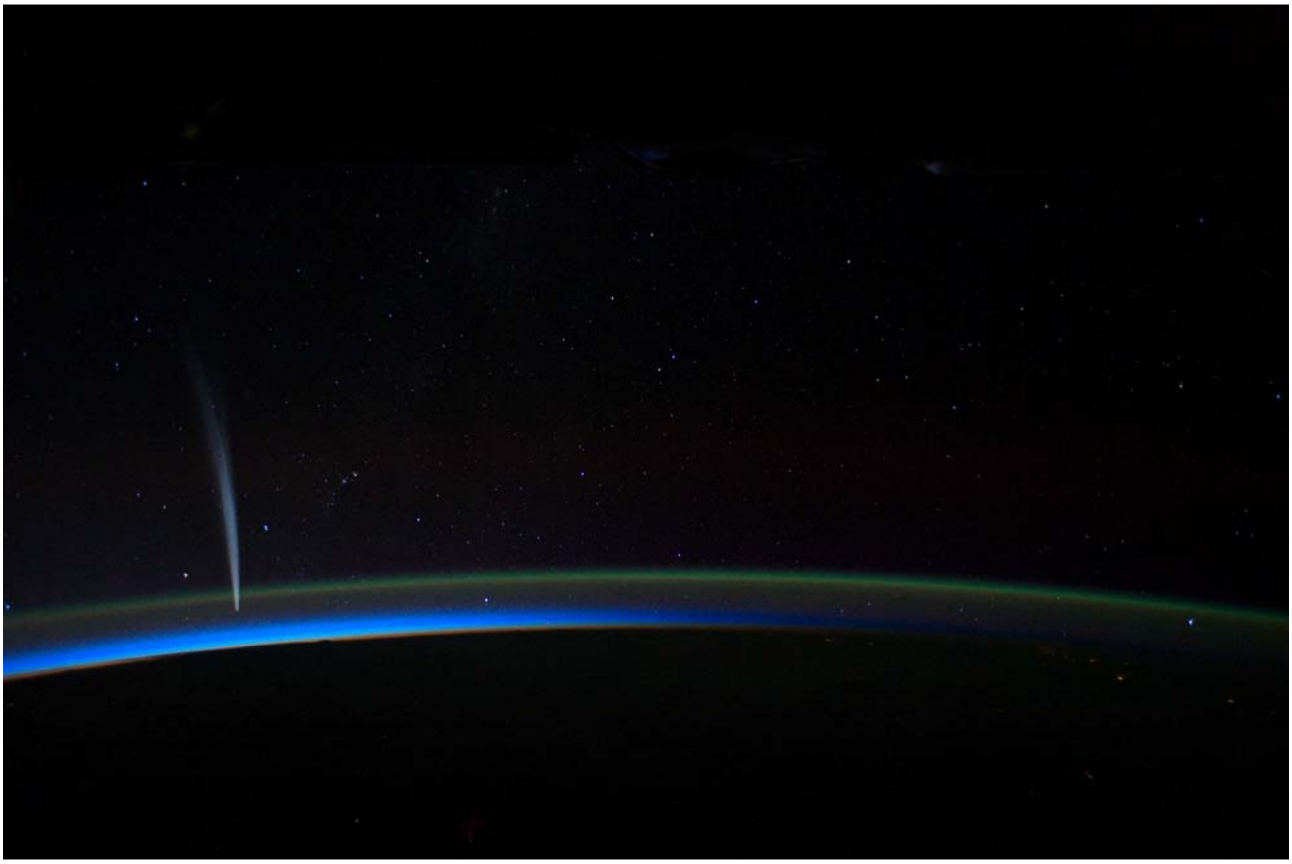
THE COMET'S TALE

Newsletter of the Comet Section of the British Astronomical Association

Number 31, 2012 January

A Great Christmas Comet



Astronaut Dan Burbank captured Comet Lovejoy from the International Space Station on December 21. Despite setting his Nikon D3S to an ISO of 12800, he still needed a steady hand for this 0.8-second exposure through an f/2.8 lens. The greenish ribbon, above the blue twilight band hugging Earth's limb, is airglow from oxygen atoms about 100 km up. *NASA / D. Burbank*

Comet 2011 W3 (Lovejoy) has really hit the headlines following its encounter with the Sun. Although clearly a small comet from its absolute magnitude, its very close pass round the Sun activated most of the nucleus giving a spectacular post-perihelion display. This has largely favoured the Southern Hemisphere [though not its polar regions!]. A meeting devoted to the comet will be held in Boulder, Colorado over 2012 March 21 and 22 (Wednesday to Thursday). Amateur astronomers are invited to this meeting, which promises to give new insights into the activity of both comets and the Sun.

I wonder, will the second decade of the 21st century turn out to be a great one for comets ??

Contents

Comet Section contacts	2
Section news	2
Tales from the past	3
Comets – where are they ?	5
Dust to dust - 2010 X1	7
Professional tales	9
Review of observations	9
Halley	23
Predictions for 2012	24

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Section News from the Director

Dear Section member,

I started compiling this edition from on board the RRS Ernest Shackleton, bound for Halley station, Antarctica. I will remain at Halley until early March, and should return via the Falkland Islands later in the month. A blog of the trip is at http://www.antarctica.ac.uk/met/jds/notes_from_south_2012.htm Our internet connectivity is about equivalent to dial-up, so I have not been able to fully appreciate the amazing images associated with 2011 W3 (Lovejoy) and show them in this edition. Neither am I able to view the images being submitted to the Section, so particularly appreciate the help that Denis Buczynski is able to give in this respect. He has selected some from the many submitted, and I have been able to download these.

There is a joint meeting between the Comet Section and the Asteroid Section in 2012 on Saturday, October 6 at Milton Keynes. Full details will appear in due course in the Journal and on the Section web pages, but in the meantime mark the date in your diary, and come along if you can. This is an opportunity to meet up with some of the experts who are producing excellent images, making follow-up astrometric observations and making visual observations. There will also be talks from professional astronomers highlighting how amateurs can contribute to their research.

One of the problems with the internet and its news groups, is that it is very easy for "experts" to take a didactic approach, which at times relates to their belief system, rather than to the actual observations. Two recent comets have brought this to the fore. First the perceived wisdom was that 2010 X1 (Elenin) had disintegrated before perihelion, so it couldn't possibly have survived. Any visual observer who dared report a positive observation must be wrong. The careful visual observers were proved correct when appropriate CCD imaging was carried out under dark skies and revealed that the disintegration cloud was present. Then came 2011 W3 (Lovejoy), which clearly had too faint an absolute magnitude to survive perihelion. It of course did, as shown by the spacecraft and ground-based observations. The real professionals will wait for sufficient evidence before making predictions, but it is often hard for the novice to decide what is fact, and what is fiction in on-line discussion. It is perfectly reasonable for anyone to make predictions based on a theory, though if the observations don't match the predictions then the theory falls. Some, however, make predictions based on belief, not facts. There may be merit in developing a rating system for commentators, but finding someone to police it would be difficult. In a different field, Opal i-spot http://www.opalexplorenature.org/ispot does however manage to do this, so perhaps comet enthusiasts should follow suit.

This issue has two articles from Roger Dymock, which are slightly modified versions of articles that have appeared elsewhere. Both may be of interest to the wider audience that reads this newsletter, and thanks are due to Roger for making them available. I would welcome contributions from other authors, as these articles make a significant contribution to the newsletter.

What also makes a big difference are the observations and calculations of the enthusiasts who submit their work, whether it is CCD images, astrometric positions (to the MPC), comet orbits, comet discoveries or visual observations. A particular thanks to those that take the trouble to make sure that they exactly follow the standard formats as this does make life much easier. Do check the data files on the section web pages, and the naming convention used to display images. You can also find additional images in the section archive on the BAA server at http://britastro.org/baa/index.php?view=category&catid=5&option=com_joomgallery&Itemid=200 which is maintained by Denis with help from Nick. If you aren't yet copying your image submissions to cometobs@britastro.org please do so, and the images will be included in the archive.

Although I fear that I will inevitably omit some names, as I don't have all the records available here in Antarctica, I would like to acknowledge contributions from James Abbott, Jose Aguiar, Alexandre Amorim, Sandro Baroni, Lester Barnes, Peter Birtwhistle, Nicolas Biver, Walter Borghini, Denis Buczynski, Jose Carvajal, Roger Dymock, John Fletcher, Maurice Gavin, Marco Goiato, Ernesto Guido, Werner Hasubick, Rich Hill, Dale Holt, Nick Howes, Guy Hurst, Nick James, Andreas Kammerer, Carlos Labordena, Rolando Ligustri, Jose Martinez, Michael Mattiazzo, Richard Miles, Martin Mobberley, Stuart Moore, Gabriel Oksa, Mieczyslaw L. Paradowski, Alex Pratt, Grant Privett, Stuart Rae, Andrew Robertson, Hirohisa Sato, Toni Scarmato, Darryl Sergison, Auke slotegraaf, Giovanni Sostero, Willian de Souza, Con Stoitsis and the Astronomical Society of Victoria http://asv.org.au/lovejoy.php , David Storey, Juan José González Suárez, Alan Tough, Rich Williams and Seiichi Yoshida (with apologies for any errors or omissions).

As noted in the last edition the newsletter is now distributed as a pdf, which is perhaps just as well as I am a long way from any printers or postal service. When I return I will produce a few printed copies for library use and for the few life Members of the Association who do not have access to computer facilities.

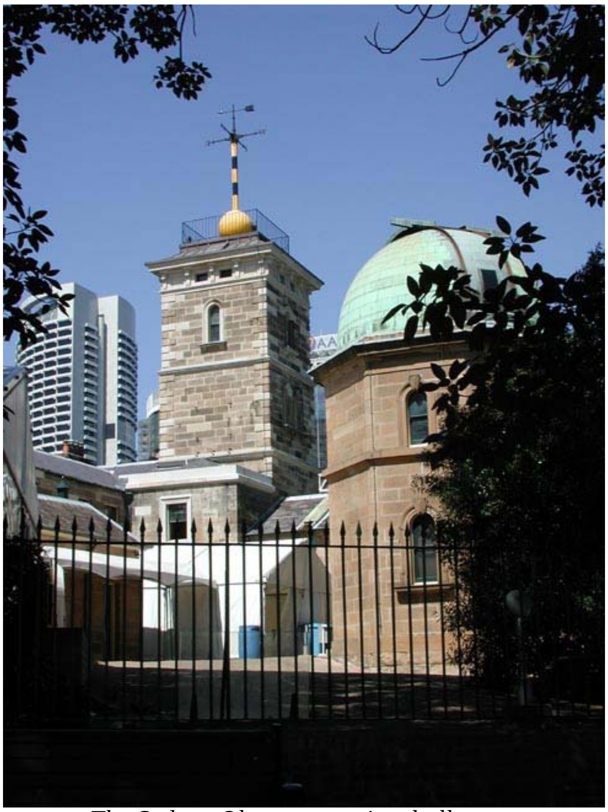
I am likely to be quite busy for the next few months, and in addition my access to the internet may become less frequent. I will probably restrict information to the Section web pages, which I will try and update when I can.

Best wishes,

Jonathan Shanklin

Tales from the Past

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



The Sydney Observatory time ball tower (Photograph by George P. Landow)

150 Years Ago: The annual Report of the Council for 1860 notes that *The list of Comets* has been enriched by the discovery of four new bodies of this class. In March the Astronomer Royal, G B Airy described a new Astronomical Instrument, for which he proposed the name "Orbit-Sweeper". This was essentially a modified German equatorial, with an additional axis to allow sweeping along the line of variation. He suggested making it from wood, as this would be sufficiently accurate and cheaper and lighter than one of metal. The comet seen at the end of June [1861 J1] produced several letters describing its sudden appearance, though news of the first discoverer followed a month later. W Scott, the Astronomer for New South Wales wrote from Sydney Observatory "I send herewith some observations of a very fine comet discovered on the 13th of May by Mr Tebbutt, a young Australian farmer and self-taught astronomer." He goes on to say "Unfortunately, the Time Ball Tower, to which such undue prominence was given in the building of the Observatory, prevents me from observing with the new instrument until a few minutes before the increasing daylight renders the comet invisible; consequently, I have been compelled to make the last two days' observations with the old instrument mounted in a window on the east side of the building." The comet was observed from HMS Meander, then at Ascension Island. The most descriptive set of observations were made at the Radcliffe Observatory, Oxford, by the Rev. R Main. A synopsis of a Turin Memoir by Jean Plana notes that the author computes a better fit to the motions of Encke's and Faye's comet if the hypothesis of a resisting medium is assumed.

100 Years Ago: 1P/Halley was still under observation by Barnard in January 1911, and he hoped to follow it for the greater part of the year. The comet was observed for longer than at any previous apparition. An excerpt from Monthly Notices suggests that the tail of a comet was determined to some extent by electrostatic forces. At the February meeting Dr Crommelin proposed a short cut to determining the perihelion date of Encke's comet. Its motion was mostly affected by Jupiter, whose influence might make a difference of two or three weeks in the time of revolution. Given that 18 revolutions of the comet did not differ much from five of Jupiter, the Jovian perturbations nearly repeated themselves after that period. As the comet had now been observed for two of these 59 year period it was a simple matter of extrapolation to get the period within a day or two. He also commented on the fact that it was at a superior brightness at its winter returns (when independent discoveries had been made) and was often visible to the naked eye, whereas in the summer returns it was an exceedingly difficult object. R T A Innes, writing from Johannesburg made a rather scathing rebutal of the assertion that the Earth had passed through the tail of comet Halley. He notes that the numerous observations of Bishop's ring and other optical meteorological phenomena at so many places seem to indicate that some cometary matter may have reached the Earth's atmosphere about May 19th. This could be explained by the existence of delicate wisps or streamers proceeding from the nucleus of the comet and lying almost along the radius vector. Many photographs ... show the existence of many such streamers. The lack of any considerable parallactic change in the positions of the main tail and broad shade as long as they were visible is also against the probability of any real encounter. In short if we say we passed through the tail, it is because we believe we did, and not because we have any observations on which to base the belief. Others also commented on the optical phenomena including sunset clouds, seen from Katoomba at about 1000m, being uniformly of a brilliant crimson colour and giving one a very distinct impression that they were self-luminous. The June meeting was cancelled because of the Coronation. A comet note from the Royal Astronomical Society on researches on Encke's comet reports that Dr Backlund finds evidence that the acceleration of the mean motion suddenly changed in 1858, 1868, 1895 and perhaps 1904, and that several of these dates were near Sun-spot maximum. He suggested that the cause be sought in some solar disturbance.

An account of “A Royal Cometographer” by George F Chambers written at the beginning of June 1911 from Lethen Grange, Sydenham, deserves a full reprint:

There came under my notice the other day Mrs Ady's Life of Henrietta, Duchess of Orleans, the daughter of Charles I of England. In this book two letters of Charles II, brother of the Duchess, are printed, and I think are of sufficient interest to deserve preservation in our pages. The first letter by the King is dated December 15, 1664, and contains the following passage:-

By the letters from Paris, I perceeve that the blazing starr hath been seen there likewise, I hope it will have the same effect heere, as that in Germany had, and then we shall beate our neighbouring Turks, as well as they beate theres.

Mrs Ady remarks that the victory over the Turks was the battle of St Gothard just won by Montecuculi over the Grand Vizier. She adds that "the Comet was at the time exciting much attention on both sides of the Channel, and causing much alarm among the prophets of evil. A French writer describes it as having a head as large as a plate, bristling all over with nails, and with a tail as long as three arms, turned now east, now west. Madame de Sevigne, writing to M. De Pompone, describes how she is sitting up till three o'clock, in hopes of seeing the phenomenon, over which all the astrologers and wise men are disputing. Was it a presage of good or evil she wonders. But the appearance of another blazing star, higher in the sky, two days before Christmas, very much disconcerted the wise men, who could not decide whether this were a new comet or the old one appearing again in a different part of the heavens."

The King takes up the subject of the comet again in a letter dated Whitehall, December 26, 1664 :-

We have seen heere the comett, but the wether has been so cloudy, as I never saw it but once. It was very low and had a taile that stood upwards, it is now above twelve days that I saw it, but upon Christmas Eve and the night before, there was another seene very much higher than the former. I saw it both nights, and it lookes much lesser than the first, but none of the Astronimers can tell whether it be a new one or the old one growne lesse and got up higher, but all conclude it to be no ordinary starr. Pray inquire of the skillfull men, and lett me know whether it has been seen at Paris. This new one was seen heere, the 23rd and 24th of the month, Old Style, and had a little taile which stood north-east.

Dr A C D Crommelin, 3rd Director of the Comet Section

The annual Section report, presented at the October meeting, noted that Professor Barnard, "one of our Members" had kept 1P/Halley under observation with the 40-in Yerkes refractor until the end of May. Five other periodic comets had been under observation. Quenisset's comet [1911 S2], discovered by him at Juvisy on September 23, had an interest for the Association, since it was independently found on the following night by a member, Mr Francis Brown, of 68, Murillo Road, Lee, S.E. (London) while he was studying a variable star in Ursa Minor. The Presidential report referred to the computational work on the orbit of 1P/Halley and concluded with a rewording of Sir George Airy "So complete are the whole of these computations, that if names were taken not from the discoverers of these bodies or from those who conjecture their identity, but from those who, by accurate calculations on a uniform system, combine the whole of our information relating to them, we should call this body, not Halley's, but Cowell and Crommelin's Comet". [Crommelin did of course ultimately get a comet named after him for his computational work].

The 70th Donohoe Comet Medal was awarded to M C C Kiess, of the Lick Observatory, for the discovery of a comet on 1911 July 6 [1911 N1], and the 71st medal to Dr W R Brooks, of the Smith Observatory, Geneva, N.Y. for a comet discovered on 1911 July 20 [1911 O1]. The 72nd and 73rd awards were made to M F Quenisset and M S Beljawsky [1911 S3] respectively.

There was debate about the accuracy of guiding in some photographs of comet Brooks, with suggestions that at least one observer had made a mistake. The response of the particularly criticised author, suggested that the critics should show their own pictures and see how they compared!

50 Years Ago: At the January meeting Michael Candy described the circumstances that lead to his discovery of 1960n. He had been on duty at Herstmonceux on Boxing Night, measuring double stars, but the seeing had been poor and he had given up and gone home. At home he decided to try a new eyepiece which had been lent to him by Horace Dall. This had a 6mm exit pupil, rather than the usual one he used under dark conditions, which had an 8mm pupil. His home location suffered from street lights and a poor horizon, with may television aerials. He decided to use his 5" comet seeker from the bedroom window as a test and focussed on Kappa Cephei. In order to check the image quality he moved the star to the edge of the field, then noticed a nebulous object. He thought this had moved after 10 minutes, so checked the Skelnate Pleso star atlas, and the BAA Handbook and found no nebula or comet was likely to be in the area. He phoned Gordon Taylor, who was able to confirm the discovery, and they estimated a position and daily motion. Amazingly the skies remained clear for three nights, so he was able to compute an orbit from his own positions. During questions he said that the only other accidental discovery whilst eyepiece testing was by Robert Burnham. On receiving the discovery card, Dr Merton said he thought the name "Christmas Candy Comet" came to mind. At the next meeting he was able to show a couple of photographs of the comet, one by Dr Waterfield from Ascot was 35 minutes, and the other by Dr Arend at Uccle was 40 minutes and on both a tail was just visible.

At the March meeting it was announced that George Alcock would receive the (first) Merlin Medal for his for his persistent and skilful observations (of meteors) and discovery of comets 1959e and f. Dr Porter gave an address on orbits, with some discussion of comet orbits and concluded by saying that the Computing Section was bringing out a new comet catalogue with 830 orbits and that he hoped the audience would enjoy wading through it – Members received a free copy of this Memoir. At this time the BAA was one of the leading computers of comet orbits, with work being carried out by Brian Marsden, Michael Candy, Cameron Dinwoodie and M G Sumner. Volume 71.7 contained a paper on alleged apparitions of Halley's Comet in the eighteenth century BC and earlier, by M L West. He disputed Professor Kamienski's previous paper on the subject and gave reasons. Professor Kamienski provided a rebuttal which said the apparition of 2320 BC was irrefutably proved. [The earliest confirmed return is that of 239 BC]. At the October meeting Michael Candy reported that since July things had been a bit hectic, with the discovery of three comets that were visible in small instruments. The first of these, comet 1961 O1 (Wilson-Hubbard) had been discovered by Stewart Wilson from an aircraft on July 21. Volume 72.1 contained a review by Colin Ronan of the book "The Controversy of the Comets of 1618", which had just been published.

Comets – where are they ?

Roger Dymock

There have been a number of schemes classifying cometary orbits and this presentation outlined them and gave examples of the various classes of comets.

Historical classification schemes

Historically comets were classified as short, intermediate or long period – the upper limit of short period comets varied from 13 to 39 years and the intermediate class sometimes included long period comets (periods > 200 years) and sometimes did not. Figure 1 shows the accepted classification immediately prior to 1996.

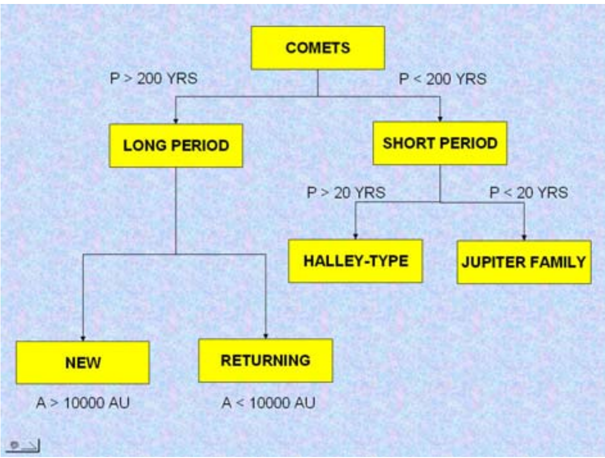


Figure 1. Pre-1996 classification of cometary orbits

Long period comets had orbits with random inclinations and short period comets orbited closer to the plane of the ecliptic. Long period comets fell into two categories – new; those with semi-major axis > 10,000 AU entering the inner Solar System for the first time and returning; comets with semi-major axis < 10,000 AU which had made a previous pass. Short period comets were divided into Halley type with periods between 20 and 200 years and Jupiter family comets with periods less than 20 years.

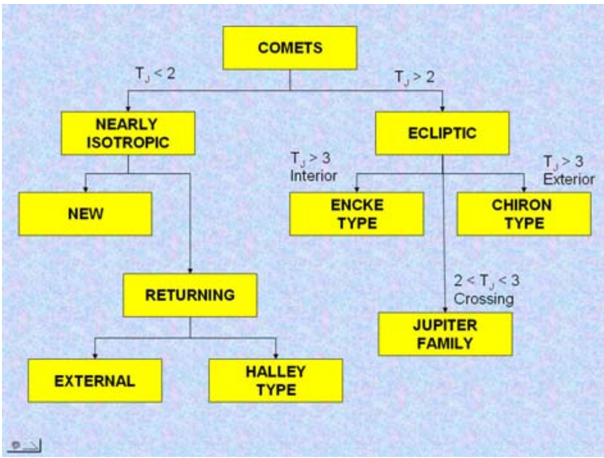


Figure 2. Harold Levison's Comet Taxonomy

Harold Levison's 1996 classification

In his 1996 paper, Comet Taxonomy, Harold F. Levison proposed the classification scheme shown in Figure 2.

The Tisserand parameter, T_J – a measure of the influence of Jupiter on cometary orbits, is used to define the various classes of comets in this scheme. The Tisserand parameter is calculated from the orbital elements of Jupiter and the comet in question and can also be used to relate comets seen at different apparitions i.e. same value of T_J indicates that the comets could be one and the same.

Nearly Isotropic comets can enter the inner Solar System at any inclination and most have semi-major axis between 10 and 100,000 AU. New comets are those visiting us for the first time whereas, as their name suggests, Returning comets have been here before and will have evolved, by planetary encounters, from the New category. Returning comets are sub-divided into two categories - Halley type comets which have less random .inclinations, semi-major axis < 40 AU and are trapped in Mean Motion Resonances (MMRs) with Jupiter. MMRs occur when the orbital period of a comet and a planet are close to the ratio of two small integers. Those comets with semi-major axis >40 AU (that of Pluto) are classified as External as such a large semi-major axis means they are unlikely to be trapped in an MMR.

How do we know whether or not a comet is of the New or Returning variety ? Figure 3 shows the distribution of the inverse of the semi-major axis, a, for comets in Brian Marsden's 1992 catalogue. The peak includes those comets which are passing through the inner solar system for the first time and have semi-major axis of approximately 20,000 AU - i.e. New comets. On making this first pass their values of 1/a will, on average, be altered, due to planetary encounters, by the amount indicated by 'Size of the average planetary kick'. Thus, on subsequent visits, their orbits will fall outside of the peak and they will be identified as Returning comets.

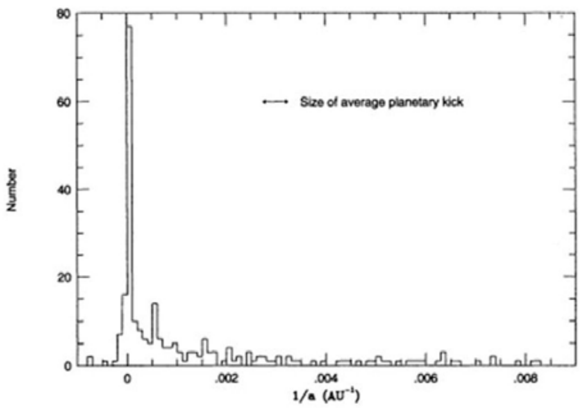


Figure 3. Distribution of the inverse of the semi-major axis for long-period comets

2010 X1 (Elenin) is an example of a New comet. This failed to live up to expectations and broke up, with post-perihelion images showing what appeared to be an elongated debris cloud.

Ecliptic comets, as their name suggests, have low inclination, between 0 and 30 degrees, and semi-major axis between 2 and 8 AU. Comets with T_J >3 do not cross the orbit of Jupiter and fall into two groups, Encke type (named after comet 2P/Encke – Figure 4) with semi-major axis <2.6 AU and Chiron types with semi-major axis >2.6 AU. Jupiter family comets are generally on orbits which cross that of Jupiter – most Ecliptic comets are in this category.

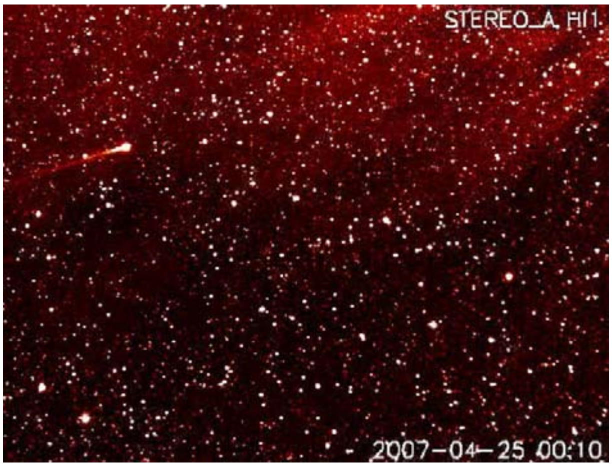


Figure 4. 2P/Encke. STEREO spacecraft image.

A diversion into orbits

In a paper 'On hyperbolic comets' published in the Journal of the British Astronomical Association in 1991 Professor David Hughes divided comets into two types – elliptical comets bound to the Solar System and hyperbolic comets not belonging to the Solar System.

As can be seen in Figure 5 orbits (elliptical or parabolic) of comets bound to the Solar system have values of eccentricity, e, between 0 and 1. Hyperbolic orbits have values of e>1 and comets in such orbits may be extra-solar in origin or have been injected into such an orbit by passing close to Jupiter. At 1 AU from the Sun objects in various orbits move at the speeds shown in Figure 5 and thus knowing the speed of a comet helps to determine the shape of its orbit and its origin.

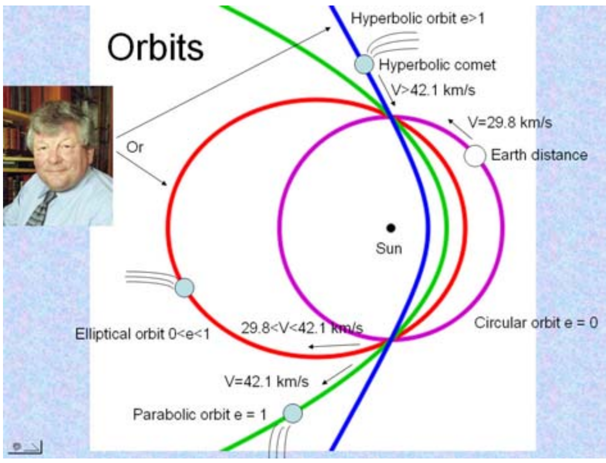


Figure 5. Cometary orbits

What else ?

So what else is out there and how do they fit into the groups previously described ?

Sungrazers and sunskirters, as their names suggest, pass very close to the Sun at perihelion. Sungrazers close to within 2 solar radii and small members don't survive their perihelion passage. These comets are comprised of Kreutz I and Kreutz II sub-groups and their orbital elements put them into the Nearly Isotropic/New category. Sunskirters with perihelion distances between 6 and 12 solar radii do, in general, survive their close approaches to the Sun. Kracht, Kracht II, Marsden and Meyer sub-groups make up this category – Kracht and Marsden comets being Halley types and Meyer Nearly Isotropic/Returning. Many of these comets have been discovered by amateurs searching images obtained by the Solar and Heliospheric Observatory (SOHO).

Within the asteroid Main Belt there are several objects which display cometary activity - for example a coma indicating outgassing of some kind. To date five are known; (7968) Elst-Pizarro, (118401) LINEAR, 238P/Read, P/2008 J2 (Belshore) and P/2008 R1 (Garradd). These fall into the category of Encke type Ecliptic comets.

The populations of comet-like bodies in the Solar System

This is the title of a paper published by Horner, Evans, Bailey and Asher in 2003. Comets are classified according to the planets which control them at perihelion and aphelion. One Hill radius marks the largest distance at which a moon may orbit a planet and, if a comet passes within three Hill radii of a planet, then that planet will, as the case may be, control the perihelion or aphelion of that comet. Table 1 lists the object classification for the region of the Solar System beyond Jupiter.

The first letter in the Object column designates the planet controlling perihelion and the second, aphelion. EK objects are close to or within the Classical Edgeworth-Kuiper Belt and T objects include Scattered Disk Objects and have aphelia beyond the outer edge of the EKB (60 AU). Figure 6 shows the orbit of (5145) Pholus – a Centaur asteroid and thus considered to be a comet-like body by this classification. Pholus has a perihelion distance of 8.7 AU and an aphelion at 32.1 AU and is therefore an SN object.

Conclusion

Not being sure as to which of the classification schemes described here was the accepted one I contacted Paul R. Weissman. Paul works at NASA JPL and is a member of International Astronomical Union (IAU) Commission 20, Positions and Motions of Minor Planets, Comets and Satellites and is thus well qualified to answer such a question. His response was '…it (Harold Levison's 1996 classification scheme) is pretty widely accepted though some people cling to the old SPC (Short Period Comet)/LPC (Long Period Comet) classification scheme'.

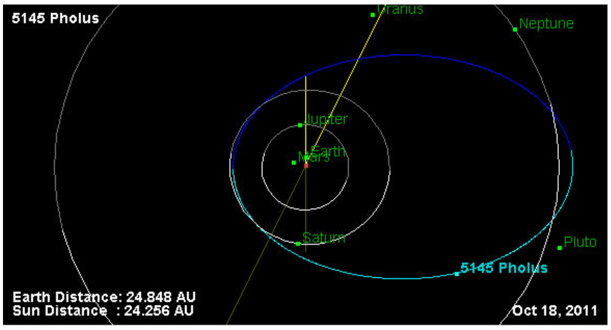


Figure 6. Orbit of (5145) Pholus. NASA/JPL

Object	Perihelion	Aphelion	Object	Perihelion	Aphelion
S	$6.6 \le q \le 12.0$	$Q \le 12.0$	**UE**	$12.0 \le q \le 22.5$	$33.5 \le Q \le 60.0$
SU	$6.6 \le q \le 12.0$	$12.0 \le Q \le 22.5$	**UT**	$12.0 \le q \le 22.5$	$Q \ge 60.0$
SN	$6.6 \le q \le 12.0$	$22.5 \le Q \le 33.5$	**N**	$22.5 \le q \le 33.5$	$Q \le 33.5$
SE	$6.6 \le q \le 12.0$	$33.5 \le Q \le 60.0$	**NE**	$22.5 \le q \le 33.5$	$33.5 \le Q \le 60.0$
ST	$6.6 \le q \le 12.0$	$Q \ge 60.0$	**NT**	$22.5 \le q \le 33.5$	$Q \ge 60.0$
U	$12.0 \le q \le 22.5$	$Q \le 22.5$	**EK**	$33.5 \le q \le 60.0$	$Q \le 60.0$
UN	$12.0 \le q \le 22.5$	$22.5 \le Q \le 33.5$	**T**	$33.5 \le q \le 60.0$	$Q \ge 60.0$

Table 1. Object classes for the Solar system beyond Jupiter

Dust to dust - Comet 2010 X1 (Elenin)

Roger Dymock

Comet 2010 X1 (Elenin) is, or rather was, a long period comet (pre-1996 classification) discovered by Russian amateur astronomer Leonid Elenin on 2010 December 10. Its discovery was announced in Minor Planet Electronic Circular (MPEC) 2010-X101 issued 2010 December 12. In Harold Levison's 1996 scheme, the norm for classifying comet orbits these days, 2010 X1 (Elenin) falls into the 'Nearly Isotropic, New' category. Such comets are visiting the inner solar system for the first time, may arrive at any inclination and have semi-major axis greater than 10,000 Astronomical Units (AU). This particular comet is thought to have its origins in the Oort Cloud with an aphelion at 63,600 AU but, after its passage through the inner Solar System, would have been perturbed, by planetary encounters, into an 11,800 year orbit with a semi-major axis of 518 AU.

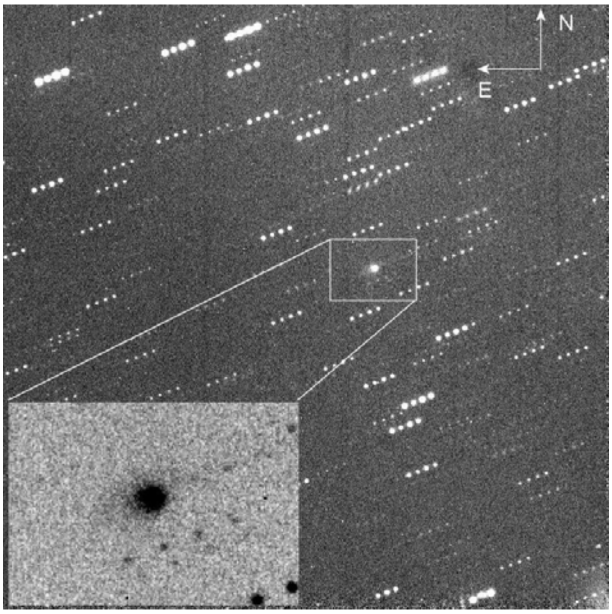


Figure 1*. 2010 X1 (Elenin), 2011 Apr 27, 0507UT, 20x20 arc mins, 4x60 sec exp, SSON OMI 0.61m f/10 Cassegrain, FLI Proline PLO9000 CCD, unfiltered, R Dymock, MPC G68*

Using the Sierra Stars Observatory Network's 0.61m robotic telescope situated in Markleeville, California, I imaged this comet several times between 2011 April and June (Figures 1 and 2). These observations were supported by the British Astronomical Association's Robotic Telescope Project.

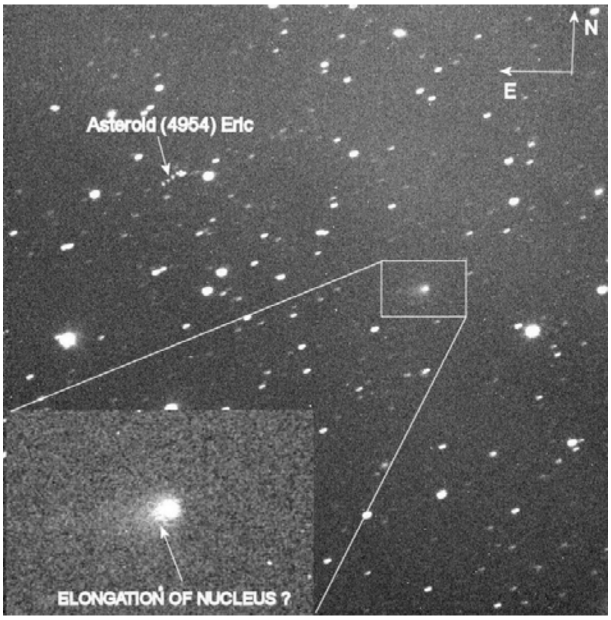


Figure 2*. 2010 X1 (Elenin), 2011 May 20, 0540UT, 20x20 arc mins, 5x60 sec exp, SSON OMI 0.61m f/10 Cassegrain, FLI Proline PLO9000 CCD, unfiltered, R Dymock, MPC G68*

In Figure 2 the nucleus appears slightly elongated so maybe this was an early sign of a possible break-up. Asteroid (4954) Eric was also captured – it is always worth checking your images for interesting objects other than your specific target.

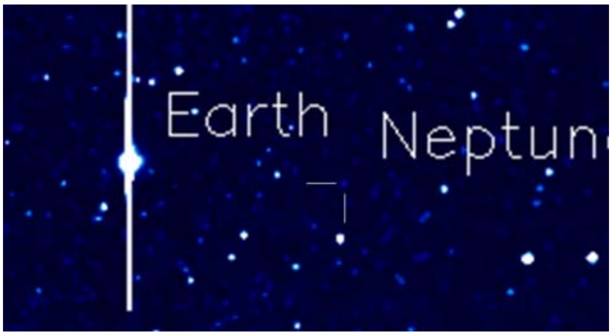


Figure 3*. STEREO A image with moving object indicated.*

Early October I noticed a moving object on images obtained by the STEREO A spacecraft. This appeared to be roughly where comet Elenin would be and moving in the right direction (Figure 3).

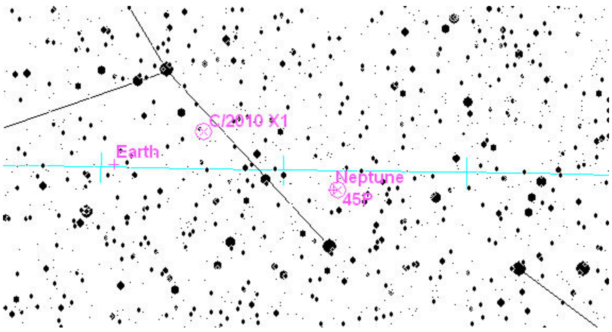


Figure 4*. Guide's view from STEREO A to same scale as STEREO A image.*

After a few days the motion of the object and its brightness made me less and less sure that it was that comet. With the help of Guide's Bill Gray I was able to produce a star chart showing the view from STEREO A (Figure 4). This established that the object in question was a comet but not 2010 X1 (Elenin). It was in fact 45P/Honda-Mrkos-Pajdusakova. As can be seen, if 2010 X1 had lived up to its reputation it would also have been visible.

Figure 5*. 2010 X1 (Elenin), 2011 October 22, 116x87 arc mins, 6x300 sec exp, GRAS Takashashi FSQ 106ED refractor, SBIG STL-8300-C CCD, Rolando Ligustri.*

As often happens with comets, this particular one did not brighten as expected and recovery of the comet after its perihelion passage on 2011 September 10 proved problematic. Finally on 2011 October [This was **after** Juan José González had reported visual observations, which alerted imagers to the possibility. Ed] Ernesto Guido, Giovanni Sostero and Nick Howes, imaged what they described as an extremely faint and diffuse blob of light measuring approximately 14 x 8 arc mins – the remains of the comet. A confirmation image by Rolando Ligustri, obtained on 2011 October 22 is shown in Figure 5.

The break-up of a comet at or near perihelion, or when passing close to Jupiter [or at any time along its orbit. Ed.], is not uncommon. Comet nuclei are loosely bound aggregates of rock and ice and are thus fairly easily disrupted by tidal forces (the part of the comet closest to the Sun or Jupiter experiencing a greater gravitational pull than the opposite side of the comet). A comet may also disintegrate as it loses its volatiles after one or more visits to the inner solar system. The debris cloud, consisting of particles of rock and ice, will remain in a similar orbit to that of the parent comet but it won't come our way again for another 12,000 years or so, according to Don Yeoman's of NASA's Near-Earth Object Program Office.

When a comet behaves in this way then, according to the Minor Planet Center's Cometary Designation System, its designation should change to reflect this. In this instance the C prefix (indicating a comet that has a period greater than 200 years or has only been observed at one perihelion passage) would be replaced by D (for a periodic comet that no longer exists or is thought to have Disappeared), hence D/2010 X1 (Elenin) [Though this style is rarely used for non-periodic comets. Ed.]. Comets condensed out of the contracting solar nebula in the distant Edgeworth-Kuiper Belt and the Oort cloud. This particular comet has returned to its original condition – dust to dust one might say.

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.

Analysis of the Orbit of the Centaur Asteroid 2009 HW$_{77}$ *I. Wlodarczyk, K. Cernis, and I. Eglitis* To appear in: Monthly Notices of the Royal Astronomical Society

We present the time evolution of orbital elements of the Centaur asteroid 2009 HW$_{77}$, discovered by KC and IE, forwards and backwards in time over a 10-Myr period. The dynamical behaviour is analysed using three software packages: the ORBFIT, the SWIFT and the MERCURY integrators. Changes in the orbital elements of 2009 HW$_{77}$ clones are calculated using the classification of Horner et al. It is shown that close approaches to the giant planets significantly change the asteroid orbit. Our computations made with the SWIFT software and with the MERCURY software give similar results. The half-life is about 5 Myr in both the forward and backward integrations. Moreover, our computations suggest that the Centaur asteroid will be temporarily locked as a periodic asteroid connected with Jupiter with a Tisserand parameter smaller than 3. Hence it is dynamically similar to the Jupiter Family Comets. The mean duration in this state is about 82 kyr, but the behaviour and lifetime depend on whether capture occurs after a few hundred thousand years or a few hundred million years. Several clones of this dynamically interesting Centaur asteroid are temporarily locked up to four times as periodic asteroids connected with Jupiter, after which they are ejected from the Solar system. According to Bailey and Malhotra, asteroid 2009 HW$_{77}$ may belong to the diffusing class of Centaurs, which can evolve into Jupiter Family Comets.

An Oort Cloud Origin for the High-inclination, High-perihelion Centaurs *R. Brasser, M.E. Schwamb, P.S. Lykawka and R.S. Gomes* To appear in: Monthly Notices of the Royal Astronomical Society**.** On the web at http://arxiv.org/abs/1111.7037

We analyse the origin of three Centaurs with perihelia in the range 15 AU to 30 AU, inclinations above 70° and semi-major axes shorter than 100 AU. Based on long-term numerical simulations we conclude that these objects most likely originate from the Oort cloud rather than the Kuiper Belt or Scattered Disc. We estimate that there are currently between 1 and 200 of these high-inclination, high-perihelion Centaurs with absolute magnitude $H<8$.

Review of comet observations for 2011 January - 2011 December

The information in this report is a synopsis of material gleaned from IAU circulars 9191 – 9249, MPECs, The Astronomer (2011 January – 2011 November) and the Internet. It covers comets designated during 2011, and those with visual observations made during the year. Note that the figures quoted here are rounded off from their original published accuracy. Lightcurves for the brighter comets are mostly from observations submitted to the Director. A report of the comets seen during the year, including observations published in The Astronomer will be produced for the Journal in due course. I have used the convention of designating interesting asteroids by A/Designation [Discoverer] to clearly differentiate them from comets, though this is not the IAU convention.

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

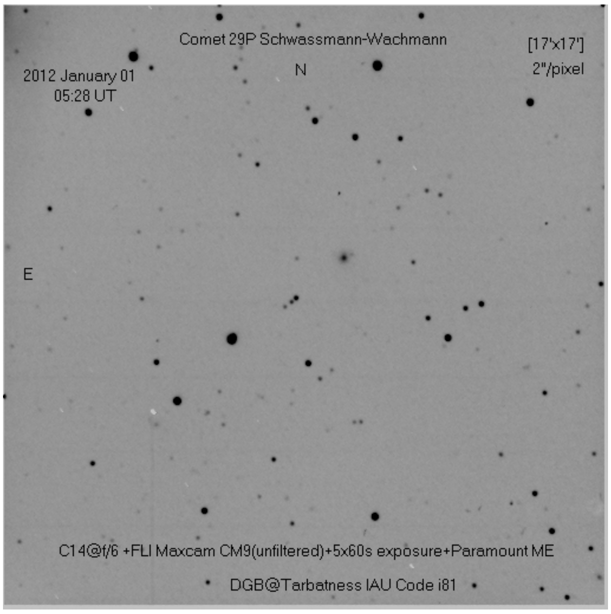
21P/Giacobini-Zinner was first discovered by Michael Giacobini at Nice observatory in December 1900 and was thought to have a period of 6.8 years. The next two returns were expected to be difficult to observe, but in October 1913, Ernst Zinner, of Bamberg, Germany, discovered a comet whilst observing variable stars in Scutum. This turned out to be the same comet, but the period had been incorrectly determined. The comet was missed at three unfavourable returns.

The comet is the parent comet of the October Draconid meteors. In 2011 Earth passed just inside the comet's orbit 132 days before the comet. Predictions made using the dust trail model forecast activity for October 8 most likely between 18 and 21 UT. An outburst was observed on October 8, between 20:05 and 20:15 UT.

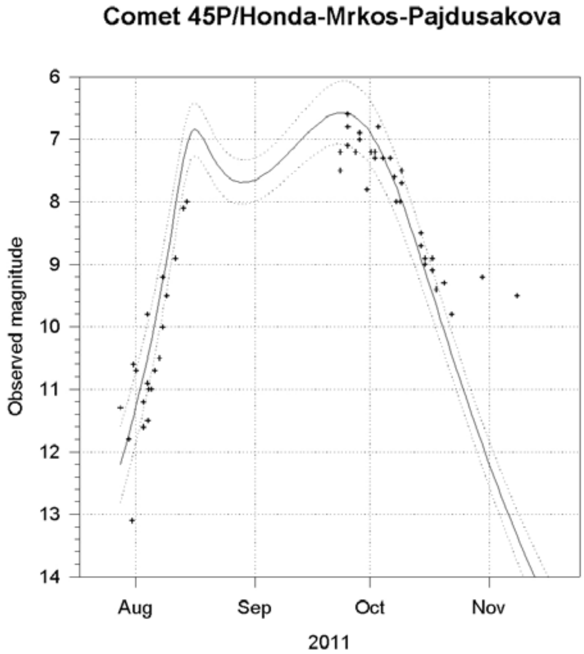
The comet reaches perihelion in 2012 February, but the return is unfavourable. Never-the-less a few observations were made during November when the comet was reported at between 12th and 13th magnitude. By December 22 it had brightened to 9th magnitude.

27P/Crommelin had a poor return. Its maximum elongation whilst brighter than 14th magnitude was only 37°, however Juan José González, who observes from a high quality mountain site, managed to observe it at 10th magnitude in July. The comet is named for the BAA Comet Section Director who first computed a linked orbit for comets seen in 1818, 1873 and 1928. It was quite well observed in 1984 when it served as a test comet for the International Halley Watch.

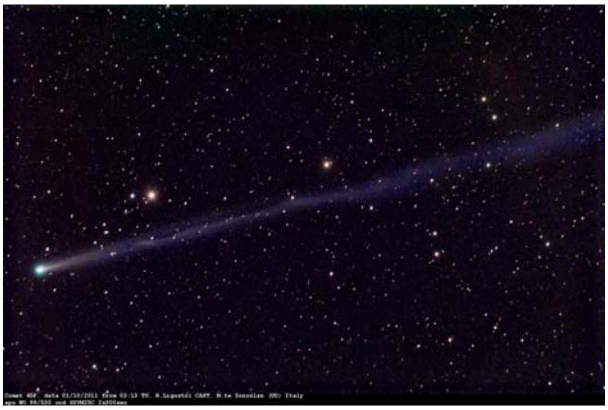
Observations show that **29P/Schwassmann-Wachmann** continued its high level of erratic outbursts. Positive reports were made from January through to June and in November and December, with the comet reaching 10th magnitude on a couple of occasions. The comet was at opposition in March and conjunction in September.



There was an excellent return of **45P/Honda-Mrkos-Pajdusakova**. It has had several close encounters with Jupiter, the most recent in 1983 which made dramatic changes to ω and Ω. The perihelion distance has steadily decreased and is now the smallest it has been for the last 200 years. It can approach quite closely to the Earth and on this occasion it did so to within 0.06 AU on August 16. The next close approach is in 2017 when it comes within 0.08 AU. It was picked up near opposition in July, when it was a 12th magnitude object in Pisces Austrinus. It headed even further south, brightening rapidly as it closed on the Earth. It then passed through conjunction at the end of August. Observers picked it up again as it approached perihelion at the end of September, when it was near its brightest, just below naked eye visibility. A short tail was noted in October. Visually it was something of a disappointment considering the close approach, however some excellent images were obtained.



The 53 observations received so far suggest an uncorrected preliminary light curve of m = 12.6 + 5 log d + 19.1 log r



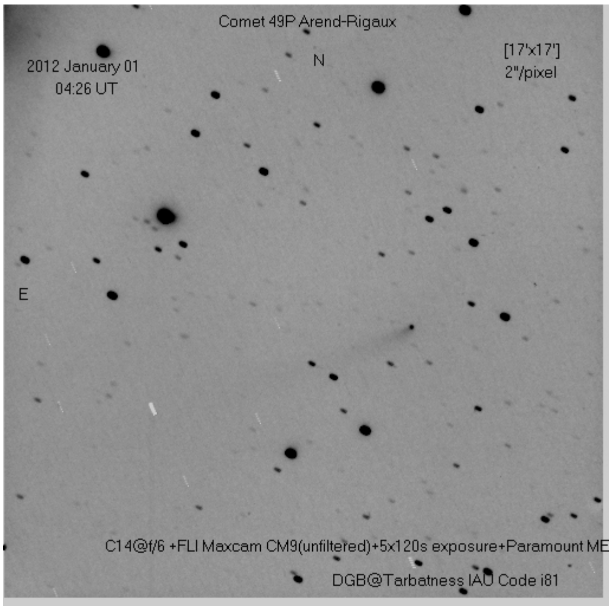
45P imaged by Rolando Ligustri on 2011 October 1

48P/Johnson was discovered by Ernest Johnson at the Union Observatory in South Africa in 1949, following a very close approach to Jupiter in 1931. It is now in a stable orbit between Mars and Jupiter and no close approaches are predicted for some centuries. At favourable apparitions, such as its first two returns, it reaches 13th magnitude. The next three returns were unfavourable, with the comet reported to reach only 18th magnitude. Returns are now improving and one observation was made in early August by Juan José González, who estimated it at 14th magnitude.

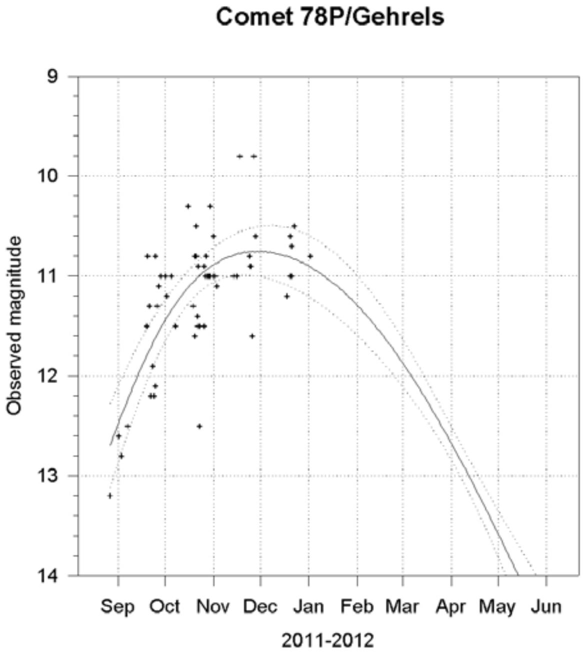
49P/Arend-Rigaux was discovered during its best ever apparition in 1950, when it reached 11^m; at another good return in 1984 it reached 12^m. At these returns it showed a faint coma and short tail, but at more distant returns it appears virtually stellar and this has lead to some reports of it being on the verge of extinction. The comet is one of a handful that has a measured nuclear rotation period, which is thought to be around 6.73 hours.

The 12 observations received so far suggest an uncorrected preliminary light curve of m = 9.6 + 5 log d

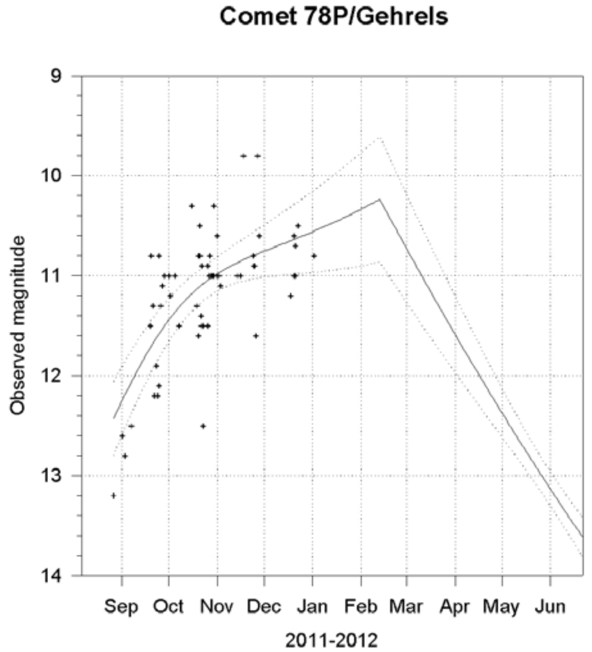
+ [10] log r however they do not fit well to a standard light curve. The observations, made between September and December, range from 10th to 14th magnitude. Whilst they are generally brighter post the October perihelion, this most likely just reflects the distribution of observations by different observers.



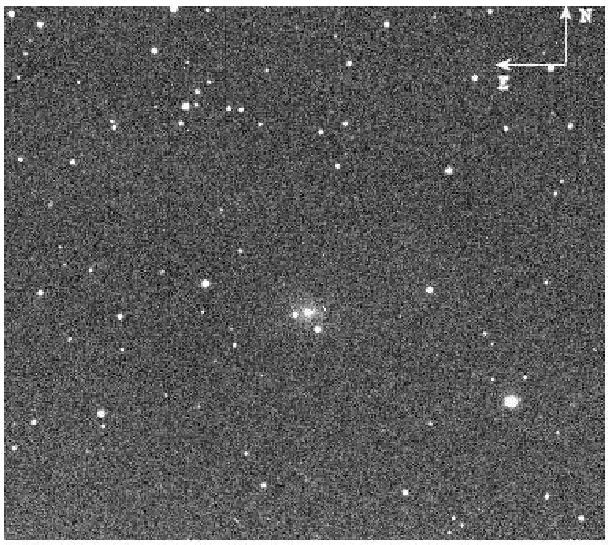
78P/Gehrels reaches perihelion in 2012 January, but its distance from the Earth is already increasing, and so it may be fading from its best in the autumn of 2011. It is however relatively well placed in the evening sky, and so a suitable target for continued telescopic observation.



The 59 observations received so far suggest an uncorrected preliminary light curve of m = -2.7 + 5 log d + 40.7 log r. This is an unusually high log r coefficient. At the last return the comet showed a linear type of light curve, and if this is followed the equation becomes m = 9.5 + 5 log d + 0.0219 (dT – 31), ie the comet will be brightest 31 days after perihelion, though an accurate time is currently indeterminate. It should become obvious fairly quickly which is the better representation.

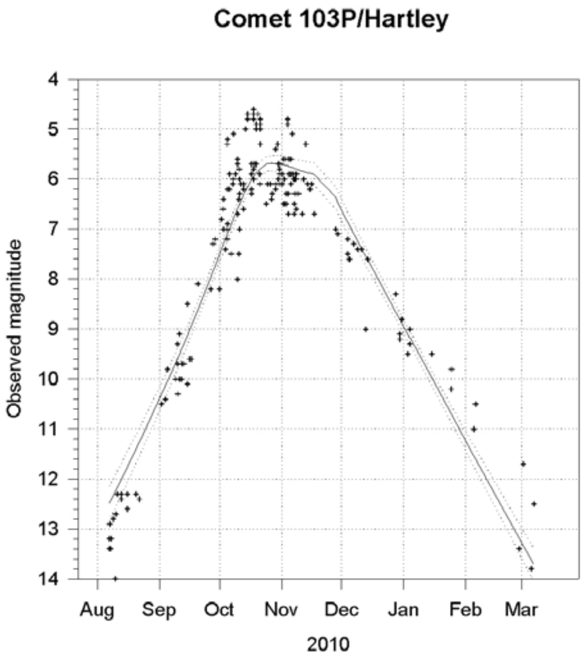


Visual observers had lost **81P/Wild** by August 2010, but imagers continued to follow it well into 2011.



81P/Wild, 2010 Jun 11, 06:03UT, 20x20 arc mins, 30s exp, SSON OMI 0.61m f/10 Cassegrain, FLI Proline PL09000 CCD, unfiltered, R Dymock, MPC G68

103P/Hartley was fading steadily after its close approach to the Earth in 2010, and started the year at 9th magnitude. The uniform fade continued and it was last seen in early March.



The 181 observations received so far give an uncorrected preliminary light curve of m = 9.0 + 5 log d + 0.0416 (dT – 26), ie the comet was brightest 26 days after perihelion.

130P/McNaught-Hughes was discovered by Rob McNaught and Shaun M Hughes with the UK Schmidt at Siding Spring on 1991 September 30.51 at photographic magnitude 16.5 when the comet was just past opposition in Aquarius and three months past perihelion. Jim Scotti recovered the comet with the 0.9-m Spacewatch telescope on 1997 April 16.45 and it was independently recovered by A Nakamura with the Kuma Kogen Astronomical Observatory 0.6-m f6 Ritchey-Chretien telescope on 1997 April 29.66. It passed moderately close (0.44 AU) to Jupiter in November 1907. It is an intrinsically faint and distant comet, which normally gets little brighter than at discovery. One observation by Juan José González made the comet 14th magnitude in early August.

174P/Echeclus = (60558) Echeclus A cometary coma was detected around the centaur asteroid (60558) 2000 EC98 on 2005 December 30.50. At discovery by Spacewatch in 2000 the object was 21st magnitude, but the development of a coma had caused it to brighten by at least 3 magnitudes. Visual reports suggested it could be even brighter. Professional observations made since December 2005 appeared to indicate that the main source of activity was a secondary body moving independently of the primary, though this has not been confirmed. Alternatively its activity may be similar to that of 29P/Schwassman-Wachmann, which for a long time only underwent occasional outbursts.

This may be one of the most distant comets that can be observed visually. The object is in a 35 year orbit, and is not due to reach perihelion until 2015, when it will be at 5.8 AU.

Michael Jaeger imaged the comet on 2011 May 30, finding it to be in outburst at 15th magnitude. At this time it was still over 8 AU from the Sun and a few days later Juan José González observed it at 14th magnitude.

213P/Van Ness M E Van Ness noted a 17th magnitude cometary object on LONEOS images taken on 2005 September 10.41. It was in a short period orbit of 6.3 years and was at perihelion at 2.13 AU in 2005 February. It brightened to visual range in October, but then faded, and it seemed that this was a temporary outburst. The comet was recovered by Gary Hug with his 0.56-m reflector at Sandlot Observatory on 2009 January 31.36. It was 21st magnitude.

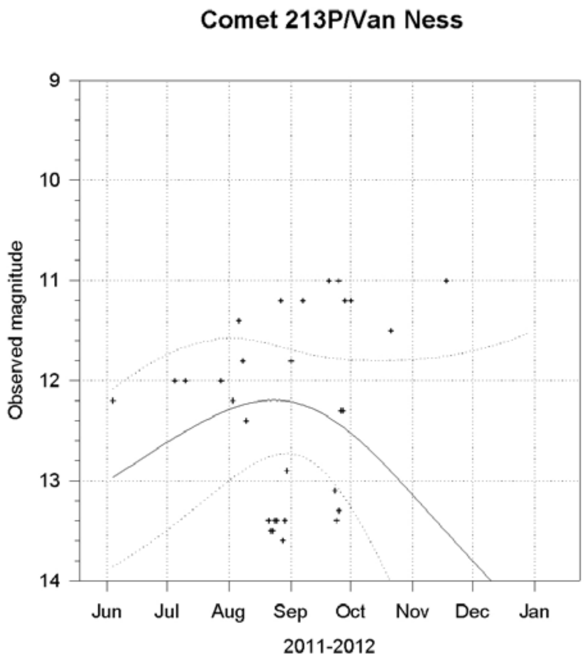


Image by Rich Williams on 2011 August 25

It became brighter than expected in 2011 and a secondary condensation was observed by Giovanni Sostero, Nick Howes, Helen Blyth and Ernesto Guido in images taken with the Haleakala-Faulkes Telescope North on August 5.5, and subsequently seen in images by J. Gonzalez at the end of July and early August.

Orbital calculations by Hirohisa Sato suggest that the split occurred in 2007 or 2008. Following an alert from a Japanese observatory, the team observed an additional component in September. The continued fragmentation may explain why the comet has remained brighter than expected.

Although a light curve is fitted to the observations, this just serves to illustrate that the comet has not followed normal behaviour.

244P/Scotti was recovered by its discoverer, Jim Scotti, in 2010, and reaches perihelion in January 2012. It will probably be too faint for visual observation, but is well within reach of imagers. It made a very close approach to Jupiter in 1998, which lead to its discovery in 2000.

```
244P Scotti. 2011 December 4, 22:43 UTC
10x60s unfiltered ST9XE + C11. FOV 12'.4x12'.4 N up
Nick James.

0244P   KC2011 12 04.94527 05 28 40.84 +26 14 43.2   17.6 N 970
0244P   KC2011 12 04.94905 05 28 40.71 +26 14 43.4   17.9 N 970
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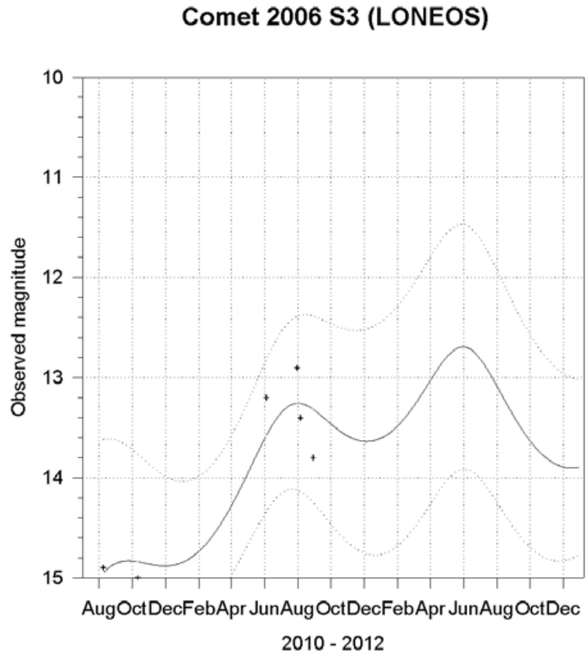
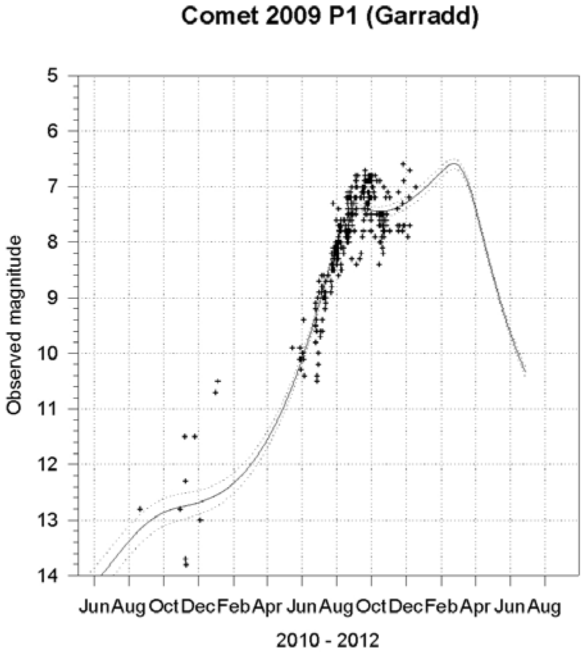
Observations of the briefly cometary main belt asteroid **(596) Scheila** continued during the first quarter of the year, though it had become an essentially stellar object of magnitude 13.5. Radio observations from Arecibo between mid December and early January showed no clear detection of OH emission in the 1667 MHz line. This may suggest that the cometary appearance was due to an impact event, or simply that gas emission was very weak. Jewett et al in a paper submitted to ApJL suggested that the activity was most likely due to impact with a 35m diameter body.

2006 S3 (LONEOS) was discovered nearly six years before its perihelion, which is near 5.1 AU in 2012 April. It has a bright absolute magnitude and observations over the northern summer made it a little fainter than 13th magnitude. It could be a little brighter next year and should still be visible in 2013.

The 6 observations received so far suggest an uncorrected preliminary light curve of m = 1.1 + 5 log d + 11.9 log r

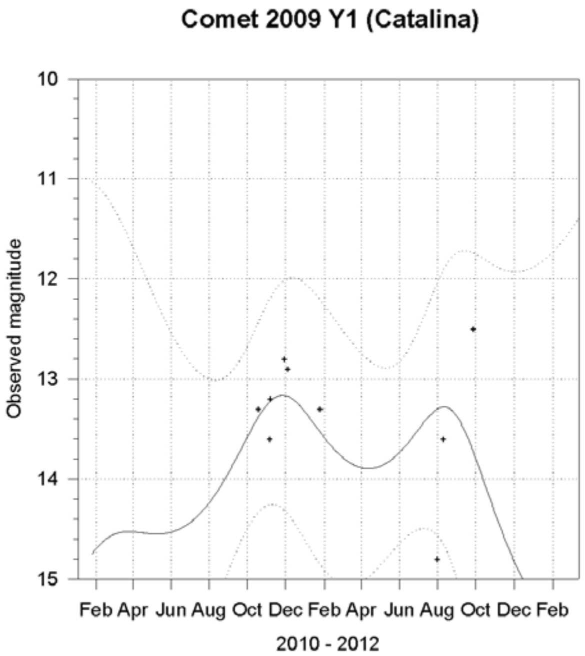
2009 P1 (Garradd) reached perihelion at 1.6 AU in December 2011. Visual observations were reported in 2010 August, with the comet already 13th magnitude, raising some hopes that it might become a naked eye object. It had reached 8.5 by 2011 July, although the rate of brightening was relatively slow. It reached a first peak of around 7.5 towards the end of August, though some observers continued to record it brightening for another month or two. This perhaps implies that not all observations are independent, and that there is a certain amount of "following the trend". It should remain an easy object for several months into the New Year.





337 observations received so far suggest an aperture corrected preliminary light curve of m = 4.2 + 5 log d + 7.3 log r

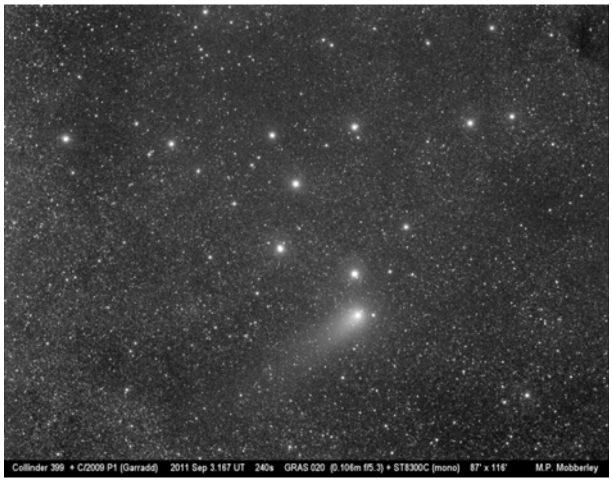
2009 Y1 (Catalina) reached perihelion at 2.5 AU in 2011 January. Visual observations are rather discordant, but suggest that the comet was brightest in late 2010 at around 13th magnitude.



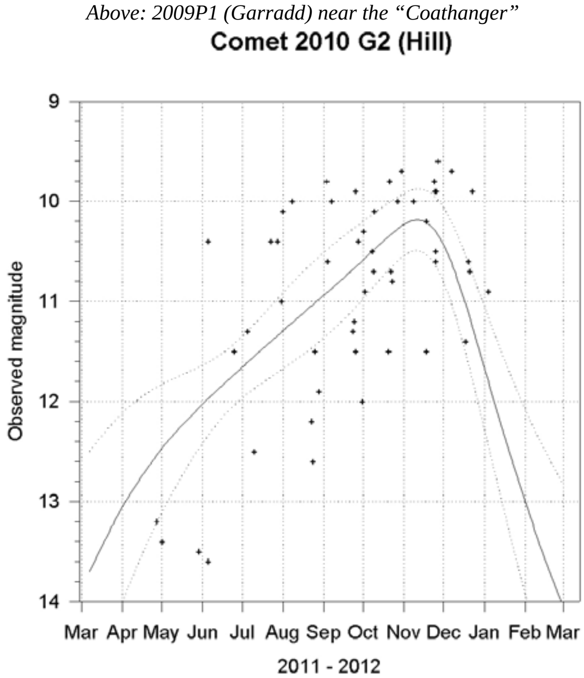
9 observations received so far suggest an uncorrected preliminary light curve of m = 10.1 + 5 log d + 2.7 log r

Visual observations of **2010 B1 (Cardinal)** suggested that it was around 14th magnitude during January and February 2011.

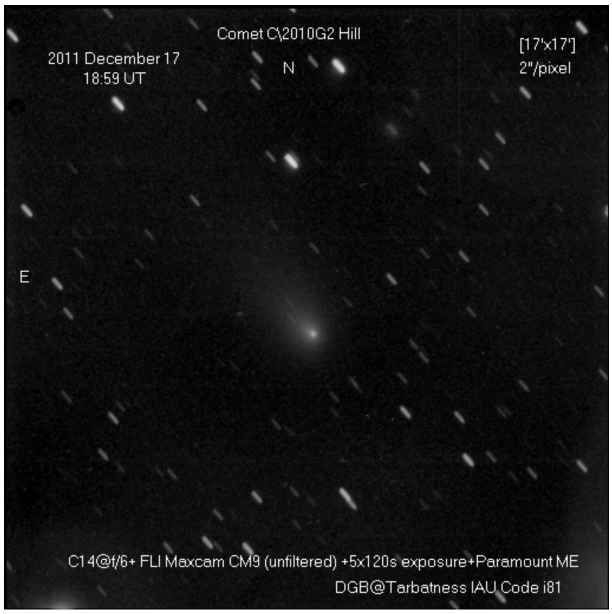
2010 G2 (Hill) was picked up as it brightened through 14th magnitude in March 2011 and reached 10th magnitude at its brightest in the autumn.

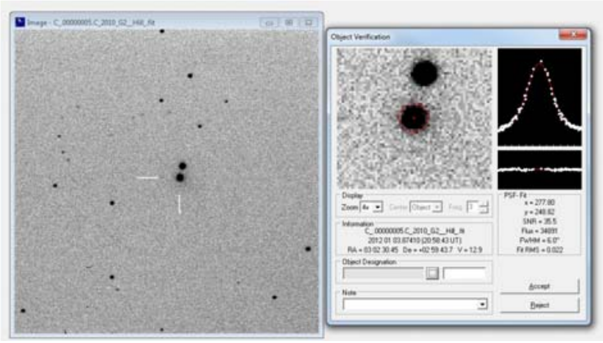


Above: 2009P1 (Garradd) near the "Coathanger"



53 observations received so far suggest an uncorrected preliminary light curve of m = 4.7 + 5 log d + 14.7 log r





The comet has undergone some outbursts, and the image above by Nick James shows an almost stellar nucleus following one at the end of the year, but it remains to be seen how well these are reflected in the overall light curve.

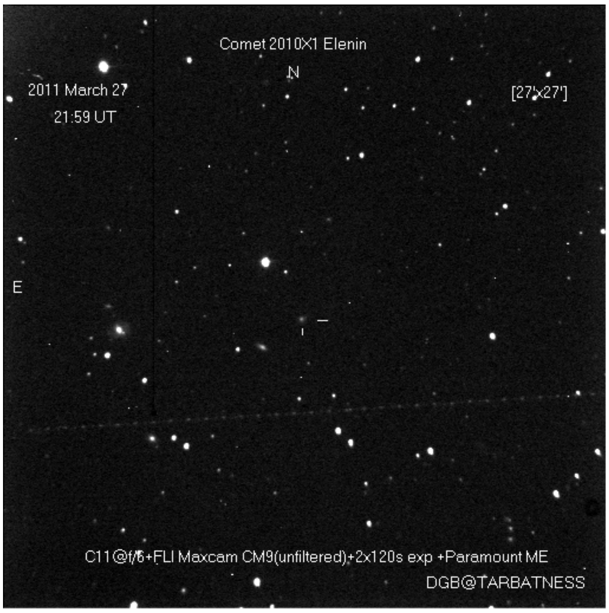
2010 JC_{81} (P/WISE) The Wide-field Infrared Survey Explorer (WISE) satellite discovered an unusual asteroid on May 10. It had an inclined orbit with a period of around 23 years and perihelion at 1.8 AU in 2011 April. [MPEC 2010-V52, 2010 November 5, 6-month orbit]. Observations by G. V. Borisov and V. Rumyantsev with the Crimean Astrophysical Observatory 2.6-m reflector and 0.2-m astrograph in early August 2011 showed that the object had brightened to 15th magnitude and showed cometary features. A visual observation put it at 13.5 in 2011 September.

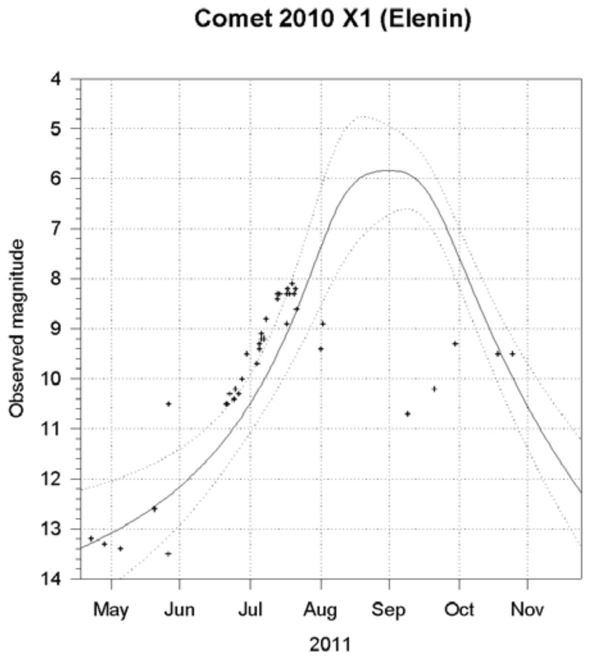
2010 S1 (LINEAR) reaches perihelion at 5.9 AU in 2013 May. Visual observations between 2011 August and November suggested that it was a little brighter than 14th magnitude.

2010 TO_{20} (P/LINEAR-Grauer) A 19th magnitude asteroidal object discovered by LINEAR on 2010 October 1.31 was found to be cometary by Al Grauer on images taken during the Mt Lemmon survey on 2011 October 19.34. The comet has a period of 13 years with perihelion at 5.1 AU in 2008 August. Gareth Williams notes on MPEC 2011-U41 [2011 October 21] *The osculation epoch for the orbit is the current standard epoch, rather than the 40-day epoch closest to perihelion, which is normal for comets. Like the recent case of P/2011 P1 (McNaught), P/2010 TO_{20} (LINEAR-Grauer) has made a recent close approach to Jupiter (0.077 AU on 2009 November 2). For current epochs, the perihelion date lies in 2008. For epochs in 2008, the perihelion date lies in 2012-2013.*

2010 UH_{55} (P/Spacewatch) Spacewatch discovered asteroid 2010 UH_{55} on October 29, and Hirohisa Sato suggested that it showed a coma the following month. This remained unconfirmed until 2011 November, when he again noted a coma. This time follow-up observations confirmed a coma and tail, resulting in the cometary designation. The comet was at perihelion at 2.8 AU in 2011 May and has a period of 16.6 years.

The first visual observations of **2010 X1 (Elenin)** were secured in early April 2011, and suggested that the comet was around 15th magnitude and nearly stellar in appearance. A few supposed authorities suggested that these observations were incorrect, forgetting that each observer has different eyes. Just because one observer can't see an object under a set of conditions doesn't mean that all observers can't see the object. As a UK example George Alcock could see features in cometary tails that very few other observers were capable of recording. Observations in late June suggested that the comet was perhaps 11th magnitude, with some scatter due to observing conditions. Observations in late August suggested that it had ceased to brighten and was becoming more diffuse, evidence that it was in the process of disintegration. CCD observers failed to recover it post perihelion and Internet chat also suggested that the comet could not possibly have survived perihelion. Many "experts" disputed reports of visual observations of a dust cloud by Juan José González, however CCD images taken in good conditions have subsequently proven that these visual observers were correct. In addition the comet was also visible in STEREO images.





Although a fitted light curve is shown, this has little meaning as the comet disintegrated.

Gareth Williams noted on MPEC 2011-R11 [2011 September 2] *The recent [astrometric] observations of C/2010 X1 (Elenin) are discordant, presumably due to* *the lack of any obvious condensation. It is probable that this comet is disintegrating.*

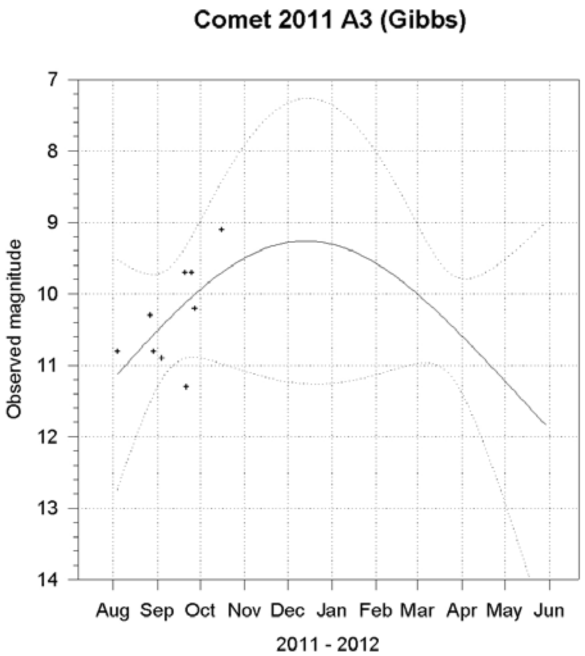
Whilst Internet chat suggested that the comet would have a significant effect on the Earth, its gravitational pull at its closest was about the same as that of a mobile phone held to your ear.

2011 A1 (250P/Larson) A 19th magnitude comet was discovered by Steve Larson on Catalina Sky Survey images taken with the 0.68-m Schmidt telescope on January 10.44. Confirming images were taken with the Mt. Lemmon 1.5-m reflector and also following posting on the NEOCP. The comet has a period of 7.3 years and was at perihelion at 2.2 AU in 2010 November. Images of the comet were subsequently found in Spacewatch images from 1995 and 2004 (identified by S Nakano) and NEAT images from 2002 (identified by Maik Meyer). The comet was then numbered.

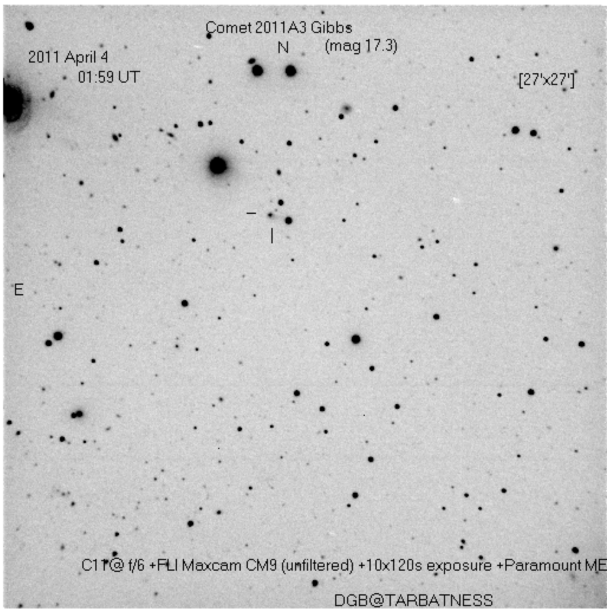
2011 A2 (P/Scotti) Jim Scotti discovered a 20th magnitude comet in Spacewatch images taken with the 0.9-m f/3 reflector at Kitt Peak on January 11.46. Further observations confirmed a short period orbit, and Hirohisa Sato gives a period of around 6.5 years with perihelion at 1.6 AU in 2010 December.

2011 A3 (Gibbs) Alex Gibbs discovered an 18th magnitude comet on Catalina Sky Survey images taken with the 0.68-m Schmidt telescope on January 15.51. The comet has perihelion at 2.3 AU in December. Visual observers picked up the comet in August when it was already 11th magnitude and it was about 10th magnitude as it headed towards conjunction in October.

10 observations received so far suggest a preliminary light curve of m = -3.9 + 5 log d + 28.6 log r, though this is likely to change once the comet is recovered after conjunction.

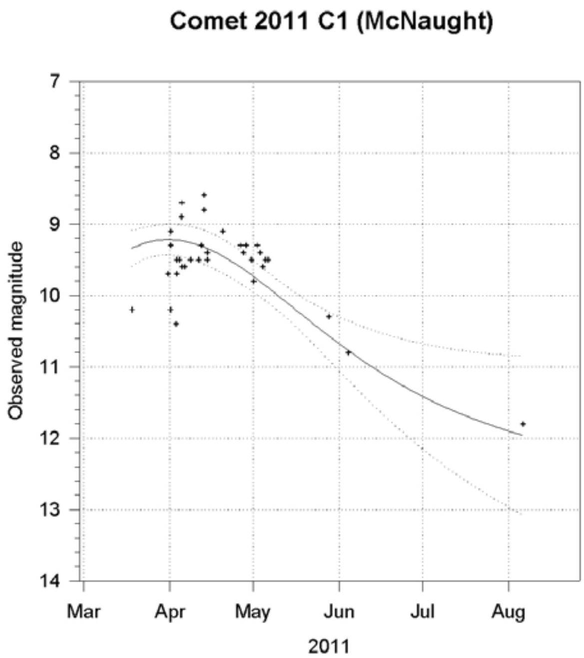


2011 A4 (249P/LINEAR) Leonid Elenin (Lyubertsy, Russia) recovered 2006 U1 (P/LINEAR) using the ISON-NM Observatory near Mayhill, New Mexico, USA. The indicated correction to the prediction by S. Nakano (2010/2011 Comet Handbook) is Delta(T) = +0.24 day.



A/2011 AF$_3$ [Catalina] This unusual Apollo asteroid was discovered by the Catalina Sky Survey with the 0.68m Schmidt on January 4.38. It has a period of 19 years and perihelion is at 0.39 AU in mid February 2011. [MPEC 2011-A18, 2011 January 4, 0.05-day orbit]. In the current orbit it can approach to around 0.4 AU of Jupiter and 0.01 AU of the Earth. Aphelion is at 13.6 AU. The orbit has a Tisserand criterion of 1.50 with respect to Jupiter. The object is very small, with an absolute magnitude of 25.1. It was found around the time of closest approach whilst almost at opposition.

A/2011 BX$_{59}$ [PanSTARRS] This unusual Amor asteroid was discovered by the Pan-STARRS 1 1.8m Ritchey-Chretien reflector on January 30.47. It has a period of 5 years and perihelion is at 1.05 AU in mid March 2011. [MPEC 2011-D12, 2011 February 19, 8-day orbit]. In the current orbit it can approach to around 0.4 AU of Jupiter and 0.07 AU of the Earth. The orbit has a Tisserand criterion of 2.94 with respect to Jupiter.



2011 C1 (McNaught) Rob McNaught discovered a 17th magnitude comet on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on February 10.72. The comet reached perihelion inside the Earth's orbit in mid April. Calculations by Hirohisa Sato suggest that the comet is in a very long period orbit.

The comet brightened rapidly as it approached perihelion and reached 11th magnitude by the equinox. It will brighten a little further, but never becomes well placed for viewing from the UK. Despite the rapid initial brightening, the overall curve has a rather low magnitude parameter.

34 observations received so far suggest a preliminary light curve of $m = 9.4 + 5 \log d + 4.3 \log r$

2011 C2 (P/Gibbs) Alex Gibbs discovered a 20th magnitude comet on February 12.29 on CCD images taken with the Mt Lemmon 1-5m reflector. The comet has a period of around 20 years and reaches perihelion at 5.4 AU in 2012 January.

2011 C3 (Gibbs) Alex Gibbs discovered a second comet on February 12.50. It was also of 20th magnitude. It reached perihelion at 1.5 AU in early April. Calculations by Hirohisa Sato suggest that a long period orbit.

A/2011 CR_{42} [CAST] This main belt asteroid was discovered at the CAST observatory, Talmassons, on February 24.88 and has not been observed since June, but it wasn't until a CBET was issued on September 23 that hints of cometary activity were given. It was at perihelion in November. It is not currently well placed for observation.

2011 E1 (P/SOHO) was discovered by Rainer Kracht in the SOHO LASCO C3 coronograph but has not been observed elsewhere. It was a sungrazing comet of the Kracht group. IAUC 9201 [2011 March 21] gives an orbit by Gareth Williams linking 2011 E1 with 2000 O3 and 2005 W4. The orbital solution requires non gravitational parameters. There was a possibility that the comet might be visible to ground based telescopes during late March and early April, but it was not seen.

A/2011 ED_{78} [Mt Lemmon] This unusual Amor asteroid was discovered by the Mt Lemmon Survey with the 1.5m reflector on March 9.38. It has a period of 5.9 years and perihelion is at 1.19 AU in early August 2011. [MPEC 2011-G02, 2011 April 1, 22-day orbit]. In the current orbit it can approach to around 0.3 AU of Jupiter and 0.2 AU of the Earth. Aphelion is at 5.3 AU. The orbit has a Tisserand criterion of 2.81 with respect to Jupiter.

2011 F1 (LINEAR) LINEAR discovered an 18th magnitude object on March 17.28, which was seen to show a coma by astrometrists, including Peter Birtwhistle, Roger Banks and other European based observers. The comet was over 7 AU from the Sun at discovery and does not reach its 1.8 AU perihelion until January 2013, when it may be around 9th magnitude. UK observers would loose it in 2012 October, by which time it might have reached 10th magnitude. An observation by Juan José González at the beginning of January 2012 put the comet at 14th magnitude, roughly a magnitude brighter than expected.

2011 G1 (McNaught) Rob McNaught discovered a 17th magnitude comet on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on April 5.74. The comet reached perihelion at 1.8 AU in September.

A/2011 GO_{44} [Catalina] This unusual asteroid was discovered by the Catalina Sky Survey with the 0.68m Schmidt on April 5.35. It has a period of 5.6 years and perihelion was at 1.32 AU in mid March 2011. [MPEC 2011-G47, 2011 April 6, 1-day orbit]. In the current orbit it can approach to around 0.5 AU of Jupiter and 0.4 AU of the Earth. The orbit has a Tisserand criterion of 2.88 with respect to Jupiter. It was found around the time of its closest approach to the Earth whilst almost at opposition.

2011 H1 (Mt Lemmon) = 2002 VQ_{94} (LINEAR) Alex Gibbs reported an asteroidal object of 20th magnitude discovered at Mt Lemmon on April 26.30, which he suspected might show some diffuseness. Subsequent images by astrometrists also showed a slightly diffuse object. MPEC 2011-H41 was issued on April 28, and gave the object the designation 2011 GK_{71} [An orbit with a 200 year period and perihelion at 7 AU with an inclination of 63 degrees, which I had noted as unusual, but which did not appear to show any planetary encounters]. Further deep astrometry showed a very faint tail and the object was designated 2011 H1 on May 5. The comet was at perihelion in 6.9 AU in 2006 January. The initial orbit is parabolic. The discovery was announced in IAUC 9206, which gives a not altogether clear account of the sequence of events.

These problems were compounded on May 14, when Hidetaka Sato noted the similarities of the orbit with that of 2002 VQ_{94} (LINEAR), which had last been observed in October 2010. The comet was at perihelion at 6.8 AU in 2006 February and has a period of around 2500 years. On IAUC 9209 [2011 May 20] Dan Green notes "The name associated with C/2011 H1 on IAUC 9206 is being abandoned, due to the belated identification of this comet."

2011 J1 (251P/LINEAR) Jim Scotti recovered 2004 HC_{18} (P/LINEAR) using the Spacewatch 1.8m reflector on May 1.47. The indicated correction to the prediction in the 2010/2011 Comet Handbook is Delta(T) = -0.10 day.

2011 J2 (LINEAR) LINEAR discovered a 20th magnitude object on May 4.19, which was seen to show a coma by astrometrists, including several amateur observers. The comet was over 8 AU from the Sun at discovery and does not reach its 3.4 AU perihelion until December 2013.

2011 J3 (LINEAR) LINEAR discovered a 20th magnitude object on May 14.38, which was seen to show a coma by astrometrists, including several amateur observers. The comet is in a Halley-type retrograde orbit of around 75 years and was at perihelion at 1.4 AU in January.

2011 JB_{15} (P/Spacewatch-Boattini) Andreas Boattini discovered a 19th magnitude comet on images obtained with the Mt Lemmon 1.5m reflector on May 28.33. After posting on the NEOCP the comet was identified with an apparently asteroidal object imaged by Spacewatch on May 8.39 and May 12. Follow up observations by other astrometrists confirmed the cometary nature. The comet has a period of around 20 years and is at perihelion at 5.0 AU in 2012 January.

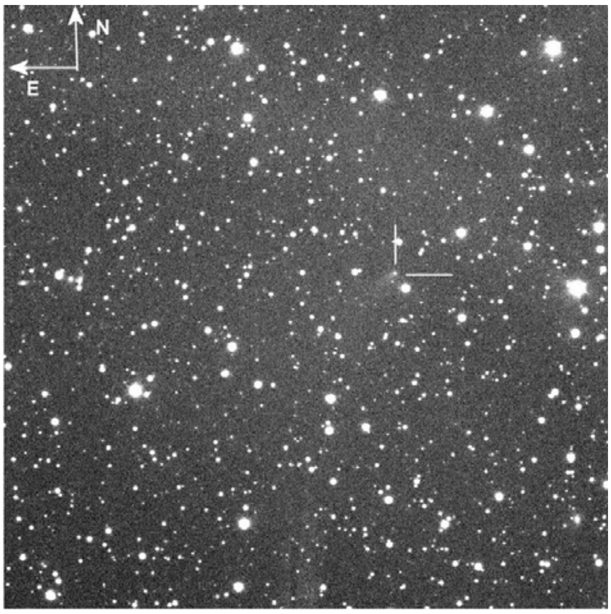
2011 K1 (Schwartz-Holvorcem) Michael Schwartz and Paulo Holvorcem discovered a comet in co-added images begun on May 26,26 taken with the Tenagra III 0.41-m astrograph. Other astrometrists confirmed the cometary nature. The comet was near perihelion at 3.4 AU.

A/2011 KP$_{36}$ [Steward Observatory] This Plutino type asteroid was discovered at the Steward Observatory, Kitt Peak with the 0.9m reflector on May 21.33. It has a period of around 370 years and perihelion is at 4.8 AU in 2016 April. [MPEC 2011-L56, 2011 June 14, 23-day orbit]. The aphelion distance is nearly 100 AU. The orbit has a Tisserand criterion of 2.61 with respect to Jupiter.

2011 L1 (McNaught) Rob McNaught discovered a 17th magnitude comet on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on June 2.63. The comet was at perihelion at 2.4 AU in January.

2011 L2 (McNaught) Rob McNaught discovered an 18th magnitude comet on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on June 2.78. The comet reached perihelion at 1.9 AU in November.

2011 L3 (McNaught) Rob McNaught discovered a 16th magnitude comet on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on June 3.77. The comet reached perihelion at 1.9 AU in August. The few visual observations made between July and September suggest that it was magnitude 13 - 14.



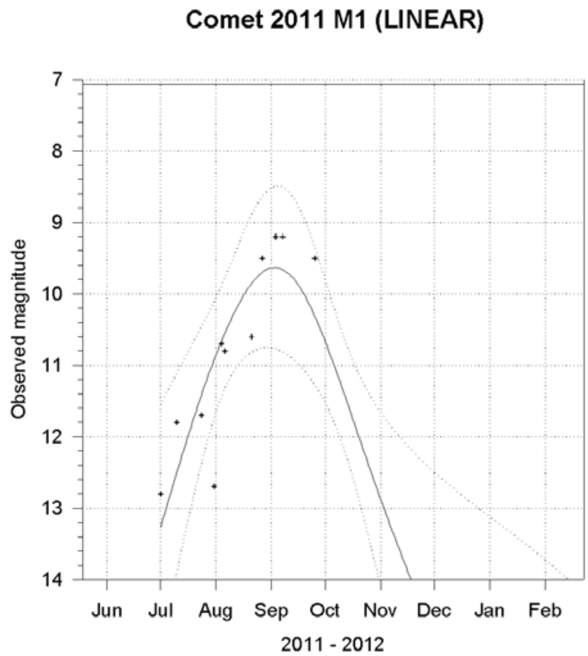
Comet C/2011 L3 (McNaught), 2011 Aug 30, 0428UT, 20x20 arc mins, 90s exp, SSON OMI 0.61m f/10 Cassegrain, FLI Proline PLO9000 CCD, unfiltered, R Dymock, MPC G68

2011 L4 (PanSTARRS) Richard Wainscoat, Institute for Astronomy, University of Hawaii, reported to the MPC that an object discovered on four CCD images taken with the 1.8-m "Pan-STARRS 1" telescope at Haleakala on June 6.39 appeared to show slight non-stellar appearance; three follow-up 30-s r-band exposures were then acquired by M. Micheli and Wainscoat with the Canada-France-Hawaii Telescope on Mauna Kea (queue observer Lisa Wells) on June 7.44 UT, showing that a coma is definitely visible with a subtle hint of a faint tail towards p.a. 60 deg. After posting on the NEOCP astrometrists confirmed the cometary nature. [IAUC 9215, 2011 June 8]. The preliminary orbit gave perihelion at 0.4 AU in March 2013, however the accuracy quoted in the IAUC was rather great for the short arc of only 15 days. There is always likely to be significant refinement as observations accumulate and many preliminary orbits bear little resemblance to the final ones. The latest orbit gives a March perihelion at 0.3 AU. The comet could be a naked eye object from the UK in March 2013.

2011 L5 (252P/LINEAR) Jim Scotti recovered comet 2000 G1 (P/LINEAR) with the Spacewatch telescope on June 9.42, when it was 23rd magnitude. It was not recovered at its previous return in 2005. The most recent perihelion was in November 2010. The indicated correction to the prediction on MPC 59601 is Delta(T) = -0.24 day.

2011 L6 (Boattini) Andrea Boattini discovered a 20th magnitude comet in Mt Lemmon survey images taken on June 8.22. The comet was at perihelion in January at 6.8 AU.

2011 M1 (LINEAR) LINEAR discovered a 19th magnitude asteroidal object on June 22.38, which was seen to show a coma by many amateur astrometrists, including Peter Birtwhistle and other European based observers. The comet was at perihelion at 0.9 AU in September, but was not particularly well placed for observation. It brightened from 13th magnitude in July to reach 9th magnitude by the time it was lost in September twilight.



11 observations received so far suggest an uncorrected preliminary light curve of m = 9.5 + 5 log d + 17.2 log r

A/2011 MT [Mt Lemmon] This unusual Amor asteroid was discovered by the Mt Lemmon Survey with the 1.5m reflector on June 22.35. [MPEC 2011-M33, 2011 June 25, 3-day orbit]. It has a period of 5.4 years and perihelion was at 1.30 AU in early June 2011. In the current orbit it can approach to within 0.5 AU of Jupiter and 0.3 AU of the Earth. The orbit has a Tisserand criterion of 2.93 with respect to Jupiter.

A/2011 MC_2 [Mt Lemmon] This unusual asteroid was discovered by the Mt Lemmon Survey with the 1.5m reflector on June 25.43. It has a period of 6.9 years and perihelion is at 1.31 AU in early July 2011. [MPEC 2011-43, 2011 June 27, 2-day orbit]. In the current orbit it can approach to within 0.1 AU of Jupiter. The orbit has a Tisserand criterion of 2.71 with respect to Jupiter.

2011 N1 (P/ASH) Ignacio de la Cueva, Ibiza, Spain reported an asteroidal object on exposures taken by J. L. Ortiz, P. Santos-Sanz, N. Morales, and himself with a 0.40-m f/3.7 reflector at San Pedro de Atacama, Chile on July 1.36. Follow up images taken on July 3.4 and 4.4 UT, by de la Cueva, Morales, and Ortiz with a 0.45-m reflector at Cerro Burek (Chile) showed a tail extending about 10" and one of 55" in the anti-solar direction. Following posting on the NEOCP other observers confirmed the cometary nature. The comet is in a short period orbit of about 16 years and reaches perihelion at 2.9 AU in 2012 May.

2011 N2 (McNaught) Rob McNaught discovered a 18^{th} magnitude comet on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on July 4.46. The comet reached perihelion at 2.6 AU in October.

2011 NO_1 (P/Elenin) An orbit for an unusual minor planet discovered by Leonid Elenin on July 3.0 using the remote 0.45m astrograph at ISON-NM Observatory, Mayhill, USA was published on MPEC 2011-O09 on July 18. The next MPEC published the following day gave a cometary designation. The object was at perihelion at 1.2 AU in January and has a period of about 13 years.

2011 O1 (LINEAR) LINEAR discovered an 18^{th} magnitude object on July 31.16, which was seen to show a coma by astrometrists. The comet reaches its 3.9 AU perihelion in 2012 August.

A/2011 OR_{17} [Siding Spring] This unusual asteroid, a Cubewano or Scattered Disk Object, was discovered by the Siding Spring Survey with the 0.5m Uppsala Schmidt on July 29.50.[MPEC 2011-O62, 2011 July 30, 1-day orbit]. It has a retrograde orbit with a period of nearly 6000 years and perihelion was at 3.1 AU in August. In the current orbit it can approach to within 1.1 AU of Saturn. The orbit has a Tisserand criterion of -0.14 with respect to Jupiter.

2011 P1 (P/McNaught) Rob McNaught discovered a 17^{th} magnitude comet on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on August 1.77. The preliminary elements were given to unreasonable precision given that Gareth Williams noted on MPEC 2011-P19 [2011 August 4] *From 12 observations 2011 August 1-4. Very uncertain elements, continuing observation very desirable.* Gareth further noted on MPEC 2011-Q34 [2011 August 26] *The orbit for P/2011 P1 (McNaught) is given for the current standard epoch (2011 August 27.0 TT) rather than the traditional 40-day-epoch closest to the date of perihelion passage. This is due to the close approach (within 0.025 AU) that the comet had with Jupiter in 2010 December. Prior to this encounter (and based on the nominal orbit above), the comet was in an 11.8-year orbit with q = 3.9 AU, Incl = 5 deg and T = 2013 March.* The current orbit has a period of 22 years with perihelion at 5.0 AU in 2010 July. Gareth Williams provides more background in The Daily Minor Planet

2011 P2 (PanSTARRS) Pan-STARRS discovered a 21^{st} magnitude comet on August 3.39. It was at perihelion at 6.1 AU in 2010 September and has a period of around 30 years.

2011 Q1 (PanSTARRS) Pan-STARRS discovered a 21^{st} magnitude comet on August 20.44. It was at perihelion at 6.8 AU in 2011 June.

2011 Q2 (McNaught) Rob McNaught discovered a 15^{th} magnitude comet on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on August 26.40. The comet reaches perihelion at 1.3 AU in 2012 January. It is poorly placed at perihelion and may not get brighter than 13^{th} magnitude.

2011 Q3 (P/McNaught) Rob McNaught discovered a 19^{th} magnitude comet on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on August 29.74. The comet reached perihelion at 2.4 AU in August and has a period of 11 years.

2011 Q4 (SWAN) Rob Matson and Vladimir Bezugly reported an object in SWAN imagery on September 5, which was then confirmed as a comet by Rob McNaught and Michael Mattiazzo. The comet was at perihelion at 1.1 AU near the September equinox. Although the comet was still approaching the Sun at discovery, it was receding from the Earth and expected to fade. Its discovery magnitude was 13, though visual observers made it a couple of magnitudes brighter. Observations continued into December, but the few observations do not produce a consistent light curve. It has a long period orbit.

2011 R1 (McNaught) Rob McNaught discovered a 17^{th} magnitude comet on CCD images taken with the 0.5-m Uppsala Schmidt telescope at Siding Spring on September 3.72. The comet reaches perihelion at 2.1 AU in 2012 October.

2011 R2 (253P/PanSTARRS) Pan-STARRS discovered a 19^{th} magnitude comet on September 4.51. It will be at perihelion at 2.0 AU in November. Subsequently S Nakano was able to identify the comet with LINEAR images of asteroid 1998 RS22 and then with 2005 observations by Spacewatch. The comet has a period of 6.5 years.

2011 R3 (P/Novichonok-Gerke) MPEC 2011-R34 announced the discovery by Artyom Novichonok of a comet with the 0.4-m f/8 Ritchey-Chretien at Ka-Dar Observatory, TAU Station, Nizhny Arkhyz on images taken on September 7.02 by Vladimir Gerke. The comet has a period of 11 years with perihelion at 3.6 AU in 2012 April. Only the name Novichonok was originally given to the comet, however the discoverer was clear that it was a team effort with Gerke, and the name was later amended. Denis Denisenko notes

As usual, there's a whole story behind the new discovery. This comet was caught just 63 (!!!) pixels from the edge of 1330x890 CCD image in 3x3 binning mode in the first night. Upon posting at NEO Confirmation Page most people (including myself) originally thought it to be identical to 111P (whose *predicted position was less than 5' away, yet the magnitude was almost identical to the new object). But the direction of motion of the Comet Novichonok was totally different from Comet Helin-Roman-Crockett, and the new object was about twice slower.*

Congratulations to Artyom with the first Russian periodic comet since the breakup of USSR! If you remember, two Comets Elenin were discovered on the telescope installed in USA. This time the observation was made in southern Russia, in the Republic of Karachay-Cherkessia in northern Caucasus, not far away from the 6-meter BTA telescope.

2011 S1 (P/Gibbs) Alex Gibbs discovered a 21st magnitude comet on September 18.27 on CCD images taken with the Mt Lemmon 1-5m reflector. The comet reaches perihelion at 7.2 AU in 2014 August and has a period of 24 years.

2011 S2 (Kowalski) A 17th magnitude comet was discovered by the Catalina Sky Survey on September 30.48. Gareth Williams notes on MPEC 2011-T12 [October 2] *The orbit of this object is essentially indeterminate at the present time. It is possible that this is a short-period comet. Among the wide range of possible short-period orbits are orbits that appear similar to P/2006 T1 (Levy). Initial attempts to link the two apparitions have not been successful. Further observations are encouraged.* Further observations showed that the comet was at perihelion at 1.1 AU in late October and has a period of around 65 years. A couple of visual observations in October suggested that the comet was a little fainter than 11th magnitude.

A/2011 SP$_{25}$ [PanSTARRS] This unusual asteroid was discovered by the Pan-STARRS 1 1.8m Ritchey-Chretien reflector on September 20.52. [MPEC 2011-S45, 2011 September 22, 2-day orbit]. It has a retrograde orbit with a period of nearly 90 years and perihelion was at 2.3 AU in November 2011. Aphelion is at 37 AU. The orbit has a Tisserand criterion of -0.12 with respect to Jupiter.

2011 U1 (P/PanSTARRS) Pan-STARRS discovered a 21st magnitude comet on October 23.45. It will be at perihelion at 2.4 AU in June 2012 and has a period of around 8.1 years.

2011 U2 (P/Bressi) Terry H Bressi discovered a 19th magnitude comet in Spacewatch images taken with the 0.9-m f/3 reflector at Kitt Peak on October 24.21. The comet will reach perihelion at 4.8 AU in May 2012 and has a period of 13 years.

2011 U3 (PanSTARRS) Pan-STARRS discovered a 22nd magnitude comet on October 24.54. It will be at perihelion at 1.1 AU in June 2012. Based on the discovery magnitude the comet will become no brighter than 14th magnitude, however it remains to be seen how much coma it will actually generate.

2011 UA$_{134}$ (P/Spacewatch-PanSTARRS) A 20th magnitude asteroid discovered by Spacewatch on October 24.43 was reported by Pan-STARRS as a 21st magnitude comet on October 25.43. It was at perihelion at 2.1 AU in December and has a period of around 13 years. This is the 50th discovery for Spacewatch.

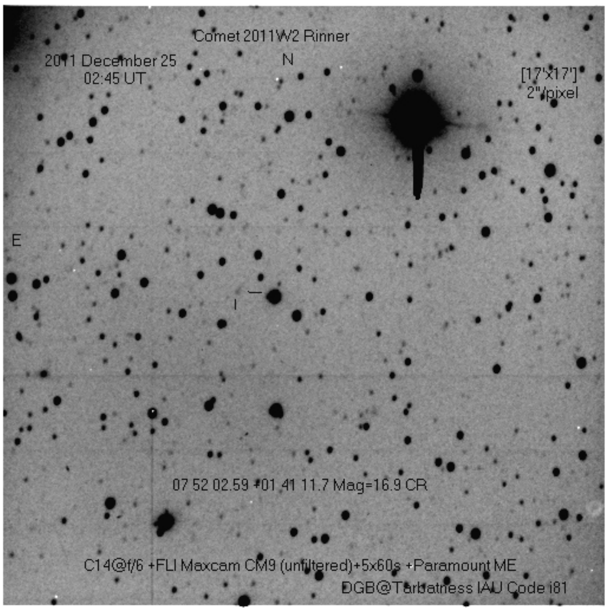
A/2011 UF$_{256}$ [Mt Lemmon] This unusual Amor asteroid was discovered by the Mt Lemmon Survey with the 1.5m reflector on October 30.44. [MPEC 2011-U117, 2011 October 31, 1-day orbit]. It has a period of 7.6 years and perihelion was at 1.2 AU in late November 2011.In the current orbit it can approach to around 0.4 AU of Jupiter and 0.3 AU of the Earth. The orbit has a Tisserand criterion of 2.31 with respect to Jupiter.

2011 UF$_{305}$ (LINEAR) This comet, originally classified as an unusual asteroid, a Cubewano or Scattered Disk Object, was discovered by LINEAR on October 31.08 with the 1-0m reflector. [MPEC 2011-V16, 2011 November 3, 3-day orbit]. The slightly retrograde high inclination orbit has a very long period and perihelion is at 2.1 AU in 2012 July. Aphelion is at over 2000 AU. The orbit has a Tisserand criterion value of 0.13. As seemed possible from the orbit, the object showed cometary characteristics, which were observed in November, but it was not reclassified as a comet until an orbit was published on MEPC 2011-Y51 [2011 December 28].

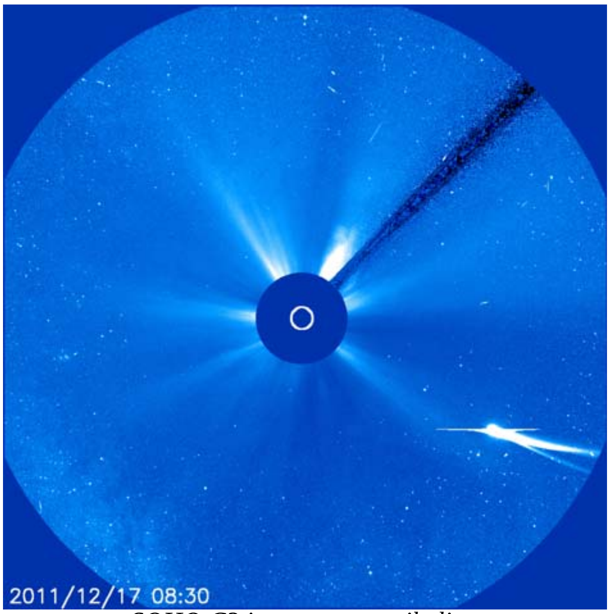
A/2011 UR$_{402}$ [PanSTARRS] This unusual asteroid was discovered by the Pan-STARRS 1 1.8m Ritchey-Chretien reflector on October 23.45. [MPEC 2011-X23, 2011 December 5, 40-day orbit]. It has an orbit with a period of around 80 years and perihelion is at 4.1 AU in May 2014. Aphelion is at 34 AU. The orbit has a Tisserand criterion of 2.44 with respect to Jupiter.

2011 V1 (P/Boattini) Andrea Boattini discovered a 19th magnitude comet in Mt Lemmon survey images taken on November 1.30 and was then able to find pre-discovery images from October 22. The comet was at perihelion in May at 1.7 AU and has a period of around 7.5 years.

2011 W1 (P/PanSTARRS) Pan-STARRS discovered a 19th magnitude comet on November 26.54. It will be at perihelion at 3.3 AU in February 2012 and has a period of around 10 years.



2011 W2 (P/Rinner) Amateur observer Claudine Rinner discovered a comet from Oukaimeden Observatory, near Marrakech, Morocco on November 28.13 on CCD images taken by herself and Michel Ory with the 0.5-m f/3 reflector. The comet was at perihelion at 2.3 AU in November and has a period of around 7.4 years.



SOHO C3 image post perihelion

2011 W3 (Lovejoy) Terry Lovejoy discovered an object on November 27.73, which was posted on the NEOCP as TLc001. As astrometry accumulated it became clear that it might be a Kreutz comet, and this was confirmed on December 2, when MPEC 2011-X16 gave a retrograde orbit with perihelion at 0.006 AU on December 16.0. The comet is intrinsically faint, and John Bortle opined that it would not survive perihelion. Orbit calculations by Hirohisa Sato and others suggest a periodic orbit, though the period is not yet well determined. The comet looks as if it belongs to the group Kreutz I. The consensus seemed to be that this is the largest of the pygmy sungrazers yet seen by SOHO.

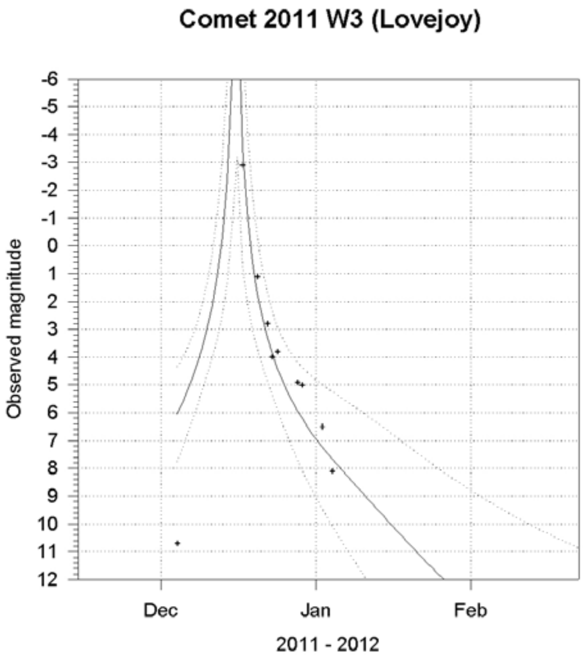
Colin Legg imaged the tail from Australia on December 21

SOHO observations suggested that the comet reached a peak of around -4, but began fading before perihelion. It showed two tails, which were probably ion (or iron) and dust tails. SDO observations show that it survived perihelion, racing through the solar corona. It then re-emerged into the SOHO field, brighter but minus the tail, which lagged behind on the other side of the sun. It was imaged by Terry Lovejoy on December 17.0, when he estimated it at -1.2. A visual observation by Alexandre Amorim on December 17.34 put the comet at -2.9. Marco Gioato observed it at 2.8 on December 22.3. There have been many spectacular images of the tail on the horizon taken from the Southern Hemisphere. The comet was essentially a Southern Hemisphere object. Details of the SOHO story.

2011 December 21, Chris Wyatt

2011 December 23, Alex Cherney

The absolute magnitude of the comet was some 5 magnitudes brighter post-perihelion than it was pre-perihelion. A likely explanation is that a part of the comet's surface was inactive prior to perihelion, and that as the nucleus rotated through the solar atmosphere the inert surface was eroded away, exposing fresh material. It is possible that as the comet recedes from the Sun, parts of the fresh surface will choke off, resulting in a relatively quick fading.



12 observations received to January 4 give an uncorrected preliminary light curve of m = 10.8 + 5 log d + 15.8 log r

Gareth Williams notes on MPEC 2011-Y16 [2011 December 22] *Although a new orbit is being published, the December 19 STEREO observations were within about 1' of the previously-published orbit. The new observations were weighted 0.1 in the above orbit. Resolution of the issues surrounding the STEREO astrometry will probably have to await the acquisition of further ground-based astrometry.*

Gareth Williams notes on MPEC 2011-Y23 [2011 December 25] *C/2011 W3 remains a difficult target for astrometry, as evidenced by the poor consistency of the latest observations. McNaught writes: "Star fit RMS 0.3", but measures are much less reliable than that. The positions are of the tip of the "spine" which lies pretty much on the front edge of the parabolic hood. It is rather less well defined than on Dec 23. For this reason I cannot be sure just how closely I am measuring the same point as on Dec 23."*

Terry provided the following background on the comets-ml

Anyway to the discovery of C/2011 W3, it was the first comet I have found with my new equipment setup. I now use a C8 Schmidt-Cassegrain scope working at f2.1 with a QHY9 CCD camera. This gives me a field of view of a 4.5 square degrees which although only 1/8th of that of my previous DSLR camera, more than makes up for this in extra sensitivity. As a result I can cover the same amount of sky to perhaps a magnitude deeper. Despite this it has been over 4 years since my last discovery and I do hope the next one comes a lot sooner!

2011 December 24, Adam Marsh

The actual discovery images of W3 were made on November 27.7UT, 2011 (Wednesday morning local time). On that morning I imaged some 200 different fields with 3 images each, taking about 2 hours to fully process. After processing, I began searching and on one set of images I noticed a rapidly moving fuzzy object. As I was unsure this was real, I noted the positions and wrote a brief comment "Possible reflection" before proceeding to search more images. The next night I decided to investigate further the suspect since its position, shape and motion didn't appear consistent with an optical reflection and for this reason I decided to make a follow-up observation.

2011 December 28, Stuart Thomson

On November 29.7 UT I began an imaging sequence around the estimated position of the object. However, if the object was real it was travelling very rapidly at 3 degrees per day so any uncertainty in the direction and speed would mean the estimated position could be in error by a couple of degrees. Furthermore cloud and haze hampered imaging that morning. Nonetheless, I was able to capture 6 images that showed a faint but definite fuzzy object near the expected position. Additionally the fuzzy object was consistent in both motion and appearance to the object found 2 mornings earlier. At this point I sent out a request for independent confirmation to a number of trusted observers.

2011 December 28, Russell Cockman

On November 30, all recovery attempts were thwarted for many reasons including weather and insufficient limiting magnitude. Interestingly though, Michael Mattiazzo made a comment that he felt the observed positions were similar to that of a Kreutz sungrazer. Then, finally, on December 1 I received an email from Alan Gilmore stating that he and Pam Kilmartin had successfully imaged the comet with the 1 metre telescope at Mt John Observatory. A few hours later I also managed to get some follow-up images. The object was then published on the NEO confirmation page before being subsequently officially announced in CBET 2930/2931 on December 2.

2011 Y1 (P/Levy) P/2006 T1 was recovered by the Mt Lemmon Survey on December 17.06 and quickly confirmed by other astrometrists, including Peter Birtwhistle and Richard Miles. At 18th magnitude the comet is much fainter than expected (10 magnitudes) and 2.6 days from the expected perihelion. It was clearly in outburst at discovery in 2006, and there is always a chance that there will be repeat at this return. Unless this happens, or the light curve is unusual it will not get within visual range.

2011 Y2 (P/Boattini) Andrea Boattini discovered a 19th magnitude comet in Mt Lemmon survey images taken on December 24.13 and was then able to find pre-discovery images from October 30. Further images from Spacewatch on October 16 and PanSTARRS on September 4 allowed a good preliminary orbit. The comet will be at perihelion in 2012 March at 1.8 AU and has a period of around 15 years.

2011 Y3 (Boattini) Andrea Boattini discovered a 19th magnitude comet in Mt Lemmon survey images taken on December 25.24. The preliminary orbit suggests that the comet was near perihelion at 5.6 AU, however calculations by Hirohisa Sato suggest a perihelion at around 3.6 - 3.8 AU some time in 2011, and slightly prefer a periodic orbit.

A/2011 YQ$_{15}$ [Mt Lemmon] This unusual asteroid was discovered by the Mt Lemmon Survey with the 1.5m reflector on December 25.14. [MPEC 2011-Y43, 2011 December 28, 3-day orbit]. It has a period of 5.7 years and perihelion is at 1.3 AU in March 2012. In the current orbit it can approach to within 0.3 AU of Jupiter. The orbit has a Tisserand criterion of 2.91 with respect to Jupiter.

Un-designated comets. Although 208 comets have been discovered with SOHO during the year, very few have confirmed orbits due to funding difficulties for data reduction. These appear to have been resolved, so the orbit back-log may be reduced. Two **Marsden Group** SOHO comets have unofficial orbits**.** Rainer Kracht suggests that a comet discovered by Rob Matson on February 15 (SOHO-2024) may be a return of either 2005 W1 or 2005 W5, with the latter slightly more likely, but still giving large residuals. Further investigation by Rainer suggested that there is a promising link between the comet and 1995 N5 and 2005 G2, though this required non gravitational forces. This would be the second three apparition linkage of a Marsden comet. On 2011 July 17 Alan Watson reported a Marsden group comet in real time C3 images (SOHO 2115). Rainer Kracht computed an orbit and then linked the object to 2000 C4 == 2005 W1. A non-gravitational parameter was required to match the perihelion dates.

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

Halley

As something of a space filler, I thought I would add a little background to my work in the Antarctic. Halley the station is named after the same Halley who predicted that what is now "his" comet would return. However he had many other interests: the earth's magnetic field, the aurora, atmospheric phenomena such as halos and parhelia, tides, atmospheric pressure and winds amongst others. These were all areas of study during the International Geophysical Year of 1957 – 1958, and when the Royal Society decided to set up a station in Antarctica, it was particularly appropriate to name it after Halley, as in addition he had been a Secretary of the Royal Society, and it was the tercentenary of his birth. The station had not been intended to go at its present location, but pack ice prevented travel further south and the buildings were erected on a floating ice-shelf formed by the flow of ice from the continent, which rises some 30m above the sea surface. They were soon buried by drifting snow, and successive stations were designed to be buried underground. The present station tried a different technique with platforms on steel legs that keep them around 5 metres above the snow surface. Although it is still some 15km inland, its location is roughly where the ice-edge was in 1957, so a new station is being constructed, which consists of towable modules on skis.

My work here is to supervise the meteorological observers and check the calibration of instruments, particularly the Dobson ozone-spectrophotometer, which was instrumental in the discovery of the ozone hole.

Left: the science building at the old station
Right: The science modules at the new station

All around the station is a vast white desert – although a metre of snow accumulated last year, it never melts, and so in not useable by living creatures. In the two weeks I have been here the only wildlife seen has been a couple of Storm Petrels and a Skua, which did several circuits around me before flying off. Mirages are relatively common, and for a brief period I saw the new station upside down! So far the halo-phenomena have been weak, but as it grows colder I'm hoping that we will get a clear day with "diamond dust", which can produce spectacular displays.

Comet Prospects for 2012

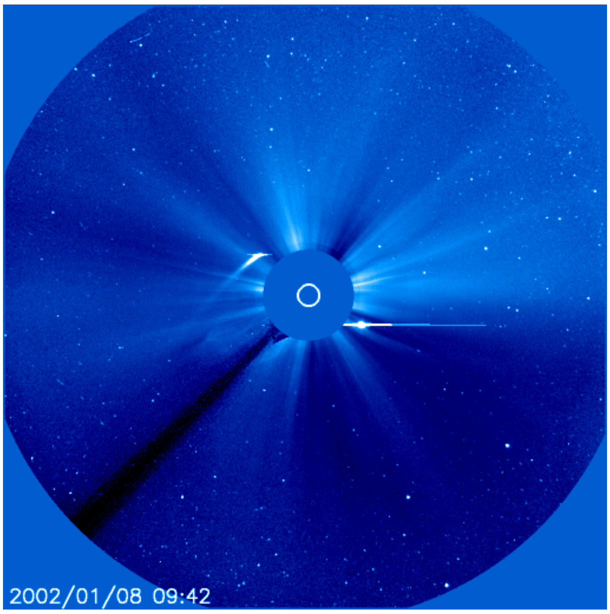
The year starts with a bright, well placed, binocular comet on view. 2009 P1 (Garradd) was at perihelion at the close of 2011, and should be 7th magnitude during January and February. Comet 96P/Machholz is the brightest comet of the year, but is then too close to the Sun for ground based observation. This is an updated version of the Prospects that was published in the December Journal.

Theories on the structure of comets suggest that any comet could fragment at any time, so it is worth keeping an eye on some of the fainter periodic comets, which are often ignored. They would make useful targets for CCD observers, especially those with time on instruments such as the Faulkes telescope. 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. A section booklet on comet observing is available from the BAA Office.

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 Corvus, less than a degree from M104, and completes its retrograde loop in nearby Virgo by mid summer. It crosses back into Corvus, before ending the year in Virgo. The comet is at opposition at the end of March and passes through solar conjunction in mid October.

78P/Gehrels reaches perihelion in January, but its distance from the Earth is already increasing, and so it is fading from its best, when it was 10.5 in the autumn of 2011. It is however relatively well placed in the evening sky, and so a suitable target for telescopic observation.

Although **96P/Machholz** could be the brightest comet of the year, it will only be the solar monitoring satellites that will see it around perihelion. Southern Hemisphere observers may get to see it as a relatively poorly placed telescopic object in the morning sky prior to perihelion, and in the evening sky post perihelion.

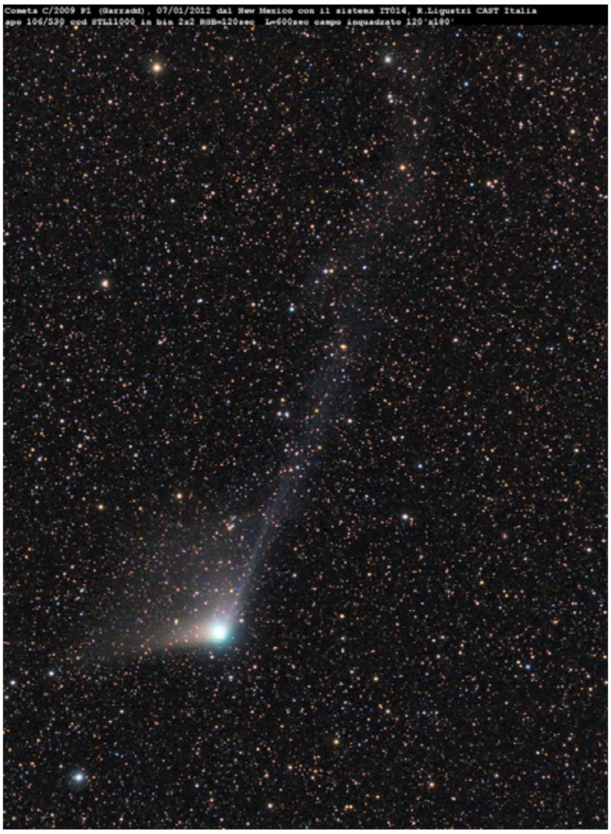


Comet 96P made a spectacular pass through the SOHO field in 2002

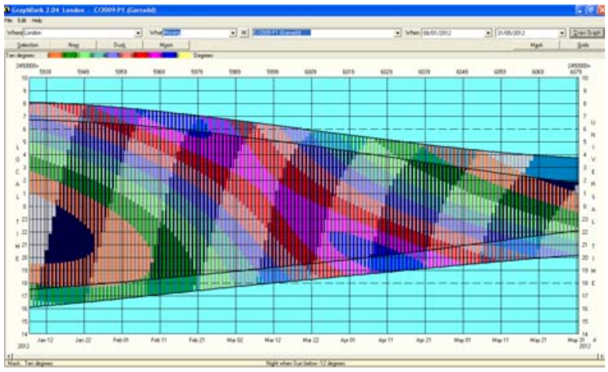
185P/Petriew makes its third return, and although predicted to reach 11th magnitude, it will be a morning object when at its best in early August.

1994 X1 (P/McNaught-Russell) makes its first return to perihelion this year. Although not observed visually at the discovery apparition, its brightness on the Schmidt plates suggests that it might have been within range and the predictions are based on this assumption. It may become visible in July, and will be at its brightest in November and December, when it is well placed in the evening sky.

David Levy made the visual discovery of **2006 T1 (P/Levy)** on October 2.50. Observing near Saturn with his 0.41-m reflector he noted a diffuse object of magnitude 10.5. The cometary nature of the object was confirmed by Peter Birtwhistle and Richard Miles amongst others. The Japanese comet hunter Shigheki Murakami made an independent discovery of the comet on 2006 October 4, but by this time the object had been placed on the NEOCP and an IAUC issued. In principle this is a very good return, as the comet passes 0.19 AU from the Earth, which gives it the potential to become a binocular object, if it behaves as it did at the discovery return. It was recovered in mid December 2011 as **2011 Y1**, but was around 10 magnitudes fainter than expected, so it seems likely that it was caught in outburst at its discovery. This would explain why the comet was not discovered previously, for example the 1991 return was relatively favourable. It is well placed in the evening sky when at its brightest, so there is merit in checking the position in case it outbursts again, but it is rapidly moving south. There is the possibility of a meteor shower from the comet with maximum on New Year's Eve.



2009 P1 (Garradd) currently holds the best prospect for UK observers. It begins the year the year at 7^m^, and whilst visible for a short time in the evening sky, it is best placed in the morning due to its location in Hercules. It is moving north, and passes less than 20' from globular cluster M92 on February 3, soon becoming visible all night. It is furthest north on March 12, at just over 70° declination, but is fading and by the end of April will be 9^th^ magnitude. Telescopic observers should be able to follow it to the end of May (see below), by which time it will have crossed half the sky to Cancer.



2011 R1 (McNaught) may just reach 11^th^ magnitude and is then an exclusively southern hemisphere object. Circumpolar and lying below the pole, it will be visible in the evening sky, which may encourage some observers to turn their telescopes towards it.

The other periodic and parabolic comets that are at perihelion during 2012 are unlikely to become brighter than 12^th^ magnitude or are poorly placed. Ephemerides for these can be found on the CBAT WWW pages. Several D/ comets have predictions for return, though searches at favourable returns in the intervening period have failed to reveal the comets and it is possible that they are no longer active. There is however always a chance that they will be rediscovered accidentally by one of the Sky Survey patrols.

Looking ahead to 2013, **2P/Encke** puts on a good showing for Northern Hemisphere observers and should be a binocular object in November. **2011 L4 (PanSTARRS)** could provide one of the brighter comets of the decade after its March perihelion. Otherwise, prospects for a comet brighter than 12^th^ magnitude in 2013 are poor.

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Jonathan Shanklin

Comets reaching perihelion in 2012

Comet	T	q	P	N	H_1	K_1	Peak mag
P/Spacewatch (2005 JN)	Jan 6.1	2.29	6.56	1	14.0	10.0	19
131P/Mueller	Jan 7.4	2.42	7.07	3	13.0	10.0	17
P/Gibbs (2011 C2)	Jan 7.8	5.39	20.0	0	9.0	10.0	19

78P/Gehrels	Jan 12.9	2.01	7.23	5	3.5	20.0	10
256P/Levy	Jan 14.9	1.01	5.29	1	18.5	10.0	15 ?
P/McNaught (2005 J1)	Jan 15.8	1.54	6.75	1	16.5	10.0	20
McNaught (2011 Q2)	Jan 19.8	1.35			10.0	10.0	13
244P/Scotti	Jan 20.3	3.92	10.8	2	9.0	10.0	17
P/Spacewatch-Boattini (2011 JB_{15})	Jan 21.1	5.02	20.0	0	9.0	10.0	19
P/PanSTARRS (2011 W1)	Feb 2.0	3.31	10.0	0	11.5	10.0	19
5D/Brorsen	Feb 5.3	0.53	5.61	5			
D/Brooks (1886 K1)	Feb 6.3	1.89	6.69	1			
Gibbs (2010 M1)	Feb 7.8	2.30			9.0	10.0	15
21P/Giacobini-Zinner	Feb 11.8	1.03	6.60	14	7.8	17.7	11
198P/ODAS	Feb 15.8	2.00	6.82	2	10.5	15.0	16
105P/Singer Brewster	Feb 26.2	2.05	6.47	4	12.5	15.0	18
3D/Biela-A	Feb 27.0	0.80	6.59	6			
182P/LONEOS	Mar 5.4	1.01	5.10	2	18.0	10.0	17
P/Boattini (2011 Y2)	Mar 21.7	1.79	15.5	0	15.0	10.0	19
P/Novochonok-Gerke (2011 R3)	Apr 2.8	3.56	10.7	0	11.0	10.0	19
242P/Spahr	Apr 3.5	3.98	13.0	2	8.0	10.0	17
58P/Jackson-Neujmin	Apr 10.0	1.37	8.22	6	11.0	15.0	18
163P/NEAT	Apr 12.8	2.06	7.30	3	14.5	10.0	19
LONEOS (2006 S3)	Apr 16.5	5.13			2.0	10.0	12
D/Denning (1894 F1)	Apr 16.8	1.36	8.11	1			
171P/Spahr	Apr 30.6	1.76	6.70	2	10.2	15.0	16
60P/Tsuchinshan	May 13.5	1.62	6.56	7	10.5	15.0	15
P/Bressi (2011 U2)	May 14.6	4.84	12.6	0	9.0	10.0	19
LINEAR (2010 R1)	May 18.9	5.62			6.0	10.0	17
P/Gibbs (2006 Y2)	May 20.8	1.26	5.35	1	18.0	10.0	20
P/ASH (2011 N1)	May 31.1	2.86	15.8	0	11.5	10.0	18
PanSTARRS (2011 U3)	Jun 4.0	1.07			14.0	10.0	14
P/LINEAR (2003 O2)	Jun 10.7	1.50	8.75	1	14.5	10.0	18
138P/Shoemaker-Levy	Jun 11.7	1.70	6.90	3	15.0	10.0	19
P/PanSTARRS (2011 U1)	Jun 20.7	2.36	8.14	0	9.0	10.0	15
152P/Helin-Lawrence	Jul 9.2	3.12	9.54	2	10.0	10.0	18
96P/Machholz	Jul 14.8	0.12	5.28	5	13.0	12.0	2
189P/NEAT	Jul 20.4	1.18	4.99	2	19.0	10.0	16
LINEAR (2011 UF305)	Jul 22.2	2.14			9.0	10.0	14
185P/Petriew	Aug 13.5	0.93	5.46	2	11.0	10.0	11
LINEAR (2011 O1)	Aug 18.5	3.89			7.0	10.0	15
P/LONEOS (2006 Q2)	Aug 22.0	1.34	5.96	1	19.5	10.0	19
P/McNaught (2005 K3)	Sep 12.7	1.50	7.02	1	13.5	10.0	14
160P/LINEAR	Sep 18.5	2.07	7.90	2	15.0	5.0	17
158P/Kowal-LINEAR	Sep 27.5	4.58	10.3	2	9.0	10.0	18
P/Larson (2005 N3)	Sep 29.4	2.19	6.78	1	14.0	10.0	18
168P/Hergenrother	Oct 1.7	1.41	6.89	2	15.5	10.0	15
P/Christensen (2005 T2)	Oct 7.1	2.21	7.47	1	14.5	10.0	19
Bressi (2011 U2)	Oct 9.2	2.49			10.0	10.0	16
3D/Biela-B	Oct 9.9	0.83	6.74	6			
McNaught (2011 R1)	Oct 19.6	2.08			6.5	10.0	11
P/McNaught-Russell (1994 X1)	Dec 4.5	1.28	18.3	1	10.0	10.0	11
P/Spacewatch (2006 F4)	Dec 14.1	2.34	6.63	1	15.0	10.0	21
P/LONEOS (1999 RO_{28})	Dec 17.6	1.22	6.58	1	18.0	5.0	19
P/Hermann (1999 D1)	Dec 18.4	1.64	13.8	1	15.0	10.0	18

The date of perihelion (T), perihelion distance (q), period (P), the number of previously observed returns (N), the magnitude parameters H_1 and K_1 [$m_1 = H_1 + 5.0 * \log(d) + K_1 * \log(r)$] 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.

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