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The International Comet Quarterly (*ICQ*) is a journal devoted to news and observation of comets, published by the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts. Regular issues are published 4 times per year (January, April, July, and October), with an annual *Comet Handbook* of ephemerides published normally in the first half of the year as a special fifth issue. An index to each volume normally is published in every other January issue (even-numbered years); the *ICQ* is also indexed in *Astronomy and Astrophysics Abstracts* and in *Science Abstracts Section A*.

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Among the Observation Coordinators (OCs) listed below, those with postal addresses have e-mail contacts with the *ICQ* Editor (or regularly send data to the Editor on IBM PC-compatible floppy disks); 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 —

- On the cover of the April 1992 issue, the Whole Number was accidentally given as 81; it *should read* Whole Number 82, as it does on page 30 of that same issue.
- In the April 1982 issue (*ICQ* No. 42), p. 38, "From the Editor", column 2, line 2, *for* page 40 *read* page 51
- In the January 1984 issue (*ICQ* No. 49), p. 3, in "Editor's Note" near the top, *for* Table I *read* Table II; and *for* second column *read* first column
- In the April 1984 issue (*ICQ* No. 50), p. 51, column 2, last paragraph, line 6, *for* Feb. 23 *read* Mar. 23
- In the January 1985 issue (*ICQ* No. 53), p. 28, delete the last two lines (this policy was never followed carefully).
- In the April 1991 issue (*ICQ* No. 78), p. 72, Periodic Comet Encke, lines 4-5, *for* p.a. 275°; 0°.02 fan-shaped tail in p.a. 85° *read* p.a. 275° ± 5°; 0°.02 sunward fan in p.a. 95° ± 5°
- In the January 1992 issue, p. 7, line 6 from bottom, end of line, *for* p.a. 85° *read* p.a. 265°
- In the January 1992 issue, p. 23, the three observations by HER02 were made with a 20.3-cm R (*not* a 15.2-cm R).
- In the April 1992 issue, p. 32, Periodic Comet Faye (1991n), line 6, *for* 0°.6 tail *read* 0°.06 tail. On the same page, line 16, *for* tail send *read* tail seen. At the top of the following page, Nov. 10.20, the central cond. was seen at 164×.
- Also in the April 1992 issue, page 52, "Recent News", paragraph 3, line 4, *for* long-period with perihelion in 1992 April *read* long-period comet (perihelion in 1992 April)

MAGNITUDE CORRECTIONS FOR ATMOSPHERIC EXTINCTION

by Daniel W. E. Green

Abstract. A standard procedure is outlined for correcting total visual magnitude estimates of comets, when objects involved in making the estimates are at low altitude (i.e., high zenith distances), to allow for the effects of atmospheric extinction.

Among the numerous problems encountered by observers in making total visual magnitude estimates of comets, perhaps the most complex significant issue involves the many times that comets are observed at great zenith distances in the sky, particularly below 20° altitude. Over the years, there has been concern as to whether all observers contributing to the *International Comet Quarterly (ICQ)* are correcting properly for this complicated phenomenon, whereby celestial light passes through increasing amounts of the earth's atmosphere (and is thus diminished) as the observer views objects at decreasing altitudes above the horizon. For example, stellar absorption is roughly 0.2 magnitudes per air mass at visual wavelengths (Schaefer 1985); at 10° altitude, the air mass is nearly 6 (air mass is discussed below). Obviously, significant errors can be made when observers do not correct for extinction, and of course improper corrections can be worse than no correction at all.

In its regular tabulation of data, the *ICQ* includes notes that indicate when an observer made an extinction correction for a particular observation (denoted on the printed pages by an exclamation mark, !, between the date column and the magnitude method column). In practice, visual observers *should* correct for extinction whenever the comet and/or the comparison star(s) is/are below altitude ~ 30°; above ~ 30°-35° altitude, the potential errors due to improper methodology, to comparison-star magnitude problems, and/or to instrumental issues probably make the effort at small extinction correction unnecessary. Eleven years ago, in the early stages of organizing the *ICQ* archive of photometric data on comets, we outlined some procedures for standardizing observations, and we mentioned then that we would review the problem of differential atmospheric extinction correction (Green and Morris 1981). This paper represents that long-overdue review, and is intended to encourage observers to correct properly and uniformly for atmospheric extinction when a comet and/or comparison star is at low altitude.

Definitions and Equations.

Air mass (X) is the amount of air that one is looking through, and viewing toward the zenith is looking through 1 air mass. The air mass, to a rough approximation, is given by $X = \sec z = 1/(\cos z)$, where z is the angular distance from the zenith (in degrees), though this simple formula breaks down quickly as one nears the horizon (*cf.* Henden and Kaitchuck 1982). In this article, we refer to altitude ($90° - z$) as the angular distance of the celestial object above the local horizon, and to elevation (h) as the observer's physical height above sea level in kilometers. While air mass actually differs for each type of extinction material in the atmosphere, a good overall representation of air mass is given by Rozenberg's (1966) equation

$$X = (\cos z + 0.025\, e^{-11 \cos z})^{-1} \equiv \frac{1}{\cos z + 0.025 \exp(-11 \cos z)}. \quad (1)$$

Note that at $z = 90°$, $X = 40$. The altitude of the object can be found by the formula

$$\sin(90° - z) = \sin\phi \sin\delta + \cos\phi \cos\delta \cos H_\theta, \quad (1a)$$

where ϕ is the observer's latitude (positive/negative in the northern/southern hemisphere), δ is the declination of the celestial object (positive/negative in the northern/southern celestial hemisphere), and H_θ is the local hour angle (measured westward from the meridian), which is

$$H_\theta = \theta - \alpha, \quad (1b)$$

where θ is the local sidereal time and α is the object's right ascension (Meeus 1982). The actual amount of atmosphere at a given air mass will vary considerably from site to site, depending especially on observer's elevation above sea level.

Hayes and Latham (1975; hereafter HL75) note that there are three sources of extinction in the earth's atmosphere that must be considered when dealing with ground-based astronomical photometry: molecular absorption, Rayleigh scattering by molecules, and aerosol scattering. At wavelength $\lambda = 510$ nm, which is the peak spectral response for the rods of the human eye used in night vision (*e.g.*, Bowen 1984), molecular absorption (which occurs in spectral lines and bands) is rather negligible (see the graph by Tüg *et al.* 1977), although for altitudes under 10°, ozone can cause extinction > 0.01 magnitude per air mass (HL75). We adopt Schaefer's (1992) value $A_{oz} = 0.016$ magnitudes per air mass for the small ozone component contributing to atmospheric extinction.

Rayleigh scattering by air molecules can be represented by the following equation (after HL75 for $\lambda = 510$ nm $= 0.51$ μm):

$$A_{\rm Ray} = 0.1451 \exp(-h/7.996) \text{ magnitude per air mass.} \quad (2)$$

Aerosol scattering is due to particulates including dust, water droplets, and manmade pollutants, and the extinction due to this is generally given by the formula

$$A_{\rm aer} = A_0 \lambda^{-\alpha_0} \exp(-h/H) \text{ magnitude per air mass,} \quad (3)$$

where the scale height, H, is usually taken as 1.5 km (HL75; however, this may vary by a factor of 2 on any given night)

(Continued on next page...)

and λ is the observed wavelength (in μm). The quantity α_o varies from site to site; Tüg *et al.* (1977) and HL75 find typical values near $\alpha_o = 0.9$, but we adopt $\alpha_o = 1.3$ after Angström (1961) and Schaefer (1992). Schaefer remarks that the variation in A_0 "is rabid . . . because the aerosol component varies greatly on all time scales". Volcanic aerosols, in particular, are highly variable from site to site and year to year. For reasons stated under "Procedure", below, I adopt $A_0 = 0.05$ as an average value. Thus, we will take the extinction due to aerosols for the human eye as

$$A_{\rm aer} = 0.120 \exp(-h/1.5), \qquad (4)$$

so that for elevations near sea level, $A_{\rm aer} \simeq 0.12$ magnitude per air mass.

Procedure.

Ideally, one should use only comparison stars that are at the same altitude as the observed comet, so that so-called differential extinction correction will not be necessary. But in practice, this is only possible some of the time, so we provide now a recommended procedure for applying corrections due to differential extinction. Given the air masses of the observed comet and comparison stars using equation (1), the observer must compute the extinctions from equations (2) and (4). Then let

$$A' \equiv A_{\rm Ray} + A_{\rm aer} + A_{\rm oz}. \qquad (5)$$

Schaefer (1987) says that A' is typically ~ 0.15 at a good observing site such as Cerro Tololo in Chile ($h = 2.22$ km) and is ~ 0.30 for a site near sea level in the eastern United States; this is in good agreement with equation (5), as, for example, $A' = 0.016 + 0.110 + 0.027 = 0.15$ mag for $h = 2.2$ km. He also notes (Schaefer 1985) that for an average night on a mountain or a good night at a dry sea-level site, $A' = 0.20$, while in a humid climate, values of 0.25, 0.3, and 0.4 correspond to good, average, and poor nights, respectively. Choosing a value $A_0 \simeq 0.05$ for equation (3) would be realistic for these typical values of A', which is why it was used to derive equation (4). The reason for choosing to adjust A_0 (and thus, $A_{\rm aer}$) is that $A_{\rm Ray}$ is well defined and $A_{\rm oz}$ has a much smaller contribution, so the variable nature of $A_{\rm aer}$ contributes much more greatly to significant variations in A'.

The total extinction at a given air mass is then

$$M_A \doteq A'X \text{ magnitudes.} \qquad (6)$$

One must compute the expected extinctions for the comet,

$$M_c = A'X_c, \qquad (7a)$$

and for the comparison star,

$$M_\star = A'X_\star. \qquad (7b)$$

Let the actual visual magnitude of the comparison star be $m_\star$, obtained from a source catalogue; then the observed magnitude of the star is

$$m_a = m_\star + M_\star. \qquad (8)$$

Likewise, the apparent total visual magnitude of the comet, m_1, is the sum of the comet's real magnitude (m_1') and M_c. If the comet is judged to be equal in brightness to the comparison star ($m_1 = m_a$), the corrected total visual magnitude of the comet is then

$$m_1' = m_a - M_c = m_\star + M_\star - M_c. \qquad (9)$$

If the comet is judged to be x magnitude brighter or fainter than the comparison star, one must subtract or add, respectively, this amount x from/to equation (9).

Use of the Tables.

Table Ia provides values of M_A for each degree of altitude in the sky (given in column 1 as zenith distance, z, in degrees), assuming the average value $A_0 = 0.05$ mentioned above. Columns 2-6 list the extinction calculated from equations 1, 2, 4, 5, and 6 for sea level ($h = 0$) and for four different elevations above sea level: $h = 0.5$, 1, 2, and 3 km. Let $\widehat{M} = M_A - M_{z=0}$, where $M_{z=0}$ is the extinction at the zenith (1 air mass). One can see that at $z \sim 35°$ (altitude $\sim 55°$), the extinction of a celestial object with respect to its apparent brightness at the zenith is near a tenth of a magnitude at sea level (*i.e.*, $\widehat{M} \sim 0.1$), while at mountain elevations the extinction doesn't reach 0.1 mag until closer to $z = 50°$ (altitude 40°). Because of the uncertainty in the magnitude estimate due to methodology, comparison-star source problems, *etc.*, it probably isn't necessary to worry about making an extinction correction until $\widehat{M} \geq 0.2$ mag, which will be at $z \sim 55°$ (altitude $\sim 35°$) near sea level and $z \sim 65°$ (altitude $\sim 25°$) for mountain sites.

Because extinction can vary significantly at a single site from night to night (even from minute to minute!), two additional tables are included, which observers can use for more dry, winter-like conditions (Table Ib) or for more humid, summer-like conditions (Table Ic). Table Ib was computed using $A_0 = 0.035$, and Table Ic using $A_0 = 0.065$.

One can then use Table Ia, Ib, or Ic to make the correction, keeping in mind that a *differential* extinction correction is what is necessary in comparing the brightness of a comet to that of a standard comparison star. As an example, suppose that an individual at sea level observes a comet at 10° altitude ($z = 80°$) to be slightly fainter than Star 1, which is at altitude 13°, and more noticeably brighter than Star 2, which is at altitude 7°. From a catalogue, it is found that the V magnitudes of Stars 1 and 2 are 7.0 and 6.6, respectively. Then add the calculated extinction (from Table Ia) to each star's real magnitude, as in equation (8), giving, say, m_{a1} for Star 1 and m_{a2} for Star 2, which would now be $m_{a1} =$ 8.2 and $m_{a2} = 8.8$. One can then compare the comet's apparent m_1 with m_{a1} and m_{a2}, and given the above description for this example, one would conclude that $m_1 \simeq 8.4$ (which now becomes m_a in equation 9). Now using equation (9), and finding $M_c = 1.6$ from Table Ia, we find $m_1' \simeq 8.4 - 1.6 = 6.8$, which is the value to report.

Table Ia. "Average" Atmospheric Extinction in Magnitudes for Various Elevations Above Sea Level (h, in km)

z	h = 0	h = 0.5	h = 1	h = 2	h = 3
1°	0.28	0.24	0.21	0.16	0.13
10	0.29	0.24	0.21	0.16	0.13
20	0.30	0.25	0.22	0.17	0.14
30	0.32	0.28	0.24	0.19	0.15
40	0.37	0.31	0.27	0.21	0.17
45	0.40	0.34	0.29	0.23	0.19
50	0.44	0.37	0.32	0.25	0.21
55	0.49	0.42	0.36	0.28	0.23
60	0.56	0.48	0.41	0.32	0.26
62	0.60	0.51	0.44	0.34	0.28
64	0.64	0.54	0.47	0.37	0.30
66	0.69	0.59	0.51	0.39	0.32
68	0.75	0.64	0.55	0.43	0.35
70	0.82	0.70	0.60	0.47	0.39
71	0.86	0.73	0.63	0.49	0.40
72	0.91	0.77	0.66	0.52	0.43
73	0.96	0.81	0.70	0.55	0.45
74	1.02	0.86	0.74	0.58	0.48
75	1.08	0.92	0.79	0.62	0.51
76	1.15	0.98	0.84	0.66	0.54
77	1.24	1.05	0.91	0.71	0.58
78	1.34	1.13	0.98	0.76	0.63
79	1.45	1.23	1.06	0.83	0.68
80	1.59	1.34	1.16	0.91	0.74
81	1.75	1.48	1.28	1.00	0.82
82	1.94	1.65	1.42	1.11	0.91
83	2.19	1.86	1.60	1.25	1.03
84	2.50	2.12	1.83	1.43	1.17
85	2.91	2.46	2.13	1.66	1.36
86	3.45	2.93	2.53	1.97	1.62
87	4.23	3.59	3.10	2.42	1.99
88	5.41	4.59	3.96	3.09	2.54
89	7.38	6.26	5.40	4.22	3.46
90	11.24	9.53	8.23	6.42	5.28

# # #

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Of course, when dealing with differential extinction, it is especially important to use several (say, N) comparison stars and take an average value, $\overline{m_1'} = (\Sigma m_1')/N$. This is the value to report for publication in the *ICQ*, placing a '!' before the magnitude on the report forms, in the same column as the magnitude (or in column 75 if sending data in archival machine-readable form); note, however, the new note 'flags' or abbreviations introduced in the next paragraph.

Closing Remarks.

It is difficult to present a simple way for applying extinction corrections for observations made at any site on Earth, because many complex issues are involved, including some in addition to those mentioned above. For example, a blue star will appear redder more quickly with increasing zenith distance than will a red star (*cf.* Hardie 1962; Henden and Kaitchuck 1982). In general, because the V photoelectric bandpass commonly used for comparison-star magnitudes is redward of the peak spectral response of the human eye's rods, observers should opt for comparison stars with color index $-0.2 < B-V < +0.7$ (*cf.* Green and Morris 1982). Refraction not only affects the degree to which red light and blue light are passed to the observer from celestial sources, but also increasingly affects the actual air mass for increasing z (Henden and Kaitchuck 1982). The recent contribution of emissions from the Pinatubo volcano greatly increased atmospheric extinction, at the rate of $\sim$ 0.1 magnitude per air mass (*cf.* Grothues and Gochermann 1992), to the extent that the Tables of this paper would not be indicative of the tremendous brightness loss of celestial objects during the second half of 1991.

(text continued on page 59)

Table Ib. "Winter" Atmospheric Extinction in Magnitudes for Various Elevations Above Sea Level (h, in km)

z	h = 0	h = 0.5	h = 1	h = 2	h = 3
1°	0.25	0.21	0.19	0.15	0.13
10	0.25	0.22	0.19	0.15	0.13
20	0.26	0.23	0.20	0.16	0.14
30	0.28	0.25	0.22	0.17	0.15
40	0.32	0.28	0.24	0.20	0.17
45	0.35	0.30	0.26	0.21	0.18
50	0.38	0.33	0.29	0.24	0.20
55	0.43	0.37	0.33	0.26	0.22
60	0.49	0.42	0.37	0.30	0.25
62	0.52	0.45	0.40	0.32	0.27
64	0.56	0.48	0.43	0.34	0.29
66	0.60	0.52	0.46	0.37	0.31
68	0.65	0.57	0.50	0.40	0.34
70	0.72	0.62	0.55	0.44	0.37
71	0.75	0.65	0.57	0.46	0.39
72	0.79	0.69	0.60	0.49	0.41
73	0.84	0.72	0.64	0.52	0.43
74	0.89	0.77	0.68	0.55	0.46
75	0.94	0.82	0.72	0.58	0.49
76	1.01	0.87	0.77	0.62	0.52
77	1.08	0.94	0.82	0.67	0.56
78	1.16	1.01	0.89	0.72	0.60
79	1.26	1.10	0.97	0.78	0.66
80	1.38	1.20	1.06	0.85	0.72
81	1.52	1.32	1.16	0.94	0.79
82	1.70	1.47	1.29	1.05	0.88
83	1.91	1.65	1.46	1.18	0.99
84	2.18	1.89	1.66	1.34	1.13
85	2.53	2.20	1.93	1.56	1.31
86	3.01	2.61	2.30	1.86	1.56
87	3.69	3.20	2.82	2.28	1.91
88	4.72	4.09	3.60	2.91	2.45
89	6.44	5.58	4.91	3.97	3.34
90	9.80	8.50	7.49	6.05	5.08

Table Ic. "Summer" Atmospheric Extinction in Magnitudes for Various Elevations Above Sea Level (h, in km)

z	h = 0	h = 0.5	h = 1	h = 2	h = 3
1°	0.32	0.26	0.22	0.17	0.14
10	0.32	0.27	0.23	0.17	0.14
20	0.34	0.28	0.24	0.18	0.15
30	0.37	0.30	0.26	0.20	0.16
40	0.41	0.34	0.29	0.22	0.18
45	0.45	0.37	0.32	0.24	0.19
50	0.49	0.41	0.35	0.26	0.21
55	0.55	0.46	0.39	0.30	0.24
60	0.63	0.53	0.45	0.34	0.27
62	0.68	0.56	0.48	0.36	0.29
64	0.72	0.60	0.51	0.39	0.31
66	0.78	0.65	0.55	0.42	0.34
68	0.85	0.70	0.60	0.45	0.36
70	0.93	0.77	0.65	0.50	0.40
71	0.97	0.81	0.69	0.52	0.42
72	1.02	0.85	0.72	0.55	0.44
73	1.08	0.90	0.76	0.58	0.47
74	1.15	0.95	0.81	0.61	0.49
75	1.22	1.01	0.86	0.65	0.53
76	1.30	1.08	0.92	0.70	0.56
77	1.40	1.16	0.99	0.75	0.60
78	1.51	1.25	1.07	0.81	0.65
79	1.64	1.36	1.16	0.88	0.71
80	1.79	1.49	1.26	0.96	0.77
81	1.97	1.64	1.39	1.06	0.85
82	2.19	1.83	1.55	1.18	0.95
83	2.47	2.06	1.75	1.32	1.07
84	2.82	2.35	1.99	1.51	1.22
85	3.28	2.73	2.32	1.76	1.41
86	3.90	3.25	2.75	2.09	1.68
87	4.78	3.98	3.38	2.56	2.06
88	6.11	5.09	4.32	3.28	2.63
89	8.33	6.93	5.89	4.47	3.59
90	12.68	10.56	8.97	6.80	5.47

(text continued from page 57)

Because the problems are so complex within $\sim 10°$ of the horizon, we are implementing two new note codes, which we ask all observers to use when the comet and/or comparison star(s) is/are at or below 10° altitude: '$' is to be used instead of '!' when extinction corrections as outlined in this paper are applied to objects at such low altitudes, and '&' is to be used when the comet is $< 20°$ and *no* extinction corrections are applied. When one of the three tables of this paper is used in making the extinction correction, especially above 10° altitude, we encourage observers to use the letters 'A', 'W', and 'S', corresponding to Tables Ia, Ib, and Ic, respectively. If one or more of the celestial objects involved in making the magnitude estimate is below 10° altitude, use of the symbol '$' is suggested over the letter codes. Effective immediately, the symbol '!' should *only* be used when extinction corrections different from that described in this paper are applied to objects at altitudes $> 10°$ ($z < 80°$). [On the regular report forms, extinction note codes are to be placed before the magnitude estimate, in the same column as the magnitude estimate. When sending observations in computer form, place this note in the column immediately preceding the observer code; see instructions below.]

It is worth repeating here: when a comet is under 10° altitude, the observer should first try locating comparison stars at the same altitude as the comet, to avoid making an extinction correction. If there are simply no such stars available, make every attempt to use stars within 1°-3° of the comet in altitude, in order to increase the accuracy of the extinction correction.

Observers also must accurately determine z (or, alternately, the celestial objects' altitudes) in order to use any extinction correction properly, being careful to note that the horizon is probably not at 0° altitude but rather some amount higher; one simple device to determine altitude (without performing a calculation from spherical trig formulae such as equation 1a above) is a protractor with a weighted plumline down the center. Despite all of the issues involved, careful use of the procedure described in this article should give reasonable magnitude corrections due to the atmospheric extinction that are good to 0.1-0.3 magnitude, within the "noise" of m_1-estimate scatter caused by other problems such as improper methodology and poor comparison-star magnitudes.

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Φ Φ Φ

COMPUTER INPUT OF TABULATED OBSERVATIONS

As noted in earlier issues of the *ICQ*, the stored archival data is in a different form from that of the published data on these pages. Given here is a description of the archival format, which is the format to be used by all contributors sending data to the *ICQ* in machine-readable form (*i.e.*, by e-mail or on floppy disk). The 80-character format is shown below and described on the following page. Below the observation line "key" is a numbered scale from 1 to 80, for easy identification of the location for a particular datum.

```
PERYYYYRNpp YYYY-MM DD.DD M/mm.m rrAAA.ATF/xxxx /dd.dd DC /t.tt ANG RRRRRR!OBSxx

123456789 123456789 123456789 123456789 123456789 123456789 123456789 1234567890
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(continued from previous page)

The first 11 columns (noted on the key at the bottom of page 59 by **PERYYYYRNpp**) are the comet's identification, with columns 1-3 reserved for a 3-digit periodic-comet code. The first 3 columns are left blank for long-period comets, and we recommend that contributors leave these columns blank for the short-period comets except the so-called annual comets, whose 3-digit codes are as follows: P/Arend-Rigaux, 621; P/Encke, 301; P/Grigg-Skjellerup, 402; P/Gunn, 627; P/Machholz, 522; P/Schwassmann-Wachmann 1, 920; P/Smirnova-Chernykh, 807.

Columns 4-9 are for the comet's Roman-numeral designation. Thus, columns 4-7 are the year of the comet's (current) perihelion passage, and columns 8-9 are the Arabic-numeral correspondance to the Roman-numeral designation (thus comet 1989 VIII is coded in columns 4-9 as '198908'). Currently-observed comets often do not yet have Roman-numeral designations, in which case the year of perihelion should be given in columns 4-7, and columns 8-9 should be left blank. Columns 10-12 are for the comet's provisional-letter designation, using the last digit of the year and the letter in columns 10-11 (with additional numerals 1 and higher given in column 12 for years where there are more than 26 comets recovered/discovered); thus comet Okazaki-Levy-Rudenko 1989 IX (= 1989r) is coded as ' 1989099r ' and comet Skorichenko-George 1990 VI (= $1989e_1$) is coded as ' 1990069e1'.

YYYY, **MM**, and **DD.DD** (columns 13-25) are the year, month, and date (to 0.01 day) of the observation in UT. Note that observations should not be reported in hours and minutes, but always converted to decimals of a day.

M (column 27) is the magnitude method used for the magnitude estimate, where a single letter is placed, such as S = Sidgwick or In-out; B = Bobrovnikoff; M = Morris; I = in-focus; O = out-of-focus method, but specific type not mentioned; E = Beyer. Some less-frequently-used codes are: C = unfiltered total CCD magnitude (fairly well approximates the Johnson *V* band); c = unfiltered nuclear CCD magnitude (fairly well approximates the Johnson *V* band); P = photographic; p = photographic with Kodak 2415 (Technical Pan) film.

/mm.m (columns 28-33, decimal point in column 31) is the total visual magnitude estimate, given to 0.1 magnitude. (Note that estimates of the nuclear condensation alone, if made, are usually placed in the 'Descriptive Information' section and are not tabulated.) The slash (/) is the column for a left bracket ([), which indicates that the comet was not seen and was fainter than the given magnitude. If the magnitude estimate is not very accurate, or made under poor conditions, then a colon (:) is placed (*always* in column 33) immediately after the magnitude (for example, 11.3:).

rr (columns 34-35) is the reference or source of comparison stars used for making the magnitude estimate (if more than one source was used, the primary source only must be listed here); here we use a 2-letter code (or 1- letter code in column 34 only). For example, use of the SAO Catalog will mean using 'S ', and use of the AAVSO Atlas will mean using 'AA'.

AAA.ATF/xxxx are the specifications concerning the instrument used for the observation. NOTE: If the magnitude estimate is made with one telescope and the tail-length estimate is made with a second telescope, two different lines must be entered! **AAA.A** (columns 36-40) is the instrument aperture in centimeters, given to 0.1 cm. An important thing for the recorder to remember is to use only significant figures (example: if the observer reports his telescope aperture as 20 cm, the recorder should not put 20.0 cm, but 20 cm). We usually give binoculars with '.0' in columns 39-40; for naked eye, the default value is '0.0' in columns 38-40 (but if you know the dark-adapted size of your pupil, such as 0.8 cm, then give this instead).

T (column 41) is the instrument type, as coded by the 1-letter key (L = reflector, R = refractor, B = binoculars, E = naked eye, A = camera, C = Cassegrain telescope, D = Schmidt telescope, S = Schmidt-Newtonian telescope, T = Schmidt-Cassegrain telescope, W = Wright-Schmidt telescope, etc.). **F/** is the focal ratio (*f*/-ratio) of the instrument, and **xxxx** is the power (magnification) used. Decimal points are not used here, so the *f*/-ratio should always be given in rounded integer form (round "even"); thus *f*/3.5 and *f*/4.5 would both be given as ' 4' in *ICQ* computer format. Both *f*/-ratio and magnification should be entered "flush right" (that is, ones digits go in the right-most column, tens digits in the second column from right, etc.).

/dd.dd (columns 49-54) is the observer's estimate of the comet's coma diameter in arc minutes at the time of observation. The slash (/) here indicates the column used for an ampersand (&), which indicates an approximate measurement, or a less-than (<) or greater-than (>) sign. The diameter may be given to 0.01 arcmin, but again only significant figures should be entered (example: when the comet was large, > 10′, measurements would probably never even be given to 0′.1, because it would be very difficult to get so exact an estimate when the coma is so large).

DC (columns 56-57) is the degree of condensation of the comet as estimated by the observer (on a scale of 0 to 9, where 0 is completely diffuse and 9 is completely stellar in appearance). The digit goes in column 56. If an observer estimates DC = 5-6, then a slash (/) goes in column 57 following a '5' (thus: '5/').

/tt.t (columns 59-63) is the tail length in degrees (to 0.1 degree of arc), with the slash (/) column covering the same as the slash for the coma diameter (see above).

ANG (columns 65-67) is the position angle in degrees at which the center of the tail is directed (0 = north, 90 = east, 180 = south, 270 = west, etc.). This number is entered flush right in integer form only, so that if the p.a. is 56°, a blank is entered in column 65 and '56' is entered in columns 66 and 67 (*not* to be entered as '056').

RRRRRR (columns 69-74) is the reference for publication. You should enter 'ICQ XX' here; the proper whole number will be entered automatically by the *ICQ* Editor upon publication, prior to entry into the archive.

! (column 75) is the column for an exclamation mark (!) or some similar note indicating that an extinction correction was applied (please see the 'Closing Remarks' to the previous article in this issue of the *ICQ*). *Note that this column is in a very different location for the archival data than it is in the tabulated, published location on the pages of the ICQ, where it appears immediately after the date.*

(text continued from page 60)

OBSxx (columns 76-80) is a 3-letter, 2-digit code to indicate who the observer is. Columns 76-78 give the first 3 letters of the observers last name (family name), and the digits are simply added in where there are more than one observer with the same first 3 letters in the last name. If precise code is unknown, give first three letters of last name and then 'xx' in columns 79-80, and the last two columns will be changed by the *ICQ* staff.

PLEASE USE THE PROPER *ICQ* CODES. If there are further questions, please contact the Editor. In the October issue, we will publish the latest 'Key to References' for comparison stars, which is now quite lengthy.

Descriptive Information. When there is important descriptive information that cannot be easily put in tabulated form, it should be written clearly in the style used on the pages of the *ICQ* (refer to text on the next few pages). Please give all of the tabulated data for all comets first (with no text), and then give the textual descriptive information at the end of your computer file (or in a separate file) in the same order as you gave the tabulated data, but please include a header at the beginning of each comet's descriptive information to clearly indicate which comet the text refers to. Each new date should begin on a new line for clarity.

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TABULATION OF COMET OBSERVATIONS

A new addition to the 'Key to References' is CO = "A New Stellar Standard Sequence in the Coma Cluster of Galaxies (Preliminary Report)", by F. Börngen and N. Richter (1978, *Astron. Nach.* **299**, 117), which is a *UBV* photometric sequence for 39 stars in the range 11.7 < *V* < 18.7. The complete list of codes for comparison-star references used in the *ICQ*'s tabulated data will be published in the October issue.

Descriptive Information (to complement the Tabulated Data):

◇ *Comet Ikeya-Seki 1968 I [all observations by BOR]* ⟹ 1968 Jan. 6.45, 9.45: no nucleus or nuclear cond. suggested; on the latter date, comet appears somewhat condensed at low magnification, but very little cond. is noted at higher powers (71×). Jan. 12.45: strong suggestion of nuclear cond., especially at low powers and w/ averted vision, but not so w/ higher powers. Jan. 19.45: nuclear cond. of very small dia. vaguely suggested, especially at low power. Jan. 22.45: stellar or almost stellar nucleus glimpsed at all powers (mag probably 11-11.5, though not estimated). Jan. 27.44: no stellar nucleus present. Feb. 5.45: existence of tail uncertain; coma has central cond. of dia. < 1′ that seems slightly offset toward p.a. 45°; no nucleus seems present at 71×; in 7×50 B, strong nucleus noted. Feb. 7.44: nuclear cond. of dia. < 15″. Feb. 16.44: nuclear cond. of dia. < 5″ and mag > 10. Feb. 26.43: central cond. of dia. < 1′ offset toward p.a. 65°; no stellar nucleus seems present. Mar. 4.42: nuclear cond. of dia. < 30″ and mag ~ 10.0 is offset ~ 1′ toward p.a. 85°, and is markedly less defined as magnification is increased. Mar. 8.42: coma fan-shaped; apparent stellar nucleus and central cond. of dia. 30″-45″ offset ~ 1′ from coma's center in p.a. ~ 65°. Mar. 14.41: stellar nucleus offset toward p.a. ~ 120°; moonlight. Mar. 20.05: clouds prevented detailed observation. Mar. 24.17: nucleus surrounded by a poorly defined central cond. of dia. ~ 1′, which is in turn surrounded by a very faint halo best seen at higher powers. Mar. 25.18: in 6-inch *f*/4 L, "both nucleus and nuclear cond." visible, passing ~ 10″ from BD 79°515 (no definite fading of star noted). Mar. 25.39: 103a-F plate exposed w/ 22-inch *f*/3 Maksutov camera showed a straight 16′ tail in p.a. 236° ± 2°, which was not more than 0′.3 wide at the coma; DC = 7; nuclear cond. of dia. 0′.5 and central cond. of dia. 1′.3, both offset from the coma's center toward p.a. 56°; outer coma has dia. ~ 2′.5. Mar. 26.15: m_1 = 7.5 using reference NS; in 4-inch *f*/10 R, strong central cond. of small dia.; in 22-inch *f*/15 M, there is a faint stellar nucleus inside a poorly-defined nuclear cond. Mar. 26.18: 103a-F plates (3- and 5-min exp.) taken with 22-inch *f*/3 M shows 18′ tail (of width not more than 0′.5) in p.a. 222° ± 3°; also two 5′ jets in p.a. ~ 217° and 242°; coma dia. ~ 2′; nuclear cond. of dia. ~ 0′.4, offset toward p.a. 40° ± 5°. Mar. 26.18: Tri-X exp. w/ 85-mm *f*/1.4 camera lens shows straight tail of width 3′-4′ and length 30′-35′ toward p.a. 215° ± 5°; coma dia. ~ 3′.5, contains a central cond., DC = 6-8; Tri-X photo w/ 200-mm *f*/3.9 lens shows the central cond. of dia. ~ 1′-1′.5, larger than seen with the 22-inch M (see above). Mar. 28.16: central cond. visible. Mar. 28.23: 103a-F plates (1-5-min exp.) taken with 22-inch *f*/3 M show coma dia. ~ 2′.8 × 3′.2; nuclear cond. strongly offset toward p.a. 40° ± 10°. Mar. 31.18: a strong nucleus was visible in binoculars but not very evident in 6-inch *f*/8 L. Mar. 31.35: 103a-F plates (5- and 10-min exp.) taken with 22-inch *f*/3 M show 7′ tail of width 1′.5-2′ in p.a. 207°; also secondary tail of length ~ 5′ in p.a. 175° (both tails are diffuse and straight); coma dia. possibly 2′ × 3′, DC = 7-8; small, very strong cond. of dia. < 0′.5 offset ~ 1′ toward p.a. 27°; major axis of coma seems to lie along p.a. 27°-207°. Apr. 2.16: strong central cond. in binoculars, much less apparent in 6-inch *f*/8 L, though a nucleus is present (best seen at low power) in the latter instrument, "certainly not stellar as seen on other occasions". Apr. 2.17: 103a-F plates (5- and 10-min exp.) taken with 22-inch *f*/3 M show a narrow (~ 1′.5 width), straight tail of length ~ 30′ in p.a. 145° ± 3°; also secondary tail 20′-25′ long, of width ~ 1′.5 in p.a. 111° ± 3°, strongly curved near its end; coma dia. 3′; cond. of dia. < 0′.5, located forward in the coma toward p.a. 325°; DC = 7-8. Apr. 8.05 and 10.04: bright moonlight; no central cond. and only a suggestion of a nucleus. Apr. 13.20: observation made during totality of lunar eclipse; 103a-F plates (2.5- and 5-min exp.) taken with 22-inch *f*/3 M show diffuse tail of length ~ 12′ (width ~ 1′) in p.a. 77°; sharper, more pronounced secondary tail of length ~ 9′ in p.a. 48° ± 3°; coma dia. 2′.5, DC = 6-8, central cond. of dia. ~ 0′.5. Apr. 15.07: very small nuclear cond. centrally located in coma (6-inch *f*/8 L and 20×50 B were also used). May 7.08 and 21.07: little or no suggestion of a nucleus or central cond. May 25.11 and 25.16: photographic plates taken w/ 13.5-inch *f*/3.5 lens (also w/ 22-inch M on May 25.17) show m_1 = 10.1 ± 0.5 (roughly photovisual, AAVSO chart for R Lyn used);

(Continued on next page...)

(Continued from previous page) w/ smaller instrument, plates show small, diffuse spot of dia. ~ 1′ w/ no cond.; w/ 22-inch M, plates show DC = 2-3?, coma dia. ~ 0′.8, central cond. of dia. < 0′.4, possibly offset from the coma's center toward p.a. 180°. Sept. 29.30: very faint stellar nucleus seen (m_2 ~ 14), possibly somewhat offset toward the S. Oct. 22.30: possibly non-stellar nucleus of mag ~ 14, possibly surrounded by a very small (~ 10″-20″) central cond., all this being *possibly* offset slightly from the coma's center toward p.a. ~ 270°. Oct. 28.21: "comet is very difficult at 85×, easy at 132×, and very easy at 264×; comet seems to have a central stellar nucleus of mag 13.7.

◇ *Comet Suzuki-Sato-Seki 1970 X [all observations by BOR]* ⟹ 1970 Oct. 28.00: in 6-inch L, there was an apparently stellar nucleus of mag 11.0 (using 10.8-mag star from AAVSO TT Oph chart) centrally located. Oct. 29.00: in 6-inch L, suggestions of a narrow tail pointing E-SE, strongly condensed coma w/ a faint outer halo that doubles its size, suggestions of a nucleus. Nov. 6.98: in 6-inch L, 2′ circular coma, no true central cond.; in binoculars, there were suggestions of a stellar nucleus.

◇ *Comet Shoemaker-Levy 1991d* ⟹ 1991 Dec. 5.51: fairly small, condensed, fan-shaped coma; "except where noted, the comet maintained this general appearance during the subsequent observations" [HAL]. 1992 Jan. 12.44: "at 110×, a tiny, not-quite-stellar nucleus not more than 0′.1 in dia.; at 68×, the coma condenses somewhat more sharply near the center than in its outer region" [BOR]. Feb. 3.43: "coma condenses almost steadily to the center; center contains a very small condensed knot of material; at 110×, no stellar nucleus — just a tiny knot" [BOR]. Apr. 10.44: comet appears somewhat less condensed than during previous observations [HAL]. Apr. 28.44: very small, condensed coma [HAL].

◇ *Comet Helin-Lawrence 1991l* ⟹ 1992 June 29.44: fairly low altitude; the comet's expected position was between two stars, magnitudes ~ 9 and ~ 11 [HAL].

◇ *Comet Shoemaker-Levy 1991a$_1$* ⟹ 1991 Nov. 30.24: a very faint candidate was suspected, but was shown on POSS prints to be two faint stars [HAL]. 1992 Apr. 28.46: observation attempt affected by low altitude, haze, and light of crescent moon [HAL]. May 11.46: low altitude [HAL]. May 13.09 and June 7.06: diffuse with central cond. [MIK]. May 29.32: "noticeably brighter than before; DC like that of comet 1991h$_1$ early in its apparition; Lumicon Swan-band comet filter leaves comet completely unchanged in appearance and visibility; no nucleus at 110×" [BOR]. May 30.00: "comet denser and brighter using Lumicon Swan Band Filter, but only slight enhancement" [MEY]. June 3.32: area of greatest cond. somewhat offset toward p.a. 85°; possible very faint, non-stellar nucleus w/in a tiny knot of material; faint, broad coma extensions suspected toward p.a. 265° [BOR]. June 7.05: visible only with averted vision [MIK]. June 10.30: "USNO stars in comet's field; a fairly bright, significantly condensed coma w/ area of greatest cond. offset toward p.a. 95°; at 110×, a slightly non-stellar 12th-mag nucleus; a very faint, vague tail suspected toward p.a. 275°; Lumicon Swan-band filter causes no change in comet's visibility" [BOR]. June 11.30: "at 55×, a rather striking object — parabolic coma w/ offset nucleus and a long, straight tail traceable 9′ in p.a. 265°; the tail is initially as wide as the coma, its edges being extensions of the coma's parabolic outline; the tail widens slowly as it advances; at 68×, a virtually stellar nucleus of mag ~ 12.0 is noted at the center of cond., which is offset toward p.a. 85° in the coma; at 110×, the nucleus is non-stellar and heavily involved w/ surrounding material" [BOR]. June 12.31: "elliptical or parabolic coma, axis aligned along p.a. 85°-265°, moderately condensed w/ a 12th-mag, non-stellar nucleus at the center of cond.; sky conditions not as favorable as on previous morning" [BOR]. June 30.97: very conspicuous central cond. of dia. ~ 1′.5, surrounded by weak outer coma [MIK]. July 3.997: a Kodak 4415 Technical Pan film taken with a 0.30-m Schmidt camera shows a faint 12′ fan-shaped tail in p.a. 321°-26° [M. Fabio, Bologna, Italy]. July 19.17: exp. on Tech Pan emulsion w/ 0.1-m Schmidt camera shows a 1°.4 straight tail in p.a. 84° and coma dia. ~ 1′.6 [P. Roques, Williams, AZ]. July 20.18: exp. on Tech Pan emulsion w/ 0.1-m Schmidt camera shows a main tail 1°.6 long in p.a. 83° and a hint of a faint, shorter fan tail spreading from p.a. 83° to 13°; coma dia. ~ 1′.9 [Roques]. July 21.18: exp. on Tech Pan emulsion w/ 0.1-m Schmidt camera shows a main ion tail 2°.3 at p.a. 80° with an apparent fan-like structure (very faint) terminating in a very diffuse 0°.5 tail at p.a. 10°; coma dia. ~ 3′ [Roques].

◇ *Comet Zanotta-Brewington 1991g$_1$* ⟹ 1991 Dec. 31.15: some degradation when viewed with a Lumicon Swan Band filter [HAL]. 1992 Jan. 11.98: "at 68×, a bright, circular, strongly condensed coma w/ diffuse boundaries; coma probably condenses steadily from edges to center; at 110×, no nucleus or separate central cond. evident" [BOR]. Jan. 13.98: w/ 20×80 B, a fairly obvious, quite noticeably condensed coma — well seen in spite of moonlight; w/ 32-cm L (68×), comet seen as a strongly condensed, fairly small, bright object w/ diffuse boundaries; Lumicon Swan-band comet filter significantly enhances comet, making it appear both brighter and more condensed [BOR]. Jan. 23.10: the observation was somewhat affected by a nearby star of mag ~ 10; the star was in the expected direction of the tail and precluded any tail measurements [HAL]. Jan. 28.10: observation affected by low altitude and zodiacal light [HAL]. Jan. 29.98: "sky not the best" [BOR]. Feb. 2.98: "comet very low in sky — not well enough seen for definite DC and coma dia. determinations" [BOR]. Feb. 9.10: very low altitude; observation also affected by damp air and light of crescent moon [HAL].

◇ *Comet Mueller 1991h$_1$* ⟹ 1992 Jan. 7.35: very faint, rapidly moving diffuse object near visual threshhold [HAL]. Jan. 24.19: neither enhancement nor degradation when viewed with Lumicon Swan Band filter [HAL]. Jan. 29.26: some enhancement when viewed with Lumicon Swan Band filter [HAL]. Jan. 29.99: exposure on hypered Tech Pan film shows no obvious comet to limiting mag 15 [REN]. Feb. 3.07: at 68×, an exceedingly faint, diffuse object; Lumicon Swan-band comet filter considerably enhances the comet [BOR]. Feb. 4.00: at 68×, an extremely faint, totally diffuse, circular coma whose outer boundaries blend perfectly w/ the sky; Lumicon Swan-band comet filter makes the comet obvious —

(Continued on next page...)

(Continued from previous page) increasing its dia. to 3'.2 [BOR]. Feb. 6.03: comet noticeably larger and brighter; at 68×, a fairly large, perhaps slightly elongated glow (axis roughly E-W); just a trace of cond.; Lumicon Swan-band filter strongly enhances comet; no central cond. or nucleus at 110× [BOR]. Feb. 6.21: probably observed through thin cirrus [HAL]. Feb. 7.02: just detectable w/ 20×80 B; w/ 32-cm L (68×), a feeble, very-ill-defined object that is slighly condensed; Lumicon Swan-band filter transforms the comet into a large, dense, rather obvious object w/ a tenuous outer halo — dia. ~ 3'.4 [BOR]. Feb. 20.10: in 41-cm L, the comet appears more condensed than previously (DC = 5-6), with hints of a small, faint condensation [HAL]. Feb. 21.01: "faint but clearly seen w/ 20×80 B; w/ 32-cm L (110×), a possible minute nucleus is glimpsed from time to time" [BOR]. Feb. 22.01: 32-cm L (68×) shows a well condensed object that condenses steadily from the edges to the center; Lumicon Swan-band filter shows the coma as larger (2'.8) and more condensed, w/ a definite outer halo [BOR]. Feb. 28.15: low altitude; the beginning of a broad, featureless tail was suspected in 41-cm L [HAL]. Feb. 29.11: in 41-cm L, the coma fades out to the E, to the beginning of a possible tail [HAL]. Mar. 5.11: low altitude; in 20-cm L, the comet appears as an asymmetric, fan-shaped coma [HAL]. Mar. 21.80: daylight search [HAL]. Mar. 24.54: for this and most subsequent observation attempts, the search was made at low altitude and during fairly bright twilight; the comet's position was higher and in a darker sky with each subsequent attempt; most searches were made both with and without Lumicon Swan Band filter [HAL]. Apr. 4.50: the comet was fainter than defocused images of the faintest stars in *Uranometria 2000.0* [HAL]. Apr. 6.39: "careful search fails to show the comet" [BOR]. Apr. 10.47: good conditions and fairly dark sky [HAL].

◇ *Comet Bradfield 1992b* ⟹ 1992 Feb. 14.54: low altitude; the observing window between the comet's rising and twilight was very short; the comet was little more than a "presence" [HAL].

◇ *Comet Tanaka-Machholz 1992d* ⟹ 1992 Apr. 4.49: there has been a distinct brightening since Apr. 1 [HAL]. Apr. 6.38: w/ 32-cm L (68×), the inner 30% of the coma is rather strongly condensed; possible faint outer halo to coma; Lumicon Swan-band comet filter leaves comet unchanged in brightness and appearance [BOR]. Apr. 10.12: with 20-cm $f/4$ L (40×) + C_2 emission filter (bandpass 494-521 nm; peak transmission at 514 nm), the coma appeared larger and much more conspicuous than without the filter [MIK]. Apr. 11.10: there was clear enhancement when using a Lumicon Swan Band Filter, comet was denser, its diameter 5'.8 [MEY]. Apr. 26.05: surprisingly weak and diffuse [MEY]. Apr. 28.03: comet involved w/ 8th-mag star [MEY]. Apr. 29.35: w/ 32-cm L (68×), a bright, well-condensed, circular coma; Lumicon Swan-band filter does not change comet's visibility; at 170×, no sign of nucleus or separate central cond. [BOR]. May 4.01, 7.02, and 9.03: AGK1 used for comparison-star magnitudes [GRA04]. May 7.32: telescope shows inner 50% of coma to be quite dense; outer halo suspected; comet filter causes no change; no nucleus at 170× [BOR]. May 11.44: there has apparently been an outburst since the previous observation (Apr. 29) [HAL]. May 12.00: starlike nucleus of mag 11 [MOE]. May 12.32: "dramatic brightness outburst!; 32-cm L (68×) shows a bright, well condensed coma w/ diffuse boundaries; there is a sharp stellar nucleus of mag ~ 11, heavily involved in the surrounding coma material; coma condenses steadily from edges to center; Lumicon Swan-band filter causes no noticeable change in comet's visibility; at 110× and 170×, the nucleus grows fainter, but there are strong suggestions of diffuse structure or companion nucleii (diffuse) immediately adjacent and almost due N and S of the primary nucleus (feature to the S noticeably stronger)" [BOR]. May 13.08: much brighter than on May 8 [MIK]. May 15.01: clearly brighter than 10 days before; outburst or effect of change of comparison stars [MEY]. May 18.96: clearly denser using a Lumicon Swan Band Filter [MEY]. May 20-23: "comet grows steadily fainter and more diffuse over the following evenings" [BOR]. May 21.00: starlike nucleus of mag 11 [MOE]. May 29.30: "coma circular, moderately condensed w/ 32-cm L (68×); there is a small brightness plateau at center of coma; no nucleus" [BOR]. June 3.30: in 32-cm L (68×), circular, significantly condensed coma; at 110×, a very faint, not-quite-stellar nucleus noted [BOR]. June 4.45: observation affected by twilight [HAL]. June 10.31: "in 20×80 B, comet just glimpsed — too faint for meaningful observation; in 32-cm L, coma dia. derived this morning seem to be about 2× too large compared w/ June 11, when the comet appeared of the same apparent size; if this morning's figures are accepted, then at 68×, the coma is suspected out to 9'.5!; at 110×, no nucleus detected; Lumicon Swan-band filter very slightly enhances the comet" [BOR]. June 11.31: a fairly large, noticeably condensed, circular coma w/ extremely vague, diffuse outer region or halo; at 55×, the coma is suspected out to a total dia. of ~ 4'.0 [BOR]. June 12.32: "coma dia. determination possibly in error" [BOR].

◇ *Comet Bradfield 1992i* ⟹ 1992 May 5.80: "brighter using Swan-band filter"; comet slightly extended in anti-solar direction [SEA]. May 12.80: "comet no longer extended" [SEA]. June 3.14: searches made with various magnifications, with and without Lumicon Swan Band filter; the altitude was quite low, and the attempt was slightly hampered by some thin clouds in the vicinity [HAL]. June 6.15: low altitude; the sky conditions were better than on June 3, but there was some interference from light of the crescent moon [HAL].

◇ *Comet Machholz 1992k* ⟹ 1992 July 3.45: observation affected by thin clouds in the comet's vicinity [HAL].

◇ *Periodic Comet Chernykh (1991o)* ⟹ 1991 Nov. 27.19: mediocre transparency; two stars of mag ~ 11 were near the comet's expected position [HAL].

◇ *Periodic Comet Faye (1991n)* ⟹ 1991 Dec. 4.27: large, fan-shaped coma [HAL]. 1992 Feb. 6.02: "small, slightly condensed coma w/ vague, diffuse boundaries — circular in outline using 96×; at 157×, a small, dense, slightly condensed mass lacking any nucleus" [BOR].

◇ *P/Giacobini-Zinner (1972 VI)* ⟹ 1972 Sept. 5.37: tail appeared somewhat fan-shaped; faint coma contained a bright central cond. of mag 10.6 and dia. ~ 0'.5 [MOR]. Sept. 6.37: tail much fainter than on Sept. 5 and less fan-shaped (i.e., it appeared straight); no central cond. was seen; "a stellar nucleus (except at high powers) was offset toward" p.a. ~ 0°. [MOR].

◇ *Periodic Comet Hartley 2 (1991t)* ⟹ 1992 Jan. 4.57: estimate is of a very diffuse suspect, later determined not to be real [HAL]. Jan. 7.42: limiting magnitude based upon a large, diffuse object [HAL].

◇ *Periodic Comet Levy (1991q)* ⟹ 1991 Nov. 5.38: referring to a tabulated observation in the April 1992 issue, "comet may be as faint as $m_1 = 14.1$; light cirrus clouds may have entered the field before mag estimate was completed" [MOD].

◇ *P/Schwassmann-Wachmann 1* ⟹ 1991 Nov. 26.17: mediocre transparency; the attempt was also hampered by a nearby star of mag ~ 8 [HAL]. Dec. 5.21: a candidate was suspected the previous evening, near a fairly bright star; the candidate was at the time dismissed as faint background stars; the reports by Tsumura and Larson (*IAUC* 5396) together with this series of observations suggests the candidate might in fact have been the comet [HAL]. Dec. 6.22: coma fairly large and diffuse [HAL]. Dec. 13.36: diffuse coma; observation affected by nearby star of mag ~ 11 and by damp air [HAL]. 1992 Jan. 1.32: attempted observation of occultation of star of mag ~ 11 by the comet; no occultation was observed; the observation was hampered by strong winds [HAL]. Feb. 6.23: observation attempted through thin cirrus; a candidate was suspected but attributed to two faint stars shown on POSS prints; attempts in subsequent days to reobserve the suspect in light of a reported outburst (*IAUC* 5446, 5451) were hampered by poor skies, by the proximity of a 6th-mag star (56 Ari) and by moonlight; this negative observation should not be considered inconsistent with the reported outburst [HAL]. Mar. 5.17: estimate is of a suspect, which was not seen on the subsequent two nights; POSS prints show three very faint stars at the suspect's location [HAL]. Apr. 7.13: some interference from moonlight [HAL].

◇ *Periodic Comet Shoemaker-Levy 6 (1991b₁)* ⟹ 1991 Nov. 25.11: very diffuse, low surface brightness coma [HAL]. Dec. 7.20: extremely diffuse, very low surface brightness coma; the comet appears as little more than a brightening of the background sky [HAL].

◇ *Periodic Comet Tsuchinshan 2 (1991e₁)* ⟹ 1992 May 27.16: low altitude [HAL].

◇ ◇ ◇

Key to observers with observations published in this issue, with 2-digit numbers between Observer Code and Observer's Name indicating source [07 = Comet Section, British Astronomical Assn.; 11 = Dutch Comet Section; 16 = Yamaneko Group of Comet Observers (c/o Akimasa Nakamura, Aichi, Japan); etc.]. Those with asterisks (*) preceding the 5-character code are new additions to the Observer Key:

CODE	S	OBSERVER, LOCATION
ALC	07	G. E. D. Alcock, England
*ALL	07	W. H. Allen, New Zealand
BEN	07	Jack C. Bennett, South Africa
*BIA	07	U. M. Bias, Uruguay
BOR		John E. Bortle, NY, U.S.A.
*BRI02	07	D. M. Brierley, Preston, U.K.
*BUH	07	M. Buhagiar, W. Australia
*BUR02	07	H. T. Burgers, Cape Province, South Africa
CAM03	14	Paul Camilleri, Australia
COL02		Mike J. Collins, England
COM	11	Georg Comello, The Netherlands
*CUR02	07	A. C. Curtis, Hampshire, U.K.
DAH	24	Haakon Dahle, Norway
DOH	07	P. B. Doherty, England
*EDE	07	H. J. Edelman, S. Australia
FEI	11	Henk Feijth, The Netherlands
GAI	07	Michael J. Gainsford, England
GAR01	14	Gordon Garradd, N.S.W., Australia
GAV	07	M. V. Gavin, United Kingdom
GRA04	24	Bjoern Haakon Granslo, Norway
HAL		Alan Hale, U.S.A.
HAS02		Werner Hasubick, West Germany
HAS07	16	Akie Hashimoto, Japan
HAY01	16	Hironori Hayashi, Japan
HEN	07	Michael J. Hendrie, England
HER02		Carl Hergenrother, NJ, U.S.A.
ISH02	16	Akiyoshi Ishikawa, Japan
*ISL	07	J. E. Isles, London, U.K.
IWA01	16	Yoshitaka Iwaki, Japan
JON	07	Albert F. Jones, New Zealand
KON03	16	Eitoshi Konno, Japan
KOR01	19	Valeriy L. Korneyev, Zelenograd, [redacted] Russia
LEM	07	A. G. le Moeur, England
*LIV	07	R. J. Livesey, Glasgow, U.K.
LUE		Hartwig Luethen, West Germany
MEA		Philip Mead, Australia
MEY	28	M. Meyer, Germany
MIK		Herman Mikuz, Yugoslavia
MIL01	07	S. W. Milbourn, England
MIT	16	Shigeo Mitsuma, Japan
MOE		Michael Moeller, West Germany
NAG04	16	Kazuro Nagashima, Japan
NAK01	16	Akimasa Nakamura, Japan
NAK05	16	Tetsuya Nakamura, Japan
*NEL	07	J. Nelson, Lancashire, U.K.
NIG	07	H. C. Nightingale, Zambia
*NOR01	07	D. J. Northwood, Middlesex, U.K.
ONO	16	Osamu Onodera, Japan
PAN	07	Roy W. Panther, England
PIC	07	R. D. Pickard, England
*PIN	07	D. J. Pinnion, Essex, U.K.
*REE02	07	C. Reeves, Botswana
REN		Alexandre Renou, France
RID	07	Harold B. Ridley, England
SCH04	11	A. H. Scholten, The Netherlands
*SCO03	05	Charles Scovil, CT, U.S.A.
SEA	14	David A. J. Seargent, Australia
SIM	05	Karl Simmons, FL, U.S.A.
SOW	16	Toshihide Sowa, Japan
*STR01	07	D. M. Strand, Surrey, U.K.
STU	07	K. M. Sturdy, England
TOM01		Maura Tombelli, Italy
TSU02	16	Mitsunori Tsumura, Japan
VIE		Jean-Francois Viens, Quebec, Canada
YAS	16	Masanori Yasuki, Japan
*YOU02	07	P. J. Young, Yorkshire, U.K.
*YUS	16	Toru Yusa, Japan

Comet Ikeya-Seki 1968 I

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1968 09 22.32		13.7	AC	20.3	L			< 0.5	0			SIM
1968 10 28.22	O	13.3	AC	55.9	M	10	85					SCO03

Comet Tago-Sato-Kosaka 1969 IX

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1969 12 09.40		5.5	Y	8.0	B		11					JON
1969 12 21.5		4.3										EDE
1969 12 23.5		4.4		5.0	B		10			3		BUH
1969 12 25.5		3.5										EDE

Comet Tago-Sato-Kosaka 1969 IX [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1969 12 25.5		4.2		5.0	B		10			2		BUH
1969 12 25.75		4.5		6.0	B		10			1.5	163	BEN
1969 12 26.5		3.5		5.0	B		10			4		BUH
1969 12 27.42		3.0		3.0	B		8			6		ALL
1969 12 27.5		3.3										EDE
1969 12 27.5		3.4		5.0	B		10			5		BUH
1969 12 28.0		4.0		4.0	B		3			>2		BIA
1969 12 28.42		3.0		3.0	B		8			4		ALL
1969 12 28.5		3.3		5.0	B		10	12		5		BUH
1969 12 29.5		3.8										EDE
1969 12 29.50		3.0		3.0	B		8			4		ALL
1969 12 29.76		4.0		6.0	B		10			>4		BEN
1969 12 30.0		4.0		4.0	B		3			2.5		BIA
1969 12 30.7		3.0		5.0	B		7			1		NIG
1969 12 30.82		3.5		1.0	E					6		REE02
1969 12 31.5		3.2		5.0	B		10			7		BUH
1969 12 31.82		3.5		1.0	E					6		REE02
1970 01 01.5		3.5		5.0	B		10			8		BUH
1970 01 01.78		4.8		6.0	B		10					BEN
1970 01 02.0		4.1		4.0	B		3			4.5		BIA
1970 01 02.40		3.0		5.0	B		7			5		ALL
1970 01 02.5		3.6		5.0	B		10			7		BUH
1970 01 04.47		3.0		5.0	B		7			6		ALL
1970 01 07.0		4.0		4.0	B		3					BIA
1970 01 07.83		3.0		1.0	E					9		REE02
1970 01 08.43		3.0		15	L					6		ALL
1970 01 08.7		3.7		7	R		92	2.5		5		NIG
1970 01 09.79		4.5		1.0	E					8		REE02
1970 01 10.0		4.1		4.0	B		3			5		BIA
1970 01 10.46		3.0		15	L			6		6		ALL
1970 01 10.78		4.5		1.0	E					8		REE02
1970 01 10.8		4.0		1.0	E					5		BUR02
1970 01 11.0		4.0		4.0	B		3					BIA
1970 01 11.4		4.5		5.0	B		10			3		BUH
1970 01 11.7		4.7	Y	3.0	B		8			2.5		NIG
1970 01 11.83		4.5		1.0	E					3		REE02
1970 01 12.04		3.5		5.0	B		7			3.5		ALL
1970 01 12.7		4.5	Y	3.0	B		8			4		NIG
1970 01 12.71		4.5		1.0	E					2		REE02
1970 01 13.0		4.0		4.0	B		3			2.5		BIA
1970 01 14.72		4.7		1.0	E					<1		REE02
1970 01 15.7		4.1		3.0	B		8					NIG
1970 01 16.4		3.9										EDE
1970 01 16.4		4.5		5	R		15					MEA
1970 01 16.7		3.9		3.0	B		8					NIG
1970 01 20.79		5.0		6	R		16	6				LEM
1970 01 20.8		5.5		1.0	E							BUR02
1970 01 22.76		4.7	SC	8.0	B		11	14				PAN
1970 01 22.77		4.7	SC	12	R		20	6				MIL01
1970 01 22.79		4.5		5.0	B		10	10				GAV
1970 01 24.39		4.5		5.0	B		7					ALL
1970 01 25.39		4.5		15	L			7				ALL
1970 01 25.79		5.4		8.0	B		11	7				BRI02
1970 01 25.8		4.5		1.0	E			7		0.5	70	GAV
1970 01 25.8		4.9		3.0	B		8					NIG
1970 01 25.8		5.0		6.0	B		13	10		1.5	30	HEN
1970 01 25.8		6.0		5.0	B		10	10				NOR01
1970 01 25.82		5.3		12	R		20	6				MIL01
1970 01 25.83		4.5		11	R							RID

Comet Tago-Sato-Kosaka 1969 IX [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1970 01 26.39		4.3		5.0	B		7					ALL
1970 01 26.77		5.0		8.0	B		11	10		0.25	75	BRI02
1970 01 26.77		5.1		22	L		35	15		0.3	80	YOU02
1970 01 26.78		5.5		15	L		48	15				BUR02
1970 01 26.8		5.2		3.0	B		8					NIG
1970 01 26.81		6.1	S	5.0	B		7	6				GAI
1970 01 26.82		4.5		5.0	B		7	15				PIC
1970 01 26.83		6.0		5.0	B		10	10				NOR01
1970 01 26.87		4.8		11	R			10		1.5	73	RID
1970 01 27.38		4.3		5.0	B		7					ALL
1970 01 27.75		5.0		8.0	B		11	7				MIL01
1970 01 27.77		5.2		8.0	B		11	12				PAN
1970 01 27.79		6.2		5.0	B		10	10				NOR01
1970 01 27.81		4.9		5.0	B		7	15				GAI
1970 01 27.89		5.2		15	L		25	10				YOU02
1970 02 01.37		5.0		5.0	B		7					ALL
1970 02 01.8		5.9		3.0	B		8			1		NIG
1970 02 02.84		6.0		15	L		48	7				BUR02
1970 02 02.90		6.2		8.0	B		11	11				PAN
1970 02 02.91		5.0		5.0	B		10	6				GAV
1970 02 03.76		5.6		5.0	B		7					STR01
1970 02 03.76		6.5		11	R		70	5				RID
1970 02 03.77		6.0		15	L		25	7			80	YOU02
1970 02 03.77		6.2		8.0	B		11	11				PAN
1970 02 03.78		5.9		8.0	B		11	5				BRI02
1970 02 03.79		6.8	S	4.0	B		12	9				ISL
1970 02 03.8		5.3		5.0	B		10					PIN
1970 02 03.8		5.9		15	L		48	7				BUR02
1970 02 03.8		6.3		8.0	B		11	10				ALC
1970 02 03.81		6.2	S	5.0	B		7	4				STU
1970 02 03.81		6.5		21	L		65	2				PIC
1970 02 03.81		6.6		22	L		35	5				GAI
1970 02 03.84		5.5		5	R		25	7		0.7		DOH
1970 02 03.89		6.9		21	L							LIV
1970 02 04.77		6.2		8.0	B		11	10				PAN
1970 02 04.78		6.5		11	R		70	6				RID
1970 02 04.8		5.5		5.0	B		10					PIN
1970 02 04.8		5.9		31	L		60					CUR02
1970 02 04.85		5.5		.0	B		12					NEL
1970 02 04.85		6.1		8.0	B		11	5				BRI02
1970 02 04.87		6.0		15	L		25	7		0.25	80	YOU02
1970 02 04.98		6.6	S	4.0	B		12	7				ISL
1970 02 05.77		5.7		21	L		35	7			180	GAI
1970 02 05.77		7.0:		5.0	B		7					REE02
1970 02 05.78		5.4		5.0	B		10					NOR01
1970 02 05.78		6.2		8.0	B		11	10				PAN
1970 02 05.78		6.2	S	15	L		31	8				STU
1970 02 05.78		6.6		11	R		70	4				RID
1970 02 05.79		5.5		15	L		25	7		0.25	80	YOU02
1970 02 05.8		6.0		3.0	B		8	2				NIG
1970 02 05.80		5.9		5	R		25	7		0.5		DOH
1970 02 05.83		6.4		8.0	B		11	8				BRI02
1970 02 06.77		5.4		5.0	B		10	7				NOR01
1970 02 06.8		5.6		8.0	B		11					ALC
1970 02 06.81		5.9		21	L		35	4.5				GAI
1970 02 06.82		6.5		16	L		50	6				LEM
1970 02 06.87		6.1		25	L		40	8				MIL01
1970 02 06.88		5.6		8.0	B		11	9				PAN
1970 02 06.92		5.5		5.0	B		10	10				GAV

Comet Tago-Sato-Kosaka 1969 IX [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1970 02 07.76		5.7		5.0	B		7					REE02
1970 02 07.77		5.2		5.0	B		7	11		0.3		STU
1970 02 07.79		4.5		15	L		25	10		0.5	80	YOU02
1970 02 07.79		5.0		5.0	B		10	15				NOR01
1970 02 07.79		5.4		8.0	B		11	11		0.3	90	PAN
1970 02 07.8		5.5		8.0	B		11			1.5		ALC
1970 02 07.8		6.0		5.0	B		10					PIN
1970 02 07.80		5.7		5	R		25	7				DOH
1970 02 07.84		4.9		5.0	B		7	9			80	GAI
1970 02 07.84		5.6		.0	B		12					NEL
1970 02 07.85		4.5		15	L		48	10		0.25	80	BUR02
1970 02 07.87		4.7		5.0	B		10					GAV
1970 02 08.73		5.9		3.0	B		8					NIG
1970 02 08.78		6.0		5.0	B		7					REE02
1970 02 08.81		6.1		5.0	B		7	12		0.17		STU
1970 02 09.78		5.0		5.0	B		10	8				NOR01
1970 02 09.80		5.4		8.0	B		11	9				PAN
1970 02 09.80		5.8	S	4.0	B		12	8				ISL
1970 02 09.81		5.2		5.0	B		7	7				GAI
1970 02 09.81		6.0		21	L		65	7				PIC
1970 02 09.82		6.9		16	L		50	15				LEM
1970 02 09.85		5.2		5.0	B		7	9				STU
1970 02 09.89		5.7		5.0	B		10	10				GAV
1970 02 10.75		5.9	S	5.0	B		7	10		0.17		STU
1970 02 10.77		5.6		5.0	B		10	7				NOR01
1970 02 10.78		5.0		15	L		25	7		0.33	80	YOU02
1970 02 10.78		6.0		21	L		65	7				PIC
1970 02 10.79		5.6		8.0	B		11	12		0.4	70	PAN
1970 02 10.84		5.7		8.0	B		11	7				BRI02
1970 02 10.84		6.0		.0	B		12					NEL
1970 02 10.85		4.9		15	L		48	6		0.4	80	BUR02
1970 02 10.87		6.2		5	R		25	7				DOH
1970 02 10.91		6.0	S	4.0	B		12	6.5				ISL
1970 02 11.8		6 :		3.0	B		8	4				NIG
1970 02 11.80		6.4	S	15	L		31	2				STU
1970 02 13.77		6.1	S	5.0	B		7	6				STU
1970 02 13.78		6.7		8.0	B		11	6				BRI02
1970 02 13.81		6.2		8.0	B		11	10				PAN
1970 02 13.84		7 :		21	L		35	& 3				GAI
1970 02 13.85		6.0		15	L		48	3		0.25		BUR02
1970 02 13.88		6.5		.0	B		12					NEL
1970 02 14.77		6.1	S	5.0	B		7	5				STU
1970 02 14.8		7.3		6.5	B		10					PIN
1970 02 14.89		6.4		8.0	B		11	8				PAN
1970 02 15.77		7.0	S	5.0	B		7	4				STU
1970 02 15.81		6.9		8.0	B		11	6				BRI02
1970 02 15.81		7.3		16	L		50	7				LEM
1970 02 16.8		6.5:		15	L		48	2			75	BUR02
1970 02 16.81		6.9		8.0	B		11	7				PAN
1970 02 17.80		7.5:		16	L		50	7				LEM
1970 02 17.83		7.1		8.0	B		11	5				BRI02
1970 02 17.88		6.9		8.0	B		11	9				PAN
1970 02 18.77		7.2	S	5.0	B		7	4				STU
1970 02 22.8		7.7	S	5.0	B		7	5				STU
1970 02 22.8		7.8	UM	4.0	B		8	2			75	BUR02
1970 02 22.80		7.6		5	R		25	5				DOH
1970 02 22.81		7.3		8.0	B		11	6				PAN
1970 02 22.81		8.1		8.0	B		11	6				BRI02
1970 02 22.9		8.0		6.5	B		10					PIN

Comet Tago-Sato-Kosaka 1969 IX [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1970 02 22.91		8.8		5.0	B		10	7				GAV
1970 02 22.93		8.8		21	L		35	3				GAI
1970 02 23.8		7.9	UM	4.0	B		8	2				BUR02
1970 02 23.8		8.5	S	5.0	B		7	5				STU
1970 02 23.80		8.4		8.0	B		11	6				BRI02
1970 02 24.75		7.5		11	R		70					RID
1970 02 24.80		8.0		21	L		65	2.5				PIC
1970 02 24.80		8.2		8.0	B		11	6				BRI02
1970 02 24.82		8.5		16	L		50	6				LEM
1970 02 24.83		7.8		7.5	R		64	4				DOH
1970 02 24.84		8.3:		21	L		35	3.6				GAI
1970 02 24.92		7.7		8.0	B		11	6				PAN
1970 02 25.81		8.1		8.0	B		11	6				BRI02
1970 02 26.82		8.3:		7.5	R		64	3.5				DOH
1970 02 27.88		8.3:		7.5	R		64	3.5				DOH
1970 02 28.95		8.3:		7.5	R		64	3				DOH
1970 03 02.80		9.0	S	15	L		31	3				STU
1970 03 02.81		8.5		12	R		20	4				BRI02
1970 03 02.82		8.1		8.0	B		11	7				PAN
1970 03 02.87		8.8		21	L		35	3.7				GAI
1970 03 02.88		9.0		11	R		70					RID
1970 03 03.8		9.3	S	15	L		60	2				STU
1970 03 03.84		8.1		8.0	B		11	7				PAN
1970 03 04.83		8.7		7.5	R		64	3				DOH
1970 03 05.81		8.9		7.5	R		64	3				DOH
1970 03 05.87		9 :		16	L		50	8				LEM
1970 03 05.87		9.2		21	L		35	3				GAI
1970 03 05.88		9.2		12	R		20	2.5				BRI02
1970 03 06.82		8.7		7.5	R		64	2.5				DOH
1970 03 06.82		8.9		8.0	B		11	6				PAN
1970 03 06.84		9.4		16	L		50	10				LEM
1970 03 06.87		9.3		21	L		35	4				GAI
1970 03 06.90		9.3		11	R		70					RID
1970 03 06.95		9.4		12	R		20	2				BRI02
1970 03 07.8		9.0	UM	15	L		48	2				BUR02
1970 03 07.84		9.5		16	L		50	8				LEM
1970 03 07.85		9.1		8.0	B		11	7				PAN
1970 03 07.89		8.8		21	L		35	4				GAI
1970 03 08.82		9.1	S	15	L		60	3				STU
1970 03 09.83		9.7		16	L		50	10				LEM
1970 03 11.79		9.1		7.5	R		64	& 2.3				DOH
1970 03 11.83		9.6	S	15	L		60	2.5				STU
1970 03 27.86		11.5:		21	L		35	2				GAI

Comet IRAS-Araki-Alcock 1983 VII

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1983 05 07.96	B	7.0:	S	4.0	B		12	12	5			KOR01
1983 05 08.95	B	5.4	S	4.0	B		12	45	4			KOR01
1983 05 10.00	B	3.5	S	4.0	B		12	55	4			KOR01
1983 05 10.95	B	2.6	S	4.0	B		12	95	5			KOR01
1983 05 11.94	B	2.4	S	4.0	B		12	115	4			KOR01
1983 05 12.92	B	2.3	S	4.0	B		12	65	4			KOR01

Comet Austin 1984 XIII

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 09 08.86	B	6.8	S	15.0	L	6	40	7	4	0.2	120	KOR01
1984 09 10.87	B	6.8	S	15.0	L	6	40	6.5	4	0.3	120	KOR01

Comet Austin 1984 XIII [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 09 11.89	B	6.9	S	15.0	L	6	40	6.5	3	0.25	115	KOR01
1984 09 18.91	B	7.4	S	15.0	L	6	40	6	3/	0.3	110	KOR01
1984 09 23.93	B	7.6	S	15.0	L	6	40	6	4	0.15	110	KOR01
1984 09 24.94	B	7.7	S	15.0	L	6	40	6	4	0.15	115	KOR01
1984 09 27.97	B	8.0	S	15.0	L	6	40	6	4	0.1	120	KOR01
1984 10 01.06	B	8.2	S	15.0	L	6	40	5	3/	0.2	120	KOR01
1984 10 04.09	B	8.4	S	15.0	L	6	40	4	3			KOR01
1984 10 07.11	B	8.7	S	15.0	L	6	40	3.5	3			KOR01

Comet Levy-Rudenko 1984 XXIII

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 12 13.96	B	8.4	S	15.0	L	6	40	4	7	0.06		KOR01
1984 12 15.95	B	8.4	S	15.0	L	6	40	6	7			KOR01
1984 12 17.98	B	8.4	S	15.0	L	6	40	7	6	0.05		KOR01
1984 12 18.11	B	8.3	S	15.0	L	6	40	10	5	0.05		KOR01
1984 12 18.17	B	8.3	S	15.0	L	6	80	8	5			KOR01
1985 01 10.23	B	8.1	S	15.0	L	6	40	9	5			KOR01
1985 01 13.27	B	8.0	S	15.0	L	6	40	7	4			KOR01
1985 01 14.29	B	8.1	S	15.0	L	6	40	7	4			KOR01
1985 01 19.23	B	8.2	S	15.0	L	6	40	7	4			KOR01
1985 01 23.22	B	8.3	S	15.0	L	6	40	5.5	4			KOR01
1985 01 27.19	B	8.6:	S	15.0	L	6	40	4.5	5			KOR01
1985 02 12.11	B	9.1	S	15.0	L	6	40	3	5			KOR01

Comet Hartley-Good 1985 XVII

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 10 14.69	B	7.1	S	5.0	B		7	15	4	0.2	340	KOR01
1985 10 16.71	B	7.0	S	5.0	B		7	15	4	0.25	340	KOR01
1985 10 24.69	B	6.9	S	5.0	B		7	17	3	0.4	355	KOR01
1985 10 27.69	B	6.9	S	5.0	B		7	15	3/	0.5	0	KOR01
1985 10 28.71	B	7.0	S	5.0	B		7	15	4	0.4	0	KOR01
1985 11 01.74	B	7.1	S	5.0	B		7	15	4	0.8	25	KOR01
1985 11 02.77	B	7.2	S	5.0	B		7	15	4	0.8	30	KOR01
1985 11 03.73	B	7.2	S	5.0	B		7	15	4	0.8	30	KOR01
1985 11 04.76	B	7.2	S	5.0	B		7	13	4	0.6	30	KOR01
1985 11 09.72	B	7.3	S	5.0	B		7	8	3	0.3	50	KOR01
1985 11 14.77	B	7.7	S	5.0	B		7	6	3			KOR01
1985 11 17.81	B	7.7	S	5.0	B		7	5	3			KOR01
1985 12 01.76	B	7.9	S	15.0	L	6	40	4.5	3			KOR01
1985 12 02.76	B	7.9	S	15.0	L	6	40	4.5	2/			KOR01
1985 12 03.77	B	8.0	S	15.0	L	6	40	4	2			KOR01
1985 12 07.79	B	8.0	S	15.0	L	6	40	4	2			KOR01

Comet Thiele 1985 XIX

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 10 27.67	B	8.4	S	15.0	L	6	40	7	4			KOR01
1985 10 28.74	B	8.4	S	15.0	L	6	40	8	4			KOR01
1985 11 03.76	B	7.9	S	15.0	L	6	40	11	4			KOR01
1985 11 04.72	B	7.9	S	5.0	B		7	10	3			KOR01
1985 11 09.74	B	7.9	S	15.0	L	6	40	13	3			KOR01
1985 11 14.80	B	7.9	S	15.0	L	6	40	10	3			KOR01
1985 11 17.83	B	8.1	S	15.0	L	6	40	7	3			KOR01
1985 11 17.84	B	8.0	S	5.0	B		7	10	4			KOR01
1985 12 03.79	B	8.7	S	15.0	L	6	40	4	5			KOR01

Comet Rudenko 1987 XXIII

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1987 09 26.07	B	7.9	A	6	R	5	20	4.5	4			KOR01
1987 09 29.11	B	7.7	A	6	R	5	20	4.3	4			KOR01
1987 10 11.13	B	7.5	A	6	R	5	20	5.5	3			KOR01
1987 10 15.15	B	7.5	A	6	R	5	20	5	3			KOR01
1987 10 29.11	B	7.4	A	6	R	5	20	4.5	4			KOR01
1987 10 30.10	B	7.4	A	6	R	5	20	4.3	4			KOR01
1987 11 01.16	B	7.2	A	6	R	5	20	3.5	3/			KOR01

Comet Bradfield 1987 XXIX

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1987 10 09.65	B	7.2	A	15.0	L	6	40	6.5	4	0.2		KOR01
1987 10 10.67	B	7.1	A	6	R	5	20	6	4	0.2		KOR01
1987 10 11.68	B	7.1	A	6	R	5	20	6	4	0.25		KOR01
1987 10 13.73	B	7.0	A	6	R	5	20	4.5	3	0.3		KOR01
1987 10 15.69	B	6.8	A	6	R	5	20	5	3/	0.3		KOR01
1987 10 19.67	B	6.7	A	6	R	5	20	7.5	4	0.4		KOR01
1987 10 24.63	B	6.3	A	6	R	5	20	9	5	0.7		KOR01
1987 10 26.64	B	5.9	A	6	R	5	20	10	5	0.6	245	KOR01
1987 10 27.60	B	5.9	A	5.0	B		7	10	5	0.5	240	KOR01
1987 10 28.63	B	5.8	A	5.0	B		7	8	4	0.8		KOR01
1987 10 29.61	B	5.7	A	5.0	B		7	7	4	0.6		KOR01
1987 10 30.59	B	5.6	A	5.0	B		7	5	3/	0.4		KOR01
1987 11 01.68	B	5.6	A	5.0	B		7	7	3	0.4		KOR01
1987 11 23.69	B	5.8	A	5.0	B		7	9	4	0.3		KOR01
1987 11 27.73	B	5.8	A	5.0	B		7	11	4			KOR01
1987 11 29.71	B	5.9	A	5.0	B		7	8	4			KOR01
1987 12 01.68	B	6.1	A	6	R	5	20	7	3	0.2		KOR01
1987 12 04.63	B	6.1	A	6	R	5	20	7	3	0.2		KOR01
1987 12 09.69	B	6.3	A	6	R	5	20	5	3/	0.1		KOR01
1987 12 13.61	B	6.4	A	6.0	R	5	20	6	4	0.2		KOR01
1987 12 14.63	B	6.4	A	6	R	5	20	6	4	0.2		KOR01
1987 12 15.59	B	6.5	A	6	R	5	20	7	5	0.1		KOR01
1987 12 16.60	B	6.5	A	6	R	5	20	7	5	0.1		KOR01
1987 12 20.63	B	6.8	A	6	R	5	20	5	4	0.3		KOR01
1987 12 30.67	B	6.9	A	6	R	5	20	5	4	0.2		KOR01
1987 12 31.69	B	7.0	A	6	R	5	20	5	4	0.2		KOR01
1988 01 02.71	B	7.0	A	6	R	5	20	4	4	0.3		KOR01
1988 01 04.73	B	7.1	A	6	R	5	20	4.5	4	0.2		KOR01
1988 01 19.76	B	7.8	A	11	L	4	25	4	5			KOR01
1988 01 23.77	B	8.0	A	11	L	4	25	4	5			KOR01
1988 01 24.75	B	8.1	A	11	L	4	25	3	6	0.1		KOR01
1988 01 25.74	B	8.2	A	11	L	4	25	3	5/			KOR01
1988 01 26.77	B	8.2	A	11	L	4	25	3.5	5	0.2		KOR01
1988 01 27.79	B	8.4	A	11	L	4	25	3	6	0.3		KOR01
1988 01 28.77	B	8.5	A	11	L	4	25	3	6	0.3		KOR01
1988 01 29.76	B	8.6	A	11	L	4	25	2.5	5	0.1		KOR01
1988 02 06.74	B	8.8	A	11	L	4	25	2.5	4			KOR01

Comet McNaught 1987 XXXII

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1988 01 10.85	S	6.4	S	12	L	6	40	3	6			HAY01
1988 01 11.86	S	6.4	S	12	L	6	40	7	4			HAY01
1988 01 17.86	S	6.7	S	12	L	6	40	8	4		300	HAY01

Comet Liller 1988 V

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1988 04 13.07	B	5.5	AA	5.0	B		7	2.5	5	0.1	220	KOR01
1988 04 14.08	B	5.6	AA	5.0	B		7	2.5	5	0.1		KOR01
1988 04 17.96	B	5.8	AA	5.0	B		7	3	4	0.2		KOR01
1988 04 22.97	B	6.2	AA	5.0	B		7	3.5	4	0.6	225	KOR01
1988 04 23.98	B	6.3	AA	8.0	B		11	4	4	0.5		KOR01
1988 04 25.01	B	6.3	AA	8.0	B		11	4	4	0.4		KOR01
1988 05 09.03	B	6.7	AA	5.0	B		7	7	4	1.1	48	KOR01
1988 05 11.99	B	6.7	AA	5.0	B		7	7.5	4	1.0	50	KOR01
1988 05 12.97	B	6.8	AA	5.0	B		7	7.5	4	0.9	60	KOR01
1988 05 14.94	B	6.5	AA	5.0	B		7	8	4	0.9	75	KOR01
1988 05 17.96	B	6.6	AA	5.0	B		7	10	4	0.7	70	KOR01
1988 05 18.90	B	6.7	AA	5.0	B		7	9	4	0.7	75	KOR01
1988 05 21.91	B	7.0	AA	5.0	B		7	6.5	4	0.6	78	KOR01
1988 05 22.90	B	7.1	AA	5.0	B		7	6.5	3/	0.5	85	KOR01
1988 05 23.88	B	7.2	AA	5.0	B		7	6	3	0.5	85	KOR01
1988 05 26.91	B	7.5	AA	5.0	B		7	4.5	2	0.3	93	KOR01
1988 05 27.90	B	7.6	AA	5.0	B		7	4.5	3	0.3	90	KOR01
1988 05 28.86	B	7.6	AA	5.0	B		7	4	2	0.2	95	KOR01
1988 05 29.88	B	7.8	AA	5.0	B		7	4.2	2	0.2	95	KOR01
1988 05 30.89	B	7.9	AA	6.0	R	5	20	4.0	3	0.13	100	KOR01
1988 06 03.86	B	8.2	AA	6.0	R	5	20	3.3	3	0.1	100	KOR01
1988 06 04.86	B	8.3	AA	6.0	R	5	20	3.1	2/			KOR01
1988 06 05.87	B	8.3	AA	6.0	R	5	20	3.0	2			KOR01
1988 06 09.89	B	8.5	AA	6.0	R	5	20	2.7	2			KOR01

Comet Tsuchiya-Kiuchi 1990 XVII

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 01 06.55	S	9.7	S	31	L	4	40	2	1			TSU02

Comet Levy 1990 XX

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 01 08.85	S	7.9	S	12	L	6	40	5	3			HAY01
1991 01 10.84	S	8.0	AA	13	L	6	24	3	3			ISH02
1991 01 15.74	B	8.5	AA	17.5	L	5	36	5	4			SOW
1991 01 15.85	S	8.3	AA	13	L	6	24	4	4			ISH02
1991 01 15.85	S	8.3	S	12	L	6	40	6	4			HAY01
1991 01 17.79	S	7.8:	S	15.0	B		25		4			NAG04
1991 01 17.84	S	8.2	AA	13	L	6	24	4	4			ISH02
1991 01 17.84	S	8.3	S	12	L	6	40	6	3			HAY01
1991 01 18.72	M	7.8	AA	12.0	B		20	5	5			MIT
1991 01 19.76	B	7.7	AA	15.0	B		25	3.9	4			NAG04
1991 01 19.77	B	7.2	AA	8.0	B		20	6	4			YUS
1991 01 19.78	S	7.6	AA	7.0	B		10	5	4			YAS
1991 01 19.78	S	8.2	AA	20	L	6	48	5	5			YAS
1991 01 23.84	S	8.5	AA	13	L	6	24	4	4			ISH02
1991 01 25.76	M	7.5	AA	12.0	B		20	6	5			MIT
1991 01 25.83	S	8.5	AA	13	L	6	24	4.5	3			ISH02
1991 01 26.83	B	7.7	S	10.0	R	4	20	4.9	4			NAG04
1991 01 27.84	S	8.5	AA	13	L	6	24	3.5	4			ISH02
1991 02 01.79	S	8.7	AA	13	L	6	44	2.5	3			ISH02
1991 02 05.63	S	8.4	AA	13	L	6	24	4	4			ISH02
1991 02 07.64	S	8.5	AA	13	L	6	44	3	3			ISH02
1991 02 08.63	B	6.7	AA	5.0	B		7	10	3			NAK05
1991 02 08.65	S	8.7	S	15	L	5	38	4	4			ONO
1991 02 08.69	S	8.4	AA	13	L	6	24	5	4			ISH02
1991 02 08.74	M	8.1	AA	12.0	B		20	6	4			MIT
1991 02 12.60	S	8.8	S	15	L	5	38	3	4			ONO

Comet Levy 1990 XX [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 02 12.62	S	8.5:	S	10.0	B		14	4	1			IWA01
1991 02 17.59	S	8.5:	S	10.0	B		14	5	3			IWA01
1991 02 19.61	S	8.3	AC	13	L	6	24	6	4			ISH02
1991 02 21.54	S	9.0	S	15	L	5	38	4	4			ONO
1991 02 21.74	B	8.7	AA	10.0	R	4	20	4.1	3			NAG04
1991 02 23.51	S	8.7	S	15	L	5	38	3	5			ONO
1991 02 23.75	B	7.4	AA	25	L	5	40	7	4			NAK05
1991 02 23.75	B	8.0	AC	12.0	B		20	5	3			HAS07
1991 02 24.59	S	8.5	AC	13	L	6	24	4.5	4			ISH02
1991 02 25.50	S	9.2:	S	15	L	5	38	2				ONO
1991 02 25.56	S	8.6	AC	13	L	6	44	4	3			ISH02
1991 02 26.54	S	8.6	AC	13	L	6	44	3.5	3			ISH02
1991 03 03.50	B	9.0	S	15.0	B		25	2.8	2/			NAG04
1991 03 03.57	S	8.8	AC	13	L	6	24	3.5	3			ISH02
1991 03 03.59	S	9.2	AC	20	L	6	48	2	4			YAS
1991 03 05.56	S	8.6	AC	13	L	6	44	4	3			ISH02
1991 03 06.50	S	9.5	AC	20	L	6	48	2	3			YAS
1991 03 06.57	S	9.2:	AA	13	L	6	44	2.5	3			ISH02
1991 03 09.54	B	8.8	AA	12.0	B		20	5	3			HAS07
1991 03 09.60	S	8.9	AC	13	L	6	24	4.5	2			ISH02
1991 03 12.53	S	9.2	AA	13	L	6	24	4	2			ISH02
1991 03 13.49	M	8.8	S	31	L	4	40	4	4			TSU02
1991 03 13.49	S	9.6	S	20	L	6	48	2	3			YAS
1991 03 17.58	S	9.5	AA	13	L	6	44	4	2			ISH02
1991 03 18.56	S	10.4	AC	20	L	6	48	2	3			YAS
1991 03 19.53	S	9.6	AC	13	L	6	44	3	2			ISH02

Comet Arai 1990 XXVI

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 01 17.96	S	11.0	A	31.0	J	6	74	0.8	2			FEI

Comet Shoemaker-Levy 1991d

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 11 17.20	S	12.0	CO	25	L	6	83	2	5	?		REN
1991 12 05.51	M	11.7	AC	41	L	4	83					HAL
1991 12 07.22	B	11.2	CO	25	L	6	83	2.5	5	?	300	REN
1991 12 14.54	M	11.2	AC	41	L	4	83					HAL
1992 01 04.55	M	10.5	AC	20	L	6	55					HAL
1992 01 10.50	! M	11.1	AC	41	L	4	83					HAL
1992 01 12.44	S	9.9	AC	31.7	L	6	68	2.2	5			BOR
1992 02 03.43	S	9.9	AC	31.7	L	6	68	2.4	4			BOR
1992 02 06.50	M	10.8	AC	41	L	4	83					HAL
1992 02 09.16	S	10.6	A	20.0	T	10	77	& 1	2			COM
1992 02 14.51	M	10.9	AC	41	L	4	183					HAL
1992 02 27.51	M	10.6	AC	41	L	4	83					HAL
1992 02 29.19	B	11.8	VF	25	L	6	83	1.5	4/			REN
1992 03 04.51	M	10.9	AC	41	L	4	83					HAL
1992 03 06.16	S	10.6	A	28.0	T	10	110	& 1	2			COM
1992 03 11.50	M	11.6	AC	41	L	4	83					HAL
1992 03 30.50	M	11.6	AC	41	L	4	83					HAL
1992 04 04.47	M	11.6	AC	41	L	4	83					HAL
1992 04 05.14	B	12.4	VF	25	L	6	83	2	4			REN
1992 04 08.09	S	11.2	A	28.0	T	10	110	1	1/			COM
1992 04 10.44	M	11.6	AC	41	L	4	83					HAL
1992 04 28.44	M	12.4	AC	41	L	4	183					HAL
1992 04 30.02	S	11.4	AC	15.2	L	5	44	3.5	1			MOE
1992 05 01.07	S	11.7	AC	15.2	L	5	44	3.5	0			MOE

Comet Shoemaker-Levy 1991d [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 05 06.01	S	11.8	AC	15.2	L	5	44	3	0			MOE
1992 05 08.09	S	11.8:	A	28.0	T	10	177		1			COM
1992 05 21.97	S	11.9	A	28.0	T	10	177	& 1	1			COM

Comet Helin-Lawrence 1991l

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 01 13.65	S	13.3	A	25	L	4	150	1.0	3			GAR01
1992 06 29.44	I	[12.0		41	L	4	183					HAL
1992 07 02.45	I	[13.0		41	L	4	183					HAL

Comet Helin-Alu 1991r

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 03 06.50	I	[13.0		41	L	4	183					HAL
1992 04 01.45	I	[13.5		41	L	4	183					HAL

Comet Shoemaker-Levy 1991a1

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 11 30.24	I	[14.0		41	L	4	183					HAL
1992 01 10.23	I	[13.0		41	L	4	183					HAL
1992 01 23.12	I	[13.5		41	L	4	183					HAL
1992 01 30.14	S	[14.0	AC	41	L	4	183	0.5				HAL
1992 02 22.10	I	[13.5		41	L	4	183					HAL
1992 04 28.46	I	[12.0		41	L	4	183					HAL
1992 04 30.04	S	11.6	AC	15.2	L	5	44	2.5	2			MOE
1992 05 01.06	S	11.7	AC	15.2	L	5	44	2	2			MOE
1992 05 01.46	I	[12.0		41	L	4	183					HAL
1992 05 02.01	S	11.7	AC	15.2	L	5	44	2.5	2			MOE
1992 05 03.06	S	11.6	AC	15.2	L	5	44	2	2			MOE
1992 05 06.02	S	11.5	AC	15.2	L	5	44	2.5	2			MOE
1992 05 09.08	S	11.6	AC	15.2	L	5	44	1.5	2			MOE
1992 05 11.46	S	11.7	AC	41	L	4	183					HAL
1992 05 12.00	S	11.6	AC	15.2	L	5	44	2	3			MOE
1992 05 12.33	! S	10.1	AC	31.7	L	6	68	1.5	1/			BOR
1992 05 13.09	S	11.5	AC	20.0	L	4	40	1.5	3			MIK
1992 05 21.01	S	11.3	AC	15.2	L	5	44	2	2			MOE
1992 05 25.00	S	11.0:	AC	13.0	L	6	36	3.7	2			MEY
1992 05 26.00	S	10.4	AC	13.0	L	6	36	3.1	2			MEY
1992 05 27.00	S	10.4	AC	13.0	L	6	36	3.4	3			MEY
1992 05 27.42	S	11.2	AC	41	L	4	83					HAL
1992 05 28.01	S	10.3	AC	13.0	L	6	36	3.5	3			MEY
1992 05 29.00	S	10.3	AC	13.0	L	6	36	2.6	3			MEY
1992 05 29.32	S	9.5	AC	31.7	L	6	68	2.4	1/			BOR
1992 05 30.00	S	10.1	AC	13.0	L	6	36	3.5	4			MEY
1992 05 30.02	S	10.0	AC	10.0	B		25	4.3	3			MEY
1992 05 31.01	S	10.0	AC	10.0	B		25	3.2	4			MEY
1992 06 03.32	S	9.1	AC	31.7	L	6	68	2.5	2/			BOR
1992 06 04.44	M	10.1	AC	41	L	4	83					HAL
1992 06 05.97	S	9.3	S	20.3	T	10	67	3.0	1			LUE
1992 06 07.05	S	10.1:	AC	6.0	B		20	& 2	1			MIK
1992 06 07.06	S	10.5	AC	20.0	L	4	40	& 3	3			MIK
1992 06 09.44	M	10.0	AC	41	L	4	83					HAL
1992 06 10.30	! S	9.2	AC	31.7	L	6	68	2.4	4	?	275	BOR
1992 06 10.30	S	9.4	NO	31.7	L	6	68					BOR
1992 06 11.30	! S	9.1	AC	31.7	L	6	68	2.0	4	0.15	265	BOR
1992 06 11.30	S	9.3	NO	31.7	L	6	68					BOR
1992 06 12.31	S	9.0	AC	31.7	L	6	68	2.3	5			BOR

Comet Shoemaker-Levy 1991a1 [cont.]

DATE (UT)		MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 06 12.31		S	9.2	NO	31.7	L	6	68					BOR
1992 06 16.06		S	10.2	AC	20.0	L	4	40	& 3	3			MIK
1992 06 17.16	!	S	9.7	NP	20	L	6	55					HAL
1992 06 18.87		S	9.7	AA	6.0	B		20	& 4	2			MIK
1992 06 20.88		S	9.6	AA	6.0	B		20	& 4	3			MIK
1992 06 25.93		S	9.3	AA	6.0	B		20	& 4	4			MIK
1992 06 26.43		S	8.9	NP	5.0	B		10					HAL
1992 06 26.92		S	9.3	AA	6.0	B		20	& 4.5	4			MIK
1992 06 27.88		S	9.2	AA	6.0	B		20	& 5	4/			MIK
1992 06 27.89		S	8.8	AA	5.0	B		7	& 4	2			MIK
1992 06 30.97		M	8.7	AA	6.0	B		20	& 4	6			MIK
1992 07 02.18					41	L	4	83			0.25	0	HAL
1992 07 02.18		M	8.5	NP	5.0	B		10					HAL
1992 07 03.93		S	8.4	AA	6.0	B		20	& 5	6/			MIK
1992 07 03.94		S	8.3	AA	5.0	B		7	& 3	8			MIK
1992 07 07.19					41	L	4	83			0.2	55	HAL
1992 07 07.19		M	7.9	NP	5.0	B		10					HAL
1992 07 13.89		S	8.2	AA	6.0	B		20	& 4	6			MIK

Comet Zanotta-Brewington 1991g1

DATE (UT)		MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 12 28.39		S	9.5	AC	20	L	6	58	3.0	3			NAK01
1991 12 29.40		S	10.4	AC	16	L	6	31	2	3			MIT
1991 12 30.38		S	9.5	AC	13	L	6	44	3	4			ISH02
1991 12 30.77		B	9.5	VF	12	L	6	40	4	4			REN
1991 12 31.15	!	M	9.8	AC	20	L	6	55					HAL
1991 12 31.38		S	9.4	AC	13	L	6	44	3	5			ISH02
1992 01 02.39		S	9.4	AC	20	L	6	48	2.5	4			YAS
1992 01 03.40		S	9.3	AC	13	L	6	44	2	3			ISH02
1992 01 04.76		S	8.6	A	20.0	T	10	77	& 2	5			COM
1992 01 06.79		B	9.0:	VF	12	L	6	40	5	5			REN
1992 01 08.09					41	L	4	83			0.17	8	HAL
1992 01 08.09		S	9.4	NP	5.0	B		10					HAL
1992 01 10.39		S	8.7	AC	13	L	6	44	3	4			ISH02
1992 01 10.40		M	8.6	AA	20	L	6	46	3	5/			NAK01
1992 01 10.74		S	8.3	A	11.0	L	7	54	& 3	3			SCH04
1992 01 11.39		S	8.7	AC	13	L	6	62	2	4			ISH02
1992 01 11.98	!	S	8.4	AC	31.7	L	6	68	2.1	5/			BOR
1992 01 12.39		S	8.4	AA	20	L	6	48	3.5	5			YAS
1992 01 13.39		S	8.4	AC	13	L	6	44	3	4			ISH02
1992 01 13.98	!	S	8.1	AC	8.0	B		20	3.0	4/			BOR
1992 01 13.98	!	S	8.2	AC	31.7	L	6	68	2.2	6			BOR
1992 01 14.12		S	7.7	AA	20.3	R	15	152					HER02
1992 01 14.39		S	8.3	AC	13	L	6	24	3.5	4			ISH02
1992 01 15.42		S	8.4	AA	13	L	6	44	3	4			ISH02
1992 01 19.39		S	8.1	AA	13	L	6	24	3	5			ISH02
1992 01 20.40		S	7.9	AA	13	L	6	24	3	5			ISH02
1992 01 21.40		S	7.9	AA	13	L	6	44	2.5	4			ISH02
1992 01 21.73		S	7.6	A	11.0	L	7	32	& 4	6			SCH04
1992 01 22.41		S	7.8	AA	13	L	6	44	3	5			ISH02
1992 01 22.77		B	8.5	VF	12	L	6	40	3.5	5/			REN
1992 01 22.79		S	7.5	A	20.0	T	10	77	& 1.5	5/			COM
1992 01 23.10		M	8.7	AC	41	L	4	83					HAL
1992 01 24.77		B	8.5	VF	12	L	6	40	3.5	5/			REN
1992 01 25.39		S	7.6	AA	10.0	B		20	2	5			ISH02
1992 01 26.75		S	7.6	A	20.0	T	10	88	& 1	5			COM
1992 01 27.39		S	7.4	AA	13	L	6	44	3	4			ISH02
1992 01 28.10	!	S	9.0	NP	5.0	B		10	.				HAL

Comet Zanotta-Brewington 1991g1 [cont.]

DATE (UT)		MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 01 28.77		B	8.3	VF	12	L	6	40	3.5	6			REN
1992 01 29.78		B	8.5:	VF	25	L	6	43	3	5			REN
1992 01 29.98					31.7	L	6	68		6			BOR
1992 01 29.98		S	7.8	NO	8.0	B		20	3.1				BOR
1992 01 31.45		M	7.0	SC	8	B		20	2	3			CAM03
1992 02 01.41		S	7.7	AA	10.0	B		20	3	4			ISH02
1992 02 01.42		M	7.8	AC	20	L	6	46	2	6/			NAK01
1992 02 02.40		M	7.9	AC	20	L	6	46	2.5	6			NAK01
1992 02 02.40		S	8.1	AA	20	L	6	48	2.0	6			YAS
1992 02 02.41		S	7.7	AC	13	L	6	62	3	4			ISH02
1992 02 02.98	!	S	7.7	AC	8.0	B		20					BOR
1992 02 04.39		S	7.8	AA	13	L	6	62	2.5	4			ISH02
1992 02 04.46		M	7.5	SC	8	B		20	2.5	3			CAM03
1992 02 09.10	!	S	8.4	NP	20	L	6	55					HAL
1992 02 24.46		M	9.0	S	20.3	L	7	56	3	3			CAM03
1992 02 25.46		M	9.0	S	20.3	L	7	56	4	2			CAM03
1992 03 01.43		S	8.4	A	5.0	B		10	2				GAR01
1992 03 06.46		M	9.6	S	20.3	L	7	56	3	3			CAM03

Comet Mueller 1991h1

DATE (UT)		MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 01 07.35		S	13.7	AC	41	L	4	183					HAL
1992 01 22.78		S	11.8	A	28.0	T	10	108	> 2	1			COM
1992 01 24.19		S	11.1	WA	41	L	4	83	5	1			HAL
1992 01 26.89		S	11.6	A	28.0	T	10	88	> 2	0			COM
1992 01 29.26		S	11.0	PC	41	L	4	83		1/			HAL
1992 01 29.81			[12.5		25	L	6	83					REN
1992 02 03.07		S	10.6	AC	31.7	L	6	68	2.2	1			BOR
1992 02 03.78		S	11.4	A	28.0	T	10	88	& 2	0/			COM
1992 02 04.00		S	10.6	AC	31.7	L	6	68	2.5	1			BOR
1992 02 06.03		S	9.9	AC	31.7	L	6	68	2.9	0/			BOR
1992 02 06.21		S	10.7	PC	41	L	4	83					HAL
1992 02 07.02		S	9.5:	AC	8.0	B		20	& 5	0			BOR
1992 02 07.02		S	9.9	AC	31.7	L	6	68	2.8	0/			BOR
1992 02 08.93		S	10.6	A	28.0	T	10	88	& 1.5	1			COM
1992 02 20.10		S	8.6	NP	5.0	B		10					HAL
1992 02 20.15		S	9.4	AA	20.3	R	15	152		2			HER02
1992 02 21.01	!	S	8.6	AC	8.0	B		20	3.0	4			BOR
1992 02 21.01	!	S	8.7	AC	31.7	L	6	68	3.2	4			BOR
1992 02 22.01	!	S	8.4	AC	8.0	B		20	3.8	4			BOR
1992 02 22.01	!	S	8.6	AC	31.7	L	6	68	2.5	4			BOR
1992 02 22.15		S	9.0	AA	15.2	R	15	72	4.0	3			HER02
1992 02 23.45		M	9.0	S	8.0	B		20	3	0			CAM03
1992 02 23.82		B	8.5	VF	25	L	6	83	3	5/			REN
1992 02 24.12		S	8.4	AA	20.3	R	15	152	4.0	4			HER02
1992 02 24.45		M	9.0	S	8.0	B		20	3	0			CAM03
1992 02 25.09		S	8.6	AA	20.3	R	15	152	2.0	5			HER02
1992 02 25.46		M	9.0	S	8.0	B		20	4	0			CAM03
1992 02 27.14		S	8.3	AA	20.3	R	15	152	2.5	5			HER02
1992 02 27.80		B	8.6	VF	12	L	6	40	4	5/			REN
1992 02 28.15	!	M	8.1:	NP	5.0	B		10					HAL
1992 02 28.80		B	8.3	VF	12	L	6	40	4	5/			REN
1992 02 29.11	!	M	8.4	NP	5.0	B		10					HAL
1992 02 29.14		S	8.0	AA	20.3	R	15	152	2.5	4			HER02
1992 03 01.02	!	S	7.5	AC	8.0	B		20	& 4	5			BOR
1992 03 02.80		B	8.3	VF	12	L	6	40	3.5	5/			REN
1992 03 04.78		B	7.6	S	10.0	B		25	2.3	3			HAS02
1992 03 05.11	!	M	8.1	NP	5.0	B		10					HAL

Comet Mueller 1991h1 [cont.]

DATE (UT)	MM MAG.	RF	AP.	T F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 03 06.79	[7 :		12	L 6	40					REN
1992 03 09.42	[7.0		8.0	B	20					CAM03
1992 03 21.80	I[-2 :		41	L 4	52					HAL
1992 03 24.54	I[-1 :		20	L 6	35					HAL
1992 03 26.52	I[3 :		20	L 6	35					HAL
1992 03 30.51	I[6.5:		20	L 6	55					HAL
1992 03 31.50	S[8.0	SC	20	L 6	35					HAL
1992 04 01.50	I[8.5:		20	L 6	55					HAL
1992 04 04.50	S[10.0:		41	L 4	83					HAL
1992 04 05.18	[8 :		25	L 6	43					REN
1992 04 06.39	S[9 :	NO	8.0	B	20					BOR
1992 04 10.47	I[12.0		41	L 4	183					HAL

Comet Helin-Alu 1992a

DATE (UT)	MM MAG.	RF	AP.	T F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 01 29.28	I[13.5		41	L 4	183					HAL
1992 03 25.16	I[13.5		41	L 4	183					HAL

Comet Bradfield 1992b

DATE (UT)	MM MAG.	RF	AP.	T F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 02 13.74	M 10.3	SM	20.3	L 7	56	2.5	2			CAM03
1992 02 14.54	! S 9.5:	AC	41	L 4	52		2/			HAL
1992 02 14.71	M 10.3	SM	20.3	L 7	56	2	2			CAM03
1992 02 15.70	M 10.5	SM	20.3	L 7	56	2	0			CAM03

Comet Tanaka-Machholz 1992d

DATE (UT)	MM MAG.	RF	AP.	T F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 04 01.48	M 9.6	AC	41	L 4	83					HAL
1992 04 04.49	M 8.3	NP	5.0	B	10					HAL
1992 04 05.14	S 8.3:		11.0	L 7	32	6	6			SCH04
1992 04 05.16			25	L 6	83	3	6	?		REN
1992 04 05.16	B 7.7	S	10.3	R 7	40	9	6			COL02
1992 04 05.16	B 8.5:	A	8.0	B	11		6			REN
1992 04 06.10	S 9.5:	AA	15.2	L 5	44	& 2	3			MOE
1992 04 06.38			31.7	L 6	68	2.6	5			BOR
1992 04 06.38	! S 8.6	AC	5.0	B	10	5				BOR
1992 04 06.38	! S 8.7	AC	8.0	B	20	3.6	4			BOR
1992 04 08.12	S 8.9:	AA	15.2	L 5	44	& 1.5	3			MOE
1992 04 08.13	S 8.5	A	11.0	L 7	32	4	4			SCH04
1992 04 08.15	S 8.5:	A	20.0	T 10	66	& 2	4			COM
1992 04 09.09	S 8.8	AA	15.2	L 5	44	3.5	4		280	MOE
1992 04 09.16	B 8.8	A	12	L 6	40	4	6	?		REN
1992 04 10.15	S 8.3	S	10.3	R 7	40	6	5			COL02
1992 04 10.19	S 8.2	S	10.0	B	25	2.2	4			HAS02
1992 04 10.46	M 8.6	NP	5.0	B	10					HAL
1992 04 11.10	S 7.9	AA	13.0	L 6	36	4.6	5			MEY
1992 04 11.10	S 8.6	AA	15.2	L 5	44	3.5	5			MOE
1992 04 12.17	S 8.6	S	10.0	B	25	3.8	4			HAS02
1992 04 13.14	S 8.5	AC	44	L 4	50					TOM01
1992 04 13.15	B 8.6	A	12	L 6	40	4	6			REN
1992 04 13.37	S 8.5	S	25.4	L 6	57		4			VIE
1992 04 14.36	S 8.5	S	11.4	L 8	40		3			VIE
1992 04 15.38	! S 8.3	AC	5.0	B	10	6	5			BOR
1992 04 16.35	S 8.2	S	11.4	L 8	40		3			VIE
1992 04 19.35	S 8.2	S	11.4	L 8	40		3			VIE
1992 04 20.04	S 8.9:	AA	15.2	L 5	44	3.5	4			MOE

Comet Tanaka-Machholz 1992d [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 04 20.14	S	8.4	AC	44	L	4	50					TOM01
1992 04 21.04	S	8.8	AA	15.2	L	5	44	4.5	4			MOE
1992 04 21.05	S	8.8	AA	5.0	B		10	4	5			MOE
1992 04 21.07	B	8.2	AA	10.0	B		25	3.7	5			MEY
1992 04 21.10	B	8.3	AA	13.0	L	6	36	4.4	6			MEY
1992 04 21.10	S	8.1	A	11.0	L	7	32	4	3			SCH04
1992 04 21.15	S	8.4	AC	44	L	4	50					TOM01
1992 04 22.03	S	8.9:	AA	15.2	L	5	44	& 3	4			MOE
1992 04 26.04	S	8.7	AA	5.0	B		10	3	6			MOE
1992 04 26.05	S	8.8	AA	15.2	L	5	44	3.5	5			MOE
1992 04 26.05	S	8.9	AA	10.0	B		25	3.6	3			MEY
1992 04 26.34	S	8.2	S	4.0	R	5	10		4			VIE
1992 04 27.04	S	8.3	S	10.3	R	7	40	6	7			COL02
1992 04 27.04	S	8.8	AA	15.2	L	5	44	3.5	5			MOE
1992 04 28.02	S	8.9:	AA	15.2	L	5	44	3	4			MOE
1992 04 28.03	S	8.9	AA	13.0	L	6	36	3.3	4			MEY
1992 04 29.12	B	8.9	A	12	L	6	40	3.5	5/	?		REN
1992 04 29.35	S	8.2	AC	5.0	B		10	3.5	5			BOR
1992 04 29.35	S	8.3	AC	31.7	L	6	68	2.5	5			BOR
1992 04 29.46	M	8.5	NP	5.0	B		10					HAL
1992 04 30.03	B	8.7	AA	5.0	B		10	4	6			MOE
1992 04 30.03	S	8.7	AC	15.2	L	5	44	4	5	?		MOE
1992 04 30.04	S	8.8	AC	15.2	L	5	100	3.5	5	0.15	280	MOE
1992 04 30.08	S	8.1	A	11.0	L	7	32	4	6			SCH04
1992 05 01.03	S	8.9	AA	13.0	L	6	36	2.3	4			MEY
1992 05 01.05	B	8.8	AA	5.0	B		10	3	7			MOE
1992 05 01.06	S	8.8	AC	15.2	L	5	44	3	6			MOE
1992 05 01.06	S	8.9	AC	15.2	L	5	100	3	6	?		MOE
1992 05 02.00	B	8.7	AA	5.0	B		10	3	7			MOE
1992 05 02.00	S	8.7	AC	15.2	L	5	44	3.5	6			MOE
1992 05 02.09	S	8.8	AC	44	L	4	50					TOM01
1992 05 03.06	S	8.7	AC	15.2	L	5	44	3	5			MOE
1992 05 03.11	B	8.7	A	12	L	6	40	3.5	5			REN
1992 05 04.01	S	8.6	AG	20.3	T	10	80	2.9	3			GRA04
1992 05 04.03	S	8.3	S	10.0	M	10	50	3.0	3			LUE
1992 05 04.04	S	8.6	AC	15.2	L	5	44	3.5	6			MOE
1992 05 04.04	S	8.9	AA	10.0	B		25	3.3	5			MEY
1992 05 04.05	S	8.9	AA	13.0	L	6	36	4.0	5			MEY
1992 05 04.08	S	8.2	A	11.0	L	7	32	6	6			SCH04
1992 05 04.08	S	8.3	A	20.0	T	10	77	& 1.5	5			COM
1992 05 05.03	B	9.1	AA	10.0	B		25	4.3	5			MEY
1992 05 05.07	S	8.1	A	11.0	L	7	32	4.5	6			SCH04
1992 05 05.32	S	8.5	S	11.4	L	8	40		3			VIE
1992 05 06.01	S	8.9	AC	15.2	L	5	44	3.5	5			MOE
1992 05 06.02	B	8.9	AA	5.0	B		10	3	6			MOE
1992 05 07.02	S	8.5	AG	20.3	T	10	80	2.8	3/			GRA04
1992 05 07.11	B	8.7	A	12	L	6	40	4	5			REN
1992 05 07.31	S	8.5	S	11.4	L	8	40		3			VIE
1992 05 07.32				31.7	L	6	68	3.6	5			BOR
1992 05 07.32	S	8.5	AC	5.0	B		10	4.5				BOR
1992 05 08.08	S	9.0	AA	6.0	B		20	& 4	3			MIK
1992 05 09.03	S	8.2	HD	20.3	T	10	80	2.2	4/			GRA04
1992 05 09.03	S	8.4	AG	20.3	T	10	80	2.2	4/			GRA04
1992 05 09.08	S	9.0	AC	15.2	L	5	44	3.5	5			MOE
1992 05 09.09	S	8.9	AA	5.0	B		10	3	6			MOE
1992 05 10.00	M	7.4	MC	20.3	T	10	80	3.0	5			GRA04
1992 05 10.00	M	8.2	BD	20.3	T	10	80	3.0	5			GRA04
1992 05 10.92	S	7.5	MC	20.3	T	10	80	2.8	4/			GRA04
1992 05 11.44	M	7.7	NP	5.0	B		10					HAL

Comet Tanaka-Machholz 1992d [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 05 11.97	S	7.3	HD	20.3	T	10	80	4.5	4/			GRA04
1992 05 11.97	S	7.3	MC	20.3	T	10	80	4.5	4/			GRA04
1992 05 11.99	B	8.1	AA	5.0	R	4	10	3	5			MOE
1992 05 11.99	S	8.3	AC	15.2	L	5	44	4	5	0.20	300	MOE
1992 05 12.00	S	8.3	AC	15.2	L	5	100	4.5	5	0.15	300	MOE
1992 05 12.08	S	8.3	A	11.0	L	7	32	5	6			SCH04
1992 05 12.32				31.7	L	6	68	3.8	5/			BOR
1992 05 12.32	S	7.0	AC	5.0	B		10	6.5	5			BOR
1992 05 12.33	S	7.1	S	5.0	B		10		4			VIE
1992 05 12.98	S	7.4	HD	20.3	T	10	80	4.7	4/			GRA04
1992 05 12.98	S	8.0	SC	20.3	T	10	133	2.5	5			DAH
1992 05 13.07	S	7.5	AA	6.0	B		20	& 8	5/			MIK
1992 05 13.08	S	7.1	AA	5.0	B		7	& 7	6			MIK
1992 05 13.89	S	8.3:	AA	5.0	B		10	& 3	5			MOE
1992 05 13.97	S	7.5	HD	20.3	T	10	80	4.0	4			GRA04
1992 05 14.08	S	8.1	A	11.0	L	7	32	5	6/			SCH04
1992 05 14.98	B	8.3	AA	5.0	R	4	10	3	4			MOE
1992 05 14.98	S	8.3	AC	15.2	L	5	44	3.5	4			MOE
1992 05 14.99	S	8.0	HD	20.3	T	10	80	3.1	3			GRA04
1992 05 15.01	S	8.6	AC	10.0	B		25	3.5	4			MEY
1992 05 15.31	S	8.0	S	11.4	L	8	40		4			VIE
1992 05 16.00	S	8.7	AC	10.0	B		25	3.5	4			MEY
1992 05 16.07	S	7.6	AA	6.0	B		20	& 4	3			MIK
1992 05 16.92	B	8.4:	AA	5.0	B		10	& 3	5			MOE
1992 05 17.00	S	8.6	AC	10.0	B		25	3.6	4			MEY
1992 05 17.31	S	8.1	S	11.4	L	8	40		3			VIE
1992 05 17.88	B	8.3	AA	5.0	R	4	10	3	4			MOE
1992 05 17.88	S	8.3	AC	15.2	L	5	44	4	4	0.1	320	MOE
1992 05 17.96	S	7.8	S	10.3	R	7	40	4	6			COL02
1992 05 18.00	S	8.7	AC	10.0	B		25	3.1	4			MEY
1992 05 18.89	B	8.4	AA	5.0	R	4	10	3	5			MOE
1992 05 18.89	S	8.4	AC	15.2	L	5	44	3.5	5	0.1	320	MOE
1992 05 18.91	B	8.1	A	12	L	6	40	5	5/	?		REN
1992 05 18.91	S	7.9	A	11.0	L	7	32	4	6/			SCH04
1992 05 18.96	S	8.4	S	10.3	R	7	40	4	5			COL02
1992 05 18.96	S	8.6	AC	10.0	B		25	3.7	5			MEY
1992 05 19.08	S	7.5	NO	8.0	B		20	3.5	5			BOR
1992 05 19.90	B	8.3	AA	5.0	R	4	10	3.5	6			MOE
1992 05 19.90	S	8.2	AC	15.2	L	5	44	4.5	5	0.1	325	MOE
1992 05 19.97	S	8.2	AA	10.3	R	7	40	4	7			COL02
1992 05 19.98	S	8.2	A	20.0	T	10	77	& 2	5/			COM
1992 05 20.09	! S	7.7	NO	8.0	B		20	3.2	6			BOR
1992 05 20.31	S	8.0	S	11.4	L	8	40		4			VIE
1992 05 20.89	S	8.3:	AC	15.2	L	5	44	3.5	5	0.1	325	MOE
1992 05 20.93	B	8.1	A	12	L	6	40	4.5	5/			REN
1992 05 20.95	S	8.2	A	20.0	T	10	77	& 1.8	5			COM
1992 05 20.98	B	8.2	AA	10.3	R	7	40	6	7			COL02
1992 05 20.99	B	8.2	AA	5.0	R	4	10	3	6			MOE
1992 05 21.00	B	8.1	S	15.2	L	5	44	4	5	0.2	330	MOE
1992 05 21.00	S	8.2	AC	15.2	L	5	100	4	5	0.15	330	MOE
1992 05 21.09	! S	7.7	NO	8.0	B		20	4.0	5			BOR
1992 05 21.31	S	8.2	S	11.4	L	8	40		3			VIE
1992 05 21.90	B	8.3	S	5.0	R	4	10	4	4			MOE
1992 05 21.90	S	8.3	AC	15.2	L	5	44	4.5	3			MOE
1992 05 21.96	S	8.3	A	20.0	T	10	77	& 1	5			COM
1992 05 21.99	S	7.7	A	11.0	L	7	32	5	5/			SCH04
1992 05 22.31	S	8.3	S	11.4	L	8	40		3			VIE
1992 05 22.90	S	8.5	AC	15.2	L	5	44	3	5	0.1	330	MOE
1992 05 22.91	S	8.4	AC	6.0	R	12	35	3.5	5			MOE

Comet Tanaka-Machholz 1992d [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 05 23.01	S	7.8	A	11.0	L	7	32	4	6/	?	45	SCH04
1992 05 23.09	S	7.9	NO	8.0	B		20	3.8	4			BOR
1992 05 23.90	S	8.5:	AC	15.2	L	5	44	3.5	4			MOE
1992 05 23.95	S	8.6	AA	10.0	B		25	4.7	5			MEY
1992 05 24.95	S	8.6	AA	10.0	B		25	4.7	5			MEY
1992 05 25.03	S	8.6	S	10.3	R	7	40	5	7			COL02
1992 05 25.93	S	8.2	A	20.0	T	10	66	& 1.8	5			COM
1992 05 25.95	S	8.6	AA	10.0	B		25	4.6	5			MEY
1992 05 26.96	S	8.8	AA	10.0	B		25	5.1	5			MEY
1992 05 26.98	S	8.3	S	10.3	R	7	40	5	6			COL02
1992 05 27.44	S	8.7	NP	5.0	B		10					HAL
1992 05 27.95	S	8.8	AA	10.0	B		25	5.8	5			MEY
1992 05 27.98	S	8.2	A	11.0	L	7	32	5	4/			SCH04
1992 05 28.96	S	8.8	AA	10.0	B		25	4.9	5			MEY
1992 05 29.01	S	8.1	A	11.0	L	7	32	5	4/			SCH04
1992 05 29.30				31.7	L	6	68	3.2	5			BOR
1992 05 29.30	! S	8.0	NO	8.0	B		20	4.8	4			BOR
1992 05 29.97	S	8.9	AA	10.0	B		25	4.1	5			MEY
1992 05 30.29	S	8.5	S	11.4	L	8	40		3			VIE
1992 05 30.96	S	8.9	AA	10.0	B		25	4.7	5			MEY
1992 05 31.02	S	8.4	S	10.3	R	7	40	5	5			COL02
1992 05 31.97	S	9.0	AA	10.0	B		25	4.6	5			MEY
1992 06 03.30	S	8.4	MP	8.0	B		20	4.7	3			BOR
1992 06 03.30	S	8.9	MP	31.7	L	6	68	2.5	4			BOR
1992 06 04.45	! S	9.4:	AC	41	L	4	83					HAL
1992 06 05.99	S	9.1	S	20.3	T	10	67	3.0	2			LUE
1992 06 10.31	S	8.6	MP	31.7	L	6	68	& 6.3	4			BOR
1992 06 11.31	S	8.8	MP	31.7	L	6	68	3.2	3			BOR
1992 06 12.32	S	8.8	MP	31.7	L	6	68	& 2.3	3			BOR
1992 06 18.18	! S	10.5	NP	20	L	6	55					HAL
1992 06 20.90	I	[11.0	AC	20.0	L	4	40					MIK

Comet Bradfield 1992i

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 05 05.77	S	9.4	A	25	L	4	80	1.5	5			GAR01
1992 05 05.80	M	9.3	AA	10.0	B		25	3	5			SEA
1992 05 12.80	S	9.4	AA	10.0	B		25	3	4			SEA
1992 05 24.34		[8.0	AA	10.0	B		25	! 3				SEA
1992 05 24.34	S	[9.0	AA	10.0	B		25	! 1				SEA
1992 05 29.32	S	10.5	AA	25	L	4	80	2	2			GAR01
1992 05 30.35	S	11.3	AA	25	L	4	150	2	0			GAR01
1992 05 31.35	S	11.3	AA	25	L	4	80	2.5	1			GAR01
1992 06 03.14	I	[11 :		41	L	4	83					HAL
1992 06 06.15	I	[11.0		41	L	4	83					HAL

Comet Machholz 1992k

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 07 03.45	S	9.2:	PC	41	L	4	83					HAL
1992 07 08.45	! M	9.2	PC	41	L	4	83					HAL

Periodic Comet Encke

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 02 24.70	B	8.8	S	11.0	B		20	4	3			KOR01
1984 02 25.65	B	8.8	S	11.0	B		20	4.2	3			KOR01
1984 02 28.68	B	8.7	S	11.0	B		20	4.3	4			KOR01
1984 03 03.64	B	8.6	S	11.0	B		20	4.5	4			KOR01

Periodic Comet Machholz

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 08 02.47	S	9.5	AC	20	L	6	58	2	5			NAK01
1991 08 12.47	S	10.1	AC	20	L	6	58	3	3			NAK01

Periodic Comet Kopff (1983 XIII)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1983 08 12.83	B	8.4	S	15.0	L	6	40	3.5	4			KOR01
1983 08 14.86	B	8.4	S	15.0	L	6	40	3.2	4			KOR01

Periodic Comet Giacobini-Zinner (1985 XIII)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 08 17.89	B	7.9	S	5.0	B		7	8	6	0.2	270	KOR01
1985 08 18.91	B	7.8	S	5.0	B		7	8	6	0.2	270	KOR01
1985 08 19.93	B	7.8	S	5.0	B		7	7	6	0.15	265	KOR01
1985 08 19.95	B	7.7	S	6.5	L	7	20	8	5/	0.15	270	KOR01
1985 08 20.99	B	7.6	S	5.0	B		7	8	5	0.3	265	KOR01
1985 08 21.87	B	7.6	S	5.0	B		7	9	5	0.3	265	KOR01
1985 08 23.88	B	7.6	S	5.0	B		7	10	4	0.5	275	KOR01
1985 08 26.90	B	7.5	S	5.0	B		7	12	4	0.7	275	KOR01
1985 09 01.93	B	7.4	S	15.0	L	6	40	7	4	1.3	285	KOR01
1985 09 02.96	B	7.4	S	15.0	L	6	40	7.5	4	1.2	285	KOR01
1985 09 12.11	B	7.7	S	15.0	L	6	40	6	3/	0.3	295	KOR01
1985 09 14.93	B	7.8	S	15.0	L	6	40	6	3	0.2	310	KOR01

Periodic Comet Tsuchinshan 2 (1991e1)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 02 28.22	I	[13.5		41	L	4	183					HAL
1992 03 25.15	I	[13.5		41	L	4	183					HAL
1992 05 27.16	I	[13.0		41	L	4	183					HAL

Periodic Comet Hartley 2 (1991t)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 08 17.07	S	8.3	A	11.0	L	6	24	8.5	4			FEI
1991 12 05.48	S	10.9	AC	41	L	4	83					HAL
1991 12 14.47	S	11.1	AC	41	L	4	83					HAL
1992 01 04.57	S	[11.5:	AC	20	L	6	55					HAL
1992 01 07.42	I	[12.5		41	L	4	83					HAL

Periodic Comet Faye (1991n)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 09 04.94	S	12.0	A	31.0	J	6	74	0.5	3			FEI
1991 11 08.46	S	10.0	A	25	L	4	80	2	8			GAR01
1991 11 27.21	S	9.7	NP	5.0	B		10					HAL
1991 12 04.27	M	9.9	AC	41	L	4	83					HAL
1991 12 13.29	M	10.3	AC	41	L	4	83					HAL
1991 12 31.18	M	10.8	WA	20	L	6	55					HAL
1992 01 07.29	! M	11.2	PC	41	L	4	83					HAL
1992 01 10.26	M	11.6	PC	41	L	4	83					HAL
1992 01 22.80	S	11.6	A	28.0	T	10	108	& 1	0/			COM
1992 01 24.16	M	11.9	PC	41	L	4	83					HAL
1992 01 26.86	S	11.7	A	28.0	T	10	108	& 1	1			COM
1992 02 03.86	S	11.9	A	28.0	T	10	88	> 1	0			COM
1992 02 06.02	S	11.8	AC	50.0	L	5	96	1.0	3			BOR

Periodic Comet Metcalf-Brewington (1991a)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 01 14.75	S	8.9	A	11.0	L	6	24	4.5	3			FEI
1991 01 15.75	S	9.2	A	11.0	L	6	24	3	2			FEI

Periodic Comet Kowal 2 (1991f1)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 01 07.41	I	[13.5		41	L	4	183					HAL

Periodic Comet Shoemaker 1 (1991p)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 11 25.06	I	[13.5		41	L	4	183					HAL
1991 12 04.14	I	[13.5		41	L	4	183					HAL

Periodic Comet Shoemaker-Levy 6 (1991b1)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 11 15.64	S	11.1	AC	13	L	6	62	2	2			ISH02
1991 11 15.65	S	11.4	AC	20	L	6	58	2.5				NAK01
1991 11 25.11	S	11.8	AC	41	L	4	83		0/			HAL
1991 12 07.20	S	12.2	AC	41	L	4	83		0			HAL

Periodic Comet Shoemaker-Levy 8 (1992f)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 04 29.49	I	[13.5		41	L	4	183					HAL
1992 05 27.18	I	[13.5		41	L	4	183					HAL
1992 06 06.27	I	[13.5		41	L	4	183					HAL

Periodic Comet Smirnova-Chernykh

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 02 28.23	I	[13.5		41	L	4	183					HAL
1992 03 24.25	I	[13.5		41	L	4	183					HAL

Periodic Comet Boethin (1986 I)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 01 23.63	B	7.9	S	15.0	L	6	40	8	4			KOR01
1986 02 05.70	B	8.7	S	15.0	L	6	40	5	5			KOR01

Periodic Comet Chernykh (1991o)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 11 27.19	I	[13.0		41	L	4	183					HAL
1991 12 04.15	I	[13.5		41	L	4	183					HAL

Periodic Comet Schwassmann-Wachmann 1

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1989 08 08.67	P	14 :		31	L	4		1.2	2			TSU02
1989 08 28.56	P	14 :		16	H	3						KON03
1989 08 28.58	P	14 :		16	H	3						KON03
1989 08 28.70	P	14 :		16	W	4		1.5	3			TSU02
1989 09 03.76	P	15 :		16	W	4		1	3			TSU02
1989 09 09.71	P	14.5:		31	L	4		1	3			TSU02
1989 09 11.77	P	15 :		16	W	4		1.5	2			TSU02
1989 09 20.49	P	13.0	GA	31	L	4		< 0.2	9			TSU02
1989 09 23.54	P	13.2:		13	H	3		1.5	8			NAK05

Periodic Comet Schwassmann-Wachmann 1 [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1989 09 24.46	P	12.5:		16	H	3		2				KON03
1989 09 24.50		12.0:		31	L	4	100	0.8	3			TSU02
1989 09 24.51	P	12.0:		31	L	4		0.7	6			TSU02
1989 09 26.49	P	12.5:		31	L	4		0.9	4			TSU02
1989 09 26.50		12.5:		31	L	4	100	1.4	1			TSU02
1989 09 29.49	P	13 :		16	H	3		2				KON03
1989 10 01.45	P	13 :		16	H	3		2				KON03
1989 10 01.62	P	12.5:		31	L	4		1	3			TSU02
1989 10 04.49	P	12.8:		31	L	4		1.8	3			TSU02
1989 10 04.51		12.8:		31	L	4	100	1.5	3			TSU02
1989 10 08.59	S	13.2	AC	20	L	6	106	1.1	2/			NAK01
1989 10 09.63	P	12.8:		31	L	4		2	3			TSU02
1989 10 09.66	P	13.5:		13	H	3		1.0	4			NAK05
1989 10 20.45		13.0:		31	L	4	103	1.5	5			TSU02
1989 10 21.48		12.8:		31	L	4	103	0.25	8			TSU02
1989 10 21.51	P	12 :		16	H	3		1	9			KON03
1989 10 22.42		13.0:		31	L	4	103	0.4	6			TSU02
1989 10 23.54		12.8:		31	L	4	103	0.5	6			TSU02
1989 10 23.60	S	13.5	AC	20	L	6	150	0.8	4/			NAK01
1989 10 25.52		13.0:		31	L	4	103	0.7	5			TSU02
1989 10 29.47	S	13.4	AC	20	L	6	150	1.0				NAK01
1989 10 30.50	P	13.5:		16	H	3		2				KON03
1989 10 30.62	P	13.2:		31	L	4		1.0	2			TSU02
1989 11 03.49	P	[14.0		13	H	3						NAK05
1989 11 20.51	P	16 :		16	H	3		2				KON03
1989 11 24.60	P	15.5:		31	L	4		0.7	1			TSU02
1989 11 26.42	P	16 :		16	H	3						KON03
1989 11 26.45	P	16 :		31	L	4		0.3	2			TSU02
1989 12 21.42	P	13.5:		31	L	4		0.6	4			TSU02
1990 01 17.43	P	14.5:		31	L	4		1.2	1			TSU02
1990 06 22.74	P	[16		16	W	4						TSU02
1990 07 05.78	P	[16		31	L	4						TSU02
1990 07 30.78	P	13.0:		31	L	4		0.5	5			TSU02
1990 08 18.65	P	14.5:		16	H	3		1				KON03
1990 08 19.68	P	16 :		16	W	4		1.5	1			TSU02
1990 08 20.61	P	15 :		16	H	3		0.5	2			KON03
1990 08 22.57	P	16 :		16	H	3						KON03
1990 08 23.78	P	15.5:		16	H	3		0.5	2			KON03
1990 08 25.66	P	15.5:		16	H	3		0.5	2			KON03
1990 08 26.74	P	16 :		16	W	4		2	1			TSU02
1990 08 27.64	P	14.5:		16	H	3		0.8	2			KON03
1990 09 15.65	P	12.5:		16	H	3		0.8	5			KON03
1990 09 16.46	P	13 :		16	H	3		1	4			KON03
1990 09 18.67	P	13 :		16	H	3		1	3			KON03
1990 09 20.55	P	12.0:		31	L	4		1.7	3	0.01	140	TSU02
1990 09 20.55	P	13 :		16	H	3		2	2			KON03
1990 09 21.74	P	12.2:		31	L	4		2.0	3	0.01	90	TSU02
1990 09 21.76	S	12.7	AC	20	L	6	106	1.1				NAK01
1990 10 10.52	P	16 :		16	H	3		1	1			KON03
1990 10 11.50	P	16 :		16	H	3		1	1			KON03
1990 10 20.58	P	16 :		16	H	3		1	1			KON03
1990 10 21.52	P	15 :		31	L	4		0.5	3			TSU02
1990 10 28.67	P	14.5:		31	L	4		0.5	3			TSU02
1990 11 12.56	P	13.0:		31	L	4		0.5	3	0.01	230	TSU02
1990 11 17.59	P	13.5:		31	L	4		0.6	2	0.01	195	TSU02
1990 12 04.40	P	15 :		16	H	3		1	3			KON03
1990 12 05.42	P	15 :		16	H	3		0.5	3			KON03
1990 12 06.48	P	14.5:		31	L	4		0.5	4			TSU02
1990 12 13.53	P	13.5:		16	H	3		1.5	4	0.02	35	KON03

Periodic Comet Schwassmann-Wachmann 1 [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1990 12 21.49	P	15 :		31	L	4		0.3	3			TSU02
1991 01 06.57	P	16 :		31	L	4		0.3	2			TSU02
1991 02 03.45	P	15 :		16	H	3		0.8				KON03
1991 02 07.45	P	[16		31	L	4						TSU02
1991 02 17.49	P	[16		31	L	4						TSU02
1991 08 12.72	S	12.1	AC	20	L	6	106	1.6	2			NAK01
1991 08 12.76	P	12 :		16	W	4		1.5	2			TSU02
1991 08 13.69	S	12.3	AC	20	L	6	106	1.6	1/			NAK01
1991 08 14.69	P	12.5:		16	H	3		2	3			KON03
1991 08 14.70	S	12.3	AC	20	L	6	106	1.7	2			NAK01
1991 09 06.72	P	12 :		16	W	4		3.5	1			TSU02
1991 09 09.67	P	14.5:		16	H	3		2.5	1			KON03
1991 10 02.58	P	13 :		31	L	4		5	1			TSU02
1991 10 02.64	P	15 :		16	H	3		2	2			KON03
1991 10 15.62	P	14.5:		16	H	3		1	2			KON03
1991 11 05.60	P	15 :		16	H	3		0.8	1			KON03
1991 11 05.61	P	14 :		31	L	4		0.5	4			TSU02
1991 11 25.49	P	14.5:		31	L	4		0.3	4			TSU02
1991 11 26.17	I	[13.0		41	L	4	183					HAL
1991 11 26.42	P	15 :		16	H	3		0.5	3			KON03
1991 11 29.55	P	13.5:		16	H	3		0.8	5			KON03
1991 12 02.53	P	12.5:		31	L	4		< 0.2	9			TSU02
1991 12 04.48	P	12.5:		16	H	3		0.3	7			KON03
1991 12 04.49	P	12 :		31	L	5		0.3	7			TSU02
1991 12 05.21	S	12.6	PC	41	L	4	183					HAL
1991 12 06.22	S	12.7	WA	41	L	4	183		2/			HAL
1991 12 07.61	S	13.1	AC	20	L	6	106	1.5				NAK01
1991 12 13.36	S	12.9	WA	41	L	4	183		1			HAL
1991 12 31.21	I	[13 :		41	L	4	150					HAL
1992 01 01.32	I	[12.0		20	L	6	110					HAL
1992 01 23.14	I	[13.5		41	L	4	183					HAL
1992 01 29.23	I	[13.5		41	L	4	183					HAL
1992 02 06.23	I	[12.5:		41	L	4	183					HAL
1992 02 20.10	I	[13.0		41	L	4	183					HAL
1992 02 22.13	I	[13.5		41	L	4	183					HAL
1992 03 05.17	S	[12.8	AC	41	L	4	183					HAL
1992 03 22.14	I	[13.5		41	L	4	183					HAL
1992 04 01.13	I	[13.5		41	L	4	183					HAL
1992 04 07.13	I	[12.5		41	L	4	183					HAL
1992 04 21.13	I	[12.5		41	L	4	183					HAL

Periodic Comet Crommelin (1984 IV)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 02 23.73	B	8.3	S	11.0	B		20	4.5	4	0.4		KOR01
1984 02 24.74	B	8.3	S	11.0	B		20	4.5	4	&0.3		KOR01
1984 02 25.69	B	8.2	S	11.0	B		20	5	5	0.3		KOR01
1984 02 26.63	B	8.1	S	11.0	B		20	4.7	5	0.4		KOR01
1984 02 28.72	B	8.1	S	11.0	B		20	4.5	5	0.2		KOR01
1984 03 03.68	B	8.3	S	11.0	B		20	4.0	4			KOR01
1984 03 04.66	B	8.4	S	11.0	B		20	3.4	4			KOR01

Periodic Comet Van Biesbroeck (1989h1)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 08 12.54	S	13.4	AC	20	L	6	150	0.7	6			NAK01
1991 08 13.63	S	13.5	AC	20	L	6	150	0.8	5/			NAK01
1991 08 14.60	S	13.3	AC	20	L	6	150	0.9	4/			NAK01
1991 11 03.53	S	13.8	AC	73	C	11	275	0.8	4/			NAK01

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Below is a drawing of periodic comet Faye (1991n), made by Stephane Garro during 1991 Nov. 10.931-10.941 UT. Garro was using a 20.3-cm f/10 T (167×) from his site at Merlette in the Hautes-Alpes of France. The three jets marked J1, J2, and J3 in his drawing (counterclockwise from lower right of center) were measured at position angles 62°, 120° (curved to 151°), and 251° (curved to 276°), respectively. The major tails marked 1 and 2 (both of length 0°.09) are at p.a. 10° and 39°, respectively.

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