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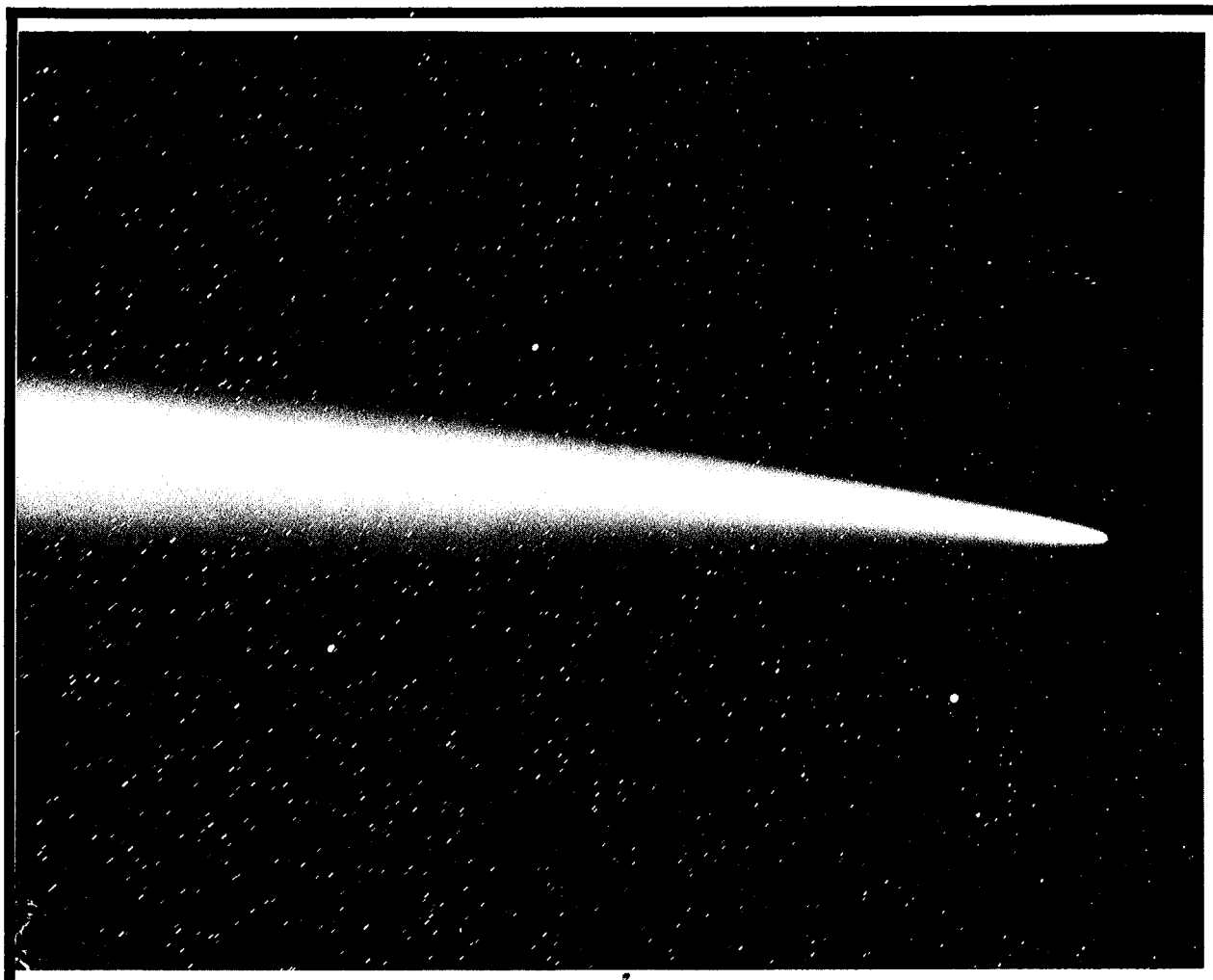

Photograph of comet Ikeya-Seki *1965 VIII* taken on 1965 Nov. 1.53 UT (11-min exposure) with a $5\frac{1}{2}$-inch-aperture $f/5$ Zeiss aerial lens (with a panchromatic plate, 3800–6300 Å) by Alan McClure from Mt. Piños, California.

INSIDE THIS ISSUE

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Manuscripts will be reviewed for possible publication (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* should be sent on standard *ICQ* observation report forms. Those who can send manuscripts and observational data in machine-readable form are encouraged to do so (especially via floppy disks, or through mail via the computer networks *BITNET* or *SPAN* to GREEN at node CFA1), and should contact the Editor for further information.

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RECENT NEWS AND RESEARCH CONCERNING COMETS

New Discoveries and Recoveries

A strange flurry of comet discoveries and recoveries in the first 5 weeks of 1987 produced comet 1987*g* by the first week of February. If this rate of assigning provisional letter designations continued the rest of the year, we could have comet 1987*z* by mid-May. It has never yet happened that 26 comets have been assigned provisional letter designations in one year, but if it does, subscripts would be used (*e.g.*, comets 1987*y*, 1987*z*, 1987a_1, 1987b_1, *etc.*).

In January alone, three comets were discovered by amateur astronomers: comets Levy 1987*a*, Nishikawa-Takamizawa-Tago 1987*c*, and Terasako 1987*d*. Together with comets 1986*n* and 1986*o*, this totalled 5 comets discovered by amateurs in 3 months, quite a bit above the normal amateur discovery rate during the past decade; only 4 comets were discovered by amateurs in the previous 2 years. Comet 1987*a*, mentioned in this column for the October 1986 issue, was rather poorly observed by both visual and astrometric astronomers, but orbital elements show that the comet passed perihelion (q = 0.92 AU) on 1986 Dec. 17.5 and that it travels in a slightly retrograde long-period orbit (*cf. MPC* 11738). On Feb. 1.5, Tom Gehrels and Jim Scotti (Kitt Peak) found comet Levy as having an asymmetric 3′ coma with a nucleus off-centered in p.a. 115° and with a 40″ tail toward p.a. 295°. This comet should be observable into mid-year.

Massachusetts Institute of Technology student Jennifer Wiseman, working temporarily at Lowell Observatory, found a new comet on plates exposed at the Anderson Mesa Station on Dec. 28 by Brian Skiff. Wiseman found the object, diffuse with strong condensation, very soon after she began looking over plates for interesting objects. This comet, 1987*b* (not 1986*r*, because observations on a second night were sought before announcement of the discovery was made) was found to have an orbital period of 6.5 years and is now known as P/Wiseman-Skiff. Comet 1987*b* was at $m_1 \sim 14$ at discovery when it was near opposition, and is now receding rapidly from the sun following perihelion (q = 1.5 AU) on 1986 Nov. 22. The comet was reported by T. Seki (Geisei, Japan, 60-cm reflector) as having a 1′ coma ($m_1 \sim 15$) on a photograph taken Jan. 20.63. (Cont. on page 92)

THE LIFETIMES OF COMETS. II. THEIR DISAPPEARANCE

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The limited lifetimes of short-period comets can be most reliably documented by the disappearance of some of them. It must be kept in mind, however, that the failure of recovery does not always imply a real disappearance. Short-period comets are most likely to be discovered under exceptionally favorable observing circumstances, passing perihelion not far from the opposition point (Kresák 1982). Unless the observed orbital arc is long enough, good predictions for the future returns are impossible, and it may require many revolutions for the repetition of a favorable configuration which might lead to another independent rediscovery. Also, planetary perturbations can move the perihelion farther from the sun, making the apparent brightness of the comet substantially lower, and thus making the comet more difficult to rediscover.

Table I lists 13 short-period comets discovered since 1840 (about the time at which reliable and coherent comet observations begin) which have been lost for more than five revolutions. It gives the definitive designation of the comet, including the year of the last observed perihelion passage *(L)*, the number of observed perihelion passages *(N)*, the number of revolutions between the first and last apparition — or, for one-apparition comets, the fraction of the revolution period covered by observations, in brackets — *(O)*, and the number of perihelion passages missed since the last apparition *(M)*. Of the comets in this list, there may be as few as two or three — P/Biela, P/Brorsen, and possibly P/Neujmin 2 — which really no longer exist. A problematical case is P/Tempel-Swift, because its perihelion distance has increased from 1.06 to 1.58 AU since its discovery, which has made a chance rediscovery almost impossible, and could explain the unsuccessful ephemeris-aided searches. All the other nine comets should be simply regarded as lost because of the inaccuracy of the predictions. Only in three cases — P/Barnard 1, P/Giacobini, and P/Swift — might extensive searches along the variation line still be of some help for finding the object. For more detailed information, see Kresák (1981).

Table II lists another 13 cases of short-period comets which were at one time considered "lost", but have been found again; here, column 2 *(L)* gives the definitive designation of the comet at its apparition immediately preceding its "lost" status, and column 3 *(R)* gives the same at the rediscovery apparition. Column 4 *(N)* gives the number of observed apparitions prior to the beginning of a comet's "lost" status, and column 5 *(M)* lists the number of missed returns until the rediscovery indicated under *R*.

Shortly after the modern computing techniques had become available, Marsden (1963) examined the orbits of seven long-lost comets of more than one apparition: P/Biela, P/Brorsen, P/Tempel-Swift, P/Neujmin 2, P/Tempel 1, P/de Vico-Swift, and P/Holmes. The result was the recovery of the latter three comets at the very next return. Based on the computations by Belyaev and Emel'yanenko (1975), one of the split components of the long-lost, one-apparition comet P/Taylor was found again in 1976. In another case, that of P/Schwassmann-Wachmann 3, the deviation from Marsden's ephemeris was too large, and the comet was rediscovered by Johnston and Buhagiar (1979) as an initially unidentified object. This was also the case with all of the remaining comets in *Table II* for which no predictions were available due to the uncertainty of the original orbit.

Table I

	Comet	L	N	O	M	status
1	P/Biela	1852 III	6	12	20	extinct
2	P/Brorsen	1879 I	5	6	19	extinct
3	P/Barnard 1	1884 II	1	(0.064)	18	recoverable ?
4	P/Brooks 1	1886 IV	1	(0.021)	15	lost
5	P/Barnard 3	1892 V	1	(0.024)	14	lost
6	P/Spitaler	1890 VII	1	(0.034)	13	lost
7	P/Giacobini	1896 V	1	(0.051)	13	recoverable ?
8	P/Swift	1895 II	1	(0.065)	12	recoverable ?
9	P/Tempel-Swift	1908 II	4	7	12	q increased
10	P/Denning	1894 I	1	(0.026)	11	lost
11	P/Metcalf	1906 VI	1	(0.022)	10	lost
12	P/Schorr	1918 III	1	(0.016)	10	lost
13	P/Neujmin 2	1927 I	2	2	10	extinct ?

Table II

	Comet	L	R	N	M	prediction/deviation
1	P/Peters-Hartley	1846 VI	1982 III	1	16	no
2	P/Tempel 1	1879 III	1966 VII	3	13	yes/0.3°
3	P/Denning-Fujikawa	1881 V	1978 XIX	1	10	no
4	P/De Vico-Swift	1894 IV	1965 VII	2	10	yes/6.6°
5	P/De Vico-Swift	1844 I	1894 IV	1	8	no
6	P/Tuttle-Giacobini-Kresák	1858 III	1907 III	1	8	no
7	P/Swift-Gehrels	1889 VI	1972 VII	1	8	no
8	P/Taylor	1916 I	1977 II	1	8	yes/1.1°
9	P/Schwassmann-Wachmann 3	1930 VI	1979 VII	1	8	yes/23.0°
10	P/Tuttle-Giacobini-Kresák	1907 III	1951 IV	2	7	no
11	P/Holmes	1906 III	1964 X	3	7	yes/0.2°
12	P/Perrine-Mrkos	1909 III	1955 VII	2	6	no
13	P/Du Toit-Hartley	1945 II	1982 II	1	6	no

By comparing *Tables I* and *II*, one can see that most of the losses come from the end of the 19^{th} century and the very beginning of the 20^{th} century. At that time, the systematic comet hunters were very active, but the use of astronomical photography for recording comets at greater solar distances, and measuring their accurate positions, was just in its beginning. It is also instructive that *Table I* would have included 19 lost comets in 1950 and 18 in 1970, as compared with the present number of 13. At the same time, the number of rediscoveries and recoveries of "lost" periodic comets given in *Table II* has increased from 2 before 1950, to 7 before 1970, to 13 at present. This trend suggests that some of the comets in *Table I* may be rediscovered in the not-too-distant future.

Table I does not include P/Westphal, with a revolution period of 62 years, which apparently ceased to exist as an active object in 1913. Although it has been lost for only one return, the observations very strongly suggest its death. After a very steep brightness decrease and disappearance of the nuclear condensation, the comet vanished completely several days before reaching perihelion.

Similar cases, necessarily lacking in confirmation from a later return, can also be found among the long-period comets. The analysis of the observational records, orbital data, and observing geometry of all long-period comets discovered since 1840 (Kresák 1984) allowed us to identify nine comets whose disappearance was very probably due to a complete extinction. These comets were conspicuous by a lack of central condensation and by rapid fading of several magnitudes before the last observation, with five cases occurring prior to perihelion passage. More about the behavior of some of these comets may be found in a paper by Sekanina (1984).

Table III summarizes all of the presumably extinct comets, irrespectively of their orbital periods (P). In addition to the definitive designations (L), the dynamical types (LP = long-period, SP = short-period) and perihelion distances, q, of the individual comets are listed. Unfortunately, very short observed orbital arcs do not allow in many cases to discriminate between new and old long-period comets in Oort's sense.

A prevalence of small perihelion distances is apparent. While 90% of the long-period comets and 50% of the short-period comets listed in *Table III* have $q < 1$ AU, the proportion of such orbits among the other, surviving comets is only 50% and 15%, respectively. This selection is quite understandable because the nearer the comet comes to the sun, the more rapidly the aging process must proceed. Weissman (1980) sets the aging rate proportional to $q^{-0.7}$, while a simplifying assumption of a direct dependence upon the integrated insolation would imply $\propto q^{-0.5}$. The difference between the two exponents is of little significance, in view of the current precision of the estimated lifetimes based on a very small sample of extinct objects.

A comparison of the number of extinct comets with those remaining active leads to the following lifetime estimates. New comets, with $P > 10^6$ years, would often survive only one perihelion passage near the sun, as demonstrated by the excess in their number. For the old long-period comets ($200 < P < 10^6$ years), the lifetime expectation, defined by the average of the reciprocal values, is $\sim 20q^{1/2}$ revolutions. For short-period comets of the P/Halley-type ($20 < P < 200$ years), it is perhaps $100q^{1/2}$ revolutions. For short-period comets of the Jupiter family ($P < 20$ years), it is about $300q^{1/2}$ revolutions, or a few thousand years. This figure is in excellent agreement with the theoretical expectation of the sublimation rate of an icy nucleus with a radius of 1 km, according to Dobrovol'skij (1972), and it is about one-half of that required by Fernández (1985) for a steady-state comet population.

Table III

	Comet	L	Dynamical type	q
1	P/Biela	1852 III	SP, Jupiter family	0.86
2	Tempel	1859	LP, new ?	0.20
3	P/Brorsen	1879 I	SP, Jupiter family	0.59
4	Perrine	1897 III	LP, new ?	1.36
5	Giacobini	1903 I	LP, old	0.41
6	P/Westphal	1913 VI	SP, Halley type	1.25
7	Ensor	1926 III	LP, new ?	0.32
8	P/Neujmin 2	1927 I	SP, Jupiter family	1.34
9	Du Toit	1945 VII	LP, Kreutz group	0.01
10	Pajdušáková	1954 II	LP, old ?	0.07
11	Kresák-Peltier	1954 XII	LP, new	0.75
12	Latyshev - Wild - Burnham	1957 IX	LP	0.54
13	Bennett	1974 XV	LP	0.86

The much shorter lifetimes of long-period comets are not generally accepted. Based on the distribution of orbital energies, Fernández (1981) suggests typical lifetimes of 200 to 500 revolutions — about the same as found by Kresák (1981) for short-period comets. Weissman (1980), based on thermal modelling experiments, finds typical lifetimes of ~ 1000 revolutions against sublimation, and attributes the disappearance of comets mainly to surface crusting and random disruption. Since a much longer time is needed for a strong perturbation by Jupiter to eject short-period comets into long-period orbits, or even outside the solar system altogether, almost all of these comets remain within the planetary region until their death.

There is apparently a very broad range of survivial times even among objects of the same dynamical type, depending on their original size, structure, and past evolution. But, in general, the longer and more complicated evolution that a comet has already experienced, the better is our expectation for its future. Three effects may contribute to this paradox. One is a different original tensile strength, which can have made the objects in the inner Oort cloud (as a main source of short-period comets) much more resistant to disintegration than the new comets from the outer Oort cloud. Another effect is a progressive removal of the small and less-resistant objects. Only exceptional long-period comets would be able to survive the whole evolution required for the transition into a short-period orbit. And finally, during a sequence of captures, with the perihelion wandering from one planet to the next inner planet, and approaching the sun in steps spaced by many revolutions, a partially insulating crust may form on the comet's surface. This would effectively reduce its activity and brightness, and make possible an ultimate change into an asteroid-like object (Kresák 1979, 1985; Rickman 1985).

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PERIODIC COMETS FOR THE VISUAL OBSERVER IN 1987

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Comet enthusiasts are likely to find 1987 a fairly busy year, with the chief attraction being the appearance of the newly-discovered comet Wilson 1986*l*, which may reach naked-eye visibility for suitably-placed observers. For those with fairly large telescopes, a large number of short-period comets making their perihelion passage during 1987 will keep things busy throughout most of the year. The majority of these objects will remain quite faint, however, with no more than two or three expected to become much brighter than magnitude 12. This article discusses only the short-period comets for 1987. Information on the long-period comets can be obtained from the *ICQ 1987 Comet Handbook*, from the regular *ICQ* column entitled "Recent News and Research Concerning Comets", and from the *IAU Circulars*. The *Comet Handbook* contains ephemerides for all of the comets discussed below.

Attention is called to several faint comets returning in 1987 which have never been observed visually. Several of these are noted in a forthcoming paper (Hale 1987), and experienced observers with telescopes of moderate- to large-aperture are encouraged to attempt observations of these objects, in the hopes of refining the database of cometary absolute magnitudes and to increase the relatively small number of m_1 data in the *ICQ* archive for $m_1 > 12$.

P/Halley 1982i

After becoming as bright as magnitude 2–2.5 during February-April 1986, this famous comet disappeared into the solar glare about four months later. Brightness estimates obtained as the comet was vanishing indicated a magnitude of $\sim$ 9–10, $\sim$ 1.5 mag brighter than the original predictions for this period. This trend has apparently been maintained up through conjunction, for the brightness estimates obtained when the comet reappeared in the morning sky at the end of October 1986 indicated a magnitude of $\sim$ 11.5.

Subsequent observations indicated that the comet faded by only a half-magnitude by the beginning of 1987, and was still $\sim 13^{th}$ magnitude when it passed opposition in early March. Fading should be more rapid after this, and the comet should not be any brighter than mag $\sim$ 14–15 when it disappears in the sun's rays in July. It will presumably be even fainter when it reappears in October.

The above predicted magnitudes should be taken with considerable reservation, as the comet's diffuse nature and low surface brightness could make the comet invisible in small instruments rather rapidly. Any observations now will be quite difficult. The heliocentric distance at opposition in March was 5.1 AU, an unusually large distance for a comet to be visually observed, and quite close to the distance it was first visually seen prior to perihelion (O'Meara 1985).

P/Encke

This comet (orbital period, P, of 3.3 years) passes perihelion on July 17.4. Unfortunately for northern hemisphere observers, this is an extremely poor apparition, with the pre-perihelion elongation never exceeding 16°. There is a possibility that it may be observed from the northern hemisphere in late July, when it will be some 25° from the sun in the evening sky and still fairly bright (magnitude 7). Southern hemisphere observers will have the comet fairly conveniently placed from late July on, with the magnitude during August probably being close to 9.

P/Borrelly

For most observers, this comet ($P = 6.9$ yr) will probably be the best periodic comet of 1987. Perihelion passage ($q = 1.36$ AU) occurs on December 18.3, at which time the comet will also be near opposition (at a geocentric distance, Δ, of 0.48 AU). If the comet behaves in brightness as it did at the well-observed 1981 return (Bortle 1981), the magnitude at this time may be 7.5 or brighter. It could become observable as a 12^{th}-magnitude object as early as July or August, and remain observable until about April or May 1988.

P/Grigg-Skjellerup 1986m

This intrinsically faint comet ($P = 5.1$ yr) comes to perihelion on June 18.0, at $q = 0.99$ AU. The 1987 return is less favorable than the 1977 and 1982 returns, but the comet should nevertheless be accessible in the evening sky during June and July as a 12^{th}-magnitude object. The comet was recovered on 1986 August 12 by K. Birkle at the Max-Planck-Institut für Astronomie, as an extremely faint object of mag 22. During recent returns this comet has exhibited a remarkably assymmetric light curve around perihelion (Bortle 1977; Morris 1983). Despite the comet's faintness, careful observation in 1987 is called for. This comet is being considered for a flyby mission by *Giotto*, one of the spacecraft that went close to P/Halley last year.

P/Klemola 1987i

Perihelion passage for this comet ($P = 11.0$ yr) occurs on July 22.6, at $q = 1.77$ AU. The observing circumstances for this return are quite similar to those at the comet's last return in 1976, when it reached a maximum brightness of magnitude 12. A similar performance can be expected in 1987, with peak brightness probably occurring during late August.

P/Denning-Fujikawa

After its initial discovery by W. F. Denning in October 1881, this comet was lost until its rediscovery by S. Fujikawa in October 1978. The 1987 return will be its first predicted return; perihelion, at $q = 0.76$ AU, is expected about August 3.9. The comet will remain in the morning sky throughout the apparition; before perihelion, it will be better placed as seen from the southern hemisphere, while northern hemisphere observers will be favored after perihelion.

The maximum brightness P/Denning-Fujikawa will attain in 1987 is difficult to predict. The 1978 observations appeared to indicate an extremely faint intrinsic brightness, and also suggested an intrinsic fading of some 4 magnitudes since 1881. The brightness estimates in 1978 suggest that the comet will achieve a peak brightness of 12^{th} magnitude in 1987, but it is entirely possible that it may be 1 or 2 mag brighter or fainter. Prospective observers should also note that in 1978 the comet apparently began to fade fairly rapidly within a few days after Fujikawa's discovery, which occurred a week after perihelion.

P/Comas Solá 1986j

The observing circumstances of this comet's ($P = 8.8$ yr) 1987 return are roughly similar to those at the comet's 1969 and 1978 returns, with perihelion ($q = 1.83$ AU) occurring on August 18.7. As seen from the northern hemisphere, the comet will appear in the morning sky sometime in September, and remain visible through the end of the year. The magnitude is not expected to get above 13, and this will fade to about 13.5 by the beginning of 1988. The comet was recovered on 1986 July 30 by T. Gehrels and J. V. Scotti, using the 91-cm SPACEWATCH telescope on Kitt Peak.

P/Schwassmann-Wachmann 2 1986h

The 1987 return of this comet ($P = 6.4$ yr) is not a very favorable one, but photographic magnitudes of ~ 13 have been reported at similar returns in the past. The comet seems to be perhaps a magnitude brighter at this return. Solar conjunction will occur in July, and when the comet reappears in the morning sky in late September it may have brightened to near magnitude 13.0. As the comet approaches opposition and its geocentric distance decreases, it may continue to brighten somewhat, reaching a maximum magnitude of ~ 12.5 in early 1988. Perihelion occurs on August 30.5, at $q = 2.07$ AU.

P/Brooks 2 1987m

This famous comet ($P = 6.9$ yrs) is predicted to pass perihelion about October 16.5, at $q = 1.84$ AU. The comet has apparently not been visually observed for several returns, but observing conditions at the 1987 return are extremely favorable, with opposition occurring almost simultaneously with perihelion. During the very similar return in 1932 the brightest estimates were near magnitude 11; consequently, a similar brightness might be expected in 1987.

P/Schwassmann-Wachmann 1

This annual comet spends almost all of 1987 in the western half of the zodiacal constellation Capricornus, passing opposition in late July. It will reach its stationary point in late September, and around that time will spend nearly a month within 1^o of the globular cluster M75.

For the most part, the inactivity of the past several years has continued. However, during early April 1986, Merlin and de Assis Neto (1986) reported it to be at $m_1 = 12.0$. Other observers, including myself, failed to detect any brightening at that time, so whether or not there was an outburst then remains an unresolved issue. Except for this possible outburst, none have been reported since the early 1980s.

The following five comets have, to the author's knowledge, never been observed visually; in fact, no such observations have apparently even been attempted. Consequently, any brightness predictions are extremely uncertain. As a starting point for such predictions, a technique described in a forthcoming paper (Hale 1987), whereby an absolute magnitude of 11.5 and a heliocentric brightening by an inverse-fourth-power law (the "11.5 rule") is assumed, was used. These five comets are noted in that paper as worthwhile candidates for observation; attempts for these objects are encouraged.

P/Howell 1987h

This comet ($P = 5.9$ yr) is predicted to pass perihelion on April 14.8 at $q = 1.61$ AU. The observing circumstances are very similar to those at the discovery return in 1981, when it was not discovered until almost four months after perihelion. The comet is in fact accessible for several months prior to T this time. While my "11.5 rule" predicts a maximum magnitude of only 14.8 (occurring from late April to late July), it is worthwhile to note that the initial 1981 estimates (all photographic) were fairly similar to those suggested by the "rule". Many comets that long past perihelion have become quite diffuse objects, and will often be much brighter visually than photographically.

P/Russell 2

Perihelion passage for this comet ($P = 7.1$ yr) is predicted to occur on July 1.7, at $q = 2.15$ AU. The observing circumstances are very favorable, with opposition occurring at about the same time. Due to the large perihelion distance, my "11.5 rule" predicts a maximum magnitude of only 15.2. Because the comet will maintain a fairly high southern declination ($\sim -40^o$) throughout its perihelion passage and opposition, southern hemisphere observers will be more favored in their observation attempts.

The photographic estimates given at the comet's discovery in 1980 were similar to those predicted by my "11.5 rule". As was the case with P/Howell in 1981, P/Russell 2 was not discovered until several months past perihelion, hence the same remarks apply.

P/Reinmuth 2 1987l

This comet ($P = 6.7$ yr) passes perihelion on October 25.7, at $q = 1.94$ AU. Opposition will occur in late July, when the geocentric distance will be slightly over 1.0 AU. The "11.5 rule" predicts a maximum magnitude of 14.7 occurring at this time. The 1987 return is somewhat similar to the 1947 (discovery) and 1967 returns, when maximum photographic magnitudes of 12.5 and 13, respectively, were reported. Taking these estimates at face value, a maximum magnitude between 13.0 and 13.5 might be expected in 1987.

P/Kohoutek 1986k

Perihelion passage of this comet ($P = 6.6$ yrs) occurs on October 29.8, at $q = 1.78$ AU. The comet will subsequently pass opposition at the end of January 1988. My "11.5 rule" predicts a maximum magnitude of 14.1 occurring at the end of 1987 and beginning of 1988. P/Kohoutek was recovered by Gehrels and Scotti at Kitt Peak on 1986 July 30. Interestingly, the photographic magnitude they gave at that time (19.5) is very similar to that predicted by the "11.5 rule". The magnitude given at the time of the comet's discovery in 1975 (which occurred three weeks after perihelion) was also approximately equal to what the "rule" would predict.

P/Harrington 1987m

This comet ($P = 6.8$ yr), initially discovered in 1953 during the course of the Palomar Sky Survey, is predicted to pass perihelion on October 31.9, at $q = 1.60$ AU. Opposition will occur in mid-July, and "perigee" ($\Delta = 0.83$ AU) a month later. My "11.5 rule" predicts a maximum magnitude of 13.5 occurring during August and September. The photographic estimates made in 1953 were $\sim$ 2 mag fainter than that predicted by the "11.5 rule". Vsekhsvyatskii (1964), in his landmark study of cometary brightnesses, described it as one of the (intrinsically) faintest comets known.

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The 1987 American Workshop on Cometary Astronomy

Charles S. Morris
International Comet Quarterly

The 1987 American Workshop on Cometary Astronomy was held on February 21-22, 1987 at the Jet Propulsion Laboratory (JPL) in Pasadena, California. A total of 45 people attended the fourth workshop in this series. The earlier ones were held in 1982 (Cambridge, MA), 1983 (JPL), and 1985 (Tucson, AZ). Not surprisingly, the focus of this workshop was the current apparition of periodic comet Halley.

The program began with a retrospective by Arnie Richards, Polaris Observatory Association, who showed his remarkable series of photographs taken of P/Halley in California and Australia. This camera's view of the comet was followed by the author's discussion of the comet's changing visual appearance. Amateur contributions to the International Halley Watch (IHW) were summarized by Stephen Edberg, JPL. In addition, Edberg outlined the importance of amateur observations of periodic comet Tempel 2, target comet for NASA's proposed *Comet Rendezvous/Asteroid Flyby Mission (CRAF)*. Visual observations of intrinsically "faint" periodic comets was the topic discussed by Alan Hale, New Mexico State University. Hale pointed out that many of these objects can be seen visually even though the photographic magnitudes obtained at previous apparitions suggest that they are too faint. Gene Lucas provided insight into doing live television broadcasts of comet Halley for a local television station.

Every meeting should have an awards ceremony and Donald Yeomans, JPL, provided the audience with an amusing set of "Dubious Achievement Awards" for research on comet Halley and comets in general. All were posthumously awarded.

The results from the spacecraft encounters were summarized by Martha Hanner, JPL. These included some remarkable processed images of P/Halley's nucleus from *Giotto*. NASA's proposed *CRAF* mission was outlined by Sylvia Miller, JPL. She described why P/Tempel 2 was the best choice for a comet rendezvous mission (assuming a launch in 1993).

The current observation program of comets by the Spacewatch Camera was reviewed by Jim Scotti, Lunar and Planetary Laboratory. David Levy, IHW, described his efforts to get asteroid *1931 AN* (a photograph of which clearly shows a coma and tail) renamed comet Tombaugh. Clyde Tombaugh, the discoverer of Pluto, also discovered this comet on an old plate; it was originally reported as an asteroid.

Evening speakers included Ilan Manulis from Israel, who reviewed the astrometry program for comet Halley in Israel, and Mike Morrow, American Meteor Society, who discussed observing meteors by radio. Sunday's program included a show-and-tell session which included many excellent photographs of P/Halley followed by a panel discussion.

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CORRIGENDA

• In the January 1987 issue (= *1987 Comet Handbook*), pages 3 and 6, the provisional-letter designation for comet Bowell *1982 I* = 1980*b* was inadvertently given as "1982*i*".

• In the October 1986 issue, p. 151 ("Book Review: *Protostars & Planets II*"), paragraph 2, the volume of the prolate spheroid should read $\sim 7.8 \times 10^{17}$ cm^3, yielding a mass of $\sim 7.8 \times 10^{17}$ g for P/Halley, and a mass for a spherical 5-km-diameter nucleus of $\sim 6.5 \times 10^{16}$ g, leading to $\sim 1 \times 10^{29}$ g for the Oort cloud ($\sim 0.00005\ M_\odot$ or $\sim 18\ M_\oplus$. Recent work by several researchers suggests that there may exist an inner cloud of comets well inside 40 000 AU that contains many more comets than the outer (40 000 – 100 000 AU) Oort cloud of comets.

TABULATION OF COMET OBSERVATIONS

We still have a backlog of observations, particularly in the way of descriptive information, which we will publish on a steady basis in future issues. Readers are again reminded that full explanations to the tabulated observations (including the headings to the published data, as well as the keys to all of the letter abbreviations in the data) are available in printed copy from the Editor (address on second page of this issue) for US$4.00 postpaid. As we've been doing for the past year, the following descriptive data, which complements the tabulated data by providing information which cannot be so easily listed in tables, is listed chronologically and by individual comet, with abbreviations for instrument type and observer being the same as for the tabulated data. *All* times in the *ICQ* are in Universal Time (unless otherwise noted).

Corrigendum. In *ICQ* No. 55, the P/Arend-Rigaux observations by Andrew Pearce (PEA) listed as being made on 1984 Nov. 2 and 3 *should read* 1984 Dec. 2 and 3. — D.W.E.G.

◇ *P/Halley* (1982*i*): 1986 Mar. 14.51: in 20×80 B, tails 0.67° and 1.25° in p.a. 330° and 270°; to naked eye, 6° tail in p.a. 315° [MOR]. Mar. 17.53: to naked eye, tail lengths 6.5° and 14° in p.a. 330° and 275°, respectively [MOR]. Mar. 18.52: to naked eye, tail 9° long in p.a. 325°; in 10×50 B, 2° tail in p.a. 295° [MOR]. Mar. 19.52: to naked eye, 7° tail in p.a. 330° [MOR]. Mar. 20.52: to naked eye, tail lengths 5°, 5°, 9°, 9°, and 10° in p.a. 0°, 325°, 285°, 310°, and 303° [MOR]. Mar. 22.50: to naked eye, tail 6° in p.a. 330° [MOR]. Mar. 25.52: in 10×50 B, 2° tail in p.a. 305° [MOR]. Mar. 25.62: tail 2.5° long [LOV]. Mar. 30.67: in 15×80 B, coma dia. 15′ [LOV]. Mar. 31.77: in 15×80 B, coma dia. 30′, DC = 7 [LOV].

Apr. 1.53: in 10×50 B, 0.17° tail in p.a. 15° [MOR]. Apr. 1.56: in 15×80 B, coma dia. 30′, DC = 7 [LOV]. Apr. 3.52: to naked eye, 8° tail in p.a. 288°; in 10×50 B, 0.17° and 4° tails in p.a. 0° and 288° [MOR]. Apr. 4.56: to naked eye, 3.5° tail in p.a. 305° [MOR]. Apr. 5.57: in 10×50 B, tails 1.25° and 3° in p.a. 45° and 310° [MOR]. Apr. 7.04: 2.5° dust tail and 2.0° gas tail [LOO01]. Apr. 7.62: in 10×50 B, tail 0.75° long in p.a. 43° [MOR]. Apr. 8.52: in 10×50 B, tails 1.25° and 2.5° in p.a. 70° and 5° [MOR]. Apr. 9.11: broad tail, brightest at p.a. ~ 330° [KAM01]. Apr. 9.48: to naked eye, tail 6° long in p.a. 350° [MOR]. Apr. 10.46: in 15×80 B, coma dia. 40′, DC = 7 [LOV]. Apr. 11.58: in 15×80 B, tail length 5° [LOV]. Apr. 12.52: in 10×50 B, DC = 4–5, tails 4.5°, 5.5°, 7.5°, and 7.5° in p.a. 20°, 30°, 72°, and 320°; to naked eye, tails 9°, 9°, and 13° in p.a. 30°, 72°, and 320° [MOR]. Apr. 12.58: in 15×80 B, coma dia. 40′, DC = 7 [LOV]. Apr. 13.46: to naked eye, tail length 2.0° at p.a. 30°, with broad tail (90° wide) spanning p.a. 350°–80° (correction to *ICQ* 58 and 59) [KEE]. Apr. 13.61: in 10×50 B, tails 3.75° and 6.5° in p.a. 30° and 90° [MOR]. Apr. 14.53: in 10×50 B, tails 3°, 3.67°, and 3.75° in p.a. 85°, 355°, and 45°; to naked eye, tail 6.5° in p.a. 80° [MOR]. Apr. 15.52: to naked eye, tail length 11.5° in p.a. 55° and 65°; in 10×50 B, tails 2.67° and 4.75° in p.a. 95° and 18° [MOR]. Apr. 15.73: in 15×80 B, coma dia. 25′ [LOV]. Apr. 18.58: in 10×50 B, tail 11.5° in p.a. 95°; to naked eye, 11.5° tail in p.a. 95° [MOR]. Apr. 19.46: to naked eye, tail 10° long [LOV]. Apr. 28.22: in 10×50 B, 13° tail in p.a. 108°; to naked eye, tail lengths 15° and 16° in p.a. 105° and 100° [MOR]. Apr. 28.41: in 15×80 B, coma dia. 20′ [LOV]. Apr. 29.22: to naked eye, tails 15° and 30° in p.a. 105° and 90° [MOR]. Apr. 30.22: in 10×50 B, tail 18° in p.a. 100° [MOR].

May 25.89: in 3-inch L, "starlike central condensation of mag ~ 10 glimpsed" [KAM01]. June 6.20: in 20×80 B, tail 0.42° in p.a. 138° [MOR]. June 7.22: in 20×80 B, tail 0.58° long in p.a. 147°; in 25.6-cm *f*/4 L (45×), 0.58° tail in p.a. 150° [MOR]. June 8.20: in 20×80 B, tail 0.33° in p.a. 129°; in 25.6-cm *f*/4 L (45×), tails 0.33° and 0.58° in p.a. 129° and 156° [MOR]. June 9.21: in 10×50 B, tail 0.67° long in p.a. 133°; in 20×80 B, tails 0.67° and 1.25° in p.a. 133° and 103°; in 25.6-cm *f*/4 L (45×), tail 0.17° in p.a. 280° [MOR]. June 10.21: in 10×50 B, tails 0.5° and 2.0° in p.a. 135° and 105°; in 25.6-cm *f*/4 L (45×), tail 0.07° in p.a. 290° [MOR]. June 11.20: in 10×50 B, tail 0.5° in p.a. 160° [MOR]. June 12.19: in 20×80 B, 0.5° tail in p.a. 140° [MOR]. Aug. 9.47: comet seen with 25-cm *f*/5 L (62×) in bright twilight, coma dia. 2.5′, DC = 1 [CLA].

Oct. 29.53: "comet quite low and Moon was nearby" [MOR]. Nov. 4.73 and Dec. 30.62: observations "very marginal" [SEA]. Nov. 7.54: "stellar condensation ($m_2 \simeq 14.0$) was suspected" [MOR]. Nov. 28.52: "faint condensation suspected" [MOR]. Nov. 28.68 and Dec. 4.67: the magnitude estimates were made using the stars marked "12.9" and "12.3" on the V Hydrae *d* chart, but "these values appear to be about 1 mag too faint" [SEA]. Dec. 29.53: "faint condensation ($m_2 \simeq 15.0$) was suspected" [MOR].

1987 Jan. 26.40 and Feb. 1.34: "comet near star" [MOR]. Feb. 6.50: "comet much more obvious" [MOR]. Mar. 18.18: "there was a non-stellar knot of material in the center of the coma" [MOR].

◇ *Comet Hartley-Good* 1985 *XVII*: 1986 Jan. 19.55: 3′ tail toward west suspected [MOR].

◇ *P/Schwassmann-Wachmann 2* 1986*h*: 1987 Jan. 31.84: "strong condensation, nearly stellar" [MER].

◇ *Churyumov-Solodovnikov* 1986*i*: 1986 Aug. 4, 6, and 8: "comet elongated" [MAC].

◇ *Nishikawa-Takamizawa-Tago* 1987*c*: 1987 Jan. 29.77: with Lumicon C_2 Swan-band filter, coma dia. 10.4′ and DC = 5 [LIN02]. Feb. 1.15: "significant enhancement with LUMICON comet filter" [MOR].

◇ *Terasako* 1987*d*: 1987 Jan. 28.46: in 15-cm *f*/8 L (64×), coma dia. 1.8′, DC = 3 [TRE]. Jan. 29.48: in 15-cm *f*/8 L (64×), coma dia. 2.7′, DC = 3 [TRE]. Jan. 30.76: "strong cond." of dia. ≃ 3′ [MER]. Jan. 31.45: "in 15-cm *f*/8 L (100×), coma dia. 3′, DC = 6 [WIL02]. Feb. 1.11: "dust fan extended from sunward tail through south to main tail; main tail more obvious in 20×80 B; sunward tail more obvious in 25.6-cm L" [MOR]. Feb. 2.12: "poorer conditions than previous night; main tail not seen in 25.6-cm L; dust fan only between p.a. 175°–220°; sunward tail not seen in 20×80 B" [MOR].

◇ *P/Lovas 2* 1986*p*: 1986 Dec. 3.11: "probable, but not certain, sighting" [KEE].

◇ *Wilson* 1986*l*: 1986 Aug. 9.43: "comet was stellar at low magnification" [MOR]. Aug. 29.90: in 30-cm *f*/5 L (124×), jet 0.4′ long in p.a. 358° [MER]. Sept. 2.88: in 40-cm *f*/5 L (254×), jet 0.5′ long in p.a. 18° [MER]. Sept. 6.43: "at 190×, possible stellar nucleus of mag ~ 13" [SEA]. Sept. 7.83: in 40-cm *f*/5 L (170×), jet 0.5′ long in p.a. 111° [MER].

Oct. 3.76: in 48.5-cm L, "spike-like tail" [MOE]. Oct. 3.93 and Oct. 4.86: elliptical coma [MOE]. Oct. 4.14: "fan shaped tail" [MOR]. Oct. 23.44: "probable larger outer coma" [SEA]. Oct. 25.42: "broad tail involved with faint stars" [SEA]. Nov. 21.12: "short tail towards the east" [MOR]. Nov. 30.10: "coma had parabolic shape; tail was very faint" [MOR].

1987 Mar. 6.77: in 7×50 B, coma dia. 3′, DC = 5 [GAR01]. Mar. 8.75: "broad tail" [SEA]. Mar. 24.74: in 15-cm L, also 0.12° "narrow" tail in p.a. 240°; other tail was "broad" [GAR01]. Mar. 27.74: in 15-cm *f*/4.6 L (54×), DC = 7, broad 0.25° and narrow 0.25° tails in p.a. 10° and 240° [GAR01].

Apr. 1.72: in 25.4-cm L (114×), "almost parabolic coma and near-stellar condensation" [SEA]. Apr. 3.78: in 15-cm *f*/4.6 L (54×), "narrow" 0.58° tail in p.a. 240°; other tail was "broad" [GAR01]. Apr. 22.60: in 15×80 B, "very broad, short fan" [SEA]. Apr. 24.57: in 15×80 B, also 0.2° tail in p.a. 200° [SEA]. Apr. 27.72: in 15×80 B, "faint cone between p.a. 190°–260°" [SEA]. Apr. 29.42: "broad tail; very faint" [SEA]. May 3.42: in 15×80 B, broad tail ~ 0.25° long in p.a. 200°; other tail was "narrow" [SEA].

◇ *Sorrells* 1986*n*: 1986 Nov. 4.51: "comet had a stellar condensation surrounded by a diffuse coma; coma was slightly extended toward the west" [MOR]. Nov. 5.31: "very faint near-stellar condensation" [KEE]. Nov. 8.88: "elliptical 1′×1.3′ coma" [MOE]. Nov. 22.86: "coma slightly elliptical" [MOE]. Nov. 23.71 and 27.80, and Dec. 3.71 and 18.69: "elliptical coma" [MOE]. Nov. 23.82: "elliptical coma; starlike condensation of mag 11.9" [MOE]. Nov. 24.79: in 25.4-cm *f*/4.5 L (36×), "nearly circular coma with extremely diffuse outer parts and indefinite edges; central cond. with extremely strong, bright, and nearly starlike nuclear region; at 112×, the central cond. had a textured appearance with two disks of sizes 1.5′ and 0.8′ [ZAN]. Nov. 24.81: in 25.4-cm *f*/4.5 L (112×), "broad and diffuse" 0.2° tail in p.a. 85° [ZAN]. Nov. 25.13: "broad tail" [KEE]. Nov. 26.93: "elliptical 1.7′ × 1.4′ coma; starlike condensation of mag 11.5" [MOE]. Nov. 27.91: in 25.4-cm *f*/4.5 L (36×), "central cond. with textured appearance" [ZAN]. Nov. 29.80: "nearly starlike nuclear cond." [ZAN]. Nov. 30.77: "elliptical coma; starlike cond. of mag 11.5" [MOE]. Nov. 30.87: at 100×, 0.067° tail in p.a. 135° [LIN02].

Dec. 3.83: in 40-cm *f*/5 L (81×), 3.5′ tail in p.a. 74° [MER]. Dec. 3.93: "broad, fan-shaped tail" [SCH05]. Dec. 6.77: "starlike nucleus of mag 11.4; elliptical shape" [MOE]. Dec. 6.94: two spikes ~ 2′ long in p.a. 80° and 100° [MOE]. Dec. 7.98: in 20×80 B, "diffuse coma with central cond. and nearly starlike nuclear region"; in 25.4-cm *f*/4.5 L (36×), small central cond. of size 3′ [ZAN]. Dec. 21.80: in 51-cm *f*/4 L (75×), 0.33° tail in p.a. 70° [BOU]. Dec. 22.14: "possible outburst" [MOR]. Dec. 22.75: in 25.4-cm *f*/4.5 L (36×), "small central cond. with prominent, nearly-starlike nuclear region" [ZAN]. Dec. 29.74: "elliptical 2.1′ × 3′ coma [MOE].

1987 Jan. 1.85: in 51-cm *f*/4 L (75×), 0.33° tail in p.a. 62° [BOU].

* * *

Key to observers with observations published in this issue [those with asterisks (*) preceding the 5-character code are new additions to the Observer Key (cf. ICQ 8, 132)]:

AND01		Karl-Gustav Andersson, Sweden
BOR		John E. Bortle, NY, U.S.A.
BOU	11	Reinder J. Bouma, The Netherlands
BRI01	11	H. J. Bril, The Netherlands
BRY02	14	K. Bryant, Australia
BUS01	11	E. P. Bus, The Netherlands
CAM	15	J. da S. Campos, South Africa
*CAR	13	Nicolas Cardiel, Spain
CLA	07	Maurice L. Clark, Australia
COM	05	Georg Comello, The Netherlands
DEA		V. F. de Assis Neto, Brazil
DIX01		Ian Dixon, Australia
FEI	11	H. Feijth, The Netherlands
*FER01	13	Enrique Fernandez, Spain
*GAL	13	Jesus Gallego, Spain
GAR01		Gordon Garradd, N.S.W., Australia
GEE	11	J. J. Geenen, The Netherlands
*GOM	13	Angel Gomez, Spain
GRE		Daniel W. E. Green, U.S.A.
HAS02		Werner Hasubick, West Germany
*HAS03		Hisaya Hasejawa, Japan
HUR	01	Guy M. Hurst, England
*JAC01		Eric A. Jacobson, MN, U.S.A.
JAN	11	D. W. Jannink, The Netherlands
KAM01		Andreas Kammerer, West Germany
KAN	06	Kiyotaka Kanai, Japan
KEE	05	Richard A. Keen, CO, U.S.A.
KEI01		P. C. Keijmel, The Netherlands
*KOR		Stefan Korth, West Germany
KUI	11	G. Kuipers, The Netherlands
LAA		T. A. van der Laan, The Netherlands
*LEV		David Levy, AZ, U.S.A.
LIN02		Juergen Linder, West Germany
LOO01		F. R. van Loo, Belgium
*LOS	13	Rodrigo Losada, Spain
LOV		Terry Lovejoy, Australia
*LOZ	13	Luis Lozano, Spain
MAC		Donald E. Machholz, CA, U.S.A.
MER		Jean-Claude Merlin, France
*MIK		Herman Mikuz, Yugoslavia
MIL02		Giannantonio Milani, Italy
MOE		Michael Moeller, West Germany
MOR		Charles S. Morris, U.S.A.
OKA03	06	Akio Oka, Japan
ROO		M. C. Roos, The Netherlands
SCH04		A. H. Scholten, The Netherlands
SCH05		Patrick Schmeer, West Germany
*SCO01		James. V. Scotti, AZ, U.S.A.
SEA		David A. J. Seargent, Australia
THO		Gregg D. Thompson, Australia
TRE		T. B. Tregaskis, Australia
WAG		Gerold Wagner, West Germany
*WAT01		Nobuo Watanabe, Japan
WEG	11	R. L. W. van der Weg, The Netherlands
WIL02		Peter F. Williams, Australia
WIL03		P. Wils, Belgium
YAS	06	Masanori Yasuki, Japan
ZAN		Mauro Zanotta, Italy
ZAN01		W. T. Zanstra, The Netherlands

Comet Shoemaker 1985 XII

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 04 04.43	M	12.5	AC	31.7	L	7	103	& 1.0	5/			MOR

Comet Hartley-Good 1985 XVII

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 09 13.67	S	11.6	AA	20	T	10	50		4			DIX01
1985 09 14.59	S	11.4	AA	20	T	10	50		4			DIX01
1985 09 15.59	S	10.9	AA	20	T	10	50		4			DIX01
1986 01 19.55	M	8.7	AA	25.6	L	4	45	2.7	3			MOR

Comet Thiele 1985 XIX

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 12 04.20	S	8.3	AA	8.0	B		20	4.5	2			MOR
1986 01 07.12		10.5:		20.0	L	6	61	& 1.0	1/			MOR

Comet Churyumov-Solodovnikov 1986i

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 07 30.25	M	12 :	S	32	L	4	66	1	2			KEE
1986 08 04.38	S	12 :	S	25.4	L	4	64	1	3	?		MAC
1986 08 06.35	S	12 :	S	25.4	L	4	64	1	3	?		MAC
1986 08 08.36	S	12 :	S	25.4	L	4	64	1	3	?		MAC

Comet Levy 1987a

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1987 01 05.55		10 :		40	L	5	63	3				LEV
1987 01 07.55		11 :		40.6	L	5	64	3	2			LEV
1987 01 09.5	S	11.3	AC	40.6	L	5	64		1			LEV
1987 01 09.85	S	11.0	A	15.0	L	6	72	1.8	1			KAN
1987 01 10.54	S	11.0	AC	40.6	L	5	156	& 3	3	&0.25	315	LEV
1987 01 10.86	S	11.0	A	15.0	L	6	72	2.4	1/			KAN
1987 01 11.56	S	10.5	AC	25.6	L	4	67	2.7	2			MOR
1987 01 25.86	S	12.0	A	15.0	L	6	100	1.4	0			KAN
1987 01 28.18	S	11.6	A	20.0	T	10	50	& 5	1			COM
1987 01 28.21	S	11.3	AC	25.4	J	6	73	2.3	1			BOU
1987 01 28.84	S	13.0	A	26.0	L	5	146	1.1	0			KAN
1987 02 01.22	S	11.9	AC	25.4	J	6	59	1.8	0			BOU
1987 02 01.52	S	11.9	AC	40.6	L	5	64	& 2.5				LEV
1987 02 02.52	S	12.1	AC	40.6	L	5	64					LEV
1987 02 06.55	S	11.2	NP	25.6	L	4	67	4.0	1			MOR

Comet Terasako 1987d

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1987 01 27.10	S	6.9	AC	20.3	L	7	44		6	0.17	260	LEV
1987 01 27.84	S	8.5	AA	13	L	4	21	2	7			CAM
1987 01 28.46	S	7.3:	AA	8.0	B		15					SEA
1987 01 28.46	S	7.6	AA	5.0	B		10					TRE
1987 01 29.44	S	7.2	AA	8.0	B		15					SEA
1987 01 29.46	S	8.0	AA	5.0	B		10					TRE
1987 01 30.04	S	7.0	A	25	L	4	46	6.3	3			JAC01
1987 01 30.04	S	7.2	A	6	R	13	32	4.3	3			JAC01
1987 01 30.05	S	7.0	A	15	S	4	22	7	4			JAC01
1987 01 30.06	S	6.7	A	5.0	B		10	7	2			JAC01
1987 01 30.06	S	6.7	A	8.0	B		20	6	2			JAC01
1987 01 30.44				15	L	8	100	3	6	2	315	WIL02
1987 01 30.44	S	7.5	A	5.0	B		10		2			WIL02

Comet Terasako 1987d (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1987 01 30.48	S	7.7	AA	5.0	B		7		5			GAR01
1987 01 30.76	B	7.3	A	15.0	L	5	25	12	4			MER
1987 01 31.04	S	7.4	A	6	R	13	32	4.1	2			JAC01
1987 01 31.05	S	6.9	A	8.0	B		20	4	2			JAC01
1987 01 31.05	S	7.1	A	25	L	4	46	7	3			JAC01
1987 01 31.44	S	7.5	AA	8.0	B		15		6			SEA
1987 01 31.45	S	7.5	A	5.0	B		10		2			WIL02
1987 01 31.76	B	7.5:	A	15.0	L	5	25	& 9	3			MER
1987 02 01.11				8.0	B		20			0.33	235	MOR
1987 02 01.11	M	7.5	S	8.0	B		20	7.5	5	0.83	78	MOR
1987 02 01.11	M	7.7	S	25.6	L	4	45	3.7	6			MOR
1987 02 01.12	S	7.2	S	12.5	R	7	27	6.2	4			MAC
1987 02 01.46	S	8.2	AA	15	L	8	64	4.0	2			TRE
1987 02 01.74	S	7.8	S	8.0	B		20	3.2	5			HAS02
1987 02 02.03	S	7.1	A	8.0	B		20	5	2			JAC01
1987 02 02.03	S	7.2	A	6	R	13	32	4.4	3			JAC01
1987 02 02.12				25.6	L	4	45			0.33	220	MOR
1987 02 02.12	M	7.6	S	8.0	B		20	7.5	4	0.42	78	MOR
1987 02 06.44	S	8.3	AA	8.0	B		15					SEA
1987 02 06.44	S	8.3	AA	8.0	B		15					SEA
1987 02 16.00	S	9.1:	AC	32	L	6	55	3.2	1			BOR
1987 02 16.02	S	8.0	A	8.0	B		20	4	2			JAC01
1987 02 16.02	S	8.3	A	6	R	13	32	3.6	2			JAC01
1987 02 16.03	S	7.7	A	25	L	4	46	4.3	2			JAC01
1987 02 16.03	S	8.1	A	15	S	4	22	4.9	3			JAC01
1987 02 17.14	M	8.5	S	25.6	L	4	45	3.2	3	0.05	235	MOR
1987 02 18.14	S	8.7	S	25.6	L	4	45		2			MOR
1987 02 18.42	S	9.1	AA	8.0	B		15					SEA
1987 02 18.42	S	9.1	AA	8.0	B		15					SEA
1987 02 22.45				15	L	5	54	3.9	3			GAR01
1987 02 22.45	S	9.3	AA	5.0	B		7		2			GAR01
1987 02 23.10	S	9.4	AA	32	L	4	33	3	1			KEE
1987 02 25.95	S	10.0	S	9.6	L			2.0				DEA
1987 02 28.09	S	9.1	AA	32	L	4	33	4	1			KEE
1987 03 02.11	S	9.3	AA	32	L	4	33	4	1			KEE

Comet Wilson 19861

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 08 08.38	S	10.5:	S	25.4	L	4	64	0.5	2			MAC
1986 08 08.96		12.5:	A	22.5	R	10	65	& 1				COM
1986 08 09.43	I	12.7	AC	25.6	L	4	45	0.0	9			MOR
1986 08 09.43	M	12.1	AC	25.6	L	4	111	0.7	8			MOR
1986 08 09.96	S	12.3	AC	20	T	10	50	1				COM
1986 08 10.37	S	11.2:	S	25.4	L	4	64	0.5	4			MAC
1986 08 15.90	S	11.7	VB	26	L	6	55	0.6	5			HUR
1986 08 16.02	S	12.1	AC	25.4	J	6	73	0.9	5/			BOU
1986 08 17.88	S	12 :	A	25.4	J	6	73	& 0.5	1			BUS01
1986 08 21.88	S	12.1	AC	40.0	L	5	170	1.0	5			MER
1986 08 24.87	S	11.4	A	25.4	J	6	73	& 0.5	4			BUS01
1986 08 25.50	S	11.8	V	15.3	L	5	54	0.3				GAR01
1986 08 26.50	S	11.6	AC	25.4	L	4	44		6			SEA
1986 08 26.88	O	11.8	A	25	L	6	120	0.5	8			AND01
1986 08 27.50	S	11.7	AC	25.4	L	4	114					SEA
1986 08 28.50	S	11.5	AC	25.4	L	4	114					SEA

Comet Wilson 19861 (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 08 28.90	S	11.5	A	10.0	L	9	23	1.5	4/			WEG
1986 08 29.90	S	12.2	AC	30.0	L	5	124	0.9	6	0.02	92	MER
1986 08 30.32	S	11.5:	S	25.4	L	4	64	0.5	2			MAC
1986 08 30.47	S	11.7	AC	25.4	L	4	114	0.6	5			SEA
1986 08 30.88	S	11.6	A	31.0	J	6	72		6			FEI
1986 08 30.92	S	11.7	AC	25.4	J	6	73	& 1	5			BOU
1986 08 30.94	S	12.2	AC	30.0	L	5	124	1.0	6	0.01	131	MER
1986 08 31.25	M	11.6	AC	40.6	L	5	81					SCO01
1986 08 31.46	S	11.7	AC	25.4	L	4	114					SEA
1986 08 31.52	S	11.9	V	15.3	L	5	54	0.3	5			GAR01
1986 08 31.88	S	12.2	AC	40.0	L	5	170	1.0	5/	0.03	101	MER
1986 08 31.90	S	11.3	A	31.0	J	6	72		7			FEI
1986 09 01.21	M	11.6	AC	40.6	L	5	64					SCO01
1986 09 01.56	S	12.0	V	15.3	L	5	54	0.25	5			GAR01
1986 09 01.87	O	11.6	A	25	L	6	120	0.8	8			AND01
1986 09 02.55	S	11.9	V	15.3	L	5	54	0.25	5			GAR01
1986 09 02.86	S	10.8:	AC	15.2	L	5	80	& 1.5	2			MOE
1986 09 02.88	S	12.0	AC	40.0	L	5	170	0.8	6	0.02	81	MER
1986 09 02.98	S	11.9:	AC	20.3	T	10	100	0.7	6			LIN02
1986 09 03.49	S	11.9	V	31	L	6	80	0.5	6			GAR01
1986 09 03.56	S	11.9	V	15.3	L	5	54	0.25	5			GAR01
1986 09 03.85	S	11.3	AC	20	T	10	50	1	3			COM
1986 09 03.86	S	11.3	AC	25.4	J	6	73	1.0	5			BOU
1986 09 03.89	O	11.7	A	25	L	6	160	0.8	8			AND01
1986 09 03.89	S	11.5	A	10.0	L	9	23	1.5	4/			WEG
1986 09 04.53	S	12.2	V	15.3	L	5	54	0.25	5			GAR01
1986 09 04.86	S	11.0	A	25.4	J	6	73	& 0.5	4/			BUS01
1986 09 04.86	S	11.4	AC	25.4	J	6	90	& 1	5/			BOU
1986 09 04.88	B	10.9	AC	20.3	T	10	85	0.5	7			HAS02
1986 09 04.89	S	10.3	AC	15.2	L	5	80	0.7	8			MOE
1986 09 04.89	S	11.4	A	10.0	L	9	23	1.5	4			WEG
1986 09 04.93	S	11.1	AC	20	T	10	50	1	3			COM
1986 09 05.51	S	12.1	V	15.3	L	5	54	0.25	5			GAR01
1986 09 05.84	B	10.7	AC	20.3	T	10	85	0.7	6			HAS02
1986 09 05.88	S	11.8	AC	40.0	L	5	170	0.8	5	0.02	77	MER
1986 09 05.98	S	11.0:	AC	20.3	T	10	100	0.8	3/			LIN02
1986 09 06.28	M	12.2	AC	40.6	L	5	64					SCO01
1986 09 06.43	S	11.6	AC	25.4	L	4	114					SEA
1986 09 06.45	S	11.8	V	15.3	L	5	54	0.3	5			GAR01
1986 09 06.86	S	10.9	A	31.0	J	6	72		7			FEI
1986 09 06.88	S	11.4	AC	25.4	J	6	59	& 1	5/			BOU
1986 09 06.89	S	10.3	AC	15.2	L	5	80	0.7	6			MOE
1986 09 06.89	S	11.7	A	25.4	L	6	71	0.7	7			KUI
1986 09 06.89	S	11.7	VB	26	L	6	55	1.0	4			HUR
1986 09 07.06	S	11 :	A	20.0	T	10	50					BUS01
1986 09 07.19	M	11.7	AC	25.6	L	4	156	1.0	7	0.03	90	MOR
1986 09 07.19	S	12.0	AC	25.6	L	4	45		8			MOR
1986 09 07.54	S	11.7	V	15.3	L	5	54	0.25	5			GAR01
1986 09 07.83	S	11.6	AC	40.0	L	5	170	0.7	5/	0.01	61	MER
1986 09 07.88	S	10.7	AC	15.2	L	5	80	0.8	3			MOE
1986 09 07.88	S	12.0	VB	26	L	6	55	0.9	5			HUR
1986 09 08.47	S	11.3	AC	25.4	L	4	114	0.8	5			SEA
1986 09 08.55	S	11.7	V	15.3	L	5	54	0.3	5			GAR01
1986 09 08.82	S	10.9	AC	15.2	L	5	80	0.8	3			MOE
1986 09 08.83	S	10.7	AC	20.3	T	10	85	0.7	6			HAS02

Comet Wilson 19861 (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 09 08.85	S	10.9	A	25.4	J	6	73	& 0.5	4			BUS01
1986 09 08.85	S	11.1	AC	25.4	J	6	59		5			BOU
1986 09 08.86	S	11.0	AC	20	T	10	50	1	3			COM
1986 09 08.90	S	11.2	A	10.0	L	9	23	1.5	4/			WEG
1986 09 09.27	M	12 :	S	32	L	4	125	0.3	3			KEE
1986 09 09.48	S	11.2	AC	25.4	L	4	114		5			SEA
1986 09 09.49	S	11.9	V	15.3	L	5	54	0.15	7			GAR01
1986 09 09.84	S	11.2	AC	15.2	L	5	80	0.7	3			MOE
1986 09 09.86	S	11.1	A	25.4	J	6	73	& 1	2/	0.01	70	BUS01
1986 09 09.86	S	12.0:	VB	26	L	6	55	& 1.0	4			HUR
1986 09 09.87	S	11.1	AC	25.4	J	6	59	1.2	5/			BOU
1986 09 09.90	S	10.8	A	31.0	J	6	72					FEI
1986 09 09.92	O	11.5	A	25	L	6	120	1	7			AND01
1986 09 09.92	S	11.0	AC	20	T	10	50	1	3			COM
1986 09 09.92	S	11.8	A	25.4	L	6	71	0.6	8			KUI
1986 09 10.86	B	10.9	AC	20.3	T	10	85	0.6	8			HAS02
1986 09 10.86	S	10.9	A	25.4	J	6	73	& 0.5	5			BUS01
1986 09 10.88	S	11.5	AC	15.2	L	5	80	0.8	3			MOE
1986 09 10.89	S	11.1	AC	25.4	J	6	59		6			BOU
1986 09 10.93	S	11.2	AC	20	T	10	50	1	3			COM
1986 09 11.01	S	11.2	A	10.0	L	9	23	1.5	3/	&0.02	90	WEG
1986 09 11.85	S	11.5	AC	15.2	L	5	80	0.8	4			MOE
1986 09 11.87	S	10.9	A	31.0	J	6	72		6			FEI
1986 09 11.90	S	11.1	AC	15.6	L	5	45		6/			BOU
1986 09 12.85	S	11.2	AC	15.2	L	5	80	0.8	4			MOE
1986 09 12.92	S	10.8	A	31.0	J	6	72		7			FEI
1986 09 12.92	S	11.2	AC	20	T	10	50	1	3			COM
1986 09 12.93	S	11.0	AC	15.6	L	5	45	1.5	6			BOU
1986 09 15.06	S	11.2	AC	25.4	J	6	59	1.2	5			BOU
1986 09 16.88	O	11.6	A	25	L	6	160	1	8			AND01
1986 09 21.43	S	11.8	V	15.3	L	5	54	0.25	4			GAR01
1986 09 24.81	S	11.0	AC	25.4	J	6	59	1.2	6			BOU
1986 09 24.82	S	11.0	AC	20	T	10	50	1.5	3			COM
1986 09 24.83	O	11.3	A	25	L	6	120	1.2	7			AND01
1986 09 24.84	S	11.0	A	31.0	J	6	72		6			FEI
1986 09 25.79	O	11.3	A	25	L	6	120	1.2	7			AND01
1986 09 25.81	S	10.6	AC	20.3	T	10	85	0.6	6			HAS02
1986 09 25.82	S	11.0	AC	25.4	J	6	59		6			BOU
1986 09 25.83	S	11.0	A	31.0	J	6	60		6			FEI
1986 09 25.85	S	11.0	AC	20	T	10	50	1.5	4			COM
1986 09 25.85	S	11.6	A	25.4	L	6	71	0.5	7			KUI
1986 09 25.86	S	10.8	A	10.0	L	9	23	1.5	3/			WEG
1986 09 25.87	S	11.4	V	26	L	6	55	0.8	5			HUR
1986 09 25.90	S	10.8	A	25.4	J	6	73	& 0.8	4/			BUS01
1986 09 26.52	S	11.7	V	15.3	L	5	54	0.25	4			GAR01
1986 09 26.80	S	10.6	AC	20.3	T	10	85	0.5	6			HAS02
1986 09 26.87	O	11.2	A	15	L	5	107	1.2	7			AND01
1986 09 27.79	O	11.2	A	25	L	6	120	1.3	7			AND01
1986 09 27.84	S	11.5	V	26	L	6	55	0.6	4			HUR
1986 09 28.80	S	10.7	AC	20.3	T	10	85	0.5	6			HAS02
1986 09 28.84	S	11.2	AC	15.0	L	5	75	1.0	4	0.03	66	MER
1986 09 29.18	I	12.0	AC	25.6	L	4	45	0.75	8/			MOR
1986 09 29.19	M	11.7	AC	25.6	L	4	156	1.0	7	0.05	90	MOR
1986 09 29.81	S	11.3	AC	15.2	L	5	80	1	2			MOE
1986 09 29.84	O	11.0	A	25	L	6	120	1.2	7			AND01

Comet Wilson 19861 (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 09 29.84	S	10.4	AC	25.4	L	4	71	4.0	5	0.1	70	ZAN
1986 09 29.85	B	11.3	AC	15.0	L	5	75	1.4	4	0.03	70	MER
1986 09 29.89	S	11.0	AC	20	T	10	50	& 1.75	4			COM
1986 09 30.83	S	11.4	AC	15.2	L	5	80	1	2			MOE
1986 09 30.84	S	10.8	AC	20.3	T	10	85	0.5	6			HAS02
1986 09 30.85	S	11.0	AC	20	T	10	50	1.5	4			COM
1986 09 30.98	S	11.0	AC	25.4	J	6	73		6/			BOU
1986 10 01.04	S	11.0	A	31	L		10	0.58				DEA
1986 10 01.15	M	11.2	AC	25.6	L	4	45	1.7	5			MOR
1986 10 01.15	M	11.2	AC	25.6	L	4	67	1.7	5/			MOR
1986 10 01.16	M	11.1	AC	25.6	L	4	111	1.5	5			MOR
1986 10 01.16	M	11.1	AC	25.6	L	4	156	1.5	4/	0.03	80	MOR
1986 10 01.83	S	10.9	AC	25.4	J	6	73	1.2	5			BOU
1986 10 01.87	S	11.6	AC	15.2	L	5	80	1	2			MOE
1986 10 01.94	S	10.9	AC	20	T	10	50		4			COM
1986 10 02.44	S	11.0	AC	25.4	L	4	114					SEA
1986 10 02.80	B	10.6	AC	20.3	T	10	85					HAS02
1986 10 02.80	B	10.6	AC	20.3	T	10	135					HAS02
1986 10 02.80	S	10.5	AC	20.3	T	10	135	0.35	5			HAS02
1986 10 02.80	S	10.6	AC	20.3	T	10	85	0.35	5			HAS02
1986 10 02.87	S	10.4	AC	25.4	L	4	71	4.0	4/	?	68	ZAN
1986 10 02.87	S	11.1	AC	15.2	L	5	80	1.1	3			MOE
1986 10 02.89	S	10.9	AC	20	T	10	50	1.5	4			COM
1986 10 02.89	S	11.9	AC	26	L	6	145	0.7	3			HUR
1986 10 02.90	B	10.8	AC	15.0	L	5	75	1.1	4/	0.03	70	MER
1986 10 03.06	S	11.0	A	31	L		10	0.58				DEA
1986 10 03.76	S	11.2	AC	48.5	L	4	163	1	4	0.05	80	MOE
1986 10 03.82	S	10.6	A	10.0	L	9	23	1.3	3			WEG
1986 10 03.82	S	10.8	A	25.4	J	6	73	& 1	2/			BUS01
1986 10 03.82	S	11.1	AC	20	T	10	50	1.5	4			COM
1986 10 03.93	S	10.8	AC	15.2	L	5	80	1	4			MOE
1986 10 04.14	M	11.2	AC	25.6	L	4	156	1.7	5	0.08	70	MOR
1986 10 04.14	M	11.5:	AC	25.6	L	4	45					MOR
1986 10 04.16	M	11.3	AC	25.6	L	4	67	1.7	7			MOR
1986 10 04.44	S	10.8:	AC	25.4	L	4	114		5			SEA
1986 10 04.45	S	11.7	V	15.3	L	5	54	0.3	5			GAR01
1986 10 04.83	S	10.9	AC	25.4	J	6	73		6			BOU
1986 10 04.84	B	10.8	AC	15.0	L	5	25	1.5	4	0.12	86	MER
1986 10 04.86	S	11.4	AC	15.2	L	5	80	1.1	3			MOE
1986 10 04.88	S	10.9	AC	20	T	10	50	1.5	3/			COM
1986 10 04.98	S	10.4	AC	25.4	L	4	71	3.0	4	?	68	ZAN
1986 10 05.15	M	11.5:	S	32	L	4	150	0.5	3			KEE
1986 10 05.26	M	11.3	AC	25.6	L	4	156	1.2	6/			MOR
1986 10 05.26	M	11.7	AC	25.6	L	4	67					MOR
1986 10 05.34	S	11.3:	S	25.4	L	4	64	1.3	2			MAC
1986 10 05.48	S	11.7	V	15.3	L	5	54	0.3	5			GAR01
1986 10 05.50	S	10.9	AC	25.4	L	4	114		5			SEA
1986 10 05.82	S	11.0	AC	20	T	10	50	1	3			COM
1986 10 05.82	S	11.6	AC	15.2	L	5	80	1	3			MOE
1986 10 06.87	S	11.0	AC	25.4	J	6	73		6			BOU
1986 10 07.83	S	10.9	AC	20	T	10	50	2	3			COM
1986 10 07.90	S	11.0	AC	25.4	J	6	90	1.4	6			BOU
1986 10 08.89	B	10.6	AC	15.0	L	5	25	1.1	4/			MER
1986 10 10.81	O	10.6	A	25	L	6	120	1.3	7			AND01
1986 10 12.82	S	11.5:	AC	15.2	L	5	80	1	2			MOE

Comet Wilson 19861 (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 10 17.80	S	10.1	A	10.0	L	9	23	1.5	3/			WEG
1986 10 17.80	S	10.4	AC	25.4	L	4	46	2.0	5/	0.05	60	ZAN
1986 10 17.80	S	11.3	AC	20	T	10	50	2	2			COM
1986 10 17.81	S	11.3	AC	25.4	J	6	90		4			BOU
1986 10 20.42	S	10.8	AC	25.4	L	4	114		5			SEA
1986 10 22.76	S	10.9	AC	15.2	L	5	80	1	5			MOE
1986 10 22.79	S	10.8	A	25.4	J	6	73	& 1	2			BUS01
1986 10 23.44	S	10.6	AC	25.4	L	4	114	1	5	&0.02	60	SEA
1986 10 23.74	S	11.0	AC	15.2	L	5	80	1.1	4			MOE
1986 10 23.79	B	10.8	AC	15.0	L	5	25	2.0	4			MER
1986 10 24.77	S	10.5	AC	30.5	L	5	94	1.7	4	?	60	ZAN
1986 10 25.42	S	10.7	AC	25.4	L	4	114		5			SEA
1986 10 26.15	M	11.2	AC	25.6	L	4	156	1.0	6	0.03	90	MOR
1986 10 26.15	M	11.3	AC	25.6	L	4	67	1.0	7/			MOR
1986 10 26.21	S	10.8:	S	13	R	7	27	2.0	2			MAC
1986 10 26.77	S	10.6	AC	30.5	L	5	60	1.4	5/			ZAN
1986 10 27.10	M	11 :	S	32	L	4	125	0.7	3	0.05	280	KEE
1986 10 27.43		12 :	A	32	L	8	150	0.4	3			TRE
1986 10 27.76	S	10.6	AC	25.4	L	4	71	2.0	5	?	60	ZAN
1986 10 28.42	S	11.9	AC	32	L	8	150	0.5	3			TRE
1986 10 28.81	S	10.9	AC	20.3	T	10	85	1.3	6			HAS02
1986 10 29.44	S	10.6	AC	25.4	L	4	114		5			SEA
1986 10 29.76	S	10.6	A	25.4	J	6	73	& 1.5	3			BUS01
1986 10 29.79	S	10.9	AC	25.4	J	6	59	& 1.5	3			BOU
1986 10 29.80	S	10.3	A	10.0	L	9	23	1.5	3/			WEG
1986 10 30.76	S	11.2	AC	15.2	L	5	80	1.1	3			MOE
1986 11 01.41	S	11.4	A	15	L	5	54		6			GAR01
1986 11 01.96	I	11.5:	A	45.0	L	4	65	2				CAR
1986 11 02.77	S	11.1	AC	15.2	L	5	80	1	3			MOE
1986 11 03.44	S	12.2	AC	32	L	8	150	0.5	2			TRE
1986 11 04.72	S	10.9	AC	15.2	L	5	80	1.3	3			MOE
1986 11 04.77	S	10.5	AC	25.4	L	4	46	2.4	5	0.06	20	ZAN
1986 11 06.75	S	11.3	AC	15.2	L	5	80	1.5	2			MOE
1986 11 06.80	S	11.1	AC	20	T	10	50	3	2			COM
1986 11 06.82	S	10.9	AC	25.4	J	6	73	& 1.8	2/			BOU
1986 11 07.74	S	11.0	AC	20.3	T	10	135	1.7	4			HAS02
1986 11 07.77	S	10.5:	A	25.4	J	6	73					BUS01
1986 11 09.73	S	10.9:	AC	15.2	L	5	80	& 0.9	3			MOE
1986 11 18.75	B	10.1	AC	40.0	L	5	81	1.5	3			MER
1986 11 20.75	S	9.8	A	10.0	L	9	23	& 2.5	4			WEG
1986 11 21.12	M	10.6	AC	25.6	L	4	67	2.0	4			MOR
1986 11 21.71	S	11.1:	AC	48.5	L	4	115	& 1.0	3			MOE
1986 11 21.75	S	10.3	AC	20.3	T	10	85	1.2	5			HAS02
1986 11 23.45	S	10.7	A	15	L	5	54		6			GAR01
1986 11 23.71	S	10.5	AC	15.2	L	5	80	1.0	5			MOE
1986 11 24.73	S	10.3	AC	25.4	L	4	71	4.0	3/			ZAN
1986 11 24.75	S	10.3	AC	20.3	T	10	85	1.1	4			HAS02
1986 11 25.08	M	10.5:	S	32	L	4	150	0.5	3	0.04	60	KEE
1986 11 25.12	M	10.5	AC	25.6	L	4	67	2.0	3	0.08	60	MOR
1986 11 25.75	S	10.3	AC	10.0	B		14		5			HAS02
1986 11 27.79	B	10.5	AC	15.0	L	5	25	5.0	2/			MER
1986 11 29.74	S	10.1	AC	25.4	L	4	36	4.0	4			ZAN
1986 11 30.10	M	10.4	AC	25.6	L	4	45	2.0	4			MOR
1986 11 30.10	M	10.4	AC	25.6	L	4	67	1.5	6	0.08	40	MOR
1986 11 30.71	S	10.7	AC	15.2	L	5	80	1.1	3			MOE

Comet Wilson 19861 (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 11 30.74	S	10.1	AC	25.4	L	4	36	4.0	4			ZAN
1986 11 30.74	S	10.4	A	11.0	L	7	32		9			SCH04
1986 11 30.75	S	10.3	AC	20.3	T	10	85	1.1	4			HAS02
1986 12 01.11	S	10.5:	S	10.8	L	5	60	1.0	3			MAC
1986 12 03.08				32	L	4	150	1.0	3	0.05	60	KEE
1986 12 03.08	M	9.8	S	32	L	4	63					KEE
1986 12 03.12	M	10.3	AC	25.6	L	4	67	2.0	3/			MOR
1986 12 03.72	S	10.5	A	11.0	L	7	32		9			SCH04
1986 12 03.74	S	9.5	A	10.0	L	9	23	& 2.5	5/			WEG
1986 12 03.76	B	10.2	AC	15.0	L	5	25	4.5	3/			MER
1986 12 05.73	S	10.5:	AC	10.0	B		14					HAS02
1986 12 06.74	S	10.2	A	11.0	L	7	32		9			SCH04
1986 12 07.63	S	10.0	AC	25.4	L	4	71	3.0	3/			ZAN
1986 12 22.11	S	9.7	AC	25.6	L	4	67	2.5	3/	0.05	55	MOR
1986 12 22.73	S	9.9	AC	25.4	L	4	71	3.0	4			ZAN
1987 02 18.76	S	8.0	AA	15	L	5	54	1.8	4			GAR01
1987 02 19.76	S	8.0	AA	15	L	5	54	2	5			GAR01
1987 02 22.77	S	8.2	AA	15	L	5	54	1.5	5			GAR01
1987 02 25.75	S	8.2	AA	15	L	5	54	2	5			GAR01
1987 02 28.77	S	7.5	AA	5.0	B		7		5			GAR01
1987 03 01.10	S	7.2	AA	13	R	4	21	3	4			CAM
1987 03 01.31	B	8.2	S	7.0	B		10					DEA
1987 03 06.76	S	7.4	AA	20	L	8	51	4.3	6	0.1	12	GAR01
1987 03 06.77	S	7.4	AA	8.0	B		15					SEA
1987 03 06.77	S	7.4	AA	15	L	5	54	4	5	0.08	12	GAR01
1987 03 07.31	B	7.5	S	7.0	B		10	4.0				DEA
1987 03 07.74	S	7.3	AA	5.0	B		7					GAR01
1987 03 07.77	S	7.2	AA	15	L	5	54	6	5	0.12	12	GAR01
1987 03 07.77	S	7.4	AA	8.0	B		15					SEA
1987 03 08.75				25.4	L	4	114	5	5	&5	300	SEA
1987 03 08.75	S	7.2	AA	5.0	B		7	6	5			GAR01
1987 03 08.75	S	7.3	AA	8.0	B		15					SEA
1987 03 09.73	S	7.3	AA	5.0	B		7		5			GAR01
1987 03 09.74				15	L	5	54	5	6	0.17	12	GAR01
1987 03 11.77	S	7.2	AA	8.0	B		15		6			SEA
1987 03 20.79	S	6.9	AA	5.0	B		7					GAR01
1987 03 21.74	S	6.8	AA	5.0	B		7					GAR01
1987 03 22.74	S	6.8	AA	5.0	B		7					GAR01
1987 03 24.74				15	L	5	54	5	7	0.2	10	GAR01
1987 03 24.74	S	6.6	AA	5.0	B		7					GAR01
1987 03 25.08	S	6.9	AA	13	L	4	21	4.0	6			CAM
1987 03 27.73	I	6.5	AA	2.5	B		2					SEA
1987 03 27.73	S	6.5	AA	5.0	B		7					GAR01
1987 03 27.73	S	6.5	AA	8.0	B		15	5	7			SEA
1987 03 28.08	S	6.7	AA	13	R	4	21	4.2	6			CAM
1987 03 29.74	S	6.6	AA	5.0	B		7					GAR01
1987 03 29.75	S	6.3	AA	8.0	B		15		7			SEA
1987 03 30.70	S	6.4	AA	5.0	B		7					GAR01
1987 03 31.30	B	6.6	S	7.0	B		10	7				DEA
1987 03 31.79	S	6.4	AA	5.0	B		7					GAR01
1987 04 01.30	B	6.3	S	7.0	B		10	7				DEA
1987 04 01.72	S	6.2	AA	2.5	B		2					SEA
1987 04 02.77	S	6.1	AA	5.0	B		7					GAR01
1987 04 03.78				15	L	5	54	8	8	0.42	355	GAR01
1987 04 03.78	S	5.9	AA	5.0	B		7					GAR01

Comet Wilson 19861 (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1987 04 05.71				8.0	B		15	6	6	0.3	255	SEA
1987 04 05.71	S	5.9	AA	2.5	B		2					SEA
1987 04 05.76	S	5.8	AA	5.0	B		7					GAR01
1987 04 11.31	B	6.0	S	7.0	B		10	12				DEA
1987 04 17.12	S	5.6	AA	13	R	4	21	6	6			CAM
1987 04 20.06	S	5.4	AA	13	R	4	21	5	8			CAM
1987 04 22.60				8.0	B		15	8	6	0.3	240	SEA
1987 04 22.60	S	5.3	AA	2.5	B		2					SEA
1987 04 24.57				8.0	B		15	4	6	0.13	240	SEA
1987 04 24.57	S	4.9	AA	0.0	E		1					SEA
1987 04 24.57	S	5.0	AA	2.5	B		2					SEA
1987 04 26.48	S	5.0	AA	2.5	B		2					SEA
1987 04 27.37	S	5.0	AA	2.5	B		2					SEA
1987 04 29.42	S	5.5	AA	2.5	B		2		6	&0.5	240	SEA
1987 05 01.36	S	5.3:	AA	2.5	B		2					SEA
1987 05 03.37	S	5.3	AA	2.5	B		2					SEA
1987 05 03.42				8.0	B		15	& 8	6	1	170	SEA

Comet Sorrells 1986n

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 11 03.54	S	12 :	S	25.4	L	4	64	0.7	3			MAC
1986 11 03.67	S	11.5	AC	25.4	L	4	114	& 1	4	?	270	SEA
1986 11 03.99	S	11.2	A	20.0	T	10	50	1	4/			COM
1986 11 04.16	S	10.8	AC	25.4	J	6	59	1.8	4/			BOU
1986 11 04.51	M	11.2	AC	25.6	L	4	111	1.5	7			MOR
1986 11 04.52	S	11.8:	S	25.4	L	4	64	0.7	3			MAC
1986 11 04.65	S	11.4	AC	25.4	L	4	114					SEA
1986 11 04.79	S	11.6	AC	15.2	L	5	80	& 1	5			MOE
1986 11 05.31	M	11 :	S	32	L	4	150	0.6	6			KEE
1986 11 05.49	S	11.5:	S	25.4	L	4	64	0.7	4			MAC
1986 11 06.07	S	11.7	AC	15.2	L	5	80	0.9	5			MOE
1986 11 06.53	S	11.5:	S	25.4	L	4	64	0.7	3			MAC
1986 11 06.82	S	11.7	AC	15.2	L	5	80	0.8	4			MOE
1986 11 06.89	S	11.5	AC	15.2	L	5	80	1.0	5			MOE
1986 11 06.93	S	11.0	AC	25.4	J	6	73	1.3	5/			BOU
1986 11 06.94	S	11.7:	VB	26	L	6	145	0.6	3			HUR
1986 11 06.95	S	11.0	A	25.8	L	5	76		4			FEI
1986 11 06.96	S	10.8	A	20.0	T	10	50	& 1	4/			COM
1986 11 07.46	S	11.5:	S	25.4	L	4	64	1.0	3			MAC
1986 11 08.46	S	11.5:	S	25.4	L	4	64	1.0	3			MAC
1986 11 08.86	S	11.2	AC	15.2	L	5	80	1.1	4			MOE
1986 11 08.88	S	11.2	AC	15.2	L	5	80	& 1	4	?0.01		MOE
1986 11 09.09	S	10.7	A	25.8	L	5	49	& 1	5			COM
1986 11 09.11	S	10.6	AC	31.0	J	6	60	& 2	5/			BOU
1986 11 09.11	S	10.9	A	25.8	L	5	49					BRI01
1986 11 09.48	S	11.0:	S	15.2	L	8	76	1.2	3			MAC
1986 11 09.91	S	11.2	AC	15.2	L	5	80	& 1	4			MOE
1986 11 09.93	S	10.8	A	31.0	J	6	60	& 0.5	5			FEI
1986 11 10.75	S	11.2	A	26.0	L	5	53	1.2	6			KAN
1986 11 12.12	S	10.8	A	20.0	T	10	50	& 1.5	5			COM
1986 11 12.16	S	10.4	AC	25.4	J	6	59	& 1.5	6			BOU
1986 11 12.16	S	10.6	AC	20.3	T	10	85	0.5	8			HAS02
1986 11 12.48	S	10.9	A	25.4	L	4	64	0.7	2			MAC
1986 11 20.85	S	10.3	A	25.4	J	6	73	1	5			BUS01

Comet Sorrells 1986n (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 11 20.94	S	10.3	A	20.0	T	10	50		5			COM
1986 11 21.76	S	10.5	PA	20.3	T	10	85	& 0.5	8			HAS02
1986 11 21.92	S	10.4	A	20.0	T	10	50		4/			COM
1986 11 22.86	S	10.9	AC	15.2	L	5	80	1.3	3			MOE
1986 11 23.13	S	10.8:	S	25.4	L	4	64	2.8	7			MAC
1986 11 23.71	S	10.6	AC	15.2	L	5	80	1.5	3			MOE
1986 11 23.82	S	10.4	AC	15.2	L	5	80	1.6	5			MOE
1986 11 24.48	S	10.6	AC	25.4	L	4	114		7			SEA
1986 11 24.75	S	10.5	PA	20.3	T	10	85	0.7	8			HAS02
1986 11 24.79	S	9.9	AA	8.0	B		20	5	3			ZAN
1986 11 24.79	S	10.0	AC	25.4	L	4	36	4.5	3/			ZAN
1986 11 25.13	M	10.5:	S	32	L	4	150	0.5	5	0.02	150	KEE
1986 11 25.19	M	9.5	AC	25.6	L	4	67	1.4	7/	0.05	90	MOR
1986 11 25.20	M	9.5	AC	25.6	L	4	45	1.4	8			MOR
1986 11 25.76	S	10.3	AC	10.0	B		14	1.8	7			HAS02
1986 11 26.78	M	9.5	AC	25.4	J	6	59	& 1.5	6	0.20	110	BOU
1986 11 26.78	S	9.8	A	25.4	J	6	73	1	5			BUS01
1986 11 26.78	S	10.0	A	11.0	L	7	32	& 5	4			SCH04
1986 11 26.85	S	9.9	A	10.0	L	9	23	& 2.5	5			WEG
1986 11 26.92	S	10.3	AC	26	L	6	55	2	5			HUR
1986 11 26.93	S	10.3	AC	20.3	T	10	80	0.8	6			SCH05
1986 11 26.93	S	10.4	AC	15.2	L	5	80	1.7	5			MOE
1986 11 26.96	S	9.2	A	31.0	J	6	72		6			FEI
1986 11 26.96	S	10.0	A	20.0	T	10	50		4			COM
1986 11 27.77	S	10.3	AC	20.3	T	10	85	0.7	7			HAS02
1986 11 27.80	S	10.5	AC	15.2	L	5	80	1.6	5			MOE
1986 11 27.82	B	9.6	AC	15.0	L	5	25	3.2	4/			MER
1986 11 27.82	S	10.3	A	20.0	T	10	50		4/			COM
1986 11 27.85	M	9.4	AC	25.4	J	6	59		6/	0.20	100	BOU
1986 11 27.85	S	9.4	AC	8.0	B		20		4			BOU
1986 11 27.91	S	9.4	AC	25.4	L	4	36	5.5	4			ZAN
1986 11 27.91	S	9.6	A	25.4	J	6	73	1.5	5			BUS01
1986 11 27.91	S	10.3	A	10.8	L	4	21	1	2			BUS01
1986 11 27.93	S	9.3	AA	8.0	B		20	6	3/			ZAN
1986 11 27.94	S	9.7	A	11.0	L	7	32	& 5	3			SCH04
1986 11 27.97	S	9.8	A	10.0	L	9	23	& 2.3	5/			WEG
1986 11 28.50	S	9.7	AA	8.0	B		15					SEA
1986 11 28.74	S	10.4	AC	20.3	T	10	85	1.0	7			HAS02
1986 11 28.75	S	10.4	AC	10.0	B		14					HAS02
1986 11 28.91	S	10.4	AC	20.3	T	10	80	0.9	6			SCH05
1986 11 29.80	M	10.2	AC	19	T	4	38	4	5/			MIK
1986 11 29.80	S	9.2	AA	8.0	B		20	7.5	3/			ZAN
1986 11 29.88	S	9.8	A	10.0	L	9	23	2.7	5/			WEG
1986 11 29.96	S	9.9	A	11.0	L	7	32	& 5	5			SCH04
1986 11 30.18	M	9.5	S	25.6	L	4	45	2.1	7	0.17	95	MOR
1986 11 30.75	S	9.8	A	11.0	L	7	32	& 7	3			SCH04
1986 11 30.76	S	9.2	AA	8.0	B		20	7.5	3/			ZAN
1986 11 30.76	S	10.4	AC	20.3	T	10	85	2.6	6			HAS02
1986 11 30.77	S	10.4	AC	15.2	L	5	80	1.9	4			MOE
1986 11 30.78	S	9.1	AA	5.0	B		10					ZAN
1986 11 30.81	M	10.3	AC	19	T	4	38	3.5	7			MIK
1986 11 30.87	B	9.8	AA	20.3	T	10	50	2.2	6			LIN02
1986 11 30.88	S	9.8	A	10.0	L	9	23	2.5	5/			WEG
1986 12 02.01	M	9.3	AC	25.4	J	6	59		6			BOU
1986 12 03.10	S	10.2	A	20.0	T	10	50			0.03		COM

Comet Sorrells 1986n (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 12 03.13				32	L	4	150	0.8	5	0.08	90	KEE
1986 12 03.13	M	9.9	AC	32	L	4	63					KEE
1986 12 03.19	M	9.4	AC	25.6	L	4	45	3.1	7	0.17	90	MOR
1986 12 03.71	S	10.2	AC	15.2	L	5	80	1.9	4			MOE
1986 12 03.74	S	9.7	A	11.0	L	7	32	& 7	3			SCH04
1986 12 03.75	S	9.9	AC	10.0	B		14	1.8	6			HAS02
1986 12 03.76				20.3	T	10	85	1.5	5	0.02	90	HAS02
1986 12 03.78	B	9.5	AC	15.0	L	5	25	3.5	5			MER
1986 12 03.83	S	9.7	A	10.0	L	9	23	3	5/			WEG
1986 12 03.86	M	9.3	AC	25.4	J	6	59	& 2	6			BOU
1986 12 03.89	S	10.3	A	20.0	T	10	50		4	0.02		COM
1986 12 03.93	M	10.1	AC	19	T	4	38	4	5			MIK
1986 12 03.93	S	10.2	AC	20.3	T	10	80	1.8	6		140	SCH05
1986 12 04.54	S	9.6	AA	8.0	B		15					SEA
1986 12 04.76	S	10.0	AA	10.0	B		14	1.6	5			HAS02
1986 12 04.92	M	9.4	AC	25.4	J	6	59		6			BOU
1986 12 04.93	S	10.4	AC	20.3	T	10	80	& 1.5	6			SCH05
1986 12 05.72	S	10.0:	AC	48.5	L	4	115	2	5	0.02	80	MOE
1986 12 05.90				20.3	T	10	85	1.3	4	0.02	80	HAS02
1986 12 05.90	S	9.6	AA	10.0	B		14	1.6	4			HAS02
1986 12 05.90	S	9.6	AC	8.0	B		10	3.5	3			MIK
1986 12 05.92	M	9.8	AC	19	T	4	38	4	5			MIK
1986 12 06.06	S	9.7	AC	8.0	B		20	5	2			BOR
1986 12 06.77	B	9.7	AC	15.2	L	5	44	2.2	5	0.03	80	MOE
1986 12 06.83	S	9.1	AA	8.0	B		15	5.5	3			HUR
1986 12 06.88	S	10.3	A	20.0	T	10	50		4			COM
1986 12 06.89	S	9.6	A	31.0	J	6	60		6			FEI
1986 12 06.90	M	9.4	AC	25.4	J	6	59	2.0	6			BOU
1986 12 06.90	S	9.2	A	25.4	J	6	73	& 3	3/			BUS01
1986 12 06.94	B	9.8	AC	15.2	L	5	44	& 2.2	5	0.03	80	MOE
1986 12 06.94	S	9.7	A	11.0	L	7	32	& 7	3			SCH04
1986 12 06.94	S	10.5	A	25.4	L	6	71	1.5	6			KUI
1986 12 07.98	S	8.7	AA	8.0	B		20	8	4			ZAN
1986 12 08.03	S	8.7	AA	5.0	B		10	11	3			ZAN
1986 12 08.86				20.3	T	10	85	1.3	5	0.02	90	HAS02
1986 12 08.86		10 :		20.3	T	10	80	& 1.3	7			SCH05
1986 12 08.86	S	9.7	AC	10.0	B		14					HAS02
1986 12 08.98	S	9.5	AC	15.6	L	5	36		4/			BOU
1986 12 08.99	S	10.2	A	20.0	T	10	50	& 2	4			COM
1986 12 18.04	S	9.8	A	25	L	4	46	2.3	3	0.05		JAC01
1986 12 18.69	S	9.8	AC	15.2	L	5	44	2.5	5			MOE
1986 12 19.04	S	9.6	A	25	L	4	46	2.5	3	0.07		JAC01
1986 12 19.48	S	9.5	AA	25.4	L	4	46					SEA
1986 12 20.74	M	9.6	AC	19	T	4	38	6	5			MIK
1986 12 20.75	S	9.7	AC	8.0	B		10	5	2			MIK
1986 12 21.05	S	9.1	A	8.0	B		20	3	3			JAC01
1986 12 21.05	S	9.4	A	25	L	4	46	2.1	4			JAC01
1986 12 21.72	M	9.5	AC	19	T	4	38	5	6			MIK
1986 12 21.78	S	9.2	A	20.0	T	10	50	& 1	3/	0.03	80	COM
1986 12 21.79	M	8.8	AC	25.4	J	6	59		6			BOU
1986 12 22.14	M	8.6	AC	25.6	L	4	45	4.7	4			MOR
1986 12 22.75	S	8.3	AA	8.0	B		20	9	5			ZAN
1986 12 22.75	S	9.2	A	20.0	T	10	50		3/	0.03	80	COM
1986 12 22.77	S	8.3	AA	5.0	B		10	10	3			ZAN
1986 12 22.80	S	9.2	AC	5.0	B		10		2			BOU

Comet Sorrells 1986n (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 12 22.81	M	9.0	AC	25.4	J	6	59		6/			BOU
1986 12 23.76	S	9.1	A	20.0	T	10	50	& 1	3			COM
1986 12 23.79	M	9.5	AC	19	T	4	38	4.5	5			MIK
1986 12 23.80	M	9.0	AC	25.4	J	6	59		6			BOU
1986 12 24.75	S	9.8	A	10.0	L	9	23	4	4/			WEG
1986 12 24.79	S	9.1	A	20.0	T	10	50		3/			COM
1986 12 26.06	S	8.5	A	5.0	B		10	3	2			JAC01
1986 12 26.06	S	8.7	A	8.0	B		20	2.7	3			JAC01
1986 12 26.07	S	8.9	A	25	L	4	46	2.1	2			JAC01
1986 12 26.85	S	9.0	AA	8.0	B		15	5.6	5			HUR
1986 12 27.78	M	9.7	AC	19	T	4	38	7	5			MIK
1986 12 27.84	S	9.3	A	20.0	T	10	50		3/			COM
1986 12 27.94	I	10.5	A	20.0	S	10	50	4	6			CAR
1986 12 27.94	I	11.0:	A	20.0	S	10	50	5	5	?	135	GOM
1986 12 27.94	M	8.9	AC	25.4	J	6	59		6			BOU
1986 12 28.00	S	9.6	AC	8.0	B		20	3				BOR
1986 12 28.74	S	8.4	AA	8.0	B		20	8	5			ZAN
1986 12 28.78	S	9.2	A	20.0	T	10	50		3			COM
1986 12 28.88	S	9.1	AA	8.0	B		15	5.6	4			HUR
1986 12 28.91	M	8.9	AC	25.4	J	6	59	& 5	5/			BOU
1986 12 29.74	S	9.6	AC	15.2	L	5	44	& 2.1	4	?0.02		MOE
1986 12 29.81	S	9.1	A	20.0	T	10	50					COM
1986 12 29.84	M	8.7	AC	25.4	J	6	59	& 6	5			BOU
1986 12 29.96	S	8.4	AA	8.0	B		20	8	4/			ZAN
1986 12 30.05	S	9.2	A	25	L	4	46	2.2	2			JAC01
1986 12 30.10				32	L	4	150	2.0	5	0.05	80	KEE
1986 12 30.10	M	9.6	S	32	L	4	33					KEE
1986 12 30.46	S	9.2	AA	8.0	B		15					SEA
1986 12 30.85	M	8.8	AC	8.0	B		20		3			BOU
1986 12 31.05	S	9.1	A	25	L	4	46	2	3			JAC01
1986 12 31.78	S	8.4	AA	8.0	B		20	8	4/			ZAN
1986 12 31.88	M	8.8	AC	25.4	J	6	59		5/			BOU
1986 12 31.88	S	9.2	A	20.0	T	10	50					COM
1987 01 01.00	S	9.7	AC	8.0	B		20	5	2			BOR
1987 01 01.00	S	9.7	AC	32	L	6	68	5.0	5/			BOR
1987 01 01.78	S	9.3	A	20.0	T	10	50		3/			COM
1987 01 01.86	M	8.8	AC	25.4	J	6	59	& 5	6			BOU
1987 01 02.81	S	9.6	AC	15.2	L	5	44	3	3			MOE
1987 01 02.86	S	10.1	A	10.0	L	9	23	& 4.5	3			WEG
1987 01 02.91	M	8.9	AC	25.4	J	6	59		6			BOU
1987 01 03.08	S	9.5	A	25	L	4	46	2	3			JAC01
1987 01 03.09	S	9.3	A	15	S	4	22	2.4	3			JAC01
1987 01 03.79	S	9.5	A	11.0	L	7	32	& 7	2			SCH04
1987 01 03.82	S	10.0	A	10.0	L	9	23	& 4.5	4			WEG
1987 01 03.88	S	8.3	AA	8.0	B		20	8.5	4/			ZAN
1987 01 03.96	I	10.0	A	6.0	R	6	20	< 5	1			CAR
1987 01 03.97	I	9.5:	A	7.5	R	7	20	10	1			GAL
1987 01 04.79	S	8.4	AA	8.0	B		20	8	4/			ZAN
1987 01 04.90	S	10.5	AC	19	T	4	38	3	2			MIK
1987 01 07.71	S	9.9	AC	15.2	L	5	44	2.5	4			MOE
1987 01 17.40	S	9.4	A	15.0	L	6	50	3.8	3			KAN
1987 01 17.71	S	10.1	AC	15.2	L	5	80	1.8	4			MOE
1987 01 18.71	S	10.0	AC	15.2	L	5	80	1.7	3			MOE
1987 01 18.77	S	8.8	AA	8.0	B		20	6.5	3/			ZAN
1987 01 19.04	S	9.9	A	25	L	5	46	1.7	2			JAC01

Comet Sorrells 1986n (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1987 01 20.13	M	8.9	AA	25.6	L	4	45	7.0	3/			MOR
1987 01 20.13	S	8.7	AA	8.0	B		20		2			MOR
1987 01 20.43	S	10.5	AA	15.0	L	6	50	2.8	2/			KAN
1987 01 24.13	M	8.9	S	25.6	L	4	45	4.6	4			MOR
1987 01 24.44	S	10.0	AA	15.0	L	6	28	2.0	1			KAN
1987 01 25.43	S	10.0	AA	15.0	L	6	28	2.0	1/			KAN
1987 01 26.74	S	10.4	AC	15.2	L	5	44	2	3			MOE
1987 01 26.75	S	9.3	A	20.5	L	6	38	4	3/			WEG
1987 01 26.76	S	10.2	A	20.0	T	10	50		2			COM
1987 01 26.77	M	9.6	AC	15.6	L	5	36		6			BOU
1987 01 28.73	S	10.4	AC	15.2	L	5	44	1.3	4			MOE
1987 01 28.78	S	9.3	A	20.5	L	6	38	4	4	0.06	60	WEG
1987 01 28.81	S	10.8	AC	36	T	11	325	& 0.7	6			KOR
1987 01 29.01	S	10.3	AC	32	L	6	68	1.8	4			BOR
1987 01 29.74	S	10.3	AC	15.2	L	5	44	2.2	4			MOE
1987 01 29.75	S	9.5	A	31.0	J	6	60	1.4	4			FEI
1987 01 29.76	M	9.5	AC	25.4	J	6	59	3.0	6			BOU
1987 01 29.76	S	10.1	A	20.0	T	10	50		2			COM
1987 01 29.78	B	8.5	A	15.0	L	5	25	6.0	2			MER
1987 01 30.73	S	10.9:	AC	48.5	L	4	115	1.5	3			MOE
1987 01 30.76	M	9.5	AC	25.4	J	6	48	3.0	5/			BOU
1987 01 30.78	S	9.4	A	20.5	L	6	38	4	3			WEG
1987 01 30.82	B	8.6	A	15.0	L	5	25	6.8	2			MER
1987 01 31.73	S	10.6:	AC	15.2	L	5	44	& 1	4			MOE
1987 01 31.75	S	9.5	AC	8.0	B		20	2.8	5			HAS02
1987 01 31.75	S	10.2	A	31.0	J	6	72	1	4			FEI
1987 01 31.76	M	9.6	AC	25.4	J	6	59		6			BOU
1987 01 31.79	B	8.5	A	15.0	L	5	25	& 5.0	3			MER
1987 01 31.79	S	10.7	AC	36	T	11	325	1.0	6			KOR
1987 02 01.17	M	9.1	S	25.6	L	4	45	3.1	4/			MOR
1987 02 01.74	S	10.4	AC	15.2	L	5	44	1.2	4			MOE
1987 02 01.75	S	9.3	AC	8.0	B		20	2.8	5			HAS02
1987 02 01.76	S	10.5	A	11.0	L	7	32	& 5	4			SCH04
1987 02 01.78	S	9.3	A	20.5	L	6	38	& 4.5	3			WEG
1987 02 02.13	M	9.1	S	25.6	L	4	45	2.6	4			MOR
1987 02 07.74	S	10.6	AC	15.2	L	5	44	1.2	4			MOE
1987 02 18.14	M	8.9	S	25.6	L	4	67	3.1	4			MOR
1987 05 09.08	S	9.4	AC	25.4	L	4	71	3	4			ZAN
1987 05 09.10	S	9.6	AC	25.4	L	4	46	2.1	4			ZAN

Comet Nishikawa-Takamizawa-Tago 1987c

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1987 01 22.12	S	8.6	S	25.6	L	4	45		2			MOR
1987 01 24.11	M	8.5	S	25.6	L	4	45	4.2	2/			MOR
1987 01 24.12	S	8.3	AA	8.0	B		20		2			MOR
1987 01 24.41	S	8.4	AA	15.0	L	6	28	6.8	2			KAN
1987 01 25.40	S	8.2	AA	15.0	L	6	28	7.1	1/			KAN
1987 01 25.40	S	9.8	S	15.3	L	8	108	4	4			HAS03
1987 01 26.40	S	9.2	AA	15.3	L	8	108	4	3			HAS03
1987 01 26.73	S	8.1	AC	15.2	L	5	44	6.5	4			MOE
1987 01 26.75	M	8.2	AC	15.6	L	5	36	& 4	4			BOU
1987 01 26.75	S	8.5	A	20.0	T	10	50		4			COM
1987 01 28.72	S	8.3	AC	15.2	L	5	44	5.5	4			MOE
1987 01 28.75	M	8.1	AC	25.4	J	6	59	4	4			BOU

Comet Nishikawa-Takamizawa-Tago 1987c (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1987 01 28.75	S	8.1	AC	10.0	B		14	5.3	3			HAS02
1987 01 28.75	S	9.1	A	31.0	J	6	60	2	3			FEI
1987 01 28.76	S	8.2	A	11.0	L	7	32	&15	6			SCH04
1987 01 28.76	S	8.5:	A	20.5	L	6	38	& 4.5	2			WEG
1987 01 28.77	S	8.4	S	10.8	L	4	22	7.5	1/			BUS01
1987 01 28.78	S	9.1	AC	36	T	11	123	& 2.5	3/			KOR
1987 01 28.99	S	8.8	AC	8.0	B		20	2.5	3			BOR
1987 01 28.99	S	8.9	AC	32	L	6	68	2.4	3			BOR
1987 01 29.73	S	8.4	AC	15.2	L	5	44	7	3			MOE
1987 01 29.75	M	8.0	AC	25.4	J	6	59	& 4	3/			BOU
1987 01 29.75	S	8.0	AC	8.0	B		20		2/			BOU
1987 01 29.75	S	8.6	A	11.0	L	6	28	3.5	4			FEI
1987 01 29.76	S	8.1	A	11.0	L	7	32	&15	6			SCH04
1987 01 29.76	S	8.2	AC	5.0	B		10		2			BOU
1987 01 29.76	S	8.5	S	14.0	S	4	20	7	5			LIN02
1987 01 29.76	S	8.6	A	20.0	T	10	50		4			COM
1987 01 29.77	B	8.2	A	15.0	L	5	25	6	3/			MER
1987 01 29.77	S	8.2	S	10.8	L	4	22	8	1			BUS01
1987 01 30.74	S	9.5:	AC	48.5	L	4	115	& 5	4			MOE
1987 01 30.75	M	8.0	AC	25.4	J	6	48	& 5	3/			BOU
1987 01 30.75	S	7.9	AC	8.0	B		20		2			BOU
1987 01 30.75	S	8.1	AC	10.0	B		14	5.3	4			HAS02
1987 01 30.76	S	8.2	A	20.5	L	6	38	& 4.5	2	0.1	240	WEG
1987 01 30.77	S	9.0	AC	36	T	11	123	3	4			KOR
1987 01 30.80	B	8.5	A	15.0	L	5	25	6	3/	0.13	100	MER
1987 01 31.13	S	9.4	AA	15.0	L	8	76	4.0	3			MAC
1987 01 31.75	S	8.1	A	11.0	L	7	32	&10	6			SCH04
1987 01 31.75	S	8.3	AA	8.0	B		20	4.3	4			HAS02
1987 01 31.75	S	8.4	A	11.0	L	6	28	4	4			FEI
1987 01 31.75	S	8.8	AC	15.2	L	5	44	6	3			MOE
1987 01 31.76	M	8.0	AC	25.4	J	6	48	4	4			BOU
1987 01 31.76	S	7.9	AC	8.0	B		20		3			BOU
1987 01 31.77	S	8.3	S	10.8	L	4	22	7	1/			BUS01
1987 01 31.77	S	8.9	AC	36	T	11	123	2	3			KOR
1987 01 31.78	B	8.5	A	15.0	L	5	25	5	4			MER
1987 02 01.13	S	8.9	AA	12.5	R	7	27	4.0	4			MAC
1987 02 01.15	M	8.5	AA	25.6	L	4	45	3.7	5			MOR
1987 02 01.15	S	8.3	AA	8.0	B		20	4.4	4			MOR
1987 02 01.74	S	8.0	A	11.0	L	7	32	&10	6			SCH04
1987 02 01.74	S	8.7	AC	15.2	L	5	44	5	5			MOE
1987 02 01.75	S	8.3	AA	8.0	B		20	3.6	5			HAS02
1987 02 01.76	S	8.3	A	20.5	L	6	38	5	2/	0.1	240	WEG
1987 02 01.81	S	7.9	AA	14.0	S	4	25	4.2	7			LIN02
1987 02 01.84	S	8.3	AA	14.0	S	4	25	4	4			WAG
1987 02 02.15	M	8.4	AA	25.6	L	4	45	4.4	4			MOR
1987 02 02.74	S	9.0:	AC	15.2	L	5	44	& 3	3			MOE
1987 02 04.99	S	8.3	AC	32	L	6	68	2.1	3			BOR
1987 02 06.08	S	8.4	AA	15	L	3	16	5	2			KEE
1987 02 07.74	S	9.0:	AC	15.2	L	5	44	& 3	2			MOE
1987 02 09.74	S	7.5	AA	10.0	B		14	4.2	5			HAS02
1987 02 15.99	S	8.3	AC	12.0	B		20	2.5	4			BOR
1987 02 17.12	M	7.8	S	25.6	L	4	45	2.8	6	0.33	25	MOR
1987 02 18.12	M	7.8	S	25.6	L	4	45	2.8	6			MOR
1987 04 01.32	B	7.0	S	7.0	B		10					DEA
1987 04 10.49	S	7.5:	A	25	L	4	82	& 4.8	3			JAC01

Comet Nishikawa-Takamizawa-Tago 1987c (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1987 04 11.32	B	7.6	S	7.0	B		10					DEA
1987 04 21.46	S	7.4	A	25	L	4	82	5.1	4			JAC01
1987 04 21.47	S	7.4:	A	6.0	R	13	80	& 4.1	2			JAC01

Periodic Comet Machholz (1986e)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 05 13.48	M	9.7	AC	25.6	L	4	67	2.5	3/			MOR
1986 05 18.45	S	10.5	AC	25.6	L	4	67	2.5	2			MOR
1986 05 27.90	S	11.3	AC	15.0	L	5	75	3.5	2			MER
1986 05 30.93	S	12.3	AC	40.0	L	5	170	2.2	1			MER

Periodic Comet Schwassmann-Wachmann 2 (1986h)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 12 03.81	S	14.5:	AC	40.0	L	5	170	0.4	2			MER
1987 01 31.84	B	12.1	AC	40.0	L	5	81	1.4	5			MER
1987 03 18.16	S	12.9	AC	25.6	L	4	156	1.1	3			MOR

Periodic Comet Wirtanen (1985q)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 04 06.40	S	9.3:	AC	12.0	B		20	4	0/			BOU
1986 04 11.92	S	8.5:	AA	14.0	S	4	56	1.2	3			LIN02

Periodic Comet Urata-Niijima (1986o)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 11 26.80	S[	12.5	AC	25.4	J	6	145					BOU
1986 12 03.86	S[	13.0	AC	25.4	J	6	145					BOU

Periodic Comet Lovas 2 (1986p)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 12 03.11	S	13.8	AC	32	L	4	150	0.8	1			KEE
1986 12 04.26	S	15 :		91	L	5	180					SCO01

Periodic Comet Wiseman-Skiff (1987b)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1987 01 26.43	S	13.3	AC	25.6	L	4	156	0.8	2			MOR
1987 01 31.88	B	13.8	AC	40.0	L	5	170	0.3	7	&0.42	262	MER

Periodic Comet Halley (1982i)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 09 14.12	B	12.5	A	25.6	L	6	85	1				GAL
1985 10 12.02	B	11.0	A	25.6	L	6	85					CAR
1985 10 12.04	B	10.5	A	15.3	L	5	96					CAR
1985 10 12.08	B	10.5	A	25.6	L	6	200	3				GAL
1985 10 13.73	M	12.5	AA	15.0	L	6	102	& 0.5	4	?0.01		WAT01
1985 10 20.06	B	9.8	A	25.6	L	6	85	4				LOS
1985 10 20.08	B	9.8	A	25.6	L	6	85	7				GAL
1985 10 20.11	B	9.4	A	25.6	L	6	85	2.5				CAR
1985 10 20.71	S	9.5	W	20	L			3				BRY02

Periodic Comet Halley (1982i) (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 10 23.71	S	10.0	AA	15	L	5	32	2	0			OKA03
1985 10 26.82	M	9.6	AA	15.0	L	6	51	4.1	5			WAT01
1985 10 26.83	S	8.9	AA	15	L	5	32	3	4			OKA03
1985 10 28.73	M	8.9	AA	15.0	L	6	51	2.6	5			WAT01
1985 10 29.77	S	9.5	W	20	L			3				BRY02
1985 11 02.72	S	9.6	AA	26	L	5	53	2.0	6			KAN
1985 11 03.48	S	8.3	AA	15	L	5	32	5	6			OKA03
1985 11 05.51	S	8.4	AA	15	L	5	32	5	6			OKA03
1985 11 10.08	B	8.0	W	25.6	L	6	85	7				GAL
1985 11 10.59	S	7.1	AA	7.0	B		10	8	6			YAS
1985 11 10.70	B	7.8	AA	15	L	6	28	10	6			KAN
1985 11 10.70	M	7.5	AA	15	L	6	28					KAN
1985 11 10.70	S	7.5	AA	15	L	6	28					KAN
1985 11 10.77	S	6.9	AA	5.0	B		7	16.6	5/			KAN
1985 11 11.02	B	7.0	W	25.6	L	6	85	7	5			LOS
1985 11 11.52	S	7.0	AA	7.0	B		10	10	6			YAS
1985 11 11.81	S	7.1	AA	5.0	B		7	12.2	5			KAN
1985 11 12.74	S	6.8	AA	5.0	B		7	16.6	5			KAN
1985 11 13.58	S	7.7	W	20	L			6				BRY02
1985 11 13.78	S	6.7	AA	5.0	B		7	18.4	6	0.3	45	KAN
1985 11 14.59	S	6.9	AA	7.0	B		10	7.5	6			YAS
1985 11 14.75	S	6.5	AA	5.0	B		7	20.8	5			KAN
1985 11 15.53	S	6.7	AA	7.0	B		10	8	7			YAS
1985 11 15.53	S	7.8	AA	15	L	5	32	10	5			OKA03
1985 11 16.48	S	6.7	AA	7.0	B		10	10	7			YAS
1985 11 16.59	S	7.2	AA	15	L	5	32	15	6			OKA03
1985 11 16.94	B	8.0	W	8.0	B		15	7				LOS
1985 11 17.07	B	6.0	W	6.0	R	12	25	17				GAL
1985 11 17.08	B	6.8	W	6.0	R	6	20	12	6			CAR
1985 11 17.09	B	6.4	W	25.6	L	6	45	17				GAL
1985 11 17.44	S	6.7	AA	7.0	B		10	11.5	7			YAS
1985 11 17.70	B	6.4	AA	5.0	B		7	21.5	6			KAN
1985 11 17.70	M	6.2	AA	5.0	B		7					KAN
1985 11 17.70	S	6.1	AA	5.0	B		7					KAN
1985 11 17.86	S	6.6	D	8.0	B		15		4			BRI01
1985 11 17.87	B	6.8	D	8.0	B		15					BRI01
1985 11 18.69	B	6.5	AA	5.0	B		7					KAN
1985 11 18.69	S	5.9	AA	5.0	B		7	19.1	6	0.3	20	KAN
1985 11 18.81	B	7.0	W	6.0	R	12	20	6				FER01
1985 11 18.90	B	6.0	W	5.0	B		20	18				GAL
1985 11 19.61	S	6.5	AA	7.0	B		10	10	7			YAS
1985 11 20.65	M	6.9	AA	8.0	B		11	20	6			WAT01
1985 11 20.65	S	6.8	AA	15	L	5	32	20	6			OKA03
1985 11 20.66	S	6.5	AA	7.0	B		10	12	7			YAS
1985 11 20.76	B	6.6	AA	5.0	B		7					KAN
1985 11 20.76	S	6.2	AA	5.0	B		7	12.1	6/			KAN
1985 11 20.93	M	6.8	W	5.0	B		10		2			LOZ
1985 11 20.94	B	6.5	W	8.0	B		15	13				LOS
1985 11 21.66	S	6.5	W	5.0	B		7					BRY02
1985 11 21.95	M	6.8	W	5.0	B		10					LOZ
1985 11 22.52				32	L	8	150	1.9	5	?0.5	70	TRE
1985 11 23.49	S	6.1	AA	5.0	B		10	12	2			TRE
1985 11 23.65	S	6.0	W	5.0	B		7					BRY02
1985 11 27.51	S	6.0	AA	5.0	B		10		1			TRE
1985 11 28.49	S	5.9	AA	5.0	B		10	6	2			TRE

Periodic Comet Halley (1982i) (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 11 28.79	M	5.2	W	5.0	B		20	25	7			GAL
1985 11 29.47	S	5.8	AA	5.0	B		10		2			TRE
1985 11 30.40	S	5.8	AA	15	L	5	32	25	7			OKA03
1985 11 30.46	M	5.8	AA	8.0	B		11	8				WAT01
1985 11 30.58	S	5.8	AA	5.0	B		10	8.5	2			TRE
1985 12 01.41	B	6.1	AA	5.0	B		7					KAN
1985 12 01.41	S	5.5	AA	5.0	B		7	16.7	6/	0.5	80	KAN
1985 12 01.78	M	5.0	W	6.0	R	12	25	20	5			GAL
1985 12 01.83	M	6.4	W	5.0	B		10		3	0.2	312	LOZ
1985 12 02.44	B	6.0	AA	5.0	B		7					KAN
1985 12 02.44	S	5.5	AA	5.0	B		7	17.9	6/	0.5	65	KAN
1985 12 02.47	S	5.8	AA	7.0	B		10	15	6			YAS
1985 12 02.77	M	5.0	W	5.0	B		20	25	4			GAL
1985 12 02.83	M	6.4	W	5.0	B		10	11	3	0.2	310	LOZ
1985 12 03.51	S	5.8	AA	7.0	B		10	15	6			YAS
1985 12 03.54	M	6.0	AA	8.0	B		11	23				WAT01
1985 12 03.58	S	6.5	W	5.0	B		7	15				BRY02
1985 12 03.91	M	6.4	W	5.0	B		10	12	3	0.24	300	LOZ
1985 12 04.49	S	5.7	AA	5.0	B		10	12	3			TRE
1985 12 04.58	S	6.5	W	5.0	B		7	10				BRY02
1985 12 04.82	M	4.9	W	8.0	B		15	25	5	1.75		GAL
1985 12 04.85	B	4.9	W	8.0	B		15	20		1.2		LOS
1985 12 04.87	M	5.0	W	8.0	B		15	12	5	1.75	70	CAR
1985 12 04.89	M	6.3	W	5.0	B		10	14	3	0.25	300	LOZ
1985 12 05.49	S	5.7	AA	5.0	B		10	8.6	3			TRE
1985 12 05.59	S	5.7	AA	7.0	B		10	15	6			YAS
1985 12 05.84	M	6.1	W	5.0	B		10	15	3	0.25	295	LOZ
1985 12 06.46	S	6.0	W	5.0	B		7	10				BRY02
1985 12 06.65	S	5.5	AA	15	L	5	32	20	6			OKA03
1985 12 06.76	M	6.1	W	5.0	B		10	15	3	0.27	298	LOZ
1985 12 07.48	S	5.8	AA	5.0	B		10		3			TRE
1985 12 07.49				15.2	L	8	64	11	6	?	90	TRE
1985 12 07.51	M	5.3	AA	8.0	B		11	15	7		45	WAT01
1985 12 07.62	S	5.6	AA	7.0	B		10	15	6			YAS
1985 12 08.52	S	5.5	AA	7.0	B		10	13	7			YAS
1985 12 09.49	S	5.5	AA	7.0	B		10	10	7			YAS
1985 12 09.81	M	5.3	W	6.0	R	6	20	8				CAR
1985 12 09.84	M	6.0	W	5.0	B		10	16	4			LOZ
1985 12 10.46	B	5.6	AA	5.0	B		7					KAN
1985 12 10.46	S	4.9	AA	5.0	B		7	14	6	0.2	65	KAN
1985 12 10.55	S	5.4	AA	7.0	B		10	10	7			YAS
1985 12 10.85	M	6.0	W	5.0	B		10	16	4	0.29	302	LOZ
1985 12 12.78	M	6.0	W	5.0	B		10	16	4	0.30	300	LOZ
1985 12 12.79	S	5.0	D	8.0	B		15		3			BRI01
1985 12 12.80	B	5.4	D	8.0	B		15					BRI01
1985 12 13.48	B	5.1	AA	5.0	B		7					KAN
1985 12 13.48	S	4.9	AA	5.0	B		7	12.7	6	0.6	60	KAN
1985 12 13.49	S	5.3	AA	5.0	B		10	12	3			TRE
1985 12 14.46	B	5.4	AA	5.0	B		7					KAN
1985 12 14.46	S	5.0	AA	5.0	B		7	13.5	6	0.3	55	KAN
1985 12 14.47	S	4.8	AA	7.0	B		10	10	7			YAS
1985 12 14.48	S	5.3	AA	5.0	B		10		3			TRE
1985 12 14.76	M	5.9	W	5.0	B		10	17	5	0.34	305	LOZ
1985 12 15.37	S	4.8	AA	7.0	B		10	9.5	7			YAS
1985 12 15.81	M	5.9	W	5.0	B		10	17	5	0.34	307	LOZ

Periodic Comet Halley (1982i) (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 12 16.79	M	5.5	W	6.0	R	6	20	11	3			CAR
1985 12 16.80	M	5.9	W	5.0	B		10	17	5			LOZ
1985 12 17.42	B	5.6	AA	5.0	B		7					KAN
1985 12 17.42	S	5.6	AA	5.0	B		7	9.7	7	0.4	65	KAN
1985 12 17.50	S	5.0	AA	5.0	B		10	12	3			TRE
1985 12 18.47	S	4.8	AA	7.0	B		10	9	7			YAS
1985 12 18.47	S	5.2	AA	5.0	B		10	12	3			TRE
1985 12 19.47	S	6.1	AA	5.0	B		10	6	2			TRE
1985 12 20.44	B	5.5	AA	5.0	B		7	7.7	7	0.4	80	KAN
1985 12 21.50	S	4.8	AA	7.0	B		10	8				YAS
1985 12 24.46	S	5.0	AA	5.0	B		10	12	3			TRE
1985 12 24.94	B	6.0	W	8.0	B		15	15				LOS
1985 12 26.49	S	4.8	AA	7.0	B		10	5				YAS
1985 12 27.40	B	5.7	AA	5.0	B		7	4.5	8	0.3	80	KAN
1985 12 27.47	S	5.6	AA	5.0	B		10	5.3	2			TRE
1985 12 28.46	S	5.6	AA	5.0	B		10	6	2			TRE
1985 12 28.47	S	4.8	AA	7.0	B		10	5				YAS
1985 12 29.47	S	4.7	AA	7.0	B		10	5				YAS
1985 12 31.45	S	4.6	AA	15	L	5	32	7	7	0.5	60	OKA03
1986 01 02.46	B	5.1	AA	5.0	B		7	4.5	7/	0.3	65	KAN
1986 01 02.46	S	5.4	AA	5.0	B		10	6	3			TRE
1986 01 03.78	M	4.5	WW	20.0	L	6	60	8		0.42		GAL
1986 01 03.85	B	5.5	WW	8.0	B		15	20		1		LOS
1986 01 04.44	M	5.3	AA	8.0	B		11	4.7	6			WAT01
1986 01 04.78	M	4.8	WW	5.0	B		20	8	4	1		GAL
1986 01 04.78	M	4.9	WW	6.0	R	6	20	4	3	1	65	CAR
1986 01 05.39	S	4.7	AA	7.0	B		10	5	7			YAS
1986 01 05.43	B	4.9	AA	5.0	B		7	3.4	8	1.5	70	KAN
1986 01 05.46	S	5.3	AA	5.0	B		10		3			TRE
1986 01 05.79	M	4.9	WW	6.0	R	6	20	3	5			CAR
1986 01 06.40	B	5.0	AA	5.0	B		7	4.5	7	1.8	60	KAN
1986 01 06.46	S	5.6	AA	5.0	B		10		3			TRE
1986 01 06.90	B	5.5	WW	8.0	B		15	20		2		LOS
1986 01 07.40	B	4.9	AA	5.0	B		7	2.3	8	0.7	60	KAN
1986 01 08.39	B	4.7	AA	5.0	B		7	3.4	7	0.7	65	KAN
1986 01 08.78	M	4.7	WW	5.0	B		20	8	8	0.42		GAL
1986 01 08.78	M	4.7	WW	6.0	R	6	20	3	6			CAR
1986 01 09.38	B	4.7	AA	5.0	B		7	3.4	7	1.1		KAN
1986 01 09.77	M	4.7	WW	6.0	R	12	25	8	8			GAL
1986 01 09.77	M	4.8	WW	6.0	R	6	20	2	5			CAR
1986 01 11.38	B	4.7	WW	5.0	B		7	3.4	7	1.5	60	KAN
1986 01 11.77	M	4.7	WW	6.0	R	12	25	6	8			GAL
1986 01 11.79	B	5.0	WW	8.0	B		15	20		1.5		LOS
1986 01 12.38	B	4.6	WW	5.0	B		7	2.7	7	1.1	60	KAN
1986 01 12.41	S	4.5	AA	7.0	B		10	5	7			YAS
1986 01 12.77	M	4.4	WW	5.0	B		20					GAL
1986 01 12.77	M	4.6	WW	6.0	R	6	20	2	8			CAR
1986 01 12.77	M	4.6	WW	6.0	R	12	25	8	8			GAL
1986 01 13.38	B	4.5	WW	5.0	B		7	2.0	8	0.7	65	KAN
1986 01 13.77	M	4.4	WW	5.0	B		20	10	7	1.5		CAR
1986 01 13.78	M	4.5	WW	6.0	R	6	20	8	8	1	70	CAR
1986 01 13.79	M	4.3	WW	5.0	B		20	10	8	1.34		GAL
1986 01 15.74				8.0	B	5	20	5	6/	1.17	59	MIL02
1986 01 15.74	S	4.0	AA	0.0	E		1					MIL02
1986 01 17.38	B	4.5	WW	5.0	B		7	2.3	7/	0.7	65	KAN

Periodic Comet Halley (1982i) (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 01 17.40	B	3.7	WW	8.0	B		20	5	7	0.5	60	OKA03
1986 01 17.73				8.0	B	5	20	5	5	1.17	60	MIL02
1986 01 17.73	S	3.8	AA	0.0	E		1					MIL02
1986 01 18.38	B	4.5	WW	5.0	B		7		8			KAN
1986 01 18.77	M	3.9	WW	5.0	B		20	3	8			GAL
1986 01 19.39	B	4.5	WW	5.0	B		7	2.3	8	0.3		KAN
1986 01 19.39	S	4.4	AA	7.0	B		10	4.5	8			YAS
1986 01 19.77	M	3.9	WW	5.0	B		20	3	8			GAL
1986 01 20.40	B	3.5	WW	8.0	B		20	4	8	0.3	60	OKA03
1986 01 21.76	M	3.8	WW	5.0	B		20	2	8			GAL
1986 01 22.38	B	4.6	WW	5.0	B		7	2.9	7	0.8		KAN
1986 01 23.76	M	3.5	WW	5.0	B		20	1	9			GAL
1986 01 24.76	M	3.5	WW	5.0	B		20	1	9			GAL
1986 01 25.38	B	4.6	WW	5.0	B		7	2.3	8	0.3		KAN
1986 01 26.37	S	4.5	WW	5.0	B		7		7/			KAN
1986 01 27.77	S	3.4:	AA	8.0	B	5	20	2.5	4/			MIL02
1986 02 15.86	S	4.5	WW	8.0	B		15	1.6	7/		300	KAN
1986 02 16.86	S	4.2	WW	5.0	B		7	3.2	6			KAN
1986 02 16.86	S	4.7	WW	8.0	B		15	1.9	6/	0.2	315	KAN
1986 02 19.77	S	3.8	AA	5.0	B		10	6	9	0.4		WIL02
1986 02 19.86	S	3.4	WW	5.0	B		7	3.2	7/			KAN
1986 02 19.86	S	4.2	WW	8.0	B		15	1.3	7/			KAN
1986 02 20.85	B	3.8	WW	5.0	B		7					KAN
1986 02 20.85	S	3.8	WW	5.0	B		7	1.9	8	0.2	285	KAN
1986 02 21.86	B	3.8	WW	5.0	B		7					KAN
1986 02 21.86	S	3.8	WW	5.0	B		7	1.9	8			KAN
1986 02 22.86	S	3.8	WW	5.0	B		7	1.6	8/			KAN
1986 02 23.79	B	4 :	WW	5.0	B		10	&20		&1	260	TRE
1986 02 23.86	B	3.8	WW	5.0	B		7					KAN
1986 02 23.86	S	3.6	WW	5.0	B		7	2.2	8	0.7	285	KAN
1986 02 24.85	B	3.6	WW	5.0	B		7					KAN
1986 02 24.85	S	3.5	WW	5.0	B		7	3.5	7/	1.5	280	KAN
1986 02 25.78	B	3.1	WW	5.0	B		10			1.8	265	TRE
1986 02 25.85	B	3.5	WW	5.0	B		7					KAN
1986 02 25.85	S	3.5	WW	5.0	B		7	3.5	8	1.5	285	KAN
1986 02 26.79	B	3.1	WW	5.0	B		10			&1.5	265	TRE
1986 03 01.83	M	4.2	WW	8.0	B		11	3	8	>0.17	315	WAT01
1986 03 02.78	B	3.1	WW	5.0	B		10		8	2.5	265	TRE
1986 03 02.84	B	3.3	WW	5.0	B		7	4.1	8	2.2	265	KAN
1986 03 03.84	B	3.2	WW	5.0	B		7	4.4	8	2.6	260	KAN
1986 03 03.85	S	3.8	WW	8.0	B		20	5	8	0.5	270	OKA03
1986 03 04.79	B	3.0	WW	5.0	B		10		8	1.7	265	TRE
1986 03 04.85	S	3.8	WW	8.0	B		20	5	8	0.5	270	OKA03
1986 03 04.85	S	3.9	WW	7.0	B		10	5	7			YAS
1986 03 05.79	B	3.1	WW	5.0	B		10	10		1.7		TRE
1986 03 05.83	M	4.0	WW	8.0	B		11	< 2	7			WAT01
1986 03 05.84	B	3.4	WW	5.0	B		7	3.2	8	2.9	275	KAN
1986 03 06.76	B	3.1	WW	5.0	B		10		8	>2.5		TRE
1986 03 06.77		2.8	WW	0.0	E		1				270	TRE
1986 03 06.84	M	3.6	WW	8.0	B		20	5	7	2	270	OKA03
1986 03 06.85	S	3.5	WW	7.0	B		10	4.5	8			YAS
1986 03 07.75	S	3.9	AA	0.0	E		1					WIL02
1986 03 07.83	B	3.5	WW	5.0	B		7	3.8	7/	3.7	270	KAN
1986 03 07.84	M	3.5	WW	8.0	B		11	4.5	6			WAT01
1986 03 07.84	M	3.6	WW	8.0	B		20	5	8	3	270	OKA03

Periodic Comet Halley (1982i) (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 03 07.84	S	3.5	WW	7.0	B		10	4.5	8			YAS
1986 03 08.83	M	3.8	WW	8.0	B		11	6	6	>3	270	WAT01
1986 03 08.84	S	3.8	WW	5.0	B		7	4.4	7	1.1		KAN
1986 03 09.80	B	3.0	WW	5.0	B		10		8	4.5		TRE
1986 03 10.74	S	3.0	AA	5.0	B		10		9	3		WIL02
1986 03 10.78		3.0	WW	0.0	E		1			3	260	TRE
1986 03 10.78	B	3.0	WW	5.0	B		10		8	5	260	TRE
1986 03 11.25	I	2.8	WW	0.0	E		1	60	6	6		GAL
1986 03 11.26	M	3.5	WW	5.0	B		20	45		4		GAL
1986 03 11.74		2.8	WW	0.0	E		1			&3	260	TRE
1986 03 11.75	B	3.0	WW	5.0	B		10		8	5	260	TRE
1986 03 11.75	S	3.0	AA	0.0	E		1		9	1.5		WIL02
1986 03 12.76		2.8	WW	0.0	E		1			3	260	TRE
1986 03 12.76	B	3.0	WW	5.0	B		10	8	8	5	260	TRE
1986 03 12.83	B	4.0	WW	5.0	B		7	4.1	7	3.3	270	KAN
1986 03 12.84	M	3.6	WW	8.0	B		20	5	7	3	270	OKA03
1986 03 12.84	S	3.5	WW	7.0	B		10	4.5	7			YAS
1986 03 12.84	S	3.8	WW	5.0	B		7					KAN
1986 03 13.34	B	2.8	WW	8.0	B		15	30		4		LOS
1986 03 13.78				15	L	8	64	5	8		260	TRE
1986 03 13.78		2.8	WW	0.0	E		1			3	260	TRE
1986 03 13.78	B	2.8	WW	5.0	B		10			5	260	TRE
1986 03 14.73	S	3.0	AA	0.0	E		1		9			WIL02
1986 03 15.83	B	3.5	WW	5.0	B		7	5.1	8	3.7	265	KAN
1986 03 16.79				15	L	8	64	6.3	8	&0.5	275	TRE
1986 03 16.79		2.8	WW	0.0	E		1			5	275	TRE
1986 03 16.79	B	2.8	WW	5.0	B		10		8	5	275	TRE
1986 03 16.80	B	4.1	WW	5.0	B		7					KAN
1986 03 16.80	S	3.8	WW	5.0	B		7	4.4	7/	2.9	260	KAN
1986 03 17.76		3.1	WW	0.0	E		1			3	270	TRE
1986 03 17.76	B	2.8	WW	5.0	B		10		8	4	270	TRE
1986 03 17.81	B	3.9	WW	5.0	B		7	4.4	8	2.9	270	KAN
1986 03 17.82	M	3.8	WW	8.0	B		11	6.3	6	3	270	WAT01
1986 03 17.82	S	3.8	WW	5.0	B		7					KAN
1986 03 19.75		2.8	WW	0.0	E		1			3		TRE
1986 03 19.76				15	L	8	64	9.9	6	&0.67	285	TRE
1986 03 19.76	B	2.8	WW	5.0	B		10		8	4		TRE
1986 03 20.83	M	3.3	WW	8.0	B		20	5	7	4	270	OKA03
1986 03 20.83	S	3.5	WW	5.0	B		7	6.7	6/	0.4	280	KAN
1986 03 20.84	B	4.0	WW	5.0	B		7					KAN
1986 03 21.49	S	2.8	D	5.0	B		10	15	6	3	270	ZAN01
1986 03 21.77	S	2.9	AA	0.0	E		1		9	1.5		WIL02
1986 03 22.20	I	3.0	WW	0.0	E		1	60		9		CAR
1986 03 22.25	I	2.6	WW	0.0	E		1	60	8	10		GAL
1986 03 22.77		2.8:	WW	0.0	E		1			&3.5		TRE
1986 03 22.77		2.8:	WW	5.0	B		10			&6		TRE
1986 03 24.72		3.3:	WW	0.0	E		1			&2.5		TRE
1986 03 24.79	S	3.7	WW	5.0	B		7	4.1	8	1.5	270	KAN
1986 03 24.80	B	3.5	WW	5.0	B		7					KAN
1986 03 25.69	B	3.2	WW	5.0	B		10	&12	8	3	270	TRE
1986 03 25.79	M	3.2	WW	8.0	B		11	&10	5			WAT01
1986 03 25.80	S	3.4	WW	5.0	B		7	6.9	7	0.7	280	KAN
1986 03 25.81	B	3.4	WW	5.0	B		7					KAN
1986 03 25.82	S	3.4	WW	7.0	B		10	6	7			YAS
1986 03 26.80	S	3.2	WW	5.0	B		7	6.7	6/	0.4	295	KAN

Periodic Comet Halley (1982i) (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 03 26.81	B	3.4	WW	5.0	B		7					KAN
1986 03 27.74		3.3	WW	0.0	E		1			&1		TRE
1986 03 27.74	B	3.3	WW	5.0	B		10	10	7	3	270	TRE
1986 03 28.79	S	3.1	W	0.0	E		1			8		LOV
1986 03 29.76	S	2.7	W	0.0	E		1			7		LOV
1986 03 30.13	B	3.4	WW	5.0	B		7		6			JAN
1986 03 30.67	S	2.6	W	0.0	E		1			5.5		LOV
1986 03 30.79		3.2	WW	0.0	E		1			&1	270	TRE
1986 03 30.79	B	3.2	WW	5.0	B		10	&20	5	&3.5	270	TRE
1986 03 31.62		3.2	WW	0.0	E		1			1	270	TRE
1986 03 31.62	S	3.2	WW	5.0	B		10	&25	5	&3.5	270	TRE
1986 03 31.77	S	2.6	W	0.0	E		1			5		LOV
1986 03 31.79	S	3.6	WW	5.0	B		7	5.4	7	0.2	320	KAN
1986 03 31.80	B	4.1	WW	5.0	B		7					KAN
1986 04 01.14	B	3.7	WW	5.0	B		7		5			JAN
1986 04 01.56	S	2.5	W	0.0	E		1			<9		LOV
1986 04 01.65		3.0	WW	0.0	E		1			1	270	TRE
1986 04 01.65	B	3.0	WW	5.0	B		10	&20	5	3	270	TRE
1986 04 01.79	S	3.2	WW	7.0	B		10	7	7			YAS
1986 04 02.56	B	3.0	WW	5.0	B		10	&25	5	3	270	TRE
1986 04 02.56	S	2.4	W	0.0	E		1			10.5		LOV
1986 04 02.57		3.0	WW	0.0	E		1			<1	270	TRE
1986 04 02.79		3.0	WW	0.0	E		1		5	<1	270	TRE
1986 04 02.81	M	3.2	WW	8.0	B		11	10.2	4			WAT01
1986 04 03.21	M	3.5	WW	5.0	B		20	60				GAL
1986 04 03.56	S	2.4	W	0.0	E		1			9		LOV
1986 04 03.73		3.3	WW	0.0	E		1					TRE
1986 04 03.74		3.3	WW	5.0	B		10	25	3	3	270	TRE
1986 04 04.09	S	3.5	WW	5.0	B		10	20	4	2.0		LOO01
1986 04 04.12	S	3.8	D	8.0	B		15	25	6/	2.0	315	WIL03
1986 04 04.57	S	2.3	W	0.0	E		1			12.5		LOV
1986 04 05.08	S	3.1	WW	5.0	B		10	30	6	2.0		LOO01
1986 04 05.15	B	4.3	WW	5.0	B		7		5			JAN
1986 04 05.17	S	2.9	D	8.0	B		15	25	7	2.5	330	WIL03
1986 04 05.53		3.4	WW	5.0	B		10		3	3		TRE
1986 04 05.58	S	2.5	W	0.0	E		1			3.5		LOV
1986 04 06.10	S	2.9	WW	8.0	B		15	20	6	2.5		LOO01
1986 04 06.13	S	3.5	D	8.0	B		15		3	3.0	300	SCH04
1986 04 06.17	S	2.9	D	8.0	B		15	25	6	3.0	340	WIL03
1986 04 06.54		3.3	WW	0.0	E		1		3			TRE
1986 04 06.54		3.3	WW	5.0	B		10	35	3	3	310	TRE
1986 04 06.58	S	2.3	W	0.0	E		1			3		LOV
1986 04 06.76	M	3.0	WW	8.0	B		20	15	6			OKA03
1986 04 06.77	B	4.1	WW	5.0	B		7					KAN
1986 04 06.77	S	3.9	WW	5.0	B		7	6.6	6	0.2	335	KAN
1986 04 06.80		2.7	WW	0.0	E		1		3			TRE
1986 04 06.80	B	2.7	WW	5.0	B		10	40	3	3	310	TRE
1986 04 07.04	S	2.6	WW	5.0	B		10	30	7	2.5		LOO01
1986 04 07.17	S	2.7	D	8.0	B		15	25	6			WIL03
1986 04 07.56		2.8	WW	0.0	E		1	&30	3			TRE
1986 04 07.56	B	2.8:	WW	5.0	B		10	40	3	3		TRE
1986 04 07.72	S	2.8	WW	7.6	S	8	15	41	7			CLA
1986 04 07.76	M	2.8	WW	8.0	B		20	20	6			OKA03
1986 04 07.76	S	3.5	WW	5.0	B		7	17.8	5/	0.4	330	KAN
1986 04 07.77	B	3.7	WW	5.0	B		7					KAN

Periodic Comet Halley (1982i) (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 04 07.81		2.6	WW	0.0	E		1	30	3			TRE
1986 04 08.10	S	3.3	D	8.0	B		15		3			SCH04
1986 04 08.17	S	2.6	D	8.0	B		15	20	7	4.5	332	WIL03
1986 04 08.46	S	1.9	W	0.0	E		1			9		LOV
1986 04 08.59	S	1.8	AA	0.0	E		1		5			WIL02
1986 04 08.64	S	2.8	WW	7.6	S	8	15	42	7			CLA
1986 04 08.81				5.0	B		10	45	5	3	315	TRE
1986 04 08.81		2.4	WW	0.0	E		1	30	3	1	315	TRE
1986 04 09.08	B	4.3	WW	5.0	B		7		5			JAN
1986 04 09.08	S	2.5	WW	5.0	B		10	25	6	5		LOO01
1986 04 09.11	B	3.3	WW	6.3	B		9	20	4	2.7	330	KAM01
1986 04 09.17	S	2.6	D	8.0	B		15	20	6	4.5		WIL03
1986 04 09.54				5.0	B		10	45	5	3	315	TRE
1986 04 09.54		2.4	WW	0.0	E		1	30	3	1	315	TRE
1986 04 09.54	S	1.9	W	0.0	E		1					LOV
1986 04 10.05	B	3.5:	WW	6.3	B		9	22	4	&2	345	KAM01
1986 04 10.10	B	3.4	WW	5.0	B		7		4			JAN
1986 04 10.12	S	2.4	WW	5.0	B		10	30	6			LOO01
1986 04 10.17	S	2.4	D	8.0	B		15	25	6	3.5	345	WIL03
1986 04 10.46	S	1.8	W	0.0	E		1			8		LOV
1986 04 11.52		3.7	WW	0.0	E		1	20	2			TRE
1986 04 11.70	S	3.9	WW	5.0	B		7	12.5	5			KAN
1986 04 12.10	S	2.5	D	8.0	B		15	20	6/	3.0	350	WIL03
1986 04 12.58		3.6	WW	0.0	E		1	45	2	&1		TRE
1986 04 12.58	S	2.3	W	0.0	E		1			8		LOV
1986 04 12.63	M	2.5	WW	8.0	B		20	20	6			OKA03
1986 04 12.63	S	3.8	WW	7.0	B		10	15	7			YAS
1986 04 13.12	S	2.7	D	0.8	E		1			1.0	0	WIL03
1986 04 13.21	M	3.0	WW	5.0	B		7	60		10		GAL
1986 04 13.54	B	3.9	WW	5.0	B		10		6	&2	0	TRE
1986 04 13.65	S	3.5	WW	5.0	B		7	14.2	5/	0.4	0	KAN
1986 04 13.67	B	4.0	WW	5.0	B		7					KAN
1986 04 13.79		3.0	WW	0.0	E		1	48	6			TRE
1986 04 14.50	S	2.4	AA	0.0	E		1		3	2		WIL02
1986 04 14.53		3.4	WW	0.0	E		1	&30		?		TRE
1986 04 14.63	S	2.1	W	0.0	E		1		7	18		LOV
1986 04 15.50	S	3.0	AA	0.0	E		1		3			WIL02
1986 04 15.73	S	2.0	W	0.0	E		1			24.5		LOV
1986 04 16.42	S	1.9	AA	0.0	E		1		3			WIL02
1986 04 16.45				15	L	8	64	15	9			TRE
1986 04 16.45		3.8	WW	0.0	E		1	&30	3			TRE
1986 04 16.59	S	4.1	WW	7.0	B		10	15	6			YAS
1986 04 16.66	M	4.1	WW	8.0	B		11	13.4	5			WAT01
1986 04 17.41	S	2.7	AA	0.0	E		1		3	14	67	WIL02
1986 04 17.54	S	2.3	W	0.0	E		1			18		LOV
1986 04 17.72	S	3.3	WW	7.6	S	8	15	35	7			CLA
1986 04 18.62	S	2.7	AA	0.0	E		1		3			WIL02
1986 04 18.67	S	2.5	W	0.0	E		1			22.5		LOV
1986 04 19.37	B	3.5	WW	5.0	B		10	35	5	1	90	TRE
1986 04 19.70	S	2.7	AA	0.0	E		1		3			WIL02
1986 04 19.91	M	3.4	WW	8.0	R	15	43	60	4	5		GAL
1986 04 20.45	M	4.1	WW	8.0	B		11	&30				WAT01
1986 04 20.49	S	4.4	WW	7.0	B		10	10	7			YAS
1986 04 21.38	S	2.7	W	0.0	E		1			5		LOV
1986 04 22.40	S	2.9	W	0.0	E		1			2		LOV

Periodic Comet Halley (1982i) (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 04 22.43	B	3.7	WW	5.0	B		10	15	3	?	45	TRE
1986 04 22.57	S	4.6	WW	7.0	B		10	10	6			YAS
1986 04 23.56	S	4.6	AA	5.0	B		7	11.0	5/			KAN
1986 04 24.52	S	3.5	A	0.0	E		1			42		LOV
1986 04 24.53	M	3.5	WW	8.0	B		20	15	5	1	80	OKA03
1986 04 24.54		3.9:	WW	0.0	E		1	>30		1	90	TRE
1986 04 24.54	M	4.3	WW	8.0	B		11	&20	6	2	90	WAT01
1986 04 24.54	S	4.8	WW	7.0	B		10	12	6			YAS
1986 04 25.40	S	4.0	A	0.0	E		1			?		LOV
1986 04 26.40	S	3.7	A	0.0	E		1			20		LOV
1986 04 26.91	B	5.0	WW	5.0	B		7	20	3	5	50	CAR
1986 04 26.92	M	4.0	WW	5.0	B		7	60	4	7		GAL
1986 04 28.41				10	L	6	24	9	5	1.17	100	TRE
1986 04 28.41	B	4.8	WW	5.0	B		10		4	2	100	TRE
1986 04 28.41	S	4.0	A	0.0	E		1			14		LOV
1986 04 28.51	S	5.0	WW	7.0	B		10	12	6			YAS
1986 04 28.89	B	4.4	WW	6.0	R	6	20	20	4	1.5		CAR
1986 04 29.41		4.8	WW	0.0	E		1			0.5	100	TRE
1986 04 29.41	B	4.8	WW	5.0	B		10	50	4	3	100	TRE
1986 04 29.42	S	4.2	A	0.0	E		1			<5		LOV
1986 04 29.49	S	5.1	AA	5.0	B		7	12.9	5			KAN
1986 04 29.50	S	5.0	WW	7.0	B		10	12	6			YAS
1986 04 29.53	M	3.8	WW	8.0	B		20	15	6	0.5	90	OKA03
1986 04 29.54	M	4.4	AA	8.0	B		11	16	6	5	130	WAT01
1986 04 29.89	B	4.5	WW	6.0	R	6	20	18	4	1		CAR
1986 04 29.91	B	6.0	D	8.0	B		15		3			KEI01
1986 04 30.47	S	4.7	AA	5.0	B		7	14.4	5/			KAN
1986 04 30.48	B	5.5	AA	5.0	B		7					KAN
1986 04 30.87	B	5.5	D	6.3	B		8	25	3			GEE
1986 04 30.87	B	6.2	D	8.0	B		15		3			KEI01
1986 04 30.88	B	6.0	WW	8.0	B		20		5			JAN
1986 04 30.88	S	4.8	WH	10.0	B		14	20	6	0.5		LOO01
1986 04 30.88	S	6.2	D	8.0	B		15		2			SCH04
1986 04 30.90	B	4.2	WW	6.0	B		12					WEG
1986 04 30.90	S	3.9	WW	6.0	B		12	18	6	1.5	105	WEG
1986 05 01.87	B	4.6	D	4.0	B		7					BUS01
1986 05 01.87	B	5.2	WH	5.0	B		10		3			ROO
1986 05 01.87	S	4.3	D	4.0	B		7	&22	4/	1.0	90	BUS01
1986 05 01.87	S	5.0	D	5.0	B		10	&10	6			LAA
1986 05 01.89	B	4.4	WW	8.0	B		10	30	4	6		CAR
1986 05 01.89	S	6.2	D	8.0	B		15	10	7			ZAN01
1986 05 01.90	B	4.5	WW	6.0	B		12					WEG
1986 05 01.90	B	4.5	WW	7.5	R	7	25	30	5	5		CAR
1986 05 01.90	S	4.2	WW	6.0	B		12	17	5	1.0	100	WEG
1986 05 01.91	S	6.3	D	8.0	B		15	&20	3			SCH04
1986 05 01.92	M	4.3	WW	7.5	R	7	25	50	6	7		GAL
1986 05 01.92	S	4.8	WH	5.0	B		10	10	5/			LOO01
1986 05 02.37		5.2	AA	0.0	E		1	&30				TRE
1986 05 02.37	B	5.2	AA	5.0	B		10	20	4	2	95	TRE
1986 05 02.58	M	5.5	AA	8.0	B		11	16.2	4			WAT01
1986 05 02.84	M	4.9	W	5.0	B		20	40	7	1		GAL
1986 05 02.90	B	6.2	D	8.0	B		15		3			KEI01
1986 05 03.38	B	5.2	AA	3.0	R		8	&15				TRE
1986 05 03.42	B	5.6	AA	5.0	B		10	15	4	2	95	TRE
1986 05 03.86	M	4.9	W	7.5	R	7	25	40	6	2		GAL

Periodic Comet Halley (1982i) (Cont.)

DATE (UT)	MM	MAG.	RF	AF.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 05 04.47	S	5.6	WW	7.0	B		10	10	6			YAS
1986 05 04.48	S	5.4	AA	5.0	B		7	11.2	4			KAN
1986 05 04.53	S	6.1	AA	15	L	6	28	6.7	5/			KAN
1986 05 04.54	M	5.3	AA	8.0	B		11	14.1	5	1	130	WAT01
1986 05 04.57	B	5.6	AA	5.0	B		10	15	4	1	100	TRE
1986 05 04.58		5.4	AA	0.0	E		1	&20				TRE
1986 05 04.87	B	4.4	W	8.0	B		10	25	4	4.5		CAR
1986 05 05.49	M	5.7	AA	8.0	B		11	10.7	5			WAT01
1986 05 05.49	S	5.7	AA	7.0	B		10	10	6			YAS
1986 05 05.87	S	5.5:	AA	6.3	B		9	12	5			KAM01
1986 05 05.89	B	6.0	D	8.0	B		15		3			KEI01
1986 05 06.50	M	4.9	AA	15	L	5	32	10	6			OKA03
1986 05 06.87	M	5.0	W	5.0	B		20	30		0.84		GAL
1986 05 07.48	M	6.2	AA	8.0	B		11	11.7	4			WAT01
1986 05 07.55	S	6.2	AA	7.0	B		10	10	6			YAS
1986 05 07.88	M	5.3	W	7.5	R	7	25	25	7	0.84		GAL
1986 05 08.42	B	5.8	AA	5.0	B		10	20	3			TRE
1986 05 08.50	M	5.7	AA	15	L	5	32	10	5			OKA03
1986 05 08.56	M	6.3	AA	8.0	B		11	14.1	3		100	WAT01
1986 05 08.87	M	5.4	W	7.5	R	7	25	20	7			GAL
1986 05 08.87	S	4.8	D	5.0	B		10	&15	5	&5	105	COM
1986 05 09.42	B	5.8:	W	3.0	B		8			3.5	91	THO
1986 05 09.90	M	5.3	W	7.5	R	7	25	30	6	3		GAL
1986 05 10.36	B	6.0	AA	5.0	B		10	&20	5			TRE
1986 05 10.55	M	6.4	AA	8.0	B		11	14	3			WAT01
1986 05 10.62	S	6.7	AA	5.0	B		10		6			WIL02
1986 05 10.88	M	5.5	W	7.5	R	7	25	15	7			GAL
1986 05 10.88	S	5.1	D	5.0	B		10	&10	4/	2	105	COM
1986 05 10.93	S	6.5	D	8.0	B		15		3			SCH04
1986 05 11.52	S	6.4	AA	5.0	B		10		6			WIL02
1986 05 12.44	B	6.0	AA	5.0	B		10		3			TRE
1986 05 12.52	M	6.1	AA	15	L	5	32	8	6			OKA03
1986 05 12.52	M	6.4	AA	8.0	B		11	10.5	5		100	WAT01
1986 05 12.90	B	6.3	D	6.0	B		12					WEG
1986 05 12.90	S	5.8	D	6.0	B		12	11	4/	0.5	105	WEG
1986 05 12.90	S	6.6	D	8.0	B		15	&10	4			SCH04
1986 05 12.91	S	4.9	D	5.0	B		10	&13	4/	4.5	105	COM
1986 05 13.44	B	6.3	AA	5.0	B		10	10	3			TRE
1986 05 13.45	S	6.4	AA	5.0	B		10		6			WIL02
1986 05 13.89	S	6.2	D	4.0	B		8		6			FEI
1986 05 14.87	M	5.7	W	20.0	L	6	60	18		0.5		GAL
1986 05 15.46	B	6.5	W	3.0	B		8			1.5		THO
1986 05 15.88	S	7.1	D	12.0	B		20	4	3/			LOO01
1986 05 17.45	S	6.6	AA	5.0	B		10		4			WIL02
1986 05 24.39	S	7.0	AA	15	L	8	64	7.5	3			TRE
1986 05 25.52	M	7.1	AA	8.0	B		11	5	4			WAT01
1986 05 25.89	S	7.0	S	6.3	B		9	10	4			KAM01
1986 05 26.36	S	7.4	AA	5.0	B		10		4			WIL02
1986 05 26.48	S	7.4	AA	15	L	8	64	7.5	3			TRE
1986 05 26.51	M	6.5	AA	15	L	5	32	8	5			OKA03
1986 05 26.53	M	6.8	AA	8.0	B		11	13	3			WAT01
1986 05 29.54	S	7.2	D	25	L	5	62	8	5			CLA
1986 05 30.44	S	7.6	AA	5.0	B		10		3			WIL02
1986 05 31.00	M	7.2	W	7.5	R	7	25	7				GAL
1986 06 01.00	M	7.2	W	7.5	R	7	25	8				GAL

Periodic Comet Halley (1982i) (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 06 03.89	S	7.6:	D	5.0	B		10		4			COM
1986 06 04.88	S	7.6	D	5.0	B		10		4/	0.5		COM
1986 06 05.89	S	7.6	D	5.0	B		10		4/			COM
1986 06 06.88	S	7.7	D	5.0	B		10		4			COM
1986 06 07.39	S	7.9	AA	15	L	8	64	7.5	3			TRE
1986 06 07.41	S	7.9	AA	10	L	6	24		3			TRE
1986 06 07.44	S	7.9	AA	5.0	B		10		3			TRE
1986 06 07.50	M	7.7	AA	15	L	5	32	5	4			OKA03
1986 06 07.88	S	7.9	D	5.0	B		10		4			COM
1986 06 08.50	M	7.9	AA	15	L	5	32	4	4			OKA03
1986 06 08.50	S	8.4	AA	15	L	6	28	4.3	3/			KAN
1986 06 08.88	S	7.9	D	5.0	B		10		4			COM
1986 06 09.89	S	8.2:	D	5.0	B		10		3			COM
1986 06 09.90	B	8.4	A	15.0	L	5	25	5.5	3/			MER
1986 06 26.43	S	9.5	AA	15	L	8	50		2			WIL02
1986 06 28.51	S	7.7	D	25	L	5	62	7	5			CLA
1986 07 26.48	S	8.6	D	25	L	5	62	4.5	3			CLA
1986 08 03.40	S	10.1:	AA	32	L	8	150	3	2			TRE
1986 10 29.53		11.5:		25.6	L	4	111		1			MOR
1986 10 31.53		11.5:		25.6	L	4	111	& 1.4	2			MOR
1986 11 01.54	S	12 :	S	25.4	L	4	64	1.0	2			MAC
1986 11 04.53	S	11.7	AC	25.6	L	4	156	1.4	2			MOR
1986 11 04.73		11.8:		25.4	L	4	190	& 1				SEA
1986 11 07.54	S	12.0	AC	25.6	L	4	156	1.2	3			MOR
1986 11 09.49	S	11 :	S	32	L	4	66	1	1			KEE
1986 11 28.52	S	12.0	AC	25.6	L	4	156	1.2	1/			MOR
1986 11 28.53	S	11.6	AC	25.6	L	4	67	1.9	2			MOR
1986 11 28.68	S	12.9:	AC	25.4	L	4	114	1.4	1			SEA
1986 11 30.24	S	12.0	AC	20.3	T	10	85	0.4	4			HAS02
1986 11 30.53	S	11.5	AC	25.6	L	4	67	1.9	1/			MOR
1986 11 30.54	S	11.5	AC	25.6	L	4	45	1.9	2			MOR
1986 11 30.54	S	11.6	NP	25.6	L	4	45					MOR
1986 11 30.54	S	11.8	AC	25.6	L	4	156	1.2	2			MOR
1986 12 02.52	S	12.2	AC	32	L	4	63	1.8	1			KEE
1986 12 03.54	S	11.9	AC	25.6	L	4	67	1.7	1/			MOR
1986 12 03.55	S	11.8	AC	25.6	L	4	45	1.9	1/			MOR
1986 12 04.42	S	12.1	AC	50	L	5	96	1.1	0			BOR
1986 12 04.67	S	12.5:	AC	25.4	L	4	114	& 1	1			SEA
1986 12 06.44	S	11.9	AC	50	L	5	96	1.2	1			BOR
1986 12 08.52	S	11.8	AC	25.6	L	4	45	2.2	1			MOR
1986 12 08.52	S	11.8	NP	25.6	L	4	45					MOR
1986 12 08.52	S	11.9	AC	25.6	L	4	67	1.9	1			MOR
1986 12 08.53	S	11.9	AC	25.6	L	4	111	1.9	1			MOR
1986 12 08.69	S	11.7	AC	25.4	L	4	114	& 2	2			SEA
1986 12 10.53	S	11.9	AC	32	L	4	63	1.8	1			KEE
1986 12 27.10	S	12.3	AC	51.0	L	4	75	& 3	1			COM
1986 12 27.11	S	12.1	AC	51.0	L	4	75	3.1	1/			BOU
1986 12 27.12	S	12.2	AC	25.4	J	6	73		1			BOU
1986 12 27.52	S	12.0	AC	25.6	L	4	67	2.3	0/			MOR
1986 12 28.11	S	12.4	AC	51.0	L	4	75	& 3	1			COM
1986 12 28.12	S	12.0	AC	51.0	L	4	75	2.8	1/			BOU
1986 12 29.14	S	12.3	AC	51.0	L	4	93		0/			BOU
1986 12 29.14	S	12.5	AC	51.0	L	4	93		1			COM
1986 12 29.53	S	12.0	AC	25.6	L	4	67	2.3	1			MOR
1986 12 30.14	S	12.3	AC	51.0	L	4	93	& 3	0/			BOU

Periodic Comet Halley (1982i) (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 12 30.62		S 12.0	AC	25.4	L	4	190					SEA
1986 12 31.15		S 12.3	AC	51.0	L	4	75	& 3	1			BOU
1986 12 31.16		S 12.5	A	51.0	L	4	75		1			COM
1986 12 31.16		S 12.5	AC	51.0	L	4	75		1			COM
1987 01 03.17		S 12.2	AC	51.0	L	4	75		1			BOU
1987 01 03.17		S 12.4	A	51.0	L	4	75		1			COM
1987 01 03.17		S 12.4	AC	51.0	L	4	75		1			COM
1987 01 03.18		S 12.3	AC	25.4	J	6	73		1			BOU
1987 01 03.50		S 13.3	AC	32	L	4	150	1.2	1			KEE
1987 01 04.12		S 12.5:	A	25.4	J	6	73	& 1.5	1			BUS01
1987 01 04.16		S 12.2	AC	51.0	L	4	75	& 2.5	1/			BOU
1987 01 04.17		S 12.3	A	51.0	L	4	75	& 3	1			COM
1987 01 04.17		S 12.3	AC	51.0	L	4	75		1			COM
1987 01 08.53		S 12.2	AC	25.6	L	4	67	1.9	0/			MOR
1987 01 10.51		S 13.2	AC	32	L	4	150	1.3	1			KEE
1987 01 26.40		S 12.4	AC	25.6	L	4	111	1.3	1			MOR
1987 01 31.15		S 12.7:	A	20.5	L	6	38	1.75	1/			WEG
1987 02 01.34		S 12.5	AC	25.6	L	4	111	1.4	0/			MOR
1987 02 05.25		S 12.8	AC	50	L	5	125	1.1	0			BOR
1987 02 06.49	!	S 13.0	AC	32	L	4	150	1.2	1			KEE
1987 02 06.50		S 11.8	AC	25.6	L	4	45	2.4	1/			MOR
1987 02 06.51		S 11.8	AC	25.6	L	4	67	2.4	1/			MOR
1987 02 06.51		S 12.0	AC	25.6	L	4	111	1.9	2			MOR
1987 02 07.46	!	S 13.1	AC	32	L	4	150	1.1	1			KEE
1987 02 21.28		S 13.5:	L	40.6	C	18	229	& 1	0/			GRE
1987 02 23.35		S 12.2:		25.6	L	4	67	2.2	0/			MOR
1987 03 01.31		S 13.3	AC	32	L	4	150	1.4	1			KEE
1987 03 01.32		S 13.2	AC	32	L	4	63	1.6	1			KEE
1987 03 02.30		S 13.2	AC	32	L	4	150	1.4	1			KEE
1987 03 04.32		S 13.2	AC	32	L	4	150	1.2	1			KEE
1987 03 06.33		S 13.3	AC	32	L	4	150	1.2	1			KEE
1987 03 18.18		S 12.8	NP	25.6	L	4	67	1.5	1/			MOR
1987 03 18.18		S 12.8	NP	25.6	L	4	111	1.5	1/			MOR
1987 03 21.26		S 13.3	AC	32	L	4	150	0.9	1			KEE
1987 03 22.40		S 13.0:	AC	20.3	T	10	135	0.3	6			HAS02
1987 03 26.21		S 12.9	NP	25.6	L	4	67	1.7	1/			MOR
1987 03 27.26		S 13.4	AC	32	L	4	150	0.9	1			KEE
1987 04 22.22	!	S 13.6	AC	31.8	L	4	150	0.8	1			KEE
1987 04 23.16		S 13.5	AC	31.8	L	4	150	0.8	1			KEE
1987 04 23.18		S 13.4	AC	31.8	L	4	63	1.0	1			KEE
1987 04 24.15		S 13.3	AC	31.8	L	4	150	1.0	1			KEE
1987 04 24.16		S 13.2	AC	31.8	L	4	63	1.2	1			KEE
1987 04 25.23		S 13.5	AC	40.6	L	5	102		1			SCO01
1987 04 26.15		S 13.6	EB	40.6	C	18	229	& 0.9	1/			GRE

Periodic Comet Boethin (1985n)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 03 12.43		S 9.5	AC	15.2	L	5	45		1			BOU

Periodic Comet Schwassmann-Wachmann 1

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 07 29.89		I[14.5	AC	40.0	L	5	170					MER
1986 08 01.88		I[14.0	AC	40.0	L	5	170					MER

Periodic Comet Schwassmann-Wachmann 1 (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 08 31.87	I	[14.0	AC	40.0	L	5	170					MER
1986 09 02.85	I	[14.0	AC	40.0	L	5	170					MER
1986 09 05.83	I	[14.0	AC	40.0	L	5	170					MER
1986 09 07.83	I	[13.0	AC	40.0	L	5	170					MER

Periodic Comet Shoemaker 3 (1986a)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 01 18.38	S	13.0	NP	25.6	L	4	156	0.9	3/			MOR
1986 01 19.53	S	13.0	NP	25.6	L	4	156	0.9	3			MOR

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RECENT NEWS AND RESEARCH CONCERNING COMETS

(Cont. from page 58) Visual observers found comet 1987*b* at $m_1 \sim 13.5$–14.0 in the second half of January. Gehrels and Scotti found P/Wiseman-Skiff to have a tail > 90″ long on Feb. 1. CCD images obtained at Lowell Observatory in April indicated that it had faded to $V \simeq 20$.

Four Japanese amateurs independently discovered comet 1987*c*: Noboru Nishikawa with a 15-cm refractor on Jan. 19, followed by Kesao Takamizawa (discoverer of comet *1984 VII*), Akihiko Tago (co-discoverer of comets *1968 IV* and *1969 IX*), and Shigeo Mitsuma on Jan. 20. Since a maximum of 3 discoverers' names are attached to comet names, the 9^{th}-magnitude diffuse comet was assigned the name Nishikawa-Takamizawa-Tago 1987*c*.

Comet Nishikawa-Takamizawa-Tago passed perhelion on Mar. 17.3 at $q = 0.87$ AU, having an orbit that takes it almost directly opposite to the paths taken by the planets around the sun ($i = 172^o$). Upon discovery, comet 1987*c* was moving southwestward in Pisces some 60^o from the sun, but it quickly moved into conjunction, passing on the far side of the sun in early March. In early April, the comet moved out of the solar glare, and it could be 8^{th} magnitude or brighter into early June, when it will be at opposition. In late May, comet 1987*c* will be closest to Earth ($\Delta \simeq 0.5$ AU), and it will pass quickly from Microscopium past the southern part of Sagittarius and through the tail of Scorpius. By late June, it will be near the Hydra-Virgo border and perhaps around $m_1 = 10$. An ephemeris is provided below, based on orbital elements by Brian G. Marsden.

On January 24.40, Masanori Terasako discovered comet 1987*d* with 15-cm binoculars. Comet Terasako was about 8^{th} magnitude and moving northeastward in Sculptor (elongation $\sim 40^o$) at discovery, and the object moved out to an elongation of only $\sim 50^o$ by mid-February before moving back towards the sun in the sky. From late-April until mid-July, comet 1987*d* will be $< 30^o$ from the sun and will fade from $m_1 \sim 14$ to perhaps $m_1 \sim 18$ during that time. Some observers reported seeing an anti-tail of comet Terasako in the days following discovery; for example, David Levy found a faint sunward "feature" some 10′ long visually in a 20-cm reflector on Jan. 27 and 30. A photograph (30-min J-plate exposure) taken with the 1.2-m U.K. Schmidt telescope at Siding Spring, Australia, by D. Waldron on Jan. 29.45 showed "a narrow gas tail 100′ long in p.a. 93^o and a dust fan from this point, through the south, increasing in length and intensity to 15′ at p.a. 238^{o}", according to Rob H. McNaught.

The next five comets to receive provisional letter designations were all short-period comets recovered by professional astronomers, and four were recovered using CCDs. P/Howell was recovered photographically on Mar. 6 and 7 by Alan C. Gilmore and Pamela M. Kilmartin, a husband-and-wife team at the Mount John University Observatory above Lake Tekapo in southern New Zealand; this comet, known now as comet 1987*h*, was at $m_2 \sim 18$ at recovery and was diffuse with condensation. P/Howell is making its second observed return to the inner solar system (its first predicted return; $P = 5.93$ years, $q = 1.61$ AU), and visual observers should try detecting it during May and June when it should be near its brightest ($m_1 \sim 13$–14?). P/Howell, first found in 1981, was one of the many comets discovered with the 18-inch Schmidt telescope at Palomar during the last decade (*cf. ICQ* **3**, 99).

Tom Gehrels and James V. Scotti of the University of Arizona announced, during the first week in February, their recoveries of 3 comets with the 91-cm (36-inch) SPACEWATCH reflector (+ CCD) at Kitt Peak: P/Wild 3 (1987*e*), P/Bus (1987*f*), and P/Tempel 2 (1987*g*). P/Wild 3 was at $m_1 \simeq 19.5$ and diffuse with a 14″–16″ coma on Jan. 29 and Feb. 1. Both P/Wild 3 and P/Bus are also making their second observed returns to the sun; the time of perihelion for both of these comets, as listed in the *1987 Comet Handbook* (January issue), should be revised to $\Delta T = +0.79$ and –1.6 day respectively (*cf. IAUC* 4309–4311). P/Bus is another comet that was initially discovered with the Palomar 18-inch Schmidt, and was also at $m_1 \simeq 19.5$ and diffuse (coma diameter 17″) when recovered this year on Jan. 29.40. P/Tempel 2 is a well-known comet that may be targeted for a space mission by NASA, and is now at the beginning its 18^{th} apparition. Comet 1987*g* was at $m_1 = 20.4$ on 1986 Dec. 29 and at $m_1 = 20.0$ on 1987 Jan. 25.

P/Klemola 1987*i* was recovered on CCD images obtained by James Gibson with the 1.5-m reflector at Palomar on Feb. 16 and Mar. 17. The object was essentially stellar, within the limits of seeing, on Feb. 16 (Gunn *r* magnitude ~ 19), but by Mar. 17 P/Klemola ($r \sim 18$) exhibited a tail between p.a. $\sim 210^o$–270^o which was bordered by streamers $\sim 15''$ long, with less-extended structure visible between the streamers. P/Klemola ($P = 10.9$ years) is making its third observed return.

Carlos Torres of the University of Chile discovered

a new comet (1987*j*) on photographs exposed at Cerro El Roble on March 28 and 29. The object was diffuse with condensation and exhibited a short tail. Preliminary parabolic orbital elements suggest $T \simeq$ 1987 Apr. 10, $q \simeq 3.6$ AU, and $i \simeq 124^o$, indicating that comet Torres 1987*j* will stay near the discovery brightness ($m_1 \sim 16$) into May before fading. Torres had previously discovered two comets (in 1979 and 1980).

P/d'Arrest was recovered earlier than expected as comet 1987*k* by Karen J. Meech and David Jewitt at Kitt Peak on CCD images obtained with the 2.1-m reflector on March 31 and April 2 (Mould R magnitude $\sim$ 23). P/d'Arrest was at $r = 4.85$ AU at recovery and will not be at perihelion until 1989 Feb. 3. This will be the 15^{th} observed return to perihelion for P/d'Arrest.

P/Reinmuth 2 was recovered as comet 1987*l* on CCD exposures obtained by Gibson on April 11 and 13 with the 60-inch (1.5-m) Palomar Cassegrain reflector; the comet was nearly stellar in appearance, with magnitude (Gunn) $r \simeq 19$. P/Reinmuth 2 has been observed at six previous apparitions. Gibson also recovered P/Brooks 2 (1987*m*) on exposures obtained the same two nights; the object was again nearly stellar, with $r \simeq$ 20–21. P/Brooks 2 is now in its 13^{th} observed apparition; the comet was not visible (limiting magnitude $V \simeq 20.0$) on SPACEWATCH CCD exposures obtained 1986 June 5 and July 10.

Other Comets under Observation

Many comets are being followed at any given time by professional observers using photography and CCDs and telescopes ranging upward from 16 inches (40 cm) in aperture. The number of comets being followed visually (and reported in the *ICQ*) has gotten fairly impressive during the past five years or so, but it would seem that amateurs with access to telescopes of 40-cm aperture and larger should be able to help considerably to increase the amount of photometric data for comets fainter than $m_1 \sim$ 13 or 14. The following synopsis of observations of comets during the past year somewhat indicates how extensively they are being observed; most information concerning faint comets has been extracted from the *Minor Planet Circulars (MPCs)*.

P/Giacobini-Zinner, the center of much attention in late 1985 when the *ICE* spacecraft flew through the comet's tail, was last observed at Perth Observatory, Western Australia, on 1986 March 6. Comet Hartley-Good (*1985 XVII*) was also last seen at Perth on 1986 March 19.

Gehrels and Scotti obtained further diffuse images of comet Bowell *1982 I* (*cf. ICQ* **8**, 114) on 1986 Dec. 29 and 30; there was no obvious central condensation. The comet was then at $r = 13.9$ AU. Comet Černis *1983 XII* was still detectable on 1986 May 5 and 6 (at $r = 9.0$ AU) by Meech and Jewitt using the Curtis Schmidt telescope at Cerro Tololo in Chile.

Comet Shoemaker *1985 XII* (1984*f*) apparently remained at $m_2 \sim 17$ during October–December of last year, though Gilmore and Kilmartin found the comet 1.1 mag fainter on Oct. 31.6 than on Oct. 29.6 (60-cm reflector, Mount John Observatory). Observers at Oak Ridge Observatory in Massachusetts found the comet on photographic plates taken with the 155-cm reflector in late January and late February of this year.

P/Gunn, observable throughout its orbit, was found by Gehrels and Scotti at Kitt Peak on 1986 Dec. 12.39 at $m_1 = 18.6$ (with a 2.2′ tail) and again on 1987 Jan. 4 at $m_1 = 18.0$.

Comet Thiele 1985*m* (= *1985 XIX*) was seen at Oak Ridge at mag 17 on 1986 April 13 and was followed by Gehrels and Scotti until late July. P/Shoemaker 3 (1986*a*) was last seen on 1986 May 14, and P/Hartley 2 (1986*c*) was followed until 1986 June 7, again by Gehrels and Scotti; the latter comet was still at $m_1 =$ 17.5–18 in mid-March and early April 1986, as seen by Malcolm Hartley at Siding Spring and by Gibson at Palomar, but attempts by Gehrels and Scotti to find this object on 1987 Feb. 28 were fruitless (limiting magnitude $V \simeq 19.5$). The Kitt Peak SPACEWATCH observers could not detect P/Shoemaker 3 to a limiting magnitude of $V \simeq 20.0$ on 1986 June 6. Gehrels was also the last observer to have detected P/Daniel 1985*j* (1986 March 7) and P/Ciffréo 1985*p* (1986 March 15, $m_1 = 18.7$); the latter comet could not be found on 1987 Jan. 3 exposures (to $V \simeq 20.5$).

The Mount John observers were the last to detect comet Hartley *1985 XIV*, on 1986 July 12, and amateur H. B. Ridley of Eastfield, England, was the last to photograph P/Wirtanen 1985*q* (on 1986 April 1); visual observers followed the latter comet through most of May, however. Only two astrometric observations of P/Wirtanen were obtained after mid-December 1985 (both by Ridley), despite the fact that comet 1985*q* remained at $m_1 =$ 9–11 for many weeks and at elongation $>$ 40° from the sun into May. P/Singer Brewster 1986*d* was followed until 1986 September 6 by Gehrels and Scotti, and the same observers also found CCD images comet Shoemaker 1986*b* on 1986 December 2.4 ($m_1 = 19.0$, 1.2′ tail) and 27.5 ($m_2 = 20$, 77″ tail).

The strange comet 1986*e* (P/Machholz) had tails of length 1.8′ and 3.7′ (and anti-tails of length 40″ and 2′), respectively, on photographs obtained by Jeremy Tatum and David Balam, University of Victoria, BC, on 1986 June 25 and 26. Gibson at Palomar found P/Machholz at $m_1 \sim 19$ on Aug. 15, and the last known images of the comet were obtained by Gehrels at Kitt Peak on Sept. 5.15 ($m_1 = 19.8$).

P/Boethin 1985*n* was followed until late March 1986 by several visual observers (when $m_1 \sim 10$ and solar elongation $\sim 60^o$), but the last reported non-visual detection of this comet was made at Victoria on 1986 March 1 (with no astrometry reported between Jan. 19 and Mar. 1).

P/Forbes 1986*g* was last detected on 1986 June 12 as a weak image on a photograph taken by John Briggs at the Chamberlin Observatory field station in Colorado (16-inch reflector); Briggs then estimated $m_1 \sim 19$. P/Forbes was at perihelion on 1987 January 1, and should be detected during the coming months with large telescopes as it moves away from the solar glare. Comet Churyumov-Solodovnikov 1986*i* was followed through mid-1986 as an object of photographic magnitude 14–15, and the last known observation was made at Mt. John on Oct. 31.

Comet Wilson 1986*l* has been picked up in the morning sky by visual observers, and by mid-April had reached visual $m_1 \simeq 5.5$ according to G. Garradd in Australia.

Gehrels and Scotti have done more in the past year in observing faint comets than any other observing group. They detected P/Wild 2 (*1984 XIV*) at $m_1 = 19.5$ on 1986 Sept. 2 and 3, and again on Sept. 26. Gehrels also obtained CCD images of P/Encke last Aug. 31 ($m_1 =$ 19.5) and Sept. 25 ($m_1 = 19.2$); this comet is another one observable throughout its orbit, and was then at $r =$ 3.3–3.4 AU (aphelion = 4.1 AU).

Comet Shoemaker *1984 XV* was last seen on 1986 Sept. 26, again by Gehrels and Scotti; they had reported $m_2 = 19.0$ on Aug. 31. They also were the last to have detected P/Holmes 1986*f*, at $m_1 = 18.2$ on 1986 Dec. 29. Their observation of P/Comas Solá 1986*j* on 1986 Nov. 30 ($m_1 = 17.6$, 27′ tail) appears to be the latest available observation of that comet; Gehrels recorded a 20″ tail on Aug. 31. P/Whipple 1985*h* was at $m_1 = 18.9$ on Sept. 26 and $m_1 = 18.0$ on Dec. 4 (with a 100″ tail), as reported by Gehrels and Scotti. The Arizona team followed P/Kohoutek 1986*k* until last October 30, when a faint image was found by Scotti. Their final definite detection of P/Maury *1985 VI* was on 1986 Jan. 7; exposures on 1986 Dec. 1 revealed no trace of the comet down to $V \simeq 20.0$.

Gehrels and Scotti also have obtained the last available astrometric observations of the following faint comets in recent months: P/Lovas 2 (1986*p* was found as a very diffuse object on CCD images obtained in late January and early March; on Jan. 25.18, $m_1 = 18.5$, on Jan. 30.10, $m_1 = 19.5$, and on Mar. 3.13, $m_1 = 20$. P/Ashbrook-Jackson 1985*a* faded from $m_1 = 17.4$ on Jan. 4.15 to $m_1 = 19.1$ on Mar. 2.25 (the comet being at $r \simeq 3.4$ AU on the latter date). P/Shajn-Schaldach 1985*i* displayed a 33″ westward tail on 1986 Dec. 4, and was last detected on 1987 Jan. 29. P/du Toit-Hartley 1986*q* was found on images obtained on Jan. 3 ($m_2 = 18.9$) and again on Jan. 25. The SPACEWATCH team could not find the following comets on the dates listed, down to a limiting magnitude of $V \simeq 20.0$: P/Wild 1 (1986 Mar. 16), P/Gehrels 1 (1986 July 10 and 30, Sept. 1 and 3; searched as far as $\Delta T = \pm 2.5$ days), or P/Longmore (1986 Dec. 29, 1987 Jan. 25, and Mar. 2; possible candidate on Dec. 29).

P/Urata-Niijima 1986*o* apparently remained at $m_1 \simeq 15.9$–16.5 during 1986 November and December. The discoverers, Urata and Niijima, photographed their comet at $m_1 = 16.5$ on 1987 Jan. 1.39. The comet then faded slowly, with the last known observation at this writing being that by Gehrels and Scotti on March 2.17, when $m_1 = 18.5$ and the comet exhibited a coma size of 14″.

P/Schwassmann-Wachmann 2 (1986*h*) has brightened from $m_1 \sim 15$ in late November to $\sim$ 12–13 during the past 3 months. This comet is now heading into solar conjunction, not to be well-placed for observing again until the closing months of 1987.

P/Grigg-Skjellerup 1986*m*, considered the prime candidate for another *Giotto* comet fly-by, is brightening as it approaches its perihelion in mid-June, and observers are encouraged to give this comet special attention. Peter Wehinger and Michael Belton found $m_1 = 20.6$ on Feb. 2.20 with the 4-m Cerro Tololo reflector. Gehrels and Scotti recorded P/Grigg-Skjellerup at $m_1 = 19.7$ on Jan. 3.28, at $m_2 = 19.1$ on Mar. 2.12, and at $m_2 = 18.6$ on Mar. 3.10.

P/Halley has gradually faded from $m_1 \sim 12$ to $\sim$ 13 during February, March, and early April, but has lost most visible condensation. It has been observed visually at this return, post-perihelion, with 20- and 25-cm reflectors to a distance further than when it was last seen by astronomers in 1911. The low surface brightness and lack of central condensation indicates that P/Halley may not be seen visually after May, however. While Alan Hale could still see comet 1982*i* visually with a 20-cm short-focus Newtonian reflector from New Mexico in early April, it was nearly impossible for me definitely to locate the diffuse object with a 41-cm Cassegrain reflector in late February from Massachusetts; the long focal length of the 41-cm instrument ($f/18$) evidently caused me to "look right through" the comet's coma. A significant outburst occurred around Apr. 21, causing a 0.6–0.9 brightness increase in total visual magnitude (first noted by Richard Fleet in Zimbabwe); the comet evidently became significantly more condensed (from DC $\sim$ 1–2 to $\sim$ 7–8) for a couple of days, but by Apr. 25, the central condensation had again became lost as seen in telescopes of 1.5-m aperture and smaller. An increase of 1.3 mag in red light was seen by W. Wisniewski and colleagues (*cf. IAUC* 4372) from Apr. 20 to 23. At Oak Ridge Observatory in Massachusetts, photographs with the 61-inch reflector showed a large coma on Apr. 26.05; exposures from previous weeks had shown almost no coma, and a May 1.06 plate revealed that the coma had again faded away.

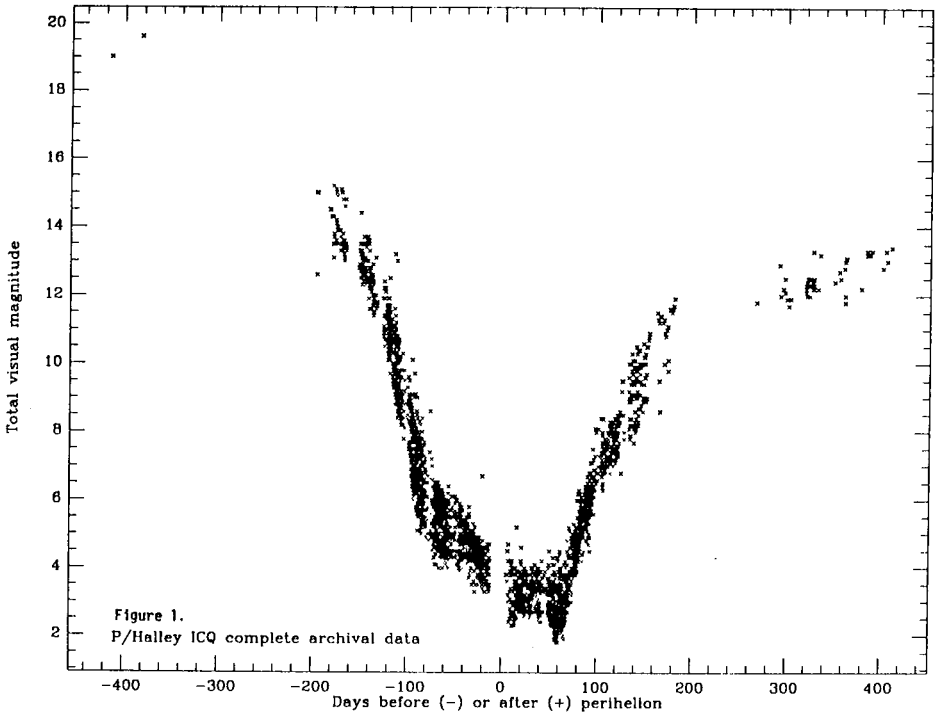
Heidelberg and the *ICQ* Archive

During October 27–31 last year, I attended the 20^{th} ESLAB Symposium on "The Exploration of Halley's Comet" in Heidelberg, West Germany, on behalf of the *ICQ*, and presented two papers which discussed *ICQ* photometric data. The first paper, describing the *ICQ* archive (by myself, Thomas Rokoske, and Charles Morris), was mentioned on page 130 of the October 1986 *ICQ*; in it we described what is available in the *ICQ* archive and what kinds of limitations are inherent in the archival data. Out of > 16,800 magnitude estimates in the *ICQ* archive (published through the July 1986 issue), < 5% are for comets where $m_1 > 12.0$, and only 33 total visual magnitude estimates are available for $m_1 > 13.9$. P/Halley has, by far, the greatest number of magnitude estimates in the archive, with > 4100 such values published through the April 1987 issue. The long-period comets Kohler *1977 XIV* and Austin *1982 VI* are next in sheer numbers of estimates, with 1013 and 823, respectively, and P/Giacobini-Zinner is fourth with 725 (all of these numbers tabulated through the July 1986 issue).

The first edition of the *ICQ* archive on magnetic tape was prepared in late 1986 including data published in the pages of this journal through the October 1986 issue. We anticipate updating the archive on magnetic tape every 1–2 years. As many researchers are interested in accessing *ICQ* photometric data, we encourage observers both to contribute data for publication as quickly as possible and to check what has been published in the *ICQ* with original data to make sure that correct data has been entered into the archive.

The second paper presented at the Heidelberg Symposium (by myself and Charles Morris) discussed the brightness behavior of P/Halley during 1981–1986, in which we used CCD data available prior to July 1986 and *ICQ* data after that point. Figure 1 is a graph of all of the *ICQ* m_1 data published through the April 1987 issue for P/Halley, to give an idea of the data we have been working through in studying the comet's light curve.

The Heidelberg meeting was quite impressive, with the largest collection of cometary astronomers ever to congregate at a single meeting (> 500 people attended); probably not until around 2061 will so many astronomers again meet at one location solely to discuss comets. Two sets of *Proceedings* are being issued from the Symposium, the first *Proceedings* being issued in February as a 3-volume set totalling > 1600 pages! (The first *Proceedings* will be discussed in a book review in an upcoming issue.) The second *Proceedings* from Heidelberg will appear as a special issue in the European journal *Astronomy and Astrophysics* in late 1987.



The first Heidelberg *Proceedings* give a good representation of what was discussed at the Symposium: a huge amount of data obtained from fly-by spacecraft, from spacecraft at large distances (including those in orbit around Earth and Venus), from aircraft in the earth's atmosphere, and from ground-based observers scattered around the globe; papers representing theoretical and laboratory work were also presented. In all, some 250 oral and 120 poster papers were presented in Heidelberg. The opportunity to meet with so many astronomers, and to discuss so many aspects of cometary observation and data, was highly rewarding. At the meeting, I encouraged three cometary scientists to join the *ICQ* Advisory Board: Drs. Zdenek Sekanina, Michael F. A'Hearn, and Ľubor Kresák.

Several invited papers reviewed various aspects of the P/Halley apparition and of our knowledge of comets. An example was the fine talk by Fred L. Whipple on "The Cometary Nucleus: Current Concepts". He discussed what we have learned about P/Halley's nucleus, including its somewhat surprising size ($\sim$ 16 km $\times$ $\sim$ 8 km), dark albedo ($\sim$ 0.03–0.05), and suggested low density (0.1–0.3 g/cm^3, calculated by Hans Rickman of Uppsala, which would make the nucleus extremely fragile). We learned from direct imaging obtained by *Giotto* and *Vega* spacecraft during their flybys that the release of dust and gas from the nucleus (in the form of jets) is confined to only a few areas representing a very small percentage of the total surface area. The imaging from *Giotto*, finally processed to reveal surface features, was presented at Heidelberg as a rather spectacular video (with music to "set the atmosphere"), the digitized pictures being strung together to show the appearance of the region around the nucleus, as the spacecraft approached P/Halley's source of activity. These pictures reveal what is evidently a shallow crater of diameter $\sim$ 1.6 km and depth $\sim$ 100 meters, and a mountain or large hill with its base in darkness and its peak in sunlight.

The actual rotation period of P/Halley's nucleus is still being hotly debated. The 7.4-day rotation period announced by Robert Millis *et al.* at the Heidelberg Symposium has shown up in many observers' data, but some astronomers are strongly holding that *only* a 52-hr period is present in their data; *Vega* investigators recently published, in a recent issue of the weekly journal *Nature*, their assertion that no 7.4-day period is visible in data obtained from the *Vega* flybys of P/Halley last year — they see only evidence of a 2.2-day period. Zdenek Sekanina, Jet Propulsion Laboratory, previously published (also in *Nature*) a model to reconcile the two periods: the comet's nucleus spins about its long axis once every 7.4 days, and this axis precesses about a fixed direction once every 2.2 days. For this to happen, however, the nucleus must be very rigid — somewhat of a contradiction to the possible low density mentioned above. More work will be necessary to help resolve this problem.

Daniel W. E. Green (1987 April 29)

THE LAST 20 COMETS TO RECEIVE PROVISIONAL LETTER DESIGNATIONS

Listed below, for handy reference, are the last 20 comets which have been given letter designations (1985a is the first comet to be discovered or recovered in 1985, 1985b is the second comet..., etc.). If a "Roman numeral designation" has been assigned, it is given in brackets at the end of the line. After the "equal sign" is given the name, preceded by an asterisk (*) if the comet is a new discovery (as opposed to a recovery from predictions of a previously-known short-period comet). Also given parenthetically are such values as the date of perihelion, T (month/date/year), and the perihelion distance, q (in AU).

1986m = P/Grigg-Skjellerup (T = 6/18/87, q = 0.99)
1986n = * Sorrells (T = 3/9/87, q = 1.72)
1986o = * P/Urata-Niijima (T = 11/22/86, q = 1.45)
1986p = * P/Lovas 2 (T = 8/29/86, q = 1.4)
1986q = P/du Toit-Hartley (T = 6/14/87, q = 1.2)

1987a = * Levy (T = 12/17/86, q = 0.92)
1987b = * P/Wiseman-Skiff (T = 11/22/86, q = 1.5, P = 6.5)
1987c = * Nishikawa-Takamizawa-Tago (T = 3/17/87, q = 0.85)
1987d = * Terasako (T = 12/24/86, q = 0.38)
1987e = P/Wild 3 (T = 9/1/87, q = 2.3, P = 6.9)

1987f = P/Bus (T = 12/19/87, q = 2.2, P = 6.54)
1987g = P/Tempel 2 (T = 9/16/88, q = 1.38, P = 5.29)
1987h = P/Howell (T = 4/14/87, q = 1.6, P = 5.9)
1987i = P/Klemola (T = 7/22/87, q = 1.77, P = 10.9)
1987j = * Torres (T = 4/9/87, q = 3.6)

1987k = P/d'Arrest (T = 2/3/89, q = 1.29)
1987l = P/Reinmuth 2 (T = 10/25/87, q = 1.9, P = 6.7)
1987m = P/Brooks 2 (T = 10/16/87, q = 1.84, P = 6.9)
1987n = P/Harrington (T = 10/31/87, q = 1.6, P = 6.8)
1987o = * Shoemaker (T = 11/20/86, q = 5.46)

EPHEMERIS FOR COMET NISHIKAWA-TAKAMIZAWA-TAGO 1987c
(from orbital elements by B. G. Marsden, MPC 11845)

Date	ET	R. A. (1950)	Decl.	Delta	r	Elong.	Mag.
1987	06 14	$14^h21^m.16$	$-30°12'.1$	0.835	1.733	138°.7	8.5
1987	06 19	13 59.03	-26 20.1				
1987	06 24	13 44.60	-23 23.4	1.128	1.863	120.5	9.5
1987	06 29	13 35.05	-21 09.8				
1987	07 04	13 28.71	-19 28.5	1.448	1.992	106.5	10.3
1987	07 09	13 24.59	-18 11.4				
1987	07 14	13 22.05	-17 12.5	1.777	2.120	94.8	11.0
1987	07 19	13 20.69	-16 27.6				
1987	07 24	13 20.22	-15 53.7	2.105	2.247	84.5	11.6
1987	07 29	13 20.45	-15 28.4				
1987	08 03	13 21.23	-15 10.2	2.426	2.373	74.9	12.2
1987	08 08	13 22.45	-14 57.5				
1987	08 13	13 24.03	-14 49.4	2.735	2.498	65.8	12.7
1987	08 18	13 25.89	-14 45.2				
1987	08 23	13 28.00	-14 44.1	3.028	2.621	57.1	13.1
1987	08 28	13 30.31	-14 45.7				
1987	09 02	13 32.79	-14 49.5	3.303	2.742	48.6	13.5

* * *

BOOK REVIEW: Asteroids, Comets, Meteors II

C.-I. Lagerkvist, B. A. Lindblad, H. Lundstedt, and H. Rickman, Eds., 620 pp. Paperback [ISBN 91-506-0492-9]. Uppsala universitet, Reprocentralen HSC, 1986 (address: Astronomiska Observatoriet, Box 515, S-75120 Uppsala, Sweden).

This book represents the proceedings of a meeting held in Uppsala during June 3–6, 1985, and contains 111 papers (most of which are only 2–4 pages long, some being merely abstracts) which are divided into three sections as suggested by the title. The meeting was the second in a series hosted by the Uppsala group on the same topics; the first meeting was attended almost exclusively by European astronomers and was held during June 20–22, 1983, and the third meeting is scheduled for 1989. A 455-page proceedings titled *Asteroids, Comets, Meteors* was issued after the 1983 meeting.

This review concentrates on the comets section of *Asteroids, Comets, Meteors II*, which constitutes ~ 50% of the book's volume. The editors admit, in their "Preface", that it was sometimes difficult to classify a particular paper as having more to do with, say, comets than asteroids, or meteors than comets; the "Asteroids" section contains some papers which discuss certain unusual asteroids as having possible relationships to the comet population. The subject matter of these different objects often overlaps, and this overlapping indicates the usefulness of bringing the study of asteroids, comets, and meteors together at one meeting and in one book.

Several papers in *Asteroids, Comets, Meteors II* discuss the Oort cloud of comets as seen through current theoretical modelling, perturbations by hypothetical stars and unknown distant planets (some of which have been speculated to periodically cause comet showers that may result in bombardment of Earth), and formation schemes for comets in the early stages of the solar system. Laboratory, observational, and theoretical studies of cometary constituents (as known before the P/Halley spacecraft flybys last year) are the topics of several papers, highlighted by Armand Delsemme's review entitled, "Elemental, Isotopic and Molecular Abundances in Comets". C. Arpigny *et al.* describe the contents of the nearly-completed new *Atlas of Cometary Spectra*, a sequel to the well-known *Atlas of Representative Cometary Spectra* (Swings and Haser, 1956).

Gas- and dust-production rates are the subjects of many papers, from both observational and theoretical standpoints. The brightness of comets is discussed by several authors, including Michel Festou ("The Derivation of OH Gas Production Rates from Visual Magnitudes of Comets"), Roman Smoluchowski ("Brightness Curve and Porosity of Cometary Nuclei"), Anita L. Cochran ("Brightness Asymmetry in Comet Kopff"), J. Svoreň ("Variations of Photometric Exponents of Long-Period Comets at Large Heliocentric Distances"), and papers by E. S. Barker and C. B. Opal and by Hyron Spinrad *et al.* which provide photometry of P/Halley obtained when the comet was at large heliocentric distance. A paper by K. R. Flammer *et al.* suggests that electrostatic levitation of dust off of the cometary nucleus may be responsible for unexplained large (1–2 mag) variations in the light curve of P/Halley at large r, and they find solar-wind observations which are consistent with this idea. The book also contains papers on cometary tails and the usual ones on observational activities planned for P/Giacobini-Zinner and P/Halley.

Asteroids, Comets, Meteors II was prepared from camera-ready typewritten (or computer typeset) copy supplied by the authors; as such, it has many different typefaces (from one paper to another), but the book is nonetheless neatly produced. Though this leads to the introduction of many typographical errors, the book is not hindered by these problems; it is a good source concerning topics which currently are being researched in these areas of astronomy, and every researcher in cometary astronomy should have access to this volume. *D. W. E. Green*