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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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CORRIGENDA

- In the July 2002 issue, page 208, line 5 of the first paragraph, *for* read coma diameters *read* real coma diameters
- In the April 2002 issue, page 54, the two observations of 1P/Halley, *for* 1986 *read* 1985 [the year was incorrect]
- In the January 2002 issue, page 42, and the July 2002 issue, page 220, the second "C/2002 A2 (LINEAR)" on each page (with $q = 5.15$ AU) should, of course, read "C/2002 A3 (LINEAR)".

What Happened to Comet C/2002 O4 (Hönig)?

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Abstract. *The evolution of comet C/2002 O4 (Hönig) is investigated from its discovery to its disappearance, and the issue of its fate is addressed. It is suggested that the comet was discovered while in outburst and that a significant fraction of its initial mass had already been lost by the time this episode terminated before mid-August 2002. The outburst, which apparently engulfed the entire subkilometer-sized nucleus, began 2–3 days before discovery, extending over a period of more than 10 days and perhaps as long as 3–4 weeks, with a peak dust-production rate of* $\sim 10^7$ *g/s, much higher than that of Halley's comet at the same heliocentric distance. The total mass of comet C/2002 O4 expended during the event is estimated at 1–2* $\times 10^{13}$ *grams, a significant fraction of its nucleus mass. The tail orientation pattern suggests that the activity-driven dust production was confined largely to the period of time from* $\sim$ *90 to 50 days before perihelion (early July to mid-August), so the comet may have been active before the outburst. The event set off a process of runaway erosion of the remaining mass of the nucleus, leading to the comet's complete disintegration into dust and minor fragments near perihelion, as indicated by the sudden fading, the loss of nucleus condensation, and the sizable nongravitational perturbations of the orbital motion. If, contrary to the evidence, the nucleus had survived essentially intact and had become dormant, the comet's motion would have been much more compatible with the gravitational law. A model of the light curve suggests that the latent energy of erosion for the nucleus of comet C/2002 O4 was only* $\sim$ *10000 cal/mole, lower than the sublimation heat of water ice. Thus, the comet's disintegration was nearly spontaneous.*

1. Introduction

At the end of September 2002, various cometary web sites reported that comet C/2002 O4 (Hönig) had been fading rapidly just days before reaching perihelion on October 1.98 ET at a heliocentric distance of $r = 0.776$ AU. Discovered on July 22, when it was 1.51 AU from the sun, the object passed within 10° of the north celestial pole in mid-August, but nothing unusual was noticed about it during the first two months of observation.

One of the alerts, released on September 30 on a German website[1], was a message announcing that comet C/2002 O4 had become "very diffuse," displaying "hints of disintegration" in images such as one taken by M. Jäger on September 29.78 UT. In fact, all images taken in the period of time from September 28 to October 1 showed dramatically the progressive loss of the nucleus condensation during the 72 hours. The next known image, taken on October 10 by K. Kadota[2], showed only a faint straight tail with no traces of the nucleus condensation (cf. Green 2002). The complete absence of the comet's head was subsequently confirmed by additional images exposed on October 11, 16, and November 6 by Y. Ohshima[3] and on October 27 by Kadota himself.

Prior to this investigation, the nature and timeline of the process of disappearance of comet C/2002 O4 was unknown. Indeed, it even was not clear *per se* whether the comet disintegrated or has only temporarily become dormant. It is shown below that the published images, light curve, orbital motion, and other available information offer an extraordinary insight into the story of comet C/2002 O4 and allow one to answer in some detail the question of what really happened to this object.

2. Tail Appearance and Evolution

The morphology of the tail of comet C/2002 O4 in the images taken in late September and in October exhibits a great deal of similarity with the tails of other comets in the process of their disappearance. Outstanding examples are C/1999 S4 (LINEAR), C/1996 Q1 (Tabur), and C/1925 X1 (Ensor). Images of the first two can be seen, for example, at the web site of the Črni Vrh Observatory[4], while two photographs of comet C/1925 X1 were published by Schorr

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[1] `http://www.fg-kometen.de`, the homepage of the *Fachgruppe Kometen der Vereinigung der Sternfreunde* (Working Group on Comets of the Organization of Star Friends).

[2] `http://www.astro.web.sh.cwidc.net/ageo/comet/200204`

[3] `http://www.hi-ho.ne.jp/hirohisa-sato/Index/c2002o4.htm`

[4] `http://www.fiz.uni-lj.si/astro/comets`

(1926). The comets were investigated, respectively, by Weaver et al. (2001), by Fulle et al. (1998b), and by Sekanina (1984). The authors concluded independently that each of these comets dissipated, the strongest evidence being available for comet C/1999 S4, thanks to the observations with the Hubble Space Telescope (HST) and the European Southern Observatory's Very Large Telescope (VLT).

One trait that these and other similar comets have in common is the sudden drop in activity occurring *before perihelion.* The perihelion distances were 0.323 AU for comet C/1925 X1, 0.840 AU for comet C/1996 Q1, and 0.765 AU (nearly identical with that of C/2002 O4) for comet C/1999 S4. The surviving tails of these comets have been shown to be composed of dust, dominated by relatively large particles (greater than ~ 100 microns in size).

2.1. Nature of the Tail

What kind of a tail did comet C/2002 O4 display? The early images, taken in late July and early August, did not show much of an appendage. The comet exhibited a diffuse coma a few arcmin in diameter, which was distinctly elongated to the southwest. From the spectral sensitivity of the employed CCD detectors, one suspects the observed traces of the tail to be probably made up of dust, but short plasma emissions may have also contributed to the observed appearance. As time went on and the earth was gradually approaching the comet's orbital plane, the tail lengthened and became more prominent. This effect appears to be due to an optical-depth enhancement caused by the increasingly more-pronounced edgewise projection, which is diagnostic of the tail's dust nature and never associated with ion tails. Only hours before the earth's transit across the plane, an image was taken by V. Gonano, L. Monzo, and M. Maestrutti[5] with a Baker-Schmidt camera, a CCD array, and an infrared filter. The appearance of the tail was the same as in other images taken with no filter at about that time. A binocular observation made nearly simultaneously by M. Meyer[6] demonstrates that the tail appeared visually to be much longer than in the images, possibly due to the loss of contrast in reproduction. Interestingly, the tail continued to project as a fairly narrow feature for almost the whole month after the earth's transit across the orbital plane, but I am unaware of any image in which the typical filamentary structure of a plasma tail could be detected. The closest the tail got to looking like an ion feature was on M. Jäger's[7] exposure from August 21. Starting in the second week of September, the tail finally began to widen, acquiring the more characteristic proportions of a dust formation.

In summary, it is probably safe to assume that the tail was made up entirely, or almost entirely, of dust at all times. Its somewhat peculiar shape was apparently a combined effect of the geometry (especially the nearness to the orbital plane) and the temporal distribution of dust production.

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TABLE 1

EPHEMERIS FOR DUST-TAIL ORIENTATION OF COMET C/2002 O4 (EQ. J2000.0).

Date 2002 (0h ET)	Time from peri-helion (days)	Comet's distance (AU) from		Earth's cometo-centric latitude	Position angle[a]		Predicted position angle P.A. and apparent length L for dust tail formed at given time before perihelion[b]									
							100 days		80 days		60 days		40 days		20 days	
		Earth	Sun		PA(*RV*)	PA(−*V*)	P.A.	*L*	P.A.	*L*	P.A.	*L*	P.A.	*L*	P.A.	*L*
July 25	−68.98	0.789	1.470	+24°	227°	200°	219°	0′.3	227°	<0′.1	...	...	...	...	...	...
Aug. 4	−58.98	0.674	1.333	+14	211	196	206	0.8	208	0.2	210°	<0′.1	...	...	...	...
14	−48.98	0.655	1.199	0	173	173	173	1.5	173	0.7	173	0.1	...	...	...	...
24	−38.98	0.727	1.071	−13	73	87	79	2.2	78	1.2	76	0.4	73°	<0′.1	...	...
Sept. 3	−28.98	0.854	0.954	−22	45	72	58	2.8	56	1.8	53	0.8	49	0.1	...	...
13	−18.98	1.000	0.859	−28	30	68	51	3.4	48	2.4	45	1.4	40	0.5	31°	<0′.1
23	−8.98	1.142	0.796	−32	15	64	45	4.2	43	3.2	39	2.1	34	1.0	24	0.1
Oct. 3	+1.02	1.265	0.776	−35	358	59	39	5.2	36	4.1	33	2.9	27	1.7	18	0.5
13	+11.02	1.359	0.805	−37	340	53	32	6.4	30	5.3	26	4.0	21	2.6	12	1.1
23	+21.02	1.421	0.876	−39	322	48	26	7.6	23	6.5	20	5.2	14	3.7	5	1.9
Nov. 2	+31.02	1.455	0.977	−40	309	45	20	8.8	17	7.8	14	6.5	8	4.9	0	2.9

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

[b] The tail is assumed to contain dust grains that are subjected to radiation-pressure accelerations not exceeding 0.2 percent of the solar gravitational acceleration; these grains are all greater than 0.76 millimeter in diameter for a density of 0.5 g/cm^3 and greater than 2.8 millimeter in diameter for 0.2 g/cm^3.

[5] http://www.uai.it/sez_com/2002o4

[6] http://cfa-www.harvard.edu/icq/CometMags.html

[7] http://www.fg-kometen.de/pix/pc02o4_e.htm

2.2. *Tail Orientation*

Since a history of dust production (including its termination) can be extracted from the dust tail's orientation pattern, a high priority in an investigation of comet C/2002 O4's fate should be examining the relevant properties of its tail. For this purpose I calculated a dust-emission ephemeris, which is presented in Table 1. The first four columns are self-explanatory. The fifth column lists the earth's cometocentric latitude, its angular deviation from the comet's orbital plane as viewed from the object — a very critical parameter. Since a dust tail's axis always lies in the comet's orbital plane (or very close to it), the tail is projected edge-on, as viewed by a terrestrial observer, at the time the earth transits across the orbital plane; no information is then available on the tail's spatial orientation. Usually, one cannot extract useful data from images taken at cometocentric latitudes smaller in absolute value than some 10°. In the case of comet C/2002 O4, this unfavorable period of time extended for about two weeks, centered on August 14, the earth's transit time. The sixth and seventh columns of Table 1 show the position angles (reckoned from the north through the east) of, respectively, the extended radius vector **RV** (i.e., the antisolar direction) and the reverse orbital-velocity vector **−V** (i.e., the direction of the orbit behind the comet), both in projection onto the plane of the sky. These two vectors determine the boundaries of the sector in which the entire dust tail is to be contained. The position angle of the extended radius vector approximates the directions of dust ejecta released at times shortly preceding the observation time, while the position angle of the reverse orbital-velocity vector defines the direction of concentration of the earliest dust ejecta.

Outside the period of unfavorable earth-comet configuration, the times of significant dust production can be estimated by measuring orientations of the dust-tail axis and comparing them with the ephemeris in Table 1. While the accuracy of this approach is much lower than that of a comprehensive and time-consuming dust-tail analysis, it provides meaningful information on the object's dust-production history. Particles assumed to have been ejected from comet C/2002 O4 between 100 and 20 days before perihelion (i.e., between 2002 June 24 and September 12) are predicted to line up in the tail along straight lines in the position angles (P.A.) that are listed in the respective columns on the right-hand side of Table 1, together with the predicted tail lengths L (in arcmin) referring to a population of grains subjected to solar-radiation-pressure accelerations not exceeding 0.002 the solar gravitational acceleration (or $\sim$ 0.0012 cm/s^2 at 1 AU from the sun). The diameters of these dust particles are density dependent, but exceed 0.11 cm at a density of 0.5 g/cm^3 and 0.28 cm at 0.2 g/cm^3.

2.3. *Constraints on Dust Production*

Cursory inspection of the tail orientations in a number of late-September images, and comparison of them with the position angles in Table 1, revealed immediately the tail's major departure from the direction of the antisolar direction. Indeed, the comet was then almost exactly to the north of the sun, but the entire body of the tail, including its leading boundary, was pointing clearly to the northeast, indicating the absence of dust ejecta for quite some time prior to perihelion. Still more obvious deviations of the tail from the antisolar direction were noticed in the October images, in which the tail was directed toward the north-northeast, whereas a tail made up of near-perihelion dust emissions should have pointed toward the northwest. It thus became obvious that *the comet's dust production did not begin to decrease significantly in late or mid-September, but much, much earlier.*

To obtain better estimates for the timing of the dust-emission activity of comet C/2002 O4, the tail orientation data were collected either as reported in the literature or measured by the author (Z.S.) on a number of selected images. The measurements could only be made on images with the cardinal directions identified or with star trails, from whose positions the orientation could be established. A list of such images is presented in Table 2. The first five columns contain the same quantities as Table 1, while the remaining six show, respectively, the tail's measured or reported position angle and length, the derived ejection time and peak solar-radiation-pressure acceleration (in units of the solar gravitational acceleration) to which dust in the tail was subjected, the observer(s), and the source of information.

The results of this exercise are astonishing: all 23 determinations of the effective time of dust ejection consistently show that it occurred more than 50 days before perihelion, and 17 of these determinations, which are considered to be reasonably accurate, yield an average of 70 $\pm$ 9 days before perihelion. Thus, evidence based on the tail orientation data suggests that comet C/2002 O4 was producing dust primarily in the period of time from some 90 to 50 days preperihelion (from early July until mid-August 2002), when its heliocentric distance ranged from $r \sim$ 1.76 to 1.21 AU. The discovery time, 72 days before perihelion, happens to be in the midst of this period of activity. The results, especially those derived from the images taken in the period September-October, also indicate that the tail indeed consisted mainly of heavy grains, subjected to radiation-pressure accelerations of only a few thousandths of the solar gravitational acceleration (cf. Sec. 4).

In the light of the surprising findings regarding the dust production's temporal profile, it is desirable to study the comet's brightness behavior, the next subject of this paper.

3. The Light Curve

It is fortunate that, due to its geocentric path that made it a circumpolar object in much of Europe and North America during August and the first half of September, the comet was observed extensively by many amateur observers, and a very dependable light curve could be constructed from a large number of magnitude estimates. My primary source was the *International Comet Quarterly* website (see footnote 6), supplemented with several data points from the Jet Propulsion Laboratory's 'Comet Observation Home Page', which is maintained by C. S. Morris[8]. The analysis followed a

[8] `http://encke.jpl.nasa.gov/RecentObs.html`

TABLE 2

ORIENTATION AND LENGTH OF THE TAIL OF COMET C/2002 O4 (EQ. J2000.0).

Date 2002 (UT)	Time from perihelion (days)	Earth's cometocentric latitude	Position angle		Observed position angle of tail	Observed apparent length of tail	Derived dust ejection time[a]	Derived radiation pressure acceleration[b]	Observer(s)	Note
			PA(*RV*)	PA(−*V*)						
July 27.65	−66.33	+22°	223°.4	199°.4	213°	1′.8	(−129)	(0.003)	Kadota	1,2
27.85	−66.13	+22	223.1	199.4	215	3	(−109)	(0.005)	Sanchez	1
28.84	−65.14	+21	221.6	199.1	217	2.5	−85	0.029	Ligustri, Degano	3
Aug. 2.88	−60.10	+15	213.0	197.1	211	2.5	−71	0.072	Ligustri, Degano	3
3.90	−59.08	+14	211.0	196.4	∼205	1	(−106)	(0.002)	Tichá, Tichý	4
5.70	−57.28	+12	207.0	195.0	207	4	...	...	Kadota	2
7.99	−54.99	+9	201.0	192.3	199	1	(−77)	(0.005)	Nicolini	3
12.91	−50.07	+2	180.4	178.8	182	6	...	...	Ligustri	3
13.90	−49.08	0	173.7	173.6	174	8	...	...	Gonano et al.	3,5
13.91	−49.07	0	173.7	173.5	175	18	...	...	Meyer	6
14.04	−48.94	0	172.7	172.7	174	6	...	...	Ligustri	3,5
15.89	−47.09	−3	155.8	158.6	157	5	...	...	Kopplin	7
19.01	−43.97	−7	117.1	124.3	117	...	...	...	Jäger	7,8
19.97	−43.01	−8	105.6	114.2	107	5	(−58)	(0.045)	Degano	3
21.07	−41.91	−9	94.2	104.3	97	...	(−73)	...	Jäger	7
30.85	−32.13	−19	50.9	74.0	58	4	−67	0.008	Ligustri, Degano	3
Sept. 1.90	−30.08	−21	46.9	72.6	56	6.5	−69	0.011	Kopplin	7
2.91	−29.07	−22	45.1	72.0	57	5	−87	0.005	Kopplin	7
5.81	−26.17	−24	40.5	70.8	49	2.5	−54	0.007	Montanucci	3,5
7.79	−24.19	−25	37.6	70.1	48	3.5	−57	0.008	Ligustri, Savani	3
8.84	−23.14	−26	36.1	69.7	48	3.5	−60	0.006	Kopplin	7
14.80	−17.18	−29	27.7	67.6	47	3	−78	0.002	Ligustri	3,5
28.77	−3.21	−33	5.9	60.9	37	4	−67	0.003	Ligustri	3,5
29.77	−2.21	−34	4.2	60.4	37	2.5	−71	0.002	Ligustri	3,5
30.75	−1.23	−34	2.4	59.8	37	5	−74	0.003	Sostero	3,5
30.76	−1.22	−34	2.4	59.8	36	4	−68	0.002	Jäger	5,7,8
Oct. 1.75	−0.23	−34	0.7	59.2	36	3	−72	0.002	Ligustri	3
10.82	+8.84	−36	343.9	54.1	30	6	−78	0.002	Kadota	2
16.80	+14.82	−37	332.9	51.0	23	8	−57	0.004	Ohshima	9
27.83	+25.85	−39	315.3	46.3	19	6	−73	0.002	Kadota	2

[a] Corresponding to the position angle of the tail's axis and expressed in days from perihelion; negative sign indicates time before perihelion. A parenthesized value means that ejection time is uncertain because the tail's dust nature is unclear (July 27.85), or the tail is too diffuse and/or short (July 27.65 and Aug. 3.90), or Earth is too close to the comet's orbital plane (Aug. 7.99, 19.97, and 21.07).

[b] Corresponding to the apparent tail length for the given ejection time and expressed in units of the solar gravitational acceleration (0.593 cm/s^2 at 1 AU from the Sun).

NOTES:

1. Hergenrother (2002).
2. http://www.astro.web.sh.cwidc.net/ageo/comet/2002O4.
3. http://www.uai.it/sez_com/2002o4.
4. http://www.klet.org/ck02o040.html.
5. http://encke.jpl.nasa.gov/images/02O4.
6. http://cfa-www.harvard.edu/icq/CometMags.html.
7. http://www.fg-kometen.de/pix/pc02o4_e.htm.
8. http://www.astrostudio.at/defaultNets.htm.
9. http://www.hi-ho.ne.jp/hirohisa-sato/Index/c2002o4.htm.

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(text continued from page 225)

standard procedure. The visual magnitude estimates and a limited number of CCD magnitudes have been standardized, to the extent possible, by applying corrections for personal and instrumental effects, and then normalized to a unit geocentric distance Δ by an inverse power law.

The magnitude standardization procedure consisted of visually comparing temporally overlapping light curves based on observations made by individual observers (separately for each instrument, when more than one was used) and minimizing the scatter among them by shifting them up or down, as needed, along the magnitude axis. If any two light curves by different observers/instruments did not overlap one another in time, effort was made to employ additional light curves by others to span the gap. In this trial-and-error manner, constant corrections for all the accepted, reasonably uniform data sets were eventually obtained and subsequently normalized to a common photometric system, for which I adopted the brightest among the personal light curves. Any data set for which an appropriate correction could not be determined was rejected. Isolated magnitudes – one or two per observer and instrument – were ignored, with the exception of the discovery magnitude estimate that was used, even though it was uncorrected for personal and instrumental effects. Thus, as usual, the normalized magnitude $H_\Delta(t,r)$ is related to the standardized apparent magnitude $H(t,r,\Delta)$ by

$$H_\Delta(t,r) = H(t,r,\Delta) - 5\log_{10}\Delta, \tag{1}$$

where Δ is in AU.

Altogether, 146 magnitudes by 19 observers were employed, covering the period July 22 through October 1. The uncorrected magnitude estimate at the time of discovery appears to match the comet's brightness behavior in the early period of time after discovery quite well. Crude postperihelion estimates of the residual tail's brightness were not included in this data set.

The brightness was plotted against time and heliocentric distance in a search for the most complete description of the light curve possible.

3.1. Temporal Variations

In order to fit the light curve plotted as a function of time, attempts were made to use various polynomials of $t-T$, where T is the time of perihelion passage. A very satisfactory fit was achieved using the following quartic polynomial:

$$H_\Delta(t) = H + a(t-T) + b(t-T)^2 + c(t-T)^3 + d(t-T)^4, \tag{2}$$

with a mean residual of $\pm$ 0.15 mag, where $H = 9.53 \pm 0.12$, $a = 0.186 \pm 0.017$, $b = 0.00753 \pm 0.00092$, $c = 0.000144 \pm 0.000019$, and $d = 0.00000115 \pm 0.00000013$. Figure 1 shows that this polynomial matches the observations extremely well at $t < T - 20$ days (that is, before September 12 and at heliocentric distances, r, exceeding 0.86 AU). The peak brightness was reached nominally at $t_{\rm peak} = T - 29.24$ days, on September 2, at which time $H_\Delta(t_{\rm peak}) = 7.77$. Because of the finite lifetime of the dust ejecta in the cloud surrounding the nucleus, the comet's dust production must have peaked long before early September, a constraint that is consistent with the conclusions in Sections 2.3 and 5.

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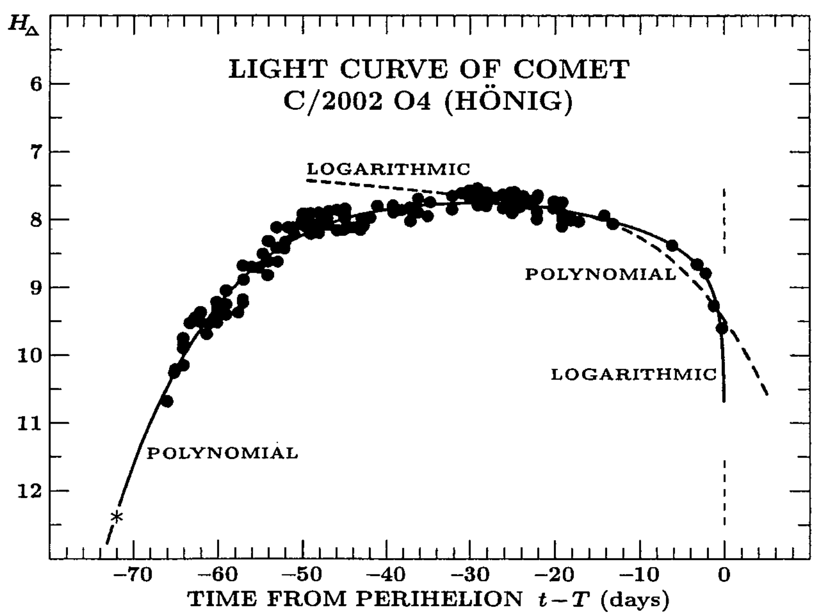

Figure 1. The magnitude $H_\Delta(t)$ of comet C/2002 O4, normalized to 1 AU from the earth, plotted as a function of time reckoned from the perihelion time T = 2002 Oct. 1.98 ET. The bullets are 145 data points based on the reported visual or CCD magnitudes, which were standardized, to the extent possible, by applying corrections for personal and instrumental effects. The asterisk is the uncorrected brightness estimate made at the time of discovery. The two fitted curves are, respectively, a quartic polynomial approximation described by Equation (2) and labeled **POLYNOMIAL**, *and a simple erosion law described by Equation (5) and labeled* **LOGARITHMIC**. *The polynomial fits the observed light curve extremely well at times $t \le T - 20$ days, while the logarithmic law at times $T - 20$ days $\le t < T$. At $t = T - 20$ days both functions give the same magnitude and the same slope.*

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Near perihelion, the polynomial does not fit the extraordinarily steep drop in the observed light curve. In this 20-day time span, a much better match is offered by a simple law based on the assumption that the comet was indeed disintegrating completely. In the first approximation, I adopt that (i) the nucleus was eroding away rapidly at a constant rate $\dot{R}$ with time and (ii) the normalized brightness $\Im_\Delta(t)$ varied with some power ν of the contracting nuclear radius $R(t)$,

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

where $R_0 = R(t_0)$ was the initial nucleus radius at time t_0, before the erosion process set in. Introducing the time of demise $t_{\rm fin}$, when $R(t_{\rm fin}) = 0$, one obtains $R(t) = \dot{R} \cdot (t_{\rm fin} - t)$ and

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

where H_1 is the normalized magnitude one day before the object eroded away completely. Assuming that $t_{\rm fin} = T$, I obtain an excellent fit to the light curve in the period $T - 20$ days $< t < T$ (September 12 through October 1, $r \leq 0.86$ AU) using the formula:

$$H_\Delta(t) = H - A \log_{10} |t - T|, \tag{5}$$

where $H = 9.22 \pm 0.08$ and $A = 1.050 \pm 0.073$. This law is represented in Fig. 1 by a curve labeled **LOGARITHMIC**; at $t = T - 20$ days, it predicts the same magnitude ($H_\Delta = 7.85$) and the same fading rate ($\dot{H}_\Delta = +0.02$ mag/day) as the polynomial (equation 2). One would expect that if physical erosion of the nucleus is indeed the cause of the precipitous drop in the comet's brightness just before perihelion, the instantaneous rate of fading should vary as the surface area, in which case $\nu = 2$ and the slope in Eq. (5) should be 5 instead of 1.05. However, the finite lifetime of erosion products lingering in the immediate proximity of the contracting nucleus should cause the observed rate of fading to appear to be much slower.

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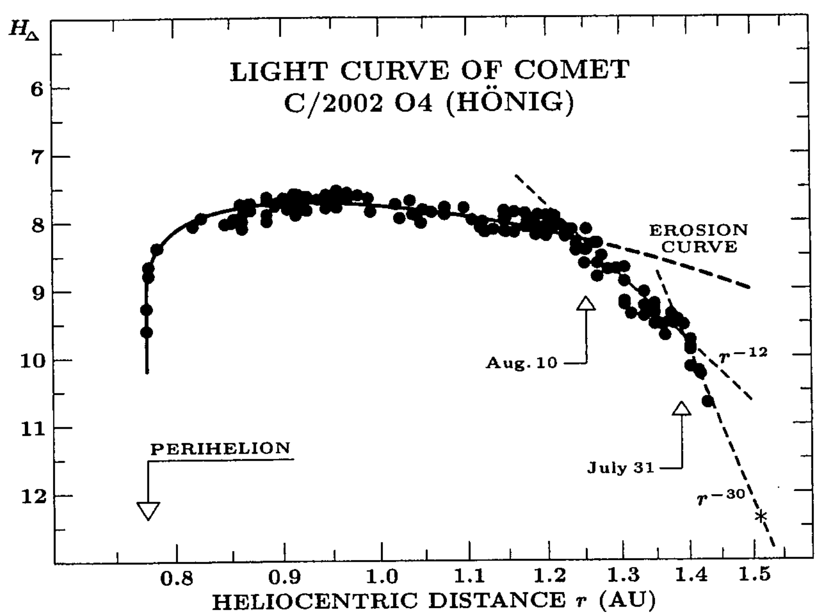

Figure 2. The magnitude $H_\Delta(r)$ of comet C/2002 O4, normalized to 1 AU from the earth, plotted as a function of heliocentric distance, r. The bullets are 145 standardized data points, as described in the caption to Fig. 1, the asterisk is the reported magnitude estimate at discovery. The two short-dash curves show the brightness variations that are consistent with the power laws r^{-30} and r^{-12}, matching reasonably well the magnitude observations at $r > 1.39$ AU (before July 31.0 UT) and $1.39 \geq r > 1.25$ AU, respectively. The data points at $r \leq 1.25$ AU (after August 10.0 UT) are fitted most satisfactorily by a law labeled **EROSION CURVE** *and derived from a comprehensive erosion model, which was recently developed to study the light curves of the SOHO sungrazers. For the nucleus of comet C/2002 O4, this model implies a latent energy of erosion of only 10000 cal/mole, which is less than the sublimation heat of water ice.*

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3.2. Variations with Heliocentric Distance

The evolution of the light curve as a function of heliocentric distance can be divided into three consecutive stages (Fig. 2). In the first nine days after discovery (July 22–30), the comet is found to have been brightening as r^{-30}. This is equivalent to $\dot{H}_\Delta \simeq -0.3$ mag/day, a rate that is sufficiently high to be symptomatic of cometary outbursts or flare-ups. Indeed, the amplitude and the rise time of one of the outbursts of C/2001 A2 (LINEAR) imply the same average brightening (Sekanina *et al.* 2002). Thus, I submit that *comet C/2002 O4 was discovered while in outburst.*

On July 31, when $H_\Delta = 9.7$ at 1.39 AU from the sun, the second stage began. The comet was brightening at a rather slower pace, but still as steeply as r^{-12}. The equivalent average daily rate was −0.14 mag/day, about one half the rate before July 31. This stage appears to have extended for 10 days, terminating 53 days before perihelion, on August 9, when the normalized magnitude reached 8.3 at 1.25 AU from the sun. The reason for the sudden change in the slope of brightening is unknown, but I suggest that it had to do with dust-production variations (or activity in general) during the outburst, just before July 31 (see Sec. 5).

On about August 10, the comet's brightening slowed down dramatically, signaling the arrival of the third stage. The normalized brightness varied as $r^{-2.5}$ in mid-August, at $r \simeq 1.2$ AU, but only as r^{-1} in late August, at $r \simeq 1$ AU. A plateau was reached between 0.9 and 1 AU, followed by the comet's accelerated fading at < 0.9 AU and by its disappearance at perihelion.

The timing coincidence between the cessation of the comet's steep brightening on approximately August 10 and the termination of the principal dust-emission activity in mid-August, as established in Sec. 2.3, is likely to be physically significant. It could mean that by about this time the comet's sublimation (of water ice and other volatiles) and associated production of dust was essentially brought to an end, and that, *from mid-August on, any lingering "activity" of comet C/2002 O4 was supported by, or related to, its nucleus erosion*, as proposed in Sec. 3.1.

To examine this possible scenario in some detail, I made an attempt to fit the third stage of the light-curve evolution by an erosion model that I recently developed (Sekanina 2002) for an in-depth investigation of the light curves of the sungrazing comets discovered with two coronagraphs onboard the *Solar and Heliospheric Observatory* (SOHO). I propose that the process of nucleus erosion for comet C/2002 O4 was dominated by runaway bulk fragmentation, which started at a particular time and proceeded continuously at a rate that is assumed to follow the same type of law as sublimation. The most critical parameter of the model is an effective latent energy of erosion, which is analogous to the latent heat of sublimation.

The result of the fitting procedure is shown as **EROSION CURVE** in Fig. 2. The curve matches the observations extremely well, strengthening the notion that this portion of the light curve signals the comet's complete disintegration rather than temporary dormancy. Interestingly, the results indicate that the erosion energy of the nucleus was only ~ 10000 cal/mole and that therefore *it was in fact easier to erode the nucleus of comet C/2002 O4 than to sublimate water ice from its surface*, which requires 11500 cal/mole at a temperature of 200°K. The model also provides information on the rate of nucleus contraction due to erosion as a function of time. The comet's brightness is found to have peaked 27 days before perihelion, on September 5, at a heliocentric distance of 0.93 AU, at which time the nucleus size was 0.78 its "initial" size, in mid-August. The nucleus dimensions are calculated to have decreased to 0.90 of the initial dimensions at 40 days before perihelion (August 23), to 0.63 at 20 days before perihelion (September 12), to 0.44 at 10 days before perihelion, and to 0.22 the initial size at 1 day before perihelion (October 1.0 ET). The nucleus is calculated to have disintegrated into a cloud of boulders and dust within a few days after perihelion.

4. The Orbit

As the interval of comet C/2002 O4's observations was growing longer, the knowledge of its orbit was gradually improving. First, a parabolic approximation was used and the planetary perturbations were ignored. Starting with early September, however, four sets of osculating orbits, fully accounting for the effects of the planets, were successively published by Marsden (2002a, b). With no nongravitational terms incorporated into the equations of motion, the original orbit[9] came out to be hyperbolic, the reciprocal semimajor axis always amounting to $(1/a)_{\rm orig} < -0.0004$ AU^{-1}.

The incorrectness of a simple-minded interpretation of this result in terms of an interstellar origin of comet C/2002 O4 is underscored by a prominent systematic trend in the values of the original semimajor axis. Evidence is provided by Marsden's four sets of orbital elements, which link all accurate astrometric positions starting with the first reported observation on July 27.65 UT and ending with the observations made, respectively, on September 2.90, 10.83, 13.90, and 23.44 UT. The intervals of heliocentric distances corresponding to these time spans are listed in the third column of Table 3. As the quality of the orbital elements gradually improved, one would expect $(1/a)_{\rm orig}$ to converge to some limit. Instead, the fourth column of the table shows that it became ever more negative with time, implying a systematically increasing hyperbolic excess. The obvious question is why was it so?

4.1. Nongravitational Perturbations

It is shown below that a systematic trend of this kind is exactly what one should expect if the comet is subjected to nongravitational forces. If the orbital arc is short enough, as it is in the case of comet C/2002 O4 — less than two months — a formal gravitational solution does not necessarily leave systematic residuals from the observed orbital track. Instead, the nongravitational forces distort the orbital elements in order to accommodate the forced value of the fundamental quantity employed — the Gaussian gravitational constant $k_\odot$ for the sun. Indeed, the nongravitational forces that cometary nuclei are subjected to have a strong tendency to act in a direction opposite that of the sun's

[9]The original orbit of a comet is determined from its osculating orbit by integrating the object's motion from the epoch of osculation back in time to a sufficiently large heliocentric distance (usually ~ 50 AU or so) and referring it to the barycenter of the solar system rather than to the sun.

gravitational force. The motions of active comets that do not disintegrate on short time scales are usually affected by small but detectable retrorocket-like forces due to sublimation of volatile substances predominantly from the sunward side of their nucleus surface. In the case of comet C/2002 O4, one suspects that a significant fraction of the nongravitational force comes from solar radiation pressure, once the bulk of the comet's mass is distributed in sufficiently small fragments. Regardless of the ratio of the relative contributions from the two sources, the object orbits the sun in a gravity field that is slightly weaker than the sun's and whose effective Gaussian gravitational constant $k_{\rm eff}$ is very slightly smaller than $k_\odot$, while the orbital elements are derived with $k_\odot$.

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TABLE 3

LEAST-SQUARES FIT TO ORIGINAL RECIPROCAL SEMIMAJOR AXIS OF COMET C/2002 O4 FROM MARSDEN'S ORBITAL RUNS.

Orbital run							
Run No.	Dates covered by astrometry, 2002 (UT)	Range of distances from Sun, r (AU)	Original reciprocal semimajor axis, $(1/a)_{\rm orig}$ (AU^{-1})	Average true anomaly, $v_{\rm aver}$	No. obs. used	Residual $o-c$ for $(1/a)_{\rm orig}$ from weighted solution (AU^{-1})
1	July 27.65–Sept. 2.90	1.434–0.955	-0.000520 ± 0.000096	$-69°.27$	946	$+0.000053$
2	July 27.65–Sept. 10.83	1.434–0.877	-0.000694 ± 0.000054	-64.76	984	-0.000029
3	July 27.65–Sept. 13.90	1.434–0.852	-0.000717 ± 0.000031	-63.07	1088	-0.000018
4	July 27.65–Sept. 23.44	1.434–0.794	-0.000772 ± 0.000021	-58.72	1135	$+0.000011$

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It is easy to find out the effect of this slight discrepancy on the orbit. Consider a comet moving about the sun in an elliptical orbit with a period P, unperturbed by the planets. This orbital period is related to the semimajor axis a by the third Keplerian law. From the condition of P = constant, a differentiation of the expression provides the following relationship between the slight changes in k and $1/a$ (dropping, from now on, the subscript):

$$d\left(\frac{1}{a}\right) = -\frac{2}{3}\left(\frac{1}{a}\right)\cdot\frac{dk}{k_\odot}. \tag{6}$$

This equation shows that when a gravitational constant ($k_\odot$) *greater* than the correct one ($k_{\rm eff}$) is employed in an orbital solution, the reciprocal semi-major axis resulting from such a solution is *smaller* (*more negative*) than is the correct $1/a$ value.

One can now make two conclusions: (i) the finding that the original orbit of comet C/2002 O4 derived with the use of $k_\odot$ was hyperbolic does not exclude the possibility that its true orbit was elliptical; and (ii) formula (6) makes it possible to investigate the magnitude of $k_{\rm eff}$ in terms of variations in $1/a$. The second conclusion is important not only because the changes in $1/a$ are readily available, but also because of the need to find out how these variations propagate along the orbit, an issue that is not addressed by Eq. (6).

4.2. Variations in Semimajor Axis Along the Orbit

It is well known that, for any k, a radial (nongravitational) acceleration $j_{\rm R}(t)$ (reckoned positive in the antisolar direction), to which the nucleus of a comet is subjected at time t, causes the following instantaneous change in the reciprocal semimajor axis:

$$d\left(\frac{1}{a}\right) = -\frac{2e}{k\sqrt{p}}j_{\rm R}(t)\sin v(t)dt, \tag{7}$$

where e is the orbit eccentricity, $p = q(1+e)$ the parameter of the orbit, q the perihelion distance, and $v(t)$ the true anomaly at time t. Because the issue of the sign of $d(1/a)$ has already been settled, only the absolute value of the effect is of interest from now on. After substituting dv for dt from the second Keplerian law, one finds:

$$\left|d\left(\frac{1}{a}\right)\right| = \frac{2e}{k^2p}j_{\rm R}(r)r^2|\sin v|dv. \tag{8}$$

An acceleration due to the nongravitational force driven by water-ice sublimation varies approximately as r^{-2} near the sun, but more steeply at heliocentric distances beyond ~ 2 AU. An acceleration due to sublimation of more volatile substances (e.g., CO_2, CO, etc.) varies as r^{-2} to much larger distances, while solar radiation pressure varies as r^{-2} at all distances from the sun. Since the comet was discovered only 1.5 AU from the sun, an approximation of variations in the effective nongravitational acceleration $j_{\rm R}$ in Eq. (8) by this law is entirely appropriate. I thus adopt

$$j_{\rm R}(r) = j_0(r_0/r)^2, \tag{9}$$

where $r_0 = 1$ AU and j_0 is the nongravitational acceleration at 1 AU, the quantity of major interest in this study. When (9) is inserted for $j_{\rm R}(r)$ in (8), the equation can immediately be integrated. Further, replacing v with $\frac{1}{2}v$, the integration of equation (8) up to an arbitrary location in the preperihelion branch of the orbit, reached by the comet at time $t = t(v)$, yields

$$\frac{1}{a} = f_0 - g_0 \cos^2 \frac{1}{2}v, \tag{10}$$

where f_0 is an integration constant (nominally, $1/a$ extrapolated to the previous aphelion), and

$$g_0 = \frac{4er_0^2}{k^2p} j_0. \tag{11}$$

Expression (10) is, of course, the equation of a straight line on a plot of $1/a$ versus $\cos^2 \frac{1}{2}v$, with g_0 being the slope.

4.3. Results from the Orbital Calculations

Each value of the original semimajor axis derived by Marsden (2002a, b) is, just as all the other elements, a function of the distribution of the employed astrometric observations along the given orbital arc, from the first measured position, at time $t_{\rm beg}$, to the last position, at $t_{\rm end}$, used in the orbital solution (Table 3). Let the true anomalies at these boundaries be, respectively, $v_{\rm beg}$ and $v_{\rm end}$, and let the observations be distributed more or less uniformly between $t_{\rm beg}$ and $t_{\rm end}$. Then the value of $1/a$ should, according to equation (10), refer to a point very near the middle of the corresponding interval. Thus, the term $\cos^2 \frac{1}{2}v$ on the right-hand side of (10) can closely be approximated by an average value in the relevant orbital arc,

$$\langle \cos^2 \frac{1}{2}v \rangle = \frac{1}{2}\left(\cos^2 \frac{1}{2}v_{\rm beg} + \cos^2 \frac{1}{2}v_{\rm end}\right). \tag{12}$$

The average true anomaly $v_{\rm aver}$, defined as

$$v_{\rm aver} = 2 \arccos \sqrt{\langle \cos^2 \frac{1}{2}v \rangle}, \tag{13}$$

and listed in the fifth column of Table 3, completes the information needed to find the parameters f_0 and g_0 from Eq. (10). Although the number of used astrometric observations increased by only 20 percent from the first to the last run (column 6), the formal error of the semimajor axis, depending critically on the length of the orbital arc, decreased by a factor of 4.6. For this reason, I employed a *weighted* least-squares solution to find

$$f_0 = +0.00115 \pm 0.00022 {\rm AU}^{-1} \tag{14a}$$

$$g_0 = +0.00254 \pm 0.00030 {\rm AU}^{-1}. \tag{14b}$$

The residuals $o - c$, observed minus calculated, are listed in the last column of Table 3, confirming that the solution is very satisfactory, because no residual exceeds 0.6 the formal mean error in the values of the original reciprocal semimajor axis.

With $k \simeq k_\odot = 0.0172021$ AU$^{\frac{3}{2}}$/day and the elements $p \simeq 1.5531$ AU and $e \simeq 1.00086$ from the most updated orbit by Marsden (2002b), one finds from Eq. (11)

$$j_0 = (2.92 \pm 0.34) \times 10^{-7} {\rm AU/day}^2 = (5.84 \pm 0.69) \times 10^{-4} {\rm cm/s}^2. \tag{15}$$

The resulting value of j_0 indicates the presence of a major effect. Compared with other comets in the orbit catalogue by Marsden and Williams (2001), *comet C/2002 O4 belongs to the objects whose motions deviate from the gravitational law most significantly*, even though quantitative comparison is difficult because for all extensively observed comets in the catalogue, whose nongravitational parameters could be derived, both the radial and transverse components were calculated. My result is equivalent to a radial nongravitational parameter of $A_1 \simeq 29 \pm 3$ units in a scenario in which $A_2 \equiv 0$ and $A_3 \equiv 0$.

The finding of this dynamical effect settles the crucial issue of *what happened to comet C/2002 O4: it truly disintegrated into a cloud of minor fragments and dust*, apparently much like comet C/1999 S4 (LINEAR) and other similar objects. Indeed, *if comet C/2002 O4 remained intact and became dormant, its orbital motion would have been (almost) purely gravitational.*

Interpreted as a combined effect of solar radiation pressure and a sublimation-driven nongravitational force, the acceleration j_0 obviously sets an upper limit on either source. Since the solar gravitational acceleration at 1 AU from the sun is 0.593 cm/s^2, the radiation pressure effect is less than 0.0010 ± 0.0001 units the solar attraction. This constraint is equivalent to a *lower* limit on dust-particle diameters of 0.23 cm for an assumed bulk density of 0.5 g/cm^3 and 0.58 cm for 0.2 g/cm^3. This minimum size is greater than the size of the smallest particles in the tail derived in Sec. 2.2 by only a factor of ~ 2.

One can now set some constraints on the true original orbit of the comet. Unfortunately, its size cannot be determined with very high accuracy, because the initiation time for the major nongravitational forces is unknown. However, since the comet was active at discovery, one can safely conclude that the nongravitational perturbations of its orbital motion had started before July 22. If one accepts, rather conservatively, that the activity began as early as $\sim$ 90 days before perihelion (in early July; see Sec. 2.3), then $v \simeq -97°$ and $(1/a)_{\rm orig} = +0.00003 \pm 0.00025$ (AU)$^{-1}$, showing that the original orbit could have been with a nearly equal probability an ellipse or a hyperbola. The rather uncertain estimate for the time of the earliest activity (late May; see Table 2) requires a true anomaly of about $-109°$ and implies that an elliptical original orbit would then be fairly likely, with a reciprocal semimajor axis of $+0.00029 \pm 0.00024$ AU^{-1} and a probable orbital period of some 200,000 years. However, this result is very uncertain, not only because of the doubts about the timing of the activity initiation, but also because the orbit was affected by an unknown transverse component of the sublimation-driven nongravitational perturbations.

5. A Model for the Outburst

Outbursts, or flare-ups, of comets are rather common, but upon the termination of such an episode the affected object usually returns gradually to its original appearance. Thus, as a rule, the light curve of an outburst is characterized by a short rise time followed by a long time of decline. These brightness variations are accompanied by simultaneous morphological changes of the coma. Such a behavior is, for example, repeatedly displayed by comet 29P/Schwassmann-Wachmann and many others. As already mentioned in Sec. 3.2, an excellent example of recurring outbursts was recently presented by comet C/2001 A2 (Sekanina *et al.* 2002). One of the implications of outbursts, seldom mentioned in the literature, was pointed out long ago by Richter (1948), who concluded that a high proportion of unconfirmed comet discoveries (fairly common in the days of slow communication) may refer to very faint objects accidentally caught in outburst and promptly lost as their brightness subsides to normal level.

It should be emphasized that comet C/2002 O4's outburst was fundamentally different. Its rise time was relatively long, more than 10 days in duration, and there was no decline to follow. Thus, the process of sudden activation involved not just a local, isolated source of volatile ices on the nucleus, but it apparently embraced a major reservoir extending over a significant fraction of the surface, since between July 31 and August 9 the comet continued to brighten rapidly, even though at a rate that was not as high as before (Fig. 2). It seems that a comet can keep a minor or moderate outburst under control, but not one of catastrophic proportions in relation to the size of its nucleus. A large comet, such as 29P/Schwassmann-Wachmann, can survive intact more powerful outbursts than can a small comet like C/2002 O4.

During this critical period of time, comet C/2002 O4 was observed in the thermal infrared by Sitko *et al.* (2002) on August 1.54 UT. Their results indicate the presence of submicron-sized grains, with the superheat[10] amounting to 1.15 $\pm$ 0.08 and a silicate feature[11] peaking $\sim$ 20 percent above the continuum. The reported magnitude in the narrow $[M]$ passband (centered at a wavelength of 4.8 microns) suggests a fairly small total cross-sectional area of the dust, only $\sim$ 30 km^2, although this may in part be an unknown aperture effect. In any case, at about the same time, on July 31.0 UT, the total visual brightness (Sec. 3.2), if due entirely to dust scattering of solar light, implies a cross-sectional area of $\sim$ 9000 km^2, assuming a geometric albedo of 0.04. For a particle density of 0.5 g/cm^3 and a relatively flat particle-size-distribution power law with a slope of -2.8, the mass M_d of the comet's dust cloud corresponding to the cross-sectional area on July 31 is estimated at

$$M_d = 1 \times 10^{13} a_{\rm max} \ \ \text{grams}, \tag{16}$$

where $a_{\rm max}$ (in cm) is the radius of the largest dust particle (or fragment). Even with a conservatively low estimate of $a_{\rm max} \simeq 1$ cm, the derived mass of the ejecta is equivalent to that of a sphere more than 0.4 km in diameter!

The dust-production rate depends critically on the lifetime of the grains in the coma. However, since the dominating large particles are always ejected from cometary nuclei with low velocities, on the order of tens of meters per second at the most, and since the coma of comet C/2002 O4 was at the beginning of August estimated at $\sim$ 5 arcmin, or $\sim$ 200,000 km in diameter, it is not difficult to show that the lifetime of large particles could easily extend over several weeks in the least. Thus, it is conceivable that virtually all the dust ejected since the beginning of the outburst was accumulating in the coma in late July and early August.

A simple model, formulated on this premise, allows one to describe the outburst in greater detail. The event's inception is assumed to have occurred at time $t_{\rm beg}$ and its termination at $t_{\rm end}$. The temporal profile of the dust-production rate $\dot{M}_d(t)$ is postulated to be symmetrical and parabolic in shape, reaching a peak value of $\dot{M}_{\rm peak}$ at time $t_{\rm peak} = \frac{1}{2}(t_{\rm beg} + t_{\rm end})$, that is,

$$\dot{M}_d(t) = 4\dot{M}_{\rm peak} \frac{(t - t_{\rm beg})(t_{\rm end} - t)}{(t_{\rm end} - t_{\rm beg})^2}, \tag{17}$$

where $t_{\rm beg} < t < t_{\rm end}$. It is assumed that $\dot{M}_d = 0$ at $t \le t_{\rm beg}$ and $t \ge t_{\rm end}$, even though this generally is not so. The

[10] Superheat, brought about by a low infrared emissivity of submicron-sized dust particles, is defined as a ratio of the particle temperature to the blackbody temperature at the same heliocentric distance, $T_{\rm dust}(r)/T_{\rm BB}(r) > 1$.

[11] A silicate feature, near a wavelength of 10 microns (in the thermal infrared) is an excess emission due to submicron-sized silicate grains that extends above the thermal continuum curve.

model is depicted schematically in Fig. 3. The amount of mass accumulated in the coma by time t is equal to

$$M_d(t) = \int_{t_{\rm beg}}^{t} \dot{M}_d(t)dt = 2\dot{M}_{\rm peak} \frac{(t - t_{\rm beg})^2}{t_{\rm end} - t_{\rm beg}} \left[1 - \frac{2}{3}\frac{t - t_{\rm beg}}{t_{\rm end} - t_{\rm beg}}\right]. \tag{18}$$

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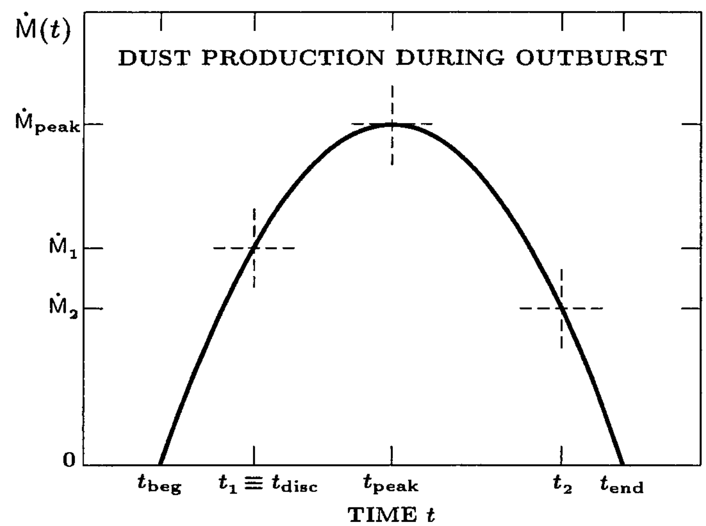

Figure 3. A model scenario for the outburst of comet C/2002 O4. The event commenced at time $t_{\rm beg}$ and terminated at $t_{\rm end}$. At $t_{\rm peak}$, halfway between $t_{\rm beg}$ and $t_{\rm end}$, the dust production rate attained its peak, $\dot{M}_{\rm peak}$. The production rates $\dot{M}_1$ and $\dot{M}_2$, reached, respectively, at time t_1 (equal to the time of discovery, $t_{\rm disc}$) and at time t_2, are used to constrain the model by stipulating that the ratio of the dust mass accumulated in the ejecta from $t_{\rm beg}$ to t_1 to the mass accumulated from $t_{\rm beg}$ to t_2 be consistent with the observed rate of brightness increase between t_1 and t_2. The dust mass variations are normalized by requiring the cross-sectional area of the dust accumulated in the coma to fit the comet's total visual brightness for chosen values of the dust albedo and bulk density and for an assumed law of the particle-size distribution.

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The total mass of dust, $M_{\rm total}$, ejected during the outburst, is of course equal to $M_d(t_{\rm end})$, or

$$M_{\rm total} = \frac{2}{3}\dot{M}_{\rm peak}(t_{\rm end} - t_{\rm beg}). \tag{19}$$

Since the average dust-production rate during the outburst is $\dot{M}_{\rm aver} = M_{\rm total}/(t_{\rm end} - t_{\rm beg})$, one finds at once from equation (19) that $\dot{M}_{\rm aver} = \frac{2}{3}\dot{M}_{\rm peak}$.

To constrain the outburst scenario, I stipulated its compliance with my finding in Sec. 3.2 that the comet's brightness, normalized to 1 AU from the earth, varied as r^{-30} between heliocentric distances $r_1 = r(t_1)$ and $r_2 = r(t_2)$ ($t_1 < t_2$). Identifying t_1 with July 22.0 (the time of discovery, $t_{\rm disc}$) and t_2 with July 31.0 UT, assuming that the particle-size-distribution law did not change with time, and accounting for an inverse-square-power-law effect of heliocentric distance on the brightness, one can write the mass ratio of the dust contained in the coma at the two times:

$$\mu_{12} = \frac{M_d(t_1)}{M_d(t_2)} = \left(\frac{r_1}{r_2}\right)^{-28} \simeq 0.091. \tag{20}$$

Comparing (18) with (20), the stipulated condition requires that

$$\mu_{12} = \left(\frac{t_1 - t_{\rm beg}}{t_2 - t_{\rm beg}}\right)^2 \frac{2t_1 + t_{\rm beg} - 3t_{\rm end}}{2t_2 + t_{\rm beg} - 3t_{\rm end}}, \tag{21}$$

from where one can establish the relationship between $t_{\rm beg}$ and $t_{\rm end}$ in terms of t_1, t_2, and μ_{12}. It is apparent that condition (21) leads to a cubic equation in $X \equiv t_{\rm end} - t_{\rm beg} > 0$ as follows:

$$X^3 - \frac{3}{1-\mu_{12}}\left[(t_{\rm end} - t_1)^2 - \mu_{12}(t_{\rm end} - t_2)^2\right]X + \frac{2}{1-\mu_{12}}\left[(t_{\rm end} - t_1)^3 - \mu_{12}(t_{\rm end} - t_2)^3\right] = 0. \tag{22}$$

The outburst could not terminate before time t_2 (July 31), because the comet's continuing steep brightening could not then be explained. However, the outburst may have been subsiding and eventually terminating after time t_2, as depicted in Fig. 3. However, a continuation of the outburst after mid-August is ruled out by the second sudden change in the light-curve slope near August 10.

Accordingly, the cubic equation was solved for outburst-termination times $t_{\rm end}$ between July 31 and August 16. For these $t_{\rm end}$ values, Eq. (22) has three real roots, only one of which is meaningful. The results, listed in Table 4, allow one to make the following conclusions: (i) the time of outburst inception is found to be fairly insensitive to the choice of the termination time; (ii) the comet appears to have been discovered some 2–3 days after the outburst had begun; (iii) the peak rate of dust production, although likewise fairly insensitive to the choice of solution, exhibits a broad minimum of 1.3×10^7 g/s for a termination date of August 5; (iv) the total mass of dust ejected during the event is found to have been $\sim$ 1–2 $\times 10^{13}$ g; and (v) the outburst apparently extended over a period of at least 11 days and possibly as long as 4 weeks, even though I prefer the solutions with the duration not exceeding $\sim$ 3 weeks.

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TABLE 4

MODEL SCENARIOS FOR THE OUTBURST OF COMET C/2002 O4.

Outburst termination		Outburst	Outburst inception		Peak rate	Distance	Total mass
Date 2002 (UT)	Days after discovery	duration (days)	Date 2002 (UT)	Days before discovery	of dust production (10^7 g/s)	from Sun at production peak (AU)	of dust lost in outburst (10^{13} g)
July 31.0	9.0	11.1	July 19.9	2.1	1.6	1.46	1.0
Aug. 2.0	11.0	13.4	19.6	2.4	1.4	1.45	1.1
4.0	13.0	15.6	19.4	2.6	1.3	1.44	1.2
6.0	15.0	17.8	19.2	2.8	1.3	1.43	1.4
8.0	17.0	19.9	19.1	2.9	1.3	1.42	1.6
10.0	19.0	22.0	19.0	3.0	1.4	1.40	1.8
12.0	21.0	24.1	18.9	3.1	1.4	1.39	2.0
14.0	23.0	26.2	18.8	3.2	1.5	1.38	2.2
16.0	25.0	28.2	18.8	3.2	1.5	1.36	2.5

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The peak dust-production rate on the order of 10^7 g/s is enormous and quite unexpected at a heliocentric distance near 1.4 AU. For example, the dust-production rate of Halley's comet reached $\sim 4 \times 10^7$ g/s at perihelion ($q = 0.59$ AU) according to Fulle *et al.* (1988). Their best-fit power law suggests that the production rate was only 1.5×10^6 g/s at 1.4 AU from the sun, just about a factor of 10 less than the result for comet C/2002 O4 in Table 4. From the extensive water-production-rate results by Schleicher *et al.* (1998), it appears that near perihelion the dust-to-water production-rate ratio of 1P/Halley was 1.5 on the average.

On the other hand, the production rate of solids from comet C/1995 O1 (Hale-Bopp) reached, for an assumed albedo of 0.04, 2×10^7 g/s already at a heliocentric distance of 4 AU (Fulle *et al.* 1998a), but, at the very low temperatures involved, much of this mass was apparently contained in water-ice grains. Indeed, Biver *et al.* (1999) found that, at 4 AU, the production rate was 1.5×10^6 g/s for water and 4×10^6 g/s for carbon monoxide, even though the H_2O-to-CO mass-outgassing-rate ratio was about 3 at perihelion (0.91 AU).

These and similar results for other comets indicate that, under normal circumstances (when outgassing proceeds from only a very small fraction of the nucleus surface), one needs a very sizable nucleus (more than $\sim$ 10 km in diameter) to understand the dust-production rate listed in Table 4 for comet C/2002 O4. Indications are that this comet was *not* large. There are two categories of arguments to explain this apparent discrepancy.

Arguments of the first category point to problems with the assumptions. For example, it could be that much of comet C/2002 O4's light near 1.4 AU was radiated in the bands of molecular carbon rather than by scattering on dust; or the dust-particle-size-distribution function could be much steeper than assumed in equation (16), in which case the same observed cross-sectional area should correspond to a much smaller total mass of dust involved. Since no narrowband photometry of comet C/2002 O4 is available and its dust-size distribution function is unknown (ignoring the weak constraint based on the infrared observation of Sitko *et al.*), such arguments can be neither dismissed nor confirmed.

Is there, however, a plausible explanation even if the inferred mass of dust in the coma of comet C/2002 O4 is approximately correct? A critical issue is to find an adequate energy source. One favorable trait of the problem is that the mass of dust ejected during a major outburst like this may be considerably greater than is the mass of the volatiles that provide the energy needed. In other words, the dust-to-gas mass-production-rate ratio may be very high, perhaps as high as 10 or more, with the required mass-outgassing rate being merely $\sim 10^6$ g/s. Numerical evaluation of such a scenario is illuminating. At 1.4 AU from the sun, a water-sublimation rate per unit surface area is about 23 μg/cm^2/s at the subsolar point of the nucleus and, on the average, about 10 μg/cm^2/s over its sunlit hemisphere. The needed outgassing area is therefore estimated at $\sim$ 10 km^2 and the required effective diameter of the nucleus is $\sim$ 2.5 km, almost certainly much too large.

What are the numbers in the case of sublimation of carbon monoxide, which is substantially more volatile than water ice? A subsolar sublimation rate at 1.4 AU is now 300 $\mu g/cm^2/s$, and an average sublimation rate over the sunlit hemisphere is almost exactly one half this rate. Thus, the needed sublimation area on the sunlit hemisphere is $\sim$ 0.7 km^2, and the effective nucleus diameter is barely 0.7 km, a more plausible size. With the density used in equation (16), this comet would have initially had a mass of 8×10^{13} g, which means that up to three-tenths of its mass were expended in the outburst!

The picture that emerges from this scenario (not necessarily the only one) is that *the massive outburst of comet C/2002 O4 can be explained if the entire nucleus is assumed to have been engulfed in an explosion caused by a suddenly exposed reservoir of highly unstable ices*, typified by carbon monoxide. One can only speculate on the details of the process (such as a blowoff of an inert surface mantle, a rapid formation of an extensive network of surface fissures, etc.), but its global grip on the nucleus is clearly critical for a successful interpretation.

6. Summary and Conclusions

By examining the tail morphology and orientation of comet C/2002 O4, its light curve, and its anomalous orbital motion, and by modeling its major outburst, I was able to describe the apparent sequence of events experienced by the object and to address the issue of its disappearance.

The proposed scenario, which of course is only one of many, envisages that the comet was discovered while in a major, persevering outburst. This episode has been detected in both the light curve and the tail orientation data. Weak activity may have been going on for quite some time before the outburst inception, perhaps since the beginning of July or even earlier. The outburst was set off most probably during July 19, 2–3 days before discovery, and lasted until at least the end of July and perhaps as long as mid-August. The production of dust during the outburst reached very high rates (peaking at more than 10 tons/s) and the total mass of dust expended in the course of the event is estimated at some 10 to 20 million tons. The energy-balance considerations require that the entire subkilometer-sized nucleus be engulfed in an explosion triggered by highly volatile ices, such as carbon monoxide, from a major reservoir.

The developments that followed the outburst appear to be its product. By mid-August, the comet must have lost a significant fraction (up to $\sim$ 30 percent) of its initial mass and the remaining nucleus was so badly shaken by the explosion that it failed to stay in one piece. The extent of structural damage the comet suffered from stresses it had been exposed to during the outburst was simply too large. As a result, a process of nearly spontaneous, runaway bulk fragmentation set in, as illustrated by the very low latent energy of nucleus erosion — lower than the sublimation heat of water ice. The anomalous orbital motion of comet C/2002 O4 and subsequently the rapid fading and eventual disappearance of its nucleus condensation and the entire head in the immediate proximity of perihelion, in late September and at the very beginning of October, were all signaling the object's true and complete disintegration.

Because of the limited amount of observational information available, it is difficult to offer a more comprehensive account of the evolution of comet C/2002 O4. Still, the presented scenario illustrates the peculiar behavior of comets. Unlike asteroids, which in order to fragment need to collide with another object whose kinetic energy at impact exceeds the target's inherent structural strength, cometary nuclei, known to be very poorly cemented objects, have a tendency — some more, others less so — to succumb to effects of their own activity, which may appear to be relatively benign by noncometary standards.

Although fragmentation has long been known to affect comets occasionally, its impact on their nuclei has been greatly underrated. Probably the main reason for this bias is observational. The process of *runaway* fragmentation of comets also appears to be much more common than previously thought; it may in fact compete with deactivation in terminating the life of an active comet. Unlike dormancy, disintegration is of course irreversible. And even though the propensity for crumbling varies from comet to comet, continual cascading fragmentation is likely to play a major role in the life cycle of most (if not all) comets. Comet C/2002 O4 (Hönig) has just provided us with a glimpse of what cometary disintegration is all about.

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Φ Φ Φ

Yuji Hyakutake (1950-2002)

Yuji Hyakutake, the well-known Japanese amateur astronomer, died on 2002 Apr. 10 at a hospital in Kokubu City, Kagoshima prefecture, due to internal bleeding caused by a heart aneurysm.

Born in the city of Shimabara (Nagasaki prefecture), Hyakutake first became interested in astronomy when he saw the great sungrazing comet C/1965 S1 (Ikeya-Seki). After graduating from the Faculty of Fine Arts at Kyushu Sangyo University, he was employed as a platemaker at the Fukunichi Newspaper in the city of Fukuoka. His search for new comets began in earnest in 1989, when he built an observatory in his backyard. However, the surrounding skies suffered from severe light pollution, and his first few years were fruitless.

In 1993, Hyakutake moved to the town of Hayato in Kagoshima prefecture, where his wife Shoko had been born. The dark sky there encouraged him to become an even-more-devoted comet hunter and led to his initial discovery, C/1995 Y1 (Hyakutake). Surprisingly, he discovered his second comet C/1996 B2 (Hyakutake) only one month later and only three degrees from his first discovery position. C/1996 B2 came close to the earth ($\Delta = 0.1$ AU on Mar. 26) and became one of the greatest comets of the 20th century. As a result, Hyakutake's notoriety soared amongst the public and his peers. He was invited by the Adler Planetarium and Astronomy Museum and by the Perth Observatory to present talks at public lectures. He received an Honorary Citizen Award from the City of Chicago and the first Kagoshima Prefectural Honor Award. In September 1996, Hyakutake took office as the director at the public observatory known as "Star Land Aira", and he made significant contributions to the popularization of astronomy in Kagoshima until his death.

In spite of his international acclaim, Hyakutake's modesty remained intact, well reflected in the words he proclaimed: "The leading role is [played by] the comet. The discoverer should [only] be a scene-shifter", and "It should not be me that is congratulated, but the comet."

His family name "Hyaku Take" means "a hundred samurai" and was given to his ancestor by a Lord. It represented his work ethic, which was said to resemble that of "a hundred samurai". Considering his passion for comet searching and keen eyes, a new Hyakutake comet was widely anticipated, yet never come to fruition. He will be sadly missed, and the astronomy community would have to concur that we have lost a great comet hunter, whose efforts were also equivalent to that of "a hundred samurai". — *Akimasa Nakamura (Kuma, Ehime, Japan)*

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COMETS FOR THE VISUAL OBSERVER IN 2003

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Two long-period comets discovered at large heliocentric distances, both with the potential of becoming prominent naked-eye objects when near perihelion in 2004, should be well-observed during their respective inbound approaches in 2003, which should in turn permit reasonably accurate projections for their peak brightnesses to be computed by the end of the year. Together with these two objects, two additional long-period comets, and one short-period comet — all of which have the potential of coming close to, or achieving, faint naked-eye visibility — constitute the expected primary cometary observing highlights of 2003. Several fainter long-period and short-period comets should also be visually detectable during the year.

Perihelion information (utilizing the most recently computed orbits at the time of this writing, in late Nov. 2002) for the comets discussed below is given in Table 1, in chronological order of perihelion passage. Ephemerides are available in the *ICQ*'s *2003 Comet Handbook*.

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TABLE 1.
PERIHELION INFORMATION FOR POTENTIALLY VISUAL COMETS IN 2003

Designation	Name	T (TT)	q (AU)
C/2001 K5	LINEAR	2002 Oct. 11.76	5.184
155P	Shoemaker	2002 Dec. 14.88	1.814
30P	Reinmuth	2002 Dec. 24.39	1.878
C/2002 U2	LINEAR	2002 Dec. 31.98	1.209
C/2001 RX_{14}	LINEAR	2003 Jan. 18.70	2.058
116P	Wild	2003 Jan. 21.59	2.170
C/2002 V1	NEAT	2003 Feb. 18.30	0.099
154P	Brewington	2003 Feb. 19.37	1.590
65P	Gunn	2003 May 11.86	2.446
2002 CE_{10}	—	2003 June 22.07	2.047
C/2001 HT_{50}	LINEAR-NEAT	2003 July 9.05	2.792
C/2002 O7	LINEAR	2003 Sept. 22.87	0.905
81P	Wild	2003 Sept. 25.94	1.590
C/2002 J4	NEAT	2003 Oct. 3.19	3.633
53P	Van Biesbroeck	2003 Oct. 9.43	2.415
2P	Encke	2003 Dec. 29.88	0.338
43P	Wolf-Harrington	2004 Mar. 17.86	1.579
C/2002 T7	LINEAR	2004 Apr. 23.51	0.615
C/2001 Q4	NEAT	2004 May 15.93	0.962
29P	Schwassmann-Wachmann	2004 July 10.83	5.724

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Long-Period Comets

C/2001 Q4 (NEAT)

This comet, discovered as far back as 2001 August 24 at the unusually large heliocentric distance of $r = 10.1$ AU, has remained near $m_1 \sim 16$ (and thus too faint for visual observations) during its viewing season in the latter months of 2002. It was at opposition in late October 2002 and should remain accessible for the first two months of 2003; the relatively high southerly declination ($\delta \sim -40°$) will favor observers in the southern hemisphere. The comet is unlikely to be visually detectable during this time.

Following conjunction with the sun, C/2001 Q4 emerges into the morning sky by May or June, and may possibly be at $m_1 \sim 13$ by mid-year. Visibility will almost be exclusively limited to the southern hemisphere during this period; if the comet is sufficiently bright, it may perhaps be accessible to observers in mid-northern latitudes around August (m_1 perhaps 12, at $\delta = -45°$), but by late September it will be in southern circumpolar skies, reaching $\delta = -79°$ in late November. Brightness predictions are necessarily uncertain at this time, but a cautiously optimisic projection suggests the comet may be near $m_1 \sim$ 8-9 around the end of the year.

Nominal predictions (assuming power-law parameters $H = 2.5$, $n = 4$) suggest that the comet may be as bright as $m_1 \sim$ 0-1 around the time of perihelion in May 2004; however, orbital calculations have shown that C/2001 Q4 is dynamically "new" in the Oort sense, and thus it is quite possible that it may be distinctly fainter than this.

C/2002 T7 (LINEAR)

This comet was discovered on 2002 October 14, at $r = 6.9$ AU, and is travelling in a highly retrograde orbit ($i = 161°$). CCD observations around the time of this writing (late Nov. 2002) indicate a brightness of $m_1 \sim$ 16-17. It is at opposition in mid-December 2002, and should remain accessible in the evening sky until perhaps early April 2003, and while C/2002 T7 might be expected to brighten somewhat by then, it is unlikely to be within the range of visual observations.

After conjunction, the comet emerges into the morning sky around August and is at opposition in mid-November. As is the case with C/2001 Q4, any brightness predictions must be considered quite uncertain, but a brightness near

$m_1 \sim 13$ in August-September, $m_1 \sim 10$ when near opposition, and a brightening of perhaps one additional magnitude by the end of the year may be somewhat realistic. Northern-hemisphere observers will be favored during this viewing season, although the comet should be accessible to observers in both hemispheres.

Similarly to C/2001 Q4, nominal predictions (assuming $H_{10} = 4.2$) suggest a peak brightness for C/2002 T7 of $m_1 \sim$ 0-1 in May 2004, in part because of an approach to the earth ($\Delta = 0.27$ AU, when near inferior conjunction) near the middle of that month. At this writing, it was not conclusive whether or not this comet is dynamically "new" in the Oort sense.

C/2002 V1 (NEAT)

This comet, initially detected by NEAT on 2002 November 6, has the smallest perihelion distance of any ground-observed comet since 1970. At this writing in late November 2002, it is near opposition and has brightened to $m_1 \sim 13$, somewhat brighter than expected based upon the brightnesses reported shortly after discovery. If this trend were to be maintained, the comet would be near $m_1 \sim 11$ at the beginning of 2003, and perhaps at $m_1 \sim$ 8-9 by the end of January.

In early February, the comet's elongation will decrease rapidly, with visibility being limited to observers in the northern hemisphere. The elongation drops below 20° on February 11, the brightness then — if the current trend holds — perhaps being $m_1 \sim$ 5-6. Visibility will very probably cease shortly after that date.

A nominal prediction (assuming $H_{10} = 11.5$), based upon the comet's current brightness, suggests that C/2002 V1 may be as bright as $m_1 \sim 0$ when at perihelion; however, the elongation will only be 6°, which would preclude it from being detected visually. (The comet will, however, be in the field-of-view of the LASCO C3 coronagraph aboard *SOHO* from February 16.5 to 20.2 UT.) Such a small perihelion distance, however, suggests that several scenarios are possible; it is entirely possible that the comet may disintegrate as it approaches perihelion, or will do so shortly thereafter.

If the comet survives perihelion, it will emerge into the evening sky near the beginning of March; visibility will be limited to observers in the southern hemisphere. It will be on the far side of the sun as viewed from the earth, and thus unless it undergoes a significant brightening around perihelion, it will likely be quite faint, and will fade rapidly. The elongation will remain fairly small (reaching a maximum of 37°.5 in early April), and C/2002 V1 is in conjunction with the sun in mid-May. By that time it will almost certainly be too faint for visual observations.

C/2002 O7 (LINEAR)

This comet may become visually detectable ($m_1 \sim 13$) by perhaps March 2003 and will be at opposition in late April ($m_1 \sim$ 11-12); northern-hemisphere observers are favored. Following opposition, the comet travels southward fairly rapidly; northern-hemisphere observers should be able to follow it until perhaps the end of June ($m_1 \sim 10$) and southern-hemisphere observers until perhaps early August ($m_1 \sim 9$). The comet is in conjunction in early September.

After conjunction, C/2002 O7 continues its southward track, and may be as bright as $m_1 \sim 7$. It enters southern circumpolar skies after mid-October, and passes 1° from the south celestial pole on November 5, at which time it is also at its closest approach to Earth ($\Delta = 0.96$ AU). After this, the comet begins traveling north, becoming accessible to northern-hemisphere observers near the beginning of December, perhaps still as bright as $m_1 \sim 9$. By the end of the year, it will probably have faded to $m_1 \sim 11$.

C/2001 RX_{14} (LINEAR)

This comet has been visually observed since August 2002, and at this writing has brightened to $m_1 \sim 11$ and is displaying relatively prominent tail structure. C/2001 RX_{14} is well placed for observations (especially for observers in the northern hemisphere) during the first several months of 2003, reaching a peak brightness of $m_1 \sim 10$ during January-March, and being at opposition in mid-March. Following opposition the comet should fade, but should remain visually detectable until perhaps June or July.

C/2001 HT_{50}

This comet, discovered as long ago as 2001 April 23 (at $r = 7.7$ AU) and traveling in a highly retrograde orbit ($i = 163°$), emerged into the morning sky in October 2002, and at this writing is visually detectable at $m_1 \sim 13$. C/2001 HT_{50} is at opposition in late January 2003 ($m_1 \sim$ 11-12) and should remain accessible until about the end of April. After conjunction in June, it emerges into the morning sky again around August, enroute to a second opposition in early November, at which time it should be approximately a half-magnitude brighter than at the earlier opposition. The comet may still be as bright as $m_1 \sim 12$ at the end of the year.

Other long-period comets

The distant comet C/2001 K5 was widely observed at $m_1 \sim$ 13-13.5 during its 2002 opposition. After conjunction in early December 2002, it has another, slightly more distant opposition at the beginning of July 2003, wherein it should be about a half-magnitude fainter than during the previous year. Visual observations may be possible from January to perhaps August; northern-hemisphere observers are favored, with the comet being near $\delta \sim +55°$ around the time of opposition.

The recent discovery C/2002 U2 has, to this writing, remained an elusive object visually, but may become bright enough to be visually detectable around perihelion (which, as indicated in Table 1, is almost exactly at the end of 2002) at perhaps $m_1 \sim 14$. Unless it exhibits an unusual brightness behavior, however, it will have faded beyond the range of visual observations by the end of January 2003. Any observations will be limited to observers in the northern hemisphere.

The rather distant comet C/2002 J4 is at opposition near the end of June, and may reach $m_1 \sim 14$ during the middle months of the year. Because of a relatively high southerly declination ($\delta \sim -55°$), most observations will probably be limited to southern-hemisphere observers, although observers in the northern hemisphere may possibly be able to detect the comet around May before it heads too far south.

Short-period comets

2P/Encke

This famous comet has an especially favorable return in 2003; for northern-hemisphere observers, at least, it will be one of the most favorable returns on record, and could in fact be considered the most favorable return of the entire 21st century.

The comet should become visually detectable, at $m_1 \sim 13$, around September, and should brighten rapidly over the subsequent two months. When nearest the earth on November 17 ($\Delta = 0.26$ AU) it may be as bright as $m_1 \sim 7$, and will be favorably located at an elongation of 85° in the evening sky. After this, the elongation decreases rapidly, although 2P/Encke should remain accessible through about the first week of December, by which time it may have brightened to $m_1 \sim 6$ and possible naked-eye visibility. After passing through inferior conjunction in mid-December, there is a further possibility of observing P/Encke during the last few days of the year, when it will be at an elongation of 20° in the morning sky, and perhaps as bright at $m_1 \sim$ 5-6.

The *CONTOUR* spacecraft, launched on 2002 July 3, was originally slated to encounter comet 2P on 2003 November 12; however, with the apparent demise of *CONTOUR*, no scientific encounter can take place.

155P/Shoemaker

This comet was successfully recovered in September 2002 and passes perihelion under circumstances almost identical to those of its discovery return in 1985-86. The comet is at opposition in mid-February, and if its brightness behavior is similar to that of the discovery return (assuming $H_{10} = 10.0$), a peak brightness of $m_1 \sim 13$ would be expected in January, with the comet remaining visually detectable for perhaps another month afterwards.

At this writing, 155P/Shoemaker has not been detected visually yet; however, CCD observations suggest it has reached $m_1 \sim 15$, and it will likely be observable by the end of the year.

30P/Reinmuth

The visual brightness record for this comet is quite spotty, and thus any brightness predictions must be considered very uncertain. The 2002-03 return is relatively favorable, however, with opposition taking place in mid-March. It is thus possible that 30P/Reinmuth may reach $m_1 \sim 13$ during the first two or three months of 2003.

116P/Wild

At both of its previously observed returns, this comet reached a peak brightness of $m_1 \sim$ 12-12.5. The 2003 return, in contrast to the previous two, is primarily a post-perihelion return, but if the comet's light curve is symmetric with respect to perihelion, a similar peak brightness can be expected (assuming $H_{10} = 8.5$). Comet 116P/Wild began to emerge into the morning sky in November 2002 and is at opposition in mid-May 2003. It should be visually detectable from the beginning of 2003 until perhaps June or July, with the peak brightness occurring about April.

154P/Brewington

This comet makes its first predicted return in 2003 and was successfully recovered in August 2002. While the comet was as bright as $m_1 \sim 11$ at the time of its discovery in 1992, that discovery did not take place until 2.5 months after perihelion, and the comet in fact faded rather rapidly after its discovery. The 2003 return is almost entirely a pre-perihelion apparition — the comet's elongation being 38° in the evening sky, and decreasing, when at perihelion — and with no previous knowledge of its pre-perihelion light curve, any predictions to its brightness must be considered very tentative. It is conceivable that the observed brightness in 1992 was due to an outburst.

Since its recovery, 154P/Brewington has remained faint, with CCD measurements at the time of this writing still indicating a relatively faint $m_1 \sim 16$. Under the assumption that the comet may begin brightening rapidly as it approaches perihelion, it may be visually detectable at $m_1 \sim$ 12-13 during January 2003, and perhaps a magnitude brighter when at perihelion. It may begin to fade slightly after that, or, perhaps (if the light curve is indeed asymmetric) may even brighten somewhat, but the comet will disappear into the solar glare by about mid-March.

65P/Gunn

The viewing circumstances for this comet in 2003 are relatively favorable, with opposition taking place in early July. Based upon its observed brightness at previous returns (assuming $H_{10} = 7.7$), 65P/Gunn should be observable visually from perhaps February to about September, with a peak brightness of $m_1 \sim$ 12-12.5 during June and July.

53P/Van Biesbroeck

This comet is at opposition during the latter part of May. Comet 53P reached a peak brightness of $m_1 \sim 13$ at the previous return in 1991 which, in contrast to the 2003 return, was primarily a post-perihelion apparition. If the comet's light curve is reasonably symmetric (assuming $H_{10} = 9.0$), a similar peak brightness should be expected in 2003, this perhaps taking place between May and August.

81P/Wild

While it has been well-observed at most of its previous apparitions, this comet's 2003 return is very unfavorable, with conjunction taking place almost simultaneously with perihelion. Comet 81P was at opposition in November 2002 and will be in the evening sky during the first several months of 2003; it may perhaps be visually detectable at $m_1 \sim$ 13-14 between March and May (assuming $H = 6.5$, $n = 5.5$), shortly before entering the solar glare. The comet may be at $m_1 \sim 13$ when it begins to emerge into the morning sky at the very end of the year, enroute to its next opposition in July 2004.

The *Stardust* spacecraft, launched in February 1999, is expected to encounter 81P/Wild on 2004 January 2. As indicated above, at that time the comet will be in the morning sky, at an elongation of 33°, and perhaps bright enough to be detected visually.

43P/Wolf-Harrington

This comet is at opposition in early September 2003, although it will probably be too faint for visual observations then. Visual observations should commence about November or December, when the comet should be near $m_1 \sim 13$ (assuming $H_{10} = 8.7$); it should be slightly brighter during the first few months of 2004.

29P/Schwassmann-Wachmann

This rather enigmatic comet has remained in almost a state of continuous outburst throughout its 2002 viewing season. Comet 29P disappears into the solar glare near the end of 2002 and, following conjunction, emerges into the morning sky around the beginning of April 2003. The comet is at opposition near the beginning of September and subsequently remains accessible in the evening sky until early 2004. If the high level of outburst activity observed in 2002 is maintained in 2003, then 29P will warrant careful monitoring throughout this viewing season.

Other objects

The "minor planet" 2002 CE_{10}, discovered by LINEAR on 2002 February 6, is traveling in a distinctly 1P/Halley-type orbit ($P = 30.8$ years, $e = 0.79$) that, moreover, is highly-inclined and retrograde ($i = 145°$). At this writing, it has recently been recovered in the morning sky and is at opposition during the latter part of December 2002 at the unusually high northerly declination of $\delta = +67°$.

After conjunction in late April 2003, the object re-emerges into the morning sky and is again at opposition (and also closest to the earth, at $\Delta = 1.23$ AU) in early September. Application of a standard inverse-square asteroidal brightness formula indicates that 2002 CE_{10} will reach a peak brightness of $m_v \sim 15.5$ around that time; however, if it should start to exhibit cometary activity, it is conceivable that the object might become a magnitude or two brighter.

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Tabulation of Comet Observations

Contributors of visual comet photometry in the past year should note that many such observations have been withheld from publication because of claimed references for comparison-star magnitudes whose catalogued magnitudes do not go to the fainter brightness of the comet in question; some of these data were contributed by experienced observers and involve Tycho/Hipparcos sources (which do not have star magnitudes fainter than ~ 12 and which have relatively few star magnitudes fainter than mag ~ 11). If you use Tycho/Hipparcos-catalogue sources for comparison-star magnitudes, be sure to send descriptive qualifying information with your tabulated data when using these sources for comets fainter than mag 10-11, explaining the situation; this also applies for any other star catalogue where the comet is fainter than the general limiting magnitude of stars therein.

No new-format CCD data were ready for publication in this issue. Note that numerous observers' data have been withheld because an improper reference was made for photometric software (mostly to `Guide` software).

New additions to the new-format codes ⟹ *CCD cameras:* `Ap7` = Apogee Ap-7 or Ap-7p; `Ap4` = APOGEE AP47p; `BT1` = BITRAN BT-11; `PSI` = Photometrics Star-I; `ST1` = SBIG ST-1001E; `ST2` = SBIG ST-2000XM; `SE7` = SBIG ST-7E; `SE8` = SBIG ST-8E. *CCD camera chips:* `KA0` = KAF-0401 (Kodak); `K10` = KAF-1001E (Kodak); `K6E` = KAF-1602E (Kodak); `KAI` = KAI-2000M (Kodak); `M47` = Marconi 47-10; `SIA` = SIA502AB (SITe) [formerly called TK512 (Tektronics)]; `TH7` = TH7883CDA (Thomson). *Computer software used for photometric reduction of CCD images:* `A41` = Astrometrica 4.1; `IPL` = IPLab; `MIm` = MaxIm DL/CCD `SI3` = StellaImage 3.

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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 7P/Pons-Winnecke* ⟹ 2002 June 5.86: "coma appears large and diffuse with a very low surafce brightness, which made the obs. quite difficult" [PEA]. July 21.75: `GUIDE 7.0` software used for comp.-star mags [TSU02]. Aug.

6.78: GUIDE 8.0 software used for comp.-star mags [TSU02]. Aug. 13.78: "faint, but a definite diffuse patch seen; check of Digitized Sky Survey revealed no diffuse objects at this location" [PEA].

◇ *Comet 22P/Kopff* ⟹ 2002 July 20.46: w/ infrared filter [TSU02]. July 20.46, 21.47, and 31.47: GUIDE 7.0 software used for comp.-star mags [TSU02]. July 31.47: GUIDE 7.0 software used for comp.-star mags [NAK01]. Aug. 5.46 and 13.47: GUIDE 8.0 software used for comp.-star mags [TSU02]. Sept. 1.43, 7.43, and 29.43: zodiacal-light interference [MAT08].

◇ *Comet 28P/Neujmin* ⟹ 2002 July 31.48: GUIDE 7.0 software used for comp.-star mags [NAK01].

◇ *Comet 29P/Schwassmann-Wachmann* ⟹ 2002 June 5.85 and Aug. 12.77: "coma appears of a relatively uniform surface brightness and relatively large, indicating that the outburst has progressed past that initial stage" [PEA]. July 21.65: GUIDE 7.0 software used for comp.-star mags [TSU02]. Aug. 1.57, 6.54, 8.55, 11.59, 13.59, Sept. 23.52, 24.53, and Oct. 10.48: GUIDE 8.0 software used for comp.-star mags [TSU02]. Aug. 5.57: MegaStar Ver.4.0 software used for comp.-star mags [MUR02]. Aug. 5.63: distinct 0'.55 coma surrounded by very faint 3'.8 outer coma [NAK01]. Aug. 7.63: distinct 0'.75 coma surrounded by very faint 3'.7 outer coma [NAK01]. Aug. 7.70, 8.72, and 9.71: GUIDE 7.0 software used for comp.-star mags [MIY01]. Sept. 12.85: ephemeris from MPC Electronic Service; checked w/ Digitized Sky Survey; limiting stellar mag 15.5 [HAS02]. Oct. 3.53 and 5.49: GUIDE 8.0 software used for comp.-star mags [OHS].

◇ *Comet 46P/Wirtanen* ⟹ 2002 Aug. 13.08: rather large, very diffuse object; obs. in twilight at alt. 9° [BOU]. Aug. 15.79, Oct. 10.84, and 14.84: GUIDE 8.0 software used for comp.-star mags [TSU02]. Aug. 17.89: "comet easily seen as a large, slightly condensed object; obs. in a dark sky at ≈ 10° alt." [PEA]. Aug. 20.77, Oct. 1.79, 12.82, and 16.81: GUIDE 6.0 software used for comp.-star mags [NAG08]. Aug. 20.77 and Oct. 5.76: GUIDE 8.0 software used for comp.-star mags [OHS]. Sept. 4.82 and 10.82: GUIDE 8.0 software used for comp.-star mags [YOS02]. Sept. 29.18: w/ 25.6-cm L (169×), central cond. of mag 13.0; small outburst; at 84×, hint of a 4' spike/tail in p.a. 300°; moonlight [BIV].

◇ *Comet 57P/du Toit-Neujmin-Delporte* ⟹ 2002 July 21.63 and 31.60: GUIDE 7.0 software used for comp.-star mags [TSU02]. Aug. 5.57, 13.55, 15.48, Sept. 23.54, Oct. 5.48, and 10.49: GUIDE 8.0 software used for comp.-star mags [TSU02]. Aug. 8.88: ephemeris from Minor Planet Center Electronic Service; checked w/ Digitized Sky Survey; limiting stellar mag 15.5 [HAS02]. Aug. 30.81, Sept. 2.82, and 8.82: at 81×, limiting mag ≈ 15 [LEH]. Aug. 30.81: second detection made at Aug. 30.90 [LEH]. Sept. 2.82: second detection made at Sept. 2.88 [LEH]. Sept. 8.82: second detection made at Sept. 8.90 [LEH]. Oct. 10.50: GUIDE 8.0 software used for comp.-star mags [OHS].

◇ *Comet 67P/Churyumov-Gerasimenko* ⟹ 2002 Sept. 10.80 and 11.81: GUIDE 8.0 software used for comp.-star mags [YOS02]. Oct. 5.73: GUIDE 8.0 software used for comp.-star mags [OHS]. Oct. 14.83: GUIDE 8.0 software used for comp.-star mags [TSU02].

◇ *Comet 89P/Russell* ⟹ 2002 Oct. 10.54: GUIDE 8.0 software used for comp.-star mags [TSU02].

◇ *Comet 90P/Gehrels* ⟹ 2002 Oct. 10.80: GUIDE 8.0 software used for comp.-star mags [TSU02].

◇ *Comet 92P/Sanguin* ⟹ 2002 July 21.67: GUIDE 7.0 software used for comp.-star mags [TSU02]. Aug. 5.55, Sept. 23.58, Oct. 9.53, 9.55, and 10.51: GUIDE 8.0 software used for comp.-star mags [TSU02]. Sept. 3.04: excellent sky conditions; comet well visible [HOR02]. Sept. 8.93, 9.82, and Oct. 28.76: at 81×, limiting mag ≈ 15 [LEH]. Sept. 9.82: second detection made at Sept. 9.90 [LEH]. Sept. 12.85: ephemeris from MPC Electronic Service; checked w/ Digitized Sky Survey; limiting stellar mag 15.5 [HAS02]. Sept. 12.87: comet close to star of mag 8.9 (ref: TK) [BOU]. Oct. 1.81 and 27.75: at 81×, limiting mag ≈ 15.5 [LEH]. Oct. 1.81: second detection made at Oct. 1.86 [LEH]. Oct. 3.56 and 10.55: GUIDE 8.0 software used for comp.-star mags [OHS]. Oct. 4.83: at 162×, limiting mag ≈ 15.6; second detection made at Oct. 4.88 [LEH]. Oct. 27.75: second detection made at Oct. 27.83 [LEH]. Oct. 28.76: second detection made at Oct. 28.84 [LEH].

◇ *Comet 118P/Shoemaker-Levy* ⟹ 2002 Oct. 10.56: GUIDE 8.0 software used for comp.-star mags [TSU02].

◇ *Comet 153P/2002 C1 (Ikeya-Zhang)* ⟹ 2002 Feb. 8.42: very strongly enhanced through Swan Band filter [SEA]. Mar. 2.39: poor conditions due to low alt., twilight, and glare from streetlights; probably only inner coma visible; strong blue color noted; no tail visible [SEA]. Mar. 5.41: tail visible for at least a half degree in twilight [SEA]. Mar. 6.41: "tail visible for ≃ 1°; quite obvious, especially with averted vision, despite low alt. and twilight; comet an impressive sight; very blue against a twilight sky" [SEA]. Mar. 7.40: tail visible for ≃ 1 ° in twilight [SEA]. Mar. 8.40: "conditions less favorable than previous evenings, with some cloud and haze; comet very low" [SEA]. May 18.66: "obs. at 20° alt., which was affected by some light pollution to the N; no correction for atmospheric extinction was required, as nearby comparison stars were available" [PEA]. May 19.63: "obs. may have been affected by some smoke in the atmosphere" [PEA]. May 30.99, June 1.98, and 9.07: w/ 25.6-cm L (169×), central cond. of mag 13.4 [BIV]. May 30.99: w/ 25.6-cm L (42×), 0°.5 dust tail in p.a. 290° [BIV]. June 1.98: w/ 25.6-cm L (42×), 0°.6 dust tail in p.a. 290° [BIV]. June 29.51: "obs. in a relatively dark sky; however, the comet appeared faint and of low surface brightness" [PEA]. July 21.55 and 31.53: GUIDE 7.0 software used for comp.-star mags [TSU02]. July 27.51 and Aug. 1.54: GUIDE 8.0 software used for comp.-star mags [YOS02]. Aug. 1.52, 5.47, 13.50, and Oct. 11.40: GUIDE 8.0 software used for comp.-star mags [TSU02]. Sept. 1.49: GUIDE 8.0 software used for comp.-star mags [OHS].

◇ *Comet 155P/Shoemaker* ⟹ 2002 Oct. 10.82: GUIDE 8.0 software used for comp.-star mags [TSU02].

◇ *Comet C/2000 SV_{74} (LINEAR)* ⟹ 2002 July 21.49 and 31.50: GUIDE 7.0 software used for comp.-star mags

[TSU02]. Aug. 2.87 and Sept. 12.84: ephemeris from Minor Planet Center Electronic Service; checked w/ Digitized Sky Survey; limiting stellar mag 15.5 [HAS02]. Aug. 5.96 and Sept. 8.96: at 81×, limiting mag ≈ 15 [LEH]. Aug. 5.96: second detection made at Aug. 6.02 [LEH]. Sept. 23.43: GUIDE 8.0 software used for comp.-star mags [TSU02].

◇ *Comet C/2000 WM₁ (LINEAR)* ⟹ 2002 Jan. 8.45: "tail difficult due to some light pollution from Sydney; same m_1 w/ 10×50 B, clearly indicating a fading since Jan. 1" [SEA]. Jan. 11.43: "only a trace of tail visible due to haze and light pollution" [SEA]. Jan. 16.46: "comet an impressive binocular sight in the dark rural sky; tail clearly visible, with S edge sharply defined and N edge quite diffuse; comet appeared to naked eye as a 'soft' star near the limit of visibility" [SEA]. Jan. 17.48: comet just visible to naked eye, but nearby star of mag 5.8 not seen [SEA]. Jan. 22.45: in moonlight and with some high cloud, only a trace of tail visible [SEA]. Jan. 22.71: in darker sky, tail well visible to at least 2°, despite very low alt. [SEA]. Feb. 2.73: "comet easily visible to naked eye, appearing slightly 'softer' than stars and with a trace of tail; in 25×100 B, comet was a magnificent sight with ≈ 2° of tail visible in moonlight; false nucleus resembled a tiny planet-like disk and sunward extremity of tail displayed 'parabolic' shape, well-defined and of high surface intensity; narrow 'shadow of nucleus' noted in center of tail; false nucleus and tail both displayed a yellow color; easily the most spectacular comet since C/1995 O1 and strongly reminiscent of C/1996 B2 following perihelion" [SEA]. Feb. 7.76: in 25×100 B, central cond. still very intense and 'planetary', although somewhat elongated along the direction of tail axis, giving coma a cone-shaped appearance; broad and bright tail visible for at least 2° [SEA]. Feb. 8.72: "tail visible via naked eye in darker sky; stars and comet placed slightly out-of-focus to achieve 'softer' star images; in 25×100 B, tail 3°.7 long in p.a. 220°, slightly curved toward S; S edge of tail broad and diffuse, while N edge sharp and clearly defined; N edge appeared like a bright, though diffuse, 'streamer', more intense than the rest of the tail" [SEA]. Feb. 10.75: "earlier obs. using single-power monocular while comet still relatively low; later, comet was easier to see at higher alt., and estimate made using right eye only; degree of astigmatism made comet and star images appear very similar; tail traced for ~ 4°.7 with 10×50 B; in 25×100 B, possible star-like point glimpsed at center of central cond., and bright spine visible in tail, contrasting with the dark 'shadow of nucleus' of earlier observations" [SEA]. Feb. 14.74: tail possibly visible to 5°.5 via naked eye [SEA]. Mar. 19.72 and 22.71: tail very obvious [SEA]. Mar. 22.71: broad fan tail spans p.a. ≈ 220°-240° [SEA]. July 7.56: w/ infrared filter [TSU02]. July 7.56, 21.59, and 31.59: GUIDE 7.0 software used for comp.-star mags [TSU02]. Aug. 8.88: ephemeris from Minor Planet Center Electronic Service; checked w/ Digitized Sky Survey; limiting stellar mag 15.5 [HAS02]. Aug. 13.55: GUIDE 8.0 software used for comp.-star mags [TSU02].

◇ *Comet C/2001 HT₅₀ (LINEAR-NEAT)* ⟹ 2002 Oct. 5.80 and 11.76: GUIDE 8.0 software used for comp.-star mags [OHS]. Oct. 10.83: GUIDE 8.0 software used for comp.-star mags [TSU02].

◇ *Comet C/2001 K5 (LINEAR)* ⟹ 2002 July 7.55: w/ infrared filter [TSU02]. July 7.55, 21.59, and 31.55: GUIDE 7.0 software used for comp.-star mags [TSU02]. Aug. 1.55, 5.49, 13.52, Sept. 23.45, Oct. 5.45, and 10.40: GUIDE 8.0 software used for comp.-star mags [TSU02]. Aug. 5.88: at 81×, limiting mag ≈ 15.5; second detection made at Aug. 5.94 [LEH]. Sept. 2.79, 3.81, 6.81, 8.79, and 9.79: at 81×, limiting mag ≈ 15 [LEH]. Sept. 2.79: second detection made at Sept. 2.85 [LEH]. Sept. 3.81: second detection made at Sept. 3.90 [LEH]. Sept. 6.81: second detection made at Sept. 6.90 [LEH]. Sept. 8.79: second detection made at Sept. 8.88 [LEH]. Sept. 9.79: second detection made at Sept. 9.88 [LEH]. Oct. 4.78: at 162×, limiting mag ≈ 15.4 [LEH].

◇ *Comet C/2001 N2 (LINEAR)* ⟹ 2002 July 21.55 and 31.53: GUIDE 7.0 software used for comp.-star mags [TSU02]. Aug. 1.53 and 13.51: GUIDE 8.0 software used for comp.-star mags [TSU02]. Aug. 8.87: ephemeris from MPC Electronic Service; checked w/ Digitized Sky Survey; limiting stellar mag 15.5 [HAS02]. Sept. 1.50: GUIDE 8.0 software used for comp.-star mags [OHS].

◇ *Comet C/2001 Q4 (NEAT)* ⟹ 2002 Aug. 5.80 and 6.80: GUIDE 8.0 software used for comp.-star mags [TSU02]. Sept. 12.74, Oct. 5.69, and 14.66: GUIDE 7.0 software used for comp.-star mags [NAK01].

◇ *Comet C/2000 RX₁₄ (LINEAR)* ⟹ 2002 Aug. 13.06: small, slightly condensed object; motion over 40-min period evident [BOU]. Aug. 15.76, Oct. 10.80, and 14.80: GUIDE 8.0 software used for comp.-star mags [TSU02]. Sept. 7.07: elongated coma [HOR02]. Oct. 1.78, 12.80, and 16.79: GUIDE 6.0 software used for comp.-star mags [NAG08]. Oct. 5.74: GUIDE 8.0 software used for comp.-star mags [OHS]. Oct. 14.78: GUIDE 6.0 software used for comp.-star mags [YOS02].

◇ *Comet C/2001 X1 (LINEAR)* ⟹ 2002 Jan. 16.52: "comet was very diffuse and of low surface brightness; dia. (and therefore m_1) difficult to determine with certainty, and the m_1 estimate may have been too optimistic; it was certainly more difficult to see than the 'average' 12th-mag comet!" [SEA].

◇ *Comet P/2002 BV (Yeung)* ⟹ 2002 Aug. 5.48: GUIDE 7.0 software used for comp.-star mags [NAK01].

◇ *Comet C/2002 E2 (Snyder-Murakami)* ⟹ 2002 Mar. 22.72: close to bright star [SEA]. July 21.52 and 31.52: GUIDE 7.0 software used for comp.-star mags [TSU02]. Aug. 8.86: ephemeris from MPC Electronic Service; checked w/ Digitized Sky Survey; limiting stellar mag 15.5 [HAS02].

◇ *Comet C/2002 F1 (Utsunomiya)* ⟹ 2002 May 17.35: comet small and quite strongly condensed, w/ a possible broad fan-shaped tail toward N; comet not as easily seen through Swan-band filter [SEA]. May 19.44: obs. made in twilight with comet's alt. ≈ 13°; comet appeared as a moderately condensed object [PEA].

◇ *Comet C/2002 H2 (LINEAR)* ⟹ 2002 July 21.50: GUIDE 7.0 software used for comp.-star mags [TSU02].

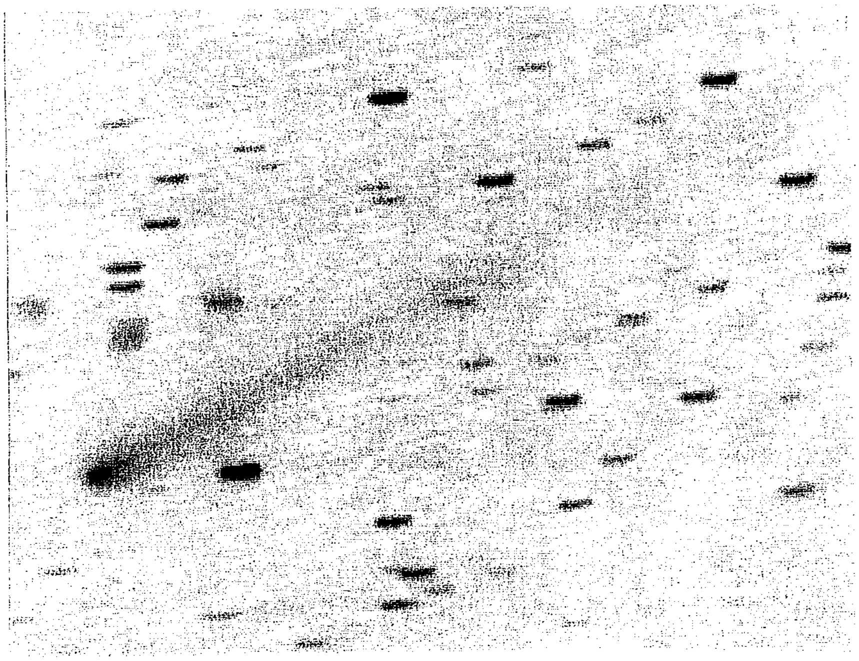

Image of comet C/2001 RX_{14} taken by Giovanni Sostero (Remanzacco, Italy) with a 45-cm f/4.5 Newtonian reflector and an SBIG-ST6 CCD camera, taken on 2002 Oct. 19.15 UT (compilation of ten 60-sec exposures).

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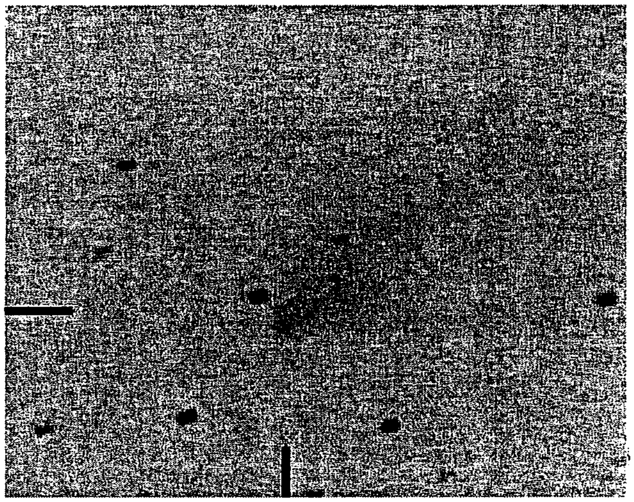
(text continued from page 242)

◇ *Comet C/2002 K4 (NEAT)* ⟹ 2002 Sept. 11.82 and 12.82: at 162×, limiting mag ≈ 16 [LEH]. Sept. 11.82: second detection made at Sept. 11.92 [LEH]. Sept. 12.82: second detection made at Sept. 12.92 [LEH].

◇ *Comet C/2002 O4 (Hönig)* ⟹ 2002 July 22.00: discovery obs.; diffuse object, slighly condensed; no tail visible; clear movement of ~ 1′ towards N after only 20 min [HOE]. July 28.88: "very diffuse in general; diffuse central region that is a bit brighter than the rest" [HOE]. July 30.71, Aug. 1.66, 12.50, and Sept. 3.48: `GUIDE 8.0` software used for comp.-star mags [YOS02]. July 30.98: faint, with diffuse coma; slightly easier at 88×; naut. twilight (sun 11° below horizon) [GRA04]. July 31.58 and 31.64: `GUIDE 7.0` software used for comp.-star mags [TSU02]. Aug. 2.57, 4.73, 7.76, 10.56, 13.76, 15.48, 20.76, 28.48, 29.45, 30.45, and Sept. 24.41: `GUIDE 6.0` software used for comp.-star mags [NAG08]. Aug. 3.98: round, diffuse coma; comet much easier to obs. than four nights ago; also faintly seen in 12×50 B; astron. twilight [GRA04]. Aug. 5.60, 7.57, 8.55, 11.59, 13.58, and 15.78: `GUIDE 8.0` software used for comp.-star mags [TSU02]. Aug. 5.70, 7.67, 8.71, 9.70, 10.59, and 20.75: `GUIDE 7.0` software used for comp.-star mags [MIY01]. Aug. 5.94: very diffuse coma; sky somewhat hazy [GRA04]. Aug. 7.00: in 15.2-cm L, the coma appeared notably larger at 30× than at 44×; not too difficult w/ 7×50 B [GRA04]. Aug. 7.66 and 10.67: `The Sky (ver.5)` software used for comp.-star mags [MIT]. Aug. 8.02: faint with 7×50 B in morning twilight [GRA04]. Aug. 8.99: very diffuse coma [GRA04]. Aug. 9.88: moderately condensed, well-defined coma; at 56×, no false nucleus brighter than mag 12.0; also visible in 9×63 B (m_1 = 8.3, coma dia. 10′) [KAM01]. Aug. 12.65 and 16.75: `GUIDE 6.0` software used for comp.-star mags [HAS08]. Aug. 13.07: easy object in 7×42 B; in 25×150 B, circular coma [ZAN]. Aug. 13.98: comet clearly seen in binoculars, its surface brightness somewhat higher than that of M33, but lower than that of M27; no tail seen; near-optimum conditions for this site near Oslo [GRA04]. Aug. 15.95: dark sky; M92 visible w/ naked eye [SKI]. Aug. 17.10: w/ 25.6-cm L (169×), central cond. of mag 14.4 [BIV]. Aug. 18.04: obs. somewhat disturbed by high clouds, but conditions considerably better than for C/2002 O6 [GRA04]. Aug. 18.10: central region more condensed; small 3′ tail within the large, 10′ coma [HOE]. Aug. 19.90: very diffuse, round coma with large, moderately bright central cond.; no pseudo-nucleus visible at 73× with a Lumicon Deep Sky filter [WAR01]. Aug. 19.99: somewhat hazy sky [GRA04]. Aug. 20.04: comet close to star of mag 7 [HOR02]. Aug. 21.90: very diffuse, round coma with large, slightly brighter center; no pseudo-nucleus visible at 103× w/ a Lumicon Deep Sky filter; comet located ~ 10′ from 4.3-mag ζ UMi, which somewhat interfered with the obs.; full moon low in SE, slightly hazy sky, and scattered cirrus [WAR01]. Aug. 23.82: moonlight [HOR02]. Aug. 24.92: moonlight, haze; comet not seen w/ smaller instruments [GRA04]. Aug. 28.94: obs. somewhat affected by thin clouds and moon [GRA04]. Aug. 30.85: comet moderately condensed; the 17′ tail was obvious using a Meade Series 4000 Broad-Band Filter (number 911B; similar to the common deep-sky filter, transmitting over 440-530 nm and from 645 nm to the infrared) [HOE]. Aug. 31.90: visibility similar to that of C/2002 O6, although this comet was considerably more extended and seen under a darker sky [GRA04].



CCD image of the fading comet C/2002 O4 taken by Giovanni Sostero (Remanzacco, Italy) with a 30-cm f/2.8 Baker reflector and an I filter, on 2002 Sept. 30.75 UT (compilation of thirty 30-sec exposures). North is to the right, and west is down; the entire frame pictured here is 13'.4 × 16'.4.

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(text continued from page 242)

Sept. 1.52: GUIDE 8.0 software used for comp.-star mags [OHS]. Sept. 1.86: some interference from nearby star of mag 6.6 [BOU]. Sept. 2.90: diffuse coma with brighter center; DC is now stronger than on Aug. 21; short, faint tail visible with Lumicon Deep Sky filter as an extension of the coma [WAR01]. Sept. 2.94: faint in 12×50 B, but easily seen in the telescope; transparent sky [GRA04]. Sept. 3.85: comet less condensed than on Aug. 30; a slightly brighter region within the coma was visible; very narrow 14' tail visible [HOE]. Sept. 8.85: surprisingly faint and diffuse coma, but still showing a central cond. [KAM01]. Sept. 10.85: well visible in a transparent sky [GRA04]. Sept. 12.81: drop-like shape [HOE]. Sept. 12.83: a bit brighter and more condensed than on Sept. 8 [KAM01]. Sept. 13.87: at 72×, coma dia. 3' [BRO04]. Sept. 23.80: nearly-full moon low over E horizon; comet appeared very faint and diffuse despite very transparent sky [BOU]. Sept. 24.41: comet not seen after evening twilight and before moonrise; in-focus stellar magnitude limit was ~ 11.0 [NAG08]. Sept. 29.79: no central cond.; featureless faint spot only 15° above horizon [HOE].

◇ *Comet P/2002 O5 (NEAT)* ⟹ 2002 Aug. 6.53: GUIDE 8.0 software used for comp.-star mags [TSU02].

◇ *Comet C/2002 O6 (SWAN)* ⟹ 2002 Aug. 2.79: GUIDE 8.0 software used for comp.-star mags [YOS02]. Aug. 3.69: also visible in 10×50 B; somewhat enhanced through Swan Band filter; rapid motion detected in only a few min [SEA]. Aug. 3.89: "comet a lot brighter than [was suggested by] the first reported obs.; however, comet is a lot better placed in the S hemisphere, where it was obs. at alt. ≈ 45°; large, round coma w/ a small hint of cond.; motion of comet obvious in only a few min" [PEA]. Aug. 4.08: low alt.; comp. stars at same alt. [HOR02]. Aug. 4.76, 7.77, 10.77, 13.77, and 20.78: GUIDE 6.0 software used for comp.-star mags [NAG08]. Aug. 5.76, 7.76, 8.76, and 9.76: GUIDE 7.0 software used for comp.-star mags [MIY01]. Aug. 5.78, 6.80, and 15.80: GUIDE 8.0 software used for comp.-star mags [TSU02]. Aug. 6.80: w/ 25×100 B, faint ion tail > 20' long in p.a. 245° [MAT08]. Aug. 7.76 and 10.76: The Sky (ver.5) software used for comp.-star mags [MIT]. Aug. 7.80: CCD image shows tail > 1° long in p.a. 250° [MAT08]. Aug. 8.16: obs. made from 1650-m alt. at Teide mountain, Teneriffe (Canary Is., Spain), with excellent conditions; although the comet was of mag 6.4 and limiting stellar mag was 6.7, comet was not detected by naked eye due to the very large coma with only medium central cond. [HOE]. Aug. 8.77: GUIDE 7.0 software used for comp.-star mags [WAT01]. Aug. 13.07: comet at only 9° alt., but very obvious; coma clearly elongated towards p.a. ~ 265° [BOU]. Aug. 13.11: in 25×150 B, no tail seen; circular coma [ZAN]. Aug. 14.05: comet well visible despite twilight and alt. 13° [GRA04]. Aug. 14.11: in 25×150 B, circular coma w/ starlike central cond. [ZAN]. Aug. 15.05: diffuse coma with moderate cond.; twilight [GRA04]. Aug. 17.01: bright and moderately-well-condensed comet with much brighter center; w/ 22-cm L (50×), tail 0°.3 in p.a. ≈ 315°; twilight [WAR01]. Aug. 17.07: faint and wide outer halo; low alt. [MEY]. Aug. 17.08: "small outburst?; comet brighter and more condensed than 24 hr ago" [BOU]. Aug. 17.10: easily visible, condensed coma; w/ 20-cm T (51×), well-condensed and defined coma; at 111×, starlike false nucleus of mag 10.0 [KAM01]. Aug. 18.04: obs. affected by high clouds and haze [GRA04]. Aug. 19.03: comet seen through a diffuse background of aurora [GRA04]. Aug. 20.79: GUIDE 8.0 software used for comp.-star mags [OHS]. Aug. 25.07: only weakly seen due to moonlight, high clouds/haze, and the comet's rather low alt. [GRA04]. Aug. 28.85: comet considerably fainter than expected; obs. shortly before setting below local horizon [GRA04]. Aug. 29.07: transparent sky w/ moonlight [GRA04]. Aug. 31.85: comet clearly visible despite astron. twilight; transparent sky [GRA04]. Sept. 1.84: "comet still well condensed, but faded dramatically since last obs. on Aug. 18" [BOU]. Sept. 2.85: "coma notably smaller than 1-2 weeks ago, but it remains rather diffuse; comet observed for some time before setting below the local horizon" [GRA04]. Sept. 6.83: "difficult obs. in twilight with comet at alt. of only 9°; definitely more diffuse than 5 days ago" [BOU]. Sept. 10.18 and 12.18: comet not seen, alt. 6°; obs. made before the beginning of morning astron. twilight, under good conditions, from a mountain location [GON05]. Sept. 10.83: comet not visible despite a clear and transparent sky; field obs. in twilight (sun 14° below horizon), shortly before setting below the natural horizon (true alt. 11°); at 88×, nearby stars to mag 11.5 (ref TK) visible [GRA04]. Sept. 13.14: very diffuse object; difficult to see in twilight at alt. of only 11° [BOU].

◇ *Comet C/2002 O7 (LINEAR)* ⟹ 2002 Aug. 6.49: GUIDE 8.0 software used for comp.-star mags [TSU02].

◇ *Comet C/2002 P1 (NEAT)* ⟹ 2002 Oct. 10.50: GUIDE 8.0 software used for comp.-star mags [TSU02].

◇ *Comet C/2002 Q2 (LINEAR)* ⟹ 2002 Sept. 1.91: fairly large, very diffuse object, with slight cond.; motion evident after only a few min; some interference from nearby star of mag 8.9 [BOU]. Sept. 11.86: at 162×, limiting mag ≈ 16; second detection made at Sept. 11.97 [LEH]. Sept. 12.86: at 162×, limiting mag ≈ 15.5; second detection made at Sept. 12.96 [LEH]. Sept. 12.90: "very difficult object; faint, rather large glow seen moving through dense Milky Way field" [BOU].

◇ *Comet C/2002 Q5 (LINEAR)* ⟹ 2002 Sept. 11.78: at 162×, limiting mag ≈ 16; second detection made at Sept. 11.90 [LEH]. Sept. 12.78: at 162×, limiting mag ≈ 15.5; second detection made at Sept. 12.90 [LEH]. Sept. 12.93: "small, somewhat-condensed object, seen moving away from star of mag 14 (not charted in *Guide8*)" [BOU]. Sept. 23.48, Oct. 5.40, and 11.42: GUIDE 8.0 software used for comp.-star mags [TSU02]. Oct. 1.78 and 4.76: at 81×, limiting mag ≈ 15.5 [LEH]. Oct. 1.78: second detection made at Oct. 1.83 [LEH].

◇ *Comet P/2002 T1 (LINEAR)* ⟹ 2002 Oct. 10.58: GUIDE 8.0 software used for comp.-star mags [TSU02]. Oct. 11.14: difficult obs. of rather large, faint, and very diffuse object; slight motion suspected over 20 min; obs. confirmed sighting of the previous morning (Oct. 10.15 UT), when an object of similar appearance was seen moving near the expected position over a 25-min period, but a nearby star of mag 6.0 and windy conditions made a secure obs. then impossible; check of Digital Sky Survey for both dates revealed no interfering stars or galaxies near the position of the comet [DIJ].

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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 [16 = Japanese observers (via Akimasa Nakamura, Kuma, Japan); etc.]. Those with asterisks (*) preceding the 5-character code are new additions to the Observer Key:*

AMO01	35	Alexandre Amorim, Brazil
BIV		Nicolas Biver, France
BOU		Reinder Bouma, The Netherlands
BRO04		Eric Broens, Belgium
CER01	23	Jakub Černý, Praha, Czech Rep.
CHE03	33	Kazimieras T. Cernis, Lithuania
COM	11	Georg Comello, The Netherlands
CRE01		Phillip J. Creed, OH, U.S.A.
CSU		Mátyás Csukás, Salonta, Romania
DIE02		Alfons Diepvens, Belgium
DIJ		Edwin van Dijk, The Netherlands
DUS	18	Grzegorz Duszanowicz, Sweden
EZA	16	Yuusuke Ezaki, Osaka, Japan
FUK02	16	Hideo Fukushima, Mitaka, Japan
GIA01		A. Giambersio, Potenza, Italy
GIL01	11	Guus Gilein, The Netherlands
GON05		Juan Jose Gonzalez, Spain
GRA04	24	Bjoern Haakon Granslo, Norway
GRA09	18	Krzysztof Graczewski, Poland
HAS02		Werner Hasubick, Germany
HAS08	16	Yuji Hashimoto, Hiroshima, Japan
HOD01	35	Felipe Hodar, Campinas, Brazil
HOE		Sebastian F. Hoenig, Germany
HOR02	23	Kamil Hornoch, Czech Republic
KAD02	16	Ken-ichi Kadota, Saitama, Japan
KAM01		A. Kammerer, Ettlingen, Germany
KAR02	21	Timo Karhula, Virsbo, Sweden
KID01	18	Krzysztof Kida, Elblag, Poland
KIS03	18	Adam Kisielewicz, Poland
KLA02		Silvio Klausnitzer, Germany
KOS		A. Kósa-Kiss, Salonta, Romania
*KOZ02	42	Alexandr Kozlovski, Russia
LEH		Martin Lehky, Czech Republic
LUE		Hartwig Luethen, Germany
MAN02	23	Roman Maňák, Lipov, Czech Rep.
MAR02	13	Jose Carvajal Martinez, Spain
MAT08		Michael Mattiazzo, S. Australia
MEY		Maik Meyer, Germany
MIT	16	Shigeo Mitsuma, Saitama, Japan
MIY01	16	Osamu Miyazaki, Ibaraki, Japan
MOM	16	Masahiko Momose, Nagano, Japan
MOR09		Philippe Morel, France
MUR02	16	Shigeki Murakami, Niigata, Japan
NAG08	16	Yoshimi Nagai, Yamanashi, Japan
NAK01	16	Akimasa Nakamura, Ehime, Japan
NED	23	Martin Nedved, Praha, Czech Rep.
NEV	42	V. S. Nevski, Vitebsk, Belarus
*OHS	16	Yuuji Ohshima, Nagano, Japan
ORI	16	Takaaki Oribe, Tottori, Japan
PEA		Andrew R. Pearce, Australia
RAE		Stuart T. Rae, New Zealand
*RIE	11	Hermanus Rietveld, Netherlands
ROM	42	Aleksandr M. Romancev, Belarus
SAN04	38	Juan Manuel San Juan, Spain
SAR02	32	Krisztián Sárneczky, Hungary
SCH04	11	Alex H. Scholten, Netherlands

SEA		David A. J. Seargent, Australia
SEG		Carlos Segarra, Valencia, Spain
SER02		Jérome Serant, Chevillon, France
SHA02	07	Jonathan D. Shanklin, England
SHU	42	Sergey E. Shurpakov, Belarus
SIE	33	Henryk Sielewicz, Lithuania
SKI	24	Oddleiv Skilbrei, Norway
SOS		Giovanni Sostero, Italy
SOU01	35	Willian Carlos de Souza, Brazil
TSU02	16	M. Tsumura, Wakayama, Japan
WAR01	21	Johan Warell, Sweden
WAT01	16	Nobuo Watanabe, Niigata, Japan
YOS02	16	K. Yoshimoto, Yamaguchi, Japan
YOS04	16	Seiichi Yoshida, Ibaraki, Japan
ZAN		Mauro Vittorio Zanotta, Italy
ZNO	23	Vladimír Znojil, Czech Republic

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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.*

Visual Data

Comet 7P/Pons-Winnecke

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 06 12.60		S	11.7	GA	25.4	L	4	71	& 6		2		SEA
2002 06 20.86	x	S	12.2	TK	41	L	4	90	2	1			PEA
2002 06 22.90	x	S	12.2	TK	41	L	4	90	1.5	1			PEA
2002 07 05.90	x	S	12.1	TK	41	L	4	90	2.2	1/			PEA
2002 07 08.82	x	S	12.2	TK	41	L	4	90	2	1			PEA
2002 07 30.57		S	12.5:	HS	28	T	6	84	2	4			MAT08
2002 08 13.78	x	S	13.7	VN	41	L	4	200	0.8	1			PEA

Comet 19P/Borrelly

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2001 08 24.09	x	S	10.5:	TT	30	L	4	96	2	3			GRA09

Comet 22P/Kopff

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 01.43		S	13.0:	HS	28	T	10	133	1.5	3			MAT08
2002 09 07.43		S	12.5	HS	28	T	6	84	1	3			MAT08
2002 09 25.41		S	12.0	GA	25.4	L	4	114					SEA
2002 09 29.43		S	12.5:	HS	28	T	6	84	1	3			MAT08

Comet 28P/Neujmin

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 07.44			[14.0	HS	28	T	6	196					MAT08
2002 09 29.46			[14.0	HS	28	T	6	196					MAT08
2002 10 27.47			[13.5	HS	28	T	10	133					MAT08

Comet 29P/Schwassmann-Wachmann

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 05.89	x	S	13.6	VN	41	L	4	200	0.6	2			PEA
2002 07 30.56		S	13.0:	HS	28	T	6	84	1	5			MAT08
2002 08 05.57	x	S	12.8	HS	45.7	L	4	170	0.3	7			MUR02
2002 08 05.92		M	11.2	TT	42	L	5	81	1	7			LEH
2002 08 07.01		S	12.0	TT	25	L	5	96	1	3			SEG
2002 08 07.17		S	11.7	TK	20	L	6	100	4	0			HOD01
2002 08 07.69		S	12.0	HS	31.7	L	6	152	1.0	5			YOS04
2002 08 07.70	x	S	11.4:	TJ	31.7	L	6	152	0.4	3/			MIY01
2002 08 08.55	x	M	12.1	HS	35.0	C	14	120	0.8	5			TSU02
2002 08 08.72	x	S	12.1	HS	31.7	L	6	152	0.4	4			MIY01
2002 08 08.88		S	12.5	HS	44.0	L	5	156	1.2	4			HAS02
2002 08 09.04		M	12.4	NP	45	L	5	100	0.5	3			MAR02
2002 08 09.05		M	12.5	NP	45	L	5	100	1	5			SAN04
2002 08 09.71	x	S	12.7:	HS	31.7	L	6	152	0.4	3/			MIY01
2002 08 10.94		S	11.5	TK	25.6	L	5	42	1.5	5			BIV
2002 08 12.08		S	12.2	TJ	20.3	T	10	133	1	3			GON05
2002 08 12.77	x	S	12.1	TK	41	L	4	90	1.2	2			PEA
2002 08 12.96		S	11.9	TK	25.6	L	5	42	1.5	3			BIV
2002 08 13.77	x	S	12.2	TK	41	L	4	90	1.4	2			PEA
2002 08 15.99		S	13.2	HS	53.0	L	3	124	0.9	0			MOR09
2002 08 17.05		S	12.1	TK	25.6	L	5	84	1.2	3			BIV
2002 08 30.85		M	12.5	HS	42	L	5	81	1.5	3			LEH
2002 09 02.90		M	12.6	HS	42	L	5	81	1.6	3			LEH
2002 09 03.54		S	12.9	GA	25.4	L	4	71					SEA
2002 09 04.55		S	12.5	HS	28	T	10	133	1.5	3			MAT08
2002 09 04.56		S	13.0	GA	25.4	L	4	71					SEA
2002 09 08.85		M	12.6	HS	42	L	5	81	1.4	3/			LEH
2002 09 10.90		S	13.2	NP	21	L	6	100	0.5	2			MAR02
2002 09 12.85		S	13.9	HS	44.0	L	5	156	0.9	3			HAS02

Comet 29P/Schwassmann-Wachmann [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 29.48		S	12.8	HS	28	T	6	84	1	6			MAT08
2002 09 30.52		S	12.9	HS	28	T	6	84	1	5			MAT08
2002 10 04.81		M	12.6	HS	42	L	5	81	1.6	4			LEH
2002 10 05.60		S	13.5:	HS	28	T	6	84	1	4			MAT08
2002 10 10.61		S	14.0:	HS	28	T	6	196	1	4			MAT08
2002 10 23.45			[13.5	HS	28	T	6	84					MAT08
2002 10 27.52		B	14.0	HS	28	T	10	133	0.5	8			MAT08
2002 10 30.52		S	13.5:	HS	28	T	6	84	0.5	6			MAT08

Comet 46P/Wirtanen

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 05.91		S	[12.0	TK	41	L	4	200	! 0.5				PEA
2002 08 13.08		S	10.4	TK	31.0	J	6	72	2.2	1/			BOU
2002 08 13.09		S	10.2	TK	31.0	J	6	72	2	0			DIJ
2002 08 13.12		S	10.9:	HS	25.6	L	5	169	1.0	3			BIV
2002 08 13.13		S	10.9:	HS	25.6	L	5	84	1.0	3			BIV
2002 08 15.11	&	S	10.5	HS	53.0	L	3	124	1.7	0			MOR09
2002 08 15.79	x	M	10.7	TT	16.0	W	4	49	1.6	2			TSU02
2002 08 16.11	&	S	11.3	HS	53.0	L	3	124	1.2	0			MOR09
2002 08 17.11		S	11.3:	TK	25.6	L	5	169	1.0	3			BIV
2002 08 17.12		S	11.3:	TK	25.6	L	5	84	1.0	3			BIV
2002 08 17.15		S	11.2:	TK	25.6	L	5	84	1.0	3			BIV
2002 08 17.89	x	S	10.2	TK	20	L	4	45	2.5	2			PEA
2002 08 19.89	x	S	10.3	TK	20	L	4	45	2.8	2			PEA
2002 08 20.77	xa	S	10.2	HS	32.0	L	5	58	2.7	4			NAG08
2002 09 04.82	x	S	10.8	TK	25.4	L	4	113	1.8	2			YOS02
2002 09 09.12		S	10.5	TT	10.0	B		25	2.9	4			HAS02
2002 09 10.10		M	10.0	TT	10	B	4	25	2	3			LEH
2002 09 10.82	x	S	10.9	TK	25.4	L	4	46	1.5	1			YOS02
2002 09 11.13		S	10.9	TK	25.6	L	5	84	1.5	4			BIV
2002 09 11.14		S	10.8	TK	25.6	L	5	42	1.5	4			BIV
2002 09 11.16		S	10.8	TK	25.6	L	5	42	1.5	4			BIV
2002 09 12.13		M	9.7	TT	10	B	4	25	2	3			LEH
2002 09 13.12		S	10.2	TK	25.4	J	6	58	2.4	2/			BOU
2002 09 14.12		S	10.3	TT	13	L	8	69	2.5	2			HOR02
2002 09 26.18		S	8.8	TJ	20.3	T	10	36	5	5			GON05
2002 09 26.19		S	8.7	TJ	8.0	B		11	4	3			GON05
2002 09 29.16		S	9.6	TK	25.6	L	5	42	3.0	6			BIV
2002 09 29.19		S	9.8	TK	25.6	L	5	84	3.0	6			BIV
2002 09 30.13		S	8.8:	TT	10.0	B		25	1.5	4			HAS02
2002 10 01.79	xa	S	10.3	TJ	32.0	L	5	58	2.0	6			NAG08
2002 10 02.19		S	9.2	TJ	20.3	T	10	77	4	3			GON05
2002 10 12.82	xa	S	10.7	TJ	32.0	L	5	58	2.6	3			NAG08
2002 10 16.81	xa	S	11.1	HS	32.0	L	5	58	2.0	2			NAG08

Comet 57P/du Toit-Neujmin-Delporte

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 30.55			[13.5	HS	28	T	6	196					MAT08
2002 08 12.94		S	13.3	SK	31.0	J	6	143	1.1	1/			BOU
2002 08 12.94		S	13.4	SK	31.0	J	6	143	1.0	1			DIJ
2002 08 30.81		M	12.9	HS	42	L	5	81	1.6	4			LEH
2002 09 02.82		B	13.4	HS	42	L	5	81	1.5	4			LEH
2002 09 08.82		B	13.5	HS	42	L	5	81	1.5	4			LEH

Comet 57P/du Toit-Neujmin-Delporte [component A]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 08.88		S	13.9	HS	44.0	L	5	226	0.4	3			HAS02

Comet 67P/Churyumov-Gerasimenko

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 16.10	&	S	12.5	HS	53.0	L	3	124	0.5	0			MOR09

Comet 67P/Churyumov-Gerasimenko [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 17.89		S	[12.0	TK	41	L	4	200	! 1.0				PEA
2002 09 10.80	x	S	12.4:	HS	25.4	L	4	113	1.0	4			YOS02
2002 09 11.81	x	S	12.2	HS	25.4	L	4	113	1.2	3/			YOS02
2002 09 14.08		M	12.9	HS	35	L	5	158	1.0	3			HOR02

Comet 92P/Sanguin

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 18.03		S	13.7	SK	31.0	J	6	109	0.9	3			BOU
2002 08 18.04		S	13.6	SK	31.0	J	6	109	1.3	0/			DIJ
2002 09 01.47		S	13.2	HS	28	T	10	133	1	5			MAT08
2002 09 01.88		S	12.9	SK	31.0	J	6	109	1.5	2/			BOU
2002 09 01.88		S	13.3	HS	30	R	20	230	0.6	3			SHA02
2002 09 01.89		S	12.8	SK	31.0	J	6	109	1	2			DIJ
2002 09 02.57		S	13.3	HS	28	T	10	133	1	4			MAT08
2002 09 02.88		S	12.9	HS	30	R	20	230	0.6	4			SHA02
2002 09 03.04		S	13.8	HS	35	L	5	158	0.6	2/			HOR02
2002 09 03.87		S	12.9:	HS	20	T	10	160	0.5	3			SHA02
2002 09 04.54		S	13.5	HS	28	T	10	133	1	5			MAT08
2002 09 04.90		S	13.2:	HS	30	R	20	300	0.4	3			SHA02
2002 09 06.98		M	13.7	HS	35	L	5	158	0.8	3			HOR02
2002 09 08.05		S	13.6	HS	35	L	5	158	0.7	2/			HOR02
2002 09 08.93		M	12.9:	HS	42	L	5	81	1.4	3/			LEH
2002 09 09.82		M	13.3	HS	42	L	5	81	1.2	4			LEH
2002 09 10.89		S	13.1	HS	30	R	20	230	0.7	4			SHA02
2002 09 12.02		M	13.6	HS	35	L	5	158	0.7	3/			HOR02
2002 09 12.85		S	13.5	HS	44.0	L	5	156	0.7	4			HAS02
2002 09 12.87		S	12.7	SK	31.0	J	6	143	1	1/			DIJ
2002 09 12.87		S	13.0	SK	31.0	J	6	143	& 1	4			BOU
2002 09 13.96		S	13.5	HS	35	L	5	158	0.8	3			HOR02
2002 09 29.50		S	13.3	HS	28	T	6	84	1	5			MAT08
2002 09 29.81		S	13.4	HS	44.0	L	5	156	0.8	4			HAS02
2002 09 30.53		S	13.5	HS	28	T	6	84	1	4			MAT08
2002 10 01.81		M	13.2	HS	42	L	5	81	1.2	3/			LEH
2002 10 04.83		M	13.3	HS	42	L	5	81	1.3	3/			LEH
2002 10 09.55	x	M	14.0:	HS	35.0	C	14	400					TSU02
2002 10 27.55		S	14.0	HS	28	T	10	133	1	5			MAT08
2002 10 27.75		B	13.4	HS	42	L	5	81	1.3	3/			LEH
2002 10 28.76		B	13.7	HS	42	L	5	81	1.2	3/			LEH

Comet 153P/Ikeya-Zhang

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 02 08.42		S	7.9	AA	10.0	B		25	3				SEA
2002 02 10.42		M	7.6	AA	10.0	B		25					SEA
2002 02 12.44		S	7.6	AA	10.0	B		25			16 m	83	SEA
2002 02 13.42		S	7.3	AA	10.0	B		25					SEA
2002 02 14.43		S	7.2	AA	10.0	B		25					SEA
2002 03 02.39		B	5.6	AA	10.0	B		25		1/	7		SEA
2002 03 04.76		S	5.4	HI	8.0	B		20	4.5	7/	0.8		SOS
2002 03 05.41		B	5.3	AA	10.0	B		25					SEA
2002 03 06.41		B	5.2	AA	10.0	B		25					SEA
2002 03 07.40		B	5.2	AA	10.0	B		25					SEA
2002 03 08.40		B	5.0	AA	10.0	B		25					SEA
2002 03 09.77		S	4.8	TJ	8.0	B		20	5	8	1.6	73	SOS
2002 03 10.77		S	4.6	TJ	8.0	B		20	6	7	1.7	66	SOS
2002 03 23.78		S	3.5	TJ	3.0	B		8	7	7	4.0	60	SOS
2002 03 24.79		S	3.6	TJ	3.0	B		8	6	7	3.0	60	SOS
2002 03 26.80		B	3.4	HS	5.0	B		10	2	4	4	110	HOE
2002 03 27.80		B	3.6	HS	5.0	B		10	2.2	4/	4	115	HOE
2002 04 03.77		S	3.1	AA	5.0	B		7	6	D6	14	8	KOS
2002 04 08.77		S	3.5	AA	5.0	B		7	4	D6	9	348	KOS
2002 04 11.81	x	B	3.8	TJ	6.0	B		20	7	7	&1.0		KID01
2002 04 12.05		I	3.9	HS	1.0	E		1			4.5		HOE
2002 04 15.78		S	4.8	AA	5.0	B		7	5	5	3.3	328	KOS

Comet 153P/Ikeya-Zhang [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 04 16.78		S	4.6	AA	5.0	B		7	5	5	6.5	325	KOS
2002 04 23.07		S	4.4	AA	5.0	B		7	8	5	5.3	290	KOS
2002 04 28.81		S	4.5	AA	5.0	B		7	6	4	6.0	273	KOS
2002 05 01.84		S	4.2	AA	5.0	B		7	10	4	1.2	263	KOS
2002 05 02.94		S	4.2	AA	5.0	B		7	12	4	2.5	256	KOS
2002 05 04.97		S	4.3	AA	5.0	B		7	14	3	15 m	242	KOS
2002 05 06.89		M	5.2	TJ	10.0	B		20	13.5	6	0.9	230	MEY
2002 05 07.03		S	5.0	AA	5.0	B		7	10	3			KOS
2002 05 07.88		M	5.3	TJ	10.0	B		20	11	5			MEY
2002 05 07.88		S	5.2	AA	5.0	B		7	8	3			KOS
2002 05 08.96		S	5.3	AA	5.0	B		7	12	3	45 m	225	KOS
2002 05 09.88		M	5.3	TJ	10.0	B		20	10.5	5/			MEY
2002 05 09.94		M	5.1	S	5.0	B		7	13	4			KLA02
2002 05 10.88		M	5.4	TJ	10.0	B		20	10	5/			MEY
2002 05 14.87		S	5.3	AA	5.0	B		7	10	3			KOS
2002 05 14.97		B	5.0	TI	0.8	E		1	20	5			CER01
2002 05 14.97		M	5.4	TI	5.0	B		10	16	4	2.0	215	CER01
2002 05 14.99		B	4.4	TI	5.0	B		10	18				NED
2002 05 15.00		B	5.5	S	5.0	B		7	20	6			KLA02
2002 05 15.89		M	5.9	TJ	10.0	B		20	13.5	5			MEY
2002 05 16.93		S	5.4	AA	5.0	B		7	10	2			KOS
2002 05 16.95		M	5.6	S	5.0	B		7	15	5			KLA02
2002 05 17.01		B	5.5	TI	0.8	E		1	15	4			CER01
2002 05 17.01		B	5.5	TI	5.0	B		10	18				NED
2002 05 17.01		M	5.9	TI	5.0	B		10	16	4	2.0	220	CER01
2002 05 18.66	x	S	5.8	TK	8.0	B		20	12	3			PEA
2002 05 18.97		S	5.8	AA	5.0	B		7	10	2			KOS
2002 05 19.63	x	S	5.9	TK	8.0	B		20	13	3			PEA
2002 05 22.02		M	6.1	TI	5.0	B		10	15	5			CER01
2002 05 26.95		S	6.2	TK	5.0	B		7	15	4			BIV
2002 05 30.91		S	6.2	AA	5.0	B		7	8	2			KOS
2002 05 30.98		S	6.4	TK	5.0	B		7	17	4			BIV
2002 05 31.44		S	6.7	AA	5.0	B		10					SEA
2002 05 31.92		S	6.6	TJ	5.0	B		10	15	4/			MEY
2002 06 01.54		S	6.7	AA	5.0	B		10					SEA
2002 06 01.99		S	6.5	TK	5.0	B		7	14	5			BIV
2002 06 02.86		S	6.6	AA	5.0	B		7	8	2			KOS
2002 06 03.87		S	6.8	AA	5.0	B		7	8	2			KOS
2002 06 04.58		S	6.6	AA	5.0	B		10					SEA
2002 06 04.88		S	7.2	AA	5.0	B		7	8	2			KOS
2002 06 05.97		S	6.8	TK	5.0	B		7	14	3			BIV
2002 06 06.52		S	6.6	AA	5.0	B		10	15				SEA
2002 06 07.85		S	7.2	AA	5.0	B		7	8	2			KOS
2002 06 08.54		S	6.7	AA	5.0	B		10					SEA
2002 06 09.06		S	7.0	TK	5.0	B		7	15	3			BIV
2002 06 09.58		S	6.8	AA	5.0	B		10					SEA
2002 06 09.87		S	7.4	AA	5.0	B		7	8	2			KOS
2002 06 09.91		M	7.0	TI	5.0	B		10	15	4			CER01
2002 06 11.44		S	6.9	AA	2.5	B		2					SEA
2002 06 11.91	x	S	7.9:	TJ	6.0	B		10	& 5	s1/			KIS03
2002 06 12.60		S	7.1	AA	5.0	B		10					SEA
2002 06 12.93		S	7.3	AA	5.0	B		7	8	1			KOS
2002 06 13.96		S	7.3	AA	5.0	B		20	7	2			DIE02
2002 06 15.51		S	7.3	AA	5.0	B		10					SEA
2002 06 15.90		S	7.8	AA	5.0	B		7	8	1			KOS
2002 06 16.53		S	7.5	AA	5.0	B		10					SEA
2002 06 16.99		S	7.6	TK	5.0	B		7	10	3			BIV
2002 06 18.00		S	7.6:	TK	5.0	B		7	10	3			BIV
2002 06 18.02		S	8.1	TK	20.3	L	6	48	6	2			BIV
2002 06 18.97		S	7.5	AA	5.0	B		7	8	1			KOS
2002 06 27.87		S	9.8	AC	6.3	R	13	52	4	0			KOS
2002 06 27.97		S	9.0	TK	20.3	L	6	48	5	2			BIV
2002 06 27.98		S	8.8:	TK	5.0	B		7	5	3			BIV
2002 06 28.93		S	8.9	TK	25.6	L	5	42	6.5	2			BIV
2002 06 29.51	x	S	9.2	TK	20	L	4	45	3.7	2			PEA

Comet 153P/Ikeya-Zhang [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 06 29.90		S	10.5	AC	6.3	R	13	52	3	0			KOS
2002 06 30.47	x	S	9.2	TK	20	L	4	45	3.5	2			PEA
2002 07 01.52	x	S	9.2	TK	20	L	4	45	5	2			PEA
2002 07 05.50	x	S	9.5	TK	20	L	4	45	3	1			PEA
2002 07 09.93		M	9.8	TI	11.4	L	8	36	8	3			CER01
2002 07 13.96		S	9.6	TK	25.6	L	5	42	6	2			BIV
2002 07 27.51	x	S	11.8:	TK	25.4	L	4	46	2.8	2			YOS02
2002 07 29.86		S	10.6	TT	35	L	5	68	3.0	1			HOR02
2002 07 30.54		S	12.0:	HS	28	T	6	84	3	1			MAT08
2002 08 01.54	x	S	11.2:	TK	25.4	L	4	46	2	1			YOS02
2002 08 02.86		S	11.9	TT	44.0	L	5	63	1.9	2			HAS02
2002 08 02.94		S	9.3	NP	7.0	B		10	5	2/			MAR02
2002 08 03.86		S	10.6	TT	35	L	5	68	3.2	1			HOR02
2002 08 03.94		S	9.1	NP	7.0	B		10	7	3			MAR02
2002 08 05.83		S	10.7	TT	35	L	5	68	3.0	0/			HOR02
2002 08 05.85		M	11.4	TI	42	L	5	81	2	3			LEH
2002 08 08.91		S	11.1	NP	45	L	5	100	1	2			MAR02
2002 08 08.92		S	11.4	NP	45	L	5	100	1.5	3			SAN04
2002 08 09.03		M	8.3	S	7.0	B		10	11	4			MAR02
2002 08 09.04		M	8.1	S	7.0	B		10	10	5			SAN04
2002 08 10.89		S	11.6:	TK	25.6	L	5	42	3	1			BIV
2002 08 10.89		S	11.8	TK	25.6	L	5	84	2.5	1			BIV
2002 08 11.94		S	11.9	TJ	20.3	T	10	77	1	1			GON05
2002 08 12.89		S	12.5	HS	25.6	L	5	84	2.8	1			BIV
2002 09 10.87	&	S	[13.1	HS	21	L	6	55	1				MAR02

Comet 154P/Brewington

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 07.45			[14.0	HS	28	T	6	196					MAT08
2002 09 29.51			[13.5	HS	28	T	6	84					MAT08
2002 10 10.60			[14.0	HS	28	T	6	196					MAT08
2002 10 23.44			[13.5	HS	28	T	6	84					MAT08
2002 10 27.51			[14.0	HS	28	T	10	133					MAT08

Comet C/2000 SV_74 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 05 15.01		M	12.5	HS	11.4	L	9	75	1	4			CER01
2002 05 17.03		M	12.6	HS	11.4	L	9	75	1	4			CER01
2002 07 17.90		S	13.6	HS	35	L	5	158	1.2	2/			HOR02
2002 08 02.87		S	14.0	HS	44.0	L	5	226	0.4	4			HAS02
2002 08 03.83		M	13.4	HS	35	L	5	158	1.4	3			HOR02
2002 08 05.93		S	13.6	HS	35	L	5	158	1.3	2/			HOR02
2002 08 05.96		M	13.4	HS	42	L	5	81	1.3	3/			LEH
2002 08 12.93		S	13.1	SK	31.0	J	6	109	0.7	0/			DIJ
2002 08 12.93		S	13.2	SK	31.0	J	6	109	1.0	2			BOU
2002 08 18.01		S	13.3	SK	31.0	J	6	109	1.0	2/			BOU
2002 08 18.02		S	13.2	SK	31.0	J	6	109	1.3	2			DIJ
2002 09 01.87		S	13.3	SK	31.0	J	6	109	1.5	1			DIJ
2002 09 01.87		S	13.5	SK	31.0	J	6	109	1.2	2			BOU
2002 09 06.82		S	13.4	HS	35	L	5	158	1.3	2/			HOR02
2002 09 08.96		M	13.0	HS	42	L	5	81	1.3	3			LEH
2002 09 11.82		S	13.5	HS	35	L	5	158	1.4	2/			HOR02
2002 09 12.83		S	13.5	HS	35	L	5	158	1.3	2/			HOR02
2002 09 12.84		S	13.5	HS	44.0	L	5	156	0.7	4			HAS02
2002 09 12.88		S	13.2	SK	31.0	J	6	109	1.3	2/			BOU

Comet C/2000 WM_1 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2001 11 12.18	x	B	9.3	TT	15	L	5	32	3	5			DUS
2002 01 08.45		B	6.2	AA	10.0	B		25	3	7	0.5	120	SEA
2002 01 11.43		B	6.1	AA	10.0	B		25					SEA
2002 01 13.44		B	6.0	AA	10.0	B		25					SEA

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 01 16.45		B	6.0	AA	10.0	B		25			2.2	153	SEA
2002 01 16.46		I	5.9	AA	0.0	E		1					SEA
2002 01 17.48		B	5.9	AA	10.0	B		25	0.8	8	2.7	155	SEA
2002 01 17.48		I	5.7	AA	0.0	E		1					SEA
2002 01 18.45		B	5.7	AA	10.0	B		25					SEA
2002 01 19.45		B	5.8	AA	10.0	B		25					SEA
2002 01 22.45		B	5.7	AA	10.0	B		25					SEA
2002 01 22.71		B	5.7	AA	10.0	B		25			2		SEA
2002 02 02.73		I	3.5	AA	0.0	E		1		9			SEA
2002 02 07.76		I	4.3	AA	0.0	E		1		9			SEA
2002 02 08.72		B	4.3	AA	0.0	E		1					SEA
2002 02 10.72		B	4.4	AA	3.0	R		1					SEA
2002 02 10.75		B	4.2	AA	0.0	E		1			3.2	224	SEA
2002 02 12.74		B	4.4	AA	0.0	E		1			6.0	220	SEA
2002 02 13.74		B	4.6	AA	0.0	E		1			5.2	220	SEA
2002 02 14.74		B	4.9	AA	0.0	E		1			3.2	225	SEA
2002 03 11.70		S	7.7	AA	10.0	B		25	3	6			SEA
2002 03 19.72		B	8.0	AA	10.0	B		25	3	5	0.5		SEA
2002 03 22.71		B	7.9	AA	10.0	B		25	3	5	1.0	230	SEA
2002 03 24.73		B	8.3	AA	10.0	B		25	4		0.7	235	SEA
2002 05 14.97		M	11.1	TI	11.4	L	9	36	2.5	4			CER01
2002 05 14.98		S	11.6	TI	11.4	L	9	36	2				NED
2002 05 15.06		S	11.5	HS	25.4	T	10	100	1.0	3			KLA02
2002 05 16.98		M	11.7	TI	11.4	L	9	36	2	5			CER01
2002 05 17.02		S	11.5	HS	25.4	T	10	100	0.75	2			KLA02
2002 05 17.98		S	11.8	TI	11.4	L	9	36	2				NED
2002 05 22.05		M	11.2	HS	11.4	L	9	36	2	3			CER01
2002 05 31.00		S	12.5	HS	25.6	L	5	84	1.3	5			BIV
2002 06 02.02		S	12.5	HS	25.6	L	5	84	1.2	4			BIV
2002 08 08.88		S	14.1	HS	44.0	L	5	226	0.7	3			HAS02

Comet C/2001 K5 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 09.98		M	13.3	HS	11.4	L	8	75	1	4			CER01
2002 07 17.86		S	13.3	HS	35	L	5	158	0.6	3			HOR02
2002 07 30.52		S	14.0:	HS	28	T	6	196	0.5	4			MAT08
2002 08 02.92		S	12.8	GA	25.4	J	6	115	1.0	3			BOU
2002 08 03.90		M	13.6	HS	35	L	5	158	0.6	3/			HOR02
2002 08 04.91		S	12.8	GA	25.4	J	6	115	0.9	3			BOU
2002 08 05.88		B	13.4	HS	42	L	5	81	1.4	4			LEH
2002 08 05.89		M	13.5	HS	35	L	5	158	0.5	4			HOR02
2002 08 08.87		S	13.3	HS	44.0	L	5	226	0.3	4			HAS02
2002 08 12.91		S	12.9	HS	31.0	J	6	109	1.0	3			BOU
2002 08 12.92		S	12.6	HS	31.0	J	6	109	1.5	1/			DIJ
2002 08 14.91		S	12.8	HS	25.4	J	6	115	0.9	3			BOU
2002 09 01.85		S	13.2	SK	31.0	J	6	109	1	1			DIJ
2002 09 01.85		S	13.3	SK	31.0	J	6	109	0.8	3			BOU
2002 09 02.79		B	13.5	HS	42	L	5	81	1.5	4			LEH
2002 09 03.81		B	13.5	HS	42	L	5	81	1	4			LEH
2002 09 06.81		B	13.6	HS	42	L	5	81	1.2	4			LEH
2002 09 06.85		M	13.3	HS	35	L	5	158	0.6	4			HOR02
2002 09 07.84		M	13.4	HS	35	L	5	158	0.6	4			HOR02
2002 09 08.79		B	13.6	HS	42	L	5	81	1.1	4			LEH
2002 09 09.79		B	13.6	HS	42	L	5	81	1.1	4			LEH
2002 09 10.89		S	[13.4	HS	21	L	6	55	1				MAR02
2002 09 11.86		M	13.5	HS	35	L	5	158	0.7	3/			HOR02
2002 09 12.85		S	13.2	SK	31.0	J	6	109	1.0	3/			BOU
2002 09 12.86		M	13.5	HS	35	L	5	158	0.6	4			HOR02
2002 09 12.86		S	12.9	SK	31.0	J	6	109	1.2	1/			DIJ
2002 09 13.84		M	13.5	HS	35	L	5	158	0.7	4			HOR02
2002 10 04.78		B	13.2	HS	42	L	5	81	1.3	3/			LEH

Comet C/2001 N2 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 09.99		M	12.7	HS	11.4	L	8	75	2	5			CER01
2002 07 17.97		S	13.7	HS	35	L	5	158	0.7	2/			HOR02
2002 07 30.53		S	14.0:	HS	28	T	6	196	1	2			MAT08
2002 08 03.93		S	13.6	HS	35	L	5	158	0.7	2/			HOR02
2002 08 05.86		S	13.7	HS	35	L	5	158	0.8	2/			HOR02
2002 08 08.87		S	14.0	HS	44.0	L	5	226	0.4	4			HAS02
2002 08 12.91		S	13.0	HS	31.0	J	6	109	1.1	2/			BOU

Comet C/2001 OG_108 (LONEOS)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 05 15.00		M	12.6	HS	11.4	L	9	75	1.5	3			CER01

Comet P/2001 Q6 (NEAT)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2001 11 09.89	x	S	12.3:	TT	15	L	5	32	2	1			DUS
2001 11 11.81	x	S	11.2:	TT	15	L	5	32	3	1			DUS
2001 11 14.09	x	S	11.9:	TT	15	L	5	32	2	1			DUS
2001 11 16.86	x	B	11.1:	TT	15	L	5	32	2.5	1			DUS

Comet C/2001 RX_14 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 13.06		S	13.2	GA	31.0	J	6	109	0.8	3			BOU
2002 08 13.07		S	13.5	GA	31.0	J	6	109	0.8	0/			DIJ
2002 08 18.06		S	13.2	GA	31.0	J	6	109	1.0	3			BOU
2002 08 18.07		S	13.0	GA	31.0	J	6	109	1.4	2			DIJ
2002 09 07.07		M	13.2	HS	35	L	5	158	0.8	3/			HOR02
2002 09 08.08		M	13.2	HS	35	L	5	158	0.6	3			HOR02
2002 09 10.07		M	12.0	TI	42	L	5	81	1.8	3/			LEH
2002 09 12.04		M	12.3	HS	42	L	5	81	1.6	4			LEH
2002 09 12.07		M	12.7	HS	35	L	5	158	0.7	4			HOR02
2002 09 13.12		S	12.9	SK	25.4	J	6	115	0.9	3/			BOU
2002 09 14.03		M	12.9	HS	35	L	5	158	1.2	3			HOR02
2002 10 01.78	x	S	12.6	HS	32.0	L	5	91	0.8	5			NAG08
2002 10 12.80	x	S	11.7	HS	32.0	L	5	91	1.9	7			NAG08
2002 10 13.05		S	12.7	NP	25	L	5	96	1	1			SEG
2002 10 14.78	x	S	11.6	TK	25.4	L	4	113	1.2	4			YOS02
2002 10 16.79	x	S	11.7	HS	32.0	L	5	91	1.4	6			NAG08

Comet C/2001 X1 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 01 16.52		S	12.0	GA	25.4	L	4	71	4		1		SEA

Comet C/2002 E2 (Snyder-Murakami)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 03 19.75		S	10.0	AA	10.0	B		25	4				SEA
2002 03 22.72		S	9.8	AA	10.0	B		25					SEA
2002 04 23.08		S	10.4	AC	6.3	R	13	52	4	1			KOS
2002 05 15.02		M	12.2	HS	11.4	L	8	75	1.5	2			CER01
2002 05 17.02		M	12.3	HS	11.4	L	8	75	1.5	2			CER01
2002 08 08.86		S	[14.0	HS	44.0	L	5	156					HAS02

Comet C/2002 F1 (Utsunomiya)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 05 17.35		B	7.6	AA	10.0	B		25					SEA
2002 05 19.44	x	S	8.0	TK	8.0	B		20	3.5	4/			PEA
2002 05 20.35		B	7.9	AA	10.0	B		25					SEA

Comet C/2002 H2 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 05 15.01		M	12.9	HS	11.4	L	8	75	1	4			CER01

Comet C/2002 K4 (NEAT)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 11.82		B	15.0	HS	42	L	5	162	0.5	5/			LEH
2002 09 12.82		B	15.1	HS	42	L	5	162	0.5	5/			LEH

Comet C/2002 O4 (Hoenig)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 22.00		S	12.0:	TK	25.4	T	6	64	2	2			HOE
2002 07 28.88		S	10.2	TK	25.4	T	6	64	4	d3			HOE
2002 07 29.90		M	9.9	TT	35	L	5	68	4.2	3/			HOR02
2002 07 29.95		S	10.4	TK	30.5	T	10	56	> 2	2			COM
2002 07 30.71	x	S	10.0	TK	25.4	L	4	46	2.6	4/			YOS02
2002 07 30.98		S	10.2	TK	15.2	L	5	60	2.0	3			GRA04
2002 07 31.64	x	M	10.2	TT	35.0	C	14	125	1.5	4			TSU02
2002 07 31.89		M	9.6	TT	35	L	5	68	4.6	3			HOR02
2002 07 31.92		B	10.0	TJ	25.0	C	5	48	2	2			CHE03
2002 08 01.66	x	S	10.1	TK	25.4	L	4	46	2.7	4			YOS02
2002 08 02.57	x	S	9.3	TJ	10.0	B		20	6	5			NAG08
2002 08 02.86		B	10.0	TT	44.0	L	5	63	2.3	3			HAS02
2002 08 02.89		M	9.2	TT	13	L	8	69	4.9	2/			HOR02
2002 08 02.92		M	9.0	TT	8.0	B		10	8	2/			HOR02
2002 08 02.93		M	9.3	TK	25.4	J	6	47	4.0	4			BOU
2002 08 02.93		S	9.4	TK	30.5	T	10	56	3	3			COM
2002 08 03.90		S	9.5	TT	25	L	5	30	4	2			SEG
2002 08 03.92		M	9.1	TT	10	B	4	25	5	3			LEH
2002 08 03.92		S	9.3	TK	30.5	T	10	56	2.5	2/			COM
2002 08 03.97		S	9.3	TK	15.6	L	5	29	4.5	3			BOU
2002 08 03.98		M	8.8	TT	8.0	B		10	8	3			HOR02
2002 08 03.98		M	9.1	TK	15.2	L	5	44	5.0	4			GRA04
2002 08 04.00		S	9.3	TJ	8.0	B		11	6	3			GON05
2002 08 04.00		S	9.3	TK	12.0	R	8	40	5	4			SKI
2002 08 04.73	x	S	9.3	TJ	10.0	B		20	6	5			NAG08
2002 08 04.91		S	9.5	TK	20	R	14	40	2.6	3			SHA02
2002 08 04.93		M	9.1	TK	25.4	J	6	47	4.5	4			BOU
2002 08 04.95		S	9.3	HS	53.0	L	3	124	4.2	3	2.5m	332	MOR09
2002 08 04.96		S	8.9	TK	15.2	L	5	44	5.5	3			GRA04
2002 08 05.70		S	8.8	TJ	31.7	L	6	63	4.2	5/			YOS04
2002 08 05.70	x	S	9.7	TJ	31.7	L	6	63	2.8	5			MIY01
2002 08 05.86		S	9.1	AA	11	B		20	5	3			NEV
2002 08 05.88		S	9.2	TT	10.0	B		25	4.3	3			HAS02
2002 08 05.92		S	8.6	TK	15.0	R	8	30	3	3			DIE02
2002 08 05.94		B	9.2	TJ	25.0	C	5	35	4	3			CHE03
2002 08 05.94		S	8.8	TK	15.2	L	5	44	5.5	4			GRA04
2002 08 06.00		M	8.6	TT	8.0	B		10	8	3			HOR02
2002 08 06.00		M	8.7	TT	10	B	4	25	7	3			LEH
2002 08 06.90		M	7.4	SE	15	R	5	42	4.5	4			SHU
2002 08 06.92		S	8.6	TK	15.0	R	8	30	3	5			DIE02
2002 08 06.93		S	8.5	TK	20	R	14	40	5.6	4			SHA02
2002 08 06.94		B	8.5	TJ	11.0	B		20	4	4			CHE03
2002 08 06.95		S	9.0	TK	15.6	L	5	29	4.5	3/			BOU
2002 08 06.96		S	9.1:	TK	15.5	L	5	30	4	4			DIJ
2002 08 06.97		S	9.1	TT	25	L	5	30	5	3			SEG
2002 08 07.00		S	7.9	TJ	8.0	B		11	7	4			GON05
2002 08 07.00		S	8.3	TK	5.0	B		7	8	2			GRA04
2002 08 07.00		S	8.3	TK	15.2	L	5	30	7.5	3			GRA04
2002 08 07.57	x	M	8.5	TT	10.0	B		26	7	4			TSU02
2002 08 07.66	x	M	8.8	HV	15.0	B		25	6.5	4			MIT
2002 08 07.67	x	S	9.6	TJ	31.7	L	6	63	3.3	5			MIY01
2002 08 07.72		S	8.5	TJ	31.7	L	6	63	4.4	6			YOS04
2002 08 07.76	x	S	8.7	TJ	10.0	B		20	6	6			NAG08
2002 08 07.90		S	9.3	TK	20.3	L	6	48	5	3			BIV

Comet C/2002 O4 (Hoenig) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 07.95		B	8.4	TJ	11.0	B		20	5	4			CHE03
2002 08 07.96		S	8.7	TK	12.0	R	8	40	5	4/			SKI
2002 08 08.02		S	8.3	TK	5.0	B		7	7	2			GRA04
2002 08 08.14		S	8.1	TK	10.0	B		20	8	d4			HOE
2002 08 08.55	x	M	8.3	TT	10.0	B		26	4	4			TSU02
2002 08 08.71	x	S	10.0	TJ	31.7	L	6	63	4.7	5			MIY01
2002 08 08.85		B	8.8	TT	10.0	B		25	5.8	4			HAS02
2002 08 08.85		S	8.5	AA	11	B		20	7	2			NEV
2002 08 08.89		M	8.3	TT	8.0	B		10	9	2/			HOR02
2002 08 08.94		B	8.5:	TJ	11.0	B		20	5	4			CHE03
2002 08 08.99		S	8.1	TK	15.2	L	5	30	7	3			GRA04
2002 08 09.70	x	S	9.7	TJ	31.7	L	6	63	3.3	5			MIY01
2002 08 09.88		S	8.3	HV	9.0	T	11	39	6.0	3			KAM01
2002 08 09.96		B	8.2	TJ	11.0	B		20	5	4			CHE03
2002 08 09.96		S	7.8	TK	15.2	L	5	30	8	3			GRA04
2002 08 09.96		S	8.3	TK	12.0	R	8	40	6	4			SKI
2002 08 09.97		S	8.8:	TK	25.6	L	5	42	4.5	3			BIV
2002 08 10.05		M	8.3	TT	5.0	B		7	9	3			ZNO
2002 08 10.06		M	8.1	TT	8.0	B		10	10	2/			HOR02
2002 08 10.56	x	S	8.3	TJ	10.0	B		20	5	6			NAG08
2002 08 10.58		S	8.3	HS	12.0	R	5	22	3	4			MOM
2002 08 10.59	x	S	8.8	TJ	12.0	B		20	4.4	4			MIY01
2002 08 10.67	x	M	8.8	TJ	15.0	B		25	6	5			MIT
2002 08 10.84		S	9.3	TI	30.4	L	5	173	1.8	s3/			SAR02
2002 08 10.85		M	8.7	S	15	L	5	42	4	4			SHU
2002 08 10.89		M	8.1	TT	5.0	B		7	11	3			ZNO
2002 08 10.90		S	8.2	AA	6.0	B		20	9	0			CSU
2002 08 10.91		S	7.8	TK	8.0	B		20	8	3			SHA02
2002 08 10.91		S	8.5	TK	25.6	L	5	42	5	4	0.2	200	BIV
2002 08 10.92		S	8.1	TK	5.0	B		7	6	4			BIV
2002 08 10.95		S	7.9	TK	5.0	B		12	9	3			GRA04
2002 08 10.95		S	7.9	TK	15.2	L	5	30	8	3/			GRA04
2002 08 10.96		B	8.3	TJ	12.0	R	5	28	10	4			CHE03
2002 08 10.99		M	8.0	TT	8.0	B		10	9	3			HOR02
2002 08 11.59	x	M	8.5	TT	10.0	B		26	7	4			TSU02
2002 08 11.83		S	8.5	TJ	7.0	B		16	5	3			GIA01
2002 08 11.86		S	8.2	AA	11	B		20	8	4			NEV
2002 08 11.99		M	7.9	TT	6.0	B		12	12	3			ZNO
2002 08 12.01		S	8.1	TJ	8.0	B		11	7	3			GON05
2002 08 12.01		S	8.2	TJ	20.3	T	10	36	8	5			GON05
2002 08 12.50	x	S	8.4:	TK	10.0	B		20	5	4			YOS02
2002 08 12.65	x	S	8.5	TJ	15.0	B		25	3	4			HAS08
2002 08 12.79		S	8.3	TJ	7.0	B		16	7	4			GIA01
2002 08 12.86		B	8.0	TT	10.0	B		25	6.9	4			HAS02
2002 08 12.89		S	7.7	TK	8.0	B		20	10	4			SHA02
2002 08 12.90		S	8.3	TK	8.0	B		15	7	4			COM
2002 08 12.93		B	8.3	TI	8.0	B		12	10	6			SER02
2002 08 12.95		S	8.2	TK	5.0	B		7	10	4			BIV
2002 08 12.95		S	8.4	TK	25.6	L	5	42	6.5	4	0.2	180	BIV
2002 08 12.97		M	7.8	TK	8.0	B		15	9	4/			BOU
2002 08 12.97		S	8.0	TK	5.0	B		7	5	4			DIJ
2002 08 13.07		S	7.7	AA	4.2	B		7	9	3			ZAN
2002 08 13.58	x	M	8.7	TT	10.0	B		26	5	4			TSU02
2002 08 13.76	x	S	7.8	TJ	8.0	B		11	7	5			NAG08
2002 08 13.89		S	8.1	TK	15.0	R	8	30	8	7			DIE02
2002 08 13.90		S	8.2	TK	8.0	B		15	& 9	4			COM
2002 08 13.91		S	7.8	TK	10.0	B		20	8.4	3	0.3	175	MEY
2002 08 13.93		S	7.9	TK	5.0	B		7	5	4/			DIJ
2002 08 13.96		B	8.7	TI	8.0	B		12	6	5			SER02
2002 08 13.97		S	8.4	TI	6.0	B		20	8	4/			SAR02
2002 08 13.98		M	7.7	TK	15.2	L	5	30	10	4			GRA04
2002 08 13.98		S	7.6	TK	5.0	B		12	11	3			GRA04
2002 08 13.98		S	8.6	TT	8.0	B		15	&10	4			SCH04
2002 08 14.04		S	7.7	AA	4.2	B		7	9	4			ZAN
2002 08 14.89		B	8.2	TT	5.0	B		10	7.1	4			HAS02

Comet C/2002 O4 (Hoenig) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 14.91		S	7.3	TK	8.0	B		20	7	5			SHA02
2002 08 14.92		M	7.8	TK	8.0	B		15	8.5	5			BOU
2002 08 14.92		S	7.1	TK	5.0	B		7	& 5.5	4			GIL01
2002 08 14.92		S	8.2	TK	5.0	B		20	8	7			DIE02
2002 08 14.94		S	8.4	TT	8.0	B		15	&10	4			SCH04
2002 08 14.96		S	8.5	TK	5.0	B		7	5	5			BIV
2002 08 14.96		S	8.5	TK	20.3	L	6	48	4	5	0.15	160	BIV
2002 08 15.04		S	7.6	TK	5.0	B		12	10	3/			GRA04
2002 08 15.04		S	7.7	AA	4.2	B		7	9	4			ZAN
2002 08 15.05		S	8.2	TK	8.0	B		15	&10	3/			COM
2002 08 15.48	x	S	7.8:	TJ	8.0	B		11	7	5/			NAG08
2002 08 15.78	x	M	8.5	TT	10.0	B		26	8	4			TSU02
2002 08 15.83		S	8.2	TJ	7.0	B		16	8	4			GIA01
2002 08 15.84		S	7.9	TT	5.0	B		10	8.6	3			HAS02
2002 08 15.91		S	8.0	TK	5.0	B		20	8	7			DIE02
2002 08 15.95		S	7.6	TK	5.0	B		7	7	4			SKI
2002 08 15.96		S	8.1	TT	8.0	B		15	&10	4/			SCH04
2002 08 15.98		S	7.5	TK	5.0	B		7	11	4			GRA04
2002 08 16.00		S	8.1	TJ	8.0	B		11	8	3			GON05
2002 08 16.02		S	8.2	TJ	20.3	T	10	36	8	5			GON05
2002 08 16.08		M	7.7	TK	8.0	B		15	8	5			BOU
2002 08 16.11		S	8.5	TK	20.3	L	6	48	4	3			BIV
2002 08 16.12		S	8.2:	TK	5.0	B		7	5	3			BIV
2002 08 16.75	x	S	8.3	TJ	15.0	B		25	4	4/			HAS08
2002 08 16.87		S	7.8	AA	6.0	B		20	9	2			CSU
2002 08 16.88		S	8.4	HS	7.8	L	6	39	5.5	2	6.3m	162	MOR09
2002 08 16.93		S	8.0	TK	5.0	B		20	8	7			DIE02
2002 08 16.93		S	8.1	TT	8.0	B		15	&10	4			SCH04
2002 08 16.94		S	8.0:	TK	8.0	B		20	6	3			SHA02
2002 08 16.95		S	8.2	TK	8.0	B		15	& 9	4			COM
2002 08 16.96		E	8.0	AA	6.0	B		20	4	6			ROM
2002 08 17.03		M	8.1	TT	8.0	B		10	8	3/			HOR02
2002 08 17.04		S	7.7	TK	5.0	B		7	6	4/			DIJ
2002 08 17.05		B	7.9	TK	10.0	B		20	8.8	3/			MEY
2002 08 17.06		M	7.7	TK	8.0	B		15	7	5	0.6	140	BOU
2002 08 17.09		S	8.5	TK	5.0	B		7	5	4			BIV
2002 08 17.10		S	8.7	TK	25.6	L	5	42	5	4	0.1	140	BIV
2002 08 17.11		S	7.9	HV	6.3	B		9	8.5	3			KAM01
2002 08 17.83		B	8.2	TT	5.0	B		10	6.7	4			HAS02
2002 08 17.89		M	7.9	TK	10.0	B		20	8.4	3/			MEY
2002 08 17.89		S	7.5	TJ	6.0	B		20	12	2			LUE
2002 08 17.95		S	8.0	TK	5.0	B		20	7	5			DIE02
2002 08 17.96		E	7.8	AA	20	L	5	20	5	5/			ROM
2002 08 17.98		M	8.3	TT	10	B	4	25	8	3			LEH
2002 08 18.00		M	9.5	S	10	B		25					MAN02
2002 08 18.03		M	7.9	TT	8.0	B		10	10	3			HOR02
2002 08 18.04		M	7.8	TK	8.0	B		15	8	5	0.5	125	BOU
2002 08 18.04		S	7.6	TK	5.0	B		12	9	4			GRA04
2002 08 18.04		S	8.1:	TK	5.0	B		7	5	3			BIV
2002 08 18.04		S	8.3	TK	25.6	L	5	42	5	4	0.1	130	BIV
2002 08 18.05		M	7.6	TK	8.0	B		15	5.5	5			DIJ
2002 08 18.06		S	8.5	TK	11	L	8	36	5	3			BRO04
2002 08 18.08		S	9.4	TT	25	L	5	60	5	4			SEG
2002 08 18.10		S	7.8	TK	15.2	L	4	42	10	4	0.05	140	HOE
2002 08 18.10		S	7.9	TJ	8.0	B		11	6	3			GON05
2002 08 18.11		S	7.8	TT	8.0	B		15	6	4			RIE
2002 08 18.11		S	8.1	TJ	20.3	T	10	36	6	5			GON05
2002 08 18.92		M	8.3	TT	10	B	4	25	8	3			LEH
2002 08 18.97		M	8.7	S	10	B		25	7				MAN02
2002 08 18.99		E	7.6	AA	20	L	5	20	6	d5			ROM
2002 08 19.03		S	7.6	TK	5.0	B		12	9	4			GRA04
2002 08 19.07		S	7.8	TT	8.0	B		15	& 8	4/			SCH04
2002 08 19.90		B	9.0	TT	10	T	10	45	7	3			WAR01
2002 08 19.92		M	7.9	TT	10	B	4	25	9	3			LEH
2002 08 19.99		E	7.3	AA	20	L	5	20	7	5/			ROM

Comet C/2002 O4 (Hoenig) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 19.99		S	7.5	TK	5.0	B		12	10	4			GRA04
2002 08 20.04		M	7.8	TT	8.0	B		10	9	3			HOR02
2002 08 20.75	x	S	9.1	TJ	31.7	L	6	63	3.0	5			MIY01
2002 08 20.76	x	S	7.7	TJ	8.0	B		11	6	5/			NAG08
2002 08 20.83		M	7.8	TT	10	B	4	25	8	3			LEH
2002 08 21.05		M	7.8	TT	8.0	B		10	10	2/			HOR02
2002 08 21.90		S	8.7	TT	10	T	10	45	6	3			WAR01
2002 08 22.01		S	7.7	TK	7.0	R	7	24	9	3/			GRA04
2002 08 23.82		S	7.8	TT	8.0	B		10	10	2/			HOR02
2002 08 24.92		S	8.0	TK	15.2	L	5	44	7	3/			GRA04
2002 08 25.82		M	7.8	TT	8.0	B		10	10	2/			HOR02
2002 08 25.84		M	7.8	TT	10	B	4	25	9	3/			LEH
2002 08 26.81		S	8.6	AA	6.0	B		20	6	1			CSU
2002 08 26.82		M	7.7	TT	8.0	B		10	12	3			HOR02
2002 08 26.83		S	7.7	TK	10.0	B		20	8.3	3			MEY
2002 08 26.86		M	7.8	TT	10	B	4	25	9	3			LEH
2002 08 27.80		S	8.6	AA	6.0	B		20	6	1			CSU
2002 08 27.85		S	7.5	TK	8.0	B		20	9	2			SHA02
2002 08 27.86		M	7.7	TT	10	B	4	25	10	3			LEH
2002 08 28.48	x	S	8.4	TJ	8.0	B		11	5	3			NAG08
2002 08 28.80		S	8.6	AA	6.0	B		20	6	1			CSU
2002 08 28.82		M	9.4	S	6	R		30					MAN02
2002 08 28.85		S	7.5:	TK	8.0	B		20	9	2			SHA02
2002 08 28.94		S	7.8	TK	5.0	B		12	8	3			GRA04
2002 08 28.94		S	8.0	TK	15.2	L	5	44	6.5	4			GRA04
2002 08 29.45	x	S	8.8	TJ	10.0	B		20	5	3			NAG08
2002 08 29.80		S	8.6	AA	6.0	B		20	6	1			CSU
2002 08 29.83		M	7.7	TT	10	B	4	25	9	3/			LEH
2002 08 29.85		M	8.7	NP	10	R	5	17	8	4/			MAR02
2002 08 29.89		S	7.9	TJ	8.0	B		11	10	4			GON05
2002 08 29.90		S	8.0	TJ	20.3	T	10	36	10	5			GON05
2002 08 30.45	x	S	8.6	TJ	10.0	B		20	6	4			NAG08
2002 08 30.81		S	8.6	AA	6.0	B		20	6	1/			CSU
2002 08 30.83		B	8.7	TT	10.0	B		25	5.4	4			HAS02
2002 08 30.83		M	7.8	TT	8.0	B		10	12	3			HOR02
2002 08 30.85		M	7.6	TK	25.4	T	6	64	7.5	4	0.28	62	HOE
2002 08 30.86		M	8.7	NP	10	R	5	17	7	5			MAR02
2002 08 30.87		M	9.0	S	16	R		120	7				MAN02
2002 08 30.96		M	7.8	TT	10	B	4	25	9	3/			LEH
2002 08 31.85		S	9.2	TT	25	L	5	30	5	4			SEG
2002 08 31.89		S	7.8:	TT	8.0	B		15	&13	1			SCH04
2002 08 31.90		M	8.2	TK	5.0	B		12	8	3/			GRA04
2002 08 31.90		M	8.2	TK	15.2	L	5	30	7	4			GRA04
2002 08 31.92		S	8.1	TJ	8.0	B		11	9	4			GON05
2002 09 01.84		S	8.7	AA	6.0	B		20	6	1			CSU
2002 09 01.85		S	8.4	TK	8.0	B		20	6	4			SHA02
2002 09 01.86		M	8.0	TK	8.0	B		15	5	5/			BOU
2002 09 01.86		S	7.7	TK	8.0	B		15	8	5			DIJ
2002 09 01.86		S	8.2	TT	8.0	B		15	7	5			SCH04
2002 09 01.87		S	8.1	TJ	8.0	B		11	8	5			GON05
2002 09 02.83		M	8.8	S	10	B		25	8				MAN02
2002 09 02.84		S	8.1	TT	8.0	B		15	6	4			RIE
2002 09 02.85		B	8.5	TJ	12.0	R	5	28	6	3			CHE03
2002 09 02.85		S	8.5	AC	15.0	R	8	30	6	4			DIE02
2002 09 02.86		S	8.1	TJ	8.0	B		11	8	4			GON05
2002 09 02.86		S	8.5	TK	8.0	B		20	5	4			SHA02
2002 09 02.87		B	8.2	TJ	12.0	R	5	28	6	4/			SIE
2002 09 02.90		S	9.1	TT	10	T	10	45	5	4	0.1	50	WAR01
2002 09 02.93		M	7.9	TK	8.0	B		15	7	4/	0.5	52	BOU
2002 09 02.94		M	8.4	TK	15.2	L	5	30	7	4			GRA04
2002 09 02.94		S	8.3	TK	5.0	B		12	7	3			GRA04
2002 09 02.95		M	7.9	TT	8.0	B		10	12	2/			HOR02
2002 09 02.96		M	8.2	TT	10	B	4	25	8	3/			LEH
2002 09 03.48	x	S	9.1	TK	10.0	B		20	4	3/			YOS02
2002 09 03.80		S	8.0	AA	30	L	5	60	4	3	0.2	40	NEV

Comet C/2002 O4 (Hoenig) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 03.81		S	8.7	AA	6.0	B		20	6	1			CSU
2002 09 03.83		S	9.0	TT	44.0	L	5	63	3.2	4			HAS02
2002 09 03.85		M	8.2	TT	10	B	4	25	7	3/			LEH
2002 09 03.85		S	7.8	TK	25.4	T	6	64	7	d2/	0.23	47	HOE
2002 09 03.85		S	8.4	TK	8.0	B		20	5	5			SHA02
2002 09 03.88		S	9.0	HS	20.3	L	4	59	5.7	1			MOR09
2002 09 03.89		S	8.2	TK	8.0	B		15	6	4			BOU
2002 09 03.93		B	8.4	TJ	15.0	R	5	25	5	3			CHE03
2002 09 03.94		M	7.9	TT	8.0	B		10	10	2/			HOR02
2002 09 04.81		M	8.0	TT	8.0	B		10	10	2/			HOR02
2002 09 04.85		S	8.3	TK	8.0	R	5	16	6	4			GIL01
2002 09 04.88		S	8.4	TK	8.0	B		15	6	3/			BOU
2002 09 04.88		S	8.5	TK	15	L	8	45	4.4	4			SHA02
2002 09 04.89		S	8.5	TK	8.0	B		15	6.5	2			DIJ
2002 09 05.84		S	8.5	TK	15.6	L	5	24	6.5	3			BOU
2002 09 05.85		S	8.6	TK	15.6	L	5	24	6.5	2			DIJ
2002 09 06.78		M	8.0	TT	5.0	B		7	8	2/			ZNO
2002 09 06.79		M	8.2	TT	8.0	B		10	12	2/			HOR02
2002 09 06.80		M	8.8	S	15	L	5	42	4	5			SHU
2002 09 06.85		M	8.5	TK	15.6	L	5	24	6	3/			BOU
2002 09 06.85		M	8.6	TT	10	B	4	25	7	3			LEH
2002 09 06.85		S	8.6	TK	15.6	L	5	24	6	2/			DIJ
2002 09 06.88		S	8.5	TK	15.0	R	8	30	4	5			DIE02
2002 09 06.93		S	8.5	TJ	8.0	B		11	7	4			GON05
2002 09 07.17		S	8.3	TJ	8.0	B		11	7	3			GON05
2002 09 07.80		M	8.1	TT	8.0	B		10	11	3			HOR02
2002 09 07.83		M	8.6	TT	10	B	4	25	7	3			LEH
2002 09 08.10		M	8.2	HP	8.0	B		16	8	5			CRE01
2002 09 08.82		S	8.2	TT	8.0	B		10	12	2/			HOR02
2002 09 08.85		S	8.2	TK	8.0	B		20	6	4			SHA02
2002 09 08.85		S	8.6	HV	20.3	T	10	50	3.3	2/			KAM01
2002 09 08.93		S	8.5	TK	15.6	L	5	29	5.5	3/			BOU
2002 09 08.99		M	8.6	TT	10	B	4	25	7	3			LEH
2002 09 09.12		S	8.9	TT	10.0	B		25	5.9	4			HAS02
2002 09 09.87		S	8.5	TJ	8.0	B		11	6	4			GON05
2002 09 09.87		S	8.6	TK	15.0	R	8	30	4	5			DIE02
2002 09 09.87		S	8.8	NP	7.0	B		10	6	4			MAR02
2002 09 09.96		M	8.5	TT	10	B	4	25	7	3			LEH
2002 09 10.85		M	8.4	TK	15.2	L	5	30	5.5	4/			GRA04
2002 09 10.88		M	8.7	NP	21	L	6	55	6	5			MAR02
2002 09 10.88		S	8.4	TK	8.0	B		20	5	4			SHA02
2002 09 11.79		M	8.4	TT	8.0	B		10	10	3			HOR02
2002 09 11.80		S	8.8	AA	30	L	5	60	3	4	0.2	45	NEV
2002 09 11.81		M	9.0	S	15	L	5	42	3	5			SHU
2002 09 11.84		M	8.6	TK	15.6	L		24	5.5	4			BOU
2002 09 11.85		S	8.9	TK	15.6	L	5	24	5	3/			DIJ
2002 09 11.91		S	8.6	TJ	8.0	B		11	5	4			GON05
2002 09 11.92		S	8.6	TJ	20.3	T	10	36	4	5	0.12	30	GON05
2002 09 12.00		M	8.7	TT	10	B	4	25	6	2/			LEH
2002 09 12.80		M	8.5	TT	8.0	B		10	9	2/			HOR02
2002 09 12.81		M	8.3	TK	25.4	T	6	64	4.5	3	0.15	35	HOE
2002 09 12.83		S	8.4	HV	20.3	T	10	50	3.6	3			KAM01
2002 09 12.83		S	8.8	TK	15.0	R	8	48	3	4			GIL01
2002 09 12.83		S	9.7	TT	44.0	L	5	63	3.8	4			HAS02
2002 09 12.84		S	8.6	TK	8.0	B		20	3	4			SHA02
2002 09 12.85		M	8.7	TK	8.0	B		15	6	4			BOU
2002 09 12.85		S	9.0	TK	8.0	B		15	5.5	3			DIJ
2002 09 12.88		S	8.6	TT	20.0	L	4	42	6	4			SCH04
2002 09 12.97		M	8.7	TT	10	B	4	25	6	2/			LEH
2002 09 13.81		M	8.6	TT	8.0	B		10	9	3			HOR02
2002 09 13.82		S	8.8	TK	15.0	R	8	30	3	4			DIE02
2002 09 13.87		S	9.4	TK	11	L	8	36		1			BRO04
2002 09 13.89		S	9.0	TT	30.0	L	5	60	5	4			SCH04
2002 09 14.74		S	9.5:	NP	6	R	10	30	& 4				KOZ02
2002 09 14.91		M	8.8	TK	15.6	L	5	24	5.2	4			BOU

Comet C/2002 O4 (Hoenig) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 14.91		S	8.9	TK	15.6	L	5	24	4.5	3			DIJ
2002 09 17.79		S	9.0	TT	10.0	B		25	4.1	3			HAS02
2002 09 23.80		S	9.8:	TK	25.4	J	6	58	3	1			BOU
2002 09 23.81		S	10.7	TK	25.4	J	6	58	2	0/			DIJ
2002 09 23.82		S	8.9:	TK	8.0	B		20	6	2			SHA02
2002 09 24.41	x	S	[10.0:	TJ	32.0	L	5	58	! 2.0				NAG08
2002 09 25.84		S	9.1	TJ	20.3	T	10	77	3	4	0.1		GON05
2002 09 29.78		S	9.5	TT	10.0	B		25	3.1	3			HAS02
2002 09 29.79		S	9.3	TK	25.4	T	6	64	3	0			HOE
2002 09 29.79		S	10.6	TK	25.4	J	6	72	3	0/			BOU
2002 09 29.79		S	10.6	TK	25.4	J	6	72	3.5	0			DIJ
2002 10 01.73		S	10.8	AS	30	L	5	60	2.5	2			NEV

Comet C/2002 O6 (SWAN)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 02.79	x	S	7.9	TK	10.0	B		20	5	3			YOS02
2002 08 03.69		M	7.4	AA	10.0	B		25	6	5			SEA
2002 08 03.89	x	S	6.9	TK	8.0	B		20	6	3			PEA
2002 08 03.89	x	S	7.0	TK	20	L	4	45	5.5	4			PEA
2002 08 04.08		S	7.1	TT	8.0	B		10	6	3			HOR02
2002 08 04.13		S	7.2	TJ	8.0	B		11	8	3			GON05
2002 08 04.14		S	7.4	TJ	20.3	T	10	50	4	4			GON05
2002 08 04.25		S	6.5	TK	5.0	B		7	10	4			AMO01
2002 08 04.25		S	6.6	TK	8.0	B		20	10	2			AMO01
2002 08 04.71		S	6.8	TT	2.1	B		8	11	4			RAE
2002 08 04.76	xs	S	6.2	TJ	5.0	B		12	8	6			NAG08
2002 08 05.33		S	6.5	TJ	5.0	B		7	10	4/			SOU01
2002 08 05.76		S	6.3	TJ	8.0	B		11	10	4			YOS04
2002 08 05.76	x	S	6.6	TJ	8.0	B		11	10	4			MIY01
2002 08 06.71		S	6.2	TT	2.1	B		8	15	4/			RAE
2002 08 06.80		S	6.6	TT	5.0	B		7	9	4			MAT08
2002 08 06.80	x	M	7.3	TT	10.0	B		26	13	4			TSU02
2002 08 06.89	x	S	6.6	TK	8.0	B		20	11	3/			PEA
2002 08 07.13		S	7.0	TJ	8.0	B		11	9	3			GON05
2002 08 07.27		S	6.3	TK	5.0	B		7	15	3			HOD01
2002 08 07.34		S	6.6	TJ	8.0	B		11	8	4			SOU01
2002 08 07.35		S	6.6	TJ	5.0	B		7	6	3			SOU01
2002 08 07.76		S	6.0	TJ	8.0	B		11	7.5	6/			YOS04
2002 08 07.76	x	M	6.3	HV	8.0	B		11	12	5			MIT
2002 08 07.76	x	S	6.0	TJ	8.0	B		11	7.6	5/			MIY01
2002 08 07.77	xs	S	5.9	TJ	3.5	B		7	13	5/			NAG08
2002 08 07.80		S	6.5	TT	5.0	B		7	9	5			MAT08
2002 08 08.16		S	6.4	TK	10.0	B		20	17	4			HOE
2002 08 08.34		S	6.2	TK	5.0	B		10	15	3			HOD01
2002 08 08.37		M	6.2	HP	8.0	B		16	8	4			CRE01
2002 08 08.73		M	6.0	TT	2.1	B		8	14	5			RAE
2002 08 08.76	x	S	6.5	TJ	8.0	B		11	8.0	5/			MIY01
2002 08 08.77	x	B	6.0	TJ	5.0	B		7	12	5			WAT01
2002 08 09.74		M	6.0	TT	5.0	B		10	14	5			RAE
2002 08 09.76	x	S	6.6	TJ	8.0	B		11	6.0	5/			MIY01
2002 08 10.33		S	6.6	TK	5.0	B		10	10	2			HOD01
2002 08 10.34		S	6.6	YG	5.0	B		7	8	3			AMO01
2002 08 10.76		S	6.0	HS	4.0	B		8	7	5			MOM
2002 08 10.76	x	M	6.0	HV	8.0	B		11	12	5			MIT
2002 08 10.77	xs	S	6.2	TJ	5.0	B		12	9	5			NAG08
2002 08 10.99		B	6.2:	TJ	15.0	R	5	25	8	2			CHE03
2002 08 11.07		M	6.0	TT	8.0	B		10	14	2/			HOR02
2002 08 11.08		S	6.2	AA	6.0	B		20	12	2			CSU
2002 08 11.09		S	6.3	TK	5.0	B		7	5	3			BIV
2002 08 11.10		S	6.3	TK	25.6	L	5	42	5	3			BIV
2002 08 11.35		S	6.4	TK	5.0	B		7	7	3			AMO01
2002 08 11.73		M	6.3	TT	5.0	B		10	10	5			RAE
2002 08 12.09		S	6.7	TI	6.0	B		20	10	4			SAR02
2002 08 12.36		S	7.0	TJ	8.0	B		20	5	2			AMO01

Comet C/2002 O6 (SWAN) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 13.07		M	6.7	TK	8.0	B		15	9	4			BOU
2002 08 13.07		S	6.4	TJ	15	M	10	50	9	4			LUE
2002 08 13.07		S	6.6	TK	5.0	B		7	11	4			DIJ
2002 08 13.09		S	6.9	TK	25.6	L	5	42	4	5	0.2	265	BIV
2002 08 13.10		S	6.1	TK	8.0	B		20	6	5			SHA02
2002 08 13.11		S	6.1	AA	4.2	B		7	11	5/			ZAN
2002 08 13.11		S	6.7	TK	5.0	B		7	5	5			BIV
2002 08 13.11	a	B	7.1	TI	8.0	B		12	10	6			SER02
2002 08 13.77	xs	S	6.3	TJ	3.5	B		7	10	6			NAG08
2002 08 14.05		M	6.1	TK	7.0	R	7	24	8	5			GRA04
2002 08 14.05		S	6.0	TK	5.0	B		12	9	4/			GRA04
2002 08 14.11		S	5.9	AA	4.2	B		7	11	5/			ZAN
2002 08 14.13	a	B	6.1	TI	5.0	B		7	10	5			SER02
2002 08 15.05		M	6.1	TK	5.0	B		12	10	5			GRA04
2002 08 15.06		B	6.4	TT	5.0	B		10	8.0	3			HAS02
2002 08 15.07		S	6.0	TK	8.0	B		20	8	4			SHA02
2002 08 15.07	$	S	6.1	TK	8.0	B		15	&10	3/			COM
2002 08 15.11		S	5.9	AA	4.2	B		7	11	5/			ZAN
2002 08 15.12		S	6.9:	TK	5.0	B		7	5	5			BIV
2002 08 15.12		S	7.3	TK	20.3	L	6	48	5	5			BIV
2002 08 15.80	x	M	6.3	TT	3.5	B		7					TSU02
2002 08 16.09		M	6.5	TK	8.0	B		15	8	4			BOU
2002 08 16.13		S	7.1:	TK	20.3	L	6	48	4	4			BIV
2002 08 17.01		B	6.2	TT	8.0	B		11	8	6			WAR01
2002 08 17.06		S	6.0	TK	5.0	B		12	9	4/			GRA04
2002 08 17.06	$	S	6.3	TK	8.0	B		15	&10	4			COM
2002 08 17.07		M	5.8	TT	8.0	B		10	12	3			HOR02
2002 08 17.07		M	6.0	TK	10.0	B		20	9.0	5/			MEY
2002 08 17.07		S	6.3	TK	5.0	B		7	12	5			DIJ
2002 08 17.08		M	6.0	TK	8.0	B		15	7	6	0.4	310	BOU
2002 08 17.10	s	S	6.2	HV	6.3	B		9	6	6/			KAM01
2002 08 17.11		S	5.7	AA	5.0	B		20	10	7			DIE02
2002 08 17.13		S	6.3	TK	5.0	B		7	4	6			BIV
2002 08 17.14		S	6.4	TK	25.6	L	5	42	5	6	0.2	300	BIV
2002 08 17.98		S	6.2	TT	5.0	B		7	15	4			KAR02
2002 08 18.04		M	6.4	TK	5.0	B		12	8	5			GRA04
2002 08 18.07		M	5.8	TT	8.0	B		10	13	2/			HOR02
2002 08 18.07		M	6.2	TK	8.0	B		15	6	5			BOU
2002 08 18.08		M	6.2	TK	8.0	B		15	8	5			DIJ
2002 08 18.10	&	S	6.0	TT	8.0	B		15	7	5			RIE
2002 08 18.15		S	6.4	TJ	8.0	B		11	8	5			GON05
2002 08 18.16		S	6.5	TJ	20.3	T	10	36	8	6			GON05
2002 08 19.01		E	6.6	AA	20	L	5	20	6	5			ROM
2002 08 19.03		M	6.3	TK	5.0	B		12	8	5			GRA04
2002 08 19.07		M	5.9	TT	8.0	B		10	11	2/			HOR02
2002 08 19.09		M	6.0	TT	10	B	4	25	7	5			LEH
2002 08 20.10		M	5.9	TT	10	B	4	25	8	5			LEH
2002 08 20.78	x$	S	6.8	TJ	8.0	B		11	10	7			NAG08
2002 08 20.93		B	6.7	TJ	15.0	R	5	25	5	3			CHE03
2002 08 21.08		M	6.2	TT	8.0	B		10	12	3			HOR02
2002 08 21.09		M	5.9	TT	10	B	4	25	8	5			LEH
2002 08 22.07		M	6.2	TK	5.0	B		12	8	5			GRA04
2002 08 25.07		M	6.1	TK	7.0	R	7	24	6	5			GRA04
2002 08 27.85		S[	6.0:	TK	8.0	B		20					SHA02
2002 08 28.85		S	7.8	TK	15.2	L	5	44	4	5			GRA04
2002 08 28.85		S[	5.5:	TK	8.0	B		20					SHA02
2002 08 29.07		M	7.6	TK	5.0	B		12	5	5			GRA04
2002 08 29.07		M	7.7	TK	7.0	R	7	24	4.5	5			GRA04
2002 08 29.87		S	7.2	TJ	8.0	B		11	8	6			GON05
2002 08 29.87		S	7.2	TJ	20.3	T	10	36	10	6			GON05
2002 08 31.85		M	7.9	TK	5.0	B		12	4.5	5			GRA04
2002 08 31.85		M	8.0	TK	15.2	L	5	44	4	5/			GRA04
2002 09 01.84		M	8.1	TK	8.0	B		15	3.5	4/			BOU
2002 09 01.84		S	8.4	TK	8.0	B		15	3.5	4/			DIJ
2002 09 01.85		S	8.1:	TK	8.0	B		20	5	2			SHA02

Comet C/2002 O6 (SWAN) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 01.85	&	S	7.3	TT	20.0	L	4	42	6	6			SCH04
2002 09 01.86		S	7.2	TJ	8.0	B		11	7	6			GON05
2002 09 02.81		B	8.3	TJ	15.0	R	5	25	1.5	5			CHE03
2002 09 02.84		S	8.0	TK	15	L	8	45	4	2			SHA02
2002 09 02.85		M	7.9	TK	15.2	L	5	44	4	5			GRA04
2002 09 03.84		S	8.7	TK	20	T	10	75	3.4	3			SHA02
2002 09 03.89		B	8.4	TJ	12.0	R	5	28	2	5	0.1		SIE
2002 09 04.07		B	8.4:	TJ	15.0	R	5	25	1.5	5	0.1		CHE03
2002 09 06.83		S	8.2	TK	15.6	L	5	29		2			BOU
2002 09 10.18			[9.0	TJ	8.0	B		11					GON05
2002 09 10.83		B	[9.4	TK	15.2	L	5	88	! 2.5				GRA04
2002 09 12.18			[11.5	TJ	20.3	T	10	36					GON05
2002 09 13.14		S	10.0:	TK	25.4	J	6	58	2.8	1			BOU

Comet C/2002 Q2 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 01.91		S	12.0:	TK	31.0	J	6	72	2	1/			BOU
2002 09 01.91		S	12.5:	TK	31.0	J	6	72	1.3	1			DIJ
2002 09 11.86		B	14.8	HS	42	L	5	162	0.5	5			LEH
2002 09 12.84		S	12.5	HS	44.0	L	5	100	1.2	3			HAS02
2002 09 12.86		B	14.9	HS	42	L	5	162	0.4	5			LEH
2002 09 12.90		S	12.8:	HS	31.0	J	6	89	& 2	0/			BOU
2002 09 12.90		S	12.9	HS	31.0	J	6	89	1.8	0/			DIJ
2002 09 29.49			[13.0	HS	28	T	6	84					MAT08

Comet C/2002 Q5 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 11.78		B	13.7	HS	42	L	5	162	0.8	4/			LEH
2002 09 12.78		B	13.8	HS	42	L	5	162	0.7	4/			LEH
2002 09 12.93	a	S	12.6:	AC	31.0	J	6	109	1.2	3/			DIJ
2002 09 12.93	a	S	13.1	AC	31.0	J	6	109	1.0	3			BOU
2002 09 27.45		S	13.0:	HS	28	T	6	84	1	3			MAT08
2002 09 29.45		S	12.8	HS	28	T	6	84	1	3			MAT08
2002 09 29.80		S	13.0	HS	44.0	L	5	100	1.3	4			HAS02
2002 09 30.45		S	13.0:	HS	28	T	6	84	1	4			MAT08
2002 10 01.78		B	13.7	HS	42	L	5	81	0.8	3			LEH
2002 10 04.76		B	13.4	HS	42	L	5	81	0.9	3			LEH

Comet P/2002 T1 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 10 05.61			[13.0	HS	28	T	6	84					MAT08
2002 10 11.14		S	13.6:	GA	31.0	J		109	1.2	0/			DIJ

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Non-Visual Data (old format)

Comet 2P/Encke

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 19.74		C	19.8:	GA	60.0	Y	6	a240	0.2				NAK01
2002 10 02.58		C	19.8	GA	60.0	Y	6	a240	0.15				NAK01

Comet 7P/Pons-Winnecke

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 21.75	xs	C	13.3	HV	35.0	C	9	a120	0.7	5	1.0m	280	TSU02
2002 08 06.78	xs	C	13.3	HV	35.0	C	9	a120	0.6	5	1.0m	275	TSU02

Comet 22P/Kopff

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 20.46	xs	C	14.0	HV	35.0	C	9	A480	0.4	4	1.0m	59	TSU02
2002 07 21.47	xs	C	14.6	HV	35.0	C	9	a120	0.4	4			TSU02
2002 07 31.47	xs	C	13.8	HV	35.0	C	9	a120	0.6	5			TSU02
2002 07 31.47	x	C	14.2	HV	60.0	Y	6	a120	0.7				NAK01
2002 08 05.46	xs	C	14.0	HV	35.0	C	9	a120	0.5	4			TSU02
2002 08 13.47	xs	C	13.6	HV	35.0	C	9	a120					TSU02
2002 08 20.44	a	H	13.5	LA	50.0	C	12	a720	0.5	2			FUK02

Comet 28P/Neujmin

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 31.48	x	C	17.4:	TJ	60.0	Y	6	a120		9			NAK01

Comet 29P/Schwassmann-Wachmann

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 06.57		C	12.5	TJ	18.0	L	6	a 60	2.3				KAD02
2002 07 21.58		C	16.6	TJ	30.0	L	6	a 60		9			EZA
2002 07 21.65	xs	C	11.9	HV	35.0	C	9	a120	3.0	3			TSU02
2002 07 31.57		C	16.9	TJ	30.0	L	6	a 60		9			EZA
2002 08 01.57	xs	C	14.4	HV	35.0	C	9	a120	0.8	3			TSU02
2002 08 05.54		C	13.3	TJ	30.0	L	6	a 60	0.6				EZA
2002 08 05.63	a	C	11.5	GA	60.0	Y	6	a120	3.8	8			NAK01
2002 08 05.63	a	C	12.3	GA	60.0	Y	6	a120	+ 0.55				NAK01
2002 08 05.65		C	12.3	TJ	18.0	L	6	a 60	0.8				KAD02
2002 08 06.54	xs	C	12.3	HV	35.0	C	9	a120	0.5	8			TSU02
2002 08 06.63		C	12.8	TJ	30.0	L	6	a 60	0.6				EZA
2002 08 07.63	a	C	11.4	GA	60.0	Y	6	a120	3.7	7/			NAK01
2002 08 07.63	a	C	12.4	GA	60.0	Y	6	a120	+ 0.75				NAK01
2002 08 11.59	xs	C	12.4	HV	35.0	C	9	a120	1.2	5			TSU02
2002 08 13.59	xs	C	12.2	HV	35.0	C	9	a120	1.3	5			TSU02
2002 08 27.64		C	12.9	TJ	18.0	L	6	a 90	1.8				KAD02
2002 08 29.57		C	12.8	TJ	30.0	L	6	a240	1.1				EZA
2002 09 05.62	a	C	12.2	GA	60.0	Y	6	a120	2.6	2			NAK01
2002 09 05.62	a	c	15.9	GA	60.0	Y	6	a120					NAK01
2002 09 08.56	a	C	12.1:	GA	60.0	Y	6	a120	2.2	7			NAK01
2002 09 08.56	a	c	15.4:	GA	60.0	Y	6	a120					NAK01
2002 09 09.59		C	13.8	TJ	30.0	L	6	a120	0.9	8			EZA
2002 09 12.62	a	C	12.5	GA	60.0	Y	6	a120	2.7	5			NAK01
2002 09 12.62	a	c	16.1	GA	60.0	Y	6	a120					NAK01
2002 09 19.52	a	H	12.6	LA	50.0	C	12	a360	0.7	3			FUK02
2002 09 19.55	a	V	14.0	LA	50.0	C	12	a600	0.5	3			FUK02
2002 09 23.50		C	14.0	TJ	30.0	L	6	a120	0.9	8			EZA
2002 09 23.52		c	16.6	TJ	30.0	L	6	a120					EZA
2002 09 23.52	xa	C	12.9	HV	35.0	C	9	a 90	1.2	5			TSU02
2002 09 24.53	xa	C	13.3	HV	35.0	C	9	a120	1.0	6			TSU02
2002 10 02.53	a	C	12.6:	GA	60.0	Y	6	a120	2.1	6			NAK01
2002 10 02.53	a	c	15.3:	GA	60.0	Y	6	a120					NAK01
2002 10 03.53	x	C	15.0	TJ	20.0	L	4	a120	0.2	4/			OHS
2002 10 05.49	x	C	15.2	TJ	20.0	L	4	a120	0.2	4/			OHS
2002 10 10.48	xa	C	13.6	HV	35.0	C	9	a120	1.4	5			TSU02
2002 10 10.49		C	15.0	TJ	30.0	L	6	a120	0.55	4			EZA
2002 10 10.50		c	17.5	TJ	30.0	L	6	a120					EZA
2002 10 11.48		C	12.7	GA	60.0	Y	6	a120	2.3	4			NAK01
2002 10 11.48		c	15.8	GA	60.0	Y	6	a120					NAK01

Comet 30P/Reinmuth

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 10 11.79		C	16.5	HS	25.0	L	5	a120	0.4		0.5m	264	KAD02
2002 10 12.80		C	16.3	HS	25.0	L	5	a120	0.4		0.7m	267	KAD02

Comet 36P/Whipple

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 07.67		C	19.3	GA	60.0	Y	6	a240	0.2				NAK01

Comet 46P/Wirtanen

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 20.77		C	14.4	HS	25.0	L	5	a 60	0.6				KAD02
2002 08 06.78		C	13.7	TJ	18.0	L	6	a 90	0.8				KAD02
2002 08 08.77		C	13.0	TJ	25.0	L	5	a 90	1.1		0.8m	267	KAD02
2002 08 10.78		C	12.6	TJ	25.0	L	5	a 90	1.2		0.9m	270	KAD02
2002 08 20.77		C	12.2	TJ	18.0	L	6	a 90	1.3		1.0m	284	KAD02
2002 08 20.77	x	C	12.5	TJ	20.0	L	4	a120	& 0.5				OHS
2002 10 01.79		C	11.3	TJ	18.0	L	6	a 90	1.8		3.8m	293	KAD02
2002 10 05.76	x	C	10.9	TJ	20.0	L	4	a120	1.0		& 0.9m	300	OHS
2002 10 10.84	xa	C	12.1	HV	35.0	C	9	a 60	1.4	5	4.0m	293	TSU02
2002 10 12.81		C	13.7	TJ	30.0	L	6	a 60	0.4		0.7m	300	EZA
2002 10 14.84	xa	C	13.3:	HV	35.0	C	9	a 90	0.8	4	1.2m	297	TSU02

Comet 54P/de Vico-Swift-NEAT

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 10 14.61		C	18.5	GA	60.0	Y	6	a240	0.25				NAK01

Comet 57P/du Toit-Neujmin-Delporte (component A)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 14.60		C	14.3	TJ	18.0	L	6	a180	0.7		1.2m	240	KAD02
2002 07 20.61		C	14.2	HS	25.0	L	5	a 90	0.8		1.3m	236	KAD02
2002 07 21.57		C	14.5	TJ	30.0	L	6	a 60	0.5				EZA
2002 07 21.63	xs	C	13.5	HV	35.0	C	9	a120	0.7	4	1.5m	240	TSU02
2002 07 27.61		C	14.4:	TJ	18.0	L	6	a180	0.6				KAD02
2002 07 31.56		C	14.8	TJ	30.0	L	6	a 60	0.5				EZA
2002 07 31.60	xs	C	13.6	HV	35.0	C	9	a120	0.7	5			TSU02
2002 08 05.53		C	14.8	TJ	30.0	L	6	a300	0.6				EZA
2002 08 05.57	xs	C	13.7	HV	35.0	C	9	a120	0.8	5			TSU02
2002 08 05.59		C	13.5	GA	60.0	Y	6	a240	1.6				NAK01
2002 08 06.62		C	14.9	TJ	30.0	L	6	a 60	0.4				EZA
2002 08 10.59		C	14.0	TJ	25.0	L	5	a 60	0.75				KAD02
2002 08 13.55	xs	C	13.9	HV	35.0	C	9	a180	0.4	5			TSU02
2002 08 15.48	xs	C	14.2	HV	35.0	C	9	a120	0.5	5			TSU02
2002 08 29.56		C	14.9	TJ	30.0	L	6	a300	0.5				EZA
2002 09 08.55		C	14.1:	GA	60.0	Y	6	a120	1.0			80	NAK01
2002 09 09.57		C	15.3	TJ	30.0	L	6	a120	0.5				EZA
2002 09 19.62	a	H	14.7	LA	50.0	C	12	a240	0.2	3			FUK02
2002 09 20.50	a	H	15.0	LA	50.0	C	12	A440	0.3	4			FUK02
2002 09 20.56	a	V	16.1	LA	50.0	C	12	A080	0.4	4			FUK02
2002 09 23.54	xa	C	14.8	HV	35.0	C	9	a 90	0.6	4	0.7m	83	TSU02
2002 10 05.48	xa	C	15.8	HV	35.0	C	9	a720	0.5	4			TSU02
2002 10 10.49	xa	C	15.5	HV	35.0	C	9	a120					TSU02
2002 10 10.50	x	C	15.2	TJ	20.0	L	4	a120	0.2	3			OHS
2002 10 10.51		C	16.7	TJ	30.0	L	6	a120	0.4				EZA
2002 10 11.49		C	15.7	GA	60.0	Y	6	a120	0.6			70	NAK01

Comet 67P/Churyumov-Gerasimenko

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 20.76		C	14.2:	HS	25.0	L	5	a 60	0.4				KAD02
2002 08 10.74		C	13.7	TJ	25.0	L	5	a 60	0.5		1.0m	273	KAD02
2002 08 20.76		C	13.1	TJ	18.0	L	6	a 90	0.7		0.8m	274	KAD02
2002 10 05.73	x	C	13.8	TJ	20.0	L	4	a120	0.9		1.4m	295	OHS
2002 10 12.78		C	14.6	TJ	30.0	L	6	a 60	0.5				EZA
2002 10 14.83	xa	C	13.3	HV	35.0	C	9	a 90	0.8	4	9.0m	288	TSU02

Comet 81P/Wild

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 12.75		C	19.1	GA	60.0	Y	6	a240	0.15				NAK01
2002 10 11.66		C	17.8	GA	60.0	Y	6	a240	0.2	8	0.8m	275	NAK01

Comet 89P/Russell

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 19.72	a	C	17.0	GA	60.0	Y	6	a240	0.5			250	NAK01
2002 09 12.66	a	C	17.1	GA	60.0	Y	6	a240	0.35			50	NAK01
2002 10 10.54	xa	C	17.4	HV	35.0	C	9	a840	0.3	3			TSU02
2002 10 11.58		C	17.2	GA	60.0	Y	6	a240	0.4				NAK01

Comet 90P/Gehrels

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 10 10.80	xa	C	16.8	HV	35.0	C	9	a120	0.4	3			TSU02
2002 10 15.73		C	16.7	TJ	30.0	L	6	a180	0.3				EZA

Comet 92P/Sanguin

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 21.67	xs	C	16.2	HV	35.0	C	9	a180	0.3	5	0.6m	243	TSU02
2002 08 05.55	xs	C	15.0	HV	35.0	C	9	a120	0.4	5			TSU02
2002 08 05.64		C	14.8	GA	60.0	Y	6	a120	0.55			225	NAK01
2002 08 10.65		C	15.0	TJ	25.0	L	5	a 60	0.55		0.6m	225	KAD02
2002 08 19.68		C	14.5	GA	60.0	Y	6	a120	0.85				NAK01
2002 08 20.64		C	14.4	TJ	18.0	L	6	a120	0.65				KAD02
2002 09 12.64		C	13.7	GA	60.0	Y	6	a120	1.5				NAK01
2002 09 23.58	xa	C	13.4	HV	35.0	C	9	a 90	0.7	6			TSU02
2002 10 03.56	x	C	14.1	TJ	20.0	L	4	a120	0.54				OHS
2002 10 05.57		C	13.6	GA	60.0	Y	6	a120	1.3				NAK01
2002 10 09.53	xa	C	13.8	HV	35.0	C	9	a 90	0.7	5			TSU02
2002 10 10.51	xa	C	13.9	HV	35.0	C	9	a 60	0.6	5			TSU02
2002 10 10.53		C	14.0	TJ	30.0	L	6	a120	0.7	8			EZA
2002 10 10.55	x	C	13.1	TJ	20.0	L	4	a 90	0.3				OHS

Comet 107P/Wilson-Harrington

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 10 25.78		C	18.2:	EC	60.0	Y	6	a 60		9			NAK01
1996 05 12.66	a	C	19.1	GA	60.0	Y	6	a240		9			NAK01
1996 05 22.59	a	C	18.9	GA	60.0	Y	6	a240		9			NAK01
1996 06 15.56		C	19.2	GA	60.0	Y	6	a240		9			NAK01

Comet 118P/Shoemaker-Levy

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 19.70		C	18.6	GA	60.0	Y	6	a240	0.2				NAK01
2002 09 05.69		C	18.3:	GA	60.0	Y	6	a240	0.25				NAK01
2002 10 02.59		C	17.7	GA	60.0	Y	6	a240	0.25				NAK01
2002 10 10.56	xa	C	17.0	HV	35.0	C	9	A080	0.3	4			TSU02

Comet 153P/Ikeya-Zhang

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 21.46		C	14.4	TJ	30.0	L	6	a 60	0.6				EZA
2002 07 21.55	x	C	11.9	HV	35.0	C	9	a120	2.0	4			TSU02
2002 07 31.51		C	11.6:	GA	60.0	Y	6	a120	2.5				NAK01
2002 07 31.53	x	C	13.9:	HV	35.0	C	9	a120	0.8	4			TSU02
2002 08 01.52	x	C	12.5	HV	35.0	C	9	a120	1.2	4			TSU02
2002 08 05.47	xs	C	12.8	HV	35.0	C	9	a120	1.8	4	8.5m	311	TSU02
2002 08 06.54		C	15.8	TJ	30.0	L	6	a120	0.3				EZA
2002 08 07.49	s	H	14.4	LA	50.0	C	12	A800	0.8	5	1.1m	53	FUK02
2002 08 13.50	xs	C	13.8	HV	35.0	C	9	a540	1.0	4			TSU02
2002 08 20.49	a	H	14.8	LA	50.0	C	12	A800	0.3	3	1.1m	64	FUK02
2002 08 21.44		C	16.0	TJ	30.0	L	6	a180	0.3				EZA

Comet 153P/Ikeya-Zhang [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 01.49	x	C	14.8	TJ	20.0	L	4	a120	0.15				OHS
2002 09 20.42	a	H	16.0	LA	50.0	C	12	a120	0.3	2			FUK02
2002 10 02.42	a	C	15.7:	GA	60.0	Y	6	a120	0.5				NAK01
2002 10 11.40	xa	C	16.7:	HV	35.0	C	9	a540	0.3	3			TSU02

Comet 154P/Brewington

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 10 02.46	a	C	17.0:	GA	60.0	Y	6	a120	0.35				NAK01

Comet 155P/Shoemaker

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 09.79	!	k	18.0	LA	103.0	C	4	a120	0.15				ORI
2002 09 12.81		C	18.6	GA	60.0	Y	6	a120	0.2				NAK01
2002 10 10.82	xa	C	16.7	HV	35.0	C	9	a540	0.3	3			TSU02
2002 10 14.75		C	17.2	GA	60.0	Y	6	a120	0.25		1.3m	279	NAK01

Comet C/1997 BA_6 (Spacewatch)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 12.65		C	18.1	GA	60.0	Y	6	a240	0.25				NAK01

Comet C/2000 CT_54 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 12.68		C	17.1	GA	60.0	Y	6	a240	0.4		0.9m	195	NAK01
2002 10 05.59		C	16.9	GA	60.0	Y	6	a240	0.45				NAK01
2002 10 14.55		C	17.1	GA	60.0	Y	6	a240	0.4				NAK01

Comet C/2000 SV_74 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 21.49	xs	C	14.9	HV	35.0	C	9	a120	0.3	5			TSU02
2002 07 31.50	xs	C	14.3	HV	35.0	C	9	a120	0.6	5			TSU02
2002 09 23.43	xa	C	15.2	HV	35.0	C	9	a120	0.3	4			TSU02

Comet C/2000 WM_1 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 06.56		C	14.7	TJ	18.0	L	6	a 60	0.7		0.8m	151	KAD02
2002 07 07.56	xs	C	14.5	HV	35.0	C	9	a120	0.4	4			TSU02
2002 07 21.50		C	15.6	TJ	30.0	L	6	a 60	0.3				EZA
2002 07 21.59	xs	C	15.8	HV	35.0	C	9	a120	0.6	4			TSU02
2002 07 31.59	xs	C	15.2	HV	35.0	C	9	a600	0.3	3			TSU02
2002 08 07.57		C	15.5	GA	60.0	Y	6	a120	0.9		1.1m	121	NAK01
2002 08 13.55	s	C	15.2	HV	35.0	C	9	a180	0.4				TSU02

Comet C/2000 Y1 (Tubbiolo)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 10 14.64		C	20.2:	GA	60.0	Y	6	a240	0.15				NAK01

Comet C/2001 HT_50 (LINEAR-NEAT)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 10 01.81		C	14.6	TJ	18.0	L	6	a 90	0.45				KAD02
2002 10 03.81		C	14.5	TJ	18.0	L	6	a 90	0.4				KAD02
2002 10 05.80	x	C	14.8	TJ	20.0	L	4	a120	0.4				OHS
2002 10 10.83	xa	C	14.3	HV	35.0	C	9	a 90	0.4	5			TSU02
2002 10 11.76	x	C	15.2	TJ	20.0	L	4	a120	0.2				OHS
2002 10 12.80		C	15.5	TJ	30.0	L	6	a 60	0.4				EZA

Comet C/2001 K5 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 06.52		C	14.1	TJ	18.0	L	6	a 60	0.5		1.3m	190	KAD02
2002 07 07.55	xs	C	14.5	HV	35.0	C	9	a 60	0.3	6	1.6m	194	TSU02
2002 07 12.64		C	14.5	TJ	18.0	L	6	a180	0.3		0.7m	187	KAD02
2002 07 14.58		C	14.3	TJ	18.0	L	6	a 90	0.45		1.1m	185	KAD02
2002 07 20.53		C	14.3	TJ	18.0	L	6	a120	0.5		1.6m	188	KAD02
2002 07 21.47		C	14.4	TJ	30.0	L	6	a 60	0.3	8	0.5m	180	EZA
2002 07 21.59	xs	C	14.3	HV	35.0	C	9	a120	0.3	7	2.0m	194	TSU02
2002 07 27.55		C	14.4	TJ	18.0	L	6	a120	0.45		0.6m	186	KAD02
2002 07 31.55	xs	C	14.6	HV	35.0	C	9	a120	0.3	7	1.8m	193	TSU02
2002 08 01.55	xs	C	14.5	HV	35.0	C	9	a120					TSU02
2002 08 05.49	xs	C	14.6	HV	35.0	C	9	a120	0.3	7	2.3m	192	TSU02
2002 08 05.50		C	14.3	GA	60.0	Y	6	a120	0.45		2.5m	190	NAK01
2002 08 06.57		C	14.5	TJ	30.0	L	6	a 60	0.3				EZA
2002 08 13.52	s	C	14.4	HV	35.0	C	9	a120	0.25	7	2.2m	193	TSU02
2002 08 21.48		C	14.7	TJ	30.0	L	6	a 60	0.3		1.0m	190	EZA
2002 08 29.50		C	14.6	TJ	30.0	L	6	a300	0.3		1.3m	190	EZA
2002 09 23.45	xa	C	14.4	HV	35.0	C	9	a 60	0.3	6	1.8m	197	TSU02
2002 10 05.40	a	H	13.4	LA	50.0	C	12	B160	0.27	7	0.3m	187	FUK02
2002 10 05.45	xa	C	14.1	HV	35.0	C	9	a 90	0.3	5	0.8m	199	TSU02
2002 10 10.40	xa	C	14.6	HV	35.0	C	9	a120	0.3	5	1.1m	198	TSU02
2002 10 10.42	a	H	13.8	LA	50.0	C	12	C600	0.40	7	2.2m	196	FUK02
2002 10 10.46		C	14.6	TJ	30.0	L	6	a360	0.37		1.0m	195	EZA
2002 10 10.46	a	V	14.5	LA	50.0	C	12	A440	0.40	7	0.7m	185	FUK02
2002 10 11.42		C	14.4	GA	60.0	Y	6	a120	0.5		2.1m	199	NAK01
2002 10 12.41	a	H	13.8	LA	50.0	C	12	B160	0.43	7	2.1m	198	FUK02
2002 10 12.44	a	V	14.6	LA	50.0	C	12	A800	0.40	7	1.5m	197	FUK02
2002 10 13.44	a	H	13.8	LA	50.0	C	12	B520	0.41	6	1.8m	197	FUK02
2002 10 13.47	a	V	13.8	LA	50.0	C	12	A080	0.36	6	1.2m	200	FUK02

Comet C/2001 M10 (NEAT)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 07.68		C	18.7	GA	60.0	Y	6	a240	0.25		0.6m	222	NAK01
2002 10 02.56		C	18.6	GA	60.0	Y	6	a240	0.2				NAK01

Comet C/2001 N2 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 06.55		C	13.8	TJ	18.0	L	6	a 60	0.8				KAD02
2002 07 07.63		C	14.3	TJ	18.0	L	6	a120	0.75		1.0m	73	KAD02
2002 07 12.67		C	14.6	TJ	18.0	L	6	a180	0.65				KAD02
2002 07 20.51		C	14.7	TJ	18.0	L	6	a120	0.7				KAD02
2002 07 21.55	xs	C	14.1	HV	35.0	C	9	a120	0.5	5	2.0m	81	TSU02
2002 07 27.57		C	15.1	TJ	18.0	L	6	a180	0.5				KAD02
2002 07 31.53	xs	C	14.8	HV	35.0	C	9	a120	0.5	4			TSU02
2002 08 01.53	xs	C	14.1	HV	35.0	C	9	a120	0.4	4			TSU02
2002 08 05.51		C	15.1	GA	60.0	Y	6	a120	0.65		3.2m	75	NAK01
2002 08 06.55		C	15.1	TJ	30.0	L	6	a 60	0.3				EZA
2002 08 13.51	xs	C	15.3	HV	35.0	C	9	a180	0.4	4			TSU02
2002 08 21.46		C	16.1	TJ	30.0	L	6	a240	0.3				EZA
2002 09 01.50	x	C	16.0	TJ	20.0	L	4	a120	0.15				OHS

Comet C/2001 Q4 (NEAT)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 05.80	xs	C	16.7:	HV	35.0	C	9	a240	0.3				TSU02
2002 08 06.80	xs	C	16.9	HV	35.0	C	9	a840	0.3	4			TSU02
2002 09 12.74	x	C	16.6	TJ	60.0	Y	6	a120	0.3			315	NAK01
2002 10 05.69	x	C	16.4	HV	60.0	Y	6	a120	0.35			320	NAK01
2002 10 14.66	x	C	16.2	HV	60.0	Y	6	a120	0.45			330	NAK01

Comet C/2001 RX_14 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 23.78		C	14.0	TJ	30.0	L	6	a 60	0.5				EZA

Comet C/2001 RX_14 (LINEAR) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 06.69		C	14.0	TJ	30.0	L	6	a 60	0.4				EZA
2002 08 10.72		C	13.9	TJ	25.0	L	5	a 90	0.4		1.5m	269	KAD02
2002 08 15.76	xs	C	14.2	HV	35.0	C	9	a120	0.4	6	6.0m	269	TSU02
2002 08 20.71		C	13.8	TJ	18.0	L	6	a120	0.55		2.7m	271	KAD02
2002 09 12.78		C	14.1	GA	60.0	Y	6	a120	0.75		> 7.3m	282	NAK01
2002 10 05.74	x	C	12.9	TJ	20.0	L	4	a120	0.8		8.5m	295	OHS
2002 10 10.66		C	13.5	TJ	30.0	L	6	a600	0.55		8.0m	295	EZA
2002 10 10.80	xa	C	13.2	HV	35.0	C	9	a 90	0.8	5	10.5m	292	TSU02
2002 10 12.77		C	12.9	TJ	30.0	L	6	a300	0.91		8.0m	295	EZA
2002 10 14.77		C	13.1	GA	60.0	Y	6	a120	1.2		>10.6m	296	NAK01
2002 10 14.80	xa	C	13.2	HV	35.0	C	9	a 60	0.8	5	11.0m	299	TSU02
2002 10 15.74		C	12.9	TJ	30.0	L	6	a 60	0.9		8.0m	300	EZA

Comet C/2001 T4 (NEAT)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 12.72		C	19.5	GA	60.0	Y	6	a240	0.2				NAK01
2002 10 05.68		C	19.5	GA	60.0	Y	6	a240	0.2				NAK01
2002 10 14.58		C	19.7	GA	60.0	Y	6	a240	0.2				NAK01

Comet C/2001 U6 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 12.61		C	18.1	GA	60.0	Y	6	a240	0.2		0.7m	4	NAK01
2002 10 11.55		C	17.8	GA	60.0	Y	6	a240	0.3		1.3m	5	NAK01

Comet P/2002 BV (Yeung)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 05.48	x	C	18.7	TJ	60.0	Y	6	a120		9			NAK01

Comet C/2002 C2 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 12.76		C	17.8	GA	60.0	Y	6	a240	0.5				NAK01
2002 10 14.71		C	17.5	GA	60.0	Y	6	a240	0.3				NAK01

Comet C/2002 E2 (Snyder-Murakami)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 21.49		C	15.5	TJ	30.0	L	6	a120	0.3	3			EZA
2002 07 21.52	xs	C	15.8	HV	35.0	C	9	A200	0.6	3			TSU02
2002 07 31.52	xs	C	16.2	HV	35.0	C	9	a720	0.4	3			TSU02
2002 08 05.61		C	16.2	TJ	30.0	L	6	a120	0.3				EZA
2002 10 11.41		C	16.3	GA	60.0	Y	6	a120	0.3				NAK01

Comet C/2002 H2 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 21.50	xs	C	18.1:	HV	35.0	C	9	A080	0.3	2			TSU02

Comet C/2002 J4 (NEAT)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 31.50		C	17.4:	GA	60.0	Y	6	a240	0.35				NAK01

Comet P/2002 JN_16 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 05.49		C	17.5	GA	60.0	Y	6	a120	0.25			105	NAK01

Comet C/2002 K1 (NEAT)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 05.57		C	18.7:	GA	60.0	Y	6	a240	0.25				NAK01

Comet C/2002 K1 (NEAT) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 10 11.45		C	18.7:	GA	60.0	Y	6	a240	0.2				NAK01

Comet C/2002 K2 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 05.52		C	18.8	GA	60.0	Y	6	a240	0.25				NAK01
2002 09 08.48		C	18.9	GA	60.0	Y	6	a240	0.2				NAK01

Comet C/2002 K4 (NEAT)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 06.68		C	16.5	TJ	18.0	L	6	a120	0.3				KAD02
2002 08 05.56		C	16.5:	GA	60.0	Y	6	a120	0.3				NAK01
2002 08 07.61		C	16.7:	GA	60.0	Y	6	a120	0.25				NAK01
2002 10 02.48		C	18.3	GA	60.0	Y	6	a240	0.25				NAK01

Comet C/2002 L9 (NEAT)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 07.58	a	C	17.2:	GA	60.0	Y	6	a240	0.3				NAK01

Comet C/2002 O4 (Hoenig)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 07 30.69		C	12.6	TJ	30.0	L	6	a180	0.7		1.0m	220	EZA
2002 07 31.56		C	12.2	TJ	30.0	L	6	a 30	0.7				EZA
2002 07 31.58	xs	C	10.7	HV	35.0	C	9	a 60	3.6	4	5.0m	208	TSU02
2002 08 05.58		C	11.4	TJ	30.0	L	6	a180	0.9		2.6m	215	EZA
2002 08 05.60	xs	C	10.7	HV	35.0	C	9	a 60	3.5	4	3.5m	210	TSU02
2002 08 06.66		C	11.6	TJ	30.0	L	6	a 30	0.9				EZA
2002 08 07.60	s	H	10.2	LA	50.0	C	12	B160	4.2	6	6.1m	198	FUK02
2002 08 07.63	s	V	9.0	LA	50.0	C	12	A800	6.4	6	3.6m	199	FUK02
2002 08 12.57		C	10.4	TJ	30.0	L	6	a120	2.0				EZA
2002 08 20.56	a	H	10.1	LA	50.0	C	12	B160	4.5	6	>10.9m	100	FUK02
2002 08 20.61		C	10.0	TJ	18.0	L	6	a 40	3.5		3.0m	105	KAD02
2002 08 21.49		C	11.3	TJ	30.0	L	6	a150	1.1		2.0m	100	EZA
2002 09 01.52	x	C	10.2	TJ	20.0	L	4	a120	1.2		3.6m	54	OHS
2002 09 20.40	a	H	14.1	LA	50.0	C	12	a600	0.28	2	0.7m	27	FUK02

Comet P/2002 O5 (NEAT)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 05.47		C	16.7	GA	60.0	Y	6	a120	0.35			120	NAK01
2002 08 06.53	xs	C	16.6	HV	35.0	C	9	a600	0.2	4			TSU02
2002 08 10.55		C	16.7	TJ	25.0	L	5	a120	0.3				KAD02

Comet C/2002 O6 (SWAN)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 02.75		C	10.5:	TJ	18.0	L	6	a 30	1.8				KAD02
2002 08 05.78		C	9.0	TJ	18.0	L	6	a 30	2.5				KAD02
2002 08 05.78	xs	C	8.6	HV	35.0	C	9	a 60	5.5	4	13 m	250	TSU02
2002 08 07.79	s	H	7.7	LA	50.0	C	12	a135	6.5	6	> 9.4m	254	FUK02
2002 08 07.79	s	V	6.7	LA	50.0	C	12	a105	8.1	6	>11.3m	255	FUK02
2002 08 20.79		C	8.0	TJ	18.0	L	6	a 30	4.7		>21 m	230	KAD02
2002 08 20.79	x	C	9.0	TJ	20.0	L	4	a120	& 2		&0.13	229	OHS
2002 08 28.79		C	9.5	TJ	18.0	L	6	a 40	1.9		>16 m	358	KAD02
2002 08 30.79		C	9.8:	TJ	18.0	L	6	a 60	1.8		7.0m	1	KAD02
2002 08 31.80		C	9.5	TJ	18.0	L	6	a 40	2.4		7.6m	2	KAD02

Comet C/2002 O7 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 06.49	xs	C	17.2:	HV	35.0	C	9	A620	0.3	3			TSU02
2002 08 07.55	a	C	18.9	GA	60.0	Y	6	a240	0.2				NAK01

Comet P/2002 08 (NEAT)

DATE (UT)	N MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 07.56	a C	17.1	GA	60.0	Y	6	a120	0.25				NAK01
2002 09 08.57	a C	17.2:	GA	60.0	Y	6	a240	0.3				NAK01

Comet C/2002 P1 (NEAT)

DATE (UT)	N MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 05.64	C	18.6:	GA	60.0	Y	6	a240	0.2				NAK01
2002 10 02.54	C	19.3	GA	60.0	Y	6	a240	0.2				NAK01
2002 10 10.50	xa C	18.5:	HV	35.0	C	9	a480	0.3	3			TSU02
2002 10 11.52	C	19.1	GA	60.0	Y	6	a240	0.2				NAK01

Comet P/2002 Q1 (Van Ness)

DATE (UT)	N MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 20.76	C	16.7:	HS	25.0	L	5	a120	0.4		0.6m	262	KAD02
2002 09 12.80	C	17.0	GA	60.0	Y	6	a240	0.45		1.2m	282	NAK01
2002 10 14.78	a C	17.4	GA	60.0	Y	6	a240	0.45				NAK01

Comet C/2002 Q2 (LINEAR)

DATE (UT)	N MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 08.51	C	14.6	GA	60.0	Y	6	a120	1.3	1			NAK01
2002 09 09.53	C	14.6	TJ	30.0	L	6	a120	0.6	2			EZA
2002 09 12.56	C	15.1	GA	60.0	Y	6	a120	1.2	1/			NAK01

Comet C/2002 Q3 (LINEAR)

DATE (UT)	N MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 09 08.52	C	15.1	GA	60.0	Y	6	a120	0.85	0/			NAK01
2002 09 12.58	C	15.7	GA	60.0	Y	6	a120	0.95	0/			NAK01

Comet C/2002 Q5 (LINEAR)

DATE (UT)	N MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 08 30.49	C	15.4	TJ	25.0	L	5	a 90	0.3		0.4m	137	KAD02
2002 09 08.54	C	14.7	GA	60.0	Y	6	a120	0.75			100	NAK01
2002 09 09.51	C	14.3	TJ	30.0	L	6	a120	0.6				EZA
2002 09 12.55	C	14.6	GA	60.0	Y	6	a120	0.9			100	NAK01
2002 09 23.48	xa C	14.0	HV	35.0	C	9	a 60	0.6	5			TSU02
2002 10 02.47	C	13.4	GA	60.0	Y	6	a120	1.4		1.4m	75	NAK01
2002 10 05.40	xa C	13.2	HV	35.0	C	9	a 90	0.8	5			TSU02
2002 10 10.47	C	14.4	TJ	30.0	L	6	a120	0.37				EZA
2002 10 11.42	xa C	13.9	HV	35.0	C	9	a 90	0.8	4			TSU02
2002 10 11.44	C	12.9:	GA	60.0	Y	6	a120	1.9		1.6m	85	NAK01

Comet C/2002 R3 (LONEOS)

DATE (UT)	N MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 10 05.67	C	17.6	GA	60.0	Y	6	a240	0.3	8			NAK01
2002 10 11.65	C	17.2	GA	60.0	Y	6	a240	0.3	8			NAK01
2002 10 14.63	C	17.3	GA	60.0	Y	6	a240	0.3	8			NAK01

Comet P/2002 S1 (Skiff)

DATE (UT)	N MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 10 14.74	C	18.1	GA	60.0	Y	6	a240	0.3		1.0m	278	NAK01

Comet P/2002 T1 (LINEAR)

DATE (UT)	N MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2002 10 05.58	C	15.9	GA	60.0	Y	6	a120	0.3	8			NAK01
2002 10 10.58	xa C	17.1	HV	35.0	C	9	a120	0.2	7			TSU02
2002 10 11.62	C	16.0	GA	60.0	Y	6	a120	0.3	8	0.6m	210	NAK01
2002 10 12.76	C	15.8	TJ	30.0	L	6	a 60	0.4	8			EZA
2002 10 14.54	C	16.3	GA	60.0	Y	6	a120	0.3	8	0.9m	201	NAK01
2002 10 15.69	C	16.1	TJ	30.0	L	6	a 60	0.4	8			EZA

2003 Comet Handbook

The *ICQ*'s *2003 Comet Handbook* is being issued within a week of this October regular issue. The 2003 edition contains orbital elements, magnitude parameters, and ephemerides for about 140 comets predicted to be brighter than mag ≈ 22 in the year 2003. The price remains unchanged at US$15.00 per copy (with one copy only available to *ICQ* subscribers at the special rate of $8.00). As usual, the annual *Comet Handbook* includes up-to-date magnitude parameters for all included comets, based on close scrutiny of photometric data over the past year.

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IWCA III in Paris (June 2004)

The third International Workshop on Cometary Astronomy (IWCA III), co-sponsored by the *ICQ*, will be held in conjunction with the transit of the sun by Venus on 2004 June 8, so as to hopefully tap into comet observers from around the world (especially the western hemisphere) who may plan to travel to Europe to view the transit. The IWCA III is tentatively scheduled to be hosted by the Societe Astronomique de France and held in Paris during the weekend of 2004 June 4-6, allowing time for people to travel to other nearby places in Europe for observing the transit. More information will appear in the *ICQ* and at the *ICQ* website as it becomes available.

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CORRIGENDUM.

In the *2002 Comet Handbook*, p. 109, 46P/Wirtanen, the pre-perihelion formula was found to be valid for 3.0-1.6 AU, while the "post-perihelion" formula was found to be valid from 1.6 AU pre-perihelion through to 1.5 AU post-perihelion (the ephemeris magnitudes were incorrectly changed at perihelion, rather than at r = 1.6 pre-perihelion).

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DESIGNATIONS OF RECENT COMETS

Listed below, for handy reference, are the last 15 comets 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. Also given 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.

Not included below are numerous recently-discovered comets observed only with the SOHO spacecraft — and seen only close to the sun with the SOHO instruments — most of which are presumed to be no longer in existence. Earlier lists and references to such comets appeared in the July 2002 issue (p. 219) and references therein.

[This list updates that in the July 2002 issue, pp. 219-220.]

	New-Style Designation	*P*	*T*	*q*	*IAUC*
⋆	C/2002 Q5 (LINEAR)		11/19/02	1.24	7962
	155P/2002 R2 (Shoemaker)	17.1	12/14/02	1.81	7969
⋆	C/2002 R3 (LONEOS)		6/13/03	3.87	7970
⋆	P/2002 S1 (Skiff)	8.12	3/25/02	2.31	7972
⋆	P/2002 T1 (LINEAR)	6.68	10/8/02	1.19	7983
#	54P/2002 T4 (de Vico-Swift-NEAT)	7.31	7/30/02	2.14	7991
⋆	P/2002 T5 (LINEAR)	18.4	6/27/03	3.94	7998
⋆	C/2002 U2 (LINEAR)		12/31/02	1.21	8000
⋆	P/2002 T6 (NEAT-LINEAR)	21.2	6/26/03	3.39	8002
⋆	C/2002 T7 (LINEAR)		4/23/04	0.61	8003
⋆	C/2002 V1 (NEAT)		2/18/03	0.10	8010
⋆	C/2002 V2 (LINEAR)		5/11/03	6.82	8013
⋆	C/2002 X1 (LINEAR)		7/12/03	2.49	8028
⋆	P/2002 X2 (NEAT)	8.1	3/29/03	2.53	8029
⋆	C/2002 X5 (Kudo-Fujikawa)		1/28/03	0.18	8032