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

The regular (invoiced) subscription rate is US$31.00 per year for surface-mail delivery (price includes the annual *Comet Handbook*; the price without the *Handbook* is US$23.00 per year). Subscribers who do not wish to be billed may subscribe at the special rate of US$23.00 per year for surface-mail delivery (rate is $15.00 without *Handbook*). Add $15.00/year to each of these rates for airmail delivery outside of the United States or for first-class delivery within the U.S. [The last set of digits (after the hyphen) on the top line of the mailing address label gives the Whole Number that signifies the last *ICQ* issue which will be sent under the current subscription status. An asterisk after these numbers indicates credit for the next annual Comet Handbook. The first five digits represent the subscriber's account number.] Make checks or money orders payable in U.S. funds (and drawn on a U.S. bank) to *International Comet Quarterly* and send to Mail Stop 18; Smithsonian Astrophysical Observatory; 60 Garden St.; Cambridge, MA 02138, U.S.A.

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Group subscription rates available upon request. Back issues are $6.00 each — *except* for "current" *Comet Handbooks*, which are available for $15.00 ($8.00 to subscribers if ordered with their *ICQ* subscription; see above). Up-to-date information concerning comet discoveries, orbital elements, and ephemerides can be obtained by subscribing to the *IAU Circulars* and/or the *Minor Planet Circulars* (via postal mail and also available via computer access); for further information, contact the above e-mail address (or the *ICQ* at the above postal address).

Cometary observations should be sent to the Editor in Cambridge; all data intended for publication in the *ICQ* that is not sent via computer electronic mail should be sent on standard *ICQ* observation report forms, which can be obtained upon request from the Editor. Those who can send observational data (or manuscripts) in machine-readable form are encouraged to do so [especially through e-mail via the computer networks *SPAN* (6700::DAN) or Internet (ICQ@CFA.HARVARD.EDU), or via floppy disks that can be read on an IBM PC], and should contact the Editor for further information. The *ICQ* has extensive information for comet observers on the World Wide Web, including the Keys to Abbreviations used in data tabulation (see URL http://cfa-www.harvard.edu/icq/icq.html). In early 1997, the *ICQ* published a 225-page *Guide to Observing Comets*; this edition is now out of print, but a revised edition is under preparation.

Most of the Observation Coordinators (OCs) listed below have e-mail contacts with the *ICQ* Editor; observers in the general area of such OCs who lack access to e-mail networks may send data to the OC for relay to the *ICQ* in electronic form.

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EDITORIAL NOTICE.

The proceedings articles for the second International Workshop on Cometary Astronomy (held in Cambridge, England, last year) have been postponed for publication until the January 2001 issue for additional editing. The *2001 Comet Handbook* is in preparation and will be mailed separately from the October issue.

Contributors of observations are again warned to check the *ICQ* that all observations have been published. E-mail problems all too frequently cause messages to go lost.

FREEMAN D. MILLER (1909-1999)

For many years Professor of Astronomy at the University of Michigan, Freeman Miller died in his home in Ann Arbor shortly after his devoted wife Marie became ill and went into a nursing home. She died about a month later.

An early student of Bart J. Bok at Harvard, Freeman did his Ph.D. thesis on galactic astronomy. While they were students at Harvard, he and Marie created a scandal in the 1930s by marrying while she was still an undergraduate at Radcliffe College. During World War II, Freeman was a Naval officer and had command of a destroyer in the North Pacific arena. After the war, he worked briefly at the Dennison Observatory in Ohio before joining the Astronomy faculty at the University of Michigan in 1946. Because of his interest in galactic structure and dynamics, he and the new Director, Leo Goldberg, convinced the University to purchase a 24/36-inch Schmidt telescope and mount it in nearby Dexter, MI. However, he soon realized the advantage of the wide field of this, the Curtis Schmidt, for cometary research, and beginning with the appearance of comets C/1955 L1 (Mrkos; 1955 III) and C/1956 R1 (Arend-Roland; 1957 III), he spent most of his research efforts thereafter on comets, concentrating mainly on the dust tails. Some of his earliest and most important papers, written in collaboration with Armand Delsemme and with Zdenek Sekanina, firmly established that the dust grains in comet tails were composed primarily of clathrate hydrates.

Miller was instrumental in having the Curtis Schmidt moved to the clearer climes of the Cerro Tololo Interamerican Observatory in Chile in 1966, and subsequent investigations included more general studies of the tail structure of comets, notably comets C/1969 Y1 (Bennett; 1970 II) and C/1969 T1 (Tago-Sato-Kosaka; 1969 IX). In 1979, Freeman and the undersigned made application for comet 1P/Halley observing time with the Schmidt as a part of NASA's program of wide-angle photography, and the two of us secured 320 plates of the comet in 1985 and 1986 (plus 217 photographs taken by the undersigned on Easter Island with an 8-inch Schmidt camera). The results of this operation were described by us at the 20th ESLAB Symposium on the Exploration of Halley's Comet in Heidelberg in 1986, and in the March 1987 issue of *Sky and Telescope*.

As an advisor of graduate students doing their doctoral work under his supervision, Freeman was as good as they come: tough but with a soft heart. A stickler for details, he devoted an enormous amount of time to each of his students including yours truly. Even after his retirement in 1977, Freeman continued to come to the Astronomy Department almost daily and frequently pour over the many plates that he or his students had taken of comets, and a neighbor of Freeman and Marie who saw them together frequently reports that up to their last days, "it was as if they were still courting." — *William Liller, Viña del Mar, Chile*

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Max Beyer (1894-1982): A Master of Comet Observing

by Hartwig Lüthen[1], *Ignacio Ferrin*[2], *Daniel W. E. Green*[3], *John E. Bortle*[4]

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Over a decade ago, Thomas Williams (1988) published an account of the most significant amateur astronomers of all time, listing the Herschels, Henry Draper, W. F. Denning, Russell Porter, Joel H. Metcalf, E. E. Barnard, and — Max Beyer. While it can be a daunting task to derive a definitive definition of "amateur astronomer", Williams' list indicates the importance of Beyer in astronomical history. Beyer's contribution was described by Williams as follows: "For over 40 years Beyer was the world's leading visual observer of comets. This vocational school teacher accumulated extensive data on over 100 cometary apparitions and published an invaluable series of papers in the *Astronomische Nachrichten.*" Beyer's appearance in this list stands in marked contrast to the lack of appreciation by the contemporary German amateur community (neither local Hamburg astronomy-club magazines nor the major German amateur journal even reported his death in 1982). Because of Beyer's prominence in the field of cometary astronomy, it was deemed most useful to publish this article on Beyer's life and work on comets. It is based both on published information and on unpublished correspondence and manuscripts.

There was an obituary written by Johannes Larink (1983) in a journal of the German professional astronomical society.* Another good source that helps in reconstructing Beyer's life is Erwin Gebhardt's very detailed unpublished compilation of biographical dates. Gebhardt, a close friend of Beyer, had access to Beyer's personal diaries (Gebhardt

* Schmadel (1999) notes that a brief obituary was also published in 1983 in *BAV Rundbrief*, 32. Jahrg., Nr. 2, p. 51. No author was given for this obituary, but it did indicate that Beyer's work was much appreciated in the variable-star community.

1982). There are also some unpublished accounts from Beyer himself (Beyer 1943, 1960). The following biographical details have been taken from these sources and from personal letters written by Beyer to J. E. Bortle, B. G. Marsden, Z. Sekanina, D. Milon, and I. Ferrin.

Max Beyer's early life

Beyer was born at Hamburg on 1894 October 22, and he lived in the metropolitan area of this north-German harbor city for most of his life. He developed his passion for astronomy during his childhood years, triggered by his "mother telling us kids a lot of sun, moon, and stars" (Beyer 1960).* In the Beyer family, the only optical aid was an opera glass that was loaned to him as a kind of reward for good marks at school (Beyer 1960). In 1910, when comet 1P/Halley was expected to make its return, Beyer made a telescope from a spectacle lens; this permitted a magnification of 35×, but "the wish for an achromatic lens was still no more than a distant dream" (Beyer 1960). In August 1914, he had just finished high school — Gymnasium Kaiser-Friedrichs-Ufer in Hamburg (Gebhardt 1982) — and was beginning the study of shipbuilding (Beyer 1980) when World War 1 (WW1) broke out. Beyer was called by the army immediately, and in February 1915 he was sent to the French front, where he was injured. After partial recovery, Beyer served in various army offices.

After the end of WW1, Beyer returned in 1919 (after 4.5 years as a soldier) to a desolate home city. Teachers were desperately needed, but almost no trained teachers were available. Beyer passed a teachers' exam after half a year of training (this degree requires today a 5-year university study followed by a teachers' training period of 2 years). This brought him into a job in a special school for special-needs pupils. His position became a permanent one in 1922. Soon after that, in September 1922, Max Beyer married Anneliese Hochfeil, who was four years younger than he (Beyer 1980). They spent their honeymoon in the unromantic city of Eckernförde, some 100 km north of Hamburg (Gebhardt 1982).

Eventually, Beyer advanced to become the head of a secondary economics school in Hamburg-Bergedorf. It remains unclear how he managed to study mathematics, physics, and astronomy at Hamburg University during 1919–1923 (Beyer 1980) in addition to his teaching duties, and to do amateur astronomy to the extent he did, but Beyer passed his final exams in 1927. After his exam, Beyer managed to keep in touch with the professionals at Bergedorf Observatory, which was a leading European center for astronomical research (for a history of this and other observatories, refer to Schramm 1996). One of the professionals there, Kasimir Graff [1878-1950], played a key role, since he appreciated the significance of amateurs in astronomy. At the time of each full moon, Graff invited all to a monthly informal meeting of professionals and amateurs at the observatory (Beyer 1959), called the "Vollmondkränzchen". Beyer took part in these meetings from May 1920 (Larink 1983; Gebhardt 1982; Beyer 1959) and eventually became Graff's successor as the key organizer when Graff became director of the Vienna Observatory in 1928. (Graff was thrown out of that position in 1938, as soon as the Nazis entered Vienna; Schramm 1996). A later result of their co-operation was the Beyer-Graff star atlas, showing stars down to 9th magnitude (discussed below).

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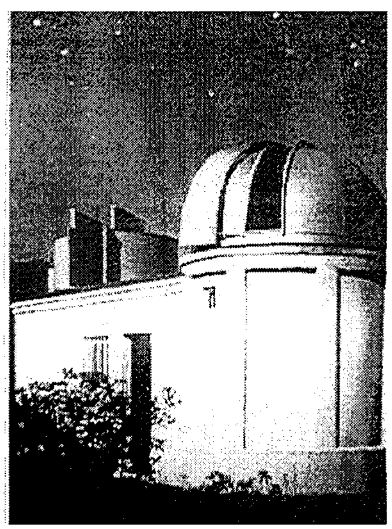


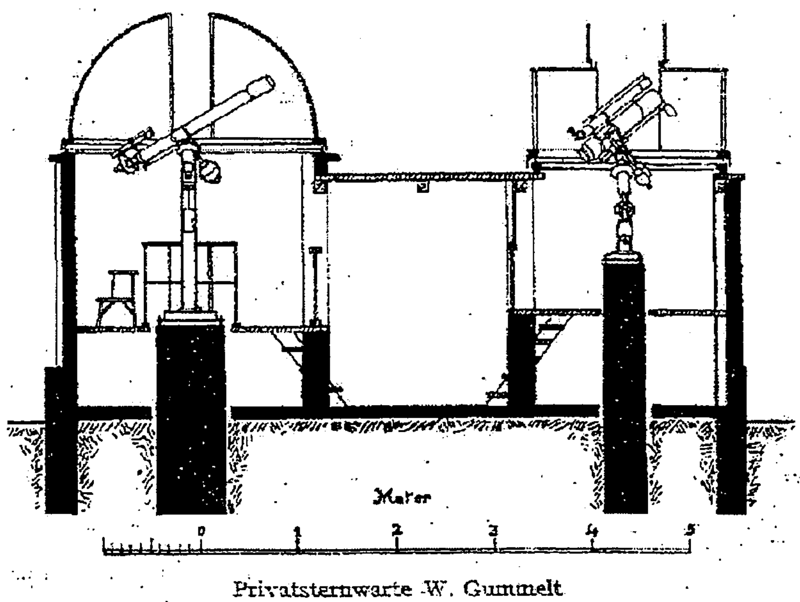
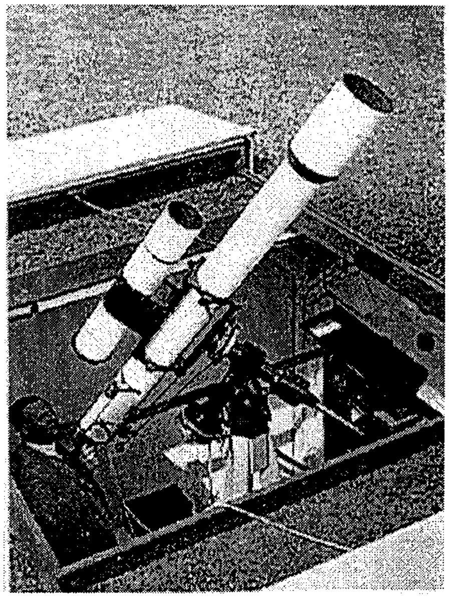


Figure 1a (left): nighttime shot of Gummelt's observatory at Hamburg-Grossborstel, around 1930 (private photograph from Beyer's documents). Figure 1b (right): drawing of the observatory (from Gummelt 1927); the smaller drum-shaped building at the right contains a little astrocamera (focal length 800 mm), which was used by Beyer to discover comet C/1930 E1; inside the dome at the left is a 115-mm refractor (focal length 1500 mm).

* This and many other quotations from German texts and manuscripts appearing in this article were translated into English by Hartwig Lüthen. The cited personal letters from Beyer to Milon, to Marsden, and to Ferrin were mostly written originally in English.



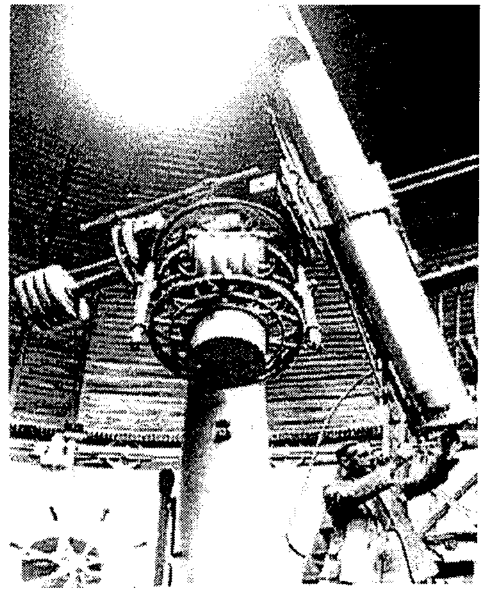


Figure 2a (upper left): Max Beyer observing in his rooftop observatory at Hamburg-Hamm in the 1930s. Figures 2b (upper right) and 2c (bottom): Beyer busily working (2b) and posing (2c) at the 26-cm equatorial refractor at Hamburg/Bergedorf observatory. Figure 2c photograph by Dr. W. Diekvoss, May 1958.

Beyer presented his first astrophotos at the Vollmondkränzchen. Amateur astrophotography was in those years a true challenge: "Beyer's first contribution was a picture of the Pleiades showing the reflection nebula. The exposure time was 11 hours, and he had guided it manually during three nights using a telescope made from spectacle glasses" (Larink 1983). Being an avid amateur astronomer then was much more difficult than today. A teacher's salary was hardly sufficient to pay for, say, a small refractor. In March 1919, Beyer built his first 3.5-inch telescope, with a Merz lens and a mount made from bicycle parts, costing 235 Marks. He managed to buy a bargain 4-inch refractor lens "for 430 Marks" (which was a lot of money), "just before the beginning of the wild inflation" of 1923, when even a box of matches cost billions (Beyer 1960). In 1920 at the Vollmondkränzchen, Beyer met "an elderly man, the upper technical secretary, Wilhelm Gummelt, who was mainly interested in making astronomical instruments and had an arsenal of self-made telescopes in a garden house at Hamburg-Grossborstel" (Beyer 1960). Beyer installed his self-made 108-mm refractor along with various cameras in a rooftop observatory at his apartment in Altona-Ottensen, in western Hamburg, in September 1922 (Beyer 1960, 1980). This 3-story house was where Beyer's parents-in-law lived. Beyer's landlord did not object to his cutting an opening into the roof and installing a run-off hatch, and he observed from this location for 3.5 years. Beyer used this telescope to guide "two small astrocameras of 4- and 6-cm aperture, $f/3.5$" (Beyer 1960). The weight-driven clock drive used to drive the mount had been taken from a gramophone.

In April 1926, Beyer moved to Hamburg-Grossborstel in the northwest part of the city. There he lived in the ground floor of Gummelt's garden house, at the invitation of Gummelt. Gummelt's significant private observatory (Figures 1a and 1b), "which [Gummelt] did not use, since he had no motivation for any observing", was located about 100 meters from the house (Beyer 1960). There Beyer had access to the following instruments (Gummelt 1927): a 115-mm refractor (focal length, $f = 1500$ mm) in a 2.5-m dome; a 160-mm astrocamera ($f = 800$ mm) for 4×5-inch plates, located in a drum-shaped building; a portable 75-mm refractor ($f = 1100$ mm); a 52-mm refractor ($f = 800$ mm); an 80-mm comet seeker ($f = 480$ mm); and 55-mm binoculars. Beyer observed at Gummelt's observatory, "continuing his extensive program to observe variable stars, which I [Gummelt] support with an additional photographic program" (Gummelt 1927). The archives of the American Association of Variable Star Observers (AAVSO) contain several letters between Beyer and Leon Campbell from 1928 to 1933, and there are 1597 variable-star observations made by Beyer in the AAVSO database. Beyer had a friend named Heylmann who assisted him for six years at Grossborstel. A spin-off from this program was the discovery of comet C/1930 E1. Later, because of "the moisture in the house due to the swampy soil [that] caused various illnesses", Beyer moved in 1932 to Hamburg-Hamm (a quarter in the outskirts of eastern Hamburg), where he again installed a rooftop observatory (Figure 2a), following the agreement of the owners there; the owners gave Beyer the use of a large laundry room, which he then converted into an observatory, a library, and a workshop (Beyer 1960).

Beyer also prepared his own star atlas (Beyer and Graff 1950), based on the *Bonner Durchmusterung*. He did this initially for his personal use, but Graff convinced Beyer to publish this work. Graff arranged for it to be printed at the map agency of the national survey at Berlin. In 1925, Beyer published the first maps of the equatorial zone. This was the first German amateur star atlas going so deep — the limiting magnitude is in fact similar to the modern *Uranometria* atlas or the *AAVSO Star Atlas* — which were, however, plotted by a computer and not manually, star by star, as was Beyer's. The equinox of Beyer's atlas was 1875.0. The complete atlas was first published in 1927. It contains 27 charts with stars down to magnitude 9.3, spanning $+90° \leq \delta \leq -23°$. A second edition was printed in 1936. Four hundred copies of that edition were sold, although 600 copies and the original drawings burned with his flat and his observatory in a WW2 air raid. In 1950, a third edition was published by Dümmler publishers at Bonn (Beyer and Graff 1950; Strothjohann 1977). The maps were quite simple but very clear. There were no text labels, and deep-sky objects were marked with small, unlabelled crosses. In 1928, Beyer provided David B. Pickering (President of the AAVSO) with numerous copies of the printed atlas for sale to AAVSO members at a reduced price — $6.75 instead of the regular $7.80 (Harwood 1928; Pickering 1928; Pickering 1929; Beyer 1972b; Mattei and Saladyga 2000). Beyer (1972b) wrote that, as no other set of highly detailed star charts (other than the expensive BD) were available to American observers in the 1920s, the AAVSO granted him an honorary membership on 1928 June 2, which apparently was terminated during WW2 — though Mattei and Saladyga (2000) report that there is no record of this honorary membership in the AAVSO archives. Pickering (1929) did write in March 1929 that German amateurs Max Beyer and Erich Leiner became "active and enthusiastic members of the A.A.V.S.O.", with Beyer's friend Paul Ahnert later also joining. Pickering had learned of Beyer from professional astronomers elsewhere in Germany, and Pickering added interestingly that "[Pickering] learned to his great surprise that not only was there no associated or concerted [variable-star] work being done outside of the great institutions, but that there was no effort on the part of the professional to encourage the amateur" — unlike the situation in the U.S., where Harvard Observatory nurtured the young AAVSO, for example.

The discovery of Beyer's comet (C/1930 E1 = 1930b = 1930 IV)

Beyer discovered comet 1930b = 1930 IV (now known as C/1930 E1) at Gummelt's observatory with the 160/800-mm astrograph while photographing star fields to generate comparison charts for his variable-star work; it was found on only the seventh of over 400 exposures that Beyer made with this astrograph (Beyer 1971a). On 1930 February 26, Beyer took exposures of the area around the open cluster M35 in Gemini, to obtain reference sequences (positions, magnitudes, color indices) for the variables WW Gem, WY Gem, and AA Gem. The exposure time was 40 minutes, and according to Beyer the limiting magnitude of the photograph was around 15 (Figure 3). The exposures were scientifically useless, since clouds moved in before the North Polar Sequence could be photographed (as the standard sequence for reducing other stellar magnitudes). The next nights were hazy, and then the typical Hamburg weather struck. On March 5, Beyer developed the single shot. The result was "a bad disappointment. There was a streak-shaped emulsion defect crossing the impressive picture of the cluster M35. When inspecting the plate with a magnifying glass, I notice a faint diffuse trail 2° north of the cluster with a position angle of 344°" (Beyer 1930b).

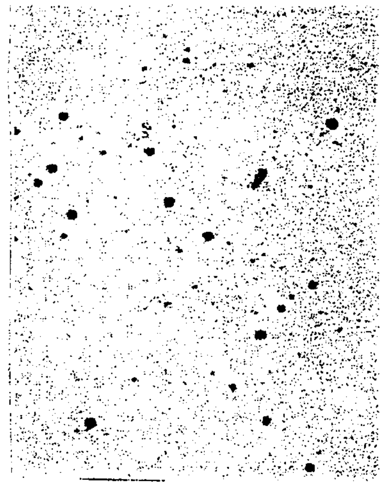


Figure 3: discovery photograph of Beyer's comet; note the trail towards the upper right corner (from Beyer 1952).

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Beyer did it right. He inspected the trail more closely, since he suspected another emulsion flaw. However "with this diffuse trail, such a flaw was not evident. The trail was very straight and uniform and evoked the impression of a real image." Beyer also made sure that the object was absent on earlier photographs of the same region. He computed the apparent daily motion and the position angle. Now the drama began. One can imagine what it meant when he writes: "Not before March 11, thirteen days after the first picture of the questionable object had been taken, did the skies clear." To make things worse, the moon was now in the evening sky — it was 3 days before full moon. Beyer was definitely not the person to report questionable objects in order to ascertain their priority, and then look to see what happens. Since Beyer did not know the direction that the object was moving, he had to take two more photographs. "Next day I found a very faint nebular spot 1° from the extrapolated position". Still Beyer's nerves were sufficiently calm. "Although I was meanwhile sure that this was the same object, I wanted to perform another control before publishing the discovery, to be absolutely sure".

On March 12 he did the following things: (1) he found the object visually with the 115-mm refractor at the expected position; (2) he made another photo of the region; and (3) he visually detected the apparent motion within 1.5 hours. This required much effort because of the brilliant moonlight. Now it was time to report his find: "Any final doubts were removed, when at midnight a black cloud obscured the sky and snow fell. The same night the approximate positions on the plates were determined. The rest was done according to the instruction in the ***Astronomisches Handbuch*** (C. Hoffmeister, 'Which steps must be followed in case of a comet discovery?'). In the early morning hours, a telegram was sent to the central bureau at Kiel. Already on the following evening, the comet could be confirmed both at Bergedorf and in Milan." Beyer (1930a) announced his find on March 14 in a ***Beobachtungs-Zirkulare*** (*B.-Z.*), where he provided 1855.0 positions for Feb. 26 and Mar. 11 and 12. Interestingly, the *IAU Circular* announcing the discovery of Beyer's comet — and containing Beyer's observation of March 11.854 UT — also included a brief announcement from Lowell Observatory of the discovery of Pluto (Strömgren 1930).

The quiet, calm, and critical way that Beyer handled his comet discovery may serve as a guide even for today's comet hunters. Since Beyer has described his discovery in detail in the journal *Die Sterne* (Beyer 1930b), it is very easy to reconstruct the events. It is evident that Beyer was quite lucky. When plotting the comet track on a star atlas, it becomes evident that the comet did move on a slightly curved path. He underestimated the apparent daily motion (Beyer gave 29′, which should have been given as 35′). Beyer was lucky that the daily motion of the comet decreased in the following days and that the curved path did not take it very far away from the expected direction. Beyer was thus able to find his object only $\approx 1^\circ$ off the predicted position. Without the clear nights on March 11 and 12, finding the comet again would have been more difficult, as the comet moved further eastward. The Astronomical Society of the Pacific (ASP) gave its Donohoe Comet Medal to Beyer for the discovery of this comet (Campbell *et al.* 1930); Beyer evidently received this Medal one day after his 36th birthday (Gebhardt 1982).

The Nazi years brought additional annoyances for unconventional people such as Beyer (and really severe trouble for his mentor Kasimir Graff). For a while the Gestapo considered Beyer a spy, since they had intercepted coded variable-star observations he received from Russian observatories. Though their investigations, of course, did not uncover any hard facts, they found Beyer a bit suspicious and mysterious, but they did not bother him seriously. The advantage of that situation was that Beyer generally was not urged by the Nazis to show more political engagement. Later in World War 2 (in 1944), Beyer was suspended in his position as an officer because the opinions that he had expressed were not in line with the Nazi ideology (Larink 1983; Gebhardt 1982).

WW2 had a significant impact on Beyer's life. Again he became a soldier, but this time his duties were more adequate for his qualifications: Beyer was sent to the naval observatory at Wilhelmshafen, where he had to help with the computation of the tides. Later in the war, he moved with the observatory to Greifswald and Cuxhaven. Beyer was a captain at both the Marine-Observatorien Wilhelmshaven and at Greifswald (Beyer 1980). Navy service did not stop Beyer's observing program completely, and he wrote: "This work was difficult because of the wartime conditions. At the various sites only small and portable binoculars (2×27-mm opera glass, 8×54-mm binoculars), and two small telescopes of aperture 80 and 50 mm and focal lengths of 50 and 30 cm, could be used. Photographic and spectral investigations were out of the question. As the war slowed down the postal services considerably, the discovery messages were often delayed by some weeks. Thus the observation of new comets often began very late" (Beyer 1948). At Greifswald, Beyer sometimes also used the 8-inch refractor of the University Observatory; however, the telescope was soon dismantled to protect it from possible allied bombing. After the war, he was corvette captain of a German unit (under Allied supervision) used to demolish sea mines in the Baltic Sea. In total, Beyer had been a soldier for 11 years of his life, including 1939-1946.

Beyer's later life

Beyer's apartment at Hamburg-Hamm, including his rooftop observatory and most of his documents, were destroyed by an allied air raid on Hamburg in March 1943, but probably that event catalyzed his later career as an amateur observer. "You may imagine the impact of that event on my life. And you also may imagine how grateful I was when Professors [Otto] Heckmann and Larink offered me an apartment at Bergedorf observatory and also access to the facilities there" (Beyer 1960). Beyer and his wife lived in Larink's observatory apartment until 1960, when they moved to a house nearby. This ensured that his close contact to the professional community continued in post-WW2 Germany. He remained a teacher at a special school for professional training in Bergedorf, not far from the observatory. Living at the observatory site made it possible for Beyer to use brief periods of clear sky for his extensive comet and variable-star observation program. In fact, in some years Beyer accumulated more observing hours than all professionals at the observatory combined.

The 26-cm equatorial refractor in Bergedorf was Beyer's favorite instrument (Figures 2b and 2c), and he used it for 32 years until his forced retirement from observing in 1977 (Beyer 1980). This was the oldest and smallest instrument, built by Repsold in 1867 (Schramm 1996). Due to Beyer's activities, the Repsold refractor became the most-used instrument on the observatory site. However, some unknown problems emerged: "Unfortunately the observations with the 26-cm refractor are hampered more and more by the trees close to the site. Most of these trees are on a cemetery, [and] the authorities do not approve cutting [the trees]". In that cemetery, by the way, is buried Bernhard Schmidt, the inventor of the Schmidt camera. Beyer lamented in a 1968 letter to Brian Marsden that "it is forbidden to cut off a single branch". Today, the 26-cm dome is situated nearly inside a forest. Light pollution became another serious problem, especially due to the booming West German economy. From 1945 to 1954, Beyer's limiting observable stellar magnitude deteriorated by 1.5 magnitudes. "The continuously increasing illumination of the sky by streetlights and illuminated advertising is extremely annoying" (Beyer 1963).

After serious accidents in 1967 and 1977 (Gebhardt 1982), he barely managed to walk to the telescope (Larink 1983). On 1967 January 8, Beyer was "run down by a car [in] a serious auto accident" (Beyer 1968), and was unable to observe again until September of that same year. But he regained his health and would continue observing comets into 1976. That summer, he and his wife spent the last of 43 consecutive summer vacations at a resort in the Tyrolian Mountains; when they returned home that year, his wife became very ill and required Beyer's constant attention (Beyer 1980) until her death on 1981 March 31 (Gebhardt 1982). Unfortunately, Beyer broke his left thigh bone while climbing into bed on 1977 March 3 (Beyer 1977, 1979, 1980), and he was hospitalized for some months; when Beyer went home, he was unable to walk without two crutches. Later that same year, he wrote: "In my age of 83 there is no hope, that the old bones can be cured again. Therefore my observational activity has finished" (Beyer 1977). From that point on, Beyer relied on friends with automobiles and on taxis to get out (Beyer 1980). But Beyer continued his correspondence with astronomers for another few years before his death on 1982 November 14 at the age of 88.

During a 'full-moon convention' after his death, many of Beyer's documents and books were distributed among amateurs. Visitors at this meeting who thus acquired Beyer's material included Erwin Gebhardt and Wolfgang Busch. When some of these older people moved, not wanting to discard Beyer's things, they sought out co-author Lüthen (and another Hamburg amateur, Christian Harder) to distribute this material; Lüthen was then issuing a comet observers' newsletter and was known in Hamburg circles as a comet observer. In this manner, Lüthen was sent packages containing Beyer's books, documents, and other things related to Beyer. Unfortunately, the Vollmondkränzchen were soon discontinued after Beyer's death. When co-author Bortle expressed his regret in a letter to Beyer that he could not obtain the Beyer-Graff Atlas because it was out-of-print, Beyer generously sent his own personal field copy of the atlas to Bortle; Beyer retained a bound copy of the volume for himself.

The comet observer

This collection of Beyer materials acquired by Lüthen added to a considerable file containing reprints of his series of 17 famous papers on "physical observations of comets" that were published over the years in ***Astronomische Nachrichten*** (*A.N.*). Also included in Lüthen's archive are an ink drawing titled "tail profile of comet Arend-Roland (1956h), 1957 May 13-June 1)" (Figure 4) and his personal issue of the 1975 edition of Marsden's ***Catalogue of Cometary Orbits***, in which Beyer had marked and numbered all comets he has sighted. The list begins with the great January comet of 1910 and ends with 76P/West-Kohoutek-Ikemura. Notes on a reprint confirm that he saw additional comets. The last entry on that list was C/1975 V1 (West), a few observations of which are published in this issue of the *ICQ*. Thus, Beyer's comet observations essentially began and ended with two "great comets".

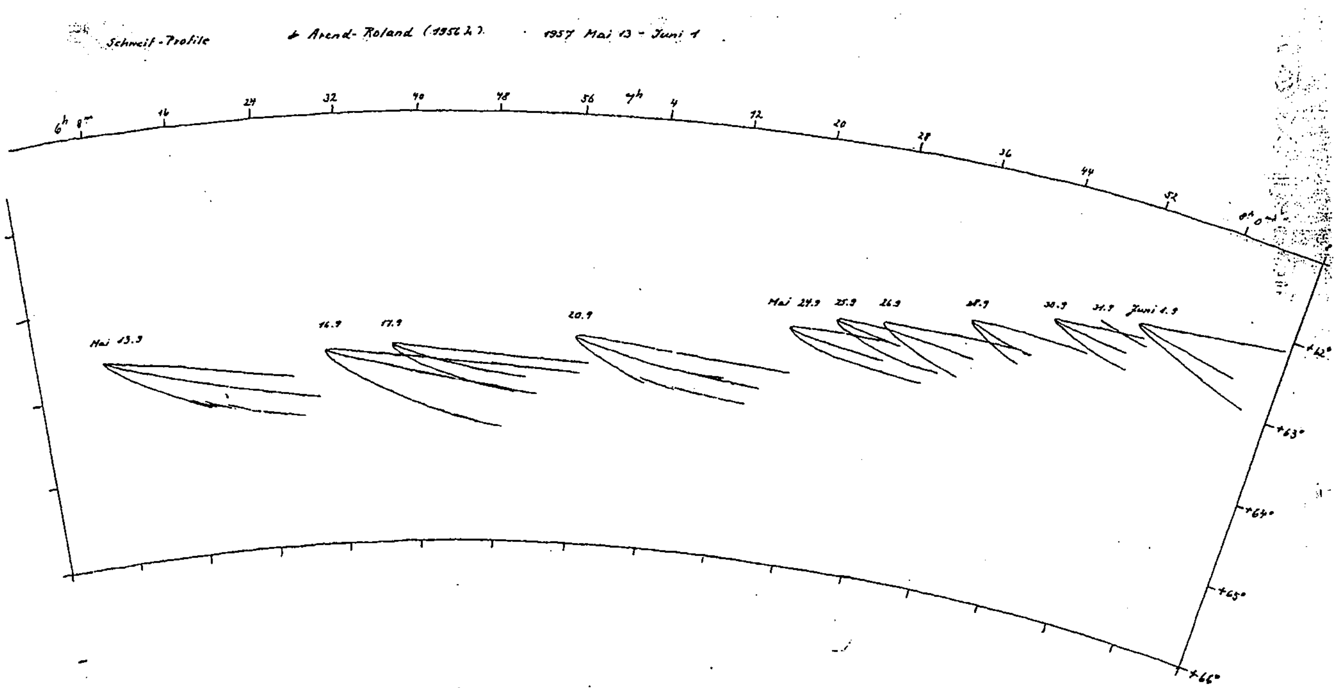

Figure 4. Tail profiles of comet C/1956 R1 (Arend-Roland). Ink drawing by Max Beyer.

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Larink (1983) writes: "Beyer himself quantified his observational effort after the end of World War II: 135,223 individual observations of 1004 objects, (not counting 7616 reference stars), 90 percent of which have been published". These numbers refer to observations of variable stars, planets, comets, and nebulae (Beyer 1980). Beyer's 125,978 variable-star observations between 1922 and 1976 (Beyer 1972b) would have ranked him within the top ten variable-star observers of all time up to 1980. He made 3004 observations of 119 comets [although the numbering in his personal copy of Marsden's 1975 comet catalogue and his handwritten notes on a reprint of a paper in *A.N.* (Beyer 1975) deviate slightly; a list can be compiled from various sources Beyer 1969, 1975, 1976)], for which he made 3999 observations of comparison stars with a wedge photometer to obtain their magnitudes. Several elaborate statistics of these observations are found among Beyer's documents (e.g., Beyer 1943, 1975).

Beyer determined the magnitudes of *all* reference stars individually by using an artificial star photometer and used the North Polar Sequence (NPS) as a reference (cf. Green 1997). Beyer explained this procedure in numerous places, including a 1970 letter to former ALPO Comet Section Recorder Dennis Milon (the pertinent contents of which were published by Green 1992). Beyer considered the problem of different photometric systems to be the greatest of the reasons why total-magnitude estimates of comets varied from observer to observer (Beyer 1971a). During 1923-1939, Beyer measured the brightness of all comparison stars with his wedge photometer, using the stars "of the Northern *Harvard* Polar Sequence" (Beyer 1971a; emphasis his). He added, "With exception of the magnitudes in the Revsied Harvard Photometry (stars brighter than mag 6.5) [in] ***Harvard Annals* 50** and **54** (faint stars), most Harvard magnitudes were not reliable and were affected with considerable systematic errors of 0.3 mag and more." Prior to 1946, Beyer apparently converted the magnitudes from ***HA* 50** according to a formula given by R. H. Seares in the *Contributions of Mount Wilson Observatory* No. 288.

Beyer (1971a) continued: "Especially the [catalogue in ***Harvard Annals* 74**, Durchmusterungszonen of Pickering] is very unreliable. It is a pity that my friend Prof. Kasimir Graff used the magnitudes of ***HA* 74** in order to calibrate Holetscheck's observations of nebulae and clusters. Therefore in 1946 I changed my photometric system and measured all my comparison stars using the magnitudes of the International Photovisual Polar Sequence (Ipv)." Beyer (1980) later elaborated: "The comparison stars must be measured by a photometer with the well-known stars of the Polar Sequence (*Ipv* = international photovisual). All my [photometric observations] were done by help of a wedge photometer ([after] Graff). A small pocket 4-volt lamp was used by only one Akku (2 volts). The [neutral-glass wedge was] from Zeiss-Jena". Beyer added that his own report "on this very reliable instrument" had been published in 1926 (Beyer 1926a). He remarked that, "as these photometric measurements [of comparison stars] have to be made only under good atmospheric conditions and [at] higher altitudes [above the horizon for] the stars, it [takes] often a longer time before the total magnitudes of the comets can be derived" (Beyer 1970).

Using the NPS with a large equatorial telescope like the Hamburg 26-cm equatorial is definitively a quite tedious process. In all of his tabulations of comet magnitude data in the *A.N.*, from his 1926b and 1933 papers onwards, Beyer carefully listed the comparison stars and their derived magnitudes. Deriving the magnitudes for comparison stars was a very lengthy and laborious procedure that Beyer took very seriously — and one that often caused comet magnitudes to be delayed for considerable periods of time until the comparison-star magnitudes could be determined (Beyer 1968, 1972a). For example, he observed seven comets in 1969-1970, for which he made 911 measurements over 20 nights (1970 Nov. 20-1971 Apr. 26) of 191 comparison stars — finally permitting the comet magnitudes to be reduced (Beyer 1972a). Indeed, the inner consistency of Beyer's data, using his very standardized methodology, is very high.

The *ICQ* archive contains some 2400 comet observations by Beyer with magnitude information, spanning the years 1926–1970, that were published by Beyer in the *A.N.*; most of these data were added to the *ICQ* archive in the early 1990s (Green 1991, 1992), and they include 571 tabulated 1-line observations of 18 numbered short-period comets and 1853 observations of 73 long-period comets from C/1925 G1 to C/1970 U1. There are, however, additional numerous early comet observations that have no indication of instrumentation in the published literature (e.g., Beyer 1930c) and that have not yet been added to the *ICQ* archive for this reason. The *ICQ* database includes most of Beyer's magnitude estimates, but there were ambiguous cases in which Beyer was not clear in his *A.N.* reports as to what instrument was used for each magnitude estimate (and the special-note letter 'i' was established to denote that the m_1 estimate may have been made using an instrument different from the coma-diameter and tail measurements, or that sometimes two instruments were given without indication as to which instrument was used for which measurement).

Beyer ranks in the top ten observers in the *ICQ* archive in terms of numbers of observations (Green 1998). This remarkable accomplishment is a result of the huge effort that Beyer made in spite of the terrible weather ("Schietwetter") at Hamburg; the data are of high value not only because of the many observations, many comets, and many years involved, but also due to the care undertaken by Beyer to ensure uniformity in the procedure for acquiring the data. Around a hundred additional observations made by Beyer in the 1970s (and made available by Beyer to Marsden and Ferrin in various letters) are on hand. Previously unpublished observations (including both tabulated data and descriptive information) for comets 21P, 59P, C/1972 U1, and C/1975 N1 appear in this issue of the *ICQ*, together with four naked-eye observations of C/1975 V1 (West); note that magnitude reference 'AN' is given in the tabulation in this issue, which was established for the archived *A.N.* data to denote that the comparison-star magnitudes derived by Beyer were published with his *A.N.* papers (though Beyer did not provide such comparison-star information with his cometary data in the personal letters to Marsden and Ferrin from which these unpublished data were extracted). There remain unpublished observations of Beyer's on hand for C/1973 E1 (7 nights), C/1974 C1 (27 nights) and C/1975 V1 (26 nights), which must await checking of the original logbooks to see which instruments were used for making the observations.

Beyer's method (*ICQ* code 'E', the "Extrafocal-Extinction" method) for estimating comet magnitudes is easy to employ (the reference stars and the comet are defocused until they are no longer visible, the observing noting which object disappears from view first). The *ICQ* discourages the use of Extrafocal-Extinction method due to various inherent problems (cf. Bobrovnikoff 1943; Meisel and Morris 1976; Morris 1980; Green 1996) that concern dependency on the sky background and comet's degree of condensation, and today few observers still employ this method. (Ferrin also published a study of the Beyer method in 1992 and has encouraged further investigation of the method.) Yet it is important to note that Beyer was the first systematic observer of comet magnitudes who regularly noted not only his methodology but also the comparison stars (and their magnitudes, derived by Beyer). As might be expected, it seems that Beyer developed his method while performing his early observations of comets, the first mention of his methodology not appearing until in the 1930s (Beyer 1933, 1934). Despite the fact that researchers using Beyer's comet-magnitude data need to consider systematic effects introduced by his methodology when comparing his data to those of other observers using different methods, Beyer's magnitude data on comets stand out as being unique for several decades, during which few other observers were putting in much effort at serious comet-magnitude estimation.

Beyer also made total magnitude estimates of deep-sky objects, and upon winning the ASP Comet Medal this was duly noted: "his brightness estimates of clusters and galaxies permit rigorous comparison of his cometary observations with the earlier ones of Holetschek, on the one hand, and with modern photoelectric measurements, on the other" (Perkins 1972). During 1943, Beyer used the nightly war blackouts to measure the total magnitudes of 81 non-stellar objects (clusters, galaxies, etc., with about half being the Messier objects); no similar highly accurate data set for deep-sky objects has been replicated since by visual means. Some of Beyer's magnitudes for deep-sky objects were published by Bortle (1984), but Beyer had clearly been inspired by Graff (1931-1938), who had earlier tackled the problem and was in turn influenced by the work of Holetschek. In the first half of 2001, Beyer's magnitude estimates of numerous deep-sky objects, as supplied to Sekanina (Beyer 1971b, c), will be published in the *ICQ*. Beyer was evidently influenced by the earlier work on deep-sky magnitudes by Holetschek and by Graff (1947-1950). Regarding Holetschek, Beyer (1971d) commented: "Graff assumes that Holetschek estimated the brightness of nebulae and comets in a scale from memory, which was based on the BD magnitudes. Only in special cases [did] Holetschek [compare] nebulae with stars".

One of Beyer's scientific aims was to demonstrate a correlation between solar activity and comet magnitudes (Beyer 1952, 1953). In some cases, he found magnitude fluctuations to correspond beautifully to changes in relative sunspot numbers; in other cases, they may reflect wishful thinking rather than a true features (Figure 5). Beyer discussed the comet-solar connection throughout his career, as evident from his published papers. His main interest in this connection is perhaps present in a letter that he wrote in 1971, in which he remarked on cometary outbursts in brightness: ". . . I think that the observation of [comets'] brightness is necessary, as these celestial objects are natural probes [of] interplanetary [space]" (Beyer 1971b).

Beyer was one of the first astronomers, together with Sergej Vsekhsvyatskij, to work on the problem of solving for values of n in the standard power-law formula ($m_1 = H + 5 \log \Delta + 2.5n \log r$) for each comet and then publishing them in his *A.N.* papers (e.g., Beyer 1933, 1934). Very early in his observing career, Beyer was making astute insights into the problems surrounding comet observation, including aperture effects (Beyer 1933). He noted early that comets appear brighter in small instruments and advocated the use of small-aperture instruments whenever possible for magnitude estimation. (It is curious, therefore, and frustrating for current researchers, that Beyer did not always carefully note in his *A.N.* articles and personal letters to other astronomers which comet magnitude estimates of his were made with

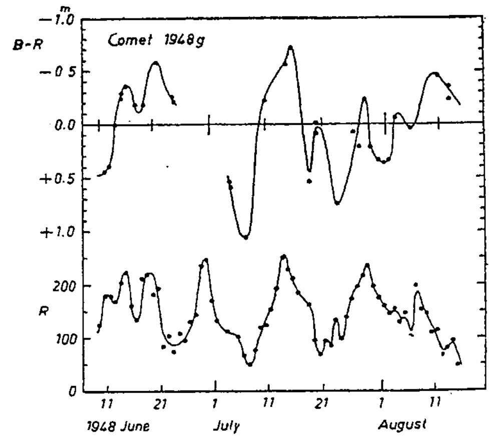

Fig. 3. Fluctuations of the brightness of Comet 1948 g and the reduced relative numbers of sunspots.

Figure 5. Beyer's painstaking effort in observing comets intended to find a correlation between solar activity and cometary brightness. This figure shows the brightness of comet C/1948 L1 (Honda-Bernasconi, upper curve), as compared to the relative sunspot number (corrected for the effect of heliocentric latitude). From Beyer (1953).

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which instruments.)

Beyer was quite established among professionals. His mentor Graff had tried without success to urge Beyer to join his staff at Vienna as a professional, but he refused all these ideas and remained an amateur for all his life. But Beyer published many papers in professional journals and visited numerous accessible national and international professional meetings. Larink wrote that his success was based "not only on his enormous vigour but on his reliable instinct to recognise which scientific problems were both interesting and still technically feasible for him" (Larink 1983). Beyer received various honors and became a member of several academies. He was a member of the Astronomische Gesellschaft (the organisation of German-language professional astronomers) for more than 50 years, and in 1951 he was awarded the title of "doctor *honoris causa*" from Hamburg University. In 1959, Beyer was honored with the naming of minor planet (1611) = 1950 DJ, which had been discovered by Karl Reinmuth on plates taken at Heidelberg on 1950 February 17; Reinmuth proposed the name "Beyer" for Max Beyer (Herget 1959). More than four decades after winning the ASP Donohoe Comet Medal, Beyer was given the renamed ASP Comet Medal in 1972 "to recognize outstanding contributions of a nonprofessional astronomer in the study of comets" (Perkins 1972). But Beyer's observations will last for ages as the best consistent series of magnitude estimates of comets for nearly half of the 20th century.

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COMETS FOR THE VISUAL OBSERVER IN 2001

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As of this writing, one moderately bright long-period comet and two relatively bright short-period comets offer the best prospects for visual cometary observations during 2001. Several fainter comets, both long-period and short-period, should be accessible to visual observers with larger instruments throughout the course of the year.

Long-Period Comets

Comet C/1999 T1 (McNaught-Hartley)

Discovered as far back as 1999 October 7 at Siding Spring (Australia), this comet passed perihelion on 2000 December 13 ($q = 1.172$ AU) and initially offered hope of being a dim naked-eye object around that time. C/1999 T1 has been under visual observation from the southern hemisphere since June 2000, and has consistently remained approximately one magnitude fainter than the original expectations. At this writing (mid-November 2000) it is slightly brighter than $m_1 \simeq 9$, and if it maintains the trend that it has exhibited to this point, it should reach a peak brightness of $m_1 \simeq 7.5$–8 at the end of 2000 and beginning of 2001. It is nearest the earth ($\Delta = 1.29$ AU) in early February 2001.

Up until the time of this writing, comet C/1999 T1 has remained visible exclusively from the southern hemisphere. It should become accessible from the northern hemisphere near the end of November 2000 — and when brightest should be conveniently accessible from both hemispheres. By the end of March 2001, the comet will enter northern-circumpolar skies, but by that time it will probably have faded to $m_1 \simeq 10$-11. Visual observers should be able to follow it until perhaps July or August.

Fainter Long-Period Comets

Most of the fainter long-period comets that should be detectable with visual instruments during 2001 are large-q objects that have been discovered by the LINEAR program in New Mexico. C/1999 T2 ($T =$ 2000 November 24, $q = 3.04$ AU) was near $m_1 \simeq 13$–13.5 in July and August 2000 and should be at a comparable brightness when near opposition in late April 2001. C/1999 Y1 ($T =$ 2001 March 24, $q = 3.09$ AU) is near opposition at this writing and is slightly brighter than $m_1 \simeq 13$; after being in conjunction in March 2001, it should be comparably bright in July and August when again near opposition. C/2000 CT_{54} ($T =$ 2001 June 19, $q = 3.16$ AU) may be near $m_1 \simeq 13$-14 around the time of perihelion; it will remain in southern-circumpolar skies ($\delta \simeq -70°$). Recently discovered C/2000 SV_{74} does not pass perihelion until 2002 May 1 ($q = 3.54$ AU), but during the latter months of 2001 it should be near $m_1 \simeq 13$–13.5 in northern-circumpolar skies near $\delta \simeq +60°$.

Other long-period comets that might become visually observable during 2001 include the Spacewatch discovery C/2000 OF_8 ($T =$ 2001 August 5, $q = 2.17$ AU), which may reach $m_1 \simeq 13$–14 when near opposition in early June and in southern-circumpolar skies near $\delta \simeq -55°$. Comet C/1999 U4 (Catalina-Skiff), which is at perihelion on 2001 October 28 at a distant $q = 4.92$ AU, is at opposition in early 2002 (in northern-circumpolar skies near $\delta \simeq +75°$) and may be near $m_1 \simeq 14$ during the latter months of 2001.

Short-Period Comets: The Brighter Ones

Comet 24P/Schaumasse

This comet has a moderately favorable return in 2001, with perihelion passage occurring on May 2 ($q = 1.205$ AU). It remains in the evening sky throughout its apparition, and should be visually observable from perhaps February until perhaps July. The peak brightness should be near $m_1 \simeq 10$-11 and should occur around the time of perihelion.

Comet 19P/Borrelly

Although the 2001 return of this comet is not as good as the recent ones in 1987 and 1994, it is nevertheless moderately favorable and the comet should be relatively easy to observe. It passes perihelion on September 14 ($q = 1.358$ AU) and should reach a peak brightness near $m_1 \simeq 10$-11 in September and October. The comet remains in the morning sky throughout the visually observable phase of its apparition, and should be detectable from perhaps June or July until early 2002.

The *Deep Space 1* spacecraft (the first mission under NASA's 'New Millennium' program), which was launched on 1998 October 28 and subsequently encountered the Mars-crossing minor planet (9969) Braille on 1999 July 28, is expected to encounter 19P/Borrelly on 2001 September 24.

Short-Period Comets: The Fainter Ones

Comet 41P/Tuttle-Giacobini-Kresák

The 2001 return of this comet (T = January 6, q = 1.052 AU) is relatively unfavorable, and the comet remains at a morning-sky elongation near 45° throughout the period of time when it is brightest (December 2000 and January 2001). Under ordinary circumstances, it would not be expected to become any brighter than $m_1 \simeq$ 13-14; however, it has occasionally been prone to significant outbursts at some previous returns, notably two outbursts of 9-10 magnitudes each (to $m_1 \simeq$ 4-5) in 1973 and one of $\approx$ 6 magnitudes (to $m_1 \simeq 8$) at the most recent return in 1995. Despite the relatively poor geometry, it might thus be worthwhile to monitor this comet during this return, in case it exhibits additional outburst activity.

Comet 45P/Honda-Mrkos-Pajdušáková

This comet's 2001 return (T = March 29, q = 0.528 AU) is also quite unfavorable. It remains hidden in the solar glare at a small elongation until after perihelion, but it may briefly be visible in late April and early May (elongation near 40°, $m_1 \simeq$ 10-11) before fading away. It will be in the evening sky at that time, and northern-hemisphere observers are favored.

Comet 29P/Schwassmann-Wachmann 1

Although this comet has been relatively active during the recent past, exhibiting 1–2 outbursts per year on the average, it appears to have been quiet during its 2000 opposition, with no outbursts definitely being recorded. Whether it continues this lack of activity into 2001, or again starts to undergo its characteristic outbursts, remains to be seen. In 2001 it emerges into the morning sky around February, is at opposition in early July, and remains visible in the evening sky until around November. The southerly declination ($\delta \simeq -28°$) will slightly favor observers in the southern hemisphere, and the fact that the comet spends the entire 2001 viewing season in the Sagittarius Milky Way will make observation attempts somewhat more difficult than they otherwise might be.

Other objects

The low-orbital-eccentricity (e = 0.15) comet 74P/Smirnova-Chernykh is at perihelion on 2001 January 15 (q = 3.46 AU) and is at opposition in mid-March 2001, and it may possibly be visually observable at $m_1 \simeq 14$ during the early months of the year. Comet 110P/Hartley 3, at perihelion on 2001 March 21 (q = 2.48 AU) and at opposition in late November 2000, may also be near $m_1 \simeq 14$ during early 2001.

One additional object that might be worth visual observation attempts is the "minor planet" 2000 DG_8, discovered by LINEAR on 2000 February 25. Despite its exhibiting a completely asteroidal appearance, it is nevertheless moving in a retrograde 1P/Halley-type orbit (P = 35 years, e = 0.79, i = 129°). It passes perihelion on 2001 January 9, at q = 2.230 AU, and is at opposition in early December 2000; application of an asteroidal brightness formula suggests it will reach a peak brightness of $m_v \simeq 16$ around that time. If it does exhibit any kind of cometary activity, it is possible that it may become slightly brighter than this — although, as of this writing, no such activity or brightening have apparently been detected.

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2001 COMET HANDBOOK

The ***2001 Comet Handbook*** is being issued immediately after this regular issue of the *ICQ*. This fifteenth edition of the *Comet Handbook* contains orbital elements and ephemerides for 137 different comets. It is available for $8.00 for a single copy to *ICQ* subscribers; additional copies, and all copies for non-*ICQ*-subscribers, may be purchased for $15.00 each, postpaid (see the second page of this issue for payment instructions).

Only half of the 136 comets listed in the *2000 Comet Handbook* were observed in the year following 1999 Dec. 8, according to positive observations received by the *ICQ* and the Minor Planet Center. Three of those comets (37P, 86P, 142P) not detected were reported as being too faint by observers with large instruments. But there were no observations for 18 comets predicted to be brighter than mag 18, another 25 comets predicted to be brighter than mag 20. Granted, a few of these particular 43 unobserved comets are short-period comets that have been observed only at one previous return to perihelion, and a few were at relatively small elongations from the sun for most of their "observable" year. And it is possible that some observers tried looking for some comets and did not submit formal reports to the *ICQ* for publication when nothing definite was found. But eager CCD observers should be able to detect some of these comets, and at any rate, we ask all observers to submit reports with limiting magnitudes for comets not detected, as such information can be scientifically useful just as are positive observations. And if any CCD observers attempted unsuccessfully to look for certain comets fainter than predicted mag 15 in the past year, it would be useful for them to compile their reports and send them for publication now in the *ICQ*.

News Concerning Recent Comets

After having a fairly regular column under this title in this journal going back fully two decades, I have had a four-year lapse for numerous reasons (the last such column appearing in the April 1996 issue). It is true that much information regarding recent comets under observation is given in the tabulated and descriptive data in each issue of the *ICQ*, together with additional articles and the regular table entitled "Designations of Recent Comets" — and one might include the availability of orbital elements, ephemerides, and light-curve parameters in the annual *Comet Handbook* (so that indeed *all* comets get at least mentioned in the *ICQ*). Yet it has been noted that, in my work with the International Astronomical Union (IAU) Central Bureau for Astronomical Telegrams (CBAT) — whereby new comet discoveries are announced on *IAU Circulars* — I am privy to potentially interesting information that may not otherwise get reported, and that continuing this column therefore has some genuine usefulness. So while it would not make sense to cover in this one column installment all of the comets discovered or observed in the past four years, I will try to do a general review and list some of the highlights (with some added perspective) and issues that have been brought up, particularly regarding discovery circumstances and naming of comets.

Readers will be well aware of the tremendous increase in the number of comet discoveries since I last wrote this column, due to the phenomenal successes of near-Earth-object (NEO) CCD survey programs such as that run by the Massachusetts Institute of Technology's "Lincoln Laboratory Near Earth Asteroid Research Team" (or LINEAR). CCD surveys have dramatically increased the number of comet discoveries by accessing more sky, more quickly, to fainter limiting magnitudes than was possible with the previous photographic surveys. There has also been a tremendous increase in assigned comet designations because of hundreds of apparent comets being found on images taken by the SOHO spacecraft — though only one of these, C/1998 J1, has been detected by ground-based observers[1] — beginning in 1996 and continuing to the present day; many of the SOHO comets are now being found by amateur astronomers using their computers to access the images via the SOHO website, but the complex astrometry reduction is still left to the SOHO team and the Minor Planet Center (MPC) staff. LINEAR began discovering comets in 1998, changing possibly forever the way that comets are found. From 1990 to 1997, there was an average of 11-12 new comets discovered each year (plus about one 'lost' comet rediscovered each year). From 1998 through October 2000, the average has been 32 new comet discoveries per year — a tripling of the pre-LINEAR discovery rate.[2] With all the survey comets, combined with the ready availability of CCD cameras for amateur usage, there are now some six dozen comets under observation each year via astrometry and/or photometry.

Are these CCD surveys finding comets that amateurs would normally have found in the past? The number of amateur discoverers is certainly down. Since April 1996, there have been six visual comet discoveries by Australian amateurs: C/1996 Q1 (Tabur), C/1997 O1 (Tilbrook), C/1998 P1 (Williams), C/1999 A1 (Tilbrook), C/1999 H1 (Lee), and C/1999 N2 (Lynn). Among the visual discoveries since 1996, two were made by Justin Tilbrook of Clare, South Australia, and two more by Syogo Utsunomiya of Azamihara, Minami-Oguni-cho, Aso-gun, Kumamoto-ken, Japan [C/1997 T1 (Utsunomiya) and C/2000 W1 (Utsunomiya-Jones)]. The only other northern-hemisphere visual discovery of a comet since 1996 was the accidental finding of C/1998 H1 by Patrick L. Stonehouse of Wolverine, MI (U.S.A.). Michael Jäger made what appears to be an increasingly rare amateur photographic discovery through his finding P/1998 U3. Six amateur discoveries of comets have been made now with CCDs: P/1997 B1 (Kobayashi), C/1997 J2 (Meunier-Dupouy), P/1998 QP_{54} (LONEOS-Tucker), P/1999 DN_3 (Korlević-Jurić), P/1999 WJ_7 (Korlević), and P/1999 X1 (Hug-Bell). The comets found by Kobayashi and by Korlević (and Jurić) were all reported as asteroidal by the discoverers and were determined to be cometary by other observers later; Tucker independently reported his discovery of P/1998 QP_{54} as a comet, while LONEOS had reported the same object as asteroidal.

Many of the comets found with the professional CCD surveys have become observable in amateur instruments. Of the 78 survey comets discovered (and re-discovered) since the end of 1997 (as of mid-October 2000), ten have become brighter than total visual mag 12, seven have become brighter than $m_1 = 10$, and four have become brighter than $m_1 = 8$. While one would think that the Edgar Wilson Award would be now encouraging many amateurs to exude great effort at discovering new comets, the large CCD surveys must be cutting down on the number of comets available for amateurs to find, as these surveys are covering more and more sky each month and are getting comets more routinely when they are fainter than had been the situation a few years ago. Furthermore, the ever-worsening effects of light pollution worldwide should not be underestimated — a factor that disheartens many amateurs (and probably prevents younger observers from employing any time at comet hunting); this is one reason why the *ICQ* maintains its extensive NELPAG webpages on light pollution. The additional new availability (as of the past decade) of cheap CCD cameras, combined with much cheaper and faster personal computers, probably encourages many newer amateurs to forego visual observations with CCD observing, leading in turn to a lack of desire to employ the extra efforts needed to observe visually (and the light-pollution issues surely encourage CCD observing over visual observing for many today).

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[1] SOHO has also detected other known comets, including 2P in 2000 and 96P in 1996.

[2] For all these statistics, discoveries are attributed solely according to accepted namings (excepting C/1996 R3, which was not named but considered here to be a survey comet) of comets observed from the ground (thus including C/1998 J1, also as a survey comet); P/1998 QP_{54} (LONEOS-Tucker) is considered here as a survey comet, as are comets P/1998 Y2 (Li), C/1999 E1 (Li), C/1999 F2 (Dalcanton), and all of the comets discovered with the Schmidt telescopes at Palomar and Siding Spring.

With this dramatic increase in survey discoveries of comets, there has also come an increase in the different types of discovery circumstances that need to be considered for naming comets. In the 1990s, the naming of comets moved from what had been strictly the domain of the CBAT and its overseeing IAU Commission (6), but former CBAT Director Brian G. Marsden wanted to have some of the 'pressure' regarding naming issues taken off the CBAT by blending the comet-naming decision-making process into the IAU's Small Bodies Names Committee (SBNC) of IAU Commission 20, which is also responsible for minor-planet names, in collaboration with the CBAT and Commission 6. Through much discussion and debate over the last several years, this Committee (whose name was changed to the 'Committee on Small Bodies Nomenclature', or CSBN, recently) has derived some general guidelines for comet naming. Comets discovered by individuals are named as before, with up to three names (if a comet is discovered nearly simultaneously at three different sites — a rarity nowadays) or two names at a single site *if there are only two members to a team.* While J.-F. Lahitte was reported as an observer along with Philippe Dupouy for their apparent discovery of C/1997 J2, only Dupouy's name was assigned to the comet because it was evidently independently discovered by Michel Meunier at another site earlier on the same night. Larger teams (which include all of the professional CCD surveys now) are restricted to a single name for each comet — generally a team name (like LINEAR, Spacewatch, LONEOS, NEAT, Catalina, *etc.*), but occasionally the name of an observer who is assumed to be alone at the telescope and handles all of the discovery circumstances (taking of image, identification of comet, and reporting of discovery and astrometry/photometry to CBAT) is placed on the comet.

There have been several interesting twists to the naming procedure in the last few years. Comet C/1997 L1 (Zhu-Balam) was discovered by Jin Zhu in the course of the Beijing Astronomical Observatory's "Schmidt CCD Asteroid Program" at Xinglong, China. It was reported on June 3 and 4 as an apparent main-belt minor planet, and was made available by the Minor Planet Center under the unpublished minor-planet designation "1997 LN" through its computer service. While randomly making observations on the basis of two-night orbit representations for numerous presumed mainbelters in the MPC files, Balam noticed that this object was a comet. The unpublished designation 1997 LN was abandoned in favor of C/1997 L1 (Xinglong). This was later changed to C/1997 L1 (Zhu-Balam), after considerable discussion by the SBNC. Comet P/1997 T3 (Lagerkvist-Carsenty) also had considerable discussion by the Committee, the comet not being named for more than 15 weeks after its discovery was announced (see *IAUC* 6811); the problem here was that two groups were working together to discover and confirm Trojan-type minor planets, and one suspect reported by C.-I. Lagerkvist and colleagues was not only confirmed by Uri Carsenty and Andreas Nathues but was noted as being cometary in appearance. The SBNC could not get the group to come up with a reasonable combined "team name" or acronym, and so one member from each team was chosen for the name.

Comets C/1996 R3 and C/1997 K2 have not received names because they were reported well after the final observations were made, and there seems to be a general tendency not to name comets that are no longer observable at the time of discovery announcement (with the singular exception of the optical SOHO comets, which can be considered to be more 'named' to identify the comets as unusual than anything else). The observations of C/1996 R3 span only a 2-day arc (*cf. IAUC* 6564), for which only a very preliminary orbit is possible. C/1997 K2 was reported in late 1999 as the "probable discovery of a comet from its hydrogen Lyman-α emission appearing on full-sky images (wavelength range 10-180 nm) taken from the SOHO spacecraft during May-July 1997" (*IAUC* 7327); the detecting 'SWAN' instrument has a resolution of only 1°, so the astrometric data were not very good. The SWAN detection was made by Teemu Mäkinen (Finnish Meteorological Institute, Helsinki) in the course of a complete survey of visible comets in the SWAN images obtained from January 1996 to June 1998. The appearance of C/1997 K2 was claimed to be comparable to that of comet C/1997 O1 (Tilbrook) in SWAN images taken during 1997 June 17-Sept. 6, suggesting m_1 was roughly 10-12 for C/1997 K2, and the object increased in size from $\approx 2°$ to $\approx 5°$ from May to July.

One of the problems that has increased markedly in the last few years of CCD surveys stems from the fact that many surveys automatically report data to the MPC (which shares offices, and works very closely, with the CBAT on comet matters), and many detections of comets are reported with no indication of cometary activity (thus under the assumption that they are asteroidal). The astrometry, however, frequently shows that the new object has unusual motion (often with a cometlike orbit), and the MPC/CBAT generally then posts such objects on its World Wide Web 'NEO Confirmation Page',[3] encouraging observers to make more observations and report any unusual appearance (such as a coma or tail). Thus, a large number of the LINEAR comets, for example, are reported by LINEAR as asteroidal objects that require confirmation by other observers as comets. But the names committee has agreed that, in most such cases, the comet is named for the survey whose observations are responsible for calling other observers' attention to the object.

In addition to the many recent discovered comets that were initially reported as asteroidal in appearance, there have been numerous interesting objects with comet-like orbits that have remained in the minor-planet lists (with minor-planet designations) because they have not been found to show any cometary activity. Among these objects are 1996 PW (on a nearly parabolic orbit with $e = 0.992$ and T = 1996 Aug. 6). In mid-1999, two asteroidal objects designated 1999 LD_{31} and 1999 LE_{31} with ***retrograde*** orbits were not found by observers to be cometary in appearance; still more retrograde "minor planets" have since been found. Other objects found to be comets have shown some interesting dynamical "facts". For example, comet P/1998 VS_{24} (LINEAR) was found to have had a very close approach to Jupiter (< 0.01 AU) in October 1971 (*IAUC* 7071). More comets are being found with large perihelion distances, two notable recent examples being C/1999 J2 (Skiff), with $q = 7.11$ AU (which showed a 3′ dust anti-tail near perihelion; cf. *IAUC* 7415), and C/2000 A1 (Montani), with $q = 9.74$ AU.

The CBAT and MPC often expend considerable efforts at getting asteroidal objects with comet-like orbits to be confirmed as having cometary appearance, but we are finding more and more cases where such objects simply do not appear to be active comets. Other comet suspects (reported as comets) sometimes take a while to get confirmation,

[3] URL `http://cfa-www.harvard.edu/iau/NEO/ToConfirm.html`

such as C/1998 H1 (Stonehouse), which (despite being as bright as 10th magnitude) took much searching over several days for numerous observers to find due to very rough positions provided by the discoverer over several nights from plots made on a copy of *Norton's Star Atlas*! Or the recently discovered C/2000 W1, which was found moving rapidly southward near the horizon by Utsunomiya in Japan and was not found despite several searches by both northern- and southern-hemisphere observers — only to be picked up accidentally a week later by veteran comet observer Albert Jones in New Zealand with a 7.8-cm refractor as he was preparing to observe visually the variable star T Aps. The interesting twist to that story is that Jones had discovered another comet previously 54 years earlier, also while observing a variable star — C/1946 P1. At age 80, the new discovery apparently makes Jones the oldest person to have ever discovered a comet. Comet C/1998 J1 (SOHO) was the brightest ground-based comet observed since the grand performance of C/1995 O1 in 1997. But the rough positions of the comet (which was estimated to be near mag 0 on the coronagraph discovery images) provided by the SOHO-LASCO Consortium permitted only a rough orbital calculation that made searching for C/1998 J1 quite arduous for numerous ground-based observers who tried looking. Finally, eight days after its appearance on SOHO images, C/1998 J1 was detected via CCD (*IAUC* 6906) while the comet was near the Pleiades in a bright sky in Germany as it moved away from the sun's glare; the next observations, which were visual, did not occur for another six days, but the comet was well observed for weeks after that. The ground-based observations showed that the "astrometry" for the SOHO comets needed much improvement, and this spurred the SOHO team to greatly improve its procedures for measuring comet positions.

Comet 133P/1996 N2 (Elst-Pizarro) is an object with a main-belt minor-planet orbit, but observations over several weeks in 1996 continued to show a tail as long as 4′ toward the west-southwest, though with no coma (*IAUC* 6495). P/1996 N2 was subsequently identified with an asteroidal object designated as 1979 OW_7 (reported on two nights), permitting it to receive a permanent comet number (which occurs after two apparitions or returns to perihelion have been observed). Because it has not been seen to be cometary in any observations in several years outside of 1996, 133P was also given the minor-planet number (7968), indicating its "dual status" — adding to a list that includes 95P = (2060) and 107P = (4015). It was proposed a couple of years ago, as well, that Pluto be considered as having "dual status" like these other objects (due to its small size, to its being regularly observed by minor-planet and comet astrometrists without a central collecting archive for observations, to its minor-planet-like orbit, and to its presence with hundreds of other trans-Neptunian objects discovered since 1992), augmented by the numbering (10000) in the "minor-planet" catalogue; however, the fierce patriotism of numerous United States astronomers arose, forcing the IAU and the MPC to retract its proposal. But the new "Terms of Reference" for the MPC now permit it to publish and archive observations of Pluto in the *Minor Planet Circulars*, and this process began a few months ago. At least sixteen trans-Neptunian objects (TNOs) have now received permanent minor-planet numberings by the Minor Planet Center, but unfortunately Pluto was not the first (as a 10000 numbering would have made it).

There are now hundreds of known TNOs, where a TNO might be defined as an object with its perihelion distance outside 25 AU or so and with the vast majority of its orbit outside the orbit of Neptune. Such known TNOs include more than 50 plutinos (objects in 2:3 resonance with Neptune, or Pluto-like orbits) and more than 200 cubewanos (or "main-belt" TNOs with relatively low orbital eccentricities and with $a \sim$ 41-47 AU). There are also many asteroidal objects now known with orbits that cross the orbits of one or more of the outer three major giant planets (Saturn, Uranus, Neptune) — generally known as centaurs — and objects with higher orbital eccentricities and inclinations beyond Neptune known generally as "scattered-disk objects" (although the distinction between centaurs and SDOs is not always clear). It is now widely believed by solar-system astronomers that most or all of these TNOs, including Pluto, are related to comets (and likely large comet nuclei). A recently discovered TNO designated 2000 WR_{106} has an absolute magnitude (H = 3.5) very close to that of the largest known main-belt minor planet, (1) Ceres, and it is thought by many that it is just a matter of time before objects as large as (or larger than) Pluto will be found beyond Neptune.

Comet C/1995 O1 (Hale-Bopp) was, of course, the most impressive cometary apparition since the last installment of this column was published in 1996. It was much discussed in several articles in the *ICQ*, and many *ICQ* pages of both tabulated data and descriptive data (including numerous CCD images and drawings) covered C/1995 O1, as well. It is remarkable for being a naked-eye comet longer than any other in recorded history — from mid-1996 until the (northern-hemisphere) autumn of 1997. Comet C/1995 O1 was brighter than total visual magnitude 0 for a remarkable eight weeks from early March to late April 1997. New molecules detected at radio wavelengths in C/1995 O1 included DCN (*IAUC* 6641), H_3O^+ (*IAUC* 6625), HCO^+ (*IAUC* 6575), SO (*IAUC* 6573), and SO_2 (*IAUC* 6591). This comet was also found unexpectedly to have a neutral sodium tail (*IAUC* 6631, 6634, 6636, 6638), in addition to the usual ion and dust tails.

Comet C/1996 B2 (Hyakutake) was under observation and thus discussed in my last edition of this column for the *ICQ*, but I did not mention some of the remarkable results from professional observations of that comet. As was noted in the *ICQ Guide to Observing Comets*, several new molecular species were detected in C/1996 B2 (including HDO, HNC, HNCO, CH_3CN, OCS, CS, and NH_3). One unexpected finding was the detection of x-rays from comet C/1996 B2 in late March 1996 with the ROSAT spacecraft (*IAUC* 6373, 6393, 6394, 6433). As the first comet found to show x-ray emission, C/1996 B2 led x-ray astronomers to search fields that contained other relatively bright comets, and numerous other comets were subsequently reported to have been visible at x-ray and extreme-ultraviolet wavelengths (*IAUC* 6404, 6413, 6472, 6486, 6667), including C/1990 K1, C/1990 N1, C/1991 A2, 6P, and 45P. These successes spurred x-ray observers to look for x-ray activity in real-time data, as well, and positive detections at x-ray wavelengths were also made for C/1996 Q1 (*IAUC* 6495), C/1995 O1 (*IAUC* 6591, 6625), C/1998 U5 (*IAUC* 7066), and C/1999 S4 (*IAUC* 7464).

Other comets that have reached visual $m_1 \simeq 8.0$ or brighter in the past few years include C/1996 N1 (Brewington), in August 1996; C/1996 Q1 (Tabur), in September-October 1996; C/1998 J1 (SOHO), in mid-1998; C/1998 P1 (Williams), in August-September 1998; C/1998 U5 (LINEAR), in November 1998; C/1999 H1 (Lee), in mid-1999; C/1999 N2 (Lynn), in July-August 1999; C/1999 J3 (LINEAR), in September-October 1999; and C/1999 S4 (LINEAR), in mid-2000. Short-period comets reaching $m_1 = 8$ since 1996 include 2P/Encke (June 1997), 22P/Kopff (July 1996), 55P/Tempel-Tuttle (January 1998), and 103P/Hartley 2 (Dec. 1997-Jan. 1998). The return to perihelion of 55P was accompanied by another hoped-for splendid showing of the associated mid-November Leonid meteors, and elevated rates in the hundreds of meteors per hour were observed in 1998, 1999, and 2000 (though no storm levels approaching the order of 10,000 meteors per hour were seen).

Comet C/1996 J1 (Evans-Drinkwater), which was found by well-known Australian amateur supernova discoverer Robert Evans on a plate taken by M. J. Drinkwater with the 48-inch Schmidt telescope at Siding Spring on 1996 May 12, was one of several comets whose nuclei have been found to have split in the last few years. Two components of C/1996 J1 were noted by J. Kobayashi on 1997 May 5 (*IAUC* 6653, 6662). Two components for comet 141P/Machholz 2 were found in late 1999 (*IAUC* 7299). Three components were found recently for comet 73P (*IAUC* 7534). While small telescopes showed nothing at its breaking apart, large telescopes showed numerous tiny, faint nuclei of comet C/1999 S4 (*IAUC* 7461, 7471, 7476). Among comets showing outbursts in brightness in recent years, one of the more remarkable might be that regarding comet 52P/Harrington-Abell in mid-1998, when it was found to be at $m_1 \sim 12$ wile predicted to be some nine magnitudes fainter.

And some additional comets have been seen apparently to break up fatally, including a comet discovered by Australian amateur Vello Tabur (Wanniassa, A.C.T.) that was designated C/1996 Q1. Curiously, before C/1996 Q1 faded dramatically in October 1996 (while still approaching perihelion at $q = 0.84$ AU), it was discovered that its orbital elements were very similar to that of the well-observed comet C/1988 A1 (Liller), and Brian G. Marsden calculated that C/1996 Q1 likely broke off from C/1988 A1 at their last perihelion passage some 2900 years ago (*IAUC* 6464). Comet C/1996 Q1 had shown "a very high gas/dust ratio . . . [with] almost no continuum" in September (*IAUC* 6476). The comet reached faint naked-eye visibility in the following weeks. But by October 20 the comet started to fade and lose central condensation, and it dropped from fifth to ninth magnitude in only a few days (when it should have remained near mag 5), gradually becoming an elongated vague "streak". A similar scenario would occur nearly four years later, as C/1999 S4 (LINEAR) began rapidly fading from a similar peak apparent brightness in late July 2000, becoming an elongated "streak" in a matter of days. Better views with large telescope (including the view from the Hubble Space Telescope that is reproduced below) revealed many small, very faint "nuclei" in early August at one end of the "streak".

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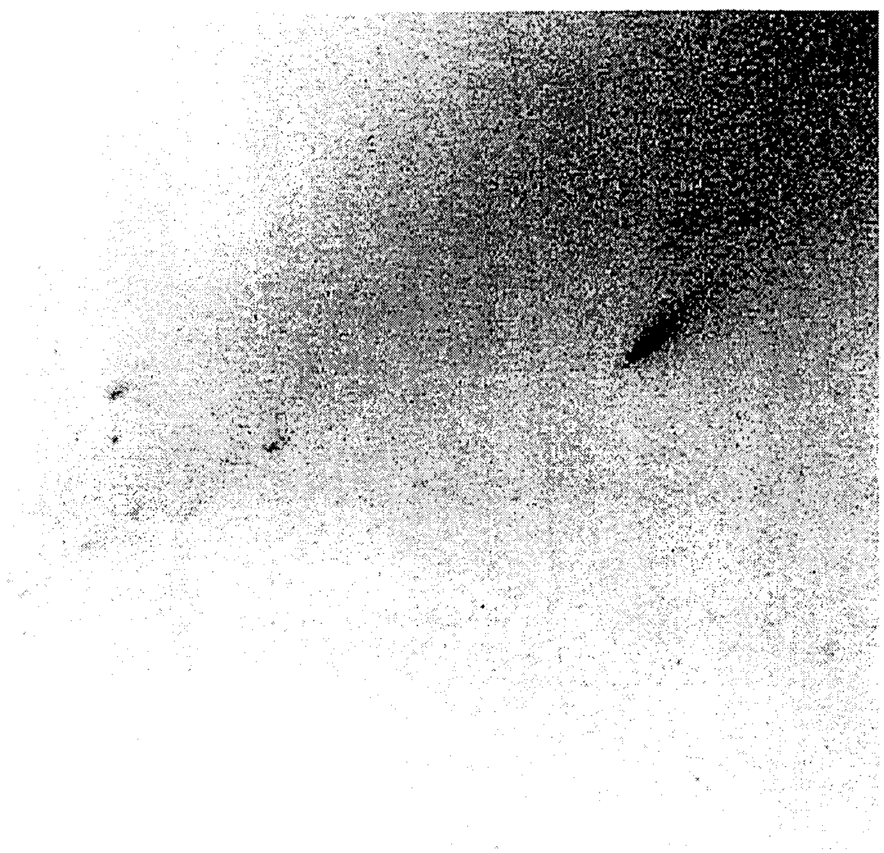

Image taken with the Hubble Space Telescope (HST), Wide Field Planetary Camera 2, on 2000 Aug. 5.167-5.396 UT. The dozen or so small active fragments scattered toward the left part of the image here were only visible with the largest ground-based telescopes; most of them are here located within $\approx 20''$ of the relatively sharp western tip of the dust tail (IAUC 7474, 7476). Courtesy of NASA, Harold Weaver (Johns Hopkins University), and the HST "Comet LINEAR Investigation Team".

Of the comets recovered since 1996, one of the most interesting is 139P/Väisälä-Oterma, which had been lost since 1939 when it had been reported as an asteroidal object (though co-discoverer L. Oterma had reported that computations suggested a cometary orbit, and her later examination of the original plates suggested that the object was perhaps indeed somewhat diffuse). LINEAR had reported an asteroidal object on two nights in November 1998, and the MPC assigned the designation 1998 WG_{22} to it. *ICQ Comet Handbook* editor Syuichi Nakano identified the two objects, and subsequent observations by several observers showed a faint coma and tail (*IAUC* 7064). Four other short-period comets that were accidentally re-discovered by LINEAR include 140P/1998 X2 (Bowell-Skiff; C/1983 C1 = 1983c = 1983 II), which has a period $P = 16.2$ yr; 143P/2000 ET_{90} (Kowal-Mrkos; D/1984 H1 = 1984n = 1984 X); 145P/2000 R1 (Shoemaker-Levy 5; P/1991 T1 = 1991z = 1991 XXII); and 146P/2000 S2. Comet C/2000 S2 was identified by Nakano with comet D/1984 W1 = 1984u = 1984 XVIII (Shoemaker 2), and the comet was renamed "Shoemaker-LINEAR". Comet 63P/Wild 1, which has a 13-year orbital period and was missed at its 1986 return, was recovered in a single-night detection by Carl Hergenrother on 1999 Feb. 14 and on images taken by T. Kojima on 1999 Oct. 24 and Nov. 4 (*IAUC* 7302). And comet 97P/Metcalf-Brewington, last seen in April 1991 (before its approach to within 0.11 AU of Jupiter in 1993), was also picked up by LINEAR on 2000 September 1 and 3 images taken in the course of its normal scanning; the LINEAR observations were then identified with 97P by Gareth Williams (*IAUC* 7487).

Another historical enigma that was recently solved concerned the long-lost object 1940 AB, which was given the cometary designations 1940a and 1939 VIII (but which was removed in recent decades from the *Catalogue of Cometary Orbits*). In late 1998, 1940 AB was identified with other observations (numerous minor-planet designations had been assigned over the years to the same object, none having really good orbits until then) and shown to be a main-belt minor planet (*IAUC* 7069), now numbered (10258). — *D. W. E. Green*

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Tabulation of Comet Observations

NOTICE to observers and users of comet photometric data. Recently, the visual observations concerning comet 97P of five different observers were questioned as a result of their data being posted on World Wide Websites, including the *ICQ* website. The five observers all claimed positive visual detections of comet 97P, with $m_1 \simeq 14$, while the observations of several CCD observers put the comet at closer to $m_1 \simeq 18$. After being confronted, four of the five observers withdrew their positive observations of 97P (the fifth refusing to do so, claiming that he was certain that he had observed the comet visually near $m_1 \simeq 14$). The challenges had been made by third parties (including both CCD and visual observers) not only because the observations were suggesting that the comet was unreasonably brighter than CCD observations were indicating, but chiefly because of concerns about the *ability* or *possibility* of seeing such faint comets with the given telescope apertures from various European observing sites. Some concern was expressed that the coma diameters, DC, and magnitude methods in various cases were even inconsistent with the experiences of other experienced visual observers for faint comets.

This presents some worrisome issues for archives such as that maintained by the *ICQ* and for researchers using photometric data on comets. Some of this was brought out in the extensive discussions that were published in the October 1998 *ICQ*. But while it is difficult and indeed undesirable for the *ICQ* staff (or anybody else) to "police" observers, and while it is even more difficult to be certain that a given visual observation was or was not of a real comet, it is certainly our obligation to do what we can to ensure that only reliable data get published. Observers absolutely must make every effort to be ***absolutely certain*** that every observation of a comet that is reported for publication is a *definite* observation. The human eye can easily play tricks on the mind when looking near the limit of a given telescope, and much time needs to be given to such observations — aided with a proper *real-image* atlas copy of the field (such as the Digital Sky Survey), *not* some computer-generated plot of stars — ensuring that the comet moves at the proper rate and direction of motion over 1-2 hours. If one is not ***absolutely certain*** of detecting the comet in question, they should either report a negative observation (with limiting cometary or stellar magnitude), or not report anything at all. Beginning with the January 2001 *ICQ*, therefore, we will require that tabulated visual observations of comets fainter than mag $\simeq$ 13.0 with a 20-cm instrument, fainter than mag $\simeq$ 13.5 with a 25-cm instrument, and fainter than mag $\simeq$ 14.0 with larger instruments must be accompanied by additional information: (1) faintest stellar magnitude near the comet; (2) a statement as to how long the comet was followed and as to how far it moved in the given time (arcsec or arcmin); (3) the star atlas used for the background stars, to identify the field (if non-professional-astronomy software was used for this purpose, very specific details about the source and a description of the output will be required); (4) the *complete* citation reference to the orbital elements used for giving the search ephemeris used; and (5) an assessment of how absolutely certain the observer is that the detection was real. Some of this information will be published with such observations in the accompanying "Descriptive Information", to help researchers and data analysts assess various data for faint comets. While this may seem like a lot to ask, it is felt that the time has come to require this extra step to help ensure that the *ICQ* database remains of the highest quality possible. Visual observations of comets after this October 2000 issue generally will not be published without such accompanying information.

The point has also been made that faint *CCD* observations of comets can also be problematical, because of the propensity of "bad pixels" to show up in either the image-taking or the image-processing procedures. For this reason, it is *highly encouraged* (but not yet required) that all observers reporting comet photometry made with CCDs also submit *at* *the same time* full-precision astrometry for publication in the ***Minor Planet Circulars***. Both photometry and astrometry can be e-mailed to the *ICQ* editor.

Meanwhile, researchers and data analysts need to be very careful about both visual and CCD observations of faint comets. One should not put too much stress, weight, or emphasis on one or two observations that are unconfirmed by other observers' data. Visual m_1 data are generally 1-2 magnitudes fainter than CCD magnitudes made by experienced CCD comet photometrists. When sparse visual m_1 data for comets fainter than mag 11 or 12 are 3-4 magnitudes or more lower (brighter) than CCD m_1 data obtained around the same time, one needs to be especially cautious and critical; it has been documented that sometimes visual m_1 values are as much as 3-4 mag brighter than CCD magnitudes, but this should not be considered routine.

Corrigendum. In the July 2000 issue (*ICQ* **22**), p. 70, line 4, **for** ◇ *Comet C/1999 K6 (LINEAR)* **read** ◇ *Comet C/1999 K5 (LINEAR)*

Descriptive Information, to complement the Tabulated Data (all times UT):

◇ *Comet C/1972 U1 (Kojima) = 1973 II = 1972j* ⟹ 1972 Dec. 30.90: $m_2 \simeq 13$; cond. shifted toward p.a. 290°; "radiation" in p.a. 110° [BEY].

◇ *Comet C/1975 N1 (Kobayashi-Berger-Milon) = 1975 IX = 1975h* ⟹ 1975 July 26.94: round central cond.; moonlight; 20' coma diameter was probably made with "25×80" instrument [BEY]. July 27.90: w/ 25-cm mirror (assumed instrument code L in tab.), photoelectric intensities yield coma dia. 15'.5; magnitudes by this observer were stated as including "the brighter parts of the tail" [WEN01]. July 27.92: 17' coma diameter was probably made with "25×80" instrument, which was certainly used to see the 0°.5 tail in p.a. ≈ 115°; moonlight [BEY]. July 28.82: w/ 25-cm L, photoelectric intensities yield coma dia. 17'.7 [WEN01]. July 28.95: w/ "25×80" instrument and/or 26.0-cm f/12 R (70×), $m_2 \approx 9$, coma dia. 20' w/ "somewhat eccentric cond.", and 1° tail in p.a. 112°; moonlight [BEY]. July 29.77: w/ 25-cm L, photoelectric intensities yield coma dia. 22'.0 [WEN01]. July 29.89: w/ "25×80" instrument and/or 26.0-cm f/12 R (70×), $m_2 \approx 9$, coma dia. 17' w/ "somewhat eccentric cond.", and ≈ 1° tail in p.a. 110°; moonlight, fog [BEY]. Aug. 1.89: w/ 25-cm L, photoelectric intensities yield coma dia. 14'.0 [WEN01]. Aug. 1.90: w/ "25×80" instrument, 21' coma w/ central cond., tail ≈ 1° long in p.a. 104° [BEY]. Aug. 1.90, 2.90, 3.89, and 10.89: hazy [BEY]. Aug. 2.88: w/ 25-cm L, photoelectric intensities yield coma dia. 17'.5 [WEN01]. Aug. 2.90: "16×50" instrument assumed in the tab. data, by the way, to be a refractor (— Ed.) [BEY]. Aug. 3.90: w/ 25-cm L, photoelectric intensities yield coma dia. 15'.0 [WEN01]. Aug. 4.89: fog [BEY]. Aug. 5.88: w/ 25-cm L, photoelectric intensities yield coma dia. 13'.5 [WEN01]. Aug. 5.89: cloudy; w/ "25×80" instrument (assumed in the tabulated data, by the way, to be a refractor — Ed.), 13' coma and 0°.5 tail in p.a. ≈ 79° [BEY]. Aug. 6.88: w/ 25-cm L, photoelectric intensities yield coma dia. 12'.3 [WEN01]. Aug. 7.90: w/ "25×80" instrument, coma dia. 18' [BEY]. Aug. 8.86: w/ 25-cm L, photoelectric intensities yield coma dia. 12'.7 [WEN01]. Aug. 8.89: Beyer listed two instruments for the m_2, coma diameter, and tail measurements (also the "25×80" instrument) [BEY]. Aug. 8.89 and 9.90: fog and clouds [BEY]. Aug. 9.86: w/ 25-cm L, photoelectric intensities yield coma dia. 10'.1 [WEN01]. Aug. 11.88, 18.89, and 26.86: clouds [BEY]. Aug. 13.88: w/ "16×50" instrument, tail 0°.3 long in p.a. ≈ 70° [BEY]. Aug. 17.88, 18.89, and 29.83: moonlight [BEY]. Aug. 26.86, 28.85, and 29.83: low alt. [BEY]. Aug. 28.85: tab. coma diameter and tail information was listed as being made with one (or both) of two instruments, the tab. "25×100" instrument and the 26.0-cm R (70×), from which $m_2 \approx 8$ was also noted [BEY]. Aug. 29.83: tab. coma diameter and tail information was possibly made w/ 26.0-cm R (70×) [BEY].

◇ *Comet C/1975 V1 (West) = 1976 VI = 1975n* ⟹ 1976 Mar. 2.22: $m_2 = 1.0$ [BEY]. Mar. 4.19: $m_2 \simeq 1.6$ [BEY]. Mar. 5.18: $m_2 \simeq 2.2$ [BEY].

◇ *Comet C/1997 BA_6 (Spacewatch)* ⟹ 2000 July 8.85: field star of mag 13.5 very close to comet, which made the comet difficult to observe [PEA]. June 5.88: comet appeared somewhat more condensed than previous obs. made on June 2nd [PEA]. Sept. 17.51 and 20.49: `GUIDE 7.0` software used for comp.-star mags [NAK01].

◇ *Comet C/1999 H1 (Lee)* ⟹ 1999 May 13.07: comet very low on SW horizon [NOW]. Sept. 2.12: easily seen in 10×50 B [NOW]. Sept. 9.11: oval coma [LOO01]. Sept. 12.20: just barely seen in 10×50 B [NOW]. Sept. 18.06: central cond. of mag 11.5 (ref: V) [LOO01]. Oct. 3.79: star in coma; weak central cond. [LOO01].

◇ *Comet C/1999 J2 (Skiff)* ⟹ 2000 Sept. 20.45: `GUIDE 7.0` software used for comp.-star mags [NAK01]. Sept. 27.76: limiting stellar mag 15.2 (162×); second detection not possible later due to low alt. [LEH]. Sept. 29.76: limiting stellar mag 15.5 (162×); second detection not possible later due to low alt. [LEH]. Sept. 30.76: limiting stellar mag 14.5 (162×) [LEH].

◇ *Comet C/1999 J3 (LINEAR)* ⟹ 1999 Sept. 12.27: low alt.; accidental discovery [NOW]. Sept. 21.13: central cond. of mag 12.4 (ref: T Lyn variable-star chart); round coma [LOO01].

◇ *Comet C/1999 K5 (LINEAR)* ⟹ 2000 Feb. 26.8: w/ 1.0-m f/8 L + CCD, 70'' tail in p.a. 317° [R. H. McNaught, Siding Spring Observatory]. July 4.87: small, diffuse coma w/ bright and prominent central cond. [PEA]. Aug. 9.83: prominent central cond. located w/in small coma [PEA].

◇ *Comet C/1999 L3 (LINEAR)* ⟹ 2000 Feb. 12.90: CCD image with Johnson V filter; comparison star GSC 1933.1710 (used mag 10.14 from Tycho catalogue) [COZ].

◇ *Comet C/1999 N4 (LINEAR)* ⟹ 2000 Sept. 20.44: `GUIDE 7.0` software used for comp.-star mags [NAK01].

◇ *Comet C/1999 S2 (McNaught-Watson)* ⟹ 2000 Feb. 28.5: w/ 1.0-m *f*/8 L + CCD, 30″ tail in p.a. 215° [R. H. McNaught, Siding Spring Observatory].

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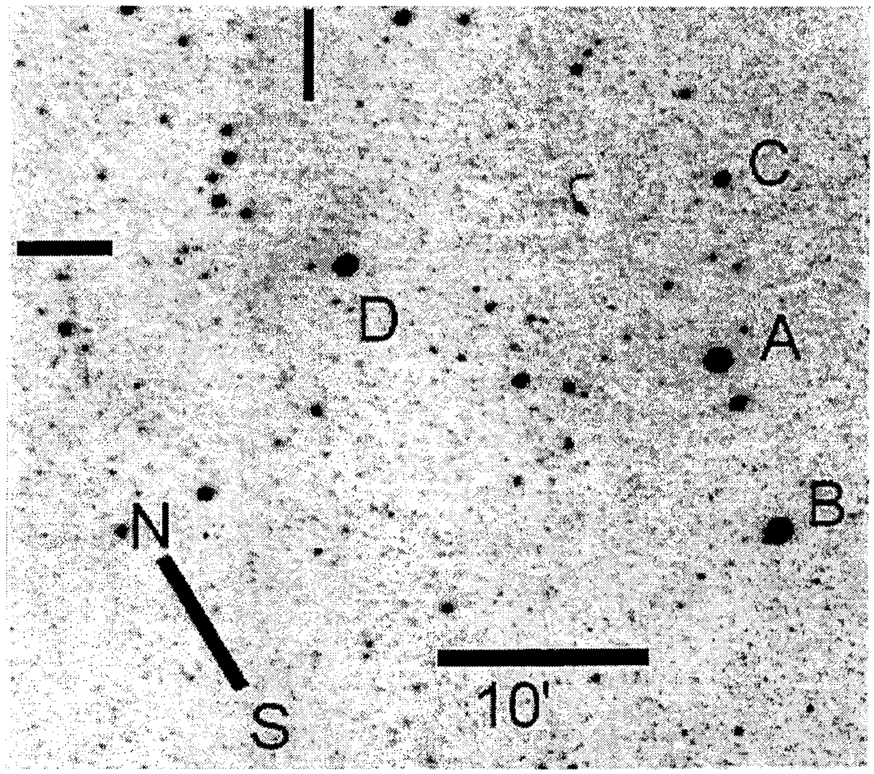

Image taken of the field of comet C/1999 S4 (LINEAR) by Hartwig Lüthen, observing from Namibia with a 14-cm Schmidt telescope and Technical Pan 2415 film (8-min exposure) on 2000 Aug. 28.760 (see text below). The stars marked with letters are identified as follows: A = SAO 157454; B = SAO 147455; C = PPM 226212; D = SAO 157465. The bar at bottom indicates a scale of 10 arcmin, and the bar at lower left shows the orientation (north-south). The two marks at upper left point toward the diffuse patch that is thought to be the remains of C/1999 S4.

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◇ *Comet C/1999 S4 (LINEAR)* ⟹ 2000 June 21.37: moonlight; comet alt. 15°; ref. star HD 14697 [AMO01]. July 18.94: w/ 25.6-cm L (169×), central cond. of mag 12.0 [BIV]. July 20.94: w/ 25.6-cm L (169×), central cond. of mag 12.2 [BIV]. July 21.94: w/ 25.6-cm L (169×), central cond. of mag ≃ 9.9; very significant brightening in < 24 hr, comet much more condensed [BIV]. July 21.97: comet clearly visible despite nautical twilight; w/ 20.3-cm T (100×), bright central cond. and tail 7′ long in p.a. 28° [GRA04]. July 22.93: w/ 25.6-cm L (169×), central cond. of mag 10.0; bright despite poor sky (cirrus) [BIV]. July 22.98: comet appeared less condensed than on previous night; observing conditions not favorable due to twilight and cirrus [GRA04]. July 24.94, 26.91, and 28.87: instrument is a Lichtenknecker's Flat-Field Schmidt Camera of focal length 500 mm at *f*/3.5; images were obtained with a Hisis 22 CCD camera placed at the flat-field focus (40′ × 25′ field); w/ clear sky and alt. > 40°, a 30-sec exp. yields stars to mag 17 [MOR09]. July 25.28: w/ 35.5-cm T (70×), central cond. of mag 11.6 [BIV]. July 26.2-Aug. 5.3: obs. from Mauna-Kea summit (4090 m elevation), dark sky, even with the moon (Aug. 3-5) [BIV]. July 26.48, 29.48, 31.47, and Aug. 2.47: `GUIDE 6.0` software used for comp.-star mags [NAG08]. July 27.25: w/ 10×50 B, "in deep astronomical (evening) twilight, comet seen shortly before clouds moved in; it was definitely in outburst, displaying a fuzzy parabolic nuclear region surrounded by a tight inner coma w/ hood/tail and a *large* and diffuse outer coma; the outer coma was most peculiar, since I had not seen anything like it in my previous obs." [OME]. July 28.29: w/ 10.2-cm R and 10×50 B, at 9000-foot elevation on Mauna Kea, "comet's appearance was dramatically different from the previous night, being a small diffuse glow with a tiny tail in the binoculars; I was most surprised, however, with the view through the 4-inch Genesis refractor, which showed a tapered glow but no nucleus at 23×; at 74×, I immediately noticed that the inner coma was a cigar-shaped haze w/ a fuzzy knot where the nucleus should have been; I saw a cond. in anti-sunward section of the cigar-shaped haze, but nothing stellar; I assumed that the nucleus was hidden by the dust after the break-up" [OME]. July 28.53 and Aug. 3.49: `GUIDE 7.0` software used for comp.-star mags [YOS02]. July 28.88: no tail seen; comet much fainter than M3; windy and hazy

[GRA04]. July 29.89: visibility of comet somewhat inferior to M81, which was seen at about the same alt.; haze and wind [GRA04]. July 30.29: obs. from the lava flows on Kilauea w/ 10×50 B; "the 'head' appeared slightly brighter than the tail, though no cond. could be seen" [OME]. July 31.29: w/ 10×50 B, "comet was but a ghost image of its former self — a headless comet, a drifting tail near the tail of Leo; it looked like the remains of a bright meteor smoking among the stars" [OME]. Aug. 5.90: comet not visible in a fairly transparent sky; no obs. since July 29 due to strong haze and clouds [GRA04]. Aug. 6.89: "comet not seen with certainty, but w/ 7.0-cm R (69×), a very faint object ($m_1 \approx 9.1$, dia. 3′) was possibly glimpsed at the correct location (I wish I had a more powerful instrument on this occasion!)" [GRA04]. Aug. 7.87: comet not visible; somewhat hazy and Moon; galaxies M49 and M87 faintly visible under similar conditions [GRA04]. Aug. 28.760: w/ 14-cm Schmidt telescope, 8-min exposure on TP2415 film (reproduced on page 123, above) beginning at this time (when comet was ~ 18° above horizon as seen from Tivoli, Namibia) shows a very diffuse, faint streak ≈ 11′ × 2′ in extent (this is an unconfirmed image of C/1999 S4, but if it is indeed the comet, this is certainly one of the last existing images of it – Ed.) [Hartwig Lüthen].

◇ *Comet C/1999 T1 (McNaught-Hartley)* ⟹ 2000 June 6.91: "comet glimpsed briefly between clouds and the onset of morning twilight; a good GSPC sequence was located close to the comet's position; comet appeared as a diffuse object that was glimpsed in moments of good seeing; will have to confirm the obs. tomorrow morning" [PEA]. June 7.91: "this obs. confirms obs. made on previous morning; comet distinctly visible and moderately condensed" [PEA]. Aug. 13.86: "moon still above W horizon; however, comet was relatively easy to see, albeit with a smaller coma dia. than previous obs." [PEA]. Sept. 11.88: "moon still just above W horizon; a large, diffuse and ill-defined coma made the comet quite difficult to observe; no trace of any appreciable cond." [PEA]. Sept. 21.83: "moon above horizon did not significantly affect the obs.; comet still vague and diffuse, with little or no cond." [PEA]. Sept. 24.87: comet located quite close to 12th-mag star [PEA]. Oct. 4.81: "obs. made at a lower alt. than I would have liked, in order to beat coming cloud" [PEA].

◇ *Comet C/1999 T2 (LINEAR)* ⟹ 2000 Sept. 19.13: central cond. of dia. 2″ and mag 15.2; coma appeared symmetrical; broad, diffuse, but prominent tail [ROQ]. Sept. 27.80: comet close to 5.63-mag star HS 3082.00784 [LEH].

◇ *Comet C/1999 U4 (Catalina-Skiff)* ⟹ 2000 Sept. 25.32: coma was generally symmetrical, merging into a very faint, diffuse tail [ROQ]. Sept. 27.85: at 162×, limiting stellar mag 15.8; second confirming detection of comet made at Sept. 27.92 [LEH].

◇ *Comet C/1999 Y1 (LINEAR)* ⟹ 2000 Sept. 21.556: cond. of the brightest point, probably the nucleus, is not located on the line of the tail extension; elongated jet-like structure extends 5″.6 toward p.a. 146°.0 from the cond. (derived by *I*-band CCD images taken with the 50-cm telescope of the National Astronomical Observatory of Japan); tab. data are for anti-tail (1′.65 in p.a. 31°.6), which seems to be connected to the edge of the elongated jet-like structure; earth's orbital-plane crossing on Oct. 1.756 [FUK02, T. Nakajima, and J. Watanabe]. Sept. 26.602: elongated jet-like structure extends 7″.1 toward p.a. 139°.1 from the cond.; see also comments for Sept. 21.556 [FUK02, T. Nakajima, and J. Watanabe]. Oct. 4.59: `GUIDE 7.0` software used for comp.-star mags [YOS02].

◇ *Comet 2P/Encke* ⟹ 2000 Aug. 3.79, 9.78, and 10.79: `GUIDE 7.0` software used for comp.-star mags [YOS02]. Aug. 5.77: `GUIDE 6.0` software used for comp.-star mags; obs. at Mt. Nyugasa (elev. 1700 m) [NAG08]. Aug. 14.82: `GUIDE 7.0` software used for comp.-star mags [NAK01]. Sept. 5.23-15.22: visual estimation of comet's brightness from SOHO website images, via SAOC stars in the same field [CHE03]. Sept. 14.138-15.446: uncertainties in m_1 range from ± 0.4-0.8 mag for the obs. fainter than mag 7.7 down to ± 0.1-0.2 mag for the obs. brighter than mag 7.5 (see SOHO image on page 125, below) [BIE01]. Sept. 25.48: "w/ 20-cm L, comet's elong. from the sun only 18°, and alt. only 4°-5°; stars of mag 8.5 seen clearly at the comet's location; however, excessive haze over the sea horizon would have hindered obs. of any extended object" [PEA]. Oct. 2.42 and 4.42: moonlight [MAT08].

◇ *Comet 9P/Tempel 1* ⟹ 2000 Feb. 28.8: *R* images w/ 1.0-m *f*/8 L + CCD; "mag is 15.5 if the comet considered a 'star'"; 10″ coma; 2′.8 tail in p.a. 249°, with fan spanning p.a. 226° to 268° [R. H. McNaught, Siding Spring Observatory].

◇ *Comet 10P/Tempel 2* ⟹ 1999 Aug. 16.10: rather hard to see against Milky Way [NOW].

◇ *Comet 21P/Giacobini-Zinner = 1972 VI = 1972d* ⟹ 1972 July 20.99, 21.99, 22.98: observed through small gaps between trees [BEY]. July 20.99 and 22.98: m_2 = 13.0 [BEY]. July 21.99: m_2 = 12.8 [BEY].

◇ *Comet 29P/Schwassmann-Wachmann 1* ⟹ 2000 Aug. 1.85: comet 5° above horizon [LEH]. Aug. 23.49: `GUIDE 7.0` software used for comp.-star mags [NAK01].

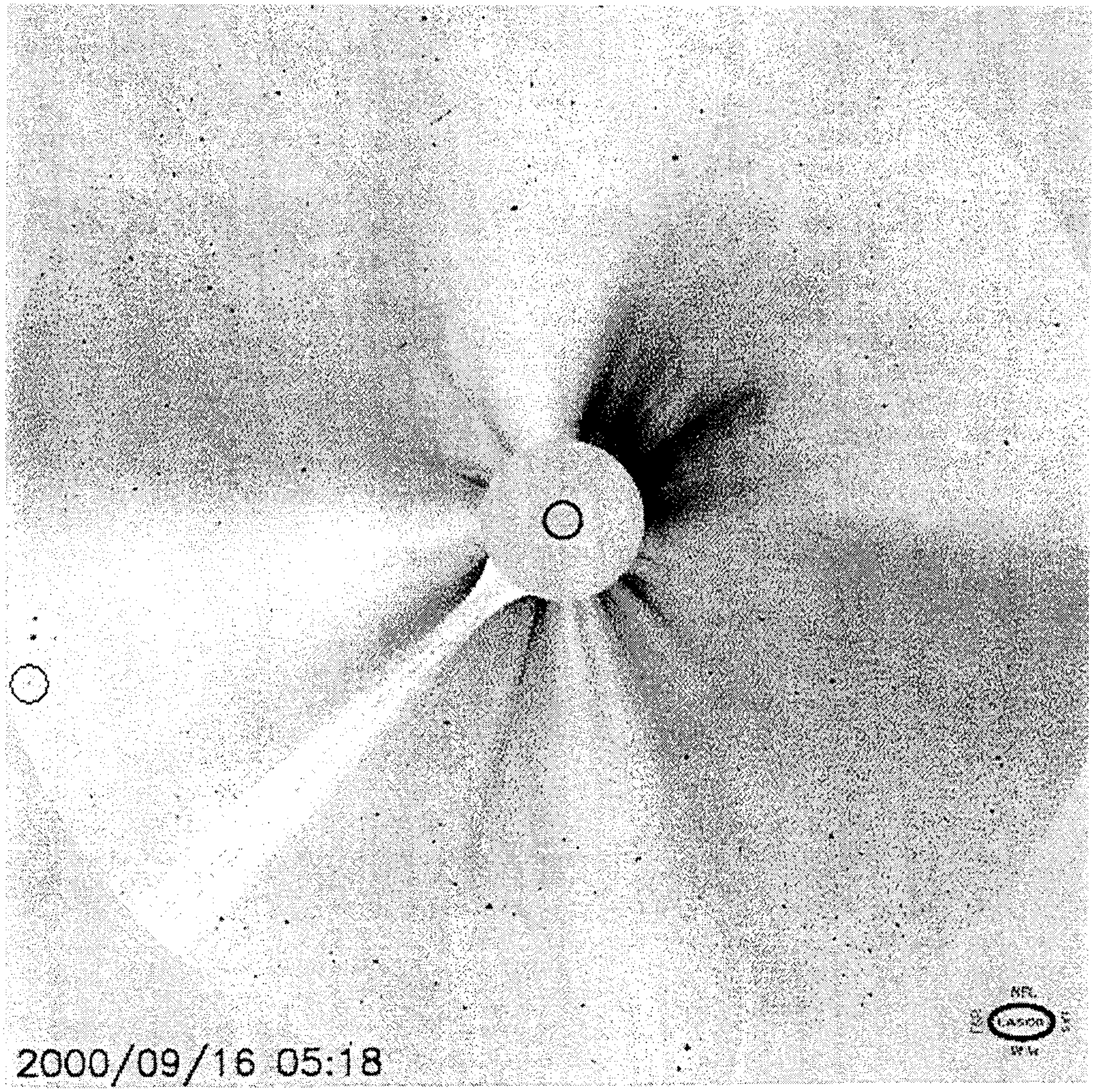
◇ *Comet 44P/Reinmuth 2* ⟹ 2000 Aug. 23.48: `GUIDE 7.0` software used for comp.-star mags [NAK01].

◇ *Comet 47P/Ashbrook-Jackson* ⟹ 2000 Aug. 7.60, 23.54, Sept. 20.49, and 27.46: `GUIDE 7.0` software used for comp.-star mags [NAK01].

◇ *Comet 145P/Shoemaker-Levy 5* ⟹ 2000 Sept. 7.40: well-condensed coma and fan-shaped tail; mag is derived from USNO A2.0 red comparison-star magnitudes (and assumed to be *R*); 1K SITe CCD used w/ Cousins *R* filter [BAL06].

◇ *Comet P/1999 XB_{69} (LINEAR)* ⟹ 2000 Feb. 26.5: w/ 1.0-m *f*/8 L + CCD, 14″ tail in p.a. 64° [R. H. McNaught, Siding Spring Observatory].

(text continued on next page)



Coronagraph image of the sun's corona, background stars, and comet 2P/Encke (near left of image, circled), taken by the SOHO spacecraft on 2000 Sept. 16.22. Magnitudes derived from SOHO images over several days appear in the tabulated data of this issue. Courtesy Doug Biesecker (Goddard Space Flight Center, NASA).

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◇ *Comet P/2000 S1 (Skiff)* ⟹ 2000 Sept. 27.86: limiting stellar mag 14.8 (162×); second confirming detection made at Sept. 27.94 [LEH]. Sept. 29.32: central cond. of dia. 2″ and mag 16.9; symmetrical coma; tail was very diffuse, making determination of length and orientation difficult [ROQ]. Oct. 17.15: central cond. of dia. < 3″ and mag 16.3; although the coma boundary was irregularly defined, the coma was collectively symmetrical [ROQ].

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Key to observers with observations published in this issue, *with 2-digit numbers between Observer Code and Observer's Name indicating source [07 = Comet Section, British Astronomical Assn. (via J. D. Shanklin); 11 = Dutch Comet Section (via A. Scholten); 13 = Agrupacion Astronomica de Madrid (via J. Carvajal); 16 = Japanese observers (via Akimasa Nakamura, Kuma, Japan); 18 = Coordinated amateur Polish group (via Tomasz Sciezor); 23 = Czech group (via P. Pravec and V. Znojil); 32 = Hungarian group (via K. Sarneczky); 42 = Belarus observers (via Sergey E. Shurpakov); 48 = Ukrainian observers via the Kharkov astronomical club "Asterion" (via Denis A. Svechkarev); etc.]. Those with asterisks (*) preceding the 5-character code are new additions to the Observer Key:*

*AKA	16	Ayahiko Akahori, Nagano, Japan
AMO01	35	Alexandre Amorim, Brazil
BAL03	42	Igor I. Baluk, Gomel, Belarus
*BAL06		David Balam, Victoria BC, Canada
BEA	07	Sally Beaumont, Cumbria, England
BEY		Max Beyer, Germany
BIE01		Doug A. Biesecker, MD, U.S.A.
BIV		Nicolas Biver, France
BLO01	11	Lex Blommers, Leiden, Holland
BOU		Reinder J. Bouma, Netherlands
BRU	42	Ivan S. Brukhanov, Belarus
CHE03	33	Kazimieras T. Cernis, Lithuania
CHO02	18	Piotr Chochlow, Poland
COZ		Elia Cozzi, Mozzate, Italy
*DAR01	34	Iliyan Darganov, Bulgaria
*DAS	34	Elena Daskalova, Bulgaria
*DAS01	34	Vasil Daskalov, Bulgaria
DRA02	18	Michal Drahus, Krakow, Poland
*END	16	Tsunenobu Endo, Nagano, Japan
*EZA	16	Yuusuke Ezaki, Osaka, Japan
FUK02	16	Hideo Fukushima, Tokyo, Japan
GLI		Gunnar Glitscher, Germany
GRA04	24	Bjoern Haakon Granslo, Norway
HAL05	23	Michal Haltuf, Kolin, Czech Rep.
HAS02		Werner Hasubick, Germany
HER02		Carl Hergenrother, AZ, U.S.A.
HOE		S. F. Hoenig, Eislingen, Germany
HOR02	23	K. Hornoch, Czech Republic
KAD02	16	KenIchi Kadota, Saitama, Japan
KOL04	42	Kirill Koloskov, Belarus
KOS	07	A. Kósa-Kiss, Salonta, Romania
LEH		Martin Lehky, Czech Republic
LOO01		Frans R. van Loo, Belgium
MAN03		Eric Mandon, France
MAR02	13	Jose Carvajal Martinez, Spain
*MAR24	34	Nikolai Marinov, Bulgaria
MAT08		Michael Mattiazzo, S. Australia
*MCB01	07	Alastair McBeath, Morpeth, U.K.
MEY	28	Maik Meyer, Germany
MIT	16	Shigeo Mitsuma, Saitama, Japan
MOR09		Philippe Morel, France
NAG08	16	Yoshimi Nagai, Yamanashi, Japan
NAK01	16	Akimasa Nakamura, Ehime, Japan
NEK		Andrey N. Nekrasov, Belarus
NEV	42	V. S. Nevski, Vitebsk, Belarus
NOW		Gary T. Nowak, VT, U.S.A.
*PAN02	34	Damiana Panaiotova, Bulgaria
PEA	14	Andrew R. Pearce, Australia
RAD01	17	Veselka Radeva, Bulgaria
*RAD02	34	Yana Radeva, Bulgaria
*RAD03	34	Nadezhda Radeva, Bulgaria
*RAL	34	Rosen Ralev, Bulgaria
RES	18	M. Reszelski, Szamotuly, Poland
ROD01	13	Diego Rodriguez, Spain
ROQ		Paul Roques, AZ, U.S.A.
SAN04	38	Juan M. San Juan, Madrid, Spain
SAN07	32	G. Sánta, Kisujszállás, Hungary
SEA		David A. J. Seargent, Australia
SEA01		John Seach, Australia
SEG	38	Carlos Segarra, Valencia, Spain
SER	42	Ivan M. Sergey, Belarus
SHA02	07	Jonathan D. Shanklin, England
SHU	42	S. E. Shurpakov, Baran, Belarus
SIE	33	Henryk Sielewicz, Lithuania
SOW	16	Toshihide Sowa, Wakayama, Japan
STO03	07	David Storey, United Kingdom
TAY	07	M. D. Taylor, Yorkshire, England
WAT01	16	Nobuo Watanabe, Hokkaido, Japan
WEN01	25	Kurt Wenske, Germany
YOS02	16	K. Yoshimoto, Yamaguchi, Japan
YOS04	16	Seiichi Yoshida, Ibaraki, Japan
YOS05	16	S. Yoshida and K. Kadota, Japan

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TABULATED DATA

The headings for the tabulated data are as follows: "DATE (UT)" = Date and time to hundredths of a day in Universal Time; "N" = notes [* = correction to observation published in earlier issue of the *ICQ*; an exclamation mark (!) in this same location indicates that the observer has corrected his estimate in some manner for atmospheric extinction (prior to September 1992, this was the standard symbol for noting extinction correction, but following publication of the extinction paper — July 1992 *ICQ* — this symbol is only to be used to denote corrections made using procedures different from that outlined by Green 1992, *ICQ* **14**, 55-59, and in Appendix E of the ***ICQ Guide to Observing Comets*** — and then only for situations where the observed comet is at altitude > 10°); '&' = comet observed at altitude 20° or less with no atmospheric extinction correction applied; '$' = comet observed at altitude 10° or lower, observations corrected by the observer using procedure of Green (*ibid.*); for a correction applied by the observer using Tables Ia, Ib, or Ic of Green (*ibid.*), the letters 'a', 'w', or 's', respectively, should be used; x indicates that a secondary source (often amateur computer software) was used to get supposedly correct comparison-star magnitudes from an accepted catalogue].

"MM" = the method employed for estimating the total (visual) magnitude; see article on page 186 of the Oct. 1996 issue [B = VBM method, M = Morris method, S = VSS or In-Out method, I = in-focus, C = unfiltered CCD, c = same as 'C', but for 'nuclear' magnitudes, V = electronic observations — usually CCD — with Johnson *V* filter, *etc.*]. "MAG." = total (visual) magnitude estimate; a colon indicates that the observation is only approximate, due to bad weather conditions, *etc.*; a left bracket ([) indicates that the comet was not seen, with an estimated limiting magnitude given (if the comet IS seen, and it is simply estimated to be fainter than a certain magnitude, a "greater-than" sign (>) must be used, not a bracket). "RF" = reference for total magnitude estimates (see pages 98-100 of the October 1992 issue, and Appendix C of the ***ICQ Guide to Observing Comets***, for all of the 1- and 2-letter codes; an updated list is also maintained at the *ICQ* World Wide Website). "AP." = aperture in centimeters of the instrument used for the observations, usually given to tenths. "T" = type of instrument used for the observation (R = refractor, L = Newtonian reflector, B = binoculars, C = Cassegrain reflector, A = camera, T = Schmidt-Cassegrain reflector, S = Schmidt-Newtonian reflector, E = naked eye, *etc.*). "F/" and "PWR" are the focal ratio and power or magnification, respectively, of the instrument used for the observation — given to nearest whole integer (round even); note that for CCD observations, in place of magnification is given the exposure time in seconds [see page 11 of the January 1997 issue; a lower-case "a" indicates an exposure time under 1000 seconds, an upper-case "A" indicates an exposure time of 1000-1999 seconds (with the thousands digit replaced by the "A"), an upper-case "B" indicates an exposure time of 2000-2999 seconds (with the thousands digit replaced by the "B"), etc.].

"COMA" = estimated coma diameter in minutes of arc; an ampersand (&) indicates an approximate estimate; an exclamation mark (!) precedes a coma diameter when the comet was not seen (*i.e.*, was too faint) and where a limiting magnitude estimate is provided based on an "assumed" coma diameter (a default size of 1′ or 30″ is recommended; cf. *ICQ* **9**, 100); a plus mark (+) precedes a coma diameter when a diaphragm was used electronically, thereby specifying the diaphragm size (i.e., the coma is almost always larger than such a specified diaphragm size). "DC" = degree of condensation on a scale where 9 = stellar and 0 = diffuse (preceded by lower- and upper-case letters S and D to indicate the presence of stellar and disklike central condensations; cf. July 1995 issue, p. 90); a slash (/) indicates a value midway between the given number and the next-higher integer. "TAIL" = estimated tail length in degrees, to 0.01 degree if appropriate; again, an ampersand indicates a rough estimate. Lower-case letters between the tail length and the p.a. indicate that the tail was measured in arcmin ("m") or arcsec ("s"), *in which cases the decimal point is shifted one column to the right.* "PA" = estimated measured position angle of the tail to nearest whole integer in degrees (north = 0°, east = 90°). "OBS" = the observer who made the observation (given as a 3-letter, 2-digit code).

A complete list of the Keys to abbrevations used in the *ICQ* is available from the Editor for $4.00 postpaid (available free of charge via e-mail); these Keys (with the exception of the Observer Codes) are also now available in the new *Guide to Observing Comets* and via the *ICQ*'s World Wide Web site. ***Please note that data in archival form, and thus the data to be sent in machine-readable form, use a format that is different from that of the Tabulated data in the printed pages of the ICQ;*** see pages 59-61 of the July 1992 issue, p. 10 of the January 1995 issue, and p. 100 of the April 1996 issue for further information [note correction on page 140 of the October 1993 issue]. Further guidelines concerning reporting of data may be found on pages 59-60 of the April 1993 issue, and in the ***ICQ Guide to Observing Comets.***

◇ ◇ ◇

Comet C/1972 U1 = 1973 II = 1972j (Kojima)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1972 12 30.90		E	10.0	AN	26.0	R	12	70	3				BEY
1972 12 31.89		E	9.9:	AN	26.0	R	12	70	3				BEY

Comet C/1975 N1 = 1975 IX = 1975h (Kobayashi-Berger-Milon)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1975 07 18.98		B	6.0	S	8.0	B		10	8.5	3			CHE03
1975 07 19.88		B	5.5	S	7.5	B		40	14	4			CHE03
1975 07 20.97		B	5.6	S	4.0	B		12	15	5			CHE03
1975 07 21.00		B	5.2	S	7.5	B		40	14	5			CHE03
1975 07 22.93		B	5.2	S	4.0	B		12	12	5	0.2		CHE03
1975 07 23.92		B	5.3	S	4.0	B		12	15	5			CHE03
1975 07 24.95		B	5.2	S	4.0	B		12	15	4			CHE03
1975 07 26.94	i	E	4.8	AN		0		2	20				BEY
1975 07 27.86		B	5.1	S	4.0	B		12	20	5	0.3		CHE03
1975 07 27.90		V	5.6:	AT	25.0	L			+ 1.38				WEN01
1975 07 27.90		t	4.4	AT	5.0	B		10					WEN01
1975 07 27.92	i	E	4.8	AN		0		2	17				BEY
1975 07 28.82		V	5.16	AT	25.0	L			+ 1.38				WEN01
1975 07 28.82		t	4.4	AT	5.0	B		10					WEN01
1975 07 28.89		B	4.9	S	4.0	B		12	18	5	0.5	135	CHE03
1975 07 28.95		E	4.5	AN	0.0	E		1					BEY
1975 07 29.77		V	4.90	AT	25.0	L			+ 1.38				WEN01
1975 07 29.77		t	4.4	AT	5.0	B		10					WEN01
1975 07 29.89		E	4.5	AN	0.0	E		1					BEY
1975 07 29.89		N	9 :		26.0	R	12	70	17		&1	110	BEY
1975 07 29.97		B	5.0	S	4.0	B		12	20	5	0.5	135	CHE03
1975 07 30.86		B	5.0	S	8.0	B		10	18	6	0.3	125	CHE03
1975 07 31.00		B	4.8	S	4.0	B		12	15	6	0.3		CHE03
1975 08 01.89		V	4.57	AT	25.0	L			+ 1.38				WEN01
1975 08 01.89	i	t	4.7	AT	5.0	B		10			1.5	90	WEN01
1975 08 01.90		E	4.3	AN		0		2					BEY
1975 08 01.96		B	4.9	S	4.0	B		12	10	6	0.5		CHE03

Comet C/1975 N1 = 1975 IX = 1975h (Kobayashi-Berger-Milon) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1975 08 02.88		V	4.44	AT	25.0	L			+ 1.38				WEN01
1975 08 02.88	i	t	4.8	AT	5.0	B		10			1.5	65	WEN01
1975 08 02.90		E	4.3	AN		O		2					BEY
1975 08 02.90		N	9 :		5.0	R		16	14		&1	99	BEY
1975 08 02.99		B	4.8	S	7.5	B		40	11	6	0.6	100	CHE03
1975 08 03.89		B	4.8	S	7.5	B		40	10	6	0.3		CHE03
1975 08 03.89		E	4.4	AN	0.0	E		1					BEY
1975 08 03.89		N	9.5:		4.0	B		8	11		0.7	84	BEY
1975 08 03.90		V	4.40	AT	25.0	L			+ 1.38				WEN01
1975 08 03.90	i	t	4.3:	AT	5.0	B		10			2.0	90	WEN01
1975 08 04.88		t	4.2:	AT	5.0	B		10			1.5	90	WEN01
1975 08 04.89		E	4.5	AN	0.0	E		1					BEY
1975 08 04.89		N	10 :		4.0	B		8	11		0.5	88	BEY
1975 08 05.88		V	4.39	AT	25.0	L			+ 1.38				WEN01
1975 08 05.88	i	t	4.4	AT	5.0	B		10			1.0	73	WEN01
1975 08 05.89		E	4.6	AN		O		2					BEY
1975 08 06.88		V	4.40	AT	25.0	L			+ 1.38				WEN01
1975 08 06.88	i	t	4.8	AT	5.0	B		10			1.0	90	WEN01
1975 08 06.89		E	4.5	AN	0.0	E		1					BEY
1975 08 06.89		N	9.5:		10.0	R		25	17		0.8	79	BEY
1975 08 06.99		B	4.8	S	4.0	B		12	11	6			CHE03
1975 08 07.90		E	4.5	AN		O		2					BEY
1975 08 07.90		t	4.6	AT	5.0	B		10					WEN01
1975 08 07.99		B	4.9	S	4.0	B		12	10	6			CHE03
1975 08 08.86		V	5.01	AT	25.0	L			+ 1.38				WEN01
1975 08 08.86		t	4.9	AT	5.0	B		10					WEN01
1975 08 08.89		E	5 :	AN	4.0	B		8					BEY
1975 08 08.89		N	9 :		26.0	R	12	70	8.2		0.6	80	BEY
1975 08 08.99		B	4.9	S	4.0	B		12	11	6	0.3		CHE03
1975 08 09.86		V	5.11	AT	25.0	L			+ 1.38				WEN01
1975 08 09.86	i	t	5.0	AT	5.0	B		10			0.5	83	WEN01
1975 08 09.90		E	4.6:	AN		O		2					BEY
1975 08 09.90		N	9 :		5.0	R		16	18		0.7	68	BEY
1975 08 10.85		t	5.0	AT	5.0	B		10					WEN01
1975 08 10.89		E	5.0:	AN	4.0	B		8					BEY
1975 08 10.89		N	9 :		10.0	R		25	14		0.8	76	BEY
1975 08 10.99		B	5.0	S	4.0	B		12	10	6			CHE03
1975 08 11.88		E	4.4	AN		O		2					BEY
1975 08 13.85		t	5.0	AT	5.0	B		10					WEN01
1975 08 13.88		E	4.6	AN	4.0	B		8					BEY
1975 08 14.88		E	4.6	AN	4.0	B		8					BEY
1975 08 14.88		N	9 :		26.0	R	12	70	13		0.8	76	BEY
1975 08 17.88		E	4.5	AN	10.0	R		25					BEY
1975 08 18.89		E	4.3:	AN	4.0	B		8					BEY
1975 08 19.91		B	4.6	S	4.0	B		12	7	6			CHE03
1975 08 20.95		B	4.8	S	4.0	B		12	5	6	0.6		CHE03
1975 08 22.86		B	5.0	S	4.0	B		12	5	6			CHE03
1975 08 23.85		B	4.9	S	4.0	B		12	3	7	0.6		CHE03
1975 08 23.86		t	4.5	AT	5.0	B		10					WEN01
1975 08 26.86		E	4.1	AN	4.0	B		8					BEY
1975 08 27.85		B	4.9	S	4.0	B		12	3	7	1.5	90	CHE03
1975 08 28.85	i	E	4.0	AN	10.0	R		25	2.2		0.7	19	BEY
1975 08 28.87		B	4.9	S	8.0	B		10	3	7/			CHE03
1975 08 29.83	i	E	4.1	AN	10.0	R		25	2.2		0.5	20	BEY
1975 08 29.87		B	4.9	S	8.0	B		10	2.5	8	1.0		CHE03
1975 08 30.86		B	5.0	S	8.0	B		10	1.5	8	0.6		CHE03
1975 08 31.86		B	5.0	S	8.0	B		10	1.5	8	1.0		CHE03
1975 09 03.84		B	5.5:	S	7.5	B		40	1.5	8	1.5		CHE03

Comet C/1975 V1 = 1976 VI = 1975n (West)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1976 03 02.22	i	E	-0.2	AN	0.0	E		1			3		BEY
1976 03 03.19	i	E	0.5	AN	0.0	E		1			3		BEY
1976 03 04.19	i	E	0.7	AN	0.0	E		1			7	320	BEY

Comet C/1975 V1 = 1976 VI = 1975n (West) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1976 03 05.18	i	E	1.1	AN	0.0	E		1			6	348	BEY

Comet C/1992 F1 = 1992 X = 1992d (Tanaka-Machholz)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1992 05 12.94		E	8.2	AA	25	L	4	56	5	4			NEV
1992 05 14.88		E	8.3	AA	25	L	4	56	4	3			NEV
1992 05 15.87		E	8.5	AA	25	L	4	56	3.5	3			NEV
1992 05 16.87		E	8.6	AA	25	L	4	56	3	2			NEV
1992 05 24.87		E	8.5	AA	25	L	4	56	3	3			NEV
1992 05 26.93		E	8.8	AA	25	L	4	56	3	2			NEV
1992 05 28.88		E	9.0	AA	25	L	4	40	3	2			NEV
1992 05 29.88		E	8.9	AA	25	L	4	45	3	3			NEV
1992 05 30.88		E	9.1	AA	25	L	4	45	3	3			NEV
1992 05 31.88		E	9.4	AA	25	L	4	45	3	2			NEV
1992 06 02.88		E	9.5	AA	25	L	4	45	2.5	2			NEV
1992 06 03.88		E	9.6	AA	25	L	4	45	3	2			NEV
1992 06 04.87		E	9.6	AA	25	L	4	45	3	2			NEV
1992 06 06.88		E	9.9	AA	25	L	4	45	2.5	1			NEV

Comet C/1995 O1 (Hale-Bopp)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 02.74		M	6.2	SP	10	R	4	18	13	4	0.4		BAL03
1996 10 04.70		S	6.2	AA	3.5	R		7	15	5			KOL04
1996 10 04.74		M	6.0	SP	5	R	4	22	12	3	0.2		BAL03
1996 10 05.70		S	6.2	AA	3.5	R		7	15	5			KOL04
1996 10 05.81		M	6.0	SP	5	R	4	22	12	3	0.2		BAL03
1996 10 07.70		S	6.1	AA	3.5	R		7	15	5			KOL04
1996 10 09.73		M	5.5:	SP	5	R	4	22	15	5	0.5		BAL03
1996 10 11.70		S	6.0	AA	3.5	R		7	10	5			KOL04
1996 10 11.73		M	6.0	SP	10	R	4	18	15	5	0.5		BAL03
1996 10 12.77		M	5.6	SP	5	R	4	22	15	5	0.4		BAL03
1996 10 13.73		M	5.4	SP	10	R	4	18	18	5	0.7		BAL03
1996 10 14.78		M	5.5	SP	10	R	4	18	17	6	0.7		BAL03
1996 10 15.77		M	5.4	SP	10	R	4	18	19	6	1	45	BAL03
1996 10 16.73		M	5.6	SP	10	R	4	18	15	5	0.8	42	BAL03
1996 10 18.76	x	M	5.4	S	5.0	B		10	11				GLI
1996 10 19.78	x	M	5.6	S	5.0	B		10	10				GLI
1996 11 09.67		B	5.2	AA	3.0	B		8	12	8	0.2	40	SER
1996 11 10.67		B	5.0	AA	3.0	B		8	12	9	0.4	12	SER
1999 06 06.37		S	12.0	VN	25.4	L	6	61	0.8	3			SEA01
1999 06 10.35		S	12.1	VN	25.4	L	6	61	0.8	4			SEA01
1999 06 11.35		S	12.2	VN	25.4	L	6	61	0.8	2			SEA01
1999 06 12.35		S	12.0	VN	25.4	L	6	61	0.7	3			SEA01
1999 06 13.76		S	12.2	VN	25.4	L	6	61	1.0	2			SEA01
1999 06 14.35		S	12.0	VN	25.4	L	6	61	0.9	3			SEA01
1999 06 16.38		S	11.9	VN	25.4	L	6	61	0.8	2			SEA01
1999 06 18.73		S	12.3	VN	25.4	L	6	61	1.0	1/			SEA01
2000 07 04.91		S	14.0:	VN	41	L	4	200	0.5	2			PEA
2000 10 01.56		S	[13.5	HS	20	L	7	160					MAT08
2000 10 19.61		S	[14.0	HS	20	L	7	160					MAT08

Comet C/1996 Q1 (Tabur)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 11.70		S	5.8	AA	3.5	R		7	18	5			KOL04
1996 10 11.73		M	6.5	SP	10	R	4	18	15	3			BAL03
1996 10 12.70		S	5.8	AA	3.5	R		7	20	5	0.8		KOL04
1996 10 12.78		M	6.3	SP	10	R	4	18	16	3			BAL03
1996 10 13.74		M	7.0	SP	10	R	4	18	12	2			BAL03
1996 10 14.80		M	6.5	SP	10	R	4	18	16	3			BAL03
1996 10 15.82		M	6.5	SP	10	R	4	18	17	4			BAL03
1996 10 16.74		M	6.7	SP	10	R	4	18	15	3			BAL03
1996 10 19.85	x	M	6.9	S	8.0	B		20	5				GLI

Comet C/1996 Q1 (Tabur) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 21.75	x	M	7.8	S	8.0	B		20	6				GLI

Comet C/1997 BA6 (Spacewatch)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 07 04.87		S	13.3	GA	41	L	4	90	1.0	2			PEA
2000 07 08.85		S	13.5	GA	41	L	4	90	0.7	2			PEA
2000 07 29.67		C	13.1	TJ	18.0	L	6	a 30	0.35				KAD02
2000 08 01.49		S	13.0	HS	20	L	7	160	1.5	5			MAT08
2000 08 09.82		S	13.3	VN	41	L	4	200	0.9	2			PEA
2000 08 10.86	a	S	13.5	VN	41	L	4	200	0.9	2			PEA
2000 08 24.61		S	13.0	HS	20	L	7	160	0.8	4			MAT08
2000 08 28.56		S	13.2	HS	20	L	7	160	1.0	4			MAT08
2000 09 02.55		C	13.9	TJ	18.0	L	6	a 40	0.4				KAD02
2000 09 17.51	x	C	13.4	TJ	60.0	Y	6	a120	1.1				NAK01
2000 09 20.49	x	C	13.2	HV	60.0	Y	6	a120	1.2				NAK01
2000 10 01.54		S	13.5:	HS	20	L	7	160	1.0	4			MAT08

Comet C/1998 M5 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 01 28.68		C	15.4	TJ	18.0	L	6	a 60	0.3				YOS05

Comet C/1998 T1 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1999 06 12.72		S	10.5	AA	25.4	L	6	61	3	1			SEA01
1999 06 13.72		S	10.2	VN	25.4	L	6	61	1.5	3			SEA01
1999 06 17.67		S	10.6	VN	25.4	L	6	61	1.4	3			SEA01
1999 06 18.67		S	10.2	VN	25.4	L	6	61	1.5	3			SEA01

Comet C/1999 E1 (Li)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 01 28.66		C	15.9	TJ	18.0	L	6	a 60	0.5				YOS05

Comet C/1999 H1 (Lee)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1999 05 13.07		B	8.2	AC	10.0	B	4	20	7	4			NOW
1999 06 06.33		B	7.6	AA	5.0	B		10	4	7			SEA01
1999 06 10.34		M	6.8	AA	5.0	B		10	3	7			SEA01
1999 06 11.34		M	6.9	AA	5.0	B		10	2.5	7/			SEA01
1999 06 12.34		M	7.0	AA	5.0	B		10	3	7			SEA01
1999 06 14.34		M	7.2	AA	5.0	B		10	4.5	7			SEA01
1999 06 16.35		M	7.3	AA	5.0	B		10	3.5	7/			SEA01
1999 06 17.33		M	7.1	AA	5.0	B		10	4	7			SEA01
1999 06 18.34		M	6.9	AA	5.0	B		10	2.5	7/			SEA01
1999 06 19.34		M	7.2	AA	5.0	B		10	2	8			SEA01
1999 09 02.12		B	7.5	AC	10.0	B	4	20	5	3			NOW
1999 09 09.11		S	8.1	AA	10.0	B		14	8	6			LO001
1999 09 12.20		B	8.3	AC	10.0	B	4	20	4	3			NOW
1999 09 18.06		S	8.6	AA	10.0	B		14	7	4			LO001
1999 09 21.12		S	8.4	AA	10.0	B		14	6	4			LO001
1999 10 03.79		S	9.1	AC	25	L	4	53	3.5	2			LO001
1999 10 05.82		S	9.3	AC	25	L	4	53	3	2			LO001

Comet C/1999 H3 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 01 19.76		C	15.0	TJ	18.0	L	6	a 60	0.5				YOS05
2000 01 25.79		C	14.9	TJ	18.0	L	6	a 60	0.5				YOS05
2000 04 02.95		C	14.7	HS	35	L	5	a120	0.5				HOR02
2000 04 21.82		k	14.9	UO	35	L	5	a180	0.5				HOR02
2000 04 22.85		k	14.9	UO	35	L	5	a240	0.5				HOR02

Comet C/1999 H3 (LINEAR) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 04 23.85		k	15.0	UO	35	L	5	a360	0.45				HOR02
2000 04 28.83		k	14.9	UO	35	L	5	a180	0.4				HOR02
2000 04 29.84		k	15.2	UO	35	L	5	a240	0.45				HOR02
2000 04 30.92		k	14.6	UO	35	L	5	a300	0.5				HOR02
2000 05 02.91		k	15.0	UO	35	L	5	a240	0.4				HOR02
2000 05 03.86		k	14.6	UO	35	L	5	a240	0.45				HOR02
2000 05 05.85		k	14.6	UO	35	L	5	a300	0.6				HOR02
2000 05 06.84		k	15.1	UO	35	L	5	a240	0.5				HOR02
2000 05 07.87		k	15.2	UO	35	L	5	a420	0.45				HOR02
2000 05 23.89		k	15.0	UO	35	L	5	a420	0.55				HOR02
2000 05 26.92		k	15.4	UO	35	L	5	a420	0.3				HOR02
2000 06 01.89	d	k	15.6	FD	35	L	5	a420	0.35				HOR02
2000 06 02.91	d	k	15.9	FD	35	L	5	a300	0.35				HOR02
2000 06 03.91	d	k	15.6	FD	35	L	5	a300	0.35				HOR02
2000 07 08.47		C	16.1	TJ	18.0	L	6	a 60	0.3				KAD02

Comet C/1999 J2 (Skiff)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 01 28.78		C	15.6	TJ	18.0	L	6	a 60	0.45				YOS05
2000 03 28.99		C	15.5	HS	35	L	5	a210	0.5				HOR02
2000 04 02.97		C	15.3	HS	35	L	5	a120	0.5				HOR02
2000 04 22.90		k	15.0	UO	35	L	5	a300	0.4				HOR02
2000 04 23.91		k	14.9	UO	35	L	5	a300	0.4		0.4m	15	HOR02
2000 04 28.85		k	15.2	UO	35	L	5	a180	0.35		0.3m	15	HOR02
2000 04 29.86		k	14.8	UO	35	L	5	a240	0.35		0.6m	15	HOR02
2000 04 30.93		k	14.7	UO	35	L	5	a300	0.3		1.0m	20	HOR02
2000 05 02.98		k	14.9	UO	35	L	5	a210	0.35		0.4m	20	HOR02
2000 05 03.97		k	14.9	UO	35	L	5	a360	0.4		0.4m	15	HOR02
2000 05 05.87		k	14.3	UO	35	L	5	a240	0.4		1.1m	17	HOR02
2000 05 06.87		k	14.1	UO	35	L	5	a420	0.35		1.5m	22	HOR02
2000 05 07.92		k	14.1	UO	35	L	5	a420	0.4		3.8m	15	HOR02
2000 05 09.99		k	14.2	UO	35	L	5	a540	0.35		3.0m	25	HOR02
2000 05 10.91		k	14.8	UO	35	L	5	a660	0.3		1.0m	25	HOR02
2000 05 12.89		k	14.5	UO	35	L	5	a240	0.35		1.2m	23	HOR02
2000 05 13.89		k	14.4	UO	35	L	5	a420	0.4		2.0m	28	HOR02
2000 05 14.92		k	14.2	UO	35	L	5	a480	0.35		1.5m	27	HOR02
2000 05 15.95		k	14.6	UO	35	L	5	a600	0.4		1.4m	29	HOR02
2000 05 23.94		k	14.8	UO	35	L	5	a420	0.35		1.0m	27	HOR02
2000 05 26.97		k	14.9	UO	35	L	5	a360	0.35		0.8m	28	HOR02
2000 05 29.96		k	14.9	UO	35	L	5	a300	0.35		0.6m	30	HOR02
2000 06 01.92	d	k	15.5	FD	35	L	5	a300	0.35		0.6m	31	HOR02
2000 06 02.94	d	k	15.4	FD	35	L	5	a300	0.3		0.9m	27	HOR02
2000 06 04.00	d	k	15.4	FD	35	L	5	a360	0.35		0.9m	26	HOR02
2000 06 10.01	d	k	15.5	FD	35	L	5	a300	0.35		1.1m	27	HOR02
2000 06 10.99	d	k	15.4	FD	35	L	5	a420	0.3		0.9m	26	HOR02
2000 06 20.02	d	k	15.7	FD	35	L	5	a300	0.3		0.8m	31	HOR02
2000 06 20.92	d	k	15.6	FD	35	L	5	a300	0.35		1.0m	35	HOR02
2000 06 21.91	d	k	15.3	FD	35	L	5	a300	0.35		1.1m	33	HOR02
2000 06 29.90	d	k	15.6	FD	35	L	5	a420	0.35		1.0m	34	HOR02
2000 07 05.91	d	k	15.5	FD	35	L	5	a420	0.4		2.8m	30	HOR02
2000 07 06.90	d	k	15.4	FD	35	L	5	a420	0.4		2.1m	30	HOR02
2000 07 08.54		C	15.9	TJ	18.0	L	6	a 60	0.3		0.7m	31	KAD02
2000 07 12.89	d	k	15.5	FD	35	L	5	a420	0.4		1.0m	19	HOR02
2000 07 20.53		C	16.0	TJ	18.0	L	6	a 60	0.3				KAD02
2000 07 23.55		C	16.1	TJ	18.0	L	6	a 60	0.25				KAD02
2000 07 25.86		B	14.5	HS	42	L	5	162	0.8	3/			LEH
2000 07 25.96	d	k	15.8	FD	35	L	5	a480	0.35		1.5m	23	HOR02
2000 07 29.53	s	H	15.3	LA	50.0	C	12	b440	0.41	6	2.9m	22	FUK02
2000 07 29.55		C	16.1	TJ	18.0	L	6	a 60	0.3				KAD02
2000 07 29.56	s	V	16.0	LA	50.0	C	12	b440	0.41	6	2.9m	22	FUK02
2000 07 30.90		B	14.5	HS	42	L	5	162	0.7	3/			LEH
2000 07 31.51	s	H	15.2	LA	50.0	C	12	b440	0.40	6	2.5m	20	FUK02
2000 07 31.53	s	V	16.2	LA	50.0	C	12	b800	0.40	6	2.5m	20	FUK02
2000 07 31.87		S	15.2:	HS	44.0	L	5	156	< 1	4			HAS02

Comet C/1999 J2 (Skiff) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 07 31.88		B	14.5	HS	42	L	5	162	0.8	4			LEH
2000 07 31.92	d	k	15.7	FD	35	L	5	a540	0.3		0.8m	18	HOR02
2000 08 01.89		B	14.5	HS	42	L	5	162	0.6	4			LEH
2000 08 01.90		S	14.7	AC	40.6	L	5	130	0.4	3			RES
2000 08 01.91	d	k	15.5	FD	35	L	5	a600	0.35		1.0m	13	HOR02
2000 08 05.91		S	14.4	AC	40.6	L	5	130	0.5	3/			RES
2000 08 07.91	d	k	15.3	FD	35	L	5	a420	0.3				HOR02
2000 08 07.92		S	14.7	AC	40.6	L	5	130	0.4	3			RES
2000 08 19.85		B	14.2	HS	42	L	5	162	0.9	3			LEH
2000 08 19.87	d	k	15.6	FD	35	L	5	a420	0.3				HOR02
2000 08 20.84	d	k	16.0	FD	35	L	5	a360	0.3				HOR02
2000 08 20.86		B	14.1	HS	42	L	5	162	0.9	3/			LEH
2000 08 22.84		S	14.4	HS	35	L	5	237	1.0	2/			HOR02
2000 08 22.85		B	14.4	HS	42	L	5	162	0.8	4			LEH
2000 08 23.46		C	16.2	GA	60.0	Y	6	a120	0.45		0.9m	25	NAK01
2000 08 23.84		B	14.3	HS	42	L	5	162	0.8	4			LEH
2000 08 23.85		S	14.4	HS	35	L	5	237	1.1	2/			HOR02
2000 08 24.86		S	14.3	HS	35	L	5	237	1.1	2/			HOR02
2000 08 25.84		B	14.4	HS	42	L	5	162	0.8	4			LEH
2000 08 25.87		S	14.4	HS	35	L	5	237	1.1	2/			HOR02
2000 08 25.88		S	14.5	AC	40.6	L	5	130	0.5	3			RES
2000 08 26.85	d	k	15.4	FD	35	L	5	a540	0.35				HOR02
2000 08 27.83		B	14.4	HS	42	L	5	162	0.7	4			LEH
2000 08 29.83	d	k	15.4	FD	35	L	5	a480	0.25				HOR02
2000 09 02.48		C	16.0	TJ	18.0	L	6	a 90	0.35				KAD02
2000 09 02.90		S	14.6	NP	45	L	5	167	< 1	6			MAR02
2000 09 19.77		B	14.2	HS	42	L	5	162	0.9	4			LEH
2000 09 20.45	x	C	16.4	HV	60.0	Y	6	a240	0.4		0.8m	28	NAK01
2000 09 21.43	s	H	15.9	LA	50.0	C	12	c880	0.34	4	2.0m	18	FUK02
2000 09 23.76		B	14.3	HS	42	L	5	162	0.8	3/			LEH
2000 09 26.44	a	H	15.8	LA	50.0	C	12	A080	0.37	4	2.3m	18	FUK02
2000 09 27.76		B	14.1	HS	42	L	5	162	0.7	4			LEH
2000 09 29.76		B	14.2	HS	42	L	5	162	0.7	4			LEH
2000 09 30.76		O	[14.2	HS	42	L	5	162	! 0.5				LEH

Comet C/1999 J3 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1999 09 12.27		B	9.0	AC	10.0	B	4	20	3	2			NOW
1999 09 21.13		S	8.1	AC	25	L	4	53	3	6			LO001
1999 10 07.15		S	8.2	AC	10.0	B		14	3	6			LO001

Comet C/1999 K5 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 07 04.89		S	13.3	GA	41	L	4	90	0.6	5/			PEA
2000 07 08.88		S	13.1	GA	41	L	4	90	0.8	4			PEA
2000 08 09.83	a	S	13.2	VN	41	L	4	200	0.6	4			PEA
2000 08 10.82		S	13.3	HS	20	L	7	160	0.8	5			MAT08
2000 08 10.86	a	S	13.5	VN	41	L	4	200	0.6	3			PEA
2000 10 02.59		S	13.5	HS	20	L	7	160	0.5	4			MAT08
2000 10 19.60		S	13.8:	HS	20	L	7	160	0.6	4			MAT08

Comet C/1999 K8 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 07 10.72		C	15.4	TJ	18.0	L	6	a 60	0.4				KAD02
2000 07 29.69		C	15.0	TJ	18.0	L	6	a 90	0.5				KAD02
2000 08 02.01		S	13.0	AC	40.6	L	5	72	1.4	3			RES
2000 08 02.02		M	12.6	HS	42	L	5	162	1.7	3			LEH
2000 08 03.03		S	12.9	AC	40.6	L	5	72	1.4	3/			RES
2000 08 04.98		S	13.0	AC	40.6	L	5	72	1.2	3			RES
2000 08 06.00		S	12.8	AC	40.6	L	5	72	1.5	4			RES
2000 08 07.98		S	12.8	AC	40.6	L	5	72	1.5	3/			RES
2000 08 10.05		S	12.8	AC	40.6	L	5	72	1.6	3			RES

Comet C/1999 K8 (LINEAR) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 08 12.02		S	12.7	AC	40.6	L	5	72	1.5	3			RES
2000 08 26.00		M	12.9	HS	42	L	5	81	1.1	3			LEH
2000 08 26.02		S	13.3	AC	40.6	L	5	72	1.3	2/			RES
2000 08 26.72		C	15.1	TJ	18.0	L	6	a 90	0.45				KAD02
2000 08 26.75		C	14.9	GA	60.0	Y	6	a120	1.0				NAK01
2000 08 27.02		S	13.5	AC	40.6	L	5	72	1.2	3			RES
2000 08 29.74		C	15.0	TJ	18.0	L	6	a 90	0.5				KAD02
2000 09 02.63		C	14.9	TJ	18.0	L	6	a 90	0.65				KAD02
2000 09 02.76		S	13.0	HS	25.4	T	6	116	1.2	4			YOS04
2000 09 03.03		S	14.3	NP	45	L	5	167	1	0			MAR02
2000 09 08.91		S	13.5	HS	44.0	L	5	156	0.5	4			HAS02
2000 09 10.66		C	15.0	TJ	18.0	L	6	a 90	0.5				KAD02
2000 09 21.66		C	15.3	TJ	18.0	L	6	a 80	0.45				KAD02
2000 09 23.96		M	12.7	HS	42	L	5	162	1.2	3			LEH
2000 09 23.96	a	S	13.5	GA	25.4	J	6	115	1.0	2/			BOU
2000 09 24.63		C	14.9	HS	20.0	T	10	a120	0.4				EZA
2000 09 24.95		S	13.5	HS	31.0	J	6	124	1.3	2/			BOU
2000 09 26.60		C	15.2	HS	20.0	T	10	a120	0.4				EZA
2000 09 26.70		C	14.7	GA	60.0	Y	6	a120	1.0				NAK01
2000 09 27.54		C	14.7	HS	20.0	T	10	a120	0.4				EZA
2000 09 27.69		C	14.9	TJ	18.0	L	6	a 90	0.65				KAD02
2000 09 27.88		B	13.0	HS	42	L	5	162	1.6	3/			LEH
2000 09 30.94		B	13.2	HS	42	L	5	162	1.2	4			LEH
2000 10 01.55		S	[13.5	HS	20	L	7	160					MAT08
2000 10 05.95		S	14.0:	VB	30	R	20	300	0.6	2			SHA02
2000 10 07.65		C	15.0	TJ	18.0	L	6	a 90	0.55				KAD02

Comet C/1999 L3 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 01 19.72		C	11.9	HS	18.0	L	6	a 30	1.0				YOS05
2000 01 21.58		C	12.1	TJ	18.0	L	6	a 40	1.1				YOS05
2000 01 25.75		C	11.8	TJ	18.0	L	6	a 40	2.0		6.4m	121	YOS05
2000 01 28.63		C	10.9	TJ	18.0	L	6	a 40	2.5		11 m	135	YOS05
2000 01 30.52		C	11.5	TJ	16.0	H	3	a 40	1.0		2.9m	134	YOS05
2000 02 05.78		S	10.9:	TJ	25.4	L	5	65	3.3	4			MEY
2000 02 12.90		V	13.4	TJ	152	L	8	a300	1		3 m	110	COZ
2000 04 21.84		k	15.6:	UO	35	L	5	a240	0.6				HOR02
2000 04 22.83		k	15.7	UO	35	L	5	a300	0.6				HOR02

Comet C/1999 N2 (Lynn)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1999 08 16.08		B	7.8	AC	10.0	B	4	20	4	4			NOW

Comet C/1999 N4 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 07 05.99	d	k	16.8	FD	35	L	5	a420	0.25				HOR02
2000 07 06.97	d	k	16.5	FD	35	L	5	a360	0.2				HOR02
2000 07 25.90	d	k	16.3	FD	35	L	5	a300	0.25				HOR02
2000 07 29.53		C	17.2:	TJ	18.0	L	6	a 60	0.2				KAD02
2000 07 30.88		B	15.2	HS	42	L	5	162	0.4	5			LEH
2000 07 31.86		B	15.2	HS	42	L	5	162	0.5	5			LEH
2000 08 01.87		B	15.1	HS	42	L	5	162	0.4	5			LEH
2000 08 01.87	d	k	16.5	FD	35	L	5	a420	0.25				HOR02
2000 08 05.89		S	14.8	AC	40.6	L	5	130	0.3	3			RES
2000 08 19.82		B	15.0	HS	42	L	5	162	0.4	4/			LEH
2000 08 19.85	d	k	16.4	FD	35	L	5	a540	0.3				HOR02
2000 08 20.83		B	14.9	HS	42	L	5	162	0.5	4			LEH
2000 08 22.83		B	14.9	HS	42	L	5	162	0.4	4/			LEH
2000 08 23.82		B	14.9	HS	42	L	5	162	0.4	4/			LEH
2000 08 25.85		B	15.1	HS	42	L	5	162	0.3	5			LEH
2000 08 27.81		B	15.0	HS	42	L	5	162	0.3	5			LEH
2000 09 20.44	x	C	17.0	HV	60.0	Y	6	a240	0.4				NAK01

Comet C/1999 S3 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 01 22.39		C	15.2	TJ	18.0	L	6	a 60	0.5				YOS05
2000 04 23.79		k	17.2:	UO	35	L	5	a480	0.5				HOR02

Comet C/1999 S4 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 01 21.53		C	15.1	TJ	18.0	L	6	a 60	0.15		0.5m	90	YOS05
2000 01 22.40		C	14.8	TJ	18.0	L	6	a 60	0.35		1.4m	70	YOS05
2000 01 30.45		C	15.2	TJ	16.0	H	3	a 40	0.5				YOS05
2000 02 05.76		S	13.7	AC	25.4	L	5	162	0.9	2/			MEY
2000 06 10.01		S	10.2	AA	6.3	R	13	52	3	1			KOS
2000 06 12.02		S	9.7	AA	6.3	R	13	52	4	1			KOS
2000 06 21.37		S	8.5	TK	14.3	L	6	78	2.5	5/			AMO01
2000 06 23.97		S	9.2	AA	6.3	R	13	52	6	2			KOS
2000 06 28.00		S	8.3	AA	6.3	R	13	52	4	6	0.12	290	KOS
2000 06 30.05		S	8.3	TT	20.0	T	10	100	2	6			BLO01
2000 07 01.98		M	7.2	TT	10	B	4	25	7	4/			LEH
2000 07 06.02	d	k	8.6	FD	35	L	5	a120	1.7		>13 m	272	HOR02
2000 07 06.95		M	6.7	TT	5.0	B		10	9	3/			LEH
2000 07 06.98		S	7.4	AA	6.3	R	13	52	4	7	0.33	273	KOS
2000 07 08.08		B	7.9	TK	5.0	B		7	8	7	0.4	260	BIV
2000 07 09.63		B	8.1	S	8.0	B		11	2	6	0.4	270	WAT01
2000 07 11.00	x	M	7.5	TJ	8.0	B		15	6	5	0.7	276	BOU
2000 07 11.02		S	6.9	AA	6.3	R	13	52	4	7	0.50	292	KOS
2000 07 11.94		S	7.4	TJ	8.0	B		20	3.1	5			SHA02
2000 07 12.97	d	k	7.8	FD	35	L	5	a120	3.2		>13 m	281	HOR02
2000 07 13.01	x	M	7.5	TJ	15.6	L	5	24	3.5	6/	0.6	281	BOU
2000 07 13.02	x	M	7.5	TJ	8.0	B		15	4	6	0.8	286	BOU
2000 07 14.94		S	7.1	TJ	8.0	B		20	3.9	5	0.33	310	SHA02
2000 07 16.92		S	6.8	VB	8.0	B		20	3.9	5	0.17	315	SHA02
2000 07 16.96		S	7.3	SC	5.0	B		7					MCB01
2000 07 17.01		S	8.3	TJ	8.0	B		20	0.8	7	0.13	302	STO03
2000 07 18.92		S	7.5:	TK	25.6	L	5	42	5	6	>0.2	320	BIV
2000 07 18.93		S	6.9	TJ	8.0	B		20	4.7	4	0.20	345	SHA02
2000 07 19.83		B	6.9	SC	5.0	R		22		8			RAD01
2000 07 19.85		S	6.8	AA	6.3	R	13	52	4	7	1.7	350	KOS
2000 07 19.93		S	7.1	TJ	8.0	B		20	3.8	5	0.50	355	SHA02
2000 07 19.94		S	7.0	TJ	5.0	B		10	4.7	5			SHA02
2000 07 19.96		S	7.9	S	6	R	7	11	5	6	0.13	355	TAY
2000 07 19.98		S	6.5	SC	5.0	B		7			0.5		MCB01
2000 07 20.91		S	7.0	TK	5.0	B		7	8	5	0.6	10	BIV
2000 07 20.92		S	7.2	TK	25.6	L	5	42	5	6	0.5	9	BIV
2000 07 20.93		S	7.1	TJ	10	B		14	4.7	6	0.60	360	SHA02
2000 07 20.94		S	7.0	TJ	5.0	B		10	5.0	5			SHA02
2000 07 20.94		S	7.4	S	6	R	7	11	2	5	0.17	357	TAY
2000 07 20.97		S	6.3	SC	5.0	B		7			0.66		MCB01
2000 07 21.51	s	S	6.5	HD	7.0	B		10	9	6	60 m	11	END
2000 07 21.83		B	6.6	SC	5.0	R		22		7			RAD01
2000 07 21.83		B	6.8	SC	5.0	R		22		7			RAD03
2000 07 21.84		B	6.7	SC	5.0	R		22		3			DAR01
2000 07 21.84		S	6.3	AA	6.3	R	13	52	3	8	3.1	30	KOS
2000 07 21.85		B	6.8	SC	5.0	R		22		5			RAD02
2000 07 21.88		S	7.0	HS	25.4	C	10	96	8	3/		10	HOE
2000 07 21.90		B	6.8	TJ	12.0	R	5	27	6	6	0.4		SIE
2000 07 21.92		S	6.5	TK	5.0	B		7	8	6	0.4	30	BIV
2000 07 21.92		S	6.6	TJ	8.0	B		20	4.7	s6	0.5	20	SHA02
2000 07 21.92		S	6.7	TK	25.6	L	5	42	3.0	8	0.3	30	BIV
2000 07 21.93		S	6.0	TJ	3.0	B		8	5	5			SHA02
2000 07 21.97		S	5.9	SC	5.0	B		7			0.75		MCB01
2000 07 21.99		S	7.5	AA	5.0	B		8	3	3	0.25	360	BEA
2000 07 22.02		S	7.0	AA	12.5	R	5	20	5	3	0.17	360	BEA
2000 07 22.47	s	S	6.6	HD	15.0	B		25	10	6	60 m	11	END
2000 07 22.51		S	6.3	HS	5.0	B		7	5	5			SOW
2000 07 22.79		B	7.0	SC	5.0	R		22		8			RAD01
2000 07 22.83		B	6.5	SC	18.0	R		72		8			RAD01

Comet C/1999 S4 (LINEAR) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 07 22.83		B	6.8	SC	5.0	B		10		2			DAR01
2000 07 22.84		B	6.4	SC	18.0	R		72		8			RAL
2000 07 22.87		S	6.1	AA	6.3	R	13	52	3	8	3.7	30	KOS
2000 07 22.88		M	6.2	TT	5.0	B		10	10	5	0.66	30	LEH
2000 07 22.92		B	7.0	TJ	12.0	R	5	27	6	6	0.2		SIE
2000 07 22.92		S	6.4:	TK	5.0	B		7	5	6			BIV
2000 07 22.92		S	6.8:	TK	25.6	L	5	42	4.0	8	0.3	50	BIV
2000 07 22.93		B	6.4	SC	18.0	R		72		6			RAD03
2000 07 22.98		S	6.8	TJ	7.0	R	7	24	3	5			GRA04
2000 07 23.80		B	7.8	SC	5.0	R		22		5			PAN02
2000 07 23.80		B	7.8	SC	5.0	R		22		7			DAS
2000 07 23.81		B	7.8	SC	5.0	R		22		7			DAS01
2000 07 23.83		B	6.5	SC	5.0	R		22		7			RAD01
2000 07 23.85		S	6.0	AA	6.3	R	13	52	3	8	4.7	35	KOS
2000 07 23.86		B	6.4	SC	5.0	R		22		7			DAS
2000 07 23.87		B	7.0	SC	5.0	B		10					RAD03
2000 07 23.90		M	6.0	TT	5.0	B		10	8	6	0.50	55	LEH
2000 07 23.95		S	6.5	AA	12.5	R	5	20	5	3	0.33	25	BEA
2000 07 24.58	&	B	6.0	S	4.2	B		9	6		30 m	30	MAN03
2000 07 24.80		B	7.3	SC	5.0	B		10					RAD03
2000 07 24.81		B	6.6	SC	5.0	R		22		6			DAS
2000 07 24.81		B	6.6	SC	5.0	R		22		6			DAS01
2000 07 24.81		B	7.3	SC	5.0	R		22		3			RAD02
2000 07 24.84		B	7.4	SC	5.0	R		22		7			PAN02
2000 07 24.94	&	C	6.7	HS	14.3	D	4	a 30	3.5	2	22 m	60	MOR09
2000 07 25.28		B	6.7	TK	5.0	B		7	7	7	1.5	60	BIV
2000 07 25.83		B	8.2	SC	5.0	R		22		5			PAN02
2000 07 25.84		B	8.6	SC	5.0	R		22		5			RAD01
2000 07 25.84		B	8.7	SC	5.0	R		22		5			RAD02
2000 07 25.84		S	6.4	AA	6.3	R	13	52	3	7	3.5	50	KOS
2000 07 25.86	x	B	7.3	S	10.0	B		25	7.5	s3	10 m	65	CH002
2000 07 25.90		M	6.6	TT	8.0	B		10	10	6	1.00	65	LEH
2000 07 25.92		B	7.2	TJ	12.0	R	5	27	6	5	0.3		SIE
2000 07 26.29		S	6.4	TK	5.0	B		7	8	5	1.1	65	BIV
2000 07 26.48	xs	S	6.6	TJ	10.0	B		20	5	5/	50 m	65	NAG08
2000 07 26.84		B	7.5	SC	5.0	R		22		4			MAR24
2000 07 26.84		S	6.6	AA	5.0	B		7	3	7	3.3	55	KOS
2000 07 26.85		B	7.6	SC	5.0	R		22		6			RAL
2000 07 26.86		B	7.3	SC	5.0	R		22		5			RAD02
2000 07 26.86		B	7.3	SC	5.0	R		22		6			RAD03
2000 07 26.87		B	7.5	SC	5.0	R		22		5			DAR01
2000 07 26.88		B	7.4	SC	5.0	R		22		7			RAD01
2000 07 26.91	&	C	6.9	HS	14.3	D	4	a 30	2.5	2	10 m	79	MOR09
2000 07 27.28		S	7.2	TK	5.0	B		7	8	5	1.2	75	BIV
2000 07 27.83		B	7.2	SC	18.0	R		72		5			RAL
2000 07 27.83		B	8.0	SC	5.0	R		22		4			RAD02
2000 07 27.84		B	7.8	SC	5.0	R		22		5			DAR01
2000 07 27.84		S	6.8	AA	5.0	B		7	5	6	2.5	50	KOS
2000 07 28.28		S	7.6	TK	5.0	B		7	9	4	0.6	80	BIV
2000 07 28.53	xs	S	7.2	TT	10.0	B		20	5	3	13 m	80	YOS02
2000 07 28.87	&	C	7.6	HS	14.3	D	4	a 30	2	2	11 m	84	MOR09
2000 07 28.88		S	7.3	TJ	7.0	R	7	24	4.5	4			GRA04
2000 07 29.26		S	7.7	TK	5.0	B		7	8	3	0.6	100	BIV
2000 07 29.45	s	H	7.9	LA	50.0	C	12	a120	5.8	D2	>10.9m	89	FUK02
2000 07 29.46	s	V	9.3	LA	18.0	L	6	a 80	2.9	3	13 m	87	KAD02
2000 07 29.47	s	H	8.1	LA	18.0	L	6	a 80	5.5	3	24 m	87	KAD02
2000 07 29.47	s	V	8.9	LA	50.0	C	12	a120	5.8	D2	>10.9m	89	FUK02
2000 07 29.48	xs	S	7.4	TJ	10.0	B		20	5	3/	20 m	80	NAG08
2000 07 29.84		S	7.3	AA	5.0	B		7	5	5	1.2	80	KOS
2000 07 29.89		S	7.5	TJ	7.0	R	7	24	5.5	4			GRA04
2000 07 29.91		S	7.1	TJ	8.0	B		20	2.1	7			SHA02
2000 07 30.27		S	7.9	TK	5.0	B		7	9	3	0.4	100	BIV
2000 07 30.46	s	H	8.2	LA	50.0	C	12	a120	4.5	D1	>11.7m	92	FUK02
2000 07 30.46	s	H	8.5	LA	18.0	L	6	a 80	4.7	2/	19 m	89	KAD02
2000 07 30.47		M	8.5	AA	15.0	B		25	5	1			MIT

Comet C/1999 S4 (LINEAR) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 07 30.47		S	7.9	TJ	25.4	T	6	62	7	3/			YOS04
2000 07 30.47	s	V	9.0	LA	50.0	C	12	a120	4.5	D1	>11.7m	92	FUK02
2000 07 30.48	s	V	9.8	LA	18.0	L	6	a 90	2.3	2/	11 m	89	KAD02
2000 07 30.88	&	C	8.4	HS	14.3	D	4	a 30	2.5	3	12 m	88	MOR09
2000 07 31.26		S	8.0	TK	5.0	B		7	9	3	0.4	90	BIV
2000 07 31.45	s	H	8.6	LA	50.0	C	12	a120	4.4	0	>11.0m	94	FUK02
2000 07 31.47	xs	S	8.4	TJ	32.0	L	5	58	5	3	15 m	100	NAG08
2000 07 31.47	s	V	9.5	LA	50.0	C	12	a180	4.4	0	>11.0m	94	FUK02
2000 07 31.85		M	7.7	TT	10	B	4	25	6	2			LEH
2000 07 31.87	&	C	8.6	HS	14.3	D	4	a 60	2.5	3	12 m	95	MOR09
2000 08 01.28		S	8.3	TK	5.0	B		7	7	3	0.8	95	BIV
2000 08 01.43		S	9.0:	TJ	10	B		25	3.0	0	0.33	90	MAT08
2000 08 01.45	s	H	8.8	LA	50.0	C	12	a120	4.5	0	>10.4m	96	FUK02
2000 08 01.46	s	V	9.6	LA	50.0	C	12	a120	4.5	0	>10.4m	96	FUK02
2000 08 01.84		M	8.1	TT	10	B	4	25	8	2			LEH
2000 08 02.28		S	8.5	TK	5.0	B		7	8	2	0.4	95	BIV
2000 08 02.44		S	9.0:	TJ	10	B		25	4.0	0	0.30	90	MAT08
2000 08 02.46	s	H	9.3	LA	50.0	C	12	a120	4.0	0	> 9.9m	97	FUK02
2000 08 02.47	xs	S	9.5:	TJ	32.0	L	5	58	& 5	0/			NAG08
2000 08 03.28		S	8.8	TK	5.0	B		7	10	1			BIV
2000 08 03.45	s	H	10.0	LA	50.0	C	12	a120	3.1	0	>10.0m	98	FUK02
2000 08 03.49	x	S	10.3	TT	25.4	L	4	46	3	2	9 m	105	YOS02
2000 08 04.27		S	9.1	TK	5.0	B		7	8	1			BIV
2000 08 04.85	!	C	9.0:	HI	40	D	2	a 60	> 1.9	d4	>11.5m	100	ROD01
2000 08 05.27		S	9.2	TK	5.0	B		7	7	1			BIV
2000 08 05.90	&	S[	8.5	TJ	7.0	R	7	24	! 3				GRA04
2000 08 06.40		S	10.0:	TJ	20	L	7	45	2.0	0	0.08	95	MAT08
2000 08 06.89	&	S[	8.5	TJ	7.0	R	7	24	! 3				GRA04
2000 08 07.87	&	S[	8.8	TJ	7.0	R	7	69	! 2				GRA04
2000 08 14.43	1	H[	15.0	HS	50.0	C	12	a 90					FUK02
2000 08 30.43		S[	12.5	HS	20	L	7	45					MAT08

Comet C/1999 T1 (McNaught-Hartley)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 07 04.87		S	12.6	GA	41	L	4	90	1.4	2			PEA
2000 07 08.89		S	12.3	GA	41	L	4	90	1.2	2/			PEA
2000 08 01.81		S	10.9	TJ	20	L	7	45	2.3	5			MAT08
2000 08 09.84		S	11.0	TT	41	L	4	90	2.2	2			PEA
2000 08 10.81		S	11.0	TJ	20	L	7	45	2.0	4/			MAT08
2000 08 10.87		S	11.3	TT	41	L	4	90	1.8	2			PEA
2000 08 13.86	x	S	11.1	TT	41	L	4	90	1.5	2/			PEA
2000 09 04.82	x	S	10.8	TT	20	L	4	45	1.5	1			PEA
2000 09 11.88	x	S	10.2	TT	20	L	4	45	2.2	1			PEA
2000 09 21.83	x	S	10.0	TT	20	L	4	45	2.5	2			PEA
2000 09 23.85	x	S	9.9	TT	20	L	4	45	2.0	3			PEA
2000 09 24.87	x	S	10.0	TT	20	L	4	45	2.0	3			PEA
2000 09 30.85	x	S	9.7	TT	20	L	4	45	3	3			PEA
2000 10 01.85	x	S	9.7	TT	20	L	4	45	2.7	3			PEA
2000 10 02.71		S	9.6	AA	10.0	B		25	2				SEA
2000 10 02.79		M	9.6	TJ	20	L	7	45	2.0	5/	0.07	230	MAT08
2000 10 02.85	x	S	9.7	TT	20	L	4	45	3.0	3			PEA
2000 10 04.81	x	S	9.8	TT	20	L	4	45	2.5	3			PEA
2000 10 07.73		S	9.4	AA	10.0	B		25					SEA
2000 10 07.85	x	S	9.5	TT	20	L	4	45	3	3			PEA
2000 10 08.78		M	9.5	TJ	20	L	7	45	2.0	6	0.05	220	MAT08
2000 10 18.83	x	S	9.3	TT	20	L	4	45	2.5	4			PEA
2000 10 21.82	x	S	9.3	TT	20	L	4	45	2.6	4			PEA
2000 10 22.84	x	S	9.1	TT	20	L	4	45	2.7	4			PEA
2000 10 23.84	x	S	9.0	TT	20	L	4	45	3.3	4			PEA
2000 10 24.80	x	S	9.0	TT	20	L	4	45	3.4	4			PEA
2000 10 25.83	x	S	8.9	TT	20	L	4	45	3.0	4			PEA
2000 10 27.75		M	8.9	TJ	10	B		25	3.0	5/			MAT08
2000 10 27.83	x	S	8.8	TT	20	L	4	45	2.5	5			PEA

Comet C/1999 T2 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 05 24.01		k	14.1	UO	35	L	5	a720	0.35				HOR02
2000 05 27.01		k	14.8	UO	35	L	5	a360	0.4				HOR02
2000 06 01.99	d	k	14.7	FD	35	L	5	a420	0.3				HOR02
2000 06 02.98	d	k	14.8	FD	35	L	5	a360	0.35				HOR02
2000 06 03.98	d	k	14.6	FD	35	L	5	a240	0.35				HOR02
2000 06 08.98	d	k	14.6	FD	35	L	5	a240	0.4				HOR02
2000 06 10.00	d	k	14.7	FD	35	L	5	a180	0.4				HOR02
2000 06 10.98	d	k	14.8:	FD	35	L	5	a180	0.3				HOR02
2000 06 21.94	d	k	14.9	FD	35	L	5	a240	0.35				HOR02
2000 06 29.93	d	k	14.3	FD	35	L	5	a180	0.5				HOR02
2000 07 05.88	d	k	13.9	FD	35	L	5	a180	0.7		0.8m	150	HOR02
2000 07 06.88	d	k	14.0	FD	35	L	5	a300	0.6		0.9m	150	HOR02
2000 07 08.53		C	14.6	TJ	18.0	L	6	a 60	0.45				KAD02
2000 07 11.02		S	13.1	AC	31.0	J	6	124	1.0	4			BOU
2000 07 20.56		C	14.3	TJ	18.0	L	6	a 60	0.5				KAD02
2000 07 22.56		C	14.4	TJ	18.0	L	6	a 60	0.45				KAD02
2000 07 24.04	d	k	14.1	FD	35	L	5	a360	0.6		0.8m	138	HOR02
2000 07 25.94		M	12.8	HS	42	L	5	81	1.4	3			LEH
2000 07 26.03	d	k	14.0	FD	35	L	5	a360	0.7		1.1m	117	HOR02
2000 07 26.89	&	C	14.1	HS	14.3	D	4	a120	0.5	1			MOR09
2000 07 28.99	&	C	14.4	HS	14.3	D	4	a120	0.5	1			MOR09
2000 07 29.63		C	14.2	TJ	18.0	L	6	a 60	0.55		0.7m	118	KAD02
2000 07 29.97		I	[13.9	VB	33	L	5	150					SHA02
2000 07 31.92		M	12.9	HS	42	L	5	81	1.3	3			LEH
2000 08 01.04	d	k	13.8	FD	35	L	5	a540	0.6		0.7m	123	HOR02
2000 08 01.91		M	12.9	HS	42	L	5	81	1.1	3			LEH
2000 08 02.01		S	13.4	AC	40.6	L	5	72	1.0	3			RES
2000 08 02.01	d	k	13.9	FD	35	L	5	a480	0.65		0.8m	122	HOR02
2000 08 02.90	x	S	13.1:	HS	25	L	7	135	0.7	s4			DRA02
2000 08 03.03		S	13.4	AC	40.6	L	5	72	1.0	2/			RES
2000 08 04.60		C	14.1	GA	60.0	Y	6	a120	1.0				NAK01
2000 08 04.97		S	13.4	HS	25.4	L	5	104	1.0	2/			MEY
2000 08 04.98		S	13.3	AC	40.6	L	5	72	1.1	3/			RES
2000 08 04.98		S	13.4	HS	31.0	J	6	143	0.8	4			BOU
2000 08 06.00		S	13.1	AC	40.6	L	5	72	1.2	3/			RES
2000 08 06.99		M	13.8	HS	35	L	5	112	1	2/			SHU
2000 08 07.94	d	k	13.9	FD	35	L	5	a600	0.6				HOR02
2000 08 08.97		S	13.4	AC	31.0	J	6	109	0.7	4			BOU
2000 08 08.98		M	14.4:	HS	35	L	5	83	0.6	3			SHU
2000 08 09.98		M	13.8	HS	35	L	5	83	1	3			SHU
2000 08 10.00		S	13.2	AC	40.6	L	5	72	1.2	3			RES
2000 08 12.85		C	13.8	HS	14.3	D	4	a 60	0.6	0			MOR09
2000 08 14.80		C	14.1	HS	14.3	D	4	a 60	0.4	0			MOR09
2000 08 19.54		C	14.1	TJ	18.0	L	6	a 60	0.45				KAD02
2000 08 19.89		B	13.3	HS	42	L	5	162	1.2	3			LEH
2000 08 19.89	d	k	14.1	FD	35	L	5	a360	0.5				HOR02
2000 08 20.82		C	14.3	HS	14.3	D	4	a 60	0.7	1			MOR09
2000 08 20.89		B	13.2	HS	42	L	5	81	1.0	3/			LEH
2000 08 20.90		S	12.8	HS	35	L	5	158	1.1	3			HOR02
2000 08 21.88		S	13.6	VB	33	L	5	150	0.5	3			SHA02
2000 08 22.86		B	13.2	HS	42	L	5	81	1.3	3/			LEH
2000 08 22.87		S	13.2	HS	35	L	5	158	1.2	3			HOR02
2000 08 23.52		C	14.0	GA	60.0	Y	6	a120	1.0		1.4m	84	NAK01
2000 08 23.86		B	13.2	HS	42	L	5	81	1.0	3			LEH
2000 08 23.87		M	13.1	HS	35	L	5	158	1.3	3			HOR02
2000 08 23.90		S	13.2	HS	31.0	J	6	124	0.9	3/			BOU
2000 08 23.95		S	13.7	VB	30	R	20	185	0.5	3			SHA02
2000 08 24.84		S	13.5	HS	44.0	L	5	156	0.3	4			HAS02
2000 08 24.85		M	13.0	HS	35	L	5	158	1.3	3/			HOR02
2000 08 24.94		C	14.8	HS	14.0	D	4	a 60	0.5	0			MOR09
2000 08 25.02		C	14.6	HS	14.0	D	4	a 60	0.5	0			MOR09
2000 08 25.85		M	13.1	HS	35	L	5	158	1.2	3			HOR02
2000 08 25.88		B	13.2	HS	42	L	5	81	0.9	3			LEH
2000 08 26.01		S	13.5	AC	40.6	L	5	72	1.0	3			RES
2000 08 26.58		C	14.3	TJ	18.0	L	6	a 60	0.4				KAD02

Comet C/1999 T2 (LINEAR) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 08 26.88		S	13.5	VB	30	R	20	185	0.5	3			SHA02
2000 08 26.89	d	k	13.9	FD	35	L	5	a300	0.5		0.8m	77	HOR02
2000 08 27.01		S	13.5	AC	40.6	L	5	72	1.0	3			RES
2000 08 27.85		B	13.2	HS	42	L	5	162	1.1	3			LEH
2000 08 27.91		C	14.4	HS	14.0	D	4	a 60	0.8	2	1.2m	78	MOR09
2000 08 28.90		S	13.5	VB	30	R	20	185	0.5	3			SHA02
2000 08 29.88	d	k	13.7	FD	35	L	5	a420	0.58				HOR02
2000 08 29.91		S	13.3	HS	31.0	J	6	124	1.0	3			BOU
2000 08 30.89		S	13.4	VB	30	R	20	185	0.5	3			SHA02
2000 08 30.92		S	13.3	HS	44.5	L	5	160	0.8	1			SAN07
2000 08 30.97		C	14.1	HS	14.3	D	4	a 60	0.7	0			MOR09
2000 09 01.86		S	13.2	HS	35	L	5	158	1.2	2/			HOR02
2000 09 02.45		C	14.2	TJ	18.0	L	6	a 60	0.6				KAD02
2000 09 02.97		S	12.9	NP	45	L	5	167	1	2			MAR02
2000 09 02.97		S	13.2	NP	45	L	5	167	0.5	1			SAN04
2000 09 03.93		S	13.7	VB	30	R	20	185	0.5	3			SHA02
2000 09 04.01		S	13.2	AC	40.6	L	5	72	1.2	3			RES
2000 09 07.51		C	14.2	HS	20.0	T	10	a 60	0.5				EZA
2000 09 08.87	d	k	13.8	FD	35	L	5	a480	0.6		1.5m	77	HOR02
2000 09 09.86	d	k	13.8	FD	35	L	5	a540	0.6		2.0m	71	HOR02
2000 09 10.83	d	k	13.7	FD	35	L	5	a540	0.7		4.3m	70	HOR02
2000 09 11.83		C	14.0	HS	14.3	D	4	a 60	0.5	0			MOR09
2000 09 13.54		C	14.5	HS	20.0	T	10	a 60	0.5				EZA
2000 09 15.53		C	14.2	TJ	18.0	L	6	a 60	0.5				KAD02
2000 09 17.49		C	13.8	GA	60.0	Y	6	a120	1.1		1.4m	77	NAK01
2000 09 17.54		C	14.4	HS	20.0	T	10	a120	0.4				EZA
2000 09 18.50		C	14.1	HS	20.0	T	10	a120	0.5				EZA
2000 09 19.13		J	13.0	SC	25.4	T	5	a100	0.71	s5	2.3m	75	ROQ
2000 09 19.45		C	14.2	GA	40.0	L	6	a 30	& 0.3				AKA
2000 09 19.80		M	12.4	HS	42	L	5	81	2	3			LEH
2000 09 20.48		C	13.9	HS	20.0	T	10	a 60	0.5				EZA
2000 09 23.78		M	12.9	HS	42	L	5	81	1.8	3			LEH
2000 09 23.79	d	k	14.0	FD	35	L	5	a480	0.55		1.6m	70	HOR02
2000 09 23.91		S	13.1	GA	25.4	J	6	100	1.2	3			BOU
2000 09 24.54		C	13.6	HS	20.0	T	10	a 60	0.5				EZA
2000 09 24.75		S	13.4	AC	40.6	L	5	72	0.8	2/			RES
2000 09 24.84		S	13.3	AC	31.0	J	6	143	1.0	3			BOU
2000 09 25.92	d	k	13.9	FD	35	L	5	a480	0.55				HOR02
2000 09 26.48		C	14.1	GA	60.0	Y	6	a120	0.9				NAK01
2000 09 26.48	a	H	13.4	LA	50.0	C	12	A440	1.0	5	5.7m	63	FUK02
2000 09 26.50		C	13.4	HS	20.0	T	10	a 60	0.5				EZA
2000 09 26.52	a	V	14.2	LA	50.0	C	12	A440	1.0	5	5.7m	63	FUK02
2000 09 26.87		S	13.6	VB	30	R	20	185	0.3	4			SHA02
2000 09 27.47		C	13.5	HS	20.0	T	10	a 60	0.5				EZA
2000 09 27.80		M	12.9:	HS	42	L	5	81	1.7	3			LEH
2000 09 28.90		S	13.4	VB	30	R	20	185	0.7	4			SHA02
2000 09 29.48		C	12.7	HS	20.0	T	10	a 60	0.5				EZA
2000 09 29.78		B	13.2	HS	42	L	5	81	1.2	3			LEH
2000 09 30.78		B	13.2	HS	42	L	5	81	1.1	3			LEH
2000 09 30.78		M	13.0	HS	35	L	5	158	1.2	3/			HOR02
2000 09 30.80	d	k	14.1	FD	35	L	5	a300	0.5				HOR02
2000 09 30.83		S	13.4	VB	30	R	20	230	0.5	3			SHA02
2000 10 03.86		S	13.2	NP	25	L	5	96	1	3			SEG
2000 10 05.88		S	13.5	VB	30	R	20	230	0.7	3			SHA02
2000 10 07.41		C	14.4	TJ	18.0	L	6	a 60	0.45				KAD02
2000 10 10.42		C	14.0	HS	20.0	T	10	a 60	0.4				EZA
2000 10 11.47		C	14.1	HS	20.0	T	10	a 60	0.4				EZA
2000 10 19.88		S	12.9	HS	33	L	5	150	1.0	3			SHA02
2000 10 21.77		S	13.1	AC	40.6	L	5	72	1.0	2/			RES
2000 10 22.77		S	13.1:	VB	30	R	20	230	0.7	3			SHA02
2000 10 22.83		C	13.7	HS	25.3	D	10	a 30	0.3	2			MOR09
2000 10 29.76		S	13.5	AC	25.4	L	5	104	1.0	3			MEY

Comet C/1999 T3 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 09 27.69	a	C	17.0	GA	60.0	Y	6	a240	0.4		1.0m	339	NAK01

Comet C/1999 U4 (Catalina-Skiff)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 07 29.73		C	16.8	TJ	18.0	L	6	a 90	0.3				KAD02
2000 08 02.01		B	14.5	HS	42	L	5	162	0.6	4/			LEH
2000 08 06.01		S	14.7	AC	40.6	L	5	130	0.5	2			RES
2000 08 10.04		S	14.7	AC	40.6	L	5	130	0.5	3			RES
2000 08 14.79		C	16.6	GA	60.0	Y	6	a240	0.5		0.5m	218	NAK01
2000 08 25.98		B	14.2	HS	42	L	5	162	0.9	4			LEH
2000 08 26.02		S	14.5	AC	40.6	L	5	130	0.7	3			RES
2000 08 26.68		C	16.7	TJ	18.0	L	6	a 90	0.25				KAD02
2000 08 26.95	d	k	15.9	FD	35	L	5	a540	0.35				HOR02
2000 08 27.02		S	14.5	AC	40.6	L	5	130	0.5	3			RES
2000 09 02.65		C	16.5	TJ	18.0	L	6	a 90	0.3				KAD02
2000 09 04.02		S	14.3	AC	40.6	L	5	130	0.7	3			RES
2000 09 08.92		S	14.0	HS	44.0	L	5	226	0.2	4			HAS02
2000 09 08.95	d	k	16.3	FD	35	L	5	a540	0.25				HOR02
2000 09 10.65		C	16.6:	TJ	18.0	L	6	a 90	0.25				KAD02
2000 09 10.90	d	k	16.2	FD	35	L	5	a720	0.25				HOR02
2000 09 19.84		B	14.3	HS	42	L	5	162	0.7	4			LEH
2000 09 23.81		B	14.1:	HS	42	L	5	162	0.4	3/			LEH
2000 09 24.93		S	14.3:	GA	31.0	J	6	143	0.5	2/			BOU
2000 09 25.32		J	16.0	SC	25.4	T	5	a100	0.33	d1	0.4m	208	ROQ
2000 09 26.73		C	16.3	GA	60.0	Y	6	a240	0.45		0.7m	219	NAK01
2000 09 27.71		C	16.5	TJ	18.0	L	6	a 90	0.3				KAD02
2000 09 27.85		B	14.2	HS	42	L	5	162	0.4	4/			LEH
2000 10 06.77		C	16.6	TJ	18.0	L	6	a 90	0.3				KAD02
2000 10 22.87		S	14.0	AC	40.6	L	5	130	0.8	3			RES

Comet C/1999 Y1 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 01 22.51		C	16.9	TJ	18.0	L	6	a 90	0.2				YOS05
2000 07 24.02	d	k	14.7	FD	35	L	5	a240	0.35				HOR02
2000 07 25.98		B	13.3	HS	42	L	5	81	1.1	4			LEH
2000 07 29.71		C	14.8	TJ	18.0	L	6	a 60	0.4				KAD02
2000 07 29.74		S	[12.8	HS	25.4	T	6	116	! 0.9				YOS04
2000 07 29.95	&	C	15.1	HS	14.3	D	4	a240	0.3	1			MOR09
2000 08 01.99		B	13.3	HS	42	L	5	81	1.5	3			LEH
2000 08 02.01		S	13.7	AC	40.6	L	5	130	0.7	2			RES
2000 08 03.03		S	13.4	AC	40.6	L	5	72	0.9	2/			RES
2000 08 05.00		S	13.7	HS	25.4	L	5	162	0.5	2/			MEY
2000 08 05.01		S	13.7	GA	31.0	J	6	143	0.8	4			BOU
2000 08 06.00		S	13.4	AC	40.6	L	5	72	0.8	1/			RES
2000 08 07.98		S	13.4	AC	40.6	L	5	72	0.7	2			RES
2000 08 07.99	d	k	14.4	FD	35	L	5	a540	0.4				HOR02
2000 08 09.02		S	13.8	HS	31.0	J	6	143	0.7	3			BOU
2000 08 10.04		S	13.2	AC	40.6	L	5	72	1.0	2			RES
2000 08 11.98		S	13.7	HS	44.0	L	5	156	0.3	4			HAS02
2000 08 14.77		C	14.5	GA	60.0	Y	6	a120	0.65				NAK01
2000 08 22.88		S	13.2	HS	35	L	5	237	0.8	3			HOR02
2000 08 22.90		B	12.9	HS	42	L	5	81	1.2	3			LEH
2000 08 23.84		S	13.2	HS	35	L	5	237	0.9	3			HOR02
2000 08 23.90		B	12.9	HS	42	L	5	81	1.2	3			LEH
2000 08 23.98		S	13.7:	VB	30	R	20	185	0.3	3			SHA02
2000 08 24.87		S	13.1	HS	35	L	5	158	1.1	3			HOR02
2000 08 25.69		C	14.7	TJ	18.0	L	6	a 60	0.35				KAD02
2000 08 25.87		S	13.1	HS	35	L	5	237	1.1	3			HOR02
2000 08 25.96		M	12.6	HS	42	L	5	81	1.5	3			LEH
2000 08 26.01		S	13.7	AC	40.6	L	5	72	1.0	2/			RES
2000 08 26.64		C	14.4	TJ	18.0	L	6	a 90	0.4				KAD02
2000 08 26.92	d	k	13.7	FD	35	L	5	a540	0.6		1.0m	14	HOR02
2000 08 27.01		S	13.6	AC	40.6	L	5	72	1.0	2			RES

Comet C/1999 Y1 (LINEAR) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 08 28.95		S	13.8:	VB	30	R	20	185	0.4	3			SHA02
2000 08 29.70		C	14.4	TJ	18.0	L	6	a 90	0.4				KAD02
2000 09 01.87		S	13.0	HS	35	L	5	158	1.2	3			HOR02
2000 09 02.60		C	14.0	TJ	18.0	L	6	a 60	0.55				KAD02
2000 09 02.74		S	[12.8	HS	25.4	T	6	116	! 0.8				YOS04
2000 09 03.02		S	13.1	NP	45	L	5	167	0.75	2			MAR02
2000 09 03.95		S	13.3	VB	30	R	20	185	0.6	2			SHA02
2000 09 04.01		S	13.5	AC	40.6	L	5	72	1.0	3/			RES
2000 09 05.78		C	13.8	GA	60.0	Y	6	a120	0.9				NAK01
2000 09 08.90		S	13.7	HS	44.0	L	5	156	0.4	4			HAS02
2000 09 08.91	d	k	13.9	FD	35	L	5	a360	0.4				HOR02
2000 09 09.89	d	k	13.9	FD	35	L	5	a600	0.4		0.6m	30	HOR02
2000 09 10.63		C	14.2	TJ	18.0	L	6	a 60	0.5				KAD02
2000 09 10.87	d	k	13.7	FD	35	L	5	a540	0.5				HOR02
2000 09 17.58		C	13.6	HS	20.0	T	10	a 60	0.5				EZA
2000 09 18.60		C	13.7	HS	20.0	T	10	a 60	0.5				EZA
2000 09 18.78		C	13.9	TJ	18.0	L	6	a 60	0.55				KAD02
2000 09 19.57		C	13.6	HS	20.0	T	10	a 60	0.5				EZA
2000 09 19.83		B	13.3	HS	42	L	5	162	1.1	3			LEH
2000 09 20.53		C	13.3	HS	20.0	T	10	a 60	0.5				EZA
2000 09 21.56	s	H	12.8	LA	50.0	C	12	a360	0.62	6	1.4m	33	FUK02
2000 09 21.60	s	V	13.5	LA	50.0	C	12	a360	0.62	6	1.4m	33	FUK02
2000 09 23.80		B	13.0	HS	42	L	5	162	1.3	3			LEH
2000 09 23.92		S	13.1	AC	25.4	J	6	115	0.9	4/			BOU
2000 09 24.58		C	12.9	HS	20.0	T	10	a 60	0.5				EZA
2000 09 24.87		S	13.0	GA	31.0	J	6	109	1.0	4/			BOU
2000 09 25.95	d	k	13.4	FD	35	L	5	a540	0.4				HOR02
2000 09 26.55		C	13.3	HS	20.0	T	10	a 60	0.5				EZA
2000 09 26.60	a	H	12.6	LA	50.0	C	12	a360	0.75	6	2.1m	29	FUK02
2000 09 26.64	a	V	13.4	LA	50.0	C	12	a360	0.75	6	2.1m	29	FUK02
2000 09 26.72		C	13.5	GA	60.0	Y	6	a120	0.95		1.1m	42	NAK01
2000 09 27.50		C	13.4	HS	20.0	T	10	a 60	0.5				EZA
2000 09 27.73		C	13.6	TJ	18.0	L	6	a 60	0.55		0.8m	34	KAD02
2000 09 27.83		M	12.6	HS	42	L	5	81	1.3	4/			LEH
2000 09 28.92		S	12.9	VB	30	R	20	185	0.6	4			SHA02
2000 09 29.52		C	12.7	HS	20.0	T	10	a 60	0.5				EZA
2000 09 29.72		C	13.6	TJ	18.0	L	6	a 60	0.5				KAD02
2000 09 29.81		B	13.0	HS	42	L	5	162	1.3	3			LEH
2000 09 29.89	d	k	13.5	FD	35	L	5	a300	0.55		0.9m	42	HOR02
2000 09 30.83		B	13.3	HS	42	L	5	162	1.2	3			LEH
2000 09 30.87		S	12.9	VB	30	R	20	230	0.4	4			SHA02
2000 10 03.90		S	13.8	NP	25	L	5	96	1	3			SEG
2000 10 04.59		S	12.3	HS	25.4	L	4	113	1.0	4			YOS02
2000 10 05.89		S	13.3	VB	30	R	20	230	0.7	3/			SHA02
2000 10 06.74		C	13.3	TJ	18.0	L	6	a 60	0.6		0.7m	37	KAD02
2000 10 07.53		C	13.2	TJ	18.0	L	6	a 90	0.7		0.9m	36	KAD02
2000 10 07.53	a	H	12.2	LA	50.0	C	12	a360	0.88	6	1.7m	31	FUK02
2000 10 10.50		C	12.2	HS	20.0	T	10	a 60	0.6				EZA
2000 10 11.51		C	12.2	HS	20.0	T	10	a 60	0.6				EZA
2000 10 13.51		C	12.7	HS	20.0	T	10	a 60	0.6				EZA
2000 10 14.52		C	12.7	HS	20.0	T	10	a120	0.6				EZA
2000 10 19.90		S	13.5	VB	33	L	5	150	0.8	4			SHA02
2000 10 21.81		S	13.0	AC	40.6	L	5	72	1.5	3/			RES
2000 10 22.84		S	13.3	VB	30	R	20	185	0.7	4			SHA02
2000 10 22.87		S	12.7	AC	40.6	L	5	72	1.5	3			RES
2000 10 23.01		C	13.8	HS	25.3	D	10	a 30	0.5	0			MOR09
2000 10 28.76		S	12.3	AC	25.4	L	5	65	1.3	3/			MEY
2000 10 28.96		S	12.6	NP	25	L	5	60	1	2			SEG
2000 10 29.77		S	12.0	AC	25.4	L	5	65	1.5	3/			MEY
2000 10 30.76		S	12.9	VB	30	R	20	185	0.5	4			SHA02
2000 10 30.78		S	12.6	NP	30	L	5	100	1.2	2			NEV

Comet C/2000 G2 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR		COMA	DC	TAIL	PA	OBS.
2000 04 30.28		k	19.1	L	226.0	L	2	a300		0.20	7	52.2s	118	HER02

Comet C/2000 H1 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR		COMA	DC	TAIL	PA	OBS.
2000 05 01.06		k	17.9	U0	35	L	5	a600		0.15				HOR02
2000 05 03.02		k	18.2	U0	35	L	5	a600		0.15				HOR02
2000 05 07.01		k	18.0	U0	35	L	5	a240		0.15				HOR02
2000 05 08.00		k	[17.5	U0	35	L	5	a360	!	0.15				HOR02

Comet C/2000 K1 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR		COMA	DC	TAIL	PA	OBS.
2000 06 02.05	d	k	15.8	FD	35	L	5	a540		0.35				HOR02
2000 06 11.01	d	k	15.8	FD	35	L	5	a420		0.3				HOR02
2000 06 21.99	d	k	15.5	FD	35	L	5	a360		0.3				HOR02
2000 06 29.99	d	k	15.1:	FD	35	L	5	a240		0.3				HOR02
2000 07 05.95	d	k	16.2:	FD	35	L	5	a180		0.3				HOR02
2000 07 06.92	d	k	16.1	FD	35	L	5	a540		0.5		1.1m	150	HOR02
2000 07 25.93		B	14.5	HS	42	L	5	162		0.6	3/			LEH
2000 07 25.93	d	k	15.7	FD	35	L	5	a420		0.4		1.2m	127	HOR02
2000 07 29.53		C	16.4	TJ	18.0	L	6	a 60		0.25				KAD02
2000 07 30.87		B	14.6	HS	42	L	5	162		0.8	4			LEH
2000 07 31.87		B	14.6	HS	42	L	5	162		0.7	4			LEH
2000 08 01.88		B	14.5	HS	42	L	5	162		0.6	3			LEH
2000 08 01.89	d	k	15.8:	FD	35	L	5	a480		0.35				HOR02
2000 08 05.90		S	14.5	AC	40.6	L	5	130		0.3	2			RES
2000 08 07.92		S	14.3	AC	40.6	L	5	130		0.5	3			RES
2000 08 19.84		B	14.7	HS	42	L	5	162		0.6	4			LEH
2000 08 20.85		B	14.7	HS	42	L	5	162		0.6	4			LEH
2000 08 20.86	d	k	17.4:	FD	35	L	5	a420		0.3				HOR02
2000 08 22.84		B	14.8	HS	42	L	5	162		0.7	4			LEH
2000 08 23.47		C	16.5	GA	60.0	Y	6	a120		0.55		0.9m	140	NAK01
2000 08 23.83		B	14.7	HS	42	L	5	162		0.7	4			LEH
2000 08 25.86		B	14.8	HS	42	L	5	162		0.6	4/			LEH
2000 08 26.83	d	k	[17.0	FD	35	L	5	a480	!	0.3				HOR02
2000 08 27.82		B	14.8	HS	42	L	5	162		0.5	4			LEH
2000 09 03.14		J	16.0	SC	25.4	T	5	a100		0.30	d3	1.2m	158	ROQ
2000 09 20.46	x	C	16.9	HV	60.0	Y	6	a240		0.35		0.9m	130	NAK01

Comet C/2000 K2 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR		COMA	DC	TAIL	PA	OBS.
2000 07 25.94	d	k	15.5	FD	35	L	5	a360		0.3		0.6m	133	HOR02
2000 07 29.51		C	16.1	TJ	18.0	L	6	a 60		0.3				KAD02
2000 07 30.91		B	14.8	HS	42	L	5	162		0.8	4			LEH
2000 07 31.90		B	14.7	HS	42	L	5	162		0.5	5			LEH
2000 07 31.94	d	k	15.6:	FD	35	L	5	a540		0.3				HOR02
2000 08 01.90		B	14.6	HS	42	L	5	162		0.5	4/			LEH
2000 08 01.93	d	k	15.5:	FD	35	L	5	a540		0.3				HOR02
2000 08 05.90		S	14.8	AC	40.6	L	5	130		0.5	2			RES
2000 08 07.58		C	16.3	GA	60.0	Y	6	a120		0.4		0.5m	115	NAK01
2000 08 19.86		B	14.4	HS	42	L	5	162		0.8	4			LEH
2000 08 20.87		B	14.4	HS	42	L	5	162		0.7	4			LEH
2000 08 20.90	d	k	15.3	FD	35	L	5	a360		0.3				HOR02
2000 08 22.88		B	14.5	HS	42	L	5	162		0.7	4			LEH
2000 08 23.52		C	15.7	GA	60.0	Y	6	a120		0.55		0.9m	109	NAK01
2000 08 23.85		B	14.5	HS	42	L	5	162		0.6	4			LEH
2000 08 23.86		S	14.6	HS	35	L	5	237		0.5	3			HOR02
2000 08 24.88		S	14.4	HS	35	L	5	237		0.8	3			HOR02
2000 08 25.87		B	14.3	HS	42	L	5	162		0.8	4			LEH
2000 08 25.88		S	14.5	HS	35	L	5	237		0.7	3/			HOR02
2000 08 26.86	d	k	15.2	FD	35	L	5	a480		0.35				HOR02
2000 08 27.84		B	14.4	HS	42	L	5	162		0.6	4			LEH
2000 08 29.85	d	k	15.0	FD	35	L	5	a600		0.4				HOR02

Comet C/2000 K2 (LINEAR) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 08 30.84		S	14.4	HS	44.5	L	5	160	0.7	0			SAN07
2000 09 02.94		S	13.6	NP	45	L	5	167	0.75	1			MAR02
2000 09 02.94		S	13.8	NP	45	L	5	167	0.5	0/			SAN04
2000 09 17.48		C	15.1	GA	60.0	Y	6	a120	0.55		0.9m	100	NAK01
2000 09 19.79		B	14.3	HS	42	L	5	162	0.6	4			LEH
2000 09 21.45		C	15.1	GA	40.0	L	6	a120	0.3		0.6m	100	AKA
2000 09 23.77		B	14.5	HS	42	L	5	162	0.5	4			LEH
2000 09 23.83	d	k	15.3	FD	35	L	5	a480	0.3				HOR02
2000 09 24.82		S	14.0	HS	31.0	J	6	143	0.7	2			BOU
2000 09 26.45		C	14.8	GA	60.0	Y	6	a120	0.6		0.9m	97	NAK01
2000 09 27.78		B	14.6	HS	42	L	5	162	0.4	5			LEH
2000 09 29.77		B	14.3	HS	42	L	5	162	0.7	4			LEH
2000 09 30.77		B	14.2	HS	42	L	5	162	0.6	4			LEH
2000 10 01.51		S	[13.0	HS	20	L	7	160					MAT08
2000 10 07.43		C	15.1	TJ	18.0	L	6	a 60	0.35				KAD02

Comet C/2000 O1 (Koehn)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 07 26.00	d	k	17.1	FD	35	L	5	a480	0.2				HOR02
2000 07 31.98	d	k	[17.0	FD	35	L	5	a480	! 0.2				HOR02
2000 08 01.96	d	k	17.6	FD	35	L	5	a540	0.25				HOR02
2000 08 23.63		C	18.2	GA	60.0	Y	6	a240	0.4				NAK01
2000 09 26.55		C	17.4	GA	40.0	L	6	a240	0.25		& 0.9m	70	AKA
2000 09 26.62		C	18.2	GA	60.0	Y	6	a240	0.3				NAK01

Comet 2P/Encke

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 07 25.09	&	C	14.1	HS	14.3	D	4	a 30	0.3	1			MOR09
2000 07 29.75		C	14.1	TJ	18.0	L	6	a 90	1.1				KAD02
2000 07 31.11	&	C	14.1	HS	14.3	D	4	a 30	0.3	1			MOR09
2000 08 03.79	x	S	11.2	HS	25.4	L	4	113	2.3	2			YOS02
2000 08 05.77	xs	S	11.0:	TJ	32.0	L	5	58	& 3	3			NAG08
2000 08 05.98	s	M	10.8	PA	30	L	5	100	1	4			NEV
2000 08 07.03		M	11.3	HS	35	L	5	83	3	2			SHU
2000 08 09.78	x	S	10.1	TT	25.4	L	4	46	2.0	3			YOS02
2000 08 09.99		M	10.3	HS	35	L	5	83	4	3			SHU
2000 08 10.05		S	9.7:	AC	40.6	L	5	72	& 2	3			RES
2000 08 10.79	x	S	10.2	TT	25.4	L	4	46	2.3	3/			YOS02
2000 08 11.98		M	10.5	HS	35	L	5	83	3	3			SHU
2000 08 12.07		S	10.0	AC	6.3	R	13	52	3	4			KOS
2000 08 12.08		S	10.3	TT	10.0	B		25	1.7	4			HAS02
2000 08 13.09	x	S	9.6	TJ	25.4	J	6	72	1.5	3/			BOU
2000 08 14.82	x	C	11.6:	TJ	60.0	Y	6	a 30	1.3				NAK01
2000 08 17.09		M	9.9	TI	15	L	4	43	5	4			HAL05
2000 09 05.23		C	[9.3	S	1.8	R	9	a 19					CHE03
2000 09 05.86		C	9.0:	S	1.8	R	9	a 19					CHE03
2000 09 06.28		C	8.7:	S	1.8	R	9	a 19					CHE03
2000 09 06.34		C	8.6:	S	1.8	R	9	a 19					CHE03
2000 09 13.61		C	8.5:	S	1.8	R	9	a 19					CHE03
2000 09 14.138		C	8.1	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.154		C	8.0	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.179		C	8.4	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.196		C	7.8	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.221		C	8.5	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.23		C	8.2:	S	1.8	R	9	a 19					CHE03
2000 09 14.238		C	8.0	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.263		C	8.0	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.279		C	8.7	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.346		C	7.9	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.388		C	8.2	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.404		C	8.3	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.446		C	8.1	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.471		C	8.2	HV	1.8	R	9	a 19	+ 2.80				BIE01

Comet 2P/Encke [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 09 14.488		C	8.5	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.513		C	8.2	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.529		C	7.8	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.571		C	7.9	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.596		C	7.9	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.613		C	7.4	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.638		C	7.0	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.679		C	6.7	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.73		C	7.5:	S	1.8	R	9	a 19					CHE03
2000 09 14.763		C	6.6	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.779		C	6.6	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.821		C	6.7	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.846		C	6.6	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.863		C	6.6	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.888		C	6.8	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.904		C	6.8	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.929		C	6.9	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.971		C	6.8	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 14.988		C	6.7	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 15.013		C	6.7	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 15.029		C	6.8	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 15.071		C	6.8	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 15.096		C	7.0	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 15.113		C	7.0	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 15.138		C	6.8	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 15.154		C	6.9	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 15.179		C	7.0	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 15.196		C	6.9	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 15.22		C	6.4:	S	1.8	R	9	a 19					CHE03
2000 09 15.221		C	6.9	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 15.238		C	6.9	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 15.263		C	6.9	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 15.279		C	7.0	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 15.321		C	7.0	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 15.363		C	7.0	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 15.388		C	6.9	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 15.404		C	6.8	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 15.429		C	6.9	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 09 15.446		C	6.8	HV	1.8	R	9	a 19	+ 2.80				BIE01
2000 10 02.42		S	10.4	TJ	20	L	7	160	1.5	4/			MAT08
2000 10 04.42		S	11.0:	TJ	20	L	7	160	1.0	4			MAT08

Comet 9P/Tempel 1

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 07 29.76		C	15.8	TJ	18.0	L	6	a 90	0.25				KAD02
2000 08 04.75		C	16.0	GA	60.0	Y	6	a240	0.7		1.3m	250	NAK01
2000 08 08.08	!	C	16.7	GA	40	D	2	a240	> 0.7	d5	> 2.0m	245	ROD01
2000 08 11.09	!	C	16.8	GA	40	D	2	a240	> 0.7	d5	> 2.3m	240	ROD01
2000 08 12.07		S	[14.5	HS	44.0	L	5	156					HAS02
2000 08 26.70		C	15.9	GA	60.0	Y	6	a240	0.7		0.9m	241	NAK01
2000 08 28.06	!	C	17.0	GA	40	D	2	a240	> 0.7	d5	> 2.3m	250	ROD01
2000 09 02.64		C	16.1	TJ	18.0	L	6	a 90	0.3		0.4m	279	KAD02
2000 09 26.66	a	C	16.1	GA	60.0	Y	6	a240	0.65				NAK01

Comet 10P/Tempel 2

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1999 08 16.10		B	9.5	AC	10.0	B	4	20	7	4			NOW

Comet 14P/Wolf

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 08 04.65		C	19.2	GA	60.0	Y	6	a240		9			NAK01
2000 08 26.63		C	18.6	GA	60.0	Y	6	a240		9			NAK01

Comet 14P/Wolf [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 09 26.58		C	18.3	GA	60.0	Y	6	a240	0.2	8			NAK01

Comet 17P/Holmes

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 08 12.06		S	[15.0	HS	44.0	L	5	156					HAS02
2000 09 09.00	d	k	17.2:	FD	35	L	5	a540	0.2				HOR02
2000 09 10.62		C	17.1:	TJ	18.0	L	6	a120	0.15				KAD02
2000 09 27.66		C	16.3	GA	60.0	Y	6	a240	0.5		0.8m	238	NAK01
2000 09 27.77		C	16.6	TJ	18.0	L	6	a120	0.3				KAD02
2000 10 06.79		C	16.7	TJ	18.0	L	6	a120	0.25				KAD02

Comet 19P/Borrelly

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1994 11 04.94		B	9.8	S	11	L	7	32	3				BRU
1994 11 05.99		B	9.6	S	11	L	7	54	5	6			BRU
1994 11 09.97		S	8.1	AA	19	L	5	38	4.5	3			SHU
1994 11 10.01		S	8.2	AA	14	L	7	50	5	3			NEK
1994 11 14.07		B	9.8	S	11	L	7	54	6	3			BRU

Comet 21P/Giacobini-Zinner

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1972 07 20.99		E	9.6	AN	26.0	R	12	70	3			265	BEY
1972 07 21.99		E	9.2	AN	26.0	R	12	70	3		?		BEY
1972 07 22.98		E	9.0	AN	26.0	R	12	70	3			261	BEY

Comet 24P/Schaumasse

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1993 02 14.73		E	9.3	AA	25	L	4	40	4.5	2			NEV
1993 02 15.77		E	9.3	AA	25	L	4	40	4	2			NEV
1993 02 16.72		E	9.2	AA	25	L	4	40	4.5	2			NEV
1993 02 24.69		E	9.5	AA	25	L	4	40	5.5	1			NEV
1993 03 11.71		E	9.7	AA	25	L	4	40	4	0			NEV
1993 03 13.73		E	9.7	AA	25	L	4	40	4.5	0			NEV
1993 03 18.72		E	9.8	AA	25	L	4	40	4.5	1			NEV
1993 03 25.75		E	9.4	AA	25	L	4	40	5	1			NEV
1993 03 27.73		E	9.5	AA	25	L	4	40	4	0			NEV
1993 04 23.79		E	10.6	AA	25	L	4	40	3	0			NEV
1993 05 10.85	!	S	11.8	NP	25	L	4	66	2.5	0			NEV
1993 05 11.83	!	S	12.0	NP	25	L	4	66	2.5	0			NEV

Comet 29P/Schwassmann-Wachmann 1

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 07 08.51		C	16.4	TJ	18.0	L	6	a 40	0.2				KAD02
2000 08 01.46		S	[13.0	HS	20	L	7	160					MAT08
2000 08 01.85		O	[12.5	HS	42	L	5	162	! 0.5				LEH
2000 08 02.57		S	[13.0	HS	20	L	7	160					MAT08
2000 08 23.49	x	C	16.0:	HV	60.0	Y	6	a240	0.5				NAK01
2000 08 23.49	x	c	17.0	HV	60.0	Y	6	a240					NAK01
2000 08 24.59		S	[12.5	HS	20	L	7	160					MAT08
2000 08 28.54		S	[13.5	HS	20	L	7	160					MAT08
2000 10 01.52		S	[13.0	HS	20	L	7	160					MAT08

Comet 44P/Reinmuth 2

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 07 08.48		C	16.5:	TJ	18.0	L	6	a 60	0.3				KAD02
2000 08 23.48	x	C	16.6	TJ	60.0	Y	6	a240	0.45				NAK01

Comet 47P/Ashbrook-Jackson

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 07 03.72		C	14.9	TJ	18.0	L	6	a 60	0.35				KAD02
2000 07 04.88		S	[14.0	VN	41	L	4	200	! 0.5				PEA
2000 07 08.84		S	[13.7	VN	41	L	4	200	! 0.5				PEA
2000 07 29.59		C	13.7	TJ	18.0	L	6	a 60	0.5		0.4m	320	KAD02
2000 08 01.48		S	13.5:	HS	20	L	7	160	1.0	4			MAT08
2000 08 07.60	x	C	13.6:	HV	60.0	Y	6	a120	0.9		0.8m	340	NAK01
2000 08 09.81	a	S	13.6	VN	41	L	4	200	0.7	2			PEA
2000 08 23.54	x	C	13.3	HV	60.0	Y	6	a120	0.95		1.0m	6	NAK01
2000 08 24.60		S	13.5	HS	20	L	7	160	1.0	5			MAT08
2000 08 26.53		C	13.9	TJ	18.0	L	6	a 60	0.35				KAD02
2000 08 28.55		S	13.5	HS	20	L	7	160	1.0	4/			MAT08
2000 09 02.52		C	13.8	TJ	18.0	L	6	a 40	0.4				KAD02
2000 09 02.96		S	13.7	NP	45	L	5	167	< 1	0/			MAR02
2000 09 02.96		S	13.8	NP	45	L	5	167	0.5	2			SAN04
2000 09 20.49	x	C	13.3	HV	60.0	Y	6	a120	1.1		1.5m	50	NAK01
2000 09 27.46	x	C	13.4	HV	60.0	Y	6	a120	1.0		1.5m	58	NAK01
2000 10 01.53		S	13.2	HS	20	L	7	160	1.0	4			MAT08

Comet 59P/Kearns-Kwee

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1972 10 04.98			[12.0	AN	26.0	R	12						BEY
1972 10 06.95			[12.5	AN	26.0	R	12						BEY
1972 10 07.94			[12.5	AN	26.0	R	12						BEY
1972 10 08.94			[12.0	AN	26.0	R	12						BEY

Comet 61P/Shajn-Schaldach

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 06 07.39		k	19.3	L	226.0	L	2	a300	0.11	7	13.8s	259	HER02
2000 08 07.62		C	17.7	GA	60.0	Y	6	a240	0.35				NAK01
2000 08 23.56		C	17.6	GA	60.0	Y	6	a240	0.3				NAK01
2000 09 20.51		C	17.9	GA	60.0	Y	6	a240	0.25				NAK01

Comet 63P/Wild 1

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 01 25.80		C	15.0	TJ	18.0	L	6	a 60	0.55	1			YOS05
2000 01 28.76		C	15.0	TJ	18.0	L	6	a 60	0.55				YOS05

Comet 73P/Schwassmann-Wachmann 3

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 04 30.17		k	18.7	L	226.0	L	2	a300	0.26	7	17.4s	108	HER02

Comet 74P/Smirnova-Chernykh

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 04 23.81		k	15.6	UO	35	L	5	a420	0.5				HOR02

Comet 97P/Metcalf-Brewington

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 09 26.64		C	17.6	GA	60.0	Y	6	a240	0.3				NAK01
2000 10 28.94		S	13.9	NP	25	L	5	60	1	4			SEG

Comet 106P/Schuster

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 01 22.41		C	14.9	TJ	18.0	L	6	a 60	0.35				YOS05

Comet 110P/Hartley 3

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 08 26.75		C	18.7	GA	60.0	Y	6	a240	0.23			245	NAK01

Comet 113P/Spitaler

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 09 27.64		C	18.2	GA	60.0	Y	6	a240	0.2				NAK01

Comet 114P/Wiseman-Skiff

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 01 21.55		C	14.7	TJ	18.0	L	6	a 60	0.5		0.7m	52	YOS05
2000 01 22.48		C	14.8	TJ	18.0	L	6	a 60	0.3				YOS05
2000 05 01.16		k	16.2	L	226.0	L	2	a300	0.70	5	70.2s	103	HER02

Comet 141P/Machholz 2 (Component A)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 01 22.38		C	14.8:	TJ	18.0	L	6	a 60	0.75	0			YOS05
2000 02 05.75		S	11.9:	AC	25.4	L	5	65	1.9	2			MEY

Comet 145P/Shoemaker-Levy 5

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 09 07.40		C	17.7	UO	182	L	5	a 90	+ 0.17		30 s	250	BAL06
2000 09 26.76		C	16.1	GA	60.0	Y	6	a240	0.55		0.6m	252	NAK01
2000 09 29.79		C	16.5	TJ	18.0	L	6	a120	0.3				KAD02
2000 10 07.72		C	16.3	TJ	18.0	L	6	a120	0.35				KAD02

Comet P/1997 T3 (Lagerkvist-Carsenty)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 05 01.19		k	22.4	L	226.0	L	2	B100	0.07	8	21.6s	277	HER02

Comet P/1998 W1 (Spahr)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 05 01.37		k	22.1	L	226.0	L	2	a900	0.11	7	22.2s	299	HER02

Comet P/1999 J5 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 06 07.41		k	20.5	L	226.0	L	2	a300	0.08	7	99.6s	261	HER02

Comet P/1999 U3 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 01 21.57		C	15.9	TJ	18.0	L	6	a 60	0.55				YOS05

Comet P/1999 XB69 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 05 01.22		k	18.8	L	226.0	L	2	a300	0.26	8	14.4s	84	HER02

Comet P/2000 B3 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 05 01.23		k	16.1	L	226.0	L	2	a300	0.86	5	1.8m	101	HER02

Comet P/2000 C1 (Hergenrother)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 06 02.88	d	k	17.2:	FD	35	L	5	a540	0.2				HOR02

Comet P/2000 R2 (LINEAR)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 09 20.52		C	18.3	GA	60.0	Y	6	a240	0.3			80	NAK01
2000 09 27.48	a	C	18.2	GA	60.0	Y	6	a240	0.3				NAK01

Comet P/2000 S1 (Skiff)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
2000 09 26.65		C	15.6	GA	60.0	Y	6	a120	0.65				NAK01
2000 09 26.67	a	H	14.8	LA	50.0	C	12	a840	0.54	5	2.2m	243	FUK02
2000 09 26.70		C	15.6	HS	18.0	L	6	a 60	0.3				KAD02
2000 09 27.68		C	15.7	TJ	18.0	L	6	a 90	0.4				KAD02
2000 09 27.86		B	13.9	HS	42	L	5	162	1.1	3/			LEH
2000 09 29.32		J	15.2	SC	25.4	T	5	a100	0.42	s3	0.9m	252	ROQ
2000 10 07.63		C	15.9	TJ	18.0	L	6	a 90	0.35				KAD02
2000 10 17.15	!	J	15.9	SC	25.4	T	5	a100	0.33	d3			ROQ

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DESIGNATIONS OF RECENT COMETS

Listed on this page and the next, for handy reference, are the last 50 comets to have been given designations in the new system. The name, preceded by a star (⋆) if the comet was a new discovery (compared to a recovery from predictions of a previously-known short-period comet) or a # if a re-discovery of a 'lost' comet. Also given are such values as the orbital period (in years) for periodic comets, date of perihelion, T (month/date/year), and the perihelion distance (q, in AU). Four-digit numbers in the last column indicate the *IAU Circular* (4-digit number) containing the discovery/recovery or permanent-number announcement.

Not included below are numerous recently-discovered comets observed only with the SOHO spacecraft — and seen only close to the sun with the SOHO instruments — that are presumed to be Kreutz sungrazers that are no longer in existence [see lists and references in the January 2000 (p. 32) and July 2000 (p. 102) issues, and earlier *ICQ* lists cited therein]; recent such SOHO discoveries were reported on *IAUC* 7506, 7508, 7514, 7517, 7519, 7520, 7534, and 7536, and include comets C/1997 T6, T7, T8, U2, U3, U4, U5, U6, U7, V3, V4, V5, V6, X3, X4, X5, X6, Y1, Y2, Y3; C/1998 X3, X4, X5, X6, X7, X8; C/1999 U6, U7, U8, U9, V2, V3, V4; C/2000 T1, T3, T4, U1, U2, U3, U4, V1, V2, and V3.

[This list updates that in the July 2000 issue, p. 102. For explanation regarding new usage of 'C/' instead of 'P/' for intermediate-period comets, see editorial note on page 2 of the January 2000 issue.]

	New-Style Designation	*P*	*T*	*q*	*IAUC*
⋆	C/1999 N2 (Lynn)		7/23/99	0.76	7222
⋆	C/1999 N4 (LINEAR)		5/26/00	5.49	7226
	141P/1999 P1 (Machholz 2)	5.22	12/9/99	0.75	7231
⋆	P/1999 RO_{28} (LONEOS)	6.46	10/2/99	1.23	7253
	142P/1999 R2 (Ge-Wang)	11.2	6/21/99	2.50	7255
⋆	C/1999 S2 (McNaught-Watson)		11/24/97	6.5	7260
⋆	C/1999 S3 (LINEAR)	82.6	11/9/99	1.89	7264
⋆	C/1999 S4 (LINEAR)		8/4/00	0.76	7267
⋆	C/1999 T1 (McNaught-Hartley)		12/13/00	1.17	7273
⋆	C/1999 T2 (LINEAR)		11/24/00	3.0	7280
⋆	C/1999 T3 (LINEAR)		9/1/00	5.4	7289
⋆	C/1999 U1 (Ferris)		9/2/98	4.1	7283
⋆	P/1999 U3 (LINEAR)	10.7	11/18/99	1.85	7295
⋆	C/1999 U4 (Catalina-Skiff)		10/28/01	4.9	7298
⋆	P/1999 V1 (Catalina)	16.8	10/25/99	2.94	7302
⋆	P/1999 WJ_7 (Korlević)	10.0	2/15/00	3.17	7368
⋆	P/1999 X1 (Hug-Bell)	7.04	6/20/99	1.94	7331
⋆	P/1999 XB_{69} (LINEAR)	9.4	2/17/00	1.64	7370
⋆	C/1999 XS_{87} (LINEAR)	72.7	8/6/99	2.77	7344
⋆	P/1999 XN_{120} (Catalina)	8.5	5/1/00	3.29	7370
⋆	C/1999 Y1 (LINEAR)		3/24/01	3.1	7338
⋆	C/2000 A1 (Montani)		7/14/00	9.8	7346
⋆	C/2000 B2 (LINEAR)		11/9/99	3.8	7354
⋆	P/2000 B3 (LINEAR)	8.0	2/14/00	1.70	7356
⋆	C/2000 B4 (LINEAR)	77.2	6/24/00	6.8	7368

	New-Style Designation	*P*	*T*	*q*	*IAUC*
⋆	P/2000 C1 (Hergenrother)	6.64	3/19/00	2.10	7357
⋆	C/2000 CT_{54} (LINEAR)		6/18/01	3.13	7368
⋆	C/2000 D2 (LINEAR)		3/2/00	2.3	7372
#	143P/2000 ET_{90} (Kowal-Mrkos)	8.95	7/1/00	2.55	7403
⋆	P/2000 G1 (LINEAR)	5.36	3/9/00	1.00	7396
⋆	C/2000 G2 (LINEAR)	53.6	2/6/00	2.7	7411
⋆	C/2000 H1 (LINEAR)		1/28/00	3.6	7410
⋆	C/2000 J1 (Ferris)		5/11/00	2.5	7416
⋆	C/2000 K1 (LINEAR)		12/14/99	6.3	7430
⋆	C/2000 K2 (LINEAR)		10/11/00	2.4	7430
⋆	C/2000 O1 (Koehn)		1/27/00	5.9	7462
	144P/2000 O2 (Kushida)	7.6	6/27/01	1.43	7467
⋆	C/2000 OF_8 (Spacewatch)		8/5/01	2.17	7484
#	145P/2000 R1 (Shoemaker-Levy 5)	8.7	8/17/00	1.99	7488
⋆	P/2000 R2 (LINEAR)	6.1	9/12/00	1.39	7492
⋆	P/2000 S1 (Skiff)	16.9	7/14/00	2.5	7496
#	146P/2000 S2 (Shoemaker-LINEAR)	7.9	7/14/00	1.32	7498
⋆	C/2000 S3	39.9	7/16/00	2.66	7501
⋆	P/2000 S4	19.0	10/19/00	2.27	7502
⋆	C/2000 SV_{74} (LINEAR)		4/30/02	3.5	7510
⋆	P/2000 SO_{253} (LINEAR)	7.04	5/2/01	1.69	7524
	147P/2000 T2 (Kushida-Muramatsu)	7.4	4/29/01	2.75	7507
⋆	C/2000 U5 (LINEAR)		3/12/00	3.48	7515
⋆	P/2000 U6 (Tichý)	7.4	10/4/00	2.15	7515
⋆	C/2000 W1 (Utsunomiya-Jones)		12/26/00	0.32	7526

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INDEX TO THE INTERNATIONAL COMET QUARTERLY: Volumes 17-22

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This index follows the style used in the previous indices for Volumes 16-17 (see October 1995 issue, p. I-1) and in *ICQ* No. 100 (October 1996 issue, p. 295). References listed below indicate page number. For example, (**18**:113) indicates page 113 of Volume 18, which was in the July 1995 issue (ascertained from the listing above). Note that a complete authors index was published in the October 1996 issue, so that the authors index below continues beginning with 1997 (while the other listings go back to the January 1996 issue). (NOTE: descriptive information and tabulated data by observers under "Tabulation of Comet Observations" in each issue are not included in this index). —D.W.E.G.

Items in Volumes 18-22, by title:

Textual articles, letters, and notes, listed alphabetically by author (Volumes 19-22):

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Corrigendum. In the July 2000 issue, page 102, "Designations of Recent Comets", line 9, *for* January 2000 *ICQ*, p. 232, *read* January 2000 *ICQ*, p. 32,