COMETS FOR THE VISUAL OBSERVER IN 2010

Alan Hale
The Earthrise Institute, Cloudcroft, NM, U.S.A.

The list of short-period comets expected to become bright enough for visual observations during 2010 is fairly small, although three of these should be easily visible in small instruments and one may reach naked-eye brightness. Two long-period comets that pass perihelion during 2010 (discovered by late Dec. 2009) also have the potential of reaching faint naked-eye visibility; of course, many others yet to be discovered will undoubtedly be visually observable during 2010.

Long-Period Comets

C/2006 W3 (Christensen)

This intrinsically bright but distant comet reached a peak brightness of $m_1 \sim 9$ when near perihelion and opposition during the middle months of 2009. Now nearing solar conjunction at this writing, it emerges into the morning sky around March 2010 and is at opposition in late July, at which time it will be located near a declination of $-46°$ and thus favoring observers in the southern hemisphere. Based upon its earlier brightness, C/2006 W3 should be near $m_1 \sim 11$ throughout the early months of this viewing season — but once past opposition, it will probably fade rapidly before it enters evening twilight around October or November.

C/2007 Q3

After emerging into the morning sky at $m_1 \sim 11$ during October 2009, this comet seems to have undergone a small nuclear outburst in early December and at this writing is near $m_1 \sim 10$. Ostensibly it is now near its expected peak brightness, and thus should fade slowly over the coming months, by perhaps half a magnitude by the time it is nearest the earth (2.19 AU) in early February and to $m_1 \sim 12$ when at opposition in early May (when it will be located near its peak northerly declination of $+64°$). Fading will probably be fairly rapid thereafter, although the comet may remain visually detectable (at $m_1 \sim 14$) up until the time it disappears into evening twilight around October.

C/2009 U3

Already past opposition and closest approach to the earth at this writing, this comet may reach a peak brightness of $m_1 \sim$ 13-14 between February and April when it is near perihelion; at that time, it will be located in the northern hemisphere's evening sky at circumpolar declinations (farthest north being at $\delta \sim +76°$ in mid-April).

C/2009 O2

Currently near conjunction with the sun, this comet emerges into the morning by about mid-February, and over the next few months follows a path through the sky strikingly reminiscent of that followed by C/1995 O1 (Hale-Bopp) exactly thirteen years earlier. It is again in conjunction with the sun (44° north of it) in late March, at which time it is also near perihelion and its closest approach to the earth (0.81 AU). Afterwards it remains visible in the evening sky until disappearing into twilight around the latter part of May.

The comet has so far remained quite faint following its discovery in July 2009, and ostensibly reaches a peak brightness of $m_1 \sim 9$ when near perihelion. If it should experience a large increase in activity as it approaches perihelion, C/2009 O2 could conceivably become somewhat brighter than that, perhaps reaching faint naked-eye visibility ($m_1 \sim$ 5-6).

C/2009 K5

Like the above comet, this one is also near solar conjunction at this writing, and emerges into the morning sky around February, perhaps already at $m_1 \sim$ 11-12. It thereafter travels northward quite rapidly, being at $\delta \sim +67°$ when at perihelion in late April and reaching its farthest-north point ($\delta \sim +83°$) in mid-May; throughout this time, it should be near its peak brightness of $m_1 \sim$ 9-10. Afterwards, C/2009 K5 remains in far-northern skies as it fades, perhaps staying visually detectable until about October, when it will still be near $\delta \sim +50°$.

C/2009 R1

Following conjunction with the sun in mid-February, this comet emerges into the morning sky during April, and although its elongation from the sun remains fairly small, it travels northward quite rapidly and should also brighten — perhaps to $m_1 \sim 10$ at the beginning of May and $m_1 \sim 8$ a month later. It then falls rapidly back towards the sun, but may become as bright as $m_1 \sim$ 4-5 by the time it goes into another conjunction with the sun and disappears into twilight near the end of June. Because the comet is then located on the far side of the sun from the earth, there is no possibility for forward scattering enhancement of its brightness.

After conjunction, the comet emerges into the southern hemisphere's morning sky around the beginning of August

($m_1 \sim$ 7-8) and may remain visually detectable until perhaps October, as it continues traveling southward.

Other comets

Among other comets, three very distant ones — C/2009 F4, C2008 FK75, and C/2006 S3 — may be visually detectable as faint objects around the time of opposition (early May, late June, and early August, respectively — C/2009 F4 primarily from the southern hemisphere, and C/2008 FK75 from the northern). C/2009 P1, an intrinsically bright comet that could reach faint naked-eye visibility when near perihelion in late 2011, may become visually detectable during the latter months of 2010, with opposition being in early September; southern hemisphere observers are favored. Finally, according to the preliminary orbit available at this writing, the recent discovery C/2009 Y1 could potentially reach $m_1 \sim 14$ during the latter months of 2010; it reaches a peak northerly declination of +72° in late September and thus northern-hemisphere observers are favored.

◇ ◇ ◇

TABLE 1.
PERIHELION INFORMATION FOR POTENTIALLY VISUAL COMETS IN 2010

Designation/Name	T (TT)	q (AU)
29P/Schwassmann-Wachmann	2004 July 10.8	5.72
C/2006 W3 (Christensen)	2009 July 6.7	3.13
C/2007 Q3 (Siding Spring)	2009 Oct. 7.3	2.25
169P/NEAT	2009 Nov. 30.3	0.61
118P/Shoemaker-Levy	2010 Jan. 2.3	1.98
81P/Wild	2010 Feb. 22.7	1.60
65P/Gunn	2010 Mar. 2.1	2.44
C/2009 U3 (Hill)	2010 Mar. 20.3	1.41
C/2009 O2 (Catalina)	2010 Mar. 24.2	0.69
(20898) Fountainhills	2010 Apr. 16.3	2.27
30P/Reinmuth	2010 Apr. 19.5	1.88
C/2009 K5 (McNaught)	2010 Apr. 30.0	1.42
C/2009 R1 (McNaught)	2010 July 2.7	0.41
10P/Tempel	2010 July 4.9	1.42
2P/Encke	2010 Aug. 6.5	0.34
C/2008 FK_{75} (Lemmon-SidingSpring)	2010 Sept. 29.2	4.51
103P/Hartley	2010 Oct. 28.3	1.06
C/2009 Y1 (Catalina)	2011 Jan. 28.3	2.55
C/2009 P1 (Garradd)	2011 Dec. 23.8	1.55
C/2009 F4 (McNaught)	2011 Dec. 31.7	5.45
C/2006 S3 (LONEOS)	2012 Apr. 16.5	5.13

◇ ◇ ◇

Short-Period Comets: Brighter Objects

29P/Schwassmann-Wachmann

Continuing the trend of unusually strong activity that it has exhibited over the past several years, as of this writing this comet has already undergone two outbursts since emerging into the morning sky in September 2009. It is at opposition in mid-February 2010 and thereafter remains accessible in the evening sky until disappearing into twilight around the beginning of July, and after conjunction with the sun reappears in the morning sky during October, en route to its next opposition in early March 2011. Based upon its recent behavior, it seems likely that there will be several additional outbursts throughout these two viewing seasons.

81P/Wild

The 2010 return of this comet is the most favorable one since its original discovery in 1978. It has been under visual observation since September 2009, and has already brightened past $m_1 \sim 11$ as of this writing. It remains well placed for observation for the next several months, being at opposition in late April and reaching a peak brightness of perhaps $m_1 \sim 9$ between February and April. Afterwards, 81P may remain visible in the evening sky until about August.

10P/Tempel

This comet also has a relatively favorable return in 2010, being at opposition in early October just three months after perihelion passage. Historically the comet tends to remain faint until shortly before perihelion, then brightens rapidly and thereafter gradually fades away over the subsequent several months; if it follows this pattern in 2010, it may become

visually detectable by late April or early May, then reach a peak brightness of $m_1 \sim$ 8-9 during July and August and remain visually detectable until November or December.

2P/Encke

This comet's 2010 return is extremely unfavorable, and in fact is almost identical to that of 1944, during which it remained unrecovered. For the northern hemisphere, the viewing conditions are all but hopeless, with maximum elongation (25°.4) occurring during mid-June, when the comet will probably still be too faint to observe; there is perhaps a slight possibility of observations in early July when the elongation will be around 20°. The viewing conditions are slightly better for the southern hemisphere after perihelion, as the comet emerges into the evening sky during the latter part of August at perhaps $m_1 \sim$ 9-10, but 2P will probably fade fairly rapidly thereafter.

103P/Hartley

This comet has a very favorable return in 2010, passing only 0.12 AU from the earth on October 20 (just over a week before perihelion passage). It should become visually accessible in the morning sky around July and is at opposition in September, and should reach a peak brightness of $m_1 \sim$ 4-5 (thus being visible to the naked eye) during October and November. After a second opposition in early January 2011, 103P remains visually detectable for another couple of months thereafter. The viewing circumstances are especially favorable for the northern hemisphere, with the comet's reaching a peak northerly declination of +57° in early October.

The *Deep Impact* spacecraft (now under the name *Deep Impact eXtended Investigation*, or *DIXI*), which encountered Comet 9P/Tempel in July 2005, is scheduled to pass 1000 km from comet 103P on November 4.

Short-Period Comets: Fainter Objects

169P/NEAT

This comet, which has the second-shortest orbital period (4.2 years) of all known short-period comets,, briefly became visually detectable at $m_1 \sim$ 12 during the latter part of November 2009. At this writing, it is near inferior conjunction (35° south of the sun) and is entering southern-circumpolar skies; 169P reaches a peak southerly declination of −71°.6 on January 6 and passes 0.19 AU from the earth six days later. Very little is known of the comet's post-perihelion activity and behavior, but it is conceivable that southern-hemisphere observers may be able to observe it during the first couple of weeks of January.

118P/Shoemaker-Levy

This comet has been somewhat fainter than expected during the current return, having only reached $m_1 \sim$ 13.5 at this writing; since it has just gone through opposition and will soon pass perihelion, this is probably about as bright as 118P will get. It should remain visually detectable for the first one to two months of 2010.

65P/Gunn

This comet was visually detectable at $m_1 \sim$ 13.5 around the time of its 2009 opposition (late March). Having recently gone through conjunction with the sun at this writing, 65P emerges into the morning sky around February 2010 ($m_1 \sim$ 13) and is at opposition in early August. It should reach a peak brightness of $m_1 \sim$ 12-13 between April and August and remain visually detectable until October or November.

30P/Reinmuth

Despite being over four months away from perihelion passage, this comet was visually detectable at $m_1 \sim$ 14 around the time of opposition in early December 2009. It may brighten slightly during the first one or two months of 2010 but will probably fade beyond the range of visual observations shortly thereafter.

Other objects

The 'cometary' asteroid (20898) Fountainhills became visually observable at mag ~ 15 in late November 2009 — slightly brighter than the ephemeris prediction, although not dramatically so. It is at opposition in late January 2010, and an asteroidal brightness formula predicts a peak magnitude of 14.5 in late January and early February and suggests that it may remain visually detectable until around the time of perihelion passage in mid-April.

Although observational records of (20898) extend back to 1951, it has never been observed closer to perihelion that it currently is at this writing. Photometric studies (E. F. Tedesco *et al.* 2002, *A.J.* **123**, 1056) at the previous return in 2000-2001 indicate that it is large (diameter ~ 37 km) and dark (albedo ~ 0.05), consistent with a cometary nucleus (albeit a large one), and if it is at all weakly active, the first few months of 2010 would seemingly provide a good opportunity to detect such activity.

Φ Φ Φ