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Cometary observations should be sent to the Editor in Cambridge; all data intended for publication in the *ICQ* that is not sent via computer electronic mail should be sent on standard *ICQ* observation report forms, which can be obtained upon request from the Editor. Those who can send observational data (or manuscripts) in machine-readable form are encouraged to do so [especially through e-mail via the computer networks *SPAN* (6700::DAN) or Internet (ICQ@CFA.HARVARD.EDU), or via floppy disks that can be read on an IBM PC], and should contact the Editor for further information. The *ICQ* has extensive information for comet observers on the World Wide Web, including the Keys to Abbreviations used in data tabulation (see URL http://cfa-www.harvard.edu/icq/icq.html). In early 1997, the *ICQ* published a 225-page *Guide to Observing Comets*; this edition is now out of print, but a revised edition is under preparation.

Most of the Observation Coordinators (OCs) listed below have e-mail contacts with the *ICQ* Editor; observers in the general area of such OCs who lack access to e-mail networks may send data to the OC for relay to the *ICQ* in electronic form.

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FROM THE EDITOR

Nicolas Biver of the Paris Observatory has kindly agreed to join the *ICQ*'s Editorial Advisory Board. He is an active observer of comets, familiar to readers of the *ICQ* both as a contributor of photometry and as an author of papers dealing with the physical nature of comets. Biver has done much to try connecting optical photometry of comets with production rates of cometary molecules derived from radio observations.

C/2004 S1 (Van Ness): A Split, Suddenly Vanishing Comet

Zdenek Sekanina
Jet Propulsion Laboratory; California Institute of Technology; 4800 Oak Grove Drive; Pasadena, CA 91109; U.S.A.
and
Miloš Tichý, Jana Tichá, and Michal Kočer
Klet′ Observatory, Zátkovo nábřeží 4, CZ-370 01 České Budějovice, South Bohemia, Czech Republic

Abstract. *We examine the observations of the dust-tail evolution, nucleus duplicity, and rapid fading of comet C/2004 S1 (Van Ness), which disappeared in late October 2004, within a month of its discovery. We show that the comet's behavior is consistent with an erosion model, developed for the SOHO comets of the Kreutz sungrazer system, except that the erosion energy required for comet C/2004 S1 to understand its light curve is extremely low, on the order of 10000 cal/mole. Thus, nucleus erosion was energetically easier than water-ice sublimation. The comet's complete disintegration was preceded, several days before discovery, by nucleus splitting accompanied by a brief, copious release of sizable refractory debris.*

1. Introduction

When M. E. Van Ness, Lowell Observatory, discovered comet C/2004 S1 with the 58-cm Schmidt LONEOS telescope on 2004 September 26, it had a moderately condensed coma and a fan-shaped tail in a position angle (p.a.; reckoned from the north through the east) of 225° (Green 2004). Less than 24 hours later, B. A. Skiff reported a poorly condensed coma, whereas J. E. McGaha saw no sharp central condensation at approximately the same time. J. W. Young's images from the following night show a coma with no central *condensation* and a very wide fan-shaped tail about 6-8″ long between p.a. 205° and 280°, with a narrow "spike" extending 25″ in p.a. 255° (Green 2004).

Although 1.54 AU from the sun and more than 10 weeks before its perihelion passage at 0.68 AU, the comet was brightening at a very slow pace during the first days after discovery. Yet, there were no obvious signs of the surprising developments that the observers were about to witness in the next 3-4 weeks. The presence of the prominent spike should have been paid more attention to from the very beginning, but, in retrospect, only the profound changes observed from mid-October on showed more convincingly that the process of disintegration was already in progress and may in fact have begun prior to the comet's discovery.

A common trait of the suddenly disintegrating comets is an observed rapid drop in their activity that begins almost always *before perihelion.* The fading sets in with very little delay, often in a few days, during which time the coma may become elongated, sometimes expanding gradually. The surface brightness decreases until the coma disappears completely before the eyes of the observers; the tail has a tendency to survive longer than the coma. The perihelion distance is usually, but not always, smaller than 1 AU.

Statistically, it appears that suddenly disintegrating comets have recently been arriving at an average rate of one every two years or so. Among the best-known objects that were under observation during (or close to) their disappearance are 20D/Westphal (in 1913), C/1925 X1 (Ensor), C/1953 X1 (Pajdušáková), C/1974 V2 (Bennett), C/1996 Q1 (Tabur), C/1999 S4 (LINEAR), and C/2002 O4 (Hönig). Their physical evolution was described, among others, by Sekanina (1984, 2002), by Fulle *et al.* (1998), and by Weaver *et al.* (2001). Sekanina (1984) remarked that the physical changes observed in the suddenly disintegrating comets resembled those known to be experienced by secondary nuclei of split comets. Twelve years later, C/1996 Q1 turned out to be a companion comet to C/1988 A1 (Liller).

2. Imaging Observations

At the Klet′ Observatory, comet C/2004 S1 was imaged with the 106-cm $f/2.7$ telescope of Project KLENOT (Tichá *et al.* 2002) on four nights: 2004 October 3, 12, 18, and 24. To augment the database for our investigation, we contacted several observers with a request for imaging information. We received a positive response from six colleagues as follows (listed alphabetically): D. Herald, Kambah, Australia (36-cm $f/3.9$ Schmidt-Cassegrain reflector); K. Kadota, Ageo, Japan (25-cm $f/5.0$ reflector); P. Kocher, Observatoire Naef, Marly, Switzerland (50-cm $f/3.3$ Hypergraph[1]); A. Nakamura, Kuma Kogen, Japan (60-cm $f/5.8$ Ritchey-Chrétien reflector); R. Naves, Observatorio Montcabrer, Barcelona,

[1] The "Hypergraph" is a Cassegrain reflector; details at http://www.astrooptik.com/Komplettgeraete/hypergraph_frame_e.htm.

Spain (30-cm $f/6.6$ Schmidt-Cassegrain reflector); and J. W. Young, Jet Propulsion Laboratory's Table Mountain Facility, Wrightwood, California, U.S.A. (61-cm $f/16$ reflector). The observers made their images available either by referring us to an appropriate web site or sending them electronically.

The imaging data used in this study cover a 28-day period, from 2004 September 26 (the date of discovery) to October 24. We also have information that provides constraints on two negative observations, by Herald on October 30.42 UT and by Nakamura on November 4.41.

3. Nature and Evolution of the Tail

The absence of rapid morphological variations and the considerable breadth in late September leave no doubt that the tail of comet C/2004 S1 was made up of dust. This conclusion is supported by the fact that the tail grew narrower with time, as Earth's transit across the comet's orbit plane, taking place 16 days after discovery, drew nearer.

3.1. Tail Appearance and Orientation

Since the history of a comet's dust production is, for a limited period of time, preserved in the morphology of its ejecta cloud (for more details see, e.g., section 2.2 of Sekanina 2002), the tail properties of comet C/2004 S1 deserve close scrutiny. The tail's rapid clockwise rotation in the plane of the sky reflected the systematic changes in the projected direction of the sun multiplied by the comet's close approach to Earth. A minimum encounter distance of 0.3172 AU was reached on October 14.5 ET, whereas the tail's rotational motion attained a peak rate of $\sim 17°$ per day on October 8. A tail-orientation ephemeris in Table 1 shows that the maximum possible width of the tail's sector, given as the angle subtended by the prolonged radius vector (the antisolar direction) and the reverse orbital-velocity vector (the direction of the orbit behind the comet), increased from 86° on September 22 to 94° on October 2, then decreased to 79° on October 7 and to a mere 2° on October 12.0 UT, $<$ 7 hours before the time of Earth's transit across the comet's orbital plane (the edge-on projection of the tail). The tail's post-transit rate of broadening was much more gradual — the predicted sector angle reaching 16° and 21° by, respectively, October 17 and 22. The tail was detected for the last time on October 20, and the comet itself on October 24.

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Table 1. Ephemeris for Dust-Tail Orientation of Comet C/2004 S1 (equinox J2000.0)

Date 2004 (0h ET)	Time[a] from peri- helion (days)	Comet's distance (AU) from		Earth's cometo- centric latitude[b]	Position angle[c]		Predicted position angle (P.A.) and apparent length (L) for synchrone formed at given time before perihelion[d]									
							225 days		150 days		100 days		80 days		60 days	
		Earth	Sun		PA(RV)	PA($-V$)	P.A.	L	P.A.	L	P.A.	L	P.A.	L	P.A.	L
Sept. 22	−77.92	0.782	1.602	+23°	264°	178°	221°	44′	237°	17′	254°	2′.6	263°	<0′.1	...	...
27	−72.92	0.638	1.528	+22	262	171	210	57	227	22	247	4.4	258	0.4	...	...
Oct. 2	−67.92	0.505	1.455	+18	255	161	190	78	206	29	230	6.4	245	1.2	...	...
7	−62.92	0.394	1.381	+12	226	147	159	131	167	48	183	9.9	200	2.2	...	...
12	−57.92	0.326	1.308	+1	132	130	130	256	130	108	130	27.9	131	8.0	132°	<0′.1
17	−52.92	0.327	1.234	−13	98	114	109	389	107	182	105	60.0	103	22.9	100	1.8
22	−47.92	0.391	1.161	−23	84	105	98	407	95	203	92	76.8	90	35.1	87	6.1
27	−42.92	0.493	1.090	−28	76	101	93	365	90	192	87	80.7	84	41.6	81	11.1

[a] Minus signs indicate preperihelion times.

[b] Earth's transit across the comet's orbit plane took place on 2004 Oct 12.28 ET, when the plane projected in the sky at a position angle of 128°.5 and the comet was 0.324 AU from Earth and 1.304 AU from the Sun.

[c] RV is the projected extended radius vector (antisolar direction); $-V$ is the projected reverse orbital-velocity vector (direction of the orbit behind the comet).

[d] The synchrone is assumed to contain dust grains that are subjected to radiation-pressure accelerations not exceeding 6 percent of the solar gravitational acceleration; these grains are all greater than 40 microns in diameter for a density of 0.5 g/cm^3 and greater than 100 microns in diameter for 0.2 g/cm^3.

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3.2. Dust Production Constraints

The broad fan-shaped tail pointing away from the sun was a major feature of the comet at the time of discovery and for several days afterwards, being consistently reported by all observers (Green 2004). For example, from his images of September 27, McGaha estimated the fan to be 30° wide, whereas according to Young it filled a sector subtending 75° the next day.

Let us inspect Young's image of September 28 (Figure 1) in greater detail. The fan's relatively sharp southern end is the trailing boundary, populated by the oldest ejecta from the comet. The direction of this boundary, in p.a. 205° according to Young, corresponds to an emission time of $\sim$ 7.5 months (or 220-230 days) before perihelion, when the comet was at a heliocentric distance of $\sim$ 3.5 AU (see Table 1). Thus, the comet had been active for a long period of time before discovery.

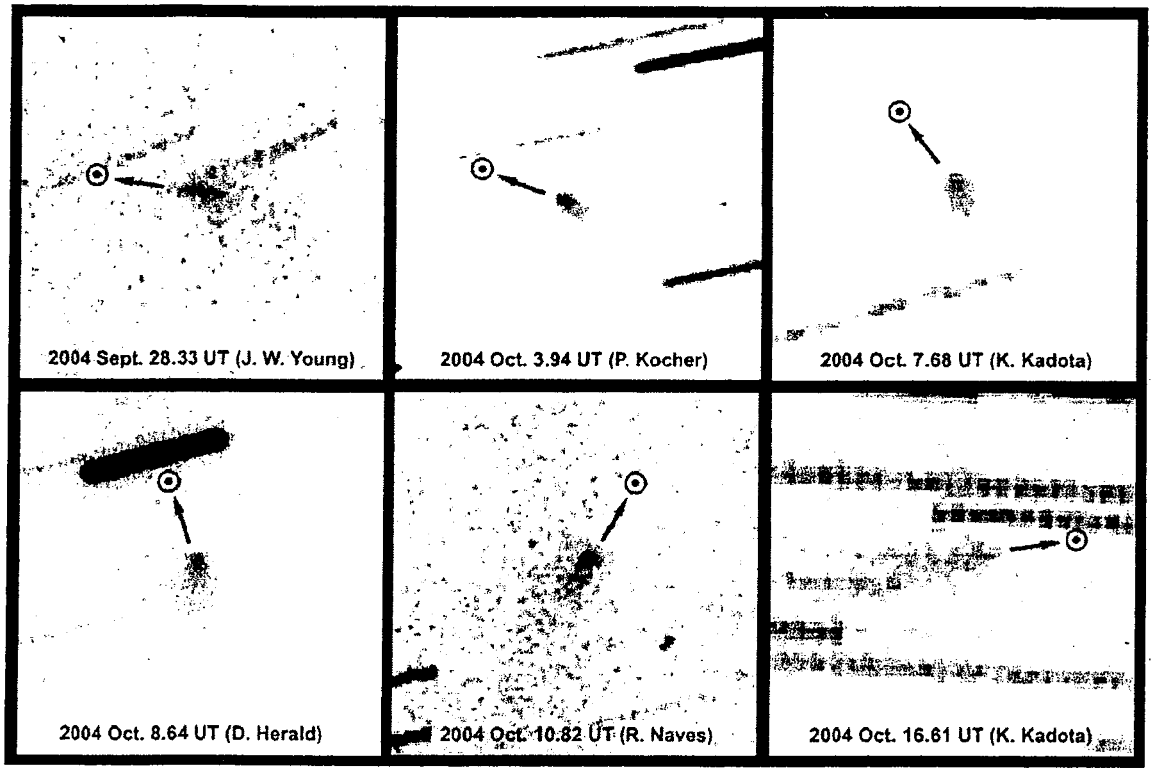

Figure 1. The evolution of comet C/2004 S1 and its tail between 2004 September 28 and October 16. Each frame is 3′ on a side, with the north up, the east to the left, and the direction to the sun indicated by an arrow. Upper left: *A coma with no central condensation and a wide, fan-shaped tail with a bright, narrow spike, directed slightly south of west, are seen in this composite image taken by J. W. Young, Table Mountain Observatory, with a 61-cm f/16 reflector on September 28.* Upper middle: *A short tail, much narrower than the September 28 fan, points to the southwest in this image by P. Kocher, Observatoire Naef, taken with a 50-cm f/3.3 Hypergraph reflector (see footnote 1) on October 3.* Upper right: *Comet is fainter than in the previous image, but of a similar appearance, with a slightly broadening tail to a little west of south apparent in an image taken by K. Kadota, Ageo, with a 25-cm f/5.0 reflector on October 7.* Lower left: *The tail fairly narrow, directed almost exactly to the south in this image taken by D. Herald, Kambah, with a 36-cm f/3.9 Schmidt-Cassegrain telescope on October 8.* Lower middle: *Less than 1.5 days before the earth's transit across the comet's orbit plane, the tail is very narrow and continues its clockwise motion, pointing now some 35° east of south in this image by R. Naves, Observatorio Montcabrer, taken with a 30-cm f/6.6 Schmidt-Cassegrain telescope on October 10.* Lower right: *Precipitous fading of the comet, with an uncondensed coma and a narrow tail slightly south of the east, is illustrated in this image taken by Kadota on October 16, using the same telescope as on October 7. (Images reproduced by permission of the observers.)*

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On the other hand, the fan's northern end, consisting of the most recent ejecta, is the leading boundary. Its p.a., reported to be 280°, is determined with lesser accuracy because this side of the tail is involved with a field star's trail. The p.a. of the prolonged radius vector, which approximates the leading-edge direction, is 261° at the time of Young's observation. Some tail broadening toward the north is expected to be due to finite ejection velocities of microscopic dust grains that dominate these ejecta. While it is questionable whether this effect could amount to nearly 20°, we do not pursue this subject any further, as it is not critical to our investigation.

3.3. The Spike As Signature of Dust Outburst

It is the spike that plays a major role in our interpretation of the events culminating in the comet's disappearance in late October 2004. As a bright, narrow, and rectilinear feature, the spike is evidence of a brief, major increase in the rate of dust production, a *dust outburst*. Unfortunately, there are no observations of an expected simultaneous gas outburst.

Morphological features like the spike are technically referred to as *synchronic* formations, because their motion through the tail is matched by synchrones, loci of particles ejected from the comet simultaneously. The orientation of a synchrone at a given time and, especially, temporal variations in its orientation allow one to determine the *outburst time*, often with unexpectedly high accuracy.

Of major interest is thus the spike's presence and orientation in other images of comet C/2004 S1. It was undoubtedly reported by McGaha as an elongated coma in his images of September 27.3 and 28.3 UT (Green 2004). It is also marginally recognized in an underexposed image taken by Kocher on September 26.9 UT.

No images are available from several nights after September 28, the date of the full moon. Until at least October 8 the tail was supposed to remain fairly broad (Table 1), but the images from October 3, 7, and 8 in Figure 1 show that this was not the case, except perhaps in the immediate proximity of the nucleus. Specifically, if the entire fan seen in the image of September 28 were detected in early October, the tail should have spanned — contrary to evidence from the images — p.a. ranges of 180°-250° on October 3, 160°-215° on October 7, and 150°-200° on October 8. The discrepancy can simply be explained by the fact that faint sections of the tail do not show in the images of shorter exposure, in which only the region corresponding to that close to the spike on September 28 can be followed to larger distances from the nucleus.

If this is so, then all images in which a narrow tail is detected (its width is expected to have dropped rapidly after October 8-9) should show its orientation to be generally consistent with that of the synchrone fitted to the spike, a premise that can readily be tested. Table 2 lists the tail-orientation data that we collected from 19 images taken between September 26 and October 20. Column 7 offers the residuals from the best fit, which indicates the date of September 21.3 ET (or 78.6 ± 1.3 days before perihelion) for the time of the dust outburst that accounts for the spike. Thus, the comet was discovered only 4-6 days after this event and possibly because of it: the outburst could have served as a trigger or catalyst of ensuing catastrophic developments.

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Table 2. Observations of Tail Orientation for Comet C/2004 S1 (equinox J2000.0)

Date 2004 (UT)	Time[a] from perihelion (days)	Earth's cometocentric latitude	Position angle PA(*RV*)	Position angle PA(−*V*)	Position angle of tail axis[b] *obs.*	Position angle of tail axis[b] *o−c*	Predicted apparent length of synchrone,[c] *L*	Observer(s)	Notes
Sept. 26.90	−73.02	+21°.8	262°.0	171°.6	250°	−9°	0′.26	Kocher	1,2
28.33	−71.59	+21.1	260.9	169.2	{255 257	−1 +1}	0.42	Young	{3,4 5,2
Oct. 3.87	−66.05	+16.6	249.5	156.5	235	−1	1.26	Tichý et al.	6,2
3.88	−66.04	+16.6	249.5	156.5	239	+3	1.26	Naves	7,2
3.94	−65.98	+16.5	249.2	156.3	232	−3	1.27	Kocher	1,4,2
4.96	−64.96	+15.2	244.2	153.4	238	+11	1.44	Kocher	1,2
6.63	−63.29	+12.7	230.5	148.1	201	−6	1.75	Nakamura	8
7.68	−62.24	+10.9	216.3	144.7	190	0	2.07	Kadota	9,4,2
8.64	−61.28	+9.0	197.8	141.4	173	−1	2.57	Herald	10,4,2
9.52	−60.40	+7.0	177.4	138.4	162	+2	3.28	Herald	10,2
10.82	−59.10	+3.9	149.5	133.7	145	+2	4.92	Naves	7,4,2
11.92	−58.00	+1.0	132.7	129.8	138	+6	6.89	Jäger & Rhemann	11,2
12.53	−57.39	−0.7	125.8	127.6	120	−6	8.21	Nakamura	8
12.89	−57.03	−1.7	122.3	126.4	125	+1	9.06	Tichý et al.	6,2
12.91	−57.01	−1.8	122.1	126.3	130	+6	9.11	Tichý et al.	2
15.82	−54.10	−10.0	102.8	116.9	109	+2	17.3	Naves	7,2
16.61	−53.31	−12.1	99.3	114.7	102	−2	19.6	Kadota	9,4,2
17.47	−52.45	−14.2	95.9	112.6	110	+9	22.1	Kadota	9,2
20.78	−49.14	−21.0	86.1	106.4	89	−3	30.2	Naves	7,2

[a] Minus signs indicate preperihelion times.
[b] Column *obs.* lists observed values: first entry for September 28 and entries for October 6 and 12.5 were taken from references in Notes 3 and 8 below; for remaining 17 values see Note 2; column *o−c* shows residual between observed orientation and synchrone corresponding to emission time of 78.6 days before perihelion or 2004 Sept. 21.3 ET.
[c] Length *L* describes loci of population of dust grains that were ejected along synchrone corresponding to emission time of 78.6 days before perihelion and were subjected to radiation-pressure accelerations not exceeding 6 percent of the solar gravitational acceleration (see footnote d to Table 1).

NOTES:

1. Images made available to us by P. Kocher; astrometry in MPECs 2004-S84 and 2004-T11.
2. Position angle determined by one of us (M. T.) from available image(s); tail axis orientation (spike orientation on September 28) was measured with respect to star trails and then converted to position angle.
3. Observer's description of comet appearance in IAUC 8412; position angle in col. 6 refers to the spike; astrometry in MPEC 2004-S81.
4. Reproduced in Figure 1.
5. Images made available to us by J. W. Young.
6. Reproduced in Figure 3.
7. Images made available to us by R. Naves (see http://astrosurf.com/cometas/cometas/2004-S1.html); astrometry in MPECs 2004-T11, 2004-T49, 2004-U15, and 2004-U33.
8. Observer's data on comet appearance in ICQ **26**, 241 (2004); astrometry in MPECs 2004-T49 and 2004-U33.
9. Images made available to us by K. Kadota (see http://members.jcom.home.ne.jp/kenic-k/comet/2004S1/image, where we abbreviate image = 2004S1-20041007.jpg for October 7, image = 2004S1-20041016.jpg for October 16, and image = 2004S1-20041017.jpg for October 17); astrometry in MPECs 2004-T49 and 2004-U33.
10. Images made available to us by D. Herald; astrometry in MPEC 2004-T49.
11. Image available at http://www.fg-kometen.de/pix/2004S1/2004S1_11102004.htm.

The measured tail orientations from Table 2 are compared in Figure 2 with the orientations of synchrones for the assumed emission times 90, 80, and 70 days before perihelion. It is apparent that the middle synchrone, which differs by $\sim 1\sigma$ from our least-squares solution, fits the data points much better than either of the other two.

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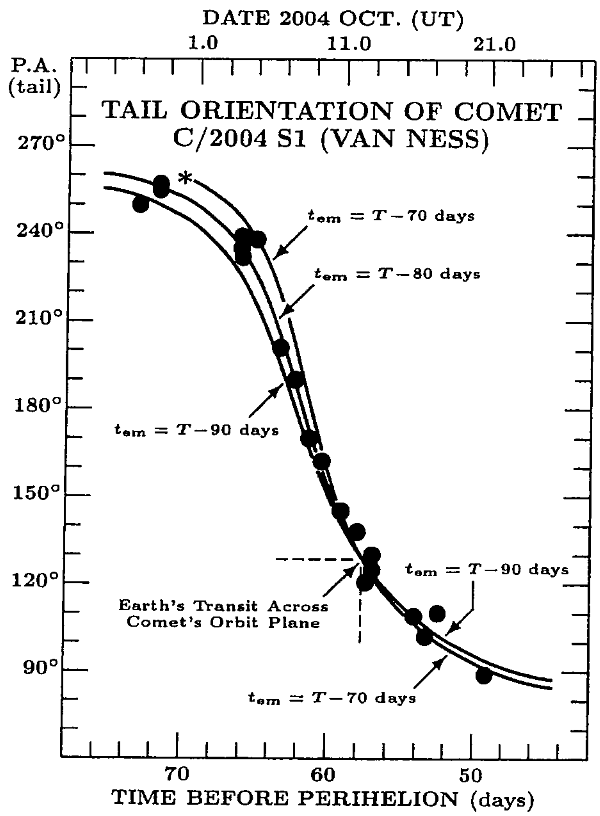

Figure 2. Temporal variations in the tail orientation of comet C/2004 S1. Bullets are the data points (Table 2). The curves show the synchrone orientations for 90, 80, and 70 days before perihelion, that is, for dust ejected from the nucleus on 2004 September 9, 19, and 29. The asterisk is the point of synchrone release from the nucleus. Earth crossed the comet's orbit plane on October 12.28 ET, or 57.64 days before perihelion, when all synchrones were at a position angle of 128°.5.

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Next, we use the spike's observed length to estimate the peak solar-radiation pressure to which dust particles in the feature were subjected and then their minimum size. At the time of Young's observation, the ejecta's age was close to 7 days — in which case the spike's observed length of 25″ corresponds to a radiation-pressure acceleration of 0.06 the sun's gravitational attraction, typical for dust grains 40 microns in diameter if their bulk density is 0.5 g/cm^3, or 100 microns in diameter if the density is 0.2 g/cm^3. Unquestionably, the spike consisted of fairly large particles.

The spike is also used to predict the length of the corresponding synchrone at all other imaging times and to compare this prediction with the observed length of the tail. This is an interesting exercise: because of a gradual expansion of the spike and dispersion of dust particles in space, the observed tail length should be getting gradually shorter with time than the calculated synchrone length. The tail-to-synchrone length ratio $\Re$ should decrease with time, while the dominant particle size in the observed tail should increase. With the production of dust essentially discontinued, the tail may survive the coma for a limited period of time, but it must eventually disappear as well.

Because of the notoriously large uncertainties in estimating a tail length, we have not pursued this issue in detail. However, we found it useful to provide a few numbers to illustrate the effect. We estimated the tail lengths in the six images in Figure 1 and compared them with the calculated synchrone lengths listed in Column 8 of Table 2. The September 28 image gives, of course, a tail-to-synchrone length ratio $\Re = 1$. For the other five images this ratio becomes, respectively, 0.31, 0.24, 0.11, 0.08, and 0.02. The corresponding peak radiation-pressure accelerations are between 2 and 0.1 percent of the solar gravitational acceleration and the minimum particle diameters at a bulk density of 0.5 g/cm^3 amount to between 120 microns and 2.5 millimeters. Using two tail-length estimates by Nakamura (for the reference, see Note 8 to Table 2), we obtain greater $\Re$ ratios, but the same trend: 0.86 for October 6.6 UT and 0.30 for October 12.5 UT. The lower of the two values implies a radiation-pressure acceleration of 1.8 percent of the solar gravitational acceleration and a minimum particle diameter of $\sim$ 130 microns.

A traditional view is that the terminal stage of disintegration of the suddenly disappearing comets — approximated in Figure 1 by the image of October 16 — is characterized by an essentially headless tail consisting of large dust particles that tends to survive longer than massive pieces (boulders) in the nucleus region. As seen from the following section, comet C/2004 S1 offers evidence that may be in conflict with this hypothesis.

4. Nucleus Duplicity

A dust outburst preceding the sudden disappearance of a comet is not an unprecedented phenomenon. Evidence of this sequence of events for the already-mentioned comets C/1925 X1 (Ensor) and C/2002 O4 (Hönig), and perhaps for other objects, such as C/1897 U1 (Perrine), was presented previously (Sekanina 1984, 2002). The behavior of comet C/2004 S1 turned out to be more intriguing.

4.1. Nucleus Imaging at Klet′ Observatory

When first observed at the Klet′ Observatory on October 3, the comet had a slightly condensed coma and a short tail to the west-southwest. The next two sets of images were taken on October 12 about 30 minutes apart. The comet's appearance was very different. The coma was elongated to the southeast, with a diffuse double nucleus detected for the first time. The tail was directed approximately along the line connecting the nuclei.

Another set of images exposed on October 18 showed that the comet faded by ~ 1 magnitude during the intervening period of six days. No tail was detected, but the nuclei, even though much fainter, were now clearly separated and their offsets were easier to measure than on October 12. The comet was observed at Klet′ for the last time on October 24. Passing across a Milky Way region, the comet was in a field crowded by a large number of stars. The nuclei, although more widely separated than on October 18, remained diffuse, fading another 1-1.5 magnitudes. Again, no tail was discerned.

The co-added and processed Klet′ images of the comet from October 3, 12 (first of the two sets), and 18 are displayed in Figure 3. It shows nuclei A and B, whose previously unpublished astrometric positions are presented in Table 3.

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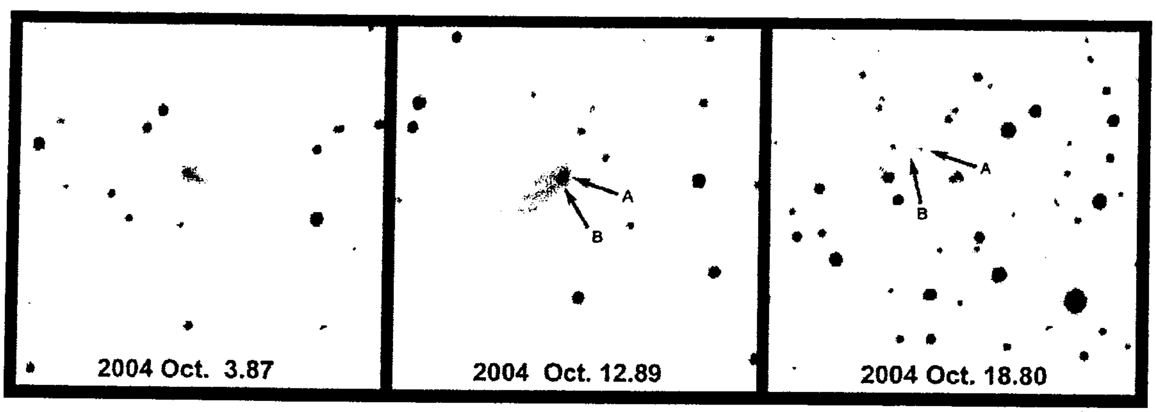

Figure 3. The double nucleus of comet C/2004 S1 observed at the Klet′ Observatory with the 106-cm f/2.7 Klenot reflector. Each frame is 3′ on a side, with the north up and the east to the left. Only a single condensation is seen in the left frame, taken on October 3. In the October 12 image (middle), two condensations in contact with one another are for the first time recognized. The trailing companion B is to the southeast of the leading primary nucleus A. By October 18 (right), the condensations grew fainter, but their angular separation increased; companion B was now almost exactly to the east of A. Although the separation between the two components increased further on October 24, the last time the comet was observed at Klet′, they were still fainter and could not be easily reproduced.

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4.2. Nucleus Imaging by Other Observers

Originally, we knew of no other reports of nucleus duplicity. Among the replies we obtained in response to our inquiry (see section 2 of this paper), the most helpful comments were those by Nakamura, who wrote:

"I have re-examined the frames taken on October 12. I can barely see another 'condensation' on the first and second frame at 4″ or so in position angle 140° from the main condensation. But, on the third one, the comet looks like to have only one 'elongated' condensation . . . A shift and co-added frame didn't show more . . . the estimates . . . not measurements . . . are very uncertain."

In his response to our request, Herald said that the comet "appeared unusual in that the nucleus is clearly elongated . . . But I don't think my images provide any strong support for a separating split nucleus ... ." In reference to his images of October 16-17, Kadota reported that "the coma is elongated, but I can't detect a separate nucleus." The replies from the other observers did not address the issue of nucleus duplicity.

Table 3. Astrometric Positions of Nuclei of Comet C/2004 S1 from Klet′ Observatory (equinox J2000.0)

Time of observation 2004 (UT)	Nucleus	Right Ascension	Declination
		h m s	° ′ ″
Oct. 12.88948	A	23 46 45.75	+22 38 37.1
	B	23 46 45.98	+22 38 34.0
12.90544	A	23 46 23.20	+22 39 08.6
	B	23 46 23.35	+22 39 04.7
12.90649	A	23 46 21.69	+22 39 10.1
	B	23 46 21.95	+22 39 05.9
18.78760	A	21 32 08.46	+22 01 46.3
	B	21 32 09.12	+22 01 46.4
18.78897	A	21 32 06.92	+22 01 42.9
	B	21 32 07.43	+22 01 43.0
18.79537	A	21 31 59.15	+22 01 29.7
	B	21 31 59.70	+22 01 29.6
18.80200	A	21 31 51.21	+22 01 13.2
	B	21 31 51.89	+22 01 13.3
18.80253	A	21 31 50.70	+22 01 13.1
	B	21 31 51.30	+22 01 13.3
24.76777	A	20 02 05.70	+17 34 25.0
	B	20 02 06.56	+17 34 25.4
24.76811	A	20 02 05.35	+17 34 22.4
	B	20 02 06.17	+17 34 23.3

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To summarize, it is apparent that the detection of the split nucleus of comet C/2004 S1 depended critically on the resolving power of the telescope and the limiting magnitude. The secondary was not observed before October 12 because the separation distance was within the seeing disc, as is implied by the results of our modeling (section 4.4 of this paper). By October 12, the distance increased enough to allow detection by the KLENOT telescope and barely by the Kuma Kogen reflector, the second largest employed at the time. In images from the second half of October, the problem was not the insufficient separation between the nuclei but their extreme faintness. Only the *Klenot* reflector could image them. Nakamura made no observations during this period of time.

Table 4 presents the list of available separations of the secondary nucleus from the primary. The first entry is the estimate by Nakamura, which is consistent with the data from the first of the Klet′ images taken about 9 hours later. All of the Klet′ entries in Table 4 are the differences between the absolute astrometric positions of the two nuclei from Table 3.

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Table 4. Observed Separations for Split Nucleus of Comet C/2004 S1 (equinox J2000.0)

Time of observation 2004 (UT)	Nucleus B relative to nucleus A: P.A.	separation distance	offset[a] in R.A.	offset in Dec.	Observer(s) and site
	°	″	″	″	
Oct. 12.52951[b]	140	4	+2.6	−3.1	Nakamura (Kuma Kogen)
12.88948	134	4.4	+3.2	−3.1	Tichý et al. (Klet′)
12.90544[c]	152	4.4	+2.1	−3.9	"
12.90649[c]	139	5.5	+3.6	−4.2	"
18.78760	89	9.2	+9.2	+0.1	"
18.78897	89	7.1	+7.1	+0.1	"
18.79537	91	7.7	+7.7	−0.1	"
18.80200	89	9.5	+9.5	+0.1	"
18.80253	89	8.3	+8.3	+0.2	"
24.76777	88	12.3	+12.3	+0.4	"
24.76811	86	11.7	+11.7	+0.9	"

[a] Including factor cos(Dec.).
[b] This is average of times for first two of three images; position of B relative to A estimated.
[c] These two entries were later averaged: Oct. 12.90597, 145°, 4″.9, +2″.8, −4″.0; see Table 6.

4.3. The Fragmentation Model

Splitting or fragmentation is a relatively common phenomenon among comets. As with comet C/2004 S1, it is usually nontidal in nature, in which case the rate at which two fragments drift apart is determined primarily by the net difference between contributions from directed outgassing to their orbital momenta. This difference, which is referred to as a differential nongravitational effect, is responsible for the characteristic configuration, in which the fragments are eventually lined up along their common orbit by decreasing mass, the leading (primary) fragment being the most massive and persistent one and *usually* the only one that survives. The trailing, less-massive fragments are the companions or secondary nuclei. Orbital effects of an extra momentum that fragments acquire during such a nontidal breakup are described by their separation velocities and are generally less significant. Comets whose fragmentation involves tidal forces behave somewhat differently, as shown by Sekanina (1997).

Some characteristics of a fragmentation event and the dynamical histories of fragments can be recovered by modeling the observed motions of companions relative to the primary. A practical approach to this fitting was proposed by Sekanina (1978) by introducing a multiparameter model that has since been successfully applied to a large number of split comets, as is apparent from the reviews by Sekanina (1982) and by Boehnhardt (2005). The model for two fragments has up to five parameters to be determined by an iterative, least-squares differential-correction procedure: the time of fragmentation; a differential nongravitational deceleration of the companion (which is assumed to act continuously between the times of separation and observation and to vary as the inverse-square of heliocentric distance); and three components of the companion's separation velocity, which are directed along the following cardinal directions defined by the heliocentric orbit of the parent comet: the radial (away from the sun), the transverse (in the orbital plane), and the normal axes of the right-handed RTN coordinate system. The mutual gravitational attraction of fragments and the differential planetary perturbations of their motions are ignored.

An important feature of the proposed approach is the option to solve for any combination of fewer than the five parameters, so that a total of 31 different versions of the code are available. This option proves most beneficial especially in the early phases of the iterative process, before the solution "settles" around the optimum parametric values, or when the convergence is slow or relatively weak.

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Table 5. Fragmentation-Model Solutions[a] *for Split Nucleus of Comet C/2004 S1*

Quantity	Solution 1	Solution 2	Solution 3	Solution 4	Solution 5	Solution 6	Solution 7
Fragmentation time and location:							
Date 2004 (ET)	Sept. 19.5	Sept. 18.5	Sept. 22.7	Sept. 23.9	(Sept. 21.3)	(Sept. 21.3)	(Sept. 21.3)
Time before perihelion (days)	80.4 ± 4.4	81.4 ± 4.7	77.2 ± 3.3	76.0 ± 3.0	(78.6)	(78.6)	(78.6)
Heliocentric distance (AU)	1.64 ± 0.06	1.65 ± 0.07	1.59 ± 0.05	1.57 ± 0.04	(1.61)	(1.61)	(1.61)
Distance from ecliptic (AU)[b]	−0.18 ± 0.05	−0.19 ± 0.06	−0.14 ± 0.04	−0.12 ± 0.04	(−0.15)	(−0.15)	(−0.15)
Separation velocity (m/s):							
Radial component, V_R	......	......	......	(+0.10)	......	......	+0.04 ± 0.67
Transverse component, V_T	......	......	(−0.10)	(−0.10)	......	......	−0.05 ± 0.23
Normal component, V_N	......	−0.05 ± 0.03	−0.08 ± 0.04	−0.09 ± 0.04	......	−0.05 ± 0.04	−0.06 ± 0.07
Total velocity	......	0.05 ± 0.03	(0.13)	(0.17)	......	0.05 ± 0.04	0.09 ± 0.34
Differential deceleration (units)[c]	29.5 ± 7.2	27.8 ± 7.0	33.9 ± 7.1	33.4 ± 7.2	32.7 ± 1.2	32.4 ± 1.2	31 ± 17
Astrometry:							
Number of observations used	9	9	9	9	9	9	9
Sum of squared residuals ($arcsec^2$)	15.11	13.44	13.40	13.39	15.28	13.81	13.38
RMS residual	±0″.97	±0″.95	±0″.95	±0″.94	±0″.95	±0″.93	±0″.98

[a] Forced fragmentation parameters are parenthesized.
[b] Minus sign indicates that fragmentation occurred south of the ecliptic.
[c] Units of 10^{-5} the solar gravitational acceleration.

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4.4. Results of Modeling for Comet C/2004 S1

Our analysis of the fragmentation episode experienced by comet C/2004 S1 was based on the offsets listed in Table 4, with a variety of parametric combinations employed. Seven solutions are summarized in Table 5. Of these, Solution 5 is a one-parameter model, Solutions 1 and 6 are two-parameter models, Solutions 2, 3, and 4 are three-parameter models, and Solution 7 is a four-parameter model. Because of inherent difficulties with bisecting the nuclei especially on the Klet′ frames from October 12, we became reconciled to tolerating residuals as high as nearly 2″. With this rejection threshold, it was possible to employ all measured offsets except the second and third ones from October 12, which both left residuals in excess of 2″ in declination and were not included in the solutions.

A major result is a superb agreement between the time of dust outburst, September 21.3 ± 1.3 ET (see section 3.3 of this paper), and the fragmentation time, which is shown by Solutions 1-4 to be nominally confined to between September 18 and 23, with a solution dependent uncertainty of ±3 to ±5 days. The range is centered almost exactly on the time of outburst. This remarkable coincidence indicates that the nucleus breakup was accompanied by a brief, major increase in the production of dust. Under these circumstances it is not surprising that a condition *requiring* that the fragmentation time be identical with the time of outburst led to equally satisfactory results, as seen from Solutions 5-7 in Table 5. The distributions of residuals from the various solutions, listed for some of them in Table 6, are also very similar. The residuals from the October 12 pair of rejected offsets have been averaged. The distributions of residuals for the other four solutions are not presented; the residuals for Solution 5 are almost identical to those for Solution 1, while the residuals for Solutions 2, 3, and 4 nearly coincide with those for Solution 7.

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Table 6. Offset Residuals from Fragmentation-Model Solutions 1, 6, and 7 for Split Nucleus of Comet C/2004 S1 (Equinox J2000.0)

Time of observation 2004 (UT)	Offset residuals[a] $o-c$ from					
	Solution 1		Solution 6		Solution 7	
	in R.A.[b]	in Dec.	in R.A.[b]	in Dec.	in R.A.[b]	in Dec.
	″	″	″	″	″	″
Oct. 12.52951	+0.3	−1.4	+0.2	−1.8	−0.1	−1.7
12.88948	+0.6	−1.4	+0.5	−1.8	+0.2	−1.7
12.90597	(+0.2)	(−2.3)	(+0.1)	(−2.7)	(−0.2)	(−2.6)
18.78760	+0.7	+1.2	+0.7	+0.7	+0.6	+0.7
18.78897	−1.4	+1.2	−1.4	+0.7	−1.5	+0.7
18.79537	−0.8	+1.0	−0.8	+0.5	−0.9	+0.5
18.80200	+1.0	+1.2	+1.0	+0.7	−0.9	+0.5
18.80253	−0.1	+1.3	−0.1	+0.8	−0.2	+0.8
24.76777	+0.5	−0.4	+0.4	−0.8	+0.7	−0.7
24.76811	−0.1	+0.2	−0.2	−0.3	+0.1	−0.2

[a] Observed minus computed; residuals from rejected offsets are parenthesized.
[b] Including factor cos(Dec.).

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It appears that the secondary nucleus separated from the parent with a very low velocity, estimated at much less than 0.5 m/s. When a component of the separation velocity was solved for, its nominal value was always less than 0.1 m/s and with a large relative error. An attempt to derive all three velocity components in Solution 7 was formally successful, but their errors greatly exceeded the nominal values. On the other hand, it was established that the fragment was subjected to a differential deceleration of $\sim 30 \times 10^{-5}$ units of the solar gravitational acceleration, suggesting that it was substantially less massive than the primary. This result appears to be broadly consistent with photometric evidence, which indicates that the companion was systematically fainter than the primary fragment by more than 1 magnitude (Table 7).

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Table 7. Panchromatic Magnitudes of Comet C/2004 S1 Measured at Klet′ Observatory

Date of observation 2004 (UT)	Panchromatic magnitude			Magnitude difference B−A
	total	nucleus A	nucleus B	
Oct. 3.87	17.0	...	...	...
12.89	17.1	17.4	18.7	+1.3
18.79	18.0	18.3	19.7	+1.4
24.77	19.4	19.7	20.9	+1.2

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Our fragmentation modeling also shows that the nucleus duplicity was detected at the earliest possible time. The predicted separation between the nuclei was only 0″.3 on October 3.9 UT, the time of previous imaging observation at Klet′, and it reached 1″ as late as October 9.

5. The Light Curve

The dust outburst should also have manifested itself in the comet's light curve. As particulate ejecta have finite lifetimes in the coma (depending on their expansion velocities and disintegration rates, the coma size, etc.), the effect of a briefly enhanced rate of dust release from the nucleus on the light curve differs from its effect on the tail morphology. At the time of such an outburst the coma begins to brighten and it continues to do so for a limited period of time. To assemble a meaningful light curve requires that all magnitudes to be included in the database be first standardized to the extent possible. They also need to be normalized to a unit geocentric distance.

5.1. Standardization Procedure

Nearly all published magnitudes of comet C/2004 S1 were determined from CCD imaging. There are two problems with standardizing such magnitudes. One involves spectral-sensitivity and quantum-efficiency variations among the different CCD array detectors used by comet observers with or without color filters. The other is introduced by an observer's choice of aperture size for integrating the comet brightness, which results in magnitudes fainter than the total magnitudes by a factor that may vary substantially from observer to observer and sometimes from detector to detector for the same observer.

A simple, straightforward standardization procedure consists of visually comparing temporally overlapping light curves by individual observers (separately for each instrumentation, when more than one was used) and minimizing the scatter among them by shifting these personal light curves along the magnitude axis until the best match has been achieved. Time gaps between any two such light curves are spanned by additional data points provided by other observers. In this trial-and-error fashion, constant corrections are determined for reasonably uniform data sets that are then converted to a common photometric system. Data sets that could not be accommodated by such corrections must be rejected.

Let $H_{j,k}(t)$ be an apparent magnitude of the comet at time t reported by observer j, who obtained it using instrumentation k. If the comet's geocentric distance at this time was Δ (in AU) and if the correction needed to convert the observer's light curve to a reference system is $corr_{j,k}$, the normalized magnitude is

$$H_{\Delta}(t) = H_{j,k}(t) + corr_{j,k} - 5\log_{10}\Delta \quad (1)$$

To proceed, we selected the Klet′ magnitudes from Table 7 as our reference light curve and applied appropriate corrections to all other sets chosen to be included in the sample. The KLENOT telescope has a Photometrics S300 CCD camera equipped with a 'SITe 003B' detector, the quantum efficiency with enhanced blue response exceeding 80% between 5500 Å and 8000 Å and 60% between 3700 Å and 8800 Å. With no filter employed, the magnitudes can best be described as panchromatic, except that they were calibrated with the R magnitudes of comparison stars taken from Monet *et al.* (1998). Square apertures ranging from 25″ on October 3 to 10″ on October 24 were used to include some coma on the one hand and to isolate the two discrete nuclei on the other hand. For the close double nucleus in the images of October 12, apertures of both 10″ and 6″ on a side were employed.

Including the Klet′ data, we collected magnitudes by nine individual observers and two teams, each observing the comet on 2 to 5 nights (Table 8). We ignored single-night observations, as they contribute no information. For observers who published more than one magnitude per night, the data points from each night were averaged.

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Table 8. Brightness Observations Available for Light Curve of Comet C/2004 S1

Observer(s)[a]	Telescope used	Number of nights	Span of dates 2004 (UT)	Correction (mag)	Notes (references)
Herald, D. (Australia)[b]	36-cm f/3.9 Schmidt-Cassegrain	4	Oct. 8–15	−1.0	1, 2
McGaha, J. E. (U.S.)	36-cm f/10.0 Schmidt-Cassegrain	2	Sept. 27–28	−0.8	3
Kocher, P. (Switzerland)	50-cm f/3.3 Hypergraph	3	Sept. 26–Oct. 4	−0.6	4
Tichý, M. (Czech Republic)[c]	106-cm f/2.7 KLENOT reflector	4	Oct. 3–24	0.0	This paper
Van Ness, M. E. (U.S.)[d]	58-cm f/1.9 LONEOS Schmidt	2	Sept. 26–27	0.0	3
Naves, R. (Spain)	30-cm f/6.6 Schmidt-Cassegrain	5	Sept. 29–Oct. 20	+0.1	1, 2, 4, 5
Shurpakov, S. E. (Belarus)	11-cm f/7 reflector	3	Oct. 6–13	+0.4	6
Nakamura, A. (Japan)[e]	60-cm f/5.8 Ritchey-Chrétien	2	Oct. 6–12	+1.0	1, 5, 6
Kadota, K. (Japan)	25-cm f/5.0 reflector	2	Oct. 7–17	+1.2	1, 5
van Dijk, E. (Netherlands)	31-cm f/6 Bird-Jones	2	Oct. 8–10	+3.5	7
Bouma, R. J. (Netherlands)	31-cm f/6 Bird-Jones	2	Oct. 8–10	+3.9	7

[a] Roman font is used for observers employing CCD detectors, slanted font for visual observers.
[b] Comet possibly detected on Oct. 24.40 UT (no magnitude given), but not on Oct. 30.42 UT, when stars to at least magnitude 19.0 were seen (Herald 2004, personal communication).
[c] Reference light curve. Additional observers: J. Tichá and M. Kočer. Measured magnitudes are listed in Table 7.
[d] Additional observer: B. A. Skiff.
[e] Comet not detected on Nov. 4.41 UT, with limiting magnitude around 19 for stars (Nakamura 2004, personal communication).

NOTES (MPEC stands for Minor Planet Electronic Circular):

1. MPEC 2004-T49.
2. MPEC 2004-U15.
3. MPEC 2004-S81.
4. MPEC 2004-S84 and 2004-T11.
5. MPEC 2004-U33.
6. Internat. Comet Quart. **26**, 241 (2004).
7. Internat. Comet Quart. **26**, 233 (2004).

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Columns 3 and 4 of Table 8 show that we collected a total of 31 magnitude determinations covering the period of time from September 26 to October 24, or exactly four weeks. The observers are listed in the order of increasing correction.

The more positive the correction, the greater the reported brightness. For most observers, the correction could be found directly by comparing the Klet′ magnitudes with their temporally overlapping light curve. For two cases of observations made only in September, the correction derivation relied on the light curves by Kocher and Naves.

The total range of derived corrections is nearly 5 magnitudes. However, the data reported by nine observers/teams required only small to moderate corrections, as they did not differ from the reference system by more than 1.2 magnitudes or a factor of 3. Exceptions are the two visual observers who estimated the comet to be between about 10 and 100 times brighter than anyone else. Their estimates appear to have included much of the outer coma (with quoted diameters of up to 2′), closely approximating the comet's total brightness.

Only two of the 31 magnitude determinations were found to be grossly inconsistent with the rest, one on October 9, the other on October 20. Neither was used in the light-curve modeling efforts. The two imaging attempts that failed to detect the comet (see section 2 of this paper) provided estimates for a limiting magnitude on October 30 and November 4; for details, see footnotes b and e to Table 8.

5.2. Modeling the Light Curve

The light curve of comet C/2004 S1 was compared with several models on the assumption that it referred to a single object, ignoring the nucleus duplicity. Plotted against time in Figures 4-5, the light curve is shown to have peaked about 68 days before perihelion, on October 1-2, at a heliocentric distance of 1.46 AU. The normalized magnitude in the reference system then reached $H_\Delta = 18.9$, corresponding to a standardized apparent magnitude of 17.4.

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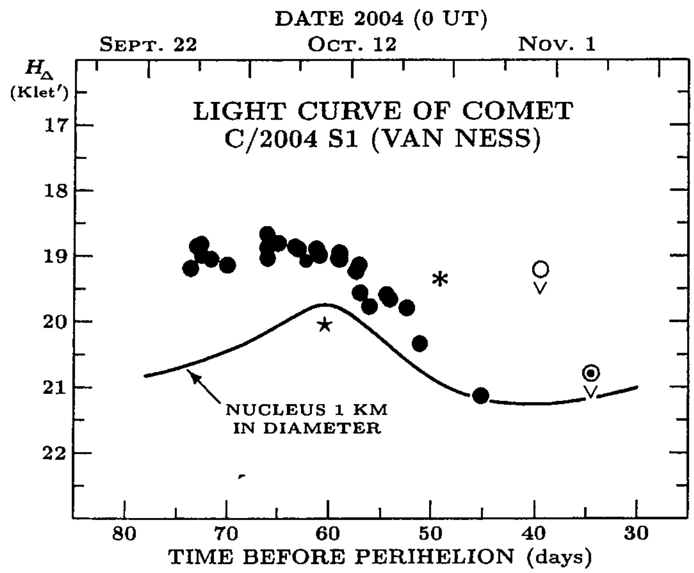

Figure 4. Magnitudes of comet C/2004 S1, normalized to 1 AU from Earth, are plotted as a function of date (upper scale) and time before the perihelion passage on 2004 December 8.92 ET (lower scale). The bullets are 29 mutually consistent data points based on mostly CCD magnitudes, reported by 11 observers or teams (Table 8), nightly averaged for each of them and converted to the Klet′ reference system. Two apparently incongruous determinations are marked, respectively, by a star (October 9; Herald) and an asterisk (October 20; Naves). The comet was not detected by Herald on October 30 and by Nakamura on November 4. The corresponding limiting magnitudes are marked in the plot by, respectively, an open circle and a circled dot with arrows pointing down. The curve shows theoretical brightness variations for a spherical nucleus 1 km across, whose geometric albedo is 4 percent in the Cousins R spectral bandpass and whose phase coefficient is 0.035 mag/deg.

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One possible scenario, presented in Figure 4, postulates the comet's rapid deactivation, whereby the magnitude at the sunward end of the observed arc is much closer to the magnitude of an inactive nucleus than at the far end. The normalized magnitudes of a bare nucleus should fit a phase-modulated inverse-square power law:

$$H_\Delta(t) = H_0 - 5\log_{10} D + 5\log_{10} r(t) + \beta\psi(t), \tag{2}$$

where D is the effective nucleus diameter (in km), $\psi(t)$ the phase angle (in deg), β the phase slope (in mag/deg), and H_0 the normalized magnitude at a heliocentric distance of $r = 1$ AU and a zero phase angle. The curve plotted in Figure 4 has been calculated with $D = 1$ km, $\beta = 0.035$ mag/deg, and $H_0 = 18.77$. Because of large variations in the phase angle, which reached 60°-70° toward the end of the critical period of time, the predicted light curve of the hypothetical inactive comet differs dramatically from a plain inverse-square power law. The fit in Figure 4, with the magnitude differences from Table 7, would imply effective diameters of 0.87 km and 0.50 km, respectively, for nuclei A and B. As they both appear diffuse in all images (see section 4.1 of this paper), these numbers represent only crude upper limits on the actual dimensions.

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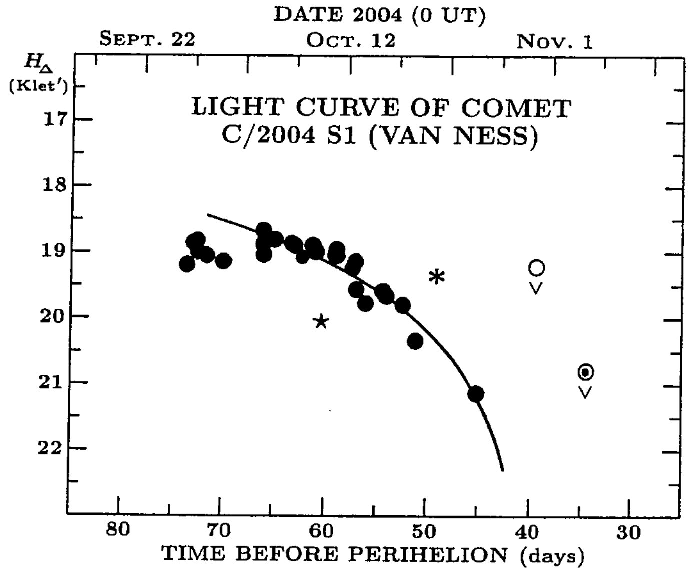

Figure 5. Magnitudes of comet C/2004 S1, normalized to 1 AU from Earth and converted to the reference system, are plotted as a function of time. For information on the observations, see the caption to Figure 4. The curve represents the approximate law for the comet's complete disintegration expressed by Eq. (4) and fitted to 23 consistent data points at times less than 67 days before perihelion or after October 2. The curve is determined by its nominal parameters: $t_{\rm fin}$ = T − 39.7 days or 2004 October 30, H_1 = 23.7, ν = 1.40.

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The aim of proposing the following alternative scenario is to fit the decreasing branch of the light curve at $t > T - 67$ days in Figure 5. The employed approximate law is based on the assumption that the comet was disintegrating completely. Applied successfully to comet C/2002 O4 (see Sekanina 2002), this law postulates that the nucleus eroded away at a constant rate $\dot{R}$ during the period of time under consideration and that the normalized brightness $\Im_\Delta(t)$ was proportional to power ν of radius $R(t)$ of the gradually contracting nucleus,

$$\Im_\Delta(t) \propto [R(t)]^\nu = \left[R_0 - \dot{R}\cdot(t-t_0)\right]^\nu, \tag{3}$$

where $R_0 = R(t_0)$ is the nucleus radius at a reference time t_0. Equation (3) can be written as a function of the time of demise $t_{\rm fin}$ (Sekanina 2002),

$$H_\Delta(t) = H_1 - 2.5\nu\log_{10}(t_{\rm fin} - t), \tag{4}$$

where H_1 is the normalized magnitude 1 day before the object eroded away completely.

A least-squares solution to Eq. (4) based on a total of 23 consistent normalized magnitudes H_Δ, corresponding to times of < 67 days before perihelion, shows that $t_{\rm fin} - T = -39.7 \pm 2.4$ days, $H_1 = 23.7 \pm 0.3$, and $\nu = 1.40 \pm 0.09$. Thus, this model predicts that the comet ceased to exist most probably between October 27 and November 1, at a heliocentric distance between 1.08 and 1.01 AU. Like with comet C/2002 O4, the exponent ν was found to have a value of < 2, expected in a theoretical case of the brightness varying as the surface area of the contracting nucleus. The suggestion — offered in Sekanina (2002) — that the value of ν derived from the observations might be affected by finite lifetimes of erosion products that linger near the nucleus needs to be invoked again.

In reality, of course, the rate of contraction of the nucleus is not constant, regardless of the quality of fit to a segment of the light curve in Figure 5. A more sophisticated model has been introduced and applied next.

5.3. Erosion Model for "Minor Sungrazers"

At first sight, the light curve of comet C/2004 S1 plotted against heliocentric distance (Figures 6 and 7) is remarkably similar to the light curves of minor sungrazing comets (Biesecker *et al.* 2002). Discovered in large numbers with the *Solar and Heliospheric Observatory* (SOHO), these minicomets are observed to disintegrate completely before they reach perihelion. The only major difference between comet C/2004 S1 and the SOHO sungrazers is in heliocentric distance (more than 1 AU versus < 0.15 AU).

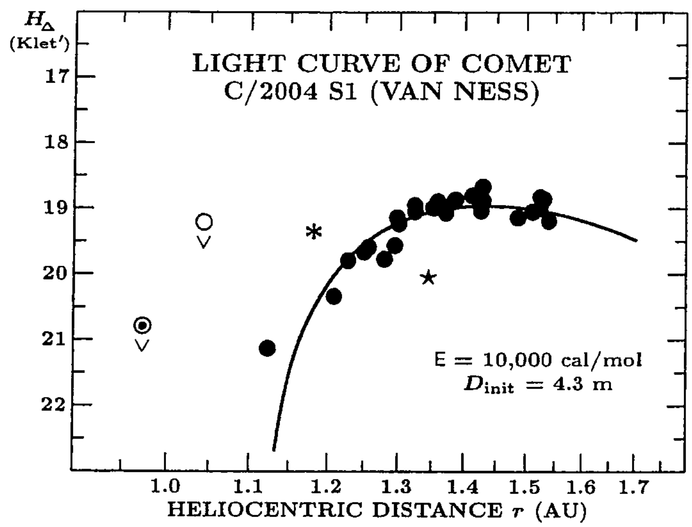
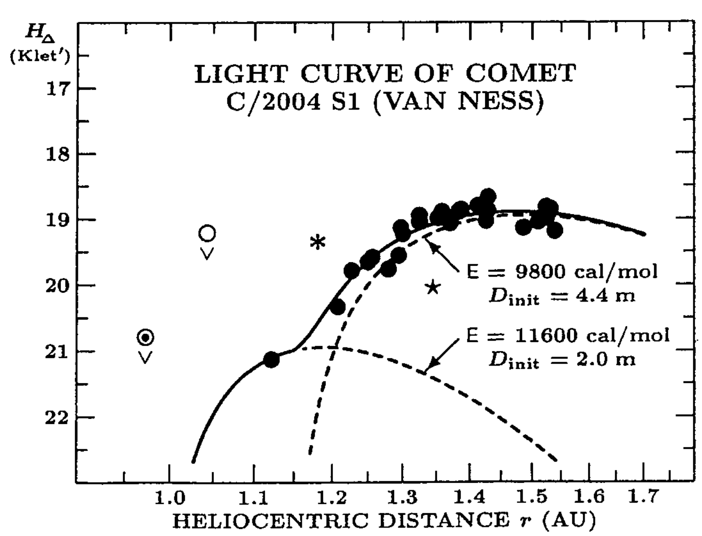


Figure 6 (above). Magnitudes of comet C/2004 S1, normalized to 1 AU from Earth, are plotted as a function of heliocentric distance. For information on the observations, see the caption to Figure 4. The curve represents a one-component solution to the erosion model expressed by Eq. (5) and fitted to all 29 consistent data points available. It is assumed that sodium emission contributed 10 percent to the reference light curve. Other assumptions included a single nucleus (whose surface area and normalized brightness are equal to the sums of their values for the two nuclei), a unit thermal emissivity of its surface, and constant values of 0.03 for its Bond albedo, 0.5 g/cm^3 for its bulk density, and 200 g/mole for the mean molecular weight of its particulate material, which is close to the numbers for various silicates. The model predicts an initial, pre-erosion nucleus diameter of 4.3 meters and a latent erosion energy of 10,000 cal/mole. If the erosion process began just after nucleus fragmentation on about September 21, the initial diameter would become 3.7 meters. The nucleus is predicted to have eroded away by October 25. It is noted that the last observation on October 24 is fitted not at all well.

Figure 7 (below). Magnitudes of comet C/2004 S1, normalized to 1 AU from Earth, are plotted as a function of heliocentric distance. For information on the observations, see the caption to Figure 4. A two-component solution is now fitted to the data points on the same assumptions as with the one-component solution (see the caption to Figure 6). The dash curves represent separate contributions from the two components, the solid curve shows their sum. This model predicts an initial nucleus diameter of 4.4 meters and an erosion energy of 9800 cal/mole for the component that provides the fit at larger heliocentric distances and 2.0 meters and 11,600 cal/mole for the longer surviving component that dominates nearer the Sun. If the erosion process began only after the nucleus split, the initial diameter of the first component would be 3.6 meters, that of the second component would not change. The nucleus is predicted to have eroded away completely by November 3.



The erosion process that the SOHO sungrazers undergo was modeled on the assumption that it consists of their continuous, progressive bulk fragmentation and sublimation (Sekanina 2003). The normalized brightness $\Im_\Delta(r)$ is a function of the erosion rate $\dot{R}(r)$, which depends strongly on heliocentric distance r and is determined primarily by the latent energy of erosion **E**, a quantity similar to the sublimation heat of a volatile substance,

$$\Im_\Delta(r) \propto \dot{R}(r)\,[R_{\rm init} - \Delta R(r)]^2\,, \tag{5}$$

where $R_{\rm init}$ is the nucleus radius before the erosion process sets in and $\Delta R(r)$ is the thickness of the eroded layer by the time the comet reaches distance r along the preperihelion branch of the parabolic orbit of perihelion distance q,

$$\Delta R(r) \propto q^{3/2} \int_0^{\sqrt{q/r}} \dot{R}(u) u^{-4} \left(1 - u^2\right)^{-1/2} du, \tag{6}$$

with

$$\dot{R}(r) \propto \frac{1}{\sqrt{\mathcal{R}T(r)}} \exp\left[\frac{-\mathbf{E}}{\mathcal{R}T(r)}\right], \tag{7}$$

$\mathcal{R}$ being the gas constant and $T(r)$ the mean temperature of the comet's surface at r.

Because magnitudes of the SOHO sungrazers are dominated by sodium emission (Biesecker *et al.* 2002), the previous modeling efforts were focused in that direction. At heliocentric distances comparable with or exceeding 1 AU, one can no longer argue that sodium atoms dominate a comet's light. Also, given that the radial heliocentric velocity of comet C/2004 S1 was close to −25 km/s throughout the critical period of time, the fluorescence rate in the sodium doublet (normalized to 1 AU) was reduced from 1.45 to 1.20 photons/cm^2/s, an effect equivalent to 0.2 magnitude.

We employed the described erosion model to investigate two scenarios for comet C/2004 S1 by searching for optimized one-component and two-component solutions. Both incorporated a major assumption that sodium emission contributed 10 percent to the reference brightness. Calculations were carried out with a unit thermal emissivity and constant values of 0.03 for the comet's Bond albedo, 0.5 g/cm^3 for its bulk density, and 200 g/mole for the mean molecular weight of its particulate material. The shape of the reference light curve was used to determine, by trial and error, the optimum values for the erosion energy **E** and the initial, pre-erosion nucleus diameter $D_{\rm init}$.

Figure 6 shows the best one-component solution that we were able to derive. The modeled light curve peaks at 1.43 AU, corresponding to slightly more than 66 days before perihelion or October 3, and matching the normalized magnitude of 18.9 on the reference light curve (see section 5.2). The initial diameter was found to be 4.3 meters, while the erosion energy was 10,000 cal/mole. This model predicts that the comet disintegrated completely at $t_{\rm fin} = T - 44.2$ days or on October 25, but Figure 6 shows that the final data point, from the previous day, is not fitted well.

For the SOHO sungrazers the erosion energy exceeded 30,000 cal/mole (Sekanina 2003). The very low value for comet C/2004 S1 indicates that energetically it is easier to erode its nucleus material than to sublimate water ice, which requires 11,500 cal/mole at a temperature of 200°K and 11,200 cal/mole at 250°K. The extremely small pre-erosion dimensions of the nucleus led us to examine whether scattering by dust grains can satisfy the comet's observed brightness.

A critical test of the model is provided by the peak magnitude. Since we assumed that sodium atoms contributed 10% to the signal, scattering by the cloud of dust particles released by the erosion process should account for a peak normalized magnitude of 19.0. The erosion rate of the nucleus radius at 1.43 AU from the sun, or $\sim$ 66 days before perihelion, is calculated to have been 3.8 cm/day. By that time, the layer of eroded material became 0.65 meter thick, so that the nucleus diameter decreased to 3.0 meters, implying a total mass erosion rate of 6.2 g/s at a bulk density of 0.5 g/cm^3. If the particle cloud was dominated by microscopic grains with a weighted mean diameter of $\sim$ 1 micron, the normalized magnitude of 19.0 would be reached after they had been accumulating in the coma over a period of 19 hours. The expansion velocity of the erosion products should have been fairly low, as the process is expected to have been accompanied by no major ice sublimation. With a velocity of 50 m/s, for example, the cloud expanding for 19 hours would reach a distance of 3400 km from the nucleus. Since the comet was at the time 0.46 AU from Earth, the corresponding angular distance projected onto the plane of the sky is $\sim 10''$, which happens to be comparable with the aperture sizes used in the Klet′ images. Thus, the erosion model with the extremely small nucleus and a very low erosion energy, is indeed found to be compatible with the reference light curve presented in section 5.1.

The main purpose for our introducing the "two-component" version of the model was to demonstrate that the data point of October 24 could readily be accommodated. The two components have nothing in common with nucleus duplicity. The name implies that this is a useful extension of the one-component model in that the nucleus is assumed to be made up of (at least) two constituents, each characterized by its own erosion energy. This generalization was used to a great advantage in applications to the SOHO sungrazers (Sekanina 2003), many of which exhibited brightness fluctuations near the sunward end of their light curves, a possible effect of unresolved, slowly eroding subfragments, a scenario supported by independent evidence (Bemporad *et al.* 2005).

However probable, an interpretation in terms of minicompanions is only one of several. Alternative two-component (or multi-component) scenarios can be visualized, such as a bifurcated, perhaps dumbbell-like body, a heterogeneous object of more complex shape, etc. In any case, the October 24 magnitude of comet C/2004 S1 may signal the presence of "pseudo-chaotic" variations at the sunward end of the light curve similar to those observed repeatedly for the SOHO sungrazers.

The best two-component solution we achieved is exhibited in Figure 7. The bulk of the data is approximated most satisfactorily by the more rapidly eroding component, whose properties differ, as expected, only slightly from those of the one-component model fitted in Figure 6. This component reached a peak brightness at 1.49 AU, corresponding to about 70 days before perihelion or September 29 and its demise occurred nearly 47 days before perihelion, on October 23. The initial diameter of 4.4 meters and the erosion energy of 9800 cal/mole are almost identical to the parameters of the one-component model.

The second, smaller, and more-slowly-eroding component significantly improved the fit near and below 1.25 AU and provided a successful link between the October 18 and October 24 data points. This component's normalized light curve peaked at 1.19 AU — that is, slightly less than 50 days before perihelion or on October 20 — with the demise two weeks later, on November 3. The parameters, an initial diameter of 2.0 meters and an erosion energy of 11,600 cal/mole, differ significantly from the first component. This model, whose properties are compared with those of the one-component version in Table 9, suggests that (i) the more-rapidly-eroding component dominated until October 13, the more-slowly-eroding component afterwards; and (ii) only this second component, whose erosion energy is equal to the sublimation heat of water ice near 200°K, was still in existence at the time of the final observation of October 24.

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Table 9. Erosion Models for the Nucleus of Comet C/2004 S1

			One-component model			Two-component model: Component 1			Two-component model: Component 2		
Date 2004 (UT)	Time[a] from perihelion (days)	Distance from Sun (AU)	Time to demise (days)	Nucleus diameter (m)	Rate of erosion (cm/day)	Time to demise (days)	Nucleus diameter (m)	Rate of erosion (cm/day)	Time to demise (days)	Nucleus diameter (m)	Rate of erosion (cm/day)
Sept. 21.0	−78.9	1.62	34.7	3.7	1.9	32.0	3.6	2.4	43.4	2.0	0.2
25.0	−74.9	1.56	30.7	3.5	2.4	28.0	3.4	2.9	39.4	2.0	0.3
29.0	−70.9	1.50	26.7	3.3	3.0	24.0	3.1	3.5	35.4	1.9	0.4
Oct. 3.0	−66.9	1.44	22.7	3.0	3.7	20.0	2.8	4.2	31.4	1.9	0.6
7.0	−62.9	1.38	18.7	2.7	4.5	16.0	2.4	5.1	27.4	1.8	0.9
11.0	−58.9	1.32	14.7	2.3	5.5	12.0	1.9	6.2	23.4	1.7	1.3
15.0	−54.9	1.26	10.7	1.8	6.6	8.0	1.4	7.4	19.4	1.6	1.8
19.0	−50.9	1.21	6.7	1.2	7.9	4.0	0.8	8.8	15.4	1.4	2.5
23.0	−46.9	1.15	2.7	0.5	9.5	0.0	0.0	10.4	11.4	1.2	3.5
25.7	−44.2	1.11	0.0	0.0	10.8	...	...	...	8.7	1.0	4.2
29.0	−40.9	1.06	...	...	...	...	...	...	5.4	0.7	5.3
Nov. 1.0	−37.9	1.02	...	...	...	...	...	...	2.4	0.3	6.5
3.4	−35.5	0.99	...	...	...	...	...	...	0.0	0.0	7.6

[a] Minus signs indicate preperihelion times.

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The one-component and two-component erosion models for comet C/2004 S1 offered attractive numerical experiments, whose results — together with the findings for other suddenly disappearing comets and for the SOHO sungrazers — present a plausible evolutionary path to a comet's sudden demise. If the erosion process in comet C/2004 S1 was triggered by the outburst and nucleus breakup — that is, if it did not get underway until September 21 or so (a more than distinct possibility) — the "initial" nucleus (at the time the outburst ended) is shown in Table 9 to have been about or less than 4 meters across.

6. Conclusions

By modeling the tail orientation, nucleus duplicity, and the peculiar light curve, we were able to describe the events experienced by comet C/2004 S1 during, and for a limited period before, the time the object was under observation. We know that the comet had split several days before it was discovered on September 26 and that the breakup was accompanied by a dust outburst, which may have facilitated the comet's detection and serve as a trigger or catalyst for a vigorous nucleus-*erosion* process, whose inception may have coincided with the fragmentation event. The erosion process was apparently responsible for the differential acceleration between the two nucleus fragments and it continued until they disintegrated completely. The comet must have been so shaken by the outburst and the extent of structural damage it sustained so overpowering that, given their miniature dimensions and undoubtedly low mechanical strength, the two boulder-sized nuclei literally fell apart, probably pulverizing in their entirety.

Unfortunately, we have no information on the amount of dust expended during the outburst nor do we know the comet's appearance and properties before the event. The original nucleus may have been considerably more massive than its two fragments together and the comet may have lost a significant fraction of its mass in the outburst. We also know next to nothing about the duration of this event, except that it could not exceed a few days, judging from the spike's sharpness. In the absence of photometry, one cannot even begin to guess the amount of mass contained in the dust tail in Young's image of September 28 and in the other images, but we know that the comet had shown signs of activity over a period of time of up to some 150 days before splitting.

Because of the limited amount of observational information available, it is difficult to offer a more comprehensive account of the evolution of comet C/2004 S1. Yet, the similarity between the phenomena displayed by this comet and by other suddenly disappearing comets and the SOHO sungrazers is striking. On the other hand, there are differences, products of each object's "personality" that depends on its physical properties, including the nucleus size, mechanical strength, density, rotation, etc.

Besides its nucleus size, smaller than for most SOHO sungrazers, a notable trait of comet C/2004 S1 is its nucleus splitting. Although it is by no means surprising that a breakup preceded the erosion process, this is only the second suddenly disappearing comet that was *observed* to be multiple in recent times. The other was comet C/1999 S4 (LINEAR), whose nucleus disintegration was monitored in unprecedented detail by the Hubble Space Telescope and the European Southern Observatory's Very Large Telescope (Weaver *et al.* 2001). We believe that the described disintegration process always begins with nucleus fragmentation and that it is only because of the faintness of the companion nucleus (or nuclei) that observers usually miss this early phase. If so, the detection of nucleus duplicity of comet C/2004 S1 is a remarkable achievement, especially given the difficult circumstances.

Comet C/2004 S1 was one of three split comets observed in 2004, if members of the Kreutz sungrazing system and the other sun-approaching groups are not included. In the first half of 2005, nucleus duplicity was already noticed for two more comets. Only very recently has the notion been widely accepted that fragmentation is in fact a common process that comets often experience during their life cycle. It is true that the propensity for splitting varies from comet to comet and that only seldom have fragmentation events been linked directly to terminal, catastrophic developments. Yet, by accelerating the disintegration of comets, nucleus fragmentation unquestionably shortens their life span. For a minority of comets, splitting becomes rapidly fatal: comet C/2004 S1 happens to be one of these objects.

Acknowledgements

We greatly appreciate the cooperation of J. W. Young, JPL Table Mountain Observatory, Wrightwood, California, U.S.A., who kindly sent us electronically his co-added images of this comet from 2004 September 28, which were critical for our investigation. We also thank the observers, who promptly responded to our inquiry about their imaging observations and provided us with requested information, namely: D. Herald, Kambah, Australia; K. Kadota, Ageo, Japan; P. Kocher, Marly, Switzerland; A. Nakamura, Kuma Kogen, Japan; and R. Naves, Barcelona, Spain. This research was carried out in part at the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration.

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Φ Φ Φ

Michiel John Bester (1917-2005)

Michiel (Mike) Bester, together with William Reid (1861-1928), jointly holds the distinction as South Africa's foremost comet discoverer. Between 1946 and 1959, he discovered six comets that bear his name, two of which were co-discovered with other individuals.

Mike was born in Colesberg, South Africa, on 1917 May 16. He matriculated from high school in Philipolis in the present-day Free State. His father worked in the mines in Brakpan, and after his death from phthisis in 1925 at the young age of 35, Mike was forced to find work with a paint company. In 1937, he read an advertisement for employment at Boyden Observatory, Bloemfontein, as an observing assistant, and after an interview with J. S. Paraskevopoulos, commenced work on 1937 December 1. Bester would spend the next 45 years of his career at Boyden, and he retired on 1982 December 1.

Bester discovered all of his comets with either the Boyden 10-inch Metcalf or 8-inch Bache instruments while examining photographic plates for image quality. These plates were exposed on behalf of Harlow Shapley for the purpose of studying southern variable stars, and the comets were discovered accidentally.

Bester discovered the first of his six comets, C/1946 U1, on 1946 November 1. It was at magnitude 10.5 upon discovery and near the border of Caelum and Columba; it reached magnitude 9 by year's end and then faded. His second discovery was C/1947 F1, made on 1947 March 24 as a magnitude-10 object in southern Centaurus; it was found independently two days later by Rondanina at Montevideo Observatory. C/1946 U1 brightened to magnitude 5 and was widely observed from South Africa during April 1947. Bester's third comet was found on 1947 May 18; designated C/1947 K1, it was at magnitude 11.5 upon discovery in Circinus but was poorly observed before it moved northwards. His fourth discovery, and third for the year 1947, was C/1947 S1 on September 25. Initially at magnitude 11 and located in Eridanus, west of Lepus, it brightened to magnitude 5 and sported a short tail during early 1948. Bester's fifth comet was C/1948 W1, discovered on 1948 November 24, an eighth magnitude object in Volans. Thereafter followed a hiatus in his comet discoveries, until July 1959. His sixth, and final, comet was discovered on plates taken on July 26 and 31 of that year on behalf of the visiting Cuno Hoffmeister. Designated C/1959 O1 (Bester-Hoffmeister), the comet was at magnitude 8 and located in Sagittarius, and already fading.

Mike married Engerda Barnard, a teacher from Bloemfontein, on 1940 July 2, and they set up home adjacent to Boyden Observatory at Mazelspoort until Mike retired. They later moved to a large house on the farm of Pieter and Martie Kemp, near the small town of Davel in present-day Mpumalanga. There they enjoyed retirement to the full, in good health and with many friends. Mike was a keen gardener, and on the farm he cultivated a large vegetable garden, much of the produce from which he delighted in giving away. Engerda passed away on 1991 July 13 from a heart attack, shortly after the 51st anniversary of their wedding.

Mike lived alone in his last years, and due to failing health spent his last days in an old-age home in Bethal. He passed away on 2005 April 15 at the age of 87. Mike Bester is survived by three daughters (Ellen, Martie, and Micheline).

In this period when amateur discovery of comets is being largely surpassed by professional programs, and with growing problems with crime and light pollution in this country, it is clear that Mike's position will remain intact for some time to come as South Africa's foremost comet discoverer. It was my privilege to have met with him.

I am indebted to Mike Bester's daughter, Martie Kemp, and grand-daughter, Gerda Heyman, for providing much information on his life, which was added to that given to me by Mike himself during my visits in 2003. Much of the information on his comet discoveries was taken from *Monthly Notes of the Astronomical Society of Southern Africa, Volumes 1-15 Condensed* (1980, edited by P. A. T. Wild) and supplemented by information from the February 1948 and October 1959 issues of *Sky and Telescope*.

Tim Cooper

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CORRIGENDA

• In the October 2002 issue, page 240, "Tabulation of Comet Observations", 'New additions to the new-format codes', last line, *for* DL/CCD SI3 *read* DL/CCD; SI3

• In the July 2004 issue, page 115, fifth paragraph, line 4, *for* such at book *read* such a book

• In the April 2005 issue, page 112, "Comet C/2004 Q2 (Machholz)", the first observation should be for year 2005, not year 2004.

• In the April 2005 issue, page 138, "Designations of Recent Comets", *for* P/2005 EL_{173} *read* C/2005 EL_{173} [*i.e.*, this is a long-period comet]

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SUBSCRIPTION-RATE INCREASE

For the first time in twelve years, we are increasing the subscription rates to the *ICQ* to reflect the ever-increasing costs in printing and postage costs. Those new rates are given on page 140 of this issue.

Review of Recent Literature: Research Concerning Comets*

Carl W. Hergenrother
Lunar and Planetary Laboratory
University of Arizona

Stardust and Comet 81P/Wild

In my previous "Literature Review" installment, the initial science results from *Deep Space 1*'s encounter with comet 19P/Borrelly were presented. In this edition, the preliminary science results from *Stardust*'s flyby of comet 81P/Wild will be summarized, in addition to other research findings concerning other comets.

A basic overview of the *Stardust* mission was published by Tsou *et al.* (2004) and by McDowell (1999). *Stardust* was launched on 1999 February 7 from Cape Canaveral on a Delta 7426 launch vehicle. The spacecraft was built by Lockheed Martin Astronautics in Denver, Colorado, and weighs 340 kg. It was the fourth mission launched in NASA's "Discovery" program. The primary goal of *Stardust* was to fly through the coma of comet 81P in January 2004 and return dust samples to Earth in January 2006. The spacecraft conducted five scientific investigations on 2004 January 2, when it passed 236.4 ± 1 km from the comet's nucleus. In addition to the dust collection and sample return, the "Comet and Interstellar Dust Analyzer" experiment measured the chemical composition of small dust grains. The "Dust Flux Monitor Instrument" recorded the flux of dust impacts and the mass of the impactors. The navigation camera was used for high-resolution imaging of the coma and nucleus. Finally, the spacecraft's radio was used to constrain the mass of the nucleus and measure any deflections to the spacecraft's motion due to large dust impacts.

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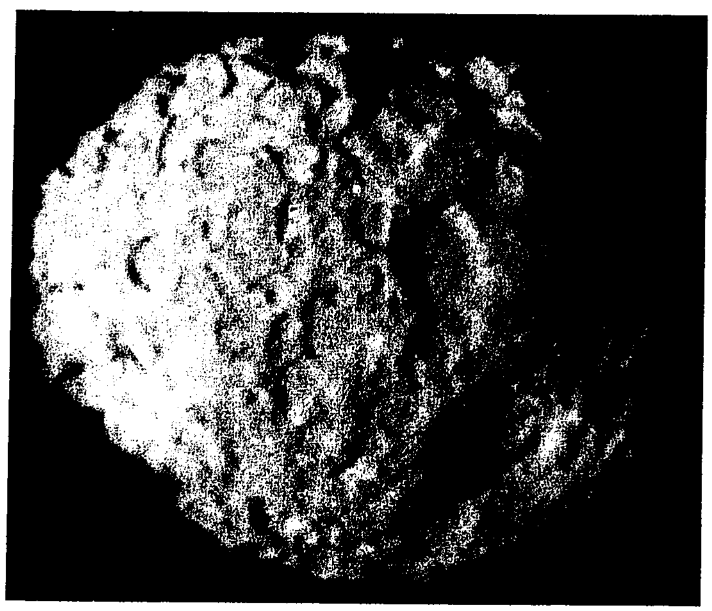

Image of comet 81P/Wild as taken by the Stardust *spacecraft on 2004 Jan. 2 (image from NASA/JPL* Stardust *website).*

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The navigation camera produced some of the best images ever taken of a comet nucleus. Duxbury *et al.* (2004) summarizes our current knowledge of 81P's nucleus. Most of the images were taken within 2000 km with the closest at 237 km. The shape of the nucleus was fit with a triaxial ellipsoidal model of dimensions 1.65 × 2.00 × 2.75 ± 0.05 km. The shortest axis, which is assumed to be the spin axis, points toward $\alpha = 110°$ and $\delta = -13°$. During the time of flyby, the region within 25° of the "bottom" pole was in continual sunlight. As the comet approaches perihelion, the sun shines continually on the "bottom" hemisphere, while the opposite is true after perihelion, when the "top" hemisphere

* This is the fifth installment of a semi-regular *ICQ* column; the last installment appeared in the October 2004 issue of the *ICQ*.

is constantly illuminated. A number of jets were observed emanating from the nucleus. The jets were normal to the limb rather than being radial from the nucleus center. A photometric analysis of the nucleus surface did not detect an opposition effect, or phase surge in brightness, at near-zero phase angles. This surprising result suggests that comet 81P/Wild may not possess a surface regolith comprised of small particles, which is common to most minor bodies. It is suggested that such a regolith may have been removed by jet activity.

The "Dust Flux Monitor Instrument" on *Stardust* made direct measurements of the dust in the mass range $10^{-14} < m < 10^{-5}$ kg. Green *et al.* (2004) reports that the mass of the dust coma was dominated by larger particles, similar to previous spacecraft findings at comets 1P/Halley and 26P/Grigg-Skjellerup. The flux of dust particles displayed large variations on small spatial scales, suggesting the detection of dust jets or the fragmentation of larger dust grains. Nearly 80% of the particles were detected after close approach at a distance of $\sim$ 4000 km from the nucleus. They estimate that 2800 ± 500 particles of diameter 15 μm or larger impacted the aerogel impactors. The largest expected collected particle has a diameter of 1 mm and mass of $\sim 6 \times 10^{-7}$ kg.

Nucleus Studies

The long wavelength channel of ISOCAM, an infrared camera aboard the *Infrared Space Observatory (ISO)*, was used to observe comets 103P/Hartley and 126P/IRAS. The observations reported by Groussin *et al.* (2004) were made with a broadband filter centered at 11.5 μm. Comet 126P/IRAS was observed 13 days after perihelion in November 1996. Using a newly developed thermal model that is optimized for comets with exposed water ice on their surfaces, a radius of 1.57 ± 0.14 km was determined. Combining this size measurement with previously published water-production rates yielded the fraction of the surface that is active ("active fraction") at 0.11 ± 0.03. Comet 103P/Hartley was observed 46 days after perihelion in February 1998. A radius of 0.71 ± 0.13 km and active fraction of 0.30 ± 0.11 was derived from the observations. Water-production rates at perihelion for 103P suggest that the active fraction approaches 1 at perihelion. This is similar to what was observed at 46P/Wirtanen, which also has a small, very active nucleus.

One of the most exotic comets discovered in recent years is 133P/Elst-Pizzaro. Dynamically, its orbit has more in common with Themis-family main-belt asteroids than any of the known comet families. Discovered in 1996, 133P/Elst-Pizzaro displayed a long, narrow dust tail, which led to the suggestion that it was produced by an impact. Hsieh *et al.* (2005) observed 133P during September and December of 2002 and September of 2003. Time-resolved photometry of the nucleus shows a double-peaked period of 3.471 ± 0.001 hr and an amplitude of 0.40 ± 0.05 mag. A linear phase-angle dependence of 0.044 ± 0.007 suggests, but does not confirm, a low-albedo surface. *BVR* filter photometry produced near-solar colors that are consistent with a C-type asteroid. A long, narrow dust tail was detected during the 2002 observations. The tail was similar in appearance to the 1996 tail. The tail faded during 2002 and was not detected in the September 2003 images. Finson-Probstein-type models suggest that 1- to 20-μm-size dust particles were released over a minimum of 5 months from July through November 2002. The detection of a tail in 1996 and 2002 suggest that 133P is a real comet with a significant reservoir of volatiles, though how a comet could reside in such an ordinary orbit has not been explained. Alternatively, the possibility still remains that it is a Themis-family asteroid that has had volatiles exposed by a recent impact. This would suggest that many objects in the main belt of asteroids may be volatile-rich and could be considered comets.

Jewitt and Sheppard (2004) report time resolved observations of the nucleus of 48P/Johnson obtained in February, March, and April of 2003, when it was nearly 4 AU from the sun. A coma was not detected, though a short, faint tail was evident. If the light curve is assumed to have two maxima per rotation, then the most likely period is 29.00 ± 0.04 hr with an amplitude of 0.32 ± 0.05 mag. A linear phase-angle dependence of 0.059 ± 0.002 mag/deg was also measured. Similar to the above report on 133P/Elst-Pizzaro, this phase-angle dependence is consistent with a low-albedo surface. The absolute magnitude of the nucleus is $m_R(1,1,0) = 15.23 \pm 0.10$. Assuming a typical cometary albedo of 0.04 yields a circular radius of 2.6 ± 0.2 km.

Comet 2P/Encke

Comet 2P/Encke is also an enigma: dynamically, its orbit does not resemble most comets. As is true in the case of 133P/Elst-Pizzaro, 2P is gravitationally decoupled from Jupiter, but unlike 133P it resides in an Earth-approaching minor-planet orbit. Its nucleus is one of the largest known, relatively bright even at aphelion. As a result, the physical properties and rotation state of the nucleus should theoretically be easy to determine. For nearly three decades, direct observation of 2P/Encke's nucleus has produced ambiguous and contradictory results. A series of papers have been published recently that shed more light on 2P/Encke.

In 1980, 2P/Encke became the first comet to be detected by radar. In November 2003, the Arecibo 305-m telescope in Puerto Rico was used to re-observe its nucleus. Harmon and Nolan (2005) report that the nucleus is an oblong object with a long-axis dimension of 9 km. The observations are also consistent with the previously reported rotation period of 11 hours — but not with other reported periods of 15 hours and 22 hours. Comet 2P/Encke is the source of the Taurid meteor shower and has been observed in the infrared to be a major producer of large dust grains. Surprisingly, the radar observations did not detect any large coma grains either gravitationally bound or unbound to the nucleus.

Fernändez *et al.* (2005) re-examined the published light-curve data from the 1980s as well as newly obtained data from 2001 and 2002. The published light-curve data suggested two possible rotation periods during the 1980s: 15.08 and 22.6 hours. The data from 2001 and 2002 now suggest two different periods of 11.079 ± 0.009 and 22.158 ± 0.012 hours. The discrepancy between the 1980s data and the more recent data set may be due to non-principal axis rotation, an unresolved but variable coma, or an actual change in rotation period. It is possible that the nucleus had a 22.6-hour rotation period in the 1980s but that, due to outgassing torques, the period has been shortened to 22.158 hours.

A companion paper to that by Fernändez *et al.* was published by Belton *et al.* (2005). Taking the same data set of light curves, they argue that the discrepancies in 2P/Encke's light curves is due to a variable, unresolved coma. Brightness variations in the light-curve observations are due to variations in coma activity with little contribution from light reflected from the nucleus. These results also suggest that 2P/Encke may always be active, even at aphelion. Their model finds two possible non-principal-axis solutions for nuclear rotation. The first solution has a primary period of 14.9 hours and a secondary period of 44.5 hours. The second, and more likely, solution has periods of 11.1 and 47.8 hours.

Meteor Showers

January's Quadrantid meteor shower is one of the few major showers that does not have an identified parent body. A number of objects have been proposed as possible parent bodies, including the Apollo-type minor planet (5496) 1973 NA and the comets 96P/Machholz and C/1490 Y1. Jenniskens (2004) reports the identification of the Amor-type minor planet[ggg] 2003 EH_1 as the parent body of the Quandrantids. Though 2003 EH_1's current orbit is very different from the visible Quadrantids, backwards orbital integrations show that their orbits were similar in the centuries prior to 1600. The possibility still exists that 2003 EH_1 was observed as the active comet C/1490 Y1 though the link between the two objects has not been proven beyond a doubt. This link would confirm evidence based on the orbital distribution of Quadrantids that suggest the stream was produced 500 years ago.

The Apollo-type object (3200) Phaethon is the likely parent of the Geminid meteor stream. Until the identification of 2003 EH_1 as a possible meteor stream parent body, Phaethon was the only non-cometary parent of a major meteor shower. A campaign to detect cometary activity on Phaethon was conducted by Hseih and Jewitt (2005); they used the University of Hawaii 2.2-m telescope on Mauna Kea to obtain deep images of Phaethon. The images were shifted and combined into a single high-signal-to-noise image. Comparing the image of Phaethon with those of background stars might allow the detection of a faint coma; no coma was detected, which places an upper limit on the mass-loss rate of ~ 0.01 kg/s. The upper limit of the active fraction is 7×10^{-6}, which is at least two orders of magnitude smaller than that observed for other known comets. A dust trail following in its orbit was searched for but not detected.

Another apparent non-cometary parent body may have been identified by Meng *et al.* (2004): the orbit of the Apollo-type minor planet 2001 YB_5 suggested a possible meteor shower around 2002 January 7.5 UT. Video and visual observations during that date found a new unidentified radiant that was not observed in previous years. The radiant located at $\alpha = 121\overset{\circ}{.}5$ and $\delta = +11\overset{\circ}{.}5$ for solar longitude $287\overset{\circ}{.}30$. Interestingly, 2001 YB_5 has been classified as a B-type asteroid. Both (3200) Phaethon and 97P/Wilson-Harrington have also been classified as B-types and both have experienced observed or suspected cometary activity. B-type asteroids have slightly bluish spectra in the visible wavelengths. Most active comet nuclei have D-type spectra, which are very red over visible wavelengths. It is possible that comet-like bodies on near-earth orbits that are gravitationally decoupled from Jupiter have a different origin than the typical Jupiter-family or Oort-cloud comet.

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CATALOGUE OF COMETARY ORBITS 2005

The 16th edition of Brian Marsden's *Catalogue of Cometary Orbits* has just been published with 207 pages, containing over 3000 orbits for 2221 different comets (including in some cases multiple nuclei). Copies can be ordered via the *ICQ* for $40.00 each ($60.00 airmail).

[ggg] Apollo-type minor planets are those with orbits having perihelion distances, q, inside that of the earth's aphelion distance ($Q_\oplus$); Amor-type minor planets are those with $q > Q_\oplus$ but with $q <$ some rather arbitrary number like 1.3 or 1.4 AU.

Tabulation of Comet Observations

Included in the tabulated data (and descriptive information) in this issue are observations made prior to 1996 that were contributed by Jonathan Shanklin from the archives of the Comets Section of the British Astronomical Association; some of these observations represent those by observers who had much data already published in the *ICQ* but for which (for some unknown reason) they had contributed data to the B.A.A. that did not get into the *ICQ* previously. As most of the data contributed by Shanklin had already been contributed to the *ICQ* closer to the time of observation (and thus already published), it took some considerable time to determine what needed to be published — partly because it appears that many observers frustratingly send different numbers for the same observations to different recipients (again for completely unknown reasons).

The single exception to all pre-1996 data in this issue being from Shanklin are the mid-1980s data by observer Cernis (code CHE03), who contributed his data directly to the *ICQ* this summer. Also included in this issue are hundreds of observations dating back to 1996 that were contributed on paper, usually years after the observations were actually made.

New reference code for comparison-star magnitudes: BR = V magnitude sequence for stars in the Coma cluster of galaxies including Abell 1656 (Börngen and Richter 1978, *A.N.* **299**, 177).

Descriptive Information, to complement the Tabulated Data (all times UT):

See the July 2001 issue (page 98) for explanations of the abbreviations used in the descriptive information.

◇ *Comet 2P/Encke* ⟹ 1994 Jan. 14.73: w/ 20.0-cm $f/17$ R (280×), coma dia. 1'.7, DC = 3 [LEH]. Jan. 15.98: w/ 20×80 B, coma dia. 4', DC = 6 [BOR]. 2003 Dec. 3.96: w/ 15×70 B, coma dia. ≈ 8', DC = 4, total visual mag 6.2 (minor atmospheric-extinction correction applied); coma remains large and just modestly condensed; comet only 13° up in the west [J. E. Bortle, Stormville, NY].

◇ *Comet 9P/Tempel* ⟹ 2005 Feb. 2.96: clearly seen; diffuse coma with starlike central cond. [BAR06]. Apr. 4.74, 13.75, 29.63, May 10.73, and 26.53: *Guide 8.0* software used for comp.-star mags [NAG04]. Apr. 4.91: possible outburst; "strong central cond. (unusually so for comets of mag 11.5)" w/ starlike pseudo-nucleus of mag 13.1; coma has high surface brightness [BAR06]. Apr. 9.93: conspicuous stellar false nucleus of mag 13.5 near the E edge of the coma (W part fan-shaped) [KAM01]. Apr. 10.86: w/ 40.7-cm L (233×), central cond. of mag 14.0; jet in p.a. 210° [BIV]. Apr. 29.94: w/ 40.7-cm L (233×), central cond. of mag 13.9; jet in p.a. 180°-200° [BIV]. May 1.05, 2.04, and 3.01: comp. stars have $B-V$ = +0.83 and +0.26 [AMO01]. May 1.87: compact inner coma w/ false nucleus of mag 13.5 displaced towards E-NE; W part of coma fan-shaped [KAM01]. May 2.75: not very condensed (evidence of faint sharp point towards center); *Guide 6* software used for comp.-star mags [COO02]. May 2.99-June 29.93: "the comet was more diffuse than during outburst in March-April — though its integrated brightness has increased due to increase in the coma size" [BAR06]. May 3.52: *Guide 8.0* software used for comp.-star mags [MIY01]. May 3.67, 7.58, 20.47, 26.56, 31.62, June 5.56, 13.50, 25.50, and July 14.49: *Guide 8.0* software used for comp.-star mags [TSU02]. May 4.57: $B-V$ values of comp. stars were +0.51, +0.63, +0.69, and +0.85 [NAK01]. May 4.85: no tail visible, but slight possible extension to the coma in p.a. 130° [BEG01]. May 5.10 and 6.00: comp. stars have $B-V$ = +0.54 and +0.52 [AMO01]. May 5.92: w/ 20.3-cm T (160×), central cond. of mag 13.9; jets in p.a. 160°, 200°, and 245° [BIV]. May 6.88: coma possibly slightly extended in p.a. 202°; *Guide 7* software used for comp.-star mags [STR03]. May 7.58: comp. star has $B-V$ = +0.44 [TSU02]. May 7.58, June 5.51, and 9.61: *Guide 8.0* software used for comp.-star mags [YOS02]. May 7.59 and July 2.50: *StellaNavigator* ver. 6.1 software used for comp.-star mags [NAG08]. May 7.61: *Megastar* ver. 5.0 software used for comp.-star mags [MUR02]. May 8.89: significant extension to the coma, 2' long in p.a. 120°; hint of a stellar central cond. at 150× [BEG01]. May 8.89: star of mag 13.7 located 1' from central cond.; star of mag 12.3 located 1'.8 from central cond. [SRB]. May 9.92 and 27.92: at 242×, stellar false nucleus of mag 13.0 [KAM01]. May 9.92: coma has grown, but comet not brighter or more conspicuous [KAM01]. May 11.86: coma very much more condensed tonight — more compact, virtually spherical in appearance, central stellar cond. visible w/ direct vision [BEG01]. May 11.97: round coma w/ cond. less conspicuous and in the center; at 242×, stellar false nucleus of mag 13.0-13.5 [KAM01]. May 12.83: no sign of coma extension (appears almost perfectly circular) [BEG01]. May 12.85: possible second tail > 1'.5 in p.a. 204° [SRB]. May 13.79: smaller then previously, but slightly more condensed; diffuse outer coma, w/ strongish center — which is, however, not stellar in appearance; no sign of any coma extention [COO02]. May 13.90: possible second tail > 2'.5 in p.a. 197°; moonlight [SRB]. May 13.90: moonlight [HOR02]. May 14.93: difficult object w/ direct vision; small, compact and faint; coma much more diffuse than at the previous obs.; very steady seeing [BEG01]. May 15.63: $B-V$ values of comp. stars were +0.69 and +0.69 [NAK01]. May 16.02: comp. stars have $B-V$ = +0.77 and +0.41 [AMO01]. May 20.47 and 26.56: comp. star has $B-V$ = +0.81 [TSU02]. May 20.89: second tail > 1' long in p.a. 217°; moonlight [SRB]. May 26.87: possible second tail > 6' long in p.a. 230° [SRB]. May 26.98: comp. stars have $B-V$ = +0.56 and +0.55 [AMO01]. May 27.90: possible second tail > 5' long in p.a. 220°; dense star field [SRB]. May 27.92: central cond. no longer conspicuous; outer coma very diffuse [KAM01]. May 28.72: possibly still some haze from high cirrus at sunset; comet faint and slightly condensed, almost spherical in appearance [COO02]. May 28.76: coma larger than at the previous obs., but still diffuse and quite spherical, w/ the central cond. possibly slightly offset in the sunward direction [BEG01]. May 29.70: conditions clearer tonight and very steady; coma appears slightly more condensed towards sharpish central point [COO02]. May 29.73: much more difficult tonight with direct vision, but steady w/ averted vision; coma decidedly smaller than at the previous obs., but still diffuse and quite spherical, and again with the central cond. possibly slightly offset in the sunward direction [BEG01]. May 31.62: comp. star has $B-V = +0.42$ [TSU02]. May 31.94: at 117×, strong stellar cond. [COM]. May 31.97: at 242×, stellar false nucleus of mag 13.5 [KAM01].

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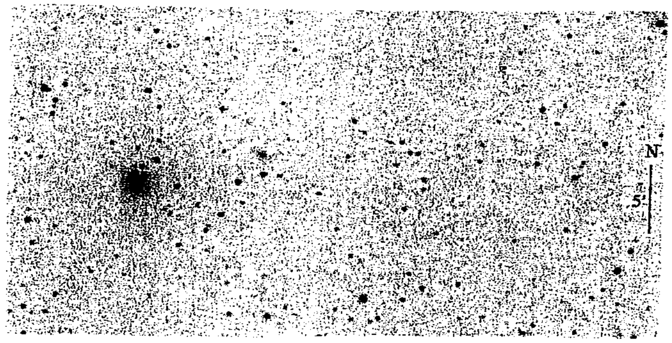

Coaddition of five 250-sec CCD images of comet 9P taken on 2005 May 8.87 UT with a 20-cm Schmidt camera (+ green filter) by Michael Jäger and G. Rhemann in Austria. The comet is to the left of this view, with the bar at far right indicating 5′ (and north up).

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June 1.88: possible second tail > 3′ long in p.a. 185° [SRB]. June 3.95: low alt. [SRB]. June 5.00: comp. stars have $B-V = +0.91$ and +0.42 [AMO01]. June 5.56: comp. star has $B-V = +0.39$ [TSU02]. June 6.31 and 7.32: difficult sky conditions (light pollution and smoke from town chimneys) [JON]. June 8.88: comet close to star of mag $V = 9.0$ [HOR02]. June 9.61: $B-V$ values of comp. stars were +0.58 and +0.71 [YOS02]. June 9.81: first attempt w/ this aperture; inner coma directly visible, and much larger outer coma traced w/ averted vision; coma slightly asymmetrical [BEG01]. June 9.92: barely visible; at 242×, stellar false nucleus of mag 14.0 [KAM01]. June 12.87: slightly more condensed, but recorded as fainter; nevertheless, outer coma through this aperture is large and diffuse [BEG01]. June 13.50: comp. star has $B-V = +0.65$ [TSU02]. June 13.68: very spurious outer coma, but definite strong cond. in center, not sharp; *Guide 6* software used for comp.-star mags [COO02]. June 14.68: not easily visible and nearby moon starting to be a problem; very diffuse [COO02]. June 25.50: comp. star has $B-V = +0.45$ [TSU02]. June 25.72: comet much more apparent tonight; larger coma but slightly more condensed than at the last obs. [BEG01]. June 29.90: comp. stars have $B-V = +0.41$ and +0.67 [AMO01]. June 30.69: just perceptible from suburban Johannesburg; very slight hint of cond.; AAVSO b chart for S Vir used for comp.-star mags [COO02].

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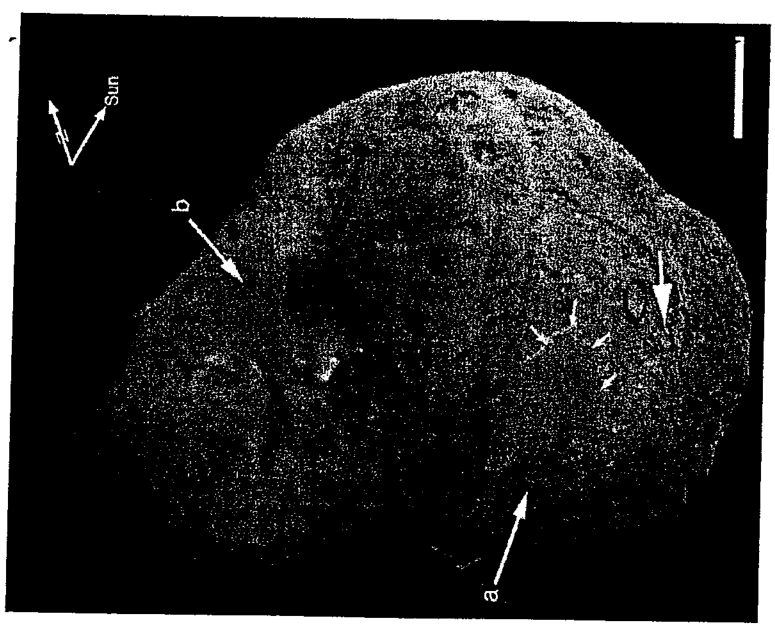

Composite image of comet 9P/Tempel taken by the Deep Impact impactor probe shortly before impact on 2005 July 4; arrows a *and* b *point to large, smooth regions, while the impact site is indicated by the third large arrow; smaller grouped arrows indicate a cliff or steep slope along the edge of a plateau. The white scale bar at upper right represents 1 km across the surface of the comet's nucleus. The two arrows at upper left point to the sun and to celestial north. (Image via NASA/JPL/University of Maryland website.)*

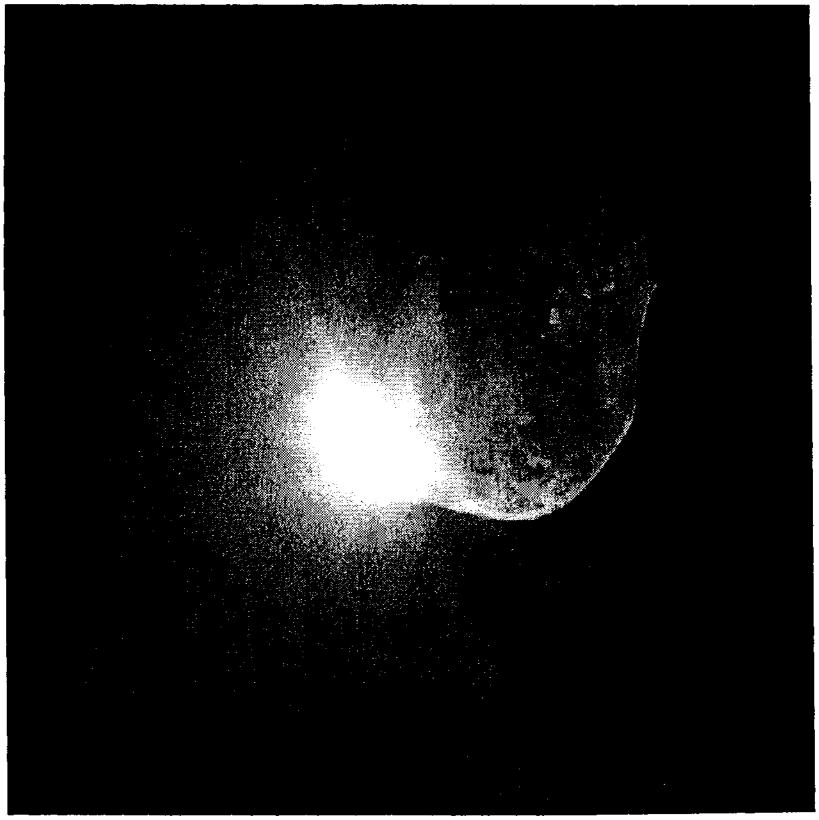

Image of comet 9P taken 67 sec after impact by Deep Impact, *via the high-resolution camera aboard the flyby craft. Scattered light from the collision saturated the camera's detector; linear spokes of light radiate away from the impact site. (Image from* Deep Impact *website, courtesy NASA/JPL-Caltech/Univeristy of Maryland.)*

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[text continued from page 162]

July 1.69: slightly smaller and more condensed than last night; coma elongated in E-W direction, not spherical; very faint in 40-cm L; in 20-cm L (90×), comet just discerned against sky background [COO02]. July 1.82: dark, clear sky; comet very difficult, coma increasingly diffuse [BEG01]. July 1.92: comp. stars have $B-V = +0.83$ and +0.59 [AMO01]. July 2.69: slightly more condensed w/ definite sign of central point again, surrounded by very spurious outer coma; AAVSO b chart for S Vir used for comp.-star mags [COO02]. July 2.85: coma appears as soft, large envelope of haziness, surrounding prominent central point, which w/ averted vision appears starlike, and looks slightly elongated toward SE; *Guide 6* software used for comp.-star mags [STR03]. July 2.88: dark, very clear sky again; coma slightly less diffuse and more compact [BEG01]. July 2.88-4.89: "for last two days (the period before and after impact by the *Deep Impact* spacecraft), the total mag and appearance of coma have not changed" [BAR06]. July 2.89: comp. stars have $B-V = +0.82$ and +0.83 [AMO01]. July 3.09: observed from Pack Monadnock Mountain, NH, U.S.A.; despite clear, dark skies, comet was not an easy object [GRE]. July 3.43 and 5.42: "very vague and difficult to see w/ certainty; possibly a little enhanced on both nights using Swan Band filter, and I suspected a small, faint, central cond. visible only through the filter on the second evening — difficult to be sure, however, as it was on the margin of visibility; there was no obvious effect due to the *Deep Impact* probe" [SEA]. July 3.70: comet at limit of visibility, no size measurement attempted [COO02]. July 3.87: very difficult object in 15×60 B, increasingly diffuse; in 20-cm $f/9$ L (72×), even more difficult, w/ little or no central cond. obvious [BEG01]. July 3.95: comp. stars have $B-V = +0.96$ and +0.11 [AMO01]. July 4.2368 and 4.2451: comet at mag 11.2 prior to impact and at time of impact by *Deep Impact* spacecraft; at 7 min post-impact (July 4.2451), mag 11.1; at 19 min post-impact (July 4.2583), mag 10.9; at 32 min post-impact (July 4.2674), mag 10.7; no perceptible change in coma dia. [LIN04]. July 4.70: more easily visible after impact by spacecraft — not much brighter but central cond. much more prominent and coma more condensed; *Guide 6* software used for comp.-star mags [COO02]. July 4.70: comet easily visible; central cond. bright and larger (dia. ≈ 30″); faint fan-shaped tail visible; *Guide 6* software used for comp.-star mags [STR03]. July 4.76: coma seems smaller, but with a higher surface brightness; detection possible without averted vision [VAN15]. July 4.83: comet no brighter than at obs. earlier in evening [COO02]. July 4.94: mountain location, clear sky; alt. 20°; asymmetric coma w/ bright inner region; near-stellar central cond. of mag ~ 12.5 in telescope [GON05]. July 4.99: *Guide 7* software used for comp.-star mags; comet has a bright center and diffuse coma [SOU01]. July 5.00: comet diffuse w/ bright center [DES01]. July 5.00, 6.99, 7.00, 8.99, and 10.02: *Guide 8* software used for comp.-star mags [DES01]. July 5.09: observed from rural area in central Massachusetts; comet much easier than two nights earlier in 25-cm L, though not an easy object in 25×100 B; horrible mosquito infestation(!); Hipparcos/Tycho cat. mags from 'Vizie-R' SDC website [GRE]. July 5.72: comet is back to 'normal' (i.e., pre-*Deep Impact* impact), surface brightness slightly fainter than before *Deep Impact* [VAN15]. July 5.77: coma is again very diffuse; central point very faint and inconspicuous; comet has returned to its pre-impact appearance [COO02]. July 5.80: coma displayed a more condensed central cond., almost but not quite stellar, w/ the faint outer coma much the same as before spacecraft impact, except that it is asymmetrical, slightly extended in p.a. 110° [BEG01]. July 5.89: "comet appears only marginally brighter and more condensed than 48 hr ago; unfortunately, the first night following the *Deep Impact* impact was clouded out after thunderstorms" [BOU]. July 6.90: comp. stars have $B-V = +0.43$ and $+0.37$ [AMO01]. July 7.90: comp. stars have $B-V = +0.35$ and $+0.43$ [AMO01]. July 8.82: difficult object again — comet has returned to the diffuse appearance that it had before the spacecraft impact, and coma appears spherical w/ no sign of extension [BEG01]. July 10.99 and 11.91: comp. stars have $B-V = +0.76$ and $+0.42$ [AMO01]. July 14.49: comp. star has $B-V = +0.55$ [TSU02]. July 28.49: low alt., so perhaps only the central part of the coma was seen [YOS04].

◇ *Comet 16P/Brooks* ⟹ 1994 Oct. 11.17 and 11.91: w/ 14.0-cm $f/1$ A, photos show $m_1 \approx 13.5$, coma dia. 1'.0, DC = 2 [HAS02].

◇ *Comet 19P/Borrelly* ⟹ 1994 Oct. 11.18: w/ 14.0-cm $f/1$ A, photo shows $m_1 \sim 9.0$, coma dia. 1'.7, DC = 4 [HAS02].

◇ *Comet 21P/Giacobini-Zinner* ⟹ 1998 Aug. 15.94-1999 Jan. 5.76: comp.-star mags taken from *Guide 6.0* software [REN]. 1998 Aug. 15.94-Sept. 17.86: 40-cm L is actually $f/4.5$ (*ICQ* tab. rounds f/-ratios to nearest even integer — Ed.) [REN]. Sept. 13.93: little enhanced w/ Swan-band filter [REN]. Sept. 17.86: enhanced w/ Swan-band filter (coma dia. 1'.5) [REN]. Sept. 20.89: less enhanced w/ Swan-band filter [REN]. Dec. 21.78: enhanced w/ Swan-band filter [REN]. 1999 Jan. 5.76: little less enhanced w/ Swan-band filter [REN].

2005 May 2.15: mountain location, very clear sky; some moonlight interference; motion checked during a 1-hr period [GON05]. May 7.76: *Megastar* ver. 5.0 software used for comp.-star mags [MUR02]. May 7.76, 14.78, and June 9.78: *Guide 8.0* software used for comp.-star mags [YOS02]. May 7.79 and June 5.78: *Guide 8.0* software used for comp.-star mags [TSU02]. May 7.79: comp. star has $B-V = +0.43$ [TSU02]. May 10.77, June 5.75, and 13.76: *Guide 8.0* software used for comp.-star mags [NAG04]. May 13.05, 27.05, June 2.03: twilight; low alt. [SRB]. May 14.78: $B-V$ values of comp. stars were +0.58, +0.64, and +0.85 [YOS02]. May 15.77: *Guide 8.0* software used for comp.-star mags; $B-V$ values of comp. stars were +0.55, +0.59, and +0.59 [NAK01]. June 4.04: star of mag 11.6 located 1′ away and star of mag 12.6 located 2′ from central cond.; twilight; low alt. [SRB]. June 5.78: comp. star has $B-V = +0.59$ [TSU02]. June 9.78: $B-V$ values of comp. stars were +0.59 and +0.81 [YOS02]. July 2.12 and 3.11: mountain location, clear sky [GON05]. July 2.12: alt. 12°; strong interference from the nearby moon; coma enhanced through Swan-band filter [GON05]. July 3.11: alt. 11° [GON05]. July 28.76: low alt., hard to see [YOS04].

◇ *Comet 29P/Schwassmann-Wachmann* ⟹ 2004 Oct. 9.47: new outburst [MAT08]. Nov. 16.50: outburst activity continues [MAT08]. 2005 June 29.02: moonlight; low alt.; star of mag 10.2 located 1'.3 from central cond. [SRB]. July 15.04: "comet also not visible on several other mornings since July 6" [BOU].

◇ *Comet 31P/Schwassmann-Wachmann* ⟹ 1994 Jan. 15.96 and Feb. 14.90: w/ 20.0-cm $f/17$ R (280×), coma dia. 0'.7, DC = 4 [LEH]. Feb. 3.80: w/ 20.0-cm $f/17$ R (280×), coma dia. 0'.7, DC = 3 [LEH]. Feb. 5.85: w/ 20.0-cm $f/17$ R (280×), coma dia. 0'.8, DC = 4 [LEH].

◇ *Comet 32P/Comas Solá* ⟹ 2005 May 4.49: comp. star has $B-V = +0.51$ [TSU02]. May 4.49 and 7.48: *Guide 8.0* software used for comp.-star mags [TSU02]. May 7.48: comp. star has $B-V = +0.55$ [TSU02]. May 7.51: *Megastar* ver. 5.0 software used for comp.-star mags [MUR02]. May 26.85: twilight; low alt. [SRB].

◇ *Comet 37P/Forbes* ⟹ 2005 May 4.67: *Guide 8.0* software used for comp.-star mags; $B-V$ values of comp. stars were +0.45 and +0.47 [NAK01]. May 20.57 and July 14.51: *Guide 8.0* software used for comp.-star mags [TSU02]. May 20.57: comp. star has $B-V = +0.44$ [TSU02]. June 9.64: *Guide 8.0* software used for comp.-star mags; $B-V$ values of comp. stars were +0.46 and +0.48 [YOS02]. July 14.51: comp. star has $B-V = +0.50$ [TSU02].

◇ *Comet 43P/Wolf-Harrington* ⟹ 1997 Oct. 29.20: comp.-star mags also extracted from ref `VF` [REN]. Nov. 30.23: tail p.a. given as simply "W" (as done also numerous other instances by this observer – Ed.) [REN].

◇ *Comet 46P/Wirtanen* ⟹ 1997 Feb. 5.79: alt. 20° [REN]. Feb. 8.79: comet enhanced w/ Swan-band filter [REN]. Feb. 27.81: comet strongly enhanced w/ Swan-band filter [REN]. Mar. 9.82 comp.-star mags also extracted from ref `AA`; comet very faint, confirmed using Swan-band filter [REN]. Apr. 1.84: not seen even w/ Swan-band filter [REN]. May 1.89: very faint [REN]. May 25.92: 94× also used [REN].

◇ *Comet 47P/Ashbrook-Jackson* ⟹ 2000 Oct. 23.79: very low in sky [REN]. Oct. 23.79-Dec. 21.77: comp.-star mags taken from *Guide 6.0* software [REN]. Nov. 17.80: very faint, verified using Swan-band filter [REN]. Nov. 23.78: comet enhanced w/ Swan-band filter [REN].

◇ *Comet 49P/Arend-Rigaux* ⟹ 2005 Feb. 10.81: diffuse w/ central cond.; comet clearly visible [BAR06]. Mar. 29.80: comet close to star of mag 11.6 [BAR06]. May 4.51: *Guide 8.0* software used for comp.-star mags; comp. star has $B-V = +0.57$ [TSU02]. May 8.85: stellar appearance [SRB]. May 12.83: moonlight [SRB].

◇ *Comet 51P/Harrington* ⟹ 1994 Oct. 11.92: w/ 14.0-cm $f/1$ A, $m_1 \approx 13.5$, coma dia. 0′.8, DC = 5 [HAS02].

◇ *Comet 52P/Harrington-Abell* ⟹ 1998 Aug. 19.07-1999 Feb. 13.90: comp.-star mags taken from *Guide 6.0* software [REN]. 1998 Aug. 29.08, Sept. 22.12, and Nov. 10.95: tail p.a. given simply as "West" [REN]. 1999 Jan. 5.84: less enhanced w/ Swan-band filter [REN]. Jan. 14.92: star of mag 12.3 only 1′ away [REN].

◇ *Comet 55P/Tempel-Tuttle* ⟹ 1997 Dec. 27.15: coma dia. > 2′ w/ Swan-band filter [REN]. 1998 Jan. 4.10: mag uncertainty given as ± 0.5 [REN]. Jan. 16.86: comp.-star mags also used from ref AA [REN]. Feb. 18.81 and 21.81: comp.-star mags also used from ref VF [REN].

◇ *Comet 62P/Tsuchinshan* ⟹ 2005 Feb. 2.97: excellent view; round coma near the extended galaxy NGC 4710 [BAR06].

◇ *Comet 63P/Wild* ⟹ 2000 Feb. 9.19 and 12.17: comp.-star mags taken from *Guide 6.0* software [REN].

◇ *Comet 69P/Taylor* ⟹ 1998 Jan. 20.91-Mar. 22.87: comp.-star mags taken from *Guide 6.0* software [REN]. Mar. 22.87: noticeably brighter than on Mar. 20.85 [REN].

◇ *Comet 78P/Gehrels* ⟹ 1997 Sept. 7.12-Oct. 11.11 and Dec. 9.09-1998 Jan. 22.82: comp.-star mags taken from *Guide 6.0* software [REN]. 2004 Nov. 16.53: surprisingly bright; in 38-cm L, a bright stellar nuclear cond. is visible with a short tail in p.a. 280° [MAT08]. 2005 May 4.46: *Guide 8.0* software used for comp.-star mags; comp. star has $B-V = +0.44$ [TSU02].

◇ *Comet 81P/Wild* ⟹ 1997 Jan. 16.07: comp.-star mags also taken from ref VF [REN]. Feb. 26.89: same photometric measurments at 68× [REN]. Apr. 30.92: tail p.a. given simply as "W" [REN]. May 29.93: tail p.a. given simply as "E" [REN]. May 30.94: very faint [REN]. June 8.94: star of mag 11.5 only 2′ away making obs. somewhat difficult [REN].

◇ *Comet 91P/Russell* ⟹ 2005 May 4.64: $B-V$ values of comp. stars were +0.51, +0.63, +0.69, and +0.85 [NAK01]. May 4.68: *Guide 8.0* software used for comp.-star mags; comp. star has $B-V = +0.98$ [OHS]. May 15.64: *Guide 8.0* software used for comp.-star mags; $B-V$ values of comp. stars were +0.55, +0.59, and +0.59 [NAK01].

◇ *Comet 93P/Lovas* ⟹ 1998 Oct. 17.99 and Oct. 27.05-Dec. 20.92: comp.-star mags taken from *Guide 6.0* software [REN].

◇ *Comet 103P/Hartley* ⟹ 1997 Oct. 25.78-1998 Mar. 20.85: comp.-star mags taken from *Guide 6.0* software [REN]. Oct. 25.78: enhanced w/ Swan-band filter (coma dia. 1′) [REN]. Oct. 29.81: enhanced w/ Swan-band filter (coma dia. 2′) [REN]. Nov. 20.77: also used comp.-star mags from ref TT [REN]. Nov. 20.77 and 1998 Mar. 20.85: enhanced w/ Swan-band filter [REN]. 1997 Dec. 26.78: nearby star of mag 8.5 made obs. a little difficult [REN]. 1998 Feb. 18.83: also used comp.-star mags from ref HS [REN]. Mar. 20.85: very faint [REN].

◇ *Comet 104P/Kowal* ⟹ 1997 Dec. 26.79: enhanced w/ Swan-band filter (coma dia. 2′) [REN]. 1998 Jan. 22.79: comp.-star mags taken from *Guide 6.0* software [REN].

◇ *Comet 105P/Singer Brewster* ⟹ 2005 May 7.56: *Guide 8.0* software used for comp.-star mags; comp. star has $B-V = +0.39$ [TSU02].

◇ *Comet 106P/Schuster* ⟹ 1999 Nov. 9.94, 15.96, and Dec. 5.87: comp.-star mags taken from *Guide 6.0* software [REN].

◇ *Comet 114P/Wiseman-Skiff* ⟹ 1999 Nov. 10.05: comp.-star mags taken from *Guide 6.0* software [REN].

◇ *Comet 117P/Helin-Roman-Alu* ⟹ 2005 May 4.65: $B-V$ values of comp. stars were +0.51, +0.63, +0.69, and +0.85 [NAK01]. May 7.11: mountain location, very clear sky; limiting stellar magnitude near comet was 15.5 [GON05]. May 12.93: dense star field; low alt. [SRB]. May 20.94: low alt.; moonlight [SRB]. June 9.62: *Guide 8.0* software used for comp.-star mags; $B-V$ values of comp. stars were +0.76 and +0.84 [YOS02]. July 3.91, 5.93, 8.91, and 10.91: see the comments by Bouma for obs. of comets fainter than mag 13.5 under C/2004 K1 (below) [BOU and DIJ]. July 14.54: *Guide 8.0* software used for comp.-star mags; comp. star has $B-V = +0.48$ [TSU02].

◇ *Comet 121P/Shoemaker-Holt* ⟹ 2005 June 5.55: *Guide 8.0* software used for comp.-star mags; comp. star has $B-V = +0.39$ [TSU02].

◇ *Comet 141P/Machholz (component A)* ⟹ 1994 Oct. 11.16: w/ 14.0-cm $f/1$ A, $m_1 \sim 10.0$, coma dia. 1′.8, DC = 3 [HAS02]. 2005 Mar. 29.73 and Apr. 4.73: difficult obs.; comet near horizon [BAR06].

◇ *Comet 144P/Kushida* ⟹ 1994 Jan. 16.00: w/ 20.0-cm $f/17$ R (280×), coma dia. 0′.7, DC = 3 [LEH]. Feb. 3.92: w/ 20.0-cm $f/17$ R (280×), coma dia. 2′.2, DC = 3 [LEH]. Feb. 5.90: w/ 20.0-cm $f/17$ R (280×), coma dia. 1′.2, DC = 2 [LEH]. Feb. 14.94: w/ 20.0-cm $f/17$ R (280×), coma dia. 0′.9, DC = 3 [LEH].

◇ *Comet 161P/Hartley-IRAS* ⟹ 2005 May 15.77: comp. star has $B-V = +0.65$ [KAD02]. May 16.77: comp. star has $B-V = +0.50$ [KAD02]. May 27.06: twilight; low alt.; star of mag 9.1 located 1′.1 from central cond. [SRB]. June 4.02: twilight; low alt. [SRB]. June 5.77: *Guide 8.0* software used for comp.-star mags; comp. star has $B-V = +0.51$ [TSU02]. June 9.78: *Guide 8.0* software used for comp.-star mags; $B-V$ values of comp. stars were +0.49 and +0.66 [YOS02]. June 13.74: *Guide 8.0* software used for comp.-star mags [NAG04]. June 23.99: star of mag 12.8 located 1′ from central cond.;

dense star field; moonlight [SRB]. June 28.97: star of mag 10.7 located 0'.5 from central cond.; possible tail 2' long in p.a. 260°; dense star field; moonlight [SRB]. July 28.50: diffuse and hard to see [YOS04].

⋄ *Comet C/1982 M1 (Austin; O.S. 1982 VI = 1982g)* ⟹ 1982 Aug. 15.83: w/ 13×60 B, $m_1 \sim 4.0$, coma dia. 6', DC = 7 [HEN]. Aug. 17.88: w/ 12×50 B, $m_1 = 5.1$, coma dia. 5' [FRY]. Aug. 18.86: w/ 12-cm R (35×), $m_1 = 5.0$, coma dia. 4', tail 0°.17 long [FRY]. Aug. 19.86: w/ 12×50 B, $m_1 = 5.2$ [FRY]. Aug. 23.96: w/ 12×50 B, $m_1 \sim 5.5$ [FRY]. Aug. 26.02: w/ 12-cm R (35×), $m_1 = 5.3$, coma dia. 2'.5 [FRY]. Aug. 30.03: w/ 20×80 B, $m_1 = 5.4$, coma dia. 2' [FRY]. Oct. 3.81: w/ 12-cm R (35×), $m_1 \sim 9.0$ [FRY].

⋄ *Comet C/1984 V1 (Levy-Rudenko; O.S. 1984 XXIII = 1984t)* ⟹ 1984 Dec. 24.76: w/ 12-cm R (20×), $m_1 = 8.4$ (ref: UM), coma dia. 2'.5 [FRY]. Dec. 26.74: w/ 12-cm R (35×), $m_1 = 8.2$ (ref: UM), coma dia. 2'.7 [FRY].

⋄ *Comet C/1985 R1 (Hartley-Good; O.S. 1985 XVII = 1985l)* ⟹ 1985 Nov. 2.79: w/ 22-cm L (50×), $m_1 = 9.5$, coma dia. 7'.5 [STU]. Nov. 9.76: w/ 22-cm L (50×), $m_1 = 8.4$ (ref: AA), coma dia. 4' [STU]. Nov. 10.74: w/ 22-cm L (50×), $m_1 = 8.6$ (ref: AA), coma dia. 4', 0°.25 tail in p.a. 115° [STU]. Nov. 11.79: w/ 22-cm L (50×), $m_1 = 8.5$, coma dia. 1'.9 [STU]. 1986 Jan. 20.27: w/ 30-cm *f*/5 L (65×), $m_1 \sim 8.0$, DC = 2 [STO02].

⋄ *Comet C/1985 T1 (Thiele; O.S. 1985 XIX = 1985m)* ⟹ 1985 Nov. 11.83: w/ 22-cm *f*/7 L (50×), $m_1 \sim 8.7$ (MM = S), coma dia. 6'.1 [STU]. Nov. 12.82: w/ 22-cm *f*/7 L (50×), $m_1 \sim 8.7$ (MM = S), coma dia. 4'.7 [STU]. Nov. 13.85: w/ 22-cm *f*/7 L (50×), $m_1 \sim 9.7$ (MM = A), coma dia. 5' [STU]. Nov. 16.94: w/ 22-cm *f*/7 L (40×), $m_1 \sim 10.0$ (MM = A), coma dia. 4' [STU].

⋄ *Comet C/1986 P1 (Wilson; O.S. 1987 VII = 1986l)* ⟹ 1986 Sept. 28.85: w/ 22-cm L (108×), $m_1 \sim 12.0$, coma dia. 2' [STU]. Sept. 29.81: w/ 22-cm L (108×), $m_1 \sim 11.0$, coma dia. 2' [STU].

⋄ *Comet C/1986 V1 (Sorrells; O.S. 1987 II = 1986n)* ⟹ 1986 Dec. 20.80: w/ 22-cm L (40×), $m_1 \sim 10.0$, coma dia. 4' [STU]. Dec. 22.83: w/ 22-cm L (72×), $m_1 \sim 10.0$, coma dia. 2' [STU]. Dec. 25.79: w/ 22-cm L (72×), $m_1 \sim 10.7$, coma dia. 2' [STU]. Dec. 26.79: w/ 22-cm *f*/7 L (72×), $m_1 \sim 9.0$, coma dia. 2'.5 [STU]. 1987 Jan. 4.80: w/ 22-cm *f*/7 L (40×), $m_1 \sim 10.0$, coma dia. 3' [STU].

⋄ *Comet C/1987 P1 (Bradfield; O.S. 1987 XXIX = 1987s)* ⟹ 1987 Nov. 10.75: w/ 10×50 B, $m_1 \sim 5.0$, coma dia. 5', DC = 3, 2° tail [Peter Stanley, Crawley, West Sussex, England]. 1988 Feb. 8.80: w/ 22-cm *f*/7 L (40×), $m_1 \sim 9.0$, coma dia. 3'.7 [STU]. Feb. 10.79: w/ 22-cm *f*/7 L (50×), $m_1 \sim 9.0$, coma dia. 2'.2 [STU]. Feb. 11.80: w/ 22-cm *f*/7 L (72×), $m_1 \sim 9.5$, coma dia. 2' [STU].

⋄ *Comet C/1988 A1 (Liller; O.S. 1988 V = 1988a)* ⟹ 1988 Apr. 23.95: w/ 22-cm *f*/7 L (40×), $m_1 \sim 6.5$, coma dia. 2'.5, tail 0°.83 long in p.a. 352° [STU]. May 7.89: w/ 22-cm *f*/7 L (40×), $m_1 \sim 6.7$, coma dia. 3'.2, tail 0°.33 long in p.a. 1° [STU]. May 20.96: w/ 22-cm *f*/7 L (40×), $m_1 \sim 7.5$, coma dia. 2'.9 [STU]. June 10.90: w/ 22-cm *f*/7 L (40×), $m_1 \sim 8.0$, coma dia. 2' [STU].

⋄ *Comet C/1989 Q1 (Okazaki-Levy-Rudenko; O.S. 1989 XIX = 1989r)* ⟹ 1989 Aug. 27.90: w/ 17-cm *f*/7 A, photo shows $m_1 \sim 12.5$, coma dia. 0'.3, DC = 2 [RID]. Aug. 28.94: w/ 17-cm *f*/7 A, photo shows $m_1 \sim 12.5$, coma dia. 0'.5, DC = 1 [RID]. Sept. 5.94: w/ 17-cm *f*/7 A, photo shows tail 0°.01 long in p.a. 90° [RID]. Sept. 20.83: w/ 15-cm *f*/8 L (50×), $m_1 = 8.6$ (MM = B), coma dia. 2'.9, DC = 4 [HEN]. Sept. 22.91: w/ 17-cm *f*/7 A, photo shows $m_1 \sim 9.0$, coma dia. 2'.5, DC = 7 [RID]. Sept. 29.89: w/ 17-cm *f*/7 A, photo shows $m_1 \sim 9.0$, coma dia. 2', DC = 7 [RID]. Oct. 4.81: w/ 17-cm *f*/7 A, photo shows $m_1 \sim 8.5$, tail 0°.07 long in p.a. 50°, coma dia. 3', DC = 7 [RID]. Oct. 5.82: w/ 17-cm *f*/7 A, photo shows $m_1 \sim 8.5$, coma dia. 3', DC = 8 [RID]. Oct. 8.81: w/ 17-cm *f*/7 A, photo shows $m_1 \sim 8.0$, coma dia. 3', DC = 8 [RID]. Oct. 17.79: w/ 17-cm *f*/7 A, photo shows $m_1 \sim 7.5$, tail 0°.05 long in p.a. 20°, coma dia. 4', DC = 6 [RID]. Oct. 31.78: w/ 17-cm *f*/7 A, photo shows $m_1 \sim 7.0$, tail 0°.10 long in p.a. 0° , coma dia. 2', DC = 6 [RID].

⋄ *Comet C/1989 T1 (Helin-Roman-Alu; O.S. 1989 XXI = 1989v)* ⟹ 1989 Nov. 3.83: w/ 17-cm *f*/7 A, photo shows $m_1 \sim 13.0$, coma dia. 0'.5, DC = 9 [RID]. Dec. 22.77: w/ 17-cm *f*/7 A, photo shows $m_1 \sim 13.0$, coma dia. 1', DC = 5 [RID].

⋄ *Comet C/1989 W1 (Aarseth-Brewington; O.S. 1989 XXII = 1989a_1)* ⟹ 1989 Nov. 22.78: w/ 17-cm *f*/7 A, photo shows $m_1 \approx 8.5$, coma dia. 2', DC = 7, tail 0°.12 long in p.a. 9° [RID]. Nov. 23.77: w/ 17-cm *f*/7 A, photo shows $m_1 \approx 8.5$, coma dia. 2', DC = 7, tail 0°.08 long in p.a. 11° [RID]. Nov. 25.75: w/ 17-cm *f*/7 A, photo shows $m_1 \approx 8.0$, coma dia. 2', DC = 7, tail 0°.67 long in p.a. 13° [RID].

⋄ *Comet C/1993 Q1 (Mueller; O.S. 1994 IX = 1993p)* ⟹ 1994 Apr. 6.32: w/ 31.7-cm *f*/5 L (53×), DC = 5, tail in p.a. 180° [JON]. Apr. 7.31: w/ 31.7-cm *f*/5 L (53×), DC = 5-6 [JON]. Apr. 13.31: w/ 31.7-cm *f*/5 L (53×), coma dia. 2'.5, DC = 6 [JON].

⋄ *Comet C/1994 G1 (Takamizawa-Levy; O.S. 1994 XIII = 1994f)* ⟹ 1994 May 14.17: w/ 31.7-cm *f*/6 L (68×), coma dia. 3'.4, DC = 5 [BOR].

⋄ *Comet C/1995 O1 (Hale-Bopp)* ⟹ 1995 Sept. 14.83: very faint and very low (alt. 12°) [REN]. 1996 Apr. 21.14: star of mag 8.5 involved; also comp.-star mags from ref VF [REN]. July 18.92: mountain obs. site, elev. 2000 m [REN]. Nov. 30.76: comet faint; alt. 7° [REN]. Dec. 7.75: alt. 10° [REN]. Dec. 14.75: alt. 9° [REN]. 1997 Jan. 13.25-Feb. 27.21: also comp.-star mags from ref HR [REN]. Feb. 20.22, 27.21, Mar. 2.19, and 16.85: moonlight [REN]. Mar. 8.19: tab. tail was of "type I"; also 4°.5 type-II tail in p.a. 300° [REN]. Mar. 11.19: tab. tail was of "type II"; also 11° type-I tail [REN].

Mar. 16.85 and Apr. 29.88: "type-II" tail [REN]. Mar. 28.86: type-I tail was bright, type-II tail was faint (both 7° long) [REN]. Apr. 5.86: tab. bright tail was of "type II"; also faint 8° type-I tail in p.a. 15° [REN]. 2005 Jan. 8.04 and 8.08: CCD images taken w/ 6.5-m Clay Telescope (+ MagIC camera) of the Magellan Observatory (Las Campanas, Chile) yield magnitudes $g' = 20.73 \pm 0.04$, $r' = 20.33 \pm 0.04$, $i' = 20.66 \pm 0.02$ (SDSS filter set) in a photometric aperture of diameter 4''.2 (IRAF 'apphot' software package used to obtain the magnitudes from the images; standard stars were PG 2336+00413 and Rubin 152 from the SDSS Primary Standard Star Network, Version 1.5; a reduced transformation yields $V = 20.48$); the g' and r' images clearly show evidence of a tail extending at least 8''.5 from the comet's head; a nearby brightness comparable in brightness to the comet was located only ~ 10'' from the comet's head [Andrew Rivkin and Richard Binzel, Massachusetts Institute of Technology].

◇ *Comet C/1996 N1 (Brewington)* ⟹ 1996 July 7.93: difficult object; alt. 10° [REN]. July 20.88, Sept. 5.87, 7.87, and 11.84: also used comp.-star mags from ref AA [REN]. Sept. 15.87: comet faint [REN].

◇ *Comet C/1996 Q1 (Tabur)* ⟹ 1996 Aug. 25.12: also used comp.-star mags from ref AA [REN].

◇ *Comet C/1997 D1 (Mueller)* ⟹ 1997 Oct. 1.16: difficult object [REN]. Oct. 29.15: faint with Swan-band filter [REN]. Dec. 26.85: star of same brightness as comet only 1' away [REN].

◇ *Comet C/1997 J1 (Mueller)* ⟹ 1997 May 13.05: star of mag 11.5 inconveniently located only 1' south of comet [REN].

◇ *Comet C/1997 J2 (Meunier-Dupouy)* ⟹ 1997 May 13.02: fainter w/ Swan-band filter [REN]. Oct. 26.79: comet very faint at 68×, and not seen at 38×; coma dia. stated as ≈ > 1' [REN]. 1998 June 15.99, 20.01, and 24.03: also used comp.-star mags from ref HS [REN]. July 20.96-Sept. 21.92: *Guide 6.0* software used for comp.-star mags [REN].

◇ *Comet C/1997 T1 (Utsunomiya)* ⟹ 1997 Oct. 11.04: w/ Swan-band filter, coma dia. 2'.5 (i.e., about half the size of unfiltered coma) [REN]. Oct. 11.08, 24.9, 28.81, and Nov. 20.76: also comp.-star mags from ref AA [REN]. Nov. 20.76: coma enhanced w/ Swan-band filter [REN].

◇ *Comet C/1998 K5 (LINEAR)* ⟹ 1998 Sept. 13.97: "fine sharp tail!" [REN]. Sept. 13.97-Oct. 27.02: comp.-star mags taken from *Guide 6.0* software [REN].

◇ *Comet C/1998 M5 (LINEAR)* ⟹ 1998 Aug. 15.99-1999 Mar. 18.93: comp.-star mags taken from *Guide 6.0* software [REN]. 1998 Nov. 10.78 and 16.78: comp.-star mags also taken from ref TT [REN].

◇ *Comet P/1998 U3 (Jäger)* ⟹ 1998 Nov. 10.93: less enhanced w/ Swan-band filter [REN]. Nov. 10.93-1999 Feb. 13.90: comp.-star mags taken from *Guide 6.0* software [REN].

◇ *Comet C/1998 U5 (LINEAR)* ⟹ 1998 Nov. 10.82-1999 Jan. 5.80: comp.-star mags taken from *Guide 6.0* software [REN]. 1999 Jan. 5.80: more enhanced w/ Swan-band filter [REN].

◇ *Comet C/1999 H1 (Lee)* ⟹ 1999 Aug. 15.10-Oct. 19.00: comp.-star mags taken from *Guide 6.0* software [REN].

◇ *Comet C/1999 H3 (LINEAR)* ⟹ 1999 July 8.97 and 2000 Mar. 1.97: comp.-star mags taken from *Guide 6.0* software [REN].

◇ *Comet C/1999 J2 (Skiff)* ⟹ 2000 Feb. 9.17 and 12.21: comp.-star mags taken from *Guide 6.0* software [REN].

◇ *Comet C/1999 J3 (LINEAR)* ⟹ 1999 Aug. 15.12-Oct. 19.18: comp.-star mags taken from *Guide 6.0* software [REN]. Oct. 19.18: enhanced w/ Swan-band filter [REN].

◇ *Comet C/1999 K8 (LINEAR)* ⟹ 2000 Aug. 29.09-Nov. 23.85: comp.-star mags taken from *Guide 6.0* software [REN].

◇ *Comet C/1999 S3 (LINEAR)* ⟹ 1999 Oct. 7.83-Dec. 5.81: comp.-star mags taken from *Guide 6.0* software [REN]. Oct. 7.83: less enhanced w/ Swan-band filter [REN].

◇ *Comet C/2000 K2 (LINEAR)* ⟹ 2000 Oct. 23.81-Dec. 16.78: comp.-star mags taken from *Guide 6.0* software [REN].

◇ *Comet P/2000 S1 (Skiff)* ⟹ 2000 Oct. 23.94 and Nov. 3.93: comp.-star mags taken from *Guide 6.0* software; verified using Digitized Sky Survey [REN].

◇ *Comet C/2000 SV_{74} (LINEAR)* ⟹ 2005 Apr. 9.21: w/ 90-cm $f/3$ L at Kitt Peak, CCD images show $V = 19.4$ and coma dia. 16'' [J. V. Scotti].

◇ *Comet C/2000 U5 (LINEAR)* ⟹ 2000 Nov. 3.99, 23.94, and 30.01: comp.-star mags taken from *Guide 6.0* software [REN]. Nov. 30.01: verified w/ "Deep Sky Survey" (possibly the Digitized Sky Survey? – Ed.) [REN].

◇ *Comet C/2001 Q4 (NEAT)* ⟹ 2005 Feb. 5.42: this comet has kept the same brightness and appearance for three months, since November; initially the brightness for this date was estimated using GSC, but the mag came out too bright due to inaccurate magnitudes of comp. stars, so the comet's mag was re-calculated using TASS-V data [YOS04].

◇ *Comet P/2002 S1 (Skiff)* ⟹ 2002 Sept. 29.05: CCD images taken by G. Masi and U. Tagliaferri w/ 80-cm $f/8$ L (+ Bessel R filter) show "a clear fuzzy aspect, with an apparent small tail" ≈ 15'' long towards p.a. 260°; total mag 18.5

(ref: R magnitudes from the USNO-A2.0 cat.) [Gianluca Masi, Campo Catino, Latina, Italy].

⋄ *Comet C/2002 T7 (LINEAR)* ⟹ 2005 May 7.51: *Guide 8.0* software used for comp.-star mags; comp. star has $B-V = +0.48$ [TSU02].

⋄ *Comet C/2003 K4 (LINEAR)* ⟹ 2004 Nov. 16.69: in 38-cm L, ion tail > 30′ long in p.a. 270° and more prominent anti-tail > 20′ long in p.a. 55°; quite similar in appearance to C/2002 T7 in April 2004 but fainter [MAT08]. Dec. 18.95: tail appears as a broad fan spanning p.a. 270°-343°, with the two brightest components being 36′ in p.a. 343° and 20′ long in p.a. 270° [BEG01; tab. data published in April 2005 *ICQ*]. 2005 Jan. 6.54: in 38-cm L, dust tail > 20′ long in p.a. 105°; stellar nuclear cond. of mag 12 [MAT08]. Jan. 18.60: comet near 5.0-mag star δ Cae [JON]. Mar. 7.75: quite strongly condensed towards center with definite sharp central cond.; *Guide 6* software used for comp.-star mags [COO02]. Mar. 28.72: very difficult, at limit of visibility under fairly clear conditions from town of Bredell; *Guide 6* software used for comp.-star mags [COO02].

⋄ *Comet C/2003 O1 (LINEAR)* ⟹ 2005 May 4.62: $B-V$ values of comp. stars were +0.51, +0.63, +0.69, and +0.85 [NAK01].

⋄ *Comet C/2003 T4 (LINEAR)* ⟹ 2005 Apr. 8.81: in 30-cm L, ion tail > 30′ long in p.a. 240° and dust tail 15′ long fanning out towards p.a. 315° [MAT08]. May 5.33: comp. stars have $B-V = +0.37$ and +0.42 [AMO01]. May 9.78: seems to be a little more diffuse; a rather hurried observation, w/ high cloud coming in [SEA]. May 12.74: thin cloud [JON]. May 28.89: comp. stars have $B-V = +0.15$ and +0.10 [AMO01]. May 29.96: poor conditions [ROB06].

⋄ *Comet C/2003 WT$_{42}$ (LINEAR)* ⟹ 2005 May 4.48: *Guide 8.0* software used for comp.-star mags; comp. star has $B-V = +0.55$ [TSU02]. May 12.87: low alt.; moonlight [SRB].

⋄ *Comet P/2004 F3 (NEAT)* ⟹ 2005 May 4.74 and 10.73: *Guide 8.0* software used for comp.-star mags [OHS]. May 4.74: comp. star has $B-V = +0.62$ [OHS]. May 10.73: $B-V$ values of comp. stars were +0.52 and +0.80 [OHS]. May 15.76: *Guide 8.0* software used for comp.-star mags; $B-V$ values of comp. stars were +0.55, +0.59, and +0.59 [NAK01]. June 5.71: *Guide 8.0* software used for comp.-star mags; comp. star has $B-V = +0.81$ [TSU02].

⋄ *Comet C/2004 K1 (Catalina)* ⟹ 2005 May 4.73: $B-V$ values of comp. stars were +0.51, +0.63, +0.69, and +0.85 [NAK01]. May 7.60: *Megastar* ver. 5.0 software used for comp.-star mags [MUR02]. May 7.68, 31.71, and June 25.58: *Guide 8.0* software used for comp.-star mags [TSU02]. May 7.68: comp. star has $B-V = +0.47$ [TSU02]. May 13.96, 26.95, June 23.94 and 28.99: moonlight [SRB]. May 15.66: $B-V$ values of comp. stars were +0.69 and +0.69 [NAK01]. May 31.71: comp. star has $B-V = +0.41$ [TSU02]. June 4.66: $B-V$ values of comp. stars were +0.66, +0.68, +0.72, +0.73, +0.76, and +0.84 [NAK01]. June 6.67: *Guide 8.0* software used for comp.-star mags; comp. star has $B-V = +0.98$ [OHS]. June 25.58: comp. star has $B-V = +0.53$ [TSU02]. July 3.93, 5.96, and 10.94: all obs. during July 2-15 made near Revest-du-Bion, France at elevation 960 m; all positions of comets fainter than mag 13.5 were checked against Digitized Sky Survey (DSS) to avoid confusion w/ faint stars or nearby galaxies, and the positions were calculated using most recent orbital elements from *MPECs* or *ICQ*/MPC website (for comets > 3 months from perihelion, orbital elements for epoch 2005 July 29 were calculated, using Bill Gray's `FIND_ORB`, from positions published on *MPECs*; this comet was faint, small, and somewhat condensed; the DSS shows nothing at plotted positions; comp.-star mags taken from Henden photometry near Z UMi [BOU and DIJ].

⋄ *Comet C/2004 L1 (LINEAR)* ⟹ 2005 May 4.47: *Guide 8.0* software used for comp.-star mags; comp. star has $B-V = +0.62$ [OHS].

⋄ *Comet C/2004 Q1 (Tucker)* ⟹ 2005 Mar. 2.80: comet close to bright star [BAR06]. May 7.45 and 31.52: *Guide 8.0* software used for comp.-star mags [TSU02]. May 7.45: comp. star has $B-V = +0.55$ [TSU02]. May 7.52: *Megastar* ver. 5.0 software used for comp.-star mags [MUR02]. May 12.89, 13.94, and 20.93: moonlight [SRB]. May 13.94: star of mag 12.5 located 0′.8 from central cond. [SRB]. May 31.52: comp. star has $B-V = +0.76$ [TSU02]. June 23.92: moonlight; star of mag 8.0 located 1′.8, and star of mag 9.2 located 1′.6, from central cond. [SRB].

⋄ *Comet C/2004 Q2 (Machholz)* ⟹ 2004 Nov. 16.59: in 38-cm L, dust tail 20′ long in p.a. 265° and short ion tail in p.a. 330°; stellar nuclear cond. of mag 11; w/ 25×100 B, a bright 20′ dust tail in p.a. 265°; comet visible to unaided eye at zenith using averted vision [MAT08]. 2005 Jan. 2.86, 8.79, 10.79, Feb. 4.79, 7.80, 28.76, Mar. 6.78, and 13.80: *Guide 8.0* software used for comp.-star mags [CSO]. Jan. 3.00 and 8.71: *Guide 8.0* software used for comp.-star mags [SAR02]. Jan. 3.68: w/ 8.0-cm R (19×), 0°.6 dust tail in p.a. 190°; central cond. of mag 7.0 [KOS]. Jan. 3.87, 8.81, 11.84, Feb. 28.79, and Mar. 31.86: *Guide 8.0* software used for comp.-star mags [TOT03]. Jan. 3.88, 4.86, 9.87, 10.86, 11.80, 13.76, and Mar. 31.90: *Guide 7.0* software used for comp.-star mags [SZA]. Jan. 4.75: w/ naked eye, $m_1 = 3.4$, dia. = 25′, DC = 6, tail 1°.5 in p.a. 190°; excellent conditions plus a power outage over the whole district resulted in a naked-eye limiting magnitude near the comet of 7.4; central cond. appeared stellar within a large and conspicuous coma; in 7×50 B, gas tail 6°.0 long in p.a. 82° and dust tail 3°.5 in p.a. 192°; coma was a milky blue-green color [BEG01; tab. data published in April 2005 *ICQ*]. Jan. 4.88, 6.83, 7.75, 9.79, 13.86, 17.73, and 30.79: *Guide 6.0* software used for comp.-star mags [KOV02]. Jan. 5.78, 6.79, 8.84, 15.88, and 16.96: *Guide 7.0* software used for comp.-star mags [SAN07]. Jan. 6.48: Pleiades cluster used for coma measurement; in 25×100 B, coma dia. 22′, ion tail > 3° long in p.a. 70°, dust tail > 1° long in p.a. 175° [MAT08]. Jan. 6.76: w/ naked eye, $m_1 = 3.3$, dia. = 25′, DC = 7, tail 1°.0 long in p.a. 190° [BEG01; tab. data published in April 2005 *ICQ*]. Jan. 6.96, 8.00, 8.77, 9.88, 15.96, 16.96, and 21.87: *Guide 8.0* software used for comp.-star mags [NAG09]. Jan. 7.76: w/ 8.0-cm R (19×), 0°.5 dust tail in p.a. 165°; central cond. of mag 7.0 [KOS]. Jan. 9.86: w/ 8.0-cm R (19×), 0°.9 dust tail in p.a. 170°; central cond. of mag 7.0 [KOS]. Jan. 11.70: w/ 7×50 B, 1°.3

dust tail in p.a. 165° [KOS]. Jan. 15.86: w/ 7×50 B, 0°.6 dust tail in p.a. 150° [KOS]. Jan. 15.87: w/ 8.0-cm R (19×), 0°.6 dust tail in p.a. 150°; central cond. of mag 6.8 [KOS]. Jan. 31.73: comet at alt. 7° [PRI04; tab. data published in April 2005 *ICQ*].

Feb. 4.71: w/ 7×50 B, 0°.3 dust tail in p.a. 155° [KOS]. Feb. 5.09: fan-like dust tail 30′ long spanning p.a. 110°-185° [BAR06]. Feb. 7.71 and 8.74: w/ 7×50 B, 0°.2 dust tail in p.a. 155° [KOS]. Feb. 8.73: w/ 8.0-cm R (19×), 0°.3 dust tail in p.a. 155°; central cond. of mag 9.0 [KOS]. Feb. 9.96 and 10.89: fan-like dust tail 20′ long in p.a. 150° [BAR06]. Feb. 26.80 and 28.78: w/ 8.0-cm R (19×), 0°.3 dust tail in p.a. 180°; central cond. of mag 9.3 [KOS]. Feb. 28.92: round, diffuse, well-condensed coma; no tail seen [WAR01]. Feb. 28.92, Mar. 20.88 and 21.84: bright sky from snow, moon, and streetlights [WAR01]. Mar. 1.93: another tail 0°.17 long in p.a. 158° [CSU]. Mar. 2.85: another tail 0°.17 long in p.a. 190° [CSU]. Mar. 2.99: w/ 36-cm *f*/6 L (80×), 0°.7 tail in p.a. 95° [BAR06]. Mar. 12.92: dust tail 15′ long in p.a. 147° [BAR06]. Mar. 20.88: round, very diffuse coma; cloudy sky (thin cirrostratus) [WAR01]. Mar. 21.84 and 24.81: round, very diffuse coma with brighter center [WAR01]. Mar. 24.81: bright moon near full [WAR01]. Mar. 26.79: round, diffuse coma with brighter center, extended in p.a. 180°; thin cirrostratus clouds; full moon rising in SE [WAR01]. Mar. 27.80 and 29.90: round, diffuse coma with well-condensed, brighter center [WAR01]. Mar. 27.80: faint, diffuse straight tail; clear, dark sky [WAR01]. Mar. 29.90: no tail seen; clear [WAR01]. Mar. 31.04: diffuse coma with well-condensed, brighter center; diffuse, wide, straight tail [WAR01]. Apr. 1.95: w/ 40.7-cm L (233×), jets in p.a. 50°, 90°, and 210°; central cond. of mag 13.2, tails in p.a. 160° and 240° (at 58×) [BIV]. Apr. 3.98: diffuse large coma with well-condensed, brighter center; diffuse, wide, short tail [WAR01]. Apr. 4.69, 13.71, 29.59, May 10.75, 26.52, and June 25.52: *Guide 8.0* software used for comp.-star mags [NAG04]. Apr. 4.69: 7′-long tail visible in p.a. 210° w/ 30.4-cm L (61×) [NAG04]. Apr. 9.91: no tail visible either in 9×63 B or w/ 30-cm T (75×); at 242×, stellar false nucleus of mag 12.0 within a small knot of material [KAM01]. Apr. 9.91: diffuse coma with brighter center; clear, dark sky [WAR01]. Apr. 12.92: diffuse round coma with slightly brighter center; thin cirrus, but clear at comet [WAR01]. Apr. 13.71: 8′-long tail visible in p.a. 210° w/ 30.4-cm L (61×) [NAG04]. Apr. 13.93: diffuse round coma with brighter center; straight, diffuse, faint, wide tail [WAR01]. Apr. 16.93: moonlight [JAN03]. Apr. 25.92: very diffuse, round coma with slightly brighter center; obs. through Lumicon 'Deep Sky' filter; clear; full moon rising [WAR01]. Apr. 26.49: *The Sky* ver. 5 software used for comp.-star mags [MIT].

May 1.88: w/ 30-cm T (75×), "remarkably-classical brightness distribution within the coma, peaking in a stellar false nucleus of mag 12.5" [KAM01]. May 3.51: *Guide 8.0* software used for comp.-star mags [MIY01]. May 3.65, 7.62, 31.63, and June 25.53: *Guide 8.0* software used for comp.-star mags [TSU02]. May 4.69, 7.60, 29.56, June 4.52, 5.53, 9.67, and 11.56: *Guide 8.0* software used for comp.-star mags [YOS02]. May 7.01: coma appeared somewhat fainter than M51, but brighter than M97; some twilight (sun 12°.2 below horizon), but transparent sky [GRA04]. May 7.60, 15.59, and July 2.51: *StellaNavigator* ver. 6.1 software used for comp.-star mags [NAG08]. May 7.62: comp. star has $B-V = +0.41$ [TSU02]. May 8.07: w/ 20.3-cm T (160×), jets in p.a. 80° and 105°; central cond. of mag 14.0 [BIV]. May 8.87: fan tail > 6′ long in p.a. 185°-240°; 12th-mag star 2′.5 from central cond. [SRB]. May 9.91: comet remarkably faint and diffuse compared w/ May 1, but still displaying a conspicuous central cond. [KAM01]. May 9.91, 11.06, and 31.99: at 242×, stellar false nucleus of mag 13.0 [KAM01]. May 11.06: central cond. and very diffuse outer coma [KAM01]. May 11.83: inner coma quite condensed, outer coma large and diffuse [BEG01]. May 11.96: faintly visible in twilight (solar alt. −11°.9) [GRA04]. May 11.98: in 9×63 B, mag 9.0 mag and coma dia. 5′ [KAM01]. May 12.06: w/ 40.7-cm L (233×), jets in p.a. 70° and 100°; central cond. of mag 13.7 [BIV]. May 12.82: coma large and diffuse; comet seen for short periods with direct vision, but difficult due to low DC and alt. [BEG01]. May 12.91: dense star field; possible tail > 17′ long in p.a. 281°; moonlight [SRB]. May 12.95: very diffuse, round coma with marginally brighter center; faint; clear weather, twilight [WAR01]. May 13.88 and 25.87: moonlight [HOR02]. May 13.92: dense star field; second tail > 6′ long in p.a. 243°; moonlight [SRB]. May 13.96: "diffuse coma; faintly seen in nautical twilight (sun 11°.5 below true horizon); probably my last visual obs. of this comet from my home location due to all-night bright twilight until the end of July" [GRA04]. May 20.91: moonlight [SRB]. May 21.91: second tail > 6′ long in p.a. 234° [SRB]. May 26.74: comet now extremely diffuse — beginning to blend into the sky background to a large extent; 12th-mag stars near the coma were more easily seen; low alt. (≈ 22°) does not help [BEG01]. May 26.93: second tail > 8′ long in p.a. 230° [SRB]. May 27.92: second tail > 5′ long in p.a. 237° [SRB]. May 27.93 and June 9.94: at 242×, stellar false nucleus of mag 13.5 [KAM01]. May 27.93: bright inner and diffuse outer coma [KAM01]. May 31.52 and June 25.49: *The Sky* ver. 5 software used for comp.-star mags [MIT]. May 31.63: comp. star has $B-V = +0.50$ [TSU02].

June 1.90: second tail > 5′ long in p.a. 218° [SRB]. June 5.55: foggy sky; inaccurate measurements [YOS04]. June 6.50: larger than 9P, w/ a central cond. a bit stronger than that of 9P [YOS04]. June 9.67: $B-V$ values of comp. stars were +0.46 and +0.74 [YOS02]. June 12.96: at 242×, stellar false nucleus of mag 14.0 within a small knot of material [KAM01]. June 13.92: coma elongated in p.a. 122° [BAR06]. June 25.53: comp. star has $B-V = +0.66$ [TSU02]. July 3.93: very diffuse coma; at 242×, stellar false nucleus of mag 14.5 within a small central cond. [KAM01]. July 9.93: visible w/ averted vision; at 242×, small central cond. but no false nucleus brighter than mag 14.5 [KAM01]. July 28.48: conditions not good (clouds); surprisingly very faint [YOS04]. July 31.89: visible w/ averted vision; very diffuse coma; at 242×, a faint, small central cond. discernible [KAM01].

◇ *Comet C/2004 R2 (ASAS)* ⟹ 2004 Sept. 17.77: coma moderately enhanced with a Swan-band filter [MAT08]. Sept. 19.80: DC has risen sharply while the coma size is considerably smaller; total mag also fainter [MAT08].

◇ *Comet C/2004 RG_{113} (LINEAR)* ⟹ 2005 May 7.53: *Guide 8.0* software used for comp.-star mags; comp. star has $B-V = +0.72$ [TSU02].

◇ *Comet C/2004 U1 (LINEAR)* ⟹ 2004 Nov. 18.05: comet in outburst; w/ 25-cm *f*/4.7 T + unfiltered CCD and using red comparison-star mags from USNO-A2.0 cat., comet had mag 14.1 in a 10″ × 10″ aperture and mag 12.9 in a

60″ × 60″ aperture [NAV01].

◇ *Comet C/2004 V13 (SWAN)* ⟹ 2005 Jan. 6.47: extremely diffuse; alt. 14°; twilight interference; CCD image displays no central cond. down to mag 17 [MAT08].

◇ *Minor planet 2004 YJ_{35}* ⟹ 2005 Mar. 7.53: w/ 1.03-m reflector at Saji Observatory, CCD images of this minor planet with a nearly parabolic orbit (T = 2005 Mar. 3.15 TT, q = 1.78 AU) yield $V = 17.99$ and $R_c = 17.47$ (uncertainty ± 0.05 mag); a stacked CCD frame (twelve 120-sec exposures w/ total integration time 24 min) shows no coma or tail [T. Oribe, Tottori, Japan].

◇ *Comet C/2005 A1 (LINEAR)* ⟹ 2005 Feb. 18.65: comet observed against bright Milky Way background [JON]. Mar. 5.58: comet much brighter than anticipated and displays a faint ion tail; comet is an easy object through 7×50 B [MAT08]. Mar. 7.76: *Guide 6* software used for comp.-star mags [COO02]. Mar. 8.48: coma slightly enhanced with a Swan-band filter [MAT08]. Mar. 28.71: alt. 19°; strongly condensed towards center of small coma [COO02]. Apr. 12.82: alt. 5° [MAT08]. June 9: "Hirohisa Sato reported that this comet looks as bright as C/2005 K2 on SWAN images" taken on this date [YOS04]. July 2.10, 3.10, and 16.10: mountain location, clear sky [GON05]. July 2.10: moonlight; coma enhanced through Swan-band filter [GON05]. July 2.10 and 3.10: alt. 14° [GON05]. July 6.06: some interference from nearby star of mag 10.7 [BOU]. July 6.09: mountain location, very clear sky; elongated inner coma [GON05]. July 16.10: inner coma elongated in p.a. 210° [GON05]. July 28.72: conditions not good (clouds); "extremely close to the half moon, hard to see; the measurements must be very inaccurate" [YOS04].

◇ *Comet C/2005 B1 (Christensen)* ⟹ 2005 May 10.66: *Guide 8.0* software used for comp.-star mags; $B-V$ values of comp. stars were +0.52 and +0.80 [OHS]. May 20.97 and June 29.00: moonlight [SRB]. June 4.61: $B-V$ values of comp. stars were +0.66, +0.68, +0.72, +0.73, +0.76, and +0.84 [NAK01]. June 25.60: *Guide 8.0* software used for comp.-star mags; comp. star has $B-V = +0.46$ [TSU02].

◇ *Comet C/2005 E2 (McNaught)* ⟹ 2005 May 7.77 and June 5.73: *Guide 8.0* software used for comp.-star mags [TSU02]. 2005 May 7.77: comp. star has $B-V = +0.58$ [TSU02]. May 15.78: *Guide 8.0* software used for comp.-star mags; $B-V$ values of comp. stars were +0.55, +0.59, and +0.59 [NAK01]. June 5.73: comp. star has $B-V = +0.67$ [TSU02]. June 6.72: *Guide 8.0* software used for comp.-star mags; comp. star has $B-V = +0.98$ [OHS].

◇ *Comet C/2005 EL_{173} (LONEOS)* ⟹ 2005 Mar. 31.54: $B-V$ values of comp. stars were +0.56, +0.61, +0.66, +0.69, +0.76, and +0.79 [NAK01].

◇ *Comet C/2005 G1 (LINEAR)* ⟹ 2005 May 4.71: $B-V$ values of comp. stars were +0.51, +0.63, +0.69, and +0.85 [NAK01]. May 7.71: *Guide 8.0* software used for comp.-star mags; comp. star has $B-V = +0.64$ [TSU02]. May 15.70: $B-V$ values of comp. stars were +0.69 and +0.69 [NAK01]. June 4.70: $B-V$ values of comp. stars were +0.66, +0.68, +0.72, +0.73, +0.76, and +0.84 [NAK01].

◇ *Comet P/2005 GF_8 (LONEOS)* ⟹ 2005 May 4.60: $B-V$ values of comp. stars were +0.51, +0.63, +0.69, and +0.85 [NAK01]. May 7.65: *Guide 8.0* software used for comp.-star mags; comp. star has $B-V = +0.63$ [TSU02].

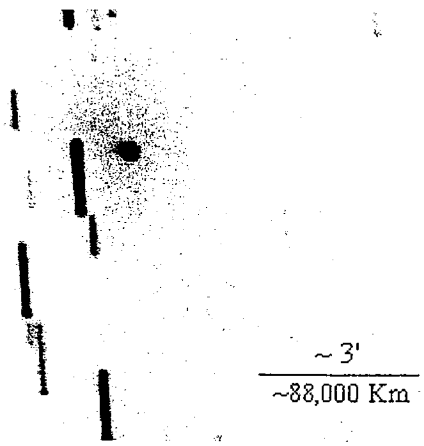
◇ *Comet C/2005 H1 (LINEAR)* ⟹ 2005 May 4.69: $B-V$ values of comp. stars were +0.51, +0.63, +0.69, and +0.85 [NAK01]. May 15.68: $B-V$ values of comp. stars were +0.69 and +0.69 [NAK01]. June 4.68: $B-V$ values of comp. stars were +0.66, +0.68, +0.72, +0.73, +0.76, and +0.84 [NAK01].

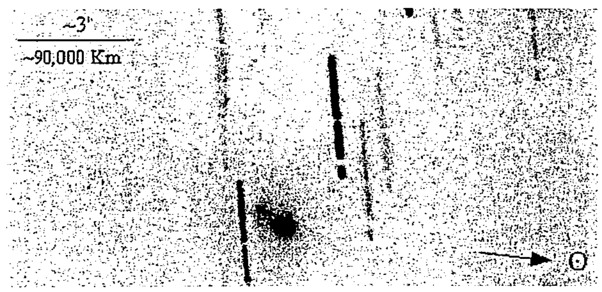
◇ *Comet P/2005 J1 (McNaught)* ⟹ 2005 May 15.74: *Guide 8.0* software used for comp.-star mags; $B-V$ values of comp. stars were +0.55, +0.59, and +0.59 [NAK01].

◇ *Comet P/2005 JQ_5 (Catalina)* ⟹ 2005 May 31.70, June 13.59, and 25.48: *Guide 8.0* software used for comp.-star mags [TSU02]. May 31.70: comp. star has $B-V = +0.70$ [TSU02]. June 4.60: $B-V$ values of comp. stars were +0.66, +0.68, +0.72, +0.73, +0.76, and +0.84 [NAK01]. June 9.59: *Guide 8.0* software used for comp.-star mags; $B-V$ values of comp. stars were +0.61 and +0.82 [YOS02]. June 13.59: comp. star has $B-V = +0.40$ [TSU02]. June 23.86: low alt. [SRB]. June 25.48: comp. star has $B-V = +0.48$ [TSU02]. June 25.94 and 26.94: mountain location, clear sky [GON05]. June 25.94: alt. 11°; "motion checked during a 20-min period; coma must be undoubtedly greater, but very difficult to observe visually" [GON05]. June 26.94: alt. 8°; motion checked during a 30-min period; coma enhanced through Swan-band filter [GON05].

◇ *Comet C/2005 K1 (Skiff)* ⟹ 2005 May 18.18: w/ 0.6-m reflector + CCD, 5″ coma, 25″ tail in p.a. 320°, and a central cond. of mag 17.0; some light cirrus clouds [Jim Young, Table Mountain Obs., Wrightwood, CA]. June 4.72: $B-V$ values of comp. stars were +0.66, +0.68, +0.72, +0.73, +0.76, and +0.84 [NAK01]. June 23.97: moonlight [SRB]. July 28.54: at high alt., and the sky was clear [YOS04].

◇ *Comet C/2005 K2 (LINEAR)* ⟹ 2005 May 26.98: moonlight [SRB]. May 28: secondary nucleus is clearly visible on twelve co-added 30-sec unfiltered CCD images taken with the Konkoly Observatory's 60-cm Schmidt telescope at Piszkéstető; the secondary nucleus is ≈ 1 mag fainter than the primary and situated 6″.3 in p.a. 312° from the primary [Krisztián Sárneczky, University of Szeged]. May 30.98: mountain location, very clear sky; motion checked during a 45-min period [GON05]. May 31.49 and June 5.48: *Guide 8.0* software used for comp.-star mags [NAK01]. May 31.49: comp. star has $B-V = +0.35$ [NAK01]. May 31.51, June 5.51, and 13.48: *Guide 8.0* software used for comp.-star mags [TSU02]. May 31.51: comp. star has $B-V = +0.53$ [TSU02]. June 2: comet well seen in SWAN *SOHO* images [CHE03]. June 4.94: comet close to bright star [BAR06]. June 5.48: $B-V$ values of comp. stars were +0.70 and +0.75 [NAK01].





Two CCD images of comet C/2005 K2 taken remotely by E. Guido (and processed by G. Sostero) using a 25-cm f/3.4 Takahashi "Epsilon 250" telescope at the New Mexico Skies Observatory. Left: taken on 2005 June 19.18 (sixteen co-added 30-sec exposures). Right: taken on June 20.16 (29 co-added 30-sec exposures). Note the tailward secondary nucleus. North is up and east to the left in both images.

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[text continued from page 170]

June 5.51: comp. star has $B-V = +0.59$ [TSU02]. June 6.48: "I was surprised that the comet was very bright, large, and easy to see; it had a weak cond., unexpectedly, and it was moving fast" [YOS04]. June 7.97: w/ 40.7-cm L (233×), central cond. of mag 13.8; comet much brighter than 4 days ago — easier to see than was comet 9P at low magnification (58×), while 4 nights before, averted vision at 116× under better skies (much less hazy) was necessary; rapid motion was obvious in both cases [BIV]. June 9.08: possible outburst [GON05]. June 9.55: *Guide 8.0* software used for comp.-star mags; $B-V$ values of comp. stars were +0.55 and +0.66 [YOS02]. June 11.54: *Guide 8.0* software used for comp.-star mags [YOS02]. June 11.94: comet in outburst [BAR06]. June 13.48: comp. star has $B-V = +0.50$ [TSU02]. June 14.96: "comet visible despite low alt., twilight, and fine display of bright noctilucent cloud, which stayed well below the comet, fortunately; a somewhat-condensed central region of dia. about 1′ was surrounded by a very faint outer coma that could be obs. to a dia. of some 3′, but was undoubtedly (considerably) larger; fast southward motion was obvious after 10-15 min" [BOU]. June 17.91: elongated inner coma; astron. twilight; moonlight [GON05]. June 24.35: low alt. and seen through glow from Cowra township; moderately enhanced w/ "Swan Band" filter [SEA].

◇ *Comet P/2005 K3 (McNaught)* ⟹ 2005 June 6.74: *Guide 8.0* software used for comp.-star mags; comp. star has $B-V = +0.67$ [OHS].

◇ *Comet P/2005 L1 (McNaught)* ⟹ 2005 June 4.64: $B-V$ values of comp. stars were +0.66, +0.68, +0.72, +0.73, +0.76, and +0.84 [NAK01].

◇ *Comet C/2005 N1 (Juels-Holvorcem)* ⟹ 2005 July 8.10 and 12.11: mountain location, very clear sky; motion checked during a 30-min period [GON05]. July 8.10: alt. 21° [GON05]. July 12.11: alt. 24° [GON05]. July 15.09: some interference from nearby 12th-mag star; comp.-star mags on both July 14 and 15 taken from Henden photometry near GK Per [BOU]. July 28.75: interference from the half moon [YOS04].

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Key to observers with observations published in this issue, *with 2-digit numbers between Observer Code and Observer's Name indicating source [07 = Comet Section, British Astronomical Association; 11 = Dutch Comet Section (Werkgroep Kometen); 16 = Japanese observers (via Akimasa Nakamura, Kuma, Japan); 35 = South American observers (c/o Jose G. de Souza Aguiar, Brazil); 42 = Belarus observers (c/o S. E. Shurpakov, Barani); 48 = Ukrainian observers (c/o Denis A. Svechkarev); etc.]:*

ABB	07	James Abbott, Essex, England
ALC	07	George E. D. Alcock, England
AMO01	35	Alexandre Amorim, Brazil
BAL04	32	János Balogh, Hungary
BAR06	37	Alexandr R. Baransky, Ukraine
BEG01	15	Mike Begbie, Harare, Zimbabwe
BIV		Nicolas Biver, France
BOR	07	John E. Bortle, NY, U.S.A.
BOU		Reinder J. Bouma, Netherlands
BRO04	27	Eric Broens, Belgium
BUS01	11	E. P. Bus, The Netherlands
CAM03	07	Paul Camilleri, Australia
CHE03	33	Kazimieras T. Cernis, Lithuania
COM	11	Georg Comello, The Netherlands
COO02		Tim P. Cooper, South Africa
CSO	32	Tibor Csörgei, Slovak Republic

CSU	32	Mátyás Csukás, Salonta, Romania
CZE03	32	Balázs Czeglédi, Hungary
DES01		Jose G. de Souza Aguiar, Brazil
DIE02		Alfons Diepvens, Belgium
DIJ		Edwin van Dijk, The Netherlands
ERD	32	József Erdei, Bogyiszló, Hungary
FRA01	07	James Fraser, Alness, Scotland
FRY	07	D. Frydman, England
GAI	07	Michael J. Gainsford, England
*GIL02	07	C. Gilbert, Christon Bank, U.K.
GON05		Juan Jose Gonzalez, Spain
GON06		Virgilio Gonano, Udine, Italy
GRA04	24	Bjoern Haakon Granslo, Norway
GRE		Daniel W. E. Green, U.S.A.
HAD01	32	Csaba Hadházi, Hungary
HAS02		Werner Hasubick, Germany
HAY03		Milton Hays, FL, U.S.A.
HAY04	07	Tim Haymes, Surrey, England
HEN	07	Michael J. Hendrie, England
HOR02	23	Kamil Hornoch, Czech Republic
HOR03	23	Petr Horalek, Czech Republic
HOS	07	J. G. Hosty, England
HUR		Guy M. Hurst, England
JAN03	23	Otto Janoušek, Czech Republic
JON		Albert F. Jones, New Zealand
KAD02	16	Ken-ichi Kadota, Japan
KAM01		Andreas Kammerer, Germany
KEE01	07	David Russell Keedy, England
KES01	32	Sándor Keszthelyi, Hungary
KOS	07	Attila Kósa-Kiss, Romania
KOV02	32	Adrián Kovács, Slovak Republic
KOZ02	42	Alexandr Kozlovski, Russia
LAB02		C. Labordena, Castellon, Spain
LEH		Martin Lehky, Czech Republic
LIN04		Mike Linnolt, Makawao, HI, U.S.A
*LUB02	07	Stephen Lubbock, Cornwall, U.K.
MAD	07	P. J. Madej, England
MAR02	13	Jose Carvajal Martinez, Spain
*MAR26	07	Kevin Marshall, Cambridge, U.K.
MAT08		Michael Mattiazzo, S. Australia
MCK	07	Richard McKim, Oundle, England
MCN	07	Robert H. McNaught, Australia
MID01	24	Oernulf Midtskogen, Norway
MIL01	07	S. W. Milbourn, England
MIT	16	Shigeo Mitsuma, Honjo, Japan
MIY01	16	Osamu Miyazaki, Yasato, Japan
MOB	07	Martin Mobberley, England
MOR03		Warren C. Morrison, Canada
*MUN01	07	C. Munday, Hull, U.K.
MUR02	16	Shigeki Murakami, Niigata, Japan
NAG04	16	Kazuro Nagashima, Nara, Japan
NAG08	16	Yoshimi Nagai, Gunma, Japan
NAG09	32	Miklós Nagy, Csenger, Hungary
NAK01	16	Akimasa Nakamura, Ehime, Japan
NOW		Gary T. Nowak, VT, U.S.A.
OHS	16	Yuuji Ohshima, Nagano, Japan
PAN	07	Roy W. Panther, England
PIC	07	R. D. Pickard, England
PIL01		Uwe Pilz, Leipzig, Germany
RAM01	07	Gavin Ramsay, England
REN		Alexandre Renou, France
RID	07	Harold B. Ridley, England
ROB06		Walter Ruben Robledo, Argentina
SAN04	38	Juan M. San Juan, Madrid, Spain
SAN07	32	Gábor Sánta, Hungary
SAR02	32	Krisztián Sárneczky, Hungary
SCA02		Toni Scarmato, Calabria, Italy
SCH04	11	Alex H. Scholten, Netherlands
SEA		David A. J. Seargent, Australia
SEM02	42	Andrey S. Semenyuta, Kazakstan
SER	42	Ivan M. Sergey, Belarus
SHA04		Gregory T. Shanos, U.S.A.
SHU	42	Sergey E. Shurpakov, Belarus
SIM		Karl Simmons, FL, U.S.A.
SOU01	35	Willan C. de Souza, Brazil
SPR		Chris E. Spratt, BC, Canada
SRB	23	Jiri Srba, Vsetin, Czech Rep.
STO02	07	D. Stott, England
STR03	15	Magda Streicher, South Africa
STU	07	K. M. Sturdy, England
SZA	32	Sándor Szabó, Sopron, Hungary
TAN02	07	Tony Tanti, Malta
TAY	07	Melvyn D. Taylor, England
TOT03	32	Zoltán Tóth, Hungary
TSU02	16	M. Tsumura, Wakayama, Japan
TUR	15	C. Turk, Cape Town, S. Africa
URB01	23	Ľubomír Urbančok, Slovak Rep.
VAN15	15	K. van Zyl, Pretoria, S. Africa
VEN01	07	Frank Ventura, Malta
WAR01		Johan Warell, Sweden
YOS02	16	Katsumi Yoshimoto, Japan
YOS04	16	Seiichi Yoshida, Japan

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TABULATED VISUAL DATA (also format for old-style CCD data)

NOTE: As begun in the October 2001 issue, the CCD and visual tabulated data are separated. The tabulated CCD data are also now generally further separated into two "CCD" sections: the first in the old format for those observations submitted only in the old format, and the second in the new format (whose columns are described on page 208 of the July 2002 *ICQ*).

The headings for the tabulated data are as follows: "DATE (UT)" = Date and time to hundredths of a day in Universal Time; "N" = notes [* = correction to observation published in earlier issue of the *ICQ*; an exclamation mark (!) in this same location indicates that the observer has corrected his estimate in some manner for atmospheric extinction (prior to September 1992, this was the standard symbol for noting extinction correction, but following publication of the extinction paper — July 1992 *ICQ* — this symbol is only to be used to denote corrections made using procedures different from that outlined by Green 1992, *ICQ* **14**, 55-59, and in Appendix E of the *ICQ Guide to Observing Comets* — and then only for situations where the observed comet is at altitude > 10°); '&' = comet observed at altitude 20° or less with no atmospheric extinction correction applied; '$' = comet observed at altitude 10° or lower, observations corrected by the observer using procedure of Green (*ibid.*); for a correction applied by the observer using Tables Ia, Ib, or Ic of Green (*ibid.*), the letters 'a', 'w', or 's', respectively, should be used; x indicates that a secondary source (often amateur computer software) was used to get supposedly correct comparison-star magnitudes from an accepted catalogue].

"MM" = the method employed for estimating the total (visual) magnitude; see article on page 186 of the Oct. 1996 issue [B = VBM method, M = Morris method, S = VSS or In-Out method, I = in-focus, C = unfiltered CCD, c = same as 'C', but for 'nuclear' magnitudes, V = electronic observations — usually CCD — with Johnson *V* filter, *etc.*]. "MAG." = total (visual) magnitude estimate; a colon indicates that the observation is only approximate, due to bad weather conditions, *etc.*; a left bracket ([) indicates that the comet was not seen, with an estimated limiting magnitude given (if the comet IS seen, and it is simply estimated to be fainter than a certain magnitude, a "greater-than" sign (>) must be used, not a bracket). "RF" = reference for total magnitude estimates (see pages 98-100 of the October 1992 issue, and Appendix C of the *ICQ Guide to Observing Comets*, for all of the 1- and 2-letter codes; an updated list is also maintained at the *ICQ* World Wide Website). "AP." = aperture in centimeters of the instrument used for the observations, usually given to tenths. "T" = type of instrument used for the observation (R = refractor, L = Newtonian reflector, B = binoculars, C = Cassegrain reflector, A = camera, T = Schmidt-Cassegrain reflector, S = Schmidt-Newtonian reflector, E = naked eye, *etc.*). "F/" and "PWR" are the focal ratio and power or magnification, respectively, of the instrument used for the observation — given to nearest whole integer (round even); note that for CCD observations, in place of magnification is given the exposure time in seconds [see page 11 of the January 1997 issue; a lower-case "a" indicates an exposure time under 1000 seconds, an upper-case "A" indicates an exposure time of 1000-1999 seconds (with the thousands digit replaced by the "A"), an upper-case "B" indicates an exposure time of 2000-2999 seconds (with the thousands digit replaced by the "B"), etc.].

"COMA" = estimated coma diameter in minutes of arc; an ampersand (&) indicates an approximate estimate; an exclamation mark (!) precedes a coma diameter when the comet was not seen (*i.e.*, was too faint) and where a limiting magnitude estimate is provided based on an "assumed" coma diameter (a default size of 1′ or 30″ is recommended; cf. *ICQ* **9**, 100); a plus mark (+) precedes a coma diameter when a diaphragm was used electronically, thereby specifying the diaphragm size (i.e., the coma is almost always larger than such a specified diaphragm size). "DC" = degree of condensation on a scale where 9 = stellar and 0 = diffuse (preceded by lower- and upper-case letters S and D to indicate the presence of stellar and disklike central condensations; cf. July 1995 issue, p. 90); a slash (/) indicates a value midway between the given number and the next-higher integer. "TAIL" = estimated tail length in degrees, to 0.01 degree if appropriate; again, an ampersand indicates a rough estimate. Lower-case letters between the tail length and the p.a. indicate that the tail was measured in arcmin ("m") or arcsec ("s"), *in which cases the decimal point is shifted one column to the right.* "PA" = estimated measured position angle of the tail to nearest whole integer in degrees (north = 0°, east = 90°). "OBS" = the observer who made the observation (given as a 3-letter, 2-digit code).

A complete list of the Keys to abbrevations used in the *ICQ* is available from the Editor for $4.00 postpaid (available free of charge via e-mail); these Keys (with the exception of the Observer Codes) are also available in the *Guide to Observing Comets* and via the *ICQ*'s World Wide Web site. *Please note that data in archival form, and thus the data to be sent in machine-readable form, use a format that is different from that of the Tabulated data in the printed pages of the ICQ;* see pages 59-61 of the July 1992 issue, p. 10 of the January 1995 issue, and p. 100 of the April 1996 issue for further information [note correction on page 140 of the October 1993 issue]. Further guidelines concerning reporting of data may be found on pages 59-60 of the April 1993 issue, and in the *ICQ Guide to Observing Comets.*

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NOTE: *The new-style CCD tabulated data begin on page 214 of this issue.*

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Visual Data

Comet 2P/Encke

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2003 11 15.09		S	10.5	AC	15	R	5	42	3	1			MOR03
2003 11 21.02		S	8.9	AC	15	R	5	42	4	2			MOR03
2003 12 02.98		S	8.5	AC	15	R	5	42	3.5	2			MOR03
2003 12 03.96	w	S	8.4	AC	15	R	5	42	3.5	2			MOR03

Comet 6P/d'Arrest

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1995 07 27.02		S	10.8:	S	6.3	R	13	52	4	1			KOS
1995 07 29.04		S	10.6:	S	6.3	R	13	52	4	2			KOS
1995 08 07.00		S	8.7	S	6.3	R	13	52	14	2			KOS

Comet 9P/Tempel

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1994 04 06.89		S	10.9	AA	15.0	R	15	85	2.0	7			DIE02
1994 04 09.84		S	10.9	AA	15.0	R	15	85	2.0	7			DIE02
1994 04 14.05		S	10.2	AA	15.0	R	15	85	2.0	5			DIE02
1994 06 27.39		S	11.5	GA	31.7	L	5	63	0.8	1			JON
1994 06 29.34		S	11.7	GA	31.7	L	5	63		1			JON
1994 07 06.35		S	11.4	GA	31.7	L	5	63	0.8	1			JON
1994 07 07.33		S	11.6	GA	31.7	L	5	63					JON
1994 07 09.35		S	11.4	GA	31.7	L	5	63	0.8	1			JON
2005 02 11.09		S	[13.3	HS	36	L	6	90	! 0.7				BAR06
2005 03 02.96		S	13.0	HS	36	L	6	90	1.3	s4			BAR06
2005 03 13.84		S	13.2	HS	34.0	L	4	166	1	3			SZA
2005 03 15.98		S	12.5	HS	27.0	L	6	120	0.8	5			TOT03
2005 03 29.87		S	11.8	HS	36	L	6	90	2.2	4			BAR06
2005 03 31.91		S	12.1	HS	34.0	L	4	166	1	3			SZA
2005 03 31.92		S	12.2	TK	25.6	L	5	84	1.5	6			BIV
2005 03 31.94		S	11.8	HS	20	L	5	70	2.1	3			BAR06
2005 04 01.82		M	12.4	HS	42	L	5	69	2.7	7			HOR03
2005 04 01.97		S	12.2	HS	40.7	L	4	58	1.5	6			BIV
2005 04 04.74	x	B	11.8	TJ	30.4	L	5	61	0.5	5			NAG04
2005 04 04.91		S	11.5	HS	36	L	6	90	2.1	s5			BAR06
2005 04 05.97		S	11.5	HS	36	L	6	90	2.0	s5			BAR06
2005 04 07.88		S	11.6	TI	8	R		5	2.0	s1			SCA02
2005 04 08.03		S	11.5	HS	20	L	5	70	2.0	4			BAR06
2005 04 08.64		S	12.0	TK	38	L	5	75	1.5	5	5 m	240	MAT08
2005 04 09.86		S	11.5	TK	25.6	L	5	42	1.5	6			BIV
2005 04 09.93		S	11.4	HS	20	L	5	70	2	4			BAR06
2005 04 09.93		S	11.7	TK	30.5	T	10	115	1.0	s4			KAM01
2005 04 10.86		S	11.6	TK	40.7	L	4	58	1.5	5			BIV
2005 04 10.92		S	11.5	TK	40.7	L	4	58	2.0	6			BIV
2005 04 12.90		S	11.3	TI	8	R		5	2.0	s1			SCA02
2005 04 13.75	x	B	11.3	TJ	30.4	L	5	79	0.5	6			NAG04
2005 04 14.90		S	11.0	TI	8	R		5	3	s3			SCA02
2005 04 26.85		S	11.6	TK	15	L	6	45	1.6	3			URB01
2005 04 28.91		S	10.5	TI	8	R		5	3.0				SCA02
2005 04 29.63	x	B	11.3	TJ	30.4	L	5	79	1.0	3			NAG04
2005 04 29.83		S	11.5	TK	15	L	6	45	2.5	4/			URB01
2005 04 29.93		S	11.3	TK	40.7	L	4	58	2.0	6			BIV
2005 04 30.88		S	11.5	TK	15	L	6	45	2.7	3/			URB01
2005 04 30.89		S	10.7	TI	8	R		5	3.5	s2			SCA02
2005 04 30.95		S	11.2	TK	40.7	L	4	58	2.2	6			BIV
2005 04 30.96		S	11.1	HS	20	L	5	70	3.2				BAR06
2005 05 01.05		S	11.2	TK	14.3	L	6	112	0.5	2			AMO01
2005 05 01.85		S	11.3	TK	15	L	6	45	2.0	3			URB01
2005 05 01.87		S	10.8	TK	30.5	L	10	75	1.6	s5			KAM01
2005 05 01.93		S	10.8	TK	44.0	L	5	63	1.9	4			HAS02
2005 05 02.04		S	11.2	TK	14.3	L	6	112	0.5	3/			AMO01
2005 05 02.08		S	11.2	TK	20.3	T	10	100	3.0	5			GON05
2005 05 02.42		S	10.7	GA	10.0	B		25	3	5			SEA
2005 05 02.75	x	S	11.6	TK	40.0	L	4	144	0.8	3			COO02
2005 05 02.81		S	10.6	TI	8	R		5	4	s3			SCA02
2005 05 02.86		S	11.2	TK	15	L	6	45	2.0	2			URB01
2005 05 02.90		M	11.0	AU	25.4	J	6	58	2.4	5/			BOU
2005 05 02.99		S	11.0	TK	20	L	5	70	3	3			BAR06
2005 05 03.01		S	11.0	TK	14.3	L	6	45	1	3			AMO01
2005 05 03.52		S	10.2	TJ	40.0	L	4	36	4.1	5			YOS04
2005 05 03.52	x	S	11.3	TJ	31.7	L	6	63	1.6	4/			MIY01
2005 05 03.67	x	M	11.1	TT	30.0	L	4	50	3.8	5			TSU02
2005 05 03.76	x	S	11.4	TK	30.0	T	10	218	1.2	3/			STR03

Comet 9P/Tempel [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR		COMA	DC	TAIL	PA	OBS.
2005 05 03.81		S	10.6	TI	8	R		5		4				SCA02
2005 05 03.90		M	10.9	AU	25.4	J	6	58		2.4	5/			BOU
2005 05 03.91		M	11.0	AU	25.4	J	6	58		2.2	5			DIJ
2005 05 03.97		S	11.2	TK	20.3	T	10	67		3.0	6			BIV
2005 05 04.49		S	10.4	TJ	40.0	L	4	36		4.5	5			YOS04
2005 05 04.85	x	S	11.4	HS	20.0	L	9	72		4	4			BEG01
2005 05 04.87		S	10.8	AU	30.5	T	10	56	&	2.5	3/			COM
2005 05 04.87		S	11.2	TK	20.3	T	10	67		3.0	5			BIV
2005 05 04.91		M	10.8	AU	15.6	L	5	36		2.6	5			BOU
2005 05 05.10		S	10.9	TK	14.3	L	6	45		1	4			AMO01
2005 05 05.54		S	10.3	AA	10.0	B		25						SEA
2005 05 05.83	x	S	11.6	HS	20.0	L	9	72		2.5	3			BEG01
2005 05 05.89		S	10.3	AU	31.0	J	6	58		2.5	4			BOU
2005 05 05.91		S	11.3	TK	20.3	T	10	67		3.0	5			BIV
2005 05 06.00		S	10.9	TK	14.3	L	6	45		1	6/			AMO01
2005 05 06.87	x	S	11.4	TK	30.0	T	10	218		2.2	3			COO02
2005 05 06.88	x	S	11.2	TK	30.0	T	10	218		2	3			STR03
2005 05 06.90		M	10.3	TK	13	L	8	69		2.9	4			HOR02
2005 05 06.90		M	10.6	AU	15.6	L	5	36		3	5			BOU
2005 05 06.91		M	10.8	AU	15.6	L	5	36		2.3	5			DIJ
2005 05 06.93		S	11.2	TK	20.3	T	10	67		3.0	6			BIV
2005 05 06.97		S	10.9	TK	20.3	T	10	100		3.0	5			GON05
2005 05 07.01		S	10.4	TK	10.0	B		25		3	5			GON05
2005 05 07.58	x	M	10.6	TK	25.4	L	4	46		2.4	6			YOS02
2005 05 07.59	x	S	10.4	TJ	10.0	B		20		4	5			NAG08
2005 05 07.61	x	S	10.7	TK	45.7	L	4	68		2.6	6	6 m	170	MUR02
2005 05 07.87		S	10.6	TI	23.5	T	10	94		3	3			LAB02
2005 05 07.90		S	11.0	TK	15	L	6	45		2.8	3			URB01
2005 05 07.93		S	10.9	TK	15.0	R	15	75		1.5	4			DIE02
2005 05 07.95		S	10.8	TK	20.0	L	4	42	&	3	3			SCH04
2005 05 08.03		M	10.7	AU	25.4	J	6	58		3	5			BOU
2005 05 08.03		M	10.8	AU	25.4	J	6	58		3.7	5			DIJ
2005 05 08.05		S	11.1	TK	20.3	T	10	67		2.4	5			BIV
2005 05 08.44		S	10.2	AA	10.0	B		25						SEA
2005 05 08.86		S	10.9	TK	15	L	6	45		2.8	3			URB01
2005 05 08.86		S	11.2	TK	20.3	T	10	67		2.8	5			BIV
2005 05 08.88		M	10.2	TK	13	L	8	69		3.2	4			HOR02
2005 05 08.89	x	S	11.6	TK	20.0	L	9	72		3.0	5			BEG01
2005 05 08.92		M	10.4	AU	15.6	L	5	29		3.5	4/			BOU
2005 05 08.95		S	10.7	TK	20	L	5	70		3.5	3			BAR06
2005 05 09.39		S	10.2	AA	10.0	B		25						SEA
2005 05 09.92		S	10.7	TK	30.5	L	10	75		2.2	s5			KAM01
2005 05 09.92		S	10.8	TK	20	L	5	70		3	3			BAR06
2005 05 09.96		S	11.1	TK	15.0	R	15	75		2	4			DIE02
2005 05 10.73	x	B	11.1	TJ	30.4	L	5	61		1.3	3/			NAG04
2005 05 10.86		S	11.1	TK	15.0	R	15	75		2	4			DIE02
2005 05 10.89		S	10.4	TI	8	R		5		4				SCA02
2005 05 10.90		S	10.6	TK	20.0	L	4	42	&	2	3			SCH04
2005 05 11.86	x	S	11.0	TK	20.0	L	9	72		2	6			BEG01
2005 05 11.87		B	10.6	TK	10.0	R	5	20		3.1	4			HAS02
2005 05 11.88		M	10.3:	TT	15	L	8	92			7			JAN03
2005 05 11.89		M	10.2	TK	13	L	8	69		3	3/			HOR02
2005 05 11.89		S	10.5	TK	20.0	L	4	80		3	2			SCH04
2005 05 11.90		S	11.0	TK	15.0	R	15	75		1.5	4			DIE02
2005 05 11.94		M	10.4	AU	15.6	L	5	29		4	5			BOU
2005 05 11.97		S	10.6	TK	30.5	L	10	75		2.0	s5			KAM01
2005 05 11.97		S	10.8	AU	30.5	T	10	56	&	3.0	2/			COM
2005 05 12.02		S	11.0	TK	40.7	L	4	58		3.0	4			BIV
2005 05 12.16		S	10.3	TK	20.0	T	10	77		1	6			SOU01
2005 05 12.44		S	10.8	TK	10	B		25		3.5	4			MAT08
2005 05 12.83	x	S	10.9	TK	20.0	L	9	72		2	5			BEG01
2005 05 12.85		S	10.4	TI	8	R		5		5				SCA02
2005 05 12.90		M	10.1	TK	13	L	8	69		3.5	3			HOR02
2005 05 12.92		S	10.6	TK	20	L	5	70		3	4			BAR06
2005 05 13.00		M	10.5	AU	31.0	J	6	58		3	5			BOU

Comet 9P/Tempel [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 05 13.00		M	10.8	AU	31.0	J	6	58	2.5	5			DIJ
2005 05 13.79	x	S	11.4	TK	40.0	L	4	144	0.7	5			COO02
2005 05 13.89		S	10.6	TK	15	L	6	45	2.0	2			URB01
2005 05 13.90		M	10.1	TK	13	L	8	69	3.5	3			HOR02
2005 05 14.90		S	10.9	AU	15.0	R	15	75	1.5	5			DIE02
2005 05 14.93	x	S	11.3	TK	20.0	L	9	72	1.5	3			BEG01
2005 05 14.97		S	10.6	TK	20	L	5	70	3	3			BAR06
2005 05 16.02		S	10.8:	TK	14.3	L	6	45	1	4			AMO01
2005 05 16.80		S	10.2	TI	20.0	L		10	5	s3			SCA02
2005 05 16.87		S	11.1	TI	23.5	T	10	94	2	2			LAB02
2005 05 18.10		S	10.2	TK	10.0	B		25	3	5			GON05
2005 05 18.11		S	10.5	TK	20.3	T	10	100	3.5	5			GON05
2005 05 25.88		S	9.8	TK	13	L	8	69	5	1/			HOR02
2005 05 25.89		S	11.5	AU	15.0	R	15	75	1	5			DIE02
2005 05 25.93		S	10.4	TK	20.3	T	10	100	3.5	4			GON05
2005 05 25.94		S	10.2	TK	10.0	B		25	3	4			GON05
2005 05 26.53	x	B	11.4	TJ	30.4	L	5	79	1.0	3			NAG04
2005 05 26.81		S	10.0	TI	8	R		5	7	s4/			SCA02
2005 05 26.89		S	9.8	TK	13	L	8	69	5.5	1/			HOR02
2005 05 26.90		M	10.1	TT	10	B	4	25	4	3			LEH
2005 05 26.91		S	10.2	TK	15	L	6	45	4.0	4/			URB01
2005 05 26.92		S	10.2	TK	10.0	B		25	3.5	4			GON05
2005 05 26.98		S	10.5	TK	14.3	L	6	45	1				AMO01
2005 05 27.85		S	10.1	TI	8	R		5	6	s4/			SCA02
2005 05 27.89		M	9.9	TT	10	B	4	25	5	3			LEH
2005 05 27.89		S	9.8	TK	13	L	8	69	6	2/			HOR02
2005 05 27.90		S	10.4	TK	15	L	6	45	3.3	3/			URB01
2005 05 27.91		S	11.5	AU	15.0	R	15	250	1	3			DIE02
2005 05 27.92		S	10.3	TK	30.5	L	10	75	2.5	4			KAM01
2005 05 27.94		M	10.4	TI	25	L	5	50	3.7	4			HOR03
2005 05 27.94		S	10.2	TK	30.0	L	5	39	& 4	2			SCH04
2005 05 27.99		S	10.3	TK	20.3	T	10	57	2	3			ROB06
2005 05 28.41		S	9.9	AA	10.0	B		25					SEA
2005 05 28.72	x	S	11.5:	TK	40.0	L	4	144	1.4	3			COO02
2005 05 28.76	x	S	10.7	TK	20.0	L	9	72	3.0	3			COO02
2005 05 28.87		M	9.9	TT	10	B	4	25	5	3/			LEH
2005 05 28.90		S	9.8	TK	13	L	8	69	6	2			HOR02
2005 05 28.90		S	10.3	TI	23.5	T	10	57	2	3			LAB02
2005 05 28.92		M	11.7	TJ	41	L	4	89	1.3	3			SHU
2005 05 28.92		S	10.3	TK	15	L	6	93	4.5	3/			URB01
2005 05 28.96		M	10.3	TI	25	L	5	50	4.2	4			HOR03
2005 05 29.70	x	S	11.2	HS	40.0	L	4	144	1.6	4			COO02
2005 05 29.72	x	S	11.3	TK	40.0	L	4	144	1.5	3			BEG01
2005 05 29.90		S	10.3	TK	15	L	6	45	2.5	4			URB01
2005 05 29.91		S	9.8	TK	13	L	8	69	5	2			HOR02
2005 05 30.42		S	10.0	AA	10.0	B		25					SEA
2005 05 30.74	x	S	11.0	HS	40.0	L	4	144	1.6	3/			COO02
2005 05 30.91		S	11.5	AU	15.0	R	15	250	1	3			DIE02
2005 05 30.93		S	10.4	TK	20.3	T	10	77	3.5	5			GON05
2005 05 31.94		M	10.5	AU	30.5	T	10	56	& 3	3/			COM
2005 05 31.94		M	10.5	AU	31.0	J	6	72	2.0	4/			DIJ
2005 05 31.94		S	10.5	AU	31.0	J	6	72	2.5	4/			BOU
2005 05 31.97		S	10.2	TK	30.5	L	10	75	2.5	3/			KAM01
2005 06 01.44		S	10.1	AA	10.0	B		25					SEA
2005 06 01.70	x	S	11.5	TK	40.0	L	4	144	1.8	3			COO02
2005 06 01.90		S	9.7	TK	13	L	8	69	6	2			HOR02
2005 06 02.01		S	10.4	TK	20.3	T	10	77	3.5	4			GON05
2005 06 02.02		S	10.2	TK	10.0	B		25	3.5	4			GON05
2005 06 02.40		S	10.2	AA	10.0	B		25					SEA
2005 06 02.88		S	9.9	TK	15	L	6	45	2.4	3			URB01
2005 06 02.94		S	10.0	TK	20	L	5	70	5	3			BAR06
2005 06 03.84		S	10.0	TI	8	R		5	6	s4			SCA02
2005 06 03.88		M	10.0	TI	10	B		25	4.0	3/			HOR03
2005 06 03.92		S	10.0	TK	15	L	8	48	3.0	2/			URB01
2005 06 04.84		S	10.1	TI	8	R		5	5	s4			SCA02

Comet 9P/Tempel [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 06 04.87		S	10.4	TK	36	L	6	80	3.8	3			BAR06
2005 06 04.90		S	10.0	TI	23.5	T	10	57	3	3			LAB02
2005 06 04.99		M	10.0	NP	12.5	B		20	2.5	4			MAR02
2005 06 05.00		S	10.6	TK	14.3	L	6	45	1	4			AMO01
2005 06 05.51	x	M	10.4	TK	25.4	L	4	46	2.8	5			YOS02
2005 06 05.96		S	10.3	TK	20.3	T	10	77	3.5	4			GON05
2005 06 05.97		S	10.1	TK	10.0	B		25	3.5	4			GON05
2005 06 06.31		S	11.6	AU	31.7	L	5	64	1	0			JON
2005 06 06.50		S	10.1	TJ	40.0	L	4	75	2.9	4/			YOS04
2005 06 06.88		S	9.6	TT	8.0	B		10	6	2			HOR02
2005 06 07.32		S	11.8	AU	31.7	L	5	64	1	0			JON
2005 06 07.41		S	10.2	AA	10.0	B		25					SEA
2005 06 08.88		S	9.7	TT	8.0	B		10	7	2/			HOR02
2005 06 08.89		S	10.3	TK	20	L	5	70	3.5	3			BAR06
2005 06 08.97		M	10.2	NP	25.5	L	5	60	1.5	3			MAR02
2005 06 08.99		S	10.3	TK	20.3	T	10	77	3.5	4			GON05
2005 06 09.00		S	10.1	TK	10.0	B		25	3.5	4			GON05
2005 06 09.70	x	S	11.4	TK	40.0	L	4	144	1.2	3			COO02
2005 06 09.81	x	S	10.5	TK	6.0	B		15	5.5	5			BEG01
2005 06 09.92		S	10.4	TK	30.5	L	10	75	2.2	3			KAM01
2005 06 10.92		S	9.8	TT	8.0	B		10	7	2			HOR02
2005 06 11.88		S	10.4	TK	36	L	6	80	3	3			BAR06
2005 06 12.27		S	10.9	TK	20	L	4	107	1.0	4			LIN04
2005 06 12.87	x	S	10.8	TK	6.0	B		15	6	4			BEG01
2005 06 13.26		S	11.1	TK	20	L	4	107	1.5	5			LIN04
2005 06 13.68	x	S	11.0	TK	40.0	L	4	144	1.5	2/			COO02
2005 06 13.91		S	10.2:	TK	20	L	5	70	3.5	3			BAR06
2005 06 14.68	x	S	10.9	TK	40.0	L	4	144	1.6	2			COO02
2005 06 19.88		S	10.6	TI	23.5	T	10	94	3	2			LAB02
2005 06 23.71	x	S	10.0	TK	6.0	B		15	6	3			BEG01
2005 06 23.89		S	10.2	TT	13	L	8	69	4.5	1/			HOR02
2005 06 24.87		S	9.8	TI	23.5	T	10	94	3	3			LAB02
2005 06 24.90		S	9.5	TK	7	R	14	50	6.3	2			URB01
2005 06 25.71		S	10.7:	TK	20.3	L	5	40	2.5				VAN15
2005 06 25.72	x	S	9.8	TK	6.0	B		15	8	4			BEG01
2005 06 25.96		S	10.1	TK	20.3	T	10	77	5	4			GON05
2005 06 25.97		S	9.8	TK	10.0	B		25	6	3			GON05
2005 06 26.96		S	10.2	TK	20.3	T	10	77	5	4			GON05
2005 06 26.97		S	9.9	TK	10.0	B		25	6	3			GON05
2005 06 27.72		S	10.4	TK	20.3	L	5	40	3	0			VAN15
2005 06 27.93		S	10.3	TK	36	L	6	80	3	3			BAR06
2005 06 28.69		S	9.9	TI	8.0	B		11	3	3	2 m		LAB02
2005 06 28.88		S	9.4	TK	7	R	14	50	6.5	1/			URB01
2005 06 28.89		S	9.7	TT	13	L	8	69	6	1/			HOR02
2005 06 29.24		S	10.9	TK	20	L	4	107	2.0	5			LIN04
2005 06 29.83	x	S	10.0	TK	6.0	B		15	6	3			BEG01
2005 06 29.90		S	11.0:	TK	14.3	L	6	45					AMO01
2005 06 29.93		S	10.3	TK	36	L	6	80	3	3			BAR06
2005 06 30.69		S	10.9	AC	40.0	L	4	144	1.3	1			COO02
2005 06 30.83	x	S	10.0	TK	6.0	B		15	5	3			BEG01
2005 07 01.66		S	10.0	TI	8.0	B		11	3	3	2 m		LAB02
2005 07 01.69		S	10.9	AC	40.0	B	4	73	1.2	2			COO02
2005 07 01.82	x	S	10.2	TK	6.0	B		15	4	2			BEG01
2005 07 01.92		S	10.8:	TK	14.3	L	6	45					AMO01
2005 07 01.96		S	10.3	TK	20.3	T	10	77	3	3			GON05
2005 07 01.97		S	10.1	TK	10.0	B		25	4	3			GON05
2005 07 02.25		S	11.0	TK	20	L	4	107	2.2	5			LIN04
2005 07 02.50	x	S	10.9	TJ	32.0	L	5	58	2.8	3			NAG08
2005 07 02.69		S	11.2	AC	40.0	B	4	144	1.2	3			COO02
2005 07 02.85	x	S	11.1	TK	30.0	T	10	150	3.1	3			STR03
2005 07 02.88	x	S	10.4	TK	6.0	B		15	3	3			BEG01
2005 07 02.88		S	10.4	TK	36	L	6	80	2.5	3			BAR06
2005 07 02.89		S	9.9	AU	8.0	B		15	4	3/			BOU
2005 07 02.89		S	10.8:	TK	14.3	L	6	45					AMO01
2005 07 02.91	&	S	11.7:	HS	32.0	L		144					PIL01

Comet 9P/Tempel [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 07 02.96		S	10.5	TK	20.3	T	10	77	3	3			GON05
2005 07 02.97		S	10.3	TK	10.0	B		25	3	2			GON05
2005 07 02.98		S	11.1	NP	44.5	L	5	65	3	2			MAR02
2005 07 03.09		S	10.6	TJ	25.4	L	4	44	& 2.5	1/			GRE
2005 07 03.43		S	10.1:	AA	10.0	B		25					SEA
2005 07 03.70		S	11.6	AC	40.0	L	4	144		1/			COO02
2005 07 03.72		S	10.9	TK	20.3	L	5	40	3	0			VAN15
2005 07 03.85	x	S	11.1	TK	30.0	T	10	150	3.0	2			STR03
2005 07 03.87	x	S	10.5	TK	6.0	B		15	4	2			BEG01
2005 07 03.89		S	9.9	TT	13	L	8	69	4.5	2			HOR02
2005 07 03.89		S	10.4	AU	31.0	J	6	72	2.0	2/			DIJ
2005 07 03.89		S	10.4	AU	31.0	J	6	72	2.5	3/			BOU
2005 07 03.89		S	11.0:	TK	30.5	L	10	75	& 2.0	1			KAM01
2005 07 03.95		S	10.8	TK	14.3	L	6	45					AMO01
2005 07 04.237		S	11.2	TK	20	L	4	107	2.2	4			LIN04
2005 07 04.245		S	11.2	TK	20	L	4	107	2.2	4			LIN04
2005 07 04.250		S	11.1	TK	20	L	4	107	2.2	6			LIN04
2005 07 04.258		S	10.9	TK	20	L	4	107	2.2	7			LIN04
2005 07 04.267		S	10.7	TK	20	L	4	107	2.2	8			LIN04
2005 07 04.65		S	9.9	TI	8.0	B		11	3	3	2 m		LAB02
2005 07 04.70	x	S	11.0	TK	40.0	T	10	290	3.5	5			STR03
2005 07 04.70		S	11.2	AC	40.0	L	4	144	1.1	6			COO02
2005 07 04.76		S	10.6	TK	20.3	L	5	40	1.5	1			VAN15
2005 07 04.89		S	10.5	TK	36	L	6	80	2	3			BAR06
2005 07 04.93		S	10.1	TK	20.3	T	10	77	4	6			GON05
2005 07 04.94		S	9.9	TK	10.0	B		25	5	4			GON05
2005 07 04.99		S	10.5	TK	20	T	10	63	3	5			SOU01
2005 07 05.00	x	S	10.5	TK	10	B		25		6/			DES01
2005 07 05.09		S	10.1	TJ	25.4	L	4	44	& 4	2/			GRE
2005 07 05.10		S	10.1:	TJ	10.0	B		25	& 5	1			GRE
2005 07 05.26		S	11.0	TK	20	L	4	107	2.2	5			LIN04
2005 07 05.42		S	10.2	AA	10.0	B		25					SEA
2005 07 05.72		S	11.2	TK	20.3	L	5	40	2	0			VAN15
2005 07 05.77	x	S	11.4	TK	40.0	L	4	144	1.2	1			COO02
2005 07 05.80	x	S	10.0	TK	6.0	B		15	5	5			BEG01
2005 07 05.90		S	10.5	AU	31.0	J	6	58	2.5	3/			DIJ
2005 07 05.90		S	10.5:	TK	30.5	L	10	75	& 1.5	3			KAM01
2005 07 05.93		S	10.2	TK	20.3	T	10	77	4	5			GON05
2005 07 05.94		S	9.9	TK	10.0	B		25	5	4			GON05
2005 07 06.26		S	11.0	TK	20	L	4	107	2.4	4			LIN04
2005 07 06.72		S	11.1	TK	20.3	L	5	40	2.5	1/			VAN15
2005 07 06.80	x	S	11.2	TK	40.0	T	10	290	4	2			STR03
2005 07 06.87		S	10.0	TT	13	L	8	69	4	2/			HOR02
2005 07 06.88		S	10.4	AU	31.0	J	6	58	2.3	3/			DIJ
2005 07 06.88		S	10.4	AU	31.0	J	6	58	2.5	4			BOU
2005 07 06.89		S	10.0	AU	8.0	B		15	3.5	3			BOU
2005 07 06.89		S	11.0	TI	20	T	10	80	3	2			LAB02
2005 07 06.90		S	10.8	TK	14.3	L	6	45					AMO01
2005 07 06.99	x	S	10.1	TK	10	B		25		6/			DES01
2005 07 07.00	x	S	10.3	TK	10	B		25		6/			DES01
2005 07 07.78	x	S	11.2	TK	40.0	L	4	144	1.5	3			COO02
2005 07 07.90		S	10.5	TK	14.3	L	6	45	1	3			AMO01
2005 07 07.93		S	10.2	TK	20.3	T	10	77	4	5			GON05
2005 07 07.94		S	10.0	TK	10.0	B		25	5	4			GON05
2005 07 08.72		S	10.8	TK	20.3	L	5	40	2.5	1			VAN15
2005 07 08.82	x	S	10.1	TK	6.0	B		15	5	3			BEG01
2005 07 08.88		S	10.5	AU	31.0	J	6	58	2.8	3/			BOU
2005 07 08.89		S	10.6	AU	31.0	J	6	58	2.0	2/			DIJ
2005 07 08.99	x	S	10.3	TK	10	B		25		6			DES01
2005 07 10.02	x	S	10.4	TK	10	B		25		6			DES01
2005 07 10.88		S	10.5	TI	20	T	10	50	3	4			LAB02
2005 07 10.89		S	10.8	TK	31.0	J	6	58	2.5	3			BOU
2005 07 10.89		S	10.9	TK	31.0	J	6	58	2.1	1/			DIJ
2005 07 10.99		S	10.8	TK	14.3	L	6	45					AMO01
2005 07 11.89		S	10.9	TK	31.0	J	6	58	2.7	2			BOU

Comet 9P/Tempel [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 07 11.89		S	11.0	TK	31.0	J	6	58	2.1	1			DIJ
2005 07 11.91		S	10.7	TK	14.3	L	6	45					AMO01
2005 07 11.95		S	10.4	TK	20.3	T	10	77	3	4			GON05
2005 07 28.49		S	10.5	TJ	40.0	L	4	144	1.6	3			YOS04
2005 07 29.87		S	12.1	TI	23.5	T	10	94	2	2			LAB02
2005 07 29.91		S	10.8	TK	20.3	T	10	100	3	3			GON05
2005 07 30.91		S	10.9	NP	44.5	L	5	65	3.5	2			MAR02
2005 07 30.99		S	10.9	TK	10	B		25	3	2			DES01
2005 07 30.99		S	11.0	TK	10.0	B		25	2	2			SOU01

Comet 10P/Tempel

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1983 07 07.05		S	10.0:	AC	11.0	B		20	7	1			CHE03
1983 07 09.05		B	9.7	AC	11.0	B		20	8	1			CHE03
1983 07 12.03		B	9.5	AC	11.0	B		20	8	2			CHE03
1983 07 13.00		B	9.4	S	11.0	B		20	8	1			CHE03
1983 07 14.05		B	9.5	S	11.0	B		20	7	1			CHE03
1983 07 17.05		B	9.9	AC	11.0	B		20	7	1			CHE03
1983 07 21.07		S	10.1	AC	11.0	B		20	7	1			CHE03
1988 07 06.77		S	11.5:	AC	25.0	C	5	36	1	1			CHE03
1988 07 07.78			[11.5		11.0	B		20	! 1				CHE03
1988 07 10.79		B	11.6	AC	25.0	C	5	48	1.5	1			CHE03
1988 07 12.80		S	11.0:	AC	11.0	B		20	2	1			CHE03
1988 07 12.81		S	11.2	AC	25.0	C	5	48	2	1			CHE03
1988 07 13.78		S	11.0	AC	25.0	C	5	48	3	1			CHE03
1988 07 14.78		B	10.8	AC	25.0	C	5	36	4	1			CHE03
1988 07 15.79		B	10.9	AC	25.0	C	5	36	5	1			CHE03
1988 07 16.80		B	11.2	AC	25.0	C	5	36	5	1			CHE03
1988 07 17.72		B	10.8	AC	25.0	C	5	36	6	1			CHE03
1988 07 18.73		B	10.7	AC	25.0	C	5	36	5	1			CHE03

Comet 19P/Borrelly

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1987 12 13.77		M	7.7	AA	8.9	R	5	18	4	5			VEN01
1987 12 16.90		M	7.5	AA	8.9	R	5	18	6	5			VEN01
1987 12 21.79		M	8.0	AA	8.9	R	5	18	4	4			VEN01
1987 12 24.85		M	7.7	AA	8.9	R	5	18	6	5			VEN01
1994 10 05.19		S	9.1	AA	10.0	B		20	2.8	5			BOR
1994 10 08.13		S	8.3	AC	15.0	R		85	5	3			DIE02
1994 10 11.12		S	8.3	AC	15.0	R		85	6	3			DIE02
1994 10 12.15		S	8.3	AC	15.0	R		85	6	3			DIE02
2001 08 18.36		S	11.6	AC	44.5	L	4	167	0.6	3			MOR03
2001 08 27.35		S	11.6	AC	44.5	L	4	167	0.8	3			MOR03
2001 08 29.36		S	11.1	AC	15	R	5	62	1.2	2			MOR03
2001 08 30.36		S	11.1	AC	44.5	L	4	80	1.2	3			MOR03
2001 09 14.36		S	10.7	AC	15	R	5	42	2	3			MOR03
2001 09 16.38		S	10.2	AC	15	R	5	42	2.5	3			MOR03
2001 10 15.39		S	10.2	AC	15	R	5	42	2.5	2			MOR03
2001 10 18.38		S	10.2	AC	15	R	5	42	3	3			MOR03
2001 10 22.39		S	10.4	AC	15	R	5	42	3	2			MOR03
2001 10 30.41		S	10.6	AC	15	R	5	42	2.5	3			MOR03
2001 11 11.44		S	11.4	AC	15	R	5	62	2.0	2			MOR03
2001 11 13.41		S	11.7	AC	44.5	L	4	80	1.8	2			MOR03
2001 11 22.43		S	11.4	AC	44.5	L	4	80	1.8	2			MOR03
2001 12 11.41		S	12.4	AC	44.5	L	4	167	0.9	2			MOR03
2001 12 22.28		S	12.5	AC	44.5	L	4	167	0.9	3			MOR03

Comet 21P/Giacobini-Zinner

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 07 08.87		B	10.5:	AC	48.0	L	5	65	1.3	4			CHE03
1985 07 09.87		B	10.8:	AC	48.0	L	5	65	2.2	4			CHE03
1985 07 20.90		B	10.5	AC	48.0	L	5	65	1.6	5	0.1		CHE03

Comet 21P/Giacobini-Zinner [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 07 22.79		B	9.4	S	11.0	B		20	2	5	0.1		CHE03
1985 07 25.80		B	9.3	S	11.0	B		20	3	5	0.1		CHE03
1985 07 27.90		B	9.6	S	20.0	R	15	120	3	5			CHE03
1985 07 28.93		B	9.2	S	11.0	B		20	3	5	0.1		CHE03
1985 08 11.87		B	8.2	S	6.0	B		20	4	5			CHE03
1985 08 12.87		B	8.3:	S	6.0	B		20	4	4	0.1		CHE03
1985 08 26.95		B	7.7:	S	11.0	B		20	6	5	0.1		CHE03
1985 08 27.99		B	7.6:	S	11.0	B		20	6	5			CHE03
1985 09 11.94		B	8.4	S	11.0	B		20		6			CHE03
1985 09 12.95		B	9.0:	S	48.0	L	5	65			0.2	275	CHE03
1985 09 13.95		B	8.6:	S	11.0	B		20		5			CHE03
1985 09 16.95		B	8.9	S	11.0	B		20					CHE03
1998 08 15.94	x	M	12.8	HS	40	L	4	150	1	5			REN
1998 08 25.87	x	M	12.7	HS	40	L	4	94	1	4/			REN
1998 09 13.93	x	M	12.2	HS	40	L	4	94	1	6			REN
1998 09 17.86	x	M	12.0	HS	40	L	4	94	1	5/			REN
1998 09 20.89	x	M	11.6	HS	12	L	6	70	& 1	5/			REN
1998 10 16.80	x	M	10.2	TT	12	L	6	38	3	5			REN
1998 10 19.82	x	M	10.1	TT	12	L	6	38	3	5			REN
1998 10 23.80	x	M	10.1	TT	12	L	6	38	3	5/			REN
1998 11 10.77	x	M	9.9	TT	12	L	6	38	3	5	0.07	60	REN
1998 11 15.81	x	M	9.7	TT	12	L	6	38	4	5/			REN
1998 12 21.78	x	M	11 :	HS	40	L	4	94	2	5			REN
1999 01 05.76	x	M	12.8	HS	40	L	4	94	2	4/			REN
2005 05 02.15		B	12.3	TK	20.3	T	10	100	0.8	6			GON05
2005 05 03.74		S	12.1	AU	40.0	L	4	144	1.1	4			YOS04
2005 05 04.76		S	11.7:	AU	40.0	L	4	144	0.8	3			YOS04
2005 05 05.07		S	11.9	AU	25.4	J	6	88	1.2	4			BOU
2005 05 06.12		S	11.4	TK	20.3	T	10	67	2.0	5	0.07	260	BIV
2005 05 07.10		S	11.1	TK	20.3	T	10	67	2.4	5	0.07	260	BIV
2005 05 07.14		S	11.8	TK	20.3	T	10	100	2.3	5			GON05
2005 05 07.76		S	10.6	AU	25.4	L	4	46	2.9	3			YOS02
2005 05 07.76	x	S	10.7	HS	45.7	L	4	68	3	6			MUR02
2005 05 08.05		S	11.7	AU	25.4	J	6	88	1.5	4			BOU
2005 05 08.06		S	11.9:	AU	25.4	J	6	88	1	2			DIJ
2005 05 10.77	x	B	11.2	TJ	30.4	L	5	79	1.2	4			NAG04
2005 05 12.10		S	11.6:	TK	40.7	L	4	116	1.5	5			BIV
2005 05 12.83		S	11.5:	TK	10	B		25	2	3			MAT08
2005 05 13.05		S	11.3	AU	31.0	J	6	89	1.8	3			BOU
2005 05 13.05		S	11.5	AU	31.0	J	6	89	1.6	2			DIJ
2005 05 18.12		S	11.2	TK	20.3	T	10	100	2.5	5			GON05
2005 05 28.02		M	9.9	TT	10	B	4	25	6	4			LEH
2005 05 29.01		S	10.8	TK	15	L	6	93	3.7	4			URB01
2005 05 30.00		S	10.6	TK	15	L	6	93	4.1	2/			URB01
2005 06 02.09		S	10.5	TK	20.3	T	10	77	2.5	4			GON05
2005 06 05.10		S	10.9	TI	23.5	T	10	94	2	3			LAB02
2005 06 05.75	x	B	10.8	TJ	25.0	H	3	57	1.0	4/			NAG04
2005 06 06.11		S	10.2	TK	20.3	T	10	77	3.0	4			GON05
2005 06 13.76	x	B	10.6	TJ	30.4	L	5	79	1.1	4			NAG04
2005 06 16.09		S	9.9	TK	20.3	T	10	77	3.0	5			GON05
2005 06 16.10		S	9.6	TK	10.0	B		25	3.5	4			GON05
2005 07 02.12		S	9.7	TK	20.3	T	10	77	3	4			GON05
2005 07 02.99		S	9.2	TI	8.0	B		11	3	3	3 m		LAB02
2005 07 03.11		S	9.4	TK	20.3	T	10	77	4	4			GON05
2005 07 06.08		M	10.2	TK	31.0	J	6	58	2	4/			BOU
2005 07 06.08		S	9.9	TK	31.0	J	6	58	1.5	4/			DIJ
2005 07 06.11		S	9.4	TK	20.3	T	10	77	4	4	0.1	280	GON05
2005 07 09.08		S	10.1	TK	31.0	J	6	72	1.4	4			DIJ
2005 07 09.09		S	10.4	TK	31.0	J	6	72	2.0	4/			BOU
2005 07 11.08		S	10.5	TK	31.0	J	6	72	2.0	4			BOU
2005 07 11.08		S	10.6	TK	31.0	J	6	72	2.0	2			DIJ
2005 07 14.09		S	10.6	TK	31.0	J	6	72	1.8	3			BOU
2005 07 14.09		S	10.7	TK	31.0	J	6	72	1.4	2			DIJ
2005 07 15.10		S	10.3	TK	31.0	J	6	72	1.8	3			DIJ
2005 07 15.10		S	10.6	TK	31.0	J	6	72	2.4	3/			BOU

Comet 21P/Giacobini-Zinner [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 07 16.12		S	9.8	TK	20.3	T	10	77	4	4			GON05
2005 07 19.13		S	9.8	TK	20.3	T	10	77	4	4			GON05
2005 07 28.76		S	9.9:	TJ	40.0	L	4	144	1.7	3/			YOS04

Comet 29P/Schwassmann-Wachmann

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1994 02 01.02		S	11.0	HS	20.3	T	10	100	0.8	2			MID01
2004 10 09.47		S	11.9	TK	38	L	5	150	0.5	7			MAT08
2004 11 16.50		S	11.9	TK	38	L	5	75	2	3			MAT08
2005 01 08.74		S	11.8	HS	20.0	L	5	111	1.5	5			NAG09
2005 01 08.82		S	12.5	HS	27.0	L	6	120	0.6	5			TOT03
2005 01 11.81		S	12.2	HS	27.0	L	6	120	0.6	6			TOT03
2005 01 13.71		S	12.8	HS	34.0	L	4	150	0.7	3			SZA
2005 02 05.73		S	13.0	HS	36	L	6	90	1.0	3			BAR06
2005 02 07.73		S	13.1	HS	36	L	6	90	0.9	3			BAR06
2005 02 10.73		S	13.3	HS	36	L	6	90	1.0	3			BAR06
2005 07 15.04		S	[13.3	AU	31.0	J	6	109	! 1.0				BOU
2005 07 15.05		S	[13.3	AU	31.0	J	6	109	! 1.5				DIJ

Comet 31P/Schwassmann-Wachmann

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1994 02 03.51		S	11.5	SM	15.2	L	8	48	1	2			CAM03
1994 02 05.48		S	11.5	SM	20.3	L	7	56	1	3			CAM03
1994 02 07.55		S	11.5	SM	20.3	L	7	56	1.5	3			CAM03

Comet 32P/Comas Solá

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2004 11 16.60		S	14.0	HS	38	L	5	75	0.5	6			MAT08
2005 01 07.78		S	11.8	HS	27.0	L	6	120	1.8	3			TOT03
2005 01 09.86		S	[12.6	HS	20.0	L	5	111	! 1				NAG09
2005 01 11.82		S	12.3	HS	27.0	L	6	120	1.1	2			TOT03
2005 02 05.82		S	12.7	HS	36	L	6	90	1.0	2			BAR06
2005 02 07.82		S	12.8	HS	36	L	6	90	1.0	2			BAR06
2005 02 08.80		M	12.5	TJ	41	L	4	113	1	3			SHU
2005 02 10.82		S	13.1	HS	36	L	6	90	0.7	2			BAR06
2005 03 02.81		S	12.8	HS	36	L	6	90	1.0	2			BAR06
2005 03 13.79		S	13.6	HS	34.0	L	4	166	0.6	2			SZA
2005 05 04.48		S	12.7	TA	40.0	L	4	144	0.8	3			YOS04
2005 05 07.51	x	S	12.1	HS	45.7	L	4	170	1.8	4			MUR02
2005 06 04.91		S	13.9	NP	44.5	L	5	100	0.5	2			MAR02

Comet 37P/Forbes

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 05 03.69		S	[11.7	AU	40.0	L	4	144	! 1.2				YOS04
2005 06 08.97		S	12.2	TK	20.3	T	10	133	0.7	3			GON05
2005 07 02.90		S	12.9	NP	44.5	L	5	100	1.5	1/			MAR02
2005 07 05.91		S	12.2	AU	31.0	J	6	89	0.7	2			BOU
2005 07 05.92		S	11.8	AU	31.0	J	6	89	1.0	2/			DIJ
2005 07 06.90		S	12.2	AU	31.0	J	6	89	0.7	3			BOU
2005 07 06.91		S	12.4	AU	31.0	J	6	89	0.6	0/			DIJ
2005 07 08.90		S	12.0	AU	31.0	J	6	109	1.1	0/			DIJ
2005 07 08.90		S	12.3	AU	31.0	J	6	109	0.8	2			BOU
2005 07 10.90		S	12.4	AU	31.0	J	6	109	0.6	1			DIJ
2005 07 10.91		S	12.1	AU	31.0	J	6	109	1.0	3/			BOU
2005 07 30.90		S	11.8	NP	44.5	L	5	100	2	2			MAR02
2005 07 30.91		S	12.2	NP	44.5	L	5	100	1	3			SAN04

Comet 43P/Wolf-Harrington

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1997 09 07.16		M	14.5:	EA	40	L	4	148	0.75	5			REN

Comet 43P/Wolf-Harrington [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1997 09 10.12		M	13.8	EA	40	L	4	148	0.75	5			REN
1997 10 01.17		M	13.1	EA	40	L	4	94	0.75	5			REN
1997 10 29.20		M	12.8	EA	40	L	4	94	1	4/	0.04	295	REN
1997 11 30.23		M	13.4	VF	40	L	4	94	1.5	4		270	REN
1997 12 07.11		M	12.7	VF	40	L	4	94	1	4/		290	REN
1998 01 04.15		M	13.5:	VF	40	L	4	94	0.75	5			REN
2004 01 16.00		S	13.8	AC	44.5	L	4	167	0.4	2			MOR03
2004 03 11.04		S	14.0	AC	44.5	L	4	167	0.5	3			MOR03

Comet 46P/Wirtanen

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1997 02 05.79		M	12.5:	VF	40	L	4	94	1	3			REN
1997 02 08.79		M	12.0	VF	40	L	4	94	1	4			REN
1997 02 27.81		M	11.5:	VF	40	L	4	94	2.5	4			REN
1997 03 01.81		M	10.8	VF	40	L	4	94	2.5	4			REN
1997 03 09.82		S	10 :	VF	12	L	6	38	& 2	4			REN
1997 03 10.83		M	10.7	VF	40	L	4	94	2.25	4			REN
1997 03 28.84		M	11.4	VF	40	L	4	94	1.5	4			REN
1997 04 01.84			[11 :		12	L	6	68					REN
1997 04 04.85		M	11.7	VF	40	L	4	94	1.67	4			REN
1997 04 08.87		M	11.8	VF	40	L	4	94	2	4			REN
1997 05 01.89		S	11.7	VF	40	L	4	94	1.67	3/			REN
1997 05 25.92			[12.5:		40	L	4	148					REN
1997 05 26.92			[13.0:		40	L	4	148					REN

Comet 47P/Ashbrook-Jackson

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 10 23.79	x	S	13.0:	HS	40	L	4	150	1	5			REN
2000 11 17.80	x	S	13.5:	HS	40	L	4	150	0.8	3			REN
2000 11 23.78	x	S	13.5	HS	40	L	4	150	1	4			REN
2000 12 16.76	x	S	14.3:	HS	40	L	4	250	0.5	5			REN
2000 12 21.77	x	S	14.0	HS	40	L	4	190	0.75	5			REN

Comet 49P/Arend-Rigaux

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 02 08.72		M	13.4	TJ	41	L	4	178	0.7	3/			SHU
2005 02 10.81		S	13.2	HS	36	L	6	90	1.1	3/			BAR06
2005 02 28.77		S	13.3	HS	27.0	L	6	120	0.7	2/			TOT03
2005 03 13.78		S	13.6	HS	34.0	L	4	166	0.5	3			SZA
2005 03 13.81		S	12.9	HS	27.0	L	6	120	1.2	3			TOT03
2005 03 29.80		S	13.0:	HS	36	L	6	90	0.6	2			BAR06
2005 03 31.87		S	13.3	HS	25.6	L	5	169	0.9	5			BIV
2005 04 01.92		S	13.2:	HS	40.7	L	4	233	0.9	3			BIV
2005 04 04.73		S	13.3	HS	36	L	6	90	0.8	3			BAR06
2005 04 10.91		S	13.6	HS	40.7	L	4	116	0.9	4			BIV
2005 05 04.46		S	[13.3	AU	40.0	L	4	144	! 0.9				YOS04

Comet 52P/Harrington-Abell

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1998 08 19.07	x	M	13.0	HS	40	L	4	94	1	5			REN
1998 08 29.08	x	M	13.5	HS	40	L	4	150	0.75	4		270	REN
1998 09 22.12	x	M	14.0	HS	40	L	4	94	1	3	& 3 m	270	REN
1998 10 23.99	x	M	13.7	HS	40	L	4	150	& 1	3			REN
1998 11 10.95	x	M	13.1	HS	40	L	4	94	0.75	5		270	REN
1998 11 15.93	x	M	13.3	HS	40	L	4	94	0.75	5			REN
1998 11 20.97	x	M	12.8	HS	40	L	4	94		5/	1.5m	265	REN
1998 11 24.00	x	M	12.3	HS	40	L	4	94	0.75	5/	1.5m	270	REN
1998 12 20.96	x	M	12.1	HS	40	L	4	94	0.75	5	1.5m	260	REN
1999 01 05.84	x	M	11.0	HS	40	L	4	94	1.5	5/		240	REN
1999 01 11.87	x	M	11.8	HS	12	L	6	70	1.75	4/			REN
1999 01 14.92	x	M	11.9	HS	40	L	4	94	1	5			REN

Comet 52P/Harrington-Abell [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1999 02 09.87	x	M	12.9	HS	40	L	4	94	1.75	4/			REN
1999 02 13.90	x	M	12.7	HS	40	L	4	94	1.33	4/			REN
1999 03 14.91		M	14.6	EA	40	L	4	170	1	4			REN

Comet 55P/Tempel-Tuttle

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1997 12 27.15		M	14.0	VF	40	L	4	94	& 2	2			REN
1998 01 04.10		M	11.5:	VF	40	L	4	57	3	2			REN
1998 01 08.17		M	10.0	VF	12	L	6	38	5	2			REN
1998 01 16.86		M	9.0	VF	8.0	B		12	10	3			REN
1998 01 16.86		M	9.0	VF	12	L	6	38	8	2			REN
1998 01 20.85		M	8.7	AA	8.0	B		12	10	2			REN
1998 01 22.97		M	9.2	AA	8.0	B		12	7	2			REN
1998 01 27.83		M	8.9	AA	8.0	B		12	5	2/			REN
1998 02 13.81		M	9.5	AA	12	L	6	38	4	4/			REN
1998 02 18.81		M	9.8	AA	12	L	6	38	2.5	5			REN
1998 02 21.81		M	9.8	AA	12	L	6	38	3	5			REN

Comet 62P/Tsuchinshan

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 01 11.97		S	12.5	HS	27.0	L	6	120	1.7	2			TOT03
2005 01 13.98		S	12.7	HS	27.0	L	6	120	1.4	2			TOT03
2005 01 16.02		S	11.9	HS	20.0	L	5	83	3	1/			NAG09
2005 02 05.97		S	12.4	HS	36	L	6	80	1.8	2/			BAR06
2005 02 10.95		S	12.6	HS	36	L	6	80	1.7	2			BAR06
2005 03 02.90		S	12.9	HS	36	L	6	80	0.9	2			BAR06
2005 04 05.99		S	[13.6	HS	36	L	6	80	! 1				BAR06
2005 05 03.51		S	[13.8	AU	40.0	L	4	144	! 0.8				YOS04
2005 06 04.96		S	14.4	NP	44.5	L	5	154	0.5	1			MAR02
2005 07 02.94		S	13.6	NP	44.5	L	5	100	1	1			MAR02

Comet 63P/Wild

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 02 09.19	x	S	15.0:	HS	40	L	4	200	& 0.5	4			REN
2000 02 12.17	x	S	15.0	HS	40	L	4	200	& 0.5	4/			REN

Comet 69P/Taylor

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1998 01 20.91	x	M	14.0	HS	40	L	4	94	0.7	5/			REN
1998 01 22.90	x	M	13.7	HS	40	L	4	94	0.7	6			REN
1998 01 31.98	x	M	13.3	HS	40	L	4	94	1.25	6			REN
1998 02 03.12	x	M	13.2	HS	40	L	4	94	1.25	5/			REN
1998 02 17.86	x	M	12.1	HS	40	L	4	94	0.8	6/			REN
1998 03 20.85	x	M	13.9	HS	40	L	4	150	1	4			REN
1998 03 22.87	x	M	13.7	HS	40	L	4	94	1	4			REN

Comet 78P/Gehrels

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1997 09 03.14		M	13.3	CE	40	L	4	150	1	5/			REN
1997 09 07.12	x	M	13.2	HS	40	L	4	150	1	5/	0.03	270	REN
1997 09 10.14	x	M	13.2	HS	40	L	4	150	1	5/		270	REN
1997 10 01.14	x	M	13.4	HS	40	L	4	94	1	5			REN
1997 10 11.11	x	M	13.5	HS	40	L	4	94	0.75	5			REN
1997 10 29.13		M	12.6	EA	40	L	4	94	1	4/			REN
1997 11 30.11		M	13.0	EA	40	L	4	94	1	5			REN
1997 12 07.04		M	13.0	EA	40	L	4	94	1	4/			REN
1997 12 09.09	x	M	12.9	HS	40	L	4	94	1.25	5			REN
1997 12 26.87	x	M	12.8	HS	40	L	4	94	& 1				REN
1998 01 20.92	x	M	14.2	HS	40	L	4	94	1	4/			REN
1998 01 22.82	x	M	13.1	HS	40	L	4	94	0.75	4/			REN

Comet 78P/Gehrels [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2004 10 09.61		S	12.0	TK	38	L	5	150	2	3			MAT08
2004 11 16.53		S	10.1	TK	10	B		25	2	6			MAT08
2005 01 05.80		S	10.8	HS	11.4	L	5	50	2.5	2			SAN07
2005 01 08.75		S	10.4	HS	40.5	L	4	70	1.7	s5	1.7m	70	SAR02
2005 01 08.83		S	11.3	HS	27.0	L	6	83	1.6	4/	1 m	70	TOT03
2005 01 09.85		S	11.4	HS	20.0	L	5	40	2	4			NAG09
2005 01 11.81		S	11.6	HS	27.0	L	6	120	1.6	3			TOT03
2005 01 13.73		S	11.4	HS	34.0	L	4	150	1	2			SZA
2005 02 05.77		S	11.9	HS	36	L	6	90	2.6	3			BAR06
2005 02 07.78		S	11.9	HS	36	L	6	90	2.5	3			BAR06
2005 02 08.69		M	12.3	TJ	41	L	4	89	1	3/			SHU
2005 02 10.84		S	12.5:	HS	36	L	6	90	1.2	2			BAR06
2005 02 28.78		S	13.0	HS	27.0	L	6	120	0.8	2			TOT03
2005 03 29.81		S	13.3	HS	36	L	6	90	0.7	3			BAR06
2005 04 01.90		S	12.6:	HS	40.7	L	4	116	1.4	2			BIV
2005 05 03.46		S	[12.7	AU	40.0	L	4	144	! 1.0				YOS04

Comet 81P/Wild

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 12 08.08		M	13.6	EA	40	L	4	94	0.5	5			REN
1996 12 15.04		M	12.8	EA	40	L	4	94	1	5			REN
1997 01 13.04		M	12.1	EA	40	L	4	94	1.25	6	&0.02	280	REN
1997 01 16.07		M	11.8	EA	40	L	4	94	1.33	6	0.03	285	REN
1997 01 28.83		M	10.9	VF	40	L	4	57	1.5	5/			REN
1997 02 05.90		M	11.6	VF	40	L	4	57	2.5	6			REN
1997 02 06.93		M	11.0	VF	12	L	6	38	2	5/			REN
1997 02 26.89		M	10.8	VF	12	L	6	38	2.25	6			REN
1997 03 10.95		M	10.7	VF	12	L	6	38	2.5	5/			REN
1997 03 30.98		M	11.5	VF	40	L	4	94	1.5	5/			REN
1997 04 01.86		M	10.5	VF	12	L	6	38	3	5			REN
1997 04 06.99		M	10.6	VF	12	L	6	38	& 3	4			REN
1997 04 30.92		M	11.1	VF	40	L	4	94	1.67	5/		270	REN
1997 05 02.94		M	11.2	VF	12	L	6	38	3	4/			REN
1997 05 07.89		M	11.1	VF	12	L	6	38	3	4/			REN
1997 05 25.93		M	12.6	VF	40	L	4	94	1.5	5			REN
1997 05 29.93		M	11.7	VF	40	L	4	94	1.75	5/		90	REN
1997 05 30.94		M	11.4	VF	12	L	6	38	2	4/			REN
1997 06 08.94		M	12.5	VF	40	L	4	94	1.5				REN

Comet 93P/Lovas

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1998 10 17.99	x	M	14.5:	HS	40	L	4	170	0.75	4			REN
1998 10 23.98			[14 :		40	L	4	170					REN
1998 10 27.05	x	M	14.3	HS	40	L	4	170	0.75	4			REN
1998 11 15.98	x	M	13.7	HS	40	L	4	170	0.75	4			REN
1998 11 20.99	x	M	13.7	HS	40	L	4	170	0.75	4			REN
1998 12 20.92	x	M	14.3	HS	40	L	4	170	0.7	5			REN

Comet 103P/Hartley

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1997 10 25.78	x	M	13.7	HS	40	L	4	94	0.75	5			REN
1997 10 29.81	x	M	12.7	HS	40	L	4	94	1.25	4			REN
1997 11 02.78	x	M	12.2	HS	40	L	4	94	1.75	4			REN
1997 11 20.77	x	M	11.0	HS	12	L	6	38		5			REN
1997 11 28.77	x	M	10.1	TI	12	L	6	38	2.75	4/			REN
1997 11 29.78	x	M	9.8	TI	12	L	6	38	3	4/			REN
1997 11 30.79	x	M	9.6	TI	12	L	6	38	3.5	4/			REN
1997 12 02.76	x	M	9.3	TI	12	L	6	38	3.5	4/			REN
1997 12 19.76	x	M	8.8	TI	5	R	4	9	& 4	4			REN
1997 12 26.78	x	M	9.0	TI	8.0	B		12	& 4	4/			REN
1997 12 27.77	x	M	8.6	TI	8.0	B		12	& 7	4/			REN
1998 01 16.79	x	M	9.3	TI	8.0	B		12	5	5			REN

Comet 103P/Hartley [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1998 01 19.81	x	M	8.9	TI	8.0	B		12	8	5/			REN
1998 01 23.78	x	M	9.4	TI	8.0	B		12	8	4/			REN
1998 01 27.81	x	M	9.2	TI	12	L	6	38	6	4/			REN
1998 02 14.82	x	M	10.7	TT	12	L	6	38	4	4			REN
1998 02 18.83	x	M	11.0	TT	12	L	6	38	& 4	4			REN
1998 02 22.81	x	M	10.7	TT	12	L	6	38	4	4			REN
1998 03 20.85	x	S	13.2	HS	40	L	4	94	& 2	2			REN

Comet 104P/Kowal

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1997 12 26.79		M	13.5	EC	40	L	4	94	& 1.5	3			REN
1998 01 22.79	x	M	13.6	HS	40	L	4	94	& 1	3/			REN

Comet 106P/Schuster

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1999 11 09.94	x	M	13.5	HS	40	L	4	150	0.7	4			REN
1999 11 15.96	x	M	13.5	HS	40	L	4	94	1	3/			REN
1999 12 05.87	x	M	14.5:	HS	40	L	4	200	& 1	4/			REN

Comet 114P/Wiseman-Skiff

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1999 11 10.05	x	M	14.5:	HS	40	L	4	250	0.4	4			REN
1999 11 15.99		M	15.0	EA	40	L	4	250	0.4	4			REN
1999 12 05.89		M	14.3	EA	40	L	4	250	0.4	5			REN
1999 12 07.97		M	14.4	EA	40	L	4	250	0.4	5/			REN
2000 01 25.83		M	14.5	EA	40	L	4	250	0.3	5			REN

Comet 117P/Helin-Roman-Alu

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 05 07.11		S	14.3	HS	20.3	T	10	160	0.6	6			GON05
2005 06 04.98		S	13.6	NP	44.5	L	5	154	0.5	3			MAR02
2005 06 04.99		S	13.7	NP	44.5	L	5	154	1	4			SAN04
2005 06 06.55		S	[13.0	AU	40.0	L	4	144	! 0.9				YOS04
2005 07 02.93		S	13.6	NP	44.5	L	5	100	1	3			MAR02
2005 07 03.91		S	13.4	AU	31.0	J	6	155	0.7	4			DIJ
2005 07 03.91		S	13.7	AU	31.0	J	6	155	0.5	4			BOU
2005 07 05.93		S	13.6	AU	31.0	J	6	155	1.0	0/			DIJ
2005 07 05.93		S	13.8	AU	31.0	J	6	155	0.6	4			BOU
2005 07 08.91		S	13.8	AU	31.0	J	6	155	0.5	5			BOU
2005 07 08.92		S	13.8	AU	31.0	J	6	155	0.6	4			DIJ
2005 07 10.91		S	13.8	AU	31.0	J	6	155	0.6	4			BOU
2005 07 10.95		S	13.8	AU	31.0	J	6	155	0.6	1			DIJ

Comet 118P/Shoemaker-Levy

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 12 08.01		M	14.0	EA	40	L	4	94	0.67	6			REN
1996 12 14.97		M	13.5	EA	40	L	4	94	0.67	6			REN
1997 01 12.99		M	13.2	EA	40	L	4	94	1.33	5			REN
1997 01 16.05		M	13.2	EA	40	L	4	94	1.25	5			REN

Comet 121P/Shoemaker-Holt

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1997 01 14.06		S	14.6	BR	40	L	4	148	0.6	4			REN
1997 01 16.11		S	14.6	BR	40	L	4	148	0.6	4			REN

Comet 122P/de Vico

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1995 10 04.51		S	5.5	AA	10.0	R	5	27	6.5	7	1.50	260	SPR

Comet 122P/de Vico [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1995 10 29.51		S	6.6	AA	8.0	R	4	19	5.0	6			SPR

Comet 141P/Machholz (component A)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1994 10 05.20		S	8.4	AA	10.0	B		20	4.5	3			HAS02
2005 03 13.76		S	11.6	HS	34.0	L	4	150	0.8	2			SZA
2005 03 29.73		S	12.0:	S	36	L	6	90	1.1	2			BAR06
2005 04 04.73		S	12.9:	S	36	L	6	90	1	2			BAR06

Comet 144P/Kushida

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1994 02 01.49		S	11.0	SM	15.2	L	8	48	2	2			CAM03
1994 02 03.52		S	11.0	SM	15.2	L	8	48	2	2			CAM03
1994 02 05.46		S	11.1	SM	20.3	L	7	56	2	4			CAM03
1994 02 07.56		S	11.1	SM	20.3	L	7	56	2	4			CAM03

Comet 157P/Tritton

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2003 10 08.39		S	12.9	AC	44.5	L	4	167	0.7	4			MOR03

Comet 161P/Hartley-IRAS

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 04 08.83		B	10.8:	AC	11.0	B		20	2	1			CHE03
1984 04 08.84		S	10.2:	AC	8.0	B		10		0			CHE03
1984 04 25.81		B	10.5:	AC	11.0	B		20		0			CHE03
1984 04 25.83		B	11.0:	AC	15.0	L	6	26	4	1			CHE03
2005 05 29.00			[10.4	TK	15	L	6	61	! 0.5				URB01
2005 06 02.10		S	11.8	TK	20.3	T	10	100	0.8	3			GON05
2005 06 05.09		S	11.7	TI	23.5	T	10	94	1	2			LAB02
2005 06 06.09		S	11.6	TK	20.3	T	10	77	1.2	3			GON05
2005 06 13.74	x	S	12.0:	HS	30.4	L	5	100	0.4	3			NAG04
2005 06 13.94		S	11.1:	TK	20	L	5	70	2.5	3			BAR06
2005 06 13.99		S	11.3	TK	15	L	6	61	2.5	3/			URB01
2005 06 16.08		S	11.3	TK	20.3	T	10	100	1.5	3			GON05
2005 06 16.95		S	10.9:	TK	36	L	6	80	2	3			BAR06
2005 06 25.92		S	11.1	TK	36	L	6	80	2	3			BAR06
2005 06 27.92		S	11.0	TK	36	L	6	80	2.1	3			BAR06
2005 06 27.98		S	11.0	TA	25.4	J	6	88	1.3	2			DIJ
2005 06 27.98		S	11.2	TA	25.4	J	6	88	1.4	2/			BOU
2005 06 28.98		S	10.9	TK	15	L	6	61	2.5	2/			URB01
2005 06 29.92		S	10.9	TK	36	L	6	80	2.5	2/			BAR06
2005 07 02.03		S	10.4	TK	20.3	T	10	77	4	3			GON05
2005 07 02.05		S	10.2	TK	10.0	B		25	5	2			GON05
2005 07 02.93		S	11.0	TK	36	L	6	80	2.1	3			BAR06
2005 07 02.99		S	10.6	TK	20.3	T	10	77	4	3			GON05
2005 07 03.04		S	12.4	NP	44.5	L	5	100	1	1/			MAR02
2005 07 03.96		S	10.8	TA	31.0	J	6	72	3	2/			BOU
2005 07 03.96		S	11.0	TA	31.0	J	6	72	3.4	2			DIJ
2005 07 04.93		S	11.0	TK	36	L	6	80	2.5	3			BAR06
2005 07 05.96		S	10.7	TK	20.3	T	10	77	4	3			GON05
2005 07 05.97		S	10.4	TA	31.0	J	6	58	3.5	3			DIJ
2005 07 05.97		S	10.8	TA	31.0	J	6	58	3.0	3			BOU
2005 07 06.94		S	11.0	TK	36	L	6	80	2.3	3			BAR06
2005 07 08.05		S	10.6	TK	20.3	T	10	77	4	3			GON05
2005 07 08.96		S	10.7	TA	31.0	J	6	58	4.0	3/			DIJ
2005 07 08.96		S	10.8	TA	31.0	J	6	58	3.2	3			BOU
2005 07 10.89		S	11.4	TI	20	T	10	50	2	2			LAB02
2005 07 11.04		S	10.7	TA	31.0	J	6	58	3.0	3			BOU
2005 07 11.04		S	11.0	TA	31.0	J	6	58	2.0	3			DIJ
2005 07 12.05		S	10.7	TK	20.3	T	10	77	4	3			GON05
2005 07 12.96		S	10.7	TA	31.0	J	6	58	3.0	3			BOU

Comet 161P/Hartley-IRAS [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 07 12.96		S	10.9	TA	31.0	J	6	58	2.0	3			DIJ
2005 07 13.98		S	10.7	TA	31.0	J	6	58	2.8	3			BOU
2005 07 13.98		S	10.8	TA	31.0	J	6	58	2.3	3/			DIJ
2005 07 14.90		S	10.9	TK	20.3	T	10	93	2.3	4			HAS02
2005 07 15.07		S	10.8	TA	31.0	J	6	58	2.7	3/			BOU
2005 07 15.07		S	10.9	TA	31.0	J	6	58	2.0	2/			DIJ
2005 07 16.05		S	11.1	TK	20.3	T	10	77	3	3			GON05
2005 07 19.09		S	11.4	TK	20.3	T	10	100	2	3			GON05
2005 07 26.91		S	10.6	TK	20.3	T	10	51	3.6	2			HAS02
2005 07 28.50		S	10.6	TJ	40.0	L	4	75	1.6	2			YOS04
2005 07 29.95		S	11.6	TK	20.3	T	10	100	2	3			GON05
2005 07 30.92		S	11.6	TA	25.4	J	6	58	2.3	2			BOU
2005 07 30.98		M	10.5	NP	44.5	L	5	100	3	3			SAN04
2005 07 30.98		M	10.8	NP	44.5	L	5	100	4	4			MAR02

Comet C/1975 V1 (West)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1976 04 20.12			7.5:		5.0	B		10	5				HOS
1976 05 11.06			7.7:		15	L	8	100	10				MAD

Comet C/1982 M1 (Austin)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1982 08 15.83			4.0:		6.0	B		13	6	7			HEN
1982 08 17.87			4.0:		8.0	B		11	7	7			MIL01
1982 08 18.85		S	4.8	S	8.0	B		12		7	0.5	0	MUN01
1982 08 18.90		B	4.9	S	4.0	B		8	5.0	7	1.0	20	RID
1982 08 19.90			4.7		13	R		25		7	0.5	18	MIL01
1982 08 21.78		S	4.8	AA	5.0	B		12	7	5			TAN02
1982 08 26.87			5.5	AA	5.0	B		7	2.2	8	0.50	41	STU
1982 08 27.85		B	5.6	AA	5.0	B		7	3.0	8	0.50	35	STU
1982 09 01.85			5.8	AA	5.0	B		7	2.4	8/	0.25	37	STU
1982 09 01.99			5.9	SP	5.0	B		10					FRY
1982 09 02.85			6.2	AA	5.0	B		7		8			STU
1982 09 03.84			6.4	SP	5.0	B		10					FRY
1982 09 04.81			6.4	SP	5.0	B		10	1.5				FRY
1982 09 05.79			6.5	SP	5.0	B		10	1.7		0.17		FRY
1982 09 06.79			6.7	SP	5.0	B		10	1.5				FRY
1982 09 07.84			6.7	SP	5.0	B		10	2.5				FRY
1982 09 08.79			6.9	SP	5.0	B		10					FRY
1982 09 08.85			7.0	AA	5.0	B		7	3.3		0.20	30	STU
1982 09 09.79		S	6.8	AA	5.0	B		20	3.5				VEN01
1982 09 09.80			6.7	SP	5.0	B		10					FRY
1982 09 10.81			6.8	SP	5.0	B		10	2		0.25		FRY
1982 09 11.79		S	6.8	AA	5.0	B		20	3.0				VEN01
1982 09 12.80			7.1	SC	5.0	B		10					FRY
1982 09 12.85			7.6	AA	5.0	B		7					STU
1982 09 13.83			6.4	AA	5.0	B		7	2.0	7	0.22	39	STU
1982 09 16.80			7.3	SC	5.0	B		10	1.5				FRY
1982 09 17.78			7.4	SC	5.0	B		10	1.7				FRY
1982 09 21.80			7.9	SC	8.0	B		20					FRY
1982 09 21.82			8.0	HS	22	L		42	2.1	5	0.07		STU
1982 09 23.81			8.2	HS	40	L		60	1.4	6	0.5	0	PIC
1982 09 23.81			8.3:	SC	8.0	B		20					FRY
1982 09 23.82			8.2	HS	22	L		42	2.7	6	0.08		STU

Comet C/1983 H1 (IRAS-Araki-Alcock)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1983 05 04.95		S	6.4	S	6.3	B		9	30				MCN
1983 05 07.06		S	5.1	S	8	R		10					MCN
1983 05 07.89		S	5.4	S	6.3	B		9	33				MCN
1983 05 08.88		S	4.2	S	6.3	B		9	33			345	MCN
1983 05 08.94			5.2		5.0	B		10					ABB

Comet C/1983 H1 (IRAS-Araki-Alcock) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1983 05 09.85		S	3.0	AA	5	R	10	20	58	3			VEN01
1983 05 09.90		S	3.1	S	0.7	E		1	60				MCN
1983 05 09.91			5.0		5.0	B		10					ABB
1983 05 09.94		S	4.1	SC	5.0	B		10	60				TAY
1983 05 10.81		S	3.0:		5	R	10	20	70	2			VEN01
1983 05 11.84		S	4.0	AA	5	R	10	20	40	2			VEN01
1983 05 11.92			4.1		5.0	B		10					ABB
1983 05 12.81		S	5.0	AA	5	R	10	20	30	2			VEN01
1983 05 13.80		S	5.5:	AA	5	R	10	20	20	1			VEN01

Comet C/1983 J1 (Sugano-Saigusa-Fujikawa)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1983 05 10.09		S	7.0	AA	8.0	B	•	15	3	7			PAN
1983 05 14.08		S	8.2	HS	7.6	R		24	6				TAY
1983 06 10.03		S	6.5:		8.0	B		15	71	2			PAN
1983 06 10.06		S	8.0:		8.0	B		15	30				HUR
1983 06 15.11			5.3		30	L	8	78	2				MAR26
1983 06 20.06			7.3		30	L	8	78	0.9	8			MAR26

Comet C/1984 N1 (Austin)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 09 14.98		B	6.8:	S	11.0	B		20	6	3			CHE03
1984 09 15.94		B	7.3	S	11.0	B		20	5	3			CHE03
1984 09 16.95		B	7.2	S	11.0	B		20	5	3			CHE03
1984 09 19.95		B	7.2	S	11.0	B		20	4	3			CHE03
1984 09 20.95		B	7.4	S	11.0	B		20	5	3			CHE03
1984 09 21.94		B	7.6	S	11.0	B		20	7	3			CHE03
1984 09 22.95		B	7.6	S	11.0	B		20	4	3			CHE03
1984 09 27.96		B	8.5	S	48.0	L	5	65	5	3	0.1	135	CHE03
1984 10 02.94		B	8.2	S	11.0	B		20	7	3			CHE03
1984 10 05.94		B	8.5	S	11.0	B		20	7	3			CHE03
1984 11 18.75		S	11.5:	AC	35.0	L	4	55	1	1			CHE03

Comet C/1984 V1 (Levy-Rudenko)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 11 22.74		S	9.3	VB	8.0	B		15	4	3			HUR
1984 11 24.78		S	9.2	VB	8.0	B		15	4	2			HUR
1984 11 24.78		S	9.4	AA	20	L	4	35	4	3			PAN
1984 11 25.75		S	9.1	VB	8.0	B		15	4	3			HUR
1984 11 25.77		S	9.3	AA	20	L	4	35	4	3			PAN
1984 11 26.75		S	9.2	VB	8.0	B		15	5.5	1			HUR
1984 11 28.79		B	10.9	HS	20	T	10	72	1.0	6			RAM01
1984 11 28.79		S	9.4	AA	20	L	4	35	2.5	2			PAN
1984 11 29.79		S	9.3	AA	20	L	4	35	2.5	2			PAN
1984 12 06.75		S	9.0	AA	20	L	4	35	2.3	2			PAN
1984 12 07.76		S	9.0	AA	20	L	4	35	3	2			PAN
1984 12 10.78		B	10.3	HS	20	T	10	72	2.1	4			RAM01
1984 12 11.74		S	9.0	AA	20	L	4	35	2.7	3			PAN
1984 12 14.77		S	8.9	AA	20	L	4	35	4	3			PAN
1984 12 24.75		S	8.9	AA	20	L	4	35	4	3			PAN
1984 12 24.79		S	8.9	VB	8.0	B		15	5	3			HUR
1984 12 28.77		S	8.8	AA	20	L	4	35	4.5	2			PAN
1984 12 31.79		S	8.8	AA	20	L	4	35	4	2			PAN
1985 01 14.69		B	8.0:	S	12.0	R	5	20	3	1			CHE03
1985 01 15.71		B	7.8:	S	12.0	R	5	20	6	3			CHE03
1985 01 20.72		B	8.1	S	12.0	R	5	20	7	3			CHE03
1985 01 21.15		B	7.9	S	12.0	R	5	35	8	3			CHE03
1985 01 23.80		S	9.0	S	20	L	4	35	7	2			PAN
1985 01 28.71		B	8.9	S	12.0	R	5	35	8	3			CHE03
1985 01 28.82		S	9.2	S	20	L	4	35	5	2			PAN
1985 02 18.86		S	9.5	AA	20	L	4	35	8	1			PAN

Comet C/1985 R1 (Hartley-Good)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 10 05.83		S	8.2	CS	8.0	B		15	8.5	2			HUR
1985 10 11.83		S	8.5	AA	8.9	R	5	18	15	1			VEN01
1985 10 12.79		S	8.2	CS	8.0	B		15	9.5	2			HUR
1985 10 12.80		S	9.7	HS	22	L	7	50	7.8				STU
1985 10 12.82		S	7.8	AA	8.0	B		15	18	2			PAN
1985 10 12.86		S	7.9	VB	25	L	6	40	1.5	1			GAI
1985 10 13.79		S	7.6	CS	8.0	B		15	11	2			HUR
1985 10 13.84		S	7.7	VB	8.0	B		11	10.6	0			GAI
1985 10 13.85		S	8.1	AA	8.9	R	5	18	10	1			VEN01
1985 10 15.82		S	7.6	AA	8.9	R	5	18	12	2			VEN01
1985 10 17.83		S	7.6:	VB	8.0	B		11	9	1			GAI
1985 10 19.83		S	7.7	VB	8.0	B		11	9.5	1			GAI
1985 10 19.85		S	8.2	VB	25	L	6	40	4	2			GAI
1985 10 20.79		S	7.1	HP	8.0	B		15	12	2			HUR
1985 10 28.81		S	8.8	S	21	L	5	38	5	1			TAY
1985 10 29.77		S	6.8	NO	8.0	B		15	9.8	3			HUR
1985 10 31.73		S	7.5	AA	8.9	R	5	18	5.5	3			VEN01
1985 10 31.83		S	8.0	V	20	T	10	72	3	3			RAM01
1985 11 01.77		S	7.7	CS	8.0	B		15	10.1	4			HUR
1985 11 01.78		S	7.3	VB	25	L	6	60	3	4			GAI
1985 11 02.76		S	7.4	AA	25	L	6	41	3.7	4		126	ABB
1985 11 02.77		S	8.3	AA	7.0	B		16	8	1			TAY
1985 11 02.77		S	9.4	HS	21	L	5	43	3.7	1			TAY
1985 11 02.78		S	7.7	VB	8.0	B		15	8.9	3			HUR
1985 11 02.79		M	8.0	V	20	T	10	72	3.5	4			RAM01
1985 11 02.79		S	7.8	CS	3.0	B		8		3			HUR
1985 11 02.80		S	7.4	VB	8.0	B		11	7.5				GAI
1985 11 02.80		S	8.1	VB	25	L	6	60	3.7	4			GAI
1985 11 03.78		S	7.3	AA	25	L	6	65	3.7	4		130	ABB
1985 11 03.82		S	7.4	VB	8.0	B		11	6				GAI
1985 11 05.79		M	7.2	VB	5.0	B		7	2	3			STO02
1985 11 05.79		S	7.2	VB	8.0	B		15	7.5	4			HUR
1985 11 05.79		S	8.5	HS	22	L		50	5		0.20		STU
1985 11 05.80		M	7.8	V	20	T	10	72	3.7	5			RAM01
1985 11 07.77		S	8.6	AA	7.0	B		16	3	5			TAY
1985 11 07.77		S	9.0	AA	21	L	5	43	1.2	5			TAY
1985 11 07.79		S	7.9	HS	22	L		50	4			120	STU
1985 11 08.73		S	7.3	AA	8.9	R	5	18	6.5	4			VEN01
1985 11 08.80		S	8.4	AA	7.0	B		16	3	3			TAY
1985 11 09.75		S	7.4	VB	8.9	R	5	18	6	3			VEN01
1985 11 09.77		S	7.2	VB	8.0	B		11	10.2				GAI
1985 11 09.78		S	7.8	VB	25	L	6	60	2.7	4			GAI
1985 11 10.75		S	7.6	HS	10	R		40	5	5			MCK
1985 11 10.75		S	8.0	AA	7.0	B		16	3	2			TAY
1985 11 10.76		M	7.2	VB	11	L	4	74		3			STO02
1985 11 10.79		S	7.6	AA	25	L	6	41	3.6	4			ABB
1985 11 11.75		S	7.0	VB	8.9	R	5	18	8	4			VEN01
1985 11 11.75		S	9.1	HS	10	R		40	3.5	5			MCK
1985 11 11.76		B	8.3	AA	21	L	5	43	3	3			TAY
1985 11 11.82		M	7.9	V	20	T	10	72	3.7	4			RAM01
1985 11 12.73		S	7.1	VB	8.9	R	5	18	8	4			VEN01
1985 11 12.75		S	7.4	VB	8.0	B		11	8.4	3			GAI
1985 11 12.75		S	7.5	VB	25	L	6	60	3.2	4			GAI
1985 11 12.76		M	7.2	VB	30	L	5	65	2	2			STO02
1985 11 12.76		S	8.7	S	7.0	B		16	3	3/			TAY
1985 11 12.83		S	7.6	CS	8.0	B		15	6.3	2			HUR
1985 11 13.74		S	7.2	VB	8.9	R	5	18	6	4			VEN01
1985 11 13.75		S	8.4	S	7.0	B		16	3	3			TAY
1985 11 13.80		S	8.7	HS	22	L	7	50	3				STU
1985 11 15.74		S	8.3	S	7.0	B		16	1.5	3			TAY
1985 11 15.75		S	7.2	VB	25	L	6	60	2.5	3		80	GAI
1985 11 15.76		M	7.2	VB	30	L	5	65	3	3			STO02
1985 11 16.78		M	8.0	V	20	T	10	72	3	4			RAM01
1985 11 17.78		S	8.4	HS	22	L	7	50	3.8				STU
1985 11 18.74		S	8.7	S	21	L	5	43	3.2	4			TAY

Comet C/1985 T1 (Thiele)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 10 19.96		S	11.2	WA	26	L	6	55	1.7	2			HUR
1985 10 20.95		S	11.0:	WA	26	L	6	55	2.9	2			HUR
1985 10 21.17		M	11.8	VB	30	L	5	65					STO02
1985 10 25.15		S	9.4	VB	25	L	7		4				LUB02
1985 10 25.16		S	7.9	AA	8.0	B		15	21	1			PAN
1985 10 25.18		M	11.1	VB	30	L	5	65					STO02
1985 11 02.79		S	7.5	S	8.0	B		15	&22	3			HUR
1985 11 02.80		S	6.7	S	3.0	B		8	&23	3			HUR
1985 11 02.84		S	10.4	VB	25	L	6	60	3	3			GAI
1985 11 02.90		M	9.8:	VB	20	T	10	72	1	2			RAM01
1985 11 03.02		S	11.1	HS	21	L	5	66	2	1			TAY
1985 11 03.83		S	9.8	VB	25	L	6	60	2.1	5			GAI
1985 11 05.80		S	7.2	HP	5.0	B		10	6.6	3			HUR
1985 11 05.85		M	9.0	VB	30	L	5	65	1.5	4			STO02
1985 11 05.90		S	9.8	VB	20	T	10	72	1.5	2			RAM01
1985 11 07.81		S	10.6	HS	21	L	5	43	1	1			TAY
1985 11 08.83		S	9.5	VB	25	L	6	60	2.1	4			GAI
1985 11 09.07		S	7.7:	S	8.0	B		15	23	3/			HUR
1985 11 10.03		S	8.0	S	8.0	B		15	5.8	3/			HUR
1985 11 10.79		S	8.0	S	8.0	B		15	10.3	3			HUR
1985 11 10.85		S	10.7	HS	21	L	5	66	2	1			TAY
1985 11 11.07		M	9.0	VB	8.0	B		20	2	3			STO02
1985 11 11.87		S	11.5	HS	21	L	5	43	2	1			TAY
1985 11 11.95		S	10.0	VB	25	L	6	60	3.3	3			GAI
1985 11 12.81		S	7.7	AA	8.0	B		11	18	1			PAN
1985 11 12.83		M	9.0	VB	8.0	B		20	2	2			STO02
1985 11 12.85		S	7.6	HP	5.0	B		10	&28	3			HUR
1985 11 12.93		S	9.8	VB	25	L	6	60	2.7	3		310	GAI
1985 11 15.81		S	10.5	HS	21	L	5	43	2	1			TAY
1985 11 15.82		M	9.6	VB	8.0	B		20	2	2			STO02
1985 11 15.86		S	7.7	S	5.0	B		10	14.6	2			HUR
1985 11 16.79		S	8.5	VB	20	T	10	72	4	2			RAM01
1985 11 17.81		S	8.5:	S	22	L	7	50	6				STU

Comet C/1986 P1 (Wilson)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 08 16.03		S	12.6	AC	25	L	4	42	0.3	3			PAN
1986 09 02.83		S	11.2	VB	20	T	10	80	0.9	3/			TAN02
1986 09 03.87		S	12.5	NP	25	L	4	42	0.4	4		90	PAN
1986 09 04.81		M	11.4	VB	20	T	10	80	0.9	5/			TAN02
1986 09 07.83		S	11.5	VB	20	T	10	80	0.7	3/			TAN02
1986 09 23.77		M	11.5	VB	20	T	10	80	1.3	5			TAN02
1986 09 28.82		S	12.2	NP	25	L	4	42	0.9	5			PAN
1986 10 04.81		M	11.7	VB	20	T	10	80	0.7	5/			TAN02
1986 10 23.76		M	11.1	VB	20	T	10	80	1.1	6/			TAN02
1986 10 26.78		S	11.9	NP	31	L	5	60	1.3	5		90	PAN
1986 10 31.77			10.9	VB	20	T	10	80	1.3	5/			TAN02
1986 11 05.76		M	10.8	VB	20	T	10	80	2.1	5			TAN02

Comet C/1986 V1 (Sorrells)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 11 12.12		S	11.2	NP	25	L	4	42	1.3	5			PAN
1986 11 22.81		M	10.7	V	20	T	10	120	1.1	6			TAN02
1986 11 28.81		S	9.8	AA	25	L	4	42	1.7	6			PAN
1986 12 03.86		M	10.0	VB	20	T	10	80	1.3	5/			TAN02
1986 12 06.79		S	10.2	AC	25	L	4	42	2	6			PAN
1986 12 07.82		M	9.9	VB	20	T	10	80	1.5	5/			TAN02
1986 12 28.74		S	10.1	AA	7.0	B		20	4.5	2/			TAN02
1987 01 03.78		S	10.5	NP	25	L	4	35	3	2			PAN

Comet C/1987 B1 (Nishikawa-Takamizawa-Tago)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1987 01 24.77		S	8.8	AA	20	T	10	80	2.1	3/			TAN02
1987 01 25.75		S	9.3	AA	20	T	10	80	2.6	3			TAN02
1987 01 29.78		S	9.2	AA	25	L	4	35	5	3			PAN
1987 01 30.81		S	8.5	HS	19	L		38	3				HAY04
1987 01 31.79		S	9.2	AA	8.0	B		15	5	2			PAN

Comet C/1987 P1 (Bradfield)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1987 09 09.77		M	8.4	AA	20	T	10	80	1.7	5/			TAN02
1987 09 10.77		S	8.6	AA	20	T	10	111	1.0	6			TAN02
1987 09 11.77		M	8.4	AA	20	T	10	80	1.8	7			TAN02
1987 09 12.77		M	8.3	AA	20	T	10	80	1.8	7			TAN02
1987 09 12.77		M	8.5	AA	8.9	R	5	18	1	6			VEN01
1987 09 13.77		M	8.3	AA	20	T	10	80	1.8	5/			TAN02
1987 09 14.77		S	8.5	AA	20	T	10	80	1.7	5/			TAN02
1987 09 15.77		S	8.2	AA	20	T	10	80	2.3	6/			TAN02
1987 09 16.76		S	8.3	AA	20	T	10	80	2.0	6			TAN02
1987 09 17.76		M	8.2	AA	20	T	10	80	1.8	5			TAN02
1987 09 19.76		S	8.2	AA	20	T	10	80	1.6	6			TAN02
1987 09 20.76		M	8.1	AA	20	T	10	50	2.3	7			TAN02
1987 09 20.77		M	8.0	AA	8.9	R	5	18	1.5				VEN01
1987 09 21.76		S	8.1	AA	20	T	10	80	1.5	5/			TAN02
1987 09 22.76		M	7.9	AA	20	T	10	50	3.9	7			TAN02
1987 09 23.76		M	7.8	AA	8.9	R	5	18					VEN01
1987 09 23.76		M	7.9	AA	20	T	10	50	2.2	7	0.05		TAN02
1987 09 24.76		M	7.8	AA	8.9	R	5	18	3	5			VEN01
1987 09 24.76		M	7.8	AA	20	T	10	50	3.2	6			TAN02
1987 09 26.76		M	7.7	AA	8.9	R	5	18		5			VEN01
1987 09 27.76		M	7.1	AA	7.0	B		20	5.4	6			TAN02
1987 09 27.76		M	7.5	AA	8.9	R	5	18	4	5			VEN01
1987 09 28.75		S	7.1	AA	7.0	B		20					TAN02
1987 10 03.75		S	6.6	AA	7.0	B		20		5			TAN02
1987 10 04.74		S	6.5	AA	7.0	B		20		6			TAN02
1987 10 08.75		M	6.7	AA	7.0	B		20		4/			TAN02
1987 10 09.75		M	6.8	AA	7.0	B		20	4.5	6			TAN02
1987 10 12.74		M	6.7	AA	7.0	B		20	3.4	6	0.3	94	TAN02
1987 10 12.75		M	6.5	AA	8.9	R	5	18	7	5			VEN01
1987 10 12.79		S	6.5	AA	7.0	B		16	5	4			TAY
1987 10 13.74		M	6.6	AA	7.0	B		20	6	6	0.3	95	TAN02
1987 10 13.75		M	6.5	AA	8.9	R	5	18	3	5	0.05		VEN01
1987 10 13.79		S	7.2	AA	21	L	5	44	1.5	5			TAY
1987 10 16.73		M	6.5	AA	7.0	B		20		5			TAN02
1987 10 17.74		M	6.2	AA	5.0	B		12	5.4	5/	0.5	95	TAN02
1987 10 17.75		M	6.2	AA	8.9	R	5	18	4	4	0.50	60	VEN01
1987 10 17.77		S	7.1	AA	7.0	B		16	6	4			TAY
1987 10 17.77		S	7.4	AA	21	L	5	44	1.5	5			TAY
1987 10 18.73		M	6.1	AA	5.0	B		12	7	6	0.8	93	TAN02
1987 10 18.75		M	6.1	AA	8.9	R	5	18	4	6	0.42	60	VEN01
1987 10 19.73		M	6.1	AA	5.0	B		12		6			TAN02
1987 10 20.73		M	6.0	AA	5.0	B		12	7	7	0.4	98	TAN02
1987 10 21.73		M	5.9	AA	5.0	B		12		6			TAN02
1987 10 22.79			5.5:		8.0	B		15	5	5	1.25	90	ALC
1987 10 23.73		M	5.8	AA	5.0	B		12	5	6			TAN02
1987 10 24.76		S	6.0	AA	7.0	B		16	5	5			TAY
1987 10 24.77		S	5.8	AA	8.0	B		15	8	6	0.70	85	PAN
1987 10 25.76		M	6.5:	AA	21	L	5	44	2.5	6			TAY
1987 10 27.74		M	5.7	AA	5.0	B		12	11	6/	1.8	84	TAN02
1987 10 28.78		S	5.7	AA	8.0	B		15	6	7	0.50	70	PAN
1987 10 29.73		M	5.7	AA	5.0	B		12		7	1.0	83	TAN02
1987 10 29.73		M	5.9	AA	8.9	R	5	18		6			VEN01
1987 10 31.73		M	5.5	AA	5.0	B		12	8	6	0.7	86	TAN02
1987 10 31.73		M	5.8	AA	8.9	R	5	18		7			VEN01
1987 11 01.73		M	5.4	AA	5.0	B		12		5/			TAN02
1987 11 01.74		M	5.6	AA	7.0	B		20	8	6	0.8	84	TAN02

Comet C/1987 P1 (Bradfield) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1987 11 02.79		M	5.4	AA	5.0	B		12					TAN02
1987 11 03.72		M	5.3	AA	5.0	B		12					TAN02
1987 11 03.73		M	5.5	AA	8.9	R	5	18		6/	0.50	90	VEN01
1987 11 07.72		M	5.5	AA	5.0	B		12		6	1.0	75	TAN02
1987 11 08.72		M	5.4	AA	5.0	B		12	10	5/	2.1	81	TAN02
1987 11 08.74		M	5.5	AA	7.0	B		20	9	6			TAN02
1987 11 10.71		M	5.2	AA	5.0	B		12		5/			TAN02
1987 11 10.73		M	5.3	AA	8.9	R	5	18	7	6	0.33	70	VEN01
1987 11 10.77		S	4.6	AA	8.0	B		15	9	7	1.50	75	PAN
1987 11 10.79		S	5.9	VB	5.0	B		10	5	6	0.25	60	RAM01
1987 11 11.72		M	5.1	AA	5.0	B		12	17	5/	2.1	75	TAN02
1987 11 11.73		M	5.2	AA	8.9	R	5	18	8	6	0.60	79	VEN01
1987 11 11.82		M	5.7	VB	5.0	B		10	5	6	0.22	55	RAM01
1987 11 12.73		M	5.2	AA	8.9	R	5	18		6			VEN01
1987 11 12.76		S	5.6	AA	5.0	B		10	4.0	7/	0.82	70	ABB
1987 11 12.78		S	6.1	SC	3.5	B		9	4.5	6	1.5	60	HEN
1987 11 13.72		M	5.1	AA	5.0	B		12	17	5/			TAN02
1987 11 13.73		M	5.1	AA	8.9	R	5	18	10	6	0.73	78	VEN01
1987 11 13.75		M	5.7	VB	5.0	B		10	5	7	0.28	55	RAM01
1987 11 13.76		S	5.4	SC	8.0	B		11					KEE01
1987 11 13.77		S	6.1	SC	3.5	B		9	4		1	60	HEN
1987 11 13.78		S	5.4	AA	8.0	B		11	9.0		0.15	55	GIL02
1987 11 14.75		S	4.6	AA	8.0	B		15	9	7	1.5	60	PAN
1987 11 14.75		S	5.7	SC	8.0	B		11					KEE01
1987 11 14.77		S	5.4	AA	20	L	4	30	8.0	3	0.15	55	GIL02
1987 11 17.75		M	5.2	AA	8.9	R	5	18		5			VEN01
1987 11 19.75		M	5.6	VB	5.0	B		10	6	7	0.30	60	RAM01
1987 11 19.79		S	5.4	AA	8.0	B		15	6	7	1.7	70	PAN
1987 11 20.76		S	5.8	HS	5.0	B		10	10	6	0.83	80	MCK
1987 11 20.77		M	5.7	VB	5.0	B		10	5	7	0.30	60	RAM01
1987 11 21.79		M	5.6	VB	5.0	B		10	6	7	0.30	60	RAM01
1987 11 22.72		M	5.3	AA	5.0	B		12	11	5	1.2	68	TAN02
1987 11 22.75		M	5.3	AA	8.9	R	5	18	8	4	0.53	66	VEN01
1987 11 23.72		M	5.3	AA	5.0	B		12	14	5	2.0	70	TAN02
1987 11 23.75		M	5.4	AA	8.9	R	5	18		4			VEN01
1987 11 24.72		M	5.4	AA	5.0	B		12		5			TAN02
1987 11 24.72		M	5.7	VB	5.0	B		10	6	7	0.25	70	RAM01
1987 11 25.71		M	5.8	VB	5.0	B		10	6	7	0.38	75	RAM01
1987 11 27.79		S	5.3	HS	5.0	B		10	15	6			MCK
1987 11 27.79		S	5.8	AA	8.0	B		15	7	5	1.2	60	PAN
1987 11 28.73		S	6.1	SC	8.0	B		11			0.33		KEE01
1987 11 28.74		S	5.3	HS	5.0	B		10	13	6	0.50		MCK
1987 11 30.72		M	5.5	AA	5.0	B		12		6			TAN02
1987 11 30.73		M	5.4	AA	8.9	R	5	18		7			VEN01
1987 11 30.79		M	5.7	VB	5.0	B		10		6			RAM01
1987 12 01.72		M	5.5	AA	8.9	R	5	18		6			VEN01
1987 12 02.79		M	5.7	VB	5.0	B		10		6			RAM01
1987 12 06.71		M	5.6	AA	5.0	B		12		5			TAN02
1987 12 08.76		S	6.2	AA	5.0	B		10	3.0	7/	2.0	60	ABB
1987 12 09.72		M	6.2	AA	8.9	R	5	18	10	4	0.27	67	VEN01
1987 12 09.75		M	5.4	AA	5.0	B		12	22	5			TAN02
1987 12 11.73		M	5.3	AA	5.0	B		12	32	5	1.7	67	TAN02
1987 12 12.75		M	5.7	VB	5.0	B		10	8	7	0.53	60	RAM01
1987 12 13.73		M	5.8	AA	5.0	B		12	18	4/	2.3	67	TAN02
1987 12 13.73		M	5.9	AA	8.9	R	5	18	9	4	0.43	59	VEN01
1987 12 14.74		M	5.8	AA	5.0	B		12	32	4/	2.2	63	TAN02
1987 12 16.73		M	5.7	AA	8.9	R	5	18	10	6			VEN01
1987 12 16.73		M	5.9	AA	5.0	B		12	23	5	1.3	69	TAN02
1987 12 19.73		M	6.0	AA	5.0	B		12		5			TAN02
1987 12 20.72		M	5.9	AA	8.9	R	5	18	13	4	0.27		VEN01
1987 12 21.73		M	6.0	AA	5.0	B		12	25	5	2.3	68	TAN02
1987 12 21.75		M	5.9	AA	8.9	R	5	18	5	6	0.20	51	VEN01
1987 12 21.85		M	6.0	VB	5.0	B		10	8	6	0.52	80	RAM01
1987 12 22.73		M	6.0	AA	5.0	B		12	26	5	2.1	65	TAN02
1987 12 24.72		M	5.9	AA	8.9	R	5	18	6	4	0.30		VEN01

Comet C/1987 P1 (Bradfield) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1987 12 24.74		M	6.0	AA	5.0	B		12	21	5	2.6	61	TAN02
1987 12 25.73		M	6.2	AA	5.0	B		12					TAN02
1988 01 02.72		S	6.7	AA	7.0	B		16	6	5			TAY
1988 01 04.73		M	6.6	AA	7.0	B		20		5			TAN02
1988 01 04.83		S	6.8	AA	7.0	B		16	9.6	4			TAY
1988 01 05.72		M	6.6	AA	7.0	B		20	16	5	1.1	55	TAN02
1988 01 06.73		M	6.8	AA	5.0	B		12	17	5	1.1	60	TAN02
1988 01 06.75		M	6.3	AA	8.9	R	5	18	14	5		60	VEN01
1988 01 06.75		M	7.3	AA	7.0	B		16	9.6	4			TAY
1988 01 07.81		S	7.0	AA	8.0	B		15	7	4	1	70	PAN
1988 01 11.75		M	6.7	AA	5.0	B		12		4/			TAN02
1988 01 11.79		S	7.4	AA	7.0	B		16	8	4			TAY
1988 01 13.79		M	7.0	AA	7.0	B		20	11	3			TAN02
1988 01 14.76		M	8.7	S	21	L	5	44	2.8	8			TAY
1988 01 14.77		M	7.0	AA	8.9	R	5	18		3			VEN01
1988 01 15.75		M	7.3	AA	8.9	R	5	18	12	4			VEN01
1988 01 19.77		S	8.1	S	7.0	B		16	4.3	3			TAY
1988 01 20.79		S	8.3	S	21	L	5	44	3.5	4		112	TAY
1988 01 20.80		M	7.6	AA	7.0	B		20	13	4/			TAN02
1988 01 22.74		M	7.6	AA	7.0	B		20	8	4/			TAN02
1988 01 22.78		S	8.4	AA	7.0	B		16	3.5	4			TAY
1988 02 06.77		M	8.9	AA	20	T	10	50	4.3	4/			TAN02
1988 02 11.77		M	9.2	AA	20	T	10	50	3.7	5/			TAN02
1988 02 17.78		S	9.4	AA	20	T	10	50	2.6	4			TAN02

Comet C/1987 Q1 (Rudenko)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1987 08 27.87		S	9.9	AA	25	L	4	35	5	2			PAN
1987 08 28.90		S	9.9	AA	25	L	4	35	5	3			PAN
1987 09 13.84		S	9.7	AA	25	L	4	50	3.5	3			PAN
1987 10 14.21		S	7.5	AA	25	L	4	50	2	7			PAN
1987 10 17.21		S	7.9	AA	25	L	4	50	2	6			PAN
1987 10 22.20			7.0:		10.5	B		25	2	7	0.25	295	ALC
1987 10 22.22		S	8.1	AA	25	L	4	50	1.5	6			PAN
1987 10 22.26		S	7.4	AA	7.0	B		16	5	5			TAY

Comet C/1987 U3 (McNaught)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1988 01 11.27		S	6.2	AA	8.0	B		15	4	5			PAN
1988 01 20.27		S	6.4	AA	8.0	B		15	6	5	0.6	330	PAN
1988 01 20.74		S	8.3	S	21	L	5	44	9	3			TAY
1988 01 22.75		S	7.1	S	7.0	B		16	4.5	3			TAY
1988 01 24.75		S	6.8	S	7.0	B		16	4.1	3			TAY
1988 01 30.26		S	7.1	AA	8.0	B		15	6	5	0.30	340	PAN
1988 02 05.24		S	7.4	AA	8.0	B		15	3	3	0.17	330	PAN

Comet C/1987 W2 (Furuyama)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1987 12 22.85		S	10.3	VB	20	T	10	80	1.6	1/			TAN02

Comet C/1988 A1 (Liller)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1988 02 06.74		S	9.5	AA	20	T	10	50	2.3	5/			TAN02
1988 02 07.74		S	9.2	AA	20	T	10	50	2.3	4/			TAN02
1988 02 11.75		M	9.1	AA	20	T	10	50	2.3	5			TAN02
1988 02 17.75		S	9.1	AA	20	T	10	80	1.2	4/			TAN02
1988 04 11.87		S	5.3	AA	8.0	B		15	3	6	0.47	345	PAN
1988 04 12.79		M	6.2	AA	7.0	B		20	3.1	6			TAN02
1988 04 14.78		M	6.1	AA	7.0	B		20	3.3	6/			TAN02
1988 04 16.79		M	5.5	AA	7.0	B		20	3.5	5			TAN02
1988 04 19.79		M	5.9	AA	7.0	B		20	3.3	6	0.5	350	TAN02

Comet C/1988 A1 (Liller) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1988 04 23.13		M	5.4	AA	7.0	B		20	3.4	6	0.3	351	TAN02
1988 04 23.87			7.0:	SP	8.0	B		11			0.33		KEE01
1988 04 23.91		S	6.0	AA	8.0	B		15	6	6	1.30	345	PAN
1988 04 25.11		M	5.4	AA	7.0	B		20	3.2	5/	0.64	353	TAN02
1988 04 26.12		M	5.6	AA	7.0	B		20	3.6	4/	0.57	358	TAN02
1988 05 07.12		S	6.8	AA	8.0	B		15	3	4	0.42	20	PAN

Comet C/1989 Q1 (Okazaki-Levy-Rudenko)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1989 08 27.87		S	10.5	AA	25	L	4	42	3	1			PAN
1989 08 31.88		S	10.8	AA	25	L	4	42	4	1			PAN
1989 09 02.86		S	10.7	AA	25	L	4	42	3	2	0.03		PAN
1989 09 05.86		S	10.7	AA	25	L	4	42	5	2			PAN
1989 09 06.86		S	10.3	AA	25	L	4	42	8	3			PAN
1989 09 10.80		S	9.4	AA	20	T	10	50	2.7	1/			TAN02
1989 09 20.82		S	9.8	AA	25	L	4	42	7	3			PAN
1989 09 24.82		S	9.0	AA	25	L	4	42	5	4			PAN
1989 09 25.78		M	8.6	AA	20	T	10	50	1.9	4/			TAN02
1989 09 25.85		S	8.3	AA	8.0	B		11					KEE01
1989 09 26.75		M	8.5	AA	20	T	10	50	2.3	4			TAN02
1989 09 27.76		M	8.5	AA	20	T	10	50	2.0	4			TAN02
1989 09 28.81		S	8.5	AA	25	L	4	42	5	4			PAN
1989 09 29.75		M	8.4	AA	20	T	10	50	2.4	4/			TAN02
1989 09 30.80		S	7.8	AA	3.5	B		8					KEE01
1989 10 01.75		M	8.4	AA	20	T	10	50	2.0	5			TAN02
1989 10 02.75		M	8.3	AA	20	T	10	50	2.4	4			TAN02
1989 10 02.81		S	8.4	AA	25	L	4	42	3	3		100	PAN
1989 10 03.75		M	8.3	AA	20	T	10	50	2.2	4/			TAN02
1989 10 11.82		S	7.7	AA	8.0	B		15	6	3			PAN
1989 10 16.74		M	7.6	AA	20	T	10	50	1.5	4/			TAN02
1989 10 17.74		M	7.1	AA	7.0	B		20	4.2	5			TAN02
1989 10 20.73		S	6.6	AA	7.0	B		20	4.3	4/			TAN02
1989 10 21.73		M	6.8	AA	7.0	B		20	3.7	5			TAN02
1989 11 01.77		S	7.0	AA	8.0	B		11	6	5			PAN
1989 11 05.23		S	6.7	AA	8.0	B		11	6	6			PAN
1989 11 09.17		S	6.2	AA	5.0	B		12	1.7	8	0.5	329	TAN02
1989 11 09.23		S	6.2	AA	8.0	B		11	5	6	0.17	325	PAN
1989 11 10.17		S	6.3	AA	5.0	B		12	2.2	7/			TAN02
1989 11 11.17		M	6.3	AA	7.0	B		20	1.7	7			TAN02
1989 11 12.17		M	6.1	AA	7.0	B		20		7			TAN02
1989 11 22.26		S	6.4	AA	8.0	B		11	6	7	0.20	300	PAN
1989 11 23.25		S	6.1	AA	8.0	B		11	6	6	0.10	310	PAN
1989 11 27.26		S	5.8	AA	8.0	B		11	6				PAN

Comet C/1989 W1 (Aarseth-Brewington)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1989 11 19.76		S	8.2	AA	25	L	4	35	8	4			PAN
1989 11 22.76		S	8.4	AA	25	L	4	35	3				PAN
1989 11 23.75		S	8.4	AA	25	L	4	35	3	4			PAN
1989 11 25.76		S	8.2	AA	8.0	B		15	7	4			PAN
1989 11 29.26		S	7.8	AA	8.0	B		11	4	3			PAN
1989 12 15.19		M	5.4	AA	5.0	B		12		7/		317	TAN02
1989 12 16.20		M	5.1	AA	7.0	B		20		8			TAN02
1989 12 17.20		M	4.3	AA	5.0	B		12	2.2	8/	2.1	322	TAN02
1989 12 18.20		M	4.5	AA	5.0	B		12	2.3	7/	2.6	319	TAN02
1989 12 19.20		M	3.9	AA	5.0	B		12	2.4	8	1.5	323	TAN02
1989 12 20.20		M	4.4	AA	5.0	B		12		7	1.7	311	TAN02
1989 12 21.20		M	3.8	AA	5.0	B		12		7			TAN02
1989 12 22.20		M	3.5	AA	5.0	B		12		7	4	296	TAN02

Comet C/1989 X1 (Austin)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1990 04 03.84		S	5.1	AA	8.0	B		15	2	7			PAN
1990 04 03.86		B	5.0:	SC	5.0	B		10	3	8			FRA01
1990 04 06.84		S	4.1	AA	8.0	B		15	2	5			PAN
1990 04 07.84		S	3.6	SC	8.0	B		11	15	5			GAI
1990 04 07.84		S	3.9	AA	8.0	B		15	2	8	0.5	45	PAN
1990 04 07.87		B	5.3	SC	5.0	B		10	4	8			FRA01
1990 04 08.85		S	5.0	AA	8.0	B		15	2	7	0.75	45	PAN
1990 04 13.89		B	5.0:	SC	5.0	B		10	5	8			FRA01
1990 04 14.14		S	4.3	SC	8.0	B		11		6	0.5	34	GAI
1990 04 15.16		S	4.5	AA	8.0	B		15	3	7	0.3	325	PAN
1990 04 16.16		S	4.5	AA	8.0	B		15	2.5	7	0.33	335	PAN
1990 04 17.15		S	4.5	AA	8.0	B		15	2	6	0.50	345	PAN
1990 04 17.15		S	4.7	SC	8.0	B		11		6	1	24	GAI
1990 04 24.13		S	4.9	AA	8.0	B		15	2.5	6	0.75	325	PAN
1990 04 25.13		S	4.9	AA	8.0	B		15	3	6	0.75	325	PAN
1990 04 27.07		B	5.5	SC	5.0	B		10	7	8			FRA01
1990 04 27.13		S	4.9	AA	8.0	B		15	6	7	1	310	PAN
1990 04 28.12		S	4.9	AA	8.0	B		15	6	6	1	300	PAN
1990 04 29.12		S	4.9	AA	8.0	B		15	6	6	1.5	300	PAN
1990 04 30.08		B	5.5	SC	5.0	B		10	5	7			FRA01
1990 04 30.12		S	4.9	AA	8.0	B		15	6	6	1	300	PAN
1990 05 01.06		B	5.9	SC	5.0	B		10	5	7			FRA01
1990 05 02.12		S	4.9	AA	8.0	B		15	7	6		290	PAN
1990 05 03.09		S	5.0	AA	8.0	B		15	8	5	1	285	PAN
1990 05 04.11		S	5.1	AA	8.0	B		15	9	5	1.25	300	PAN
1990 05 05.10		S	5.1	AA	8.0	B		15	8	5	1.17	285	PAN
1990 05 19.00		S	5.9	SC	5.0	B		10	11	4			FRA01
1990 05 20.00		S	5.9	SC	5.0	B		10	15	3			FRA01
1990 05 25.03		S	5.0:	SC	5.0	B		10	13	2			FRA01

Comet C/1989 Y1 (Skorichenko-George)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1990 04 03.87		S	9.7	AA	25	L	4	42	5	2			PAN

Comet C/1993 Q1 (Mueller)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1994 01 03.46		S	11.1	SM	15.2	L	8	48	2	2			CAM03
1994 01 04.44		S	11.1	SM	15.2	L	8	48	1.5	2			CAM03
1994 01 09.45		S	11.1	SM	15.2	L	8	48	2	1			CAM03
1994 01 10.45		S	11.1	SM	15.2	L	8	48	2	1			CAM03
1994 04 04.32		S	8.0	RC	7.8	R	7	30		3			JON
1994 04 05.32		S	8.2	RC	7.8	R	7	30					JON
1994 04 06.32		S	8.4	RC	7.8	R	7	30	1				JON
1994 04 07.31		S	8.0	RC	7.8	R	7	30	2				JON
1994 04 11.33		S	7.2	SC	7.8	R	7	30	2				JON
1994 04 13.31		S	7.6	SC	7.8	R	7	30	2.5	3			JON
1994 04 14.31					31.7	L	5	53	1.5	5		180	JON
1994 04 14.31		S	7.9	SC	7.8	R	7	30					JON
1994 04 17.31		S	8.3	SS	7.8	R	7	30					JON
1994 04 17.31		S	9.2	SS	31.7	L	5	53	1.5	3			JON
1994 04 18.31		S	9.7	SS	31.7	L	5	53	1.5	3			JON
1994 04 30.31		S	10.2	VN	31.7	L	5	63	1	3		180	JON
1994 05 02.38		S	10.2	VN	31.7	L	5	63	1.5	3			JON
1994 05 05.29		S	10.4	GA	31.7	L	5	63	1	3			JON
1994 05 06.30		S	10.9	RC	31.7	L	5	63	0.7				JON
1994 05 13.34		S	10.8	GA	31.7	L	5	63	1	1			JON

Comet C/1993 Y1 (McNaught-Russell)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1994 02 15.39		S	10.6	VN	31.7	L	5	97	2	2			JON
1994 02 15.44		S	10.4	VN	31.7	L	5	97					JON
1994 02 16.39		S	10.6	VN	31.7	L	5	53	1.5	1			JON

Comet C/1993 Y1 (McNaught-Russell) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1994 02 17.40		S	10.4	VN	31.7	L	5	53	1.5	1			JON
1994 02 28.37		S	9.7	C	31.7	L	5	53	1				JON
1994 03 03.38		S	9.5	C	31.7	L	5	53	2.5				JON
1994 03 04.36		S	9.5	C	31.7	L	5	53	3				JON
1994 03 06.39		S	9.4	C	7.8	R	7	30					JON
1994 03 08.36		S	9.1	C	7.8	R	7	30	2				JON
1994 03 12.36		S	8.6	CS	7.8	R	7	30	2.5				JON
1994 03 20.35		S	7.5	SC	7.8	R	7	30	2.5	3			JON
1994 03 21.34		S	8.0	CS	7.8	R	7	30	2	2			JON
1994 04 05.84		S	6.5	AA	5.0	B		20	5.0	8			DIE02
1994 04 06.84		S	6.5	AA	5.0	B		20	6.0	8			DIE02
1994 04 09.86		S	6.4	AA	5.0	B		20	7.0	8			DIE02
1994 05 02.96		S	8.8	AA	11.4	L	8	36	3.0	5			BRO04
1994 05 15.92		S	9.9	AA	15.0	R	15	85	2.5	1			DIE02

Comet C/1994 G1 (Takamizawa-Levy)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1994 05 31.98		S	8.9	AA	11.4	L	8	72	3.0	7			BRO04
1994 06 05.91		S	8.7	AA	15.0	R	15	85	3.0	7			DIE02
1994 06 05.98		S	8.7	AC	35.0	L	5	117	4.5	8			BRO04
1994 06 07.98		S	8.7	AC	35.0	L	5	117	4.0	7			BRO04
1994 06 08.94		S	8.8	AA	15.0	R	15	85	3.0	8			DIE02
1994 06 11.94		S	8.7	AA	15.0	R	15	85	3.0	7			DIE02
1994 06 14.98		S	8.8	AC	35.0	L	5	103	4.5	7			BRO04

Comet C/1994 J2 (Takamizawa)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1994 05 14.15		S	9.8	AC	31.7	L	6	68	2.5	6			BOR
1994 05 14.15		S	9.9	AC	8.0	B		20	4.5	5			BOR

Comet C/1994 N1 (Nakamura-Nishimura-Machholz)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1994 08 08.99		S	8.9	AC	35.0	L	5	103	6.5				BRO04
1994 08 30.08	*	S	8.3	NO	8.0	B		20	7.5	2			BOR
1994 08 30.08	*	S	8.6	NO	31.7	L	6	68	4.3	3			BOR

Comet C/1995 O1 (Hale-Bopp)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1995 09 14.83		M	10.7	VF	12	L	6	38	& 3	4			REN
1996 04 16.15		M	9.5	VF	40	L	4	94	1	6/	0.02	0	REN
1996 04 21.14		M	9.0	AA	12	L	6	38	1.67	5			REN
1996 04 25.14		M	8.6	AA	12	L	6	38	3.5	5		315	REN
1996 05 20.06		M	7.6	AA	5	R	4	9		4			REN
1996 05 21.08		M	7.6	AA	5	R	4	9	12	4			REN
1996 06 12.07		M	6.4	AA	5	R	4	9	12	4			REN
1996 06 19.06		M	6.4	AA	5	R	4	9	12	5			REN
1996 06 24.03		M	6.0	AA	5	R	4	9	12	5			REN
1996 07 07.97		M	5.9	AA	5	R	4	9	12	5			REN
1996 07 15.97		M	6.3	AA	5	R	4	9	14	5			REN
1996 07 18.92		M	6.3	AA	5	R	4	9	17	5/	0.8	140	REN
1996 08 12.92		M	6.0	AA	5	R	4	9	14	5			REN
1996 08 15.96		M	5.8	AA	5	R	4	9	16	5/			REN
1996 09 04.91		M	6.2	AA	5	R	4	9	15	5/			REN
1996 09 15.89		M	6.2	AA	5	R	4	9	12	6			REN
1996 10 01.83		M	5.9	AA	5	R	4	9	12	5/	0.5	95	REN
1996 10 04.83		M	5.8	AA	5	R	4	9	15	5/	0.5		REN
1996 10 12.80		M	5.7	AA	5	R	4	9	15	5/	0.5		REN
1996 10 15.83		M	5.6	AA	5	R	4	9	12	5/			REN
1996 11 05.76		M	5.4	AA	5	R	4	9	13	6	0.3	90	REN
1996 11 07.76		M	5.2	AA	5	R	4	9	14	6			REN
1996 11 14.76		M	5.1	AA	5	R	4	9	14	6	0.3	95	REN

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 11 30.76		M	5 :	AA	5	R	4	9		5			REN
1996 12 07.75		M	4.7:	AA	5	R	4	9	15	6			REN
1996 12 14.75		M	4.2	AA	5	R	4	9	15	6			REN
1997 01 13.25	G		3.2	AA	0.0	E		1		8/			REN
1997 01 16.25	G		3.1	AA	0.0	E		1	30	8			REN
1997 02 07.22	G		2.1	AA	0.0	E		1	18	8			REN
1997 02 15.22	G		1.4	AA	0.0	E		1	&60	8			REN
1997 02 16.23	G		1.5	AA	0.0	E		1	&60	8			REN
1997 02 17.22	G		1.3	AA	0.0	E		1	&60	8	7	320	REN
1997 02 20.22	G		1.3	AA	0.0	E		1	&60	8	6		REN
1997 02 27.21	G		0.9	AA	0.0	E		1	&60	7/	4		REN
1997 03 02.19	G		0.4	HR	0.0	E		1		7/			REN
1997 03 08.19	G		0.5	HR	0.0	E		1	&60	7/	8	325	REN
1997 03 11.19	G		0.2	HR	0.0	E		1	60	7/	11		REN
1997 03 16.85	G		-0.2	HR	0.0	E		1	&60	7/	6		REN
1997 03 28.86	G		-0.5	HR	0.0	E		1	<60	7/	7		REN
1997 04 05.86	G		-1.1	HR	0.0	E		1	66.7	7/	14	355	REN
1997 04 29.88	G		0.5	HR	0.0	E		1	&30	7	5		REN

Comet C/1996 B2 (Hyakutake)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 01 31.74			10.0		12.0	B		20	4				MCN

Comet C/1996 N1 (Brewington)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 07.93		M	10.2	VF	12	L	6	38	& 4	2			REN
1996 07 20.88		M	9.1	VF	12	L	6	38	5.5	5/			REN
1996 08 12.88		M	9.0	AA	12	L	6	38	6	5			REN
1996 08 16.90		M	8.9	AA	8.0	B		12	6	4			REN
1996 09 05.87		M	9.6	VF	12	L	6	38	5.5	4/			REN
1996 09 07.87		M	9.7	VF	12	L	6	38	5.5	4			REN
1996 09 11.84		M	9.8	VF	12	L	6	38	5.5	4			REN
1996 09 15.87		M	10.8	VF	12	L	6	38	& 4	3/			REN
1996 10 01.85		M	[11 :	VF	12	L	6	38	! 2				REN
1996 10 02.84		M	13.0	VF	40	L	4	94	2	2			REN

Comet C/1996 Q1 (Tabur)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 25.12		M	9.9	VF	12	L	6	38	3.5	2			REN
1996 09 12.11		M	8.5	AA	6.0	B		8	& 5	5			REN
1996 09 14.11		M	7.3	AA	6.0	B		8	8	6			REN
1996 09 17.14		M	7.0	AA	5	R	4	9	8	5/			REN
1996 09 21.16		M	7.0	AA	5	R	4	9	10	5			REN
1996 09 24.15		M	6.4	AA	5	R	4	9	16	5			REN
1996 10 05.99		M	5.5	AA	5	R	4	9	10	5/			REN
1996 10 10.09		M	6.2	AA	5	R	4	9	15	5			REN
1996 10 13.03		M	6.2	AA	5	R	4	9	17	5			REN
1996 10 16.17		M	6.0	AA	5	R	4	9	&13	5/			REN
1996 10 18.16		M	6.9	AA	5	R	4	9	&10	5/			REN
1996 10 22.17		M	7.8	AA	5	R	4	9	&12	5			REN
1996 11 07.77			[9.0	AA	12	L	6	38	! 3				REN
1996 11 09.20			[10 :	VF	40	L	4	94					REN

Comet C/1997 D1 (Mueller)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1997 10 01.16		M	13.5	VF	40	L	4	94	1.5	2/			REN
1997 10 29.15		M	13.2	VF	40	L	4	94	1	4/			REN
1997 11 30.09		M	12.8	VF	40	L	4	94	1.25	4/			REN
1997 12 07.01		M	12.7	VF	40	L	4	94	1	4/			REN
1997 12 09.06		M	13.0	VF	40	L	4	94	1	4			REN
1997 12 26.85		M	13.5:	VF	40	L	4	94	& 1	4			REN

Comet C/1997 J1 (Mueller)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1997 05 13.05		M	13.5:	VF	40	L	4	148	1.25	4/			REN
1997 05 13.10		M	13.2	VF	40	L	4	94	1.25	4/			REN
1997 05 26.95		M	13.2	VF	40	L	4	148	1.25	4			REN
1997 06 08.97		M	13.1	VF	40	L	4	94	2	4			REN

Comet C/1997 J2 (Meunier-Dupouy)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1997 05 13.02		M	12.6	VF	40	L	4	94	1.5	3			REN
1997 05 25.94		M	12.8	VF	40	L	4	94	1	4			REN
1997 05 29.95		M	13.3	VF	40	L	4	148	1.5	4			REN
1997 06 02.98		M	13.2	VF	40	L	4	94	1.5	5/			REN
1997 06 08.99		M	12.8	VF	40	L	4	94	1.17	5/			REN
1997 07 05.97		M	12.8	VF	40	L	4	94	1.25	5			REN
1997 07 09.95		M	12.7	VF	40	L	4	94	1.33	5			REN
1997 08 31.91		M	12.4	VF	40	L	4	94	2	5			REN
1997 09 30.87		M	12.3	VF	40	L	4	57	1.67	4/			REN
1997 10 25.82		M	11.8	VF	40	L	4	57	2.75	5			REN
1997 10 26.79		M	11.8:	VF	12	L	6	68	& 1	5			REN
1998 06 15.99		M	12.2	VF	40	L	4	94	1	4			REN
1998 06 20.01		M	12.4	VF	40	L	4	94	1	4/			REN
1998 06 24.03		M	12.4	VF	40	L	4	94	1.33	4/			REN
1998 07 20.96	x	M	12.1	HS	33	L	4	80	1	4/			REN
1998 08 19.98	x	M	12.1	HS	40	L	4	94	1.25	5/			REN
1998 08 25.93	x	M	12.1	HS	40	L	4	94	1.25	5/			REN
1998 09 13.91	x	M	13.2	HS	40	L	4	94	1.5	5			REN
1998 09 17.91	x	M	13.0	HS	40	L	4	94	1	5			REN
1998 09 21.92	x	M	12.9	HS	40	L	4	94	1	5			REN
1998 10 17.82		M	13.5	EC	40	L	4	94	1	4/			REN

Comet C/1997 T1 (Utsunomiya)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1997 10 11.04		M	11 :	VF	40	L	4	57	1.5	5	4.5m	100	REN
1997 10 11.08		M	10.0	VF	8.0	B		12	& 3	4			REN
1997 10 24.85		M	10.0	VF	8.0	B		12	& 3	4/			REN
1997 10 24.95		M	10.5	VF	12	L	6	38		5			REN
1997 10 28.81		M	10.3	VF	12	L	6	38	3.5	4/			REN
1997 10 29.83					40	L	4	94	2.5	5	0.2	60	REN
1997 11 20.76		M	10.4	VF	12	L	6	38	3.33	5			REN
1997 11 29.80		M	10.5:	VF	12	L	6	38	& 2	4			REN
1997 12 02.77		M	10.0	VF	12	L	6	38	2.5	3			REN

Comet C/1998 K5 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1998 09 13.97	x	B	12.8	HS	40	L	4	150	& 0.15	8/	>0.01	270	REN
1998 09 19.96	x	B	13.0	HS	40	L	4	150	0.08	8/	45 s	270	REN
1998 09 22.00	x	B	12.8	HS	40	L	4	150		8/	45 s	270	REN
1998 10 17.93	x	B	13.1	HS	40	L	4	170		8	45 s	270	REN
1998 10 23.96	x	B	13.3	HS	40	L	4	170		8			REN
1998 10 27.02	x	B	13.5	HS	40	L	4	250		8	>25 s		REN
1998 11 10.92			[14 :		40	L	4	250					REN

Comet C/1998 M5 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1998 08 15.99	x	M	13.0	HS	40	L	4	94	1.25	6			REN
1998 08 19.07	x	M	12.8	HS	40	L	4	94	1.25	6			REN
1998 08 25.95	x	M	12.5	HS	40	L	4	94	1	5/	0.1	150	REN
1998 09 13.89	x	M	12.0	HS	40	L	4	94	1.25	5/			REN
1998 09 17.87	x	M	12.0	HS	40	L	4	94	1	5/			REN
1998 09 19.94	x	M	12.5	HS	40	L	4	94	1	5/			REN
1998 09 21.91	x	M	12.5	HS	40	L	4	94	1	5/			REN
1998 10 17.84	x	M	12.0	HS	40	L	4	94	1.5	4/			REN

Comet C/1998 M5 (LINEAR) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1998 10 23.87	x	M	11.5	HS	40	L	4	94	1.33	4/			REN
1998 11 10.78	x	M	11.5	HS	12	L	6	70	1.25	5/			REN
1998 11 16.78	x	M	11.5	HS	12	L	6	70	1.25	4/			REN
1998 12 20.78	x	M	10.8	TT	12	L	6	70	1	4			REN
1999 01 11.78	x	M	11.2	TT	12	L	6	70	& 1.5	4			REN
1999 03 15.15	x	M	9.9	TT	8.0	B		12	& 3	5			REN
1999 03 18.93	x	M	10.2	TT	10.0	B		20	& 3	4			REN
1999 03 20.89	x	M	10.5	TT	10.0	B		20	& 3	4			REN

Comet P/1998 U3 (Jaeger)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1998 11 10.93	x	M	12.7	HS	40	L	4	94	1	6			REN
1998 11 15.92	x	M	12.5	HS	40	L	4	94	1	5/			REN
1998 11 20.96	x	M	12.6	HS	40	L	4	94	0.75	6	0.9m	280	REN
1998 11 23.99	x	M	12.4	HS	40	L	4	94	0.75	5/	0.9m		REN
1998 12 20.94	x	M	11.3	HS	40	L	4	94	1.33	5	1.5m	275	REN
1998 12 21.08	x	M	11.4	HS	12	L	6	70	& 1	5			REN
1998 12 29.24	x	M	11.4	HS	12	L	6	70	& 1	5			REN
1999 01 11.82	x	M	11.3	HS	12	L	6	38	& 2.5	5			REN
1999 01 14.91	x	M	11.7	HS	40	L	4	94	1	5/		280	REN
1999 01 17.92	x	M	11.5	HS	12	L	6	38	& 1	5			REN
1999 02 07.93	x	M	11.8	HS	40	L	4	94	2	5			REN
1999 02 09.88	x	M	11.8	HS	40	L	4	94	1.75	4/			REN
1999 02 13.90	x	M	12.3	HS	40	L	4	94	1	5/			REN
1999 03 14.10		M	14.0	EA	40	L	4	170	1	5			REN

Comet C/1998 U5 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1998 11 10.82	x	M	9.4	TT	12	L	6	38	4	5			REN
1998 11 15.82	x	M	9.4	TT	12	L	6	38	4	5			REN
1998 11 23.84	x	M	9.7	TT	12	L	6	38	4	5			REN
1998 12 20.80	x	M	11.2	HS	12	L	6	70	2.25	4			REN
1999 01 05.80	x	M	12.0	HS	40	L	4	94	& 1.75	2			REN

Comet C/1999 H1 (Lee)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1999 08 15.10	x	M	7.6	TT	8.0	B		12	4.5	6			REN
1999 09 04.08	x	M	7.7	TT	8.0	B		12	5	5			REN
1999 09 07.04	x	M	7.8	TT	8.0	B		12	5	4			REN
1999 09 11.13	x	M	8.0	TT	8.0	B		12	9	5			REN
1999 09 15.08	x	M	8.3	TT	8.0	B		12	9	4			REN
1999 10 04.99	x	M	10.2	TT	12	L	6	38	4	4			REN
1999 10 07.15	x	M	10.1	TT	12	L	6	38	4	4/			REN
1999 10 19.00	x	M	10.2	TT	12	L	6	38	4.5	3			REN

Comet C/1999 H3 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1999 07 08.97	x	M	14.5:	HS	40	L	4	150	0.5	5			REN
2000 03 01.97	x	S	15.0	HS	40	L	4	250	& 0.25	3			REN

Comet C/1999 J2 (Skiff)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 02 09.17	x	S	15.0	HS	40	L	4	250	& 0.2	7			REN
2000 02 12.21	x	S	15.0	HS	40	L	4	250		7			REN

Comet C/1999 J3 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1999 08 15.12	x	M	11.3	HS	12	L	6	70	1	4			REN
1999 09 11.10	x	M	9.0	TT	8.0	B		12	5	5			REN

Comet C/1999 J3 (LINEAR) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1999 09 15.08	x	M	8.8	TT	8.0	B		12	4	5			REN
1999 09 21.12	x	M	8.1	TT	8.0	B		12	4	5/			REN
1999 10 05.06	x	M	7.9	TT	8.0	B		12	5	4/			REN
1999 10 07.16	x	M	7.9	TT	8.0	B		12	6	4/			REN
1999 10 19.18	x	M	8.7	TT	12	L	6	38	6	4			REN

Comet C/1999 K8 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 08 29.09	x	S	14.5:	HS	40	L	4	200	0.6	2/			REN
2000 09 05.07	x	S	14.5:	HS	40	L	4	200	& 0.5	2			REN
2000 10 23.96	x	S	15.0:	HS	40	L	4	150	& 1	3/			REN
2000 11 03.97	x	S	15.0:	HS	40	L	4	150	& 1	3			REN
2000 11 23.85	x	S	15.0:	HS	40	L	4	150	& 0.8	3/			REN

Comet C/1999 S3 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1999 10 07.83	x	M	13.4	HS	40	L	4	94	0.25	6			REN
1999 10 16.93	x	M	12.8	HS	40	L	4	94	0.5	6			REN
1999 10 27.77	x	M	12.8	HS	40	L	4	94	1.33	5/			REN
1999 11 02.90	x	M	12.5	HS	40	L	4	94	1.33	5/	0.04	104	REN
1999 11 09.90	x	M	12.5	HS	40	L	4	94	1	5/	0.04	100	REN
1999 11 15.98	x	M	12.8	HS	40	L	4	94	1.25	5/	0.04		REN
1999 12 05.81	x	M	12.7	HS	40	L	4	150	0.6	6/			REN

Comet C/2000 K2 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 10 23.81	x	S	14.2	HS	40	L	4	250	0.5	5			REN
2000 11 17.81	x	S	14.5	HS	40	L	4	250	0.3	5			REN
2000 11 23.80	x	S	15.0	HS	40	L	4	250	& 0.3	4/			REN
2000 12 16.78	x	S	15.0	HS	40	L	4	250	& 0.3	4			REN

Comet P/2000 S1 (Skiff)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 10 23.94	x	S	15 :	HS	40	L	4	250	0.4	4/			REN
2000 11 03.93	x	S	15 :	HS	40	L	4	250	0.4	5			REN

Comet C/2000 U5 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 11 03.99	x	B	14.7	HS	40	L	4	250	0.5	4/			REN
2000 11 23.94	x	S	15.0:	HS	40	L	4	250	0.4	4			REN
2000 11 30.01	x	S	15.0:	HS	40	L	4	250	& 0.3	5			REN

Comet C/2000 WM_1 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2001 09 14.39		S	13.8	AC	44.5	L	4	167	0.6	2			MOR03
2001 09 29.37		S	13.0	AC	44.5	L	4	167	0.7				MOR03
2001 10 15.40		S	11.4	AC	15	R	5	42	2.5	3			MOR03
2001 10 22.26		S	10.5	AC	15	R	5	42	2.5	2			MOR03
2001 10 30.42		S	10.0	AC	15	R	5	42	3	4			MOR03
2001 11 06.03		S	9.4	AC	15	R	5	42	2.5	4	0.06	240	MOR03
2001 11 08.03		S	9.6	AC	15	R	5	42	2	3			MOR03
2001 11 11.13		S	7.8	AA	20.0	T	10	50		4			SHA04
2001 11 11.33		S	7.6	AC	3.5	B		7	9	3			MOR03
2001 11 13.43		S	7.5	AC	3.5	B		7	10	3			MOR03
2001 11 15.14		S	7.3	AC	3.5	B		7	12	3			MOR03
2001 11 16.06		S	7.5	AA	20.0	T	10	50	3.6	6			SHA04
2001 11 17.10		S	7.1	AC	3.5	B		7	14	3			MOR03
2001 11 18.08		S	7.0	AA	20.0	T	10	50	5.7	8			SHA04
2001 11 18.12		S	6.9	AC	3.5	B		7	15	3			MOR03

Comet C/2000 WM_1 (LINEAR) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2001 11 22.15		S	6.0	AC	3.5	B		7	12	3			MOR03
2001 11 24.06		S	5.9	AC	3.5	B		7	15	3			MOR03
2001 12 02.97		S	6.0	AA	3.5	B		7	13	3			MOR03
2001 12 04.03		S	5.9	AA	3.5	B		7	13	3			MOR03
2001 12 06.00		M	6.0	AA	3.5	B		7	13	4	0.50	40	MOR03
2001 12 07.03		M	6.0	AA	3.5	B		7	12	4	0.60	45	MOR03
2001 12 08.05		M	5.8	AA	3.5	B		7	14	4			MOR03
2001 12 10.03		S	6.0	AA	3.5	B		7	14	4	0.42	45	MOR03
2001 12 10.97		S	5.9	AA	3.5	B		7	12	4			MOR03
2002 02 18.46		S	6.1	AC	3.5	B		7	12				MOR03
2002 03 04.42		S	7.8	AC	6	R	15	36	4.5	2			MOR03
2002 03 17.39		S	8.2	AC	15	R	5	42	3	4	0.13	240	MOR03
2002 03 22.39		S	8.4	AC	15	R	5	42	3.5	3			MOR03
2002 03 25.40		S	8.5	AC	15	R	5	42	3.5	3			MOR03
2002 04 05.37		S	9.5	AC	15	R	5	42	3	3			MOR03
2002 04 12.37		S	9.6	AC	15	R	5	42	2.5	3			MOR03
2002 04 17.37		S	9.5	AC	15	R	5	42	3.5	3			MOR03
2002 04 21.34		S	9.5	AC	15	R	5	42	3	3			MOR03
2002 05 10.32		S	12.6	AC	44.5	L	4	167	0.8	4			MOR03
2002 05 22.34		S	13.0	AC	44.5	L	4	167	0.8	2			MOR03

Comet C/2001 HT_50 (LINEAR-NEAT)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 12 02.41		S	13.2	AC	44.5	L	4	167	0.5	5			MOR03
2002 12 03.42		S	13.0	AC	44.5	L	4	167	0.7	5			MOR03
2002 12 17.44		S	12.9	AC	44.5	L	4	167	0.8	3			MOR03
2003 01 14.40		S	12.7	AC	44.5	L	4	167	0.6	4			MOR03
2003 01 30.10		S	13.4	AC	44.5	L	4	167	0.5	4			MOR03
2003 02 24.02		S	13.2	AC	44.5	L	4	167	0.6	4			MOR03
2003 03 07.04		S	13.5	AC	44.5	L	4	167	0.5	3			MOR03
2003 03 31.06		S	13.9	AC	44.5	L	4	167	0.3	5			MOR03
2003 09 26.36		S	12.8	AC	44.5	L	4	167	0.6	5			MOR03
2003 11 21.07		S	13.9	AC	44.5	L	4	167	0.4	6			MOR03
2003 12 18.99		S	13.4	AC	44.5	L	4	167	0.5	5			MOR03
2004 01 15.99		S	13.7	AC	44.5	L	4	167	0.6	2			MOR03

Comet P/2001 MD_7 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2001 12 06.98		S	12.2	AC	44.5	L	4	167	0.9	2			MOR03

Comet C/2001 OG_108 (LONEOS)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 03 17.35		S	11.3	AC	44.5	L	4	80	1.4	2			MOR03
2002 03 25.41		S	11.0	AC	15	R	5	62	2.0	2			MOR03
2002 04 05.28		S	11.5	AC	15	R	5	62	1.4	2			MOR03
2002 04 07.35		S	11.5	AC	15	R	5	62	2.1	2			MOR03
2002 04 17.09		S	12.1	AC	44.5	L	4	80	1.3	2			MOR03

Comet P/2001 Q2 (Petriew)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2001 08 27.34		S	10.9	AC	44.5	L	4	80	1.7	2			MOR03
2001 08 29.38		S	10.8	AC	44.5	L	4	80	1.9	3			MOR03
2001 08 30.37		S	10.7	AC	44.5	L	4	80	1.8	3			MOR03
2001 09 14.35		S	9.7	AC	15	R	5	42	2.5	3			MOR03
2001 09 16.38		S	10.4	AC	15	R	5	42	2	3			MOR03
2001 10 18.38		S	12.9	AC	44.5	L	4	167	0.7	1			MOR03

Comet C/2001 Q4 (NEAT)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 01 11.80		S	13.2	HS	27.0	L	6	167	0.7	2			TOT03

Comet C/2001 Q4 (NEAT) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 02 05.42	*	S	12.5	TA	40.0	L	4	144	0.9	2			YOS04
2005 02 05.85		S	13.4	HS	36	L	6	90	0.9	1/			BAR06
2005 02 07.88		S	13.5	HS	36	L	6	90	0.6	2			BAR06

Comet P/2001 Q6 (NEAT)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2001 10 18.39		S	12.7	AC	44.5	L	4	167	1.1	1			MOR03
2001 11 08.01		S	12.0	AC	44.5	L	4	80	1.8	1			MOR03
2001 12 07.09		S	13.2	AC	44.5	L	4	167	0.8	1			MOR03

Comet C/2001 RX_14 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 11 05.41		S	12.9	AC	44.5	L	4	167	0.7	4			MOR03
2002 11 13.12		S	12.1	TI	25.0	T	5	45	& 1	s5	3 m		SCA02
2002 12 03.41		S	12.8	AC	44.5	L	4	167	0.3	5	0.8m	295	MOR03
2002 12 17.43		S	12.7	AC	44.5	L	4	167	0.9	4			MOR03
2003 01 07.37		S	13.0	AC	44.5	L	4	167	0.5	4	1.1m	290	MOR03
2003 01 30.28		S	12.8	AC	44.5	L	4	167	0.6	4	0.8m	240	MOR03
2003 02 11.45		S	12.8	AC	44.5	L	4	167	0.3	5	1.0m	250	MOR03
2003 02 26.42		S	12.5	AC	44.5	L	4	167	0.7	5			MOR03
2003 03 07.08		S	12.5	AC	44.5	L	4	167	0.9	4			MOR03
2003 03 27.13		S	12.3	AC	44.5	L	4	167	0.9	5			MOR03
2003 03 31.07		S	12.5	AC	44.5	L	4	167	0.8	5			MOR03
2003 04 24.17		S	13.2	AC	44.5	L	4	167	0.7	5			MOR03
2003 05 05.09		S	13.0	AC	44.5	L	4	167	0.6	3			MOR03
2003 05 19.12		S	13.3	AC	44.5	L	4	167	0.7	1			MOR03

Comet C/2001 W2 (BATTERS)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2001 12 06.98		S	11.8	AC	44.5	L	4	167	0.9	3			MOR03

Comet C/2002 E2 (Snyder-Murakami)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 03 17.38		S	10.8	AC	15	R	5	42	1.2	2			MOR03
2002 03 22.38		S	10.7	AC	15	R	5	42	3	2			MOR03
2002 03 25.40		S	11.1	AC	15	R	5	62	2.0	2			MOR03
2002 04 05.31		S	11.6	AC	44.5	L	4	80	1.1	2			MOR03
2002 04 18.37		S	11.4	AC	44.5	L	4	80	1.5	2			MOR03
2002 04 21.36		S	12.0	AC	44.5	L	4	80	1.0	2			MOR03

Comet C/2002 F1 (Utsunomiya)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 03 25.41		S	9.1	AC	6	R	15	50	2.5	2			MOR03
2002 04 05.39		S	9.2	AC	15	R	5	42	0.7		0.05	295	MOR03
2002 04 07.40		S	9.1	AC	15	R	5	42	0.8		0.07	290	MOR03
2002 04 12.39	w	S	6.0	AA	3.5	B		7					MOR03
2002 04 17.38	w	S	6.2	AA	15	R	5	42	0.5	7	0.09	330	MOR03
2002 04 21.05		S	5.5	AA	15	R	5	42	0.3	8	0.04	355	MOR03
2002 04 23.06	w	M	5.8	AA	15	R	5	42		S9	0.07	350	MOR03
2002 04 24.06	w	M	5.7	AA	15	R	5	42		S9	0.08	355	MOR03
2002 04 27.06		S	4.5	AA	3.5	B		7		S9			MOR03
2002 04 27.06		S	4.9	AA	15	R	5	42		S9	0.08	15	MOR03
2002 05 01.06	w	S	5.3	AA	15	R	5	42	1	5	0.12	35	MOR03

Comet C/2002 H2 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 05 11.17		S	13.8	AC	44.5	L	4	167	0.7	1			MOR03

Comet C/2002 T7 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 01 11.97		S	[12.5	HS	27.0	L	6	167	! 0.5				TOT03

Comet C/2002 V1 (NEAT)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 12 03.04		S	13.5	AC	44.5	L	4	167	0.7	2			MOR03
2002 12 09.08		S	13.1	AC	44.5	L	4	167	1.1	3			MOR03
2003 01 07.06		S	8.4	AC	15	R	5	42	4	3			MOR03
2003 01 07.07		S	8.0	AC	3.5	B		7	5	2			MOR03
2003 01 14.03		S	7.4	AC	3.5	B		7	5				MOR03
2003 01 20.99		S	6.7	AA	3.5	B		7	5	3			MOR03
2003 01 22.00		S	6.6	AA	3.5	B		7	4.5	5			MOR03
2003 01 23.02		S	6.5	AA	3.5	B		7	4.5	5			MOR03
2003 01 24.03		S	6.4	AA	3.5	B		7	4.5	5			MOR03
2003 01 26.99		S	6.3	AA	3.5	B		7	4	5			MOR03
2003 01 30.06	w	S	5.9	AA	3.5	B		7	3.5	6			MOR03
2003 01 31.00		S	6.0	AA	3.5	B		7	4	6			MOR03
2003 02 03.03	w	S	5.8	AA	3.5	B		7	4	7			MOR03
2003 02 09.99		S	3.8	AA	3.5	B		7		S9	0.8	40	MOR03

Comet C/2002 X5 (Kudo-Fujikawa)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 12 27.44	w	S	7.2	AC	3.5	B		7	6	3			MOR03
2002 12 29.40		S	6.8:	AA	20.0	T	10	50	2.3	4			SHA04
2003 01 02.46	w	S	6.9	AC	3.5	B		7	8	4			MOR03
2003 01 07.47	w	S	6.6	AC	3.5	B		7	5	4			MOR03
2003 01 10.47	w	S	6.2	AC	3.5	B		7	3.5	5			MOR03
2003 01 12.47		S	6.5	AC	3.5	B		7	3	5			MOR03
2003 01 14.47		S	6.2	AA	3.5	B		7	6				MOR03

Comet C/2002 Y1 (Juels-Holvorcem)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2003 02 10.34		S	9.0	AC	15	R	5	42	4.5	3			MOR03
2003 02 11.41		S	8.5	AC	15	R	5	42	6	3			MOR03
2003 02 20.41		S	8.1	AC	15	R	5	42	5	3			MOR03
2003 02 25.43		S	8.2	AC	15	R	5	42	3.5	4			MOR03
2003 02 25.79		S	7.0	TI	5.0	B		7	10	s4			SCA02
2003 02 26.43		S	8.2	AC	15	R	5	42	3.5	4			MOR03
2003 02 27.77		S	7.0	TI	5.0	B		7	10	s4			SCA02
2003 02 28.02	w	S	8.0	AC	15	R	5	42	5	4			MOR03
2003 02 28.75		S	7.0	TI	5.0	B		7	8	s5			SCA02
2003 03 03.43		S	8.1	AC	15	R	5	42	4	4			MOR03
2003 03 07.03		S	8.0	AC	15	R	5	42	3	4			MOR03
2003 03 10.03		S	7.8	AC	15	R	5	42	3.5	4			MOR03
2003 03 27.41	w	S	7.0	AC	6	R	15	36	2.5	5			MOR03
2003 04 06.39	w	S	7.1	AC	6	R	15	36	2	6			MOR03
2003 04 10.39		S	6.9	AA	15	R	5	42	1.7	6			MOR03
2003 04 13.38	w	S	6.9	AA	15	R	5	42	1.3	6			MOR03

Comet C/2003 K4 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2004 11 06.73		S	7.2	TK	10	B		25	4.0	4			MAT08
2004 11 16.69		S	7.2	TK	10	B		25	4	4			MAT08
2005 01 02.49		S	8.0	TK	7.8	R	4	13	7	1			JON
2005 01 06.42		S	7.6	TK	7.8	R	4	13	4	1			JON
2005 01 06.54		S	7.6	TK	5.0	B		7	6	4			MAT08
2005 01 12.59		S	7.8	TK	7.8	R	4	13	5	1			JON
2005 01 14.58		S	8.4	TK	7.8	R	4	13	4	1			JON
2005 01 17.59		S	8.7	TK	7.8	R	4	13	3	1			JON
2005 01 18.60		S	10.1	TK	31.7	L	5	64	4	5			JON
2005 01 21.60		S	9.8	TK	31.7	L	5	64	2	3			JON
2005 02 04.41		S	10.5	TK	31.7	L	5	64	2	5			JON

Comet C/2003 K4 (LINEAR) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 02 05.75		M	9.2	TK	5.0	B		10	4	3			BAR06
2005 02 06.43		S	10.0	TK	31.7	L	5	64	2	5			JON
2005 02 07.72		M	9.3	TK	5.0	B		10	4	3			BAR06
2005 02 07.73		M	9.4	HS	36	L	6	90	4	4			BAR06
2005 02 08.43		S	10.3	TK	31.7	L	5	64	1.5	3			JON
2005 02 10.73		M	9.6	HS	36	L	6	90	4	4			BAR06
2005 03 02.38		S	11.0	AU	31.7	L	5	64	1	1			JON
2005 03 03.10		M	9.1	TK	36	L	6	80	3	4/			BAR06
2005 03 07.36		S	11.2	AU	31.7	L	5	64	1	1			JON
2005 03 07.75	x	S	9.8	TK	40.0	L	4	144	1.2	5			COO02
2005 03 13.10		S	8.1:	TK	6.0	B		20	4	4			BAR06
2005 03 27.09		S	7.9:	HS	6.0	B		20	4	4			BAR06
2005 03 28.72	x	S	11.5:	TK	40.0	L	4	144		2			COO02

Comet C/2003 T4 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 01 08.69		S	11.5	HS	40.5	L	4	70	1.5	4/			SAR02
2005 01 16.09		S	11.8	HS	20.0	L	5	111	1	3			NAG09
2005 01 16.72		S	11.5	HS	27.0	L	6	120	1.3	4			TOT03
2005 02 06.11		M	9.6	TJ	15	B		25	2	3/			SHU
2005 02 09.08		M	10.9	TJ	41	L	4	113	3	4			SHU
2005 04 08.81		S	7.7	TK	10	B		25	4	5			MAT08
2005 04 09.71		S	7.8	TK	7.8	R	4	15	2	1			JON
2005 04 11.71		S	8.2	TK	7.8	R	4	15	2	1			JON
2005 04 12.72		S	8.0	TK	7.8	R	4	15	3	1			JON
2005 04 14.72		S	8.4	TK	7.8	R	4	15	2	1			JON
2005 04 15.72		S	8.3	TK	7.8	R	4	15	2	1			JON
2005 04 21.70		S	8.5	TK	7.8	R	4	15	2	1			JON
2005 05 05.33		S	7.9	TK	8.0	B		20	3	7			AMO01
2005 05 08.75		S	9.8	TK	31.7	L	5	64	2	3			JON
2005 05 09.78		S	8.0	AA	10.0	B		25					SEA
2005 05 12.74		S	10.3	TK	31.7	L	5	64	1.5	4			JON
2005 05 12.81		S	8.4	TK	10	B		25	3	6			MAT08
2005 05 15.74		S	9.8	TK	31.7	L	5	64	2	4			JON
2005 05 28.89		S	8.5:	TK	8.0	B		20					AMO01
2005 05 29.96		S	9.5:	TK	20.3	T	10	57	& 2	1			ROB06

Comet C/2004 K1 (Catalina)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 05 03.73		S	[14.0	AU	40.0	L	4	144	! 0.6				YOS04
2005 05 04.73		S	[13.3	AU	40.0	L	4	144	! 0.5				YOS04
2005 05 07.60	x	S	15.0	HS	45.7	L	4	291	0.6	3			MUR02
2005 06 06.53		S	[13.7	AU	40.0	L	4	144	! 0.7				YOS04
2005 07 03.93		S	14.2	HN	31.0	J	6	155	0.4	4/			BOU
2005 07 03.94		S	14.4	HN	31.0	J	6	155	0.6	2/			DIJ
2005 07 05.96	w	S	14.2	HN	31.0	J	6	155	0.4	4			BOU
2005 07 05.96	w	S	14.2	HN	31.0	J	6	155	0.7	1			DIJ
2005 07 10.94	w	S	14.3	HN	31.0	J	6	155	0.5	0/			DIJ
2005 07 10.94	w	S	14.4	HN	31.0	J	6	155	0.5	4			BOU

Comet C/2004 L1 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 05 03.49		S	[12.6	AU	40.0	L	4	144	! 0.8				YOS04

Comet C/2004 Q1 (Tucker)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2004 10 09.60		S	11.4	TK	38	L	5	150	2.5	5			MAT08
2004 11 16.48		S	10.6	TK	10	B		25	3.0	4			MAT08
2005 01 08.73		S	11.6	HS	40.5	L	4	128	1.9	D6			SAR02
2005 01 08.76		S	11.4	HS	20.0	L	5	83	2	4/			NAG09
2005 01 11.77		S	11.3	HS	27.0	L	6	88	2.0	4			TOT03

Comet C/2004 Q1 (Tucker) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 01 13.83		S	11.4	HS	34.0	L	4	150	1	2			SZA
2005 02 05.80		S	11.2	HS	36	L	6	90	1.9	2			BAR06
2005 02 10.90		S	10.9	HS	36	L	6	90	2.6	2			BAR06
2005 03 02.80		S	12.5:	HS	36	L	6	90	1.2	2			BAR06
2005 03 13.81		S	11.6	HS	34.0	L	4	166	2.5	1			SZA
2005 04 05.98		S	13.0:	HS	36	L	6	90	1	2			BAR06
2005 05 03.50		S	[12.6	TA	40.0	L	4	144	! 0.9				YOS04
2005 05 04.46		S	12.8	TA	40.0	L	4	144	1.0	3			YOS04
2005 05 07.52	x	S	12.9	HS	45.7	L	4	170	1.3	3			MUR02
2005 05 13.02	a	S	13.4	HN	31.0	J	6	155	0.8	2/			BOU
2005 05 13.02	a	S	13.4:	HN	31.0	J	6	155	0.7	1			DIJ
2005 06 06.49		S	[11.8	HS	40.0	L	4	144	! 0.9				YOS04

Comet C/2004 Q2 (Machholz)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2004 09 17.67		S	10.4	TK	10	B		25	2	5			MAT08
2004 09 19.79		S	10.0	TK	10	B		25	2	4	5 m	290	MAT08
2004 10 08.73		S	8.9	TK	10	B		25	4	5	8 m	250	MAT08
2004 11 06.56		S	7.0	TK	10	B		25	7	5			MAT08
2004 11 16.59		S	6.4	TK	5.0	B		7	9	5			MAT08
2004 12 18.21		B	4.5	AC	3.5	B		7	38	5			NOW
2004 12 19.06		B	4.8	A	5.0	B		7	19	5			SIM
2004 12 19.06		B	5.0	A	5.6	B		8	22	6			HAY03
2005 01 01.84		S	4.1	AA	5.0	B		7		5	1	140	TUR
2005 01 02.13		B	3.9	AC	3.5	B		7	47	6			NOW
2005 01 02.41		S	4.9	TK	3.0	B		8	14	6			JON
2005 01 02.41		S	5.3	TK	4.5	R	6	13	14	6			JON
2005 01 02.86		S	5.0	TI	7.0	R	5	14	15	S4	0.66	90	CSO
2005 01 03.00		S	4.3	TI	0.0	E		1	30	2/			SAR02
2005 01 03.67		S	3.8	AA	5.0	B		7	16	5			KOS
2005 01 03.67		S	3.9	AA	0.0	E		1	13	4			KOS
2005 01 03.68		S	3.8	AA	8.0	R	6	19	17	S5	4.2	90	KOS
2005 01 03.87		S	3.8	TI	3.0	B		8	30	6	1.5	70	TOT03
2005 01 03.88		S	3.7	TI	0.0	E		1	15	5			SZA
2005 01 04.86		S	3.8	TI	0.0	E		1	15	5	0.25	70	SZA
2005 01 04.88		S	4.5	TI	5.0	B		15	15	5			KOV02
2005 01 05.74		S	3.8	AA	8.0	B		20	15	6	1.5	80	KES01
2005 01 05.77		S	3.5	AA	0.0	E		1	12	4			KOS
2005 01 05.78		M	3.2	TI	0.0	E		1	30	s4			SAN07
2005 01 05.78		S	3.4	AA	5.0	B		7	15	5	6	87	KOS
2005 01 06.41		S	4.5	TK	3.0	B		8	19	5			JON
2005 01 06.48			3.6	TK	0.7	E		1	25	5			MAT08
2005 01 06.79		M	3.0	TI	0.0	E		1	30	s5			SAN07
2005 01 06.79		S	3.5	AA	6.0	B		20	15	6	1.5	80	BAL04
2005 01 06.83		S	4.4	TI	5.0	B		15	10	4			KOV02
2005 01 06.90		S	3.7	AA	5.0	B		7	3.5	6	1.4	120	TUR
2005 01 06.96		S	3.8	TI	0.0	E		1	30	5			NAG09
2005 01 07.09		B	4.0	A	5.0	B		7	12	4			SIM
2005 01 07.75		S	3.3	AA	0.0	E		1	12	4			KOS
2005 01 07.75		S	4.4	TI	5.0	B		15	10	5			KOV02
2005 01 07.76		S	3.2	AA	5.0	B		7	15	5	4	83	KOS
2005 01 07.76		S	3.2	AA	8.0	R	6	19	16	S5	5	83	KOS
2005 01 08.00		S	3.6	TI	0.0	E		1	35	6			NAG09
2005 01 08.40		S	4.6	TK	3.0	B		8	10	5			JON
2005 01 08.70		S	3.3	AA	0.0	E		1	15	4			KOS
2005 01 08.71		S	3.2	AA	5.0	B		7	18	5	5	85	KOS
2005 01 08.71		S	4.0	TI	0.0	E		1	35	5/			SAR02
2005 01 08.72		S	3.2	AA	8.0	R	6	19	18	S5	5	85	KOS
2005 01 08.77		S	3.8	TI	0.0	E		1	30	7	1	170	NAG09
2005 01 08.79		S	4.0	TI	7.0	R	5	14	10	S4	1.5	115	CSO
2005 01 08.81		S	4.0	TI	0.0	E		1	30	6			TOT03
2005 01 08.84		M	3.3	TI	0.0	E		1	25	D5			SAN07
2005 01 09.76		S	3.5	AA	3.0	B		8	35	D4	3	200	HAD01
2005 01 09.79		S	4.5	TI	5.0	B		15	7	5			KOV02

Comet C/2004 Q2 (Machholz) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 01 09.83		S	3.9	AA	5.0	B		7	3.8	6	0.6	125	TUR
2005 01 09.86		S	3.2	AA	8.0	R	6	19	12	S6	6.5	87	KOS
2005 01 09.87		S	3.8	TI	0.0	E		1	20	4			SZA
2005 01 09.88		S	3.6	TI	0.0	E		1	25	6			NAG09
2005 01 10.01		B	4.1	A	0.0	E		1	15	2			SIM
2005 01 10.75		S	3.7	AA	8.0	B		20	20	5			KES01
2005 01 10.79		S	4.3	TI	7.0	R	5	14	10	S4	1	75	CSO
2005 01 10.86		S	3.8	TI	0.0	E		1	15	4			SZA
2005 01 11.70		S	3.4	AA	0.0	E		1	12	5			KOS
2005 01 11.70		S	3.4	AA	5.0	B		7	15	6	5.4	85	KOS
2005 01 11.80		S	4.0	TI	0.0	E		1	15	4			SZA
2005 01 11.84		S	3.8	TI	4.8	R	6	15	25	5/			TOT03
2005 01 12.04			4.3	A	0.0	E		1	12	1			SIM
2005 01 12.41		S	5.0	TK	3.0	B		8	13				JON
2005 01 13.68		M	3.9	HD	6.0	B		20	20	3	0.9m	110	SHU
2005 01 13.76		S	4.0	TI	0.0	E		1	25	5			SZA
2005 01 13.86		S	4.5	TI	5.0	B		15	7	5	0.33	50	KOV02
2005 01 15.86		S	3.3	AA	0.0	E		1	12	5			KOS
2005 01 15.86		S	3.4	AA	5.0	B		7	15	6	3.3	85	KOS
2005 01 15.87		S	3.3	AA	8.0	R	6	19	15	S6	1.8	85	KOS
2005 01 15.88		M	4.0	TI	0.0	E		1	20	d4			SAN07
2005 01 15.96		S	3.6	TI	0.0	E		1	20	6			NAG09
2005 01 16.91		S	4.6	AC	5.0	B		10	25	s3			ERD
2005 01 16.96		M	4.0	TI	0.0	E		1	20	D4/			SAN07
2005 01 16.96		S	3.6	TI	0.0	E		1	25	s7	1	80	NAG09
2005 01 17.73		S	5.0	TI	5.0	B		15	3	5			KOV02
2005 01 21.87		S	4.4:	TI	5.0	B		10	15	5	0.5	95	NAG09
2005 01 27.02		B	5.3	A	5.0	B		7	16	3			SIM
2005 01 29.09		B	4.7	AC	3.5	B		7	41	4			NOW
2005 01 30.79		S	5.6	TI	5.0	B		15	3	4			KOV02
2005 02 04.71		S	4.8	AA	5.0	B		7	11	6	1.7	83	KOS
2005 02 04.71		S	5.0	AA	0.0	E		1	8	5			KOS
2005 02 04.79		S	5.0	TI	7.0	R	5	14	10	2			CSO
2005 02 04.83		M	4.9	HV	3.0	B		8	18	5/			SHU
2005 02 04.90		M	4.9	TK	3.0	B		4	18	4/			BAR06
2005 02 05.09					5.0	B		10	18	5	1.5	80	BAR06
2005 02 05.09		M	5.0	TK	0.0	E		1	16	S5			BAR06
2005 02 05.64		M	4.8	HD	6	R	10	10	14	6			KOZ02
2005 02 05.73		B	5.0	TK	3	O		8	11	3	19.2s	101	SER
2005 02 05.76		I	4.9	HV	0.0	E		1	11	4			SHU
2005 02 05.76		M	4.9	HV	3.0	B		8	15	5/			SHU
2005 02 05.95		S	4.8	AC	6.0	B		20	21	5	0.9	85	CZE03
2005 02 06.75		M	5.1	TK	5.0	B		10	14	D4/			BAR06
2005 02 06.88		M	5.1	HV	3.0	B		8	15	5/			SHU
2005 02 07.71		S	5.3	AA	5.0	B		7	11	6	1.2	83	KOS
2005 02 07.72		S	5.4	AA	0.0	E		1	8	6			KOS
2005 02 07.80		S	5.4	TI	5.0	B		15	12	2	1.5	75	CSO
2005 02 07.85		M	5.1	TK	5.0	B		10	14	D5			BAR06
2005 02 08.73		S	5.3	AA	8.0	R	6	19	13	S6	0.9	83	KOS
2005 02 08.74		S	5.4	AA	5.0	B		7	10	6	0.8	83	KOS
2005 02 08.74		S	5.5	AA	0.0	E		1	8	6			KOS
2005 02 08.78		I	4.9	HV	0.0	E		1	8	4			SHU
2005 02 08.78		M	5.2	HV	3.0	B		8	9	5	10 m	65	SHU
2005 02 08.93		M	5.1	TK	5.0	B		10	15	D5			BAR06
2005 02 09.16		M	5.2	HV	3.0	B		8	7	5			SHU
2005 02 09.73		M	4.7	HV	3.0	B		8	8	5			SHU
2005 02 09.74		S	4.9	AA	3.0	B		8	20	6	2	110	HAD01
2005 02 09.96		M	5.2	TK	5.0	B		10	14	D4/			BAR06
2005 02 10.89		M	5.0	TK	5.0	B		10	18	5	1.7	77	BAR06
2005 02 11.10		B	5.4	A	5.0	B		7	9	3			SIM
2005 02 26.80		S	5.3	AA	8.0	R	6	19	6	s5	0.8	96	KOS
2005 02 26.80		S	5.5	AA	5.0	B		7	5	5			KOS
2005 02 26.81		S	5.6	AA	0.0	E		1	3	4			KOS
2005 02 28.76		S	6.1	TI	5.0	B		15	12	4	1	100	CSO
2005 02 28.78		S	5.5	AA	8.0	R	6	19	8	s4	1.0	100	KOS

Comet C/2004 Q2 (Machholz) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 02 28.79		S	5.5	AA	5.0	B		7	7	4	0.8	100	KOS
2005 02 28.79		S	5.6	AA	0.0	E		1	4	4			KOS
2005 02 28.79		S	5.8	TI	27.0	L	6	60	14	5			TOT03
2005 02 28.80		M	5.7	TK	5.0	B		10	12	5			BAR06
2005 02 28.92		B	6.1	TK	8.0	B		11	10	6			WAR01
2005 03 01.91		M	5.9	TT	5.0	B		7	20	6			JAN03
2005 03 01.93		S	5.8	AA	6.0	B		20	9	4/	0.25	118	CSU
2005 03 02.85		S	5.8	AA	6.0	B		20	8	4/	0.17	160	CSU
2005 03 02.99		M	5.9	TK	3.0	B		4	11	4/			BAR06
2005 03 03.83		M	6.3:	TT	6	R		15	20	6			JAN03
2005 03 06.78		S	6.4	TI	5.0	B		15	10	2			CSO
2005 03 10.76		S	6.0	TI	5.0	B		7	9	s5			SCA02
2005 03 10.84		S	6.1	AA	6.0	B		20	6	4			CSU
2005 03 11.05		B	7.1	A	5.0	B		7	9	2			SIM
2005 03 11.76		S	6.1	TI	5.0	B		7	10	s4			SCA02
2005 03 12.76		S	6.0	TI	5.0	B		7	12	s4/			SCA02
2005 03 12.92		M	6.3	TK	5.0	B		10	11	4/			BAR06
2005 03 13.73		M	6.3	TK	5.0	B		10	14	4/			BAR06
2005 03 13.79		M	6.7:	TT	6	R		15		6			JAN03
2005 03 13.80		S	7.2	TI	5.0	B		15	8	2			CSO
2005 03 14.75		M	6.3	TK	5.0	B		10	10	5			BAR06
2005 03 14.76		S	6.3	TI	5.0	B		7	9	s4			SCA02
2005 03 14.85		S	6.8	AA	6.0	B		20	6	4			CSU
2005 03 15.73		M	6.4	TK	5.0	B		10	12	5			BAR06
2005 03 15.76		S	6.4	TI	5.0	B		7	10	s4			SCA02
2005 03 16.76		S	6.5	TI	5.0	B		7	9	s3/			SCA02
2005 03 17.77		S	6.5	TI	5.0	B		7	10	s4			SCA02
2005 03 19.74		M	6.4	TK	5.0	B		10	11	5			BAR06
2005 03 19.79		M	7.3	TI	5.0	B		7	8.5	5			HOR03
2005 03 19.92		S	6.8	AA	6.0	B		20	6.5	3/			CSU
2005 03 20.76		S	6.8	AA	6.0	B		20	6	3/			CSU
2005 03 20.81		M	7.3	TI	5.0	B		7	8	4/			HOR03
2005 03 20.88		S	7.3	TK	8.0	B		11	10	3			WAR01
2005 03 20.98		M	6.5	TK	5.0	B		10	11	5			BAR06
2005 03 21.84		S	7.3	TK	8.0	B		11	10	4			WAR01
2005 03 21.89		M	7.4	TI	5.0	B		7	7.5	4/			HOR03
2005 03 24.81		S	7.1	TK	8.0	B		11	10	4			WAR01
2005 03 26.79		B	7.2	TK	8.0	B		11	12	5			WAR01
2005 03 26.82		M	6.7	TK	5.0	B		10	10	4			BAR06
2005 03 27.10		M	6.7	TK	5.0	B		10	12	4			BAR06
2005 03 27.80		B	7.1	TK	8.0	B		11	13	5/	0.3	175	WAR01
2005 03 28.79		M	6.6	TK	5.0	B		10	12	4			BAR06
2005 03 28.85		M	7.7	TI	5.0	B		7	8.5	3			HOR03
2005 03 29.81		M	6.8	TK	5.0	B		10	12	4			BAR06
2005 03 29.84		S	7.3	TI	5.0	B		15	6	2	0.33	80	CSO
2005 03 29.90		B	7.1	TK	8.0	B		11	11	5/			WAR01
2005 03 29.90		M	7.7	TI	5.0	B		7	9	3			HOR03
2005 03 30.84		M	6.9	TK	5.0	B		10	10	4			BAR06
2005 03 30.84		S	7.1	AA	6.0	B		20	6.5	3			CSU
2005 03 30.90		M	7.8	TI	5.0	B		7	9	3			HOR03
2005 03 31.04		B	7.0	TK	8.0	B		11	13	5/	0.4	245	WAR01
2005 03 31.85		M	7.9	TI	25	L	5	50	12	5/			HOR03
2005 03 31.86		S	7.5	TI	27.0	L	6	43	7	5	5 m	200	TOT03
2005 03 31.90		S	6.9	TI	5.0	B		7	8	4			SZA
2005 03 31.91		S	7.0	TK	5.0	B		7	11	5			BIV
2005 03 31.95		M	6.9	TK	5.0	B		10	11	4			BAR06
2005 04 01.69		M	6.9	TK	5.0	B		10	14	4			BAR06
2005 04 01.81		M	7.9	TI	10	B		25	11	4/			HOR03
2005 04 01.85		S	7.1	TK	5.0	B		10	12	2			HUR
2005 04 01.85		S	7.1	TK	8.0	B		15	10	2			HUR
2005 04 01.92		M	7.5	TT	5.0	B		7	20	7			JAN03
2005 04 01.96		S	7.1	TK	5.0	B		7	12	4			BIV
2005 04 02.83		S	7.2	TI	5.0	B		7	14	s2/			SCA02
2005 04 02.84		M	7.0	TK	5.0	B		10	10	4			BAR06
2005 04 02.93		M	7.5	TI	5.0	B		7	13	4			HOR03

Comet C/2004 Q2 (Machholz) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 04 03.81		M	7.9	TI	5.0	B		7	9	3/			HOR03
2005 04 03.88		S	7.2	AA	6.0	B		20	6.0	3			CSU
2005 04 03.98		B	7.1	TK	8.0	B		11	13	5	0.3	250	WAR01
2005 04 04.69	x	B	7.5	HV	5.0	B		10	11	5			NAG04
2005 04 04.77		M	8.0	TI	5.0	B		7	8.5	3			HOR03
2005 04 04.88		M	6.8	TK	5.0	B		10	11	4			BAR06
2005 04 04.92		S	7.3	TK	8.0	B		15	12	2			HUR
2005 04 04.92		S	7.4	TK	5.0	B		10	9	2			HUR
2005 04 05.97		S	7.3	AA	6.0	B		20	5.5	3			CSU
2005 04 05.99		M	7.1	TK	5.0	B		10	10	4			BAR06
2005 04 06.86		M	8.1	TI	5.0	B		7	7.5	3			HOR03
2005 04 07.83		S	7.5	TI	5.0	B		7	12	s2/			SCA02
2005 04 07.89		M	7.1	TK	5.0	B		10	10	4			BAR06
2005 04 08.83		S	7.4	AA	6.0	B		20	5.5	3			CSU
2005 04 08.84		S	7.5	TK	8.0	B		15	8	4			HUR
2005 04 08.85		S	7.4	TK	5.0	B		10	8	3			HUR
2005 04 08.92		M	7.2	TK	5.0	B		10	12	4			BAR06
2005 04 09.84		S	7.4	TK	5.0	B		7	8	5			BIV
2005 04 09.87		M	7.1	TK	5.0	B		10	12	4			BAR06
2005 04 09.91		B	8.0	TK	8.0	B		11	7	5			WAR01
2005 04 09.91		S	7.5	HV	6.3	B		9	11	5			KAM01
2005 04 10.85		S	7.5	TK	5.0	B		7	9	5			BIV
2005 04 10.97		S	7.4	TK	5.0	B		10	12	3			HUR
2005 04 10.97		S	7.5	TK	8.0	B		15	15	2			HUR
2005 04 11.92		S	7.5	TK	5.0	B		10	12	2			HUR
2005 04 11.92		S	7.6	TK	8.0	B		15	12	1			HUR
2005 04 12.90		S	7.5	TI	5.0	B		7	12	s2			SCA02
2005 04 12.92		B	8.0	TK	8.0	B		11	7	5			WAR01
2005 04 13.71	x	B	8.1	HV	10.0	B	5	26	4.7	4/			NAG04
2005 04 13.93		B	7.8	TK	8.0	B		11	10	6	0.3	275	WAR01
2005 04 13.98		S	7.8	TK	8.0	B		15	12	2			HUR
2005 04 14.83		S	7.6	TI	5.0	B		7	12	s3			SCA02
2005 04 14.98		S	7.5	TK	5.0	B		10	15	2			HUR
2005 04 14.98		S	7.6	TK	8.0	B		15	15	2			HUR
2005 04 15.04		M	7.4	TT	5.0	B		10	13	3/			HOR02
2005 04 15.91		M	7.3	TK	5.0	B		10	9	4			BAR06
2005 04 15.91		M	8.3	TI	10	B		25	8.5	3			HOR03
2005 04 16.92		S	7.8	TK	8.0	B		15	9	2			HUR
2005 04 16.93		M	7.5	TK	5.0	B		10	9	3			BAR06
2005 04 16.93		M	8.1:	TT	15	L	8	46	20	7			JAN03
2005 04 18.90		S	7.9	TK	8.0	B		15	12	2			HUR
2005 04 18.90		S	8.0	TK	5.0	B		10	9	2			HUR
2005 04 19.84		M	8.0	TK	5.0	B		10	8	3			BAR06
2005 04 19.84		M	8.1	TK	6.0	B		20	6	3			BAR06
2005 04 21.91		S	7.9	TK	8.0	B		15	6	2			HUR
2005 04 25.87		S	8.6	TK	8.0	B		15	7	2			SCH04
2005 04 25.92		B	8.7	TK	14.0	S	4	17	9	3			WAR01
2005 04 26.49	x	M	8.8	TJ	15.0	B		25	7	4			MIT
2005 04 26.80		S	8.2	S	8.0	B		20	6	2			KOZ02
2005 04 26.88		M	8.3	TK	15	L	6	45	6	4/			URB01
2005 04 27.84		S	8.4	AA	6.0	B		20	5.0	2/			CSU
2005 04 27.85		S	8.4	HV	6.3	B		9	8	3			KAM01
2005 04 27.87		S	8.7	TK	8.0	B		15	7	2			SCH04
2005 04 28.82		S	8.4	AA	6.0	B		20	5.0	2/			CSU
2005 04 28.88		S	8.3	TI	8	R		5	10	s2/			SCA02
2005 04 28.90		M	7.8	TT	8.0	B		10	13	3/			HOR02
2005 04 28.92		M	8.3:	TT	15	L	8	46	20	7			JAN03
2005 04 29.59	x	B	8.9	TJ	10.0	B	5	26	5.4	2			NAG04
2005 04 29.85		S	8.4	AA	6.0	B		20	5.0	2/			CSU
2005 04 29.87		M	8.1	TK	15	L	6	45	6	5			URB01
2005 04 29.90		S	8.1	TK	5.0	B		7	8	4			BIV
2005 04 29.91		S	8.3	TK	40.7	L	4	58	6	4			BIV
2005 04 30.85		S	8.3	TI	5.0	B		7	12	s3			SCA02
2005 04 30.90		M	8.3	TK	15	L	6	45	7	4			URB01
2005 04 30.94		S	8.3	TK	5.0	B		7	7	4			BIV

Comet C/2004 Q2 (Machholz) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 04 30.94		S	8.4	TK	40.7	L	4	58	6	4			BIV
2005 05 01.03		M	8.5:	TK	20	L	5	70	4	3			BAR06
2005 05 01.87		M	8.3	TK	15	L	6	45	4.7	3/			URB01
2005 05 01.88		S	8.4	HV	6.3	B		9	7	4			KAM01
2005 05 01.89		M	7.9	TT	8.0	B		10	11	3/			HOR02
2005 05 02.07		S	8.0	TK	5.0	B		7	9	3			GON05
2005 05 02.85		S	8.5	TI	8	R		5	10	s3			SCA02
2005 05 02.87		M	8.4	TK	15	L	6	45	4.5	3/			URB01
2005 05 02.90		M	8.4:	TT	15	L	8	46	20	7			JAN03
2005 05 02.91		M	8.0	TT	8.0	B		10	12	3/			HOR02
2005 05 02.92		M	8.3	TK	8.0	B		15	7	4			BOU
2005 05 03.01		M	8.4	TK	20	L	5	70	7	3			BAR06
2005 05 03.01		S	8.3	TK	5.0	B		10	8	4			BAR06
2005 05 03.51	x	S	8.6	TJ	8.0	B		11	6.8	3/			MIY01
2005 05 03.53		S	8.1	TJ	7.0	R		10	8	6			YOS04
2005 05 03.53		S	8.3	TJ	40.0	L	4	36	7	6			YOS04
2005 05 03.65	x	M	8.5	TT	10.0	B		26	8	4			TSU02
2005 05 03.79		S	8.5	TI	8	R		5	10	s3			SCA02
2005 05 03.91		M	8.3	TK	8.0	B		15	7	4			BOU
2005 05 03.91		M	8.4	TK	8.0	B		15	8	3/			DIJ
2005 05 03.93		S	8.6	TK	8.0	B		15	& 8	3/			COM
2005 05 03.98		S	8.7	TK	20.3	T	10	67	6.5	5			BIV
2005 05 03.99		S	8.4	TK	5.0	B		7	7	5			BIV
2005 05 04.49		S	8.4	TJ	40.0	L	4	36	7	5			YOS04
2005 05 04.50		S	8.0	TJ	7.0	R		10	7	4			YOS04
2005 05 04.69	x	M	8.5	TK	10.0	B		20	6	4			YOS02
2005 05 04.82	&	S	8.5	AA	6.0	B		15	5	4			BEG01
2005 05 04.85		S	8.5	TK	5.0	B		7	7	5			BIV
2005 05 04.90		M	8.3	TK	15.6	L	5	24	6.5	3/			BOU
2005 05 04.96		M	8.5	TK	10.0	R	6	25	7	3			GRA04
2005 05 05.80		S	8.5	S	8.0	B		20	5	3			KOZ02
2005 05 05.80	&	S	8.7	AA	6.0	B		15	5	3			BEG01
2005 05 05.95		S	8.6	TK	20.3	T	10	67	6	5			BIV
2005 05 05.97		M	8.5	TK	10.0	R	6	25	7	3/			GRA04
2005 05 05.97		S	8.5	TK	5.0	B		7	6	4			BIV
2005 05 06.80		M	8.4	TK	15.6	L	5	24	6	4/			BOU
2005 05 06.80		S	8.6	S	8.0	B		20	5	3/			KOZ02
2005 05 06.86		S	8.6	TI	10.2	T	5	20	5	3			LAB02
2005 05 06.88		M	8.0	TT	8.0	B		10	11	3/			HOR02
2005 05 06.88		M	8.5	NP	12.5	B		20	6	4			MAR02
2005 05 06.88		S	8.8	TK	8.0	B		15	& 8	2			COM
2005 05 06.89		M	8.5	TK	15.6	L	5	24	6.0	4/			DIJ
2005 05 07.01		M	8.6	TK	10.0	R	6	25	7	3/			GRA04
2005 05 07.02		S	8.4	TK	10.0	B		25	7	3			GON05
2005 05 07.03		S	8.3	TK	5.0	B		7	8	3			GON05
2005 05 07.06		S	8.6	TK	5.0	B		7	7	4			BIV
2005 05 07.06		S	8.6	TK	20.3	T	10	67	6	5			BIV
2005 05 07.60	x	M	8.4	TK	10.0	B		20	8	5			YOS02
2005 05 07.60	x	M	8.6	TJ	10.0	B		20	5	5/			NAG08
2005 05 07.74		S	8.8	S	8.0	B		20	5	3			KOZ02
2005 05 07.89		S	8.3	TI	8.0	B		11	5	3			LAB02
2005 05 07.94		S	8.4	TK	5.0	B		20	4	4			DIE02
2005 05 07.97		S	8.4	TK	5.0	B		10	10	3			SCH04
2005 05 08.04		M	8.4	TK	8.0	B		15	8	3/			BOU
2005 05 08.04		M	8.5	TK	8.0	B		15	7.5	4			DIJ
2005 05 08.07		S	8.8	TK	20.3	T	10	67	6	4			BIV
2005 05 08.08		S	8.7	TK	5.0	B		7	6	3			BIV
2005 05 08.79	&	S	8.6	AA	6.0	B		15	6	2			BEG01
2005 05 08.86		M	8.1	TT	8.0	B		10	12	3/			HOR02
2005 05 08.87		M	8.3	TK	15	L	6	45	6	4			URB01
2005 05 08.90		S	8.8	TK	5.0	B		7	6	3			BIV
2005 05 08.91		M	8.4	TK	15.6	L	5	24	7	4/			BOU
2005 05 08.96		S	8.6	TK	5.0	B		10	7	4			BAR06
2005 05 09.87		S	8.5	TK	5.0	B		10	10	5			GON06
2005 05 09.90		S	8.4	TK	5.0	B		20	4	4			DIE02

Comet C/2004 Q2 (Machholz) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 05 09.91		S	9.0	HV	30.5	T	10	75	3.5	s3			KAM01
2005 05 09.93		S	8.6	TK	5.0	B		10	9	3			BAR06
2005 05 09.93		S	8.8	TK	6.0	B		20	8	3			BAR06
2005 05 10.75	x	B	9.6	HV	30.4	L	5	47	2.8	4			NAG04
2005 05 10.87		S	8.7	TI	8	R		5	10	s3			SCA02
2005 05 10.88		S	8.6	TK	5.0	B		20	4	4			DIE02
2005 05 10.89		S	9.1	TK	8.0	B		15	& 8	3			SCH04
2005 05 10.98		M	8.2	TT	5.0	B		10	11	3			HOR02
2005 05 11.06		S	9.0	HV	30.5	T	10	75	4.0	s3			KAM01
2005 05 11.83	&	S	9.0	AA	20.0	L	9	72	5	5			BEG01
2005 05 11.86		B	8.4	TK	10.0	R	5	20	4.8	4			HAS02
2005 05 11.87		M	8.2	TT	8.0	B		10	13	3			HOR02
2005 05 11.90		S	9.0	TK	8.0	B		15	&10	3/			SCH04
2005 05 11.91		S	8.6	TK	5.0	B		20	4	4			DIE02
2005 05 11.93		M	8.5	TK	15.6	L	5	24	6.5	4/			BOU
2005 05 11.94		S	8.4	TK	5.6	B		10	& 7	4			BUS01
2005 05 11.96		S	8.7	TK	10.0	R	6	25	6	2/			GRA04
2005 05 11.98		S	9.0	HV	30.5	T	10	75	5.0	s4			KAM01
2005 05 11.98		S	9.2	TK	8.0	B		15	& 5.0	3			COM
2005 05 12.05		S	8.8	TK	40.7	L	4	58	5	4			BIV
2005 05 12.06		S	8.8	TK	5.0	B		7	7	3			BIV
2005 05 12.82	&	S	9.0	AA	20.0	L	9	72	6	3			BEG01
2005 05 12.88		M	8.2	TT	8.0	B		10	14	3/			HOR02
2005 05 12.93		M	8.9	TK	20	L	5	70	5	4			BAR06
2005 05 12.93		S	8.7	TK	5.0	B		10	6	3			BAR06
2005 05 12.95		B	9.5:	TK	14.0	S	4	17	5	2			WAR01
2005 05 13.01		M	8.6	TK	8.0	B		15	7.5	3/			DIJ
2005 05 13.01		S	8.6	TK	8.0	B		15	7	3/			BOU
2005 05 13.88		S	8.3	TT	8.0	B		10	13	3			HOR02
2005 05 13.92		M	8.6	TK	15	L	6	45	6	3/			URB01
2005 05 13.96		S	8.9	TK	20.3	T	10	83	5.5	2			GRA04
2005 05 14.91		S	8.9	TK	15.0	R	8	75	3	3			DIE02
2005 05 14.93		S	8.8	TI	10.2	T	5	20	5	3			LAB02
2005 05 14.99		S	8.8	TK	5.0	B		10	9	3			BAR06
2005 05 15.59	x	S	9.1	TJ	10.0	B		20	6	5			NAG08
2005 05 15.85		S	8.9	TI	10.2	T	5	20	5	2			LAB02
2005 05 15.93		M	9.0	TK	20	L	5	70	7	4			BAR06
2005 05 16.77		E	8.9	HD	6	R	10	30	2.2	5			SEM02
2005 05 17.77		S	9.0	HD	6	R	10	30	2.0	4			SEM02
2005 05 18.13		S	8.6	TK	5.0	B		7	8	3			GON05
2005 05 19.90		M	9.8	TT	10	B	4	25	6	3/			LEH
2005 05 24.86		S	9.0	TT	8.0	B		10	8	2/			HOR02
2005 05 25.87		S	9.0	TT	8.0	B		10	10	2/			HOR02
2005 05 25.90		S	9.2	TK	15.0	R	8	75	3	3			DIE02
2005 05 25.92		S	8.8	TK	10.0	B		25	6	3			GON05
2005 05 26.52	x	S	10.5	TJ	30.4	L	5	61	2.7	3			NAG04
2005 05 26.74		S	9.5	AA	20.0	L	9	72	6	2			BEG01
2005 05 26.86		S	8.9	TI	8	R		5	12	s3			SCA02
2005 05 26.87		S	9.1	TT	8.0	B		10	10	2/			HOR02
2005 05 26.90		S	8.9	TJ	8.0	B		20		7			PIL01
2005 05 26.92		M	10.0	TT	10	B	4	25	5	3/			LEH
2005 05 26.94		S	8.8	TK	10.0	B		25	8	3	0.2	280	GON05
2005 05 26.95		S	9.6	TK	15	L	6	45	6	3			URB01
2005 05 27.87		S	9.2	TT	8.0	B		10	11	2/			HOR02
2005 05 27.91		S	9.2	TK	15.0	R	8	75	3	3			DIE02
2005 05 27.92		M	10.0	TT	10	B	4	25	6	3/			LEH
2005 05 27.92		S	9.8	TK	15	L	6	45	4	4/			URB01
2005 05 27.93		S	9.2	HV	30.5	T	10	75	3.5	5			KAM01
2005 05 27.93		S	9.5	TK	8.0	B		15	&10	3			SCH04
2005 05 27.96		M	10.1	TI	25	L	5	50	6.0	3/	0.1	277	HOR03
2005 05 27.96		S	8.4	TJ	32.0	L		72		6			PIL01
2005 05 28.88		M	9.2	TT	8.0	B		10	9	2/			HOR02
2005 05 28.89		S	9.2	TI	8.0	B		11	4	3			LAB02
2005 05 28.91		M	10.0	TT	10	B	4	25	5	3/			LEH
2005 05 28.92		M	9.2	TK	20	L	5	70	6	3			BAR06

Comet C/2004 Q2 (Machholz) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 05 28.94		M	11.3	TJ	41	L	4	89	2	4			SHU
2005 05 28.94		S	9.3	HV	30.5	T	10	75	3.7	4			KAM01
2005 05 28.96		M	10.2	TI	25	L	5	50	6.5	3	0.1	279	HOR03
2005 05 29.56	x	S	9.5	TK	10.0	B		20	5	4			YOS02
2005 05 29.89		S	9.3	TT	8.0	B		10	9	2/			HOR02
2005 05 29.90		M	11.2	TJ	41	L	4	89	3	4/			SHU
2005 05 29.92		S	9.8	TK	15	L	6	45	6	3			URB01
2005 05 30.91		S	9.2	TK	15.0	R	8	75	3	3			DIE02
2005 05 30.94		S	9.3	TK	20.3	T	10	77	6	3			GON05
2005 05 31.52	x	S	10.1	TJ	15.0	B		25	4	3			MIT
2005 05 31.96		S	9.6	TK	30.5	T	10	56	& 5	2/			COM
2005 05 31.99		S	9.5	HV	30.5	T	10	75	3.7	4			KAM01
2005 06 01.92		S	9.5	TT	8.0	B		10	9	2/			HOR02
2005 06 01.96		M	9.5	TK	20	L	5	70	5	3/			BAR06
2005 06 01.96		S	9.4	TK	20.3	T	10	77	6	3			GON05
2005 06 01.97		S	9.2	TK	10.0	B		25	7	3			GON05
2005 06 02.90		S	10.2	TK	15	L	6	45	3.5	2			URB01
2005 06 02.98		M	9.6	TK	20	L	5	70	4	3/			BAR06
2005 06 03.88		M	10.4	TI	10	B		25	4.5	3			HOR03
2005 06 03.90		S	9.6	TT	8.0	B		10	8	2/			HOR02
2005 06 03.90		S	10.1	TK	15	L	8	48	2.5	2			URB01
2005 06 03.98		M	9.6	TK	20	L	5	70	5	3/			BAR06
2005 06 04.52	x	S	9.6	TK	10.0	B		20	6	4			YOS02
2005 06 04.91		S	9.6	TI	23.5	T	10	57	4	2			LAB02
2005 06 04.92		M	9.7	TK	36	L	6	80	3.5	3			BAR06
2005 06 05.01		M	9.5	NP	12.5	B		20	4	5			MAR02
2005 06 05.02		M	9.6	NP	12.5	B		20	4	4			SAN04
2005 06 05.53	x	M	9.7	TK	25.4	L	4	46	4.0	5			YOS02
2005 06 05.55		S	10.5:	TJ	40.0	L	4	75	3.1	5			YOS04
2005 06 05.94		S	9.6	TK	20.3	T	10	77	6	3			GON05
2005 06 05.95		S	9.4	TK	10.0	B		25	7	3			GON05
2005 06 06.50		S	9.8	TJ	40.0	L	4	36	6.5	4/			YOS04
2005 06 06.89		S	9.7	TT	8.0	B		10	9	2			HOR02
2005 06 07.92		S	9.8	TK	15.0	R	8	75	3	2			DIE02
2005 06 08.90		S	9.8	TT	8.0	B		10	8	2			HOR02
2005 06 08.91		M	9.7	TK	20	L	5	70	4	3			BAR06
2005 06 08.94		S	9.7	TK	20.3	T	10	77	6	3			GON05
2005 06 08.94		S	9.8	TK	15.0	R	8	75	3	2			DIE02
2005 06 08.95		M	9.7	NP	25.5	L	5	60	4	4			MAR02
2005 06 08.95		S	9.5	TK	10.0	B		25	7	3			GON05
2005 06 08.97		S	10.1	TK	20.0	L	4	80	4	2			SCH04
2005 06 09.94		M	9.8	NP	12.5	B		20	6	3			MAR02
2005 06 09.94		M	9.9	NP	25.5	L	5	60	5	2/			MAR02
2005 06 09.94		S	9.7	TK	30.5	T	10	75	3.5	3			KAM01
2005 06 10.02		S	9.8	TK	20.3	T	10	77	5	3			GON05
2005 06 10.03		S	9.4	TK	8.0	B		11	6	3			GON05
2005 06 10.92		S	9.7	TK	7.8	R	4	12	& 7	2/			BUS01
2005 06 11.56	x	S	9.9	TK	10.0	B		20	6	4			YOS02
2005 06 11.92		M	10.0	TK	36	L	6	80	4.5	s4			BAR06
2005 06 12.96		S	10.2	TK	30.5	T	10	75	2.7	3			KAM01
2005 06 13.92		M	10.1	TK	20	L	5	70	4	4			BAR06
2005 06 14.97		S	10.0	TK	25.4	J	6	47	& 4	2			BOU
2005 06 14.98		S	10.4	TK	25.4	J	6	47	2.3	1			DIJ
2005 06 16.05		S	10.2	TK	20.3	T	10	77	5	3			GON05
2005 06 16.06		S	9.9	TK	10.0	B		25	6	2			GON05
2005 06 16.92		M	10.5	TK	36	L	6	80	3.7	4			BAR06
2005 06 17.92		S	11.0	TI	23.5	T	10	57	3	2			LAB02
2005 06 23.91		S	10.4	TT	13	L	8	69	5.5	2			HOR02
2005 06 25.49	x	S	11.2	TJ	15.0	B		25	4	2			MIT
2005 06 25.52	x	B	11.5	TJ	30.4	L	5	61	1.1	2/			NAG04
2005 06 25.92		M	10.8	TK	36	L	6	80	3.0	4			BAR06
2005 06 26.98		S	10.6	TK	20.3	T	10	77	3.5	4			GON05
2005 06 27.93		M	10.9	TK	36	L	6	80	3.0	4			BAR06
2005 06 27.96		S	10.5	TK	25.4	J	6	47	3.5	1			DIJ
2005 06 27.96		S	10.7	TK	25.4	J	6	47	3	2			BOU

Comet C/2004 Q2 (Machholz) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 06 28.91		S	10.7	TT	13	L	8	69	5	2			HOR02
2005 06 29.66		S	10.4	TI	8.0	B		11	2	2			LAB02
2005 06 29.92		M	11.0	TK	36	L	6	80	2.8	4			BAR06
2005 07 01.98		S	10.6	TK	20.3	T	10	77	3	4			GON05
2005 07 02.51	x	S	11.6	TJ	32.0	L	5	58	3.0	4/			NAG08
2005 07 02.91		S	10.9	HS	32.0	L		72	2.5	1			PIL01
2005 07 02.91		S	10.9	TK	36	L	6	80	2.5	3			BAR06
2005 07 02.95		M	11.3	NP	44.5	L	5	65	2.5	5			MAR02
2005 07 03.02		S	10.6	TK	20.3	T	10	77	3	3			GON05
2005 07 03.93		S	10.9	TK	30.5	T	10	75	2.3	2			KAM01
2005 07 04.91		S	11.4	TK	36	L	6	80	2.5	3			BAR06
2005 07 05.94		S	10.6	TA	31.0	J	6	58	3.3	2/			DIJ
2005 07 05.94		S	10.9	TA	31.0	J	6	58	3.3	2/			BOU
2005 07 05.96		S	10.9	TK	30.5	T	10	75	2.4	3			KAM01
2005 07 06.00		S	10.7	TK	20.3	T	10	77	3	3			GON05
2005 07 06.91		S	10.9	TA	31.0	J	6	58	3	3			BOU
2005 07 06.92		S	11.0	TA	31.0	J	6	58	2.8	3			DIJ
2005 07 06.93		S	11.8	TK	36	L	6	80	2	2/			BAR06
2005 07 07.97		S	10.7	TK	20.3	T	10	77	3	3			GON05
2005 07 08.92		S	11.1	TA	31.0	J	6	58	2.5	3/			DIJ
2005 07 08.92		S	11.1	TA	31.0	J	6	58	3	2/			BOU
2005 07 09.93		S	11.0	TK	30.5	T	10	75	2.0	2			KAM01
2005 07 10.88		S	10.9	TI	20	T	10	50	2	2			LAB02
2005 07 10.96		S	11.0	TA	31.0	J	6	58	1.4	2/			DIJ
2005 07 10.96		S	11.3	TA	31.0	J	6	58	3	3			BOU
2005 07 12.02		S	10.7	TK	20.3	T	10	77	3	3			GON05
2005 07 12.94		S	11.3	AU	31.0	J	6	58	2.5	2			BOU
2005 07 12.95		S	11.3	AU	31.0	J	6	58	2.1	0/			DIJ
2005 07 13.96		S	11.3	AU	31.0	J	6	58	2.0	2			DIJ
2005 07 13.96		S	11.4	AU	31.0	J	6	58	2.5	2			BOU
2005 07 28.48		S	12.7	AU	40.0	L	4	144	1.5	2			YOS04
2005 07 29.87		S	11.9	TI	23.5	T	10	94	2	2			LAB02
2005 07 29.93		S	10.9	TK	20.3	T	10	100	3	4			GON05
2005 07 30.94		M	11.4	NP	44.5	L	5	100	3	3/			MAR02
2005 07 31.89		S	12.0	TK	30.5	T	10	75	2.0	2			KAM01

Comet C/2004 R2 (ASAS)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2004 09 17.77		S	8.4	TK	10	B		25	3.5	4			MAT08
2004 09 18.77		S	8.2	TK	10	B		25	3.5	5			MAT08
2004 09 19.80		S	8.3	TK	10	B		25	2.0	6			MAT08

Comet P/2004 T1 (LINEAR-NEAT)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2004 10 09.62		S	13.8	HS	38	L	5	150	1	4			MAT08
2004 11 16.51		S	14.5	HS	38	L	5	150	1	2			MAT08

Comet C/2004 U1 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 01 13.96		S	13.8	HS	27.0	L	6	120	0.5	2			TOT03

Comet C/2004 V13 (SWAN)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 01 06.47		S	12.1	HS	38	L	5	75	2	1			MAT08
2005 01 16.70		S	[12.0	HS	27.0	L	6	120	! 0.8				TOT03

Comet C/2005 A1 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 01 18.15		S	11.8	HS	27.0	L	6	120	1.3	4			TOT03
2005 02 14.63		S	10.9	AU	31.7	L	5	64	1	4			JON

Comet C/2005 A1 (LINEAR) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 02 17.65		S	10.5	AU	31.7	L	5	64	1.5	3			JON
2005 02 18.65		S	11.0	AU	31.7	L	5	64	1	2			JON
2005 02 21.65		S	10.1	AU	31.7	L	5	64	1	3			JON
2005 03 05.58		S	8.1	TK	10	B		25	4	4	20 m	200	MAT08
2005 03 07.76	x	S	9.5	TK	40.0	L	4	144	1.5	6			COO02
2005 03 08.48		S	8.2	TK	10	B		25	4	4			MAT08
2005 03 12.69		S	9.3	TK	31.7	L	5	64	3	5			JON
2005 03 15.35		S	9.4	TK	31.7	L	5	64	2	5			JON
2005 03 28.71	x	S	8.6	TK	40.0	L	4	144	1.1	6			COO02
2005 04 12.82		S	7.8:	TK	10	B		25	3	4			MAT08
2005 05 12.82		S	8.9	TK	10	B		25	3	4			MAT08
2005 05 20.20		S	9.8	TK	14.3	L	6	45	2.5	2			AMO01
2005 07 02.10		S	11.1	TK	20.3	T	10	100	2	3			GON05
2005 07 03.10		S	10.9	TK	20.3	T	10	77	3	3			GON05
2005 07 06.06		S	11.0	AU	31.0	J	6	58	2.5	2			BOU
2005 07 06.06		S	11.1	AU	31.0	J	6	58	2.0	2/			DIJ
2005 07 06.09		S	10.8	TK	20.3	T	10	100	3	3			GON05
2005 07 09.05		S	10.7	AU	31.0	J	6	58	2.1	1			DIJ
2005 07 09.05		S	11.2	AU	31.0	J	6	58	2.4	2/			BOU
2005 07 11.06		S	11.3	AU	31.0	J	6	58	2.5	2/			BOU
2005 07 11.06		S	11.3	AU	31.0	J	6	58	2.5	1/			DIJ
2005 07 14.06		S	10.9	AU	31.0	J	6	58	2.0	1/			DIJ
2005 07 14.06		S	11.4	AU	31.0	J	6	58	2.2	2/			BOU
2005 07 15.05		S	11.3	AU	31.0	J	6	58	1.9	2			DIJ
2005 07 15.05		S	11.4	AU	31.0	J	6	58	2.2	3			BOU
2005 07 16.10		S	11.2	TK	20.3	T	10	100	3	4			GON05
2005 07 19.12		S	11.3	TK	20.3	T	10	133	2	4			GON05
2005 07 28.72		S	11.4:	AU	40.0	L	4	144	1.1	3			YOS04
2005 07 31.00		M	11.5	NP	44.5	L	5	100	2	3			MAR02

Comet P/2005 JQ_5 (Catalina)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 06 06.51		S	[13.7	AU	40.0	L	4	257	! 0.7				YOS04
2005 06 25.94		S	10.3	TK	20.3	T	10	77	4	2			GON05
2005 06 26.94		S	10.5	TK	20.3	T	10	77	4	2			GON05
2005 07 28.77		S	[9.5	TJ	40.0	L	4	144	! 1.1				YOS04

Comet C/2005 K1 (Skiff)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 07 28.54		S	13.8	TA	40.0	L	4	257	0.5	4			YOS04
2005 07 29.91		S	13.0	TA	23.5	T	10	188	1	2			LAB02

Comet C/2005 K2 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 05 30.98		S	12.1	TK	20.3	T	10	100	1.8	2			GON05
2005 05 31.03		S	12.7	HS	40.7	L	4	116	1.3	3			BIV
2005 06 03.06		S	12.4	HS	40.7	L	4	116	1.9	2			BIV
2005 06 04.92		S	12.4	TI	23.5	T	10	188	2	2			LAB02
2005 06 04.94		M	11.6	NP	44.5	L	5	100	1.5	4			SAN04
2005 06 04.94		M	12.8:	TK	36	L	6	80	1.5	3			BAR06
2005 06 04.94		S	11.7	NP	44.5	L	5	100	1.5	2			MAR02
2005 06 06.10		S	11.6	TK	20.3	T	10	77	2.5	2			GON05
2005 06 06.48		S	11.7	TJ	40.0	L	4	144	1.6	3			YOS04
2005 06 07.97		S	10.3	TK	40.7	L	4	58	3.0	4			BIV
2005 06 08.94		M	10.9	NP	25.5	L	5	60	2	3/			MAR02
2005 06 09.08		S	9.8	TK	10.0	B		25	4	3			GON05
2005 06 09.91		M	9.5	NP	12.5	B		20	3.5	3			MAR02
2005 06 09.91		M	9.7	NP	25.5	L	5	60	3	4			MAR02
2005 06 09.93		S	9.5	TK	20.3	T	10	77	4.5	5			GON05
2005 06 09.94		S	9.1	TK	10.0	B		25	6	4			GON05
2005 06 09.95		S	8.9	TK	8.0	B		11	6	4			GON05
2005 06 11.54	x	S	9.2	TK	10.0	B		20	6	2/			YOS02

Comet C/2005 K2 (LINEAR) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 06 11.94		M	9.7	TK	36	L	6	80	5	4			BAR06
2005 06 12.00		S	9.0	TT	20.0	L	4	42	& 6	2			SCH04
2005 06 13.93		M	9.6	TK	20	L	5	70	4	3			BAR06
2005 06 14.96		S	9.1	TK	25.4	J	6	58	& 3	3			BOU
2005 06 14.96		S	9.5	TK	25.4	J	6	58	1.8	2/			DIJ
2005 06 16.90		S	9.4	TK	7	R	14	50	2	3/			URB01
2005 06 17.88		S	9.8	TI	23.5	T	10	57	2	3			LAB02
2005 06 17.91		S	9.2	TK	20.3	T	10	77	3	3			GON05
2005 06 24.35		S	9.9	GA	25.4	L	4	71	3	4			SEA

Comet C/2005 N1 (Juels-Holvorcem)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2005 07 08.10		S	12.4	TK	20.3	T	10	133	0.8	3			GON05
2005 07 12.11		S	12.3	TK	20.3	T	10	133	0.8	3			GON05
2005 07 14.05	w	S	12.4	HN	31.0	J	6	109	1.0	3			BOU
2005 07 14.06	w	S	12.3	HN	31.0	J	6	109	0.8	2/			DIJ
2005 07 15.09	w	S	12.2	HN	31.0	J	6	109	0.9	2/			DIJ
2005 07 15.09	w	S	12.5	HN	31.0	J	6	109	0.8	4			BOU
2005 07 19.10		S	12.3	TK	20.3	T	10	133	0.8	3			GON05
2005 07 28.75		S	11.0	TJ	40.0	L	4	144	1.5	3			YOS04
2005 07 30.94		S	11.8	TA	25.4	J	6	88	1.2	3/			BOU

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Non-Visual Data (old format)

Comet C/1987 P1 (Bradfield)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1987 11 14.76		P	5.0:		36	L	5		4	5	0.67	55	MOB

Comet C/1989 Q1 (Okazaki-Levy-Rudenko)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1989 11 06.23		P	5.0:		36	L	5		4.5	4	0.5	327	MOB
1989 11 25.24		P	5.0:		36	L	5		5		>1	290	MOB

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Non-Visual Data (new format)

TABULATED NON-VISUAL DATA

The new format for non-visual data was introduced in the October 2001 issue of the *ICQ*, chiefly to help researchers make more sense of comet photometry obtained with CCD cameras, to determine what effects various instrumental factors play (spectral responses, exposure times, photometric aperture sizes, etc.). As described in that issue, almost all of the new information is added to the original observation records in columns 81-129, thereby leaving the first 80 columns essentially unchanged (except that in the "coma-diameter" column, true coma diameters are now given without exception in the new format; the old format allowed CCD users to put instead an aperture size in the "coma-diameter" column, but this is now allowed for in columns 87-93 of the new-format records). See also page 208 of the July 2002 issue.

Most of the columns below are as for the visual data (described on pages 172-173 of this issue). While electronic magnitudes *can* be submitted to 0.01 magnitude, for many reasons it is highly advised to continue giving total comet magnitudes only to 0.1 mag. Similarly, it is advised to continue giving all times to 0.01 day, as 0.001 day is usually unnecessary for cometary photometry.

The headings for the tabulated data are as follows: The date (UT), notes, magnitude method (including filters for CCDs, and "P" for photographs), magnitude, reference, instrument aperture, instrument type, instrument *f*-ratio, exposure time, coma diameter, degree of condensation, tail length and position angle, and observer are all as described for the visual tabulation. The column headed "APERTUR" gives the photometric aperture, preceded by "S" for square aperture and "C" for circular aperture, and followed by "d" for degrees, "m" for arcmin, and "s" for arcsec. The column "Chp" contains the 3-character code for the computer chip, given to indicate spectral response of the CCD camera. This column will also be used to indicate photographic emulsion when such information is provided for photographic photometry. The column "Sfw" contains the 3-character code for the software used to actually perform the photometric measures (not solely to extract comparison-star magnitudes). A lower-case "a" between these two columns indicates an anti-blooming CCD. The column headed "C" gives a number as follows: 0 = no correction; 1 = correction for bias (bias subtracted); 2 = flat-field corrected (flat-fielded); 3 = 1 + 2; 4 = dark-subtracted (and bias-subtracted) 5 = 2 + 4. The column headed "P" includes a P if the images used to measure the photometry were also measured for astrometry *and* those astrometric measures were published in the *Minor Planet Circulars* (meaning they were refereed); a U in this column indicates that the respective astrometric was sent to the MPC for publication but that either (a) they are unpublished at the time of reporting the photometry or (b) the observer is unaware of the publication status; a blank in this column indicates that no astrometry was measured. The 3-character CCD-camera code is listed under "Cam".

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Comet 9P/Tempel

DATE (UT)	n M	MAG.	RF	AP. T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp Sfw	C	P	Cam	OBS.
2005 05 04.57	C	11.1	GA	60.0Y	6	a120	3.6				S 3.6 m	SIA IPL	5	U	Ap7	NAK01
2005 05 07.58	axC	10.8	HV	35.0C	10	a 60	2.5	5			S 5.28m	KAIaSI4	5		ST2	TSU02
2005 05 08.89	d C	10.7	LB	6.3M	8	a900	3.2		> 2.2m	197	C 4.95m	K40 GAI	5*		ST7	SRB
2005 05 08.89	d C	11.0	LB	6.3M	8	a900	3.2		> 2.2m	197	C 3.20m	K40 GAI	5*		ST7	SRB
2005 05 08.89	d C	11.3	LB	6.3M	8	a900	3.2		> 2.2m	197	C 1.75m	K40 GAI	5*		ST7	SRB
2005 05 08.89	d C	11.8	LB	6.3M	8	a900	3.2		> 2.2m	197	C 1.00m	K40 GAI	5*		ST7	SRB
2005 05 08.89	d C	12.5	LB	6.3M	8	a900	3.2		> 2.2m	197	C 0.50m	K40 GAI	5*		ST7	SRB
2005 05 12.85	d C	10.8	LB	6.3M	8	a900	4.0		> 2 m	158	C 6.90m	K40 GAI	5*		ST7	SRB
2005 05 12.85	d C	11.0	LB	6.3M	8	a900	4.0		> 2 m	158	C 3.95m	K40 GAI	5*		ST7	SRB
2005 05 12.85	d C	11.3	LB	6.3M	8	a900	4.0		> 2 m	158	C 2.00m	K40 GAI	5*		ST7	SRB
2005 05 12.85	d C	11.9	LB	6.3M	8	a900	4.0		> 2 m	158	C 1.00m	K40 GAI	5*		ST7	SRB
2005 05 12.85	d C	12.5	LB	6.3M	8	a900	4.0		> 2 m	158	C 0.50m	K40 GAI	5*		ST7	SRB
2005 05 13.90	d C	10.7	LB	6.3M	8	a900	4.5		> 3 m	165	C 5.90m	K40 GAI	5*		ST7	SRB
2005 05 13.90	d C	10.8	LB	6.3M	8	a900	4.5		> 3 m	165	C 4.50m	K40 GAI	5*		ST7	SRB
2005 05 13.90	d C	10.9	LB	6.3M	8	a900	4.5		> 3 m	165	C 3.95m	K40 GAI	5*		ST7	SRB
2005 05 13.90	d C	11.3	LB	6.3M	8	a900	4.5		> 3 m	165	C 2.00m	K40 GAI	5*		ST7	SRB
2005 05 13.90	d C	11.9	LB	6.3M	8	a900	4.5		> 3 m	165	C 1.00m	K40 GAI	5*		ST7	SRB
2005 05 13.90	d C	12.6	LB	6.3M	8	a900	4.5		> 3 m	165	C 0.50m	K40 GAI	5*		ST7	SRB
2005 05 15.63	C	11.3	GA	60.0Y	6	a120	3.2				S 3.2 m	SIA IPL	5	U	Ap7	NAK01
2005 05 20.47	axC	10.7	HV	35.0C	10	a120					S 3.12m	KAIaSI4	5		ST2	TSU02
2005 05 20.89	d C	10.6	LB	6.3M	8	a900	> 4.0		2 m	137	C 5.45m	K40 GAI	5*		ST7	SRB
2005 05 20.89	d C	10.8	LB	6.3M	8	a900	> 4.0		2 m	137	C 3.95m	K40 GAI	5*		ST7	SRB
2005 05 20.89	d C	11.1	LB	6.3M	8	a900	> 4.0		2 m	137	C 2.00m	K40 GAI	5*		ST7	SRB
2005 05 20.89	d C	11.8	LB	6.3M	8	a900	> 4.0		2 m	137	C 1.00m	K40 GAI	5*		ST7	SRB
2005 05 20.89	d C	12.6	LB	6.3M	8	a900	> 4.0		2 m	137	C 0.50m	K40 GAI	5*		ST7	SRB
2005 05 26.56	axC	11.1	HV	35.0C	10	a120					S 3.52m	KAIaSI4	5		ST2	TSU02
2005 05 26.87	d C	10.6	LB	6.3M	8	a900	6.0		> 6 m	162	C 7.90m	K40 GAI	5*		ST7	SRB
2005 05 26.87	d C	10.7	LB	6.3M	8	a900	6.0		> 6 m	162	C 6.15m	K40 GAI	5*		ST7	SRB
2005 05 26.87	d C	10.9	LB	6.3M	8	a900	6.0		> 6 m	162	C 3.95m	K40 GAI	5*		ST7	SRB
2005 05 26.87	d C	11.3	LB	6.3M	8	a900	6.0		> 6 m	162	C 2.00m	K40 GAI	5*		ST7	SRB
2005 05 26.87	d C	12.0	LB	6.3M	8	a900	6.0		> 6 m	162	C 1.00m	K40 GAI	5*		ST7	SRB
2005 05 26.87	d C	12.8	LB	6.3M	8	a900	6.0		> 6 m	162	C 0.50m	K40 GAI	5*		ST7	SRB
2005 05 27.90	d C	10.8	LB	6.3M	8	A020	6.5		> 4 m	156	C 6.55m	K40 GAI	5*		ST7	SRB
2005 05 27.90	d C	10.8	LB	6.3M	8	A020	6.5		> 4 m	156	C 7.90m	K40 GAI	5*		ST7	SRB
2005 05 27.90	d C	10.9	LB	6.3M	8	A020	6.5		> 4 m	156	C 3.95m	K40 GAI	5*		ST7	SRB
2005 05 27.90	d C	11.4	LB	6.3M	8	A020	6.5		> 4 m	156	C 2.00m	K40 GAI	5*		ST7	SRB
2005 05 27.90	d C	12.0	LB	6.3M	8	A020	6.5		> 4 m	156	C 1.00m	K40 GAI	5*		ST7	SRB
2005 05 27.90	d C	12.7	LB	6.3M	8	A020	6.5		> 4 m	156	C 0.50m	K40 GAI	5*		ST7	SRB
2005 05 31.62	axC	11.5	HV	35.0C	10	a120	1.6	5			S 2.53m	KAIaSI4	5		ST2	TSU02
2005 06 01.88	d C	10.7	LB	6.3M	8	a900	4.0		> 2.5m	147	C 6.90m	K40 GAI	5*		ST7	SRB
2005 06 01.88	d C	10.9	LB	6.3M	8	a900	4.0		> 2.5m	147	C 3.95m	K40 GAI	5*		ST7	SRB
2005 06 01.88	d C	11.3	LB	6.3M	8	a900	4.0		> 2.5m	147	C 2.00m	K40 GAI	5*		ST7	SRB
2005 06 01.88	d C	11.9	LB	6.3M	8	a900	4.0		> 2.5m	147	C 1.00m	K40 GAI	5*		ST7	SRB
2005 06 01.88	d C	12.8	LB	6.3M	8	a900	4.0		> 2.5m	147	C 0.50m	K40 GAI	5*		ST7	SRB
2005 06 03.95	d C	10.7	LB	6.3M	8	A020	5.4		> 1.5m	148	C 5.45m	K40 GAI	5*		ST7	SRB
2005 06 03.95	d C	10.7	LB	6.3M	8	A020	5.4		> 1.5m	148	C 7.40m	K40 GAI	5*		ST7	SRB
2005 06 03.95	d C	10.8	LB	6.3M	8	A020	5.4		> 1.5m	148	C 3.95m	K40 GAI	5*		ST7	SRB
2005 06 03.95	d C	11.2	LB	6.3M	8	A020	5.4		> 1.5m	148	C 2.00m	K40 GAI	5*		ST7	SRB

Comet 9P/Tempel [cont.]

DATE (UT)	n M	MAG.	RF	AP. T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C P	Cam	OBS.
2005 06 03.95	d C	11.9	LB	6.3M	8	A020	5.4		> 1.5m	148	C 1.00m	K40	GAI	5*	ST7	SRB
2005 06 03.95	d C	12.7	LB	6.3M	8	A020	5.4		> 1.5m	148	C 0.50m	K40	GAI	5*	ST7	SRB
2005 06 05.56	axC	11.2	HV	35.0C	10	a120	1.5	5			S 4.07m	KAIa	SI4	5	ST2	TSU02
2005 06 09.61	x C	11.4	GA	15.0L	6	a 60	2.9				S 2.9 m	K26	SI5	5	ST9	YOS02
2005 06 13.50	axC	11.6	HV	35.0C	10	a120	0.8	6			S 2.35m	KAIa	SI4	5	ST2	TSU02
2005 06 23.88	d C	9.9	LB	6.3M	8	a900	> 6				C 7.90m	K40	GAI	5*	ST7	SRB
2005 06 23.88	d C	10.3	LB	6.3M	8	a900	> 6				C 5.90m	K40	GAI	5*	ST7	SRB
2005 06 23.88	d C	10.7	LB	6.3M	8	a900	> 6				C 3.95m	K40	GAI	5*	ST7	SRB
2005 06 23.88	d C	11.3	LB	6.3M	8	a900	> 6				C 2.00m	K40	GAI	5*	ST7	SRB
2005 06 23.88	d C	12.1	LB	6.3M	8	a900	> 6				C 1.00m	K40	GAI	5*	ST7	SRB
2005 06 23.88	d C	12.9	LB	6.3M	8	a900	> 6				C 0.50m	K40	GAI	5*	ST7	SRB
2005 06 25.50	axC	11.4	HV	35.0C	10	a120	1.2	5			S 3.12m	KAIa	SI4	5	ST2	TSU02
2005 07 14.49	axC	12.1	HV	35.0C	10	a 60	0.8	5			S 2.25m	KAIa	SI4	5	ST2	TSU02

Comet 21P/Giacobini-Zinner

DATE (UT)	n M	MAG.	RF	AP. T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C P	Cam	OBS.
2005 05 07.79	axC	11.8	HV	35.0C	10	a 90	1.5	5	5 m	269	S 2.18m	KAIa	SI4	5	ST2	TSU02
2005 05 13.05	d C	10.9	LB	6.3M	8	a900	3.5		> 6.5m	264	C 3.95m	K40	GAI	5*	ST7	SRB
2005 05 13.05	d C	11.0	LB	6.3M	8	a900	3.5		> 6.5m	264	C 3.45m	K40	GAI	5*	ST7	SRB
2005 05 13.05	d C	11.2	LB	6.3M	8	a900	3.5		> 6.5m	264	C 2.00m	K40	GAI	5*	ST7	SRB
2005 05 13.05	d C	11.7	LB	6.3M	8	a900	3.5		> 6.5m	264	C 1.00m	K40	GAI	5*	ST7	SRB
2005 05 13.05	d C	12.4	LB	6.3M	8	a900	3.5		> 6.5m	264	C 0.50m	K40	GAI	5*	ST7	SRB
2005 05 14.78	axC	11.8	GA	15.0L	6	a 60	1.4		4.5m	265	C 1.4 m	K26	SI5	5	ST9	YOS02
2005 05 15.77	C	11.4	TJ	60.0Y	6	a120	2.2		> 7.7m	265	S 2.2 m	SIA	IPL	5 U	Ap7	NAK01
2005 05 27.04	d C	11.0	LB	6.3M	8	a900	> 4.5		>10 m	269	C 4.70m	K40	GAI	5*	ST7	SRB
2005 05 27.04	d C	11.0	LB	6.3M	8	a900	> 4.5		>10 m	269	C 7.40m	K40	GAI	5*	ST7	SRB
2005 05 27.04	d C	11.0	LB	6.3M	8	a900	> 4.5		>10 m	269	C 3.95m	K40	GAI	5*	ST7	SRB
2005 05 27.04	d C	11.4	LB	6.3M	8	a900	> 4.5		>10 m	269	C 2.00m	K40	GAI	5*	ST7	SRB
2005 05 27.04	d C	11.9	LB	6.3M	8	a900	> 4.5		>10 m	269	C 1.00m	K40	GAI	5*	ST7	SRB
2005 05 27.04	d C	12.6	LB	6.3M	8	a900	> 4.5		>10 m	269	C 0.50m	K40	GAI	5*	ST7	SRB
2005 06 02.03	d C	10.4	LB	6.3M	8	a720	> 5		> 6 m	270	C 6.40m	K40	GAI	5*	ST7	SRB
2005 06 02.03	d C	10.5	LB	6.3M	8	a720	> 5		> 6 m	270	C 3.95m	K40	GAI	5*	ST7	SRB
2005 06 02.03	d C	10.5	LB	6.3M	8	a720	> 5		> 6 m	270	C 5.20m	K40	GAI	5*	ST7	SRB
2005 06 02.03	d C	10.7	LB	6.3M	8	a720	> 5		> 6 m	270	C 2.00m	K40	GAI	5*	ST7	SRB
2005 06 02.03	d C	11.2	LB	6.3M	8	a720	> 5		> 6 m	270	C 1.00m	K40	GAI	5*	ST7	SRB
2005 06 02.03	d C	12.0	LB	6.3M	8	a720	> 5		> 6 m	270	C 0.50m	K40	GAI	5*	ST7	SRB
2005 06 04.04	d C	10.4	LB	6.3M	8	a540	> 3		>13 m	262	C 3.95m	K40	GAI	5*	ST7	SRB
2005 06 04.04	d C	10.5	LB	6.3M	8	a540	> 3		>13 m	262	C 3.45m	K40	GAI	5*	ST7	SRB
2005 06 04.04	d C	10.9	LB	6.3M	8	a540	> 3		>13 m	262	C 1.50m	K40	GAI	5*	ST7	SRB
2005 06 04.04	d C	11.2	LB	6.3M	8	a540	> 3		>13 m	262	C 1.00m	K40	GAI	5*	ST7	SRB
2005 06 04.04	d C	11.9	LB	6.3M	8	a540	> 3		>13 m	262	C 0.50m	K40	GAI	5*	ST7	SRB
2005 06 05.78	axC	10.6	HV	35.0C	10	a 60	1.2	5	4 m	268	S 2.80m	KAIa	SI4	5	ST2	TSU02
2005 06 09.78	x C	10.7	TJ	15.0L	6	a 30	1.8		6 m	268	S 1.8 m	K26	SI5	5	ST9	YOS02

Comet 29P/Schwassmann-Wachmann

DATE (UT)	n M	MAG.	RF	AP. T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C P	Cam	OBS.
2005 06 29.02	d C	12.1	LB	6.3M	8	a900	2.5				C 3.45m	K40	GAI	5*	ST7	SRB
2005 06 29.02	d C	12.8	LB	6.3M	8	a900	2.5				C 2.45m	K40	GAI	5*	ST7	SRB
2005 06 29.02	d C	13.4	LB	6.3M	8	a900	2.5				C 1.50m	K40	GAI	5*	ST7	SRB
2005 06 29.02	d C	14.0	LB	6.3M	8	a900	2.5				C 1.00m	K40	GAI	5*	ST7	SRB
2005 06 29.02	d C	15.1	LB	6.3M	8	a900	2.5				C 0.50m	K40	GAI	5*	ST7	SRB

Comet 32P/Comas Solá

DATE (UT)	n M	MAG.	RF	AP. T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C P	Cam	OBS.
2005 05 04.49	axC	14.0	HV	35.0C	10	a120	0.3	3			S 0.70m	KAIa	SI4	5	ST2	TSU02
2005 05 07.48	axC	14.4	HV	35.0C	10	a120	0.4	4			S 0.57m	KAIa	SI4	5	ST2	TSU02
2005 05 08.83	d C	13.0	LB	6.3M	8	a840	0.8		1 m	83	C 1.75m	K40	GAI	5*	ST7	SRB
2005 05 08.83	d C	13.1	LB	6.3M	8	a840	0.8		1 m	83	C 1.25m	K40	GAI	5*	ST7	SRB
2005 05 08.83	d C	13.4	LB	6.3M	8	a840	0.8		1 m	83	C 0.80m	K40	GAI	5*	ST7	SRB
2005 05 08.83	d C	13.9	LB	6.3M	8	a840	0.8		1 m	83	C 0.50m	K40	GAI	5*	ST7	SRB
2005 05 26.85	d C	12.7	LB	6.3M	8	a900	1.8				C 2.00m	K40	GAI	5*	ST7	SRB
2005 05 26.85	d C	12.8	LB	6.3M	8	a900	1.8				C 1.80m	K40	GAI	5*	ST7	SRB

Comet 32P/Comas Solá [cont.]

DATE (UT)	n M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 05 26.85	d C	13.1	LB	6.3	M	8	a900	1.8				C 1.00m	K40	GAI	5*		ST7	SRB
2005 05 26.85	d C	13.9	LB	6.3	M	8	a900	1.8				C 0.50m	K40	GAI	5*		ST7	SRB

Comet 37P/Forbes

DATE (UT)	n M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 05 04.67	x C	15.6:	TJ	60.0	Y	6	a240	0.45				S 0.45m	SIA	IPL	5	U	Ap7	NAK01
2005 05 20.57	axC	13.4	HV	35.0	C	10	a450	0.5	4			S 0.85m	KAIa	SI4	5		ST2	TSU02
2005 06 09.64	x C	12.9	GA	15.0	L	6	a240	0.8				S 0.8 m	K26	SI5	5		ST9	YOS02
2005 07 14.51	axC	12.5	HV	35.0	C	10	a120	0.8	5			S 1.12m	KAIa	SI4	5		ST2	TSU02

Comet 49P/Arend-Rigaux

DATE (UT)	n M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 05 04.51	axC	15.5	HV	35.0	C	10	A080	0.3				S 0.56m	KAIa	SI4	5		ST2	TSU02
2005 05 08.85	d C	14.5	LB	6.3	M	8	a780					C 1.00m	K40	GAI	5*		ST7	SRB
2005 05 12.83	d C	14.9	LB	6.3	M	8	a900	0.8				C 1.25m	K40	GAI	5*		ST7	SRB
2005 05 12.83	d C	15.0	LB	6.3	M	8	a900	0.8				C 0.75m	K40	GAI	5*		ST7	SRB
2005 05 12.83	d C	15.5	LB	6.3	M	8	a900	0.8				C 0.50m	K40	GAI	5*		ST7	SRB

Comet 78P/Gehrels

DATE (UT)	n M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 05 04.46	axC	15.3	HV	35.0	C	10	a810	0.5				S 0.73m	KAIa	SI4	5		ST2	TSU02

Comet 91P/Russell

DATE (UT)	n M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 05 04.64	a C	17.2:	GA	60.0	Y	6	a240	0.4				S 0.4 m	SIA	IPL	5	U	Ap7	NAK01
2005 05 04.68	x C	16.8	TJ	25.0	L	5	a240	0.4				S 0.4 m	K42	SI5	5	U	SE7	OHS
2005 05 15.64	x C	17.3	TJ	60.0	Y	6	a240	0.4				S 0.4 m	SIA	IPL	5	U	Ap7	NAK01

Comet 105P/Singer Brewster

DATE (UT)	n M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 05 07.56	axC	18.4	HV	35.0	C	10	A800	0.3	4			S 0.69m	KAIa	SI4	5		ST2	TSU02

Comet 117P/Helin-Roman-Alu

DATE (UT)	n M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 05 04.65	a C	15.0	GA	60.0	Y	6	a120	0.5		2.7m	293	S 0.5 m	SIA	IPL	5	U	Ap7	NAK01
2005 05 12.93	d C	14.0	LB	6.3	M	8	a900	0.8				C 1.25m	K40	GAI	5*		ST7	SRB
2005 05 12.93	d C	14.3	LB	6.3	M	8	a900	0.8				C 1.00m	K40	GAI	5*		ST7	SRB
2005 05 12.93	d C	14.4	LB	6.3	M	8	a900	0.8				C 0.80m	K40	GAI	5*		ST7	SRB
2005 05 12.93	d C	14.5	LB	6.3	M	8	a900	0.8				C 0.75m	K40	GAI	5*		ST7	SRB
2005 05 12.93	d C	14.6	LB	6.3	M	8	a900	0.8				C 0.50m	K40	GAI	5*		ST7	SRB
2005 05 20.94	d C	14.1	LB	6.3	M	8	a900	0.6				C 0.60m	K40	GAI	5*		ST7	SRB
2005 05 20.94	d C	14.1	LB	6.3	M	8	a900	0.6				C 1.00m	K40	GAI	5*		ST7	SRB
2005 05 20.94	d C	14.3	LB	6.3	M	8	a900	0.6				C 0.50m	K40	GAI	5*		ST7	SRB
2005 06 09.62	x C	14.6	GA	15.0	L	6	a240	0.6		1.1m	300	S 0.6 m	K26	SI5	5		ST9	YOS02
2005 07 14.54	axC	14.4	HV	35.0	C	10	a120	0.3	5			S 1.00m	KAIa	SI4	5		ST2	TSU02

Comet 121P/Shoemaker-Holt

DATE (UT)	n M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 06 05.55	axC	17.0	HV	35.0	C	10	A560	0.3	3			S 0.60m	KAIa	SI4	5		ST2	TSU02

Comet 161P/Hartley-IRAS

DATE (UT)	n M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 05 15.77	C	13.5	TJ	25.0	L	5	a720	1.3				S 1.3 m	K26	SI4	5*	U	ST9	KAD02
2005 05 16.77	C	13.6	TJ	25.0	L	5	a720	1.2				S 1.2 m	K26	SI4	5*	U	ST9	KAD02
2005 05 27.06	d C	11.0	LB	6.3	M	8	a480	> 1.5				C 3.45m	K40	GAI	5*		ST7	SRB
2005 05 27.06	d C	12.1	LB	6.3	M	8	a480	> 1.5				C 1.50m	K40	GAI	5*		ST7	SRB
2005 05 27.06	d C	12.5	LB	6.3	M	8	a480	> 1.5				C 1.00m	K40	GAI	5*		ST7	SRB

Comet 161P/Hartley-IRAS [cont.]

DATE (UT)	n	M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 05 27.06	d	C	13.4	LB	6.3	M	8	a480	> 1.5				C 0.50m	K40	GAI	5*		ST7	SRB
2005 06 04.02	d	C	12.9	LB	6.3	M	8	a600	> 2.5				C 2.45m	K40	GAI	5*		ST7	SRB
2005 06 04.02	d	C	12.9	LB	6.3	M	8	a600	> 2.5				C 4.95m	K40	GAI	5*		ST7	SRB
2005 06 04.02	d	C	13.2	LB	6.3	M	8	a600	> 2.5				C 2.00m	K40	GAI	5*		ST7	SRB
2005 06 04.02	d	C	13.9	LB	6.3	M	8	a600	> 2.5				C 1.00m	K40	GAI	5*		ST7	SRB
2005 06 04.02	d	C	14.8	LB	6.3	M	8	a600	> 2.5				C 0.50m	K40	GAI	5*		ST7	SRB
2005 06 05.77	ax	C	13.0	HV	35.0	C	10	a 90	1.2	5			S 1.45m	KAIa	SI4	5		ST2	TSU02
2005 06 09.78	x	C	13.0	GA	15.0	L	6	a120	1.2				S 1.2 m	K26	SI5	5		ST9	YOS02
2005 06 23.99	d	C	13.1	LB	6.3	M	8	a900	> 3				C 2.00m	K40	GAI	5*		ST7	SRB
2005 06 23.99	d	C	13.3	LB	6.3	M	8	a900	> 3				C 1.00m	K40	GAI	5*		ST7	SRB
2005 06 23.99	d	C	14.0	LB	6.3	M	8	a900	> 3				C 0.50m	K40	GAI	5*		ST7	SRB
2005 06 28.97	d	C	11.6	LB	6.3	M	8	a360	3.0				C 4.95m	K40	GAI	5*		ST7	SRB
2005 06 28.97	d	C	11.9	LB	6.3	M	8	a360	3.0				C 2.95m	K40	GAI	5*		ST7	SRB
2005 06 28.97	d	C	12.4	LB	6.3	M	8	a360	3.0				C 2.00m	K40	GAI	5*		ST7	SRB
2005 06 28.97	d	C	13.4	LB	6.3	M	8	a360	3.0				C 0.75m	K40	GAI	5*		ST7	SRB
2005 06 28.97	d	C	13.8	LB	6.3	M	8	a360	3.0				C 0.50m	K40	GAI	5*		ST7	SRB

Comet C/2002 T7 (LINEAR)

DATE (UT)	n	M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 05 07.51	ax	C	15.3	HV	35.0	C	10	a120	0.4	4	0.7m	113	S 0.90m	KAIa	SI4	5		ST2	TSU02

Comet C/2003 O1 (LINEAR)

DATE (UT)	n	M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 05 04.62		C	18.0	GA	60.0	Y	6	a240	0.35		1.7m	88	S 0.35m	SIA	IPL	5	U	Ap7	NAK01

Comet C/2003 WT_42 (LINEAR)

DATE (UT)	n	M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 05 04.48	ax	C	15.4	HV	35.0	C	10	a720	0.3	4			S 0.57m	KAIa	SI4	5		ST2	TSU02
2005 05 12.87	d	C	14.9	LB	6.3	M	8	a900	0.6				C 1.25m	K40	GAI	5*		ST7	SRB
2005 05 12.87	d	C	15.0	LB	6.3	M	8	a900	0.6				C 0.60m	K40	GAI	5*		ST7	SRB

Comet P/2004 F3 (NEAT)

DATE (UT)	n	M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 05 04.74	ax	C	15.7	TJ	25.0	L	5	a120	0.4				S 0.4 m	K42	SI5	5	U	SE7	OHS
2005 05 10.73	x	C	15.1	TJ	25.0	L	5	a120	0.5		1.2m	258	S 0.5 m	K42	SI5	5	U	SE7	OHS
2005 05 15.76	x	C	14.8	TJ	60.0	Y	6	a120	0.6		2.8m	255	S 0.6 m	SIA	IPL	5	U	Ap7	NAK01
2005 06 05.71	ax	C	14.7	HV	35.0	C	10	a 90	0.4	5	2.5m	266	S 0.73m	KAIa	SI4	5		ST2	TSU02

Comet C/2004 K1 (Catalina)

DATE (UT)	n	M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 05 04.73		C	15.3	GA	60.0	Y	6	a120	0.55		2.3m	125	S 0.55m	SIA	IPL	5	U	Ap7	NAK01
2005 05 07.68	ax	C	15.2	HV	35.0	C	10	a120	0.3	5	0.6m	140	S 0.70m	KAIa	SI4	5		ST2	TSU02
2005 05 12.95	d	C	14.9	LB	6.3	M	8	a900	0.8				C 1.00m	K40	GAI	5*		ST7	SRB
2005 05 12.95	d	C	14.9	LB	6.3	M	8	a900	0.8				C 0.80m	K40	GAI	5*		ST7	SRB
2005 05 12.95	d	C	15.0	LB	6.3	M	8	a900	0.8				C 0.75m	K40	GAI	5*		ST7	SRB
2005 05 12.95	d	C	15.2	LB	6.3	M	8	a900	0.8				C 0.50m	K40	GAI	5*		ST7	SRB
2005 05 13.96	d	C	14.4	LB	6.3	M	8	a900	0.8				C 1.65m	K40	GAI	5*		ST7	SRB
2005 05 13.96	d	C	15.0	LB	6.3	M	8	a900	0.8				C 0.80m	K40	GAI	5*		ST7	SRB
2005 05 13.96	d	C	15.4	LB	6.3	M	8	a900	0.8				C 0.50m	K40	GAI	5*		ST7	SRB
2005 05 15.66		C	15.2	GA	60.0	Y	6	a120	0.55		3.0m	123	S 0.55m	SIA	IPL	5	U	Ap7	NAK01
2005 05 26.95	d	C	14.4	LB	6.3	M	8	a900	1.2				C 2.00m	K40	GAI	5*		ST7	SRB
2005 05 26.95	d	C	14.8	LB	6.3	M	8	a900	1.2				C 1.25m	K40	GAI	5*		ST7	SRB
2005 05 26.95	d	C	15.1	LB	6.3	M	8	a900	1.2				C 1.00m	K40	GAI	5*		ST7	SRB
2005 05 26.95	d	C	15.6	LB	6.3	M	8	a900	1.2				C 0.50m	K40	GAI	5*		ST7	SRB
2005 05 27.93	d	C	14.6	LB	6.3	M	8	a900	0.9				C 2.00m	K40	GAI	5*		ST7	SRB
2005 05 27.93	d	C	15.1	LB	6.3	M	8	a900	0.9				C 1.00m	K40	GAI	5*		ST7	SRB
2005 05 27.93	d	C	15.6	LB	6.3	M	8	a900	0.9				C 0.50m	K40	GAI	5*		ST7	SRB
2005 05 31.71	ax	C	15.2	HV	35.0	C	10	a 90	0.3	5	2.5m	121	S 0.65m	KAIa	SI4	5		ST2	TSU02
2005 06 01.98	d	C	15.2	LB	6.3	M	8	A200	1.0				C 1.25m	K40	GAI	5*		ST7	SRB
2005 06 01.98	d	C	15.2	LB	6.3	M	8	A200	1.0				C 1.00m	K40	GAI	5*		ST7	SRB

Comet C/2004 K1 (Catalina) [cont.]

DATE (UT)	n	M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 06 01.98	d	C	15.9	LB	6.3	M	8	A200	1.0				C 0.50m	K40	GAI	5	*	ST7	SRB
2005 06 03.99	d	C	15.4	LB	6.3	M	8	a900	0.8				C 1.00m	K40	GAI	5	*	ST7	SRB
2005 06 03.99	d	C	15.5	LB	6.3	M	8	a900	0.8				C 0.75m	K40	GAI	5	*	ST7	SRB
2005 06 03.99	d	C	15.8	LB	6.3	M	8	a900	0.8				C 0.50m	K40	GAI	5	*	ST7	SRB
2005 06 04.66		C	15.8	GA	60.0	Y	6	a120	0.5		3.5m	112	S 0.5 m	SIA	IPL	5	U	Ap7	NAK01
2005 06 06.67	x	C	15.9	TJ	25.0	L	5	a120	0.4		1.0m	121	S 0.4 m	K42	SI5	5	U	SE7	OHS
2005 06 23.94	d	C	14.9	LB	6.3	M	8	a900	0.8				C 1.00m	K40	GAI	5	*	ST7	SRB
2005 06 23.94	d	C	15.3	LB	6.3	M	8	a900	0.8				C 0.75m	K40	GAI	5	*	ST7	SRB
2005 06 23.94	d	C	15.9	LB	6.3	M	8	a900	0.8				C 0.50m	K40	GAI	5	*	ST7	SRB
2005 06 25.58	ax	C	15.5	HV	35.0	C	10	a120	0.3	4	0.8m	107	S 0.74m	KAIa	SI4	5		ST2	TSU02
2005 06 28.99	d	C	15.5	LB	6.3	M	8	a900	0.9				C 1.00m	K40	GAI	5	*	ST7	SRB
2005 06 28.99	d	C	15.9	LB	6.3	M	8	a900	0.9				C 0.75m	K40	GAI	5	*	ST7	SRB
2005 06 28.99	d	C	16.0	LB	6.3	M	8	a900	0.9				C 0.50m	K40	GAI	5	*	ST7	SRB

Comet C/2004 L1 (LINEAR)

DATE (UT)	n	M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 05 04.47	x	C	15.7	TJ	25.0	L	5	a120	0.4		0.7m	115	S 0.4 m	K42	SI5	5		SE7	OHS

Comet C/2004 Q1 (Tucker)

DATE (UT)	n	M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 05 07.45	ax	C	13.9	HV	35.0	C	10	a120	0.6	5			S 0.98m	KAIa	SI4	5		ST2	TSU02
2005 05 08.92	d	C	12.2	LB	6.3	M	8	a900	1.8				C 2.95m	K40	GAI	5	*	ST7	SRB
2005 05 08.92	d	C	12.8	LB	6.3	M	8	a900	1.8				C 2.00m	K40	GAI	5	*	ST7	SRB
2005 05 08.92	d	C	13.4	LB	6.3	M	8	a900	1.8				C 1.00m	K40	GAI	5	*	ST7	SRB
2005 05 08.92	d	C	14.3	LB	6.3	M	8	a900	1.8				C 0.50m	K40	GAI	5	*	ST7	SRB
2005 05 12.89	d	C	12.9	LB	6.3	M	8	a900	2.0				C 2.95m	K40	GAI	5	*	ST7	SRB
2005 05 12.89	d	C	13.1	LB	6.3	M	8	a900	2.0				C 2.00m	K40	GAI	5	*	ST7	SRB
2005 05 12.89	d	C	13.7	LB	6.3	M	8	a900	2.0				C 1.00m	K40	GAI	5	*	ST7	SRB
2005 05 12.89	d	C	14.5	LB	6.3	M	8	a900	2.0				C 0.50m	K40	GAI	5	*	ST7	SRB
2005 05 13.94	d	C	13.2	LB	6.3	M	8	a900	> 1.5				C 2.20m	K40	GAI	5	*	ST7	SRB
2005 05 13.94	d	C	14.0	LB	6.3	M	8	a900	> 1.5				C 1.50m	K40	GAI	5	*	ST7	SRB
2005 05 13.94	d	C	14.1	LB	6.3	M	8	a900	> 1.5				C 1.00m	K40	GAI	5	*	ST7	SRB
2005 05 13.94	d	C	14.7	LB	6.3	M	8	a900	> 1.5				C 0.50m	K40	GAI	5	*	ST7	SRB
2005 05 20.93	d	C	12.3	LB	6.3	M	8	a900	2.0				C 3.95m	K40	GAI	5	*	ST7	SRB
2005 05 20.93	d	C	12.9	LB	6.3	M	8	a900	2.0				C 2.00m	K40	GAI	5	*	ST7	SRB
2005 05 20.93	d	C	13.7	LB	6.3	M	8	a900	2.0				C 1.00m	K40	GAI	5	*	ST7	SRB
2005 05 20.93	d	C	14.6	LB	6.3	M	8	a900	2.0				C 0.50m	K40	GAI	5	*	ST7	SRB
2005 05 31.52	ax	C	14.3	HV	35.0	C	10	a360	0.4	4			S 0.88m	KAIa	SI4	5		ST2	TSU02
2005 06 01.95	d	C	13.1	LB	6.3	M	8	a900	1.5				C 2.00m	K40	GAI	5	*	ST7	SRB
2005 06 01.95	d	C	13.6	LB	6.3	M	8	a900	1.5				C 1.50m	K40	GAI	5	*	ST7	SRB
2005 06 01.95	d	C	13.9	LB	6.3	M	8	a900	1.5				C 1.00m	K40	GAI	5	*	ST7	SRB
2005 06 01.95	d	C	14.7	LB	6.3	M	8	a900	1.5				C 0.50m	K40	GAI	5	*	ST7	SRB
2005 06 23.92	d	C	13.2	LB	6.3	M	8	a900	> 1.8				C 1.50m	K40	GAI	5	*	ST7	SRB
2005 06 23.92	d	C	13.9	LB	6.3	M	8	a900	> 1.8				C 1.00m	K40	GAI	5	*	ST7	SRB
2005 06 23.92	d	C	14.9	LB	6.3	M	8	a900	> 1.8				C 0.50m	K40	GAI	5	*	ST7	SRB
2005 06 28.95	d	C	14.0	LB	6.3	M	8	a900	2.3				C 2.45m	K40	GAI	5	*	ST7	SRB
2005 06 28.95	d	C	14.3	LB	6.3	M	8	a900	2.3				C 2.00m	K40	GAI	5	*	ST7	SRB
2005 06 28.95	d	C	14.8	LB	6.3	M	8	a900	2.3				C 1.00m	K40	GAI	5	*	ST7	SRB
2005 06 28.95	d	C	15.5	LB	6.3	M	8	a900	2.3				C 0.50m	K40	GAI	5	*	ST7	SRB

Comet C/2004 Q2 (Machholz)

DATE (UT)	n	M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 05 07.62	ax	C	9.3	HV	35.0	C	10	a 60	5.5	5			S 7.28m	KAIa	SI4	5		ST2	TSU02
2005 05 08.87	d	C	8.9	LB	6.3	M	8	a960	8.4		> 6 m	215	C10.85m	K40	GAI	5	*	ST7	SRB
2005 05 08.87	d	C	9.0	LB	6.3	M	8	a960	8.4		> 6 m	215	C 7.90m	K40	GAI	5	*	ST7	SRB
2005 05 08.87	d	C	9.4	LB	6.3	M	8	a960	8.4		> 6 m	215	C 3.95m	K40	GAI	5	*	ST7	SRB
2005 05 08.87	d	C	10.1	LB	6.3	M	8	a960	8.4		> 6 m	215	C 2.00m	K40	GAI	5	*	ST7	SRB
2005 05 08.87	d	C	10.9	LB	6.3	M	8	a960	8.4		> 6 m	215	C 1.00m	K40	GAI	5	*	ST7	SRB
2005 05 08.87	d	C	11.8	LB	6.3	M	8	a960	8.4		> 6 m	215	C 0.50m	K40	GAI	5	*	ST7	SRB
2005 05 12.91	d	C	9.1	LB	6.3	M	8	a900	8.0		>10 m	243	C12.35m	K40	GAI	5	*	ST7	SRB
2005 05 12.91	d	C	9.2	LB	6.3	M	8	a900	8.0		>10 m	243	C 7.90m	K40	GAI	5	*	ST7	SRB
2005 05 12.91	d	C	9.6	LB	6.3	M	8	a900	8.0		>10 m	243	C 5.45m	K40	GAI	5	*	ST7	SRB

Comet C/2004 Q2 (Machholz) [cont.]

DATE (UT)	n M	MAG.	RF	AP. T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C P	Cam	OBS.
2005 05 12.91	d C	9.8	LB	6.3M	8	a900	8.0		>10	m243	C 3.95m	K40	GAI	5*	ST7	SRB
2005 05 12.91	d C	10.5	LB	6.3M	8	a900	8.0		>10	m243	C 2.00m	K40	GAI	5*	ST7	SRB
2005 05 12.91	d C	11.2	LB	6.3M	8	a900	8.0		>10	m243	C 1.00m	K40	GAI	5*	ST7	SRB
2005 05 12.91	d C	12.1	LB	6.3M	8	a900	8.0		>10	m243	C 0.50m	K40	GAI	5*	ST7	SRB
2005 05 13.92	d C	9.4	LB	6.3M	8	a900	7.5		>18	m283	C 7.90m	K40	GAI	5*	ST7	SRB
2005 05 13.92	d C	9.4	LB	6.3M	8	a900	7.5		>18	m283	C 7.50m	K40	GAI	5*	ST7	SRB
2005 05 13.92	d C	9.8	LB	6.3M	8	a900	7.5		>18	m283	C 3.95m	K40	GAI	5*	ST7	SRB
2005 05 13.92	d C	10.4	LB	6.3M	8	a900	7.5		>18	m283	C 2.00m	K40	GAI	5*	ST7	SRB
2005 05 13.92	d C	11.2	LB	6.3M	8	a900	7.5		>18	m283	C 1.00m	K40	GAI	5*	ST7	SRB
2005 05 13.92	d C	12.1	LB	6.3M	8	a900	7.5		>18	m283	C 0.50m	K40	GAI	5*	ST7	SRB
2005 05 20.91	d C	9.9	LB	6.3M	8	a900	7.7		>22	m282	C 7.90m	K40	GAI	5*	ST7	SRB
2005 05 20.91	d C	9.9	LB	6.3M	8	a900	7.7		>22	m282	C 7.40m	K40	GAI	5*	ST7	SRB
2005 05 20.91	d C	10.0	LB	6.3M	8	a900	7.7		>22	m282	C 3.95m	K40	GAI	5*	ST7	SRB
2005 05 20.91	d C	10.6	LB	6.3M	8	a900	7.7		>22	m282	C 2.00m	K40	GAI	5*	ST7	SRB
2005 05 20.91	d C	11.4	LB	6.3M	8	a900	7.7		>22	m282	C 1.00m	K40	GAI	5*	ST7	SRB
2005 05 20.91	d C	12.2	LB	6.3M	8	a900	7.7		>22	m282	C 0.50m	K40	GAI	5*	ST7	SRB
2005 05 26.93	d C	10.2	LB	6.3M	8	a900	7.0		>25	m287	C 3.95m	K40	GAI	5*	ST7	SRB
2005 05 26.93	d C	10.2	LB	6.3M	8	a900	7.0		>25	m287	C 7.90m	K40	GAI	5*	ST7	SRB
2005 05 26.93	d C	10.9	LB	6.3M	8	a900	7.0		>25	m287	C 2.00m	K40	GAI	5*	ST7	SRB
2005 05 26.93	d C	11.6	LB	6.3M	8	a900	7.0		>25	m287	C 1.00m	K40	GAI	5*	ST7	SRB
2005 05 26.93	d C	12.5	LB	6.3M	8	a900	7.0		>25	m287	C 0.50m	K40	GAI	5*	ST7	SRB
2005 05 27.92	d C	10.3	LB	6.3M	8	a900	8.0		>23	m287	C 3.95m	K40	GAI	5*	ST7	SRB
2005 05 27.92	d C	10.3	LB	6.3M	8	a900	8.0		>23	m287	C 7.90m	K40	GAI	5*	ST7	SRB
2005 05 27.92	d C	10.9	LB	6.3M	8	a900	8.0		>23	m287	C 2.00m	K40	GAI	5*	ST7	SRB
2005 05 27.92	d C	11.7	LB	6.3M	8	a900	8.0		>23	m287	C 1.00m	K40	GAI	5*	ST7	SRB
2005 05 27.92	d C	12.5	LB	6.3M	8	a900	8.0		>23	m287	C 0.50m	K40	GAI	5*	ST7	SRB
2005 05 31.63	axC	10.0	HV	35.0C	10	a120	3.5				S 5.07m	KAIa	SI4	5	ST2	TSU02
2005 06 01.90	d C	9.7	LB	6.3M	8	a900	7.2		>32	m288	C 7.90m	K40	GAI	5*	ST7	SRB
2005 06 01.90	d C	9.8	LB	6.3M	8	a900	7.2		>32	m288	C 7.20m	K40	GAI	5*	ST7	SRB
2005 06 01.90	d C	10.2	LB	6.3M	8	a900	7.2		>32	m288	C 3.90m	K40	GAI	5*	ST7	SRB
2005 06 01.90	d C	10.9	LB	6.3M	8	a900	7.2		>32	m288	C 2.00m	K40	GAI	5*	ST7	SRB
2005 06 01.90	d C	11.7	LB	6.3M	8	a900	7.2		>32	m288	C 1.00m	K40	GAI	5*	ST7	SRB
2005 06 01.90	d C	12.7	LB	6.3M	8	a900	7.2		>32	m288	C 0.50m	K40	GAI	5*	ST7	SRB
2005 06 03.98	d C	9.1	LB	6.3M	8	a900	7.0		>29	m289	C 8.90m	K40	GAI	5*	ST7	SRB
2005 06 03.98	d C	9.2	LB	6.3M	8	a900	7.0		>29	m289	C 7.15m	K40	GAI	5*	ST7	SRB
2005 06 03.98	d C	9.7	LB	6.3M	8	a900	7.0		>29	m289	C 3.95m	K40	GAI	5*	ST7	SRB
2005 06 03.98	d C	10.4	LB	6.3M	8	a900	7.0		>29	m289	C 2.00m	K40	GAI	5*	ST7	SRB
2005 06 03.98	d C	11.2	LB	6.3M	8	a900	7.0		>29	m289	C 1.00m	K40	GAI	5*	ST7	SRB
2005 06 03.98	d C	12.0	LB	6.3M	8	a900	7.0		>29	m289	C 0.50m	K40	GAI	5*	ST7	SRB
2005 06 09.67	x C	10.1	GA	15.0L	6	a 60	5.8		>30	m290	S 5.8 m	K26	SI5	5	ST9	YOS02
2005 06 23.90	d C	9.9	LB	6.3M	8	a900	> 8		>25	m296	C10.35m	K40	GAI	5*	ST7	SRB
2005 06 23.90	d C	10.1	LB	6.3M	8	a900	> 8		>25	m296	C 7.90m	K40	GAI	5*	ST7	SRB
2005 06 23.90	d C	10.7	LB	6.3M	8	a900	> 8		>25	m296	C 3.95m	K40	GAI	5*	ST7	SRB
2005 06 23.90	d C	11.4	LB	6.3M	8	a900	> 8		>25	m296	C 2.00m	K40	GAI	5*	ST7	SRB
2005 06 23.90	d C	12.2	LB	6.3M	8	a900	> 8		>25	m296	C 1.00m	K40	GAI	5*	ST7	SRB
2005 06 23.90	d C	13.1	LB	6.3M	8	a900	> 8		>25	m296	C 0.50m	K40	GAI	5*	ST7	SRB
2005 06 25.53	axC	11.7	HV	35.0C	10	a120	2.2	4			S 2.84m	KAIa	SI4	5	ST2	TSU02
2005 06 28.93	d C	9.9	LB	6.3M	8	a900	8.6		>30	m298	C12.35m	K40	GAI	5*	ST7	SRB
2005 06 28.93	d C	10.1	LB	6.3M	8	a900	8.6		>30	m298	C 9.90m	K40	GAI	5*	ST7	SRB
2005 06 28.93	d C	10.2	LB	6.3M	8	a900	8.6		>30	m298	C 7.90m	K40	GAI	5*	ST7	SRB
2005 06 28.93	d C	10.8	LB	6.3M	8	a900	8.6		>30	m298	C 3.95m	K40	GAI	5*	ST7	SRB
2005 06 28.93	d C	11.5	LB	6.3M	8	a900	8.6		>30	m298	C 2.00m	K40	GAI	5*	ST7	SRB
2005 06 28.93	d C	12.3	LB	6.3M	8	a900	8.6		>30	m298	C 1.00m	K40	GAI	5*	ST7	SRB
2005 06 28.93	d C	13.0	LB	6.3M	8	a900	8.6		>30	m298	C 0.50m	K40	GAI	5*	ST7	SRB

Comet C/2004 RG_113 (LINEAR)

DATE (UT)	n M	MAG.	RF	AP. T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C P	Cam	OBS.
2005 05 07.53	axC	16.2	HV	35.0C	10	a120	0.3	3			S 0.80m	KAIa	SI4	5	ST2	TSU02

Comet C/2005 B1 (Christensen)

DATE (UT)	n M	MAG.	RF	AP. T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C P	Cam	OBS.
2005 05 10.66	axC	16.8	TJ	25.0L	5	a120	0.3		0.5m	186	S 0.3 m	K42	SI5	5 U	SE7	OHS
2005 05 20.97	d C	[16.0	LB	6.3M	8	a900					C 1.00m	K40	GAI	5*	ST7	SRB

Comet C/2005 B1 (Christensen) [cont.]

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DATE (UT)        n M MAG. RF   AP. T f/ EXP.   COMA   DC   TAIL  PA APERTUR Chp Sfw C P Cam    OBS.
2005 06 04.61      C 16.8 GA  60.0Y  6 a240    0.5              185 S 0.5 m SIA IPL 5 U Ap7   NAK01
2005 06 25.60 axC 16.7 HV   35.0C 10 A320    0.3   4     0.5m180 S 0.68m KAIaSI4 5   ST2   TSU02
2005 06 29.00 d C[16.0 LB    6.3M  8 a900                        C 1.00m K40 GAI 5*  ST7   SRB
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Comet C/2005 E2 (McNaught)

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DATE (UT)        n M MAG. RF   AP. T f/ EXP.   COMA   DC   TAIL  PA APERTUR Chp Sfw C P Cam    OBS.
2005 05 07.77 axC 15.5 HV   35.0C 10 a 90    0.2   6             S 1.03m KAIaSI4 5   ST2   TSU02
2005 05 15.78 axC 15.1 TJ   60.0Y  6 a120    0.55        1.1m265 S 0.55m SIA IPL 5 U Ap7   NAK01
2005 06 05.73 axC 14.3 HV   35.0C 10 a 90    0.3   5             S 0.70m KAIaSI4 5   ST2   TSU02
2005 06 06.72 sxC 14.4 TJ   25.0L  5 a120    0.5       ?     279 S 0.5 m K42 SI5 5 U SE7   OHS
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Comet C/2005 EL_173 (LONEOS)

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DATE (UT)        n M MAG. RF   AP. T f/ EXP.   COMA   DC   TAIL  PA APERTUR Chp Sfw C P Cam    OBS.
2005 03 31.54      C 19.6 GA  60.0Y  6 a240           9             S 0.25m SIA IPL 5 U Ap7   NAK01
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Comet C/2005 G1 (LINEAR)

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DATE (UT)        n M MAG. RF   AP. T f/ EXP.   COMA   DC   TAIL  PA APERTUR Chp Sfw C P Cam    OBS.
2005 05 04.71      C 18.5 GA  60.0Y  6 a240    0.3                   S 0.3 m SIA IPL 5 U Ap7   NAK01
2005 05 07.71 axC 18.6 HV   35.0C 10 a540    0.2                   S 0.50m KAIaSI4 5   ST2   TSU02
2005 05 15.70      C 18.3 GA  60.0Y  6 a240    0.35                  S 0.35m SIA IPL 5 U Ap7   NAK01
2005 06 04.70      C 18.4 GA  60.0Y  6 a240    0.35              160 S 0.35m SIA IPL 5 U Ap7   NAK01
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Comet P/2005 GF_8 (LONEOS)

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DATE (UT)        n M MAG. RF   AP. T f/ EXP.   COMA   DC   TAIL  PA APERTUR Chp Sfw C P Cam    OBS.
2005 05 04.60 a C 17.4 GA   60.0Y  6 a240    0.35                  S 0.35m SIA IPL 5 U Ap7   NAK01
2005 05 07.65 axC 17.3 HV   35.0C 10 A800    0.3   4             S 0.80m KAIaSI4 5   ST2   TSU02
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Comet C/2005 H1 (LINEAR)

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DATE (UT)        n M MAG. RF   AP. T f/ EXP.   COMA   DC   TAIL  PA APERTUR Chp Sfw C P Cam    OBS.
2005 05 04.69      C 19.3 GA  60.0Y  6 a240    0.25                  S 0.25m SIA IPL 5 U Ap7   NAK01
2005 05 15.68      C 19.2 GA  60.0Y  6 a240    0.3                   S 0.3 m SIA IPL 5 U Ap7   NAK01
2005 06 04.68      C 19.4 GA  60.0Y  6 a240    0.3                   S 0.3 m SIA IPL 5 U Ap7   NAK01
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Comet P/2005 J1 (McNaught)

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DATE (UT)        n M MAG. RF   AP. T f/ EXP.   COMA   DC   TAIL  PA APERTUR Chp Sfw C P Cam    OBS.
2005 05 15.74 x C 18.3 TJ   60.0Y  6 a120    0.35                  S 0.35m SIA IPL 5 U Ap7   NAK01
```

Comet P/2005 JQ_5 (Catalina)

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DATE (UT)        n M MAG. RF   AP. T f/ EXP.   COMA   DC   TAIL  PA APERTUR Chp Sfw C P Cam    OBS.
2005 05 26.89 d C 14.6 LB    6.3M  8 a900    1.0                   C 2.00m K40 GAI 5*  ST7   SRB
2005 05 26.89 d C 15.0 LB    6.3M  8 a900    1.0                   C 1.00m K40 GAI 5*  ST7   SRB
2005 05 26.89 d C 15.8 LB    6.3M  8 a900    1.0                   C 0.50m K40 GAI 5*  ST7   SRB
2005 05 31.70 axC 15.6 HV   35.0C 10 A200    0.3   3             S 0.80m KAIaSI4 5   ST2   TSU02
2005 06 01.86 d C 13.4 LB    6.3M  8 a900    1.2                   C 2.00m K40 GAI 5*  ST7   SRB
2005 06 01.86 d C 14.2 LB    6.3M  8 a900    1.2                   C 1.20m K40 GAI 5*  ST7   SRB
2005 06 01.86 d C 14.4 LB    6.3M  8 a900    1.2                   C 1.00m K40 GAI 5*  ST7   SRB
2005 06 01.86 d C 15.4 LB    6.3M  8 a900    1.2                   C 0.50m K40 GAI 5*  ST7   SRB
2005 06 04.60      C 15.5 GA  60.0Y  6 a120    0.55        0.8m130 S 0.55m SIA IPL 5 U Ap7   NAK01
2005 06 09.59 x C 14.5 GA   15.0L  6 a360    0.6         1.0m130 S 0.8 m K26 SI5 5   ST9   YOS02
2005 06 13.59 axC 14.3 HV   35.0C 10 a900    0.4   4             S 1.26m KAIaSI4 5   ST2   TSU02
2005 06 23.86 d C 10.3 LB    6.3M  8 a900 > 6                     C 9.85m K40 GAI 5*  ST7   SRB
2005 06 23.86 d C 10.6 LB    6.3M  8 a900 > 6                     C 6.90m K40 GAI 5*  ST7   SRB
2005 06 23.86 d C 11.4 LB    6.3M  8 a900 > 6                     C 3.95m K40 GAI 5*  ST7   SRB
2005 06 23.86 d C 12.4 LB    6.3M  8 a900 > 6                     C 2.00m K40 GAI 5*  ST7   SRB
2005 06 23.86 d C 13.5 LB    6.3M  8 a900 > 6                     C 1.00m K40 GAI 5*  ST7   SRB
2005 06 23.86 d C 14.8 LB    6.3M  8 a900 > 6                     C 0.50m K40 GAI 5*  ST7   SRB
2005 06 25.48 axC 11.7 HV   35.0C 10 a660    3     2             S 4.06m KAIaSI4 5   ST2   TSU02
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Comet C/2005 K1 (Skiff)

DATE (UT)	n	M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 06 04.72		C	16.5	GA	60.0	Y	6	a240	0.5		1.0m	332	S 0.5 m	SIA	IPL	5	U	Ap7	NAK01
2005 06 23.97	d	C	[15.4	LB	6.3	M	8	a900					C 1.00m	K40	GAI	5*		ST7	SRB

Comet C/2005 K2 (LINEAR)

DATE (UT)	n	M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 05 26.98	d	C	[15.6	LB	6.3	M	8	a900					C 1.00m	K40	GAI	5*		ST7	SRB
2005 05 31.49	x	C	13.1	TJ	60.0	Y	6	a120	1.9				S 1.9 m	SIA	IPL	5	U	Ap7	NAK01
2005 05 31.51	ax	C	11.7	HV	35.0	C	10	a360	2.0	3			S 3.12m	KAI	aSI4	5		ST2	TSU02
2005 06 05.48	x	C	12.5	TJ	60.0	Y	6	a120	2.0				S 2.0 m	SIA	IPL	5	U	Ap7	NAK01
2005 06 05.51	ax	C	12.2	HV	35.0	C	10	a 60					S 4.27m	KAI	aSI4	5		ST2	TSU02
2005 06 09.55	x	C	10.7	GA	15.0	L	6	a 60	3.7				S 3.7 m	K26	SI5	5		ST9	YOS02
2005 06 13.48	ax	C	11.1	HV	35.0	C	10	a 60	2.5	4			S 2.76m	KAI	aSI4	5		ST2	TSU02

Comet P/2005 K3 (McNaught)

DATE (UT)	n	M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 06 06.74	x	C	16.6	TJ	25.0	L	5	a240	0.4				S 0.4 m	K42	SI5	5	U	SE7	OHS

Comet P/2005 L1 (McNaught)

DATE (UT)	n	M	MAG.	RF	AP.	T	f/	EXP.	COMA	DC	TAIL	PA	APERTUR	Chp	Sfw	C	P	Cam	OBS.
2005 06 04.64	a	C	17.2:	GA	60.0	Y	6	a240	0.35				S 0.35m	SIA	IPL	5	U	Ap7	NAK01

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DESIGNATIONS OF RECENT COMETS

Listed below, for handy reference, are the last 19 comets (non-spacecraft) to have been given designations in the new system. The name, preceded by a star (⋆) if the comet was a new discovery (compared to a recovery from predictions of a previously-known short-period comet) or a # if a re-discovery of a 'lost' comet. (The 'P/' prefix for designations is used for new comets with orbital periods < 30 yr; otherwise, 'C/' is used.) Also tabulated below are such values as the orbital period (in years) for periodic comets, date of perihelion, T (month/date/year), and the perihelion distance (q, in AU). Four-digit numbers in the last column indicate the *IAU Circular* (4-digit number) containing the discovery/recovery or permanent-number announcement.

Permanent-numeral designations were given to the "centaur" comets 165P/2004 B4 (LINEAR) and 166P/2001 T4 (NEAT) [see *IAUC* 8552]. [This list updates that in the April 2005 issue, pp. 137-138.]

	New-Style Designation	*P*	*T*	*q*	*IAUC*
⋆	P/2005 K3 (McNaught)	7.11	8/11/05	1.51	8535
⋆	P/2005 L1 (McNaught)	7.92	12/12/05	3.14	8535
⋆	C/2005 L2 (McNaught)		7/14/05	3.19	8536
⋆	C/2005 L3 (McNaught)		1/15/08	5.59	8536
⋆	P/2005 JY_{126} (Catalina)	7.27	2/21/06	2.13	8537
⋆	P/2005 L4 (Christensen)	8.35	8/24/05	2.37	8543
⋆	167P/2004 PY_{42} (CINEOS)	64.8	4/24/01	11.8	8545
⋆	170P/2005 M1 (Christensen)	8.63	1/26/06	2.93	8547
⋆	P/2005 JD_{108} (Catalina-NEAT)	16.4	8/4/05	4.03	8554
⋆	C/2005 N1 (Juels-Holvorcem)		8/22/05	1.13	8557
	168P/2005 N2 (Hergenrother)	6.92	11/2/05	1.43	8560
⋆	P/2005 N3 (Larson)	6.80	12/10/05	2.20	8560
⋆	C/2005 N4 (Catalina)		7/2/05	2.30	8568
⋆	C/2005 N5 (Catalina)		8/22/05	1.63	8568
⋆	169P/2002 EX_{12} (NEAT)	4.20	9/17/05	0.61	8578
⋆	C/2005 O1 (NEAT)		5/24/05	3.62	8578
⋆	C/2005 O2 (Christensen)		9/25/05	3.36	8579
⋆	C/2005 P3 (SWAN)		8/9/05	0.53	8587
⋆	C/2005 Q1 (LINEAR)		7/22/05	6.4	8590