible using the northern and southern hemisphere SSON telescopes. Figure 6 is a plot of all observations submitted to the Spanish group up to 2010 October 13.

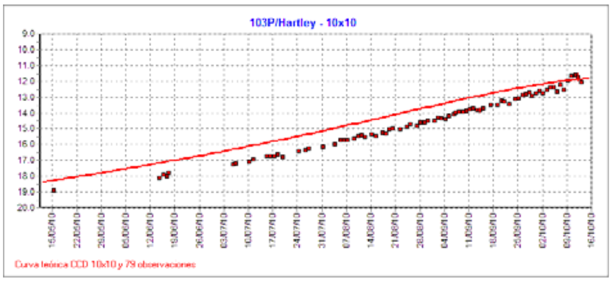


Figure 6. Plot of observations of comet 103P/Hartley. Credit: Cometas_Obs

Websites mentioned in this report

BAA - http://britastro.org/baa/

JPL What's Observable - http://ssd.jpl.nasa.gov/sbwobs.cgi
MPC - http://minorplanetcenter.org/iau/mpc.html
SSON - http://www.sierrastars.com/
Megastar - http://www.willbell.com/software/megastar/index.htm
Guide - http://www.projectpluto.com/
Spanish Group (Cometas) - http://astrosurf.com/cometas-obs/
Italian Group (CARA) - http://www.cara-project.org/
Astrometrica - http://www.astrometrica.at/
The Astronomer - http://www.theastronomer.org/index.html
EPOXI Mission - http://www.nasa.gov/mission_pages/epoxi/index.html

If you would like a pdf copy of the presentation made at the workshop please email Roger at roger.dymock@ntlworld.com .

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.

Detectability of Oort Cloud Objects Using Kepler
Eran O. Ofek and Ehud Nakar Astrophysical Journal Letters. Preprint at http://arxiv.org/abs/0912.0948

The size distribution and total mass of objects in the Oort Cloud have important implications to the theory of planet formation, including the properties of, and the processes taking place in the early solar system. We discuss the potential of space missions, such as Kepler and CoRoT, designed to discover transiting exoplanets, to detect Oort Cloud, Kuiper Belt, and main belt objects by occultations of background stars. Relying on published dynamical estimates of the content of the Oort Cloud, we find that Kepler's main program is expected to detect between 0 and ~100 occultation events by deca-kilometer-sized Oort Cloud objects. The occultation rate depends on the mass of the Oort Cloud, the distance to its "inner edge", and the size distribution of its objects. In contrast, Kepler is unlikely to find occultations by Kuiper Belt or main belt asteroids, mainly due to the fact that it is observing a high ecliptic latitude field. Occultations by solar system objects will appear as a photometric deviation in a single measurement, implying that the information regarding the timescale and light-curve shape of each event is lost. We present statistical methods that have the potential to verify the authenticity of occultation events by solar system objects, to estimate the distance to the occulting population, and to constrain their size distribution. Our results are useful for planning of future space-based exoplanet searches in a way that will maximize the probability of detecting solar system objects, without hampering the main science goals.

Comet McNaught had unusually long ion tail. *RAS* SPA ENB 287

British scientists have shown from Ulysses spacecraft data that 2006 P1 (McNaught), which in early 2007 became the brightest comet seen for 40 years, disturbed a region of space much larger than that occupied by the visible tail. Analysis of magnetometer data suggests that the comet was surrounded by a shock wave created where the fast-flowing particles of the solar wind were slowed down abruptly when they impinged on the ionized gas emitted from the comet's nucleus. It was just by chance that Ulysses happened to pass through the tail of 2006 P1; it encountered the tail of ionized gas at a distance downstream of the comet's nucleus more than 1.5 times the distance between the Earth and the Sun - much further away than the visible dust tail extended. Ulysses took 8 days to traverse the shocked solar wind surrounding 2006 P1, compared to 2.5 days in shocked wind surrounding 1996 B2 (Hyakutake) in 1996. The Giotto spacecraft's encounter with 26P/Grigg-Skjellerup in 1992 took less than an hour from one shock crossing to another; to cross the shocked region at 1P/Halley took a few hours. The comparisons show that 2006 P1 was not only spectacular from the ground but was an unusually large obstacle to the solar wind.

Capture of the Sun's Oort Cloud from Stars in its Birth Cluster *H.F. Levison, M.J. Duncan, R. Brasser, and D. Kaufmann* To appear in: Science

Oort cloud comets are currently believed to have formed in the Sun's proto-planetary disk, and to have been ejected to large heliocentric orbits by the giant planets. Detailed models of this process fail to reproduce all of the available observational constraints, however. In particular, the Oort cloud appears to be substantially more populous than the models predict. Here we present numerical simulations that show that the Sun captured comets from other stars while it was in its birth cluster. Our results imply that a substantial fraction of the Oort cloud comets, perhaps exceeding 90%, are from the proto-planetary disks of other stars.

IAU S263 Icy Bodies of the Solar System 3-7 August, 2009, Rio de Janeiro, Brazil

Topics addressed in the symposium covered different aspects of icy bodies, going from formation conditions in the protoplanetary disk, reservoirs and dynamical transport within the solar system, the influence of the early galactic environment on shaping the Oort cloud, physics, space missions with special focus on the upcoming Rosetta and New Horizons missions, and the comet-asteroid transition objects, the latter a hot topic given the observation of activity in some main-belt asteroids. The question on where the Earth's water comes from was also discussed, bearing in mind the discrepancy between the deuterium/hydrogen (D/H) ratio found in Earth and that found in comets. The outer part of the asteroid belt appears as a promising source of Earth's water, idea that has been strengthened by the discovery of activity in a few outer main belt asteroids, suggesting that they might be ice-rich. Deep Impact results and new ground-based observations of comets were presented, providing us a more refined view of their physical structure and size distribution. These results give new support to the view that comets are very fluffy, weakly consolidated structures (mean density ~ 0.5 g cm-3). Last but not least, the relevance of icy bodies for life on Earth and elsewhere in the solar system was also addressed, in particular given the possibility that some large icy satellites of the Jovian planets might contain subsurface oceans. In this regard, the Cassini mission has uncovered geysers on Enceladus which points to a very active body powered by the energy released by tidal friction, and the real possibility that the ice in its interior has melted. The symposium was very fruitful to assess the state of the art of our knowledge in this field today, and what are the new problems that challenge us for the next few years.

David Seargent suggests that it seems that P/2010 A2 might be a comet after all. In their paper "**Water-ice driven activity on Main-Belt Comet P/2010 A2 (LINEAR)?",** *Fernando Moreno et. al.* analyse a series of images taken last January from Observatorio del los Muchachos on La Palma in Spain and find that the dust tail of this comet is best explained as consisting of large particles ejected over a period of about 8 months from late March 2009 until early December, with maximum activity in June last year. The ejection velocities fit ordinary cometary activity driven by sublimating ice. The tail cannot be explained by a single burst of particles as would be expected from a collision between two asteroids.

A minor impact may have triggered the activity, but the increase and decrease in the quantity of ejected dust over time reflects activity that built up for about two months, then levelled off for a while before decreasing and eventually stopping altogether just after perihelion. Maybe the deposit of exposed ice was exhausted by then, or the active region turned away from direct sunlight. According to Moreno et al, activity was probably confined to a single region at high southerly latitudes on the nucleus surface.

These results bring this object more into line with the other Main-Belt comets and once more raise the question as to whether it is a true member of the S-Type Flora family or a C-Type interloper. I ran a D-criterion comparison of the orbit of this object and that of Flora and the "Flora interloper" (298) Baptistina and found that for the latter D = 0.134 while for the former D = 0.272. Clearly, the orbit of A2 has a greater similarity with 298 than with Flora.

Planetary Trojans - The Main Source of Short Period Comets? *Jonathan Horner and Patryk Sofia Lykawka* To appear in: International Journal of Astrobiology Preprint at http://sites.google.com/site/patryksofialykawka/

One of the key considerations when assessing the potential habitability of telluric worlds will be that of the impact regime experienced by the planet. In this work, we present a short review of our understanding of the impact regime experienced by the terrestrial planets within our own Solar system, describing the three populations of potentially hazardous objects which move on orbits that take them through the inner Solar system. Of these populations, the origins of two (the Near-Earth Asteroids and the Long-Period Comets) are well understood, with members originating in the Asteroid belt and Oort cloud, respectively. By contrast, the source of the third population, the Short-Period Comets, is still under debate. The proximate source of these objects is the Centaurs, a population of dynamically unstable objects that pass perihelion (closest approach to the Sun) between the orbits of Jupiter and Neptune. However, a variety of different origins have been suggested for the Centaur population. Here, we present evidence that at least a significant fraction of the Centaur population can be sourced from the planetary Trojan clouds, stable reservoirs of objects moving in 1:1 mean-motion resonance with the giant planets (primarily Jupiter and Neptune). Focussing on simulations of the Neptunian Trojan population, we show that an ongoing flux of objects should be leaving that region to move on orbits within the Centaur population. With conservative estimates of the flux from the Neptunian Trojan clouds, we show that their contribution to that population could be of order $\sim$3%, while more realistic estimates suggest that the Neptune Trojans could even be the main source of fresh Centaurs. We suggest that further observational work is needed to constrain the contribution made by the Neptune Trojans to the ongoing flux of material to the inner Solar system, and believe that future studies of the habitability of exoplanetary systems should take care not to neglect the contribution of resonant objects (such as planetary Trojans) to the impact flux that could be experienced by potentially habitable worlds.

An Ancient Greek Sighting of Halley's Comet? *Daniel W. Graham and Eric Hintz,* Journal of Cosmology, http://journalofcosmology.com/AncientAstronomy106.html

The regularity of the orbits of comet Halley has made possible the determination of its visits backwards in time through the Middle Ages to antiquity. Computer models have provided correlations between reports of comets back to the second and third centuries BC and astronomical records of the Babylonians and Chinese. So far the earliest probable sighting is the return of 240 BC, confirmed by Chinese observers. Thus far ancient Greek records, which do not contain systematic diaries of heavenly events, have not been considered in this connection. One famous event recorded by Greek philosophers and historians is the fall of a meteor in northern Greece in 467/6 BC. At the time of the meteor, a comet was visible. This coincides with the retrodicted appearance of comet Halley in the summer of 466 BC. Using computer models we examine the probable path of comet Halley on that return and find it is consistent with reports about features of the observed comet. The philosopher and scientist Anaxagoras is said to have predicted the fall of the meteor. One ancient source corrects this confusion and allows us to see how the Greeks combined theory and observation in this case.

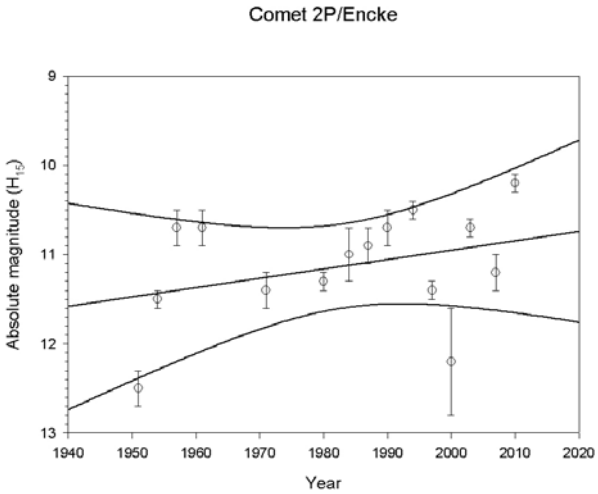
[One problem is the authors' choice of magnitude 4.2 for first detection. This is based on knowing exactly where to look with the naked eye, rather than spotting an unknown object which would need to be brighter. Ed.]

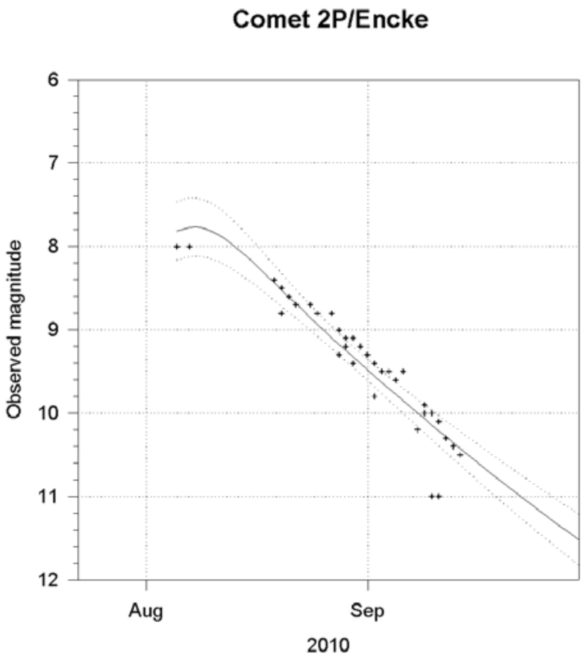
Review of comet observations for 2010 January - 2010 December

The information in this report is a synopsis of material gleaned from IAU circulars 9108 – 9190, The Astronomer (2010 January – 2010 December) 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.

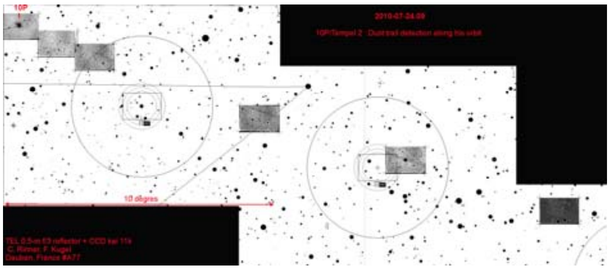
Further information can be found on the Section web pages and in the BAA Guide to Observing Comets.

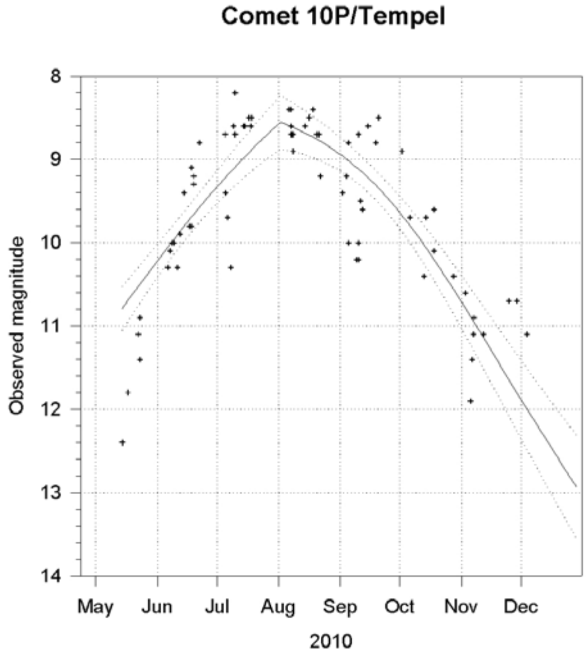
2P/Encke was first picked up in the SOHO C3 field on August 4. It became visible to Southern Hemisphere observers mid-month. The 34 observations received give an uncorrected preliminary light curve of m = 10.2 + 5 log d + 6.4 log r The log r exponent is relatively small, and the indicated absolute magnitude is somewhat brighter than that determined over the past 50 years. Whilst there may have been a slight brightening of the absolute magnitude, the determinations are consistent with no change over this period.





10P/Tempel made its 23rd observed return and reached 8th magnitude. Despite the relatively bright peak magnitude observations were sparse, because it was a morning object relatively low in UK skies. I'll confess that I didn't observe it myself. Deep images of the comet showed a dust trail in the plane of the comet's orbit. Francois Kugel and C Rinner obtained a mosaic on July 14. Further images on July 24 show the trail extending over 20 degrees from the nucleus.

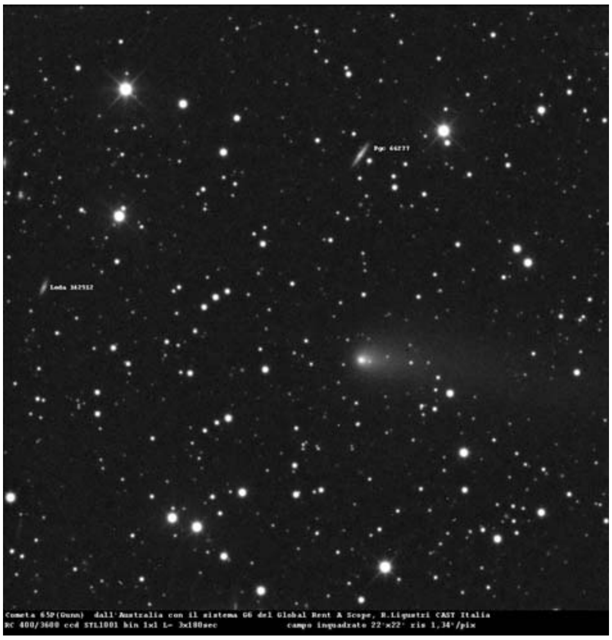




The 73 observations received so far give an uncorrected preliminary light curve of m = 9.4 + 5 log d + 0.0152 (dT – 28), ie the comet was brightest 28 days after perihelion.

10P/Tempel imaged by Rolando Ligustri on 2010 September 18

Observations suggest that **29P/Schwassmann-Wachmann** continued its erratic outbursts. Positive reports were made from February through to June, with the comet reaching 10th magnitude at a very bright outburst in February. The comet was at opposition on February 11, when it had a phase angle of only 0.3 degrees and this may have lead to an opposition effect brightening. The comet is reported to be a slow rotator (about 60 days).



65P/Gunn imaged by Rolando Ligustri on 2010 July 8

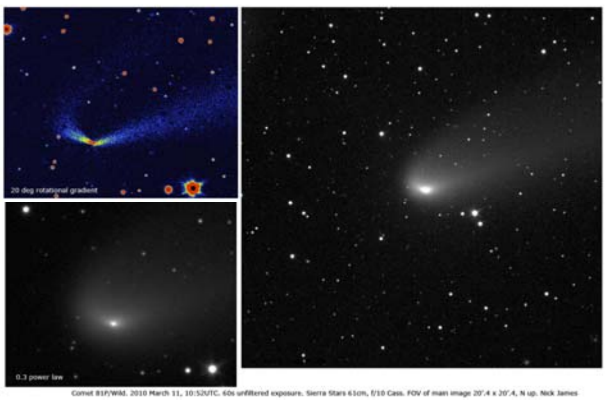
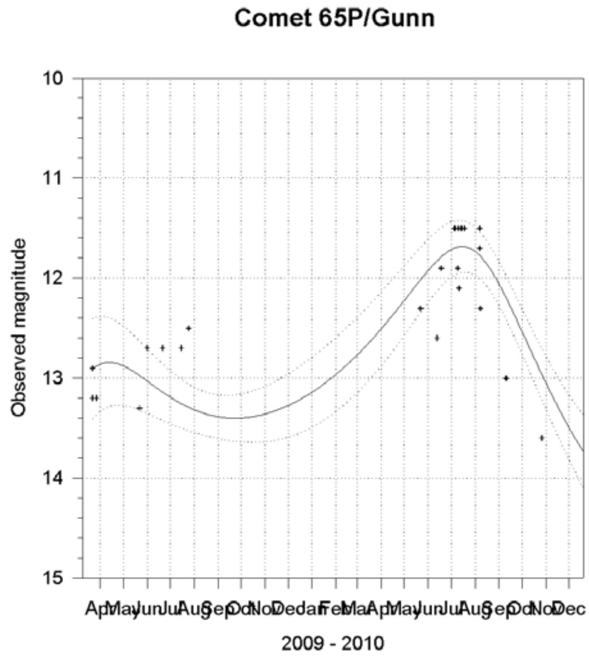
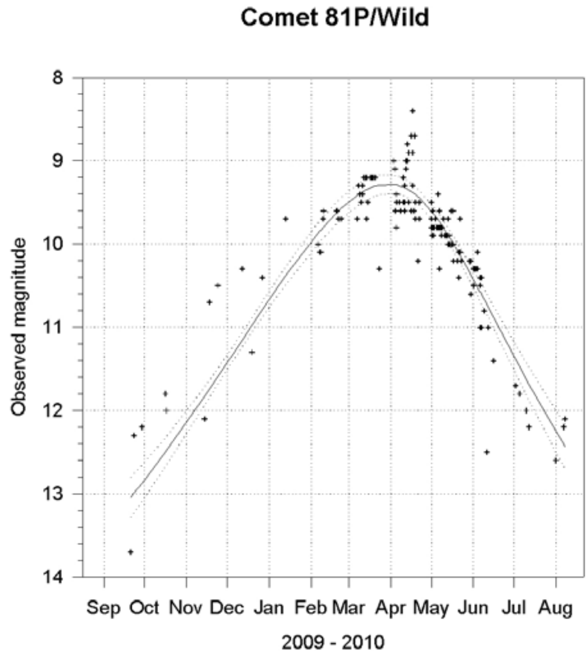


Image of 81P/Wild by Nick James on 2010 March 11

Comet **65P/Gunn** was brighter than expected, and reached 11th magnitude in June. Unfortunately its southern declination made it next to impossible for UK observers.

The visual and CCD observations received so far (25) give an uncorrected preliminary light curve for the 2010 apparition of m = 7.9 + 5 log d + 6.6 log r

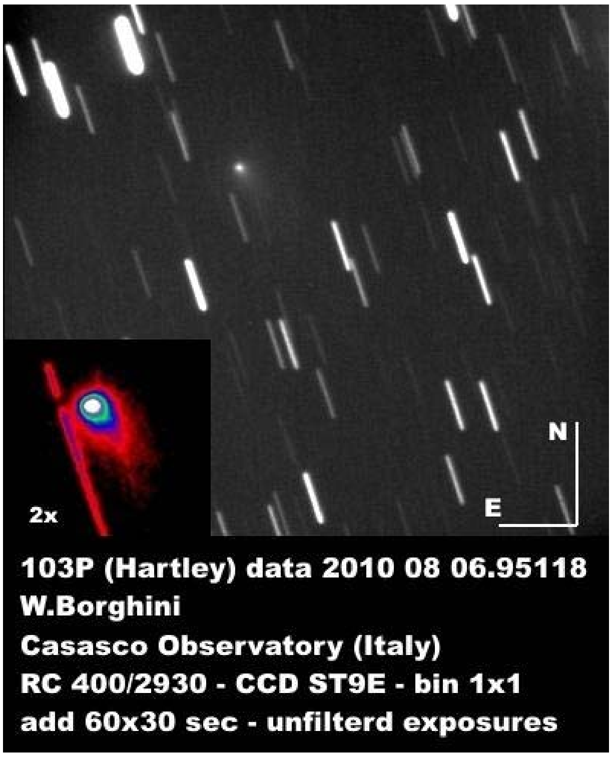




81P/Wild was quite well observed and reached 9th magnitude, much as expected, although the provisional magnitude parameters are somewhat different to previous apparitions.

The 137 observations received so far give an uncorrected preliminary light curve of m = 8.7 + 5 log d + 6.9 log r.

103P/Hartley made its close approach to the Earth in October (0.12 AU) and was a large diffuse naked eye object. The comet was a target for the extended mission of the Deep Impact spacecraft. The spacecraft made its closest approach to the comet on November 4 at 14:02 UT and returned some spectacular images (eg below). NASA continued its bad practice of using the obsolete name of the come, Comet Hartley 2, and many Journals simply copied information from the press releases, thus propagating this bad practice.

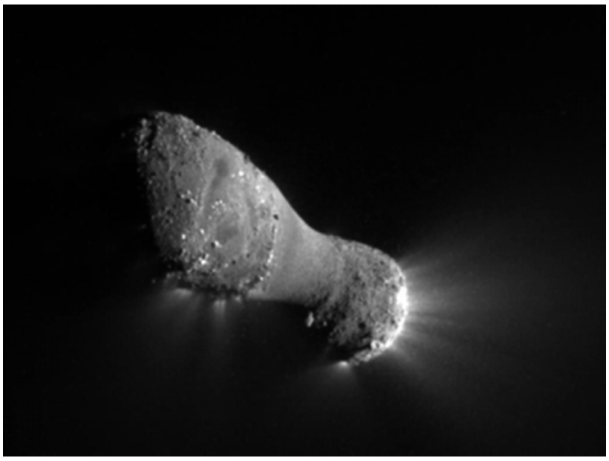


Near the Packman Nebula. Rolando Ligustri on 2010 October 2

There was no obvious indication of meteors from the comet around the expected time in November, although American cameras did report some fireballs, which according to a NASA Press Release (not the most reliable of sources) had similar orbits to 103P.

Image by Nick Howes on 2010 October 6

Image by Alan Tough on 2010 October 17



EPOXI image

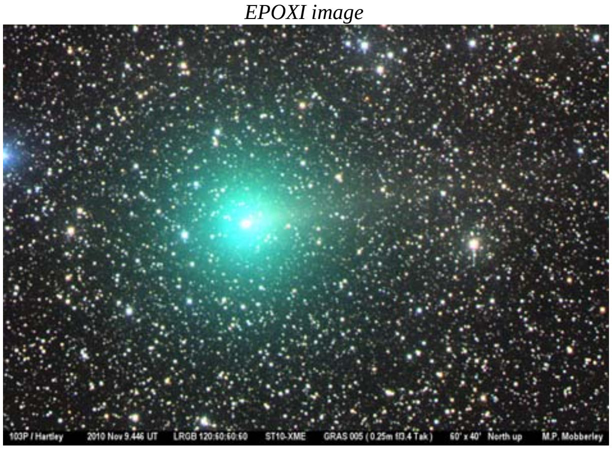
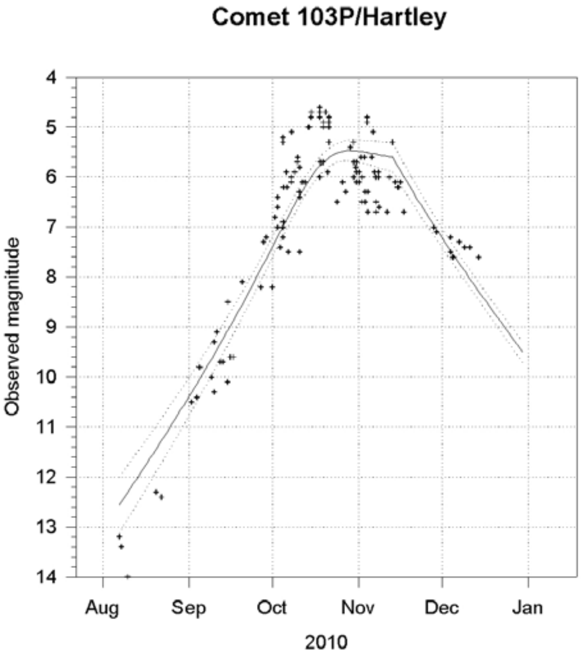
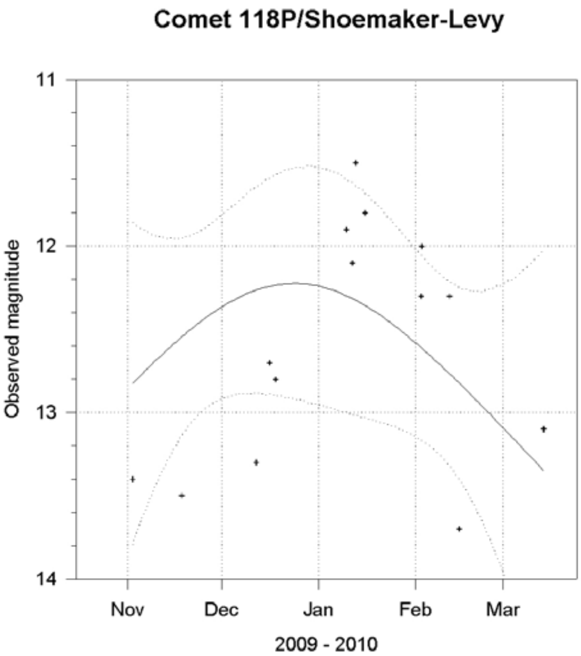


Image by Martin Mobberley on 2010 November 9



The 119 observations received so far give an uncorrected preliminary light curve of m = 9.1 + 5 log d + 0.0450 (dT – 16), ie the comet was brightest 16 days after perihelion.

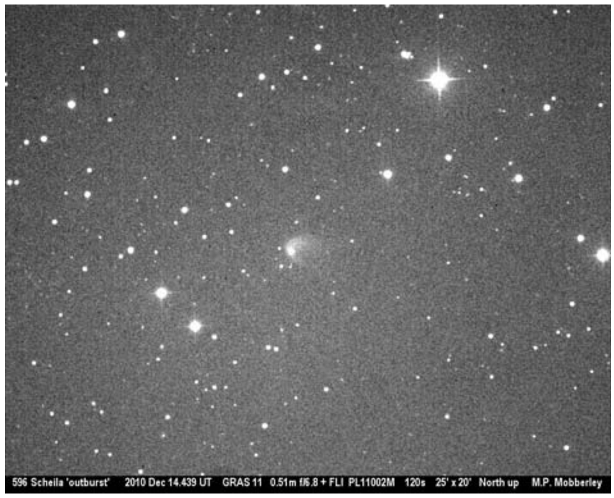
118P/Shoemaker-Levy reached 12th magnitude at the beginning of the year and was followed by a handful of observers till March.



The 14 observations received so far give an uncorrected preliminary light curve of m = 9.3 + 5 log d + 9.6 log r, very similar to the previous apparition.

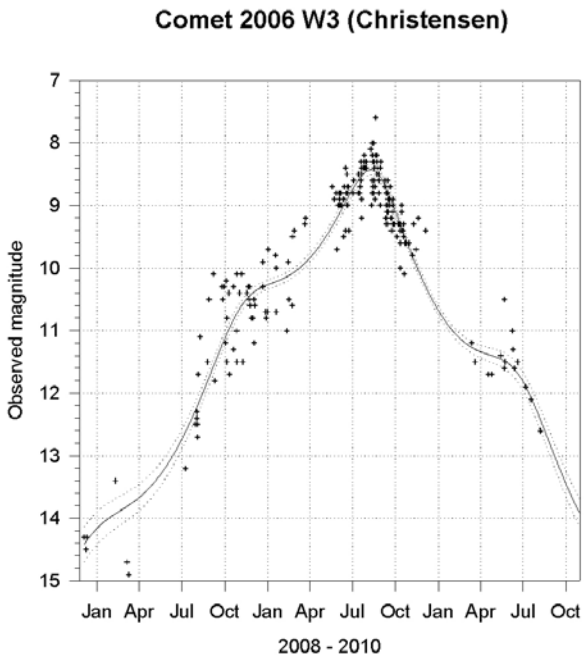
As expected, no observations of **141P/Machholz** were received, at what was a poor return.

CBET 2583, issued on 2010 December 12, announced the discovery of a spiral like structure around main belt asteroid **(596) Scheila** by Steve Larson in the course of Catalina Sky Survey (CSS) with the Catalina 0.68-m Schmidt telescope, on images obtained on 2010 December 11.44. The cometary appearance has been confirmed by other observers. In the Catalina images, the "coma" is bright (~13.5 compared to the expected 14.2), and extends some 2 arcmin north and 5 arcmin west from the central condensation in a spiral like structure reminiscent of 29P in outburst. Recent images show a stellar appearance in October and November, but slight diffuseness on December 3.4



(596) Scheila imaged by Martin Mobberley on December 14

The "Dictionary of Minor Planet Names" notes that (596) Scheila was discovered on 1906 February 21 by August Kopff at Heidelberg. It is named in honour of an acquaintance of the discoverer, a female English student in Heidelberg. (596) Scheila is a main-belt asteroid with an orbit inclined roughly 14 degree to the ecliptic and it is now 3.1 AU from the Sun and 2.5 AU from the Earth. It is next at perihelion in 2012 May and has a period of 5.0 years. Its distance from the sun varies between 2.4 and 3.4 AU. It is about 117km diameter and has an albedo of 0.036. Richard Miles notes that it is one of very few T-type asteroids. These have similar spectra to a bare cometary nucleus may therefore be dormant comets.



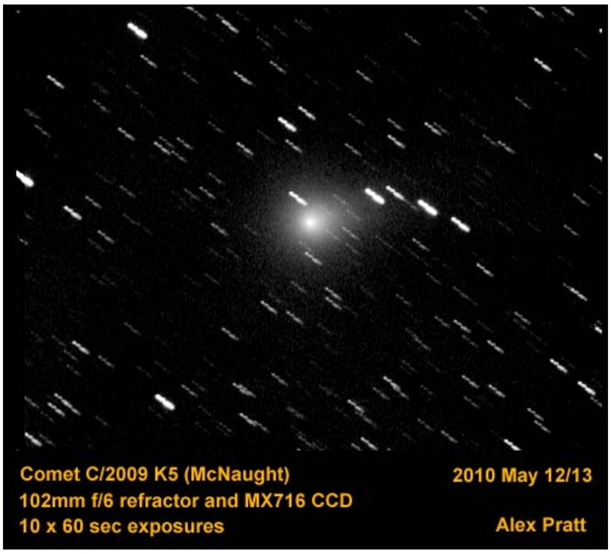
2006 W3 (Christensen) has a long period of observation, from 2007 December to 2010 August. It is intrinsically quite a bright object, with an absolute magnitude of -0.7, suggesting that it is either very large or very active. The former is more likely as it is a relatively distant object with perihelion at 3.1 AU.

The 228 observations received so far give an uncorrected preliminary light curve of m = -0.7 + 5 log d + 14.6 log r.

2007 Q3 imaged by David Strange on 2010 March 14

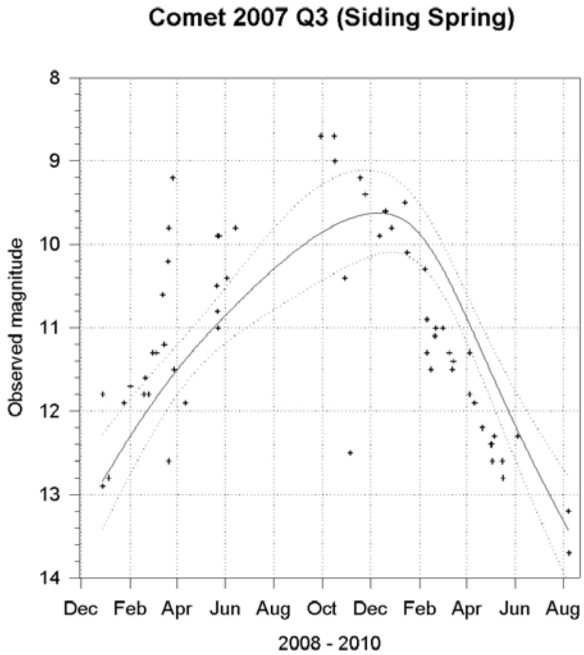
2007 Q3 (Siding Spring) was at perihelion at 2.3 AU in October 2009. Observations began at the end of 2008 in the Southern Hemisphere, and observations show that the comet brightened steadily. Observers in the Northern Hemisphere picked it up after solar conjunction, however it was a morning object and despite its relative brightness few observers braved the winter weather. As is often the case, there is something of a discord between CCD magnitudes and the visual observations.

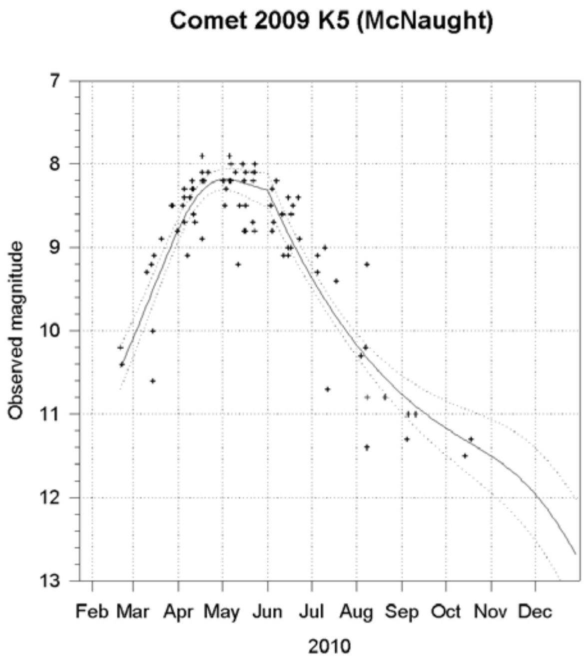
The 61 observations received so far suggest a preliminary uncorrected light curve of m = 3.2 + 5 log d + 11.9 log r



2009 K5 (McNaught) was at perihelion at 1.4 AU in late April 2010 and reached 8th magnitude around this time, becoming well placed in the northern sky. The comet was on its first visit to the inner solar system.

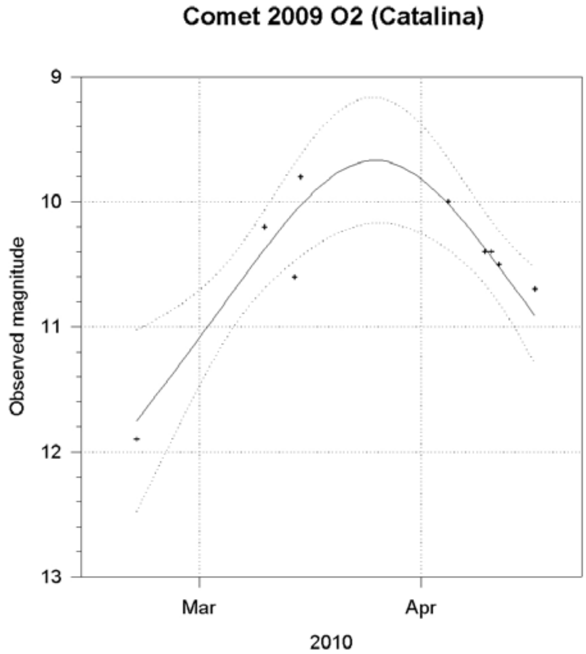
The 84 observations received so far suggest a preliminary uncorrected light curve of m = 7.0 + 5 log d + 0.0172 (dT – 32). If the comet had continued following this light curve it would still be visible, but there are indications that it faded very rapidly in November with the last positive observations from mid October.



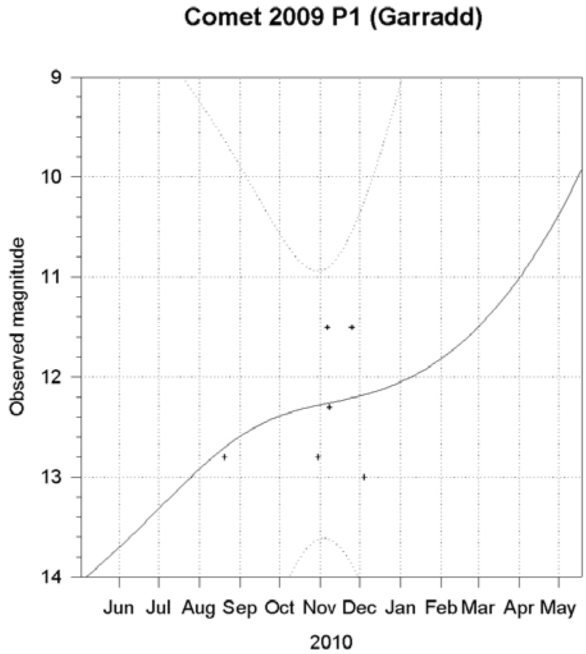


Comet **2009 O2 (Catalina)** was discovered during the Catalina Sky Survey, but not immediately recognised as a comet until verified by other observers. Observations were sparse, possibly because of its positioning in the northern sky below the pole.

The 9 observations available so far suggest a preliminary uncorrected light curve of m = 11.0 + 5 log d + 5.7 log r

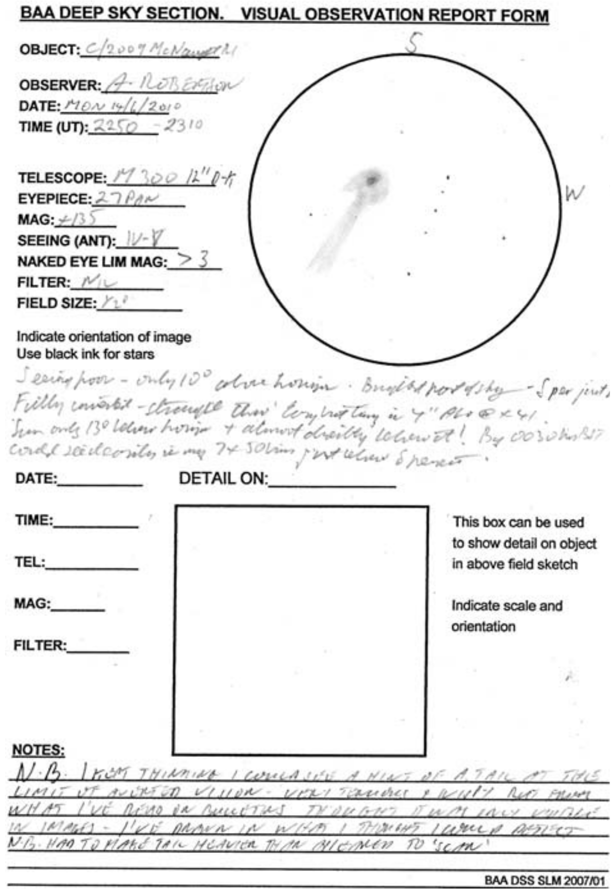


Visual observations of **2009 P1 (Garradd)** began earlier than expected when Juan Gonzalez picked it up at 13th magnitude in August. Further information is given in the predictions for 2011.



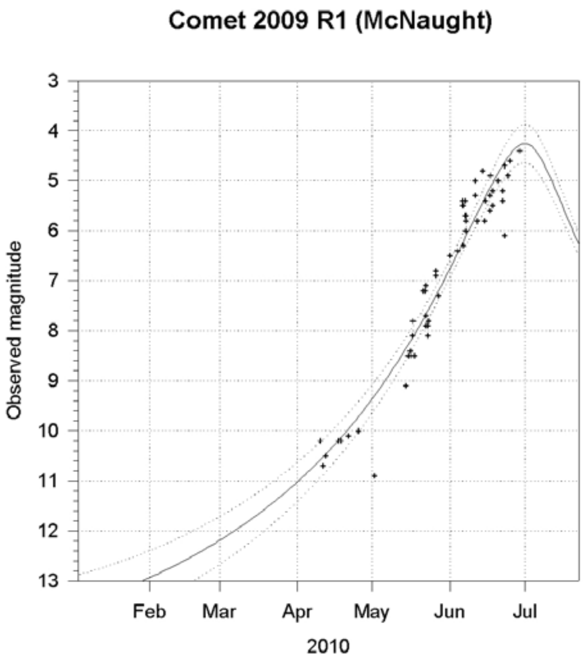
The 6 observations received so far suggest a preliminary uncorrected light curve of m = 3.2 + 5 log d + 8.1 log r, suggesting a peak of around 6th magnitude, however applying an aperture correction allows the possibility of a naked eye object for several months. In addition, the most recent observations are above the curve shown here.

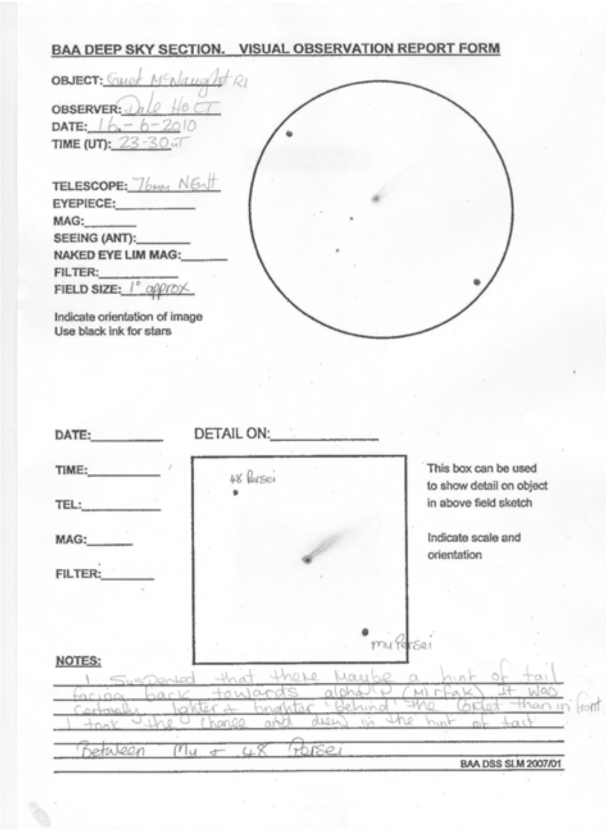
Hopes were high that **2009 R1 (McNaught)** might prove an interesting object in the summer, though it was not particularly well placed for observation from the UK. The comet reached perihelion at 0.4 AU in early July 2010, but faded during the run up and has not been seen after perihelion. It is likely that the comet was on its first visit to the inner solar system and did not survive perihelion.



The 58 observations received so far suggest a preliminary uncorrected light curve of m = 6.7 + 5 log d

+ 7.6 log r If the comet had continued following this light curve it would still be visible from the Southern Hemisphere.





BAA DEEP SKY SECTION. VISUAL OBSERVATION REPORT FORM

OBJECT: Comet McNaught R1
OBSERVER: Dale Holt
DATE: 16-6-2010
TIME (UT): 23-30UT

TELESCOPE: 76mm Newt
EYEPIECE:
MAG:
SEEING (ANT):
NAKED EYE LIM MAG:
FILTER:
FIELD SIZE: 1° approx

Indicate orientation of image
Use black ink for stars

DATE: DETAIL ON:
TIME:
TEL:
MAG:
FILTER:

48 Persei
mu Persei

This box can be used to show detail on object in above field sketch

Indicate scale and orientation

NOTES:
I suspected that there maybe a hint of tail facing back towards alpha P (Mirfak). It was certainly lighter & brighter 'behind' the comet than in front I took the chance and drew in the hint of tail Between Mu & 48 Persei

BAA DSS SLM 2007/01

2009 Y1 (Catalina) reaches perihelion at 2.6 AU in 2011 January. It has just come within visual range and is likely to remain 13th – 14th magnitude for several months.

The 5 observations received so far suggest a preliminary uncorrected light curve of m = 3.3 + 5 log d + 18.5 log r

Satellite Comets. Another 222 SOHO comets and 19 STEREO comets were discovered during the year, though orbits for over 100 are still to be determined. Archival comets are still being found, and it seems possible that more may still be findable. The SOHO total now stands at just over 2000, together with 41 STEREO comets.

Meyer Group SOHO comets 2010 A17, F8, G5, L11 were discovered with the SOHO LASCO coronographs and have not been observed elsewhere.

Marsden Group SOHO comet 2010 H3 was discovered with the SOHO LASCO coronographs and was not observed elsewhere.

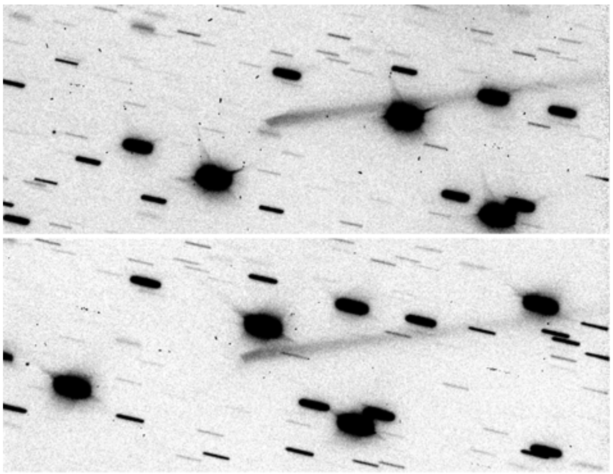
Brian Marsden noted on MPEC 2010-H37 that *The orbital elements of C/2010 H3 are similar to those that follow from the prediction (ICQ 2009/2010 Comet Handbook, p. H12) corresponding to the suggestion on MPEC 2004-X73 that the Marsden-group comet C/2004 V9 was a return of C/1999 J6, except that this prediction gives T = 2010 May 1.5 TT. The orbital linkage of comets C/2004 V9 and C/2010 H3 (using C2 observations only) gives a passage within 1.2 AU of Jupiter in June 2008, and extrapolation back a further revolution yields T = 1999 May 23.3 (compared to the observed date of 1999 May 11.6). Given also that a fainter second fragment, C/2004 V10, was at perihelion 0.11 day earlier than C/2004 V9, the possibility remains that further fragments will be recorded over the course of the next two weeks (i.e., closer to the time of the Comet Handbook prediction).*

Following some further STEREO observations, Brian Marsden in conjunction with Rainer Kracht computed a linked orbit with adopted non-gravitational parameters of A1 = +0.31, A2 = -0.1892. He noted on MPEC 2010-J28 that *The object passed 0.014 AU from the moon on 1999 June 12.09, 0.013 AU from the earth on 1999 June 12.19 and 1.16 AU from Jupiter on 2008 June 24. A moderately close approach to the earth to 0.32 AU occurs on 2010 May 29. The expected magnitude is very uncertain, but might be around 20th magnitude. The predicted positions should be good to about 1', and astrometry and photometry would be very desirable.*

Michael Knight notes that the lightcurves of the three objects are so similar, and brighter than any other Marsden group objects that they are probably returns of the same object.

Kreutz group comets. SOHO comets 2000 P4, P5, S8, S9, 2001 A5, O3, R10, 2008 P7, 2010 A6, A7, A8, A9, A10, A11, A12, A14, A15, A16, B6, B7, B8, B9, B10, B11, B12, B13, C3, C4, C5, D6, D7, D8, E7, E8, E9, E10, E11, E12, E13, F5, F6, F7, F9, F10, F11, G4, G6, H6, H7, H8, H9, H10, H11, H12, J6, J7, J8, J9, J10, J11, J12, J13, J14, J15, J16, K3, K4, K5, K6, K7, K8, K9, K10, K11, K12, L6, L7, L8, L9, L10, L12, L13, L14, L15, L16, L17, L18, L19 were discovered with the SOHO LASCO coronographs and 2010 A13, A17, A18, A19, A20, A21, A22, A23, B3, B4, B5 with the STEREO coronagraph. They have not been observed elsewhere.

2001 Q11 (P/NEAT) Maik Meyer, Limburg, Germany, discovered a 19th magnitude comet on images obtained by the NEAT project on three nights at Palomar and on five nights at Haleakala during August - December 2001. The August 18.47 Palomar discovery-night images show a 21" tail in p.a. 256 deg, and there was a 0'.2 tail in p.a. 264 deg on the August 22 Haleakala frames. The August 18 observations were reported (though not as being cometary) by NEAT at the time (mag 18.6-18.7), but the object was never followed up; likewise for four LONEOS observations (mag 17.9) on October 24. The comet was at perihelion in 2001 June and has a period of around 6.2 years. Searches of relevant frames by Meyer and others have so far failed to show the comet at its return in 2007. [IAUC 9129, 2010 March 19]. Maik describes further details of the discovery on his web page.



COMET P/2010 A2 (LINEAR) and Asteroid 2010 AA15 imaged on 2010 January 19
Top image, mid-time: 09:41 UT, stack of 11 x 50 sec exposures
Lower image, mid-time: 11:13 UT, stack of 16 x 30 sec exposures
2.0-m Faulkes Telescope North, Sloan-r' filter, image width 4.7 arcmin
R. Miles

2010 A2 (A/LINEAR) Javier Licandro, G. P. Tozzi, and Tiina Liimets note: *On January 14 we obtained images of this object using the Nordic Optical Telescope in La Palma, and on Jan 15 we made the following report to the CBAT:"J. Licandro (Instituto de Astrof¡sica de Canarias, Spain), G. P. Tozzi (INAF, O. di Arcetri), and Tiina Liimets (Nordic Optical Telescope, NOT, Spain & Tartu Obs., Estonia) report the presence of an object, probably an asteroid, 2 arcsec to the East of A/2010 A2 (LINEAR). Six images of 5 minute exposure time each were obtained on Jan. 14 using ALFOSC (Andalucia Faint Object Spectrograph and Camera) on the 2.6m NOT telescope at the "Roque de los Muchachos" Observatory (La Palma, Canary Islands, Spain). Four images were obtained in the R band and two in the V band, starting 22:41 ending 23:39 UT, in non-photometric but very good seeing (0.6 arcsec) conditions. The asteroid moves in the same direction and at the same rate as the comet. In adition, the A/2010 A2 (LINEAR) image does not show any central condensation and looks like a "dust swarm". It is 4 arcmin long and only about 5 arcsec wide (177.000 and 3700 km respectively at the comet distance) with a PA=277 degrees. These observations suggest a connection between the asteroid and the dust swarm. A short lived event, such as a collision, may have produced the observed dust ejecta.". Next night, Jan. 16, the object was observed with the 10.4m GTC telescope and we made the following report "J. Licandro (Instituto de Astrof¡sica de Canarias, IAC, Spain), A. Cabrera-Lavers and G. G¢mez (IAC & GTC Project Office, Spain) confirms the detection of an object, probably an asteroid, abut 2 arcsec to the East of A/2010 A2 (LINEAR), reported on Jan. 15 by Licandro et al. , on a series of 30s images obtained with the OSIRIS instrument on the 10.4m Gran Telescopio Canarias (GTC) at the "Roque de los Muchachos" Observatory (La Palma, Canary Islands, Spain), on Jan 16, starting 1:41 and ending 3:11 UT. A total of 54 images 30s exp. time each were obtained, 24 with the r, 18 with the i and 12 with the g sloan filters respectively. The object is visible in all images."*

Following a suggestion by Jonathan Shanklin, Darryl Sergison imaged the comet with the 2.0-m Faulkes Telescope. Richard Miles reports: *A few images were taken of A/2010 A2 by Darryl Sergison using the 2.0-m Faulkes Telescope North on January 15 and these showed no evidence of condensations within the elongated coma however the seeing was not particularly good at the time. Another attempt stacking a dozen or so images when subarcsecond seeing is present will be necessary*.

The Hubble Space Telescope took a spectacular image of the object on January 29. Z. Sekanina, Jet Propulsion Laboratory, writes that the orientations of the tail of this comet reported from the observations made between January 7 and 16 (IAUC 9105, 9109; CBET 2134) suggest its formation between January and August 2009. Because of the edge-on projection (with the earth only 2 to 3 degrees below the comet's orbital plane) it is not possible to decide whether the tail is a product of one or more brief emission events or continuous activity over a period of time. From the tail's length, the maximum solar radiation pressure acceleration exerted on the dust is estimated at about 0.1 percent of the solar gravitational acceleration, which implies that the smallest dust particles in the tail are about 1 mm in diameter (at an assumed density of 1 g/cm^3).

From the width of the tail, a lower limit on the normal component of the particle velocity is about 0.1 m/s. An improved estimate can be determined from the tail width around the time of the earth's crossing the orbital plane on 2010 February 9. [IAUC 9110, 2010 January 25]

Latest studies suggest that a collision between two asteroids took place in mid February 2009, the larger around 120m across and the smaller 5m. The collision created a debris trail containing objects from mm to cm in size. I suggest that perhaps a similar collision created the debris that today forms the Geminid meteor shower.

2010 A3 (P/Hill) Computations by Kenji Muraoka and Hirohisa Sato had quickly suggested that it was a short period object, though the preliminary orbit was parabolic. The comet reached perihelion at 1.6 AU in April 2010 and has a period of around 15 years.

2010 A4 (Siding Spring) Brian Marsden noted on MPEC 2010-J04 [2010 May 3] that *The "original" and "future" barycentric values of 1/a are +0.003716 and +0.003785 (+/- 0.000022) AU^-1, respectively.* The large "original" value suggests that this comet has made a previous visit to the inner solar system.

2010 A5 (P/LINEAR) An apparently asteroidal object of 20th magnitude discovered by LINEAR with the 1.0-m reflector on January 14.45 was found to show a cometary appearance by other astrometrists, including Rolando Ligustri, Ernesto Guido and Giovanni Sostero. The comet has a period of 11.5 years, with perihelion at 1.7 AU in April.

A/2010 AJ [Steward] This unusual asteroid was discovered at the Steward Observatory, Kitt Peak with the 0.9m reflector on January 6.29. It has a period of 5.5 years and perihelion was at 1.14 AU in October 2009. [MPEC 2010-A27, 2010 January 7, 1-day orbit]. In the current orbit it can approach to around 0.3 AU of Jupiter and 0.15 AU of the Earth. The orbit has a Tisserand criterion value of 2.87. This type of orbit is typical of Jupiter family comets.

A/2010 AD_3 [Mt Lemmon] This unusual asteroid was discovered from Mt Lemmon with the 1.5m reflector on January 8.21. It has a period of 5.1 years and perihelion was at 1.09 AU in late January 2010. [MPEC 2010-A42, 2010 January 9, 1-day orbit]. In the current orbit it can approach to around 0.4 AU of Jupiter and 0.11 AU of the Earth and will get about as close as it can later in the month. The orbit has a Tisserand criterion value of 2.93. This type of orbit is typical of Jupiter family comets.

2010 B1 (Cardinal) An apparently asteroidal object of 18th magnitude found by Canadian astronomer Rob Cardinal of the Rothney Astrophysical Observatory, with the University of Calgary 0.50-m f/1.0 reflector at Priddis, Canada on January 19.22 was found to show cometary characteristics by other observers after posting on the NEOCP. The comet is at perihelion at 2.9 AU in 2011 February.

Brian Marsden noted on MPEC 2010-F17 [2010 March 17] that *The "original" and "future" barycentric values of 1/a are +0.000754 and +0.000419 (+/- 0.000025) AU^-1, respectively.* The moderate "original" value suggests that this comet has made a previous visit to the inner solar system.

2010 B2 (P/WISE) A comet was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on January 22.64. The object showed a hazy coma and tail in all the infra-red images. It was confirmed by ground-based observations from Mauna Kea and Kitt Peak. The comet has a period of 5.5 years and was at perihelion at 1.6 AU in 2009 December.

A/2010 BK_{118} [WISE] This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on January 30. It has a retrograde orbit with a period of around 5000 years and perihelion is at 6.1 AU in April 2012. [MPEC 2010-S36, 2010 September 22]. The orbit has a Tisserand criterion value of 3.07 and has not approached closely to Jupiter or Saturn. It is classed as a scattered disk object. Unless it shows cometary activity it will remain at around 19th magnitude, so in range of amateur CCD observations.

2010 C1 (P/Scotti) Jim Scotti discovered a 20th magnitude comet during Spacewatch observations with the 0.9-m f/3 reflector at Kitt Peak on February 9.21. It was then located on Mount Lemmon images from 2008/9 winter, and in other recent Spacewatch images. The comet has a period of 19 years with perihelion at 5.2 AU in 2009 December.

2010 C2 (239P/LINEAR) In August, images from WISE taken in early February were linked by Gareth Williams to P/1999 XB_{69} (LINEAR). This then allowed images from the Mt Lemmon Survey taken at the end of 2008 October to be included in the orbital solution. The indicated correction to the prediction on MPC 56804 is Delta(T) = -0.34 day. The comet has a period of 9.5 years and was at perihelion in 2009 July.

2010 C6 (SOHO) This was a non-group comet discovered in C2 images by Zhijian Xu on 2010 February 13.

2010 C7 (SOHO) This was a non-group comet discovered in C2 images by Masanori Uchina on 2010 February 15.

2010 C8 (SOHO) This was a non-group comet discovered in C2 images by Masanori Uchina and Michal Kusiak on 2010 February 15. Comets 2010 C7 and 2010 C8 are related.

A/2010 CQ_{19} [Mt Lemmon] This unusual asteroid was discovered from Mt Lemmon with the 1.5m reflector on February 15.28. It has a period of 4.8 years and perihelion was at 1.01 AU in late January 2010. [MPEC 2010-C75, 2010 February 15, 0.07-day orbit]. In the current orbit it can approach to around 0.4 AU of Jupiter and 0.02 AU of the Earth and was about as close as it can get at discovery. The orbit has a Tisserand criterion value of 2.96. This type of orbit is typical of Jupiter family comets.

A/2010 CG_{55} [Catalina] This unusual asteroid was discovered during the Catalina Sky Survey with the 0.68m Schmidt on February 15.36. It has a retrograde orbit with a period of around 180 years and perihelion was at 2.9 AU in October 2010. [MPEC 2010-T90, 2010 October 12, 9-month orbit]. The orbit has a Tisserand criterion value of 2.22.

A/2010 CR_{140} [WISE] This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on February 14.35. It has a highly inclined orbit with a period of around 13 years and perihelion was at 3.1 AU in November 2008. [MPEC 2010-D71, 2010 February 22, 6-day orbit]. The orbit has a Tisserand criterion value of 2.80.

A/2010 CT_{149} [Mt Lemmon] This unusual asteroid was discovered from Mt Lemmon with the 1.5m reflector on February 14. It has a period of around 130 years and perihelion is at 1.88 AU in September 2010. [MPEC 2010-J10, 2010 May 3]. Aphelion is just under 50 AU. The orbit has a Tisserand criterion value of 1.87.

2010 D1 (P/WISE) A comet was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on February 17.34. The object showed a hazy coma and tail though the nuclear condensation was less pronounced than that of P/2010 B2. It was confirmed by Spacewatch observations on February 19.2. Additional images were then found in Catalina observations made on 2009 November 9 and December 10. The comet has a period of 8.5 years and was at perihelion at 2.7 AU in 2009 June.

2010 D2 (P/WISE) A comet was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on February 25.69. The object showed a hazy coma and tail. Peter Birtwhistle made confirming observations on March 4.83, giving it a magnitude of 19.5. The comet was at perihelion at 3.7 AU in March. Calculations by Hirohisa Sato suggested an elliptical orbit with a period of around 17 years and this is confirmed by the latest MPEC.

2010 D3 (WISE) A comet was discovered in images from the the Wide-field Infrared Survey Explorer (WISE) satellite on February 26.52. The object showed a hazy coma. The comet was at perihelion at 4.2 AU in September.

Brian Marsden noted on MPEC 2010-M39 [2010 June 22] that *The "original" and "future" barycentric values of 1/a are +0.000004 and +0.000175 (+/- 0.000041) AU^-1, respectively.* The small "original" value shows that this comet is on its first visit to the inner solar system from the Oort cloud.

2010 D4 (WISE) A comet was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on February 28.02. The object showed a "blurry" central condensation in 12-micron images, however ground-based observers have not detected any cometary activity. The comet was at perihelion at 7.1 AU in 2009 March and moves in a long period ellipse of around 600 years.

2010 D5 (SOHO) This was a non-group comet discovered in C2 images by Masanori Uchina on 2010 February 19.

2010 DG_{56} (WISE) This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on February 18.00. It has a retrograde orbit with a period of around 500 years and perihelion was at 1.6 AU in mid May. [MPEC 2010-D79, 2010 February 25]. The orbit has a Tisserand criterion value of 1.69. This type of orbit is typical of Halley family comets, so it may show activity nearer perihelion.

This suggestion was shown to be correct, and on March 10 it was given a cometary designation following further observations from Mauna Kea made on March 5. The comet was poorly placed at perihelion.

2010 E1 (Garradd) Gordon Garradd discovered a 17th mag comet during the Siding Spring Survey with the 0.5-m Uppsala Schmidt telescope on March 11.57. The comet was at perihelion at 2.7 AU in 2009 November. It has a period of over 1000 years.

Brian Marsden noted on MPEC 2010-J82 [2010 May 13] that *The "original" and "future" barycentric values of 1/a are +0.009378 and +0.009091 (+/- 0.000047) AU^-1, respectively.* The large "original" value confirms that this comet has made a previous visit to the inner solar system.

2010 E2 (P/Jarnac) An apparently asteroidal object of 19th magnitude was discovered at the Jarnac Observatory in Vail, AZ, U.S.A., on March 9.31, with follow-up images on March 10 and 12, by the team of D. Levy, W. Levy, and T. Glinos. It was linked with observations from the Mount Lemmon made on February 17, before being posted on the NEOCP. Other astrometrists then showed that it had cometary characteristics. It was approaching perihelion in early April at 2.4 AU and has a period of around 25 years.

2010 E3 (WISE) An object reported as asteroidal in images from the Wide-field Infrared Survey Explorer (WISE) satellite on March 5.10, but placed on the NEOCP was found to be diffuse with a faint tail in images taken with the Magdalena Ridge Observatory 2.4-m f/8.9 reflector. Further checking of the WISE images showed that the object had a small coma. The comet was near perihelion at 2.3 AU and has a slightly retrograde orbit.

2010 E4 (234P/LINEAR) An apparently asteroidal object discovered on 2002 February 8.32 by the LINEAR survey, and designated 2002 CF_{140}, was found to show cometary appearance on Mount Lemmon 1.5-m reflector CCD images taken by R. A. Kowalski in poor seeing on March 15. The orbit on MPO 30668 requires a correction of Delta(T) = -0.8 day. The comet has a period of 7.5 years and was last at perihelion in 2009 December, at 2.9 AU.

2010 E5 (Scotti) Jim Scotti discovered a 20th magnitude comet on CCD mosaic images obtained with the 0.9-m f/3 Spacewatch reflector at Kitt Peak on March 14.23. It was confirmed by many astrometrists after posting on the NEOCP. The comet was at perihelion at 3.9 AU in 2009 November and has a period of around 125 years.

A/2010 EA_{46} [Catalina] This unusual asteroid was discovered during the Catalina Sky Survey with the 0.68m Schmidt on March 15.45. It has a period of around 5.0 years and perihelion was at 1.01 AU in mid February. [MPEC 2010-F07, 2010 March 16, 1-day orbit]. In the current orbit it can approach to around 0.3 AU of Jupiter and 0.03 AU of the Earth. The orbit has a Tisserand criterion value of 2.92.

A/2010 EB_{46} [Catalina] This unusual asteroid was discovered during the Catalina Sky Survey with the 0.68m Schmidt on March 12.38. It has a retrograde orbit with a period of around 19 years and perihelion is at 1.5 AU in late April. [MPEC 2010-F12, 2010 March 17, 5-day orbit]. In the current orbit it can approach to around 0.9 AU of Jupiter and 0.8 AU of Saturn. The orbit has a Tisserand criterion value of 2.16. Aphelion is at 12.8 AU. No cometary activity has yet been detected.

A/2010 EJ_{104} [PMO] This unusual asteroid was discovered by the Purple Mountain Observatory NEO Survey Program with the 1.0/1.2m Schmidt telescope at Xuyi station on March 10. It has a moderately inclined orbit with a period of around 100 years. Perihelion was at 2.1 AU in 2010 March. Aphelion is at 41 AU. [MPEC 2010-L40, 2010 June 8]. The Tisserand criterion for the orbit is 2.01

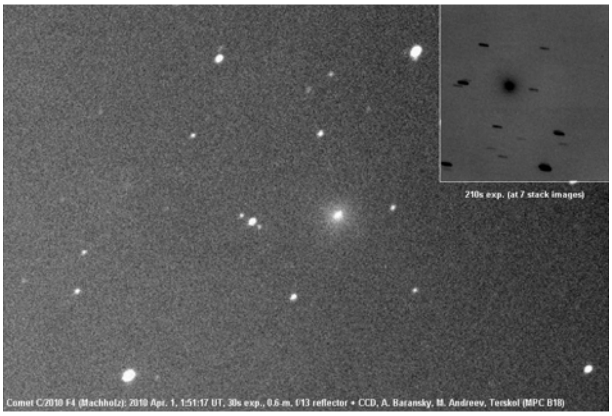
2010 F1 (Boattini) Andrea Boattini discovered an 18th magnitude comet on March 17.20 during the Catalina Sky Survey with the 0.68m Schmidt. The comet was at perihelion at 3.6 AU in 2009 November and has an elliptical orbit with a period of around 600 years.

Brian Marsden noted on MPEC 2010-H52 [2010 April 24] that *The "original" and "future" barycentric values of 1/a are +0.014902 and +0.014613 (+/- 0.000000) AU^-1, respectively.* The moderate "original" value suggests that this comet has made a previous visit to the inner solar system.

2010 F2 (235P/LINEAR) An apparently asteroidal object discovered on 2002 March 16.32 (the IAUC says "last year") by the LINEAR survey, and designated 2002 FA_9, was re-discovered by Rob McNaught on CCD images taken with the 0.5-m Uppsala Schmidt telescope on 2010 March 20.61 and noted to show cometary appearance. The orbit on MPO 30730 requires a correction of Delta(T) = -0.8 day. The comet has a period of 8.0 years and was very close to perihelion at 2.7 AU.

2010 F3 (Scotti) Jim Scotti discovered a 20th magnitude comet on CCD images obtained with the 0.9-m f/3 Spacewatch reflector at Kitt Peak on March 20.19. It was confirmed by many astrometrists, including Peter Birtwhistle, after posting on the NEOCP. The comet reached perihelion at 5.4 AU in 2010 August and has a period of around 500 years.

Brian Marsden noted on MPEC 2010-L23 [2010 June 6] that *The "original" and "future" barycentric values of 1/a are +0.015850 and +0.015937 (+/- 0.000001) AU^-1, respectively.* The moderate "original" value suggests that this comet has made a previous visit to the inner solar system.



2010 F4 (Machholz) Don Machholz made a visual discovery of an 11th magnitude comet on March 23.53 using a 0.47-m f/4.8 reflector (77x) at his home in Colfax, CA, U.S.A. Machholz had searched for 607 hours since his previous find on 2004 Aug. 27. The comet is moving rapidly towards perihelion and is already poorly placed for observation. The comet was at perihelion at 0.6 AU in early April, when the comet was at 1.4 AU from the Earth. Observing circumstances do not improve a great deal. Don provides discovery details on his webpage.

2010 FB$_{87}$ (WISE-Garradd) An apparently asteroidal object discovered by WISE on March 28.22 was briefly on the NEOCP before being given an asteroidal designation. An independent discovery of an object showing a possible faint tail was made by Gordon Garradd on April 21.67 and placed on the NEOCP where it was confirmed by S. Foglia, P. Miller, and J. Wood from a 30-s CCD exposure by Wood with the 2.0-m 'Faulkes Telescope South'. The comet reached perihelion at 2.8 AU in November, and has a period of over 5000 years.

Brian Marsden noted on MPEC 2010-M40 [2010 June 22] that *The "original" and "future" barycentric values of 1/a are +0.004320 and +0.004449 (+/- 0.000040) AU^-1, respectively.* The large "original" value suggests that this comet has made a previous visit to the inner solar system.

A/2010 FD [Mt Lemmon] This unusual asteroid was discovered from Mt Lemmon with the 1.5m reflector on March 16.34. It has a period of 4.8 years and perihelion was at 1.05 AU in late March 2010. [MPEC 2010-F10, 2010 March 17, 0.6-day orbit]. In the current orbit it can approach to around 0.3AU of Jupiter and 0.06 AU of the Earth and was about this close in the second half of March. The orbit has a Tisserand criterion value of 2.97. This type of orbit is typical of Jupiter family comets.

A/2010 FY$_{80}$ [WISE] This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on March 28.11. It has a period of around 18 years and perihelion is at 1.1 AU in mid May. Aphelion is at 12.8 AU. [MPEC 2010-G05, 2010 April 3, 6-day orbit]. The orbit has a Tisserand criterion value of 2.00 and can approach within 0.2 AU of both Jupiter and the Earth. This type of orbit is typical of Jupiter family comets.

A/2010 FH$_{92}$ [WISE] This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on March 17.24. It has a period of around 110 years and perihelion was at 5.7 AU in early July. Aphelion is at 41 AU. [MPEC 2010-G101, 2010 April 13, 25-day orbit]. The orbit has a Tisserand criterion value of 3.00.

2010 G1 (Boattini) Andrea Boattini discovered a 14th magnitude comet on April 5.12 during the Catalina Sky Survey with the 0.68m Schmidt. The comet was at perihelion at 1.2 AU at discovery and is now too faint for visual observation.

Brian Marsden noted on MPEC 2010-L68 [2010 June 14] that *The "original" and "future" barycentric values of 1/a are +0.002877 and +0.002232 (+/- 0.000138) AU^-1, respectively.* The moderate "original" value suggests that this comet has made a previous visit to the inner solar system.

2010 G2 (Hill) Rik Hill discovered a 19th magnitude comet on April 10.43 during the Catalina Sky Survey with the 0.68m Schmidt. The comet was over 5 AU from the Sun at discovery. Perihelion is at 2.0 AU in September 2011 and it has a period of around 1000 years. It could come into visual range in May 2011, and reach 12th magnitude at its brightest in the autumn.

Brian Marsden noted on MPEC 2010-M41 [2010 June 22] that *The "original" and "future" barycentric values of 1/a are +0.011116 and +0.010947 (+/- 0.000029) AU^-1, respectively.* The very large "original" value shows that this comet has made a previous visit to the inner solar system.

2010 G3 (WISE) A comet was discovered in images from the the Wide-field Infrared Survey Explorer (WISE) satellite on April 14.14. The 19th magnitude object showed a coma and tail, and was the brightest seen so far in the 22 micron band. The comet was at perihelion at 4.9 AU in April.

Brian Marsden noted on MPEC 2010-M42 [2010 June 22] that *The "original" and "future" barycentric values of 1/a are +0.000613 and +0.000922 (+/- 0.000058) AU^-1, respectively.* The moderate "original" value suggests that this comet has made a previous visit to the inner solar system.

A/2010 GK$_{23}$ [WISE] This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on April 5.00. It has a period of around 5.2 years and perihelion was at 0.9 AU in mid February. [MPEC 2010-G59, 2010 April 9, 5-day orbit]. The orbit has a Tisserand criterion value of 2.80 and can approach within 0.4 AU of Jupiter and 0.10 AU from the Earth. This type of orbit is typical of Jupiter family comets.

A/2010 GF$_{30}$ [Mt Lemmon] This unusual asteroid was discovered from Mt Lemmon with the 1.5m reflector on April 10.21. It has a period of 5.2 years and perihelion was at 1.24 AU in mid March 2010. [MPEC 2010-G83, 2010 April 11, 1-day orbit]. In the current orbit it can approach to within 0.5 AU of Jupiter and 0.26 AU of the Earth. The orbit has a Tisserand criterion value of 2.96. This type of orbit is typical of Jupiter family comets.

A/2010 GW$_{64}$ [WISE] This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on April 6.78. It has a retrograde orbit with a period of around 900 years. Perihelion was at 3.7 AU in mid April and aphelion is around 190 AU. [MPEC 2010-G109, 2010 April 14, 7-day orbit]. The orbit has a Tisserand criterion value of 2.42. This type of orbit is typical of Halley family comets.

A/2010 GQ$_{75}$ [WISE] This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on April 12.68. It has a moderately inclined orbit with a period of around 9.6 years. Perihelion was at 0.3 AU in mid February. [MPEC 2010-H08, 2010 April 17, 5-day orbit]. The orbit has a Tisserand criterion value of 1.85.

A/2010 GW$_{147}$ [WISE] This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on April 14.20. It has a retrograde orbit with a period of around 76 years. Perihelion was at 5.5 AU in March and aphelion is around 30 AU. [MPEC 2010-H33, 2010 April 20, 5-day orbit]. The orbit has a Tisserand criterion value of 2.96. The object can pass 2 AU from Saturn. This type of orbit is typical of Halley family comets.

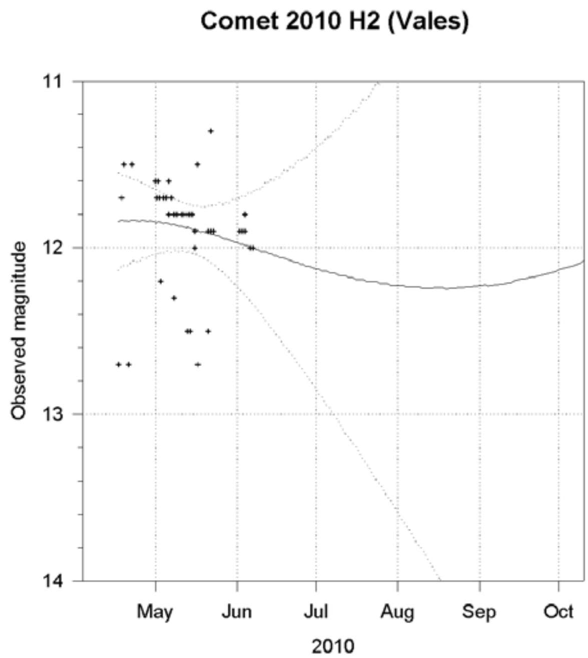
2010 H1 (Garradd) Gordon Garradd discovered a 19th mag comet during the Siding Spring Survey with the 0.5-m Uppsala Schmidt telescope on April 16.65. The comet was at perihelion at 2.7 AU in mid June.

Brian Marsden noted on MPEC 2010-N08 [2010 July 4] that *The "original" and "future" barycentric values of 1/a are +0.000018 and +0.000563 (+/- 0.000036) AU^-1, respectively.* The small "original" value shows that this comet is on its first visit to the inner solar system from the Oort cloud.

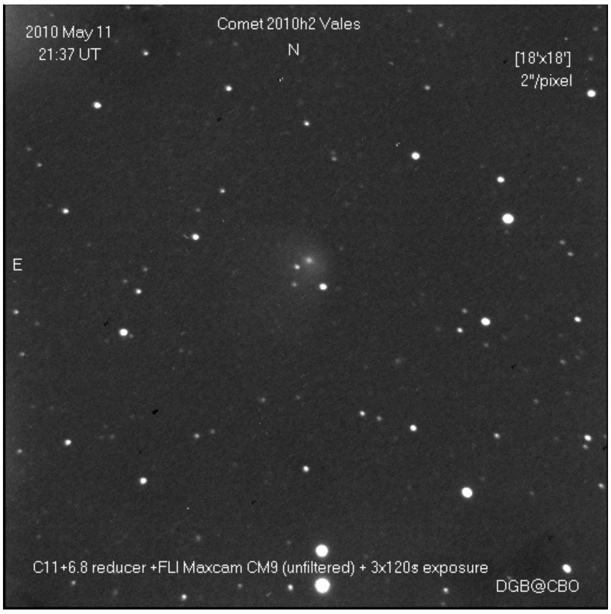
2010 H2 (P/Vales) A 13th magnitude object discovered on April 16.01 has been identified as a comet. It was at perihelion at 3.1 AU in early March and has a period of 7.5 years. Richard Miles obtained some of the early astrometry and photometry and provides the following additional information: *On 2010 April 16.0, Jan Vales of the Crni Vrh observatory, Slovenia, discovered a 13th magnitude 'star' moving slowly across the sky. Observations using larger telescopes some hours later showed the object was slightly more diffuse than the adjacent stars and it was subsequently identified as a new comet, one that seems to have undergone an outburst of 7 magnitudes or more within a time interval of less than 14 hr. This unusual comet, P/2010 H2 was observed on April 19.4 with the 2.0-m Faulkes Telescope North by myself using six different filters in all. At this time, the comet has a very bright slightly elliptical central region some 3.3"x3.9" in size (fwhm) and the outer coma extends some 35"x40" tilted at a position angle of 70/250 deg. A set of 13 images were tracked and stacked using Astrometrica software and then subjected to rotational gradient processing using IRIS software to bring out the faint details within the inner coma as shown in the accompanying image.*

The orbit of the object shows that the parent body is one of the family of asteroids known as the Hildas, which are held in their orbit through resonance with the planet Jupiter. We may have witnessed an event whereby the asteroid in question has collided with a smaller body causing it to disintegrate into fragments, releasing dust and gas in the process. On the other hand, some internal process may have triggered what is essentially a cometary outburst - we just do not know at this stage!

We already know of almost 20 Hilda-type comets and P/2010 H2 appears to be the newest member to join this group. In the latest image, outflowing jets of dust can be seen emanating in at least 5 different directions. However, the majority of material reflecting sunlight still remains within less than 5 arcseconds of the nucleus almost 4 days after the initial outburst, which means that most of the mass of the parent body is moving away in all directions at less than 30 m/s, i.e. something of a snail's pace for such a relatively massive outburst. Further observations to follow the evolution of this new comet, which reaches perihelion around May 21, will help to understand its true nature.



The available observations are not sufficient to deduce a meaningful light curve. Although it remained at a reasonable elongation for southern observers into August, no visual observations have come in since early June. The likelihood is that as with many outbursting objects it remained at a relatively constant total magnitude, becoming ever larger and more diffuse.



2010 H4 (P/Scotti) Jim Scotti discovered a 21st magnitude comet on CCD mosaic images obtained with the 0.9-m f/3 Spacewatch reflector at Kitt Peak on April 20.27. The comet was at perihelion at 4.8 AU in June and has a period of around 17 years.

2010 H5 (P/Scotti) Jim Scotti discovered a 21st magnitude object with a slightly cometary appearance on images obtained with the 0.9-m f/3 Spacewatch reflector at Kitt Peak on April 21.15. It was confirmed as cometary following further images with the 1.8-m Spacewatch reflector and the Magdalena Ridge 2.4-m reflector in early May. The comet has a period of 19 years and was at perihelion at 6.0 AU in April.

2010 J1 (Boattini) Andrea Boattini discovered a 16th magnitude comet on May 6.38 during the Catalina Sky Survey with the 0.68m Schmidt. The comet was at perihelion at 1.7 AU in early February and was discovered when near its brightest. It has a period of over 200 years.

Brian Marsden noted on MPEC 2010-N56 [2010 July 13] that *The "original" and "future" barycentric values of 1/a are +0.027310 and +0.027684 (+/- 0.000005) AU^-1, respectively.* The large "original" value shows that this comet has made a previous visit to the inner solar system.

2010 J2 (McNaught) Rob McNaught discovered a 17th mag comet during the Siding Spring Survey with the 0.5-m Uppsala Schmidt telescope on May 8.75. The comet was a month from perihelion at 3.4 AU at discovery.

Brian Marsden noted on MPEC 2010-N57 [2010 July 13] that *The "original" and "future" barycentric values of 1/a are +0.000577 and +0.000568 (+/- 0.000044) AU^-1, respectively.* The moderate "original" value suggests that this comet has made a previous visit to the inner solar system.

2010 J3 (P/McMillan) A Spacewatch object discovered with the 0.9-m f/3 reflector at Kitt Peak on May 12.21 and posted on the NEOCP was quickly noted as cometary by John Cave and Richard Miles on images taken with the Faulkes telescope. It was confirmed the next day in an IAUC. The comet reaches perihelion at 2.5 AU in August.

Calculations by Hirohisa Sato suggested that a rather better fit to the observations was given by a periodic orbit of around 25 years. Further observations linked the comet with asteroid 2010 CG_6, observed by WISE in February and refined the period to 27 years.

2010 J4 (WISE) A comet was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on May 12.24. The 19th magnitude object showed a coma and tail, and was the brightest discovered so far by WISE. The comet was near perihelion at 1.1 AU.

2010 J5 (P/McNaught) Rob McNaught discovered a 19th mag comet during the Siding Spring Survey with the 0.5-m Uppsala Schmidt telescope on May 12.70. The initial orbit promised a visual object, however this soon changed into a periodic orbit. The comet was at perihelion at 3.7 AU in 2009 November and has a period of 8.3 years. The orbital eccentricity is small, with a value of 0.09.

A/2010 JC_{81} [WISE] This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on May 10. It has an inclined orbit with a period of around 23 years. Perihelion is at 1.8 AU in 2011 April. [MPEC 2010-V52, 2010 November 5, 6-month orbit]. The orbit has a Tisserand criterion value of 2.21. Aphelion is at 14.5 AU.

A/2010 JH_{124} [WISE] This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on May 12.37. It has an inclined orbit with a period of around 120 years. Perihelion is at 2.7 AU in 2011 April. [MPEC 2010-K24, 2010 May 20, 7-day orbit]. The orbit has a Tisserand criterion value of 2.18. At 4 AU from the sun at discovery, the object may show cometary activity as it nears perihelion.

A/2010 JC_{147} [WISE] This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on May 15.67. It has an inclined orbit with a period of around 45 years. Perihelion was at 3.4 AU in 2010 April. [MPEC 2010-K28, 2010 May 20, 5-day orbit]. The orbit has a Tisserand criterion value of 2.54. Aphelion is at 22 AU.

2010 K1 (236P/LINEAR) Jim Scotti recovered comet 2003 UY_{275} on May 20.44 with the Spacewatch 1.8-m f/2.7 reflector at Kitt Peak. The indicated correction to the orbit on MPC 59600 is Delta(T) = -0.70 day.

2010 K2 (P/WISE) An object noted in images from the Wide-field Infrared Survey Explorer (WISE) satellite on May 27.18 and posted on the NEOCP has been found to show cometary characteristics Jim Scotti with the Spacewatch 1.8-m reflector and Alan C. Gilmore and Pamela M. Kilmartin with the Mount John 1.0-m reflector. Further inspection of the WISE images also showed a coma and tail. The comet was at perihelion at 1.2 AU in July and has a period of 5.0 years.

2010 KW_7 (WISE) This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on May 16.06. It has a retrograde orbit with a period of around 130 years. Perihelion was at 2.6 AU in 2010 October. [MPEC 2010-K29, 2010 May 20]. The orbit has a Tisserand criterion value of 2.10. Aphelion is at 49 AU. The object may show cometary activity as it nears perihelion.

As predicted, the object did show slight cometary activity near perihelion. Observations in mid October and early November showed a slight coma and short tail.

2010 L1 (245P/WISE) A comet was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on June 2.50. The comet showed a coma and tail, and was around magnitude 20 when confirmed with ground based images. Richard Miles made confirming observations with the Faulkes Telescope North. The comet was at perihelion at 2.1 AU in February and has a period of 8.1 years.

Rob Matson identified the comet on NEAT images from Palomar taken in August and September 2002, which have been given the identity 2002 Q16.

2010 L2 (237P/LINEAR) A cometary object discovered by WISE on June 10.57 was quickly linked by the WISE team to an asteroidal object found by LINEAR on 2002 June 6.23. The comet has a period of 7.2 years and was at perihelion at 2.4 AU in 2009 December.

2010 L3 (Catalina) An apparently asteroidal object of 20th magnitude discovered by the Catalina Sky Survey on June 15.30 and placed on the NEOCP was found to show a small coma by other observers, including Peter Birtwhistle (imaging from the UK). The comet reached perihelion at 9.9 AU in 2010 November.

Brian Marsden noted on MPEC 2010-Q16 [2010 August 20] that *The "original" and "future" barycentric values of 1/a are +0.000122 and +0.000050 (+/- 0.000008) AU^-1, respectively.* The small "original" value shows that this comet is probably on its first visit to the inner solar system from the Oort cloud.

2010 L4 (WISE) A comet was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on June 15.46. The object showed a "hazy" coma and tail in 12 and 22 micron images. It was confirmed by ground based observers including Peter Birtwhistle and Richard Miles, who estimate it at around 20th magnitude. The comet was at perihelion at 2.8 AU in February and has a long period orbit of around 700 years.

Brian Marsden noted on MPEC 2010-Q17 [2010 August 20] that *The "original" and "future" barycentric values of 1/a are +0.012771 and +0.012812 (+/- 0.000004) AU^-1, respectively.* The large "original" value shows that this comet has made a previous visit to the inner solar system.

2010 L5 (WISE) A relatively bright (for WISE) comet was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on June 14.29. The object showed a coma and tail in all wavebands. It was confirmed by ground based observers over the next week, who estimated it at around 18th magnitude. The comet was at perihelion at 0.8 AU in late April, with a period of around 30 years. It has a faint absolute magnitude.

A/2010 LP_{33} [WISE] This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on June 2.63. It has a period of around 9.6 years and perihelion is at 1.6 AU in mid June. [MPEC 2010-L49, 2010 June 9, 7-day orbit]. The orbit has a Tisserand criterion value of 2.56 but there are currently no significant approaches to either Jupiter or Saturn.

A/2010 LG_{61} [WISE] This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on June 2.69. It has a retrograde orbit with a period of around 20 years and perihelion at 1.4 AU. [MPEC 2010-O48, 2010 July 30, 55-day orbit]. The original orbit, published on MPEC 2010-L63 on June 13 and based on only 1 day of observations was completely wrong, though noted as being indeterminate.

2010 M1 (Gibbs) Alex Gibbs discovered a 21st magnitude comet during the course of the Mt Lemmon Survey with the 1.5-m reflector on June 22.22. The comet reaches perihelion at 2.2 AU in 2012 February, but is unlikely to become a visual object.

2010 N1 (P/WISE) A comet was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on July 5.48. The comet showed a coma and tail. The comet is at perihelion at 1.5 AU in August and has a period of 5.7 years.

2010 N2 (238P/Read) Jana Pittichova recovered P/2005 U1 on images obtained with the 2.2-m University of Hawaii reflector at Mauna Kea on July 7.43. The comet was around mag 24. The indicated correction to the prediction on MPC 62880 is Delta(T) = -0.2 day.

A/2010 NV_1 [WISE] This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on July 2.00. It has a retrograde orbit with a period of around 1000 years and was at perihelion at 9.3 AU in 2009 September. [MPEC 2010-N54, 2010 July 13, 12-day orbit]. It has aphelion at around 200 AU. The orbit has a Tisserand criterion value of 3.74 with respect to Jupiter.

A/2010 OR_1 [WISE] This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on July 16.42. In August it was linked to 2010 BY_{83}, also discovered by WISE, enabling an improved orbit to be calculated. It has a retrograde orbit with a period of 142 years and was near perihelion at 2.1 AU. [MPEC 2010-Q40, 2010 August 29]. It can pass within 1 AU of Saturn and has aphelion near 50 AU. The orbit has a Tisserand criterion value of 1.93 with respect to Jupiter.

A/2010 OA_{101} [WISE] This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on July 17.08. It has a highly inclined orbit with a period of around 9 years and perihelion at 1.4 AU. [MPEC 2010-P07, 2010 August 3, 17-day orbit]. There have been no recent planetary encounters. The orbit has a Tisserand criterion value of 2.52 with respect to Jupiter.

A/2010 OE_{101} [WISE] This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on July 25.02. It has a period of around 6.6 years and perihelion at 1.4 AU. [MPEC 2010-P11, 2010 August 3, 9-day orbit]. It can pass within 0.1 AU of Jupiter. The orbit has a Tisserand criterion value of 2.78 with respect to Jupiter.

A/2010 OM_{101} [WISE] This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on July 28.19. It has a retrograde orbit with a period of around 1000 years and reaches perihelion at 2.1 AU in October. [MPEC 2010-P16, 2010 August 4, 7-day orbit]. It has aphelion at around 200 AU. The orbit has a Tisserand criterion value of 1.85 with respect to Jupiter.

2010 P1 (240P/NEAT) 2002 X2 (P/NEAT) was independently recovered between August 9 and 11 by H. Taylor (Rayle, GA, U.S.A., 25-cm reflector), by H. Sato (Tokyo, Japan; remotely, 25-cm reflector, RAS Observatory, Mayhill, NM, U.S.A.; 20" coma and 30" tail in p.a. 260 deg), by L. Elenin (Lyubertsy, Russia; remotely, 45-cm f/2.8 astrograph, ISON-NM Observatory, Mayhill; 50" tail), and by T. Yusa (telescope data same as for Sato; faint 25" tail in p.a. 252 deg). The indicated correction to the prediction by S. Nakano (ICQ 2009/ 2010 Comet Handbook, p. 108) is Delta(T) = -0.63 day. [IAUC 9159, 2010 August 12].

2010 P2 (241P/LINEAR) H. Sato, Tokyo, recovered P/1999 U3 on August 12.44 on CCD images obtained remotely with a 0.25-m f/3.4 reflector located at the RAS Observatory near Mayhill, NM, U.S.A when it showed a 15" coma. The indicated correction to the prediction by S. Nakano on MPC 59600 is Delta(T) = -0.22 day. [IAUC 9160, 2010 August 13]

2010 P3 (242P/Spahr) Gary Hug recovered comet 1998 U4 (P/Spahr) on August 14.41 on images taken with a 0.56-m reflector located near Scranton, KS, U.S.A. The indicated correction to the prediction by B. G. Marsden on MPC 65938 is Delta(T) = +0.04 day.

2010 P4 (P/WISE) Amy Mainzer, Jet Propulsion Laboratory, reported that a comet was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on August 6.59. The comet showed a 150" tail. Following posting on the NEOCP, ground based observers did not note any cometary characteristics in the nearly 22nd magnitude object. The comet was at perihelion at 1.9 AU in July and has a period of 7.1 years.

2010 P5 (243P/NEAT) Ernesto Guido and Giovani Sostero recovered comet 2003 S2 (P/NEAT) on August 15.31 on images taken with a 0.25-m f/3.4 reflector located at the RAS Observatory near Mayhill, NM, U.S.A. The indicated correction to the prediction by B. G. Marsden on MPC 62880 is Delta(T) = -0.33 day.

A/2010 PO_{58} [WISE] This unusual asteroid was discovered in images from the Wide-field Infrared Survey Explorer (WISE) satellite on August 5.84. It has a retrograde orbit with a period of around 25 years. Perihelion was at 3.0 AU in 2009 May. Aphelion is at nearly 15 AU. [MPEC 2010-P59, 2010 August 13, 7-day orbit].

2010 Q1 (244P/Scotti) Jim Scotti recovered comet 2000 Y3 (P/Scotti) as an essentially stellar object on images obtained on August 19.38 and 20 with the 0.9-m Spacewatch reflector at Kitt Peak. The indicated correction to the prediction on MPC 65937 is Delta(T) = -0.46 day.

2010 R1 (LINEAR) An apparently asteroidal object of 21st magnitude discovered by LINEAR on September 4.15 was found to be "fuzzy" with a tail in follow-up observations with the Magdalena Ridge 2.4-m reflector. The comet reaches perihelion at 5.6 AU in 2012 May.

2010 R2 (P/La Sagra) The La Sagra team (Spain) discovered another comet on September 14.87 and were able to find pre-discovery observations from August 13.0. The object was confirmed as cometary by Peter Birtwhistle and fellow astrometrists. The comet is around 19th magnitude. It has a period of 5.5 years and was at perihelion at 2.6 AU in late June. The object appears to be another main-belt comet, similar to 133P = (7968) Elst-Pizarro.

A/2010 RP_{80} [LINEAR] This unusual asteroid was discovered by LINEAR on 2010 September 10.30 with the 1-0m reflector. It has a period of 5.3 years and perihelion is at 1.16 AU in 2010 October. [MPEC 2010-R97, 2010 September 12, 2-day orbit]. In the current orbit it can approach to around 0.5 AU of Jupiter and 0.17 AU of the Earth. The orbit has a Tisserand criterion value of 2.90. This type of orbit is typical of Jupiter family comets.

2010 S1 (LINEAR) An apparently asteroidal object of around 18th magnitude discovered by LINEAR on September 21.36 was found to have a bright coma with a tail in follow-up observations. The comet reaches perihelion at 5.9 AU in 2013 May according to the latest MPEC orbit. Calculations by Hirohisa Sato suggest an elliptical orbit with a period of over 4000 years and perihelion at 6.0 AU in 2013 May.

A/2010 SU_{15} [Mt Lemmon] This unusual asteroid was discovered from Mt Lemmon with the 1.5m reflector on September 30.25. It has a period of 5.8 years and perihelion was at 1.08 AU in late September 2010. [MPEC 2010-S70, 2010 September 30, 0.1-day orbit]. In the current orbit it can approach to around 0.2 AU of Jupiter and 0.08 AU of the Earth and was about as close as it can be (passing inside the MOID) just after discovery. It has the very faint absolute magnitude of 25.7. The orbit has a Tisserand criterion value of 2.80. This type of orbit is typical of Jupiter family comets.

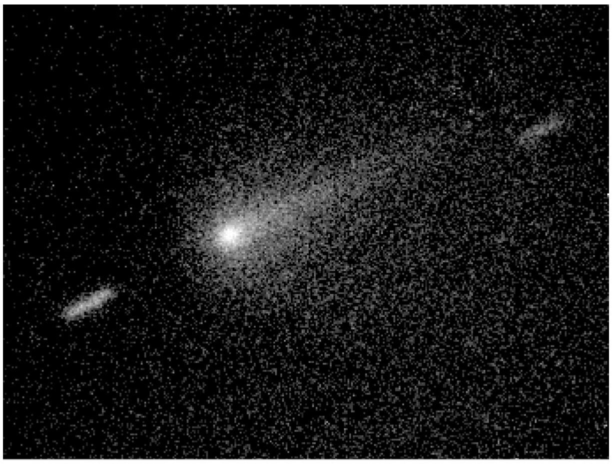
2010 T1 (P/McNaught) Rob McNaught discovered a diffuse 19th mag comet during the Siding Spring Survey with the 0.5-m Uppsala Schmidt telescope on October 4.57. Following posting on the NEOCP, Brian Marsden identified the object in previous SSS astrometry from September 11.5, and it was confirmed by other observers. The comet reaches perihelion at 3.2 AU in late October and has a period of 10 years.

2010 T2 (P/PANSTARRS) PANSTARRS discovered its first comet on October 6.43 when Richard Wainscoat noted a 21st magnitude diffuse object amongst those identified by the Pan-STARRS Moving Object Processing System. He then found additional images from the following day and it was confirmed after posting on the NEOCP. The comet has a period of around 13 years and perihelion is at 3.7 AU in 2011 July.

2010 U1 (P/Boattini) Andrea Boattini discovered a 19th magnitude comet with the Mt. Lemmon 1.5-m reflector on October 17.23. It was confirmed following posting on the NEOCP. The comet was at perihelion in 2010 March at 4.9 AU and has a period of 17 years.

2010 U2 (P/Hill) Rik Hill discovered an 18th magnitude comet on Catalina 0.68-m Schmidt telescope CCD images on October 17.32. It was confirmed following posting on the NEOCP. The comet was at perihelion in November at 2.6 AU and has a period of 8.8 years.

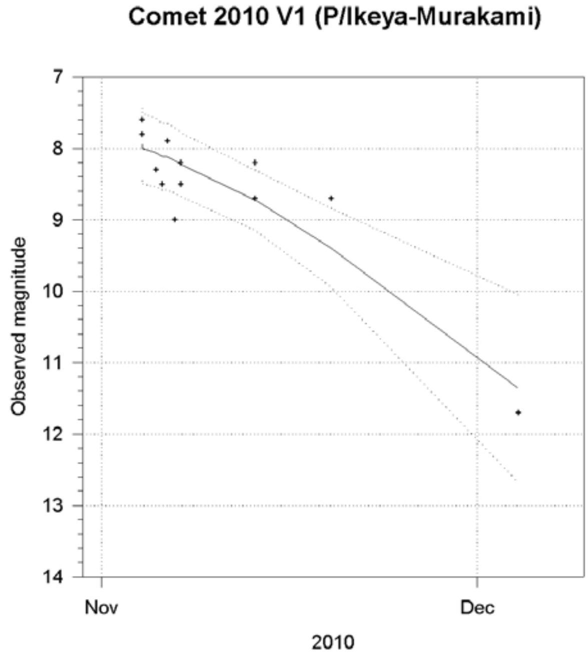
2010 U3 (Boattini) Andrea Boattini discovered a 19th magnitude comet with the Mt. Lemmon 1.5-m reflector on October 31.33. It was confirmed following posting on the NEOCP. The comet is at perihelion in 2019 at 8.5 AU. It was discovered whilst still over 18.5 AU from the Sun. The orbit is still uncertain, and one possibility is that it is a Centaur or SDO on a periodic orbit. In this case, like Chiron, its light curve might be rather erratic.



Comet C/2010 V1 (Ikeya-Murakami)
2010 November 08 12:24 UT
0.40-m Ritchey-Chretien, Tzec Maun New Mexico observatory (H10)
Stack of images taken with V and Ic filters: total integration time = 340 s
V magnitude = 11.1 (60" diam. aperture)
V magnitude = 11.7 (40" diam. aperture)
V magnitude = 12.6 (20" diam. aperture)
V-Ic colour index = +0.6 +/-0.2
B-V colour index = +0.4 +/-0.3
Field of view = 5.7' x 4.5', North up
R. Miles

2010 V1 (P/Ikeya-Murakami) A visual comet has been discovered by Japanese amateur observers, Kaoru Ikeya (Mori-machi, Shuchi-gun, Shizuoka-ken; 25-cm reflector at 39x; diffuse with some condensation; coma diameter 1' on November 2.831 UT and 2' on November 3.812) and by Shigeki Murakami (Toukamachi, Niigata-ken; 46-cm reflector at 78x; coma diameter 4' with a 2' tail in p.a. 90 deg on November 3.801; moving eastward at approximately 2'/hr). It is 47 years since the first discovery by Ikeya (1963 A1).

The comet was magnitude 8.5 at discovery by Ikeya, and 8 the following day. It seemed to be brightening rapidly, as visual observation by Juan Jose Gonzalez on November 4.2 put it as bright as 7.6 in 10x50B. This may indicate that the comet was undergoing an outburst. This suggestion is partially confirmed by Ikeya's failure to spot the comet when he searched the discovery area on November 1.8. The coma expanded, and the comet had faded to around 12th magnitude by early December, much faster than any plausible light curve would suggest.



The orbit is elliptic, with the comet at perihelion at 1.6 AU in mid October and a period of around 5.3 years, as first suggested by Hirohisa Sato. Maik Meyer noted that there were similarities with the orbit of P/2010 B2, however once the orbit of 2010 V1 became better known Hirohisa Sato was able to show that the two orbits did not converge when computed back in time.

2010 V2 (246P/NEAT) Comet 2004 F3 (P/NEAT) was recovered by E. Romas (Rostov-na-Donu, Russia), A. Novichonok (Kondopoga, Russia), and Dmitry Chestnov (Saransk, Russia) on forty stacked 120-s images obtained on November 2.0 UT with the 0.5-m f/8.3 Maksutov-Cassegrain reflector at the Kislovodsk Mountain Astronomical Station of Pulkovo Observatory. Gary Hug (Scranton, KS, U.S.A.) found the comet to be slightly diffuse on images taken with a 0.56-m reflector on November 3.5. The indicated correction to the prediction on MPC 69908 is Delta(T) = -0.02 day.

2010 V3 = 2002 VP_{94} (LINEAR) was discovered by LINEAR as an asteroid, of 19th magnitude, on 2002 November 5.31. It had an 8.0 year orbit, with perihelion at 1.52 AU and an eccentricity of 0.62. It was at perihelion in 2003 January. [MPEC 2002-V70, 2002 November 15, 10-day orbit] Brian Marsden noted that it was not clear if the object was in fact a comet. The orbit is typical of a Jupiter family comet and it can pass within 0.4 AU of the planet.

It was re-found by LINEAR on 2010 November 15.39 at 18th magnitude. It was finally confirmed as a comet in 2010 December when observations at the Haute Province Observatory as part of the T2 project showed that it had a tail. This was confirmed by follow-up observations and announced on MPEC 2010-Y29 on December 27. The comet reaches perihelion in early January at this return, at a distance of 1.48 AU and has a period of 7.9 years.

2010 W1 (P/Gibbs) A 19th magnitude object discovered by Alex Gibbs during the Catalina Sky Survey on November 27.19 and confirmed with images from Mt Lemmon in early December was linked to earlier Mt Lemmon observations in late October and early November. The object was then identified by Tim

B. Spahr with the following objects that had received minor-planet designations: 1996 TT_{65}; 2010 MS_{75}; 2010 RR_{59}; 2010 RN_{141}; 2010 SQ_{31}; and 2010 TL_{69}. [MPEC 2010-X102, 2010 December 13]. The comet has a period of 14.6 years and will reach perihelion at 2.1 AU in 2011 February.

2010 WK (P/LINEAR) An apparently asteroidal object of 17th magnitude discovered by LINEAR on November 17 was found to show cometary features in December. The comet has a period of 14 years and was at perihelion at 1.8 AU in October.

2010 X1 (Elenin) Leonid Elenin discovered a 19th magnitude comet on December 10.42 using the 0.45-m astrograph at the ISON-NM observatory, Mayhill. The comet reaches perihelion at around 0.5 AU in 2011 September. Roughly a fortnight after perihelion it passes through the SOHO C3 field, when it may be around 4^{th} magnitude, although the tail geometry is poor. See also the Comet Prospects.

A/2010 XX_{58} [Catalina] This unusual asteroid was discovered during the Catalina Sky Survey with the 0.68m Schmidt on December 12.42. It has an orbit with a period of around 4.6 years and perihelion is at 0.3 AU in February 2011. [MPEC 2010-X106, 2010 December 13, 1-day orbit]. The orbit has a Tisserand criterion value of 2.51. The object can approach to within 0.1 AU of Jupiter and 0.3 AU of Earth.

A/2010 XB_{73} [Mt Lemmon] was discovered from Mt Lemmon with the 1.5m reflector on December 14.13. It has a period of 6.6 years and perihelion is at 1.18 AU in early January 2011. [MPEC 2010-Y17, 2010 December 19, 1-day orbit]. In the current orbit it can approach to around 0.5 AU of Jupiter and 0.2 AU of the Earth. The orbit has a Tisserand criterion value of 2.71**.** This type of orbit is typical of Jupiter family comets.

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

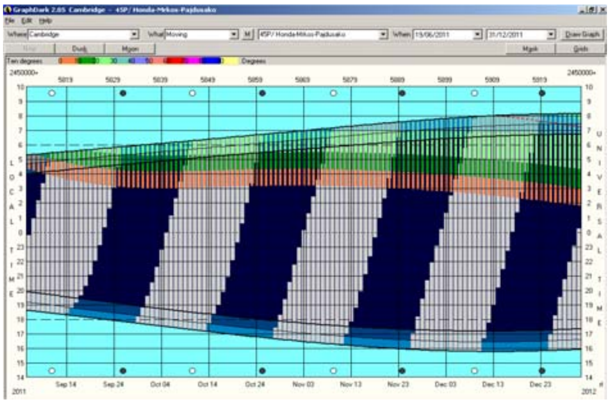
Comet Prospects for 2011

For many, the best comet for the year is likely to be 2009 P1 (Garradd), which might reach 6^{th} magnitude at the end of the year. 45P/Honda-Mrkos-Pajdusakova makes a close pass to the earth and will be well placed in the Southern Hemisphere prior to perihelion in September and visible in the north post perihelion. 73P/Schwassmann-Wachmann also returns, but it is not clear how many of the multiple fragments will be visible and even the brightest is likely to be fainter than 12^{th} magnitude. P/Levy (2006 T1) may reach 9^{th} magnitude at the end of the year prior to perihelion in mid January 2012. [Note that this is an updated version of the report that appeared in the December Journal]

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, and which returns this year. 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.

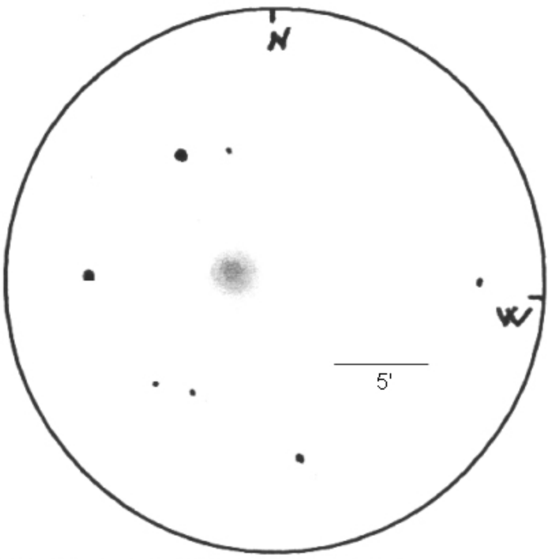
27P/Crommelin has a poor return and will not be visible from the UK. Its maximum elongation whilst brighter than 14^{th} magnitude is only 37°, and it is then at a northern declination, so it is possible that no-one will make a visual observation. The comet is named for the BAA Comet Section Director, A C Crommelin, who first computed a linked orbit for comets seen in 1818, 1873 and 1928. It was quite well observed in 1984 when it served as a test comet for the International Halley Watch.

29P/Schwassmann-Wachmann is an annual comet that has outbursts, which in recent years seem to have become more frequent. The outbursts were more or less continuous in 2008/9 and at some the comet became as bright as 10^{m}. The comet is an ideal target for those equipped with CCDs and it should be observed at every opportunity. The comet begins the year retrograding in Leo and reaches opposition on March 7, when it may show some additional brightening because of the small phase angle (1°). The comet is reported to be a slow rotator (about 60 days) and this is likely to give slow evolution of any features in the coma. It moves into Sextans in late March and resumes direct motion in May, when UK observers will loose it. The comet passes through solar conjunction in September but UK observers are unlikely to pick it up again until the new year as it is now at a southern declination.



45P/Honda-Mrkos-Pajdusakova

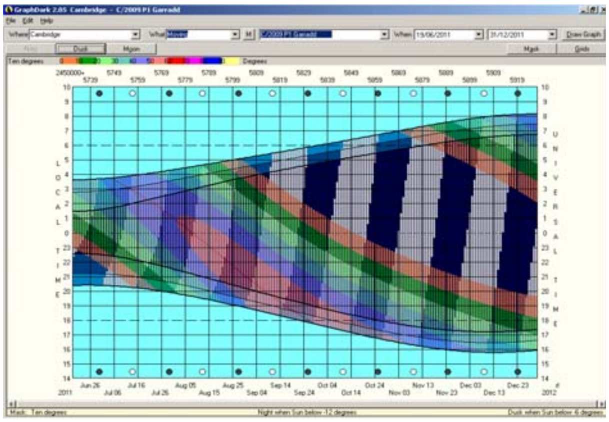
This year there is an excellent return of **45P/Honda-Mrkos-Pajdusakova**. Southern Hemisphere observers are likely to pick it up near opposition in July, when it is a 12^{th} magnitude object in Pisces Austrinus. It heads even further south, brightening rapidly as it passes only 0.06 AU from the Earth on August 16, when it might be seen with the naked eye. It passes through conjunction at the end of the month and fades a little, but brightens again as it approaches perihelion at the end of September. UK observers get a chance to see it between mid September and mid October, although it will be quite low in the morning sky.



Comet 45P/Honda-Mrkos-Pajdusakova 2001 April 17 19:10 UT

Coordinates of centre (J2000): RA = 03h 46m || DEC = +20deg 45min ||
m1= 9.3 (S, TJ) || Dia = 2.5' || DC = 4 || 15-cm R; f4; 60x |||
Very transparent sky. Comet only 13 deg over NW horizon in Taurus. Solar el. = 31 deg.
(C) Gabriel Oksa, Trnava, Slovakia

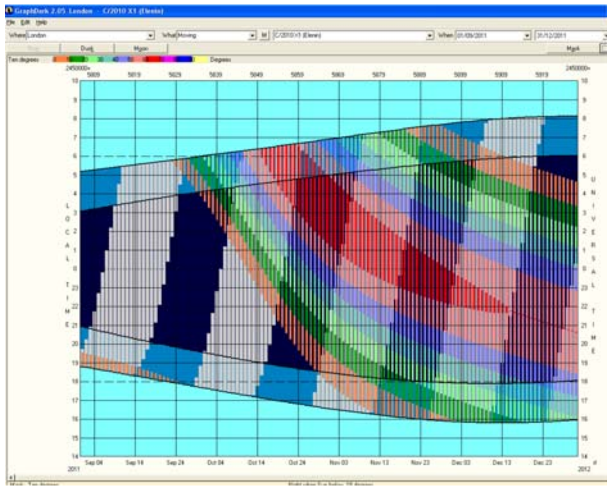
73P/Schwassmann-Wachmann is unlikely to be as well seen this year when compared to its astonishing display in 2006, when many fragments were seen strung along the orbit. The two brightest fragments should be recovered, but their brightness is uncertain as the fresh surfaces from the break-up are likely to have aged.



2009 P1 (Garradd)

2009 P1 (Garradd) is likely to be a good object for UK observers. We should be able to pick it up around mid-summer, when it may already be 9th magnitude. Moving north and west from Pisces, it reaches opposition in early August on the borders of Pegasus at perhaps 8th magnitude. It becomes nearly stationary in Hercules in November, but then accelerates northwards, ending the year here at approaching 6m. Its exact magnitude in 2011 is uncertain, but early observations when it emerges from solar conjunction in April will help refine predictions.

2010 X1 (Elenin) may be within visual range in April and May before passing through solar conjunction. It then emerges into the morning sky of very late September as a 4th magnitude object, passing around 0.3 AU from the Earth in mid October, when it may sport a 3° tail. Its elongation rapidly increases, but it fades, although should remain visible in telescopes until the end of the year. It is unfortunately another comet that will be at its best in the morning sky.



2010 X1 (Elenin)

One SOHO comet is predicted to return, and should become visible in the SOHO LASCO field if the satellite is still operation, or in the STEREO fields.

The other periodic and parabolic comets that are at perihelion during 2011 are unlikely to become brighter than 12th magnitude or are poorly placed. Ephemerides for these can be found on the CBAT WWW pages. Several D/ comets have predictions for return, though searches at favourable returns in the intervening period have failed to reveal the comets and it is possible that they are no longer active. There is however always a chance that they will be rediscovered accidentally by one of the Sky Survey patrols.

Looking ahead to 2012, **P/Levy (2006 T1)** could be 7th magnitude just after perihelion in mid January 2012, when it passes 0.19 AU from the Earth. It is well placed prior to perihelion and UK observers should be able to follow it through the autumn and winter of 2011, with the comet reaching 9th magnitude by the end of the year. There is however some uncertainty about its brightness, as it seems probable that it was in outburst at discovery. **2009 P1 (Garradd)** will be at its best during the first couple of months of the year and becomes circumpolar at this time. **96P/Machholz** will be a bright object at perihelion, but is then close to the Sun and will not be visible from the UK.

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Comets reaching perihelion in 2011

Comet	T	q	P	N	H_1	K_1	Peak mag
Beshore (2009 K3)	Jan 9.3	3.90			8.5	10.0	17
9P/Tempel	Jan 12.4	1.51	5.52	11	7.0	21.5	13
Catalina (2009 Y1)	Jan 28.9	2.52			9.0	10.0	15
D/Helfenzrieder (1766 G1)	Jan 29.7	0.42	4.52	1	6.0	10.0	
Cardinal (2010 B1)	Feb 7.1	2.94			7.5	10.0	14
247P/Gibbs (2010 W1)	Feb 8.7	2.15	14.6	1	14.0	10.0	19
D/Swift (1895 Q1)	Mar 1.4	1.48	7.40	1	11.4	10.0	
243P/NEAT (2010 P5)	Mar 3.5	2.46	7.52	1	12.5	10.0	19
D/Barnard (1884 O1)	Mar 7.9	1.33	5.45	1	8.9	10.0	
238P/Read (2010 N2)	Mar 10.7	2.36	5.63	1	14.5	10.0	20
P/LINEAR (2006 U1)	Apr 15.8	0.51	4.63	1	18.5	10.0	16
D/van Houten (1960 S1)	Apr 23.3	4.07	15.7	1	8.5	10.0	
P/LINEAR-NEAT (2004 T1)	Apr 24.9	1.71	6.47	1	12.5	10.0	17
231P/LINEAR-NEAT	May 16.7	3.03	8.08	1	14.5	5.0	19
164P/Christensen	Jun 2.4	1.68	6.98	2	11.0	10.0	15
Boattini (2008 S3)	Jun 7.4	8.02			4.0	10.0	17
213P/Van Ness	Jun 16.2	2.12	6.33	2	10.5	10.0	14
130P/McNaught-Hughes	Jun 24.8	2.10	6.65	3	12.5	10.0	16
62P/Tsuchinshan	Jun 30.4	1.38	6.37	7	9.5	15.0	13
123P/West-Hartley	Jul 4.5	2.13	7.58	3	11.5	10.0	17
P/PANSTARRS (2010 T2)	Jul 11.8	3.74	13.2	0	11.5	10.0	19
69P/Taylor	Jul 17.2	2.27	7.64	6	7.3	10.0	13
3D/Biela	Jul 29.9	0.80	6.56	6	7.5	10.0	
D/Harrington-Wilson (1952 B1)	Jul 30.1	1.28	5.58	1	12.1	10.0	
27P/Crommelin	Aug 3.8	0.75	27.92	5	12.0	20.0	11
97P/Metcalf-Brewington	Aug 21.0	2.60	10.53	3	4.6	15.0	12
228P/LINEAR (2009 U2)	Aug 23.8	3.43	8.51	1	14.5	5.0	19
Hill (2010 G2)	Sep 2.1	1.98	930		8.0	10.0	12
P/SOHO (1999 R1)	Sep 7.1	0.05	3.99	3	22.1	12.8	6
Elenin (2010 X1)	Sep 9.4	0.48			8.0	10.0	4
45P/Honda-Mrkos-Pajdusakova	Sep 28.8	0.53	5.25	11	12.5	20.0	6
48P/Johnson	Sep 29.3	2.30	6.94	9	5.6	15.0	12
115P/Maury	Oct 7.0	2.04	8.76	3	11.5	15.0	17
73P-Schwassmann-Wachmann C	Oct 16.8	0.94	5.36	2			12 ?
P/Lagerkvist (1996 R2)	Oct 17.1	2.61	7.38	1	11.0	10.0	16
73P-Schwassmann-Wachmann B	Oct 18.6	0.94	5.36	6			12 ?
49P/Arend-Rigaux	Oct 19.1	1.42	6.72	9	11.3	11.0	14
41P/Tuttle-Giacobini-Kresak	Nov 12.2	1.05	5.43	10	9.4	17.2	11
P/Larsen (2004 H3)	Nov 23.3	2.45	7.72	1	13.0	10.0	19
P/LINEAR-NEAT (2004 R3)	Nov 28.4	2.13	7.49	1	14.5	10.0	19
Lemmon (2009 S3)	Dec 10.3	6.48			6.5	10.0	19
37P/Forbes	Dec 11.0	1.58	6.35	10	10.5	10.0	15
71P/Clark	Dec 15.8	1.57	5.53	7	9.7	7.9	13
Garradd (2009 P1)	Dec 23.7	1.55			3.2	8.1	6
36P/Whipple	Dec 29.6	3.09	8.54	11	8.5	15.0	17
McNaught (2009 F4)	Dec 31.9	5.45			3.0	10.0	14

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. The magnitudes, orbits, and in particular the time of perihelion of the D/ comets, are uncertain.

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.