THE COMET'S TALE

Newsletter of the Comet Section of the British Astronomical Association

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2013 The Year of the Comets?

The Great Comet of 1680 over Rotterdam by Dutch artist Lieve Verschuier. The observers in the painting are using cross-staffs to measure the comet's position and tail. This comet has been suggested as an analogue of 2012 S1 (ISON).

This year is likely to have several bright comets and there could always be additional surprises. 2011 L4 (PanSTARRS), 2012 F6 (Lemmon) and 2012 S1 (ISON) could all reach naked eye brightness. 2P/Encke has a good apparition for the northern hemisphere and will be the focus of a Section campaign. The lead time for 2012 S1 (ISON) in particular gives opportunity for outreach activities, perhaps including persuading local councils to switch off street lights to allow public viewing of what may be a memorable object. 2011 L4 (PanSTARRS) has a longer period of visibility and may be more widely seen.

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Section News from the Director

Dear Section member,

I have now retired from full-time employment with the British Antarctic Survey, so I should have slightly more time to devote to cometary matters, though it is amazing how many other things come along. My first month of retirement was very busy, but this did include writing a paper on 67P/Churyumov-Gerasimenko for the BAA Journal and attending the workshop described elsewhere in this newsletter. This initiative will hopefully continue and may lead to a European Comet Workshop.

I do retain links with BAS as a BAS Fellow, and continue to work on ozone and climate studies in a voluntary capacity in return for access to computing facilities. I hope to continue with visits to the Southern Hemisphere, perhaps with BAS or as a lecturer on Antarctic cruises. I have been elected to the Council of the Botanical Society of Britain and Ireland, as well as being on the Council of my local Cambridge Natural History Society, so my time is quickly being filled!

Important developments are in progress within the Section. Denis Buczynski and Nick James have set up an archive for images, and normally all images and electronic drawings should be sent to Denis. They have also set up a discussion forum and Nick can add you to the list if you contact him at ndj@nickdjames.com Roger Dymock has developed a process for getting photometry from images, which is broadly comparable to visual measurements (see http://www.britastro.org/projectalcock/CCD%20Astrometry%20and%20Photometry.htm). The astrometry that is produced as part of this process (and which most imagers should be carrying out) doesn't need to be sent to the Section, but should go to the Minor Planet Center. Summaries are published in the Minor Planet Circulars which are freely available at http://www.minorplanetcenter.net/iau/ECS/MPCArchive/MPCArchive_TBL.html I would like to encourage all CCD imagers to follow Roger's example and reduce their observations and submit the photometry to me in the standard ICQ format. To avoid confusion with the multiple formats that are currently being used for photometry (BAA, ICQ, TA and many others), observers should only use the internationally agreed ICQ format. The BAA format, which differed only slightly from the ICQ one, is being dropped. Guy will continue to publish in TA format, so I will convert the ICQ format observations, both visual and CCD, to TA format using a computer program and send them on. This will avoid duplication of effort and multiple reformatting, which inevitably leads to errors. Please try and stick exactly to the ICQ format – a few observers still have parameters positioned incorrectly (especially coma diameter and degree of condensation). Denis and Nick are organising a Section Meeting in Northampton on May 18. This will be an opportunity to learn how to make and reduce observations, how to name images, the campaign on 2P/Encke (see http://www.ast.cam.ac.uk/~jds/camp2013.htm and the predictions for 2013 later in this newsletter), plans for 2012 S1 (ISON) and much more. Do come along!

2013 is likely to be a year filled with comets, and once they become bright enough for binocular or naked eye observation I am likely to be inundated with observations. These may take many forms, and I would welcome sketches, wide field photogenic images, detailed images of coma and tail, visual and CCD photometry and perhaps even examples of the hyperbole of the media. When taking wide-field images of the bright comets, Nick James' suggestion of taking multiple short exposures and stacking them is worth bearing in mind. Keep an eye on the web page for all the latest news.

Sadly 2012 saw the deaths of Giovanni Sostero and Sir Patrick Moore. Giovanni Sostero contributed much to the Section, including visiting the UK to share his knowledge. Although Patrick Moore was best known for his lunar and planetary observations, he contributed a few observations of comets including 1966 P1

(Kilston), 1966 P2 (Barbon) and 1973 E1 (Kohoutek). Early 2013 saw fire raging through Siding Spring in Australia, and while this seems not to have affected the telescopes (though Australia is unfortunately cutting the funding of the Survey), it has destroyed infrastructure and homes (including that of Rob McNaught).

Patrick Moore's study in 2005

It is clear that many professionals prefer names to numbers for periodic comets and this was true at the Rosetta workshop. A few do stick to the IAU nomenclature, and for example Stephen Lowry used the numbers. In one presentation the only "number" used was 2002 T7 (given without a space), which happens to be one of many LINEAR objects. This proved the point that I made earlier in discussion with one of the RAS press officers who had used the name Wild2 in a press release. I argued that whilst NASA may have used something like this (they use Wild 2) they were making themselves a hostage to the future when it came to describing LINEAR 233 or whatever, and that it would be better to use the correct 81P/Wild. Unfortunately the media are quite happy to continue to promulgate the technically incorrect name, on the grounds that "everyone uses it and it would cause confusion to use the correct technical name". 2011 L4 is now being quoted as comet PANSTARRS, and 2012 S1 as "The comet ISON", so what they will do if either programme discovers another bright comet that is visible simultaneously I don't know. Such sloppiness is a shame, when the public can quite happily cope with the complex Latin names of dinosaurs!

Although I fear that I will inevitably omit some names, I would like to acknowledge visual and CCD photometric contributions from James Abbott (Essex), Salvador Aguirre (Mexico), Alexandre Amorim (Brazil), Sandro Baroni (Italy), Paul Camilleri (Australia), Roger Dymock (Hampshire), James Fraser (Rossshire), Marco Goiato (Brazil), Juan José González Suárez (Spain), Stephen Getliffe (Suffolk), Werner Hasubick (Germany), Guy Hurst (Hampshire), Vyacheslav Ivanov (Russia), Andreas Kammerer (Germany), Carlos Labordena (Spain), Martin Lehky (Czech Republic), Michael Mattiazzo (Australia), Artyom Novichonok (Russia), Roy W. Panther (Northamptonshire), Mieczyslaw L. Paradowski (Poland), Jan Qvam (Norway), Jonathan D. Shanklin (Cambridge), Willian de Souza (Brazil), Graham W. Wolf (New Zealand) and Seiichi Yoshida (Japan). Other contributions came from Alexander Baransky (images), Dave Eagle (image), Maurice Gavin (image), Dale Holt (drawings), Heinz Kerner (image), Rolando Ligustri (images), Danilo Privato (image), David Pulley (image), Andrew Robertson, Hirohisa Sato (orbits), Toni Scarmato (images) and Alan Tough (images) and several of the imagers sent astronomy to the MPC (with apologies for any errors or omissions).

I look forward to seeing you at the Section Meeting.

Best wishes, *Jonathan Shanklin*

Section News from the Secretary

I was asked by Jon Shanklin to act as the Section Secretary to receive and archive the ccd images which are submitted by Comet Section Members and to acknowledge the receipt of these images and deal with any subsequent queries. The Comet Gallery on the BAA website as the year ended contained 341 comet images (52 comets) of which 240 have been submitted during 2012 from 20 individual Section members. Considering the generally poor weather we have endured this year in the UK this is a great effort. Individual tallies are as follows: L. Adams (1), P. Birtwhistle (5), P. Brierley (1), D. Buczynski (109), M. Cole (2), R. Dymock (20), N. Evetts (3), M. Farrow (1), N. Howes (13), M. Harlow (1), N. James (23), R. Miles (2), M. Mobberley (28), D. Peach (2), G. Relf (2), D. Storey (7), G. Sostero (13), I. Sharp (6), D. Strange (1) and C. Snodgrass(1). The best observed comets have been 2009 P1 (Garrard), 168P/Hergenrother, 260P/McNaught, 2012 K5 (LINEAR) and 2012 S1 (ISON).

The dome of the NTT at La Silla

It is interesting to note that 9 of our observers use overseas robotic telescopes in addition to their own instruments. The largest telescope used was the 3.6m NTT at La Silla (C. Snodgrass) and the smallest is the 60mm at Golden Hill Observatory (R. Miles). The vast majority are monochrome images with only a few submitted in colour.

Spot the (non) comet (near bottom left) (See page 4)

I have announced the placement of some images on our Gallery to the comet-ml mailing list and we have had many observers from that Yahoo group access our gallery. I have had many exchange emails with many comet imagers across the world as a result.

I hope that I have answered all queries in a timely fashion and will continue to promote the work and activities within our Section at all times.

Very occasionally these days a request comes to us to judge on a discovery claim or resolve an observing oddity. One of these instances came to us this year from an observer in Malta. He submitted three images (see page 3 for an example), made in succession in very good conditions that seemed to show a moving comet like object. Whilst Martin Mobberley and I were trying to decide the possibility of the images being a real comet, the observer reported back that the suspect was in fact an internal lens reflection from a bright star just outside the field. The suspect images look like a comet, complete with a tail, and there is no doubt that they could easily fool even an experienced observer. Make up your own mind, look at the images reproduced here.

Let us hope that 2013 will be a vintage one for comet observers and that the comets approaching perihelion will bring about views that will rival any other comet apparitions of the past. I look forward to receiving images of all comets from Comet Section members. Please send images to cometobs@britastro.org or to my personal email address at buczynski8166@btinternet.com

Denis Buczynski

Tales from the Past

This section gives a few excerpts from early RAS Monthly Notices and BAA Journals. The BAA was formed in 1890.

150 Years Ago: The annual report of the RAS Council given at the 42nd Annual General Meeting, notes that three comets had been discovered during the year. These were 1861 G1 (Thatcher), 1861 J1 (Great Comet) that "must be regarded as one of the most splendid of modern times" and finally Mr Tuttle had discovered 1861 Y1 at the Observatory of Harvard College on December 29. A letter from the Rev. Dr. Mackay, Missionary at Chinsurah, Bengal reports his observations of the great comet, and he also comments on the comet of 1858 L1 (Donati), which he thought was identical to the comet of 1781 T1 (Mechain), and says would then rank with 1P/Halley. A note from Sir Thomas Maclear clearly laments the lack of ephemerides for periodic comets. He says "It would be well to get up a rough working ephemeris of all the periodic comets several months beforehand, and to circulate them freely. By rough I mean with omission of the perturbation corrections." In April there was a note from M O Struve at Pulkova, which included some comments on the great comet. "the comet will approach the north pole within a degree, a circumstance that, it appears, will complicate a little the reduction of the observations, if such should succeed about that time." He goes on to say "on the other hand there is a strong suspicion, as already Prof. Schonfeld has pointed out, that the intensity of light of this comet is subject to considerable variability, and this circumstance might, perhaps, favour a rediscovery.". A letter from W Scott, Astronomer for New South Wales in the July Notices notes "The weather has been cloudy or hazy for the last two months, and 2P/Encke was, at the best, very indistinct and ill defined". A Supplemental Notice issued in November has a long article by the Rev. T W Webb on the Great Comet of 1861. He describes observations of the nucleus, the complex envelopes, the luminous sector or fan, the coma and the tail. Lieut. Chimmo on Canna Island in the Hebrides gives a position for 1862 N1 (Schmidt) and notes that the position was made under the disadvantage of a bright aurora, which was coruscating towards the zenith. He also noted a jet, which apparently waved to and fro, but says "this is however doubtful, and it may be an illusion, caused probably by the shooting coruscations of the aurora." The November Notices include observations of 1862 N1 by F Abbott from Hobart. He saw the comet on September 6, when it was distinct in a clear sky with a moon thirteen days old. On the evening of the 12th the condensed head of the comet covered the small nebula M80, which nebula could not be seen at this time by any means he could adopt. On the 21st the comet had apparently diminished so much as to be just visible to the naked eye when pointed out, and on the 22nd it became telescopic. A letter in the December Notices giving the elements of two comets was in French and concludes "Tandis que la premiere comete sera visible dans nos observatoires boreals, l'autre disparait deja au milieu de Decembre par suite de sa declinaison australe, mais elle va reparaitre probablement au milieu de Fevrier." The Notices record the recent publication of Volume III of the Annals of the Astronomical Observatory of Harvard College, which are an account of the Great Comet of 1858 [1858 L1 (Donati)]. The outline of the monograph concludes "The naked-eye and telescopic views of the comet, shown on a dark ground, are very beautiful specimens of steel engraving." Finally the review of the year notes that four comets had been discovered. The short period comet of Brorsen [5D] had passed its perihelion unobserved, chiefly owing, no doubt, to its unfavourable position in the morning twilight.

Pulkova Observatory (Vladimir Ivanov)

100 Years Ago: At the January BAA meeting Dr Crommelin reported on several comets, including 24P/Schaumasse, which was of the Jupiter Family. They had not yet disposed of Halley's Comet as he had not had time to prepare the Memoir, so Dr Smart had kindly taken up the work, and hoped to publish it in the next few months. They were expecting another comet of the Neptune group, 20D/Westphal. There were altogether six comets of that group. The comet was discovered in 1852, and had not yet seen a second return [it returned in 1913, but has not been seen since]. The period was not certain, but it was thought worth looking for it, as it might be as bright as Halley's comet was when it was recovered. He also noted that the discordance between the predicted and observed positions of 2P/Encke was resolved when it was discovered that the ephemeris was calculated from elements that had a misprint in the angle of eccentricity that was 10' wrong. He also noted that the comet appeared to suffer abrupt changes in its rate of acceleration, that seemed to coincide with sunspot maxima, and speculated that it might be caused by light pressure or the emission of electrified ions. He thought that it was a very old comet, at least thousands of years old. This suggested that it had to regenerate - the orbit intersected that of 3D/Biela and at the intersection their velocity was nearly the same, so it might recover matter from the meteoric stream of Biela. One difficulty with this idea was that it should work the other way, and Biela had not recuperated. A final speculation concerned the observation that Encke was far brighter before than after perihelion passage. This was explained by supposing that the particles of Encke were not round but flat particles, all oriented in parallel planes. That might arise from some electrical or magnetic action. Then when either the Earth or the Sun was in the main plane of the particles there would be a great loss of light, just as Saturn's ring vanished when its plane passed through either the Earth or the Sun. A comment from Harold Thomson suggested that he was fortunate in being in the southern hemisphere during the apparition of Halley's comet, and he could assure the audience that those who said the comet was a failure were utterly mistaken. At one time the tail stretched from the horizon to the zenith. He also said that the negro population of Brazil were convinced that the world was to come to an end on the night that the Earth passed through the tail of the comet, and quite a number of mistresses received notice from their servants on the ground that they wished to spend their last few hours amongst their own people. Charles Olivier had published a paper on meteors in the Transactions of the American Philosophical Society. In it he established a connection between 1P/Halley and the eta Aquarids, but found a connection to the Orionids far more doubtful. He estimated that the Aquarids filled a cylinder of radius 20 million kilometres. A summary of the Memoir on Halley's comet was read by Dr Smart at the February meeting. Observations had been received from around the world, and not only from members. The different observations coincided almost perfectly in detail, which showed that they had been carefully made and very correctly recorded. Dr Crommelin drew attention to a very useful method for representing the motion of the comet with regard to the Sun and the Earth, both of which were represented by fixed points. This had been published in the Canadian Astronomical Society's Journal in 1910 November 12. It had the great advantage that the same curve would do for any return, if the point representing the Earth was shifted. He fancied that the next return would be something like that of 1759, perihelion being somewhere about 1986. Again the southern hemisphere would be the most favoured. In the March comet notes Dr Crommelin called attention to the fact that the notes were his normal method of communicating with the Section. [Today I consider the web page to be the equivalent]. A letter from C J Westland on recent comet observations from New Zealand notes a remark in Chambers Story of the Comets about the close approach of two comets in 1890 quoting Professor Barnard that "such a thing had never happened before and was unlikely to occur again". He had just seen Quenisset's comet 1911 S2 close to Brooks's comet 1911 O1. [Today Seichi Yoshida regularly communicates close approaches of comet pairs. I am sure a triplet will occur!] The 74th award of the Donohoe Comet Medal had been made to M A Schaumasse for his discovery on 1911 November 30.

The report of the April meeting of the New South Wales Branch included a talk on the impact theory of cosmogenesis. Mr Short pointed out that in the case of a comet which crossed the orbit of the Earth, the chances of a central impact were 72,000 to one against, and of grazing 24,000 to one against. In the Meteor Section report the Rev Davidson noted that "It would be unwise to affirm definitely that the Lyrids are the debris of this comet [1861 G1 (Thatcher)], although the probabilities seem in favour of such a view." At the June meeting Dr Crommelin reported that he had recently received a Harvard Memoir by Prof W H Pickering, dealing with the statistics of cometary orbits. In it he had assigned comets into planetary families and had deduced that there were four major planets beyond Neptune. Nature noted a publication by M Borelly which gave various particulars of 376 comets discovered since the 16th century. Sixty-four were discovered at Marseilles, 46 at Paris. Slough was first on the British list, with 7, and Bristol had 4. Nearly two thirds were discovered in the morning, and the second half of the year was more prolific than the first. Seven had been seen in full daylight. The annual report of the Comet Section notes the several comets that had been under observation. It also records "the withdrawal from membership of Mr John Grigg, of Thames, New Zealand, whose zeal in comet observation has been rewarded by several discoveries." [It is possible that he had ceased observing comets altogether at this time] It also mentions that Mr Walter F Gale of the NSW Branch had discovered a 6th magnitude comet.

Tewfik Pasha, ruler of Egypt in 1882, after whom the eclipse comet was named.

Gale recounted the discovery in a paper at the October meeting. It was made with a 50mm field glass with a magnification of x3. At the same meeting Rev Thomas Roseby presented a paper entitled "Comet Problems". It is rather wordy, but contains a few gems. He describes Tewfik's comet [X/1882 K1] by analogy using "the piquant Australian phrase as a ‘Rosella among Kukuburras’". Later he describes the density of a comet nucleus as "three golf balls to a cubic mile" and concludes with reference to Virgil's Georgics "The interesting thing is to find Proteus in however unique and 'questionable shape' he comes".

A letter from David Ross in the November Journal recounts the story of Mechain and his comet greed: At the time of his wife's death, a comet was discovered. Meantime, a friend wrote him a letter of condolence over his earthly loss. In his reply he entirely forgets the import of his friend's letter; instead of which he enumerates the discoveries he has already made, and sorrowfully laments the loss of this would-be ninth comet. A subsequent letter from W F Denning, suggests that the comet-finder might have been Messier rather than Mechain, and goes on to say "Breen, in his Planetary Worlds, says of Messier that on one occasion he was anticipated in a discovery by Montaigne, and that he appears to have regretted the loss of the comet more than that of his wife, who had just been taken from him. A friend visiting him offered a few words of condolence with reference to his bereavement, but Messier, in despair about the comet, exclaimed, 'I had discovered twelve - alas that I should have been robbed of the thirteenth by Montaigne!' and his eyes filled with tears. Recollecting himself, however, and appreciating the loss he had sustained in his wife, he added, 'Ah, this poor woman!'. Breen tells us that Messier lived in troubled times and encountered many discouraging obstacles to his favourite pursuit. On one occasion, when walking in President Saron's garden, he fell into an ice house and was disabled for a time. Subsequently the Revolution deprived him of his little income. Every evening it was his custom to repair to the residence of Lalande to replenish the supply of oil for his midnight lamp. The political disturbances forced his removal to another neighbourhood, where he no longer heard the clocks of 42 Parisian churches sounding the hours during his nocturnal sweeping.".

Donohoe Comet Medal (State Library of New South Wales)

The death of Lewis Swift, who was an original member of the Association and who had discovered about a dozen comets was announced in the December Journal [which clearly came out in January, as he died on January 5]. Swift had found his first comet in 1862, though it was already claimed by Tuttle, and his last on 1899 March 3, when he was 79 years of age. He had been born on the extra day of a leap year, so had only enjoyed 22 birthdays! The 74th Donohoe Comet Medal went to Mr Gale, the 75th to Mons. Borrelly and the 76th to Mons. Schaumasse, who also received the Prix Valz from the Academie des Sciences.

50 Years Ago: There is a short note on the orbit of 1959 O1 (Bester-Hoffmeister) by Brian Marsden in the February Journal. He notes that the orbit was hyperbolic with a value of e of 1.002656, a value exceeded only by 8 other comets. He had used an IBM650 computer at Yale University to calculate the original orbit, which he found to be essentially parabolic. At the February BAA meeting Michael Candy spoke about the forthcoming new comet 1962 C1 (Seki-Lines), saying that on April 1 it would be half a day past perihelion and -5, and that it might be visible in daylight. At the next meeting, he didn't predict a magnitude, but said that Albert Jones had observed it on March 9, when it was 4th magnitude. He didn't expect a "beard" or "spike" as the Earth did not pass through the orbital plane of the comet. At the April meeting he reported that poor weather and then moonlight had prevented most observers from seeing the comet at its best. [Given the hyperbole about 2012 S1 (ISON), I wonder if a similar report will be made at the 2013 December meeting of the BAA?] The same Journal has a paper by Harold Ridley, linking the December Phoenicid shower seen on 1956 December 5, with comet 1819 W1 (D/Blanpain). [More recent studies suggest that there will be no further outbursts before 2050.] The annual report of the Section notes that six comets were under observation during the session, of which three reached naked eye visibility. In issue No 8 Michael Hendrie presented a paper on an Analysis of Comet Discoveries, using data from 1948 to 1960. He gave a table listing the discoveries, giving details of the comet position, magnitude and the instrument used. Unfortunately the Editor printed the table with half the information on the following page, rather than on opposite pages, which makes it difficult to follow. Northern Hemisphere discoveries were favoured, largely due to the location of observers. There were more comets discovered in the morning sky. He concluded that only by continual and adequate coverage of the whole sky can we be sure that comets are not slipping by undiscovered. [Today we are perhaps nearly there!]

Rosetta Workshop

These notes give an outline view of a meeting held at University College, London in support of European planning for ground-based observations in support of the Rosetta spacecraft. It was organised by the Europlanet consortium, which is funded through an EU grant under the Seventh Framework Programme. Europlanet covers several activities, and this event came under Networking Activities which aims to foster co-operation in the field of planetary science. They have a web site at http://www.europlanet-ri.eu Guy Hurst, Richard Miles and Jonathan Shanklin were invited to attend to represent the amateur community.

Tuesday, 2012 April 17

Steve Miller introduced the workshop, describing how Europe had been poor compared to the US in providing ground-based support to space missions.

Rita Schulz, Rosetta Project Scientist, introduced the Rosetta Mission. Her opening slide showed a last perihelion of 1.30 AU, when in fact it was 1.25 AU. She suggested that Mike A'Hearn thinks the comet will become less active by 0.2 mags per apparition. Long term evolution is critical to the mission. The mission hopes to see long term production rate evolution of different species as the comet approaches the Sun and recedes. Rosetta was launched in March 2004, and has had four gravity assists and has since had two asteroid flybys. It will wake from hibernation in January 2014, will rendezvous in May 2014 and deliver the lander in November 2014. The comet passes perihelion in 2015 August and the nominal end of mission is December, but could in principle continue for another few months. The spacecraft has 11 instruments/packages giving rise to 18 experiments, the weight is 170kg. The lander weighs 110kg, and has 16 experiments in 10 instruments. In principal all can work together, but there are constraints on power and pointing requirements.

The Rosetta orbiter

The orbiter instruments are: Grain Impact Analyser and Dust Accumulation, Visible and Infrared Thermal Imaging Spectrometer, Optical Spectroscope and Infrared Remote Imaging System (OSIRIS) – camera, Ultraviolet Imaging Spectrometer, Comet Nucleus Sounding – radio sounding experiment to do tomography of the comet, which needs lander, Micro-Imaging Dust Analysis System (nanometre imaging), Cometary Secondary Ion Mass Analyser, Rosetta Orbiter Spectrometer for Ion and Neutral Analysis (gas), Microwave Instrument for the Rosetta Orbiter – measuring species, Rosetta Plasma Consortium – plasma activity.

The lander has two imaging instruments (wide-field, though down to 10 cm resolution near landing, and microscope), three composition analysis, two physical properties, drilling and sampling, magnetic field and plasma, and the radar tomography. There is a harpoon on the lander, which will help secure it, that can penetrate up to 2.5m. The design is such that even if things go wrong some measurements should be made.

On arrival it will go into a Keplerian orbit and do wide-field imaging to select the landing site. The lander will then take priority for 60 days, then move back to orbit science. As the comet gets closer to the Sun it becomes more difficult to stay in a close orbit, so Rosetta will move into an elliptic orbit of 5 to 100km. This will also allow the possibility of investigating phenomena that can only be seen from greater distances. Beyond 4.6 AU the spacecraft does not receive enough sunlight to power the spacecraft. There are five cometary science objectives, and it has already achieved the asteroid objective. Rosetta should answer the question of how comet nucleus activity works. It may need a lot of modelling to explain how the close up observations translate into what is seen from a distance, and link it to a wider range of comets. The lander should be able to analyse material that lifts off the comet, but falls back without reaching the coma.

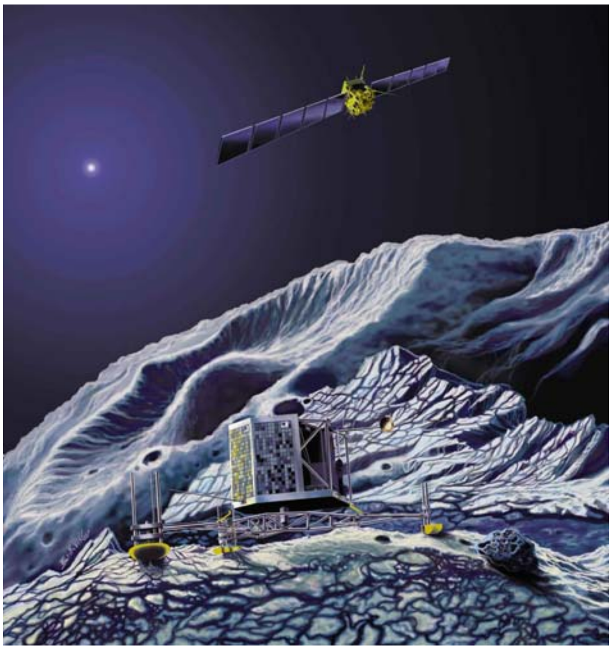
ESO should be making supporting observations, but there doesn't appear to be any agreement in place between ESO and ESA, other than that there may be some directors discretionary time available. She had hoped that a formal ESO representative would be present. The Dawn and other spacecraft may be able to provide some support by imaging from different perspectives.

There have been no convincing images of the ion tail of the comet. Amateur observations may be important here, as they can image using the optimum waveband and at times of their choosing.

Ewine van Dishoeck – From ISM to comets. Ewine showed a nice graphic showing star and planet formation from ISM collapse. Look at dark pre-stellar cores, low mass protostars, disks, comets & planets. Follow a parcel from the dark core at 10K to comet-forming zone of disk. Wide range of physical conditions encountered on route. Most of the chemistry is governed by gas-grain surface chemistry. Many icy molecules freeze out onto grains in dark interstellar clouds. Spitzer used the technique of subtracting silicate continuum to tease out lines of ices. As the grains warm, we start to see a range of gas-phase molecules. We are beginning to be able to distinguish the chemistry of low mass and high mass protostars. Not all of the material will end up in the disk. Material in-falling to disk undergoes turbulent layered accretion onto the disk, with ever-more distant material forming layers of a sandwich. Material that ends up in the comet forming zone is partially preserved, partially processed. Using different infra-red wavelengths allows probing of different parts of the disk. ALMA will provide a lot of exciting observations once it becomes fully operational; 30 telescopes are now working. The ortho/para water ratio may reflect the temperature of the formation region. The boundary between the inner and outer disk was around 10 – 20 AU. A second presentation spoke further about the D/H ratio in comets, as measured with Herschel. A ratio similar to that found on earth was found in 103P/Hartley, which is a Jupiter family comet. This strengthens the view that Earth received its water from such comets. The $_{14}N/_{15}N$ isotope ratios of nitrogen are enhanced in 17P/Holmes and most other comets, which implies fractionation, though the mechanism is not clear. $_{13}C$, $_{18}O$, $_{34}S$ are consistent with terrestrial ratios.

Stephen Lowry lead discussion of remote observations of the comet which have thrown light on its shape and thermal properties. At the time of selection as the Rosetta target not much was known about the nucleus. The orbit is chaotic. It is important to establish the nucleus size, shape, spin and surface properties. Ground based observation of 67P combined with the spacecraft observations will help when observing other comets from the ground. Hubble observations were made in 2003, which gave an estimated radius of 1.98±0.02 km and a rotation period of 12.4±0.4 hours. A double peaked light curve implies dimensions of 2.41x1.55km. VLT observations from 2004 to 2006 refined the rotation period to 12.705 hours and effective radius to 2.38±0.04km. These assume an albedo of 0.04, whereas it may be higher at 0.06. A dust trail was detected. NTT observations were made from 2004 to

2007, the last being close to the comparable encounter point of Rosetta. These gave a rotation period of 12.72 hours, with a very asymmetric light curve, which implies a/b >1.4 (2.07/2.94), with a mean radius of 2.26km. [Quite neat plot showing where observations were made along orbit] Some more recent observations are available, and more will be made as the comet passes through aphelion. Activity starts between 4.1 and 3.4 AU inbound and ends between 3.8 and 4.7 AU outbound, which limits the phase angle and hence models of the nucleus. All optical light curves have been used to refine the shape model and these imply a typical pebble shaped object (perhaps similar to 9P/Tempel) with a rotation period of 12.76 hours (no change 2003-2008) and give an estimate of the pole position. Using this model gives a good fit to thermal infra-red data and suggests an albedo of 0.06, which in turn gives a smaller radius of 1.96 km. The surface seems finer grained than lunar regolith. The success of the Philae lander depends crucially on bulk density, and estimates suggests that the density is probably around 0.5, which is close to the hit/miss line. Paul Wiseman suggested that comet rotations faster than 6 hours are not seen, which implies density of around 0.5 – 0.6, but could be 0.3 – 0.4 for 1993 F2 (D/Shoemaker-Levy). Non-gravitational force estimates of comets suggest a lower density. It may be possible to choose a suitable landing point on an asymmetric nucleus to maximise success. Jet structures have been seen close to the nucleus with a 2.2m telescope. C_2 and CN production rates are stable around perihelion with no outbursts detected. There was a steep decline in CN around 2.5 AU post perihelion, which needs to be investigated, however the main mission ends before this point. Some of the unpublished data is because the team is working on removing stellar background



The Philae lander with orbiter

It is possibly worth amateurs making observations of the comet in next observing window in 2013, particularly photometry to tie down the rotational model. Amateurs in particular are not limited by the solar elongation constraints than apply at many professional observatories.

Alma observations: Colin Snodgras described IRAM observations of 103P. ALMA will be able to observe in 2015 May and an hours integration should resolve the nucleus. Spectroscopy will be possible in June or November.

Jo Fabbri jfabbri@star.ucl.ac.uk described EuroPlaNet, which aims to provide networking facilities between ground based and space missions to enable pooling of resources. Amateurs can index their facilities at http://europlanet-na1.oeaw.ac.at/matrix/ this may lead to collaborations with professionals who need observations of certain types. Signing up for Rosetta may be a good case study. In the first instance it will be best to restrict amateurs to half a dozen who will produce worthwhile data. Richard Miles suggesting putting together a list of amateur accessible robotic telescopes.

Gian Paulo Tozzi described observations of Afp from June 2008 to January 2009. ΣAf should be constant with p when the comet is inbound, but changes if there is variable activity. Afp cannot be used as a proxy for dust production in 67P because Σ is non constant. He fitted two exponentials and deduced a lot of parameters from them. Paul Wiseman suggested that ground based telescopes may give different results to an in-situ spacecraft. Comets do random walk in perihelion distance, and this certainly applies to 9P, though he thinks 81P may be new. 67P could be anything, but is probably Kuiper Belt rather than Oort cloud but that is not impossible.

Yudish Ramanjooloo at MSSL is using amateur images to derive solar wind velocities. For 67P the spacecraft will be inside the diamagnetic cavity created by the solar wind, so remote ion tail observations will be key to understanding the cavity volume. Alphonse Diepvens imaged an ion tail on 49P in 2012 March, though it did require an hour long integration. Observing one on 67P may therefore be possible. Ion tail will however tend to be in the same plane as the dust tail, so difficult to disentangle. STEREO will probably have the wrong geometry.

Wednesday, 2012 April 18

Alan Tokunaga – NASA Infra-red Telescope Facility (IRTF). In general there is no co-ordination of all the Mauna Kea telescopes except in exceptional circumstances for mission support, eg Deep Impact. The IRTF is a 3m telescope and provides planetary science support, with funding from NASA. There are two spectrometers and two cameras, with the opportunity to deploy additional community instruments. It can be used remotely and this type of observing has been increasing in recent years. For special observing campaigns (eg for 103P/Hartley) they adopt a policy of making all the data publicly available, but only after six months. A Rosetta campaign would have strong support.

Colin Snodgrass. ESO has two ways of getting telescope time – regular programme time, or through ESA/ESO agreement on Director's time. The telescopes either operate in visitor mode, where observers have whole nights at the telescope, or in service mode where shorter observations are scheduled for remote observers. There was a lot of argument during the meeting as to how any Rosetta campaign would actually be given time.

Jonathan Shanklin and Richard Miles gave talks on amateur work. Jonathan introduced the BAA comet Section and gave an outline of some amateur capabilities. He then focussed on visual observations, as these help define the long term behaviour of comets, and 67P in particular. His analysis of the comets light curve suggested that its intrinsic brightness peaked some 40 days after perihelion and that there was a correlation between the perihelion distance and the comets intrinsic brightness. He noted that the observing circumstances were similar to the 2002 return, when the comet was a morning object and not particularly well placed. The perihelion distance was similar to that of 2009, so a similar light curve was expected.

Richard made a point about technique – if you are sidereal tracking then image for long enough to give exactly 2 or 4 pixel trailing. Longer tracking time is possible when the comet is near a stationary point.

Nick Howes has plans for using the Faulkes Telescope over next few years. It is a 2m telescope. They are using EPOXI model of having a collated central repository. Going to start imaging in the next few weeks [In fact Richard imaged the comet the next day, despite doubts at the meeting that this was possible]. Could get half a day time for imaging! Looking at getting light curve photometry. Involve schools and colleges to get images which are collated. Amateurs elsewhere can do regular monitoring using smaller telescope (some are 1m). Being able to compute rotation of nucleus using rotational gradients and look at pre and post perihelion. ESA needs daily or more frequent images in Sloan R band ($150 dollars for small filter) – amateurs may be able to provide this. Don't need images in real time, but would want alerts of outbursts. Looking at Afp and how it relates to spectral changes. Need FITS images with metadata (ie darks and flats). Osiris will be imaging every day, but not continuously so could miss an outburst. Also would like images of ion tail – broad band images (or blue sensitive) would be helpful. The original shorter exposure frames should be kept, so that if a tail is detected any features can be traced. Another attraction is getting your name on a professional paper. Would be nice to have observations with two Osiris filters to complement the spacecraft in addition to the R – this would need to be on a single telescope at an optimum location – probably Faulkes north. Limit is 28° elevation and 50 degrees elongation. This constrains observations to start late March 2014 to end of October 2014 and late August 2015 and can run to the end of July 2016. ESA/MPI can probably provide funding to purchase such filters for amateur European observers.

Publicity for the general public need twitter feeds etc. For a community event you need an additional carrot to bring in additional people. It might be possible to get COST funding [EU] to provide travel grants. RAS might provide grants for speakers. Astrofest might be a carrot and we could have meeting "European Comet Workshop" in BH. Rita would come and give a talk as Rosetta Science Manager. Possibly arrange for discounts from manufacturers. Need ESO input for database, and perhaps have a web page for announcements etc. Really need positive collaboration for publishing papers – perhaps carrot of having earlier access to data and perhaps find something new, then working with professional to research what has been found. Also has potential for undergraduate projects.

UK based observers won't be able to do much until August 2015, when the comet is already bright. Those using remote telescopes could pick it up sometime between March and September 2014, when it may be around 19th magnitude.

Various discussion groups reported their conclusions. ESO should initially concentrate on mission support with astrometry and monitoring of the start of activity, perhaps once a fortnight. In 2014 March to October they would move to more complex imaging, with spectral observations. Northern Hemisphere is constrained by low declination of the comet. In 2013 should concentrate on optical imaging for astrometry and photometry, perhaps once per week. Need to know when the comet turns on. In 2014 continuing monitoring and begin infrared and spectroscopic work. Ideally make daily observations in November at the time of landing. 2015 will see continued monitoring and much more complex science observations.

Anita Heward from the Europlanet media centre spoke about outreach activities. Good internal communications lead to good external communications. Need to start planning how to communicate with media now. The media centre can co-ordinate. Different types of outreach are needed for different countries (because each country in Europe has different styles), and need to be localised. DLR made a Lego model of the lander.

Faulkes Telescope
http://www.faulkes.com/dfet/index.php/faulkes-telescope-project

Nick Howes spoke about Faulkes observations of 67P, mostly by schools, mostly UK but across Europe. The project has set up observation guides. An aim is to confirm the rotation rate using schools themed observing days. They will also use rotational gradient filters to look at jet structure and monitor for short term variability and outbursts. All data is publicly available in real time. They will work with the CARA group and Spanish group. They can react quickly to requests. Nick has extensive press contacts and is familiar with social media. This may focus on communication and the glory of publicity rather than the actual science, but it produces results. Also this will reach the next generation of astronomers. Faulkes has had most success when focussing on near solar system objects. The project needs advice on what science to focus on in schools context. When the comet is brighter the use of interference filters may be possible. There is a need to be inclusive of non-European amateurs.

Steve Miller commented that most UK journalists go to NASA for material, rather than going to ESO or ESA for European stories [Though the Europlanet Media Centre does just regurgitate NASA material, cf Wild2 - Ed]. He also noted that there is a lack of clarity over who has the power to authorise press releases. Osiris seems to have power to issue its own releases, however Rosetta has to put things out after sanction by the Press Office.

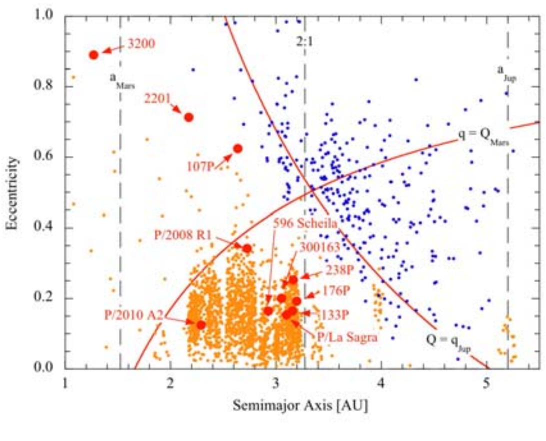
In a summary session Colin Snodgrass described observation plans. There are possibilities for space based systems (eg Dawn, Deep Impact etc) to observe the comet. For the professional community there is the issue of whether to go for separate science proposals or a single community survey. Then there is the issue of co-ordinating observatories. Rita Schulz hopes to take a lead. Who will fund future co-ordination meetings ? The professionals also need to prepare submissions for what support observations (as opposed to science observations) are needed. The 2013 European Planetary Science Congress is at UCL from 8 - 13 September and will have a Rosetta session, and probably other comet sessions. The 2012 meeting is in Madrid. Alan FitzSimmons noted that there are some missions with open time (eg HST), and space missions which require PI intervention, which could contribute to Rosetta support.

Observing Projects with Asteroid-Comet Connections

(A joint meeting of the BAA Comet Section and Asteroids & Remote Planets Section)

Richard Miles of the ARPS did all the hard work of organising venue and speakers for what proved to be an informative and educational meeting. An audience of nearly 70 assembled in the Berrill Lecture Theatre at the Open University in Milton Keynes on 2012 October 6. Richard had organised a format of many short talks, and this worked very well.

Richard Miles, Director of ARPS, began proceedings with a talk on *Icy asteroids and rocky comets: an introduction*. Brian Marsden had noted in 1969 that 28P/Neujmin and 49P/Arend-Rigaux might be transition objects. At that time it was thought that comet orbits were unstable whilst asteroid orbits were stable.



David Jewitt had published a paper (see for example http://www2.ess.ucla.edu/~jewitt/mbc.html) on what he described as "Main Belt Comets", which showed several comets with asteroidal orbits in the main belt, in particular with orbits with the Tisserand criteria with respect to Jupiter being greater than 3. Cometary activity could be caused by: a) Sublimation, e.g. asteroids (24) and (65) have evidence for water, b) rotational breakup, c) collision e.g. 2010 A2 (P/LINEAR) and (596) Scheila. 2010 R2 (P/La Sagra) was a typical MBC. 107P/Wilson-Harrington was a dead comet, as no activity had been seen since 1949. No cometary activity has been seen in (3200) Phaethon but it is linked to the Geminid meteors.

Jonathan Shanklin, Director of the Comet Section, followed with an introduction to *Comets, quasi-comets and the Comet Section*. He began with a short introduction to the Section, then moved on to describe how Section visual observations of Rosetta target 67P/Churyumov-Gerasimenko had been used to construct light curves. It is a relatively "new" periodic comet having entered the present orbit in 1959, and the perihelion distance of the comet has varied slightly since the discovery apparition. The comet is usually intrinsically at its brightest some 40 days after perihelion, and seems to be intrinsically brighter when the perihelion distance is smaller. He then gave an overview of the prospects for the two potential "Great" comets of 2013, 2011 L4 (PanSTARRS) and 2012 S1 (ISON). One memorable observation that he had made concerned 1998 K5 (LINEAR), which appeared nearly asteroidal during a close approach to the Earth, but become more diffuse as its distance increased. He also drew attention to the point that comets could outburst at more or less any time, so that an apparently dead asteroidal object could suddenly show its cometary nature. He noted several recent comets that had originally been designated as asteroids, and also several asteroids which had cometary orbits.

Simon Green, Senior Lecturer in Planetary and Space Sciences at the OU spoke about *Sample return from asteroids and comets*. He began by asking the question of Why study asteroids and comets? They retain information about the early solar system; comets from the outer part, asteroids from the inner part. They also contain material that pre-dates the solar system. They show how planets form. They create an impact hazard, but may have seeded life. Space missions allow direct resolution of craters, activity etc. We have imaged around a dozen objects. Each one tells us something new. Comets are hard to get to and are active. Stardust collected 4mg of material whilst doing a flypast, but Rosetta will land and do in-situ observations, which is much more difficult. Stardust particles include high temperature grains which are crystalline, which implies a high temperature origin, so there must have been some mixing between inner and outer solar system. The Rosetta instrumentation is a compromise – its resolution is limited, and uses 20 year old technology to answer a 20 year old question. We really need samples in laboratories and take time for detailed analysis, and also store samples for future technology. Whilst meteorites are samples of asteroids, they are difficult to compare as asteroids are subject to space weathering. Fragile objects don't survive entry through earth's atmosphere. The Tagish Lake meteorite samples, even though collected and bagged very quickly after their fall, were contaminated by skidoo exhaust. Even more fragile specimens would not survive re-entry. Hayabusa did pick up grains from S-type asteroid (25143) Itokawa, but we need to go to a primitive asteroid. The NASA mission OSIRIS-REx will be launched in 2016 to carbonaceous asteroid (101955). Marco Polo is an ESA mission to return 100g from a near-Earth asteroid. Samples will tell us much about processes.

The speakers outside the OU

Stephen Lowry, Lecturer in Astronomy and Astrophysics at the University of Kent, covered *YORP and other perturbation effects affecting asteroids and comets*. He works on a range of programs from ground based observation, space telescope and space missions. Solar radiation can change the rotation of an asymmetric body by reflection, and also by absorption and re-emission of thermal radiation. This also changes the object's surface properties. The effect is demonstrated by the Koronis family, which have their rotation axes aligned into two groups. YORP can create monolithic fast rotators, fission effects and tumbling slow rotators. The Yarkovsky effect can change the orbit, e.g. (6489) Golevka, as can outgassing. YORP can explain the shape of small rubble pile asteroids and their binary nature by acting over millions of years, e.g. the "diamond" shape of (2867) Steins. Radar images confirm several similar objects. We see an evolution of the spin rate in 2000 PH_5 over five years which matches that expected from YORP. His group is carrying out a program at ESO over four years to make further detections. YORP might create tails or a coma if it leads to rotational break-up.

Sam Duddy, Post-Doctoral Research Associate at the University of Kent, took this theme a little further with a *Characterisation of unbound asteroid pairs*. Asteroids larger than a few hundred metres don't rotate faster than 2 – 5 hours. This implies that there is a limit on the bulk density which is much smaller than that of meteorites, which implies voids or fissures. Some may be 70% empty space. Radar shows some contact binaries. Itokawa may also be a contact binary. YORP spin-up takes material from the poles to the equator and spins it off. This drift would take place over long timescales, but could occur in discrete surface landslides, which could create a coma. The spun-off material can accumulate to create a satellite. Alternatively a rapidly spinning sphere can disrupt. On occasion a binary can become unbound, particularly if the ratio of relative masses is less than 0.2. At least 35 MBA pairs may have this origin. He is doing a spectroscopic survey to see if they have a similar composition, and have found several that show similar spectra. A few don't, but this could be a snapshot effect of looking at different ends.

Speaking on *Methods common to observing comets and asteroids*, **Nick James** uses a C11, with a 72mm f/6 Megrez refractor to give wide-field imaging for his work. Moving objects need different comparison stars each night. He uses *Astrometrica* as it is one of the best programs ever written. It does astrometry and stacking. Astrometry is very important for NEOs, e.g. to decide radar targets. We need cometary photometry to predict future brightness, but CCD photometry of comets is much harder. What is the reported magnitude ? – nuclear, central, total coma ? Ideally it needs something like *Astrometrica*. There is a utility called FoCAs, which looks at the *Astrometrica* log file and can give box magnitudes out to 60" in 10" steps. The scatter is quite small between observers. Alternatively you could curve fit the coma and integrate. A comet with a tail creates further problems. For a bright object, taking 1/3 second images and stacking is a good technique. *KPhot* is a DOS program that gives a total magnitude.

The final speaker of the morning session was **Graham Relf**, from the BAA Computing Section, who described *New observing aids for asteroids and comets on the Computing Section website*. The website has various aps. There is a quick look at what is observable – clicking near an object gives further information, and scope to generate a chart. There is also an option to display the Kreutz search area. There are charts for all the brighter comets, see http://britastro.org/computing/charts_comet.html

During the lunch break there was an opportunity to view several poster displays that had been brought along, including a display by members of the local Milton Keynes Astronomical Society, an item on the closest approaching comets by Kenelm England, and a display of the work of ARPS members.

Method / Activity	Visual/ Binos	Visual/ telescope	CCD imaging	DSLR imaging	Webcam imaging	On-line images
Observing known comets	x	x	x	x	x	
Observing comets of particular interest	x	x	x	x	x	
Follow-up obs of newly discovered comets			x			
Asteroids that might be comets			x			
Recovery of returning periodic comets			x			
Discovering comets	x	x		x		x
Discovering sungrazers			x			x

[*Slightly modified from Roger's presentation to include sun-skirters and non-group comets.*]

The afternoon session began with **Roger Dymock** describing *Project Alcock: Encouraging comet observations, imaging and discovery*. The idea of the project was to get people out looking at comets, where there is a whole range of possible opportunities. Local societies have members who are keen to follow more serious projects. He presented a matrix showing what was possible with different types of instrument.

Luca Buzzi had specially come from Italy for the meeting and told us about *Finding comets amongst the asteroid population: Project T3*. He is co-ordinator of the T3 Project, which was launched in 2006. The Tisserand parameter was defined by Francois-Felix Tisserand in the second half of the 18^{th} century. Usually T_j for comets is less than 3, but MBC have it greater than 3. There are normally about 30 observable objects that are sufficiently bright and un-numbered. To detect potential cometary activity needs good seeing, a sufficient exposure time to get a good signal to noise ratio and flat and dark fields. Having taken an image the object needs to be checked for a coma compared to stellar images. The Project has found 10 objects that turned out to be comets. They mostly use amateur telescopes, but have access to some professional telescopes, e.g. Faulkes.

By co-incidence **Gareth Williams**, Associate Director of the Minor Planet Center, was in Milton Keynes for his PhD viva. He described the subject of his PhD, *Improving the absolute magnitudes: Correcting the astrophotometry*. MPC minor planets magnitudes are often too bright and accurate to ±0.5. The MPC H photometric magnitudes are offset by about -0.5 at 14^{th} magnitude, and a standard value of the slope parameter, G is used. Historically astrometry was most important, and there was a massive change in accuracy between 1945 and 1990. Now it is time to improve the photometry. Magnitudes are different from different stations, even for asteroids, and often by a magnitude or more. Catalogue magnitudes are often different as well. What was needed was a UBVRI catalogue to 20^{th} magnitude, so he constructed one. He then derived a correction for each astrometric catalogue. This was used to revise WISE albedos, and now the majority of asteroids have albedos less than 0.55, though a few problems remain. A paper is in preparation, and public release will occur after submission of his thesis. Funding of the MPC was by subscription, but NASA had given full funding a few years ago.

Eamonn Ansboro concluded the first afternoon session, with a talk on *Detecting TNOs by occultation methods*. There are four classes of Trans-Neptunian Objects – classical (ecliptic), scattered disc, resonance (Neptune) and oddities. To get full information on size distribution down to 10km would require surveys down to 30^{th} magnitude. The occultation technique could go further. It needs a star with a small angular diameter. Diffraction effects can enhance the apparent size of the TNO. Using a two colour system allows discrimination of occultation events.

After tea, **Richard Miles** gave two short presentations, first on the theme of *Frosty asteroids and Project Themis*. A Nature paper had reported on the detection of ice on (24) Themis. Asteroids brighten above the standard log r rate at low phase angle, to give an opposition brightness surge, which depends on the nature of the surface regolith. The size of the effect increases with the albedo, but there is some scatter. He has preliminary data for 14 asteroids, but using the APASS catalogue will give better results. (7102) Neilbone was found to have a very small opposition effect. Detection needs good photometry, hence the need for APASS. He has tested APASS against a wide-field frame taken using a 105mm aperture f/2.8 Canon lens with an SXVR-H18 camera and V filter from which magnitudes were derived using Astrometrica and the CMC14 catalogue showing no significant discrepancy greater than +/-0.02 mag down to 14.5.

He followed up with Target Asteroids for Spacecraft: Observing opportunities for amateurs. OSIRIS-Rex has a target of (101955) 1999 RQ36. A "Citizen Science Project" has been set up, overseen by Carl Hergenrother and Dolores Hill of the University of Arizona, to encourage amateurs to provide observations of potential target asteroids (contact: Target_Asteroids@lpl.arizona.edu). Only around 300 asteroids have reasonable orbits for a sample return, 27 are greater than 200m and five are carbonaceous. (101955) might be YORP shaped. Hyabusa II is going to 1999 JU_3. The Marco Polo target is 1996 FG_3, which is a binary, but has a relatively high delta V. There may be others that are more suitable, but spectral information is lacking. Josh Hopkins of Lockheed-Martin has asked for follow-up astrometry and photometry of selected targets during favourable observing windows. Some objects on the NEO Confirmation Page also prove to be suitable mission targets and require follow-up observations over the days following their discovery. In a subsequent discussion, Simon Green referred to 2008 EV_5 as a potential alternative target for the Marco Polo mission.


2009 P1 on 2011 September 14 by Graham Relf

Graham Relf has a background in image processing. He showed an image of 2009 P1 (Garradd) which had 600 stars in the frame, but these need removing for photometry. He has written an app to set the stars to background levels, which gives better contours. There was a discussion on coma fitting – visual observers don't often need to take this into account, but removing stars is quite important for fainter CCD objects where stars form a greater percentage of the background. **Gareth Williams** said that two pre-discovery positions of 2012 S1 (ISON) had allowed him to do a full orbit solution, which was essentially parabolic, i.e. 1/a (orig) is essentially 0.

In response to an inquiry from **Jonathan Shanklin**, there was a general feeling that the audience would like specific projects on observing targets. Following the meeting he has set up one for 2013 to follow 2P/Encke, which is described elsewhere. Other future projects will include following comets which have had significant perturbation to their perihelion distance, comets which are potential spacecraft targets and comets which reach low phase angles.

Jonathan Shanklin

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.

Possible Origin of the Damocloids: The Scattered Disk or a New Region? *S. Wang, H.B. Zhao, J.H. Ji, S. Jin, Y. Xia, H. Lu, M. Wang, and J.S. Yao* Research in Astronomy and Astrophys. 12, 1576 (2012 November)

The Damocloids are a group of unusual asteroids that recently added a new member: 2010 EJ_{104}. The dynamical evolution of the Damocloids may reveal a connection from the Main Belt to the Kuiper Belt and beyond the scattered disk. According to our simulations, two regions may be considered as possible origins of the Damocloids: the scattered disk, or a part of the Oort cloud, which will be perturbed to a transient region located between 700 AU and 1000 AU. Based on their potential origin, the Damocloids can be classified into two types, depending on their semi-major axes, and about 65.5% of the Damocloids are classified into type I which mainly originate from the Oort cloud. Whether the Damocloids are inactive nuclei of the Halley Family of Comets may depend on their origin.

A Search for Volatile Ices on the Surfaces of Cold Classical Kuiper Belt Objects *D.M. Wright* M.S. Thesis (2012 May).

The surprisingly complex dynamical distribution of small bodies among and beyond the orbits of the planets has changed our understanding of Solar System evolution and planetary migration. Compositional information about the small bodies in the Solar System provides constraints for models of Solar System formation. According to most models, the Kuiper Belt population known as the cold classicals formed at distances far enough from the Sun for these objects to be composed of an appreciable fraction of volatile ices of diverse composition (H_2O, CO_2, CH_4, light hydrocarbons, e.g. CH_3OH) and their orbits have remained stable. Cold classical objects should still be volatile rich. Broadband data from the *Spitzer Space Telescope* Infrared Array Camera (IRAC) can detect and distinguish between absorptions of relevant ices in the 3-5 μm infrared region. Of the 46 cold classical Kuiper Belt Objects in this study, 35 (78%) objects' surfaces exhibit absorptions from ices or organics in IRAC channel 1 (3.6 μm). The combination of data from IRAC channels 1 and 2 (4.5 μm) provides gross surface composition for six objects with secure observations in both channels. These six objects are observed to have ices or organics on their surfaces; this is the first detection of ices on four of these objects. The surface of (20000) Varuna contains organic material. The surface of (50000) Quaoar is confirmed to be rich in water ice. The surface composition of (19521) Chaos is mixed ice and organics. Mixed ices, with a high fraction of water ice, and other components are on the surface of (119951) 2002 KX_{14}. The surface of (66652) Borasisi is methane rich. Methanol or light hydrocarbons are on the surface of (138537) 2000 OK_{67}. Cold classical objects are found to be volatile rich and of diverse surface composition. The presence of ices and organics indicate these objects formed far from the Sun.

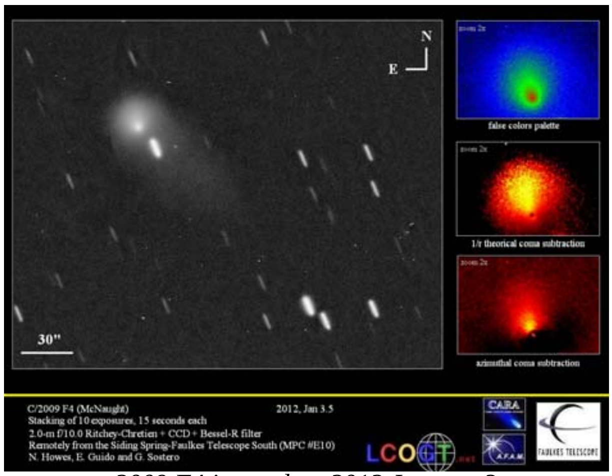
The Christmas issue of Nature includes a note on "**From the Kuiper Belt to comets**" which appeared in *Astrophys. J.* **761**, 150 (2012): A hunt for the smallest members of the Kuiper Belt - a disk of icy cold objects at the Solar System's edge - has revealed a potential source of local comets.

Hilke Schlichting at the University of California, Los Angeles, and her colleagues made use of the Hubble Space Telescope's Fine Guidance Sensors to search the Kuiper Belt. These sensors stabilize the telescope by watching distant stars, which are occasionally eclipsed by a passing Kuiper Belt Object. By trawling more than nine years' worth of data, the team found a single candidate for a new object just 530 metres across. Combining that result with a previous one, the team estimates that small objects in the Kuiper Belt are abundant enough to be the source of the short-period comets observed in the inner Solar System.

Review of comet observations for 2012 January - 2012 December

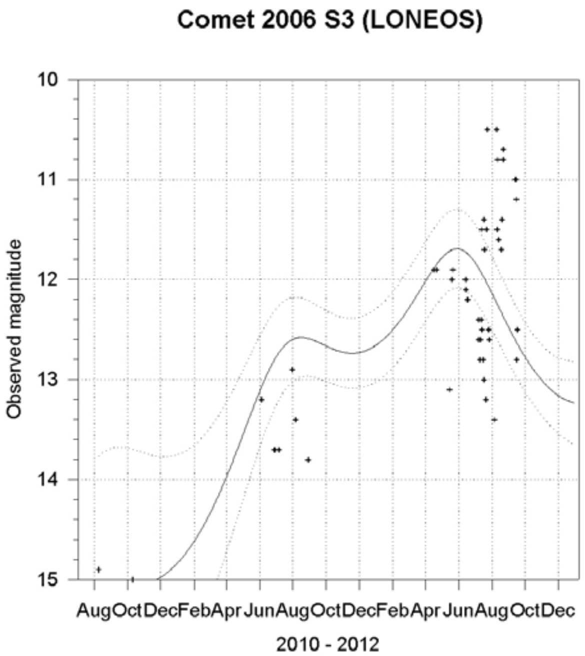
The information in this report is a synopsis of material gleaned from IAU circulars 9250 – 9253 [It is regrettable that CBETs appear to have replaced IAUC], MPECs, some CBETs, The Astronomer (2012 January – 2012 November) and the Internet. It covers comets designated during 2012, and those with visual observations made during the year. Note that the figures quoted here are rounded off from their original published accuracy. Light-curves for the brighter comets are from observations submitted to the Director and TA. A report of the comets seen during the year, including observations published in The Astronomer will be produced for the Journal in due course, though in future these reports will only cover the brighter comets. 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.



2009 F4 imaged on 2012 January 3

2006 S3 (LONEOS) was at perihelion near 5.1 AU in 2012 April and reached around 12th magnitude near the time of perihelion, although there is a large scatter in the observations. It is intrinsically a bright comet, with an absolute H_{10} magnitude of 1.7.

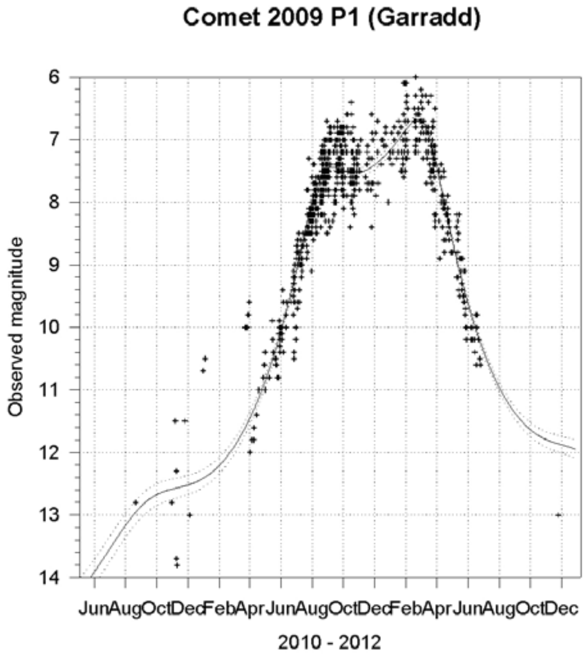


2009 F4 (McNaught) was at perihelion at 5.5 AU in 2011 December. Graham Wolf reported some visual observations in 2012 September, estimating it at around 13.5. See image on page 13.

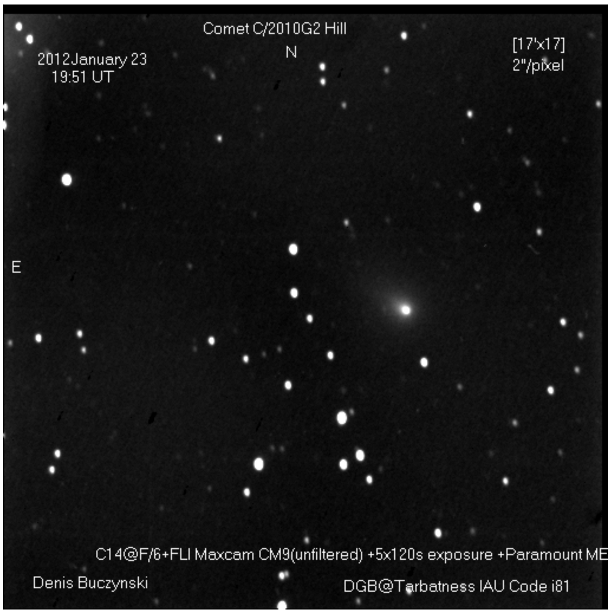
2009 P1 imaged near M92 by Heinz Kerner on 2012 February 2

2009 P1 (Garradd) reached perihelion at 1.6 AU in 2011 December. As 2012 opened it was again approaching the earth, and continued to brighten, reaching a peak magnitude of 6.5. It was well placed for observation from the northern hemisphere, and was well condensed so that there were a few naked eye observations. Most observers however used binoculars, for example Roy Panther used 15x70B on 2012 January 27 when he estimated it at 6.1. It was brightest at the end of February and was fading by the time I returned from the Antarctic in March. The comet was however moving south and northern hemisphere observations ceased after May. Only one observation has been received after solar conjunction, with Seichi Yoshida estimating it at 13.0 on November 24 in a 40cm reflector. Visually the comet showed a short tail when brightest, but most observers saw less than 1°.

The 768 observations received so far suggest an uncorrected preliminary light curve of m = 4.4 + 5 log d + 6.8 log r

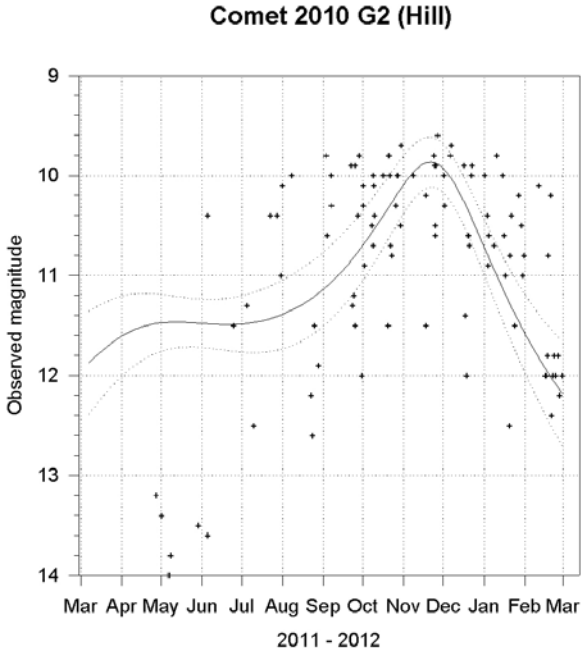


2010 G2 (Hill) was at perihelion at 2.0 AU in September 2011 and it has a period of around 1000 years. The comet may have undergone one or more minor outbursts, but the effect of these is not clear in the overall light curve, which just shows a large scatter, and which is not particularly well fitted by any magnitude equation. It appears to have faded rapidly during the first two months of 2012, and was not seen after February. For light-curve see page 15.



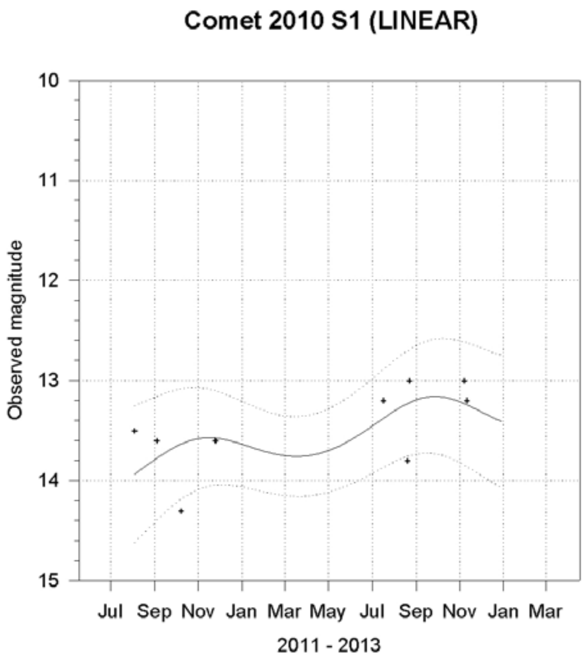
2010 G2 imaged by Denis Buczynski on January 23

2010 R1 (LINEAR) was at perihelion at 5.6 AU in 2012 May. Roger Dymock imaged it in June, when he found a visual equivalent magnitude of around 16.



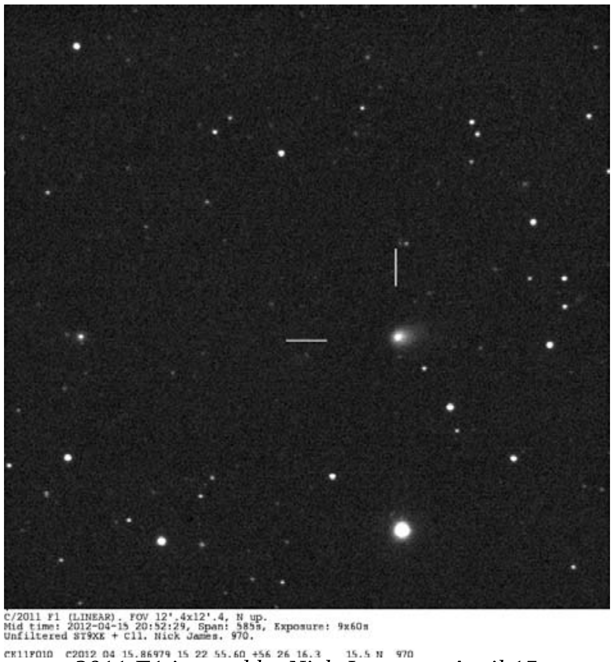
2010 S1 (LINEAR) is another distant comet, and reaches perihelion at 5.9 AU in 2013 May. Visual observations suggest that it was a around 13th magnitude. It will remain around this brightness for some time.

10 observations received so far suggest an aperture corrected preliminary light curve of m = 1.2+ 5 log d + [10] log r

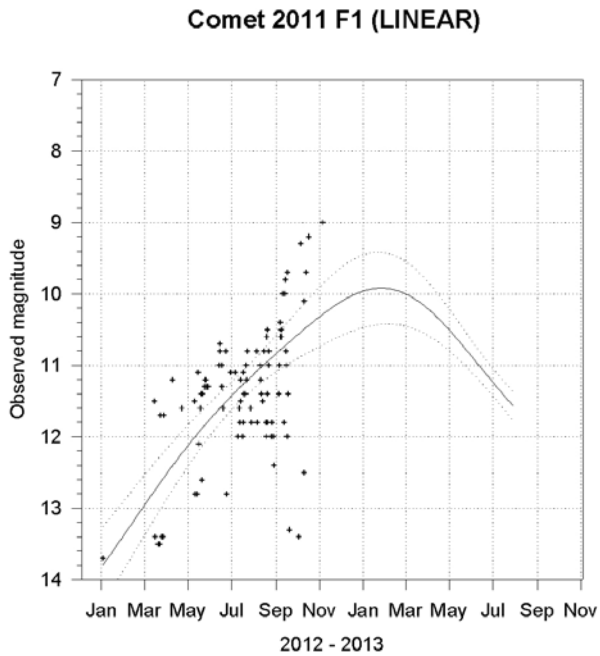


2011 F1 (LINEAR) reaches its 1.8 AU perihelion in January 2013. Visual observations in 2012 show it brightening to around 10th magnitude. It will emerge from solar conjunction in February at near peak brightness, but will remain a southern hemisphere object as it fades.

93 observations received so far suggest a preliminary light curve of m = 6.0 + 5 log d + 6.9 log r



2011 F1 imaged by Nick James on April 15

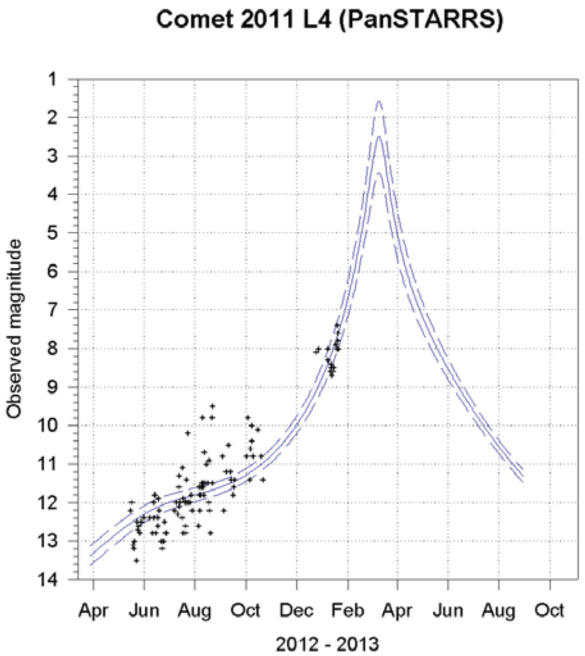


Composite sequence of 2009 P1 by Rolando Ligustri imaged on 2012 March 3, 4, 5 and 6

2011 L4 (PanSTARRS) has perihelion at 0.3 AU in 2013 March. The comet could be a naked eye object from the UK after perihelion.

Visual observations began in 2012 March, when the comet was a stellar 14th magnitude, but by May it had developed a coma, and it was around 12th magnitude by mid year. It continued brightening relatively quickly and by October it was 10th magnitude. Some observers reported brighter magnitudes in August, and they also gave a much larger coma diameter. It is possible that the comet has a larger outer coma that is not visible to observers in less good conditions. Alexander Amorim recovered the comet at 8.1 in his 0.18m reflector on December 24.3.

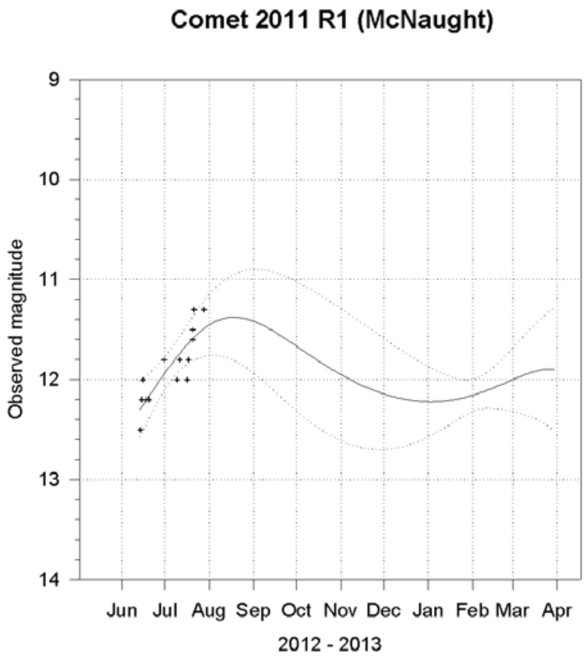
110 observations received so far suggest an aperture corrected preliminary light curve of m = 5.3 + 5 log d + 5.3 log r which gives a peak magnitude of 2. The error bars on the peak magnitude are now only ±1 magnitudes. The predicted peak magnitude is currently becoming fainter as more observations are received. If the outer coma develops significantly then the comet could be brighter than this prediction.



2011 L4 imaged by Rolando Ligustri on 2012 July 7

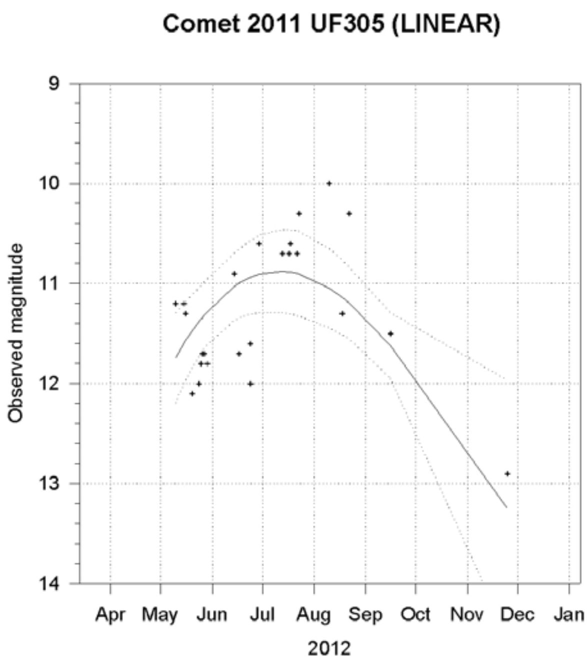
2011 R1 (McNaught) reached perihelion at 2.1 AU in 2012 October and should remain near its current brightness for several more months.

14 observations received so far suggest a preliminary light curve of m = 7.8 + 5 log d + 6.0 log r



2011 UF$_{305}$ (LINEAR) had perihelion at 2.1 AU in 2012 July, when the comet reached around 11th magnitude.

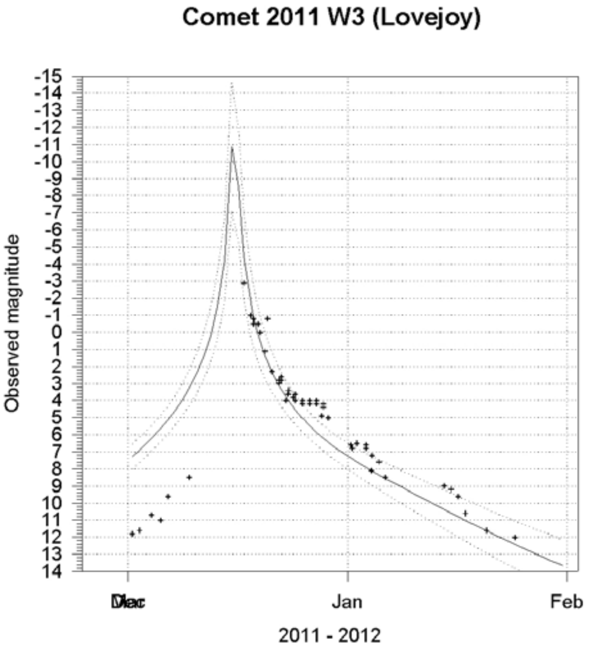
24 observations received so far suggest a preliminary light curve of m = -2.6 + 5 log d + 34.2 log r



2011 W3 (Lovejoy) faded rapidly after its spectacular showing at the end of 2011, ending up being mostly tail. The light curve gives a peak of -11, which is rather similar to that forecast for 2012 S1 (ISON), however the predictions of light curves when comets are close to the sun should not be given too much credence.

Sergei Schmalz reported from the Asteroids Comets Meteors 2012 conference held in Niigata, Japan in 2012

May: *A presentation "A Multiwavelength Investigation of the Remains of the Sungrazing Comet Lovejoy (C/2011 W3)", was given by Matthew Knight. It was interesting to see images of the comet's remains obtained by Hubble, Swift and Spitzer telescope, showing the absence of the nucleus and lots of dust.*



51 observations received suggest a post-perihelion light curve of m = 11.4 + 5 log d + 17.5 log r

SOHO Comets. 219 SOHO and one STEREO comet were discovered during the year. Only three were given identifications. There were 13 non-group, 20 Meyer, six Marsden and four Kracht group comets, the rest being Kreutz group.

The number of Meyer group members discovered is towards the extreme tail of the normal distribution and is the largest yearly total to date. There is speculation that a larger member of the group might be on its way.

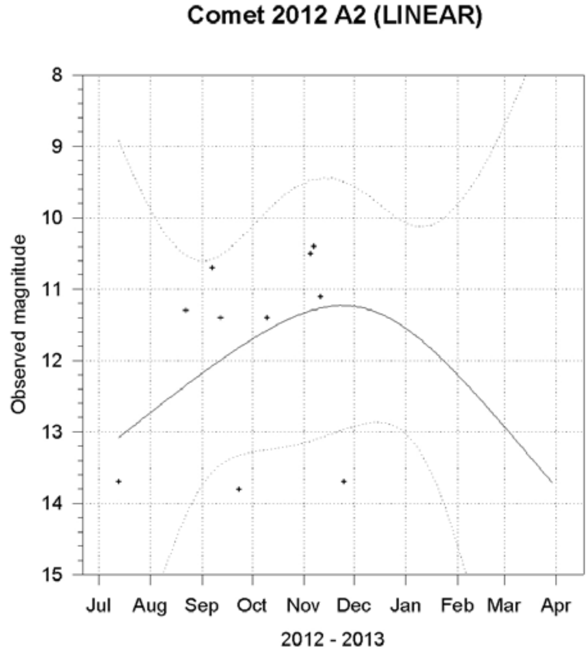
Rainer Kracht suggests that the Kracht group comet discovered on January 18 was a return of 2001 R8, and that it made an approach of 1.02 AU to Jupiter on 2008 March 16

Kracht also suggests possible linkages of the Marsden group comets of April 10 = 2006 E2 = 2000 C4 (or C3) and April 13 = 2005 W5 = 1999 U2. If this second linkage is real he notes a substantial change in period from 5.9 years in 1999 to 6.4 years in 2012. The family tree for these latest objects is not entirely clear, but a linkage to 2000 C3 or 2000 C4 seems probable. Kracht notes that the comet discovered on April 22 has similar elements to the one found in March.

2012 A1 (PanSTARRS) Pan-STARRS discovered a 20th magnitude comet on January 2.45. It will reach perihelion at 7.6 AU in 2013 December.

2012 A2 (LINEAR) LINEAR discovered an 18th magnitude comet on January 15.41. It reached perihelion at 3.5 AU in November. Visual observations show that it peaked at about 11th magnitude in November.

10 observations received so far suggest a preliminary light curve of m = 0.7 + 5 log d + [15] log r



2012 A3 (P/SOHO) On January 19 Alan Watson discovered a fuzzy object with tail in STEREO H1b images from January 17. William Thompson then found images in COR2B. It showed strong forward scattering brightening. Man-To Hui (Cantonese, "Wentao Xu", "Wen-Tao Hsu" in Mandarin) calculated a preliminary parabolic orbit and added astrometric measurements of the COR2B images. Rainer Kracht added STEREO vectors and calculated a short period orbit, which he then linked to 2003 T12 (SOHO), which Brian Marsden had noted might be a short period comet. He suggested that it should also be visible in STEREO images from 2007, and Alan Watson found it in images from November that year. Kracht notes that the comet made an approach to the Earth at 0.18 AU on 2008 January 26. At the time of closest approach it was around -50 declination and near quadrature. The comet has a period of 4.1 years, with perihelion at 0.57 AU.

The comet was first observed from the ground by Hidetaka Sato, using the remote facility at Mayhill, New Mexico. It was around 15th magnitude in the images, but probably brighter visually.

The preliminary designation given by myself (2012 B1) was not issued by the MPC/IAUC. In the event they decided to ignore the discovery and orbit computation sequence because pre-discovery observations made earlier in January became available, and gave the designation of 2012 B1 to the comet discovered by PanSTARRS on January 25.

2012 B1 (P/PanSTARRS) Pan-STARRS discovered a 20th magnitude comet on January 25.52. Pre-discovery images by the University of Szeged, Piszkesteto Stn. (Konkoly) were found from 2011 December 31. It will reach perihelion at 3.8 AU in 2013 July and has a period of around 17 years. Following improvements in the orbit, the comet was reported to have been located in observations made by NEAT in 1997, though the comet has not yet been numbered.

2012 B2 (256P/LINEAR) = 2003 HT_{15} An apparently asteroidal object of 18th magntiude found by LINEAR on 2003 April 26.26 was found to be cometary by Carl Hergenrother on images taken with the Mount Hobkins 1.2-m telescope on 2003 June 24.3. The comet had perihelion at 2.7 AU and a period of 9.9 years.

The comet was recovered at Geisei by observers T. Seki, S. Shimomoto and H. Sato on 2012 January 26.5 using the 0.70-m f/7 reflector + CCD. The return to perihelion is 0.17 days later than the prediction on MPC 69909. The current period is 10.0 years.

2012 B3 (La Sagra) The observing team at OAM Observatory, La Sagra (S. Sanchez, J. Nomen, M. Hurtado, J. A. Jaume, W. K. Y. Yeung, P. Rios and F. Serra) using the 0.45-m f/2. 8 reflector discovered an 18th magnitude comet on January 29.18. It was at perihelion at 3.5 AU in 2011 December.

2012 BJ_{98} (Lemmon) An object reported as asteroidal in images obtained in the second half of January, was identified as cometary in images taken by the Mt Lemmon Survey on March 1, and then linked to images obtained by the Steward Observatory, Pan-STARRS and the Catalina Sky Survey. The comet has perihelion at 2.2 AU in September and has a period of around 70 years.

2012 C1 (McNaught) Rob McNaught discovered a 19th magnitude comet on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on February 5.56. The comet will reach perihelion at 4.8 AU in 2013 February.

2009 P1 imaged near NGC4236 by Rolando Ligustri on 2012 February 13

2012 C2 (Bruenjes) Manfred (Fred) Bruenjes discovered a 15th magnitude comet in CCD data obtained at Moonglow Observatory, Warrensburg on February 11.14. Visual observations in the second half of February give a magnitude of around 11. Further astrometric observations initially suggested a link with comet 1943 R1 (Daimaca), however further astrometry showed that this could not be the case. According to calculations by Hirohisa Sato the orbit is likely be hyperbolic. Perihelion was in mid March at 0.8 AU, but the comet was receding from Earth and faded. The ephemeris suggests that it would have been brightest in late January, though perhaps large and diffuse.

2012 C3 (P/PanSTARRS) Pan-STARRS discovered a 21st magnitude comet on February 15.35. Following confirmation by Giovanni Sostero, Nick Howes and Ernesto Guido using the Faulkes South telescope at Siding Spring, pre-discovery images from late January were found in Mt Lemmon Survey data. The comet was at perihelion at 3.7 AU in 2011 October and has a period of around 30 years.

2012 CH_{17} (MOSS) The Morocco Oukaimeden Sky Survey (MOSS) discovered this comet on February 7.12, though it had earlier been flagged as an asteroid. It reached perihelion at 1.3 AU in September. It was not well placed for observation from the UK. One visual observation put it at 13th magnitude in July.

A/2012 DG_{61} [PanSTARRS] This unusual asteroid was discovered by the Pan-STARRS 1 1.8m Ritchey-Chretien reflector on February 28.33. It has an orbit with a period of around 5.9 years and perihelion is at 0.85 AU in 2012 July. It can approach Jupiter within 0.25 AU and the Earth to 0.16 AU. The orbit has a Tisserand criterion of 2.75 with respect to Jupiter. It is classed as an Apollo asteroid, with an approximate diameter of 1.7km.

2012 E1 (Hill) Richard Hill discovered a 20th magnitude comet on March 2.48 on images taken during the Mt Lemmon Survey with the 1.5m reflector. It was at perihelion in 2011 July at 7.5 AU.

2012 E2 (SWAN) A comet was reported in SWAN images taken on March 4, 5 and 6 by Vladimir Bezugly on March 8 and was listed on the NEOCP as RMAT012. The comet was another Kreutz group member, and had perihelion on March 15.03. When the comet entered the SOHO field of view it appeared as a bright object, though not exceptional, and faded as it approached perihelion. It is very unusual for a "normal" SOHO Kreutz comet to appear bright in SWAN images, and this might imply that it suffered some disintegration ten days prior to perihelion. There is some speculation that the recent bright objects may imply more to come over the next decade. After an orbit was published on MPEC 2012-F03, Terry Lovejoy re-processed his ground based images from March 10 and noted the presence of a nearly starlike object of 9th magnitude.

2012 E3 (PanSTARRS) Pan-STARRS discovered a 20th magnitude comet on March 14.60. The comet was at perihelion at 3.7 AU in 2011 May.

2012 F1 (Gibbs) Alex Gibbs discovered a 19th magnitude comet in images from the Catalina Sky Survey taken on March 16.28 with the 0.68-m Schmidt. The comet was near perihelion at 2.6 AU.

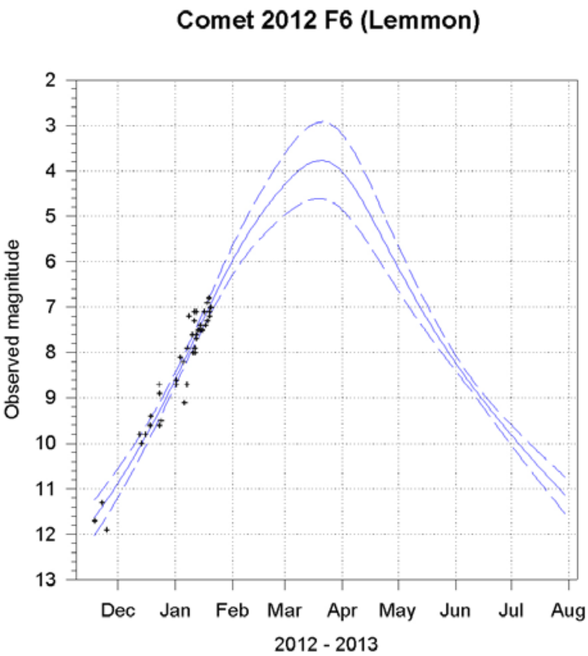
2012 F2 (P/PanSTARRS) Pan-STARRS discovered a 20th magnitude comet on March 16.49. The latest orbit has a period of around 16 years, with perihelion at 2.9 AU in 2013 April.

2012 F3 (PanSTARRS) Pan-STARRS discovered a 21st magnitude comet on March 16.32. Following confirming images taken at Mauna Kea the next day, images of the object were found in Pan-STARRS data from January 19. The comet is at perihelion at 3.5 AU in 2015 April.

2012 F4 (257P/Catalina) = 2005 JY_{126} An 18th magnitude comet found during the Catalina Sky Survey on 2005 June 7.32 was linked to an asteroid detected at the Steward Observatory on May 3.37, and with earlier observations by the Catalina Sky Survey on April 17.40. It reached perihelion in late February 2006 at 2.13 AU and has a period of 7.3 years.

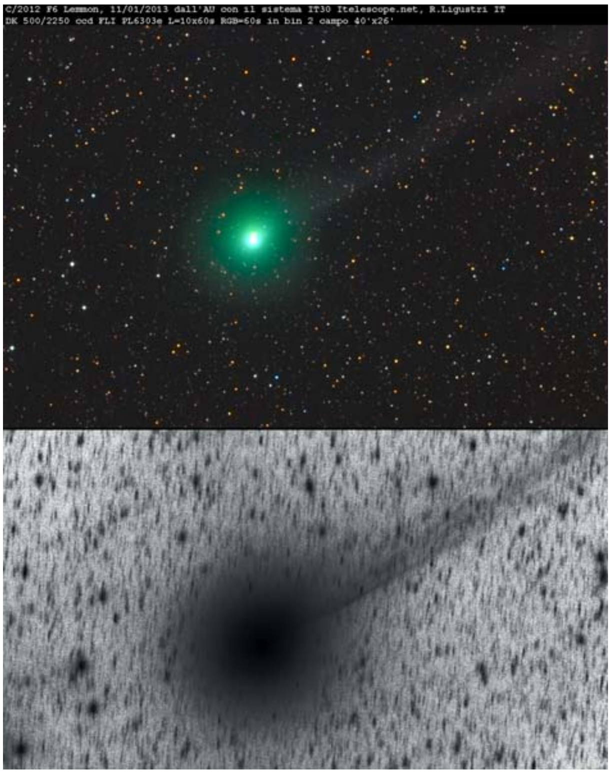
The comet was recovered by G. Sostero, N. Howes, A. Tripp, E. Guido using the 2.0-m Siding Spring-Faulkes Telescope South on 2012 March 21.60. The comet will reach perihelion 0.01 days later than the prediction on MPC 69910.

2012 F5 (P/Gibbs) Alex Gibbs discovered a 20th magnitude comet on March 22.29 on images taken during the Mt Lemmon Survey with the 1.5m reflector. The comet has a period of around 5.2 years and was at perihelion at 2.9 AU in 2010 March. Given the interval since perihelion, it may be in outburst.



2012 F6 (Lemmon) Images taken during the Mt Lemmon Survey with the 1.5m reflector on March 23.21 showed another comet, of 21st magnitude. It reaches its perihelion of 0.7 AU in 2013 March. At discovery it was nearly 6 AU from the Sun. The comet came into visual range in 2012 November but is at a high southern declination. It is poorly placed at perihelion, but UK observers may get it in May when it might be 7th magnitude. A visual observation by Marco Goiato with a 0.22m reflector on November 18 made the comet 11.7, much brighter than expected. Observations in early January put it between 8^{th} and 9^{th} magnitude. The observations suggest that the comet might reach 3^{rd} to 4th magnitude at perihelion.

43 observations received so far suggest a preliminary aperture corrected light curve of m = 5.3 + 5 log d + 8.9 log r



2012 F6 imaged by Rolando Ligustri 2013 January 11

2012 G1 (P/PanSTARRS) Pan-STARRS discovered a 21st magnitude comet on April 13.35. Confirmation was made by other astrometrists amongst whom was a team including Richard Miles, Giovanni Sostero, Nick Howes and Ernesto Guido using the Faulkes North telescope at Haleakala. The comet was at perihelion at 2.6 AU in 2012 June and has a period of around 8.5 years.

A/2012 GS_5 [PanSTARRS] This unusual asteroid was discovered by the Pan-STARRS 1 1.8m Ritchey-Chretien reflector on April 11.39. It has an orbit with a period of 6.3 years and perihelion was at 0.5 AU in 2012 June. It can approach Jupiter within 0.5 AU and the Earth to 0.29 AU. The orbit has a Tisserand criterion of 2.34 with respect to Jupiter. It is classed as an Apollo asteroid, with an approximate diameter of 1.2km.

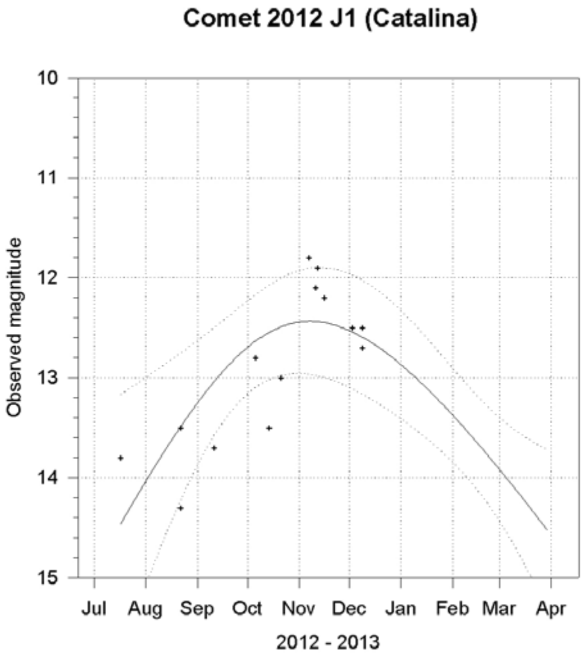
2012 H1 (258P/PanSTARRS) Pan-STARRS discovered a 22nd magnitude comet on 2012 April 27.43. Images of the comet were then found in Mt Lemmon survey data from February 7 and March 28, and Spacewatch data from March 29. The comet was at perihelion at 3.5 AU in 2011 March and has a period of around 9.2 years.

As the orbit became better defined, observations from 2002 were found, confirming the period.

2012 H2 (McNaught) Rob McNaught discovered a 19th magnitude comet on CCD images taken with the

0.5-m Uppsala Schmidt telescope at Siding Spring on April 29.37. The comet was near perihelion at 1.7 AU.

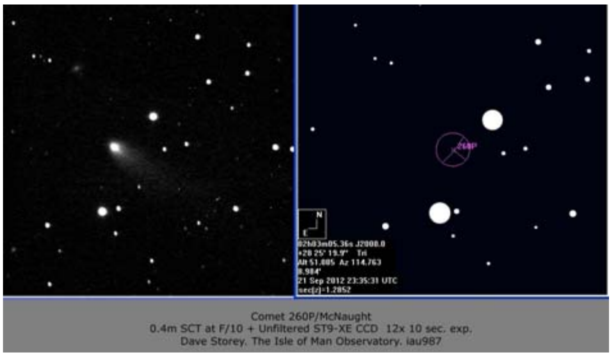
A/2012 HD$_2$ [Spacewatch] This unusual asteroid was discovered at the Steward Observatory, Kitt Peak by Jim Scotti with the 0.9m Spacewatch reflector on April 18.28. It has a period of over 400 years and perihelion was at 2.55 AU in 2012 August. It has a retrograde orbit, with aphelion at over 120 AU. The orbit has a Tisserand criterion of -0.94 with respect to Jupiter. It is classed as a Cubewano or scattered disk object, with an approximate diameter of 5.2km.



2012 J1 (Catalina) A 17th magnitude object found in images from the Catalina Sky Survey taken on May 13.44 with the 0.68-m Schmidt was found to show cometary features by other observers. The comet reached perihelion at 3.2 AU in December, but was brightest at 12th magnitude a month earlier.

13 observations received so far suggest a preliminary light curve of m = 3.2 + 5 log d + [15] log r

2012 K1 (PanSTARRS) Pan-STARRS discovered a 19th magnitude comet on May 17.55. The comet has perihelion at 1.1 AU in 2014 August. It could reach 6th magnitude in the morning sky in October and November 2014.

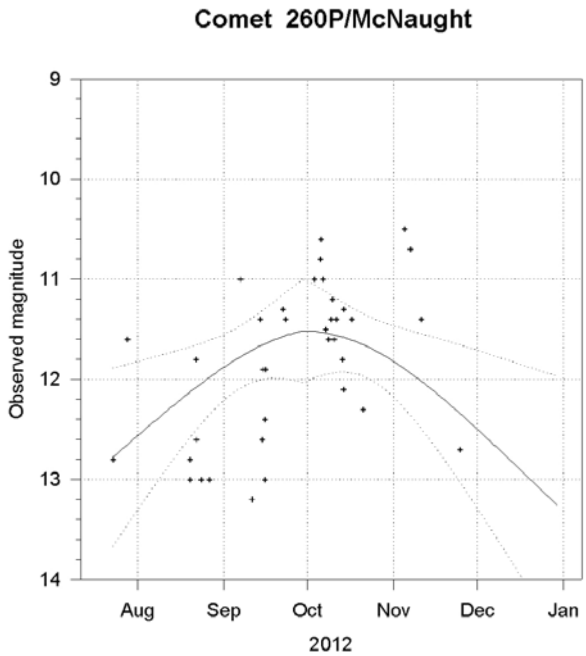


260P imaged by David Storey on 2012 September 21

2012 K2 (260P/McNaught) = 2005 K3 Rob McNaught discovered a comet with the 0.5-m Uppsala Schmidt during the Siding Spring Survey on 2005 May 20.79 and was 17th magnitude at discovery. Its period is 7.1 years with perihelion at 1.51 AU in 2005 August.

260P imaged by Rolando Ligustri on 2012 October 9

The comet was recovered by M Masek with the 0.3m reflector at the Pierre Auger Observatory, Malargue on 2012 May 15.38 and it had perihelion in September, 0.22 days earlier than predicted from the discovery apparition. It reached a peak near 11th magnitude in 2012 October.



36 visual observations give a preliminary uncorrected light curve with a linear fit of m = 13.2 + 5 log d + 0.0145 abs(t-T-17).

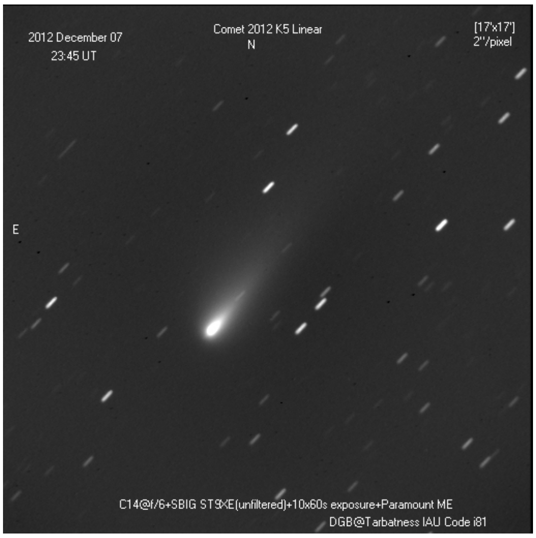
2012 K5 imaged by Rolando Ligustri 2013 January 4

2012 K3 (P/Gibbs) Alex Gibbs discovered a 19th magnitude comet on May 21.35 on images taken during the Mt Lemmon Survey with the 1.5m reflector. The comet has a period of around 6.9 years and was at perihelion at 2.1 AU in 2012 September.

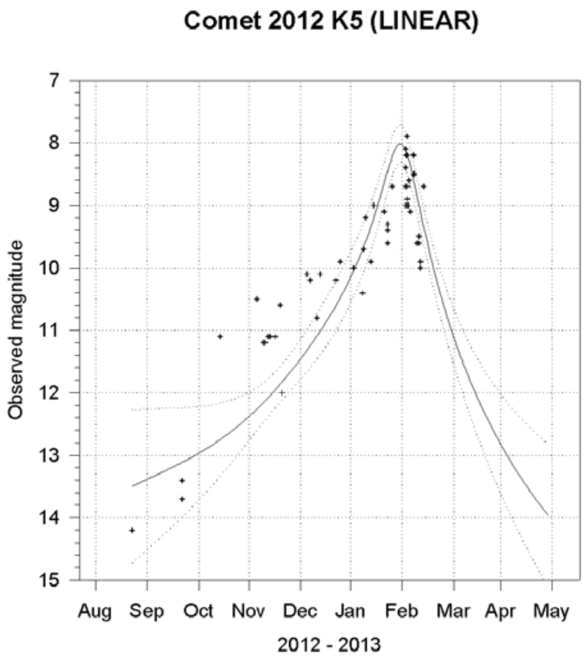
2012 K4 (261P/Larson) = 2005 N3 Steve Larson discovered a 20th magnitude comet during the course of the Mt Lemon Survey on 2005 July 5.38. It was a short period comet with perihelion at 2.2 AU in 2005 December and a period of 6.8 years.

The comet was recovered by Nick Howes, Giovanni Sostero and Ernesto Guido on 2012 May 22.57 using the 2.0-m Faulkes Telescope North when it was 20th magnitude. It reached perihelion in September, 0.27 days earlier than predicted from the discovery apparition.

2012 K5 (LINEAR) LINEAR discovered an 18th magnitude comet on May 25.33. It reached perihelion at 1.1 AU in November but was brightest at 8th magnitude at the end of 2012, and will now fade rapidly. The preliminary orbit was thought to have some similarities with that of 1995 O1 (Hale-Bopp), but this is a completely different comet. I observed it from a dark site outside Cambridge with 20x80B on December 13.18 it was an easy well-condensed object of 9.9. Its appearance changed in the new year, becoming much more diffuse.



A pair of images by Denis Buczynski showing the change in appearance between 2012 December 7 and 2013 January 1



51 observations received so far suggest a preliminary light curve of m = 10.1 + 5 log d + 6.0 log r, though there are systematic residuals, with the comet fainter than the mean curve during December and brighter from September to November, and it may be a linear

type. There are some indications that there might be a discontinuity in the light curve between the end of August and early September.

2012 K6 (McNaught) Rob McNaught discovered a 19th magnitude comet on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on May 27.78. The comet is at perihelion at 3.4 AU in 2013 May.

2012 K7 (262P/McNaught-Russell) Comet 1994 X1 (P/McNaught-Russell) was recovered by Giovanni Sostero, Nick Howes and Ernesto Guido on 2012 May 29.61
using the 2.0-m Faulkes Telescope North. It reached perihelion in December, 0.02 days earlier than predicted from the discovery apparition.

Although not observed visually at the discovery apparition, its brightness on the Schmidt plates suggests that it might have been within range and my predictions were based on this assumption. These suggested that it might become visible in 2012 July, and would be at its brightest in November and December, when it was well placed in the evening sky. In the event it wasn't seen visually until early November, when it was 13th magnitude. A month later it had brightened further to 11th magnitude. This behaviour suggests that it may be a comet that shows a linear brightening, so could brighten further. There are unfortunately few observations, so it is difficult to say much about the light curve.

2012 K8 (Lemmon) A distant periodic object discovered during the Mt Lemmon Survey on May 30.35, was shown to have cometary features by other observers. The comet is at perihelion at 6.5 AU in 2014 August.

2012 K9 (263P/Gibbs) = 2006 Y2 Alex Gibbs discovered an 18th magnitude comet on 2006 December 26.49 during the course of the Catalina Sky Survey with the 0.68-m Schmidt. The comet was near perihelion at 1.3 AU, and has a period of 5.3 years.

H Sato recovered the comet on May 16.14, though confirmatory images were not taken until June, when the recovery was announced. The comet was near perihelion at 1.3 AU at recovery.

2012 L1 (LINEAR) LINEAR discovered a 19th magnitude comet on June 1.33. It reached perihelion at 2.3 AU in December, when a visual observation put it at near 14th magnitude.

2012 L2 (LINEAR) LINEAR discovered a 20th magnitude comet on June 1.37. It will reach perihelion at 1.5 AU in 2013 May. Maik Meyer noted that the preliminary orbit had similarities with the orbit of 1785 A1 (Messier-Mechain). It had reached 12th magnitude in early January, and so may reach 10th magnitude by April, but is poorly placed at perihelion.

2012 L3 (LINEAR) LINEAR discovered a 19th magnitude comet on June 10.31. Although the initial orbit suggested a small perihelion distance, the latest orbit shows that it was near perihelion at 3.0 AU.

2012 L4 (264P/Larsen) = 2004 H3 Jim Larsen discovered a 19th magnitude comet in Spacewatch images of 2004 April 22.33. It has an elliptical orbit, with period of 7.7 years and was at perihelion in mid March 2004 at 2.4 AU.

K Sarneczky recovered the comet on 2012 June 15.92 with the University of Szeged 0.60-m Schmidt at Piszekesteto Station (Konkoly), when the comet was some seven months past perihelion. The comet has a period of 7.7 years, and returned to perihelion 1.29 days earlier than predicted from the last apparition.

2012 M1 (265P/LINEAR) = 2003 O2 A 19th magnitude comet was discovered by LINEAR on 2003 July 29.38, although other CCD observers estimated it at 17th magnitude. It reached perihelion at 1.5 AU in early September 2003 and had a period of 8.8 years. Peter Birtwistle imaged it on 2003 July 31.04. It showed a surprisingly long tail, perhaps suggesting a recent outburst.

H Sato recovered the comet on 2012 June 18.43 using the 0.51-m f/6.8 astrograph at the RAS Observatory, Mayhill. The comet was near perihelion and now has a period of 8.7 years.

2012 NJ (P/La Sagra) The La Sagra team reported an asteroid found on images taken on July 13.03, and their positions combined with those from several other observatories lead to the automatic determination of an orbit, which had a high inclination and a period of around 50 years. This was published on July 14. Further observations and indications that the object had a tail lead Gareth Williams to compute a manual orbit for the comet, which was published on July 18. The comet was around a month past perihelion at 1.3 AU and the period is around 25 years. Visual observers found it essentially stellar and no brighter than 14th magnitude in the month after discovery.

2012 O1 (P/McNaught) Rob McNaught discovered a 19th magnitude comet on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on July 18.74. The comet was near perihelion at 1.5 AU and has a period of 6.7 years.

2012 O2 (P/McNaught) Rob McNaught discovered a 19th magnitude comet on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on July 20.60. The comet was around a month past perihelion at 1.7 AU and has a period of around 6.8 years.

2012 O3 (P/McNaught) Rob McNaught discovered an 18th magnitude comet on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on July 23.69. The comet was near perihelion at 1.6 AU and has a period of 9.7 years.

A/2012 OP [Siding Spring] This unusual asteroid was discovered during the Siding Spring Survey with the 0.5-m Uppsala Schmidt on July 16.62. It has a near parabolic retrograde orbit and perihelion was at 3.6 AU in 2012 December. The orbit has a Tisserand criterion of -0.76 with respect to Jupiter. It is classed as a Cubewano or scattered disk object, with an approximate diameter of 10.4km.

2012 P1 (266P/Christensen) = 2006 U5 Eric Christensen discovered an 18th magnitude comet on 2006 October 27.39 during the course of the Catalina Sky Survey with the 0.68-m Schmidt telescope. The comet had a period of 6.6 years, with perihelion at 2.3 AU in mid 2007 January.

Recovery mages were taken at Majdanak on 2012 August 15 by O. Burhonov with the 1.5m Ritchey-Chretien, with confirmation images taken on August 28, and measured by Artyom Novichonok. The comet will reach perihelion 0.21 days early compared to predictions on the MPC.

2012 P2 (268P/Bernardi) = 2005 V1 Fabrizio Bernardi discovered a 20th magnitude comet on CFH telescope images taken on 2005 November 1.62. It had a period of 9.5 years, with perihelion at 2.3 AU in mid August 2005.

David Tholen's team recovered the comet with the 8.2m reflector at Mauna Kea on
2012 August 13.55, when it was 24th magnitude. It doesn't return to perihelion until 2015.

2012 Q1 (Kowalski) Richard Kowalski discovered a 19th magnitude comet during the course of the Mt Lemmon Survey with the 1.5m reflector on August 28.20. It was near perihelion at 9.5 AU at discovery and has a period of around 150 years. The CBET announcing the discovery gave the comet name as LEMMON, whilst the name used here is from the MPEC. The latest orbit from Hirohisa Sato gives the period as around 130 years, with perihelion at 9.5 AU in 2012 February.

2012 R1 (267P/LONEOS) = 2006 Q2 A 19th magnitude asteroid was discovered by LONEOS on 2006 August 29.27 and when posted on the NEOCP was found to show a coma and tail by Peter Birtwhistle and others. The object was at perihelion at 1.3 AU in early September 2006 and had a period of 6.0 years. It was near its brightest and faded after mid September.

The comet was recovered by V. Nevski, D. Ivanov, A. Novichonok and I. Kondratenko on images taken on 2012 September 11.9 with the 0.4m reflector at the ISON-Kislovodsk Observatory. Additional images were taken by Robert Holmes on September 12.3 with the 0.61m astrograph at the Astronomical Research Observatory, Westfield. The comet reached perihelion 0.8 days late in 2012 August compared to predictions on the MPC.

2012 R2 (269P/Jedicke) = 1996 A1 The comet was discovered on 1996 January 14.26 by Victoria and Robert Jedicke with the Spacewatch telescope at Kitt Peak. It was 17th magnitude with a short tail.

The comet was recovered on images taken on 2012 September 11.86 by O Burhonov with the 1.5m Ritchey-Chretien at the Majdanak Observatory and measured by Artyom Novichonok. Additional observations were made at the Steward Observatory, Kitt Peak, later in the month, and the recovery allowed identification of further pre-discovery images taken at the Observatory in 1993 October. The comet will reach perihelion 0.74 days early in 2014 November compared to predictions on the MPC, and has a period of 19.8 years.

2012 S1 (ISON) An 18th magnitude comet was discovered with the 0.4-m f/3 reflector of the International Scientific Optical Network (ISON) at Kislovodsk Observatory, Russia, by observers Vitali Nevski and Artyom Novichonok. Following further positions taken by various astrometrists, including Peter Birtwhistle, the preliminary orbit allowed pre-discovery detections from the Mt Lemmon survey in 2011 December and Pan-STARRS in 2012 January. The comet has a perihelion at 0.012 AU in 2013 November, when it will briefly be a brilliant object. It will pass within 0.1 AU of Mars on 2013 October 3. It is a Sun-skirting comet.

Gareth Williams notes on MPEC 2012-T08 [2012 October 3] that the "original" and "future" barycentric values of 1/a are (1/a)_orig = +0.000058, (1/a)_fut = +0.000008. The small "original" value suggests that this comet has not made a previous visit to the inner solar system, and is a "new" comet from the Oort cloud. It is therefore not a returning comet, as has been speculated.

The comet should emerge from solar conjunction in 2013 September as a 10th magnitude object in the morning sky. It remains in the morning sky, reaching a maximum elongation of 54° towards the end of October, and continues to brighten. It should be a naked eye object by the time it approaches conjunction in late November. It rapidly rounds the Sun and emerges back into the morning sky in early December, becoming visible in the evening sky from mid month. There is a possibility that the tail may be seen in the morning sky from November 30. The comet rapidly moves north, passing only 4° from the pole in early January 2014, when it may still be a naked eye object. Because the comet passes close to the Sun, there is a possibility that it may become very bright. The current magnitude formula gives a peak of -13 around midnight UT on November 28/29, when it is less than a degree from the Sun. It might be visible in daylight from the UK on November 28 or 29 when it could be -6, but at only 3° elongation. The comet passes close to Spica on November 18, and five degrees from M13 on December 22.

2012 S1 imaged by Maurice Gavin on 2013 January 16

There is much media hype surrounding the comet, and much speculation from people who should know better. The quoted peak brightness is based on the standard magnitude law, which in fact few comets follow. It could be brighter than 3rd magnitude for only a week when it is also at an elongation of less than 15° from the Sun (assuming a more conservative magnitude law), compared to 2011 L4 which could be this bright for six weeks and in a dark sky for some locations. Tail development is uncertain, but could be much greater for 2012 S1 than for 2011 L4. It is still on the faint side for visual observation, though visual observers are reporting it at around a stellar 14.5 in early January, when it was at opposition at 170° elongation with a phase angle of 2°.

2012 S2 (P/La Sagra) The observing team at OAM Observatory, La Sagra (S. Sanchez, J. Nomen, M. Hurtado, J. A. Jaume, W. K. Y. Yeung, P. Rios, F. Serra and T. Valls) using the 0. 45-m f/2. 8 reflector discovered an 18th magnitude comet on September 23.07. It was at perihelion at 1.4 AU in mid August and has a period of 9.3 years.

2012 S3 (PanSTARRS) Pan-STARRS discovered a 20th magnitude comet on September 27.30. It will reach perihelion at 2.3 AU in 2013 August.

2012 S4 (PanSTARRS) Pan-STARRS discovered a 19th magnitude comet on September 28.41. It will reach perihelion at 4.3 AU in 2013 June.

2012 S5 (270P/Gehrels) = 1997 C1 Tom Gehrels discovered this comet by eye during the course of the Spacewatch survey.

The comet was recovered on images taken on 2012 September 25.38 by the Mt Lemmon Survey with the 1.5-m reflector. The comet will reach perihelion 1.74 days later in 2013 July compared to predictions on the MPC.

2012 SB$_6$ (P/Lemmon) An asteroidal object of 19th magnitude found during the Mt Lemmon Survey with the 1.5m reflector on September 17.42, was later seen to have cometary characteristics. Images taken shortly before discovery by the Catalina Sky Survey were also found. The comet was near perihelion at 2.4 AU and has a period of around 7.7 years.

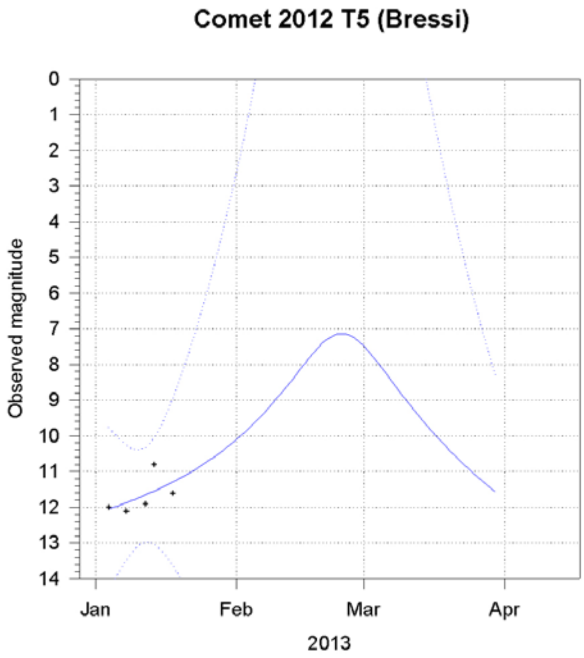
2012 T1 (P/PanSTARRS) Pan-STARRS discovered a 21st magnitude comet on October 6.53. Confirmation was made by astrometrists from the T3 group. Archival observations from Pan-STARRS were found from 2011 July. The comet was at perihelion at 2.4 AU in 2012 September and has a period of around 5.6 years. It is a Main Belt Comet.

2012 T2 (P/PanSTARRS) Pan-STARRS discovered a 21st magnitude comet on October 10.36. Confirmations included measurements by several amateur astrometrists. It is a Main Belt Comet. Hirohisa Sato provides an improved orbit which has perihelion at 4.8 AU in 2013 April and a period of around 14 years.

2012 T3 (P/PanSTARRS) Pan-STARRS discovered a 21st magnitude comet on October 10.35. Confirmations included measurements by several amateur astrometrists. The comet was at perihelion at 2.4 AU in 2012 April and has a period of around 15 years.

2012 T4 (McNaught) Rob McNaught discovered an 18th magnitude comet on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on October 13.43. The comet was near perihelion at 2.0 AU.

2012 T5 (Bressi) Terry Bressi discovered a 19th magnitude comet on October 14.42 on CCD images taken with the 0.9m Spacewatch reflector at Kitt Peak. The comet reaches perihelion at 0.3 AU in 2013 February, when it could be 7th magnitude. Unfortunately it is intrinsically faint and will be too far south for UK observers prior to perihelion, and too faint when it emerges into UK skies after solar conjunction. The error bars are however extremely large, so things may change. Juan José González Suárez and Carlos Labordena observed it in early January, when it was 12th magnitude.



2012 T6 (Kowalski) Richard Kowalski discovered a 17th magnitude comet on October 16.46 on CCD images taken during the Mt Lemmon Survey with the 1.5m reflector. Pre-discovery images were found in Catalina Sky Survey and LINEAR data from the day before. The comet was at perihelion at 1.8 AU in August. It has a period of around 50 years.

2012 T7 (P/Vorobjov) Tomas Vorobjov discovered a 20th magnitude comet on October 15.37 on CCD images taken with the 0.81m f/7 Ritchey-Chretien at the Mount Lemmon SkyCenter. The comet is at perihelion at 3.9 AU in 2013 January and has a period of 12.5 years. As the orbit improved, pre-discovery images taken by the Mt Lemmon Survey in 2011 November were found. Rob Matson then found and measured images taken by NEAT in 2000 December and 2001 January.

2012 TK$_8$ (P/Tanagra) A 20th magnitude asteroidal object discovered at the Tanagra Observatory on October 6.32 by Michael Schwartz and Paulo Holvorcem was subsequently shown to be a comet. It reaches perihelion at 3.1 AU in 2013 May and has a period of around 8.6 years.

2012 TB$_{36}$ (271P/van Houten-Lemmon) = 1960 S1 An asteroidal object of 21st magnitude found during the Mt Lemmon Survey with the 1.5m reflector on September 17.35, was later seen to have cometary features.

Immediately following publication of the MPEC announcing the discovery, Maik Meyer suggested an identity with P/van Houten (1960 S1), and Gareth Williams then computed a linked orbit. The comet is at perihelion at 4.2 AU in 2013 July and has a period of 18 years. Jovian perturbations have increased the period from 15.8 years in 1960, and increased the perihelion distance from 3.9 AU. The comet was only observed for a month in 1961 and the date of perihelion was 6 days out, and the period 70 days too short.

A/2012 TA$_{53}$ [Mt Lemmon] This unusual asteroid was discovered the Mt Lemmon Survey with the 1.5-m reflector on October 8.24. It has an orbit with a period of around 6.3 years and perihelion was at 1.4 AU in 2012 September. It can approach Jupiter within 0.22 AU and the Earth to 0.42 AU. It has an approximate diameter of 380m. The orbit has a Tisserand criterion of 2.85 with respect to Jupiter.

A/2012 TL$_{139}$ [PanSTARRS] This unusual asteroid was discovered by the Pan-STARRS 1 1.8m Ritchey-Chretien reflector on October 9.56. [MPEC 2012-T75, 2012 October 13]. It has a retrograde orbit with a period of around 160 years and perihelion was at 3.5 AU in 2012 October. It has an approximate diameter of 7.2km. The orbit has a Tisserand criterion of -2.00 with respect to Jupiter.

2012 U1 (PanSTARRS) Pan-STARRS discovered a 21st magnitude comet on October 17.39. It will reach perihelion at 5.3 AU in 2014 July.

2012 U2 (P/PanSTARRS) Pan-STARRS discovered a 19th magnitude comet on October 20.35. It reached perihelion at 3.5 AU in 2012 December and has a period of around 20 years.

2012 US$_{27}$ (P/Siding Spring) This unusual asteroid was discovered during the Siding Spring Survey with the 0.5-m Uppsala Schmidt on October 17.58. [MPEC 2012-U49, 2012 October 20].

In November, further observations at Siding Spring showed that it had cometary features and it was reclassified. It has a period of around 12 years and perihelion is at 1.8 AU in 2013 February.

A/2012 UU$_{27}$ [LINEAR] This unusual asteroid was discovered during the LINEAR Survey with the 1.0-m reflector on October 16.31. [MPEC 2012-U52, 2012 October 20]. It has a period of around 9.1 years and perihelion was at 1.6 AU in 2012 December. It has an approximate diameter of 1.4km. The orbit has a Tisserand criterion of 2.00 with respect to Jupiter and approaches to within 0.5 AU of the planet.

A/2012 US$_{136}$ [Mt Lemmon] This Apollo asteroid was discovered the Mt Lemmon Survey with the 1.5-m reflector on October 21.09. [MPEC 2012-U84, 2012 October 24]. It has an orbit with a period of around 8.9 years and perihelion was at 0.38 AU in 2012 September. It can approach the Earth to 0.0850 AU. It has an approximate diameter of 4.4km. The orbit has a Tisserand criterion of 1.61 with respect to Jupiter.

2012 V1 (PanSTARRS) Pan-STARRS discovered a 20th magnitude comet on November 3.34. It will reach perihelion at 2.1 AU in 2013 July.

2012 V2 (LINEAR) LINEAR discovered a 19th magnitude comet on November 5.08, at relatively high northern declination. It will reach perihelion at 1.5 AU in 2013 August. It is poorly placed at perihelion, though might reach 12th magnitude, and then moves to high southern declination.

2012 V3 (272P/NEAT) = 2004 F1 The Near-Earth Asteroid Tracking project discovered a faint comet on 2004 March 18.31 on CCD images taken with the 1.2-m Palomar Schmidt telescope. Pre-discovery observations were found back to 2003 December 1 and these showed that the comet was in a 9.5 year periodic orbit, with perihelion in mid October 2003 at 2.45 AU.

The comet was recovered on images taken on 2012 November 12.49 by the Mt Lemmon Survey with the 1.5-m reflector. The comet will reach perihelion 1.0 days earlier in 2013 February compared to predictions on the MPC.

2012 V4 (273P/Pons-Gambart) = 1827 M1. Rob Matson discovered a comet in SWAN images taken on November 7, 10, 11, 13 and 19 on November 29, and this was quickly confirmed in ground based images taken by Terry Lovejoy on November 29.40. The comet was around 10.5 in his images. Maik Meyer and independently, Gareth Williams, suggested an identity with D/Pons-Gambart (1827 M1), which itself had been linked to a comet seen in 1110 in China and Korea. At the 1827 return the comet had an absolute magnitude of 7, whereas the preliminary estimate for the current return is 9.5, based on an assumed 15 log r brightening rate. A possible explanation for the difference, first suggested by Jakob Cerny, is that the comet has a linear light-curve and is brightest after perihelion. The comet reached perihelion at 0.81 AU on December 19 and is in a retrograde orbit with a period of 188 years. Despite the computation of an orbit based on the SWAN data, the name SWAN has not been incorporated into the comet name.

Gareth Williams notes on MPEC 2012-X14 [2012 December 5] that *These orbital elements, like those on MPEC X02, assume that C/2012 V4 is a return of D/1827 M1 (Pons-Gambart). Whereas that earlier orbit assumed that there were two missed returns between 1827 and 2012, the above orbit assumes no missed returns. The much longer period was suggested by the current observations not being well fit to orbital periods of ~62 and ~94 years. Noting the obvious discordance between the two E27 observations on Nov. 29, the semi-major axis fit by the 2012 observations alone is at least 26 AU, discounting the two-and three-missed revolution solutions. At the present time, the solution presented here is believed to be correct, as the fit of the bulk of the 1827 observations (known to be grossly inaccurate by modern standards) is far better than earlier attempts with shorter orbital periods. There is a slight systematic trend in the current residuals, which may be related to observation weighting. Continued observation is clearly desirable.*

The latest orbit by Hirohisa Sato, based only on the 2012 observations, gives a period of 196 years, ie the last perihelion was in 1819. Forcing a fit to 1827 M1 increases the residuals of the modern observations. This could imply that there are significant non-gravitational forces acting, or that possibly the comet split at some point in the past and this is not a return of the comet seen in 1827. This might explain the apparent discrepancy in absolute magnitude.

The comet emerges from conjunction towards the end of January for visual observers as an 11th magnitude or brighter object. CCD imagers may be able to get it earlier, and Richard Miles demonstrated that observations can be made in conditions when visual observation is virtually impossible, with images of the comet taken from the UK on December 5. In fact Juan José González recovered it on January 20.27 at 8.7 in his 20cm Schmidt-Cassegrain. The available observations are consistent with no change in brightness during conjunction and it is not currently possible to fit a good light curve.

2012 WX_{32} (274P/Tombaugh-Tenagra) An asteroid was discovered at the Tenagra II observatory by Michael Schwartz and Paulo Holvorcem with the 0.41m astrograph on November 27.50. On December 3 they noted cometary features during follow-up observations and these were confirmed by other observers.

Syuichi Nakano then linked the comet to asteroid 2003 WZ_{141} which was observed by Spacewatch and LINEAR in 2003, and to a comet discovered by Clyde Tombaugh in 1932 on plates taken in 1931 January and which was originally logged as asteroid 1931 AN. Details of the chain of events surrounding 1931 AN are given by Gary Kronk in Volume 3 of Cometography. Gareth Williams then computed an orbit linking the three apparitions. The new orbit is very different to that calculated for 1931 AN, largely on account of large errors in the position from the first of its three plates. The new orbit has the 1931 perihelion at 2.4 AU cf the 0.9 AU calculated from four positions, and is periodic rather than parabolic. The current period is 9.1 years, and this is the 10th return, reaching perihelion in 2013 February. It seems likely that the comet may have outburst in 1931, as it was estimated at 12th magnitude on the plates, some 6 magnitudes brighter than suggested by the ephemeris. Alternatively it may have a linear type light curve.

2012 WA34 (P/Lemmon-PanSTARRS) An asteroid was discovered during the Mt Lemmon survey on November 26.40 and by PanSTARRS on 2013 January 7.24 when cometary features were noted. Additional observations from PanSTARRS from 2011 September were then found. It has a period of 10.5 years, with perihelion at 3.2 AU in 2013 January.

A/2012 WJ_4 [LINEAR] This unusual asteroid was discovered during the LINEAR Survey with the 1.0-m reflector on November 19.13. [MPEC 2012-W35, 2012 November 23]. It has a period of around 5.6 years and perihelion was at 1.3 AU in 2012 December. It has an approximate diameter of 1.7km. The orbit has a Tisserand criterion of 2.83 with respect to Jupiter and approaches to within 0.5 AU of the planet.

2012 X1 (LINEAR) LINEAR discovered a 19th magnitude comet on December 8.39. It will reach perihelion at 1.6 AU in 2014 February, when it may reach 12th magnitude.

2012 X2 (PanSTARRS) Pan-STARRS discovered a 19th magnitude comet on December 12.53. It reaches perihelion at 4.7 AU in 2013 March and has a period of about 90 years.

A/2012 XE_{55} [LINEAR] This unusual asteroid was discovered during the LINEAR Survey with the 1.0-m reflector on December 6.39. [MPEC 2012-X41, 2012 December 10, JPL 15-day orbit]. It has a period of around 6.1 years and perihelion is at 1.3 AU in 2013 January. It has an approximate diameter of 720m. The orbit has a Tisserand criterion of 2.64 with respect to Jupiter and approaches to within 0.3 AU of the planet.

A/2012 XF_{112} [PanSTARRS] This Amor asteroid was discovered by the Pan-STARRS 1 1.8m Ritchey-Chretien reflector on December 10.46. [MPEC 2012-X74, 2012 December 13]. It has an orbit with a period of 5.7 years and perihelion is at 1.2 AU in 2013 January. It has an approximate diameter of 720m. It can approach Jupiter within 0.1 AU and the Earth to 0.19 AU. The orbit has a Tisserand criterion of 2.83 with respect to Jupiter.

A/2012 XM_{134} [Mt Lemmon] This Apollo asteroid was discovered the Mt Lemmon Survey with the 1.5-m reflector on December 13.18. [MPEC 2012-X93, 2012 December 14]. It has an orbit with a period of around 6.0 years and perihelion was at 1.0 AU in 2012 November. It can approach the Earth to 0.0382 AU and Jupiter to 0.3 AU. The orbit has a Tisserand criterion of 2.68 with respect to Jupiter. It has an approximate diameter of 200m.

2012 Y1 (LINEAR) LINEAR discovered a 19th magnitude comet on December 18.26. It reaches perihelion at 2.0 AU in 2013 January.

2012 Y2 (275P/Hermann) = 1999 D1 S M Hermann of the LONEOS team discovered a comet on images taken on February 20.4 [IAUC 7111, 1999 February 20]. It is an intrinsically faint short period comet and was predicted to return on 2012 December 18.4.

Pan-STARRS discovered a 20th magnitude comet on December 22.61. Following posting on the NEOCP and confirmation by T. Linder and R. Holmes at Cerro Tololo with the 0.41-m f/11 Ritchey-Chretien, Gareth Williams and Maik Meyer linked it to 1999 D1 (P/Hermann). The comet reaches perihelion at 1.6 AU on December 27.3 and has a period of around 14 years.

2012 Y3 (McNaught) Rob McNaught discovered a 15th magnitude comet on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on December 30.58. The comet was at perihelion at 1.8 AU in August, when it might have been around 13th magnitude. It has a period of around 150 years. This was the 100th comet discovered by the Siding Spring search programme.

A/2012 YN_3 [Catalina] This unusual asteroid was discovered the Catalina Sky Survey with the 0.68-m Schmidt on December 20.32. [MPEC 2012-Y22, 2012 December 23]. It has an orbit with a period of around 6.2 years and perihelion was at 1.3 AU in 2012 December. It can approach the Earth to 0.4 AU and Jupiter to 0.2 AU. The orbit has a Tisserand criterion of 2.74 with respect to Jupiter. It has an approximate diameter of 630m.

A/2012 YO_6 [PanSTARRS] This unusual asteroid was discovered by the Pan-STARRS 1 1.8m Ritchey-Chretien reflector on December 22.40. [MPEC 2012-Y36, 2012 December 29]. It has a retrograde orbit with a period of about 15 years and perihelion is at 3.3 AU in 2012 July. The orbit has a Tisserand criterion of 0.30 with respect to Jupiter. It has an approximate diameter of 7.2km.

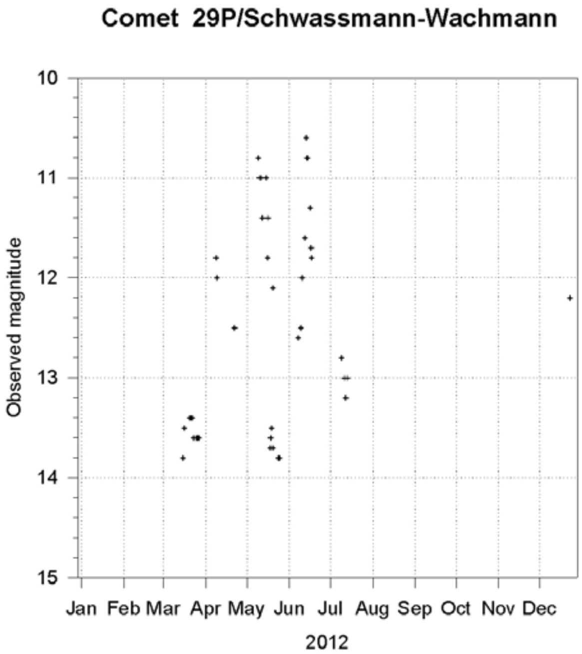
2013 A1 (Siding Spring) An 18th magnitude comet was discovered at Siding Spring on 2013 January 3.54.

Follow-up observations led to pre-discovery observations from the Catalina Sky Survey made on 2012 December 8. It was discovered when still 7.2 AU from the Sun, and does not reach its 1.4 AU perihelion until 2014 October. [MPEC 2013-A14, 2013 January 5] It will be a southern hemisphere object when at its brightest of around 7th magnitude, and will have faded to around 10th magnitude when it enters UK skies in 2015 January.

2013 A2 (P/Scotti) Jim Scotti discovered a 20th magnitude comet in Spacewatch images taken with the 0.9-m f/3 reflector at Kitt Peak on 2013 January 6.29. It has a period of around 8 years and is at perihelion at 2.2 AU in February. The preliminary orbit was based on a two day arc, yet gave values to five significant figures. [MPEC 2013-A45, 2013 January 8]

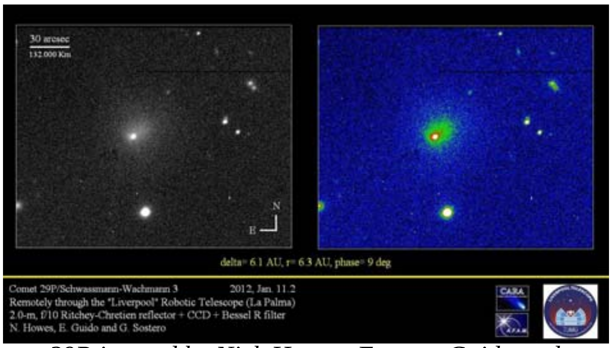
2013 A3 (P/LINEAR) = 2005 YQ_{127}. LINEAR discovered an asteroid of 18th magnitude on 2005 December 28, which had an orbit typical of Jupiter family comets. [MPEC 2006-A07, 2006 January 2, 5-day orbit]. It can approach within 0.3 AU of Jupiter. As an asteroid it was estimated to be around 6km in diameter. Further observations showed cometary characteristics. Perihelion was at 1.9 AU in early November 2005, and it has a period of 7.6 years.

Jim Scotti recovered 2005 YQ_{127} in Spacewatch II images taken with the 1.8-m f/2.7 reflector at Kitt Peak on 2013 January 7.10. Perihelion is in June, 0.12 days later than predicted from the discovery apparition.



21P/Giacobini-Zinner reached perihelion in 2012 February, but the return was unfavourable. Never-the-less a few observations were made during November when the comet was reported at between 12^{th} and 13^{th} magnitude. By December 22 it had brightened to 9^{th} magnitude.

The 7 observations received to date gave an uncorrected preliminary light curve of 5.4 + 5 log d + 30.8 log r, though the error bars are large as can be seen from the graph.

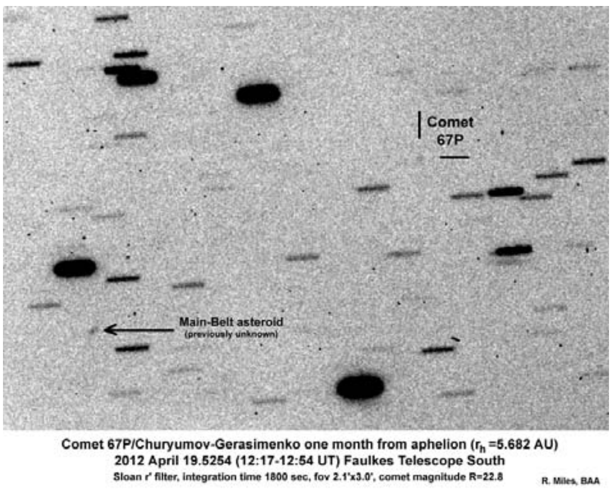


29P imaged by Nick Howes, Ernesto Guido and Giovanni Sostero on 2012 January 11 with the Liverpool Telescope

29P/Schwassmann-Wachmann. The high state of activity continued during the year, with the comet undergoing a series of outbursts between March and July, reaching magnitude 10.5 at the brighter ones.

49P/Arend-Rigaux was at perihelion in 2011 October, and Rolando Ligustri obtained this stunning image on 2012 January 19.

67P/Churyumov-Gerasimenko is the target comet of the Rosetta mission, and thought to have been beyond imaging range this year. Richard Miles proved the professionals wrong by imaging it on April 19 when it was just a month from aphelion.

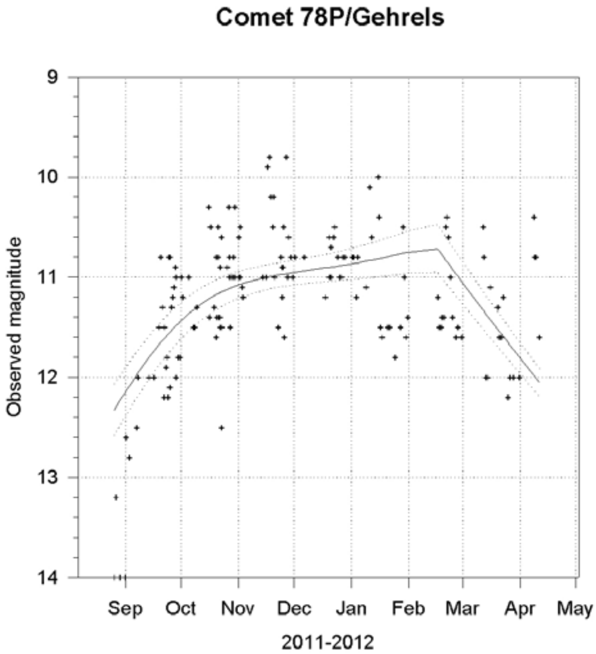


78P/Gehrels Tom Gehrels discovered this comet at Palomar in 1973. Its perihelion distance is slowly decreasing and is currently around the lowest for 200 years. The eccentricity is slowly increasing, with a marked jump in both following a moderately close approach to Jupiter in 1995.

The comet reached perihelion in 2012 January, and was observed until it reached a poor elongation in April. It was too faint for visual observation after conjunction in July. At its best it reached 10th magnitude, again following a linear light curve.

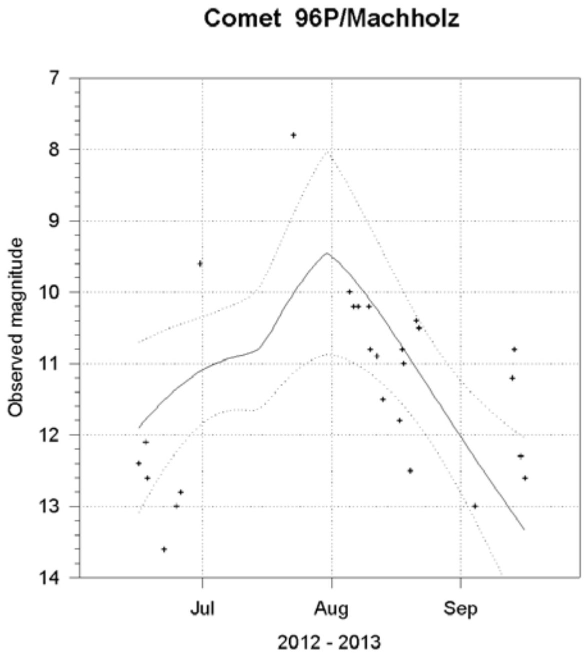
The observations (151) give an uncorrected preliminary light curve of m = 8.9 + 5 log d + 0.0156 abs(t-T-33).

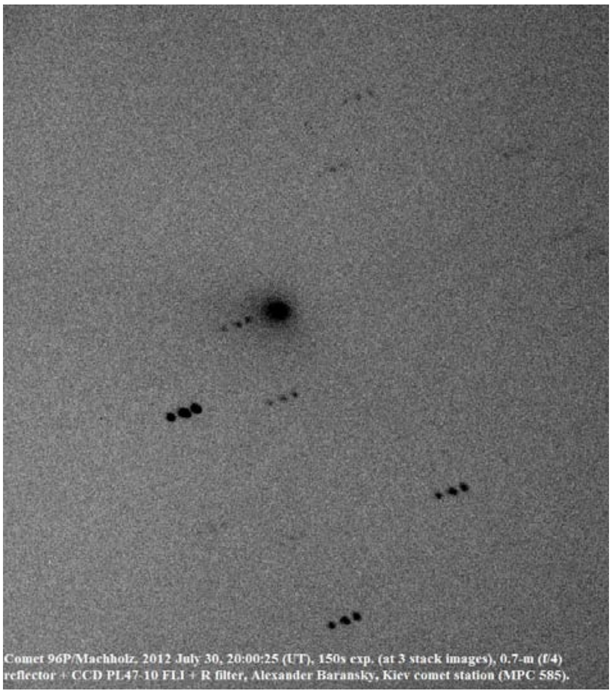
78P imaged by Graham Relf on 2012 January 16



96P/Machholz The orbit of 96P/Machholz is very unusual, with the smallest perihelion distance of any short period comet (0.13 AU), which is decreasing further with time, a high eccentricity (0.96) and a high inclination (60°). Studies by Sekanina suggest it has only one active area, which is situated close to the rotation pole and becomes active close to perihelion. The comet may be the parent of the Quadrantid meteor shower. The comet again passed through the SOHO field of view in 2012 July. Two fragments were discovered, which probably detached at the previous perihelion passage.

Marco Antônio Coelho Goiato observed it on June 17 when it was 12th magnitude. The magnitude estimates pre- and post- perihelion aren't fitted by a standard light curve. Given that the comet does get very close to the Sun, its active regions may change as it passes through perihelion. The linear light curve suggests that the intrinsic brightness is greatest 16 days after perihelion.



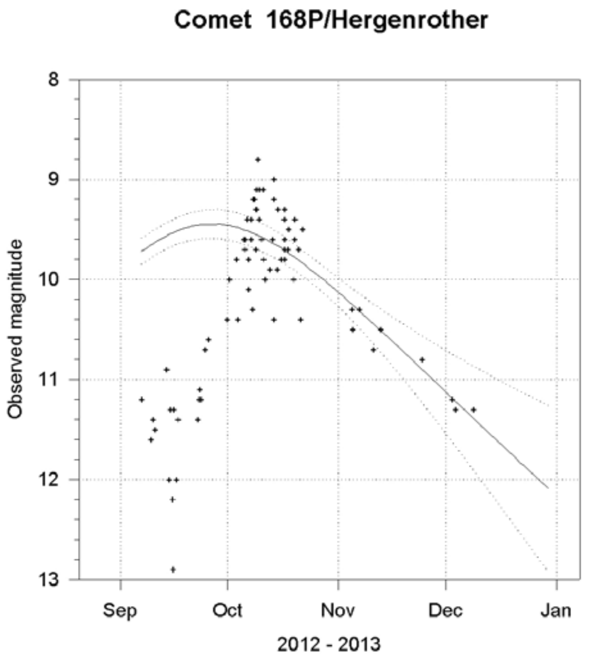


96P imaged by Alexander Baransky on 2012 July 30

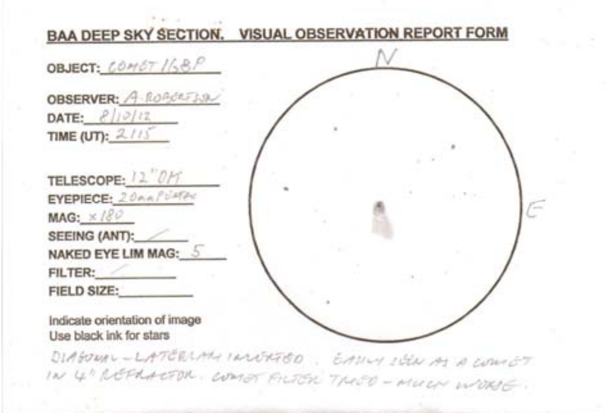
168P/Hergenrother C W Hergenrother found a comet on CCD images obtained by Timothy B. Spahr on 1998 November 22.10 in the course of the Catalina Sky Survey. The comet was 17th magnitude. The comet was a short period one, almost at perihelion. [IAUC 7057, 1998 November 23]. Following recovery in 2005 it was numbered 168.

The comet outburst at its 2012 return, suddenly brightening from around 11th magnitude in September to around 9.5 in early October. After the outburst it faded quite normally.

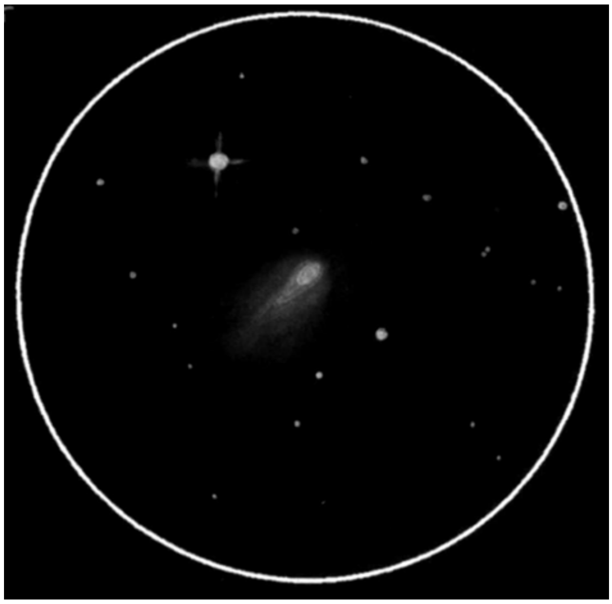
73 observations received give an uncorrected preliminary light curve post outburst of m = 10.3 + 5 log d + 6.7 log r



168P imaged by Danilo Privato on 2012 October 5

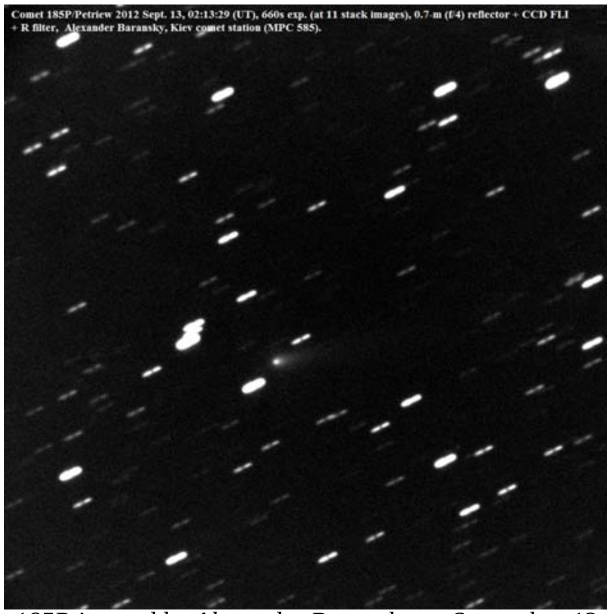


168P drawn by Andrew Robertson on 2012 October 8



168P drawn by Dale Holt on 2012 October 10

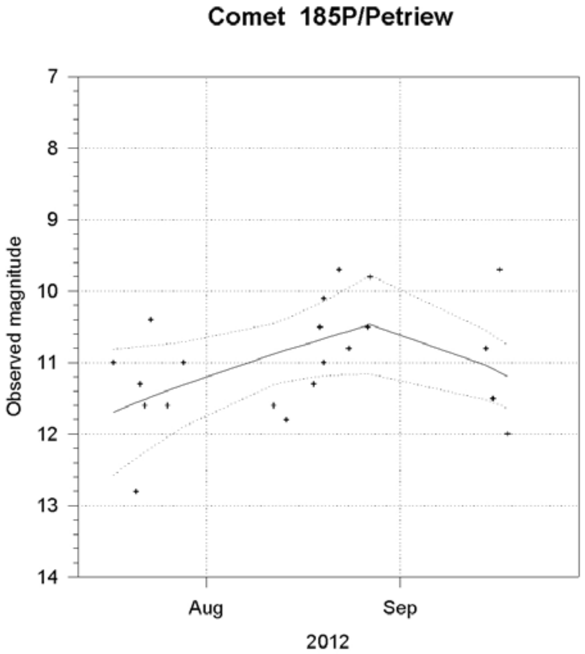
168P imaged by David Strange on 2012 October 16 using the Faulkes Telescope (South).



185P imaged by Alexander Baransky on September 13

185P/Petriew. Canadian amateur Vance Petriew discovered an 11th magnitude comet during a star party at Cypress Hills Interprovincial Park, Saskatchewan on 2001 August 18.42. The comet was put into its present orbit following a Jupiter encounter in 1982. It was not observed visually at the 2007 return.

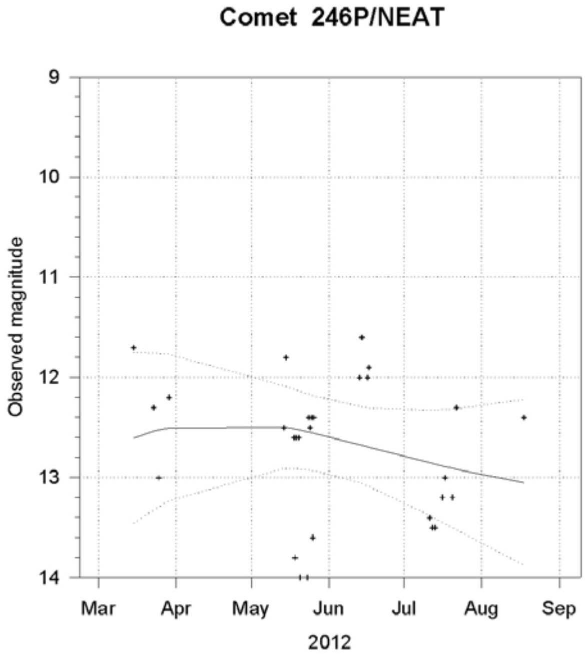
The observations for this apparition are discordant and cover a relatively short arc, but hint that the comet may have been intrinsically brighter post perihelion.



189P/NEAT is intrinsically very faint (H0=18). The orbital period of 5.0 years is one of the shorter of current P/ comets. At a favourable return it can pass 0.2 AU from the Earth and this was one of them, with the comet passing 0.17 AU from our planet on July 9. It was around 14.5 at this time.

246P/NEAT = 2004 F3 = 2010 V2 Kazuo Kinoshita calculated that a passage of about 0.37 AU from Jupiter in July 2001 reduced the perihelion distance from 3.8 AU to 2.9 AU. The comet will approach Jupiter again in 2024, when the perihelion will be increased to 3.5 AU. The returns of 2005, 2013 and 2021 are the closest over the last 200 years. The comet should have been bright enough for discovery at earlier returns, which suggests that the change in perihelion distance has enhanced the activity of the comet.

Although not due to reach perihelion until 2013 January, Juan Jose Gonzalez reported it at 12th magnitude on 2012 March 15 and it was still around this magnitude in August. The light curve is indeterminate, and the observations are consistent with no change in brightness.



Southern Hemisphere observers may see the comet in the evening sky post perihelion and it could be brightest in June and July.

259P/Garradd = 2008 R1 Observations by Henry Hsieh in 2012 confirmed observations made in 2010 and 2011 and give a perihelion date in 2013 January, 0.10 days earlier than predicted. With observations made near aphelion it was not given a designation for the 2013 return. It has a periodic orbit of 4.5 years, one of the shorter ones known, with perihelion at 1.8 AU.

Only a small number of submitted images have been reproduced here, but you can find many more, particularly those of fainter comets, at the BAA Comet Gallery at http://britastro.org/baa/index.php?view=category&catid=5&option=com_joomgallery&Itemid=200

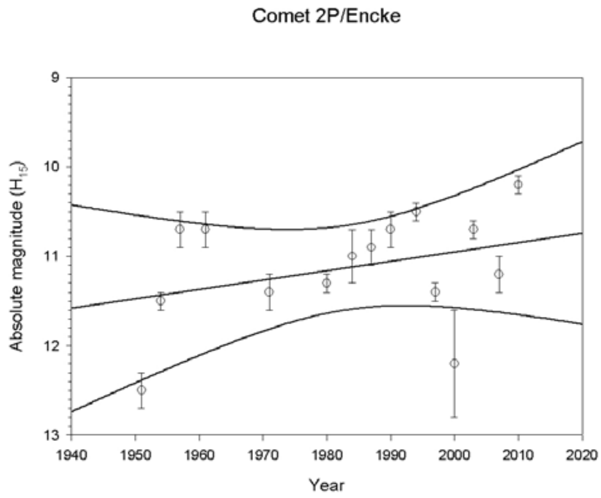
Comet Prospects for 2013

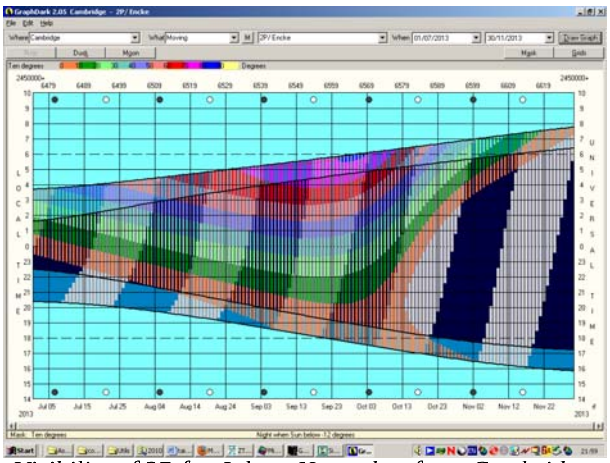
2013 has the prospect of several comets discovered in the last few years reaching naked eye visibility, but shows little promise for the return of bright periodic comets. Only two periodic comets are likely to be readily visible, but one is 2P/Encke, which returns for the 62nd time of observation and should be a binocular object. To make up for the lack of periodic comets two of the parabolic comets may become the brightest comets for several years.

These predictions focus on comets that are likely to be within range of visual observers. Members are encouraged to make visual magnitude estimates, particularly of periodic comets, as long term monitoring over many returns helps understand their evolution. Guidance on visual observation and how to submit estimates is given in the BAA Observing Guide to Comets. Drawings are also useful, as the human eye can sometimes discern features that initially elude electronic devices.

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 comets, which are often ignored. They would make useful targets for CCD observers, especially those with time on instruments such as the Faulkes telescope. CCD observers are encouraged to report total magnitude estimates, using the ICQ format given in the BAA Guide. When possible use a waveband approximating to Visual or V magnitudes. Such estimates can be used to extend the visual light curves, and hence derive more accurate absolute magnitudes.

In addition to those in the BAA Handbook, ephemerides for new and currently observable comets are published in the *Circulars*, and on the Section, CBAT and Seiichi Yoshida's web pages. Complete ephemerides and magnitude parameters for all comets predicted to be brighter than about 21^m are given in the International Comet Quarterly Handbook; details of subscription to the ICQ are available on the Internet. The BAA Observing Guide to Comets is available from the BAA Office; a new edition is planned for 2013.





Visibility of 2P for July to November from Cambridge, plotted using Richard Fleet's GraphDark software. Bright bands show moonlight, colour shows altitude : brown=low, red=high

This year sees comet **2P/Encke's** 62^{nd} observed return to perihelion since its discovery by Mechain in 1786. The orbit is quite stable, and with a period of 3.3 years apparitions repeat on a 10-year cycle. This year the comet is well seen from the Northern Hemisphere prior to perihelion, which is in late November. The comet brightens rapidly during September and could be visible in large binoculars by the end of the month. It crosses from the evening to the morning sky through October and will sink into the morning twilight by mid November, when it could be 6^{th} magnitude. This magnitude may however be optimistic as observations from the SOHO spacecraft in 2000 showed that it suddenly brightened after perihelion, by which time it will be at a poor elongation. A possible explanation for this behaviour is that Encke has two active regions, an old one with declining activity, which operates prior to perihelion and a recently activated one present after perihelion. There is, however, little evidence for a secular fading in the archive of BAA observations of the comet. The comet is the progenitor of the Taurid meteor complex and may be associated with several Apollo asteroids. This suggests that on occasion it may outburst, though nothing major has been detected to date.

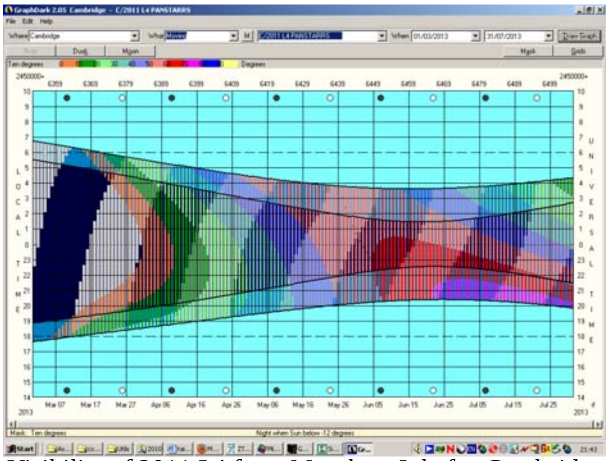
The comet will be the focus of a Section campaign for 2013 and suggestions and information are given on the web page at http://www.ast.cam.ac.uk/~jds/camp2013.htm Visual observers are requested to try and obtain accurate magnitude estimates for as long an arc as possible. Please use the magnitudes given on the charts that are available on the Computing Section web page. I would like CCD observers to try and obtain comparable magnitude estimates to those of the visual observers using the technique developed by Roger Dymock (see http://www.britastro.org/projectalcock/CCD%20Astrometry%20and%20Photometry.htm), particularly when the comet is out of visual range. Use of the Aprho technique might reveal minor outbursts, though it is important not to claim an outburst on the basis of isolated observations. Imagers could also monitor when the ion tail first forms, and how it and the dust tail develop. There are few conjunctions to image, though the comet does pass close to open cluster NGC 2281 around October 1. There is also a conjunction with 2012 S1 (ISON), but this occurs when they are too close to the Sun for viewing. Further details of the campaign will be given on the Section web page.

29P/Schwassmann-Wachmann is an annual comet that has outbursts, which over the last decade seem to have become more frequent. The comet had one of its strongest outbursts yet recorded in early 2010. The comet is an ideal target for those equipped with CCDs and it should be observed at every opportunity. The comet begins the year in Virgo, and completes its retrograde loop on the border with Hydra by mid summer. It ends the year in nearby Libra. The comet is at opposition towards the end of April and passes through solar conjunction early in November.

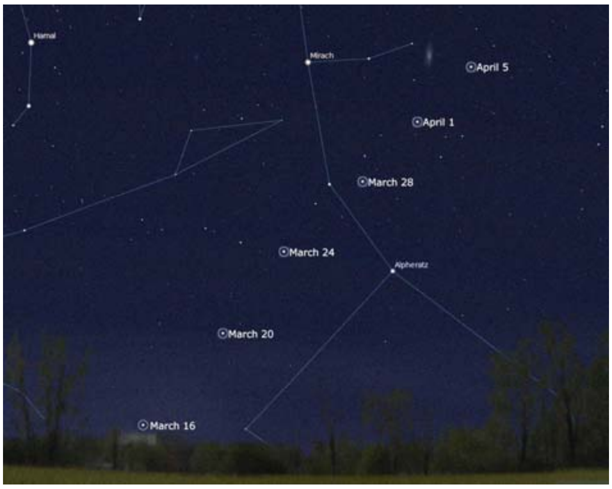
154P/Brewington makes its third return since its discovery by Howard J Brewington of Cloudcroft, New Mexico, as a small diffuse 10^m object on 1992 August 28.41 using a 0.40-m reflector x55. This was his fourth discovery and his second periodic one. The comet is in a Jupiter crossing orbit, but has not approached the planet for several revolutions. At a really favourable return it could reach 7^m, but at this return it will only reach 10^{th} magnitude, although it is conveniently placed. Observers located in the UK should pick it up as a 12^m object in the August morning sky, although Southern Hemisphere observers may find it a couple of months earlier. By October it could be 10^m and has moved to the evening sky. It is at its brightest around the time of the new moon in early November, when it is on the border of Aquarius and Pegasus. By the end of the year it has faded to 11^{th} magnitude, but remains well placed in the evening sky.

2011 F1 (LINEAR) should reach 10^{th} magnitude at perihelion, but it is then poorly placed for observation. After perihelion it slowly emerges from conjunction for Southern Hemisphere observers, but remains at a fairly high negative declination.

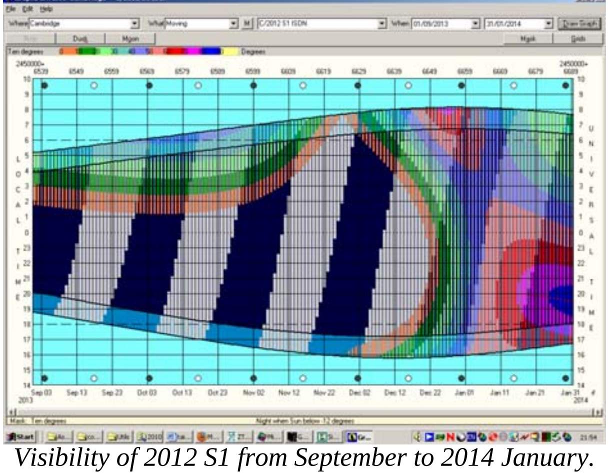
2011 L4 (PanSTARRS) was raising some excitement in the blogosphere, however comet brightness is notoriously difficult to predict. At the time of writing it seems likely to be around 2nd magnitude at perihelion. It will not be visible from the UK prior to perihelion, but some Southern Hemisphere locations have observed it as a binocular object early in 2013. After perihelion in March it rapidly emerges into our evening sky in Pisces when it could be a naked eye comet with a 10° tail. By April it is visible all night, and is still a binocular object. It fades relatively quickly and by the end of July a telescope will be needed.



Visibility of 2011 L4 from March to July for Cambridge

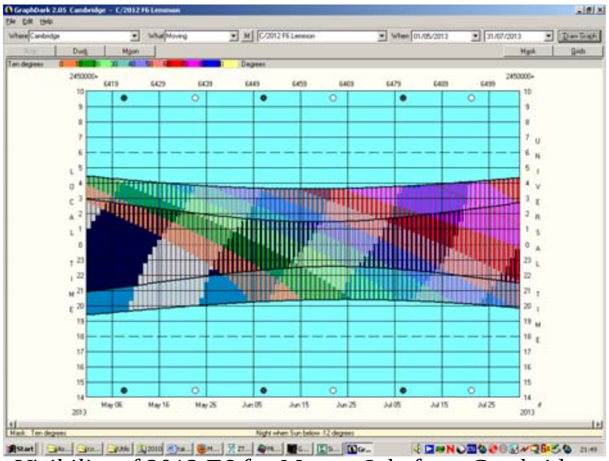


The position of 2011 L4 in the evening sky from March 16 to April 5 (Nick James)



Visibility of 2012 S1 from September to 2014 January.

2012 F6 (Lemmon) will be best seen from the Southern Hemisphere. It came into visual range at the end of 2012, and could reach around 3rd magnitude near the time of perihelion in March. It is poorly placed after perihelion, but UK observers may get it as a morning object in May, when it is 7th magnitude and fading rapidly.

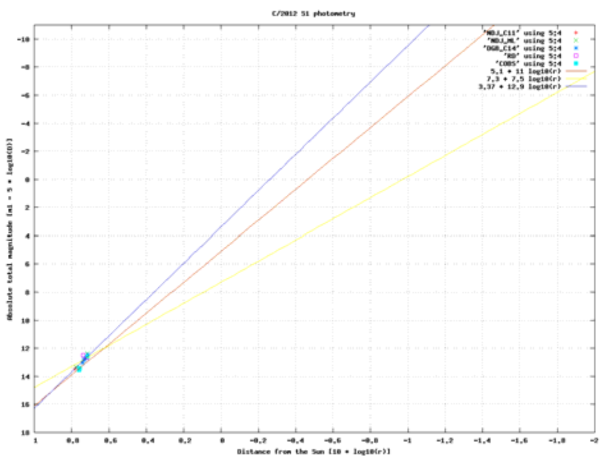


Visibility of 2012 F6 for May to July from Cambridge.

2012 K5 (LINEAR) was at perihelion in 2012 November, and passed 0.3 AU from the Earth at the end of 2012 December. It is well placed for Northern Hemisphere observation and was circumpolar around the time of closest approach when it reached 8th magnitude. It passed some 4° from M37 around 2013 January 3/4, but it is now fading quite rapidly, though should still be in visual range all month.

2012 S1 (ISON) is a Sun-skirting comet and has perihelion at 0.013 AU at the end of November. It is raising even more excitement than 2011 L4, but there is even less data on its likely peak brightness, although some visual observations have been obtained.

Nick James has analysed some of the CCD photometric data, and demonstrates that the available data can fit just about any light curve that you care to use. The comet is clearly brightening, but so far the observations only cover a small range of r (and even smaller log r). When this is extrapolated all the way to perihelion, the possible range of brightness is very large indeed.



CCD photometric data for 2012 S1 fitted to K_1 values of 11 (brown, JPL), 7.5 (yellow, Comet Section) and 13 (blue, data)

The comet may emerge from solar conjunction in September as an 11th magnitude object in the morning sky. It remains in the morning sky, reaching a maximum elongation of 54° towards the end of October, and continues to brighten. It should be a naked eye object by the time it approaches conjunction in late November. It rapidly rounds the Sun and emerges back into the morning sky in early December, becoming visible in the evening sky from mid month. There is a possibility that the tail may be seen in the morning sky from November 30. The comet rapidly moves north, passing only 4° from the pole in early January 2014, when it may still be a naked eye object. Because the comet passes close to the Sun, there is a possibility that it may become very bright. Using the standard magnitude formula gives a peak of -13 around midnight UT on November 28/29, when it is less than a degree from the Sun. It might be visible in daylight from the UK on November 28 or 29 when it could be -4, but is then only 3° from the Sun in the sky. The period of extreme brightness is short – perhaps only five days of negative magnitudes, though it could be a naked eye object for all of December. The comet passes close to Spica on November 18, and five degrees from M13 on December 22.

Although **2012 T5 (Bressi)** gets moderately close to the Sun, it is intrinsically faint, and may only reach 7th magnitude at perihelion. It is poorly placed then, and there are only limited observing opportunities prior and post perihelion for more southerly situation observers.

2012 V4 (273P/Pons-Gambart) emerges from conjunction towards the end of January for visual observers as an 11th magnitude or brighter object. CCD imagers may be able to get it earlier, and Richard Miles demonstrated that observations can be made in conditions when visual observation is virtually impossible, with images of the comet taken from the UK on December 5.

The other periodic and parabolic comets that are at perihelion during 2013 are unlikely to become brighter than 12th magnitude or are poorly placed. Ephemerides for these can be found on the CBAT WWW pages. One D/ comet has predictions for a return, though searches at favourable returns in the intervening period have failed to reveal the comet and its orbit has been perturbed by Jupiter to give a larger perihelion distance. There is however always a chance that it will be rediscovered accidentally by one of the Sky Survey patrols. Several SOHO comets are predicted to return, however these will only be visible from the SOHO or STEREO satellites.

Looking ahead to 2014, the prospects for bright periodic comets are even worse, with the most interesting object being 209P/LINEAR, which could reach 11th magnitude when it passes 0.06 AU from the earth in May. 2012 K1 (PanSTARRS) may reach 6th magnitude after its August perihelion, but is unfortunately a morning object.

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Minor Planet Circulars

Nakano Notes at http://www.oaa.gr.jp/~oaacs/nk/

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The Comet Orbit Home Page http://jcometobs.web.fc2.com/

Jonathan Shanklin

Comets reaching perihelion in 2013

Comet	T	q	P	N	H_1	K_1	Peak mag
LINEAR (2011 F1)	Jan 8.0	1.82			6.6	5.2	10
P/Vorobjov (2012 T7)	Jan 16.1	3.92	12.5	1	11.5	10.0	20
LINEAR (2012 Y1)	Jan 18.4	2.02			15.0	10.0	18
P/Lemmon-PanSTARRS (2012 WA_{34})	Jan 24.8	3.17	10.5	1	13.5	10.0	20
259P/Garradd (2008 R1)	Jan 25.4	1.80	4.51	1	15.5	10.0	20
246P/NEAT (2010 V2)	Jan 28.7	2.88	8.08	1	2.5	15.0	12
111P/Helin-Roman-Crockett	Jan 30.7	3.70	8.49	3	5.0	20.0	19
P/LINEAR (2000 R2)	Feb 2.4	1.46	6.13	1	18.0	10.0	21
McNaught (2012 C1)	Feb 4.6	4.84			7.5	10.0	18
P/Siding Spring (2012 US_{27})	Feb 8.6	1.82	11.8	1	13.5	10.0	17
133P/Elst-Pizarro	Feb 9.0	2.65	5.62	5	12.0	10.0	18
125P/Spacewatch	Feb 17.0	1.53	5.53	4	15.5	10.0	19
120P/Mueller	Feb 22.4	2.73	8.39	3	12.0	10.0	19
274P/Tombaugh-Tenagra (2012 WX_{32})	Feb 22.8	2.44	9.09	3	13.0	10.0	18
P/Scotti (2013 A2)	Feb 23.2	2.18	8.08	1	15.5	10.0	19
Bressi (2012 T5)	Feb 24.1	0.32			10.6	8.1	7
P/Kowalski (2007 T2)	Feb 25.6	0.69	5.43	1	18.5	10.0	18
272P/NEAT (2012 V3)	Feb 27.2	2.42	9.36	1	16.0	5.0	19
91P/Russell	Mar 1.2	2.62	7.70	4	7.5	15.0	15
PanSTARRS (2011 L4)	Mar 10.2	0.30			5.2	5.4	2
P/Christensen (2006 S1)	Mar 17.0	1.36	6.53	1	17.5	10.0	21

256P/LINEAR (2012 B2)	Mar 17.3	2.69	9.96	1	14.0	5.0	17
Lemmon (2012 F6)	Mar 24.5	0.73			5.3	9.1	3
197P/LINEAR	Mar 24.9	1.06	4.85	2	16.5	5.0	17
PanSTARRS (2012 X2)	Apr 4.3	4.74			9.0	10.0	19
PanSTARRS (2012 F2)	Apr 10.0	2.90	15.8		12.0	10.0	18
63P/Wild	Apr 10.8	1.95	13.2	3	12.0	10.0	15
P/SOHO (2002 R4 = 2007 Y4)	Apr 13.5	0.05	5.31	2			
P/PanSTARRS (2012 T2)	Apr 20.6	4.82	13.8	1	10.0	10.0	20
76P/West-Kohoutek-Ikemura	May 7.7	1.60	6.47	5	8.0	30.0	16
LINEAR (2012 L2)	May 9.3	1.51			10.0	10.0	13
P/Tanagra (2012 TK_8)	May 10.4	3.09	8.55	1	13.0	10.0	20
114P/Wiseman-Skiff	May 13.9	1.57	6.67	4	11.5	15.0	16
LINEAR (2010 S1)	May 20.3	5.90			3.5	10.0	15
McNaught (2012 K6)	May 21.5	3.35			8.5	10.0	16
P/LINEAR (2010 A2)	May 23.1	2.00	3.47	1	15.5	10.0	20
175P/Hergenrother	May 23.6	1.95	6.34	2	14.0	10.0	17
P/SOHO (2002 R1 = 2008 A3)	Jun 1.1	0.05	5.37	2			
257P/Catalina (2012 F4)	Jun 4.4	2.13	7.27	1	11.5	10.0	16
P/LINEAR (2005 YQ_{127} = 2013 A3)	Jun 5.9	1.91	7.59	2	14.0	10.0	19
112P/Urata-Niijima	Jun 24.3	1.46	6.64	4	14.0	15.0	18
PanSTARRS (2012 S4)	Jun 28.1	4.35			8.5	10.0	17
P/LINEAR (2003 U2)	Jun 29.0	1.69	9.52	1	15.0	10.0	19
271P/van Houten-Lemmon (2012 TB_{36})	Jul 5.8	4.25	18.5	2	9.0	10.0	20
26P/Grigg-Skjellerup	Jul 6.0	1.09	5.24	19	12.0	40.0	14
270P/Gehrels (2012 S5)	Jul 8.0	3.60	18.0	1	8.0	10.0	16
46P/Wirtanen	Jul 9.4	1.05	5.43	10	8.5	20.5	11
PanSTARRS (2012 V1)	Jul 21.6	2.09			9.0	10.0	13
178P/Hug-Bell	Jul 23.1	1.93	7.03	2	13.5	10.0	18
PanSTARRS (2012 B1)	Jul 23.1	3.83	16.5		9.0	10.0	17
84P/Giclas	Jul 23.2	1.84	6.94	6	9.5	20.0	16
184P/Lovas	Jul 28.5	1.39	6.61	2	14.0	10.0	15
P/McNaught (2006 K2 = 2013 B1)	Aug 2.5	2.10	7.12	2	14.0	10.0	18
98P/Takamizawa	Aug 5.4	1.67	7.43	4	11.5	15.0	15
LINEAR (2012 V2)	Aug 16.5	1.45			9.0	10.0	12
79P/du Toit-Hartley	Aug 23.3	1.12	5.06	5	14.0	15.0	16
PanSTARRS (2012 S3)	Aug 31.1	2.31			10.0	10.0	15
266P/Christensen (2012 P1)	Aug 31.6	2.33	6.64	2	12.0	10.0	17
102P/Shoemaker	Sep 1.0	1.97	7.22	4	8.0	15.0	13
121P/Shoemaker-Holt	Sep 8.3	3.75	9.94	3	4.5	15.0	15
P/SOHO (2002 Q8 = 2008 E4)	Sep 10.5	0.05	5.52	2			
P/SOHO (2002 S11 = 2008 G6)	Oct 26.9	0.05	5.53	2			
83D/Russell	Nov 7.4	2.14	7.53	2	12.0	10.0	18
P/Christensen (2007 C1)	Nov 16.2	2.19	6.80	1	15.0	10.0	20
2P/Encke	Nov 21.7	0.34	3.30	61	10.0	8.8	6
P/McNaught (2005 L1)	Nov 24.6	3.16	7.96	1	9.5	10.0	16
ISON (2012 S1)	Nov 28.8	0.01			5.3	7.5	-9 ?
PanSTARRS (2012 A1)	Dec 2.2	7.60			6.0	10.0	19
P/Larsen (2004 H2)	Dec 11.6	2.64	9.63	1	13.5	10.0	20
154P/Brewington	Dec 12.2	1.61	10.8	2	7.0	15.0	10
P/NEAT (2003 S1)	Dec 16.1	2.59	9.71	1	11.5	10.0	17
87P/Bus	Dec 19.6	2.10	6.38	5	10.0	15.0	17
LINEAR (2011 J2)	Dec 25.9	3.45			6.0	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 [$m_1 = H_1 + 5.0 * \log(d) + K_1 * \log(r)$] 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.

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