Comet Prospects for 2010

2010 sees a very favourable return of 103P/Hartley, which should reach naked eye visibility during a close pass to the earth in the autumn. Newly discovered comet 2009 R1 (McNaught) could reach 5th magnitude in June, but will be low in the summer twilight. Comet 2P/Encke will be a bright object at perihelion, but is then too close to the Sun for observation from the ground. 81P/Wild should be a binocular object in the spring.

Theories on the structure of comets suggest that any comet could fragment at any time, so it is worth keeping an eye on some of the fainter periodic comets, which are often ignored. This would make a useful project for CCD observers. Perhaps the most spectacular example of such fragmentation is 73P/Schwassmann-Wachmann, which exhibited a debris string of over 60 components as it passed close to the Earth in May 2006. Ephemerides for new and currently observable comets are published in the *Circulars*, Comet Section Newsletters and on the Section, CBAT and Seiichi Yoshida's web pages. Complete ephemerides and magnitude parameters for all comets predicted to be brighter than about 21^{m} are given in the International Comet Quarterly Handbook; details of subscription to the ICQ are available on the Internet. A section booklet on comet observing is available from the BAA Office.

This is comet **2P/Encke's** 61st observed return to perihelion since its discovery by Mechain in 1786. The orbit is quite stable, and with a period of 3.3 years apparitions repeat on a 10-year cycle. This year it has a poor elongation prior to perihelion, but it will be visible passing through the SOHO LASCO field and that of its successors, the twin STEREO satellites in late July and early August. After perihelion the comet becomes visible from the Southern Hemisphere in mid August as a fading binocular object, and can be followed throughout September. BAA Members have been observing the comet for over 50 years and there is little evidence for a secular fading, although the comet is often brighter post perihelion than it is before. The comet is the progenitor of the Taurid meteor complex and may be associated with several Apollo asteroids.

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 planned 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. With a 5.5 year period alternate returns are favourable and this is one of them, although not the best. A combination of summer twilight and a southerly declination will make viewing from the UK difficult until mid July, when it will be near its brightest at 10th magnitude. It remains a morning object in Cetus throughout the UK apparition, slowly fading and moving south. Circumstances are better in the Southern Hemisphere and it will be visible throughout the apparition, although best in the morning sky.

29P/Schwassmann-Wachmann is an annual comet that has outbursts, which in recent years seem to have become more frequent. The outbursts were more or less continuous in 2008/9 and at some the comet became as bright as 10^{m}. The comet is an ideal target for those equipped with CCDs and it should be observed at every opportunity. The comet begins the year retrograding in Leo and reaches opposition on February 11, when it may show some additional brightening because of the small phase angle. It returns to Cancer in mid March and resumes direct motion in mid April. It is still in Cancer when UK observers will loose it in mid May. The comet passes through solar conjunction in late August and will emerge into the morning sky in Leo in late October. It crosses the celestial equator in early December, and remains a morning object at the end of the year.

81P/Wild is a new comet that made a very close (0.006 AU) approach to Jupiter in 1974. Prior to this it was in a 40 year orbit that had perihelion at 5 AU and aphelion at 25 AU. The comet was discovered by Paul Wild with the 40/60-cm Schmidt at Zimmerwald on 1978 January 6. The Stardust spacecraft visited it in 2004 and the recovered material was returned to earth in 2006, throwing more light on the origin of comets. The 2010 return is a good one and the comet should be visible in binoculars at around 9^{th} magnitude when at its brightest in March. It is a good apparition for UK observers, starting the year as a 10^{th} magnitude morning object in Virgo and will remain in that constellation until lost in the mid-summer twilight.

In 1982 comet **103P/Hartley** made a close approach to Jupiter, and it was discovered by Hartley four years later, around nine months after perihelion. It was accidentally recovered by T V Kryachko of Majdanak, USSR, on 1991 July 9.85, returning 5.6 days earlier than predicted. It was well observed by the section at this return and observations showed that the brightness peaked around 13 days after perihelion. The 1997 return was also good, with the comet peaking at 8^{th} magnitude, but the 2004 return was poor. This return is exceptionally good and the comet will pass only 0.121 AU from the Earth on October 20.8. If it behaves similarly to previous returns it should be recovered visually in July or August and will be a well placed binocular object in Cygnus in September. Remaining in Cygnus for most of October, it should be visible to the naked eye throughout October and into November as it fades and still be visible in telescopes as a 10^{th} magnitude object at the end of the year.

The orbit comes close to that of the Earth and it could produce a meteor shower at the descending node in November. Calculations by Harold Ridley gave a radiant of 19h56m +14°, some 5° Nf Altair, with a likely maximum around November 17, however Robert McNaught gave 19h50m +29° around November 2. No meteors were seen at the favourable return in 1997 and later calculations suggest that there are no favourable encounters with likely dust trails until 2062.

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. 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.

The main component of the comet (A) again reached 10th magnitude in 1999, with the secondary (D) at least a magnitude fainter, but the last return was unfavourable and only component A was recovered. This is a very poor return and visual observations are very unlikely.

157P/Tritton was discovered by Keith Tritton in 1978 when working on the Southern UK Schmidt Sky Survey. The comet was only observed over a very short arc and it was very faint at discovery. The first return was very unfavourable, so it couldn't be seen, and the orbital inaccuracy was so large that the predictions for the second return had huge uncertainties and it was lost. In October 2003 Paulo Holvorcem reported that Charles Juels had found a fast moving cometary object at around 12th magnitude and this was confirmed by other observers. Following suggestions from Sebastian Hoenig, based on computations by Maik Meyer, Brian Marsden was able to confirm the identity with comet D/1978 (Tritton). The linkage showed that the period estimated from the 1978 apparition was incorrect and so the early searches were perhaps doomed to failure. The brightness in 2003 suggested that the object was in outburst and its future brightness is uncertain.

Comet **2009 K5 (McNaught)** is another of the many comets discovered by Rob McNaught during the course of the Siding Spring Survey. The comet could reach 10th magnitude in late April. It moves out from conjunction into the morning sky in late February as an 11th magnitude object and becomes circumpolar by mid April. It fades slowly, but remains relatively well placed in the northern sky until July.

Comet **2009 O2 (Catalina)** was discovered during the Catalina Sky Survey, but not immediately recognised as a comet until verified by other observers. It emerges from solar conjunction in late February at 12th magnitude and could reach 9th magnitude by the equinox, when it passes north of M31. Thereafter it heads south and UK observers will loose it by late April, by which time it will have faded to 11th magnitude.

Comet **2009 R1 (McNaught)** was Rob's 51st discovery and promises to be an easily observable comet, though it will be low in the summer twilight when at its brightest. It emerges from solar conjunction relatively slowly and it will already be 9th magnitude before UK observers pick it up in late May. It brightens rapidly and moves into the evening sky, however it is never high in the sky. The best viewing will probably be around mid June, when it is highest in a moonless sky, though it will brighten another magnitude by the time we loose it at the end of the month.

A couple of SOHO comets are predicted to return, and although both objects have been seen at two returns, the exact linkages of these members of the Marsden family of

comets remain a little uncertain. Here I use a provisional numbering scheme for the periodic SOHO objects, as none has yet been introduced by the IAU. This follows the scheme for periodic comets that are known to return, and I number them in order of discovery of the second member of any pairings. A more permanent numbering scheme is also needed, although with incomplete SOHO coverage and cascading fragmentation this is difficult. M01 is 1999 J6 and 2004 V9, which split to give a minor component 2004 V10. M02 is 1999 N5, which split to give 2005 E4 (M02A), which returns in 2010 and 2005 G2 (M02B), which returns in 2011. Both M01 and M02 themselves probably split from a progenitor that was at perihelion in 1993 November.

The other periodic and parabolic comets that are at perihelion during 2010 are unlikely to become brighter than 12th magnitude or are poorly placed. Ephemerides for these can be found on the CBAT WWW pages. D/van Houten was observed for just over a month in 1960, but was not recovered at the two subsequent returns. D/Haneda-Campos was observed for four months at its discovery apparition, but was not recovered at the four subsequent returns. Searches at favourable returns in the intervening period have failed to reveal the comets and it is possible that they are no longer active.

Looking ahead to 2011 rather fewer comets make good returns, however comet 2009 P1 (Garradd) might reach 7th magnitude at the end of the year. 45P/Honda-Mrkos-Pajdusakova makes a close pass to the earth and will be well placed in the Southern Hemisphere prior to perihelion in September and in the north post perihelion. 73P/Schwassmann-Wachmann also returns, but it is not clear how many of the multiple fragments will be visible and even the brightest is likely to be fainter than 12th magnitude. P/Levy (2006 T1) may reach 9th magnitude at the end of the year.

Comets reaching perihelion in 2010

Comet	T	q	P	N	H_1	K_1	Peak mag
Hill (2009 O4)	Jan 1.3	2.56			10.0	10.0	17
118P/Shoemaker-Levy	Jan 2.3	1.98	6.45	3	8.7	10.0	12
LINEAR (2009 T3)	Jan 12.0	2.28			12.5	10.0	18
82P/Gehrels	Jan 12.1	3.63	8.42	3	6.0	15.0	17
P/La Sagra (2009 T2)	Jan 12.8	1.75	20.9	1	14.0	10.0	17
224P/LINEAR-NEAT (2009 Q2)	Jan 31.8	1.99	6.29	1	15.5	10.0	20
Catalina (2009 K2)	Feb 7.5	3.24			10.0	10.0	18
203P/Korlevic	Feb 8.2	3.18	10.0	1	14.5	5.0	19
Boattini (2009 P2)	Feb 10.9	6.54			6.0	10.0	18
149P/Mueller	Feb 19.2	2.65	9.03	2	11.5	10.0	17
157P/Tritton	Feb 20.5	1.36	6.30	2	14.0	10.0	16
81P/Wild	Feb 22.7	1.60	6.42	5	6.9	11.4	9
126P/IRAS	Feb 22.8	1.71	13.4	2	8.5	15.0	14
P/McNaught (2004 R1)	Feb 23.7	0.99	5.48	1	18.5	10.0	20
65P/Gunn	Mar 2.1	2.44	6.79	7	5.0	15.0	12
219P/LINEAR	Mar 5.7	2.36	6.99	1	11.0	10.0	17
162P/Siding Spring	Mar 8.4	1.23	5.33	3	15.0	10.0	17
Hill (2009 U3)	Mar 18.5	1.38			13.0	10.0	15
Catalina (2009 O2)	Mar 25.1	0.71			11.0	10.0	9
P/LINEAR-Skiff (2001 R6)	Mar 26.1	2.18	8.52	1	13.0	10.0	19
94P/Russell	Mar 29.7	2.24	6.60	4	9.0	15.0	15
30P/Reinmuth	Apr 19.5	1.88	7.34	10	9.5	15.0	15
Spacewatch (2007 VO_5)	Apr 26.8	4.85			7.0	10.0	17

McNaught (2009 K5)	Apr 30.0	1.42			7.5	10.0	10
M01P/SOHO	May 1.5	0.05	5.50	2			
104P/Kowal	May 4.6	1.18	5.89	4	9.8	9.3	12
141P-Machholz-A	May 24.5	0.76	5.24	3	13.0	10.5	13
141P-Machholz-D	May 29.7	0.76	5.25	2	13.4	29.8	?
142P/Ge-Wang	May 30.5	2.49	11.1	2	12.3	11.0	17
D/Haneda-Campos (1978 R1)	Jun 7.4	1.28	6.42	1	13.5	10.0	?
215P/NEAT	Jun 8.0	3.21	8.07	1	8.0	10.0	15
43P/Wolf-Harrington	Jul 1.7	1.36	6.12	10	8.9	10.0	12
McNaught (2009 R1)	Jul 2.7	0.41			8.0	10.0	5
10P/Tempel	Jul 4.9	1.42	5.37	22	9.0	12.5	10
Garradd (2009 U1)	Jul 7.8	2.96			10.5	10.0	18
P/LINEAR (1999 U3)	Jul 18.5	1.92	11.0	1	13.5	10.0	18
2P/Encke	Aug 6.5	0.34	3.30	60	10.5	15.0	4
223P/Skiff (2009 L18)	Aug 14.5	2.42	8.45	1	11.0	10.0	16
227P/Catalina-LINEAR (2009 S4)	Sep 3.7	1.79	6.80	1	16.5	5.0	20
P/LINEAR (2002 UY_{215})	Sep 9.5	1.83	7.21	1	14.0	10.0	17
31P/Schwassmann-Wachmann	Sep 29.5	3.42	8.74	12	6.7	11.3	15
Lemmon-Siding Spring (2008 FK_7)	Sep 29.7	4.51			5.0	10.0	15
P/NEAT (2002 X2)	Oct 4.9	2.13	7.60	1	12.0	10.0	16
D/van Houten (1960 S1)	Oct 16.3	4.14	16.6	1	9.0	10.0	19?
103P/Hartley	Oct 28.3	1.06	6.47	4	8.7	24.0	5
M02AP/SOHO	Oct 29.8	0.05	5.67	2			
P/LINEAR (2000 G1)	Nov 13.9	1.00	5.34	1	19.5	5.0	21
P/LINEAR (2004 HC_{18})	Dec 29.6	1.71	6.52	1	16.5	5.0	20
Grauer (2009 U5)	Aug 23.0	0.57			10.0	10.0	7

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. D/Haneda-Campos and D/van Houten have not been seen for several returns. The orbit of D/ van Houten is based on only 8 observations and other predictions suggest a possible return in 2011.

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

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