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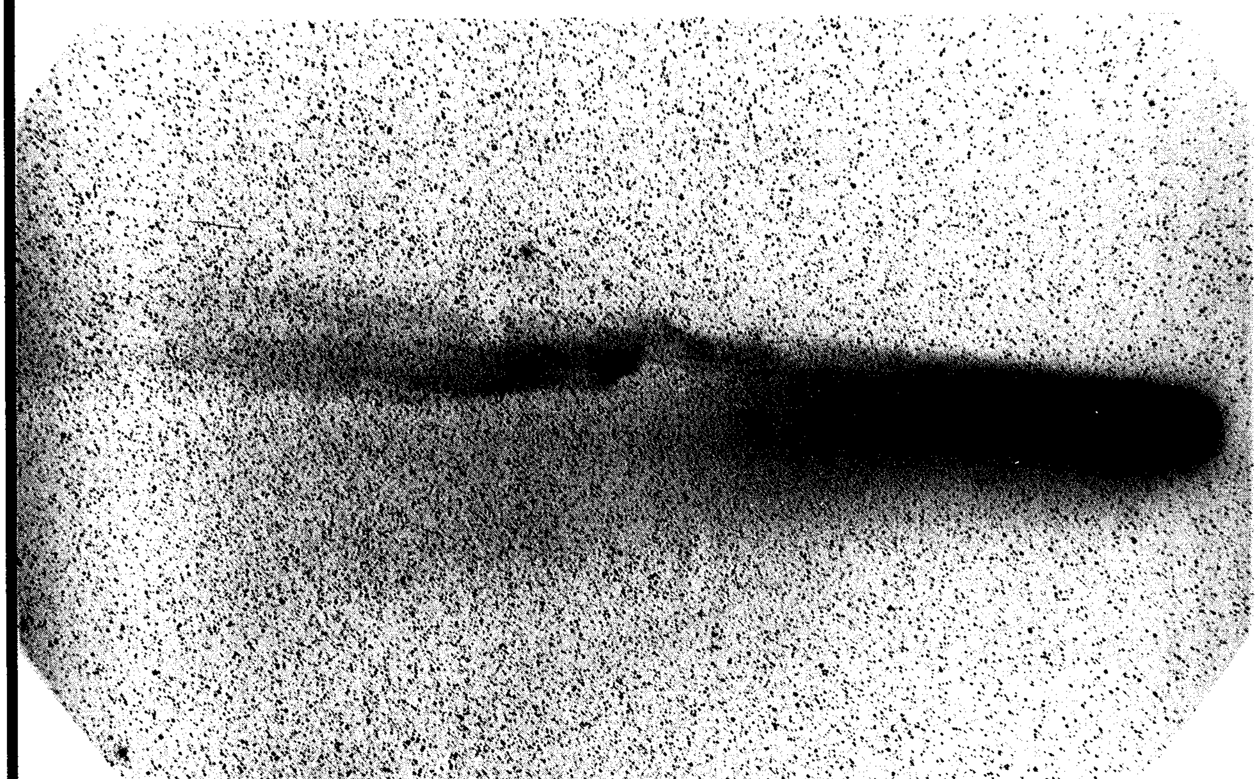

Photograph of P/Halley taken on 1986 March 21.4 UT with the Curtis 24-inch *f*/3.5 Schmidt telescope in Chile (15-min exposure on 2415 Tech Pan hypersensitized film). The visible tail extends to a length of $\sim 12.9 \times 10^6$ km. (Photo courtesy of William Liller and Freeman Miller.)

INSIDE THIS ISSUE

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RECENT NEWS AND RESEARCH CONCERNING COMETS

Four new comets have been discovered, and two short-period comets recovered, since I wrote this column for the October issue. As I predicted in that issue, P/Grigg-Skjellerup was recovered (comet 1986m) as a stellar-appearing object of magnitude $R \sim 22$ on Aug. 12 by K. Birkle with the 3.5-m reflector at Calar Alto, Spain. P/du Toit-Hartley was recovered (comet 1986q) in late December by Jim Scotti at Kitt Peak with the 91-cm reflector; the comet was then at $m_1 \simeq 19.3$ and "essentially stellar with a hint of diffuseness". Both Birkle and Scotti made their recoveries using CCDs.

William Sorrells, an amateur astronomer observing from Pleasanton, California, discovered his first comet (1986n) on a photograph taken Nov. 1 with his 16-inch $f/5$ reflector. The comet was at $m_1 = 11.2$ three nights later, according to observations by Alan Hale and Charles Morris. At discovery, the comet was moving west-northwestwards in Taurus, toward perihelion on 1987 March 9 at $q = 1.72$ AU. By late December, the comet had reached total visual mag 9. It is very unusual for amateurs to discover comets photographically, but T. Urata and T. Niijima of Japan join Sorrells with back-to-back discoveries in this manner. P/Urata-Niijima 1986o was initially reported as a 16^{th}-magnitude fast-moving minor planet discovery on October 30, but T. Seki noted it as diffuse on his Nov. 3 photographs. Comet 1986o passed perihelion on 1986 Nov. 22 at $q = 1.45$ AU, and has an orbital period of 6.62 years.

Miklos Lovas discovered his second periodic comet (P/Lovas 2 1986p) as a 14^{th}-magnitude object, diffuse with condensation and a short tail, on photographs taken Nov. 28 and 30, as the object was moving slowly northeastward in Aries. Lovas' fifth comet to be named for him, P/Lovas 2 had passed perihelion on 1986 Sept. 1.5 at a heliocentric distance of 1.45 AU, and it has an orbital period of 6.61 years. By Jan. 3, comet 1986p had faded to $m_1 \sim 17$ ("somewhat diffuse with a 1′ coma"), according to Scotti, though other observers in December were not able to locate the comet.

David Levy of Tucson, Arizona, discovered a new comet in the first week of January 1987, giving him two visual comet discoveries in < 3 years. The comet was diffuse with slight condensation and moving slowly southwestward in Ophiuchus with a total visual magnitude of ~ 11. Levy found comet 1987a, using a 16-inch $f/5$ reflector (64×), some 205 search-hours after finding comet Levy-Rudenko 1984t. As of this writing, no orbit was available for comet Levy 1987a.

Jim Scotti and Tom Gehrels, observing at Kitt Peak, found comet Bowell 1982 *I* at mag ~ 21 with a 25″-diameter coma on 1986 Dec. 2.16, with no discernible nucleus, after Karen Meech and David Jewitt had reported the comet at $m_1 \sim 18$ in early November. On Dec. 2, the comet was 13.7 AU from the sun. *(Cont. on page 152)*

THE LIFETIMES OF COMETS. I. INDIRECT EVIDENCE

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From the evolutionary point of view, the comets are the most conspicuous objects in the solar system. On one hand, they are the most primordial products of the first phases of formation of the system, most of them having remained essentially unchanged for the following 4.6 billion years. On the other hand, they are the only objects in which physical aging processes, as well as drastic changes of orbits, can be observed within a few decades to centuries. This apparent paradox is due to the enormous acceleration of the aging of individual objects with time. According to our present knowledge, a complete scenario of the evolution can be described as follows:

During the first billions of years, the comet is circulating slowly, as a non-evolving, dormant object, at a great distance from the sun, completing there hundreds to thousands of revolutions and constituting, together with other similar objects, the huge Oort cloud (Oort 1950). After a passage of a star nearby, decelarating the comet's motion, the first visit of the planetary system takes place. The transport takes typically 2 million years, and, in a case where it leads the comet to only few astronomical units (AU) from the sun, the comet already starts its aging and deterioration process. Otherwise, a progressive capture by the outer planets is necessary, which would typically take $\sim 10^9$ years (or 5×10^5 revolutions) if starting with perihelion near the orbit of Neptune, but only 2×10^5 years (or 10^3 revolutions) if starting with perihelion near the orbit of Jupiter (Everhart 1977). The ultimate stage is that of a short-period comet, revolving with a period of 5–10 years mainly between the sun and Jupiter, until a complete extinction a few thousand years later.

However, only a very small fraction of all comets experiences this full range of changes. At every evolutionary stage, escape from the solar system is possible. Nearly half of all "new" comets are removed just after their first passage near the sun, leaving the planetary region on slightly hyperbolic orbits. A random succession of decelerating and accelerating encounters can return the comets to a less-advanced dynamical stage, thereby reversing — temporarily or forever — the evolutionary trend. Both due to the loss of comets from the solar system and to the progressive mass-loss by individual objects, a great majority of comets would occupy the earliest evolutionary stage at any time, as inactive and unobservable objects; a small fraction as observable objects of high orbital eccentricity and very long period (up to millions of years — which limits our observing opportunities of them); and a minute fraction as short-period comets observable many times per century, or even all around their orbits. Current estimates set the total number of comets at $\sim 10^{12}$, that of the "new" ones passing near the sun for the first time at $\sim 10^7$, and that of the short-period comets at $\sim 10^3$. Modern computing techniques make it possible to model the dynamical evolutions of large comet samples from arbitrary initial conditions, and to check the results with the observations. The extensive modelling experiments by Everhart (1972) show that, beginning with the first passage near the sun, the number of comets bound to the solar system tends to decrease with the inverse square-root of the number of revolutions covered (*i.e.*, to 10% after 100 revolutions and to 1% after 10,000 revolutions). Only comets of originally-low inclinations can enter short-period orbits, typically after thousands of revolutions.

Recent developments in this area have indicated that the first phase of the above scenario may be incomplete. First, the Oort cloud of comets, stretching at least 5×10^4 AU from the sun, may be stable enough against perturbations by individual stars, but not stable enough against passages of the solar system through giant molecular clouds (Clube and Napier 1983). Second, the observed number and short lifetimes of short-period comets would require an excessive original population of the Oort cloud (Joss 1973). There is still no general consensus about the significance of these conjectures, but they can be removed by assuming an additional original source of comets — the inner Oort cloud, situated not far beyond the outer planets and concentrated towards the fundamental plane of the solar system (Whipple 1964; Hills 1981; Bailey 1983). This source would supply most objects evolving into typical short-period comets, while comets such as P/Halley would come from the outer cloud. For a more complete review of the dynamical models, refer to the study by Weissman (1985).

In all purely dynamical models, the ultimate fate of each individual object is ejection from the solar system; even when destruction by planetary collisions is taken into account, its effect comes out statistically negligible (Weissman 1980). The problem of final fates is the weak point of dynamical modelling. For a realistic solution, one would have to include the progressive deterioration of individual objects, which is poorly known and can be hardly expressed by means of mathematical functions. The original size, composition and structure, and past dynamical evolution are decisive not only for the survival time but also for the final fate: whether a complete disintegration or a change of the core into an extinct, asteroidal-like object.

The physical aging is apparently going on at much shorter time-scales. We have about a dozen examples of observed comet extinctions (Kresák 1985). At the same time, the forward and backward integrations, covering altogether more than 12,000 revolutions, of all the known short-period comets have revealed not a single ejection from the solar system, and only one questionable case of transition of a "new" comet into a short-period orbit — P/Wild 2 in 1702 (Carusi *et al.* 1985). This demonstrates the order-of-magnitude difference between the two time-scales. Hence, the equilibrium between captures and ejections, which should be a natural consequence of a random distribution of perturbing decelerations and accelerations, in fact does not exist: the comets moving in short-period orbits die out before they can be ejected again.

Unfortunately, the progressive disintegration makes it impossible to trace the motion of real objects very far back in time. The asymmetric ejection of gas and dust, caused by the solar irradiation of the rotating nucleus from one side, gives rise to nongravitational effects in the orbital motion. The effects are so irregular that they cannot be reliably extrapolated in time (Marsden 1985). This makes the past evolution of individual objects indeterminate on longer time-scales, and drives us to rely on modelling experiments with the physical aging processes involved, at least in some reasonable approximations. The required basis information includes the active lifetimes of comets, their distribution, and dependence on the size and shape of the orbit.

The active lifetime of a comet is determined by its relative mass-loss per revolution, which would obviously vary with time. The recent progress in observing techniques has made it possible to estimate the absolute loss of gas and dust, by spacecraft observations in the ultraviolet and by ground-based observations in the infrared, respectively (for reviews, see Feldman 1982 and Ney 1982). Information on the long-term production of larger particles can be obtained from the observations of meteor showers, but a great deal of extrapolation is necessary to take also into account those parts of the stream which do not intersect the earth's orbit (McIntosh and Hajduk 1983). The only direct evidence of the relative mass-loss is the strength of the nongravitational effects in the motion of individual comets. However, these are variable, difficult to determine exactly, and correct interpretation requires certain assumptions about the accelerating mechanism.

The absolute mass-loss could be converted into the relative one if we knew the masses, or sizes and densities, of individual comets. Unfortunately, the cometary nuclei are much too small to be measured from the earth's distance and are always hidden within a much brighter coma; moreover, photometric size estimates are complicated by the unknown albedo. Even the best existing radar measurements leave an uncertainty of one order of magnitude in the linear size of the nucleus (Kamoun *et al.* 1982), which corresponds to three orders of magnitude in its mass. Determination of comet masses from their perturbing effects on other objects is entirely out of the question. These effects are just on the verge of detectability for the largest asteroids, which have masses about a million times greater, much higher probabilities of low-velocity encounters with other similar objects, and Newtonian motion unaffected by nongravitational forces.

The *Vega* and *Giotto* missions, the first results of which will become available before this article appears, will undoubtedly provide us with fundamental information on the size, shape, surface properties, and activity of P/Halley. This milestone in our understanding of comets will elucidate many problems of their physical aging. One will have to bear in mind, however, that P/Halley is by no means a typical comet. Its highly eccentric retrograde orbit is indicative of a past dynamical evolution entirely different from typical short-period comets. The relative stability of its orbit, the high brightness, high absolute mass-loss, and the extraordinarily-broad meteor stream dispersed all around its orbit make it clear that its total active lifetime must be much longer than that of average comets.

Apart from the quantitative aspect of the mass-loss, there are different cometary phenomena which cast light on the aging process. The most promising objects from this point of view are the short-period comets which can be observed and compared at a number of subsequent apparitions. As already mentioned, they represent a more advanced evolutionary stage than the long-period comets. They are also considerably fainter, on the average (Yabushita and Hasegawa 1981; Hughes and Daniels 1982).

However, it is not easy to draw correct conclusions from such statistical comparisons. On one hand, short-period comets can be discovered at any of the recurrent perihelion passages, preferably at those of unusually-favorable observing geometry, and sometimes during irregular brightness outbursts. Their brightness at the time of discovery is lower, on the average, because such a discovery is more often made on survey plates taken with larger instruments around opposition. Many of the long-period comets are discovered, even nowadays, during visual searches with small telescopes at small solar elongations. On the other hand, the proportion of small perihelion distances (say, $q < 1$ AU) is much larger for the long-period comets, which makes them apparently brighter at the same absolute magnitude, reduced to a unit heliocentric and geocentric distance. In spite of this, there is a definite lack of absolutely-faint long-period comets, as demonstrated by the statistics of those objects which passed close to the earth (Kresák 1978).

Statistical analysis of the photometric data on short-period comets covering decades to centuries (Vsekhsvyatskij 1958) has indicated their progressive brightness decrease by several magnitudes per century. However, these data taken at their face value have led to gross underestimates of the comet "death" dates – already failing for 7 objects. The reasons of this failure are explained in detail elsewhere (Kresák 1974), and can be summarized as follows:

First, the absolute brightness of comets is subject to irregular fluctuations, the amplitude of which varies substantially from one object to another. If the comet is decelerated by Jupiter into an orbit of appreciably smaller perihelion distance — and such captures are responsible for $\sim 20\%$ of short-period comet discoveries (Kresák 1982) — the change in the insolation regime makes them absolutely brighter for one or two apparitions (Kresák 1973). Also, if there are major brightness variations from one revolution to another, it is more probable that the comet will be discovered just at an increased activity level. Thus the first apparition cannot be relied upon in determining the general rate of fading. As shown by Svoreň (1979), just the removal of the discovery apparitions is sufficient to reduce the secular brightness decrease by 40%. Second, and in particular, the photometric data on short-period comets, covering nearly two centuries, bear definite signatures of the development of observing techniques. However, paradoxical as it may appear, the instrumental effects make the comets fainter with time. This is because the detection threshold is improving, and large telescopes tend to record only the central condensation of the coma. The outer coma, instead of being added, is subtracted as a part of the background; and underestimates of over 7 magnitudes, or a brightness ratio of almost 1:1000, may occur for very diffuse objects.

The impossibility of obtaining reliable data for longer time spans, without the poorly-known instrumental corrections and calibrations, can be illustrated by another secular trend obtained from the very same kind of data. The mean photometric exponent, n (*i.e.*, the exponent approximating the brightness variations with heliocentric distance), comes out 4.2 for the comets observed before 1900, 4.6 between 1900 and 1930, 5.3 between 1930 and 1950, and 5.9 between 1950 and 1970. A physical explanation of this progressive change is entirely out of the question. It is evident that this is simply due to the inclusion of systematically underestimated brightness data, obtained with large, long-focus photographic telescopes at large solar distances. It is essentially the same effect which simulates the rapid brightness decrease of short-period comets.

Current efforts in better calibrated magnitude estimates of comets, and their unified annotated listing in the *International Comet Quarterly*, lend promise of improvement in this respect. While this is obviously a long-term task, just the first processing and summarization demonstrates that many comets, previously believed to fade rapidly, did not indeed exhibit significant changes since their discovery (Meisel and Morris 1982). There are undoubtedly examples of a real, progressive brightness drop over a limited time span, such as P/Faye in the second half of the 19th century. On the other hand, there are comets like P/d'Arrest which was at its last apparition 2 mag brighter than at the discovery apparition 20 revolutions ago, or P/Perrine-Mrkos, the variations of which are entirely erratic. For a great majority of short-period comets, the total systematic reduction of absolute brightness since their discovery appears to be deep within the noise of irregular fluctuations.

References

Bailey, M. E. (1983). *M.N.R.A.S.* **204**, 603–633.

Carusi, A.; Ľ. Kresák; E. Perozzi; and G. B. Valsecchi (1985). in *Dynamics of Comets: Their Origin and Evolution* (A. Carusi and G. B. Valsecchi, eds.; D. Reidel Publ., Dordrecht), 319–340.

Clube, S. V. M.; and W. M. Napier (1983). *Highlights Astron.* **6**, 355–362.

Everhart, E. (1972). *Astrophys. Lett.* **10**, 131–135.

——— (1977). in *Comets, Asteroids, Meteorites* (A. H. Delsemme, ed.; Univ. of Toledo Press), 99–104.

Feldman, P. D. (1982). in *Comets* (L. L. Wilkening, ed.; Univ. of Arizona Press), 461–479.

Hills, J. G. (1981). *Astron. J.* **86**, 1730–1740.

Hughes, D. W.; and P. A. Daniels (1982). *M.N.R.A.S.* **198**, 573–582.

Joss, P. C. J. (1973). *Astron. Astrophys.* **25**, 271–273.

Kresák, Ľ. (1973). *Bull. Astron. Inst. Czech.* **24**, 264–283.

——— (1974). *Bull. Astron. Inst. Czech.* **25**, 87–112.

——— (1978). *Bull. Astron. Inst. Czech.* **29**, 103–125.

——— (1982). in *Comets* (L. L. Wilkening, ed.; Univ. of Arizona Press), 56–82.

——— (1985). in *Dynamics of Comets: Their Origin and Evolution* (A. Carusi and G. B. Valsecchi, eds.; D. Reidel Publ., Dordrecht), 283–306.

Marsden, B. G. (1985). in *Dynamics of Comets: Their Origin and Evolution* (A. Carusi and G. B. Valsecchi, eds.; D. Reidel Publ., Dordrecht), 343–352.

McIntosh, B. A.; and A. Hajduk (1983). *M.N.R.A.S.* **205**, 931–943.

Meisel, D. D.; and C. S. Morris (1982). in *Comets* (L. L. Wilkening, ed.; Univ. of Arizona Press), 413–432.

Ney, E. P. (1982). in *Comets* (L. L. Wilkening, ed.; Univ. of Arizona Press), 323–340.

Oort, J. H. (1950). *Bull. Astron. Inst. Neth.* **11**, 91–110.

Svoreň, J. (1979). *Contrib. Astron. Obs. Skalnaté Pleso* **8**, 105–140.

Vsekhsvyatskij, S. K. (1958). *Fizicheskie kharakteristiki komet* (Moscow; English translation: *Physical Characteristics of Comets*, NASA TT F-80, 1964).

Weissman, P. R. (1980). *Astron. Astrophys.* **85**, 191–196.

——— (1985). *Space Sci. Rev.* **41**, 299–350.

Whipple, F. L. (1964). *Proc. Natl. Acad. Sci.* **51**, 711–718.

Yabushita, S.; and I. Hasegawa (1981). *M.N.R.A.S.* **195**, 361–370.

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CATALOGUE OF COMETARY DISCOVERY POSITIONS

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A number of catalogues have appeared in the past relating to one aspect or another about comets. There is, however, one compilation which this author has not seen published: a list of cometary discovery positions. The nearest thing to such a listing is that by Vsekhsvyatskii (1964), where constellations are frequently given. The availability of catalogues of orbital elements, together with information regarding discovery dates, enables one to *calculate* approximate discovery positions. The listing which follows (pp. 119–129) represents the author's attempt to do precisely that. Some additional data have also been included, in the hope that it might prove useful to some readers.

The basis for this listing is the most recent (fifth) edition of the *Catalogue of Cometary Orbits* (Marsden 1986a), which includes comets discovered during the time span from −239 through 1985. The orbital elements listed by Marsden were used in combination with computer programs based on algorithms published by Meeus (1982) to generate the ephemerides. Included are only those comets listed in Marsden's catalogue for which a reasonably reliable discovery date could be determined. The discovery dates came, for the most part, from information found in Kronk's (1984) recent catalogue.

The following comets in Marsden's catalogue had to be excluded from this listing, due to lack of accurate discovery date information: −239, −163, −86, 218, 295, 609, 912, 1500, and 1686. Since the publication of Marsden's recent catalogue, a number of new comets have been discovered and are included in this present list, namely: 1983 *XX*, 1986*a*, 1986*b*, 1986*c*, 1986*d*, 1986*e*, 1986*i*, and 1986*l*. Revised orbital elements for comets 1981 *XXI* and 1984 *XII* (Marsden 1986b) have also been used. The newly-designated periodic comet Skiff-Kosai 1976 *XVI* (see *IAU Circ.* No. 4250) is also included here. Finally, an identification (Kresák 1986) of P/Grigg-Skjellerup with a comet discovered by Pons in February 1808 has yielded new orbital elements, enabling comet 1808 *III* to be included in this catalogue.

Even when a date is given, the problem of determining the actual discovery date is not as straightforward as one might at first think. In some cases, prediscovery images, on photographs taken at some earlier date, were found some time after the initial reported discovery; but, as a careful examination of observatory plate collections could probably turn up prediscovery images for many comets, it seemed most reasonable simply to use the date of the observation when the comet was originally noticed. Moreover, as a rule, visual discovery circumstances were selected over a possibly earlier photographic discovery of the same comet — reflecting this author's personal prejudices and interests at this time. Also, it is not known how soon before actual discoveries that comets were discoverable with similar or better observing/observability conditions. These factors, along with errors in judgment and possible missing information, tend to cause the dates selected to be somewhat arbitrary. The interested reader should consult other sources (such as Kronk 1984) for information regarding such multiple-discovery situations.

There are 807 entries in this listing. Some periodic comets have been rediscovered, without prior knowledge as to their position, during more than one apparition. When the comets had been lost, or unobserved for many revolutions, it seemed reasonable to treat these "accidental recoveries" as genuine discoveries, and thus consider them to be legitimate candidates for this listing. Intentional comet recoveries (*i.e.*, those aided by ephemerides) have been excluded. Again, lack of scholarship on the author's part may have resulted in some comets being included in this listing when they should not have been, and *vice versa.*

The data are listed under the following columns:

1) designation, as it appears in Marsden's catalogue
2) discovery date (year, month, date)
3) comet's right ascension (α), in hours and minutes (equinox 1950.0)
4) comet's declination (δ), in degrees and minutes (equinox 1950.0)
5) elongation of the comet from the sun, in degrees
6) an indication of relative comet/sun position: morning (M) *vs.* evening (E) sky
7) delta (Δ), the comet's geocentric distance, in astronomical units (AU)
8) *r*, the comet's heliocentric distance, in AU
9) days since the previous occurrence of full moon
10) method of discovery: u = unaided eye, t = telescope, p = photographic
11) rate of motion on discovery date, in degrees per day
12) direction of motion on discovery date, to nearest compass setting
13) approximate discovery magnitude, when known
14) name, as given in Marsden's catalogue

Some remarks are in order. First, as the time of day of discovery was frequently not easily determinable, it was decided to have all data refer to 12^h UT on the date given. For fast-moving comets, therefore, there can be considerable differences in a comet's position at 12^h UT, as opposed to the true hour of discovery on a given date. One is cautioned to check the rate of motion figures in order to spot these cases. The method of discovery is generally based on the discovery circumstances listed by Kronk (1984); however, in some cases, it was not immediately apparent and then had to be guessed. The magnitudes are also, for the most part, extracted from Kronk's book. Special attention should be called to the fact that these magnitudes should be viewed as being merely suggestive, and very possibly in error. Finally, the morning/evening sky information was based only on differences in right ascension between the comet and the Sun on the date given; considerations such as the angle the ecliptic makes with the horizon were not taken into account.

It is hoped that even with all these misgivings, this catalogue will prove to be of some use.

References

Kresák, Ľ. (1986). *IAU Circ.* No. 4234.

Kronk, G. W. (1984). *Comets: A Descriptive Catalog* (Hillside, NJ: Enslow Publishers, Inc.).

Marsden, B. G. (1986a). *Catalogue of Cometary Orbits,* fifth edition (Cambridge, MA: IAU Minor Planet Center, Smithsonian Astrophysical Observatory).

Marsden, B. G. (1986b). *IAU Circ.* No. 4230.

Meeus, J. (1982). *Astronomical Formulae for Calculators,* second edition (Richmond, VA: Willmann-Bell, Inc.).

Vsekhsvyatskii, S. K. (1964). *Physical Characteristics of Comets,* translated from the Russian version *Fizicheskie kharakteristiki komet* (1958) by the Israel Program for Scientific Translations (Jerusalem), available from the U.S. Superintendent of Documents (NASA TT F-80).

desig	disc	date	RA (1950)	DEC	eln	s	del	r	fm	m	motion	magn	name
-146	-146	8 6	16 24.0	-21 15	88	E	0.19	1.02	9	u	7.5 ENE		
-11	-11	8 26	6 22.0	+26 25	84	M	0.57	1.10	22	u	1.1 ENE		P/Halley
66	66	1 31	21 14.2	-9 24	19	M	1.43	0.60	1	u	0.5 WSW		P/Halley
141	141	3 26	23 38.7	+7 13	33	M	1.08	0.59	16	u	0.2 NNW		P/Halley
240	240	11 10	17 25.1	-11 11	15	E	1.22	0.37	23	u	2.3 E		
374	374	3 3	21 50.1	-5 54	38	M	1.03	0.67	18	u	0.4 WSW		P/Halley
390	390	8 22	7 43.6	+32 13	59	M	0.12	0.95	10	u	6.9 NNE		
400	400	3 19	0 27.4	+29 5	24	M	0.29	0.75	22	u	1.4 N		
442	442	11 10	10 40.7	+56 0	108	M	1.00	1.60	6	u	0.8 WNW		
451	451	5 17	3 19.5	+20 25	25	M	1.88	1.04	16	u	0.2 NE		P/Halley
530	530	8 28	8 35.7	+37 11	56	M	0.36	0.86	4	u	5.2 E		P/Halley
539	539	11 17	18 59.3	-24 16	27	E	0.78	0.45	6	u	3.0 ENE		
565	565	7 22	9 3.9	+47 11	33	M	1.49	0.84	23	u	0.5 N		
568	568	9 3	15 49.5	-10 25	56	E	0.27	0.88	11	u	1.0 ENE		
574	574	4 4	5 24.2	+26 39	47	E	0.89	0.76	12	u	1.9 NE		
684	684	9 6	11 52.4	+34 13	36	M	0.26	0.81	7	u	9.5 ESE		P/Halley
760	760	5 16	2 22.0	+25 29	35	M	0.92	0.59	11	u	1.0 NE		P/Halley
770	770	5 26	5 17.0	+41 21	18	M	1.50	0.62	12	u	0.6 N		
837	837	3 22	22 10.3	-4 7	49	M	0.71	0.75	26	u	0.3 SW		P/Halley
868	868	1 21	7 51.8	+65 5	127	E	0.14	1.08	8	u	7.9 W		
905	905	5 18	4 9.4	+41 29	21	M	0.32	0.73	26	u	4.3 ENE		
961	962	1 28	18 8.8	+2 45	59	M	0.83	0.91	5	u	0.8 W		
989	989	7 6	4 59.8	+23 21	46	M	1.83	1.34	15	u	0.3 ENE		P/Halley
1014	1014	2 12	14 1.8	-44 3	114	M	0.42	1.23	24	u	0.4 W		
1018	1018	8 3	11 30.5	+56 9	47	E	0.40	0.80	4	u	2.5 SW		
1066	1066	4 1	23 17.5	+4 23	38	M	0.88	0.63	18	u	0.1 N		P/Halley
1080	1080	8 10	12 23.7	+13 11	28	E	0.09	0.93	7	u	6.0 WNW		
1092	1092	1 8	5 0.7	-6 13	122	E	0.25	1.14	11	u	7.6 WNW		
1097	1097	10 6	15 35.2	-8 51	25	E	0.59	0.52	12	u	2.8 NE		
1110	1110	5 29	1 27.4	+26 18	56	M	0.70	0.86	24	u	2.2 N		
1132	1132	10 5	7 30.2	+61 16	103	M	0.07	1.01	9	u	16.4 W		
1145	1145	4 14	0 39.9	+13 2	29	M	1.21	0.58	5	u	0.2 NNW		P/Halley
1147	1147	1 4	22 12.2	+21 35	50	E	0.37	0.80	15	u	4.2 SSE		
1222	1222	9 3	10 23.7	+38 41	43	M	0.33	0.79	11	u	7.2 E		P/Halley
1230	1230	12 4	20 15.5	+50 43	80	E	0.18	0.97	12	u	2.5 SW		
1240	1240	1 27	23 55.1	-25 3	32	E	0.41	0.68	17	u	3.9 N		
1245	1245	2 24	19 34.1	-20 37	61	M	0.12	0.94	11	u	9.2 ENE		
1264	1264	7 14	11 29.2	+33 57	40	E	0.26	0.83	4	u	1.6 W		
1293	1293	11 7	14 1.8	-56 58	42	M	0.27	0.81	22	u	1.9 NNW		
1299	1299	1 24	6 16.1	-20 9	120	E	0.79	1.55	7	u	1.8 WNW		
1301	1301	9 14	7 15.8	+37 13	83	M	0.40	1.03	25	u	2.6 NE		P/Halley
1305	1304	12 24	21 21.4	-19 38	27	E	0.17	0.84	11	u	9.6 N		
1337	1337	6 26	4 20.5	+49 5	46	M	0.99	0.78	13	u	0.9 N		
1340	1340	3 24	14 8.3	-16 53	164	M	0.39	1.39	10	u	4.8 WNW		
1345	1345	7 31	10 36.7	+57 59	45	E	0.05	0.98	16	u	14.7 SW		
1351	1351	11 24	0 43.0	+19 57	118	E	0.06	1.01	20	u	5.6 E		
1362	1362	3 4	22 31.8	-2 15	22	M	0.95	0.38	23	u	1.2 NNW		
1366	1366	10 25	11 30.3	+47 45	81	M	0.04	0.98	6	u	30.5 NE		P/Tempel-Tuttle
1368	1368	3 7	18 33.0	-40 55	87	M	0.95	1.34	2	u	0.4 ENE		
1376	1376	6 22	1 58.2	-5 44	82	M	0.23	1.01	19	u	5.7 NNE		
1378	1378	9 26	6 35.2	+42 4	102	M	0.29	1.09	19	u	3.1 NNE		P/Halley
1385	1385	10 23	11 50.4	+0 3	49	M	0.92	0.79	5	u	1.8 S		
1402	1402	2 8	3 24.8	+0 3	74	E	0.72	1.05	20	u	1.3 NW		
1433	1433	9 15	14 18.3	+52 15	60	E	1.41	1.26	16	u	1.3 SE		
1439	1439	3 25	10 19.8	-6 28	137	E	0.34	1.27	24	u	3.9 NW		
1449	1449	12 20	17 37.8	-15 36	22	M	1.18	0.45	21	u	1.0 NW		
1456	1456	5 26	2 49.9	+25 22	34	M	1.18	0.66	6	u	0.6 NE		P/Halley
1457 I	1457	1 14	23 48.2	-2 36	46	E	0.74	0.71	4	u	1.0 E		
1457 II	1457	6 15	21 56.4	+12 38	120	M	0.39	1.26	8	u	1.8 NE		
1458	1458	12 24	9 30.0	-4 12	139	M	0.21	1.15	4	u	6.4 NNW		
1462	1462	6 29	0 46.1	+58 56	78	M	0.30	1.00	17	u	6.5 NNE		
1468	1468	9 18	10 49.3	+48 40	58	M	0.87	0.92	16	u	2.2 ENE		
1472	1471	12 25	13 19.9	+0 54	91	M	1.09	1.48	28	u	0.2 ENE		
1491 I	1490	12 31	21 20.9	+26 21	52	E	0.63	0.78	4	u	2.3 ESE		
1491 II	1491	1 19	1 7.0	-11 18	58	E	0.35	0.85	23	u	0.3 ENE		
1499	1499	8 16	18 48.8	+24 6	115	E	0.06	1.04	25	u	9.6 NNW		
1506	1506	7 31	4 40.0	+66 12	71	M	0.56	0.99	26	u	0.9 ENE		
1531	1531	8 1	6 19.4	+36 6	51	M	0.74	0.79	3	u	2.0 ENE		P/Halley
1532	1532	9 2	6 41.7	-23 57	77	M	0.78	1.13	18	u	1.6 E		
1533	1533	7 1	5 37.3	+37 58	32	M	1.01	0.56	25	u	1.0 NW		
1537	1538	1 9	21 35.2	-5 50	21	E	1.14	0.42	24	u	2.6 NE		
1539	1539	4 20	8 49.8	+42 33	79	E	0.49	1.04	17	u	0.6 SSE		
1556	1556	2 27	12 46.9	-11 36	157	M	0.31	1.28	2	u	1.0 NNE		

desig	disc date	RA (1950)	DEC	eln	s	del	r	fm	m	motion	magn	name
1557	1557 10 10	16 18.1	+1 55	37	E	0.50	0.66	2	u	2.0 ESE		
1558	1558 7 14	1 57.9	-2 5	99	M	0.93	1.49	14	u	0.4 NE		
1577 I	1577 11 1	15 32.9	-30 2	11	E	0.79	0.27	6	u	3.1 E		
1577 II	1577 10 19	19 42.3	-25 58	72	E	0.19	0.95	22	u	1.7 WNW		
1580	1580 10 1	1 33.7	-11 48	159	M	0.34	1.32	8	u	2.6 WNW		
1582	1582 5 12	4 49.3	+34 38	15	E	0.89	0.28	5	u	3.1 NE		
1585	1585 10 13	23 25.7	-24 0	134	E	0.14	1.10	5	u	2.7 NE		
1590	1590 3 5	0 46.5	+24 14	35	E	0.26	0.79	14	u	8.6 NE		
1593	1593 7 30	8 7.6	+43 3	28	M	0.80	0.48	17	u	1.5 NNW	3	
1596	1596 7 11	5 9.6	+38 2	37	M	0.59	0.65	2	u	4.1 NE		
1607	1607 9 21	7 54.7	+41 43	72	M	0.40	0.95	15	u	3.7 ENE		P/Halley
1618 I	1618 8 25	10 9.1	+30 2	22	M	0.54	0.55	19	u	1.7 NW		
1618 II	1618 11 16	15 48.5	-34 27	15	E	0.59	0.44	14	u	1.1 NW		
1618 III	1618 11 10	15 13.0	-20 41	3	M	0.20	0.79	8	u	2.9 W		
1639	1639 10 25	6 1.8	+3 33	123	M	0.09	1.04	14	u	14.7 SSE		
1652	1652 12 16	6 48.5	-47 9	108	M	0.16	1.04	1	u	7.8 NW	2	
1661	1661 2 3	20 39.2	+4 41	23	M	0.62	0.48	19	u	1.7 WNW		
1664	1664 11 18	12 42.4	-19 57	45	M	1.50	1.06	15	u	0.1 WSW		
1665	1665 3 27	20 24.4	+3 16	64	M	0.65	0.93	26	u	3.0 ENE		
1668	1668 3 3	23 53.0	-8 58	10	E	0.81	0.25	5	u	4.4 W		
1672	1672 3 2	23 1.5	+32 48	38	M	1.11	0.70	18	u	2.1 ENE		
1677	1677 4 27	1 46.9	+29 46	18	M	0.72	0.40	10	u	2.8 ENE		
1678	1678 9 11	21 52.3	-13 19	153	E	0.28	1.26	10	u	1.2 E		
1680	1680 11 14	10 25.8	+11 11	83	M	0.72	1.15	8	t	1.7 ESE	4	
1682	1682 8 24	7 52.2	+40 56	47	M	0.54	0.75	6	u	3.7 E		P/Halley
1683	1683 7 21	7 45.6	+50 57	32	M	1.10	0.59	13	u	0.7 WNW	3	
1684	1684 6 30	12 51.6	+0 14	89	E	0.19	1.03	3	u	6.5 NE		
1689	1689 12 1	16 49.0	-19 14	3	M	0.92	0.09	5	u	2.2 WSW		
1695	1695 10 28	13 20.9	-12 40	16	M	0.92	0.27	6	u	2.2 WSW		
1698	1698 9 2	0 43.6	+60 41	110	M	0.27	1.13	12	u	6.1 WNW	3	
1699 I	1699 2 17	23 12.7	+78 36	89	E	0.18	1.00	3	u	10.8 WNW		
1699 II	1699 10 26	7 38.5	-27 36	92	M	0.08	1.00	18	u	26.3 SSW		P/Tempel-Tuttle
1701	1701 10 28	11 55.1	-6 41	37	M	1.00	0.64	12	u	1.4 SSW		
1702	1702 4 20	20 18.9	+24 29	82	M	0.04	1.00	8	u	18.0 WSW		
1706	1706 3 18	16 9.1	+35 37	113	M	0.31	1.15	19	u	3.9 W		
1707	1707 11 25	20 46.8	-25 19	62	E	0.18	0.91	16	u	8.6 N		
1718	1718 1 18	13 42.2	+69 56	111	M	0.10	1.03	2	u	21.5 N		
1723	1723 10 10	6 37.3	-36 59	92	M	0.18	1.02	26	u	6.7 SW		
1729	1729 8 1	21 0.4	+7 25	155	M	3.13	4.07	22	u	0.3 WNW	5	
1737 I	1737 2 6	22 34.0	-7 47	16	E	1.11	0.32	21	u	2.9 ENE		
1737 II	1737 7 2	1 49.0	+17 4	72	M	0.54	0.99	20	u	2.0 SSE	3	
1739	1739 5 27	7 0.4	+50 28	41	E	1.21	0.81	4	u	0.6 WSW		
1742	1742 2 6	19 1.2	-47 36	45	M	1.00	0.77	17	u	0.6 NNW		
1743 I	1743 2 10	12 49.2	+72 30	115	M	0.04	1.01	2	u	13.4 SSW		
1743 II	1743 8 18	8 45.2	+76 1	65	M	0.48	0.92	13	u	4.7 E		
1744	1743 11 29	2 22.9	+27 50	150	E	1.15	2.06	27	u	0.8 W	4	
1747	1746 8 13	22 4.8	+13 14	152	M	2.22	3.16	12	u	0.5 SW	5.5	
1748 I	1748 4 25	22 41.8	+20 55	53	M	0.35	0.84	12	u	5.4 N	3	
1748 II	1748 5 19	8 28.9	+21 47	63	E	0.45	0.90	6	u	2.7 SSW		
1750	1750 2 1	21 35.8	+4 36	22	E	0.31	0.70	10	u	5.5 ESE	2.5	
1757	1757 9 11	5 44.0	+35 30	85	M	0.43	1.06	13	u	3.2 E	5.5	
1758	1758 5 26	5 37.5	-5 25	33	E	1.00	0.57	4	u	1.4 NNE	2.5	
1759 II	1760 1 26	10 50.9	-14 24	135	M	0.46	1.35	24	t	2.8 NNW	5.5	Messier
1759 III	1760 1 7	9 1.6	-20 9	132	M	0.07	1.03	5	u	29.2 W	2	Great comet
1762	1762 5 17	3 36.5	+65 16	45	M	1.44	1.03	9	u	1.6 ENE		Klinkenberg
1763	1763 9 28	16 28.3	-7 19	60	E	0.15	0.93	6	t	5.8 NNW	5	Messier
1764	1764 1 3	15 29.8	+57 12	92	M	0.29	1.03	14	u	7.3 ENE	3	Messier
1766 I	1766 3 8	1 18.9	+16 4	34	E	1.18	0.67	12	t	1.2 ESE	6	Messier
1766 II	1766 4 1	3 28.3	+30 35	44	E	0.51	0.73	6	u	1.2 WSW	3	P/Helfenzrieder
1769	1769 8 8	2 22.8	+12 45	101	M	1.04	1.58	21	t	0.7 E	5.5	Messier
1770 I	1770 6 14	18 21.8	-16 46	169	M	0.21	1.23	6	t	0.3 N	7	P/Lexell
1770 II	1771 1 9	8 56.7	+0 40	151	M	0.19	1.15	8	u	10.7 WNW	5	Great comet
1771	1771 4 1	2 43.8	+20 54	31	E	1.66	0.96	2	u	1.1 ENE	4.5	Messier
1772	1772 3 8	4 29.0	-2 55	75	E	0.63	1.03	19	t	1.4 E	6.5	P/Biela
1773	1773 10 13	10 24.6	+5 51	47	M	1.72	1.28	13	t	0.7 ENE	4.5	Messier
774	1774 8 11	1 53.2	+79 38	80	M	1.20	1.43	19	t	0.3 SW	6.5	Montaigne
779	1779 1 6	20 24.2	+20 43	46	E	0.56	0.71	4	t	1.3 NW	5.5	Bode
780 I	1780 10 27	11 46.4	+13 30	47	M	1.19	0.88	14	t	0.8 N	7	Messier
780 II	1780 10 18	17 59.3	-7 46	63	E	1.02	1.05	5	t	1.3 SSW	6	Montaigne-Olbers
781 I	1781 6 28	9 54.9	+62 35	51	E	0.74	0.80	22	t	1.9 SE	7	Mechain
781 II	1781 10 9	8 36.5	+18 31	72	M	1.20	1.30	7	t	0.4 NNE	8	Mechain
783	1783 11 19	2 53.8	+3 22	159	E	0.49	1.46	10	t	1.6 NW	7	P/Pigott
784	1783 12 15	13 41.2	-55 0	54	M	1.21	1.02	7	u	1.0 SSE	5	Great comet

desig	disc	date	RA (1950)	DEC	eln	s	del	r	fm	m	motion	magn	name
1785 I	1785	1 7	2 17.4	+5 59	104	E	0.47	1.19	12	t	2.4 S	6.5	Messier-Mechain
1785 II	1785	3 11	0 37.7	+27 26	33	E	1.43	0.81	15	t	0.3 WNW	7	Mechain
1786 I	1786	1 17	21 33.2	-4 14	26	E	0.65	0.49	3	t	1.2 SW	5	P/Encke
1786 II	1786	8 1	11 38.6	+25 39	39	E	1.16	0.73	21	t	1.7 ENE	7.5	Herschel
1787	1787	4 10	4 3.0	+19 44	40	E	1.35	0.87	8	t	0.7 NW	6	Mechain
1788 I	1788	11 26	11 15.2	+48 37	98	M	0.36	1.09	13	t	4.7 N	6	Messier
1788 II	1788	12 21	18 41.8	+32 20	56	E	1.04	0.95	8	t	0.8 N	7.5	P/Herschel-Rigollet
1790 I	1790	1 7	21 13.5	+22 31	52	E	0.68	0.78	6	t	2.8 ESE	7	Herschel
1790 II	1790	1 9	1 46.9	+9 15	96	E	0.39	1.10	8	t	2.6 SSE	6	P/Tuttle
1790 III	1790	4 18	0 12.0	+32 34	31	M	1.73	1.01	19	t	0.5 N	7	Herschel
1792 I	1791	12 15	22 18.7	+46 39	94	E	0.89	1.37	5	t	2.2 SSE	6	Herschel
1792 II	1793	1 8	16 2.2	+49 2	85	M	0.22	0.99	11	u	6.5 NNE	2	Gregory
1793 I	1793	9 27	16 19.3	+14 42	60	E	1.01	1.01	8	t	1.6 SSW	6	Messier
1793 II	1793	9 24	2 3.4	+59 29	118	M	0.97	1.70	5	t	1.1 NNW	7.5	Perny
1795	1795	11 7	20 14.2	+41 39	93	E	0.26	1.04	10	t	3.2 WSW	5.5	P/Encke
1796	1796	3 31	13 27.8	-15 19	166	M	0.59	1.58	8	t	3.0 WSW	8	Olbers
1797	1797	8 14	6 16.6	+48 46	55	M	0.11	0.95	7	u	14.1 N	3	Bouvard-Herschel-Lee
1798 I	1798	4 12	3 25.6	+23 28	30	E	0.98	0.52	12	t	2.0 NNE	6	Messier
1798 II	1798	12 7	16 56.6	+29 35	53	M	0.13	0.91	14	t	16.5 ESE	7	Bouvard
1799 I	1799	8 7	7 23.4	+42 45	36	M	1.64	1.02	21	t	0.7 NE	6.5	Mechain
1799 II	1799	12 26	16 43.0	+3 15	37	M	0.98	0.63	14	t	0.8 SSW	4.5	Mechain
1801	1801	7 11	6 0.0	+73 21	53	M	0.38	0.85	15	t	6.0 ESE	6.5	Pons
1802	1802	8 26	16 42.2	-12 21	96	E	0.39	1.12	13	t	2.6 N	7	Pons
1804	1804	3 7	14 46.1	-20 8	123	M	0.23	1.13	11	t	4.8 N	6.5	Pons
1805	1805	10 20	11 17.6	+32 3	56	M	0.44	0.83	12	t	3.0 SE	5.5	P/Encke
1806 I	1805	11 10	1 15.0	+41 29	146	E	0.25	1.21	3	t	0.3 WSW	4.5	P/Biela
1806 II	1806	11 10	12 14.3	+1 40	47	M	1.81	1.34	14	t	0.3 S	8	Pons
1807	1807	9 9	13 0.0	-17 44	34	E	1.20	0.68	22	u	1.6 ENE	1	Great comet
1808 I	1808	3 25	10 42.2	+81 4	95	E	0.58	1.20	13	t	3.1 W	7	Pons
1808 II	1808	6 24	3 37.1	+58 23	45	M	0.75	0.72	16	t	3.0 ENE	7	Pons
1808 III	1808	2 6	15 46.5	+4 47	86	M	0.12	0.98	24	t	6.2 ESE		P/Grigg-Skjellerup
1810	1810	8 23	13 59.1	+82 0	75	E	1.02	1.23	9	t	1.2 SW	6.5	Pons
1811 I	1811	3 25	8 9.1	-30 22	114	E	2.16	2.72	15	t	0.6 NNW	5	Great comet
1811 II	1811	11 16	4 36.0	-26 28	132	M	0.74	1.58	16	t	0.5 NNW	6.5	Pons
1812	1812	7 21	6 13.2	+59 53	45	M	1.78	1.28	27	t	0.8 SE	6.5	P/Pons-Brooks
1813 I	1813	2 4	22 10.2	+49 40	66	E	0.36	0.90	19	t	5.9 ESE	6.5	Pons
1813 II	1813	4 3	18 17.1	+8 3	99	M	0.85	1.41	17	t	0.5 SSW	5.5	Pons
1815	1815	3 6	3 24.4	+32 23	71	E	1.41	1.43	11	t	0.5 NNE	7.5	P/Olbers
1816	1816	1 22	15 2.1	+85 4	109	M	0.48	1.23	7	t	2.5 NE	7.5	Pons
1818 I	1818	2 23	2 14.3	-14 30	55	E	0.69	0.81	2	t	1.7 ESE	7.5	P/Crommelin
1818 II	1817	12 26	19 51.8	+55 23	81	E	1.34	1.53	3	t	0.8 S	7	Pons
1818 III	1818	11 28	11 56.5	-31 8	60	M	0.66	0.86	16	t	0.7 ENE	7	Pons
1819 I	1818	11 26	22 17.7	+9 1	94	E	0.80	1.31	14	t	0.4 SW	8	P/Encke
1819 II	1819	7 1	6 49.2	+38 46	16	E	0.76	0.35	23	u	2.5 NNE	1	Great comet
1819 III	1819	6 12	10 14.0	+25 2	65	E	0.79	0.99	4	t	0.4 ESE	8	P/Pons-Winnecke
1819 IV	1819	11 28	12 20.0	-1 4	62	M	0.24	0.90	26	t	0.9 NNE	6.5	P/Blanpain
1821	1821	1 21	0 9.3	+17 45	67	E	1.69	1.59	3	t	0.2 SW	6.5	Nicollet-Pons
1822 I	1822	5 12	5 33.5	+27 40	31	E	0.87	0.53	6	t	2.0 NNE	4.5	Gambart
1822 III	1822	5 31	22 50.1	+0 20	87	M	0.66	1.18	25	t	0.7 SE	5.5	Pons
1822 IV	1822	7 13	23 56.9	+64 12	81	M	1.81	1.93	9	t	0.6 NW	6.5	Pons
1823	1823	12 24	17 10.2	+4 0	32	M	0.91	0.52	7	u	1.3 NNW	2	Great comet
1824 I	1824	7 14	9 43.2	+1 33	36	E	0.76	0.59	3	t	2.9 ENE	5	Rumker
1824 II	1824	7 23	17 59.1	+12 48	133	E	0.64	1.52	12	t	1.5 NW	7	Scheithauer
1825 I	1825	5 19	0 27.2	+49 39	50	M	1.14	0.91	17	t	1.4 NNE	6.5	Gambart
1825 II	1825	8 9	5 37.3	+41 23	55	M	0.94	0.90	11	t	1.3 SSE	6	Pons
1825 IV	1825	7 15	4 12.2	+26 47	49	M	3.00	2.45	15	t	0.1 ESE	6.5	Pons
1826 I	1826	2 27	1 54.1	+9 47	50	E	1.21	0.95	5	t	1.0 E	8.5	P/Biela
1826 II	1825	11 7	3 39.5	-14 16	147	M	1.91	2.80	12	t	0.3 SSW	8.5	Pons
1826 IV	1826	8 7	3 8.4	-25 35	98	M	0.83	1.40	19	t	1.0 ENE	7.5	Pons
1826 V	1826	10 22	14 22.0	+44 41	57	E	1.05	0.97	7	t	1.4 SSE	6.5	Pons
1827 I	1826	12 26	16 34.6	+21 8	52	M	1.29	1.04	12	t	1.6 E	6.5	Pons
1827 II	1827	6 21	2 18.4	+68 46	56	M	0.53	0.85	12	t	4.4 NNE	5.5	P/Pons-Gambart
1827 III	1827	8 3	5 22.4	+62 20	58	M	1.30	1.16	26	t	0.9 E	6.5	Pons
1830 I	1830	3 16	6 47.3	-80 33	91	E	0.19	1.02	7	u	2.8 SSW	3	Great comet
1830 II	1831	1 3	18 2.8	-14 15	16	M	1.07	0.30	5	u	1.5 WNW	2	Great comet
1832 II	1832	7 19	17 3.3	+26 15	116	E	0.85	1.58	7	t	2.2 WSW	7.5	Gambart
1833	1833	9 30	14 52.1	-19 4	38	E	1.06	0.67	2	t	2.1 ESE	6	Dunlop
1834	1834	3 8	19 59.0	-23 35	52	M	0.60	0.78	13	t	2.6 ENE	3.5	Gambart
1835 I	1835	4 20	12 6.9	-13 4	153	E	1.11	2.06	7	t	1.6 WNW	7.5	Boguslawski
1840 I	1839	12 3	12 46.5	-2 41	61	M	0.82	0.92	12	t	2.2 E	5.5	Galle
1840 II	1840	1 25	20 12.3	+63 27	82	M	1.17	1.43	6	t	1.7 E	8.5	Galle
1840 III	1840	3 7	21 38.8	+29 45	42	M	1.37	0.91	19	t	1.5 E	6.5	Galle
1840 IV	1840	10 26	18 36.1	+61 0	91	E	1.12	1.50	15	t	0.5 E	9	Bremiker

desig	disc date	RA (1950)	DEC	eln	s	del	r	fm	m	motion	magn	name
1842 II	1842 10 28	16 35.7	+69 6	86	E	0.69	1.17	9	t	1.7 SE	8.5	Laugier
1843 I	1843 2 5	1 13.2	-30 34	55	E	0.88	0.87	20	u	1.4 NW	3.5	Great March comet
1843 II	1843 5 3	21 49.5	+30 6	68	M	1.69	1.62	19	t	0.5 E	7.5	Mauvais
1843 III	1843 11 23	5 29.6	+6 57	154	M	0.79	1.73	16	t	0.2 SSW	6	P/Faye
1844 I	1844 8 23	23 33.9	-22 37	158	M	0.19	1.19	25	t	1.0 ENE	7	P/de Vico-Swift
1844 II	1844 7 8	16 30.2	+45 49	102	E	1.41	1.90	8	t	1.2 WSW	6.5	Mauvais
1844 III	1844 12 17	18 35.6	-28 25	12	E	1.15	0.27	23	u	2.7 SE	0	Great comet
1845 I	1844 12 28	19 40.7	+36 27	62	E	0.80	0.93	4	t	0.4 NNW	6.5	d'Arrest
1845 II	1845 2 25	11 52.6	+54 40	132	M	0.65	1.50	3	t	1.1 WSW	7.5	de Vico
1845 III	1845 6 2	3 21.7	+36 56	23	M	0.84	0.41	12	u	3.5 NE	1.5	Great June comet
1846 I	1846 1 24	4 11.8	-7 32	111	E	0.81	1.48	12	t	1.3 N	7	de Vico
1846 III	1846 2 26	0 58.4	+14 28	41	E	0.67	0.65	15	t	1.5 N	7.5	P/Brorsen
1846 IV	1846 2 20	1 3.0	-7 25	40	E	1.08	0.72	9	t	1.8 N	7	P/de Vico
1846 V	1846 7 29	3 25.7	+60 56	68	M	1.72	1.64	21	t	0.4 WNW	9	de Vico-Hind
1846 VI	1846 6 26	15 12.7	-22 21	136	E	0.62	1.52	17	t	0.9 NNE	9	P/Peters-Hartley
1846 VII	1846 5 1	21 26.9	+24 42	73	M	0.36	0.97	20	t	5.4 NNE	7.5	Brorsen
1846 VIII	1846 9 23	8 36.7	+63 55	75	M	0.72	1.07	18	t	2.1 E	9	de Vico
1847 I	1847 2 6	21 6.3	+72 4	87	M	1.17	1.50	6	t	0.9 SE	7.5	Hind
1847 II	1847 5 7	10 12.2	+35 26	94	E	1.82	2.14	7	t	0.4 NNW	9.5	Colla
1847 III	1847 7 4	22 13.1	+80 25	74	M	1.83	1.83	6	t	1.0 NNW	6.5	Mauvais
1847 IV	1847 8 30	2 24.8	+65 47	95	M	1.04	1.51	4	t	1.7 WNW	8	Schweizer
1847 V	1847 7 20	1 51.8	+26 3	83	M	0.77	1.20	22	t	1.8 ENE	9.5	P/Brorsen-Metcalf
1847 VI	1847 10 2	1 21.9	+83 55	100	M	0.36	1.12	8	t	2.7 NW	6	Mitchell
1848 I	1848 8 8	6 24.4	+40 56	45	M	1.21	0.88	23	t	1.3 SE	7	Petersen
1849 I	1848 10 26	18 16.7	+63 29	90	E	1.38	1.70	14	t	0.7 SE	8	Petersen
1849 II	1849 4 15	11 13.8	-27 20	142	E	0.39	1.33	8	t	2.8 N	6.5	Goujon
1849 III	1849 4 11	15 17.1	+28 19	134	M	0.45	1.35	4	t	1.3 W	7.5	Schweizer
1850 I	1850 5 1	19 24.5	+71 17	81	M	1.54	1.70	5	t	0.2 NNW	9	Petersen
1850 II	1850 8 30	3 36.7	+58 24	91	M	0.62	1.19	8	t	1.5 E	8.5	Bond
1851 II	1851 6 28	0 38.7	+11 6	84	M	0.71	1.18	15	t	1.1 E	10	P/d'Arrest
1851 III	1851 8 1	13 58.7	+30 46	70	E	0.84	1.08	19	t	0.6 NE	7.5	Brorsen
1851 IV	1851 10 22	13 43.0	+31 44	43	M	0.98	0.73	12	t	1.4 NE	4	Brorsen
1852 II	1852 5 16	22 37.0	+67 38	67	M	0.83	1.02	13	t	2.8 N	9.5	Chacornac
1852 IV	1852 7 24	1 16.3	+1 16	105	M	1.13	1.70	23	t	0.7 NNE	7.5	P/Westphal
1853 I	1853 3 6	4 58.1	-16 32	85	E	0.58	1.10	11	t	2.6 NNW	6.5	Secchi
1853 II	1853 4 5	20 10.9	+13 29	72	M	0.86	1.10	11	t	0.3 E	7.5	Schweizer
1853 III	1853 6 11	9 38.4	+43 0	55	E	2.21	1.83	20	t	0.2 SE	7.5	Klinkerfues
1853 IV	1853 9 12	8 37.1	+44 16	55	M	1.18	1.02	25	t	1.1 ESE	7.5	Bruhns
1854 I	1853 11 25	2 14.8	+61 12	135	E	1.28	2.10	10	t	1.3 SSW	8.5	van Arsdale
1854 II	1854 3 23	23 44.3	+15 47	16	M	1.00	0.28	9	u	2.9 ENE	2	Great comet
1854 III	1854 6 5	2 8.7	+33 15	39	M	1.18	0.74	24	t	1.8 NNE	6	Klinkerfues
1854 IV	1854 9 11	7 35.7	+75 28	78	M	0.84	1.17	5	t	1.5 ESE	8	Klinkerfues
1854 V	1854 12 22	13 43.5	-22 59	60	M	1.55	1.36	18	t	0.9 ESE	8	Winnecke-Dien
1855 I	1855 4 11	12 27.8	-18 14	164	E	1.33	2.31	9	t	1.3 NW	8.5	Schweizer
1855 II	1855 6 3	6 40.8	+36 11	28	E	0.57	0.57	3	t	3.6 E	6	Donati
1855 IV	1855 11 13	10 0.2	+1 40	80	M	0.94	1.25	19	t	0.6 W	7.5	Bruhns
1857 I	1857 2 23	21 27.8	+22 43	36	M	1.53	0.92	15	t	1.0 NE	7.5	d'Arrest
1857 II	1857 3 18	2 7.2	+8 28	34	E	1.19	0.66	8	t	1.3 NE	5.5	P/Brorsen
1857 III	1857 6 23	3 35.3	+40 51	37	M	1.23	0.75	16	t	1.5 NE	8	Klinkerfues
1857 IV	1857 7 26	3 45.0	+59 13	64	M	0.65	0.93	19	t	1.8 ESE	8.5	Peters
1857 V	1857 8 20	5 18.2	+76 50	74	M	0.68	1.05	15	t	3.1 NE	8	Klinkerfues
1857 VI	1857 11 10	15 24.7	+55 31	73	E	0.67	1.02	8	t	3.5 E	9	Donati-van Arsdale
1858 I	1858 1 5	23 49.0	+39 53	90	E	0.80	1.27	6	t	1.3 SE	8	P/Tuttle
1858 II	1858 3 9	17 22.9	-1 59	90	M	0.60	1.16	10	t	1.7 E	7.5	P/Pons-Winnecke
1858 III	1858 5 3	9 54.3	+34 26	94	E	0.46	1.14	5	t	1.1 ENE	9.5	P/Tuttle-Giacobini-Kresak
1858 IV	1858 5 22	1 45.9	+41 9	35	M	1.08	0.64	24	t	2.4 NE	7	Bruhns
1858 VI	1858 6 2	9 30.4	+23 21	65	E	2.47	2.23	6	t	0.1 N	7.5	Donati
1858 VII	1858 9 6	4 47.1	+44 59	89	M	1.16	1.52	13	t	0.6 WNW	7.5	Tuttle
1859	1859 4 2	14 16.8	+71 12	102	M	0.87	1.46	15	t	1.4 NW	7.5	Tempel
1860 I	1860 2 27	5 2.3	-61 34	85	E	0.78	1.21	20	t	1.0 WNW	6.5	Liais
1860 II	1860 4 17	2 50.4	+48 40	40	E	2.07	1.45	12	t	0.9 ENE	7.5	Rumker
1860 III	1860 6 18	6 9.3	+39 47	17	E	1.04	0.30	15	u	1.5 NE	3.5	Great comet
1860 IV	1860 10 24	10 9.8	+28 32	69	M	0.45	0.94	24	t	1.5 N	7.5	Tempel
1861 I	1861 4 5	17 32.0	+55 37	97	M	0.82	1.37	10	t	0.7 NW	7.5	Thatcher
1861 II	1861 5 13	3 57.7	-30 28	50	E	1.27	0.99	19	u	0.0 ESE	4.5	Great comet
1861 III	1861 12 29	14 17.5	-5 33	65	M	0.68	0.93	12	t	1.8 N	7.5	Tuttle
1862 II	1862 7 2	0 16.7	+50 52	77	M	0.13	1.00	20	t	13.6 NNE	4.5	Schmidt
1862 III	1862 7 16	5 29.0	+67 0	51	M	1.49	1.16	5	t	0.3 NNE	7.5	P/Swift-Tuttle
1862 IV	1862 11 28	14 0.3	-12 12	35	M	1.61	0.98	22	t	0.6 S	6.5	Respighi
1863 I	1862 12 1	10 38.0	-3 22	88	M	1.04	1.41	25	t	0.8 ENE	9	Bruhns
1863 II	1863 4 12	20 40.4	-1 48	72	M	0.80	1.07	8	t	2.0 N	5.5	Klinkerfues
1863 III	1863 4 13	22 49.7	+19 51	40	M	0.86	0.65	9	t	2.7 NE	5.5	Respighi
1863 IV	1863 11 5	11 40.3	-10 23	45	M	0.80	0.71	10	t	2.0 NE	4	Tempel

desig	disc date	RA (1950)	DEC	eln	s	del	r	fm	m	motion	magn	name
1863 V	1863 12 28	18 52.7	+25 57	49	E	0.83	0.77	3	t	0.6 NNE	6.5	Respighi
1863 VI	1863 10 10	9 47.2	+29 28	60	M	2.03	1.76	13	t	0.7 ENE	7.5	Baeker
1864 I	1864 9 10	10 28.4	+35 7	33	M	1.79	1.10	24	t	0.5 NNE	8.5	Donati
1864 II	1864 7 5	3 1.1	+18 48	57	M	1.36	1.17	16	t	0.1 ENE	6	Tempel
1864 III	1864 7 23	13 0.9	+21 19	66	E	1.76	1.63	4	t	0.7 SSW	9.5	Donati-Toussaint
1864 IV	1864 12 15	18 43.9	-0 34	28	E	1.51	0.78	2	t	1.5 E	6.5	Baeker
1864 V	1864 12 31	14 6.4	-13 37	67	M	1.03	1.12	18	t	0.5 WSW	9	Bruhns
1865 I	1865 1 17	20 27.8	-30 2	11	E	0.96	0.19	6	u	3.5 SSE	2	Great southern comet
1866 I	1865 12 19	14 41.9	+73 32	102	M	0.21	1.05	17	t	10.1 NE	6	P/Tempel-Tuttle
1867 I	1867 1 22	2 31.6	+14 21	97	E	1.12	1.58	2	t	0.7 NE	8.5	P/Stephan-Oterma
1867 II	1867 4 3	15 7.4	-2 32	146	M	0.71	1.64	14	t	0.1 ENE	9	P/Tempel 1
1867 III	1867 9 26	9 38.7	+50 48	62	M	1.11	1.09	12	t	1.7 E	6.5	Baeker-Winnecke
1868 II	1868 6 13	3 10.1	+47 6	37	M	1.03	0.65	8	t	1.4 NE	6.5	Winnecke
1869 II	1869 10 12	10 38.1	+1 34	40	M	1.81	1.23	22	t	0.7 S	7.5	Tempel
1869 III	1869 11 27	22 46.7	+14 31	102	E	0.26	1.07	8	t	1.5 ENE	9	P/Tempel-Swift
1870 I	1870 5 30	0 53.8	+29 27	50	M	1.65	1.26	15	t	0.3 SE	7	Winnecke-Tempel
1870 II	1870 8 28	3 13.2	+5 47	108	M	1.23	1.82	17	t	0.8 NW	7	Coggia
1870 IV	1870 11 24	12 50.9	-4 0	50	M	0.52	0.76	16	t	3.9 E	7.5	Winnecke
1871 I	1871 4 7	2 30.9	+54 25	50	E	1.82	1.41	2	t	0.9 ESE	8	Winnecke
1871 II	1871 6 14	10 33.7	+56 38	62	E	1.39	1.29	11	t	0.4 WNW	8	Tempel
1871 IV	1871 11 3	18 42.0	-8 53	60	E	1.27	1.15	6	t	1.0 S	8.5	Tempel
1873 II	1873 7 3	0 9.7	-4 8	102	M	0.70	1.35	23	t	0.8 E	9.5	P/Tempel 2
1873 IV	1873 8 20	7 31.4	+39 11	43	M	1.31	0.90	12	t	1.0 SSE	6.5	Borrelly
1873 V	1873 8 23	7 30.7	+59 27	57	M	1.13	1.03	15	t	0.8 ESE	6.5	Henry
1873 VII	1873 11 10	16 28.9	+28 1	50	E	0.24	0.85	6	t	3.0 SW	8	P/Crommelin
1874 I	1874 2 21	20 41.6	+25 51	44	M	0.76	0.68	20	t	2.5 SE	8.5	Winnecke
1874 II	1874 4 12	21 26.0	-6 19	62	M	1.00	1.03	11	t	1.0 NW	6.5	Winnecke
1874 III	1874 4 17	6 37.1	+69 55	74	E	1.64	1.67	16	t	0.1 SW	7.5	Coggia
1874 IV	1874 8 19	4 1.3	+27 26	84	M	1.53	1.74	21	t	0.5 ESE	8.5	Coggia
1874 V	1874 7 26	15 52.0	+59 38	84	E	0.61	1.12	27	t	0.9 NW	7.5	Borrelly
1874 VI	1874 12 7	16 2.9	+36 13	61	M	1.29	1.18	14	t	0.9 NNE	8.5	Borrelly
1877 I	1877 2 9	17 17.9	-0 34	66	M	0.44	0.90	11	t	3.3 N	6.5	Borrelly
1877 II	1877 4 6	22 11.6	+15 41	43	M	1.41	0.97	8	t	1.2 N	7	Winnecke
1877 III	1877 4 10	0 39.6	+52 3	44	M	1.50	1.05	12	t	1.3 NE	8	Swift-Borrelly-Block
1877 V	1877 10 2	23 56.2	-9 30	163	E	0.88	1.85	10	t	1.5 SW	7.5	Tempel
1877 VI	1877 9 14	8 37.5	+48 9	59	M	1.84	1.58	22	t	0.3 SSW	9.5	Coggia
1878 I	1878 7 8	17 36.0	+16 18	134	E	0.49	1.40	24	t	2.7 SSW	7.5	Swift
1879 II	1879 6 17	2 50.8	+60 15	48	M	1.70	1.26	13	t	1.0 N	6.5	Swift
1879 IV	1879 8 24	12 18.0	+61 18	55	E	1.13	1.00	22	t	2.0 SE	10.5	Hartwig
1879 V	1879 8 21	10 4.4	+48 49	37	M	1.89	1.24	19	t	1.0 E	7.5	Palisa
1880 I	1880 2 1	21 33.9	-27 0	12	E	0.77	0.29	5	u	3.5 ESE	3	Great southern comet
1880 II	1880 4 7	7 29.1	+84 11	83	E	1.98	2.11	12	t	0.8 SSW	7.5	Schaeberle
1880 III	1880 9 29	14 4.9	+29 29	40	E	0.52	0.69	11	t	4.7 E	5.5	Hartwig
1880 IV	1880 10 11	21 36.3	+17 52	127	E	0.20	1.13	23	t	0.6 N	8	P/Tempel-Swift
1880 V	1880 12 16	18 51.1	+10 27	38	E	1.57	0.99	30	t	1.3 ENE	7.5	Pechule
1881 II	1881 5 1	0 6.7	+37 10	40	M	1.11	0.73	17	t	1.1 SE	7	Swift
1881 III	1881 5 22	5 0.9	-35 30	58	E	0.77	0.89	9	u	0.4 NNE	3	Great comet
1881 IV	1881 7 14	5 49.9	+38 42	29	M	1.79	1.03	3	t	0.4 NE	6	Schaeberle
1881 V	1881 10 4	9 25.3	+14 19	53	M	0.76	0.82	26	t	0.6 E	7.5	P/Denning-Fujikawa
1881 VI	1881 9 18	13 25.3	+0 13	24	E	1.11	0.46	10	t	1.5 NNE	6.5	Barnard
1881 VIII	1881 11 17	2 18.0	+75 9	123	E	1.20	1.93	11	t	1.6 SW	8.5	Swift
1882 I	1882 3 18	17 54.4	+32 33	90	M	1.79	2.06	13	t	0.6 NE	7	Wells
1882 II	1882 9 1	8 51.5	-1 20	30	M	1.36	0.70	4	u	1.3 E	0	Great September comet
1882 III	1882 9 14	7 21.6	+16 33	63	M	1.52	1.39	17	t	0.9 SSE	10	Barnard
1883 I	1883 2 24	23 6.1	+30 37	41	E	1.17	0.77	2	t	2.0 ENE	6.5	Brooks-Swift
1883 II	1884 1 7	21 11.2	-36 0	28	E	0.74	0.49	24	t	3.0 ESE	5	Ross
1884 I	1883 9 2	16 37.7	+65 2	82	E	2.36	2.44	15	t	0.2 SSW	10	P/Pons-Brooks
1884 II	1884 7 17	15 55.7	-37 19	127	E	0.44	1.33	9	t	0.3 E	9.5	P/Barnard 1
1884 III	1884 9 17	21 17.1	+24 6	136	E	0.82	1.69	12	t	0.4 S	9.5	P/Wolf
1885 II	1885 7 8	17 24.5	-5 6	148	E	1.60	2.53	11	t	0.7 SW	11	Barnard
1885 III	1885 9 1	13 37.1	+35 31	48	E	1.11	0.86	7	t	1.2 ENE	8.5	Brooks
1885 V	1885 12 26	19 52.5	+3 33	34	E	1.87	1.19	5	t	1.1 ENE	7.5	Brooks
1886 I	1885 12 1	0 43.5	+21 24	127	E	1.57	2.29	9	t	0.6 W	8.5	Fabry
1886 II	1885 12 4	4 24.3	+4 55	162	E	1.76	2.71	12	t	0.6 W	9.5	Barnard
1886 III	1886 5 1	23 9.4	+23 13	50	M	1.01	0.84	13	t	2.2 NNE	4.5	Brooks
1886 IV	1886 5 23	11 53.7	+8 59	112	E	0.57	1.34	5	t	0.7 SSE	8.5	P/Brooks 1
1886 V	1886 4 28	0 28.9	+62 19	52	M	1.36	1.09	10	t	1.0 ESE	8	Brooks
1886 VII	1886 9 26	17 5.2	-26 8	74	E	1.14	1.28	13	t	0.5 E	11	P/Finlay
1886 VIII	1887 1 24	19 10.4	+25 30	49	M	2.16	1.68	15	t	0.9 NE	10	Barnard
1886 IX	1886 10 5	10 39.5	+0 38	33	M	2.27	1.52	22	t	0.5 ENE	8	Barnard-Hartwig
1887 I	1887 1 18	20 26.2	-37 12	17	E	0.70	0.38	9	u	3.2 SE	1.5	Great southern comet
1887 II	1887 1 23	18 4.3	+72 18	95	M	1.40	1.78	14	t	1.1 NE	8.5	Brooks
1887 III	1887 2 17	7 59.4	-15 2	139	E	0.27	1.21	9	t	7.6 NW	10.5	Barnard

desig	disc date	RA (1950)	DEC	eln	s	del	r	fm	m	motion	magn	name
1887 IV	1887 5 13	15 15.1	-30 41	168	E	0.48	1.48	6	t	0.6 NNE	9.5	Barnard
1887 V	1887 8 25	8 35.9	+29 5	30	M	2.14	1.37	22	t	0.9 E	8.5	P/Olbers
1888 I	1888 2 19	19 19.3	-55 28	56	M	0.89	0.88	22	u	1.6 NE	3	Sawerthal
1888 III	1888 8 8	10 15.5	+44 27	31	E	1.61	0.91	16	t	1.3 E	8.5	Brooks
1888 V	1888 10 31	9 46.3	-15 36	68	M	1.77	1.67	12	t	0.4 ENE	9.5	Barnard
1889 I	1888 9 3	6 55.6	+10 55	59	M	2.96	2.59	13	t	0.1 SSW	8.5	Barnard
1889 II	1889 4 1	5 24.1	+16 10	69	E	2.57	2.40	15	t	0.2 W	12	Barnard
1889 III	1889 6 24	1 24.6	+39 12	63	M	1.10	1.11	11	t	1.1 ENE	9.5	P/Barnard 2
1889 IV	1889 7 19	11 53.7	-42 20	83	E	0.38	1.04	7	u	3.5 NE	3.5	Davidson
1889 V	1889 7 7	23 47.5	-8 47	113	M	1.46	2.08	24	t	0.3 ENE	11	P/Brooks 2
1889 VI	1889 11 16	22 42.4	+11 44	110	E	0.66	1.37	9	t	0.6 ENE	10.5	P/Swift-Gehrels
1890 I	1889 12 12	18 7.8	+49 11	73	E	1.01	1.19	5	t	1.0 SSE	9.5	Borrelly
1890 II	1890 3 20	21 12.1	+5 55	43	M	2.73	2.11	14	t	0.4 N	7.5	Brooks
1890 III	1890 7 18	8 48.9	+44 47	26	E	1.55	0.79	16	t	1.6 ESE	8	Coggia
1890 IV	1890 11 15	5 41.9	+33 18	146	M	1.48	2.37	19	t	1.2 WNW	8	Zona
1890 VI	1890 7 23	15 13.5	+78 38	73	E	1.53	1.58	21	t	0.9 S	9.5	Denning
1890 VII	1890 11 17	5 31.1	+33 45	150	M	0.90	1.83	21	t	0.3 NNW	11	P/Spitaler
1891 I	1891 3 30	1 4.5	+44 48	41	E	1.24	0.82	5	t	1.2 SSE	8	Barnard-Denning
1891 IV	1891 10 3	7 33.6	-27 57	76	M	0.95	1.20	15	t	1.9 SE	8	Barnard
1892 I	1892 3 7	19 2.1	-31 17	65	M	1.13	1.15	24	t	1.3 NE	4	Swift
1892 II	1892 3 18	22 40.5	+59 19	61	M	2.36	2.08	5	t	0.8 ENE	10	Denning
1892 III	1892 11 7	0 50.4	+38 51	145	E	1.52	2.40	3	t	0.1 SW	4	P/Holmes
1892 V	1892 10 13	19 35.3	+12 52	96	E	1.11	1.57	7	p	0.6 SE	11.5	P/Barnard 3
1892 VI	1892 8 28	6 1.3	+31 59	66	M	2.35	2.15	20	t	0.5 E	9	Brooks
1893 I	1892 11 20	12 59.6	+12 45	53	M	1.75	1.40	16	t	0.5 NE	10	Brooks
1893 II	1893 6 20	2 44.7	+18 3	46	M	0.93	0.76	21	t	1.1 NE	5	Rordame-Quenisset
1893 IV	1893 10 17	12 24.7	+12 41	28	M	1.72	0.96	22	t	0.7 NNE	7	Brooks
1894 I	1894 3 26	9 56.3	+32 11	131	E	0.39	1.29	5	t	1.0 SE	10	P/Denning
1894 II	1894 4 1	2 22.5	-55 15	63	E	0.91	1.01	11	t	0.7 E	6.5	Gale
1894 IV	1894 11 21	22 21.7	-12 46	93	E	1.03	1.46	8	t	0.8 ENE	13	P/de Vico-Swift
1895 II	1895 8 21	0 31.0	+5 53	139	M	0.35	1.30	16	t	0.6 E	10.5	P/Swift
1895 III	1895 11 22	9 53.8	-17 33	84	M	0.40	1.03	20	t	2.3 NNW	7.5	Brooks
1895 IV	1895 11 17	13 47.3	+1 25	33	M	1.59	0.94	15	t	0.7 SE	6.5	Perrine
1896 I	1896 2 15	19 24.2	-2 56	39	M	0.53	0.67	16	t	3.3 NNE	7.5	Perrine-Lamp
1896 III	1896 4 14	3 41.5	+11 41	31	E	0.61	0.57	16	t	2.4 N	6.5	Swift
1896 IV	1896 9 1	13 13.5	+55 28	56	E	1.70	1.41	9	t	1.0 E	11	Sperra
1896 V	1896 9 4	17 12.9	-7 30	95	E	1.12	1.57	12	t	0.5 ESE	11.5	P/Giacobini
1896 VII	1896 12 9	0 56.4	+6 39	117	E	0.26	1.13	19	t	1.8 ESE	8	P/Perrine-Mrkos
1897 I	1896 11 3	20 23.5	+25 7	93	E	1.52	1.86	13	t	0.9 SSW	11	Perrine
1897 III	1897 10 17	3 39.6	+67 21	119	M	0.81	1.56	7	t	1.6 NNW	8	Perrine
1898 I	1898 3 20	21 20.9	+16 55	43	M	1.59	1.10	12	t	1.4 NE	7	Perrine
1898 V	1898 6 19	20 35.2	-21 7	143	M	0.65	1.59	15	t	2.5 W	10.5	Giacobini
1898 VI	1898 6 15	3 33.4	+58 45	42	M	1.95	1.37	11	t	0.8 ESE	10	Perrine
1898 VII	1898 6 10	16 33.6	-24 15	170	E	1.10	2.11	6	p	1.0 SW	7	Coddington-Pauly
1898 VIII	1898 11 15	10 10.3	+22 42	88	M	2.20	2.37	17	p	0.4 E	12	Chase
898 IX	1898 9 13	9 38.6	+30 52	38	M	1.56	0.98	13	t	1.4 ESE	8	Perrine-Chofardet
898 X	1898 10 21	14 50.3	+59 7	71	E	0.62	0.99	22	t	3.7 SE	7	Brooks
899 I	1899 3 4	3 54.0	-27 57	72	E	0.78	1.06	7	t	2.1 NW	6	Swift
899 V	1899 9 29	16 30.5	-5 32	61	E	2.05	1.80	10	t	0.5 NE	11	Giacobini
900 I	1900 1 31	3 0.9	-7 51	89	E	1.58	1.84	16	t	0.8 WNW	11	Giacobini
900 II	1900 7 24	2 46.6	+13 19	79	M	0.47	1.03	12	t	2.8 N	6.5	Borrelly-Brooks
900 III	1900 12 20	22 33.8	-21 45	64	E	0.88	0.99	14	t	1.4 E	10.5	P/Giacobini-Zinner
901 I	1901 4 12	0 25.3	+17 43	17	M	1.32	0.46	8	u	0.8 SSE	1.5	Great comet
902 I	1902 4 15	22 59.2	+29 23	41	M	0.51	0.70	22	t	3.2 SE	7.5	Brooks
902 II	1902 7 23	11 38.3	+6 39	52	E	0.82	0.82	3	t	1.6 ESE	9.5	P/Grigg-Skjellerup
902 III	1902 9 1	3 20.8	+34 49	101	M	1.29	1.79	13	t	0.4 NNW	9	Perrine
903 I	1903 1 15	22 56.1	+1 35	51	E	1.77	1.39	2	t	0.3 NE	10	Giacobini
903 II	1902 12 2	7 20.2	-2 9	133	M	2.24	3.00	17	t	0.1 NNW	11	Giacobini
903 III	1903 4 17	3 8.9	-11 7	31	E	1.38	0.73	5	t	1.5 ESE	9	Grigg
903 IV	1903 5 29	21 54.7	-18 28	103	M	1.45	1.94	18	t	0.3 NNE	8	Borrelly
904 I	1904 4 17	16 59.0	+44 23	109	M	2.24	2.74	17	t	0.8 NW	9	Brooks
904 II	1904 12 18	16 17.2	+27 29	55	M	2.35	1.96	25	t	0.7 NE	11	Giacobini
905 II	1904 12 28	1 14.2	-10 53	96	E	0.92	1.41	6	t	0.9 NNE	10	P/Borrelly
905 III	1905 3 26	5 45.6	+10 35	81	E	0.70	1.12	5	t	1.5 NE	11.5	Giacobini
905 IV	1906 3 3	11 38.4	+1 24	168	M	2.60	3.58	22	p	0.1 WNW	10	Kopff
905 V	1905 11 17	6 52.1	+85 58	112	M	0.27	1.12	5	t	7.2 WNW	7	Schaer
905 VI	1906 1 27	16 20.7	+47 20	87	M	1.04	1.40	17	t	1.6 N	9	Brooks
906 I	1905 12 7	14 25.2	+20 39	57	M	1.46	1.24	25	t	1.2 ESE	8	Giacobini
906 II	1906 3 18	2 6.4	-7 22	34	E	1.50	0.88	8	t	1.4 NE	8	Ross
906 IV	1906 8 20	22 53.7	+10 41	153	M	1.02	1.98	16	p	0.2 W	11.5	P/Kopff
906 VI	1906 11 15	4 6.7	-2 16	156	M	0.72	1.67	14	p	0.2 SSW	11.5	P/Metcalf
906 VII	1906 11 11	9 19.8	+12 40	90	M	0.71	1.22	10	t	1.6 NE	8.5	Thiele
907 I	1907 3 9	7 7.6	-18 48	114	E	1.44	2.06	9	t	1.2 NW	11	Giacobini

desig	disc	date	RA (1950)	DEC	eln	s	del	r	fm	m	motion	magn	name
1907 II	1907	4 8	4 38.9	-43 28	70	E	0.23	0.95	10	t	7.8 NE	6.5	Grigg-Mellish
1907 III	1907	6 1	10 14.9	+23 55	77	E	0.85	1.17	5	t	1.0 E	13	P/Tuttle-Giacobini-Kresak
1907 IV	1907	6 10	23 51.2	-0 51	81	M	1.61	1.77	14	t	0.7 ENE	9.5	Daniel
1907 V	1907	10 14	8 32.8	-9 33	70	M	0.93	1.11	23	t	0.7 WNW	9	Mellish
1908 III	1908	9 3	3 24.9	+67 10	91	M	1.77	2.05	22	t	0.6 NNW	9	Morehouse
1908 IV	1902	3 4	11 6.6	+1 1	174	M	6.31	7.30	10	p	0.1 WNW	12	P/Schwassmann-Wachmann 1
1909 I	1909	6 15	1 40.1	+27 56	53	M	0.92	0.86	11	t	1.6 NNE	9	Borrelly-Daniel
1909 IV	1909	12 7	6 19.1	+34 10	159	M	0.42	1.39	10	t	0.8 N	9	P/Daniel
1910 I	1910	1 13	19 0.3	-29 43	12	M	1.05	0.22	18	u	2.0 E	1	Great January comet
1910 IV	1910	8 9	16 16.3	+14 36	100	E	1.56	2.00	18	t	0.6 WNW	8.5	Metcalf
1911 II	1911	7 7	4 54.4	+35 19	31	M	1.34	0.70	26	p	0.4 WSW	6	Kiess
1911 IV	1911	9 29	10 48.4	+8 15	25	M	1.05	0.45	21	u	2.5 ENE	3	Beljawsky
1911 V	1911	7 21	22 15.4	+21 23	127	M	1.19	1.97	10	t	0.6 NNW	10	Brooks
1911 VI	1911	9 23	14 19.3	+75 45	78	E	0.93	1.22	15	t	2.2 SSE	7.5	Quenisset
1911 VII	1911	12 1	13 15.3	+5 35	55	M	1.53	1.25	25	t	0.9 ESE	12	P/Schaumasse
1912 II	1912	9 9	13 40.2	-36 33	54	E	0.93	0.88	13	t	1.8 NE	5	Gale
1912 III	1912	11 2	17 45.7	+39 25	71	E	0.95	1.12	7	t	2.4 SE	7.5	Borrelly
1913 II	1913	5 7	20 55.2	+10 20	88	M	1.10	1.46	17	t	1.2 NW	9.5	Schaumasse
1913 III	1913	9 4	23 53.3	-1 29	164	M	0.55	1.55	19	p	0.5 NNW	10	P/Neujmin 1
1913 IV	1913	9 2	6 53.3	+56 29	66	M	1.42	1.37	17	t	0.6 NNW	9.5	Metcalf
1913 V	1913	10 23	18 42.2	-4 15	72	E	0.58	0.99	8	t	1.4 SE	10	P/Giacobini-Zinner
1913 VI	1913	9 27	21 54.9	-2 3	145	E	0.60	1.53	12	t	1.2 NW	8	P/Westphal
1914 I	1914	5 15	2 52.2	+49 22	31	M	0.66	0.56	6	t	3.0 E	4	Zlatinsky
1914 II	1914	3 24	15 57.2	-12 9	123	M	0.85	1.63	12	t	0.8 ENE	9.5	Kritzinger
1914 III	1914	6 24	18 13.5	-14 13	171	M	2.75	3.76	16	p	0.4 NW	14	Neujmin
1914 IV	1914	9 18	4 21.2	-57 16	102	M	0.31	1.11	14	t	4.4 W	3.5	Campbell
1914 V	1913	12 18	3 4.7	-7 15	130	E	3.53	4.23	5	t	0.2 WNW	11	Delavan
1915 II	1915	2 10	17 3.9	+3 10	69	M	2.75	2.57	10	t	0.3 ESE	9	Mellish
1915 IV	1915	9 14	9 54.1	+27 50	33	M	1.47	0.83	21	t	1.6 E	9.5	Mellish
1916 I	1915	11 24	5 29.4	-1 23	149	M	0.78	1.70	3	t	0.1 NW	10	P/Taylor
1916 II	1916	2 24	9 0.5	+16 25	158	E	0.38	1.35	5	p	0.5 S	11	P/Neujmin 2
1917 I	1917	3 20	2 11.7	+14 22	36	E	1.21	0.71	12	t	0.4 NNW	7	P/Mellish
1917 II	1917	4 26	23 7.6	+10 42	46	M	1.20	0.88	19	t	0.5 NNE	9.5	Schaumasse
1917 III	1916	4 4	12 54.3	+0 4	174	E	4.19	5.18	16	p	0.2 NW	13	Wolf
1918 II	1918	6 12	9 18.1	-8 2	66	E	1.02	1.11	18	t	1.0 S	10.5	Reid
1918 III	1918	11 23	4 14.1	+11 40	170	M	0.96	1.94	5	p	0.2 W	14	P/Schorr
1919 III	1919	8 21	22 51.4	+25 40	140	M	0.34	1.29	10	t	1.9 NNW	5.5	P/Brorsen-Metcalf
1919 V	1919	8 23	14 5.3	+26 53	58	E	2.31	1.97	12	t	0.5 SE	8	Metcalf
1920 I	1919	12 19	15 31.1	-28 16	31	M	0.69	0.53	12	t	3.9 SE	8.5	Skjellerup
1920 III	1920	12 8	8 27.8	-15 46	117	M	0.30	1.15	12	t	1.7 NE	10	Skjellerup
1921 I	1921	4 24	6 22.8	+45 2	62	E	1.16	1.13	2	t	0.9 E	10	P/Dubiago
1921 II	1921	3 14	20 15.9	-18 41	52	M	1.75	1.38	20	t	0.5 NNE	9	Reid
1921 V	1922	1 20	9 59.6	-32 35	121	M	1.27	1.97	7	t	0.4 SSW	9.5	Reid
1922 I	1922	5 17	7 54.9	+19 16	61	E	0.39	0.89	6	t	1.4 NE	12	P/Grigg-Skjellerup
1922 II	1922	10 19	19 46.7	+37 59	98	E	1.89	2.26	13	p	0.5 ESE	10.5	Baade
1923 I	1922	11 26	10 59.4	-10 21	74	M	0.91	1.15	22	t	1.6 SE	7	Skjellerup
1923 III	1923	10 12	7 32.9	-10 6	83	M	0.46	1.05	17	t	4.0 SSE	8	Dubiago-Bernard
1924 I	1924	3 25	2 40.3	-36 11	51	E	2.22	1.76	4	t	0.9 ENE	10	Reid
1924 II	1924	9 15	13 13.2	+19 16	29	E	0.91	0.49	2	t	3.1 ESE	4	Finsler
1924 IV	1924	12 22	4 10.6	+24 55	154	E	1.51	2.43	11	p	0.3 SSW	16	P/Wolf-Harrington
1925 I	1925	4 3	22 26.4	+15 7	37	M	1.74	1.11	24	t	1.0 NNE	9	Orkisz
1925 II	1927	11 15	1 33.6	+21 2	155	E	5.11	6.02	6	p	0.1 WSW	13.5	P/Schwassmann-Wachmann 1
1925 III	1925	3 24	13 31.5	-20 19	153	M	1.39	2.32	14	t	0.3 SW	8	Reid
1925 VI	1925	3 22	11 51.7	+1 28	176	E	3.42	4.41	12	p	0.5 W	11	Shajn-Comas Sola
1925 VII	1925	11 17	11 57.8	+34 46	74	M	1.67	1.69	17	t	0.4 SSE	8	Van Biesbroeck
1925 XI	1925	11 14	15 39.0	+43 39	62	E	0.58	0.88	14	t	4.1 ESE	8	Wilk-Peltier
1926 I	1926	1 16	12 15.4	-30 38	98	M	0.81	1.36	17	t	1.2 NW	9.5	Blathwayt
1926 III	1925	12 13	3 54.8	-60 25	95	E	0.98	1.44	13	t	1.7 WSW	8	Ensor
1926 VII	1927	1 25	22 17.7	-57 31	43	E	1.32	0.91	8	t	1.5 E	8	Reid
1927 II	1927	1 11	15 42.2	-28 16	51	M	1.51	1.18	23	t	1.1 SSE	9	Blathwayt
1927 III	1926	11 4	2 58.4	+6 37	170	M	1.22	2.20	14	p	0.2 WNW	12	P/Comas Sola
1927 IV	1927	3 10	15 17.3	-7 25	120	M	3.09	3.69	22	t	0.3 N	10	Stearns
1927 VI	1927	6 7	21 39.3	-30 58	118	M	0.35	1.22	22	t	1.3 E	8	P/Gale
1927 IX	1927	11 28	15 26.5	-59 54	40	M	0.99	0.67	19	u	1.3 NE	3	Skjellerup-Maristany
1928 I	1928	2 22	9 16.5	+21 36	161	E	0.91	1.87	17	p	0.1 NNW	12	P/Reinmuth 1
1929 I	1929	1 17	5 42.0	+20 29	148	E	1.24	2.14	22	p	0.1 WNW	11	P/Schwassmann-Wachmann 2
1929 II	1929	8 1	20 55.4	-30 30	167	M	0.57	1.57	11	t	0.1 NNW	10	P/Forbes
1929 III	1929	8 2	21 17.4	-12 38	172	M	1.06	2.07	12	p	0.1 SW	13	P/Neujmin 3
1930 I	1930	2 20	9 19.5	+41 33	147	E	0.28	1.23	7	t	4.6 NNW	10	Peltier-Schwassmann-Wachmann
1930 II	1929	12 20	18 6.4	+36 34	60	E	0.90	0.95	4	t	2.6 ESE	7	Wilk
1930 III	1930	3 21	1 32.5	+18 7	29	E	1.06	0.51	7	t	1.5 NNW	6	Wilk
1930 IV	1930	2 26	6 12.2	+25 41	115	E	1.55	2.16	13	p	0.6 NNW	14	Beyer
1930 V	1930	5 29	23 53.8	-34 8	85	M	0.72	1.19	17	t	1.0 WNW	9	Forbes

desig	disc date	RA (1950)	DEC	eln	s	del	r	fm	m	motion	magn	name
1930 VI	1930 5 2	16 3.6	+35 59	125	M	0.25	1.17	19	p	0.6 ENE	9.5	P/Schwassmann-Wachmann 3
1931 III	1931 7 16	10 34.4	+9 38	43	E	1.71	1.19	16	t	1.1 E	7	Nagata
1931 IV	1931 8 10	7 44.8	+23 34	23	M	1.40	0.61	12	t	1.1 E	5	Ryves
1931 V	1932 4 5	12 44.9	+30 9	144	E	1.85	2.72	14	p	0.5 SW	12	Carrasco
1932 I	1932 4 1	13 50.5	-77 33	107	M	0.66	1.35	10	t	1.3 NNW	9	Houghton-Ensor
1932 V	1932 8 8	3 5.7	+32 19	83	M	0.60	1.11	22	t	2.5 NNE	7	Peltier-Whipple
1932 VI	1932 6 22	9 42.8	-84 17	110	E	1.99	2.53	4	t	0.9 NE	8.5	Geddes
1932 VII	1932 6 20	15 37.8	+8 4	134	E	1.24	2.07	2	p	0.8 NW	12.5	Newman
1932 X	1932 12 15	22 56.7	-30 6	71	E	1.00	1.16	2	t	1.0 NE	8	Dodwell-Forbes
1933 I	1933 2 16	23 0.1	+61 45	75	E	0.60	1.01	6	t	2.8 E	8	Peltier
1933 IV	1933 10 15	3 26.2	+10 4	149	M	1.64	2.54	12	p	0.1 SW	13	P/Whipple
1934 II	1935 6 3	17 15.8	-18 41	171	M	3.25	4.25	16	p	0.5 W	13	Jackson
1935 I	1935 1 7	1 0.2	-52 18	71	E	1.11	1.22	18	p	1.0 N	10	Johnson
1936 I	1935 8 21	19 42.2	-17 18	146	E	3.74	4.62	7	p	0.2 WNW	14	Van Biesbroeck
1936 II	1936 5 15	23 51.6	+73 35	62	M	1.55	1.40	9	t	0.1 SE	9	Peltier
1936 III	1936 7 17	9 48.7	+35 16	30	E	0.98	0.52	13	t	0.4 NE	5.5	Kaho-Kozik-Lis
1936 IV	1936 9 15	22 54.8	-10 27	168	E	0.48	1.48	14	p	0.5 SSE	12	P/Jackson-Neujmin
1936 V	1937 8 4	22 50.1	-20 56	153	M	2.62	3.56	12	p	0.2 SW	13	Hubble
1937 II	1937 2 27	0 35.0	+19 10	39	E	0.85	0.63	2	t	1.5 NNE	7	P/Wilk
1937 IV	1937 2 7	13 20.4	+35 25	124	M	1.72	2.41	12	p	0.5 NE	12	Whipple
1937 V	1937 7 4	3 7.3	+38 46	50	M	1.49	1.15	11	t	0.6 NNE	7	Finsler
1939 I	1939 1 17	21 6.9	+28 24	52	E	0.88	0.82	12	t	1.2 E	8	Kozik-Peltier
1939 III	1939 4 15	0 57.8	+39 20	31	M	0.68	0.54	11	u	4.2 ENE	3	Jurlof-Achmarof-Hassel
1939 IV	1939 2 8	9 44.8	+15 55	175	M	0.94	1.93	4	p	0.2 NNW	15	P/Vaisala 1
1939 VI	1939 7 28	4 55.9	+26 30	49	M	0.83	0.78	27	t	2.2 NE	8	P/Herschel-Rigollet
1939 IX	1939 11 1	16 22.7	+35 43	57	E	0.98	0.95	4	t	1.7 ESE	9	Friend
1940 III	1940 9 30	10 5.4	+22 47	43	M	1.84	1.30	14	t	0.6 NNE	9	Okabayasi-Honda
1940 IV	1940 8 8	20 1.5	-6 50	160	E	0.46	1.45	20	p	1.9 SSW	10.5	Whipple-Paraskevopoulos
1941 I	1940 9 5	21 14.7	+54 34	115	E	1.95	2.55	19	p	0.4 W	13	Cunningham
1941 II	1941 1 17	22 18.9	+43 11	72	E	0.44	0.94	4	t	0.7 NE	10	Friend-Reese-Honda
1941 IV	1941 1 15	15 40.1	-32 47	56	M	0.69	0.82	2	t	1.4 SE	5.8	de Kock-Paraskevopoulos
1941 VII	1941 7 18	19 59.2	-7 0	166	M	0.30	1.31	10	t	0.4 ENE	9.5	P/du Toit-Neujmin-Delporte
1941 VIII	1941 5 27	18 4.6	-40 22	150	M	0.92	1.87	16	t	1.0 WNW	11	van Gent
1942 II	1942 3 11	10 55.5	-1 7	171	E	0.34	1.33	8	p	2.2 NNE	13	P/Vaisala 2
1942 IV	1942 1 25	12 59.5	+23 49	118	M	1.30	1.96	23	p	0.4 WSW	10	Whipple-Bernasconi-Kulin
1942 VII	1943 3 8	12 37.9	-1 18	158	M	2.52	3.46	16	p	0.1 WNW	15	P/Oterma
1942 VIII	1942 2 12	10 36.4	+16 51	167	M	3.57	4.54	11	p	0.4 WNW	15	Oterma
1942 IX	1942 11 6	4 11.1	+0 43	154	M	0.74	1.68	13	p	0.3 N	13	P/Stephan-Oterma
1943 I	1942 12 8	7 51.2	+15 27	139	M	0.73	1.61	16	p	0.5 NE	10	Whipple-Fedtke-Tevzadze
1943 II	1943 9 3	7 44.6	+40 35	52	M	0.70	0.80	19	t	1.6 NNE	8	Daimaca
1944 I	1943 11 27	8 10.4	-33 45	101	M	0.52	1.20	15	t	2.0 SW	9	van Gent-Peltier-Daimaca
1944 III	1944 5 16	19 49.5	-60 20	119	M	0.52	1.35	8	p	1.1 ESE	10	P/du Toit
1944 IV	1944 5 23	9 24.5	-49 33	100	E	1.91	2.31	15	t	0.8 NNE	12	van Gent
1945 I	1944 4 18	12 51.2	+0 2	163	E	2.69	3.66	10	p	0.2 W	14.5	Vaisala
1945 II	1945 4 9	10 58.8	-0 56	146	E	0.29	1.25	12	p	0.6 SSE	10	P/du Toit-Hartley
1945 III	1945 6 11	1 7.5	-20 7	75	M	0.74	1.09	15	p	1.1 SSW	10	du Toit
1945 VI	1945 11 22	16 18.9	+30 54	51	E	0.76	0.79	3	t	1.8 S	7	Friend-Peltier
1945 VII	1945 12 11	15 22.8	-64 42	45	M	0.62	0.70	22	p	3.4 ENE	7	du Toit
1946 I	1946 2 2	9 47.0	+42 57	152	M	1.02	1.95	16	p	1.2 NNW	9	Timmers
1946 II	1946 5 30	20 18.7	+32 54	102	M	0.18	1.07	14	t	10.9 NW	6	Pajdusakova-Rotbart-Weber
1946 VI	1946 8 6	7 53.9	-13 17	35	M	2.43	1.70	23	t	0.8 ESE	9	Jones
1947 I	1946 10 31	5 5.8	-38 30	115	M	2.07	2.64	21	p	0.6 W	10	Bester
1947 III	1947 3 27	19 20.2	+80 45	85	M	0.67	1.16	20	t	3.0 NNE	9	Becvar
1947 IV	1947 3 24	13 16.3	-60 29	119	M	0.48	1.31	17	p	2.2 SSW	10.5	Rondanina-Bester
1947 V	1947 5 18	14 46.1	-57 8	141	E	0.48	1.41	13	p	3.5 NW	11	Bester
1947 VI	1947 7 18	21 4.9	-1 57	153	M	1.88	2.83	15	p	0.7 WNW	12	Wirtanen
1947 VII	1947 9 10	23 27.3	+9 52	165	M	0.89	1.88	10	p	0.1 W	12.5	P/Reinmuth 2
1947 VIII	1948 10 7	21 29.7	+2 55	129	E	4.20	4.89	19	p	0.3 SW	14	Wirtanen
1947 X	1947 11 13	12 8.8	-23 57	43	M	1.07	0.76	15	t	2.0 SSE	9	Honda
1947 XII	1947 12 7	17 27.7	-33 40	13	E	0.85	0.25	9	u	4.4 ESE	0	Southern comet
1947 XIII	1948 1 15	4 36.9	+26 4	137	E	0.83	1.69	19	p	0.3 NNE	16	P/Wirtanen
1948 I	1947 9 25	4 46.7	-19 50	108	M	1.98	2.49	25	p	0.6 SSW	11	Bester
1948 II	1947 12 20	15 16.1	-2 8	43	M	2.29	1.70	22	t	0.7 ENE	9.5	Mrkos
1948 III	1948 9 1	23 40.9	-35 51	149	M	3.95	4.85	13	p	0.2 SSW	13	Johnson
1948 IV	1948 6 3	2 50.9	+43 15	32	M	0.53	0.63	11	u	2.2 NW	3.5	Honda-Bernasconi
1948 V	1948 3 13	18 25.7	+15 59	78	M	2.22	2.24	18	t	0.7 NNE	10	Pajdusakova-Mrkos
1948 IX	1948 8 26	23 11.8	-14 49	167	M	1.33	2.33	7	p	0.2 W	11.5	P/Ashbrook-Jackson
1948 X	1948 11 24	7 29.5	-74 36	79	M	1.15	1.37	8	p	1.2 W	7.5	Bester
1948 XI	1948 11 1	14 17.5	-15 50	3	M	0.74	0.26	14	u	1.9 WSW	-3	Eclipse comet
1948 XII	1948 12 3	13 53.3	-24 1	38	M	0.56	0.65	17	t	0.6 WSW	9	P/Honda-Mrkos-Pajdusakova
1949 I	1948 7 15	21 13.7	+7 54	143	M	3.06	3.91	24	p	0.4 WSW	15.5	Wirtanen
1949 II	1949 8 25	20 33.9	-26 32	151	E	1.31	2.25	17	p	0.1 SSW	13.7	P/Johnson
1949 III	1949 11 19	0 15.1	+13 41	131	E	0.31	1.22	14	p	1.8 ENE	16	Wilson-Harrington

desig	disc	date	RA (1950)	DEC	eln	s	del	r	fm	m	motion	magn	name
1949 IV	1949	6 29	19 56.7	+37 9	116	M	1.87	2.49	19	p	0.8 NW	13	Bappu-Bok-Newkirk
1949 VI	1949	9 18	0 8.9	-1 24	173	M	1.29	2.29	11	p	0.2 SW	12.5	P/Shajn-Schaldach
1950 I	1949	5 20	15 15.3	-44 37	154	E	2.66	3.60	8	p	0.5 WNW	13	Johnson
1950 VII	1951	2 5	7 22.5	+23 29	153	E	0.54	1.49	13	p	0.5 NNE	11	P/Arend-Rigaux
1951 I	1950	5 19	18 16.6	+12 3	131	M	2.84	3.58	17	p	0.5 W	11	Minkowski
1951 II	1951	2 4	20 34.5	+15 13	33	M	1.32	0.73	12	t	1.3 NNE	8.5	Pajdusakova
1951 IV	1951	4 24	8 38.8	+30 24	91	E	0.51	1.13	3	t	0.9 ENE	10	P/Tuttle-Giacobini-Kresak
1951 IX	1952	1 30	12 33.3	+11 38	125	M	1.12	1.87	18	p	0.3 NE	15	P/Harrington-Wilson
1951 X	1951	10 4	1 2.9	+23 19	160	M	0.91	1.88	19	p	0.4 NW	14	P/Arend
1952 I	1951	8 6	17 34.8	-6 23	128	E	1.94	2.69	19	p	0.7 WSW	15	Wilson-Harrington
1952 II	1951	10 4	0 43.8	+37 10	147	M	1.09	2.00	19	p	0.2 WSW	16	P/Wolf-Harrington
1952 V	1952	4 27	23 54.8	+42 59	42	M	2.00	1.43	17	t	0.1 SSE	10	Mrkos
1952 VI	1952	6 20	14 36.8	+67 25	82	E	0.90	1.26	12	t	0.3 NNE	10	Peltier
1953 I	1952	8 18	23 29.4	+65 10	100	M	2.06	2.44	13	p	0.1 N	13	Harrington
1953 II	1952	11 28	13 12.2	-3 16	48	M	1.74	1.31	27	t	0.8 SSE	10	Mrkos
1953 III	1953	4 12	21 10.9	+16 29	62	M	1.37	1.26	13	t	1.4 NNE	9	Mrkos-Honda
1953 VI	1953	8 14	23 42.9	-10 34	149	M	0.79	1.73	19	p	0.3 SE	15	P/Harrington
1953 VIII	1954	8 8	22 31.3	-23 56	160	M	2.73	3.70	23	p	0.2 WSW	19	P/Gunn
1954 I	1954	6 24	15 22.3	+32 24	111	E	2.22	2.76	8	p	0.6 W	19	Harrington
1954 II	1953	12 3	2 17.2	-16 13	129	E	0.63	1.47	13	t	1.6 WSW	11	Pajdusakova
1954 IV	1954	9 1	22 47.8	-9 37	178	M	1.85	2.86	18	p	0.2 SW	15	P/Van Biesbroeck
1954 V	1955	4 13	13 29.1	+48 2	123	M	4.83	5.45	6	p	0.3 W	15	Abell
1954 VIII	1954	7 28	6 55.8	+65 35	49	M	1.70	1.29	12	t	0.8 NNE	9	Vozarova
1954 X	1953	10 15	6 15.3	+81 1	101	M	3.49	3.80	22	p	0.2 NNE	15	Abell
1954 XII	1954	6 26	14 47.5	+12 42	117	E	0.61	1.40	10	t	2.2 WSW	10	Kresak-Peltier
1954 XIII	1955	3 22	11 8.0	+20 27	155	E	1.05	2.00	14	p	0.2 NNW	17	P/Harrington-Abell
1955 III	1955	6 12	4 42.7	+43 47	22	M	1.36	0.57	7	t	1.7 NE	3	Mrkos
1955 IV	1955	7 13	22 50.7	+19 56	115	M	0.66	1.43	8	t	1.5 NNW	8	Bakharev-Macfarlane-Krienke
1955 V	1955	7 29	4 49.0	-2 50	59	M	0.72	0.89	24	t	1.0 N	8	Honda
1955 VI	1954	7 31	14 47.0	+66 37	74	E	5.22	5.04	15	p	0.1 SW	15	Baade
1955 VII	1955	10 19	8 34.9	+14 54	78	M	0.89	1.19	18	t	0.9 SE	9	P/Perrine-Mrkos
1956 I	1954	12 18	4 29.5	+22 4	163	E	4.34	5.29	8	p	0.2 WNW	16	Haro-Chavira
1956 III	1956	3 12	18 21.5	+7 21	78	M	0.55	1.03	15	t	3.0 NNE	9	Mrkos
1957 III	1956	11 8	2 2.0	+29 32	162	E	1.87	2.83	20	p	0.6 WSW	10	Arend-Roland
1957 V	1957	7 29	7 39.8	+27 44	15	M	1.23	0.36	18	u	2.2 NE	1	Mrkos
1957 VI	1956	3 16	11 47.7	-30 48	148	M	5.28	6.14	19	p	0.1 WNW	15	Wirtanen
1957 IX	1957	10 16	3 27.2	+12 47	150	M	0.21	1.18	8	t	6.2 SW	8	Latyshev-Wild-Burnham
1958 III	1958	2 21	5 51.5	+9 53	115	E	0.84	1.54	17	t	0.4 NNE	9	Burnham
1958 VI	1958	12 10	2 45.0	+28 15	148	E	1.76	2.65	14	p	0.1 SW	16	P/Slaughter-Burnham
1959 I	1958	9 7	21 18.9	+10 24	149	E	1.94	2.85	9	p	0.4 WNW	14	Burnham-Slaughter
1959 III	1959	7 26	19 36.0	-38 38	159	E	0.26	1.26	6	p	1.4 ESE	8	Bester-Hoffmeister
1959 IV	1959	8 24	15 47.1	+35 42	79	E	0.79	1.16	6	t	1.3 SE	10	Alcock
1959 VI	1959	8 30	8 12.9	+17 8	35	M	0.95	0.59	12	t	2.6 ESE	6	Alcock
1959 VII	1960	1 21	3 42.2	+14 18	116	E	1.45	2.08	8	p	0.5 N	14	Burnham
1959 IX	1959	12 3	15 4.8	-5 16	28	M	2.08	1.29	18	t	0.9 ESE	8	Mrkos
1959 X	1960	6 18	16 17.8	+41 48	112	E	4.08	4.55	9	p	0.4 W	17	Humason
1960 I	1960	3 26	10 38.0	+14 52	149	E	1.00	1.93	13	p	0.3 SSW	14.3	P/Wild 1
1960 II	1959	12 30	1 50.1	+4 11	109	E	1.11	1.71	15	p	1.2 WSW	13	Burnham
1961 II	1960	12 26	20 21.3	+77 17	102	E	0.64	1.29	23	t	3.3 SE	8	Candy
1961 V	1961	7 23	7 7.5	+29 40	17	M	0.83	0.33	25	u	2.0 NW	3	Wilson-Hubbard
1961 VIII	1961	10 10	11 29.8	+14 7	31	M	1.31	0.68	16	t	0.3 W	8	Seki
1961 X	1960	9 24	0 35.5	+1 10	172	M	3.11	4.11	19	p	0.1 WSW	17	P/van Houten
1962 III	1962	2 4	8 11.1	-37 59	124	E	0.80	1.58	15	t	1.4 WSW	8.5	Seki-Lines
1962 IV	1962	4 28	1 48.0	+51 20	38	M	1.07	0.68	8	t	0.9 NNW	8	Honda
1962 VIII	1961	9 1	1 7.6	+31 31	127	M	4.59	5.26	6	p	0.2 WSW	14	Humason
1963 I	1963	1 2	13 52.2	-26 57	66	M	1.72	1.61	22	t	0.3 SSE	12	Ikeya
1963 III	1963	3 1	19 40.5	+46 32	68	M	1.89	1.78	21	t	0.1 N	8	Alcock
1963 V	1963	9 14	9 34.6	-4 20	29	M	1.57	0.85	11	t	0.4 SSW	2	Pereyra
1963 VIII	1963	8 17	4 37.0	+30 44	72	M	2.50	2.38	12	p	0.4 ENE	12	P/Kearns-Kwee
1963 IX	1963	11 22	8 42.3	+18 35	111	M	1.59	2.15	21	p	0.3 E	16	Anderson
1964 VI	1964	6 6	2 1.2	+9 14	44	M	0.98	0.75	11	t	1.2 NE	6	Tomita-Gerber-Honda
1964 VIII	1964	7 3	4 14.7	+16 42	37	M	1.58	0.98	8	t	0.1 SE	8	Ikeya
1964 IX	1964	8 7	15 18.0	-8 48	95	E	0.71	1.28	14	t	1.5 NNE	9	Everhart
1965 I	1965	1 1	6 44.8	+25 18	178	E	0.53	1.51	13	p	0.3 N	15	P/Tsuchinshan 1
1965 II	1965	1 11	8 15.6	+17 37	169	M	0.81	1.79	23	p	0.2 SW	15	P/Tsuchinshan 2
1965 VI	1965	10 28	22 55.0	-8 23	127	E	1.14	1.91	18	p	0.3 E	17	P/Klemola
1965 VIII	1965	9 18	8 44.2	-8 35	46	M	1.56	1.12	8	t	0.9 ESE	8	Ikeya-Seki
1965 IX	1965	9 26	16 52.6	+35 17	75	E	1.23	1.37	16	t	1.0 SE	10	Alcock
1966 II	1966	8 15	0 47.7	-0 1	131	M	1.68	2.47	14	p	0.3 S	9	Barbon
1966 IV	1966	9 8	13 0.8	+22 12	32	E	1.78	1.07	8	t	1.3 ESE	8	Ikeya-Everhart
1966 V	1966	8 8	17 54.3	+21 36	119	E	1.90	2.55	7	t	0.3 S	10.6	Kilston
1967 II	1966	10 15	2 38.7	+2 13	159	M	1.03	1.99	16	p	0.4 WSW	13.5	Rudnicki
1967 III	1967	2 11	6 59.9	+80 53	111	E	0.64	1.36	16	p	2.6 SW	12	Wild

desig	disc	date	RA (1950)	DEC	eln	s	del	r	fm	m	motion	magn	name
1967 IV	1967	2 4	18 10.2	+22 11	58	M	1.01	0.97	9	t	2.2 ENE	11	Seki
1967 VII	1967	6 29	8 28.1	+17 11	28	E	0.91	0.48	7	t	2.9 SE	5	Mitchell-Jones-Gerber
1967 XV	1967	3 9	11 53.1	+10 45	169	M	2.57	3.55	13	p	0.2 WNW	15	P/Smirnova-Chernykh
1968 I	1967	12 28	16 32.2	-2 40	34	M	2.59	1.87	12	t	0.4 NNE	9	Ikeya-Seki
1968 III	1968	10 17	2 59.0	+39 17	144	M	2.48	3.34	11	p	0.6 WSW	15	Wild
1968 IV	1968	4 25	23 12.8	+6 22	44	M	0.33	0.80	12	t	6.2 NNE	7	Tago-Honda-Yamamoto
1968 V	1968	6 15	15 17.3	+2 13	138	E	0.29	1.25	5	t	3.3 N	9	Whitaker-Thomas
1968 VI	1968	7 6	5 8.7	+40 37	30	M	2.05	1.27	26	t	0.3 N	8	Honda
1968 VII	1968	8 24	19 3.9	+31 57	118	E	1.06	1.77	16	t	1.0 W	11.5	Bally-Clayton
1968 IX	1968	8 30	6 2.1	-6 29	70	M	1.53	1.51	22	t	0.9 SSE	10	Honda
1969 I	1968	12 19	5 22.1	+81 45	122	E	2.70	3.32	15	p	0.1 WNW	13	Thomas
1969 II	1970	10 27	1 23.5	-2 3	162	E	2.81	3.76	13	p	0.2 W	16	P/Gunn
1969 IV	1969	9 11	7 9.5	+23 49	62	M	1.39	1.28	15	p	0.9 E	13	P/Churyumov-Gerasimenko
1969 VII	1969	8 12	5 41.1	+19 2	54	M	1.68	1.36	14	t	1.0 E	11	Fujikawa
1969 IX	1969	10 10	16 20.1	-2 18	50	E	2.01	1.56	15	t	0.5 SSE	10	Tago-Sato-Kosaka
1970 I	1970	1 26	18 53.1	+6 47	35	M	1.30	0.76	4	t	1.2 ESE	8	Daido-Fujikawa
1970 II	1969	12 28	1 4.7	-65 53	73	E	1.70	1.69	5	t	0.5 WNW	8.5	Bennett
1970 III	1969	7 26	19 40.0	+27 13	132	E	2.59	3.35	27	p	0.4 WNW	14	Kohoutek
1970 VI	1970	5 18	4 29.9	+15 59	13	E	1.14	0.27	27	u	2.5 ESE	1	White-Ortiz-Bolelli
1970 X	1970	10 19	15 52.4	-5 28	34	E	1.06	0.61	5	t	2.0 ENE	7	Suzuki-Sato-Seki
1970 XII	1970	12 27	13 25.3	-12 43	71	M	1.87	1.80	15	p	0.5 ESE	14	P/Kojima
1970 XV	1970	7 3	2 17.8	+23 25	61	M	2.28	2.00	14	t	0.4 N	10	Abe
1971 I	1972	3 16	12 7.7	-3 6	172	M	4.13	5.12	16	p	0.4 WNW	16	Gehrels
1971 V	1971	3 7	21 34.9	+23 37	37	M	2.04	1.38	25	t	0.4 SSE	9.5	Toba
1972 III	1972	3 12	22 50.3	-32 19	30	M	1.68	0.97	12	t	0.7 SE	10	Bradfield
1972 VII	1973	2 8	8 7.3	+22 4	160	E	1.32	2.27	21	p	0.2 WSW	19	P/Swift-Gehrels
1972 VIII	1973	1 11	12 28.9	+13 11	109	M	2.24	2.72	22	p	0.6 NNW	12	Heck-Sause
1972 IX	1972	6 9	15 27.3	+21 25	129	E	3.76	4.47	12	p	0.2 NW	13	Sandage
1972 XII	1972	12 9	4 35.0	-56 58	100	E	4.59	4.86	19	p	0.3 W	12.5	Araya
1973 I	1972	10 11	1 8.9	+8 27	178	M	2.03	3.03	18	p	0.2 W	19	P/Gehrels 1
1973 II	1972	10 31	8 23.8	-18 49	85	M	2.34	2.46	9	p	0.3 WSW	14	Kojima
1973 III	1973	4 25	14 36.4	+33 19	133	M	1.63	2.43	8	p	0.4 SW	13	Huchra
1973 V	1973	6 9	20 51.9	-31 22	130	M	0.71	1.57	23	p	0.4 ESE	13	P/Clark
1973 VII	1973	2 28	11 8.2	+22 10	165	M	0.99	1.96	11	p	1.7 NW	14	Kohoutek
1973 IX	1973	11 24	3 24.7	-52 58	106	E	3.56	3.95	14	p	0.3 WSW	15	Gibson
1973 X	1973	7 4	15 12.2	+21 56	110	E	4.47	4.91	19	p	0.2 W	15	Sandage
1973 XI	1973	9 29	1 38.4	+13 42	158	M	1.43	2.39	17	p	0.1 SW	15.5	P/Gehrels 2
1973 XII	1973	3 7	8 22.6	+4 29	138	E	3.96	4.75	18	p	0.2 WNW	16	Kohoutek
1974 III	1974	2 12	23 37.4	-33 43	33	E	1.57	0.92	6	t	0.7 ENE	9	Bradfield
1974 VIII	1974	7 26	18 55.9	-35 11	156	E	0.76	1.73	22	p	2.3 W	14	Cesco
1974 XII	1974	11 12	1 32.6	+30 54	155	E	5.15	6.06	12	p	0.2 SSW	17	van den Bergh
1974 XIV	1975	6 10	18 54.3	-58 41	140	M	1.91	2.76	16	p	0.2 SW	17	P/Longmore
1974 XV	1974	11 13	11 16.8	-34 8	54	M	1.03	0.93	13	t	0.7 S	9	Bennett
1975 I	1975	1 4	23 1.7	-5 11	61	E	1.14	1.09	6	t	1.1 ENE	12.3	P/Boethin
1975 II	1976	2 25	11 1.1	-42 46	127	M	6.73	7.37	10	p	0.2 W	15	Schuster
1975 III	1975	2 9	3 46.5	+19 25	99	E	1.09	1.58	13	p	0.6 E	14	P/Kohoutek
1975 IV	1974	10 15	1 5.4	-49 57	122	E	1.26	1.97	14	p	0.2 W	12	P/West-Kohoutek-Ikemura
1975 V	1975	3 12	1 6.1	-22 6	30	E	2.02	1.27	14	t	0.9 E	9	Bradfield
1975 VII	1975	3 4	9 23.8	+23 49	152	E	2.70	3.61	6	p	0.1 WNW	15	P/Smirnova-Chernykh
1975 VIII	1974	3 21	12 45.4	-0 1	169	M	4.66	5.64	13	p	0.2 W	13	Lovas
1975 IX	1975	7 2	21 46.6	-7 37	133	M	0.57	1.47	9	t	1.3 NNW	8	Kobayashi-Berger-Milon
1975 X	1975	10 5	11 10.7	+43 41	52	M	0.94	0.86	15	t	0.1 ESE	8.5	Suzuki-Saigusa-Mori
1975 XI	1975	11 11	10 54.6	-37 26	58	M	1.25	1.10	22	t	1.5 SE	9.5	Bradfield
1975 XII	1975	10 5	8 20.8	+3 22	66	M	2.12	1.94	15	t	0.6 SSE	10.5	Mori-Sato-Fujikawa
1976 I	1975	11 30	12 12.7	+27 27	78	M	0.67	1.07	12	t	1.2 S	9.5	Sato
1976 IV	1976	2 19	1 55.1	-33 17	56	E	0.78	0.85	4	t	1.0 ENE	10	Bradfield
1976 V	1976	3 3	21 25.3	-46 37	44	M	0.65	0.70	17	t	3.2 ESE	9	Bradfield
1976 VI	1975	8 10	21 56.8	-37 53	156	M	2.61	3.56	18	p	0.3 SW	16.5	West
1976 IX	1976	10 27	9 39.3	+70 29	95	M	5.75	5.91	19	p	0.1 NNW	17	Lovas
1976 XII	1977	2 17	10 36.9	+35 15	155	M	4.85	5.77	13	p	0.2 WSW	16	Lovas
1976 XIII	1976	5 3	13 27.0	+44 52	117	E	2.22	2.83	19	p	0.2 WSW	16	Harlan
1976 XVI	1977	2 13	10 22.1	+14 57	171	M	2.03	3.01	9	p	0.2 WNW	17.5	P/Skiff-Kosai
1977 III	1977	4 24	14 2.1	-12 54	179	E	3.66	4.67	20	p	0.1 WNW	16.5	P/Kowal 1
1977 VII	1975	10 27	1 51.6	+12 18	177	E	2.88	3.87	7	p	0.2 WSW	17	P/Gehrels 3
1977 VIII	1977	4 16	12 38.8	-6 44	165	E	0.64	1.63	12	p	1.2 SW	15	Helin
1977 IX	1978	1 12	14 30.6	-13 36	72	M	5.98	5.75	18	p	0.1 NNE	17.5	West
1977 X	1977	11 3	1 24.0	+2 48	159	E	2.77	3.72	8	p	0.6 WSW	13.5	Tsuchinshan
1977 XII	1977	10 15	22 28.8	-7 20	135	E	0.99	1.83	18	p	0.4 SE	16	P/Sanguin
1977 XIII	1978	2 11	10 46.9	-0 44	157	M	0.87	1.82	18	p	0.2 W	20	P/Tritton
1977 XIV	1977	9 2	15 20.2	+30 5	68	E	1.57	1.51	5	t	0.5 SE	10	Kohler
1978 I	1977	10 9	23 33.3	-36 55	133	E	1.03	1.86	12	p	0.3 NW	17	P/Schuster
1978 IV	1977	8 19	0 20.5	-3 9	142	M	2.08	2.95	20	p	0.1 SSW	14	P/Chernykh
1978 VII	1978	2 4	18 19.3	-50 4	48	M	1.41	1.05	11	t	1.2 ENE	7.5	Bradfield

desig	disc date	RA (1950)	DEC	eln	s	del	r	fm	m	motion	magn	name
1978 XI	1978 1 6	5 35.0	+19 23	158	E	1.22	2.16	12	p	0.3 W	13.5	P/Wild 2
1978 XIII	1978 9 12	6 39.2	-18 24	73	M	1.84	1.81	25	t	0.8 S	10.7	Machholz
1978 XV	1978 10 1	11 56.2	-36 45	35	M	0.95	0.58	15	t	1.6 S	5	Seargent
1978 XVIII	1978 10 10	11 1.3	-18 45	32	M	0.84	0.52	24	t	1.4 S	9	Bradfield
1978 XIX	1978 10 9	10 24.8	+5 2	40	M	0.30	0.79	23	t	1.2 NNW	11	P/Denning-Fujikawa
1978 XX	1978 9 1	20 51.1	-29 24	147	E	0.23	1.21	14	t	0.6 SSE	10	P/Haneda-Campos
1978 XXI	1978 4 27	7 19.0	+53 46	71	E	3.19	3.01	4	t	0.3 SSE	10	Meier
1978 XXII	1978 9 8	0 8.2	-9 2	164	M	0.87	1.86	21	p	0.2 S	15.6	P/Giclas
1979 II	1979 1 27	2 59.3	+9 23	99	E	1.03	1.53	14	p	0.6 E	17	P/Kowal 2
1979 V	1979 6 16	14 11.3	-3 1	127	E	0.80	1.63	6	p	0.4 NE	17	P/Russell 1
1979 VI	1979 6 26	19 49.2	-11 31	155	M	3.75	4.69	16	p	0.3 WNW	18	Torres
1979 VII	1979 6 24	8 37.4	-1 15	44	E	1.16	0.82	14	t	1.2 N	10	Bradfield
1979 VIII	1979 8 13	12 36.1	-2 25	50	E	1.27	0.99	5	p	1.0 SE	13	P/Schwassmann-Wachmann 3
1979 IX	1979 9 20	13 33.5	+68 28	69	E	1.50	1.48	14	t	0.4 SSW	11.5	Meier
1979 X	1979 12 24	16 19.4	-35 11	26	M	1.22	0.55	21	t	0.5 SW	6	Bradfield
1979 XI	1979 8 30	10 18.7	+8 19	3	M	1.02	0.06	22	p	5.8 E	-3.5	Howard-Koomen-Michels
1980 II	1980 6 13	19 13.5	-32 57	154	M	1.70	2.65	15	p	0.6 NW	15	Torres
1980 III	1980 9 28	21 44.7	-32 7	130	E	1.60	2.37	4	p	0.2 N	17	P/Russell 2
1980 IV	1980 7 31	11 46.2	+32 40	44	E	1.46	1.01	4	t	1.3 E	9	Cernis-Petrauskas
1980 V	1980 12 5	9 11.9	+33 40	121	M	1.22	1.93	13	p	0.1 E	17	P/Lovas
1980 VII	1980 4 11	13 30.6	+12 29	159	M	1.61	2.58	11	p	0.2 W	15.5	P/Wild 3
1980 XII	1980 11 6	18 5.9	+41 55	74	E	1.54	1.59	14	t	0.7 SSW	10.5	Meier
1980 XV	1980 12 17	16 18.9	-36 18	22	M	1.20	0.46	25	t	0.7 ENE	6	Bradfield
1981 I	1981 1 26	20 48.8	-20 26	4	E	0.96	0.07	6	p	4.5 NW	0	(SOLWIND 2)
1981 II	1980 12 25	18 46.8	+38 51	63	E	1.93	1.71	4	t	0.2 NNE	10	Panther
1981 V	1980 9 6	3 13.8	-34 57	115	M	2.38	2.96	11	p	0.6 SSW	17	Russell
1981 VII	1981 6 29	0 8.6	-51 36	111	M	2.01	2.57	12	p	0.8 S	15	Gonzalez
1981 X	1981 8 29	0 37.5	-7 35	148	M	1.02	1.95	14	p	0.2 WSW	15	P/Howell
1981 XI	1981 3 2	11 53.5	-0 10	163	M	1.33	2.30	12	p	0.1 WNW	17.5	P/Bus
1981 XIII	1981 7 19	7 39.3	+18 31	4	M	1.07	0.09	2	p	3.6 NE	-0.8	(SOLWIND 3)
1981 XIV	1981 4 26	15 25.8	-6 44	161	M	1.70	2.67	7	p	1.0 W	16.5	Bus
1981 XV	1981 4 3	11 17.7	-77 3	107	E	4.47	4.86	14	p	0.3 NW	15	Elias
1981 XXI	1981 11 3	14 15.7	-17 42	5	M	0.92	0.11	21	p	4.9 ENE		(SOLWIND 4)
1982 I	1980 2 11	10 37.0	+10 4	164	M	6.50	7.46	10	p	0.1 WNW	16.5	Bowell
1982 II	1982 2 5	12 31.2	-7 2	126	M	0.51	1.35	27	p	0.8 ESE	14	P/du Toit-Hartley
1982 III	1982 7 11	16 49.5	-7 0	141	E	0.84	1.75	5	p	0.4 N	15	P/Peters-Hartley
1982 VI	1982 6 18	4 4.3	-40 8	68	M	1.49	1.45	12	t	0.3 NE	10.4	Austin
1982 IX	1983 6 14	20 36.5	-3 49	130	M	2.04	2.81	19	p	0.1 NNW	16	P/Russell 3
1983 I	1983 5 13	9 16.8	-15 8	95	E	1.79	2.13	16	p	0.5 N	17	IRAS
1983 II	1983 2 11	9 25.7	+18 37	175	E	0.99	1.97	14	p	0.1 W	16.2	P/Bowell-Skiff
1983 III	1983 5 8	15 34.0	-15 37	171	M	1.62	2.63	11	p	0.1 WNW	16	P/Kowal-Vavrova
1983 V	1983 5 8	1 34.6	+39 21	29	M	1.01	0.50	11	t	0.6 WNW	7	Sugano-Saigusa-Fujikawa
1983 VI	1983 7 11	11 57.8	-48 58	94	E	2.25	2.54	16	p	0.6 N	17	IRAS
1983 VII	1983 5 3	18 55.6	+52 37	92	M	0.20	1.04	6	t	1.1 NNW	6.4	IRAS-Araki-Alcock
1983 XII	1983 7 19	2 43.0	+11 38	74	M	3.45	3.32	24	t	0.2 S	10.7	Cernis
1983 XIV	1983 6 28	1 22.2	-22 4	87	M	1.55	1.80	3	p	0.4 NE	15	P/IRAS
1983 XV	1983 9 7	23 52.8	+20 34	150	M	2.51	3.42	15	p	0.6 SW	16	Shoemaker
1983 XVI	1983 7 27	10 54.7	-67 23	91	E	2.43	2.65	3	p	0.7 NE	18	IRAS
1983 XIX	1984 1 7	15 50.8	-46 36	46	M	1.84	1.37	18	t	1.0 SE	10.7	P/Bradfield
1983 XX	1983 9 24	11 45.2	-1 7	4	M	0.97	0.08	2	p	6.2 E		(SOLWIND 6)
1984 I	1984 3 2	13 32.7	+0 36	139	M	1.31	2.16	14	p	0.0 NNW	13	P/Russell 4
1984 III	1983 11 4	21 50.7	-21 30	101	E	1.02	1.56	14	p	1.2 NW	15	P/Hartley-IRAS
1984 VII	1984 7 30	21 12.6	-18 41	172	M	0.72	1.73	17	t	0.2 SSW	9.4	P/Takamizawa
1984 X	1984 4 23	13 11.3	-11 48	167	E	1.00	1.99	8	p	0.1 NW	15	P/Kowal-Mrkos
1984 XII	1984 7 28	8 31.1	+19 8	0	E	1.01	0.01	15	p	4.3 E		(SOLWIND 5)
1984 XIII	1984 7 8	4 41.6	-38 54	70	M	0.26	0.96	25	t	8.1 E	5.8	Austin
1984 XV	1984 10 23	3 24.8	+18 32	156	M	4.58	5.50	13	p	0.3 WSW	16	Shoemaker
1984 XVI	1984 9 27	23 15.0	+17 3	159	E	1.01	1.98	17	p	0.4 WNW	13	P/Shoemaker 1
1984 XVIII	1984 11 21	3 5.4	+18 24	170	E	0.50	1.48	13	p	0.7 NNW	14.5	P/Shoemaker 2
1984 XX	1984 9 18	15 8.3	+10 59	52	E	1.19	0.98	8	t	0.9 SW	11.7	Meier
1984 XXIII	1984 11 13	18 48.0	+9 23	60	E	1.14	1.07	5	t	0.5 N	9.5	Levy-Rudenko
1984s	1984 10 25	1 57.0	+18 57	173	E	0.62	1.61	15	p	0.3 S	12	Shoemaker
1986c	1986 3 15	11 23.0	-7 29	169	E	2.22	3.21	19	p	0.3 WNW	17	P/Hartley 2
1985k	1985 8 16	21 50.0	-1 33	168	M	1.10	2.10	16	p	0.2 SW	16	P/Maury
1985f	1985 6 13	11 45.6	+4 33	93	E	1.11	1.54	10	p	0.7 SSE	16	P/Hartley 1
1985e	1985 5 27	0 49.9	+15 12	49	M	1.34	1.02	23	t	1.4 ENE	9.5	Machholz
1984f	1984 5 27	16 36.8	+13 49	145	M	4.39	5.24	12	p	0.3 W	14	Shoemaker
1984v	1984 11 17	5 6.5	-10 24	142	M	3.99	4.80	9	p	0.3 SW	15	Hartley
1985p	1985 11 8	4 32.7	+23 32	155	M	0.75	1.71	11	p	0.3 NNW	10	P/Ciffreo
1985l	1985 9 11	1 12.7	-27 29	144	M	0.84	1.75	12	p	0.9 W	12	Hartley-Good
1985m	1985 10 9	5 54.5	+21 25	107	M	1.08	1.67	10	p	0.8 NW	13	Thiele
1986a	1986 1 10	9 34.6	+20 40	150	M	0.89	1.81	14	p	0.1 NNE	10	P/Shoemaker 3
1986b	1986 3 4	12 14.0	+23 50	155	M	2.69	3.61	8	p	0.6 WNW	15.5	Shoemaker
1986e	1986 5 12	0 40.5	+38 37	39	M	0.63	0.66	18	t	1.5 WNW	11	P/Machholz
1986i	1986 7 14	21 53.9	-12 12	145	M	1.85	2.74	22	p	0.8 SW	13	Churyumov-Solodovnikov
1986d	1986 5 3	14 50.1	-6 32	171	M	0.96	1.96	9	p	0.2 NNW	15	Singer Brewster
1986l	1986 8 5	22 21.9	+25 10	133	M	2.88	3.65	15	p	0.4 WSW	10.5	Wilson

TABULATION OF COMET OBSERVATIONS

Some of the descriptive data listed below complement tabulated observations which appeared in previous issues of the *ICQ* (especially the last issue). Again, due to lack of space and time, some descriptive data complementing tabulated data in this issue will be published in the next issue, notably observations by C. S. Morris and R. Fleet which contain large amounts of tail information. Fleet had m_1 estimates of P/Halley on > 180 nights by mid-August 1986, placing him in first place in that category.

See page 77 of the July issue for further information and keys regarding the descriptive and tabulated data. As in the July issue, all descriptive data are listed by comet and in chronological order; if an instrument is not stated specifically therein, assume that the descriptive information refers to whichever instrument was in use at the same UT date by that observer (as listed in the tabulated data). New references added to the Reference Key include *NN* (cluster photometry of NGC 2129, in *Publications of the U.S. Naval Observatory*, Vol. **XVII**, part VII, 1961, p. 406), *PC* (Pleiades sequence in *Astronomical Photometry*, by Henden and Kaitchuck, 1982, pp. 298–300), *WE* (AAVSO chart of X Sextantis, supplied by IHW), *WF* (AAVSO chart of S Sextantis, supplied by IHW), and *WG* (AAVSO chart of SX Leonis, supplied by IHW). Steve Edberg, IHW, notes that no changes were made to these AAVSO charts by the IHW.

At the 20th ESLAB Symposium "on the Exploration of Halley's Comet", held in Heidelberg, West Germany, during 1986 Oct. 27–31, I presented a paper by the *ICQ* Staff (DWEG, TLR, CSM) entitled "The *ICQ* Photometric Archive for P/Halley and Other Comets" (abstract in ESA SP-250, p. 431; full version to be published in the conference proceedings). In that paper and at the Heidelberg meeting, we announced the availability of the *ICQ* archive on 9-track magnetic tape to researchers. The archive tape includes nearly 20 000 "observations" of ~ 90 long-period and ~ 60 short-period comets as published through the October 1986 issue of the *ICQ*; each "observation" is represented by one 80-character record. Further information will be given in the next issue, and interested individuals should contact the Editor at the address given on the second page of this issue. — D.W.E.G.

◇ *P/Halley* (1982i): 1985 Sept. 12.13: at 62×, m_2 = 13.5–14.0 [KEI]. Sept. 26.17: "open to NE", m_2 = 13.5 [KEI]. Sept. 29.17: m_2 = 13.9 [OME]. Oct. 9.73: "roundish" [BOE]. Oct. 11.43: (correction to *ICQ* **8**, 77) Oct. 7 remark concerning central cond. refers to Oct. 11 [MOR]. Oct. 18.05: "round coma with central cond." [CAM]. Oct. 22.72: "coma elongated toward SW" [BOE].

Nov. 3.86: "round coma with central cond." [CAM]. Nov. 5.59: "elongated toward E" [BOE]. Nov. 5.93: "fan-shaped coma" [CAM]. Nov. 8.54: in 15-cm $f/8$ L (64×), coma dia. 2.3′, DC = 4 [TRE]. Nov. 12.50: in 10-cm $f/6$ L (24×), coma dia. 6.5′, DC = 4 [TRE]. Nov. 13.50: in 15-cm $f/8$ L (64×), coma dia. 3.2′, DC = 3 [TRE]. Nov. 17.49: in 20-cm $f/6$ L (61×), 1° tail in p.a. 125°, and a second 12′ tail in p.a. 135°; with Swan-band comet filter, latter tail was more visible while former tail became "almost invisible" [HAL]. Nov. 20.46: in 20-cm $f/6$ L (61×), 40′ tail in p.a. 105° [HAL].

Dec. 5.84: in 11×80 B, coma size 18′ × 15′ [FLE]. Dec. 6.83: coma size 20′ × 15′ [FLE]. Dec. 7.74: in 11×80 B, coma size 20′ × 15′ [FLE]. Dec. 7.78: strong central cond. [BEN]. Dec. 9.24: in 20-cm $f/6$ L (61×), 30′ tail in p.a. 80° [HAL]. Dec. 10.52: in 20×56 B, coma dia. 28′ [BOE]. Dec. 13.74: coma size 16′ × 13′ [FLE]. Dec. 28.23, 29.23, 30.23: in 10×50 B, 5° tail [OME].

1986 Feb. 15.13: coma size 2.5′ × 4.5′ [FLE]. Feb. 16.12: "coma fan" 2.5′ × 8′ spanning p.a. 250°–310° [FLE]. Feb. 19.11: in 11×80 B, m_1 = 4.5 using ρ Cap for comparison, m_1 = 3.1 using ϵ Aqr; 0.7°-long tail, 8′ wide, in p.a. 285°; to naked eye, m_1 = 3.3 using ϵ Aqr, 2.8 using ρ Cap [FLE]. Feb. 20.10: "elongated coma; tail 10′ at widest" [CAM]. Feb. 20.11: in 11×80 B, tail 11′ wide at length 0.3°; naked-eye m_1 comparison star was α_2 Cap [FLE]. Feb. 20.12: m_1 comparison star ϵ Aqr [FLE]. Feb. 21.11: in 11×80 B, coma dia. 4′, DC = 7, tail 0.8° long in p.a. 282°, "fan to 0.3° in p.a. 320°"; naked-eye m_1 comparison star was α_2 Cap, and using same star, m_1 = 3.7 in 11×80 B (other binocular m_1 estimate was made using ϵ Aqr) [FLE]. Feb. 22.13: in 11×80 B, DC = 7, 0.5° tail in p.a. 277°, m_1 = 3.9 using α_2 Cap, 3.3 using ϵ Aqr [FLE]. Feb. 23.56: in 20×80 B, comet fan-shaped with faint material between the tails; northern dust tail slightly curved toward N; in 25.6-cm L (67×), central cond. was elongated toward the dust tail and coma had bulge of material on S side hooking toward gas tail [MOR]. Feb. 25.11: "tail 12′ at widest;" central cond. ~ 1′ [CAM]. Feb. 25.56: "dust tail curved significantly ~ 2° from head, w/ the p.a. for the last 2° being 310°; in 20-cm T (160×), central cond. is offset toward N" [MOR]. Feb. 27.88: "comet naked-eye object despite nearly-full moon" [BOE].

Mar. 1.35: "coma unsymmetrical with cond. offset toward the N; bright swath of material ~ 10′ long extends from the N side of the cond. into the tail" [MOR]. Mar. 2.55: in 10×50 B, "the tail split half-way down its length, with the S fork being straighter and brighter" [HAL]. Mar. 4.3: "dust tail in p.a. 280° was curved;" end of tail at p.a. 300° [MOR]. Mar. 5.55: in 10×50 B, 3° tail in p.a. 270° [HAL]. Mar. 5.87: in 8×30 B, tail 1.3° long [BOE]. Mar. 7.12: "tail 14′ at its widest point" [CAM]. Mar. 7.87: in 20-cm L, tail 40′ wide [BOE]. Mar. 10.3: "in 16×70 B, central cond. has a hooked-shaped feature from N side back into tail" [MOR]. Mar. 11–June 12: "unless otherwise noted, multiple tail p.a.s define observed fan-shaped tail (edges, plumes of material, etc.)" [MOR]. Mar. 12.87: in 8×30 B, tail 5.15° long [BOE]. Mar. 14.85: in 8×30 B, tail > 5.0° [BOE]. Mar. 16.50: in 20-cm $f/6$ L (61×), coma dia. 12′ [HAL]. Mar. 20.11: in 30×80 B, "narrow, straight bluish tail"; in 13-cm R, 5° tail was straight, and there was a 3.5° dust tail in p.a. 277° [CAM]. Mar. 20.5: "fan tail brightest in p.a. 265°, 325°, and 0° to the naked eye" [MOR]. Mar. 26.54: "using 24.1-cm $f/14.8$ R (398×) and 30.5-cm $f/16.4$ R (476×), two jets were seen coming from the cond. in p.a. ~ 30° and ~ 90°" [MOR].

Apr. 1.90: in 13-cm R, "tail very faint, coma bluish; tail not visible w/ naked eye" [CAM]. Apr. 3.80: light pollution caused m_1 and tail-length estimates to be suspect [HAL]. Apr. 3.88: 6.8° tail was curved; also naked-eye 6° narrow, straight tail in p.a. 276° [CAM]. Apr. 4.55: "using 31.7-cm L (308×), two jets were observed: 0.77′ in p.a. 70° and ~ 0.2′ in p.a. 150°; coma was distorted in the direction of the jets" [MOR]. Apr. 5–15: "trailing edge of dust tail sharply defined" [MOR]. Apr. 5.04: also 4.7° tail in p.a. 307° [FLE]. Apr. 5.90: "material out to" 0.5° at p.a. 30° [FLE].

◇ *P/Halley (cont.)*. 1986 Apr. 6.33: "shadow behind nucleus" in tail [LIN02]. Apr. 6.89: in 11×80 B, "material out to" 1.8° at p.a. 313° [FLE]. Apr. 7.76, 9.59: m_1 "was measured several times throughout the night, with the brightness remaining constant"; on latter date, in 10×50 B, tails 2° and 30′ in p.a. 335° and 60°, respectively, w/ some material between the two tails visible in 20-cm L [HAL]. Apr. 7.82: in 30×80 B, also 4° tail in p.a. 321° [CAM]. Apr. 7.96: in 11×80 B, also 3.0° tail at p.a. 322° [FLE]. Apr. 8.5: "prominent dust plume" in p.a. 5° [MOR]. Apr. 8.82: in 30×80 B, 6° tail was straight; also curved, 4° tail in p.a. 332° [CAM]. Apr. 9.82: in 30×80 B, 6.1° tail was straight; also curved, 4.2° tail in p.a. 350° [CAM]. Apr. 10.82: in 30×80 B, 7.4° tail was straight; also curved, 4.5° tail in p.a. 355° [CAM]. Apr. 11.75: in 10×50 B, tails 2°, 30′, and 3° in p.a. 5°, 70°, and 340°; "the two eastern-most tails are probably the edges of one very broad, fan-shaped dust tail, as some material between them was observed; the tail at p.a. 340° was clearly an ion tail and showed a pronounced broadening at the end" [HAL]. Apr. 11.82: in 30×80 B, 7.5° tail was straight and faint; also curved, 5° dust tail in p.a. 5° [CAM]. Apr. 12.5: "prominent dust plumes in p.a. 20° and 30°; gas tail (p.a. 320°) is very obvious" [MOR]. Apr. 13.5: "gas tail (p.a. 345°) is much fainter; leading edge of dust fan (p.a. 30°) is strongly curved toward the E" [MOR]. Apr. 13.62: to naked eye, also tails of length 4°, 2.75°, 8.75°, 8.75° in p.a. 345°, 5°, 40°, 75° [MOR]. Apr. 14.5: "gas tail (p.a. 355°) had a kink in it toward the W, ~ 1.5° from the head; leading edge (p.a. 45°) was brightest part of dust fan in 10×50 B" [MOR]. Apr. 15.48 and 16.48: to naked eye, tail length 5° [OME]. Apr. 15.5: "in 10×50 B, edges were the brightest part of the fan, with the trailing edge being brighter" [MOR]. Apr. 16.48: in 10×50 B, tails 4.5° and 3.5° in p.a. 35° and 80° [HAL]. Apr. 17.50: in 10×50 B, coma dia. 20′, gas tail at p.a. 45° and southern border of dust tail at p.a. 95° [MAR01]. Apr. 20.30: in 10×50 B, 2° tail in p.a. 55°; in 20-cm L, "a very broad dust fan was observed" [HAL]. Apr. 28.2: "in 25.6-cm *f*/4.5 L (67×), non-stellar cond. was offset toward the S" [MOR]. Apr. 30.31: "naked-eye tail very long but extremely faint; difficult to tell where tail ends and sky begins" [HAL].

May 1.08: in 10×50 B, 10° tail [OME]. May 1.84: "broad, fan-shaped tail" spanning p.a. 96°–115° [CAM]. May 2.90: "broad, fan-shaped tail" spanning p.a. 98°–126° [CAM]. May 3.26: "using 44.5-cm *f*/4.5 L (224×), a bright sector coming from the central cond. was seen between p.a. ~ 240° and ~ 340°" [MOR]. May 3.31: to naked eye, 19° tail (extremely faint) in p.a. 90° [HAL]. May 6.22: tail suspected to 11° [MAR01]. May 6.48: naked-eye tail 6.5° long in p.a. 100° [LOV]. May 9.30: to naked eye, 4° tail in p.a. 105° [HAL]. May 10.23: "width of tail was 30′ at 4.5° from the head; using 25.6-cm *f*/4.5 L (222×), a bright sector was coming from the non-stellar cond. between p.a. ~ 320° and ~ 10°; a distinct jet was seen at the p.a.-320° boundary; length of sector was only a few arcsec" [MOR]. May 12.2: "width of tail was 20′ at 5° from the head" [MOR]. May 13.38: in 7×50 B, DC = 6, tail ≥ 5° long, "arrow-shaped coma" [LOV]. May 26.21: in 20-cm L, "a distinct brightening in the outer coma, detached from the central cond., was observed" [HAL]. May 26.34: in 31.7-cm *f*/5 L (86×), coma dia. 3′, DC = 6 [JON].

June 1.32: in 31.7-cm *f*/5 L (86×), diffuse coma, DC = 5, tail 9′ long in p.a. 115°; in 7.8-cm *f*/7.5 R (30×), coma dia. 5′, DC = 4 [JON]. June 1.45: "broad, triple tail" [LOV]. June 2.20: "tail very faint" [HAL]. June 5.32: in 31.7-cm *f*/5 L (86×), coma dia. 1.8′, DC = 5 [JON]. June 6.20: also 0.42° tail in p.a. 138° [MOR]. June 6.33: in 31.7-cm *f*/5 L (86×), coma dia. 2.5′, DC = 4 [JON]. June 7.20: in 20-cm *f*/6 L (61×), tails 30′ and 24′ in p.a. 105° and 85° [HAL]. June 8.21: "nuclear outburst; using 25.6-cm *f*/4.5 L (222×), bright (m_2 ~ 9.5) cond. was stellar; no stellar cond. was visible on June 7" [MOR]. June 9.23: "using 25.6-cm *f*/4.5 L (156×), stellar cond. of June 8 replaced with diffuse disk of 0.3′; at 45×, sunward tail was very faint" [MOR]. June 10.23: "using 25.6-cm *f*/4.5 L (156×), stellar cond. (m_2 ~ 10.3) offset toward the N; at 45×, sunward tail was very faint" [MOR]. June 11.19: in 20-cm *f*/6 L (61×), tails 1° and 15′ in p.a. 110° and 60° [HAL]. June 11.22: "using 25.6-cm *f*/4.5 L (156×), disk dia. of central cond. was 0.8′; at 45×, sunward tail was suspected" [MOR]. June 11.40: in 31.7-cm *f*/5 L (86×), coma dia. 2.5′, DC = 4–5 [JON]. June 22.28: comet only "suspected" [JON]. June 25.20: "comet could just barely be seen with 10×50 B" [HAL].

◇ *P/Tempel 2* 1983 *X*: 1983 Oct. 1.70: comet totally diffuse [PEA]. Oct. 8.73: comet "extremely difficult" [PEA]. Nov. 26.58 and Dec. 7.61: comet not visible in 41-cm *f*/4.2 L at 86× (limiting stellar magnitude ~ 15.0) [CLA].

◇ *P/Hartley-IRAS* 1984 *III*: 1983 Dec. 26.75, 30.76: "fanned to NE" [KEI].

◇ *P/Schaumasse* 1984 *XXII*: 1985 May 18.93, June 11.93: also searched with magnifications of 57×–150× under very good observing conditions [ZAN].

◇ *P/Shoemaker 1* 1984 *XVI*: 1984 Oct. 18.80: "fanned N–NW" [KEI].

◇ *P/Giacobini-Zinner* 1984*e*: 1985 July 21.92: "coma elliptical" [LIN02]. Aug. 8.98: in 40.6-cm *f*/4.5 L (138×), tail 13.1′ long in p.a. 225° [LIN02]. Sept. 13.13: in 20.3-cm *f*/10 T (62×), m_1 ~ 9, coma dia. 1.1′, DC = 3 [LIN02]. Sept. 14.52: in 20-cm *f*/6 L (61×), 0.33° tail in p.a. 310° [HAL]. Nov. 3.91: "coma centrally condensed" [BEN].

◇ *Comet Machholz* 1985 *VIII*: 1985 July 17.86–31.84: also searched with magnifications of 57×–150× under excellent observing conditions [ZAN].

◇ *Comet Hartley-Good* 1985 *XVII*: 1985 Oct. 6.42: elongated coma to E [TRE]. Oct. 8.44 and 13.40: "head extended to E" [TRE]. Dec. 6.11: comet altitude only 3°, while altitude of comparison-star field was 15°; no extinction correction applied [HAL].

◇ *P/Wirtanen* 1985*q*: 1986 Jan. 28.14: "cometary candidate only suspected under poor observing conditions; confirmed on Feb. 2.17" [HAL].

◇ *Churyumov-Solodovnikov* 1986*i*: 1986 Aug. 23.4 and 24.4: "not seen; was there an outburst in early Aug.?" [SEA].

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, 85)]:

BEN	15	Jack C. Bennett, South Africa
BOE	05	Leo Boethin, The Philippines
*BOE01		Bernd Boettger, West Germany
CAM	15	J. da S. Campos, South Africa
CLA	07	Maurice L. Clark, Australia
*COO01		Anthony Cook, CA, U.S.A.
*FLE	15	Richard Fleet, Zimbabwe
*GLO		Christian Glowinski, West Germany
GRE		Daniel W. E. Green, U.S.A.
HAL		Alan Hale, MD, U.S.A.
HAS02		Werner Hasubick, West Germany
JON	09	Albert F. Jones, New Zealand
KEI	01	Graham Keitch, England
LIN02		Juergen Linder, West Germany
LOV		Terry Lovejoy, Australia
MAR01		Joseph N. Marcus, OH, U.S.A.
MOE		Michael Moeller, West Germany
MOR		Charles S. Morris, U.S.A.
OME	05	Stephen O'Meara, MA, U.S.A.
PEA		Andrew R. Pearce, Australia
*SCH05		Patrick Schmeer, West Germany
SEA		David A. J. Seargent, Australia
SIM	05	Karl Simmons, FL, U.S.A.
SIM01	05	Wanda Simmons, FL, U.S.A.
SPR		C. E. Spratt, BC, Canada
TRE		T. B. Tregaskis, Australia
ZAN		Mauro Zanotta, Italy

omet Machholz (1985 VIII)

TE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
985 07 17.86	S	[10.0	AA	25.4	L	4	46					ZAN
985 07 21.86		[8 :	S	12.7	T	10	60					HAS02
985 07 21.87	S	[11.0	AA	25.4	L	4	46					ZAN
985 07 22.86	S	[10.5	AA	30.5	L	5	60					ZAN
985 07 23.86	S	[10.5	AA	30.5	L	5	60					ZAN
985 07 31.84	S	[12.0	AC	30.5	L	5	60					ZAN

omet Hartley-Good (1985 XVII)

TE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
985 09 22.46	S	9.5	AA	32	L	8	150	4.4	2	?	90	TRE
985 10 03.43	S	9.0	AA	32	L	8	150	2.3	2	?	60	TRE
985 10 06.42	S	8.8	AA	32	L	8	150	4.7	3	?		TRE
985 10 07.43	S	8.4	AA	15	L	8	64	9.4	2			TRE
985 10 08.43	S	8.9	AA	32	L	8	150	5.9	3	?0.17	90	TRE
985 10 08.44	S	8.8	AA	15	L	8	64	9.5	2			TRE
985 10 08.46	S	8.8	AA	5.0	B		10		2			TRE
985 10 09.43	S	8.4	AA	15	L	8	64	9.5	2			TRE
985 10 10.40	S	8.1	AA	15	L	8	64	12	2			TRE
985 10 10.83	M	9.3	AA	20	L	7	35	3.0	3			CAM
985 10 11.26	S	6.9	AA	5.0	B		10					HAL
985 10 11.84	M	9.1	AA	20	L	7	35	4	4			CAM
985 10 13.40	S	8.7	AA	32	L	8	150	3.9	3		90	TRE
985 10 14.43	S	8.4	AA	15	L	8	64	13	3			TRE
985 10 16.43	S	8.0	AA	15	L	8	64	11	2			TRE
985 10 16.82	M	7.8	AA	13	R	4	21	10	5			CAM
985 10 17.89	S	7.7	AA	14	S	4	20	5.6	4			BOE01
985 10 19.46	S	7.7	AA	15	L	8	64	11	3			TRE
985 10 19.75	S	8.5	S	20.3	L	6	38	4	4/			GLO
985 10 20.48	S	7.9	AA	15	L	8	64	7.5	2			TRE
985 10 31.43	S	7.7	AA	15	L	8	64	5.0	3			TRE
985 11 01.43	S	7.9	AA	15	L	8	64	4.0	3			TRE
985 11 02.13	M	7.3	NP	5.0	B		10					HAL
985 11 02.42	S	7.6	AA	15	L	8	64	4.5	4			TRE
985 11 03.42	S	7.7	AA	15	L	8	64	3.2	3			TRE
985 11 03.74	S	7.5	S	8.0	B	4	15	3	5/			GLO
985 11 03.76	M	7.3	AA	8.0	B		11	6	5			CAM
985 11 03.78	S	7.5	S	20.3	L	6	38	3	6			GLO
985 11 05.78	M	7.3	AA	13	R	4	21	8	5			CAM
985 11 06.73	S	8.0	S	8.0	B	4	15	4.5	5/			GLO
985 11 08.43	S	8.2	AA	15	L	8	64	4.0	4			TRE
985 11 13.78	S	8.3	SC	15	L	8	30	2.4	3			BOE01
985 11 14.19	M	7.7	AA	5.0	B		10					HAL
985 12 06.11	M	8.4	AA	5.0	B		10					HAL

Comet Hartley-Good (1985 XVII) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 12 17.55	S	8.2	AA	5.0	B		10					HAL
1986 01 07.57	S	8.5	NP	5.0	B		10			0.5	75	HAL
1986 01 12.57	S	8.7	NP	5.0	B		10					HAL
1986 01 18.54	S	8.8	NP	5.0	B		10					HAL
1986 02 09.46	S	10.0	NP	20	L	6	61		0/			HAL

Comet Thiele (1985 XIX)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 10 17.38	S	9.4	WA	5.0	B		10		1/			HAL
1985 11 02.16	S	8.5	NP	5.0	B		10					HAL
1985 11 13.24	S	8.0	AA	5.0	B		10					HAL

Comet Churyumov-Solodovnikov (1986i)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 08 01.50	S	12.6	AC	25.4	L	4	114					SEA
1986 08 02.46	S	12.4	AC	25.4	L	4	114		2			SEA

Comet Wilson (1986l)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 08 13.25	S	10.9	A	20.0	C	10	127	1.25	2			SPR
1986 08 14.25	S	10.9	A	20.0	C	10	127	1.25	2	?	295	SPR
1986 08 15.00	S	11.4	AC	20	T		80	1.0	5			SCH05
1986 08 16.93	S	11.0:	AC	15.2	L	5	80	< 1	2			MOE
1986 08 17.93	S	11.0:	AC	15.2	L	5	80	< 1	2			MOE
1986 08 25.19	S	11.2	AC	32	L	5	63	1.37	6			COO01
1986 08 25.21	S	10.4	A	20.0	C	10	127	2.0	2			SPR
1986 08 25.86	S	10.9	AC	20.3	T	10	85	0.4	8			HAS02
1986 08 25.87	S	11.2	AC	15.2	L	5	80	1.2	2			MOE
1986 08 27.26	S	10.6	A	20.0	C	10	64	1.75	2			SPR
1986 08 29.84	S	11.1	AC	20.3	T	10	85	0.6	7			HAS02
1986 08 30.03	S	11.3	AC	30.5	L	5	60	1.0	5			ZAN
1986 08 30.12	S	11.3	L	45.7	R	16	281	& 0.8	5			GRE
1986 08 31.84	S	11.0	AC	20.3	T	10	85	0.45	7			HAS02
1986 08 31.88	S	11.3	AC	30.5	L	5	60	1.0	4			ZAN
1986 09 02.84	S	10.9	AC	20.3	T	10	85	0.7	6			HAS02
1986 09 03.23	S	10.1	A	20.0	C	10	127	1.0	1			SPR
1986 09 04.23	S	10.2	A	20.0	C	10	64	1.0	1			SPR
1986 09 04.88	S	10.9	AC	20.3	T	10	85	0.5	7			HAS02
1986 09 05.00	S	11.5	AC	20	T		80	1.0	7			SCH05
1986 09 05.21	S	10.0	A	20.0	C	10	64	1.0	1			SPR
1986 09 05.84	S	10.7	AC	20.3	T	10	85	0.7	6			HAS02
1986 09 06.04	S	11.5	AC	20	T		80	0.9	5			SCH05
1986 09 06.83	B	10.8	AC	20.5	L	4	78	1.2	6			HAS02
1986 09 06.85	S	11.1	AC	25.4	L	4	71	1.4	5	&0.02	85	ZAN
1986 09 08.21	S	10.0	A	20.0	C	10	64	1.5	2			SPR
1986 09 08.83	B	10.7	AC	20.3	T	10	85	0.7	6			HAS02
1986 09 09.22	S	10.4	A	20.0	C	10	64	1.25	2			SPR
1986 09 09.94	S	11.5	AC	20	T		80	1.0	5			SCH05
1986 09 21.78	S	10.7	AC	30.5	L	5	60	1.4	5	&0.04	78	ZAN

Comet Sorrells (1986n)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 11 25.13	M	9.7	PC	22.9	R	12	86					GRE
1986 11 25.13	S	9.8	PC	22.9	R	12	86	& 3	7			GRE
1986 12 05.12	M	9.7	PC	22.9	R	12	86					GRE
1986 12 05.12	S	9.8	PC	22.9	R	12	86	& 3	7			GRE

Periodic comet Tempel 2 (1983 X)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1983 09 06.03	S	9.4	AA	29.8	L	5	62	2.3				KEI
1983 09 07.06	S	9.2	AA	8.0	B		20	5.3				KEI
1983 10 04.74	S	10.9	AC	15.2	L	5	30	2.8	0/			PEA
1983 10 05.75	S	11.0	AC	15.2	L	5	30	3.5	1			PEA
1983 10 08.73	S	11.0	AC	15.2	L	5	30	2.5	0			PEA

Periodic comet Giacobini-Zinner (1985 XIII)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 07 12.92	B	9.7	S	20.3	T	10	52	2.7	4			BOE01
1985 07 12.95	S	9.2:	S	20.3	T	10	62	1.5	4			LIN02
1985 07 21.92	B	9.3:	S	20.3	T	10	62	& 1.8	5/			LIN02
1985 08 02.91	S	8.6	AA	14.0	S	4	45	1.8	4			LIN02
1985 08 08.95	B	9.1	S	15	L	8	60	1.0	3			BOE01
1985 08 08.98	B	8.4	AC	14.0	S	4	28	5.6	6			LIN02
1985 08 10.96	B	9.1	S	15	L	8	60	1.0	5			BOE01
1985 08 11.01	B	8.4:	AA	14.0	S	4	25	3.6	5	0.07	265	LIN02
1985 08 15.00	B	8.7	AA	15	L	8	60	1.4	3			BOE01
1985 08 18.02	S	8.5	AA	8.0	B	4	15	4	5		270	GLO
1985 08 20.11	S	7.6:	AA	14.0	S	4	25	& 8	5			LIN02
1985 08 21.03	B	8.5	AA	14.0	S	4	25	3.4	5	0.10	285	LIN02
1985 08 21.04	B	8.5	AA	14	S	4	25	2.7	4	0.18	285	BOE01
1985 08 22.01	B	8.6	AA	15	L	8	30		5		240	BOE01
1985 08 24.04	B	8.5	AA	15	L	8	30	1.8	4			BOE01
.985 08 26.10	S	8.3	AA	8.0	B	4	15	2.5	5		290	GLO
.985 09 11.12	B	9.2	AA	15	L	8	30	1.7	3			BOE01
.985 09 12.09	B	9.7	AA	15	L	8	30	1.4	3			BOE01
.985 09 12.45	M	8.6	NP	5.0	B		10			0.4	305	HAL
.985 09 13.08	M	9.5	WB	13	R	4	21	2.5	1			CAM
.985 09 13.10	M	9.6	WB	20	T	10	35	2.0	2			CAM
.985 09 14.52	M	8.7	NP	5.0	B		10					HAL
.985 09 19.07	S	8.7	AA	10.0	B		14	7.1	3			LIN02
.985 09 19.12	S	8.8	S	14.0	S	4	25	7.1	3			LIN02
.985 09 22.12	S	9.8	AA	14	S	4	25	& 4.2	3			BOE01
985 10 13.54	M	9.7	W	20	L	6	61					HAL
985 10 14.76	S	10.2	AA	15	L	8	64	0.7	2			TRE
985 10 17.46	M	10.2	W	20	L	6	61					HAL
985 11 03.91	S	9.5	S	12	R	4	21	2.5				BEN
985 11 17.52	S	11.3	W	20	L	6	122					HAL

eriodic comet Wirtanen (1985q)

ATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
986 01 28.14	S	11 :	AA	20	L	6	122					HAL
986 02 02.17	S	11.5	AA	20	L	6	122					HAL
986 02 03.13	S	11.4	AA	20	L	6	61		2			HAL
986 03 28.16	M	10.5	AA	20	L	6	61					HAL

Periodic comet Takamizawa (1984 VII)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 08 06.00	S	9.0	AA	8.0	B		20	2.8	6			KEI
1984 08 19.90	S	10.0	AA	29.8	L	5	62	2				KEI

Periodic comet Ashbrook-Jackson (1985a)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 09 07.25	M	12.6	AA	20	L	6	122		4/			HAL

Periodic comet Giclas (1985 XV)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 10 13.48	S	13.4:	NP	20	L	6	122					HAL
1985 10 15.33	S	13.3	WA	20	L	6	122					HAL
1985 10 16.33	S	13.3	WA	20	L	6	122		1			HAL
1985 10 17.34	S	13.3	WA	20	L	6	122		1			HAL

Periodic comet Shoemaker 1 (1984 XVI)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 10 18.80	S	12.5	A	29.8	L	5	62	0.8	3	?	338	KEI
1984 10 18.80	S	12.7	A	29.8	L	5	142					KEI
1984 10 20.78	S	12.6	A	29.8	L	5	62	1.0	3			KEI
1984 11 25.96	S	11.3	A	29.8	L	5	62	1.8	1			KEI

Periodic comet Ciffréo (1985 XVI)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 11 15.31	S	13.3	WA	20	L	6	122					HAL
1985 11 17.45	S	13.3	WA	20	L	6	122		4			HAL
1985 11 20.39	S	12.0	WA	20	L	6	61		0/			HAL

Periodic comet Schaumasse (1984 XXII)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 05 18.93	S	[14.0	AC	25.4	L	4	60					ZAN
1985 06 11.93	S	[14.5	AC	30.5	L	5	46					ZAN

Periodic comet Halley (1982i)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 07 21.13		[13.6	WA	35	L	6	160					FLE
1985 07 28.13		[14.6	WA	35	L	6	160					FLE
1985 08 14.12		[14.6	WB	35	L	6	160					FLE
1985 08 15.12		[14.7	WB	35	L	6	160					FLE
1985 08 17.12		[14.7	WB	35	L	6	160					FLE
1985 08 18.12	M	14.9:	WB	35	L	6	160					FLE
1985 08 22.12	M	15.1	WB	35	L	6	160		9			FLE
1985 08 26.10	M	14.6	WB	35	L	6	160	0.3	6			FLE
1985 08 27.09	M	14.8	WB	35	L	6	160	0.3	6			FLE
1985 09 11.16	S	12.9	NN	29.8	L	5	89	0.7				KEI
1985 09 12.13	S	12.5	NN	29.8	L	5	62	1.2				KEI
1985 09 12.13	S	12.7	NN	29.8	L	5	89	1.0	3/			KEI
1985 09 13.14	S	12.7	NN	29.8	L	5	62	1.1	3/			KEI
1985 09 15.17	S	12.7	NN	29.8	L	5	89	0.6	4			KEI
1985 09 16.12	M	13.7	WB	35	L	6	160		5			FLE

Périodic comet Halley (1982i) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 09 17.09	M	13.5	WB	35	L	6	160		5			FLE
1985 09 18.07	M	13.4	WB	35	L	6	160	0.15	6			FLE
1985 09 19.05	M	13.6	WB	35	L	6	160	0.20	6			FLE
1985 09 19.07	M	13.5	WB	22	L	8	150		6			FLE
1985 09 20.05	M	13.6	WB	35	L	6	160	0.25	6			FLE
1985 09 20.11	M	13.6	WB	22	L	8	150					FLE
1985 09 21.06	M	13.6	WB	35	L	6	100	0.25	6			FLE
1985 09 21.07	M	13.5	WB	35	L	6	160	0.25	5			FLE
1985 09 21.08	M	13.6	WB	22	L	8	150					FLE
1985 09 22.08	M	12.7	WB	35	L	6	100	0.5	5			FLE
1985 09 22.08	M	12.7	WB	35	L	6	160	0.4	5			FLE
1985 09 22.10	M	12.7	WB	22	L	8	90	0.25	4			FLE
1985 09 23.08	M	12.6	WB	35	L	6	100	0.5	6			FLE
1985 09 23.09	M	12.8	WB	35	L	6	160	0.6	6			FLE
1985 09 23.10	M	12.8	WB	22	L	8	150	0.25	6			FLE
1985 09 25.08	M	12.5	WB	35	L	6	160	0.4	6			FLE
1985 09 25.10	M	12.6	WB	35	L	6	100	0.5	6			FLE
1985 09 26.10	M	12.3	WB	35	L	6	160	0.5	6			FLE
1985 09 26.10	M	12.4	WB	35	L	6	100	0.45	6			FLE
1985 09 26.17	S	11.5:	NN	29.8	L	5	62	0.8	4			KEI
1985 09 29.17	M	11.6	W	23	R	12	120					OME
1985 09 30.19	M	11.8	W	23	R	12	120					OME
1985 10 07.3	M	11.1	W	46	R	15	240					OME
1985 10 07.96	M	11.9	WB	35	L	6	100	0.4	6			FLE
1985 10 08.98	M	12.1	WB	35	L	6	100	0.8	6			FLE
1985 10 08.99	M	12.2	WB	35	L	6	160	0.6	6			FLE
1985 10 09.01	M	12.1	WB	22	L	8	90	0.4	5			FLE
1985 10 09.73	S	11.5	AA	20.3	L	8	38	2.5	3			BOE
1985 10 09.99	M	11.5	WB	35	L	6	100	0.8	6			FLE
1985 10 10.98	M	11.3	WB	35	L	6	100	1.1	6			FLE
1985 10 11.01	M	11.6	WB	35	L	6	160	1.0	6			FLE
1985 10 11.05	M	11.3	WB	22	L	8	90	1.0	6			FLE
1985 10 11.05	M	11.6	WB	15	L	4	50		7			FLE
1985 10 12.00	M	11.1	WB	35	L	6	100	0.9	6			FLE
1985 10 12.07	M	11.3	WB	35	L	6	100	1.0	6			FLE
1985 10 12.08	M	11.5	WB	22	L	8	90	0.9	6			FLE
1985 10 12.08	M	11.9	WB	15	L	4	50		7			FLE
1985 10 13.01	M	11.2	WB	35	L	6	100	1.1	6			FLE
1985 10 13.02	M	11.3	WB	22	L	8	90	0.6	6			FLE
1985 10 13.98	M	11.0	WB	35	L	6	100	1.1	6			FLE
1985 10 14.05	M	10.7	WB	22	L	8	90	1.0	6			FLE
1985 10 14.07	M	10.9	WB	15	L	4	50	0.8	5			FLE
1985 10 15.05	M	11.2	WB	35	L	6	100	1.0	6			FLE
1985 10 15.07	M	11.3	WB	22	L	8	90	0.9	6			FLE
1985 10 16.01	M	10.7	WB	22	L	8	90	1.0	6			FLE
1985 10 16.03	M	10.8	WB	35	L	6	100	1.2	6			FLE
1985 10 16.04	M	11.3	WB	15	L	4	50	0.3	6			FLE
1985 10 17.03	M	10.6	WB	35	L	6	100	1.2	6			FLE
1985 10 17.05	M	10.9	WB	22	L	8	90	1.0	6			FLE
1985 10 17.08	M	11.1	WB	15	L	4	50	0.5	6			FLE
1985 10 18.00	M	10.7	WB	35	L	6	100	1.5	6			FLE
1985 10 18.01	M	10.9	WB	15	L	4	50	0.7	6			FLE
1985 10 18.04	M	10.6	WB	22	L	8	90	1.4	6			FLE
1985 10 18.05	M	10.7	WB	20	T	10	50	2	6			CAM
1985 10 18.99	M	11.1	WB	35	L	6	100	1.8	6			FLE

Periodic comet Halley (1982i) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 10 19.01	M	11.6	WB	15	L	4	50	0.4	5			FLE
1985 10 19.02	M	10.9	WB	22	L	8	90	1.3	6			FLE
1985 10 19.06	M	10.8	WB	13	R	4	21	1.5	8			CAM
1985 10 19.76	S	11.4	WC	32	L	8	150	0.6	3			TRE
1985 10 20.02	M	11.0	WB	22	L	8	90	1.4	6			FLE
1985 10 20.04	M	10.8	WB	35	L	6	100	1.5	6			FLE
1985 10 20.05	M	10.6	WB	13	R	4	21	2	7			CAM
1985 10 21.00	M	10.5	WB	35	L	6	100	1.4	6			FLE
1985 10 21.01	M	10.5	WB	22	L	8	90	1.4	6			FLE
1985 10 21.02	M	10.5	WB	15	L	4	50	1.0	6			FLE
1985 10 21.06	M	10.1	WB	8.0	B		11		8			FLE
1985 10 21.76	S	10.3	WC	15	L	8	64	0.9	1			TRE
1985 10 22.00	M	10.8	WB	22	L	8	90	1.5	6			FLE
1985 10 22.06	M	10.5	WC	13	R	4	21	2	6			CAM
1985 10 22.07	M	10.7	WB	15	L	4	50	1.2	5			FLE
1985 10 22.08	M	10.6	WB	22	L	8	90	1.5	6			FLE
1985 10 22.08	M	10.6	WB	35	L	6	100	1.7	6			FLE
1985 10 22.72	S	8.6	S	20.3	L	8	38	4	4			BOE
1985 10 23.02	M	10.5	WB	15	L	4	50	1.4	6			FLE
1985 10 23.04	M	10.7	WB	22	L	8	90	1.5				FLE
1985 10 23.05	M	10.4	WB	35	L	6	100	1.8	6			FLE
1985 10 24.06	M	10.7	WB	15	L	4	50	0.9	6			FLE
1985 10 24.08	M	10.6	WB	22	L	8	90	0.9	6			FLE
1985 10 24.09	M	10.7	WB	35	L	6	100	1.1				FLE
1985 10 25.06	M	10.2	WB	15	L	4	50	1.1	6			FLE
1985 10 28.79	S	9.1	WC	15	L	8	64	0.9	2			TRE
1985 10 29.35	M	9.2	W	23	R	12	120	13				OME
1985 11 03.86	M	9.0	WC	8.0	B		30	13	5			CAM
1985 11 03.91	S	9.5	S	12	R	4	21	2.5				BEN
1985 11 04.00	S	8.3	AA	20.3	L	6	38	2	6			GLO
1985 11 04.85	M	9.0	WC	15	L	4	50		6			FLE
1985 11 04.86	M	9.0	WC	8.0	B		11	1.8				FLE
1985 11 05.59	S	8.6	S	20.3	L	8	38	4	7			BOE
1985 11 05.83	M	8.4	WC	8.0	B		11	3.8	6			FLE
1985 11 05.87	M	8.4	WC	15	L	4	25	4.7	6			FLE
1985 11 05.90	M	8.8	WC	13	R	4	21	10	6			CAM
1985 11 05.93	M	8.3	WC	15	L	4	50	2.8	6			FLE
1985 11 05.93	M	8.7	WC	8.0	B		30	14	6			CAM
1985 11 05.95	K	8.4	AA	8.0	B	4	15	3	6			GLO
1985 11 06.59	S	8.3	S	20.3	L	8	38	5	7			BOE
1985 11 06.85	M	8.2	WC	8.0	B		11	5.0	6			FLE
1985 11 06.86	M	8.6	WC	15	L	4	50	3.4	6			FLE
1985 11 06.89	M	8.7	WC	7.5	R	16	50	1.7	6			FLE
1985 11 06.90	M	8.3	AA	15	L	8	30	2.4	5			BOE01
1985 11 06.91	M	9.1	WC	22	L	8	90	2.8	6			FLE
1985 11 06.92	M	10.1	WC	35	L	6	100	2.8	6			FLE
1985 11 07.58	S	8.0	S	20.3	L	8	38	5	6			BOE
1985 11 08.12	M	7.7	W	5.0	B		10	24				OME
1985 11 08.58	S	7.9	S	20.3	L	8	38	5	5			BOE
1985 11 08.99	M	8.0	WC	8.0	B		11	5.5	6			FLE
1985 11 09.01	M	8.0	WC	15	L	4	25	5.5	6			FLE
1985 11 09.87	M	7.8	WC	8.0	B		11	2.7	6			FLE
1985 11 09.88	M	7.8	WC	15	L	4	25	4.5	6			FLE
1985 11 09.90	S	8.3	S	6.0	B		10					BEN
1985 11 10.06	M	8.2	WC	7.5	R	16	50	2.2	6			FLE

Periodic comet Halley (1982i) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 11 10.08	M	9.1	WC	35	L	6	100	2.9	6			FLE
1985 11 10.84	M	8.1:	AA	15	L	8	30	3.8	6			BOE01
1985 11 10.94	S	7.9	AA	8.0	B	4	15	8	7			GLO
1985 11 10.95	B	7.3	AA	5.0	B		10	12.8	4			BOE01
1985 11 12.08	S	7.2	AA	8.0	B	4	15	8	6/			GLO
1985 11 12.49	S	6.4	AA	5.0	B		10	16	2			TRE
1985 11 12.57	S	7.4	S	20.3	L	8	38	4	5			BOE
1985 11 12.83	M	7.5	WC	8.0	B		30	15	6			CAM
1985 11 12.91	S	7.5	S	6.0	B		10					BEN
1985 11 12.92	M	7.4	WC	5.0	B		7	20	6			CAM
1985 11 13.49	S	6.9	AA	5.0	B		10		2			TRE
1985 11 13.62	S	6.9	AA	15	L	8	64	6.0	5			TRE
1985 11 13.84	M	8.0	WC	8.0	B		11	6.5	6			FLE
1985 11 13.98	B	7.2	AA	8.0	B	4	15	& 7	6			GLO
1985 11 14.04	M	7.7	WC	15	L	4	50	4.0	6			FLE
1985 11 14.86	M	7.9	WC	15	L	4	50	5.0	6			FLE
1985 11 14.87	M	7.7	WC	8.0	B		11	6	6			FLE
1985 11 14.88	M	8.3	WC	35	L	6	100	6	6			FLE
1985 11 14.90	M	7.9	WC	7.5	R	16	50	3.1	6			FLE
1985 11 14.91	M	8.3	WC	22	L	8	90	5	6			FLE
1985 11 15.58	S	6.9	AA	5.0	B		10		2			TRE
1985 11 15.86	B	6.6	AA	5.0	B		10	10.8	6			BOE01
1985 11 15.94	M	8.2	WC	35	L	6	100	& 3.75	6			FLE
1985 11 15.96	M	7.7	WC	8.0	B		11	5	6			FLE
1985 11 15.97	M	7.8	WC	15	L	4	50	5	6			FLE
1985 11 15.99	M	7.7	WC	7.5	R	16	50	6.5	6			FLE
1985 11 16.89	M	7.1	SC	8.0	B		11	9	6			FLE
1985 11 16.90	M	7.2	SC	15	L	4	50	6.5	6			FLE
1985 11 16.94	M	7.4	SC	7.5	R	16	50	6.5	6			FLE
1985 11 16.96	M	7.6	WC	22	L	8	90	6.5	6			FLE
1985 11 17.89	S	6.7:	AA	8.0	B	4	15	& 6	6			GLO
1985 11 17.94	M	7.0	SC	8.0	B		11	8.5	6			FLE
1985 11 17.97	M	8.4	WC	35	L	6	100	4.2	6			FLE
1985 11 18.00	M	7.5	SC	15	L	4	50	5.5	6			FLE
1985 11 18.01	M	7.4	SC	7.5	R	16	50	4.5	6			FLE
1985 11 18.86	S	7.0	S	6.0	B		10					BEN
1985 11 19.00	M	7.1	SC	8.0	B		11	4.0	6			FLE
1985 11 19.96	M	7.3	SC	8.0	B		11	8.5	6			FLE
1985 11 19.97	M	7.7	SC	7.5	R	16	50	5.5	6			FLE
1985 11 19.99	M	7.6	SC	15	L	4	50	6	6			FLE
1985 11 20.49	S	6.2:	AA	5.0	B		10	11	3			TRE
1985 11 21.03	M	7.1	SC	8.0	B		11	7.5	6			FLE
1985 11 21.04	M	7.2	SC	7.5	R	16	50	6	6			FLE
1985 11 21.05	M	7.1	SC	15	L	4	50	5				FLE
1985 11 21.10	M	5.7	W	5.0	B		10				90	OME
1985 11 21.99	M	6.3	WC	8.0	B		30	32	5			CAM
1985 11 22.03	M	6.9	SC	8.0	B		11	8.5	6			FLE
1985 11 22.50	S	6.1	AA	5.0	B		10	11	2			TRE
1985 11 23.03	M	6.5	SC	8.0	B		11	8.5	6			FLE
1985 11 24.05	M	6.7	SC	8.0	B		11	4.3	6			FLE
1985 11 29.73	M	6.0	W	8.0	B		11	&13	6			FLE
1985 11 30.76	M	5.9	W	8.0	B		11	&15.5	6	1.0	76	FLE
1985 11 30.78	M	6.3	W	7.5	R	16	50	& 8	6			FLE
1985 11 30.80	M	5.9	W	8.0	B		30	27	6			CAM
1985 11 30.82	G	5.7:	W	0.0	E		1		8			CAM

Periodic comet Halley (1982i) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 12 01.74	M	5.4	AA	5.0	B		10	15.9	6			BOE01
1985 12 01.80	M	5.8	W	8.0	B		30	25.	6			CAM
1985 12 01.84	S	6.3	S	6.0	B		10					BEN
1985 12 02.56	S	6.5	S	8.0	B		30	12	5			BOE
1985 12 02.72	M	5.6	AA	5.0	B		10	13	5			BOE01
1985 12 02.83	M	6.2	W	8.0	B		11	12	6			FLE
1985 12 03.56	S	6.0	AA	8.0	B		30		4	1.0		BOE
1985 12 03.99	M	5.5	W	5.0	B		10					OME
1985 12 04.88	M	5.5	AA	5.0	B		10	14	5			BOE01
1985 12 05.84	M	5.8	W	8.0	B		11	&16.5	6	1.9	72	FLE
1985 12 05.86	M	6.2	W	7.5	R	16	50	&13.5	6			FLE
1985 12 05.88	M	5.5	AA	5.0	B		10	19	5			BOE01
1985 12 06.83	M	5.8	W	8.0	B		11	&17	6	1.9	74	FLE
1985 12 07.18	B	6.1	AA	5.0	B		10	15	3			MAR01
1985 12 07.18	S	5.0	AA	5.0	B		10	15	3			MAR01
1985 12 07.74	M	5.9	W	8.0	B		11	&17.5	6	1.2	73	FLE
1985 12 07.74	M	6.1	W	7.5	R	16	50	&11	6	0.3	74	FLE
1985 12 07.78	S	6.2	S	6.0	B		10	12				BEN
1985 12 10.14	M	5.8	W	0.0	E		1					OME
1985 12 10.52	S	5.7	AA	20.3	L	8	38			1.0		BOE
1985 12 10.78	M	5.2	AA	5.0	B		10	14	5			BOE01
1985 12 12.07	S	5.2	AA	5.0	B		10	11.5	3			MAR01
1985 12 12.75	S	5.4:	AA	8.0	B		15	6	7			GLO
1985 12 13.74	M	5.6	W	8.0	B		11	&14.5	6	1.5	65	FLE
1985 12 28.05	S	4.8:	AA	5.0	B		10					MAR01
1985 12 28.23	M	4.5	W	0.0	E		1					OME
1985 12 29.02	S	4.8:	AA	5.0	B		10					MAR01
1985 12 29.23	M	4.5	W	0.0	E		1					OME
1985 12 30.23	M	4.4	W	0.0	E		1					OME
1986 01 01.04	B	5.1	AA	5.0	B		10	9.1	4	0.32	60	MAR01
1986 01 01.04	S	4.8	AA	5.0	B		10	9.1	4	0.32	60	MAR01
1986 01 02.03	S	4.8	AA	5.0	B		10	8.4	5	1.05	58	MAR01
1986 01 02.49	S	4.7	AA	20.3	L	8	38		7	1.5		BOE
1986 01 04.03	B	4.9	AA	5.0	B		10	7	6	1.62	67	MAR01
1986 01 04.03	S	4.8	AA	5.0	B		10	7	6	1.62	67	MAR01
1986 01 04.50	S	4.5	AA	20.3	L	8	38		6	2.0		BOE
1986 01 05.03	B	4.9	AA	5.0	B		10	7	6	1.30	52	MAR01
1986 01 05.03	S	4.7	AA	5.0	B		10	7	6	1.30	52	MAR01
1986 01 07.50	S	4.7	AA	20.3	L	8	38					BOE
1986 01 08.75	M	4.9	WW	8.0	B		11	4.5	7	1.5	62	FLE
1986 01 09.03	B	4.6	AA	5.0	B		10					MAR01
1986 01 09.03	S	4.4	AA	5.0	B		10	5.7		1.94	59	MAR01
1986 01 09.45	S	4.8	AA	20.3	L	8	38					BOE
1986 01 12.03	B	4.7	WW	5.0	B		10					MAR01
1986 01 12.03	S	4.6	WW	5.0	B		10	4.2	8	3.4	61	MAR01
1986 01 13.03	B	4.4	WW	5.0	B		10					MAR01
1986 01 13.03	S	4.3	WW	5.0	B		10	4.2	8	2.9	67	MAR01
1986 01 13.94	M	4.9	W	5.0	B		10					OME
1986 01 14.74	M	4.9	WW	8.0	B		11	4.0	7	0.7	65	FLE
1986 01 15.74	M	4.8	WW	8.0	B		11	4.0	7	0.6	68	FLE
1986 01 16.74	M	4.8	WW	8.0	B		11	3.5	7	0.7	63	FLE
1986 01 21.94	M	4.3	W	5.0	B		10					OME
1986 01 24.94	M	4.2	W	5.0	B		10					OME
1986 01 27.94	M	4.3	W	5.0	B		10					OME
1986 02 15.13	M	3.8	WW	8.0	B		11	& 3.5	7			FLE

Periodic comet Halley (1982i) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 02 16.12	M	3.6	WW	8.0	B		11	& 2.5	7	0.13	280	FLE
1986 02 16.13	M	3.8	WW	7.5	R	16	50					FLE
1986 02 19.11	M	3.1	WW	8.0	B		11	4.8		0.5	287	FLE
1986 02 19.13	G	3.9	WW	0.0	E		1		7			FLE
1986 02 19.13	M	2.8	WW	8.0	B		11					FLE
1986 02 20.10	M	3.0	WW	13	R	4	21	& 5	7	0.5	280	CAM
1986 02 20.11	G	4.1	WW	0.0	E		1		7			FLE
1986 02 20.11	M	3.9	WW	8.0	B		11	5.0	7	0.5	281	FLE
1986 02 20.12	G	3.0	WW	0.0	E		1		8			CAM
1986 02 20.12	M	2.6	WW	8.0	B		11					FLE
1986 02 20.14	M	3.0	WW	8.0	B		11					FLE
1986 02 20.56	! M	2.3:	AA	8.0	B		20		8	1.5		MOR
1986 02 21.12	G	3.9	WW	0.0	E		1		7			FLE
1986 02 21.12	M	2.7	WW	8.0	B		11					FLE
1986 02 21.56				8.0	B		20			0.5	300	MOR
1986 02 21.56	! M	2.3:	AA	5.0	B		10	& 9	7			MOR
1986 02 21.56	! M	2.3:	AA	8.0	B		20	& 7	8	2	285	MOR
1986 02 22.14	M	3.3	WW	8.0	B		11					FLE
1986 02 23.12	G	3.4	WW	0.0	E		1		7			FLE
1986 02 23.13	M	3.0	WW	8.0	B		11					FLE
1986 02 23.56				8.0	B		20			1	290	MOR
1986 02 23.56	! M	2.4	Y	8.0	B		20	3.5	8	1	270	MOR
1986 02 23.57	! M	2.3	AA	5.0	B		10					MOR
1986 02 24.12				8.0	B		11	4.0	8	0.8	278	FLE
1986 02 24.12	G	3.6	WW	0.0	E		1		7			FLE
1986 02 24.14	M	3.5	WW	8.0	B		11					FLE
1986 02 25.11	M	3.0	WW	13	R	4	21	4	8	1.25	278	CAM
1986 02 25.56				5.0	B		10			4	290	MOR
1986 02 25.56	! M	2.6	AA	5.0	B		10	4.7	8	3	275	MOR
1986 02 26.42	M	3.4	W	5.0	B		10		5	1		OME
1986 02 27.86	S	3.4	W	7.6	L	8	15	3	7	2	286	CLA
1986 02 27.88	S	3.0	AA	20.3	L	8	38					BOE
1986 02 28.43	M	3.5	W	5.0	B		10			5		OME
1986 02 28.88	S	3.1	AA	20.3	L	8	38					BOE
1986 03 01.08	M	3.8	WW	8.0	B		11	4.3	7	2.3	269	FLE
1986 03 01.11	G	3.4	WW	0.0	E		1		6	1.1	268	FLE
1986 03 01.35	M	2.9	AA	5.0	B		10	4.7	8	5	270	MOR
1986 03 01.35	M	2.9	AA	7.0	B		16	4.7	8			MOR
1986 03 01.36	I	2.8	AA	0.7	E		1			5	270	MOR
1986 03 02.10	M	3.8	WW	8.0	B		11	4.0	7	2.7	267	FLE
1986 03 02.11	G	3.2	WW	0.0	E		1		6	1.9	273	FLE
1986 03 02.25	B	4.6	WH	5.0	B		7			1		SIM
1986 03 02.88	S	3.0	AA	20.3	L	8	38			&2.0		BOE
1986 03 03.09	G	3.4	WW	0.0	E		1		7	1.5	274	FLE
1986 03 03.10	M	3.7	WW	8.0	B		11	4.3	7	3.3	261	FLE
1986 03 03.34	M	2.7	AA	5.0	B		10	4.7	8	5		MOR
1986 03 03.36	M	2.8	AA	7.0	B		16	4.4	8	5		MOR
1986 03 04.12	G	3.6	WW	0.0	E		1			2.0	269	FLE
1986 03 04.13	M	3.8	WW	8.0	B		11	4.0	7	2.3	258	FLE
1986 03 04.31				5.0	B		10			5.5	280	MOR
1986 03 04.31	M	2.7	AA	5.0	B		10			2	270	MOR
1986 03 04.32	B	2.9	AA	5.0	B		10					MOR
1986 03 04.84	S	3.5	W	7.6	L	8	15	5	6	2.4	278	CLA
1986 03 05.33	I	2.5	AA	0.7	E		1					MOR
1986 03 05.33	M	2.6	AA	5.0	B		10		8	5		MOR

Periodic comet Halley (1982i) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 03 05.87	S	2.8	AA	20.3	L	8	38					BOE
1986 03 06.12	G	3.5	WW	0.0	E		1			2.3	272	FLE
1986 03 06.12	M	3.8	WW	8.0	B		11	4.3	7	3.3	264	FLE
1986 03 06.33	I	2.6	AA	0.7	E		1		8	2		MOR
1986 03 06.33	M	2.7	AA	5.0	B		10	7	8	4	270	MOR
1986 03 07.12	G	3.0	WW	0.0	E		1			1.5	280	CAM
1986 03 07.12	M	3.1	WW	8.0	B		30	5	7	3.5	282	CAM
1986 03 07.12	M	3.2	WW	13	R	4	21	6	7	2.5	283	CAM
1986 03 07.23	B	3.8	WH	5.0	B		7			3		SIM
1986 03 07.87	S	3.0	AA	8.0	B		30			1.3		BOE
1986 03 08.10	G	3.3	WW	0.0	E		1		7	2.5	275	FLE
1986 03 08.11	G	3.0	WW	0.0	E		1		8	1.5		CAM
1986 03 08.11	M	3.0	WW	8.0	B		30	5	7	4	270	CAM
1986 03 08.12	M	3.5	WW	8.0	B		11	4.3	7	3.8	261	FLE
1986 03 08.22	B	3.7	WH	5.0	B		7					SIM
1986 03 09.87	S	3.4	WW	25	L	5	62	5.5	7	3.75	261	CLA
1986 03 10.31	M	2.7	AA	5.0	B		10	7	8	6	280	MOR
1986 03 10.32	I	2.7	AA	0.7	E		1		7	9.5	280	MOR
1986 03 10.32	M	2.8	AA	7.0	B		16		7/			MOR
1986 03 10.80	S	3.4	WW	25	L	5	38	8	7	4.1	259	CLA
1986 03 11.12	M	3.2	WW	13	R	4	21	4	7	3	279	CAM
1986 03 11.39				0.7	E		1			9.5	295	MOR
1986 03 11.39	M	2.7:	AA	5.0	B		10					MOR
1986 03 11.39	S	2.6	AA	0.7	E		1			11.5	265	MOR
1986 03 11.85	S	3.0	AA	8.0	B		30					BOE
1986 03 12.10	G	3.4	WW	0.0	E		1		6	2.7	270	FLE
1986 03 12.12	M	3.8	WW	8.0	B		11	5.5	7	4.0	265	FLE
1986 03 12.87	S	3.0	AA	8.0	B		30			5.15		BOE
1986 03 13.08	M	3.8	WW	8.0	B		11	4.3	7	5.5	264	FLE
1986 03 13.09	M	3.2	WW	8.0	B		30	4.5	7	4.25	270	CAM
1986 03 13.10	G	3.0	WW	0.0	E		1			5	275	CAM
1986 03 13.10	M	3.1	WW	13	R	4	21	5	7	4	272	CAM
1986 03 13.11	G	3.4	WW	0.0	E		1		6	4.0	271	FLE
1986 03 13.82	S	3.5	WW	25	L	5	38	10	7	3.9	258	CLA
1986 03 14.08	G	3.3	WW	0.0	E		1			3.7	270	FLE
1986 03 14.09	M	3.7	WW	8.0	B		11	6	7	5.4	259	FLE
1986 03 14.51				5.0	B		10	7	7/	5	270	MOR
1986 03 14.51	! M	2.8	AA	8.0	B		20	7	7/	0.5	245	MOR
1986 03 14.53	! S	2.7	AA	0.7	E		1		8	10.5	280	MOR
1986 03 14.85	S	2.9	AA	8.0	B		30			>5		BOE
1986 03 15.09	M	3.5	WW	8.0	B		11	9	7	9.1	260	FLE
1986 03 15.10	G	3.2	WW	0.0	E		1		7	4.0	269	FLE
1986 03 15.81	S	3.6	WW	25	L	5	38	14	7	4.3	262	CLA
1986 03 16.07	M	3.5	WW	8.0	B		11	8	7	5.5	262	FLE
1986 03 16.11	G	3.3	WW	0.0	E		1		7	3.2	269	FLE
1986 03 17.12	G	3.4	WW	0.0	E		1		6	2.3	264	FLE
1986 03 17.12	M	3.8	WW	8.0	B		11	10	6	4.4	258	FLE
1986 03 17.53	! M	2.8	AA	0.7	E		1			10	267	MOR
1986 03 17.53	! M	2.8	AA	5.0	B		10	8.4	7/	5	270	MOR
1986 03 18.06	G	3.2	WW	0.0	E		1			4.9	275	FLE
1986 03 18.07	M	3.4	WW	8.0	B		11	11	7	2.3	259	FLE
1986 03 18.52	! M	2.8	AA	0.7	E		1		8	11	285	MOR
1986 03 18.52	! M	2.9	AA	5.0	B		10	11	7/	3	265	MOR
1986 03 18.53	! M	2.9	AA	8.0	B		20	10	7			MOR
1986 03 19.09	G	3.4	WW	0.0	E		1		6	3.7	278	FLE

Periodic comet Halley (1982i) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 03 19.09	M	3.7	WW	8.0	B		11	11	6	4.0	262	FLE
1986 03 19.52	! M	3.0	AA	0.7	E		1		7/	9	290	MOR
1986 03 19.53	! M	3.1	AA	5.0	B		10	12.5	7/	2	270	MOR
1986 03 20.10	G	3.4	WW	0.0	E		1		6	5.0	276	FLE
1986 03 20.10	M	3.9	WW	8.0	B		11	12	6	5.3	259	FLE
1986 03 20.11	M	3.5	WW	8.0	B		30	11	6	6	275	CAM
1986 03 20.52	! M	2.8	AA	0.7	E		1		7	4	265	MOR
1986 03 20.53	! M	3.0	AA	5.0	B		10	14	7/	7	270	MOR
1986 03 21.52	! M	3.0	AA	5.0	B		10	14	7	5		MOR
1986 03 21.83	S	3.5	WW	25	L	5	38	16	7	3.6	276	CLA
1986 03 22.02	G	3.3	WW	0.0	E		1		6	4.1	272	FLE
1986 03 22.09	M	3.6	WW	8.0	B		11	13	6	4.4	261	FLE
1986 03 22.12	M	3.5	WW	13	R	4	21	7	7	5	262	CAM
1986 03 22.22	B	3.9	WH	5.0	B		7					SIM
1986 03 22.50	M	2.6	Y	0.7	E		1		7	13	275	MOR
1986 03 22.51	M	2.7	Y	5.0	B		10					MOR
1986 03 22.76	S	3.4	WW	25	L	5	38	17	7	5.8	263	CLA
1986 03 23.19	B	3.9	WH	5.0	B		7			3		SIM
1986 03 25.52	! M	2.9	AA	0.7	E		1		7			MOR
1986 03 25.52	! M	3.0	AA	5.0	B		10		7	4	265	MOR
1986 03 26.07	G	3.2	WW	0.0	E		1			2		CAM
1986 03 26.07	M	3.7	WW	8.0	B		30	13	6	2.25	278	CAM
1986 03 27.09	M	3.8	WW	3.5	B		7	7	6	3	268	CAM
1986 03 27.52	! M	3.0	AA	0.7	E		1					MOR
1986 03 27.52	! M	3.1	AA	5.0	B		10	14	6/	5		MOR
1986 03 27.67	M	3.2	W	0.0	E		1			5		OME
1986 03 28.13	G	3.3	WW	0.0	E		1		5			FLE
1986 03 28.13	M	3.9	WW	8.0	B		11	12	6			FLE
1986 03 30.04	G	3.3	WW	0.0	E		1		6	2.4	283	FLE
1986 03 30.08	M	3.7	WW	8.0	B		11	12	6	0.5	270	FLE
1986 03 30.67	M	3.5	W	0.0	E		1					OME
1986 03 31.06	G	3.3	WW	0.0	E		1		6	2.5	286	FLE
1986 03 31.10	M	3.6	WW	8.0	B		11	15	6	0.9	266	FLE
1986 03 31.55				5.0	B		10	20	6	1	300	MOR
1986 03 31.56	M	2.6	AA	0.7	E		1	&30	4			MOR
1986 04 01.10	G	3.2	WW	0.0	E		1			3.5	284	FLE
1986 04 01.12	M	3.7	WW	8.0	B		11	15	6	1.9	283	FLE
1986 04 01.53	M	2.7	AA	0.7	E		1	18	6	9	283	MOR
1986 04 01.53	M	2.8	AA	5.0	B		10	12	5	8	283	MOR
1986 04 01.63	S	3.4	WW	25	L	5	38	22	7	1.3	271	CLA
1986 04 01.90	G	3.3	WW	0.0	E		1	20	8			CAM
1986 04 01.90	M	3.5	WW	13	R	4	21	10	6	3		CAM
1986 04 02.12	G	3.3	WW	0.0	E		1		6	2.2	308	FLE
1986 04 02.12	M	3.6	WW	8.0	B		11	18	6	2.7	276	FLE
1986 04 02.53	M	2.3	AA	0.7	E		1	27	5	8	280	MOR
1986 04 02.53	M	2.4	AA	5.0	B		10			8	280	MOR
1986 04 02.71	M	2.7	W	0.0	E		1			&2		OME
1986 04 02.86	G	3.0	WW	0.0	E		1	40				CAM
1986 04 02.94	M	3.4	WW	13	R	4	21	14	6	2.75		CAM
1986 04 02.95	G	3.0	WW	0.0	E		1	65	7			CAM
1986 04 02.96	M	3.3	WW	3.5	B		7	25	6	3	285	CAM
1986 04 03.16	B	3.0	WW	0.8	E		1	18	5	2.8	321	LIN02
1986 04 03.52	M	2.5	AA	0.7	E		1	30	6	10	270	MOR
1986 04 03.53	M	2.5	AA	5.0	B		10	15	6	4	270	MOR
1986 04 03.58	M	2.5	AA	5.0	R		8					MOR

Periodic comet Halley (1982i) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 04 03.62	S	3.3	WW	25	L	5	38	24	7	1.6	282	CLA
1986 04 03.88	G	3.0	WW	0.0	E		1	60		6.8	312	CAM
1986 04 03.93	M	3.8	WW	13	R	4	21	16	5	5.63	278	CAM
1986 04 04.16	B	3.2	WW	5.0	B		7	10	5/	0.4	305	LIN02
1986 04 04.53	S	3.1	WW	25	L	5	38	34	7	2.7	286	CLA
1986 04 04.56	M	2.4	AA	5.0	B		10	15	6	0.25	10	MOR
1986 04 04.56	S	2.4	AA	0.7	E		1	30	6	7	280	MOR
1986 04 05.03	G	3.2	WW	0.0	E		1		4	2.1	297	FLE
1986 04 05.04	M	4.1	WW	8.0	B		11	21	6	1.8	299	FLE
1986 04 05.57	M	2.4	AA	0.7	E		1	30	7	4	285	MOR
1986 04 05.57	M	2.5	AA	5.0	B		10	15	6	3	280	MOR
1986 04 05.57	M	2.5	AA	5.0	R		8					MOR
1986 04 05.65	S	3.2	WW	25	L	5	38	31	7	2.4	290	CLA
1986 04 05.89	G	3.1	WW	0.0	E		1		6	2.6	303	FLE
1986 04 05.90	M	3.6	WW	8.0	B		11	22	6	3.4	304	FLE
1986 04 05.96	M	3.8	WW	13	R	4	21	16	5	4	316	CAM
1986 04 06.33	B	2.9	WW	0.0	E		1	32	5	2.7	318	LIN02
1986 04 06.46	M	2.7	W	0.0	E		1			2		OME
1986 04 06.89	G	2.8	WW	0.0	E		1		7	2.0		FLE
1986 04 06.89	M	3.3	WW	8.0	B		11	23	6	3.0	299	FLE
1986 04 07.19	B	2.5	WW	0.0	E		1	32	6	2.4	315	LIN02
1986 04 07.62				0.7	E		1	&40	7	13	300	MOR
1986 04 07.62	M	2.3	AA	5.0	B		10	21	5	3.75	297	MOR
1986 04 07.73	S	3.3	WW	25	L	5	38	35	7	4.7	304	CLA
1986 04 07.82	G	3.0	WW	0.0	E		1	60	3	3	310	CAM
1986 04 07.82	M	3.4	WW	8.0	B		30	50	5	5.5	305	CAM
1986 04 07.96	G	2.8	WW	0.0	E		1		4	2.9	314	FLE
1986 04 07.96	M	3.5	WW	8.0	B		11	28	5	3.7	306	FLE
1986 04 08.52	M	2.7	AA	5.0	B		10	23	6	6	335	MOR
1986 04 08.54	S	2.6	AA	0.7	E		1	33	6			MOR
1986 04 08.65	S	3.3	WW	25	L	5	38	37	7	4.1	307	CLA
1986 04 08.82	G	3.0	WW	0.0	E		1	75	4	4.25	330	CAM
1986 04 08.82	M	3.5	WW	8.0	B		30	65	5	6	307	CAM
1986 04 08.93	M	3.5	WW	8.0	B		11	36	6	4.0	308	FLE
1986 04 09.01	G	2.9	WW	0.0	E		1		6	3.5	330	FLE
1986 04 09.14	B	2.4	WW	0.0	E		1	&60	6	4.5	328	LIN02
1986 04 09.48	M	2.7	AA	0.7	E		1		5	4	315	MOR
1986 04 09.63	S	3.4	WW	25	L	5	38	38	7	4.2	312	CLA
1986 04 09.82	M	3.3	WW	8.0	B		30	78	5	6.1	314	CAM
1986 04 09.83	G	3.0	WW	0.0	E		1	90	4	4.5	330	CAM
1986 04 09.94	G	3.0	WW	0.0	E		1		6	1.5	349	FLE
1986 04 09.95	M	3.3	WW	8.0	B		11	29	5	4.3	315	FLE
1986 04 10.10	B	4.2	WH	5.0	B		7					SIM
1986 04 10.10	B	4.3	WH	5.0	B		7					SIM01
1986 04 10.21	B	2.4	WW	0.0	E		1	68	6	1.9	345	LIN02
1986 04 10.57	S	2.7	AA	0.7	E		1	&25	5			MOR
1986 04 10.78	S	3.4	WW	25	L	5	38	42	7	4.5	337	CLA
1986 04 10.82	M	3.4	WW	8.0	B		30	60	5	7.4	328	CAM
1986 04 10.83	G	2.8	WW	0.0	E		1	120	4	4	340	CAM
1986 04 10.91	G	3.1	WW	0.0	E		1		4	2.9	338	FLE
1986 04 10.91	M	3.9	WW	8.0	B		11	30	5	6.3	325	FLE
1986 04 11.38	M	3.0	W	0.0	E		1			5		OME
1986 04 11.62	M	3.2	W	0.0	E		1			5		OME
1986 04 11.82	M	3.5	WW	8.0	B		30	75	5	7.5	340	CAM
1986 04 11.83	G	3.0	WW	0.0	E		1	120	4	5.25	350	CAM

Periodic comet Halley (1982i) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 04 11.84	M	3.9	WW	8.0	B		11	34	5	6.9	342	FLE
1986 04 11.88	G	3.0	WW	0.0	E		1	50	4	4.2	6	FLE
1986 04 12.24	B	4.4	WH	10.0	B		14					SIM01
1986 04 12.25	B	3.8	WH	5.0	B		7					SIM01
1986 04 12.25	B	4.5	WH	10.0	B		14			<1		SIM
1986 04 12.26	B	4.0	WH	5.0	B		7			<1		SIM
1986 04 12.48	M	3.0	AA	5.0	R		8		5			MOR
1986 04 12.60	S	3.4	WW	25	L	5	38	39	7	3.1	355	CLA
1986 04 12.77	M	4.0	WW	8.0	B		11	30	5	4.2	341	FLE
1986 04 12.78	G	3.3	WW	0.0	E		1	50	3	5.6	30	FLE
1986 04 13.61	M	2.9	AA	5.0	B		10	21	6	4	345	MOR
1986 04 13.61	M	2.9	AA	5.0	R		8	21	5			MOR
1986 04 13.62	M	2.9	AA	0.7	E		1		6	11.5	63	MOR
1986 04 13.78	M	3.2	W	0.0	E		1			5		OME
1986 04 13.85	M	3.8	WW	8.0	B		11	31	6	3.9	356	FLE
1986 04 13.87	G	3.1	WW	0.0	E		1	40	5	5.4	51	FLE
1986 04 14.54	M	2.8	AA	0.7	E		1	38	6	3.5	0	MOR
1986 04 14.55	M	2.8	AA	5.0	R		8	19	5			MOR
1986 04 14.89	M	3.5	WW	8.0	B		11	31	5	4.3	4	FLE
1986 04 14.91	G	3.0	WW	0.0	E		1	40	4	9.3	62	FLE
1986 04 15.15	B	3.0	WW	0.0	E		1	48	5/	3.4	13	LIN02
1986 04 15.52	M	2.8	AA	0.7	E		1			4.83	15	MOR
1986 04 15.52	M	2.8	AA	5.0	R		8	26	5			MOR
1986 04 15.56	B	2.5	WW	0.7	E		1					MAR01
1986 04 15.56	S	3.6	WW	25	L	5	38	32	7	4.0	21	CLA
1986 04 15.94	M	3.7	WW	8.0	B		11	31	6	2.8	31	FLE
1986 04 15.96	G	3.1	WW	0.0	E		1	40	4	3.5	39	FLE
1986 04 16.59				5.0	B		10	13	5	6.0		MOR
1986 04 16.59	M	3.0	AA	5.0	R		8	16.5	5			MOR
1986 04 16.86	G	3.2	WW	0.0	E		1	40	4	5.7	69	FLE
1986 04 16.86	M	3.7	WW	8.0	B		11	30	6	3.2	37	FLE
1986 04 17.50	B	2.4	WW	0.7	E		1			5.6	80	MAR01
1986 04 17.73	S	3.6	WW	25	L	5	38	30	7	5.6	37	CLA
1986 04 18.58	M	3.2	AA	5.0	B		10	18	5	11.5	65	MOR
1986 04 18.59	B	3.0	AA	0.7	E		1		4	17	65	MOR
1986 04 18.75	S	3.6	WW	25	L	5	38	28	7	2.7	48	CLA
1986 04 19.62	S	3.8	WW	25	L	5	38	21	7	1.1	51	CLA
1986 04 19.86	G	3.4	WW	0.0	E		1		3			FLE
1986 04 19.86	M	4.5	WW	8.0	B		11	22	6	1.8	73	FLE
1986 04 19.95	B	4.1	WW	5.0	B		7	14	5	&0.5		LIN02
1986 04 20.24	M	3.3	AA	5.0	B		10					MOR
1986 04 20.75	S	3.7	WW	25	L	5	38	26	7	6.1	89	CLA
1986 04 21.24	M	3.2	AA	5.0	B		10	11	4			MOR
1986 04 21.73	S	3.8	WW	25	L	5	38	24	7	6.9	93	CLA
1986 04 22.89	M	4.4	WW	8.0	B		11	20	5	1.7	75	FLE
1986 04 22.90	G	4.3	WW	0.0	E		1					FLE
1986 04 24.20	S	4.9	A	8.0	B		11	5.0	4	?		SPR
1986 04 24.52	S	4.0	WW	25	L	5	38	18	7	28.9	99	CLA
1986 04 24.52	S	4.9	AA	8.0	B		30	10.0		0.85		BOE
1986 04 25.82	G	4.3	WW	0.0	E		1					FLE
1986 04 25.84	M	5.0	WW	8.0	B		11	17	5	?1.5	76	FLE
1986 04 26.50	S	4.5	AA	8.0	B		30	25		0.93		BOE
1986 04 26.73	M	5.3	WW	8.0	B		11	17	5	2.5	86	FLE
1986 04 27.20	M	4.4	AA	5.0	B		10	16	4	5	90	MOR
1986 04 27.21	S	4.3	AA	0.7	E		1			5	90	MOR

Periodic comet Halley (1982i) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 04 27.47	S	4.6	AA	8.0	B		30					BOE
1986 04 27.73	M	4.8	WW	13	R	4	21	16.	5	2.25	107	CAM
1986 04 27.75	M	4.6	WW	8.0	B		30	25	5	2	105	CAM
1986 04 27.76	G	4.0	WW	0.0	E		1	60	4	3	100	CAM
1986 04 27.76	G	4.5	WW	0.0	E		1		4	12	102	FLE
1986 04 27.77	M	5.1	WW	8.0	B		11	18	6	3	97	FLE
1986 04 28.22	M	4.3	AA	5.0	B		10	16	4/	13	95	MOR
1986 04 28.24	S	4.3	AA	0.7	E		1			11	73	MOR
1986 04 28.80	M	4.8	WW	8.0	B		30	20	5	2.5	105	CAM
1986 04 28.81	G	4.3	WW	0.0	E		1	60	4	0.5	100	CAM
1986 04 29.22	S	4.4	AA	0.7	E		1		4	30	80	MOR
1986 04 29.24	M	4.4	AA	5.0	B		10	17	5			MOR
1986 04 29.26	M	4.5	AA	8.0	B		20	15	5			MOR
1986 04 29.62	S	4.3	AA	25	L	5	38	16	7	3.3	102	CLA
1986 04 29.81	G	4.4	WW	0.0	E		1		3	0.6	102	FLE
1986 04 29.81	M	5.2	WW	8.0	B		11	17	5	2.9	106	FLE
1986 04 30.21	S	4.9	A	8.0	B		11	6	4	?		SPR
1986 04 30.22	M	4.6	AA	5.0	B		10	21	4/	18	85	MOR
1986 04 30.23	S	4.6	AA	0.7	E		1		3	30	95	MOR
1986 04 30.56	S	4.7	AA	8.0	B		30	20		0.69		BOE
1986 05 01.08	M	5.0	W	0.0	E		1					OME
1986 05 01.84	M	5.3	AA	8.0	B		30	18	6	1.9	115	CAM
1986 05 01.93	G	5.2	AA	0.0	E		1			5.2	102	FLE
1986 05 01.94	M	5.4	AA	8.0	B		11	22	5	8.7	104	FLE
1986 05 02.19	M	4.7	AA	5.0	B		10	15	5	9	100	MOR
1986 05 02.20	M	4.7	AA	8.0	B		20	15	4			MOR
1986 05 02.21	S	4.7	AA	0.7	E		1					MOR
1986 05 02.84	M	5.4	AA	8.0	B		11	22	6	1.9	97	FLE
1986 05 02.85	M	5.1	AA	0.0	E		1			7.8	104	FLE
1986 05 02.90	M	5.4	AA	13	R	4	21	15	6	2.75	126	CAM
1986 05 03.23	M	4.8	AA	5.0	B		10	15	5	10	100	MOR
1986 05 03.24				0.7	E		1			19	100	MOR
1986 05 03.35	S	4.8	V	0.0	E		1		7	7		LOV
1986 05 04.17	M	4.9	AA	5.0	B		10					MOR
1986 05 04.21	S	5.2	A	8.0	B		11	5.5	3	?		SPR
1986 05 04.22	S	5.5	AA	5.0	B		10	11.5	4	3.5	68	MAR01
1986 05 04.72	G	5.0	AA	0.0	E		1					FLE
1986 05 04.72	M	5.7	AA	8.0	B		11	13	4	2.7	105	FLE
1986 05 05.18	M	4.9	AA	5.0	B		10					MOR
1986 05 05.35	S	5.0	V	0.0	E		1	12		7.5	114	LOV
1986 05 05.71	G	5.2	AA	0.0	E		1					FLE
1986 05 05.71	M	5.7	AA	8.0	B		11	12	5	3.2	105	FLE
1986 05 05.86	M	5.5	AA	13	R	4	21	13	6	1.5	106	CAM
1986 05 06.22	S	5.4	AA	5.0	B		10	11.5	4	3.5	77	MAR01
1986 05 06.72	M	5.5	AA	8.0	B		11	11	5	1.3	108	FLE
1986 05 06.78	M	5.5	AA	13	R	4	21	10	6	2	104	CAM
1986 05 07.19	S	5.1	AA	5.0	B		10					MOR
1986 05 07.74	M	5.7	AA	8.0	B		11	12	5	3.4	107	FLE
1986 05 07.75	G	5.2	AA	0.0	E		1		8			FLE
1986 05 08.22	S	5.2:	AA	0.7	E		1			10	100	MOR
1986 05 08.23	M	5.4	AA	5.0	B		10	13	4	10	100	MOR
1986 05 08.52	S	6.3	AA	25	L	5	38	14	7	1.9	103	CLA
1986 05 08.76	G	5.5	AA	0.0	E		1			3.6	108	FLE
1986 05 08.77	M	5.9	AA	8.0	B		11	14	6	3.8	106	FLE
1986 05 08.87	B	6.4:	AA	5.0	B		7		4			LIN02

Periodic comet Halley (1982i) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 05 09.17	S	5.5	AA	5.0	B		10	13	3/			MOR
1986 05 09.17	S	5.5	AA	8.0	B		20					MOR
1986 05 09.74	M	5.8	AA	13	R	4	21	9	5	2.5	106	CAM
1986 05 09.75	M	5.9	AA	8.0	B		11	12	6	5.3	107	FLE
1986 05 09.76	G	5.7	AA	0.0	E		1			3.0	106	FLE
1986 05 10.20	M	5.6	AA	5.0	B		10	13	5	8	105	MOR
1986 05 10.21				0.7	E		1			4	105	MOR
1986 05 10.22	M	5.6	AA	8.0	B		20	13	4/			MOR
1986 05 10.23	M	5.6	AA	5.0	R		8					MOR
1986 05 10.24	M	5.5	AA	1.5	B		6	18	4			MOR
1986 05 10.77	M	6.4	AA	8.0	B		11	10	6	3.3	107	FLE
1986 05 10.78	G	5.5	AA	0.0	E		1					FLE
1986 05 11.17	M	5.7	AA	5.0	B		10	13	3/			MOR
1986 05 11.17	M	5.7	AA	8.0	B		20	13	3			MOR
1986 05 11.17	S	5.7	AA	5.0	B		10					MOR
1986 05 11.17	S	5.7	AA	8.0	B		20					MOR
1986 05 11.24	S	5.4	A	8.0	R	4	19	5	3			SPR
1986 05 11.26	S	5.4	A	8.0	B		11	5.5	3			SPR
1986 05 11.54	S	6.4	S	20.3	L	8	38	6.0		0.24		BOE
1986 05 11.75	M	6.0	AA	8.0	B		11	11	6	4.8	106	FLE
1986 05 11.78	G	5.6	AA	0.0	E		1					FLE
1986 05 12.17	M	5.7	AA	5.0	B		10	16	4	5	113	MOR
1986 05 12.19	S	5.5:	AA	0.7	E		1					MOR
1986 05 12.22	S	5.7	AA	5.0	B		10	10.3	3	3.2	87	MAR01
1986 05 12.80	G	5.8	AA	0.0	E		1					FLE
1986 05 12.80	M	6.1	AA	8.0	B		11	11		5.6	108	FLE
1986 05 13.20	M	5.7	AA	8.0	B		20	11	4			MOR
1986 05 13.21	M	5.6	AA	5.0	B		10	13	4			MOR
1986 05 13.83	G	5.9	AA	0.0	E		1					FLE
1986 05 13.83	M	6.0	AA	8.0	B		11	11	6	3.9	107	FLE
1986 05 14.69	M	6.3	AA	13	R	4	21	7	5			CAM
1986 05 14.85	G	5.9	AA	0.0	E		1					FLE
1986 05 14.85	M	6.1	AA	8.0	B		11	10	6	5.9	108	FLE
1986 05 15.88	M	6.5	AA	8.0	B		11	10	5	2.9	108	FLE
1986 05 16.82	M	6.7	AA	8.0	B		11	8.5	6	3.4	106	FLE
1986 05 17.58	S	5.6	AA	8.0	B		15		5	1		LOV
1986 05 17.59	S	6.4	AA	25	L	5	38	8	7			CLA
1986 05 17.60	M	6.6	AA	13	R	4	21	5	5			CAM
1986 05 17.79	M	6.7	AA	8.0	B		11	6.5	6	2.4	106	FLE
1986 05 18.19	S	6.1	AA	8.0	B		20	9	3			MOR
1986 05 18.81	M	6.9	AA	8.0	B		11	4.5	5	1.2	107	FLE
1986 05 19.19	S	6.3	AA	8.0	B		20	11	3			MOR
1986 05 19.70	M	6.8	AA	13	R	4	21	4	5			CAM
1986 05 20.19	S	6.5	AA	8.0	B		20	11	3			MOR
1986 05 20.72	M	6.8	AA	8.0	B		11	5	6	1.2	106	FLE
1986 05 21.74	M	7.0	AA	8.0	B		11	5	5	2.1	109	FLE
1986 05 22.78	M	7.3	AA	8.0	B		11	5	5	1.2	112	FLE
1986 05 25.19	M	6.7	AA	8.0	B		20					MOR
1986 05 25.70	M	7.3	AA	8.0	B		11	6.7	6	2.3	108	FLE
1986 05 26.19	S	6.7	AA	5.0	B		10		3			MOR
1986 05 26.34	S	7.6	MP	7.8	R	8	30					JON
1986 05 26.42	S	6.4	AA	3.0	R	7	8	10		1		LOV
1986 05 26.71	M	7.1	AA	13	R	4	21	6	4			CAM
1986 05 27.38	S	6.5	AA	8.0	B		15	11		1	128	LOV
1986 05 27.71	M	7.4	AA	13	R	4	21	5.5	4			CAM

Periodic comet Halley (1982i) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 05 27.73	M	7.5	AA	8.0	B		11	7	6	3.1	109	FLE
1986 05 28.78	M	7.4	AA	8.0	B		11	6.5	6	1.3	110	FLE
1986 05 29.13				5.0	B		10			1.5	120	MOR
1986 05 29.23	S	7.0	AA	5.0	B		10	14.5	3	1.67	108	MOR
1986 05 29.42	S	7.0	AA	8.0	B		15					LOV
1986 05 29.73	M	7.6	AA	8.0	B		11	7	5	3.0	108	FLE
1986 05 29.74	M	7.5	AA	13	R	4	21	6	4			CAM
1986 05 30.33	S	7.3	AA	4.5	R	6	13					JON
1986 05 30.74	M	7.6	AA	8.0	B		11	6.5	6	2.8	108	FLE
1986 05 31.72	M	7.7	AA	8.0	B		11	6.3	6	2.8	109	FLE
1986 05 31.74	M	8.0	AA	15	L	4	50	5	6	0.9	109	FLE
1986 06 01.32	S	7.5	AA	5.0	B		7					JON
1986 06 01.45	S	7.3	AA	8.0	B		15		5	1.5		LOV
1986 06 01.75	M	7.7	AA	13	R	4	21	5.5	4			CAM
1986 06 01.76	M	7.8	AA	8.0	B		11	6.5	6	3.9	109	FLE
1986 06 02.20	S	7.2	AA	5.0	B		10	12.5	3			MOR
1986 06 02.20	S	7.2	AA	8.0	B		20	12.5	2/	1.17	115	MOR
1986 06 02.72	M	8.0	AA	8.0	B		11	5.9	6	1.3	109	FLE
1986 06 02.73	M	8.2	AA	15	L	4	50	5	6	1.1	108	FLE
1986 06 03.73	M	8.1	AA	8.0	B		11	5.2	6	3.5	111	FLE
1986 06 03.74	M	8.3	AA	15	L	4	50	5.5	5	0.7	109	FLE
1986 06 04.19	S	7.3:	AA	8.0	B		20	10				MOR
1986 06 04.72	M	8.0	AA	8.0	B		11	5.2	6	1.6	111	FLE
1986 06 04.73	M	8.2	AA	15	L	4	50	4.6	5	0.7	106	FLE
1986 06 05.32	S	8.2	MP	7.8	R	8	30	2.5	4			JON
1986 06 05.73	M	7.9	AA	8.0	B		11	5.9	6	3.0	111	FLE
1986 06 05.75	M	8.1	AA	15	L	4	50	5.0	6	0.7	110	FLE
1986 06 06.20	M	7.0	AA	8.0	B		20	14.5	3	0.42	110	MOR
1986 06 06.21	S	7.0	AA	5.0	B		10	18	3			MOR
1986 06 06.33				7.8	R	8	30	5	2	0.15	108	JON
1986 06 06.33	S	8.0	MP	4.5	R	6	13					JON
1986 06 06.71	M	8.0	AA	8.0	B		11	5.6	5	2.5	110	FLE
1986 06 06.72	M	8.3	AA	15	L	4	50	4.6	5	0.8	108	FLE
1986 06 06.74	M	7.8	AA	13	R	4	21	6	5			CAM
1986 06 07.21	S	7.2	AA	5.0	B		10	16	3			MOR
1986 06 07.22	M	7.2	AA	8.0	B		20	10	3	0.42	112	MOR
1986 06 07.23	M	7.4	AA	25.6	L	4	45	7	4	0.42	112	MOR
1986 06 08.20	M	7.2	AA	5.0	B		10	14.5	3			MOR
1986 06 08.20	M	7.2	AA	8.0	B		20	9	3	0.42	76	MOR
1986 06 08.21				25.6	L	4	45	6.0	5	0.42	76	MOR
1986 06 09.21	S	7.4	AA	5.0	B		10	11	4	1.25	95	MOR
1986 06 09.22	M	7.4	AA	8.0	B		20	7	4	1.75	68	MOR
1986 06 09.23				25.6	L	4	45	& 3.6	5	0.5	110	MOR
1986 06 09.71	M	8.0	AA	8.0	B		11	4.8	5	2.6	110	FLE
1986 06 09.73	M	8.2	AA	13	R	4	21	5	4			CAM
1986 06 09.74	M	8.2	AA	15	L	4	50	4.6	6	0.8	110	FLE
1986 06 10.21	S	7.5	AA	5.0	B		10	11	3	2.0	95	MOR
1986 06 10.22	M	7.4	AA	8.0	B		20	9	3			MOR
1986 06 10.23				25.6	L	4	45	4.3		0.33	105	MOR
1986 06 10.45	S	7.8	AA	8.0	B		15		4	1.5	128	LOV
1986 06 10.74	M	8.0	AA	8.0	B		11	4.8	6	2.4	110	FLE
1986 06 10.75	M	8.3	AA	15	L	4	50	5.7	6	0.7	109	FLE
1986 06 11.20	S	7.3	AA	5.0	B		10	14.5	3	1.83	108	MOR
1986 06 11.21	M	7.3	AA	8.0	B		20	9	3			MOR
1986 06 11.22	M	7.9	AA	25.6	L	4	45	4.5	4			MOR

Periodic comet Halley (1982i) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 06 11.40	S	8.5	MP	7.8	R	8	30	4	2			JON
1986 06 11.73	M	8.2	AA	8.0	B		11	5.2	6	2.1	109	FLE
1986 06 11.74	M	8.4	AA	15	L	4	50	5.5	6	0.6	112	FLE
1986 06 12.19	S	7.4	AA	8.0	B		20	9	3	1.33	108	MOR
1986 06 12.20	S	7.3	AA	5.0	B		10	14.5	3			MOR
1986 06 12.70	M	8.2	AA	8.0	B		11	4.8	5	1.8	111	FLE
1986 06 12.72	M	8.3	AA	15	L	4	50	5.0	6	0.5	108	FLE
1986 06 13.72	M	8.3	AA	13	R	4	21	5	5			CAM
1986 06 13.74	M	8.3	AA	8.0	B		11	5.2	5	1.5	106	FLE
1986 06 13.75	M	8.6	AA	15	L	4	50	4.6	5	0.3	108	FLE
1986 06 14.71	M	8.5	AA	8.0	B		11	3.7	5			FLE
1986 06 15.34	S	9.2	MP	7.8	R	8	30					JON
1986 06 15.34	S	9.5	MP	31.7	L	5	86	2	3			JON
1986 06 16.33	S	9.5	MP	31.7	L	5	86	> 1	4			JON
1986 06 22.28	S	10 :	MP	31.7	L	5	86					JON
1986 06 22.69	M	9.2	AA	8.0	B		11	2.6	4			FLE
1986 06 22.71	M	9.6	AA	15	L	4	50	1.9	3			FLE
1986 06 22.72	M	10.0	WF	35	L	6	100	1.6	6			FLE
1986 06 24.20	M	8.4	S	25.6	L	4	45	5.6	3			MOR
1986 06 24.20	S	7.8	S	5.0	B		10	11	2			MOR
1986 06 24.20	S	7.9	S	8.0	B		20	8	2	&0.5	103	MOR
1986 06 24.71	M	8.9	WF	8.0	B		11	3.7	6	0.9	107	FLE
1986 06 24.72	M	9.4	WF	15	L	4	50	3.6	6	0.4	105	FLE
1986 06 24.73	M	10.0	WF	35	L	6	100	3.2	6	0.5	110	FLE
1986 06 25.41	S	8.4	AA	20	L	6	50	4	3			LOV
1986 06 25.77	M	9.8	WF	15	L	4	50	3.0	5	0.3	112	FLE
1986 06 25.77	M	10.3	WF	35	L	6	100	3.2	6	0.4	112	FLE
1986 06 25.78	M	9.0	WF	8.0	B		11	4.4	3			FLE
1986 06 26.73	M	9.7	WF	15	L	4	50	3.6	6	0.5	109	FLE
1986 06 26.74	M	9.1	WF	8.0	B		11	3.7	5	0.7	110	FLE
1986 06 26.75	M	10.1	WF	35	L	6	100	3.4	6	0.5	110	FLE
1986 06 27.70	M	9.1	WF	8.0	B		11	4.1	5	0.3	110	FLE
1986 06 27.72	M	9.4	WF	15	L	4	50	3.6	6	0.3	111	FLE
1986 06 27.72	M	9.9	WF	35	L	6	100	3.4	6	0.4	111	FLE
1986 06 28.71	M	9.1	WE	8.0	B		11	4.1	6	0.3	110	FLE
1986 06 28.73	M	9.4	WE	15	L	4	50	3.6	6	0.3	111	FLE
1986 06 28.73	M	9.9	WE	35	L	6	100	3.4	6	0.4	111	FLE
1986 06 28.74	M	10.1	WE	20	L	7	35	3	4			CAM
1986 06 29.20	M	8.6	S	25.6	L	4	45	5.6	3			MOR
1986 06 29.20	S	8.2	S	8.0	B		20	& 8	2			MOR
1986 06 29.71	M	9.0	WE	8.0	B		11	3.7	5	0.6	109	FLE
1986 06 29.73	M	9.6	WE	15	L	4	50	3.3	6	0.2	112	FLE
1986 06 29.74	M	9.8	WE	35	L	6	100	3.0	6	0.4	108	FLE
1986 06 30.19	S	8.0	S	5.0	B		10	11	1/			MOR
1986 06 30.19	S	8.1	S	8.0	B		20	8	2			MOR
1986 06 30.20	M	8.6	S	25.6	L	4	45	5.0	3			MOR
1986 06 30.32	S	10.5	AC	31.7	L	5	86	> 1	2/			JON
1986 06 30.71	M	9.0	WE	8.0	B		11	4.4	6	0.5	110	FLE
1986 06 30.72	M	9.9	WE	35	L	6	100	3.1	6	0.4	107	FLE
1986 06 30.73	M	9.6	WE	15	L	4	50	3.3	6	0.2	108	FLE
1986 07 01.20	S	8.1:	S	5.0	B		10	11	1/			MOR
1986 07 01.20	S	8.2	S	8.0	B		20	8	2			MOR
1986 07 01.30	S	10.3	AC	31.7	L	5	86	2	3/			JON
1986 07 01.70	M	9.2	WF	8.0	B		11	3.7	5	0.6	111	FLE
1986 07 01.72	M	9.5	WF	15	L	4	50	3.5	6	0.2	111	FLE

Periodic comet Halley (1982i) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 07 01.72	M	9.8	WF	35	L	6	100	3.4	6	0.4	108	FLE
1986 07 02.31	S	10.4	AC	31.7	L	5	86					JON
1986 07 02.70	M	9.1	WF	8.0	B		11	3.7	5	0.5	111	FLE
1986 07 02.71	M	9.9	WF	35	L	6	100	3.0	6	0.3	108	FLE
1986 07 03.19	S	8.3	S	8.0	B		20	7	2			MOR
1986 07 03.20	S	8.2:	S	5.0	B		10	8	1			MOR
1986 07 03.20	S	8.7	S	25.6	L	4	45	5.6	2			MOR
1986 07 03.31	S	10.4	AC	31.7	L	5	86	2	2/			JON
1986 07 03.70	M	10.0	WE	35	L	6	100	3.1	6	0.3	108	FLE
1986 07 04.31	S	10.4	AC	31.7	L	5	86	2	2/			JON
1986 07 04.72	M	9.7	WE	15	L	4	50	3.2	5			FLE
1986 07 04.73	M	9.1	WE	8.0	B		11	4.4	3			FLE
1986 07 04.74	M	10.0	WE	30	L	8	120	2.7	6	0.1	111	FLE
1986 07 05.71	M	9.4	WE	8.0	B		11	3.7	5	?0.2	114	FLE
1986 07 05.72	M	9.9	WE	35	L	6	100	2.9	6	0.3	112	FLE
1986 07 05.72	M	10.0	WE	15	L	4	50	2.6	6	0.2	115	FLE
1986 07 08.19	S	8.9	S	25.6	L	4	45	3.8	2			MOR
1986 07 08.30	S	10.6	AC	31.7	L	5	86	2	2/			JON
1986 07 08.71	M	9.4	WE	8.0	B		11	4.1	3			FLE
1986 07 08.72	M	10.0	WE	15	L	4	50	3.2	4			FLE
1986 07 08.72	M	10.2	WE	35	L	6	100	3.1	6	0.3	111	FLE
1986 07 09.70	M	9.6	WF	8.0	B		11	3.7	4			FLE
1986 07 09.71	M	9.6	WF	15	L	4	50	3.2	5			FLE
1986 07 09.72	M	10.2	WF	35	L	6	100	3.2	6	0.3	109	FLE
1986 07 10.35	S	9.0	AC	8.0	B		15					SEA
1986 07 10.71	M	9.6	WF	8.0	B		11	3.7	3			FLE
1986 07 10.72	M	10.3	WF	35	L	6	100	3.0	6	0.2	105	FLE
1986 07 10.73	M	10.0	WF	15	L	4	50	3.2	4			FLE
1986 07 11.35	S	8.9	AC	8.0	B		15					SEA
1986 07 11.71	M	9.7	WF	8.0	B		11	4.0	4			FLE
1986 07 11.72	M	10.5	WF	35	L	6	100	2.4	6	?0.2	107	FLE
1986 07 12.35	S	9.0	AC	8.0	B		15					SEA
1986 07 12.71	M	10.5	WF	35	L	6	100	2.2	5			FLE
1986 07 13.70	M	10.7	WF	35	L	6	100	2.2	5			FLE
1986 07 13.81	S	10.8	AC	31.7	L	5	86					JON
1986 07 14.70	M	10.9	WF	35	L	6	100	1.2	4			FLE
1986 07 22.70	M	11.5	WF	35	L	6	100	1.4	6			FLE
1986 07 23.72	M	11.3	WF	35	L	6	100	1.5	6			FLE
1986 07 24.70	M	11.2	WF	35	L	6	100	1.5	5			FLE
1986 07 25.36	S	9.5	AC	8.0	B		15					SEA
1986 07 25.71	M	11.4	WF	35	L	6	100	1.5	5			FLE
1986 07 26.70	M	11.4	WF	35	L	6	100	1.7	5			FLE
1986 07 28.72	M	11.2	WE	20	L	7	78	1.8	4			CAM
1986 07 29.71	M	11.3	WG	35	L	6	100	1.7	6			FLE
1986 07 30.36	S	10.0:		20	L	6	118	2	3			LOV
1986 07 30.71	M	10.9	WG	35	L	6	100	1.4	7			FLE
1986 07 31.70	M	10.8	WG	35	L	6	100	1.1	7			FLE
1986 08 01.70	M	11.0	WG	35	L	6	100	1.1	6			FLE
1986 08 02.71	M	11.1	WG	35	L	6	100	1.4	6			FLE
1986 08 03.35	S	9.8:		20	L	6	52	3	3			LOV
1986 08 04.70	M	11.6	WG	35	L	6	100	1.6	5			FLE
1986 08 05.70	M	11.6	WG	35	L	6	100	1.4	4			FLE
1986 08 06.70	M	11.5	WG	35	L	6	100	1.6	5			FLE
1986 08 07.70	M	11.6	WG	35	L	6	100	1.3	4			FLE

Periodic comet Halley (1982i) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 08 08.70	M	11.7	WG	35	L	6	100		3			FLE
1986 08 09.70	M	11.9	WG	35	L	6	100		3			FLE

Periodic comet Boethin (1985n)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1985 11 08.44	S	10.2	AA	15	L	8	64	4.5	1			TRE
1985 11 09.44	S	10.2	AA	15	L	8	64	2.3	1			TRE
1985 11 12.43	S	10.2	AA	15	L	8	64	4.0	1			TRE
1985 11 13.44	S	11.0	AA	15	L	8	64	5.0	1			TRE
1985 11 14.17	S	10.2	AA	20	L	6	61					HAL
1985 12 04.18	M	9.0	S	20	L	6	61					HAL
1986 01 18.16	S	7.9	AA	20	L	6	61		4			HAL
1986 01 28.74	S	8.7	AA	20.3	L	6	61	2.5	3			GLO
1986 02 02.20	S	8.4	NP	5.0	B		10					HAL
1986 02 03.16	S	8.5	NP	5.0	B		10					HAL
1986 02 06.10	S	7.5	A	8.0	B		11	4	2			SPR
1986 02 07.10	S	7.7	A	20.0	C	10	64	4	2			SPR
1986 02 08.10	S	7.9	A	8.0	R	4	19	4	2			SPR
1986 02 09.10	S	8.1	A	8.0	R	4	19	3	1			SPR

Periodic comet Hartley-IRAS (1984 III)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1983 12 26.75	S	10.1	A	29.8	L	5	62	2.4	3	?	45	KEI
1983 12 30.76	S	10.0	A	29.8	L	5	62	3.0	2	?	45	KEI
1984 01 03.77	S	10.0	A	29.8	L	5	62	2.3	2			KEI
1984 01 05.76	S	10.0	A	29.8	L	5	62	2.5	2/			KEI

Periodic comet Shoemaker 3 (1985 XVIII)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1986 01 18.44	S	13.2	NP	20	L	6	122		2/			HAL

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OMAN NUMERAL DESIGNATIONS OF COMETS IN 1985.

The following tabulation continues that on MPC 10330 and ICQ 8, 38. he references below give the most-recently-published orbits in the Minor lanet Circulars or IAU Circulars. [From MPC 11376.] The designations 808 III, 1976 XVI and 1983 XX were belatedly given to P/Grigg-Skjellerup, /Skiff-Kosai and SOLWIND 6, respectively (see IAUC 4234, 4250 and 4229).

omet	T		Name	Year/letter	Ref.
985 I	Jan.	2.4	P/Tsuchinshan 1	1984p	MPC 9830
985 II	Jan.	3.9	Shoemaker	1984s	MPC 9425
985 III	May	23.9	P/Honda-Mrkos-Pajdušáková	1985c	IAUC 4055
985 IV	June	3.4	P/Gehrels 3	1984l	NK 458
985 V	June	5.2	P/Hartley 2	1986c	MPC 11236
985 VI	June	8.2	P/Maury	1985k	MPC 10377
985 VII	June	11.6	P/Hartley 1	1985f	MPC 10031
985 VIII	June	28.7	Machholz	1985e	MPC 9753
985 IX	July	5.2	P/Russell 1	1985b	IAUC 4053
985 X	July	21.2	P/Tsuchinshan 2	1985d	MPC 9830
985 XI	Aug.	4.3	P/Daniel	1985j	IAUC 4092
985 XII	Sept.	4.6	Shoemaker	1984f	MPC 9426
985 XIII	Sept.	5.2	P/Giacobini-Zinner	1984e	MPC 9762
985 XIV	Sept.	28.4	Hartley	1984v	MPC 10298
985 XV	Oct.	1.2	P/Giclas	1985g	MPC 10156
985 XVI	Oct.	30.1	P/Ciffréo	1985p	MPC 10817
985 XVII	Dec.	9.1	Hartley-Good	1985l	MPC 10377
985 XVIII	Dec.	18.6	P/Shoemaker 3	1986a	MPC 10817
985 XIX	Dec.	19.2	Thiele	1985m	MPC 10377

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).

1985o = P/Kojima (T = 4/4/86, q = 2.4)
1985p = * P/Ciffréo (T = 10/30/85, q = 1.70) [1985 XVI]
1985q = P/Wirtanen (T = 3/19/86, q = 1.08)
1986a = * P/Shoemaker 3 (T = 12/18/85, q = 1.8) [1985 XVIII]
1986b = * Shoemaker (T = 3/11/86, q = 3.6)

1986c = * P/Hartley 2 (T = 6/5/85, q = 0.96) [1985 V]
1986d = * P/Singer Brewster (T = 6/5/86, q = 1.93)
1986e = * P/Machholz (T = 4/23/86, q = 0.13)
1986f = P/Holmes (T = 3/14/86, q = 2.17)
1986g = P/Forbes (T = 1/1/87, q = 1.47)

1986h = P/Schwassmann-Wachmann 2 (T = 8/30/87, q = 2.07)
1986i = * Churyumov-Solodovnikov (T = 5/5/86, q = 2.6)
1986j = P/Comas Solá (T = 8/18/87, q = 1.83, P = 8.8)
1986k = P/Kohoutek (T = 10/29/87, q = 1.77, P = 6.6)
1986l = * Wilson (T = 4/20/87, q = 1.2)

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)

BOOK REVIEWS

Protostars & Planets II

David C. Black and Mildred S. Mathhews, Eds., 1293 pp. Price $45.00, clothbound. [ISBN 0-8165-0950-6] Univ. of Arizona Press (1615 E. Speedway, Tucson, AZ 85719), 1985.

This book is another in an excellent series of books published by the University of Arizona Press on various subjects concerning the solar system. Reviews of two volumes in this series, *Comets* and *Asteroids*, have appeared previously in the *ICQ* (**6**, 8 and 88). *Protostars & Planets II* was a planned outcome of papers presented at a meeting with the same title held in Tucson in Janaury 1984. Only 6 years earlier, a similar meeting had spawned the book *Protostars and Planets*, which has been out of print already for some time. The new, large book contains > 40 papers by some 70 authors, and it is dedicated to the memory of the late Bart Bok. Some of the book's articles are quite lengthy, with John Scalo's "Fragmentation and Hierarchical Structure in the Interstellar Medium" lasting 96 pages.

Eugene Levy discusses the importance of studying comets as a link to the formation of stellar and planetary environments: "Detailed study of cometary material can be expected to forge an important link in our understanding of the transition from a molecular cloud core to a star- and planet-producing nebula." Comets are discussed in various places in the book, although only one article deals specifically with comets: Paul Weissman's "The Origin of Comets: Implications for Planetary Formation". His paper reviews statistics concerning cometary orbits and relates these statistics to various circulating ideas concerning the formation of comets. Weissman's estimate of the total number of comets in the Oort cloud, N_O, is around 2×10^{12}. However, his average mass, M_{avg}, for cometary nuclei is $\sim 7.3 \times 10^{15}$ g. This leads to a total mass of the Oort cloud, M_O, of $\sim$ 2.5–3.0 $M_\oplus$. However, recent findings indicate that cometary nuclei are much larger than had been anticipated because their albedos are appearing much lower than previously thought. After Weissman wrote his paper, *Giotto* found P/Halley's nucleus to be $\sim 15 \times \sim 10$ km; if one assumes a prolate spheroid, one gets a volume of $\sim 6.3 \times 10^{21}$ cm^3. Then if one takes the density, ρ, to be 1 gm cm^{-3}, the mass of P/Halley comes out around 6.3×10^{21} g. It is now not absurd to assume an average comet nucleus diameter as being around 5 km. With the same ρ, this would give $M_{avg} \sim 5 \times 10^{17}$ g and, with Weissman's N_O, yields $M_O \sim 1 \times 10^{30}$ g, or $\sim 175\ M_\oplus$ ($\sim 0.0005\ M_\odot$). If comets exist in comparable number and mass around a fair number of other stars in the galaxy, they could conceivably account for a fair amount of the unseen galactic mass. (Some scientists have recently suggested that the density for P/Halley is < 0.5 gm cm^{-3}!)

Al Cameron discusses how material from the evolving solar nebula might coagulate into clumps to form the comets, perhaps at heliocentric distances as small as a few thousand AU, "from which stellar encounters can perturb them into the Oort cloud". He notes in his article, entitled "Formation and Evolution of the Primitive Solar Nebula", that comet formation likely occurred during the T-Tauri stage of the early sun, with the solar winds inducing the "gentle collisions among interstellar grains" which lead to clump production and comets.

Protostars & Planets II has all of the references contained in one large, 85-page listing near the end of the book, a rather different approach in conference proceedings volumes. There is an 11-page index to subjects and terms, but I found that it was nowhere near complete; some major discussions concerning comets and the Oort cloud were omitted from the index. The book also includes, as is customary with the University of Arizona solar system books, a 20-page glossary. The glossary's definition for "aphelion" is incorrect (it says, "distance of greatest separation between two bodies orbiting in an eccentric orbit"). The value given for the Hubble time should evidently be 19.4 ($\pm$ 1.6) $\times 10^9$ yr, rather than 19.4 + 1.6 $\times 10^9$ yr. Also in the glossary, the formula for the Planck function should read $B_\nu = 2h\nu^3/c^2\ [\exp(h\nu/kT) - 1]^{-1}$, instead of what is printed on p. 1170.

One gets the impression that the books in the Arizona series contain fewer errors than do other published proceedings of astronomical meetings; other such proceedings papers are usually sent camera-ready (often in typewritten form) by authors to publishers, and thereby contain many typographical errors. *Protostars & Planets II* is attractively typeset, and it appears to contain very few typographical errors, outside of the glossary, indicating much effort by editors and authors to keep it that way.

Protostars & Planets II contains many articles concerning stellar formation and interstellar clouds. Indeed, large molecular clouds and other similar galactic entities may harbor very large numbers of comets. This review has concentrated on the book's relevance to the study of comets. I can highly recommend the book for its significance to the study concerning evolution of planetary systems, which necessarily concerns comets. *D. W. E. Green*

Annual Review of Astronomy and Astrophysics, 22–24

Volume 22 (1984) [ISBN 0-8243-0922-7], 635 pp.; *Volume 23* (1985) [ISBN 0-8243-0923-5], 466 pp.; *Volume 24* (1986) [ISBN 0-8243-0924-3], 627 pp. G. Burbidge, D. Layzer, and J. G. Phillips, Eds. Price $44.00 (USA), $47.00 (outside USA), per volume, hardbound. Annual Reviews, Inc., 4139 El Camino Way, Palo Alto, CA 94306, U.S.A.

The 22nd, 23rd, and 24th volumes in this series contains articles on many astronomical and astrophysical topics. Nineteen articles appear in the 1984 edition, while 13 articles appear in the 1985 volume and 16 exist in the 1986 volume. Each volume also contains a handy subject index, plus author and title indices for the preceding 10 volumes of the *Annual Review of Astronomy and Astrophysics*. Each volume's first article is by a respected, senior astronomer who reflects back on a long astronomy-related career: Vol. 22 has such an article by Jesse Greenstein, Vol. 23 has one by

T. G. Cowling, and Vol. 24 contains "A Half-Century of Astronomy", by A. E. Whitford. These articles are among the most interesting in the two volumes to the general reader. It's amazing to read how many different areas Greenstein has worked in throughout his life, of which his study of comets was a very small phase. He discusses the first high-resolution spectra of comets which he obtained using the 200-inch telescope at Palomar, leading him to discover what now is known as the "Greenstein effect". Greenstein notes an experience in the early 1970s: "I built a high-resolution image-tube camera (0.2 Å) for Comet Kohoutek, but the latter's brightness failed to justify early expectations and I also encountered foul weather. I never returned to comets." I'd heard this from many a layman, but this is the first time I've ever seen a *professional* astronomer say that the performance of comet Kohoutek 1973 *XII* moved him to extinguish his interest in comets!

The other articles tend to be of a technical nature, intended to be understood chiefly by researchers tackling various observational and theoretical astrophysical problems. While neither volume contains articles about comets, those studying the physical nature of comets will find some of the articles applicable to their research, at least indirectly. Such articles in the 1984 edition are three concerning solar problems ("Solar Rotation", by Robert Howard; "Coronal Mass Ejections", by William Wagner; and "High-Energy Neutral Radiations from the Sun", by E. L. Chupp) and one concerning theoretical models and observational constraints dealing with planetary formation ("Origin and History of the Outer Planets", by James Pollack). Such articles in the 1985 edition include "Fundamental and Applied Aspects of Astronomical 'Seeing'", by C. E. Coulman, and "Sunspots", by Ronald Moore and Douglas Rabin, and in Vol. 24 are "Charge-Coupled Devices in Astronomy", by Craig D. Mackay, and a paper on clouds and gas in the interstellar medium by L. L. Cowie and A. Songaila.

As noted in my review of Volume 21 (*ICQ* **7**, 14, 1985), these volumes contain papers concerning most areas of astrophysics. The editors collect review articles on areas of research which currently are quite "popular" in the astronomical community, such as Bruce Margon's "Observations of SS 433" and Martin Rees' "Black Hole Models for Active Galactic Nuclei" in Vol. 22. Other articles, such as that by Moore and Rabin, cover topics which have been explored for many years (even in previous volumes in this series), but which have been in need of updated reviews. There are also some general review papers, of interest to many researchers across different disciplines, which do not necessarily cover new topics, such as Coulman's article mentioned above.

In looking back through past volumes of *Annual Review of Astronomy and Astrophysics*, I found that Volumes 2–14 contained five articles devoted to comets, or better than a comet review paper every 3 years. There has not been one article devoted to comets in this review series in 11 years, however. With the vast knowledge that has been accumulated concerning comets in the past 10 years or so, especially with the current visit of P/Halley to the inner solar system, and with the obvious link of comets to conditions in interstellar space and in the early solar system, one would expect to see not one, but two or three, review(s) concerning comets published in this series in the next four or five years.

As noted before, every serious astronomer should have access to, and should make use of, this worthwhile annual review series which serves as excellent reference material. It would be difficult to find a major astronomical topic/subject not covered in any of the 24 volumes published thus far. *D. W. E. Green*

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RECENT NEWS AND RESEARCH CONCERNING COMETS

(Cont. from page 114) Comet Wilson 1986*l* slowly brightened to $m_1 \simeq 10.0$ by late December, with Alan Hale finding it at $m_1 = 10.2$ on Dec. 27.07 in a 20-cm reflector. For several months, comet 1986*l* has been following an unusual power-law formula of $m_1 = 6.0 + 5 \log \Delta + 6.0 \log r$; such a formula would make the comet's brightness in late April 1987 around $m_1 \sim 5.5$, but the rate of rise in heliocentric brightness will probably change somewhat before then. Brian Marsden has found that comet 1986*l* is likely a 'new' one from the so-called Oort cloud (*cf.* IAUC 4294), which does not lend promise to the comet's getting much brighter than $m_1 \simeq 6$ in April; such 'new' comets often brighten rapidly after discovery and then have a dramatic slow-down in the rate of brightness increase as they approach perihelion.

P/Halley has been followed since late October, as it has remained close to $m_1 = 12$ for a couple of months. Many interesting results have been gained from observation of comet 1982*i* at its current return, including the announcement by Robert L. Millis *et al.*, at the October conference in Heidelberg devoted to P/Halley, that the comet exhibits a rotation period close to 7 days (in addition to the 52-hr period reported many months ago). Upcoming issues will contain more details concerning these results.

Most subscribers should have received the January 1987 issue before this one, which constituted the *Comet Handbook for 1987*; this comprehensive listing of comet ephemerides computed by Syuichi Nakano is available to non-subscribers (and additional copies for subscribers) for US$10.00 postpaid, and we anticipate publishing the *Comet Handbook* on a regular basis each year. The *ICQ* distribution of the *Comet Handbook* means that very few ephemerides will be published in regular issues of the *ICQ* in the future, where only occasional ephemerides will appear for newly-discovered comets. Readers should consult the *IAU Circulars* and the *Minor Planet Circulars (MPCs)* for all newly-discovered comets, where publication is much quicker than the *ICQ* can accomplish (information concerning subscription to these publications, and the *IAUC/MPC* computer service, is available from the undersigned upon request).

Daniel W. E. Green *(1987 Jan. 10)*

CORRIGENDA

• The correction concerning page 39 of the January 1986 issue (given on page 112 of the July issue) referred to the drawing by S. O'Meara. • In *ICQ* **8**, 13 (Jan. 1986 issue), the observations of comet Hartley-Good 1985*l* attributed to LIN01 were actually made by LIN02. • In *ICQ* **7**, 46 (April 1985 issue), the reference D. W. Hughes (1983) is in the *Quarterly Journal* (not the *Monthly Notices*) of the R.A.S.