Comet Prospects for 2015

Comet 2013 US_{10} (Catalina) could be a bright object towards the end of the year. Comets 2014 Q1 (PanSTARRS) and 2014 Q2 (Lovejoy) could also reach naked eye brightness. There are no bright periodic comets predicted to return in 2015. What excitement there is comes from 67P/Churyumov-Gerasimenko, which reaches perihelion in August. It creeps into the morning sky shortly after perihelion and visual observations will be important to put the Rosetta observations into the context of previous apparitions.

This draft version was updated on 2014 December 2. Last comet added was 2014 W6.

These predictions focus on comets that are likely to be within range of visual observers. Members are encouraged to make visual magnitude estimates, particularly of periodic comets, as long term monitoring over many returns helps understand their evolution. Guidance on visual observation and how to submit estimates is given in the BAA Observing Guide to Comets. Drawings are also useful, as the human eye can sometimes discern features that initially elude electronic devices. Images of these comets are in the BAA/TA comet image archive at http://www.britastro.org/cometobs/, which is regularly updated with the latest images and drawings.

Theories on the structure of comets suggest that any comet could fragment at any time, so it is worth keeping an eye on some of the fainter comets, which are often ignored. They would make useful targets for observers using electronic imaging, especially those with time on instruments such as the Faulkes telescopes. Such observers are encouraged to report total magnitude estimates, using the ICQ format given in the BAA Guide and the reduction techniques described by Roger Dymock. When possible use a waveband approximating to Visual or V magnitudes. Such estimates can be used to extend the visual light curves, and hence derive more accurate absolute magnitudes.

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

15P/Finlay was at perihelion in 2014 December, and may begin the year as a binocular object in the early evening sky. It quickly fades in January and February, but remains conveniently placed.

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. Richard Miles has developed a theory that suggests that these outbursts are in fact periodic, and arise from at least four independent active areas on the slowly rotating nucleus. The activity of the active areas evolves with time. The comet is an ideal target for those equipped with CCDs and it should be observed at every opportunity. The comet is at a southern declination, reaching opposition in Scorpius in June and passing through solar conjunction at the end of December.

10P/Tempel makes its 23rd observed return since its discovery by William Tempel (Milan, Italy) as a 9th magnitude object in 1873. Several unfavourable returns were missed in the earlier years. The orbit is very stable, which is one reason why it is a favoured target for possible spacecraft missions. In 1983 the IRAS satellite detected an extensive dust trail behind the comet. Normally the light curve is highly asymmetric with a late turn on. There is a rapid rise in brightness as perihelion approaches, which continues more slowly for a couple more weeks after perihelion, followed by a slow decline until activity switches off. The activity may originate from a single high latitude source. It is one of the few comets with a measured rotation period (8.95 hours) and there is evidence that the period has increased over the last few apparitions. With a 5.5 year period alternate returns are favourable. The comet can be followed from the UK until early July, when it has brightened to 12th magnitude. The comet is better seen from the southern hemisphere, and at its best in October is 11th magnitude.

22P/Kopff was discovered photographically by A Kopff at Konigstuhl Observatory in 1906, when it was around 11^m. The next return was unfavourable, but it has been seen at every return since then. Following an encounter with Jupiter in 1942/43 its period was reduced and the perihelion distance decreased to 1.5 AU. The following return was one of its best and it reached 8^m. The next return was unusual, in that it was 3^m fainter than predicted until perihelion, when it brightened by 2^m. It suffered another encounter with Jupiter in 1954, but this made significant changes only to the angular elements. 1964 was another good return and the comet reached 9^m. This is not a good return, and for UK observers it will barely be into visual range before it is lost in the summer twilight. Southern hemisphere observers do a little better, being able to follow it until just after perihelion, but it will only reach 11th magnitude.

67P/Churymov-Gerasimenko was discovered in 1969 September, by Klim Churyumov and Svetlana Gerasimenko on a plate taken for 32P/Comas Sola at Alma Ata observatory. It reached its present orbit after a very close encounter (0.05 AU) with Jupiter in 1959, which reduced the perihelion distance from 2.74 to 1.28 AU. During 2015 the Rosetta spacecraft and lander will be accompanying the comet on its way to perihelion, with the mission due to be completed at the end of the year. At the good apparition of 1982, when it approached the Earth to 0.4 AU and was well observed by the comet section, it reached 9th magnitude. Section observations show that the comet is usually brightest some 40 days after perihelion, which suggests that this year it should peak at around 9th magnitude in late September. Unfortunately the observing circumstances are not particularly good, with the comet a morning object. Because of the importance of providing ground truth for the spacecraft and putting the apparition into a historical context observations are particularly encouraged. The Section will be carrying out a special observing project on the comet, details of which are given elsewhere.

Ellen Howell discovered **88P/Howell** in 1981 with the 0.46-m Palomar Schmidt. It passed 0.6 AU from Jupiter in 1978, which reduced the perihelion distance, but the biggest change to its orbit occurred in 1585 when an encounter reduced q from 4.7 to 2.4 AU. The comet was well observed in 2009, though the light curve can be fitted by both a linear or standard curve. Assuming a standard light curve, this return may see the comet reach 9th magnitude at its brightest in April, however it is a southern hemisphere object that is best seen in the morning sky.

Donald Machholz discovered **141P/Machholz** with his 0.25-m reflector at 10^m in August 1994. It proved to have multiple components, first reported by Michael Jager (Vienna, Austria). The four secondary components could all be described by the same orbit, but with perihelion delayed by up to half a day from the primary. At times there seemed to be a faint trail of material linking the components. The comet has a short period of 5.2 years with a perihelion distance of 0.75 AU and aphelion just inside the orbit of Jupiter. The orbit has been slowly evolving, with progressive changes occurring about every 50 years, thanks to approaches to Jupiter. The most recent close approach was in 1982. With a relatively stable perihelion distance, which is slowly increasing, it is perhaps surprising that the comet was not discovered earlier. There was a favourable return in winter of 1978/79 when it might have reached 8th magnitude and very favourable returns in the autumns of 1920, 1936 and 1957 when it might have reached 6th magnitude. The fact that it was not discovered at any of these returns suggests that the absolute magnitude at the 1994 return was not typical, and was the result of the fragmentation. The last return, in 2010, was a very poor one and visual observations were not received. At present the earth passes about 0.25 AU outside the descending node and the orbital evolution will slowly decrease this distance, raising the possibility of meteor shower from the comet in a few hundred years time. Whilst this return is better than that of 2010, there is a relatively short observing window in the northern summer morning sky when at best it will just reach 11th magnitude, and it may well be fainter than this.

2012 K1 (PanSTARRS) was at perihelion in 2014, but remains visible for southern hemisphere observers. It fades from around 10th magnitude, but its solar elongation is decreasing and it will be lost in February. It emerges from conjunction in May, and could still be bright enough to be observed visually in the Southern Hemisphere.

2013 US_{10} (Catalina) is a Southern Hemisphere object for much of the year. There the comet emerges from solar conjunction in late March and brightens until the comet is lost in the dusk in mid October. It is a morning object at the end of the year for UK observers, entering our skies from mid November, when the electronic observations received up to early December strongly suggest that it may be a prominent naked eye comet. Mars, Venus and the crescent moon will be close by around December 7.

2014 Q1 (PanSTARRS) is a Southern Hemisphere object throughout its apparition and is poorly placed prior to perihelion in July, though it might be visible in the dawn sky in May and early June. Electronic observations by Kevin Hills, with the comet still over nine months from perihelion suggest that it could become a bright object, though the error bars on the peak magnitude are 8 magnitudes! If it does continue brightening as at present the comet will become a prominent object with a significant tail in late July. It will also be well-observed as it is an evening object in southern winter skies. There might be a good imaging opportunity around July 21, when Venus and Jupiter are close by.

2014 Q2 (Lovejoy) begins the year as an easy binocular object in Lepus below Orion, and may be visible to the naked eye. It is likely to be at its brightest in the first half of January. It moves northwards, reaching Andromeda in early February and Cassiopeia in

March, when it may still be a binocular object. Some wide-field imaging opportunities include the early hours of 2014 December 29 when it is very close to M79, mid January when it is relatively close to the Pleiades and February 2 when it transects the line between M34 and NGC752. It could remain within visual range until July.

The other periodic and parabolic comets that are at perihelion during 2015 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 a return, though searches at favourable returns in the intervening period have failed to reveal the comets and the orbits will have been perturbed by Jupiter. There is however always a chance that they will be rediscovered accidentally by one of the Sky Survey patrols. Three SOHO comets are predicted to return, however these will only be visible from the SOHO or STEREO satellites.

Looking ahead to 2016, 45P/Honda-Mrkos-Pajdusakova may be visible at the end of the year. Comet 252P/LINEAR passes within 0.0357 AU of earth, but is only 10^{th} magnitude at high southern declination when at its best. 2013 US_{10} may still be a bright binocular object in the morning sky at the start of the year.

Comets reaching perihelion in 2015

Comet	T	q	P	N	H_1	K_1	Peak mag
Tenagra (2014 F2)	Jan 2.3	4.31			9.0	10.0	18
PanSTARRS (2013 W2)	Jan 4.4	4.45	34	1	13.5	5.0	18
P/PanSTARRS (2014 V1)	Jan 12.9	2.61	17.0	1	14.0	10.0	21
201P/LONEOS	Jan 14.6	1.34	6.43	2	12.7	10.0	14
Tenagra (2013 G9)	Jan 14.7	5.34			7.0	10.0	17
D/Brooks (1886 K1)	Jan 21.6	1.36	5.71	1	8.0	15.0	11 ?
Lovejoy (2014 Q2)	Jan 30.1	1.29			4.4	15.5	5 ?
7P/Pons-Winnecke	Jan 30.5	1.24	6.32	23	10.0	15.0	13
PanSTARRS (2014 G3)	Feb 2.6	4.70			9.0	10.0	19
309P/LINEAR	Feb 16.8	1.74	9.36	2	15.0	10.0	19
Catalina (2014 W6)	Feb 19.5	3.18			10.5	10.0	17
299P/Catalina-PanSTARRS	Feb 23.3	3.14	9.15	2	11.5	10.0	18
Catalina (2014 AA52)	Feb 27.7	2.00			10.0	10.0	15
92P/Sanguin	Mar 1.2	1.83	12.4	3	12.0	15.0	18
6P/d'Arrest	Mar 2.5	1.36	6.56	19	12.4	15.0	16
PanSTARRS (2014 Q6)	Mar 3.9	3.79			11.0	10.0	20
NEOWISE (2014 N3)	Mar 13.1	3.88			7.0	10.0	16
D/Barnard (1884 O1)	Mar 13.6	1.32	5.41	1	11.5	15.0	15 ?
44P/Reinmuth	Mar 24.1	2.12	7.10	10	8.5	15.0	16
P/LINEAR (2008 WZ96)	Mar 25.9	1.65	6.16	1	13.5	10.0	18
C/PANSTARRS (2012 F3)	Apr 1.8	3.50			6.5	10.0	14
86P/Wild	Apr 3.4	2.26	6.84	5	8.5	15.0	15
88P/Howell	Apr 6.2	1.36	5.48	7	1.8	42.6	9
42P/Neujmin	Apr 8.3	2.03	10.8	5	13.0	15.0	19
310P/Hill	Apr 18.5	2.38	8.47	2	13.5	10.0	19
174P/Echeclus (60558)	Apr 22.5	5.82	34.9	1	9.5	5.0	17
218P/LINEAR	Apr 23.2	1.17	5.45	2	16.0	10.0	15
113P/Spitaler	Apr 23.7	2.12	7.06	4	12.5	5.0	16
268P/Bernardi	Apr 27.4	2.42	9.76	1	13.5	10.0	19
308P/Lagerkvist-Carsenty	May 7.2	4.23	17.1	2	13.0	5.0	19
P/Zhao (2007 S1)	May 9.9	2.49	7.41	1	13.0	10.0	19

205P/Giacobini	May 14.1	1.54	6.69	2	13.0	10.0	16
LINEAR-Hill (2008 QP2)	May 17.3	1.72	6.52	1	15.5	10.0	20
PanSTARRS (2014 S1)	May 17.7	8.17			7.0	10.0	20
57P/du Toit-Neujmin-Delporte	May 22.3	1.73	6.42	7	12.5	15.0	17
19P/Borrelly	May 28.9	1.35	6.83	14	6.6	14.0	10
P/Boattini (2009 Q4)	Jun 13.4	1.32	5.55	1	15.5	10.0	19
P/WISE (2010 B2)	Jun 13.4	1.61	5.48	1	17.0	10.0	21
P/Gibbs (2012 F5)	Jun 13.5	2.88	5.21	1	12.0	10.0	18
148P/Anderson-LINEAR	Jun 13.8	1.69	7.04	3	17.0	5.0	20
220P/McNaught	Jun 13.8	1.55	5.50	2	15.0	10.0	18
196P/Tichy	Jun 14.8	2.14	7.33	2	13.5	10.0	19
P/Catalina (2009 WX51)	Jun 25.3	0.80	5.39	1	19.0	5.0	19
233P/La Sagra	Jun 25.4	1.79	5.28	2	15.0	10.0	20
P/Catalina-McNaught (2008 S1)	Jul 1.9	1.20	6.76	1	15.0	10.0	15
PanSTARRS (2014 Q1)	Jul 5.2	0.32			6.5	8.5	3 ?
221P/LINEAR	Jul 11.6	1.76	6.44	2	14.0	10.0	16
162P/Siding Spring	Jul 12.0	1.24	5.34	4	15.0	10.0	17
P/LINEAR (2004 FY140)	Jul 24.8	4.06	10.8	1	12.5	5.0	18
140P/Bowell-Skiff	Aug 8.6	1.99	16.4	2	11.5	15.0	18
P/McNaught (2004 R1)	Aug 12.3	0.98	5.46	1	18.5	10.0	16
51P/Harrington	Aug 12.4	1.70	7.16	7	10.0	10.0	12
67P/Churyumov-Gerasimenko	Aug 13.1	1.24	6.44	7	9.5	10.0	9
P/WISE (2010 K2)	Aug 13.6	1.27	5.10	1	19.0	10.0	21
P/Yang-Gao (2009 L2)	Aug 15.0	1.43	6.61	1	15.0	10.0	17
141P/Machholz	Aug 24.9	0.76	5.25	4	13.0	10.5	11
PanSTARRS (2014 M1)	Aug 27.7	5.57			9.0	10.0	20
Tenagra (2013 C2)	Aug 31.7	9.13	64	1	10.0	10.0	24
P/SOHO (1999 R1)	Sep 4.1	0.05	3.99	4	22.1	12.8	
SONEAR (2014 A4)	Sep 6.0	4.18			6.0	10.0	15
34D/Gale	Sep 8.3	1.20	11.2	2	11.0	20.0	13 ?
P/SOHO (1999 J6)	Sep 26.4	0.05	5.43	3	19.0	10.0	
61P/Shajn-Schaldach	Oct 2.2	2.11	7.06	7	10.0	10.0	13
Catalina (2013 V4)	Oct 7.6	5.19			6.0	10.0	16
151P/Helin	Oct 8.1	2.47	13.9	2	12.0	10.0	17
P/NEAT (2001 H5)	Oct 21.8	2.44	15.0	1	12.0	10.0	18
P/Hill (2007 V2)	Oct 23.1	2.78	8.22	1	13.0	10.0	19
P/McNaught-Hartley (1994 N2)	Oct 24.5	2.45	20.6	1	10.0	10.0	15
22P/Kopff	Oct 25.1	1.56	6.40	16	7.0	15.0	11
P/LONEOS-Christensen (2005 RV25)	Oct 28.5	3.58	8.94	1	9.5	10.0	17
D/Helfenzrieder (1766 G1)	Nov 4.7	0.40	4.50	1	3.2	10.0	
P/Gibbs (2008 Y2)	Nov 6.0	1.63	6.78	1	16.0	10.0	19
214P/LINEAR	Nov 12.7	1.85	6.87	2	13.0	10.0	18
10P/Tempel	Nov 14.3	1.42	5.36	22	8.6	7.7	11
Catalina (2013 US10)	Nov 15.7	0.82			0.6	12.4	1 ?
230P/LINEAR	Nov 18.1	1.49	6.27	3	13.0	10.0	13
249P/LINEAR	Nov 26.7	0.50	4.59	2	18.5	10.0	16
P/La Sagra (2010 R2)	Nov 30.1	2.62	5.45	1	13.0	10.0	18
P/SOHO (1999 U2)	Dec 3.7	0.05	5.38	3			
P/LINEAR-Catalina (2003 WC7)	Dec 4.9	1.66	11.8	1	13.5	10.0	15
PanSTARRS (2014 S2)	Dec 7.9	2.10			10.0	10.0	15
P/Van Ness (2002 Q1)	Dec 10.9	1.56	6.73	1	13.0	10.0	16
204P/LINEAR-NEAT	Dec 11.6	1.93	6.99	2	9.9	10.0	13
180P/NEAT	Dec 13.0	2.49	7.59	3	11.0	10.0	17
P/PanSTARRS (2014 W4)	Dec 25.6	4.23	17.1	1	11.0	10.0	20
P/LONEOS-Tucker (1998 QP54)	Dec 26.0	1.89	8.62	1	9.7	15.0	15

The date of perihelion (T), perihelion distance (q), period (P), the number of previously observed returns (N), the magnitude parameters H_1 and K_1 and the brightest magnitude (which must be regarded as uncertain) are given for each comet. The magnitudes, orbits, and in particular the time of perihelion of the single apparition D/ comets, are uncertain. 34D was last seen in 1938, when it may have been recovering from an outburst at the previous (discovery) return. The peak magnitude for 67P is based on its linear lightcurve, rather than the parameters given here. Magnitude information is not given for the SOHO comets; these have not been numbered by the IAU despite having been observed over several returns.

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

References and sources

Belyaev, N. A., Kresak, L., Pittich, E. M. and Pushkarev, A. N., *Catalogue of short Period Comets*, Bratislava (1986).
Dymock, R., Project Alcock at http://www.britastro.org/projectalcock/Contents.htm
Jenniskens, P. *Meteor Showers and their Parent Comets.* Cambridge University Press (2006).
Kozlov, E. A., Medvedev, Y. D., Pittichova, J., and Pittich, E. M. *Catalogue of short Period Comets, 2nd edition*, (http://astro.savba.sk/cat/) (2003).
Kronk, G. W., *Cometographia*, Cambridge University Press, (1999, 2004, 2007, 2009, 2010) and http://www.cometography.com.
Marsden, B. G. and Williams, G. V. *Catalogue of Cometary Orbits*, 17th edition, IAU MPC/CBAT, (2008).
Minor Planet Electronic Circulars
Nakano Notes at http://www.oaa.gr.jp/~oaacs/nk/
Shanklin, J. D., *Observing Guide to Comets*, 3rd edition (2013)
The Comet Orbit Home Page http://jcometobs.web.fc2.com/

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