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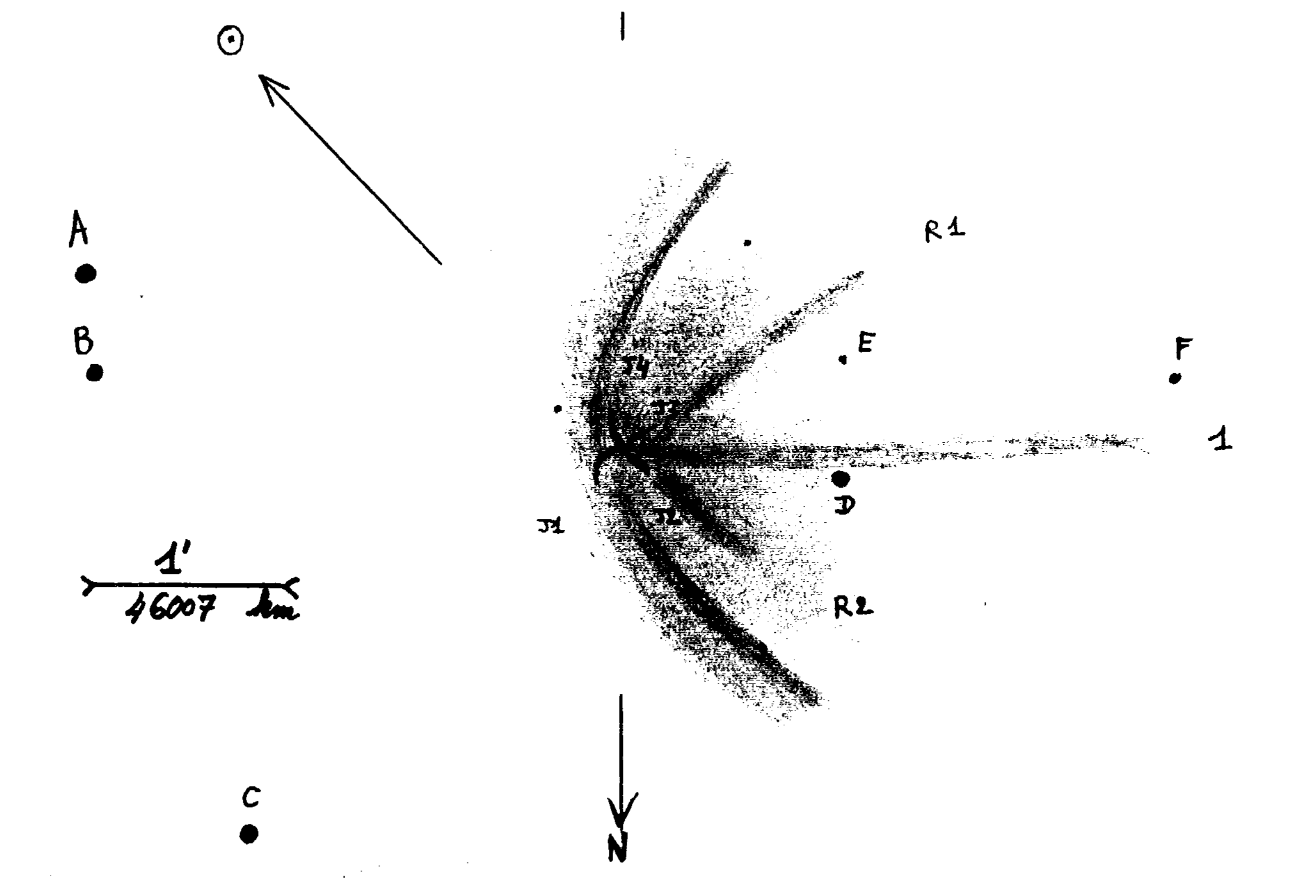

Drawing of the inner coma of comet Zanotta-Brewington 1991g$_1$ by Stéphane Garro from the Hautes Alpes in France with a Celestron 8 reflector on 1991 Dec. 29.77 UT (see p. 102).

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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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Manuscripts will be reviewed for possible publication (if possible, send via computer networks; or, send typed, double-spaced copy to the Editor at the Cambridge address above); authors should first obtain a copy of "Information and Guidelines for Authors" from the Editor. Cometary observations also should be sent to the Editor in Cambridge; all data intended for publication in the *ICQ* that is not sent via computer electronic mail should be sent on standard *ICQ* observation report forms, which can be obtained upon request from the Editor. Those who can send manuscripts and observational data in machine-readable form are encouraged to do so [especially through e-mail via the computer networks *SPAN* (CFAPS2::GREEN), *BITNET* (GREEN@CFA), or Internet (GREEN@CFA.HARVARD.EDU), or via floppy disks that can be read on an IBM PC], and should contact the Editor for further information.

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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— FIRST INTERNATIONAL WORKSHOP ON COMETARY ASTRONOMY —

After sponsoring four successful American Workshops on Cometary Astronomy (AWCA I-IV) during 1982-1987, the *ICQ* announces plans for its first International Workshop on Cometary Astronomy (IWCA), to be held on 1994 February 19 in Milan, Italy (possibly in nearby Bergamo). The occasion marks the 15th anniversary of the *ICQ* as a unique astronomical journal, and it will also mark 20 years since the founding of this publication under the original title *The Comet.* If interest is high, the meeting could be extended to a second day (perhaps Feb. 18). We have found a most enthusiastic host organizer in Mauro V. Zanotta, and we hope to get widespread attendance of cometary observers, not only from those throughout Europe but also from avid observers on other continents. As anyone familiar with organizing meetings knows, it is vital for a good meeting to have a strong and committed local organizing group.

A meeting such as this is made more valuable by an increased number of attendees, and we hope that — through early, widespread announcement — we will draw many amateurs. This meeting provides an excellent first opportunity for *ICQ* Observation Coordinators to collect in a single location to discuss observational and reporting/archiving problems and strategies. We will invite several professional astronomers to provide reviews of various aspects of cometary astronomy that relate directly to the type of observing results that are published in the *ICQ*, thereby keeping the emphasis of the first AWCA, which was to show how professional and amateur astronomers can mutually benefit from exchanging information with regard to comets. A few invited papers from amateur astronomers will also be scheduled, and there may be time for a few additional selected contributed papers. But a large amount of time will be scheduled either for panel discussions or simply for informal roundtable discussions of various issues regarding cometary observing.

(Cont. on page 94)

AN INTERCOMPARISON OF THE MAJOR 20TH CENTURY SUNGRAZING COMETS

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Abstract. Photometric and tail length observations of the three recent bright sungrazing comets are examined. Magnitude formulae and computed tail lengths representing these data are presented and a comparison is made between these three obects and other members of the Kreutz sungrazing group of comets.

During the present century three major comets belonging to the Kreutz sungrazing comet group have been observed by Earth-based observers. Even a cursory examination of the observational data from their respective apparitions clearly indicates that one of them, comet 1965 VIII, was far more spectacular than the other two. This could easily lead to the conclusion that 1965 VIII was intrinsically larger and brighter than either of the others. However, Earth-comet-sun geometry can dramatically influence the brightness and appearance of these comets, producing a highly deceptive impression of relative importance. It will be shown that this was the case for the objects under discussion.

The Kreutz sungrazing comet group includes at least 8 major and 15 lesser objects travelling in similar orbits that bring them within 0.01 AU of the sun at perihelion. The celestial longitude and latitude of perihelia for the best observed sungrazers are almost identical, and it is unquestionable that they have evolved from the break-up of a single large comet at some time in the past. Marsden (1967, 1989) has shown that the period of revolution of the individual members of the group ranges from 4 to 10 centuries. Orbital inclination is such that any members coming to perihelion during the months of December, January, and May will be observable as bright objects exclusively from Earth's southern hemisphere. Further, if perihelion occurs from early June through mid-August the comet will remain deep in twilight until it has grown faint and will likely escape detection. Notable also is that the dates of the observed comets' perihelia are spread in a highly nonrandom fashion over the past 3.5 centuries. Groupings of apparitions occur during the late 1600s, late 1800s, and shortly after mid 20th century.

The *International Comet Quarterly* has published a large body of data on comet 1965 VIII in recent years, including extensive and separately listed observations by Bortle (1982, 1991), Jones (1987), and members of the A.L.P.O. (Green 1991a). In contrast, physical observations of comets 1963 V and 1970 VI are very few in number and, prior to recent publication in the *ICQ* (Jones 1987; McClure 1990; Green 1990, 1991b; and the Descriptive Information on page 101 of this issue), have appeared only in small groups scattered through the literature. To the author's knowledge, no definitive photometric formulae have previously been published for either comet 1963 V or 1970 VI.

In an effort to produce as complete a picture of these comets' photometric and physical activities as possible, a number of publications and sources in addition to the *ICQ* were examined. Once a working list of data had been compiled, the author began by analyzing the largest body of data — that for comet 1965 VIII.

I. HISTORIES AND PHOTOMETRIC DATA

COMET 1965 VIII. This object was one of the 20th century's most spectacular comets. It was discovered in the morning sky by Ikeya and Seki one month before perihelion passage. Within a day or two of its perihelion the comet was observable in full daylight! As it receded from the sun, it developed a very bright, 30°-long tail. The apparition's geometrical circumstances were highly favorable, with the comet fairly well placed for observation from the time of discovery until it faded from view. The *ICQ* data base reflects this in the > 150 published photometric observations spanning 4.5 months.

This data base was first refined by the consolidation of multiple magnitude estimates made by single observers on a given day, and then further improved by the elimination of a small number of obviously discordant values. These included the two final observations of the data set, made by A. Herring; they were brightness estimates only to the nearest whole magnitude and seem to be impressions of the comet's brightness rather than estimates by actual comparison with stars of known magnitude. Since virtually all the daytime magnitude estimates (Oct. 20-23 UT) were strictly subjective and showed a scatter of several magnitudes, they were also eliminated. The singular exception was a determination by Meisel (1976) on October 20.90, which was the only one obtained using a comparison source of known brightness and was retained.

It has been the author's experience that the need for aperture correction is evident to some degree in virtually all comet magnitude data. Since a very large percentage of the photometric observations for 1965 VIII were made using small aperture binoculars, there were insufficent data upon which to determine any comet-specific aperture corrections. Considering that the aperture correction formulae proposed by Bobrovnikoff (1941) and Morris (1973) have been widely used in past analyses of comet data, and tended to reduce scatter in the 1965 VIII data, they were employed as published for the data on each of the three comets. The author does acknowledges, however, that the validity of *standard* aperture correction is not universally accepted. For this reason reductions were conducted both with and without these standard corrections being applied.

The final working list for comet 1965 VIII contained 133 magnitude determinations, split almost evenly between pre- and post-perihelion (68 datapoints vs. 65 datapoints), while spanning a range in heliocentric distance (r) of 0.04-1.63 AU. A number of analyses using various combinations of the data were made. The first included all the data except the Meisel daytime observation, to avoid its possible undue influence on the results. In the next run the Meisel data was included. Additional runs split the data to determine strictly pre-T and post-T values (T = time of perihelion). In each case the data were reduced by the method of least squares to determine the best fit to the standard power-law formula:

$$m_1 = H_o + 5 \log \Delta + 2.5n \log r,$$

where m_1 is the total visual magnitude, H_o is the comet's so-called absolute magnitude, n is the power-law exponent, and Δ is the comet's geocentric distance in AU.

The resulting values of H_o and n for the complete sets of data with and without Meisel's observation agreed within a probable error of $\pm$ 0.02 in each term, confirming the validity of Meisel's daytime magnitude determination. When splitting the data base, the pre- and post-T values for H_o and n differed noticeably and it was reluctantly concluded that the comet faded somewhat more rapidly following perihelion. The figures obtained for H_o and n are shown in Table I. Values shown in parentheses are probable errors (p.e.).

The formulae's fits to the data were extremely good. Neither with regard to the rise in brightness as the comet approached perihelion, nor in its subsequent decline, was there any noticeable deviation in the data from formulae expectations. These formulae are also in very good agreement with those determined in studies by Meisel *et al.* (1965) and by Meisel and Morris (1976), both of which employed similar but slightly smaller bodies of data.

In sharp contrast to the overly abundant amount of data available for comet 1965 VIII, the combined number of reliable photometric observations of comets 1963 V and 1970 VI gleaned from the *ICQ* and other sources amounted to just thirty.

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TABLE I

MAGNITUDE PARAMETERS

Observations	Aperture Corrected	No Aperture Correction	Range in r
COMET 1963 V			
(13 obs)	H_o = 5.43 ± 0.09 p.e. n = 3.90 ± 0.29 p.e.	H_o = 5.37 ± 0.09 p.e. n = 4.42 ± 0.34 p.e.	0.90-1.54AU
COMET 1965 VIII			
(133 obs., all data)	H_o = 6.38 ± 0.03 n = 3.58 ± 0.05	H_o = 6.33 ± 0.04 n = 3.70 ± 0.05	1.02-0.04-1.63
(68 obs., pre-T only)	H_o = 6.13 ± 0.04 n = 3.35 ± 0.06	H_o = 6.07 ± 0.04 n = 3.46 ± 0.06	1.02-0.04
(65 obs., post-T only)	H_o = 6.66 ± 0.05 n = 3.84 ± 0.06	H_o = 6.61 ± 0.05 n = 3.97 ± 0.07	0.24-1.63
COMET 1970 VI			
(16 obs.)	H_o = 5.79 ± 0.18 n = 3.62 ± 0.25	H_o = 6.01 ± 0.21 n = 4.00 ± 0.30	0.26-0.90

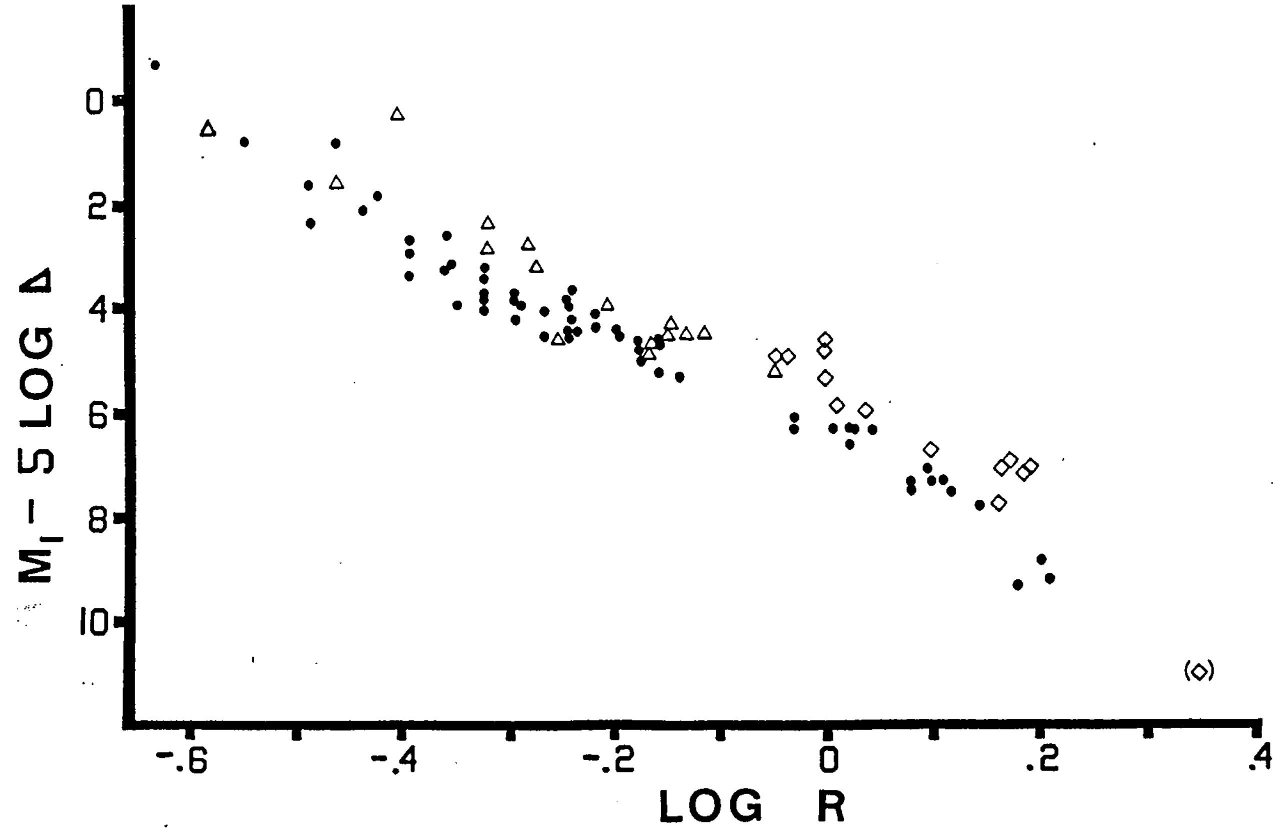

Figure 1. Post-T aperture-corrected heliocentric magnitudes ($H_\Delta = m_1 - 5 \log \Delta$) are plotted against the logarithm of their respective heliocentric distances (r). Diamonds represent comet 1963 V data, filled circles comet 1965 VIII, and triangles comet 1970 VI. The data point at the lower right is Jones' final observation of comet 1963 V, which was not included in the final reductions.

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COMET 1963 V. This sungrazer was not discovered until it was nearly 3 weeks past perihelion, and the magnitude of its head by then was already approaching the naked-eye limit. During mid-September, as a morning object, its tail reached a maximum length of 16°. A morning object, it remained visible in modest-sized telescopes for somewhat more than 2 months.

From the *ICQ* records, a total of 14 usable magnitude determinations were extracted by the author. Several of the observations were somewhat approximate, but all appear to be reasonably consistent. Most important is the series of determinations by A. Jones (1987) spanning six weeks.

For three of the early observations, no instrument was listed and an assumption as to instrument aperture was necessary before the data could be reduced. Specifying a likely instrument size was not unduly difficult, since binoculars were being employed by most observers at the time and it is reasonable to assume, given the large bright nature of the comet, the others did so as well.

Reduction of the data showed that Jones' final observation (which was also the last observation of the data set), on November 23 UT, was probably inferior, falling far below that predicted by the derived magnitude formula. In his orginal report, Jones' (1977) comments indicate that the comet was just glimpsed near the visibility threshold of the instrument and that the coma appeared very small and diffuse. In the author's experience, as a comet's brightness approaches the visibility threshold of an instrument usually its size seems to decrease and the total magnitude decline precipitously. In light of this, it is reasonable to conclude that at the time of Jones' final observation he may only have been seeing the coma's innermost region and that his magnitude determination probably does not represent the true brightness of the entire coma. For this reason the observation was deleted. The remaining 13 magnitudes produced a formula whose terms appear in Table I and have a significantly lower error.

It might be worth addressing Zenon Pereyra's rather discordant discovery magnitude at this point. At discovery Pereyra reported a visual magnitude of 2 for the comet. Only 48 hours later experienced observers were in agreement that the total magnitude of the comet's head was only 6.0, or some four magnitudes fainter. Neither does Pereyra's magnitude conform with the formula presented here, being far too bright.

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The discrepancy seems never to have been satisfactorily explained, but it is highly unlikely that the comet declined drastically in brightness immediately following discovery. Had some sort of large alteration in dust and gas production occurred in the coma, some change would have been reflected in the appearance of the comet's tail. As the comet's huge tail remained photographically quite uniform over its entire length in the days following discovery, no evidence for a striking alteration in brightness is indicated. More likely, Pereyra was misled by the tail's high surface brightness near the head. The tails of sungrazing comets are unusually brilliant in the first weeks following perihelion passage, and from its striking tail, Pereyra may have inferred that the comet's head must have been much brighter than it seemed.

COMET 1970 VI. This final object, comet White-Ortiz-Bolelli, was the most poorly observed of the trio of recent sungrazers. Discovery came at 4 days post-perihelion. The comet was observed in the evening sky from Earth's southern hemisphere under marginal viewing conditions as a faint naked-eye object with a 15° tail. Its elongation from the sun never reached much more than 20°, and had it come to perihelion only two or three weeks later it would undoubtedly have escaped detection completely, remaining deep in the twilight until it had grown very faint. As it was, visual observations spanned only 20 days.

Sixteen estimates of the comet's brightness were culled from the *ICQ*. Notes on the comet's physical appearance were obtained from descriptions by RASNZ members submitted to Gilmore (1980), from Marsden (1971), and from *IAU Circulars* 1841, 2246, 2250, and 2251 (1970). Several magnitude values were rather approximate, and in 4 cases no instrument was listed. Fortunately, at that time, the comet's brightness and size made the use of binoculars or the naked eye logical, and it can safely be assumed that only small-aperture instruments or none at all were employed.

Both the earliest and final few magnitude determinations were seriously affected by twilight. To judge from the last few observations, the comet seems to have declined catastrophically in brightness just before disappearing. In fact, in communicating their observations to Gilmore (1980), both M. Jones and A. Jones described the comet as faint and totally diffuse, with no distinct head on June 7th. Although the sungrazing comet 1880 I was observed simply to fade away before observer's eyes, a more reasonable explanation for the behavior of comet 1970 VI can be had by assuming that, as it receded from the sun and grew fainter, its head became larger and more diffuse — providing less and less contrast with the twilight sky background, eventually becoming completely invisible.

Of the limited data available, the best set of observations are those by S. McMillan, but they extend over less than a week. Albert Jones, the only observer included in the study to have reported observations of all three sungrazers, employed a very large aperture telescope to observe the comet. This appears to have resulted in his seriously underestimating the object's brightness. Comparing Jones' aperture-corrected estimates directly with those by McMillan indicates that the former values need an adjustment of −2.5 magnitudes to make then congruent.

Since Jones' observations were somewhat in question, analyses were conducted both with and without them. The results were almost identical, and the −2.5 magnitude correction was held valid. All 16 magnitude estimates were used to determine the values set forth in Table I.

II. INTERCOMPARISON

One will note that the value of the power-law exponent n in the magnitude formula for comet 1963 V is virtually identical with that found for comet 1965 VIII. In the case of comet 1970 VI, the probable error of n allows for the real possibility that it also shares essentially the same parameter (the data for all three comets are plotted in Figure 1). Further, from comparatively primitive 19th-century magnitude estimates, Kritzinger (1914) found $n = 3.2$ for the brilliant sungrazing comet 1882 II; given the approximate nature of the magnitude estimates involved, one might assume $n = 3.8$ (and $H_o = 0.0$) for this object, as well. This suggests to the author that, at least during the post-perihelion phase of their apparitions, major Kreutz sungrazing group comets may display very similar lightcurves that differ mainly in H_o, the comet's so-called absolute magnitude.

With regard to the H_o values of the three recent bright sungrazers, comet 1963 V was decidedly the brightest and 1965 VIII the faintest, with 1970 VI falling about midway between the two. It was only chance geometry between the earth and the comets that resulted in the intrinsically faintest member of the trio appearing to us to be the most spectacular of the group.

III. TAIL DEVELOPMENT

Each of the three sungrazers under discussion developed a very large, high-surface-brightness tail. Some spectroscopic and color index observations have suggested that these tails were composed of a strong combination of gas and dust, rather than being largely one or the other. The weak curvature displayed by the tails of comets 1965 VIII and 1970 VI suggests that they were of Bredichin type-II classification (long, curving, plume-like tails that typically lag the extended radius vector to some degree). Additionally, the author has examined a few photographs, such as those accompanying an article by Milon (1969) and also elsewhere in *Sky and Telescope* (1970), that show a very weak ion tail-like feature emerging from the main tail of both comets, a further indication that these appendages were examples of very-low-curvature type-II tails.

Table II lists the observed tail lengths gleaned from various sources in the literature, together with the computed true dimensions of the tails in astronomical units (AU). The following formula (from McCants 1965) was employed to calculate the tail lengths:

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$$L = 0.107 L_o \Delta \left(1 - \frac{(r^2\Delta^2-1)^2}{(2r\Delta)^2}\right)^{-\frac{1}{2}},$$

where L_o is the observed length in degrees and L is the actual length. This formula assumes the appendage to be directed radially away from the sun and normally might not produce accurate values for a significantly curved type-II tail. However, due to the extremely elongated nature of the sungrazer orbits, once these comets are more than a few days from perihelion passage their tails exhibit very little curvature and the values derived from the formula should be reasonably accurate. Milon (1969) has already shown that, in the case of comet 1965 VIII, the tail was directed within a few degrees of the extended radius vector less than a week following perihelion and the other two sungrazers seem to have evolved similarly. The development of the main tails is summarized below and plotted in Figure 2.

COMET 1963 V. Observations are limited to the period after perihelion ($T = +23$ to $+34$ days). The data show a high degree of scatter, but there may be a vague trend toward increasing length during the period. Two significantly differing pairs of photographic tail-lengths for Sept. 21 and 22 by Capen appear in the literature without explanation. In an article regarding his own data, Capen (1964) provides one set of values, while those reported to the ALPO and appearing in the *ICQ*, give quite another. Both are listed in the table. The shorter lengths are believed to be more acceptable, being in much better agreement with concurrent values. A maximum mean tail length of about 0.70 AU near $T = +30$ days was derived from the data.

COMET 1965 VIII. A large body of published data was available for this object during its post-T period. Visual and photographic tail lengths were combined to give a daily mean figure. The main tail increased steadily in length from 0.25 AU at $T = +4$ days, to 0.41 AU at $T = +10$ days, 0.48 AU on $T = +16$ days, and further to a maximum of 0.66 AU near $T = +33$ days.

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TABLE II

SUNGRAZER TAIL LENGTHS

1963 V

T+	Lgth Obs.	Lgth A.U.	M	Obs.
24^d	10°.5	0.50	v	McClure
	12°.5	0.60	p	McClure
27	8°	0.39	v	Milon
	16°	0.76	v	Capen
28	15°	0.72	p	"
	[18°+	0.89	p]	
29	13°:	0.65	p	"
	[18°+	0.90	p]	
	10°	0.50	V	McClure
	11°.5	0.57	p	McClure
30	12°	0.60	p	Capen
31	12°	0.61	p	"
32	13°	0.66	p	"
33	11°.2	0.57	p	"
	10°.5	0.54	v	"
34	11°.8	0.61	p	"

1965 VIII

T+	Lgth Obs.	Lgth A.U.	M	Obs.
4^d	13°.5	0.25	-	(2)ALPO
5	14°.0	0.26	-	(3) "
6	16°.7	0.31	-	(8) "
7	15°.4	0.29	-	(4) "
8	18°.9	0.35	-	(7) "
9	18°.3	0.35	-	(12) "
10	19°.6	0.37	-	(7) "
11	20°.3	0.39	-	(6) "
12	21°.4	0.41	-	(10) "
13	22°.9	0.44	-	(5) "
14	22°.5	0.44	-	(3) "
15	23°.0	0.45	-	(3) "
16	25°.3	0.50	-	(4) "
17	22°	0.43	v	(1) "
30	20°	0.43	v	(1) "
31	23°	0.50	v	(1) "
33	30°	0.66	v	(1) "
39	29°	0.67	p	(1) "
44	25°	0.62	p	(1) "

1970 VI

T+	Lgth Obs.	Lgth A.U.	M	Obs.
6^d	10°	0.27	v	White
8	12°	0.37	v	Jones
9	15°	0.49	v	Pereyra
10	10°	0.35	v	Pereyra
	15°	0.52	v	Maitzen
	15°-20	0.60:	v	Savio
11	12°	0.43	p	SAO
	12°	0.43	v	Pereyra
12	15°	0.56	p	SAO
13	14°	0.56	v	Jones
	15°	0.60	p	SAO

Figures in parenthesis are the number of tail length estimates combined to derived a mean value for a given date for Comet 1965 VIII. Listed under the heading M is whether the length was determined visually (v) or photographically (p). Bracketed tail length values for 1963V are alternate figures reported by Capen.

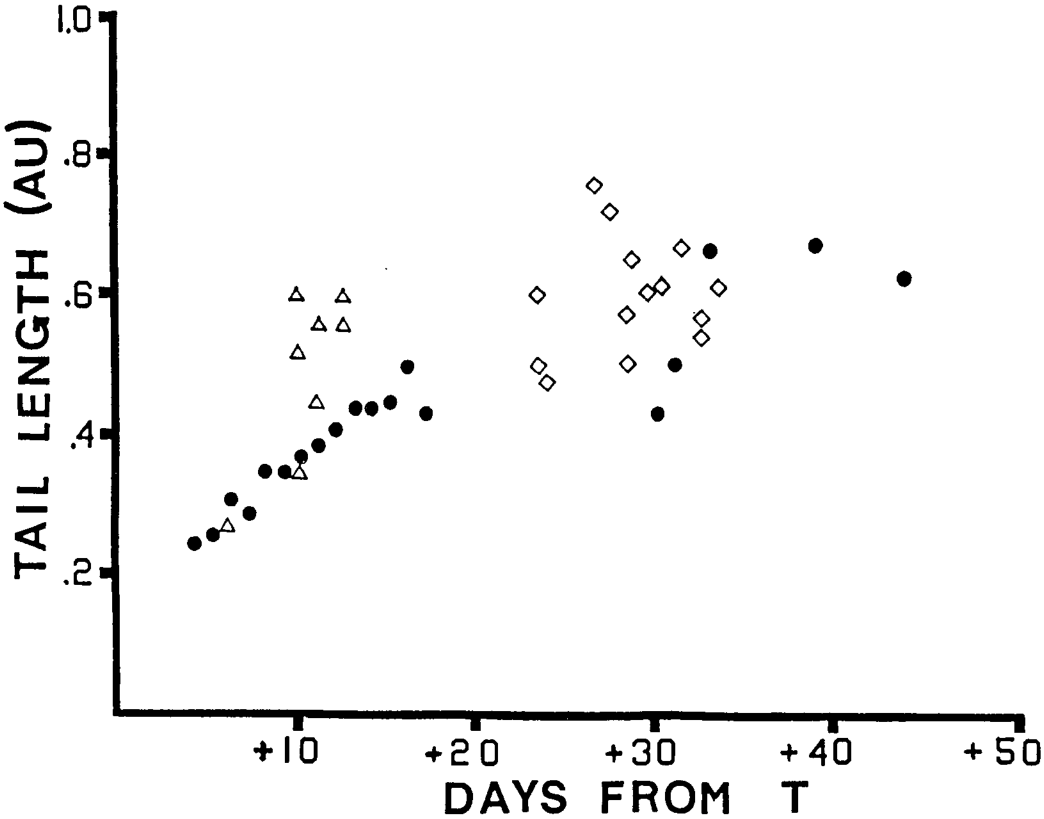

Figure 2. Plot of actual tail lengths in astronomical units (AU) vs. the time from perihelion passage in days. Diamonds represent comet 1963 V data, filled circles comet 1965 VIII, and triangles 1970 VI.

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COMET 1970 VI. Because of this comet's relatively poor location, Observations of its tail were significantly hindered, and useful data extends only from $T = +6$ to $+12$ days. However, the data shows a strong trend in increasing length during the period. The first meaningful observation of the tail, at $T = +6$ days, gave a true length of 0.27 AU. This value increased dramatically to a mean of 0.57 AU by $T = +12$ days. Thereafter, the tail rapidly dropped below the sky background threshold.

IV. INTERCOMPARISON

The physical tail lengths for comet 1963 V, during the period $T = +23$ to $+34$ days, are fully comparable to those exhibited by comet 1965 VIII at a similar post-T interval. However, the tail of comet 1970 VI at $T = +12$ days was considerably longer than that of comet 1965 VIII on the same post-T date. Further, although the earliest data for 1970 VI must have been strongly affected by twilight, the data indicate a much more rapid lengthening of the tail than was observed in the case of the 1965 object during the early post-T period.

V. DISCUSSION

Based on the derived photometric parameters and actual tail lengths, it is indicated that both comets 1963 V and 1970 VI, had they been observed under more favorable circumstances, would have been superior to comet 1965 VIII in brightness and tail development. This conclusion comes in spite of the fact that, historically, comet 1965 VIII is considered one of the most significant comets of the 20th century, while the other two are relegated to second-class status at best.

As a farther-ranging comparison, it is noted that comet 1963 V ranks either second or third in order of intrinsic brightness (depending on which of several H_0 values is accepted for comet 1843 I) among all the members of the sungrazing group (using the H_{10} values published by Vsekhsvyatskii 1964), being clearly exceeded only by comet 1882 II. Conversely, comet 1965 VIII is arguably the faintest intrinsically of the group to have survived perihelion passage fully intact, comet 1880 I having dissipated at $T = +21$ days and comet 1887 I surviving only as a synchronic ray.

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PERIODIC COMETS FOR THE VISUAL OBSERVER IN 1992

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After a rather 'off' year for short-period comets in 1992, visual observers of these objects can expect an increase in activity to occur in 1993. One periodic comet should become bright enough for observation with binoculars, perhaps as many as four or five others should reach $m_1 \sim$ 10-11, and a few fainter objects might become observable in larger visual instruments.

P/Swift-Tuttle (1992t)

The recovery of this comet, the parent object of the Perseid meteors, was made by Tsuruhiko Kiuchi on 1992 September 26, and was announced just before this article went to press (see 'Recent News', p. 95). The observations indicate that perihelion occurs on 1992 December 12, at q = 0.96 AU, only $2\frac{1}{2}$ weeks after the date predicted by Brian G. Marsden (1973, *A.J.* **78**, 654). P/Swift-Tuttle's identity with comet 1737 II, the assumption upon which Marsden's prediction was made, is confirmed.

The geometry of this return is relatively poor, although observations should still be obtainable without much difficulty. A peak brightness of $m_1 \sim 4\frac{1}{2}$ may be reached in late November and early December; the comet will be in the western evening sky as seen from the northern hemisphere. By the end of December, it enters the solar glare. Southern-hemisphere observers may be able to pick it up by the end of February 1993, the comet then perhaps being $m_1 \sim$ 9-10. It enters southern circumpolar skies by early April, and by that time may have faded to $m_1 \sim$ 11-12. It should be kept in mind that the comet has not been observed this far beyond perihelion during previous returns; hence these magnitudes are rather uncertain.

P/Schaumasse (1992x)

This should be the best short-period comet visible during 1993. Perihelion occurs on 1993 March 4, at q = 1.20 AU, and the viewing geometry is very favorable. It is at opposition in late 1992, and may have $m_1 \sim$ 9-10 at the beginning of 1993. It may be perhaps a magnitude brighter when it passes its minimum geocentric distance (Δ = 0.55 AU) in late January, and should be as bright as $m_1 \sim$ 7-8 around the time of perihelion passage. The comet should subsequently remain accessible to visual instruments until about May or June.

P/Ashbrook-Jackson (1992j)

This comet passes perihelion on 1993 July 14 (q = 2.32 AU), when it will be well placed in the morning sky at $m_1 \sim$ 12. It may brighten a half- to a full-magnitude over the following 2-3 months, with opposition occurring in mid-October. Then it will probably fade to below the threshhold of visual instruments by about the end of 1993.

P/West-Kohoutek-Ikemura

This comet is making its first favorable return since its discovery in 1975. Perihelion passage is predicted to occur on 1993 December 25 (q = 1.58 AU), less than three weeks after opposition. If the brightness observed in 1975 holds through this return, it may become visually observable about October, peak at $m_1 \sim 10.5$ around perihelion, and remain observable for the first couple of months of 1994.

P/Ciffréo (1992s)

P/Ciffréo makes its first predicted return to perihelion on 1993 January 23, at q = 1.71 AU. Opposition occured in September 1992, and it is conveniently placed for observation until March 1993. If the comet behaves similarly in brightness to its discovery apparition in 1985, a peak brightness of $m_1 \sim 13$ may be obtained in late 1992 and early 1993. It should be noted that the 1985 discovery did not occur until over a week after perihelion; thus any pre-perihelion brightness predictions are especially uncertain.

P/Väisälä 1 (1992u)

P/Väisälä 1 passes perihelion on April 29, at q = 1.78 AU, having gone through opposition $\sim 2\frac{1}{2}$ months earlier. Peak brightnesses of $m_1 \sim$ 14-15 have been recorded photographically at those previous returns which exhibited geometry similar to this one. These photographic observations also suggest that the comet does not develop much coma as it passes perihelion.

Two additional short-period comets with perihelia in early 1994 should be easily observable in late 1993. P/Schwassmann-Wachmann 2, with perihelion passage on 1994 January 23 (q = 2.07 AU), is extremely well placed at this return and should be as bright as $m_1 \sim 11$ at the end of 1993. P/Encke, at perihelion on 1994 February 9 (q = 0.33 AU), is well placed in the evening sky in late 1993, and at year's end should be near $m_1 \sim 10$.

P/Schwassmann-Wachmann 1 is at opposition in December 1992, and is well placed for observation (near $\delta \sim +30°$) in the evening sky until about mid-May 1993. It reappears in the morning sky by mid-August and is again well placed through the end of the year, enroute to its next opposition in January 1994. Observers are always encouraged to monitor this comet for outbursts; as of late September 1992, none have so far been observed during its 1992-93 viewing season.

The following comets may or may not be visually observable during 1993, and even if visible are likely to be quite faint. Experienced visual observers with large instruments are encouraged to attempt observations of them.

P/Shajn-Schaldach is at perihelion on 1993 November 15, at q = 2.34 AU. The viewing circumstances of this return are very favorable, with opposition occurring about a month and a half before perihelion. This return is very similar to the discovery return in 1949, when the comet reached a peak brightness of $m_1 \sim 12$. There perhaps is some reason to suspect the comet was anomalously bright in 1949, and during the 1971 return, which also had similar geometry, a peak photographic brightness of $m_1 \sim 16$ was recorded. There do not seem to have been any visual observations attempted in 1971, however.

P/Howell 1992c (perihelion 1993 February 26, at q = 1.41 AU) and P/Forbes (perihelion March 14, at q = 1.45 AU) are both rather unfavorably placed during 1993. Southern-hemisphere observers may possibly pick up one or both objects in the morning sky perhaps 1-2 months after perihelion, but neither one will probably be any brighter than $m_1 \sim 13$.

(2060) Chiron is at opposition in mid-February 1993, $\sim 10°$ southwest of the star Regulus. It is accessible to observation attempts until June, and is accessible again in late 1993 enroute to its next opposition in late February 1994. Ordinarily, Chiron's brightness might be expected to be $m_v \sim 15.0$ or slightly fainter at the earlier opposition, and perhaps 0.3 magnitude brighter at the latter one. However, the increasing signs of cometary activity, including occasional small outbursts, which Chiron has displayed as it approaches its perihelion passage in February 1996 suggest visual monitoring is warranted.

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— FIRST INTERNATIONAL WORKSHOP ON COMETARY ASTRONOMY —

(continued from page 86)

The language of the meeting will be English. We may dedicate a subsequent issue of the *ICQ* to the *Proceedings* of this first IWCA. As part of the IWCA, we also hope to hold comet observing sessions at a prime site in or near the Italian Alps, away from the city lights of Milan (the moon will be near first quarter), to go over observing methodologies.

Milan has a large airport that accepts direct flights on major airlines from many countries, including the U.S. and Canada. February is 'low season' for airfares, often meaning a substantial reduction in costs over flying during the summer months. Effort will be made to keep meeting costs to a minimum, and possibly to find good reduced group-rate lodging in the Milan area, further to entice as many astronomers to the meeting as possible. We encourage all of our readers seriously to consider attending this meeting, and also to spread the word about the meeting. More information will be provided in coming issues of the *ICQ*.

Discussions have also been held with amateur astronomers in other European countries, particularly England, where we also hope to hold an IWCA in the next few years. We did learn from the AWCAs of the 1980s that it is not wise to plan meetings more frequently than once every several years if the goal is to have a quality meeting with many active comet observers present. — D.W.E.G.

RECENT NEWS AND RESEARCH CONCERNING COMETS

Periodic comet Swift-Tuttle (1862 III) was recovered by Japanese comet hunter Tsuruhiko Kiuchi, using 25×150 binoculars and the ephemeris published by Brian G. Marsden nearly 20 years ago (*A.J.* **78**, 662; see Marsden's review of the situation in the July 1981 issue of the *ICQ*, p. 69). The telegram from the National Astronomical Observatory in Tokyo arrived at the Central Telegram Bureau on Saturday evening, and it included the note that this could be P/Swift-Tuttle. Calls went out to astrometric observers at various observatories, and to several visual observers who help out with confirming comet discovery reports, on the west coast of North America, and by Sunday numerous positive reports were in hand. Noteworthy was the work by Jeremy Tatum (University of Victoria, British Columbia, Canada), who obtained photographs spread over several hours and quickly measured the accurate positions and forward them to Marsden for confirmation of the identity as P/Swift-Tuttle. The date of perihelion passage was only 17 days later than that predicted by Marsden.

I have looked at the visual magnitude data of P/Swift-Tuttle from 1862, as published by N. T. Bobrovnikoff (1941, *Contrib. Perkins Obs.* No. 15, Part I, Table 8), which yield a formula $m_1 = 4.5 + 5 \log \Delta + 15 \log r$ (where Δ and r are the comet's geocentric and heliocentric distances, in AU, respectively). While we have no idea how well the data from 130 years ago can compare with present-day data in terms of methodology and comparison-star magnitudes, there did seem to be a trend along the lines of r^{-6} (possibly even r^{-8} pre-perihelion). All of the data in Bobrovnikoff's list are allegedly naked-eye estimates, probably making the data much more compatible with current-day methodology than the century-old data obtained with telescopes; with naked-eye views, it would be much harder to distinguish between the coma and the nuclear condensation. Somewhat worrisome at the current return, however, is the question about a possible outburst having occurred around the time of discovery.

The formula derived from the 1862 data actually agrees rather well with the early m_1 estimates reported just after P/Swift-Tuttle was recovered, and this has been used in the ephemeris by Syuichi Nakano on the following two pages. The m_2 formula is based on an m_2 result from J. V. Scotti at Kitt Peak in late September.

New discoveries

Donald E. Machholz (Colfax, CA) visually discovered his sixth comet on July 2. At that time, comet Machholz 1992k sported a diffuse 3′ coma with some condensation, and it was moving southeastward near the Auriga/Perseus border. The comet was very difficult in the morning twilight, and precise astrometric observations were only obtained on three nights (July 5-10); the preliminary orbit showed perihelion occurring around the time of discovery.

Howard J. Brewington discovered his fourth comet on August 28, an eleventh-magnitude object soon found to be in an 8.6-year orbit about the sun. P/Brewington 1992p is fading, having been found nearly 3 months past perihelion. Eleanor Helin found her eleventh comet, together with Kenneth J. Lawrence, in late August in the course of her on-going near-Earth-asteroid survey with the 18-inch (46-cm) Schmidt telescope at Palomar. Comet Helin-Lawrence 1992q has been observed visually in late September at $m_1 \sim 13$.

Other comets observed recently

The new Spacewatch comet mentioned on page 52 of the April issue, which was given the designation 1992h, may become visible in large amateur telescopes during the second half of 1993. The Spacewatch team has recovered P/Ciffréo (1992s), P/Väisälä 1 (1992u), and P/Gehrels 3 (1992v), the latter two being of stellar appearance and near $m_2 = 22$. P/Ciffréo, making its first observed predicted return following discovery in 1985, was at $m_1 = 18.0$ ($m_2 = 20.6$) upon recovery on Sept. 24, with a 15″ coma and a 22″ tail; the orbital elements in the 1992 and 1993 *ICQ Comet Handbooks* must be corrected by $\Delta T = +0.6$ day. P/Gehrels 3 and P/Väisälä 1 are making their third and sixth observed 'apparitions'.

The well-known comet observer T. Seki (Geisei, Japan) recovered P/Giclas (1992l), P/Wolf (1992m), P/Schuster (1992n), P/Daniel (1992o), and P/Schaumasse (1992x), all in close agreement with the predictions (though the correction to the prediction for P/Schaumasse in the *1993 Comet Handbook* is $\Delta T = -0.02$ day). Comets 1992m and 1992x were reported near $m_1 = 20$ when recovered, and the other three comets were noted as closer to $m_1 = 18$; comet 1992n was diffuse without condensation, with a faint tail, while the other three were noted as being simply diffuse with condensation. P/Schuster is making its first observed predicted return to perihelion, having been missed at its 1985 return due to unfavorable geometry. P/Giclas is making its second observed predicted return, while the other three comets recovered by Seki have all been now observed at eight or more returns.

P/Ashbrook-Jackson was recovered as comet 1992j by Alan C. Gilmore and Pamela M. Kilmartin at Mount John in New Zealand, the object appearing stellar in May; this confirmed previously-unconfirmed images obtained at La Palma (Canary Islands) in April 1991. P/Slaughter-Burnham was recovered as comet 1992w by the first co-discoverer (Charles D. Slaughter), working with Stephen M. Larson at the 1.5-m Catalina reflector of the University of Arizona on Sept. 18, 24, and 25, the 10″ coma having $m_1 = 21.5$ (Cousins R band). Having an orbital period similar to that of Jupiter, P/Slaughter-Burnham has now been observed at each return since its discovery in 1959. P/Tuttle was recovered at La Palma (Canary Islands) by G. Tancredi and M. Lindgren in late July (unexpectedly early, because its brightness, $V = 21.3$ is greater than predicted), nearly two years prior to perihelion; the designation 1992r was given to this object.

Richard West and colleagues of the European Southern Observatory have continued to monitor P/Halley, and he reports on *IAUC* 5535 that observations made in April with the 3.5-m New Technology Telescope failed 'convincingly' to show the comet. A very faint image ($V = 25.8 \pm 0.4$) was present at the predicted position on CCD frames obtained in 1991 February and March.

(continued on page 98)

P/Swift-Tuttle 1992t Orbit by Marsden B.G. IAUC 5620 (1992)

Equinox 1950.0

T/TT	q (AU)	e	P	Peri.	Node	Inc.	Epoch
1992 Dec. 12.391	0.95876	0.96362	135	152.975	138.730	113.413	1992 Dec. 4.0

m1 = 4.5+5log(delta)+15.0log(r)   m2 = 14.0+5log(delta)+ 5.0log(r)+0.03(phase)

Date/ 0h TT	R.A.(1950) h m	Decl. ° '	R.A.(2000) h m	Decl. ° '	Delta	r	Daily motion m	'	Magnitude m1	m2	Mot./PA ' °	Elong. °	P °	Moon °	Age
1992 Sept.15	10 43.61	+57 52.0	10 46.73	+57 36.2	2.073	1.715	+4.67	+ 8.2	9.6	17.6	38.0/ 75	55.4	28.9	102	.92
20	11 07.11	+58 33.4	11 10.08	+58 17.1	1.955	1.655	+5.42	+ 7.0	9.2	17.5	42.9/ 78	57.8	30.9	64	.48
25	11 34.40	+59 08.9	11 37.16	+58 52.3	1.837	1.595	+6.29	+ 4.6	8.9	17.3	48.7/ 81	60.1	33.0	57	.03
30	12 06.11	+59 32.1	12 08.62	+59 15.4	1.722	1.536	+7.25	+ 0.2	8.5	17.2	55.5/ 86	62.2	35.2	90	.16
Oct. 5	12 42.65	+59 33.1	12 44.86	+59 16.7	1.610	1.478	+8.17	- 6.8	8.1	17.0	63.5/ 92	64.1	37.5	114	.63
10	13 23.83	+58 58.2	13 25.73	+58 42.7	1.504	1.420	+8.88	-17.0	7.7	16.8	72.5/ 99	65.6	39.8	114	.97
15	14 08.48	+57 31.6	14 10.11	+57 17.4	1.407	1.364	+9.15	-30.3	7.3	16.7	82.4/107	66.6	42.1	98	.89
20	14 54.39	+54 57.9	14 55.86	+54 45.8	1.322	1.309	+8.90	-45.5	6.9	16.5	92.4/115	67.1	44.5	81	.41
25	15 38.91	+51 07.8	15 40.35	+50 58.2	1.253	1.256	+8.20	-60.6	6.5	16.4	101.5/123	66.9	46.7	71	.01
30	16 19.82	+46 02.0	16 21.33	+45 55.0	1.202	1.206	+7.25	-73.3	6.1	16.3	108.2/129	65.9	48.7	72	.19
Nov. 4	16 55.92	+39 52.8	16 57.59	+39 48.3	1.173	1.158	+6.26	-81.8	5.8	16.2	111.3/135	64.1	50.3	84	.65
9	17 27.04	+33 01.7	17 28.89	+32 59.4	1.167	1.114	+5.34	-85.1	5.5	16.1	110.0/139	61.6	51.4	108	.98
14	17 53.58	+25 54.3	17 55.60	+25 53.9	1.184	1.074	+4.56	-83.7	5.3	16.1	104.8/142	58.4	51.7	132	.85
19	18 16.21	+18 54.3	18 18.39	+18 55.5	1.223	1.039	+3.91	-78.8	5.2	16.1	97.0/144	54.8	51.0	108	.33
24	18 35.61	+12 18.6	18 37.93	+12 21.3	1.279	1.009	+3.38	-72.2	5.1	16.0	87.8/145	50.9	49.4	56	.00
29	18 52.40	+06 16.6	18 54.84	+06 20.5	1.349	0.986	+2.96	-64.9	5.1	16.0	78.6/146	46.8	46.8	30	.21
Dec. 4	19 07.09	+00 50.9	19 09.63	+00 55.9	1.428	0.970	+2.62	-58.0	5.1	16.0	70.0/146	42.6	43.5	71	.66
9	19 20.10	-03 59.9	19 22.74	-03 54.0	1.513	0.961	+2.35	-51.7	5.1	16.0	62.5/146	38.4	39.5	130	.99
14	19 31.80	-08 19.3	19 34.51	-08 12.7	1.600	0.959	+2.15	-46.3	5.2	16.0	56.1/146	34.1	35.1	157	.80
19	19 42.47	-12 11.4	19 45.25	-12 04.1	1.685	0.965	+1.99	-41.6	5.4	16.0	50.8/145	29.9	30.5	91	.26
24	19 52.38	-15 40.3	19 55.22	-15 32.3	1.767	0.979	+1.88	-37.8	5.6	16.0	46.4/145	25.7	25.9	26	.00
29	20 01.73	-18 49.7	20 04.62	-18 41.1	1.844	1.000	+1.80	-34.5	5.8	16.0	42.8/144	21.8	21.4	34	.22
1993 Jan. 3	20 10.68	-21 42.7	20 13.62	-21 33.6	1.915	1.028	+1.75	-31.8	6.1	16.0	39.9/143	18.2	17.3	93	.68
8	20 19.39	-24 22.2	20 22.36	-24 12.6	1.979	1.061	+1.72	-29.6	6.4	16.0	37.7/142	15.1	14.0	158	1.00
13	20 27.96	-26 50.6	20 30.97	-26 40.5	2.036	1.099	+1.72	-27.8	6.7	16.1	35.9/141	12.9	11.6	128	.74
18	20 36.52	-29 09.9	20 39.56	-28 59.3	2.084	1.142	+1.73	-26.3	7.0	16.2	34.6/140	12.2	10.5	62	.21
23	20 45.14	-31 21.9	20 48.20	-31 10.8	2.126	1.189	+1.76	-25.2	7.3	16.3	33.6/139	13.2	10.9	16	.00
28	20 53.89	-33 28.3	20 56.98	-33 16.7	2.160	1.238	+1.79	-24.3	7.6	16.5	33.0/138	15.4	12.2	61	.23
Feb. 2	21 02.84	-35 30.4	21 05.95	-35 18.3	2.186	1.290	+1.85	-23.7	7.9	16.7	32.6/137	18.5	14.0	117	.70
7	21 12.06	-37 29.4	21 15.18	-37 16.9	2.207	1.344	+1.91	-23.3	8.1	16.8	32.4/137	22.0	16.0	154	1.00
12	21 21.60	-39 26.5	21 24.74	-39 13.6	2.221	1.400	+1.99	-23.1	8.4	17.0	32.5/136	25.8	17.9	96	.68
17	21 31.53	-41 22.6	21 34.68	-41 09.2	2.230	1.457	+2.08	-23.1	8.7	17.1	32.7/136	29.8	19.7	43	.18
22	21 41.93	-43 18.5	21 45.08	-43 04.7	2.233	1.515	+2.19	-23.2	9.0	17.3	33.1/136	33.8	21.3	41	.00
27	21 52.88	-45 15.1	21 56.02	-45 00.9	2.233	1.574	+2.31	-23.5	9.2	17.4	33.6/135	37.9	22.7	86	.25
Mar. 4	22 04.45	-47 12.9	22 07.59	-46 58.2	2.229	1.633	+2.46	-23.8	9.4	17.5	34.3/135	42.0	24.0	133	.74
9	22 16.77	-49 12.2	22 19.89	-48 57.1	2.223	1.693	+2.63	-24.1	9.7	17.6	35.1/135	46.1	25.0	125	.99
14	22 29.98	-51 13.3	22 33.06	-50 57.8	2.215	1.753	+2.84	-24.5	9.9	17.7	35.9/134	50.2	25.8	73	.62
19	22 44.24	-53 16.1	22 47.27	-53 00.3	2.205	1.813	+3.09	-24.8	10.1	17.8	36.8/134	54.2	26.5	46	.16
24	22 59.75	-55 20.5	23 02.72	-55 04.3	2.196	1.874	+3.38	-25.0	10.3	17.9	37.7/133	58.2	26.9	66	.01
29	23 16.76	-57 25.7	23 19.63	-57 09.3	2.187	1.934	+3.73	-25.0	10.5	17.9	38.7/132	62.2	27.2	104	.28
Apr. 3	23 35.56	-59 30.8	23 38.31	-59 14.2	2.179	1.994	+4.15	-24.6	10.7	18.0	39.5/131	66.0	27.3	125	.80
8	23 56.50	-61 34.1	23 59.08	-61 17.4	2.174	2.055	+4.65	-23.9	10.9	18.1	40.3/129	69.7	27.2	98	.98
13	00 20.00	-63 33.4	00 22.36	-63 16.8	2.172	2.115	+5.24	-22.6	11.1	18.1	40.9/126	73.3	27.0	68	.58
18	00 46.48	-65 26.1	00 48.54	-65 09.7	2.174	2.175	+5.89	-20.6	11.2	18.2	41.4/123	76.7	26.7	67	.14
23	01 16.31	-67 08.6	01 18.01	-66 52.8	2.181	2.234	+6.59	-17.9	11.4	18.2	41.6/119	79.8	26.3	87	.01
28	01 49.70	-68 37.0	01 50.96	-68 22.2	2.193	2.294	+7.26	-14.3	11.6	18.3	41.6/114	82.7	25.8	105	.33
May 3	02 26.50	-69 47.3	02 27.26	-69 33.9	2.211	2.353	+7.81	-10.1	11.8	18.3	41.3/109	85.2	25.3	101	.86
8	03 06.03	-70 35.7	03 06.31	-70 24.2	2.236	2.412	+8.12	- 5.3	12.0	18.4	40.7/102	87.5	24.7	86	.95

Date/ 0h TT	R.A.(1950) h m	Decl. ° '	R.A.(2000) h m	Decl. ° '	Delta	r	Daily motion m	Daily motion '	Magnitude m1	Magnitude m2	Mot./PA ' / °	Elong. °	P °	Moon °	Age
May 13	03 47.05	-70 59.9	03 46.92	-70 50.8	2.266	2.471	+8.12	- 0.5	12.2	18.5	39.9/ 96	89.3	24.1	82	.55
18	04 27.94	-70 59.9	04 27.54	-70 53.4	2.304	2.529	+7.81	+ 3.9	12.4	18.5	38.8/ 89	90.8	23.6	89	.12
23	05 07.10	-70 37.7	05 06.59	-70 33.8	2.348	2.587	+7.25	+ 7.6	12.5	18.6	37.5/ 83	91.9	23.0	93	.02
28	05 43.34	-69 57.0	05 42.86	-69 55.8	2.398	2.645	+6.57	+10.4	12.7	18.7	36.0/ 77	92.6	22.5	88	.41
June 2	06 16.06	-69 02.6	06 15.72	-69 03.7	2.455	2.702	+5.86	+12.3	12.9	18.8	34.4/ 72	92.9	22.0	84	.92
7	06 45.18	-67 58.9	06 45.04	-68 02.1	2.517	2.760	+5.20	+13.4	13.1	18.9	32.7/ 69	92.8	21.6	92	.93
12	07 10.95	-66 49.9	07 11.02	-66 55.0	2.585	2.816	+4.60	+13.9	13.3	18.9	31.0/ 66	92.4	21.1	102	.52
17	07 33.75	-65 39.0	07 34.05	-65 45.7	2.658	2.873	+4.09	+13.8	13.5	19.0	29.2/ 64	91.7	20.7	99	.10
22	07 54.02	-64 28.7	07 54.52	-64 36.7	2.735	2.929	+3.66	+13.3	13.7	19.1	27.5/ 63	90.7	20.3	82	.05
27	08 12.13	-63 20.9	08 12.83	-63 30.0	2.817	2.985	+3.30	+12.6	13.9	19.2	25.8/ 63	89.4	19.9	71	.51
July 2	08 28.45	-62 16.8	08 29.32	-62 26.9	2.901	3.041	+2.99	+11.7	14.1	19.3	24.1/ 63	88.0	19.5	85	.95
7	08 43.25	-61 17.2	08 44.27	-61 28.2	2.989	3.096	+2.74	+10.7	14.2	19.4	22.6/ 63	86.4	19.1	108	.91
12	08 56.80	-60 22.8	08 57.95	-60 34.5	3.079	3.151	+2.52	+ 9.7	14.4	19.5	21.1/ 64	84.7	18.7	113	.50
17	09 09.27	-59 33.8	09 10.55	-59 46.1	3.170	3.206	+2.34	+ 8.6	14.6	19.6	19.8/ 66	82.8	18.3	94	.08
22	09 20.84	-58 50.4	09 22.22	-59 03.2	3.263	3.260	+2.18	+ 7.5	14.8	19.7	18.5/ 67	80.9	17.9	65	.09
27	09 31.63	-58 12.6	09 33.11	-58 25.9	3.356	3.314	+2.04	+ 6.4	14.9	19.8	17.3/ 69	78.9	17.5	68	.60
Aug. 1	09 41.74	-57 40.2	09 43.30	-57 54.0	3.450	3.368	+1.92	+ 5.3	15.1	19.8	16.3/ 72	76.9	17.1	99	.98
6	09 51.26	-57 13.2	09 52.90	-57 27.3	3.544	3.422	+1.81	+ 4.3	15.3	19.9	15.3/ 75	74.9	16.6	121	.89
11	10 00.25	-56 51.2	10 01.97	-57 05.7	3.636	3.475	+1.72	+ 3.3	15.4	20.0	14.5/ 78	72.8	16.2	112	.46
16	10 08.79	-56 34.3	10 10.57	-56 49.1	3.728	3.528	+1.64	+ 2.4	15.6	20.1	13.7/ 81	70.8	15.7	79	.05
21	10 16.91	-56 22.0	10 18.75	-56 37.1	3.819	3.581	+1.56	+ 1.5	15.7	20.1	13.0/ 84	68.9	15.3	55	.15
26	10 24.65	-56 14.3	10 26.54	-56 29.6	3.908	3.633	+1.49	+ 0.7	15.9	20.2	12.3/ 88	67.0	14.8	80	.67
31	10 32.04	-56 10.8	10 33.98	-56 26.3	3.994	3.685	+1.42	- 0.1	16.0	20.3	11.8/ 91	65.1	14.4	114	.99
Sept. 5	10 39.09	-56 11.3	10 41.08	-56 27.0	4.079	3.737	+1.36	- 0.9	16.1	20.3	11.3/ 95	63.4	14.0	126	.87
10	10 45.84	-56 15.6	10 47.88	-56 31.5	4.161	3.789	+1.30	- 1.6	16.3	20.4	10.9/ 99	61.7	13.5	101	.43
15	10 52.29	-56 23.6	10 54.37	-56 39.6	4.239	3.840	+1.24	- 2.3	16.4	20.5	10.5/103	60.2	13.1	62	.02
20	10 58.46	-56 35.0	11 00.58	-56 51.1	4.315	3.891	+1.18	- 2.9	16.5	20.5	10.1/108	58.8	12.8	59	.21
25	11 04.34	-56 49.6	11 06.49	-57 05.9	4.388	3.942	+1.13	- 3.5	16.6	20.6	9.8/112	57.6	12.4	96	.72
30	11 09.93	-57 07.3	11 12.12	-57 23.6	4.457	3.993	+1.07	- 4.1	16.8	20.6	9.5/116	56.5	12.1	126	.99
Oct. 5	11 15.23	-57 27.8	11 17.46	-57 44.2	4.522	4.043	+1.01	- 4.7	16.9	20.7	9.3/121	55.7	11.8	120	.85
10	11 20.25	-57 51.0	11 22.52	-58 07.5	4.584	4.093	+0.95	- 5.2	17.0	20.7	9.1/125	55.0	11.5	84	.37
15	11 24.97	-58 16.7	11 27.26	-58 33.3	4.641	4.143	+0.89	- 5.6	17.1	20.8	8.9/130	54.5	11.3	51	.00
20	11 29.37	-58 44.9	11 31.69	-59 01.5	4.695	4.193	+0.82	- 6.1	17.2	20.8	8.7/135	54.3	11.1	74	.26
25	11 33.43	-59 15.2	11 35.78	-59 31.8	4.745	4.242	+0.75	- 6.5	17.3	20.8	8.6/139	54.3	11.0	112	.75
30	11 37.13	-59 47.6	11 39.51	-60 04.2	4.791	4.292	+0.67	- 6.8	17.4	20.9	8.5/144	54.5	10.9	128	1.00
Nov. 4	11 40.46	-60 21.8	11 42.86	-60 38.4	4.832	4.341	+0.59	- 7.2	17.5	20.9	8.4/150	55.0	10.8	105	.82
9	11 43.37	-60 57.7	11 45.80	-61 14.4	4.870	4.389	+0.50	- 7.5	17.6	21.0	8.3/155	55.7	10.7	66	.31
14	11 45.84	-61 35.1	11 48.29	-61 51.8	4.904	4.438	+0.40	- 7.7	17.7	21.0	8.2/160	56.6	10.7	56	.00
19	11 47.82	-62 13.8	11 50.28	-62 30.5	4.934	4.486	+0.29	- 8.0	17.7	21.0	8.2/166	57.8	10.7	92	.30
24	11 49.25	-62 53.6	11 51.72	-63 10.3	4.961	4.534	+0.17	- 8.1	17.8	21.1	8.2/172	59.2	10.8	122	.76
29	11 50.10	-63 34.1	11 52.58	-63 50.8	4.983	4.582	+0.04	- 8.2	17.9	21.1	8.2/178	60.7	10.8	120	1.00
Dec. 4	11 50.31	-64 15.1	11 52.79	-64 31.8	5.003	4.630	-0.10	- 8.2	18.0	21.2	8.3/184	62.4	10.9	86	.78
9	11 49.81	-64 56.4	11 52.28	-65 13.1	5.019	4.677	-0.26	- 8.2	18.1	21.2	8.4/191	64.3	10.9	56	.24
14	11 48.54	-65 37.5	11 50.99	-65 54.1	5.033	4.725	-0.43	- 8.1	18.1	21.2	8.5/198	66.3	11.0	72	.01
19	11 46.42	-66 17.9	11 48.85	-66 34.6	5.044	4.772	-0.61	- 7.9	18.2	21.2	8.7/204	68.5	11.1	107	.32
24	11 43.39	-66 57.2	11 45.78	-67 13.9	5.052	4.819	-0.81	- 7.5	18.3	21.3	8.8/211	70.8	11.1	123	.77
29	11 39.39	-67 34.9	11 41.72	-67 51.5	5.058	4.865	-1.02	- 7.1	18.3	21.3	9.1/218	73.1	11.2	104	1.00
1994 Jan. 3	11 34.35	-68 10.2	11 36.62	-68 26.8	5.063	4.912	-1.24	- 6.5	18.4	21.3	9.3/225	75.6	11.2	70	.72
8	11 28.26	-68 42.7	11 30.43	-68 59.2	5.067	4.958	-1.46	- 5.7	18.5	21.3	9.6/233	78.1	11.2	61	.18
13	11 21.08	-69 11.5	11 23.15	-69 27.9	5.069	5.004	-1.67	- 4.8	18.5	21.4	10.0/240	80.6	11.2	90	.01
18	11 12.84	-69 35.8	11 14.80	-69 52.1	5.071	5.050	-1.87	- 3.8	18.6	21.4	10.3/247	83.2	11.2	116	.33
23	11 03.62	-69 54.8	11 05.45	-70 11.0	5.074	5.096	-2.04	- 2.6	18.6	21.4	10.6/255	85.7	11.1	113	.78
28	10 53.55	-70 07.9	10 55.24	-70 23.9	5.076	5.141	-2.18	- 1.2	18.7	21.4	11.0/262	88.3	11.0	85	1.00
Feb. 2	10 42.80	-70 14.3	10 44.34	-70 30.1	5.079	5.187	-2.27	+ 0.2	18.8	21.4	11.4/270	90.8	11.0	63	.65
7	10 31.59	-70 13.6	10 32.99	-70 29.1	5.083	5.232	-2.31	+ 1.7	18.8	21.4	11.7/277	93.2	10.8	79	.14

For explanation of columns, see ICQ Comet Handbook 1993; tail information has been deleted.

(Continued from page 95)

P/Schwassmann-Wachmann 2 has been observed at several observatories during the past year or so, and is not being given a provisional letter designation. It therefore joins the following so-called 'annual' comets, which are observed throughout their orbits (even at aphelion): P/Arend-Rigaux, P/Encke, P/Grigg-Skjellerup, P/Gunn, P/Machholz, P/Schwassmann-Wachmann 1, P/Smirnova-Chernykh, and P/Tempel 2. Now that very efficient CCD detectors on telescopes are being used to look at comets while they are quite faint, more and more comets are going to be observable at aphelion, producing a dilemma for the Central Bureau for Astronomical Telegrams in deciding when to give provisional letter designations. The problem is that many observers like the 'publicity' involved with recovering comets (publication on an *IAU Circular* with assignment of a letter designation, and later parenthetical inclusion in Brian Marsden's *Catalogue of Cometary Orbits* in the table of discovery circumstances), but they will not observe comets other than to recover them. There is thus a scientific problem: should letters be assigned simply to get astrometric data? Will less astrometry be available (thereby causing orbital data to deteriorate, and possibly even for some comets to become lost)?

Objects in cometary orbits

Edward Bowell (Lowell Observatory, Flagstaff, AZ) noted in August that the Earth-crossing minor planet known as (4015) 1979 VA was observed as a comet by the Palomar Sky Survey in 1949. Brian Marsden then pointed out that the 1949 object had been called comet Wilson-Harrington 1949 III, having exhibited a tail-like feature on one night (see *IAUC* 5585). Careful examination of enhanced plates by Richard West at ESO showed the diffuse appendage on both plates taken on 1949 Nov. 19; further Palomar plates taken in 1949, the whereabouts of which are unknown, reportedly showed the object as being absolutely stellar in appearance. All known observations of (4015) since 1949 have also shown the object to be completely asteroidal. Perhaps some strange outgassing occurred on this object on 1949 Nov. 19, suggesting it may be a defunct comet nucleus.

Object (5145) 1992 AD, mentioned in my April column, has been named 'Pholus', who was a centaur in Greek mythology like Chiron. A most unusual, faint, slow-moving asteroidal object was found in late August by David Jewitt (University of Hawaii) and Jane Luu (Harvard-Smithsonian Center for Astrophysics and University of California). The object was given the minor-planet designation 1992 QB_1 and announced on *IAUC* 5611. At visual magnitude $\sim$ 23, 1992 QB_1 appears to be well beyond the orbit of Neptune (r > 35 AU), and could well be another object in the Pluto/Chiron/Pholus class of objects, which, while being much smaller than the major planets, are possibly links between comets and planets. It will take months before the indeterminate orbit is well known, as observations in the first month can be satisfied both by a circle and a parabola, but the Oct. 11 *Minor Planet Circulars* contain an orbit by Marsden that assumes 1992 QB_1 is in a Pholus/Chiron-type orbit and is now near aphelion, bringing it to q = 8.5 AU, when the visual magnitude would be around 16 (e = 0.68, P = 138.5 yr).

Spacecraft and comets

The Giotto spacecraft, which so successfully imaged P/Halley at close range in March 1986, made a fruitful flyby of P/Grigg-Skjellerup this past July 10, only $\sim$ 200 km from the comet's nucleus. While the imaging camera ceased functioning after the P/Halley encounter, data were collected showing a prominent bow shock, a gas coma out to $\sim$ 50,000 km from the nucleus, and a dust coma out to $\sim$ 20,000 km [H. Böhnhardt *et al.* 1992, *ESO Messenger* No. 69].

Unfortunately, NASA refused to recommend extending the CRAF spacecraft mission for fiscal year 1993, after spending hundreds of millions of dollars up through the current year, so it was not included in the federal budget. NASA is still supporting the Cassini probe to Saturn, however. — D. W. E. Green (1992 Oct. 7)

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MAGNITUDE-REFERENCE KEY

It has been more than four years since we last published the Key to comparison-star references for use in making total visual magnitude estimates of comets (see April 1988 issue, page 34), and there have been numerous additions to the Key over the past few years. For observers' convenience, we list the full updated Key below, and ask that all who contribute observations use these 1- and 2-letter abbreviations. At the end of each reference is given an *ICQ* reference in brackets that identifies the issue in which the source was introduced, or a location in which the reader can obtain more detailed information concerning that particular reference. If a magnitude source is used that is not listed below, please provide full publication details (authors, publisher, year and location of publication, and language if not English), so that we may assign an *ICQ* code. (The full set of *ICQ* Keys is available from the Editor for $4.00 postpaid.)

A = Charts or Atlas of the A.A.V.S.O. (**please use AA or AC instead**) [*ICQ* **3**, 47]
AA = A.A.V.S.O. Variable Star Atlas [*ICQ* **4**, 6]
AC = Charts of the American Assn. of Variable Star Observers (AAVSO) [*ICQ* **4**, 7]
AE = Planetary magnitudes from the *American Ephemeris and Nautical Alamanc* (for use with bright comets) [*ICQ* **4**, 105]; also star magnitudes from the same book
AG = *Astronomisches Gesellschaft Katalog* [*ICQ* **2**, 6]
AH = G. D. Roth's *Astronomy: A Handbook*, p. 534 (chart of the Pleiades) [*ICQ* **6**, 64]
AN = Comparison-star sequences as published by M. Beyer in articles in *Astron. Nachrichten* [see bottom of page 100, this issue of *ICQ*]
AP = *Atlas Photometrique des Constellations* (1948), by Antoine Brun (has stars to mag 7.5 labeled with Harvard

[cont. from previous page] photometry magnitudes) [*ICQ* **5**, 24]
AT = Arizona-Tonantzintla Catalog (publ. in July 1965 *Sky & Telescope*) [*ICQ* **2**, 6; **4**, 8]
BC = Boss Catalogue
BD = *Bonner Durchmusterung* (Argelander *et al.*) [*ICQ* **2**, 59; **4**, 63]
C = Photovisual magnitudes from "Cape Photographic Catalogue for 1950.0", in *Annals* of the Cape Observatory, Vols. **17-22**. [*ICQ* **9**, 142]
CA = M44 standard sequence as published in Henden and Kaitchuck's *Astronomical Photometry* (1982, New York: Van Nostrand Reinhold), pp. 301-302. [*ICQ* **9**, 99]
CC = Carte du Ciel, Paris (Astrographic Catalogue?) [*ICQ* **10**, 35]
CM = Photovisual and photoelectric-V magnitudes from *Cape Mimeograms* (Royal Observatory, Cape of Good Hope). [*ICQ* **9**, 142]
CO = *UBV* photometry for 39 stars in the range 11.7 < V < 18.7, from "A New Stellar Standard Sequence in the Comet Cluster of Galaxies" (F. Börngen and N. Richter 1978, *Astron. Nach.* **299**, 117) [*ICQ* **14**, 61]
CR = V magnitudes of 13 stars surrounding NGC 3627 (M66), as given by Ciatti and Rosino (1977, *A.Ap.* **56**, 62). The range in V is 13.8-16.9, and the stars are fairly red. [*ICQ* **11**, 30]
CS = *Catalogue of Stellar Identifications* (1979, Strasbourg). Large compilation of many catalogues. For information, see F. Ochsenbein *et al.* (1981), *A.Ap. Suppl.* **43**, 259, and Ochsenbein (1974), *A.Ap. Suppl.* **15**, 215. The visual magnitudes with colons (:) should be avoided if possible. [*ICQ* **10**, 35]
D = *Dutch Comet Halley Handbook* (E. P. Bus) [*ICQ* **7**, 96]
E = One of Everhart's three Selected Area charts (1984, *Sky Telesc.* **67**, 28)
EA = Selected Area 51: From Everhart (1984, *Sky Telesc.* **67**, pp. 28-30).
EB = Selected Area 57: From Everhart (1984, see EA, above) [*ICQ* **7**, 51]
EC = Selected Area 68: From Everhart (1984, see EA, above) [*ICQ* **7**, 51]
FA = V photometry by Harold Ables, U.S. Naval Observatory, Flagstaff, "Region No. 6", unpublished (stellar V magnitude range 11.1-15.8 photoelectric and 13.7-21.6 electronographic). [*ICQ* **9**, 99]
GA = Guide Star Photometric Catalog - I, in *Astrophysical J. Suppl. Ser.*, Vol. **68**, No. 1 (1988 September). Contains nearly 1500 stars with V magnitudes and convenient finder charts throughout the sky. [*ICQ* **10**, 124]
GP = [apparently same as 'HE'; see below]
GR = Groombridge [*ICQ* **3**, 15]
HD = Henry Draper Catalog (*Harvard Coll. Obs. Annals*) [*ICQ* **2**, 39]
HE = Harvard E Regions ($\delta \sim -45°$), Kron-Cousins V photometry for nine fields; stars range generally between 7 < V < 16 (Graham 1982, *P.A.S.P.* **94**, 244) [*ICQ* **10**, 124]
HP = Harvard Photometry (*Harvard College Obs. Annals*) [*ICQ* **4**, 8]
HR = Harvard Revised Photometry (*H.C.O. Annals*) [*ICQ* **1**, 42; **4**, 8]
L = Landolt V Photoelectric Sequences (*AJ* **78**, 959) [*ICQ* **6**, 37]
LN = Lampkin's Naked-Eye Stars [*ICQ* **2**, 6]
LM = V magnitudes from "A Visual Atlas of the Large Magellanic Cloud", by Mati Morel (1983), Rankin Park, New South Wales [*ICQ* **10**, 67]
MC = Carlsberg Meridian Catalogue (1989). La Palma. Several volumes; more than 50,000 stars with visual magnitudes down to $V = 13$; do not use stars with magnitudes given to less than 0.01 mag.
ME = V photometry by Tedesco, Tholen, and Zellner (1982, *A.J.* **87**, 1585); mag range 6-13 [*ICQ* **8**, 77]
ML = V magnitudes on chart of Large Magellanic Cloud by Mati Morel (apparently same as LM)
MM = V magnitudes on chart of Small Magellanic Cloud by Mati Morel (apparently same as SM)
MP = McCormick Photovisual Sequence (Univ. of Virginia) [*ICQ* **3**, 15]
MS = From "McCormick Photovisual Sequences", by C. A. Wirtanen and A. N. Vyssotsky (1945, *Ap.J.* **101**, 141-178). [*ICQ* **9**, 142]
MV = From *Publ. Leander McCormick Obs.*, Vol. **VI**, Part II, pp. 201-306 ("Magnitudes and Coordinates of Comparison Stars in Regions of Long-Period Variables, by S. A. Mitchell, 1935) or Vol. **IX**, Part V, pp. 59-88 ("Sequences for Fifty Variable Stars", by Mitchell and C. A. Wirtanen, 1939). [*ICQ* **9**, 142]
NH = North Polar Sequence as published by Henden and Kaitchuck (1982, *Astronomical Photometry*, NY: Van Nostrand Reinhold), p. 305.
NN = NGC 2129/6531/1342 cluster photometry, in *Publ. U.S.N.O.* Vol. **XVII**, parts VII, VIII (1961), pp. 406, etc. [*ICQ* **8**, 130]
NO = *U.S.N.O. Photoelectric Photometry Catalogue* [*ICQ* **2**, 6; **4**, 8]
NP = North Polar Sequence (publ. by the A.A.V.S.O.; 3 charts showing stars w/ useful range m_v = 5.0 and fainter [*ICQ* **1**, 17; **3**, 7]
NS = "Magnitudes and Colors of Stars North of +80°", by Seares, Ross, and Joyner (1941, *Carnegie Inst. Publication* 532) [*ICQ* **4**, 80]
OH = From listing of bright stars in *Observers' Handbook*, R.A.S.C. [*ICQ* **7**, 51]
PA = M45 sequence, Johnson and Mitchell (1958, *Ap.J.* **128**, 31) [*ICQ* **8**, 77]
PB = Pleiades chart in *Sky and Telescope* **70**, 465 (1985). [*ICQ* **8**, 77]
PC = Pleiades sequence, Henden and Kaitchuck (1982, *Astronomical Photometry*, N.Y.: Van Nostrand Reinhold), pp. 298-300 [*ICQ* **8**, 130]
PD = "Photometrische Durchmusterung: Generalkatalog", by G. Mueller and P. Kempf (1907), in *Publ. Astrophysikalischen Observatoriums zu Postdam* No. 52 (Vol. **17**); B.D. stars to mag 7.5 [*ICQ* **10**, 35]
PI = IC 4665 sequence as found in Henden and Kaitchuck (1982, *Astronomical Photometry*, New York: Van Nostrand

[cont. from previous page] Reinhold), pp. 302-304. [*ICQ* **10**, 35]

PK = From the Soviet Program for Comet Halley; Dr. Klim Churyumov, Kiev University, describes the method as follows (edited): Comparison stars were noted on the Palomar Sky Survey prints; the visual magnitudes of these stars were determined by comparison with standards stars from the galactic cluster NGC 2129 (V magnitudes taken from the paper by Hoag *et al.* in *Publ. U.S.N.O.*, Second Series, Vol. **XVII**, Part VII, pages 406 and 518, 1961). The visual magnitudes were determined by use of the formula $m_v = V + 0.16(B-V)$.

PL = star(s) and sources quoted for photoelectric data, but difference (comet – comparison-star) > 4.5 mag [*ICQ* **10**, 35]

RA = *Annual Ephemeris* of the Royal Astronomical Society of Canada (not recommended, even for bright comets) [*ICQ* **5**, 64]

RB = "Photoelectric Magnitudes and Colours of Southern Stars", A. W. J. Cousins and R. H. Stoy (1963), in *Royal Observatory Bulletin* No. 64 (Royal Greenwich Obs.), Series E3, pp. E101-E248. [*ICQ* **9**, 142]

RC = "Standard Magnitudes in the E Regions", A. W. J. Cousins and R. H. Stoy (1962), in *Royal Observatory Bulletin* No. 49 (Royal Greenwich Obs.), Series E2, pp. E1-E59. [*ICQ* **9**, 142]

S = *Smithsonian Astrophysical Obs. Star Catalog* [*ICQ* **1**, 17; **4**, 9]

SA = M67 sequence by R. E. Schild (1983, *PASP* **95**, 1021), Kron-Cousins magnitudes [*ICQ* **10**, 35]

SC = *Sky Catalogue 2000.0* (Sky Publishing; stars of magnitude $V < 8.1$) [*ICQ* **4**, 62; **4**, 105]

SE = V magnitudes of 134 stars of the II Persei Association (stars of spectral types A and B, mag range 5.1-11.4; C. K. Seyfert *et al.*, *Ap.J.* **132**, 58). [*ICQ* **11**, 30]

SM = V magnitudes from "A Visual Atlas of the Small Magellanic Cloud", by Mati Morel (1989), Rankin Park, N.S.W., Australia

SP = *Skalnate-Pleso Atlas Catalog (Atlas Coeli Cat.)* [*ICQ* **2**, 6; **4**, 10]

SS = Various regions covering $\delta = -60°$ to $+10°$, with stars having general range $12 < V < 24$; Stobie *et al.* (1985), *Astron. Astrophys. Suppl. Ser.* **60**, 503

SW = Four half-degree fields with finder charts and *UBV* photometry, range $10 < V < 15$ (except field IV, which has a gap between $11.5 < V < 13.5$), published by W. Saurer *et al.* (1992) in *Astron. Astrophys. Suppl. Ser.* **93**, 553. The four fields average about 40 stars each, roughly centered at the following α and δ (B1950.0): I, 1^h27^m, $+58°.2$; II, 3^h24^m, $+45°.2$; III, 7^h15^m, $-10°.1$; IV, 21^h31^m, $+50°.2$.

TB = *Supernova Search Charts*, by G. D. Thompson and J. T. Bryan, Jr. (1989, Cambridge University Press) [*ICQ* **13**, 141]

TG = CCD magnitudes on the Thuan-Gunn system; standard stars in Thuan and Gunn (1976, *PASP* **88**, 543).

TS = Field of 13 stars ($\alpha \sim 22^h02^m$, $\delta \sim -19°.1$, equinox 1950.0), V magnitudes with finding chart, $9.7 < V < 19.2$, by Tritton *et al.* (1984), *MNRAS* **206**, 843-847.

V = Variable star charts from recognized sources [*ICQ* **1**, 42]

VB = Variable star charts of the British Astr. Assn. [*ICQ* **4**, 64]

VF = Variable star charts of the A.F.O.E.V. (France) [*ICQ* **4**, 64]

VN = Variable star charts of the R.A.S. of New Zealand [*ICQ* **4**, 64]

W = International Halley Watch (IHW) version of an unspecified AAVSO chart [*ICQ* **7**, 96]

WA = Special IHW version of AAVSO chart for SU Tauri [*ICQ* **7**, 96]

WB = Special IHW version of AAVSO chart for CZ Orionis [*ICQ* **7**, 96]

WC = Special IHW version of AAVSO chart for Y Tauri [*ICQ* **7**, 96]

WD = Special IHW version of AAVSO chart for V Tauri [*ICQ* **7**, 96]

WE = IHW version of AAVSO chart for X Sextantis [*ICQ* **8**, 130]

WF = IHW version of AAVSO chart for S Sextantis [*ICQ* **8**, 130]

WG = IHW version of AAVSO chart for SX Leonis [*ICQ* **8**, 130]

WH = Unspecified IHW charts [*ICQ* **8**, 44]

WW = B.A.A. Charts as published in the *IHW Observers' Manual* [*ICQ* **8**, 44]

Y = *Yale Bright Star Catalogue* [*ICQ* **1**, 42; **4**, 8]

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Max Beyer made thousands of valuable visual m_1 estimates of comets over many decades, ending with his death in the early 1970s. He published his observations in a long series of papers in the *Astronomische Nachrichten*, and, as noted last year in these pages, nearly all of these observations are now part of the *ICQ* Archive (though they will not be reprinted on these pages). The value of his observations lies in the care with which he estimated the total visual magnitudes of so many comets. Following are some excerpts from a letter that Beyer wrote to Dennis Milon (then Recorder of the A.L.P.O. Comets Section) on 1970 Sept. 16: "From 1930 to 1946 all observations are given in magnitudes of the Revised Harvard Photometry (*Harv. Ann.* **50** or Pickering's Northern Polar Sequence). Later I reduced all my observations (variable stars and comets) to the Internat. Photovisual System. The very reliable magnitudes in *Harv. Ann.* **50**, **54**, and **74** can be reduced to the Ipv-System by using *Pv(Mt. Wilson) = Harv. + Korr. + fC* given in *Mt. Wilson Contributions* 88. Most stars with magnitudes brighter than 7.5 are given in the Harv. Catalogues. Pickering's Durchmusterungszonen in *Harv. Ann.* **70** show systematic errors by more than 0.3 mag. Therefore all the fainter stars have been measured by myself applying a Graff-wedge-photometer and for comparison the IPv Northern Polar Sequence. As these photometric measurements have to be made only under good atmospheric conditions and in higher altitudes of the stars, it lasts often a longer time before the total magnitudes of the comets can be derived."

TABULATION OF COMET OBSERVATIONS

As noted on these pages previously, Alan Hale is by far the most prolific contributor to the *ICQ* Archive of limiting magnitude estimates for faint comets that are not seen. Often Hale has reported negative observations with no magnitude reference cited, with the limiting magnitude estimate given based on his deep experience. We still are uncomfortable with *any* magnitude estimates given without the use of specific comparison stars, and beginning with this issue, such estimates automatically receive a colon (:). We will *not* correct his previously-published observations, but ask potential users of the data to be aware of the potential problems involved. As noted on these pages on numerous occasions, we again state that *all* observers who obtain limiting magnitude estimates for negative observations should make actual estimates *using an extrafocal method* of comparison stars using a specified coma diameter (usually 1'.0 or 0'.5), with the 'assumed' coma diameter given as a coma diameter estimate with an exclamation mark (!) preceding the number.

Robert J. Modic (observer code MOD) has been monitoring the light pollution at his observing site closer to home, and also at a darker site (often on the same night), by observing comets, and he submitted some observations "corrected for light pollution" effects. We have reservations about observers modifying their observations for any reason other than atmospheric extinction, and would prefer to get raw data (with appropriate remarks if deemed necessary to comment on the situation). So given here are Modic's unaltered data, and in the descriptive notes below, we give Modic's suggested "corrections". Modic's corrections vary from night to night, but for comet 1992d, they averaged −0.3 mag for m_1, +0'.8 for the coma diameter, and +1 for degree of condensation.

And speaking of unaltered data, we again remind observers that special note must be made whenever any observational information is obtained using a special filter: our policy has been to ignore such data, because the meaning of such data is highly questionable, and such data certainly are not directly comparable with unfiltered visual observations. We may publish filtered estimates under the "Descriptive Information", if provided. Charles S. Morris has noted that the effect of light pollution on a comet's m_1 and diameter may be correlated with the comet's dust/gas ratio: a gassy comet often shows little or no effect, while a dusty comet can be significantly fainter in light-polluted skies. The *ICQ* believes that observers should make an effort (when feasible) to observe from the best observing site available. Also, a magnitude estimate made with a filter is meaningless because one doesn't know the "brightness" of the comparison star in that wavelength band (as an example).

Over the years, we have had several letters inquiring as to why we do not archive such information as "faintest naked-eye star" near the comet at the time of a cometary observation. There are several reasons for this. The biggest reason is probably that, even if the data were accurate, it would be very hard to reduce or use such data in a subsequent analysis, and it certainly would take a lot of extra effort to enter the data and also more computer space. But almost as big a reason to ignore "faintest naked-eye star" data is the fact that such information is probably not very reliable on average. No one has ever statistically demonstrated a correlation between faintest naked-eye star and the observed brightness of a comet *or* that such information is useful in data analysis. In fact, the most significant correlation of observed brightness is with observer expexperience (see the paper by Edberg and Morris 1986, in *20th ESLAB Symposium on the Exploration of Halley's Comet*, ESA SP-250, Vol. **I**, p. 609). Adverse conditions can and should be noted on the observation report. As an aside, many observers who normally use glasses or contact lenses do not have perfect '20-20' vision because their subscription is constantly deteriorating, and people generally allow their vision to deteriorate somewhat below the 20-20 threshold before getting new corrective lenses. This would in no way affect their cometary magnitude estimates, which normally are obtained with binoculars or telescopes, but would seriously affect "faintest naked-eye star" magnitudes. Also, many comets are necessarily observed low in the sky, where atmospheric extinction is a problem, and certainly in such cases the "faintest naked-eye star" is rendered more meaningless. If there are researchers who believe that faintest naked-eye star (or any other parameter) should be archived by the *ICQ* to support data analysis, they must demonstrate statistically that the given parameter is important and that it is useful.

Early in the process of defining the *ICQ* project, the *ICQ* staff had many discussions concerning the most important data to include in the archiving, and it was concluded that coma information (estimated diameter and DC), along with *full* instrumentation details (aperture, type of instrument, *f*/-ratio, magnification), would be the most important information for defining the conditions under which the comet was observed. Combined with the magnitude method and the source for comparison stars, these quantites are the ones with which researchers can best utilize in determining the quality of the data. A smaller coma will usually mean either an instrumental contribution (such as longer focal length, higher magnification, or larger aperture) or a local environmental effect (light pollution, atmospheric extinction, clouds, *etc.*). We do ask that all observers make an attempt to determine the coma diameter and DC *every time* an m_1 estimate is made, *with the same instrument and eyepiece*. A quick way is simply to estimate the size with respect to two nearby stars, and then measure the distance of the stars on a star atlas with a respectable scale and overlay grid (such as the *SAO Star Atlas*, *Uranometria 2000.0*, *etc.*). The coma information is potentially useful for anyone who uses m_1 data.

Descriptive Information (to complement the Tabulated Data):

◇ *Comet Pereyra 1963 V [observations submitted by J. E. Bortle to supplement his paper on sungrazing comets elsewhere in this issue]* ⟹ 1963 Sept. 16.5: in 8-cm B, mag 6.0 [A. McClure; cf. *Sky Tel.* **26**, 5]. Sept. 17.12: mag 6.0 (in 5-cm B?) [J. Bennett; ALPO/private communication]. Sept. 20.48: mag 6.0 (in 5-cm B?) [G. de Vaucouleurs, *JALPO* **17**, 9-10]. Sept. 21.52: mag 7.0 (in 5-cm B?) [A. McClure; cf. *Sky Tel.* **26**, 5].

◇ *Comet White-Ortiz-Bolelli 1970 VI [observations submitted by J. E. Bortle to supplement his paper on sungrazing comets elsewhere in this issue]* ⟹ 1970 May 18.32: in 5-cm B, mag 1.0: [G. White; *IAUC* 2251; *QJRAS* **12**, 244]. May 20.33: in 5-cm B, mag 1.0: [G. White; *ibid.*]. May 21.63: mag 1.0 (naked eye?) [E. Ortiz, *IAUC* 2250]. May 23.95: mag

3.0: (naked eye?) [Z. Pereyra, *IAUC* 2246]. May 23.96: mag 3.5 (naked eye?) [J. Savio, *IAUC* 2251]. May 25.44: mag 4.0: (5-cm B?) [M. Candy, *IAUC* 2246]. May 25.26: in 5-cm B, mag 3.5 [W. Fisher, private communication].

◇ *Comet Austin 1990 V* ⟹ 1990 May 26.72: "stellar nucleus; faint fan tail suspected" [DRU01].

◇ *Comet Levy 1990 XX* ⟹ 1990 July 17.95: at 220×, starlike cond. [DIO]. July 20.04: also 4'.6 tail in p.a. 254°; in 20.0-cm *f*/10 T (220×), short jet extending from central cond. toward p.a. ~ 14° [DIO]. July 22.09: in 20.0-cm *f*/10 T (220×), short tail ~ 40" long in p.a. 190°, curving out to 1' at p.a. 140°; second short tail extending ~ 0'.6 at p.a. 358°, curving to 1'.5 at p.a. 332° [DIO]. July 23.04: in 20.0-cm *f*/10 T (220×), central cond. of dia. ~ 21"; some other jetlike condensations seen (of size ~ 10"-25"), incl. a jet ~ 23" long in p.a. 0°-330° [DIO]. Aug. 11.02: in 20.0-cm *f*/10 T (440×), central cond. of dia. 6" [DIO]. Aug. 14.02: in 20.0-cm *f*/10 T, 10' coma [DIO]. Aug. 20.96: in 20.0-cm *f*/10 T, 20' coma, DC = 7-8 [DIO].

◇ *Comet Shoemaker-Levy 1991d* ⟹ 1991 Dec. 7.20: at 80×, disklike coma had dia. 2'.5, and w/ averted vision there was a 0°.1 tail in p.a. 330° or 340° [GAR02]. 1992 Jan. 2.20: a small triangle of stars close to the comet slightly disturbed the observation [GAR02]. Mar. 1.17: hazy sky [GAR02]. Mar. 1.41: very light haze; at 214×, stellar central cond. of mag 13.8 ± 0.1 [MOD]. Mar. 5.43: light haze; at 164×, stellar cond. of mag 13.9 ± 0.1 offset to NW, w/ sunward fan to SE [MOD]. Apr. 6.36: at 164×, stellar central cond. of mag 13.8 ± 0.1 [MOD]. May 28.28: comet ~ 1' from a 10th- or 11th-mag star; at 164×, "stellar cond. of mag 14.3 ± 0.1 offset toward p.a. ~ 340°?" [MOD]. May 29.24: at 164×, stellar cond. offset to N [MOD]. June 10.27: at 164×, "stellar cond. of mag ~ 14 offset to N-NW?" [MOD]. Aug. 24.92: three 5-sec exp. on T-Max 400 film (40-cm L + RTC XX 1390 image intensifier) show a nearly stellar cond. of mag ~ 14.0 (m_1 ~ 13.5) and a 30" coma [MER].

◇ *Comet Shoemaker-Levy* $1991a_1$ ⟹ 1992 May 24.04: in 20.0-cm *f*/17.5 R (87×), m_1 = 10.2: [ref: S(?), MM: M], 1' coma, DC = 1 [LEH]. May 25.04: in 20.0-cm *f*/17.5 R (87×), m_1 = 10.1: [ref: S(?), MM: M], 1' coma, DC = 1 [LEH]. May 28.34: in 35.9-cm L, elliptical or parabolic coma w/ minor axis 1'.2 across; at 164×, DC = 3-4, non-stellar cond. located at extreme E side of coma (coma elongated to W) [MOD]. May 29.33: elliptical or parabolic coma, minor axis 1'.5 across; in 40-cm *f*/7 L (190×), almost stellar cond. of mag 13.5-14.0 located at extreme E side of coma (coma elong. to W) [MOD]. June 3.35: in 35.9-cm L (164×), coma elongated toward p.a. 229° ± 3° [MOD]. June 9.28: in 20-cm L, elliptical or parabolic coma, coma elongated toward p.a. 270° ± 5°, minor axis 2'.4 [MOD]. June 9.34: in 35.9-cm L, coma appearance like that in 20-cm L (see previous note), w/ minor axis 2'.0; at 164×, stellar cond. of mag ~ 13.5 [MOD]. June 10.31: in 35.9-cm L, coma appearance like that on June 9.34, w/ minor axis 1'.5 across; at 164×, stellar cond. of mag 13.7 ± 0.1 [MOD]. June 10.33: in 20-cm L, coma appearance like that on June 9.28, w/ 1'.7 minor axis [MOD]. June 11.32: coma appearance like that in 35.9-cm L on June 9.34, w/ 2'.0 minor axis [MOD]. June 12.33: elliptical or parabolic coma w/ minor axis 1'.0; Modic suggests "corrections for the moderate light pollution: m_1 = 10.3 (*i.e.*, −0.2 mag), 2'.2 × 1'.6 coma, DC = 3" (see Editor's remarks prior to the 'Descriptive Information', above) [MOD]. June 22.21: at 68×, stellar cond. of mag 11.5 ± 0.2, coma elongated toward p.a. 300° ± 5°; suggested "corrections for the moderate light pollution: m_1 = 9.3, 2'.2 coma, DC = 4" [MOD]. June 24.10: 1'.0 central cond. [DID]. June 25.27: suggested "corrections for the moderate light pollution: m_1 = 9.0, 2'.2 coma, DC = 4" [MOD]. June 26.30: suggested "corrections for the moderate light pollution: m_1 = 9.3, 2'.2 coma, DC = 4"; at 68×, stellar cond. of mag 11.7 ± 0.2, possibly offset to E-SE [MOD]. June 26.92: remarks from the observer [GAR02] suggest that the observation, made under strong light pollution from Toulouse, was made with an 'LPR filter'. June 26.95: tail 0°.15 long in p.a. 347° [KOS]. June 27.30: suggested "corrections for the moderate light pollution: m_1 = 9.3, 2'.2 coma, DC = 4"; at 68×, stellar cond. of mag 11.8 ± 0.05; at 169×, stellar cond. of mag 12.1 ± 0.05 [MOD]. June 28.27: in 35.9-cm L, "in addition to main tail, suspected slight extension of coma to the W"; at 164×, stellar cond. of mag 12.0 ± 0.05 [MOD]. June 30.21: at 35×, suggested "corrections for the moderate light pollution: m_1 = 8.9, 2'.2 coma, DC = 3" [MOD].

July 3.17: more diffuse at p.a. 230° [DID]. July 8.98: beginning of tail [LOO01]. July 13.896: noted large discrepancy between *SAO Star Catalog* and *Sky Catalogue 2000.0* magnitudes for SAO 27957 and 27979; adopted m_v = 7.9 (from SC) and 8.8 (from S), respectively [DIO]. July 13.93: 20-sec unfiltered CCD frame obtained in moonlight under very good conditions w/ 20-cm *f*/2 Baker-Schmidt camera shows 1'.8 × 3'.2 oval coma and fan-like tail 0°.25 long in p.a. 50° [MIK]. July 17.84: also "dust" tail ~ 25' long in p.a. ~ 50° [DIO]. July 21.18: "the tail could just barely be seen with 10×50 B" [HAL]. July 21.88: 2-min unfiltered CCD frame w/ 19-cm *f*/4 flat-field camera shows 5'.4 × 4'.6 oval coma and a very conspicuous, straight, thread-like ion tail 0°.6 long in p.a. 93°, extending even beyond the frame; also fan-like tail ~ 0°.4 long in p.a. 93°-170° [MIK]. July 23.18: photo w/ Tech Pan film and 10-cm D shows that primary tail is now more diffuse and distorted, being 1°.9 long in p.a. 90°; very diffuse secondary tail 0°.5 long in p.a. 28° [Paul Roques, Williams, AZ]. July 24.17: photo taken as on July 23.18 shows the primary tail, now very diffuse, traced out to ~ 1° in p.a. 90°; the faint, diffuse secondary tail that was recorded on earlier images (July 20, 21, 23), reaching maximum intensity on July 23, was no longer evident [Roques]. July 25.08: tail fanned in p.a. 60°-95° (length 3'.3 in p.a. 95°) [DID]. July 26.17: poor sky; some interference from cirrus [HAL]. July 27.38: somewhat enhanced using Swan-band filter [SEA]. July 31.05: at 100×, 2'.5 tail in p.a. 100° [DID]. Aug. 1.36: comet difficult due to light from crescent moon nearby [CAM03]. Aug. 3.17: low altitude; interference from crescent moon in sky; a very vague tail, 20' long in p.a. 75°, was suspected [HAL]. Aug. 18.37: "enhanced using Swan-band filter, and seemed longer" [SEA].

◇ *Comet Zanotta-Brewington* $1991g_1$ ⟹ 1991 Dec. 29.77: **[cover drawing]** at 250×, tail streamers 0°.03 and 0°.02 long in p.a. 128° and 52°, and jets 14", 12", 11", and 12" long in p.a. 300° (curving to p.a. 324°), 52°, 125°, and 195°, respectively [GAR02]. Dec. 30.77: in 20.3-cm *f*/10 T (250×), tails 0°.02 and 0°.06 long in p.a. 65° and 77°; 0°.02 streamer in p.a. 17°; 9" jet in p.a. 322° [GAR02]. 1992 Jan. 1.80: at 250×, also 0°.04 tail and 0°.04 streamer in p.a. 64° and 128°; 11", 15", 14", and 7" jets in p.a. 12°.5 (curved to p.a. 26°.5), 128°, 202° (curved to p.a. 189°), and 292°, respectively

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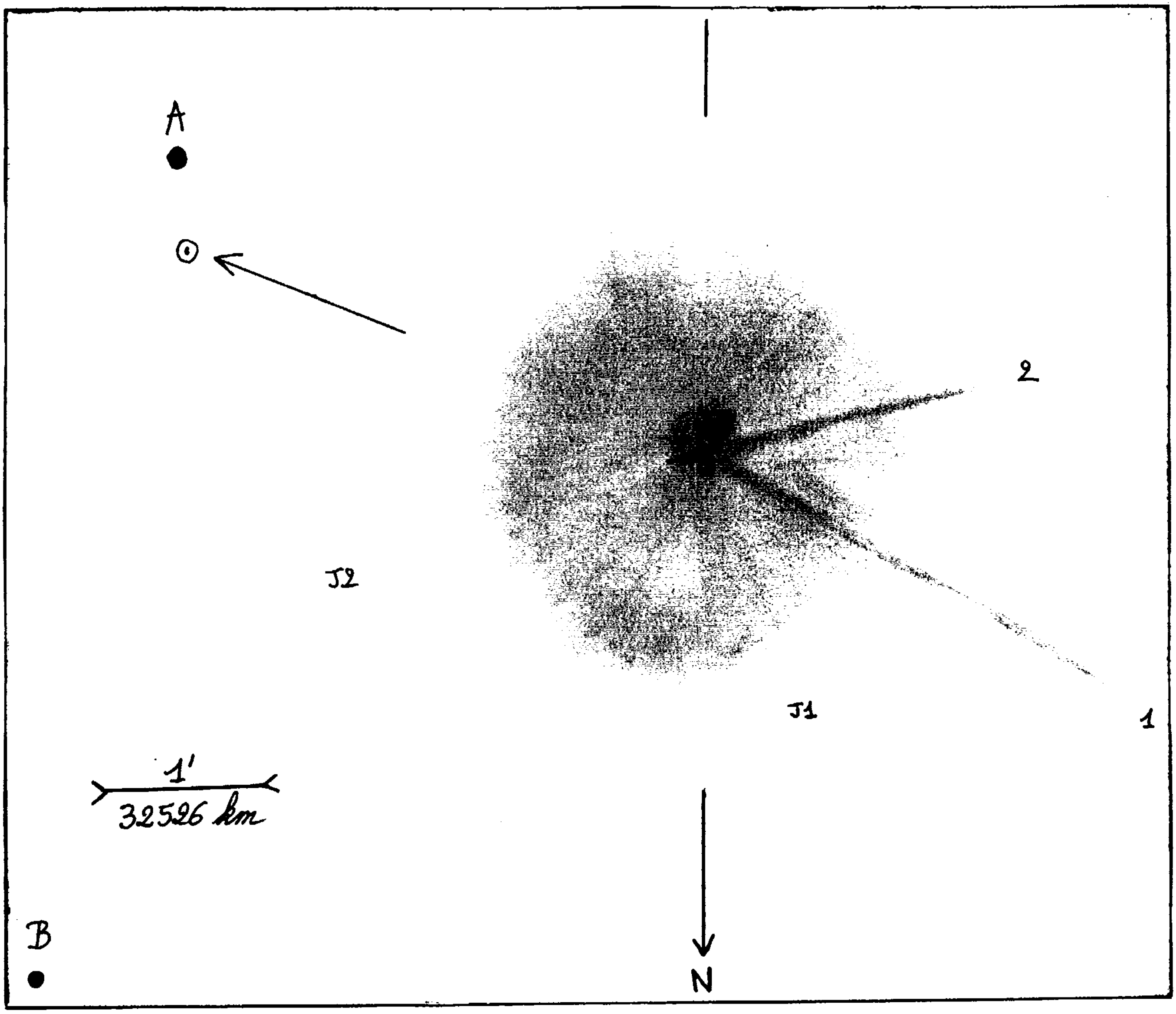

[cont. from previous page] [GAR02]. Jan. 2.76: at 250×, tail > 0°.06 long in p.a. 99°, 0°.02 streamer in p.a. 71°; also curved tail structures 0°.03 long in p.a. 44° (curved to p.a. 50°), 230° (curved to 195°), and 328° (curved to 265°); 7″ jet in p.a. 255° [GAR02]. Jan. 25.78: in 20.3-cm T (80×), 0°.2 tail in p.a. ~ 65°; at 250×, **[drawing, above]** 0°.18 tail in p.a. 60°, 0°.05 streamer in p.a. 103°, and 10″ and 13″ jets in p.a. 15° and 291° [GAR02]. Jan. 26.80: at 250×, 0°.11 tail in p.a. 51° and 0°.19 streamer in p.a. 94° [GAR02]. Jan. 31.78: in 20.3-cm T (80×), 0°.13 tail in p.a. ~ 80° [GAR02].

◇ *Comet Mueller 1991h₁* ⟹ 1992 Feb. 23.78: in 20.3-cm T (80×), coma dia. almost 3′, 0°.25 tail toward p.a. 60°; at 250×, stellar central cond., m_2 ~ 11.5 [GAR02]. Feb. 29.79: at 167×, 0°.13 tail in p.a. 70° [GAR02].

◇ *Comet Tanaka-Machholz 1992d* ⟹ 1992 Apr. 8.40: Modic's suggested "corrections for moderate light pollution [see Editor's introductory notes, page 101; it should be noted that Modic notes there was either light haze or cirrus, or twilight, during nearly all of these observations where he proposes corrections]: m_1 = 8.6, 2′.2 coma, DC = 4"; comet ~ 2′ from a star of mag ~ 8, possibly affecting m_1 est. [MOD]. Apr. 15.40: suggested "corrections for moderate light pollution: m_1 = 8.2, 2′.2 coma, DC = 5"; at 68×, stellar central cond. of mag 11.1 ± 0.2 [MOD]. Apr. 19.40: suggested "corrections for moderate light pollution: m_1 = 8.4, 2′.0 coma, DC = 4" [MOD]. Apr. 23.39 and 27.37: suggested "corrections for moderate light pollution: m_1 = 8.5, 2′.2 coma, DC = 4" [MOD]. May 2.38 and 3.38: suggested "corrections for moderate light pollution: m_1 = 8.6, 2′.2 coma, DC = 4" [MOD]. May 6.36: suggested "corrections for moderate light pollution: m_1 = 8.4, 2′.0 coma, DC = 4"; comet ~ 2′ from a star of mag ~ 8, possibly affecting m_1 est. [MOD]. May 9.38: "outburst has begun"; suggested "corrections for moderate light pollution: m_1 = 8.0, 1′.7 coma, DC = 5" [MOD]. May 10.00: also 2′ tail in p.a. 0° [DIO]. May 10.10: a Kodak 2475 film exp. w/ a 25-cm *f*/4.4 L shows coma dia. ~ 2′.5, DC = 6-7 [L. Quaglietti, Roma, Italy]. May 10.36: suggested "corrections for moderate light pollution: m_1 = 7.3, 3′.0 coma, DC = 4" [MOD]. May 12.46: elongated coma (possible tail) [HER02]. May 14.36 and 15.34: suggested "corrections for moderate light pollution: m_1 = 7.9, 2′.8 coma, DC = 4" [MOD]. May 16.37: moderate twilight; suggested "corrections for light pollution: m_1 = 8.1, 2′.2 coma, DC = 4" [MOD]. May 25.34: suggested "corrections for moderate light pollution: m_1 = 8.6, 2′.6 coma, DC = 3" [MOD]. May 29.04: "faint nucleus" [LOO01].

◇ *Comet Bradfield 1992i* ⟹ 1992 May 29.37: very diffuse w/ no central cond., seeing not very good [CAM03]. May 30.37: very diffuse w/ no central cond., seeing much better than previous night, coma elongated 3′ × 5′ [CAM03].

◇ *Comet Machholz 1992k* ⟹ 1992 July 18.5, 19.5, 21.5, 24.5, 28.5, Aug. 3.5, and 5.5: in 12-cm *f*/7 R (27×), comet not seen (m_1 [9.0: or [9:, ref: S, MM: S), coma dia. < 3′; on Aug. 1.5, same at 64× [MAC]. July 27.5 and 30.5: in 25-cm *f*/4 L (64×), comet not seen (m_1 [9:, ref: S, MM: S), coma dia. < 3′ [MAC]. July 28.81: "uncertain observation" [SEA]. July 29.81: "very marginal, apparent confirmation of previous observation" [SEA]. July 30.81: "marginal under prevailing conditions; may have been slightly enhanced by Swan-band filter" [SEA]. Aug. 3.47: low elevation; all nearby stars shown in *Uranometria 2000.0*, plus some fainter ones, were seen [HAL]. Aug. 7.5, 10.5, and 21.5: in 12-cm *f*/7 R (27×), comet not seen (m_1 [8:, ref: S, MM: S), coma dia. < 3′ [MAC]. Aug. 8.5 and 9.5: in 12-cm *f*/7 R (27×), comet not seen (m_1 [8.5:, ref: S, MM: S), coma dia. < 3′ [MAC]. Aug. 17.5: in 25-cm *f*/4 L (64×), comet not seen (m_1 [8:, ref: S, MM: S), coma dia. < 3′ [MAC].

◇ *P/Arend Rigaux* ⟹ 1992 Feb. 2.065: a 60-min exp. (TP2415 hypered film) centered at this time w/ 20.3-cm *f*/6 T also failed to record the comet [GAR02].

◇ *Periodic Comet Brewington (1992p)* ⟹ 1992 Aug. 31.48: the comet was 2′ from a 5th-mag star (65 Aur), which significantly affected the observation [HAL]. Sept. 3.12: diffuse with slight cond. [MIK].

◇ *P/Daniel (1992o)* ⟹ 1992 Sept. 1.48: "some interference from occasional clouds moving through comet's vicinity" [HAL].

◇ *Periodic Comet Faye (1991n)* ⟹ 1991 Oct. 18.65: strong cond.; small nucleus of mag ~ 12 [JON]. Oct. 28.44: poor sky transparency [JON]. Nov. 4.45: at 86×, 0′.8 coma, DC = 6 [JON]. Nov. 12.42 and 14.42: at 86×, DC = 6 [JON]. Nov. 24.41: at 86×, DC = 7 [JON]. Nov. 25.42: at 86×, DC = 5 [JON]. Nov. 30.41: at 86×, DC = 6, coma dia. 1′.3 [JON]. Dec. 2.43: at 86×, 1′ coma, DC = 4-5 [JON]. Dec. 4.42: at 86×, 1′ coma, DC = 5 [JON]. Dec. 4.86: at 167×, 0°.13 tail in p.a. 40°, 18″ jet in p.a. 80°; there was a 'nodosity' near the nucleus, at p.a. 164° [GAR02]. Dec. 6.85: at 167×, main tail at p.a. 22°, streamer at p.a. 54°, and jet at p.a. 108°; "a 'nodosity' was again visible, as on Dec. 4, and 3 observations at 1-hr intervals showed a perceptible rotation, indicating a rotation period of ~ 0.3 or 0.4 day; such a period fits *a posteriori* the observation of Dec. 4 and also some of the observed jets; the details were only seen w/ averted vision"; on Dec. 6.95, the nodosity was measured at p.a. 214°, while the main tail was still at p.a. 22° [GAR02]. Dec. 14.02: at 80×, 0°.10 tail toward p.a. 60° or 65° [GAR02]. 1992 Jan. 2.78: at 167×, 0°.02 and 0°.04 tails in p.a. 15° and 40° [GAR02].

◇ *P/Grigg-Skjellerup* ⟹ 1992 Aug. 3.15: low altitude; interference from nearby crescent moon; a faint, diffuse candidate was suspected, but could not be confirmed as the comet; unfortunately, clouds had prevented earlier observation attempts (when the moon would not have interfered), and moonlight (and poor weather) precluded any further attempts [HAL].

◇ *Periodic Comet Hartley 2 (1991t)* ⟹ 1991 Oct. 14.69 and 18.68: low altitude in haze [JON].

◇ *Periodic Comet Kowal 2 (1991f_1)* ⟹ 1991 Dec. 29.99: search made at both 80× and 250× [GAR02]. 1992 Feb. 6.25: comet involved w/ 2 stars (magnitudes 14.5-15.0), possibly affecting m_1 estimate slightly [MOD].

◇ *Periodic Comet Levy (1991q)* ⟹ 1991 Aug. 21.14: "coma not circular" [DIO].

◇ *P/Schwassmann-Wachmann 1* ⟹ 1991 Dec. 5.77: "comet very small and faint, close to the limit of the instrument; cometary appearance more evident at 250×; motion noted visually, and 45-min exp. with 20.3-cm *f*/6 T (hypered 2415 film) confirmed identity" [GAR02]. Dec. 14.05: "a lot of faint stars not present on the *Stellarum* chart were seen, but nothing w/ a cometary appearance" [GAR02]. Dec. 29.89: a photo (45-min exp. on hypered TP2415) also failed to show the comet [GAR02]. 1992 Jan. 1.92: "photo of Dec. 29 was used as a reference, and comet was carefully searched for" [GAR02]. Aug. 3.43: "for this and all subsequent observation attempts, there is some interference from very rich surrounding star fields" [HAL]. Aug. 4.084-4.093: several 1- and 2-min CCD exp. taken with 19-cm *f*/4 flat-field camera shows the comet as a faint, mag ~ 16, diffuse object with cond.; coma dia. ~ 0′.5 [MIK]. Aug. 6.088: two 2-min CCD frames taken with 19-cm *f*/4 flat-field camera shows the comet at mag ~ 15, w/ a 12″ distinctive central cond. and a faint coma of size ~ 0′.6, DC = 6 [MIK]. Aug. 8.076-8.078: two 2-min CCD frames taken with 19-cm *f*/4 flat-field camera shows the comet at mag ~ 15; circular coma of dia. ~ 0′.5, w/ central cond. of size ~ 6″; DC = 6; comet not seen in 36-cm *f*/11 T (80×) under good conditions [MIK]. Aug. 9.089-9.092: two 2-min CCD frames taken with 19-cm *f*/4 flat-field camera shows the comet at mag ~ 15; coma dia. ~ 0′.5, DC = 5 [MIK]. Aug. 25.040-25.123: several 2-min unfiltered CCD frames taken with 19-cm *f*/4 flat-field camera show 25″ starlike central cond. of mag ~ 14, w/ no trace of coma, possibly in early stage of outburst; due to the completely stellar appearance, longer monitoring was necessary so that the comet was finally identified through its apparent motion [MIK]. Aug. 31.44: "comet's expected position close to star of mag 8-9" [HAL]. Sept. 3.48: "comet's expected position close to star of mag ~ 8" [HAL].

◇ *Periodic Comet Shoemaker-Levy 6 (1991b_1)* ⟹ 1992 Jan. 2: a 60-min photo (2415 hypered film) w/ 20.3-cm T failed to show the comet, in addition to the three visual attempts (1991 Dec. 3-1992 Jan. 1) [GAR02].

◇ *Periodic Comet Swift-Tuttle (1992t)* ⟹ 1992 Sept. 27.47: large and diffuse coma; there is a slight enhancement when viewed with a Lumicon Swan Band filter [HAL]. Oct. 4.79: "the comet was only weakly condensed, but it had a

(continued on next page...)

[cont. from previous page] higher surface brightness than on Sept. 30.14" [GRA04]. Oct. 7.08: "the coma was brighter and somewhat more condensed than on Sept. 30.14 and Oct 4.79; no nucleus brighter than mag 12.5 was seen" [GRA04]. Oct. 7.35: observation made from Harvard, MA, some 40 miles W of Boston, where light pollution was a factor, making the comet less pronounced visually than on Oct. 4.37, when the observation was made from a very dark rural site in central NH (and the comet was very easy in 12×50 B) [GRE]. Oct. 9.14: "AC" m_1 estimates made of this comet until now were made using the chart for T UMa; no nucleus brighter than mag 13.0 was seen (ref: *ibid.*) [GRA04]. Oct. 9.16-9.17: obtained 1-min CCD exp. w/ 19-cm $f/4$ flat field camera (+ 574×384 CCD + V, I standard CCD filters); through V filter, there is a prominent circular coma of dia. ~ 11′ (no other activity present); through I filter, there is a faint 3′ coma and a 1′ starlike central cond. [MIK].

◇ *Periodic Comet Wirtanen (1991s)* ⟹ 1991 Dec. 7.18: "comet was only suspected at 167×, but detection not confirmed" [GAR02].

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OBSERVATIONS OF COMETS

The headings for the tabulated data are as follows: "DATE (UT)" = Date and time to hundredths of a day in Universal Time; "MM" = the method employed for estimating the total visual magnitude [B = Bobrovnikoff, M = Morris, S = Sidgwick/In-out — see October 1980 issue of *ICQ*, pages 69-73 — etc.; also, P stands for photographic magnitude, and photoelectrically-determined values fall under U, L, and V for the standard U, B, and V, respectively]. "MAG." = total visual magnitude estimate; a colon indicates that the observation is only approximate, due to bad weather conditions, *etc.*; a left bracket ([) indicates that the comet was not seen, with an estimated limiting magnitude given [if the comet *is* seen, and it is simply estimated to be fainter than a certain magnitude, a "greater-than" sign (>) must be used, not a bracket]. "RF" = reference for magnitude estimates (see pages 98-100 of this issue for the 1- and 2-letter codes). "AP." = aperture in centimeters of the instrument used for the observations, usually given to tenths. "T" = type of instrument used for the observation (R = refractor, L = Newtonian reflector, B = binoculars, C = Cassegrain reflector, A = camera, T = Schmidt-Cassegrain reflector, S = Schmidt-Newtonian reflector, E = naked eye, *etc.*). "F/" and "PWR" are the focal ratio and power or magnification, respectively, of the instrument used for the observation — given to nearest whole integer (round even).

"COMA" = estimated coma diameter of the comet in minutes of arc. An ampersand (&) indicates an approximate estimate. An exclamation mark (!) precedes a coma diameter when the comet was not seen (*i.e.*, was too faint) and where a limiting magnitude estimate is provided based on an "assumed" coma diameter (a default size of 1′ or 30″ is recommended; cf. *ICQ* **9**, 100); a plus mark (+) precedes a coma diameter when a diaphragm was used electronically, thereby specifying the diaphragm size (i.e., the coma is almost always larger than such a specified diaphragm size). "DC" = degree of condensation on a scale where 9 = stellar and 0 = diffuse; a slash (/) indicates a value midway between the given number and the next-higher integer. "TAIL" = estimated tail length in degrees, to 0°.01 if appropriate; again, an ampersand indicates a rough estimate. "PA" = estimated measured position angle of the tail to nearest whole integer in degrees (north = 0°, east = 90°). "OBS" = the observer who made the observation (3-letter, 2-digit code).

An asterisk between the published DATE and MM columns indicates that the observation is an updated version of one already published in a previous issue of the *ICQ*, *The Comet Quarterly*, or *The Comet*. An exclamation mark (!) in this same location indicates that the observer has corrected his estimate in some manner for atmospheric extinction; prior to September 1992, this was the standard symbol for noting extinction correction, but following publication of the extinction paper (July 1992 *ICQ*), this symbol is only to be used to denote corrections made using procedures different from that outlined by Green (1992, *ICQ* **14**, 55-59), and then only for situations where the observed comet is at altitude > 10°. We have yet to receive any observations using the new standard extinction procedure, but here again are the new special symbols: '&' = comet observed at altitude 20° or less with no atmospheric extinction correction applied; '$' = comet observed at altitude 10° or lower, observations corrected by the observer using procedure of Green (*ibid.*); for a correction applied by the observer using Tables Ia, Ib, or Ic of Green (*ibid.*), the letters 'A', 'W', or 'S', respectively, should be used.

◇ ◇ ◇

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; 32 = Hungarian observers, c/o Krisztian Sarneczky; etc.)
Those with asterisks (*) preceding the 5-character code are new additions to the Observer Key:

CODE	S	OBSERVER, LOCATION
BAR		Sandro Baroni, Italy
*BEA	07	Sally Beaumont, England
CAM01	09	Robert N. Campbell, New Zealand
CAM03	14	Paul Camilleri, Australia
COM	11	Georg Comello, The Netherlands
DAH	24	Haakon Dahle, Norway
DEA		Vicente Ferreira de Assis Neto, Brazil
DID		Richard Robert Didick, MA, U.S.A.
DIO		Massimo Dionisi, Italy
*DRU01	09	John Drummond, New Zealand
FIE		Marsilio Fierimonte, Italy
GAR02		Stephane Garro, France
GIB		James Gibson, Palomar Obs., U.S.A.
GRA04	24	Bjoern Haakon Granslo, Norway
GRE		Daniel W. E. Green, U.S.A.
HAL		Alan Hale, U.S.A.
HER02		Carl Hergenrother, NJ, U.S.A.
JON	09	Albert F. Jones, New Zealand
KEE		Richard A. Keen, CO, U.S.A.
KER	32	Akos Kereszturi, Hungary
KOC03	32	Antal Kocsis, Hungary
KOS	07	Attila Kosa-Kiss, Romania
KRO02		Gary W. Kronk, IL, U.S.A.
*LEH		Martin Lehky, Czechoslovakia
LOO01		Frans R. van Loo, Belgium
MAC		Donald E. Machholz, CA, U.S.A.
MAR02	13	Jose Carvajal Martinez, Spain
MIK		Herman Mikuz, Slovenia
MIZ01	12	Attila Mizser, Hungary
MOD		Robert J. Modic, OH, U.S.A.
MOE		Michael Moeller, West Germany
MOR03		Warren C. Morrison, Canada
*ORC	09	Wayne Orchiston, New Zealand
PAN	07	Roy W. Panther, England
PAP03	32	Csaba Pap, Hungary
PRY		Jim Pryal, WA, U.S.A.
RIP	13	Jose Ripero Osorio, Spain
SAR02	32	Krisztian Sarneczky, Hungary
SCH04	11	A. H. Scholten, The Netherlands
SCO01		James V. Scotti, AZ, U.S.A.
SEA	14	David A. J. Seargent, Australia
SEA01	14	John Seach, Australia
SHA02	07	Jonathan D. Shanklin, England
SHA04		Gregory T. Shanos, U.S.A.
SHU		Sergey Shurpakov, Russia
*STO03	07	David Storey, Oxfordshire, England
SZA02	32	Levente Szarka, Hungary
VIE		Jean-Francois Viens, Quebec, Canada
ZAN01	11	W. T. Zanstra, The Netherlands
ZHU		Sergey Valentinowich Zhuiko, Russia

Comet Wilson 1987 VII

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 08 29.20	B	12 :	S	33.3	L	4	122	0.5	3			KRO02
1986 08 31.14	B	12 :	S	33.3	L	4	122	0.5	3			KRO02
1986 09 09.15	B	11.5	A	33.3	L	4	122	0.5	2			KRO02
1986 10 30.10	B	11.1	A	33.3	L	4	56	1	2			KRO02
1987 03 27.75	B	6.5	SC	8.0	B		15	10	4			SEA01
1987 04 28.54	B	6 :	SC	8.0	B		15		2	2	120	SEA01
1987 05 18.40	B	7.0	SC	8.0	B		15					SEA01
1987 05 22.50	B	7.1	SC	8.0	B		15		3			SEA01

Comet Austin 1990 V

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1990 01 31.03	B	8.3:	S	33.3	L	4	56	& 2	1			KRO02
1990 02 25.05	B	7.7	S	33.3	L	4	56	& 2	4			KRO02
1990 03 02.03	B	7.5:	S	33.3	L	4	56	& 3	4		100	KRO02
1990 03 03.05	B	7.5	S	33.3	L	4	56	& 3	3			KRO02
1990 03 04.04	B	7.4	S	33.3	L	4	56	2.7	4			KRO02
1990 03 16.05	B	5.0:	S	8.0	B		20					KRO02
1990 03 17.06	B	5.0:	S	8.0	B		20					KRO02
1990 03 18.06	B	7.0:	S	15.2	L	8	68	2.3	4			KRO02
1990 03 21.05	B	6.6	S	33.3	L	4	56	2.5	5			KRO02
1990 03 27.05	B	5.6	S	8.0	B		20	2	7	1	70	KRO02
1990 04 04.05	B	5.4	S	8.0	B		20	2	8	0.5	64	KRO02
1990 04 05.05	B	5.4	S	8.0	B		20	2	8			KRO02
1990 04 06.05	B	5.2	S	8.0	B		20	2	8			KRO02
1990 04 07.06	B	4.8	S	8.0	B		20	2	8	1	40	KRO02
1990 04 08.06	B	5.0:	S	8.0	B		20		7	0.5		KRO02
1990 04 23.43	B	5.3	S	8.0	B		20	3	7	1	315	KRO02
1990 04 25.42	B	5.4	S	8.0	B		20	4	7	1	314	KRO02
1990 04 26.42	B	5.4	S	8.0	B		20	3	7	1	306	KRO02
1990 04 26.42	B	5.6	S	33.3	L	4	56	3.1	7			KRO02
1990 04 29.41	B	5 :	S	8.0	B		20	3	7	2	292	KRO02
1990 05 07.41	B	5.5	S	8.0	B		20	5	7	1	296	KRO02
1990 05 10.41	B	5.5	S	8.0	B		20	7				KRO02
1990 05 18.39	B	5.2	S	8.0	B		20	16	6			KRO02
1990 05 23.23	B	5.4	S	8.0	B		20	20	4			KRO02
1990 05 26.72	B	5.2:	S	25	T	10	62	10	7	0.25	300	DRU01
1990 05 29.34	B	6.3	S	8.0	B		20	15	3			KRO02
1990 06 03.38	B	7.1	S	8.0	B		20	11	2	2	320	KRO02
1990 06 12.15	B	8.4	S	8.0	B		20	5	2			KRO02
1990 06 13.19	B	8.2	S	8.0	B		20	4	2			KRO02
1990 06 21.14	B	9.7:	S	8.0	B		20	3	2			KRO02
1990 06 24.15	B	10.2:	S	33.3	L	4	56	& 3	2			KRO02

Comet Tsuchiya-Kiuchi 1990 XVII

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1990 07 19.86	S	9.0	AA	20.0	T	10	80	3	3			DIO
1990 07 24.12	B	8.9	S	33.3	L	4	56	& 2	4			KRO02
1990 07 25.11	B	8.7	S	33.3	L	4	56	3.5	4			KRO02
1990 07 25.12	B	9.1	S	33.3	L	4	56					KRO02
1990 10 30.47	B	7.4	S	8.0	B		20	2	6			KRO02
1990 11 06.47	B	6.9	S	8.0	B		20	3	6			KRO02
1990 11 17.42	B	7.4	S	33.3	L	4	56	7.4				KRO02

Comet Levy 1990 XX

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1990 05 29.36	B	9.2	S	33.3	L		56	1.7	6			KRO02

Comet Levy 1990 XX [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1990 06 01.06	S	10 :	AA	20.0	T	10	80		4			DIO
1990 06 03.39	B	9.3	S	33.3	L		56	2.2	5			KRO02
1990 06 23.25	B	8.8	S	33.3	L		56	3.8	5		260	KRO02
1990 07 16.20	B	7.4	S	8.0	B		20	5				KRO02
1990 07 17.05	S	7.0	AA	15.0	L	6	36		5			DIO
1990 07 17.38	B	7.3	S	8.0	B		20	8	3			KRO02
1990 07 17.95	S	7.0	AA	20.0	T	10	80	2.5	6	&0.06	305	DIO
1990 07 19.22	B	7.2	S	8.0	B		20	8				KRO02
1990 07 20.04	S	7.0	AA	20.0	T	10	80	4	6	0.22	240	DIO
1990 07 20.23	B	7 :	S	8.0	B		20	8	4			KRO02
1990 07 22.09	S	6.8	AA	15.0	L	6	36	6	6			DIO
1990 07 23.04	S	6.8	AA	15.0	L	6	36		5			DIO
1990 07 24.20				33.3	L		56	6.5	7	0.5		KRO02
1990 07 24.20	B	7.1	S	8.0	B		20	8	5	0.25		KRO02
1990 07 25.20	B	6.9	S	8.0	B		20	8	5			KRO02
1990 07 28.41	B	6.8	S	8.0	B		20	11	5	1	228	KRO02
1990 07 30.18	B	6.5	S	8.0	B		20	13	6			KRO02
1990 07 31.15	B	6.5	S	8.0	B		20	11	5	0.75	232	KRO02
1990 07 31.15	B	7 :	S	33.3	L		56	3.8	7			KRO02
1990 08 01.22	B	6.3	S	8.0	B		20	12	6	0.5	240	KRO02
1990 08 02.41	B	6.3	S	8.0	B		20	12	6	0.83	225	KRO02
1990 08 09.17	B	5.5	S	8.0	B		20	14		0.5	238	KRO02
1990 08 10.24	B	5.5	S	8.0	B		20	14	5			KRO02
1990 08 11.02	S	5.0	AA	8.0	B		20		6			DIO
1990 08 14.02	B	4.0	SC	0.0	E		1		7			DIO
1990 08 15.17	B	4.3	S	0.0	E		1					KRO02
1990 08 15.17	B	4.6	S	8.0	B		20	18	6			KRO02
1990 08 17.16	B	4.3	S	0.0	E		1					KRO02
1990 08 18.15	B	4.2	S	0.0	E		1					KRO02
1990 08 18.15	B	4.4	S	8.0	B		20	19	6			KRO02
1990 08 19.40	B	4.2	S	0.0	E		1					KRO02
1990 08 19.40	B	4.5	S	8.0	B		20	15	6			KRO02
1990 08 19.40	B	4.7	S	33.3	L		56		5			KRO02
1990 08 20.96	B	3.5	SC	0.0	E		1					DIO
1990 08 25.20	B	3.6	S	0.0	E		1					KRO02
1990 08 25.20	B	3.9	S	8.0	B		20	22		1.5	69	KRO02
1990 08 26.14	B	3.6	S	0.0	E		1					KRO02
1990 08 27.08	B	3.5:	S	0.0	E		1					KRO02
1990 08 27.08	B	4.0:	S	33.3	L		56					KRO02
1990 08 27.15	B	3.7	S	0.0	E		1					KRO02
1990 08 27.15	B	4.0	S	8.0	B		20	16		1	70	KRO02
1990 08 29.14	B	3.7	S	0.0	E		1					KRO02
1990 08 29.14	B	4.0	S	8.0	B		20		6	1		KRO02
1990 08 31.10	B	4.0:	S	0.0	E		1					KRO02
1990 09 02.17	B	4.0:	S	0.0	E		1					KRO02
1990 09 06.33	S	6.0:	S	5.0	B		10	20	5	1.0	90	DRU01
1990 09 08.40	S	4.5	S	25	T	10	62	8	8	0.3	100	DRU01
1990 09 15.08	B	4.2	S	33.3	L		56	12				KRO02
1990 09 16.06	B	4.3	S	8.0	B		20	11				KRO02
1990 09 16.06	B	4.5:	S	0.0	E		1					KRO02
1990 09 17.06	B	4.5	S	8.0	B		20	12				KRO02
1990 09 20.41	S	4.2	AA	5.0	B		12					ORC
1991 02 11.28	B	7.5	S	8.0	B		20	10	3	1	155	KRO02
1991 02 12.27	B	7.6	S	8.0	B		20	10	3			KRO02
1991 03 04.16	B	8.0	S	8.0	B		20	5	1			KRO02
1991 03 09.18	B	8.7	S	33.3	L		56	4.6	4			KRO02
1991 03 10.15	B	8.9	S	8.0	B		20					KRO02
1991 03 10.15	B	9.2	S	33.3	L		56	4.6	5	?	135	KRO02
1991 03 24.15	B	9.9:	S	33.3	L		56	& 1	1			KRO02

Comet Levy 1990 XX [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 04 06.10	B	10.2:	S	33.3	L		56	1.4	5			KRO02
1991 04 07.09	B	10.3:	S	33.3	L		56	1.5	4			KRO02
1991 04 09.15	B	10.3:	S	33.3	L		56	& 2	3			KRO02
1991 04 11.14	B	10.3:	S	33.3	L		56	2.1	4			KRO02

Comet Arai 1990 XXVI

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 01 19.09	B	11.2:	S	33.3	L		56	2.1	3			KRO02

Comet Shoemaker-Levy 1991d

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 03 10.17	B	13 :	S	33.3	L		216	0.5	6			KRO02
1991 12 05.20	S	10.9	AC	20.3	T	10	62	1	6			GAR02
1991 12 07.20	B	10.6	CS	12.7	T	10	40	2	3			GAR02
1991 12 14.20	S	10.6	AC	20.3	T	10	62	2.5	4	0.17	340	GAR02
1992 01 02.20	S	9.3	CS	20.3	T	10	62	1.5	3	0.07	300	GAR02
1992 02 02.16	S	10.9	AC	20.3	T	10	62	1.6	2	0.13	335	GAR02
1992 02 09.15	S	11.5	AC	20.3	T	10	62	1	2			GAR02
1992 02 15.53	M	10.4	AC	31.8	L	4	63	1.5	3			KEE
1992 03 01.17	I	[12 :	AC	20.3	T	10	62					GAR02
1992 03 01.41	M	11.6	GA	35.9	L	7	85	0.8	4			MOD
1992 03 01.43	B	10.3:	S	33.3	L		56	0.9	3			KRO02
1992 03 05.43	M	11.6	GA	35.9	L	7	85	0.8	3			MOD
1992 03 29.39	M	11.7	GA	20.0	L	5	35	1.5	1			MOD
1992 04 05.37	M	11.9	GA	35.9	L	7	85	1.0	4			MOD
1992 04 05.38	M	11.7	GA	20.0	L	5	35	1.5	2			MOD
1992 04 06.34	M	11.9	GA	35.9	L	7	85	1.0	4			MOD
1992 04 10.36	M	11.9	GA	35.9	L	7	85	0.9	4			MOD
1992 04 13.36	M	11.8	GA	35.9	L	7	85	0.9	3			MOD
1992 04 29.27	M	12.2	GA	35.9	L	7	85	0.7	3			MOD
1992 05 07.30	M	12.2	GA	35.9	L	7	85	0.60	3			MOD
1992 05 11.33	M	12.3	GA	35.9	L	7	85	0.60	2/			MOD
1992 05 26.97	S	11.9	A	28.0	T	10	177	& 1.0	1			COM
1992 05 28.24	M	12.7	GA	35.9	L	7	85	0.65	3			MOD
1992 05 29.24	M	12.7	GA	35.9	L	7	85	0.75	3/			MOD
1992 05 29.27	M	12.4	GA	20.0	L	5	68	1.0	2			MOD
1992 06 03.29	M	12.9	GA	35.9	L	7	85	0.70	2/			MOD
1992 06 09.32	M	13.1	GA	35.9	L	7	85	0.65	3/			MOD
1992 06 10.27	M	13.1	GA	35.9	L	7	85	0.65	3			MOD
1992 07 02.94	S	12.4	A	28.0	T	10	112	& 0.5	2/			COM
1992 07 07.99	S	12.4	A	28.0	T	10	112	& 0.5	2			COM
1992 07 23.93	S	12.8	A	28.0	T	10	112	& 0.4	1/			COM
1992 07 27.98	S	13.3	A	28.0	T	10	108	& 0.6	0			COM
1992 07 28.93	S	13.2	A	28.0	T	10	108	& 0.5	1			COM
1992 07 30.99	S	13.3:	A	28.0	T	10	108	& 0.8	0/			COM
1992 07 31.96	S	13.3	A	28.0	T	10	108	& 0.7	0/			COM
1992 08 03.93	S	13.1	A	28.0	T	10	108	& 1	1			COM
1992 08 04.93	S	13.1	A	28.0	T	10	108	& 0.8	1			COM
1992 08 05.93	S	13.1:	A	28.0	T	10	108	& 1	0/			COM
1992 08 06.93	S	13.0	A	28.0	T	10	108	& 1.5	1			COM
1992 08 20.94	S	12.7	AC	20.3	T	10	123	0.9	3			GRA04

Comet Helin-Lawrence 1991l

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 12 13.69	S	8.9	AA	8.0	B		15	2	3			SEA01
1991 12 14.70	S	8.8	AA	8.0	B		15	2	3			SEA01
1992 08 03.41	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 12 11.10	S	[14.7	GA	40	L	7	190	! 0.5				MOD
1991 12 26.15	S	[14.6	GA	40	L	7	190	! 0.5				MOD
1991 12 28.13	S	[14.6	GA	40	L	7	190	! 0.5				MOD
1992 01 27.04	S	[13.9	GA	35.9	L	7	164	! 0.5				MOD
1992 02 03.04	S	[13.7	GA	40	L	7	190	! 0.5				MOD
1992 02 04.08	S	[13.8	GA	40	L	7	190	! 0.5				MOD
1992 02 06.05	S	[14.0	GA	40	L	7	190	! 0.5				MOD
1992 03 01.03	S	[13.0	GA	40	L	7	190	! 0.5				MOD
1992 03 02.03	S	[13.0	GA	40	L	7	190	! 0.5				MOD
1992 04 28.37	M	12.2	GA	35.9	L	7	164	0.7	2			MOD
1992 04 29.37	S	12.1	GA	35.9	L	7	85	0.9	2			MOD
1992 05 07.36	M	12.1	GA	35.9	L	7	85	0.9	2/			MOD
1992 05 07.40	B	11.7:	S	33.3	L		216	0.9	2			KRO02
1992 05 11.36	M	11.8	GA	35.9	L	7	85	0.9	2			MOD
1992 05 12.37	M	11.8	GA	35.9	L	7	85	0.8	2			MOD
1992 05 26.98	S	11.1	A	20.0	T	10	77	& 1	1			COM
1992 05 28.33	S	10.6	GA	20.0	L	5	35	1.9	1			MOD
1992 05 28.34	M	11.1	GA	35.9	L	7	85	1.5	2/			MOD
1992 05 29.02	S	10.3	AC	25.5	L	4	53	1.5	2/			LOO01
1992 05 29.33	M	10.6	GA	20.0	L	5	35	2.0	2			MOD
1992 06 03.33	M	10.5	GA	20.0	L	5	35	1.6	2			MOD
1992 06 03.35	M	10.9	GA	35.9	L	7	85	1.2	3			MOD
1992 06 06.05	M	10.0	AA	33.5	L	4	125					RIP
1992 06 06.33	S	9.4	AA	20	T	10	100	1.1	3			PRY
1992 06 06.45	S	9.8	AA	20.3	R	15	152	2.5	2			HER02
1992 06 07.45	S	10.1	AA	20.3	R	15	152	1	0			HER02
1992 06 09.28	M	10.1	NO	20.0	L	5	35	2.8	2/			MOD
1992 06 09.34	M	10.7	NO	35.9	L	7	85	2.5	3/			MOD
1992 06 10.31	M	10.7	NO	35.9	L	7	85	1.8	3/			MOD
1992 06 10.33	M	10.2	NO	20.0	L	5	35	2.0	3			MOD
1992 06 11.29	S	9.7	GA	11.5	L	8	50	2.3	1			DID
1992 06 11.32	M	10.3	NO	20.0	L	5	35	2.4	3			MOD
1992 06 12.33	M	10.5	NO	20.0	L	5	68	1.4	2/			MOD
1992 06 12.39	B	9.2	S	33.3	L		56	1.2	5			KRO02
1992 06 13.30	S	9.7	GA	11.5	L	8	50	2.7	2			DID
1992 06 17.89	S	9.2	AC	12.0	R		20		3			LOO01
1992 06 19.10	S	9.5	GA	11.5	L	8	50	4.3	2			DID
1992 06 19.87	B	9.8	AA	6.3	R	13	54	4	5			KOS
1992 06 19.87	S	9.8	A	6.3	R	13	52	4	5			KOS
1992 06 20.97	S	9.4	AA	20	R	14	40	2.9	3			SHA02
1992 06 21.27	B	8.6	S	8.0	B		20	5	2			KRO02
1992 06 22.21	M	9.8	GA	20.0	L	5	35	1.7	3			MOD
1992 06 22.92	S	8.5	A	6.0	B		20	3	3			MIZ01
1992 06 22.94	B	9.5	AA	6.3	R	13	54	4	5			KOS
1992 06 22.94	S	9.5	A	6.3	R	13	52	4	5			KOS
1992 06 23.03	S	8.5	A	11.0	L	7	32	4	2/			SCH04
1992 06 23.13	S	8.8	GA	11.5	L	8	50	5.0	3			DID
1992 06 23.95	B	8.1	AA	5.0	R	4	10	3	5			MOE
1992 06 23.95	S	8.1	A	6.0	B		20	5	4			KOC03
1992 06 23.95	S	8.1	AC	15.2	L	5	44	3.5	4			MOE
1992 06 24.10	S	8.7	GA	11.5	L	8	50		3			DID
1992 06 24.92	S	8.5	A	16.2	L		42	4	3			SZA02
1992 06 24.93	S	8.4	AC	15.2	L	5	44	4	4			MOE
1992 06 25.27	M	9.5	GA	20.0	L	5	35	1.6	3			MOD
1992 06 25.94	S	8.3	AC	15.2	L	5	44	3.5	4			MOE
1992 06 25.98	S	8.7	A	11.0	L	7	32	5	2/			SCH04
1992 06 25.98	S	9.1	A	20.0	T	10	80	& 2	5/			COM
1992 06 26.03	S	7.9	A	6.0	B		20	6	5			KER
1992 06 26.13	S	8.7	GA	11.5	L	8	50	5.0	3			DID

Comet Shoemaker-Levy 1991a1 [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 06 26.30	M	9.5	GA	20.0	L	5	35	1.8	3			MOD
1992 06 26.92	S	8.5:	S	12.7	T	10	51	3	2			GAR02
1992 06 26.95	B	8.8	AA	6.3	R	13	54	7	7	0.18	334	KOS
1992 06 26.95	S	8.8	A	6.3	R	13	52	7	7	0.2	350	KOS
1992 06 26.97	S	8.9	A	20.0	T	10	80	& 2	5			COM
1992 06 26.99	M	8.2	S	10.0	B	4	25	6	5			LEH
1992 06 27.03	S	7.9	A	6.0	B		20	6	6			SAR02
1992 06 27.05	B	8.6	S	30.0	L	5	75					MAR02
1992 06 27.19	B	8.7	S	33.3	L		56	3.3	5			KRO02
1992 06 27.30	M	9.5	GA	20.0	L	5	35	1.9	3			MOD
1992 06 27.92	M	8.4	S	10.0	B	4	25	6	6			LEH
1992 06 27.96	S	8.6	AA	20	R	14	40	1.5	3			SHA02
1992 06 27.97	S	8.3	AC	15.2	L	5	44	4	4			MOE
1992 06 27.98	S	8.4	A	11.0	L	7	32	4	3			SCH04
1992 06 28.00	S	8.9	AA	12.0	R		20		7			LOO01
1992 06 28.07	S	9.5	A	8	R	6	50	5	1			PAP03
1992 06 28.18	M	9.0	GA	20.0	L	5	35	2.2	4			MOD
1992 06 28.21	B	8.2	S	8.0	B		20	4				KRO02
1992 06 28.21	B	8.5	S	33.3	L		56	3.4	6			KRO02
1992 06 28.25	M	8.5	GA	7.0	B		10	4.5	3			MOD
1992 06 28.27				35.9	L	7	85	1.2	5	0.05	330	MOD
1992 06 28.29	S	8.5	S	11	L	8	40	4	4			VIE
1992 06 28.94	S	8.1	A	6.0	B		20	4	4			KOC03
1992 06 28.99	S	8.0	A	6.0	B		20	4	1			KER
1992 06 29.03	S	8.2	A	11.0	L	7	32	4	1/			SCH04
1992 06 29.04	S	7.8	A	6.0	B		20	5	6			SAR02
1992 06 29.10	S	8.6	GA	11.5	L	8	50	4.8	5		215	DID
1992 06 29.15	M	9.0	GA	20.0	L	5	35	2.2	4			MOD
1992 06 29.31				35.9	L	7	85	1.2	5	0.05	340	MOD
1992 06 29.32	M	8.4	GA	5.0	B		10	6.0	3			MOD
1992 06 29.89	S	8.5	A	19	T	6	45	6	2			PAP03
1992 06 29.92	M	8.7	S	10.0	B	4	25	4	5			LEH
1992 06 29.94	S	8.4	AC	15.2	L	5	44	3	4			MOE
1992 06 29.99	S	8.3	A	6.3	R	13	34	5	4			KOC03
1992 06 30.03	S	8.6	AA	10.0	B		14	3	7			LOO01
1992 06 30.10	S	8.3	GA	11.5	L	8	50	4.8	4/	?0.41	240	DID
1992 06 30.21	M	9.4	GA	20.0	L	5	35	1.9	2			MOD
1992 06 30.21	M	9.6	GA	20.0	L	5	68	1.5	2/			MOD
1992 06 30.91	S	7.7	A	6.0	B		20					SZA02
1992 06 30.91	S	8.0	A	16.2	L		42	4	3			SZA02
1992 06 30.92	M	8.4	S	10.0	B	4	25	6	6			LEH
1992 07 01.04	S	7.8	A	6.0	B		20	5	5			SAR02
1992 07 01.92	S	7.8	A	6.0	B		20	6	4			MIZ01
1992 07 01.94	S	8.5	A	8.0	R	6	20	7	3			KOC03
1992 07 02.93	S	8.4	AC	15.2	L	5	44	4	5			MOE
1992 07 02.97	S	8.1	A	20.0	T	10	80	& 2.5	6	&0.25	320	COM
1992 07 03.17	S	8.0	GA	11.5	L	8	50	5.5	5			DID
1992 07 03.29	S	8.1	S	11	L	8	40	5	4			VIE
1992 07 03.94	S	8.2	AC	15.2	L	5	44	4	6			MOE
1992 07 03.95	E	8.7	S	30.0	L	5	75	1.4	5	0.04	330	MAR02
1992 07 04.18	B	8.4	S	8.0	B		20	4				KRO02
1992 07 04.18	B	8.6	S	33.3	L		56	3.6	5	0.07	15	KRO02
1992 07 06 98	S	8.6	S	8.0	B		20		5			STO03
1992 07 06.91	S	7.9	AC	15.2	L	5	44	3.5	6	0.2	55	MOE
1992 07 06.92	S	7.9	A	6.0	B		20	8	4			KOC03
1992 07 06.95	S	7.9	S	8.0	B		20	2.2	4			SHA02
1992 07 06.97	S	7.9	A	20.0	T	10	61		6			COM
1992 07 06.98	S	7.8	A	8.0	B		15	7	5/			SCH04
1992 07 06.98	S	8.0	A	11.0	L	7	32	4	5/	?		SCH04

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DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 07 07.19	B	8.1	S	8.0	B		20	5	4			KRO02
1992 07 07.85	S	7.0	AA	8.0	B		20	5	3			BAR
1992 07 07.89	B	8.3	AA	6.3	R	13	54	6	7	0.07	30	KOS
1992 07 07.92	S	7.8	AC	15.2	L	5	44	4.5	6	0.3	60	MOE
1992 07 07.92	S	8.0	A	6.0	B		20	8	4			KOC03
1992 07 07.93	B	7.9	AA	5.0	R	4	10	4	6			MOE
1992 07 07.97	S	7.9	A	20.0	T	10	61	& 4	5/			COM
1992 07 07.98	S	7.9	A	11.0	L	7	32	5	5/			SCH04
1992 07 08.01	S	8.5:		15.5	L	8	50	3	5			ZAN01
1992 07 08.09	S	7.5	SC	11.5	L	8	50	4.9	7		290	DID
1992 07 08.29	S	7.9	S	11	L	8	40	5	5			VIE
1992 07 08.89	M	7.8	S	10.0	B	4	25	4	7			LEH
1992 07 08.92	S	7.8	AC	15.2	L	5	44	4	6	0.2	60	MOE
1992 07 08.93	B	7.8	AA	5.0	R	4	10	3.5	6			MOE
1992 07 08.98	S	7.8	AA	10.0	B		14	3	7			LOO01
1992 07 08.99	S	8.1	A	20.0	T	10	61	& 3	5/			COM
1992 07 09.90	M	7.3	S	10.0	B	4	25	5	7			LEH
1992 07 09.94	S	8.0:	AA	20	T	10	80		4			DIO
1992 07 10.06	S	7.5	SC	11.5	L	8	50	4.5	7		345	DID
1992 07 10.25	S	7.0	S	20	T	10	63	1.9	6			PRY
1992 07 10.88	S	8.1	S	20	T	10	80	0.75	4			DIO
1992 07 11.08	S	7.5:	SC	11.5	L	8	50	3.9	7			DID
1992 07 12.06	S	7.4	SC	11.5	L	8	50	4.5	5			DID
1992 07 12.13	S	7.7	S	11	L	8	40	5	4			VIE
1992 07 12.89	B	8.5	AA	33.5	L	4	125	3				RIP
1992 07 12.92	S	7.8	AC	15.2	L	5	44	4	6	0.3	80	MOE
1992 07 12.98	S	8.3	A	11.0	L	7	32	3	5			SCH04
1992 07 13.20	B	8.0	S	8.0	B		20	5	3			KRO02
1992 07 13.88	S	6.7	AA	8.0	B		20	8	5			BAR
1992 07 13.90	S	8.1	S	20	T	10	80		5			DIO
1992 07 13.92	S	7.6	SC	8.0	B		20					DIO
1992 07 14.92	S	7.7	AC	15.2	L	5	44	3.5	6	0.2	80	MOE
1992 07 15.89	S	8.2	AA	6.0	B		20	& 4	6			MIK
1992 07 15.91	S	7.6	AC	15.2	L	5	44	4.5	6	0.4	80	MOE
1992 07 15.94	S	7.5	AA	20	T	10	80		5			DIO
1992 07 16.12	S	7.7	S	11	L	8	40	4	5			VIE
1992 07 16.85	S	7.3	AA	8.0	B		20	4	5	&0.42	15	DIO
1992 07 17.08	S	7.1	SC	11.5	L	8	50	5.0	6	0.25	45	DID
1992 07 17.84	S	7.2	AA	8.0	B		20	4	5	&0.50	20	DIO
1992 07 17.89	S	8.4	AA	6.0	B		20	& 3	7/			MIK
1992 07 17.94	S	8.2	VB	8.0	B		20	2.7	4			SHA02
1992 07 18.89	B	8.0	AA	33.5	L	4	125	5				RIP
1992 07 18.90	S	7.0	AA	8.0	B		20		5			DIO
1992 07 18.92	B	7.8	S	7.0	B		10	6.4	4			DEA
1992 07 18.92	S	7.6	AC	15.2	L	5	44	4.5	6	0.5	90	MOE
1992 07 19.87	M	7.7	S	8.0	B		10	3	7			LEH
1992 07 19.87	S	7.3	AA	10.0	B		14		5			LOO01
1992 07 19.88	B	8.0	AA	33.5	L	4	125	5				RIP
1992 07 19.88	M	7.7	S	10.0	B	4	25	2.5	7/			LEH
1992 07 19.91	S	7.6:	AC	15.2	L	5	44	4	6	0.3	90	MOE
1992 07 19.92	B	7.7	S	7.0	B		10	6.4	4			DEA
1992 07 20.13	S	7.7	S	11	L	8	40	5	5		50	VIE
1992 07 20.87	S	7.4	AA	10.0	B		14		6			LOO01
1992 07 20.88	B	8.0	AA	33.5	L	4	125	5				RIP
1992 07 21.18				41	L	4	83			0.5	65	HAL
1992 07 21.18	M	7.8	SC	5.0	B		10					HAL
1992 07 21.87	M	7.6	S	8.0	B		10	4	7			LEH
1992 07 21.88	B	8.5	AA	33.5	L	4	125	5				RIP
1992 07 21.88	M	7.7	S	10.0	B	4	25	3	7/			LEH

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DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 07 21.92	B	8.0	S	7.0	B		10	7.8	5			DEA
1992 07 21.97	S	8.3	AA	8.0	B		20	2.7	4			SHA02
1992 07 22.11	S	7.9	S	11	L	8	40	4	5			VIE
1992 07 22.88	B	7.9	S	8.0	B		12	3	5	0.30	40	GAR02
1992 07 22.88	B	8.5	AA	33.5	L	4	125	5				RIP
1992 07 22.91	B	8.1	S	7.0	B		10	7.8	5			DEA
1992 07 23.08	S	6.8:	SC	11.5	L	8	50	2.5	8			DID
1992 07 23.88	B	8.3	AA	33.5	L	4	125	5				RIP
1992 07 23.88	M	7.8	S	10.0	B	4	25	4	7/			LEH
1992 07 24.85	S	7.8	AA	10.0	B		14		7			LOO01
1992 07 24.91	M	7.9	S	10.0	B	4	25	5	6			LEH
1992 07 24.93	S	8.5	S	20	R	14	40	1.5	3			SHA02
1992 07 25.08	S	7.4	SC	11.5	L	8	50	4.5	8	0.16	70	DID
1992 07 25.09	S	8.1	S	11	L	8	40	3	5			VIE
1992 07 25.92	B	7.8	S	7.0	B		10	12	5			DEA
1992 07 25.94	E	8.4	S	30.0	L	5	75	2.3	4			MAR02
1992 07 26.08	S	8.0:	AA	20.0	T	10	50	1.7	6			SHA04
1992 07 26.09	S	7.4	SC	11.5	L	8	50	4.5	8	0.16	55	DID
1992 07 26.17	M	7.8	NP	5.0	B		10					HAL
1992 07 26.91	B	8.0	S	7.0	B		10	12	5			DEA
1992 07 27.08	S	7.9	AA	20.0	T	10	50	1.6	6			SHA04
1992 07 27.38		8 :	AA	10.0	B		25		5			SEA
1992 07 28.10	B	8.2	S	33.3	L		56	2.8	6			KRO02
1992 07 28.88	M	8.5	S	10.0	B	4	25	4.5	5			LEH
1992 07 28.93	S	8.3	S	20	R	14	40	2.0	4			SHA02
1992 07 29.05	S	7.7	SC	11.5	L	8	50	2.5	8	0.16	70	DID
1992 07 29.08	S	7.8	AA	20.0	T	10	50	1.9	7	0.25	65	SHA04
1992 07 29.38	M	7.6	AA	10.0	B		25		5			SEA
1992 07 30.08	S	8.0	AA	20.0	T	10	50	1.9	8	1.0	135	SHA04
1992 07 30.38	S	7.9	AA	10.0	B		25	3	5			SEA
1992 07 31.05	S	7.9	SC	11.5	L	8	50	2.0	9			DID
1992 07 31.08	S	8.1	AA	20.0	T	10	50	1.9	8	0.5	92	SHA04
1992 07 31.37	M	7.9	AA	10.0	B		25		5			SEA
1992 07 31.82	S	7.4	HD	20.3	T	10	80	2.6	6			DAH
1992 07 31.86	B	8.1	S	8.0	B		12	2	4			GAR02
1992 07 31.92	B	8.0	S	7.0	B		10	10.5	4			DEA
1992 08 01.08	S	8.2	AA	20.0	T	10	50	1.9	8	1.0	100	SHA04
1992 08 01.10	B	8.6	S	33.3	L		56	2.6	7			KRO02
1992 08 01.30	B	9.0	AA	22	L	7	30	10	0			CAM01
1992 08 01.36	S	8 :	AA	8.0	B		20	& 3	3			CAM03
1992 08 01.83	S	8.1	HD	20.3	T	10	80	3.1	6			DAH
1992 08 02.83	S	8.0	HD	20.3	T	10	80	2.9	5			DAH
1992 08 02.92	S	8.1	S	7.0	B		10	7.0	4			DEA
1992 08 03.17	M	8.3:	AC	41	L	4	52					HAL
1992 08 03.83	S	8.3	HD	20.3	T	10	80	& 2.0	5			DAH
1992 08 05.10	B	8.8	S	33.3	L		122	2.0	7			KRO02
1992 08 05.31	B	9.5	AA	22	L	7	30	8	0			CAM01
1992 08 16.37	S	9.1	SM	8.0	B		20	& 2	2			CAM03
1992 08 18.37	S	9.1	AA	10.0	B		25	2	4			SEA
1992 08 19.37	S	9.1	AA	10.0	B		25					SEA

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DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 12 25.74	S	9.5:	AA	20.0	T	10	80	& 4	5	&0.1	30	DIO
1991 12 27.76	S	9.5:	AA	20.0	T	10	80	& 4	4			DIO
1991 12 28.74	S	9.4:	AA	20.0	T	10	80	& 6	4			DIO
1991 12 28.79	S	9.0:	CS	20.3	T	10	62	1.7	3			GAR02
1991 12 29.74	B	9.2	CS	20.3	T	10	62	2	4	0.18	92	GAR02

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DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 12 30.96	S	9.7	AC	15	R	5	62	2.4	3			MOR03
1991 12 31.98	S	9.7	AC	15	R	5	62	2.7	2			MOR03
1992 01 01.75	B	9.0	CS	20.3	T	10	62	2	3	0.18	78	GAR02
1992 01 02.74	B	9.0	CS	20.3	T	10	62	2	4			GAR02
1992 01 05.65	S	8.7	AA	20.0	R	15	60	4	4			ZHU
1992 01 06.76	S	8.7	AA	25	L	4	50	4	5			PAN
1992 01 09.03	B	8.7	S	33.3	L		56	2.3	4			KRO02
1992 01 10.76	S	8.7	AA	25	L	4	50	4	4			PAN
1992 01 11.07	B	8.7	S	33.3	L		56	2.3	3			KRO02
1992 01 19.04	B	8.4	S	33.3	L		56	& 2	5			KRO02
1992 01 20.01	B	8.4	S	33.3	L		56	2.2	5			KRO02
1992 01 21.01	B	8.3	S	33.3	L		56	2.7	6	0.22	52	KRO02
1992 01 25.78	B	8.3	CS	12.7	T	10	40	1.5	6			GAR02
1992 01 26.07	B	8 :	S	33.3	L		56	& 2	7			KRO02
1992 01 26.63	S	7.7:	AA	19.9	L	4	52	& 5	5			ZHU
1992 01 26.77	B	8.2	S	20.3	T	10	62	1.5	6	0.18	51	GAR02
1992 01 26.99	S	8.7	AC	6	R	15	50	2.2	4			MOR03
1992 01 28.02	B	8.5	S	8.0	B		20	4				KRO02
1992 01 28.02	B	8.9	S	33.3	L		56	3.7	6	0.32	48	KRO02
1992 01 28.72	S	8.6	AG	20.3	T	10	133	1.6	5			DAH
1992 01 31.78	S	7.5	AC	12.7	T	10	40	1.3	5			GAR02
1992 02 01.02	B	7.9	S	8.0	B		20	4	6			KRO02
1992 02 01.02	B	8.0	S	33.3	L		56	2.9	6	0.17	78	KRO02
1992 02 01.99	S	8.6	AC	15	R	5	62	2.6	2			MOR03
1992 02 02.02	B	7.9	S	8.0	B		20	3	7			KRO02
1992 02 02.02	B	8.3	S	33.3	L		56	3.1	7	?	76	KRO02
1992 02 08.02	B	8.1	S	33.3	L		56	2.9	5			KRO02
1992 02 10.42	B	8.0	AA	10.0	B		25		0			CAM01
1992 02 29.40	B	8.5	AA	10.0	B		25		0			CAM01

Comet Mueller 1991h1

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 01 26.16	B	11.3:	S	33.3	L		216	& 4	2	?	100	KRO02
1992 01 28.07	B	11.4:	S	33.3	L		122	4.7	1			KRO02
1992 02 05.16	B	11 :	S	33.3	L		216		1			KRO02
1992 02 07.11	M	9.8	AA	31.8	L	4	48	7	0			KEE
1992 02 08.06	B	10.6:	S	33.3	L		122	3.8	2			KRO02
1992 02 09.06	B	10.4:	S	33.3	L		122	4.6	2			KRO02
1992 02 22.01	S	9.0	AC	6	R	15	50	3.5	2			MOR03
1992 02 22.06	B	8.5	S	8.0	B		20	5	4			KRO02
1992 02 22.06	B	8.7	S	33.3	L		56	4.1	4			KRO02
1992 02 23.78	S	8.7	CS	5.0	R		8	1.5	3			GAR02
1992 02 28.06	B	8.4	S	33.3	L		56	3.8	5	0.12	54	KRO02
1992 02 29.07	B	7.8	S	33.3	L		56	4.4	6			KRO02
1992 02 29.79	B	8.0	S	20.3	T	10	62	2	2	0.13	70	GAR02
1992 03 01.05	B	7.9	S	33.3	L		56	4.2	6			KRO02
1992 03 03.05	B	8.5	S	33.3	L		56	1.9	7			KRO02
1992 03 05.02	S	8.3	AC	6	R	15	50	2	2			MOR03
1992 04 05.41	S	[10.0	GA	35.9	L	7	85	! 2.0				MOD
1992 04 06.41	S	[10.5	GA	35.9	L	7	85	! 2.0				MOD
1992 04 06.41	S	[11.0	GA	35.9	L	7	164	! 1.0				MOD
1992 04 10.41	S	[11.0	GA	35.9	L	7	164	! 1.0				MOD
1992 04 13.39	S	[13.0	GA	40	L	7	190	! 1.0				MOD

Comet Helin-Alu 1992a

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 02 06.22	S	[14.5	GA	40	L	7	190	! 0.5				MOD

Comet Helin-Alu 1992a [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 03 05.15	S	[14.5	GA	40	L	7	190	! 0.5				MOD
1992 03 28.14	S	[14.1	GA	40	L	7	190	! 0.5				MOD
1992 04 06.15	S	[14.0	GA	40	L	7	190	! 0.5				MOD
1992 04 29.08	S	[14.0	GA	40	L	7	190	! 0.5				MOD

Comet Tanaka-Machholz 1992d

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 03 31.51	S	9.4	S	12	R	7	21	3	5			MAC
1992 04 02.52	S	8.7	S	12	R	7	21	3	5			MAC
1992 04 03.51	B	8.4	S	8.0	B		20	2.5	7			MAC
1992 04 04.49	S	8.6	AA	20.3	R	15	152	3	4			HER02
1992 04 04.51	B	8.2	S	8.0	B		20	3	5			MAC
1992 04 05.40	M	8.3	AA	20.0	L	5	35	2.2	4			MOD
1992 04 06.39	M	8.3	AA	20.0	L	5	35	2.3	3			MOD
1992 04 06.40	M	8.2	AA	5.0	B		10	& 4	2			MOD
1992 04 06.52	B	8.2	S	8.0	B		20	3	5			MAC
1992 04 08.11	S	8.7	AC	25.5	L	4	53	3.5	6			LOO01
1992 04 08.40	M	8.9	NO	20.0	L	5	35	1.5	3			MOD
1992 04 09.49	S	8.6	AA	20.3	R	15	152	4	3			HER02
1992 04 10.40	M	8.2	GA	5.0	B		10	4.0	3			MOD
1992 04 13.37	M	8.2	GA	5.0	B		10	4.5	3			MOD
1992 04 13.38	S	8.3	GA	11.4	L	8	50	5	4			DID
1992 04 13.68	S	7.9	AA	12.0	B		20	5				LOO01
1992 04 15.10	B	9.4	AA	6.3	R	13	54	4	1			KOS
1992 04 15.40	M	8.6	GA	20.0	L	5	35	1.5	4			MOD
1992 04 19.40	M	8.7	GA	20.0	L	5	68	1.5	3			MOD
1992 04 20.09	M	8.2	S	10.0	B	4	25	5	3			LEH
1992 04 21.08	M	8.2	S	10.0	B	4	25	6	4			LEH
1992 04 23.39	M	8.8	GA	20.0	L	5	35	1.7	3			MOD
1992 04 25.09	M	8.1	S	10.0	B	4	25	9	3			LEH
1992 04 25.58	S	8.0:	AA	10.0	B		14					LOO01
1992 04 26.56	S	8.2	AA	25.4	J	6	58		7			LOO01
1992 04 27.37	M	8.8	GA	20.0	L	5	35	1.4	3			MOD
1992 04 28.08	M	8.1	S	10.0	B	4	25	5	4			LEH
1992 04 28.09	M	7.9	S	8.0	B		10	7	2			LEH
1992 04 28.34	M	8.7	GA	20.0	L	5	35	2.2	4			MOD
1992 04 28.34	S	8.6	GA	11.4	L	8	50	5	3			DID
1992 04 28.35	M	8.7	GA	5.0	B		10	2.5	3			MOD
1992 04 28.98	M	8.6	AA	19.9	L	4	52	5	4			ZHU
1992 04 29.08	B	8.9	AA	16	L	10	54	4	1			KOS
1992 04 29.35	M	8.6	GA	20.0	L	5	35	2.1	3			MOD
1992 04 29.98	S	8.5	AA	12.0	R	5	23	6	3			ZHU
1992 04 29.99	M	8.6	AA	19.9	L	4	52	5	4			ZHU
1992 04 30.61	S	7.8	AA	12.0	R		20	2.5	7			LOO01
1992 05 02.38	M	8.9	GA	20.0	L	5	35	1.7	3			MOD
1992 05 03.38	M	8.9	GA	20.0	L	5	35	1.8	3			MOD
1992 05 04.07	B	9.1	AA	16	L	10	54	3	1			KOS
1992 05 04.92	! S	8.6	NP	18.7	L	5	38	3	3			SHU
1992 05 05.07	M	8.7	S	10.0	B	4	25	5	3			LEH
1992 05 05.08	M	8.6	S	8.0	B		10	7	2			LEH
1992 05 06.07	M	8.6	S	10.0	B	4	25	6	4			LEH
1992 05 06.08	M	8.5	S	8.0	B		10	10	3			LEH
1992 05 06.36	M	9.4	GA	20.0	L	5	68	1.5	3			MOD
1992 05 06.39	B	9.1	S	33.3	L		56	2.0	5			KRO02
1992 05 06.47	S	8.9	AA	20	T	10	63	1.8	3			PRY
1992 05 07.33	M	8.8	GA	20.0	L	5	35	2.2	3/			MOD
1992 05 07.38	B	8.8	S	33.3	L		56	2.3	5			KRO02
1992 05 09.38	M	8.3	NO	20.0	L	5	35	1.1	4			MOD

Comet Tanaka-Machholz 1992d [cont.]

DATE (UT)		MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 05 09.39		B	7.8	S	8.0	B		20	& 3	3			KRO02
1992 05 10.00		S	7.6	AA	25.5	L	4	35	& 2	5	0.10	300	DIO
1992 05 10.07		S	7.3	SC	7.5	R	7	21	2.1				FIE
1992 05 10.36		M	7.6	SC	20.0	L	5	35	2.0	3			MOD
1992 05 11.09		S	8.5	AA	7.5	R		50	15	3			BEA
1992 05 11.26		M	7.3	SC	20.0	L	5	35	2.8	3/			MOD
1992 05 11.35		M	7.2	SC	5.0	B		10	3.8	3			MOD
1992 05 11.41		M	7.2	S	15.2	L	3	16	5	4			KEE
1992 05 11.89		S	8.3	AA	12.0	R	5	23	6	3			ZHU
1992 05 11.95		M	8.3	AA	19.9	L	4	52	7	4			ZHU
1992 05 12.26		S	7.6	GA	11.4	L	8	50	6.5	5			DID
1992 05 12.35		M	7.3	SC	5.0	B		10	4.2	3			MOD
1992 05 12.36		M	7.6	SC	20.0	L	5	35	3.0	4			MOD
1992 05 12.46		S	7.7	AA	20.3	R	15	152	3.5	6			HER02
1992 05 12.80		S	8.1	AA	18.7	L	5	38	4	3			SHU
1992 05 13.09		S	8.5	AA	15.0	L	6	36	& 6	6			DIO
1992 05 13.80		S	8.0	NP	18.7	L	5	38	3	3			SHU
1992 05 13.95		M	8.8	S	10.0	B	4	25	5	3			LEH
1992 05 13.96		M	8.7	S	8.0	B		10	7	1			LEH
1992 05 14.36		M	8.2	NO	20.0	L	5	35	2.1	3			MOD
1992 05 14.47		S	7.6	AA	5.6	B		8	4.5				HER02
1992 05 14.80		S	8.0	AA	18.7	L	5	38	3.5	4			SHU
1992 05 14.99		M	8.8	S	10.0	B	4	25	4	3			LEH
1992 05 15.00		M	8.8	S	8.0	B		10	6	2			LEH
1992 05 15.34		M	8.2	NO	20.0	L	5	35	2.0	3			MOD
1992 05 15.80		S	8.1	AA	18.7	L	5	38	3	3			SHU
1992 05 15.95		M	8.4	S	8.0	B		10	6	3			LEH
1992 05 16.06		M	8.4	S	10.0	B	4	25	5	4			LEH
1992 05 16.37		M	8.4	NO	20.0	L	5	68	1.2	3			MOD
1992 05 16.86		S	8.2	AA	18.7	L	5	38	3	2			SHU
1992 05 16.88		M	8.3	S	8.0	B		10	7	1			LEH
1992 05 16.88		M	8.3	S	10.0	B	4	25	5	3			LEH
1992 05 16.93		S	7.3	AA	20	R	14	40	3.6	3			SHA02
1992 05 17.04		S	5.8	AA	25.5	L	4	53	4	5			LOO01
1992 05 17.26		S	7.5	GA	11.4	L	8	50	5.5	4			DID
1992 05 17.87		S	6.0	AA	10.0	B		14	3.5	5			LOO01
1992 05 17.92		M	8.4	S	10.0	B	4	25	4	3			LEH
1992 05 17.93		M	8.3	S	8.0	B		10	6	2			LEH
1992 05 17.94		S	8.6	AA	19.9	L	4	52	4	4			ZHU
1992 05 18.82	!	S	7.8	NP	18.7	L	5	38	4.5	3			SHU
1992 05 18.92		S	7.6	SC	15	L	8	67	1.8	3			SHA02
1992 05 18.94		S	9.3	AA	7.5	R		50	6	4		135	BEA
1992 05 19.10		M	8.5	NO	20.0	L	5	35	2.3	3			MOD
1992 05 19.11		M	8.4	NO	5.0	B		10	2.5	2			MOD
1992 05 19.27		S	7.5	GA	11.4	L	8	50	5	5			DID
1992 05 19.35		M	8.9	NO	20.0	L	5	35	2.2	3			MOD
1992 05 19.35		M	9.0	NO	20.0	L	5	68	2.0	3			MOD
1992 05 19.92		M	8.5	S	10.0	B	4	25	4	4			LEH
1992 05 19.93		M	8.4	S	8.0	B		10	8	3			LEH
1992 05 19.94		S	6.8	AA	25.5	L	4	53	2.5	6			LOO01
1992 05 20.12		M	8.6	NO	20.0	L	5	35	2.2	3			MOD
1992 05 20.37		M	8.9	NO	20.0	L	5	35	1.8	3			MOD
1992 05 20.92		M	8.2	S	10.0	B	4	25	4	4			LEH
1992 05 20.93		M	8.1	S	8.0	B		10	7	3			LEH
1992 05 21.15		M	8.5	NO	20.0	L	5	35	2.3	3			MOD
1992 05 21.26		S	7.7	GA	11.4	L	8	50	4	6			DID
1992 05 21.92		M	8.6	S	10.0	B	4	25	4	2			LEH
1992 05 22.00		S	8.2	AA	20	R	14	40	4.9	3			SHA02
1992 05 22.14		M	8.5	NO	20.0	L	5	35	2.3	3			MOD

Comet Tanaka-Machholz 1992d [cont.]

DATE (UT)		MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 05 22.16		M	8.4	NO	5.0	B		10	2.5	3			MOD
1992 05 22.84	!	S	8.1	NP	18.7	L	5	38	5	4			SHU
1992 05 22.97		M	8.5	S	10.0	B	4	25	5	4			LEH
1992 05 22.98		M	8.5	S	8.0	B		10	7	3			LEH
1992 05 23.23		M	8.6	NO	20.0	L	5	35	2.1	3			MOD
1992 05 23.23		S	7.7	GA	11.4	L	8	50	5	6			DID
1992 05 23.92		M	8.5	S	8.0	B		10	6	3			LEH
1992 05 23.93		M	8.5	S	10.0	B	4	25	4	5			LEH
1992 05 23.98		M	9.0	S	20.0	R	18	87	3	6			LEH
1992 05 24.02		S	8.5	AA	25.5	L	4	53	1.8	6			LOO01
1992 05 24.26		S	8.0	GA	11.4	L	8	50	4	6			DID
1992 05 24.82	!	S	8.3	NP	18.7	L	5	38	4	4			SHU
1992 05 24.92		M	8.3	S	8.0	B		10	9	4			LEH
1992 05 24.93		M	8.4	S	10.0	B	4	25	6	5			LEH
1992 05 24.98		M	8.9	S	20.0	R	18	87	3	6			LEH
1992 05 25.34		M	9.0	NO	20.0	L	5	35	1.8	3			MOD
1992 05 25.92		M	8.6	S	8.0	B		10	7	4			LEH
1992 05 25.93		M	8.6	S	10.0	B	4	25	5	6			LEH
1992 05 25.96		M	8.8	S	20.0	R	17	87	3	6			LEH
1992 05 26.23		S	7.7	GA	11.4	L	8	50	4.5	6			DID
1992 05 26.92		M	8.2	S	8.0	B		10	8	4			LEH
1992 05 26.93		M	8.2	S	10.0	B	4	25	6	5			LEH
1992 05 26.94		S	8.6	AA	20	R	14	40	3.2	3			SHA02
1992 05 26.97		S	8.3	A	20.0	T	10	66	& 1.6	5			COM
1992 05 27.95		S	8.8	AA	18.7	L	5	38	3	3			SHU
1992 05 28.17		M	8.6	NO	20.0	L	5	35	2.6	2/			MOD
1992 05 28.35		M	8.7	NO	20.0	L	5	35	2.8	3			MOD
1992 05 28.79		S	8.9	AA	18.7	L	5	38	3	3			SHU
1992 05 28.93		M	8.6	S	10.0	B	4	25	5	4			LEH
1992 05 29.04		S	8.3	AC	25.5	L	4	53	2	5			LOO01
1992 05 29.14		M	8.7	NO	20.0	L	5	35	3.0	2/			MOD
1992 05 29.26		S	8.4	GA	11.4	L	8	50	4	3			DID
1992 05 29.92		M	8.7	S	8.0	B		10	10	3			LEH
1992 05 29.92		S	8.6	AA	18.7	L	5	38	3	3			SHU
1992 05 29.93		M	8.7	S	10.0	B	4	25	7	4			LEH
1992 05 29.96		M	9.0	S	20.0	R	17	87	5	6			LEH
1992 05 30.27		S	8.4	GA	11.4	L	8	50	4	3			DID
1992 05 30.86		S	8.9	AA	18.7	L	5	38	3	4			SHU
1992 05 30.99		M	9.0	S	10.0	B	4	25	5	3			LEH
1992 05 31.25		B	9.5	S	33.3	L		56	& 2.5	3			KRO02
1992 05 31.25		S	8.3	AA	20	T	10	63	1.6	1			PRY
1992 05 31.85		S	9.2	AA	18.7	L	5	38	3	3			SHU
1992 06 01.86		S	9.4	AA	18.7	L	5	38	3	3			SHU
1992 06 02.85		S	9.5	AA	18.7	L	5	38	3	3			SHU
1992 06 03.18		M	9.4	GA	20.0	L	5	35	2.4	3			MOD
1992 06 03.89		S	9.5	AA	18.7	L	5	38	3	2			SHU
1992 06 04.90		S	9.6	AA	18.7	L	5	38	2	2			SHU
1992 06 05.85		S	9.5	AA	18.7	L	5	38	2.5	2			SHU
1992 06 06.28		S	9.1	AA	20	T	10	63	1.4	2			PRY
1992 06 06.45		S	8.9	S	12	R	7	27	3.5	2			MAC
1992 06 06.87		S	9.6	AA	18.7	L	5	38	2	2			SHU
1992 06 09.24		M	9.9	GA	20.0	L	5	35	1.8	2			MOD
1992 06 10.34		M	9.9	GA	20.0	L	5	35	2.0	2			MOD
1992 06 11.34		M	9.9	GA	20.0	L	5	35	2.0	2			MOD
1992 06 11.46		S	9.0	S	12	R	7	27	3.5	2			MAC
1992 06 23.96		S	10.1	AC	15.2	L	5	44	2.5	3			MOE
1992 06 28.14		M	11.2:	GA	20.0	L	5	68	1.2	2			MOD
1992 06 29.13		M	11.6	GA	35.9	L	7	85	1.0	2			MOD
1992 06 29.14		M	11.4	GA	20.0	L	5	68	0.9	1			MOD

Comet Tanaka-Machholz 1992d [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 07 06.14	S	[11.5	GA	35.9	L	7	85	! 1.0				MOD
1992 07 06.14	S	[12.0	GA	35.9	L	7	164	! 0.5				MOD

Comet Bradfield 1992i

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 05 05.81	M	9.5	SM	8.0	B		20	2	5			CAM03
1992 05 09.82	M	9.4	SM	8.0	B		20	2	5			CAM03
1992 05 29.37	M	11.0	SM	20.3	L	7	56	2	0			CAM03
1992 05 30.37	M	11.0	SM	20.3	L	7	56	3	0			CAM03

Comet Machholz 1992k

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 07 02.46	S	9 :	S	12	R	7	27	3	7			MAC
1992 07 05.45	S	9.0	S	11	L	5	34	2.0	2			MAC
1992 07 06.46	S	9.1	S	15	L	8	71	2.0	3			MAC
1992 07 07.47	S	8.7	S	15	L	8	71	2.0	2			MAC
1992 07 08.47	S	9.0	S	12	R	7	27	3	4			MAC
1992 07 13.5	S	[9.5:	S	12	R	7	27	< 3				MAC
1992 07 14.5	S	[9.5:	S	12	R	7	27	< 3				MAC
1992 07 15.5	S	[9.5:	S	12	R	7	27	< 3				MAC
1992 07 16.5	S	[9.0:	S	12	R	7	27	< 3				MAC
1992 07 25.5	S	[9.0:	S	25	L	4	64	< 3				MAC
1992 07 28.81		10 :		10.0	B		25					SEA
1992 07 29.81		10 :	AA	10.0	B		25					SEA
1992 07 30.81	S	9.8	AA	10.0	B		25					SEA
1992 07 31.5	S	[9 :	S	25	L	4	64	< 3				MAC
1992 08 03.47	I	[10 :		20	L	6	110					HAL
1992 08 06.5	S	[8 :	S	12	R	7	27	< 3				MAC
1992 08 11.5	S	[8.5:	S	25	L	4	32	< 3				MAC
1992 08 19.5	S	[8 :	S	25	L	4	64	< 3				MAC
1992 08 25.5	S	[8 :	S	12	R	7	27	< 3				MAC

Comet Helin-Lawrence 1992q

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 08 31.43	I	[13.0:		41	L	4	183					HAL
1992 09 03.45	I	[13.5:		41	L	4	183					HAL
1992 09 25.33	S	13.3	AC	41	L	4	183	1				HAL

Periodic Comet Grigg-Skjellerup

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 08 03.15	I	[12 :		41	L	4	183					HAL

Periodic Comet Machholz

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 08 12.09	B	11 :	S	33.3	L		216	& 3	3			KRO02

Periodic Comet Wolf (1992m)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 08 26.44	I	[13.5:		41	L	4	183					HAL

Periodic Comet Daniel (1992o)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 08 26.46	I	[13.5:		41	L	4	183					HAL
1992 09 01.48	I	[13.0:		41	L	4	183					HAL
1992 09 06.47	S	[13.3	WA	41	L	4	183	1				HAL
1992 09 24.47	I	[13.0:		41	L	4	183					HAL

Periodic Comet Wirtanen (1991s)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 08 13.45	S	11.4	NP	40.6	L	5	64		2			SCO01
1991 08 19.39	B	11 :	S	33.3	L		122					KRO02
1991 08 22.39	B	10.7:	S	33.3	L		122	0.9	3			KRO02
1991 09 05.42	B	10.6:	S	33.3	L		122	& 1	1			KRO02
1991 09 07.35	S	10.9	AC	44.5	L	4	80	1.7	2			MOR03
1991 09 07.38	B	10.2:	S	33.3	L		122	3.1	1			KRO02
1991 09 17.37	S	10.5	AC	15	R	5	62	2.0	3			MOR03
1991 09 20.35	S	10.6	AC	15	R	5	62	2.0				MOR03
1991 10 06.39	S	10.6	AC	15	R	5	62	2.4	2			MOR03
1991 10 08.43	B	10.3:	S	33.3	L		122	2.3	2			KRO02
1991 10 14.38	S	10.7	AC	15	R	5	62	2.3	1			MOR03
1991 10 17.42	S	10.8	AC	15	R	5	62	2.2	1			MOR03
1991 10 18.43	B	10.8:	S	33.3	L		122	& 1	2			KRO02
1991 11 10.45	S	11.8	AC	44.5	L	4	80	1.7	1			MOR03
1991 11 17.43	S	11.4	AC	44.5	L	4	80	2.7	1			MOR03
1991 12 05.14	I	[13.2:		20.3	T	10	80					GAR02
1991 12 07.18	I	[12.8:		20.3	T	10	167					GAR02
1992 01 02.16	I	[13.2:		20.3	T	10	167					GAR02

Periodic Comet Arend-Rigaux

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 12 05.13	I	[13.2:		20.3	T	10	167					GAR02
1992 01 02.15	I	[13.2:		20.3	T	10	167					GAR02
1992 02 02.12	I	[13.2:		20.3	T	10	167					GAR02

Periodic Comet Tsuchinshan 1

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 01 02.18	I	[13.2:		20.3	T	10	167					GAR02
1992 02 02.14	I	[13.0:		20.3	T	10	167					GAR02

Periodic Comet Wild 2 (1990 XXVIII)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1989 09 10.47	r	19.25		152	C	9		+ 0.2				GIB
1990 12 31.47	B	11.0:	S	33.3	L		216	1.5	2			KRO02
1991 06 07.18	B	12.6:	S	33.3	L		216	& 1	1			KRO02

Periodic Comet Hartley 2 (1991t)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 07 15.39	B	11.5:	S	33.3	L		122	& 5	2			KRO02
1991 07 24.34	S	11.2	AC	15	R	5	62	1.8	2			MOR03
1991 08 11.36	B	8.9	S	33.3	L		56	5.3	2			KRO02
1991 08 12.30	B	8.8	S	33.3	L		56	5.1	3			KRO02
1991 08 13.44	S	10.0	NP	40.6	L	5	64		7			SCO01
1991 08 19.40	B	8.7	S	33.3	L		56	4.1	5			KRO02
1991 08 21.10	S	8.3	AA	8.0	B		20	& 5.5	3			DIO
1991 08 22.36	S	8.2	AC	15	R	5	31	3.5	3			MOR03
1991 08 22.38	B	8.3	S	33.3	L		56	3.7	5			KRO02

Periodic Comet Hartley 2 (1991t) [cont.]

DATE (UT)		MM	MAG.	RF	AP.	T	F/	PWR		COMA	DC	TAIL	PA	OBS.
1991 09 05.41		B	8.6	S	33.3	L		56		4.4	7			KRO02
1991 09 06.41		B	7.7	S	8.0	B		20		5	5			KRO02
1991 09 07.35		B	8.1	S	8.0	B		20		4	5			KRO02
1991 09 07.35		B	8.5	S	33.3	L		56		4.4	6			KRO02
1991 09 07.35		S	8.2	AC	15	R	5	31		3	4			MOR03
1991 09 10.13		S	8.5:	AA	8.0	B		20			3			DIO
1991 09 12.42		B	8.0	S	8.0	B		20		6	5			KRO02
1991 09 17.41		S	8.0	AC	15	R	5	31		3	4			MOR03
1991 09 20.36		S	8.2	AC	15	R	5	31		3.5	4			MOR03
1991 09 21.41		B	8.1	S	8.0	B		20		6	6			KRO02
1991 10 06.39		M	8.4	AC	15	R	5	31		4.5	4			MOR03
1991 10 08.42		B	8.5	S	8.0	B		20		5	7			KRO02
1991 10 08.42		B	8.7	S	33.3	L		56		4.3	7			KRO02
1991 10 14.37		S	8.8	AC	15	R	5	31		3	3			MOR03
1991 10 14.69		S	9.7	GA	31.7	L	5	86	&	2	1/			JON
1991 10 17.42		S	8.8	AC	15	R	5	31		3.5	3			MOR03
1991 10 18.40		B	8.9	S	8.0	B		20		6	6			KRO02
1991 10 18.40		B	9.2	S	33.3	L		56		4.1	5	0.06	285	KRO02
1991 10 18.68		S	10.2	GA	31.7	L	5	86	&	2	1/			JON
1991 10 19.68		S	9.7	GA	31.7	L	5	86		2	2			JON
1991 11 04.41		S	10.4	AC	15	R	5	62		2.4	2			MOR03
1991 11 04.66		S	10.1	L	31.7	L	5	86		1.5	1/			JON
1991 11 05.41		S	10.4	AC	15	R	5	62		1.8	2			MOR03
1991 11 10.41		S	10.7	AC	15	R	5	62		1.8	2			MOR03
1991 11 17.42		S	11.0	AC	44.5	L	4	80		2.5	2			MOR03
1991 11 18.43		S	11.0	AC	15	R	5	62		2.0	1			MOR03
1991 12 05.11		S	12.3	AC	20.3	T	10	62		1.6	1			GAR02
1991 12 07.16		S	12.2	AC	20.3	T	10	62		1.2	2			GAR02
1991 12 12.46		S	12.0	AC	44.5	L	4	80		2.2	0			MOR03
1991 12 14.10		S	12.5	AC	20.3	T	10	62		2	2			GAR02
1992 01 02.13		S	13.3	AC	20.3	T	10	80		1	1			GAR02
1992 02 01.98		I	[13.5:		20.3	T	10	62						GAR02

Periodic Comet Faye (1991n)

DATE (UT)		MM	MAG.	RF	AP.	T	F/	PWR		COMA	DC	TAIL	PA	OBS.
1991 09 05.40		B	10.4:	S	33.3	L		122	&	1	2			KRO02
1991 09 07.34		S	12.5	AC	44.5	L	4	167		0.7	4			MOR03
1991 09 07.36		B	10.5:	S	33.3	L		122		1.2	3			KRO02
1991 09 20.33		S	12.0	AC	44.5	L	4	80		1.0	4	0.03	250	MOR03
1991 10 02.86	!	S	10.5	AC	20.3	T	10	133		1.7	5			DAH
1991 10 06.40		S	10.9	AC	15	R	5	62		2.0	3			MOR03
1991 10 08.41		B	8.9	S	33.3	L		56		1.8	6			KRO02
1991 10 14.38		S	10.5	AC	15	R	5	62		2.0	4			MOR03
1991 10 14.63		S	10.3	GA	31.7	L	5	86		1	5			JON
1991 10 16.64		S	10.1	GA	31.7	L	5	86		1	4/			JON
1991 10 17.41		S	10.0	AC	15	R	5	62		2.5	4			MOR03
1991 10 18.39		B	9.3	S	33.3	L		56		2.0	7			KRO02
1991 10 18.65		S	10.1	GA	31.7	L	5	86	&	1	6			JON
1991 10 19.64		S	10.1	GA	31.7	L	5	86		0.8	5			JON
1991 10 28.44		S	10.4	GA	31.7	L	5	86		0.7	4/			JON
1991 10 30.47		S	10.2	GA	31.7	L	5	86		0.8	6			JON
1991 10 31.21		S	10.4	AC	15	R	5	62		1.8	4			MOR03
1991 11 04.40		B	10.5	AA	22	L	7	56			0			CAM01
1991 11 04.45		S	10.0	L	31.7	L	5	48						JON
1991 11 05.04		S	10.6	AC	15	R	5	62		2.0	3			MOR03
1991 11 09.43		S	10.0	L	31.7	L	5	86		1	5/			JON
1991 11 10.05		B	9.1	S	33.3	L		56		2.5	5			KRO02
1991 11 10.20		S	10.5	AC	15	R	5	62		2.6	3			MOR03

Periodic Comet Faye (1991n) [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 11 10.92	S	9.2	AC	20.3	T	10	62	2	5	0.07		GAR02
1991 11 12.12	S	10.5	AC	15	R	5	62	2.4	3			MOR03
1991 11 12.42	S	9.9	L	31.7	L	5	48	1.3				JON
1991 11 13.15	B	9.4	S	33.3	L		56	2.4	6			KRO02
1991 11 14.42	S	10.4	L	31.7	L	5	48	& 1	3			JON
1991 11 24.41	B	10.5	AA	22	L	7	56		0			CAM01
1991 11 24.41	S	10.1	L	31.7	L	5	48		6			JON
1991 11 25.42	S	10.2	L	31.7	L	5	48	1	4			JON
1991 11 30.41	S	10.4	L	31.7	L	5	48					JON
1991 12 02.43	S	10.5	L	31.7	L	5	48					JON
1991 12 03.80	S	9.8	CS	20.3	T	10	62	2	5	0.12	45	GAR02
1991 12 04.42	S	10.4	L	31.7	L	5	48					JON
1991 12 04.83	B	9.8	CS	20.3	T	10	62	1.7	5	0.13	50	GAR02
1991 12 06.20	B	10.7:	S	33.3	L		216	& 2	6			KRO02
1991 12 06.82	B	9.9	CS	20.3	T	10	62	2.5	4	0.10		GAR02
1991 12 10.16	B	10.7:	S	33.3	L		122	2.6	4			KRO02
1991 12 10.44	S	11.0	L	31.7	L	5	86	1	3/			JON
1991 12 12.26	S	11.6	AC	44.5	L	4	80	1.7	4			MOR03
1991 12 14.02	S	10.1	CS	12.7	T	10	40	1.5	2			GAR02
1991 12 14.11	B	11 :	S	33.3	L		216	& 2	4			KRO02
1991 12 28.48	S	11.5	L	31.7	L	5	86	& 1	1			JON
1991 12 28.87	S	10.7	AC	20.3	T	10	62	1	2			GAR02
1991 12 30.83	S	11.0	AC	20.3	T	10	62	1	2			GAR02
1991 12 31.14	S	11.9	AC	44.5	L	4	80	1.3	3			MOR03
1992 01 01.42	S	12.1	L	31.7	L	5	86	0.6	1			JON
1992 01 01.91	S	10.9	AC	20.3	T	10	62	1.2	3	0.03	70	GAR02
1992 01 09.07	B	11.3:	S	33.3	L		216	0.8	2			KRO02
1992 01 25.83	S	12.2	AC	20.3	T	10	62	0.9	2			GAR02
1992 01 27.03	S	13.3	AC	44.5	L	4	167	0.7	2			MOR03
1992 01 31.82	S	12.5	AC	20.3	T	10	62	0.8	2			GAR02
1992 02 07.10	S	[13.0	AC	31.8	L	4	150	! 1				KEE
1992 02 08.93	S	12.9	AC	20.3	T	10	62	0.6	1			GAR02
1992 02 23.83	I	[13.2:		20.3	T	10	167					GAR02

Periodic Comet Metcalf-Brewington (1991a)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 01 14.07	B	9.4	S	33.3	L		56	1.5				KRO02
1991 01 19.06	B	9.4	S	8.0	B		20					KRO02
1991 01 19.06	B	9.6	S	33.3	L		56	2.9	4			KRO02
1991 01 23.03	B	9.3	S	33.3	L		56	2.6	4			KRO02
1991 01 24.03	B	9.3	S	33.3	L		56	2.5	3			KRO02
1991 01 27.04	B	10 :	S	33.3	L		56	& 1	1			KRO02
1991 01 29.05	B	9.9:	S	33.3	L		56	1.5	1			KRO02
1991 01 31.04	B	10.4:	S	33.3	L		56	3.0	3			KRO02
1991 02 01.03	B	10.1:	S	8.0	B		20					KRO02
1991 02 01.03	B	10.7:	S	33.3	L		56	3.0	3			KRO02
1991 02 03.03	B	10.3:	S	33.3	L		56	3.1	3			KRO02
1991 02 09.07	B	11.2:	S	33.3	L		122	3.0	4			KRO02
1991 02 12.08	B	11 :	S	33.3	L		122	2.2	1			KRO02
1991 04 06.09	B	11.1:	S	33.3	L		122	0.5	2			KRO02

Periodic Comet Schuster (1992n)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 08 25.45	I	[13.5:		41	L	4	183					HAL
1992 09 06.43	I	[13.5:		41	L	4	183					HAL
1992 09 24.40	I	[13.5:		41	L	4	183					HAL

Periodic Comet Giclas (1992l)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 09 03.43	I	[13.5:		41	L	4	183					HAL
1992 09 24.39	I	[13.5:		41	L	4	183					HAL

Periodic Comet Kowal 2 (1991f1)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 12 29.99	I	[13.2:		20.3	T	10	250					GAR02
1992 01 12.32	M	13.8	GA	40	L	7	190	0.9	4			MOD
1992 02 06.25	S	13.9	GA	40	L	7	190	0.5	2			MOD
1992 02 10.25	S	14.0	GA	40	L	7	190	0.45	3			MOD
1992 03 05.17	S	[14.1	GA	40	L	7	190	! 0.5				MOD

Periodic Comet Shoemaker 1 (1991p)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 12 03.76	I	[13.2:		20.3	T	10	80					GAR02

Periodic Comet Shoemaker-Levy 6 (1991b1)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 12 03.75	I	[13.2:		20.3	T	10	167					GAR02
1991 12 04.80	I	[13.2:		20.3	T	10	80					GAR02
1992 01 01.89	I	[13.2:		20.3	T	10	167					GAR02

Periodic Comet Brewington (1992p)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 08 31.48	S	11.5:	WA	41	L	4	183					HAL
1992 09 01.46	M	10.8	WA	41	L	4	83					HAL
1992 09 03.12	S	10.9	AC	20.0	L	4	40	& 3	2			MIK
1992 09 04.12	S	11.0	AC	20.0	L	4	40	& 3	2			MIK
1992 09 05.40	B	11.7:	S	33.3	L		122	1.5	4			KRO02
1992 09 06.12	S	11.2	AC	20.0	L	4	40	& 2.5	2			MIK
1992 09 06.45	S	11.1	WA	41	L	4	83					HAL
1992 09 07.12	S	11.0	AC	20.0	L	4	40	& 4	2			MIK
1992 09 08.13	S	11.2	AC	20.0	L	4	40	& 3	2			MIK
1992 09 24.42	B	11.9:	S	33.3	L		122	1.6	3			KRO02
1992 09 24.46	S	12.3	CA	41	L	4	83					HAL

Periodic Comet Halley (1986 III)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 08 08.41	B	13.5:	A	33.3	L	4	216	& 0.2				KRO02
1985 08 25.42	B	13 :	A	33.3	L	4	216	& 0.3				KRO02
1985 09 16.42	B	12.5	A	33.3	L	4	216	0.7				KRO02
1985 09 18.43	B	12.3	A	33.3	L	4	216	0.9	1			KRO02
1985 09 27.42	B	11.7	A	33.3	L	4	122	& 1	2			KRO02
1985 10 16.42	B	10.3	A	33.3	L	4	56	& 2	7			KRO02
1985 10 25.44	B	9.3	A	33.3	L	4	56	3.0	7			KRO02
1985 11 03.22	B	8.9	A	15.2	L	8	68	4.4	6			KRO02
1985 11 04.13	B	8.7	A	33.3	L	4	56	5.2	7			KRO02
1985 11 05.15	B	8.7	A	33.3	L	4	56	4.8	8			KRO02
1985 11 05.15	N	12.5	A	33.3	L	4	216					KRO02
1985 11 06.15	B	8.6	A	8.0	B		20	8	5			KRO02
1985 11 08.23	B	8.5	A	33.3	L	4	56	8.3	8			KRO02
1985 11 08.23	N	12 :	A	33.3	L	4	122					KRO02
1985 11 17.15	B	6.4	A	8.0	B		20	15	6			KRO02
1985 11 17.19	B	7.8	A	33.3	L	4	56	10.8	8			KRO02
1985 11 21.10	B	6.4	A	8.0	B		20	14	8			KRO02

Periodic Comet Halley (1986 III) [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 11 23.16	B	6.3	A	8.0	B		20	15				KRO02
1985 12 01.81	S	6.8	SC	7.0	B		20	6.6	1			FIE
1985 12 02.86	S	6.7	SC	7.0	B		20	10.5	0			FIE
1985 12 03.15	B	5.8	A	8.0	B		20	16				KRO02
1985 12 03.17				33.3	L	4	56				77	KRO02
1985 12 03.17	B	6.8	A	33.3	L	4	56	11.5			292	KRO02
1985 12 06.10	B	5.6	A	8.0	B		20	14				KRO02
1985 12 06.13				33.3	L	4	56				71	KRO02
1985 12 06.13	B	6.2	A	33.3	L	4	56	9.7	8		341	KRO02
1985 12 07.04	B	5.6	A	8.0	B		20	16				KRO02
1985 12 07.05	B	6.2	A	33.3	L	4	56	9	8		75	KRO02
1985 12 07.78	S	6.4	SC	7.0	B		20	2.8	0			FIE
1985 12 08.15	B	5.8	A	8.0	B		20	14				KRO02
1985 12 09.04	B	6.2	A	8.0	B		20	16				KRO02
1985 12 09.06	B	6.6	A	33.3	L	4	56	9.9		0.17	85	KRO02
1985 12 14.06	B	5.8	A	8.0	B		20	16				KRO02
1985 12 15.06	B	5.7	A	8.0	B		20	16				KRO02
1985 12 15.06	B	6.6	A	15.2	L	8	68	10.3		0.22	65	KRO02
1985 12 17.12	B	5.8	A	8.0	B		20	11	6			KRO02
1985 12 18.13	B	5.5	A	8.0	B		20	11	8			KRO02
1985 12 19.12	B	5.6	A	8.0	B		20	12	7			KRO02
1985 12 19.13	B	6.0	A	15.2	L	8	68	& 9	7			KRO02
1985 12 21.09	B	5.7	A	8.0	B		20	12	7			KRO02
1985 12 21.10	B	6.4	A	33.3	L	4	56	7.7	8			KRO02
1985 12 28.05	B	5.5	A	8.0	B		20	10	6			KRO02
1985 12 29.01	B	5.4	A	8.0	B		20	13				KRO02
1985 12 29.03	B	6.0	A	33.3	L	4	56	7.8	6	0.45	80	KRO02
1985 12 30.05	B	5.5	A	8.0	B		20	12				KRO02
1985 12 30.05	B	6.1	A	33.3	L	4	56	6.8		0.48	69	KRO02
1986 01 01.01	B	4.5:	A	0.0	E		1					KRO02
1986 01 01.01	B	5.1	A	8.0	B		20	11		0.7	65	KRO02
1986 01 01.02	B	5.9	A	33.3	L	4	56	6.6				KRO02
1986 01 02.02	B	5.1	A	8.0	B		20			1		KRO02
1986 01 02.02	B	5.8	A	33.3	L	4	56	6.1			73	KRO02
1986 01 06.01	B	4.9	A	8.0	B		20	8		1		KRO02
1986 01 06.02	B	5.7	A	33.3	L	4	56	8.4		0.58	71	KRO02
1986 01 08.02	B	4.7	A	8.0	B		20	9		1.1		KRO02
1986 01 08.02	B	5.5	A	33.3	L	4	56	6.6			69	KRO02
1986 01 09.03	B	4.9	A	8.0	B		20	9		0.83		KRO02
1986 01 09.03	B	5.7	A	15.2	L	8	68	5.4	8	0.53	55	KRO02
1986 01 10.04	B	4.9	A	8.0	B		20			0.33		KRO02
1986 01 10.04	B	5.6	A	33.3	L	4	56	6.4		0.5	57	KRO02
1986 01 11.01	B	4.9	A	8.0	B		20	7		0.75		KRO02
1986 01 11.01	B	5.5	A	33.3	L	4	56	5.2	8	0.5	45	KRO02
1986 01 12.03	B	4.8	A	8.0	B		20			0.67		KRO02
1986 01 12.03	B	5.4	A	33.3	L	4	56	3.7			61	KRO02
1986 01 13.03	B	4.7	A	8.0	B		20			1		KRO02
1986 01 13.03	B	5.4	A	33.3	L	4	56	5.6	8		58	KRO02
1986 01 21.01	B	4.2	A	8.0	B		20			0.5		KRO02
1986 03 03.48	B	3.6	A	8.0	B		20	6	5	0.67	270	KRO02
1986 03 14.47	B	3.4	A	8.0	B		20	7		2		KRO02
1986 03 15.48				15.2	L	8	68	10.9	8			KRO02
1986 03 15.48	B	3.2	A	8.0	B		20	12		3	270	KRO02
1986 03 21.42	B	3.8	A	8.0	B		20	13		2		KRO02
1986 03 21.46				33.3	L	4	56	10.6	7			KRO02
1986 03 23.47	B	3.6	A	8.0	B		20	10		1.5	300	KRO02
1986 03 30.46	B	3.3	A	8.0	B		20					KRO02
1986 03 30.47				15.2	L	8	68	& 6	8	0.25	315	KRO02
1986 04 12.29	B	4 :	A	33.3	L	4	56				338	KRO02

Periodic Comet Halley (1986 III) [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 04 22.23				15.2	L	8	68	6.3	3			KRO02
1986 04 22.23	B	5.5	A	8.0	B		20					KRO02
1986 04 29.21	B	5.3	A	8.0	B		20	16				KRO02
1986 04 29.22				15.2	L	8	68	10.2		0.62	96	KRO02
1986 04 30.16	B	5.5	A	8.0	B		20	12				KRO02
1986 04 30.16	B	5.7	A	33.3	L	4	56	6.6			102	KRO02
1986 05 02.13	B	5.5	A	8.0	B		20	11	3			KRO02
1986 05 02.15	B	5.8	A	33.3	L	4	56	6	5	0.5	85	KRO02
1986 05 03.11	B	5.8	A	8.0	B		20					KRO02
1986 05 04.11	B	5.8	A	8.0	B		20	15	5			KRO02
1986 05 07.17	B	6.1	A	8.0	B		20	13	3			KRO02
1986 05 08.14	B	6.4	A	8.0	B		20	14	3			KRO02
1986 05 13.15	B	6.6	A	8.0	B		20	10	2			KRO02
1987 02 04.29	B	12.3:	A	33.3	L	4	216	0.5				KRO02

Periodic Comet Swift-Tuttle (1992t)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 09 27.47	S	10.2	CA	20	L	6	34	& 4	2			HAL
1992 09 28.88	S	9.9	AA	15.2	L	5	44	3	1			MOE
1992 09 29.11	B	9.1	S	33.3	L		56	3.6	1			KRO02
1992 09 29.85	S	9.3	AC	20.3	T	10	80	2.8	3			DAH
1992 09 30.06	B	9.1	S	33.3	L		56	3.4	1			KRO02
1992 09 30.14	S	9.0	AC	20.3	T	10	80	4.5	2			GRA04
1992 09 30.86	S	9.1	AC	20.3	T	10	80	& 2.4	2			DAH
1992 09 30.90	S	9.4	AA	15.2	L	5	44	4.5	1			MOE
1992 10 01.04	B	9.0	S	33.3	L		56	3.4	2			KRO02
1992 10 03.81	S	9.0	AC	4.0	B		12	5	3			DAH
1992 10 03.91	S	8.8	AC	20.3	T	10	80	4.2	3			DAH
1992 10 04.36	B	9.2	AA	8.0	B		20					GRE
1992 10 04.37	S	8.3	AA	8.0	B		20	& 8	3/			GRE
1992 10 04.37	S	8.4	AA	5.0	B		12	& 9	2			GRE
1992 10 04.39	S	8.3	MC	8.0	B		20					GRE
1992 10 04.79	S	8.7	AC	20.3	T	10	80	3.5	2			GRA04
1992 10 04.85	S	9.0	AC	20.3	T	10	80	& 2.6	2			DAH
1992 10 06.90	S	8.7	AC	20.3	T	10	80	4.2	3			DAH
1992 10 07.08	S	8.6	AC	20.3	T	10	80	3.1	3			GRA04
1992 10 07.35	S	8.4	MC	8.0	B		20	& 6.5	2/			GRE
1992 10 07.36	S	8.3	AA	8.0	B		20					GRE
1992 10 09.14	S	8.5	AC	20.3	T	10	80	4.5	3/			GRA04
1992 10 09.14	S	8.5	AG	20.3	T	10	80					GRA04
1992 10 09.15	S	8.5	AA	6.0	B		20	& 5	3			MIK

Periodic Comet Chernykh (1991o)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 11 10.87	I	[13.0:		20.3	T	10	62					GAR02
1991 12 04.82	I	[13.2:		20.3	T	10	80					GAR02
1991 12 25.02	S	[14.1	GA	40	L	7	190	! 0.5				MOD
1991 12 28.04	S	[13.9	GA	40	L	7	190	! 0.5				MOD
1991 12 30.80	I	[13.2:		20.3	T	10	250					GAR02
1992 02 03.01	S	[14.0	GA	40	L	7	190	! 0.5				MOD
1992 02 06.03	S	[14.0	GA	40	L	7	190	! 0.5				MOD

Periodic Comet Schwassmann-Wachmann 1

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1990 09 15.18	B	12 :	S	33.3	L	4	216	0.5				KRO02
1990 09 16.23	B	12.1:	S	33.3	L	4	216	0.4				KRO02

Periodic Comet Schwassmann-Wachmann 1 [cont.]

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1990 09 17.16	B	12.3:	S	33.3	L	4	216	0.4	2			KRO02
1991 11 10.83	I	[13.0:		20.3	T	10	80					GAR02
1991 12 03.78	I	[13.2:		20.3	T	10	80					GAR02
1991 12 04.80	I	[13.2:		20.3	T	10	80					GAR02
1991 12 05.77	S	13.4	AC	20.3	T	10	80	0.5	4			GAR02
1991 12 06.80	S	13.6	AC	20.3	T	10	80	0.7	2			GAR02
1991 12 14.05	I	[13.0:		20.3	T	10	167					GAR02
1991 12 28.84	I	[13.2:		20.3	T	10	250					GAR02
1991 12 29.89	I	[13.5:		20.3	T	10	250					GAR02
1991 12 30.81	I	[13.2:		20.3	T	10	167					GAR02
1992 01 01.92	I	[13.5:		20.3	T	10	167					GAR02
1992 01 02.80	I	[13.2:		20.3	T	10	167					GAR02
1992 01 25.85	I	[13.0:		20.3	T	10	167					GAR02
1992 01 31.83	I	[13.3:		20.3	T	10	167					GAR02
1992 02 23.81	I	[13.2:		20.3	T	10	250					GAR02
1992 02 29.82	I	[12.8:		20.3	T	10	250					GAR02
1992 08 03.43	I	[13.5:		41	L	4	183					HAL
1992 08 25.43	I	[13.5:		41	L	4	183					HAL
1992 08 31.44	I	[13.0:		41	L	4	183					HAL
1992 09 03.48	I	[13.0:		41	L	4	183					HAL
1992 09 23.39	I	[13.5:		41	L	4	183					HAL

Periodic Comet Levy (1991q)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1991 07 01.36	B	8.7	S	33.3	L		56	3.5	5			KRO02
1991 07 05.38	B	8.4	S	8.0	B		20	5	3			KRO02
1991 07 14.33	S	8.8	AC	15	R	5	31	3	3			MOR03
1991 07 14.38	B	8.9	S	33.3	L		56	3.9	5			KRO02
1991 07 15.36	B	8.5	S	8.0	B		20	5	4			KRO02
1991 07 15.36	B	8.8	S	33.3	L		56	4.4	5			KRO02
1991 07 24.34	S	8.7	AC	15	R	5	31	3.5	3			MOR03
1991 08 11.40	B	9.1	S	33.3	L		56	3.1	5			KRO02
1991 08 21.14	S	9.5:	AA	8.0	B		20		2			DIO
1991 08 22.37	S	10.5	AC	15	R	5	62	1.8	1			MOR03
1991 08 22.41	B	9.8:	S	33.3	L		56	2.9	3			KRO02
1991 09 07.39	B	10.7:	S	33.3	L		56	& 3	2			KRO02
1991 09 20.34	S	12.3	AC	44.5	L	4	80	1.8	1			MOR03
1992 01 01.94	I	[13.2:		20.3	T	10	167					GAR02

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A complete list of the Keys to abbrevations used in the *ICQ* is available from the Editor for $4.00 postpaid. *Please note that data in archival form, and thus the data to be sent in machine-readable form, use a format that is different from that of the Tabulated data in the printed pages of the ICQ;* see pages 59-61 of the July 1992 issue for further information.

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— *The Editor*

Φ Φ Φ

The Last 25 Comets to Receive Provisional Letter Designations

Listed below, for handy reference, are the last 25 comets which have been given letter designations (1989a is the first comet to be discovered/recovered in 1989, 1989b is the second comet..., etc.). After the "equal sign" is given the name, preceded by a star (⋆) if the comet is a new discovery (compared to a recovery from predictions of a previously-known short-period comet); a 'sharp' sign (#) is used to indicate a 're-discovery' of a comet that had been lost for many years (or one significantly off from the prediction). Also given are such values as the orbital period (in years) for periodic comets, date of perihelion, T (month/date/year), and the perihelion distance (q, in AU). Four-digit numbers in the second-to-last column indicate the *IAU Circular* containing the discovery/recovery announcement. The last column lists the 3-digit code for short-period comets as used internally in archival data (first 3 characters), and which should be used by those observers contributing data in computer-readable form. [This list updates that in the Jan. 1992 issue, p. 28.]

Desig.			*Comet*	*P*	*T*	*q*	*IAUC*	P/ code
1991f_1	=	#	P/Kowal 2	6.4	11/4/91	1.5	5406	717
1991g_1	=	⋆	Zanotta-Brewington		1/31/92	0.64	5412	
1991h_1	=	⋆	Mueller		3/21/92	0.20	5420	
1992a	=	⋆	Helin-Alu		7/8/92	3.0	5432	
1992b	=	⋆	Bradfield		3/19/92	0.50	5442	
1992c	=		P/Howell	5.6	2/26/93	1.4	5472	634
1992d	=	⋆	Tanaka-Machholz		4/22/92	1.26	5487	
1992e	=		P/Singer Brewster	6.4	10/28/92	2.0	5490	638
1992f	=	⋆	P/Shoemaker-Levy 8	7.5	6/13/92	2.7	5493	730
1992g	=	⋆	P/Mueller 4	9.0	2/16/92	2.6	5495	952
1992h	=	⋆	Spacewatch		9/6/93	3.1	5509	
1992i	=	⋆	Bradfield		5/25/92	0.59	5514	
1992j	=		P/Ashbrook-Jackson	7.5	7/14/93	2.3	5546	638
1992k	=	⋆	Machholz		7/11/92	0.82	5553	
1992l	=		P/Giclas	7.0	9/13/92	1.85	5561	716
1992m	=		P/Wolf	8.2	8/28/92	2.4	5567	603
1992n	=		P/Schuster	7.3	9/6/92	1.5	5570	715
1992o	=		P/Daniel	7.1	9/1/92	1.6	5581	612
1992p	=	⋆	P/Brewington	8.6	6/4/92	1.56	5596	815
1992q	=	⋆	Helin-Lawrence		3/11/93	2.1	5597	
1992r	=		P/Tuttle	13.5	6/25/94	1.00	5604	908
1992s	=		P/Ciffréo	7.2	1/23/93	1.7	5618	723
1992t	=	#	P/Swift-Tuttle	135	12/12/92	0.96	5620	909
1992u	=		P/Väisälä 1	10.8	4/29/93	1.8	5623	923
1992v	=		P/Gehrels 3	8.1	7/25/93	3.4	5624	808

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Corrigenda to *ICQ* 76 (October 1990 issue): Comet Austin 1989c_1, observer CAM03, 1990 May 24.68, the magnification for the naked-eye estimate on page 137 *should read* 1 (*not* 21); May 27.80, page 138, the instrument given as a 5.0-cm R was actually 10×50 binoculars.