INTERNATIONAL COMET QUARTERLY

Whole Number 100 | OCTOBER 1996 | Vol. 18, No. 4

— Table of Contents —

SMITHSONIAN ASTROPHYSICAL OBSERVATORY
60 Garden Street · Cambridge, MA 02138 · U.S.A.

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 (odd-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.

Credit cards may be used for payment of subscriptions, though a minimum of US$20.00 can be accepted for each charge. Credit-card orders may be placed by e-mail (to iausubs@cfa.harvard.edu), by fax (to USA 617-495-7231), or by telephone (to USA 617-495-7280, generally between 14:00 and 21:00 UT, Monday to Friday). When sending orders by fax or e-mail, please include the following information: (1) your name (as given on the credit card); (2) card type (MasterCard, Visa, or Discover); (3) credit-card number and expiration date; (4) address at which the card is registered; (5) which services you wish to subscribe to; (6) if the payment is for the renewal of a current or expired account, please include your account number.

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/cfa/ps/icq.html).

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.

ICQ EDITORIAL STAFF::

Daniel W. E. Green.....Editor Charles S. Morris.....Associate Editor
Syuichi Nakano.....*Comet Handbook* Editor

OBSERVATION COORDINATORS::

AUSTRALIA ..... Paul Camilleri (51 Mookarii Street; Cobram 3644, Victoria); David A. J. Seargent
BELARUS ..... Vitali S. Nevski (Moskovski pr. h.11/5, ap.27; Vitebsk, 210015)
BRAZIL..... José Guilherme de S. Aguiar (R. Candido Portinari, 241; 13089-070 - Campinas - S.P.)
BULGARIA ..... Veselka Radeva (Astronomical Observatory and Planetarium; P.O.B. 120; 9000 Varna)
CHINA ..... Chen Dong Hua (101 Quan Zhou Road; Gulangyu, Xiamen 361002)
CZECH REPUBLIC..... Petr Pravec (Astronomical Institute; CS-25165 Ondřejov); Vladimir Znojil
FRANCE..... Stephane Garro (Horizon 1800; Batiment A; 05170 Orcieres-Merlette)
GERMANY ..... Jost Jahn (Neustaedter Str. 11; D-29389 Bodenteich)
HUNGARY..... Krisztián Sárneczky (Kadar u. 9-11., H-1132 Budapest)
ITALY ..... G. Antonio Milani (Dip. Scienze Biomediche; via Trieste 75; 35121 Padova)
JAPAN..... Akimasa Nakamura (P.O. Box 9, Kuma Post Office; Kuma-cho, Ehime 791-12)
Syuichi Nakano (P.O. Box 32; Sumoto Post Office; Hyogo-Ken, 656-91)
THE NETHERLANDS ..... Alex Scholten (Horsterdijk 6a; NL-6961 KP Eerbeek)
NEW ZEALAND ..... Alan C. Gilmore and Pamela Kilmartin (P.O. Box 57; Lake Tekapo 8770)
NORWAY ..... Bjoern H. Granslo (Postboks 1029; Blindern; N-0315 Oslo 3)
POLAND..... Janusz Pleszka and Tomasz Sciezor (Faculty of Physics and Nuclear Technique; University of Mining and Metallurgy; Al. Mickiewicza 30; 30-059 Cracow)
PORTUGAL ..... Alfredo Pereira (R. Antero de Quental 8, 2 dto; Carnaxide; 2795 Linda-a-Velha)
SLOVENIA..... Herman Mikuž (Kersnikova 11; 61000 Ljubljana)
SOUTHERN AFRICA..... Tim Cooper (P.O. Box 14740; Bredell 1623; Kempton Park; South Africa)
SPAIN ..... Jose Carvajal Martinez (San Graciano 7; 28026 Madrid)
SWEDEN ..... Joergen Danielsson (Hasselstigen 2D; 386 00 Farjestaden)
UKRAINE ..... Alexandr R. Baransky (Komarova 12; Vladimir — Volynsky; Volynska 264940)
UNITED KINGDOM..... Jonathan Shanklin (11 City Road; Cambridge CB1 1DP; England)
Guy M. Hurst (16 Westminster Close; Kempshott Rise; Basingstoke, Hants RG22 4PP; England)
former U.S.S.R..... Klim I. Churyumov (Astronomical Observatory; Kiev University; Observatorna 3; Kiev 254053; Ukraine)

EDITORIAL ADVISORY BOARD::

Michael F. A'Hearn, *University of Maryland*
Michel Festou, *Observatoire Midi-Pyrenees, Toulouse*
Brian G. Marsden, *Harvard-Smithsonian Center for Astrophysics*
David D. Meisel, *State University College of New York, Geneseo*
Zdenek Sekanina, *Jet Propulsion Laboratory, California Institute of Technology*

++++++++++++

This issue is No. 100 of the publication originally called *The Comet* (founded March 1973) and is Vol. 18, No. 4, of the *ICQ*. *[ISSN 0736-6922]*

****

Corrigenda

In the April 1996 issue, page 67, the dates 1996 02 15.01, 1996 02 15.92, and 1996 02 16.91 *should be changed to* 1996 03 15.01, 1996 03 15.92, and 1996 03 16.91 (observer MAI).

In the April 1996 issue, page 94, 'Comet 65P/Gunn', *for* the date '1996 03 13.81' *read* '1996 03 18.81' (observer NAK01).

In the July 1996 issue, page 134, for the date '1996 05 22.50' *read* '1996 05 21.50' (observer SEA01).

From the Editor

This issue marks Number 100 in the series that began as *The Comet* in March 1973 (see *ICQ* **16**, 128), with the name change to *International Comet Quarterly* being effective with the January 1979 issue (issue Number 29). The October batch of *Minor Planet Circulars* contains my suggested name for asteroid (5865) 1984 QQ, to commemorate the *ICQ*: *Qualytemocrina* (which is a play on the letters of *International Comet Quarterly*) — discovered by A. Mrkos on 1984 August 31 (and which I later identified with 1988 VM_7). One usually takes advantages of anniversaries to look at accomplishments, but I have been drawn more to the centennial anniversaries surrounding two of the most influential and productive researchers of the past century regarding cometary brightness: Nicholas Bobrovnikoff was born in 1896, and Johann Holetschek published the first of his monumental historical studies on cometary brightness in the same year, essentially marking the beginning of serious comet photometrical study and observation.

This issue reflects 100 years of comet photometry in several ways. Klim I. Churyumov kindly agreed to write an obituary of the Soviet cometary scientist Sergej Vsekhsvyatskij, who worked on the problems of cometary brightness (as an archivist/researcher and as an observer) for much of the twentieth century and has had continuing influence in the field. That "biography" of Vsekhsvyatskij will be found in this issue. Also included herein is my article on the history of comet-magnitude-estimation methodology, covering the ground that was paced by Holetschek, Vsekhsvyatskij, and Bobrovnikoff in the past century. Churyumov has also contributed a short article for this issue on the history of magnitude methodology in the former Soviet Union, to complement my research. It is intriguing to wonder what the next 100 years will see in the way of cometary photometry. The past 100 years saw vastly-improved stellar-magnitude catalogues as well as the steadily-increasing availability of ever-better optical instruments for comet observing (both at the professional and amateur levels), and one must mention the improved capability (via electronic computers) of being able to quickly perform orbital calculations — and the not-unrelated communications revolution that makes updated orbital and ephemeris information readily available at lightning speed to observers around the globe.

CCD observation of comets is having a tremendous impact on this field, particularly due to the widespread availability of CCD cameras to amateur astronomers in the past 5 years. There has been, however, a very negative factor on comet observing that has steadily increased throughout the twentieth century: the problem of light pollution. One would hope that this problem will see some sort of satisfactory resolution for celestial observers during the next century — and *every* serious astronomical observer should set aside several hours each year to actively promote good outdoor night lighting in their community or country! While it is difficult to predict what detectors will routinely determine comet magnitudes in 100 years, and at what wavelength bandpasses, one can be assured that — if light pollution has not made observing nearly impossible by the year 2096 — there will be observers routinely obtaining magnitudes of comets to complement the large compilation of visual photometry dating back over (what will then be) two full centuries.

At this time, we also announce the publication of the first edition of the *ICQ Guide to Observing Comets*, with contributions from numerous experienced comet observers — including a Foreward by Fred L. Whipple, whom we wish well as he celebrates his 90th birthday on 1996 November 5. This *Guide* has been in the planning stages for many years (and in the writing stages for the past two years). The *Guide* is written with the goal of being useful to both beginning and experienced observers of comets — with sections on definitions and on observing techniques via different techniques and media; lists of resources (both printed and electronic); and numerous helpful indices. We expect further editions as time permits, to add and revise material as needed, and at some point in the next couple of years, we expect the publication of a quality highly-illustrated edition by a major publisher. For now, particularly to aid beginning observers during the apparition of C/1995 O1 (Hale-Bopp), we are publishing the first edition of the *Guide to Observing Comets* as a special *ICQ* publication at the Smithsonian Astrophysical Observatory (expected to be mailed sometime in November). *ICQ* Observation Coordinaters will receive a complimentary copy. Other *ICQ* subscribers may purchase a copy through the regular procedures for US$8.00 (add US$3.00 for airmail delivery outside North America); non-*ICQ* subscribers may purchase a copy for US$15.00. (Readers with severe financial hardship may apply for a complimentary copy, as well.)

I note a new feature tabulation for the *ICQ*, which is fittingly introduced (considering Holetschek's oft-cited catalogue of total magnitudes of deep-sky "nebulae") at the time of this centennial anniversary. We will publish and archive total visual/CCD magnitudes of deep-sky objects — that is, galaxies, emission nebulae, and globular clusters that show a general appearance somewhat like that of comet's comae — made by experienced cometary photometrists, with the eventual goal of establishing a small catalogue of recommended "test" objects for beginning observers to use in learning the proper methodologies for such estimations. [My previous call for such deep-sky photometry (*ICQ* **16**, 129) has yielded only a few estimates from a couple of observers, so I hope that a regular published tabulation will create more eagerness by experienced observers to contribute to this potentially-useful project.] I ask that only observers with more than 100 *ICQ*-published m_1 estimates of comets contribute such magnitudes of deep-sky objects. Furthermore, the deep-sky objects chosen should be round or slightly-elliptical, but *not* irregular (like M42) or highly elongated (like an edge-on galaxy) — so as to more closely approximate the appearance of a comet. Try observing the deep-sky objects (globular clusters, nebulae, galaxies) as high in the sky as possible, especially for visual observations (so as to avoid the need for atmospheric-extinction corrections). CCD observers should note exposure times in their comments.

Observers should contribute "deep-sky" photometric data in the standard *ICQ* computer format, placing the designation of the object in columns 1-10 (as "NGC04321", "IC 01234", "UGC10244", etc., beginning in column 1); those contributors using paper forms (sent by postal mail) should put the deep-sky object's designation in the Remarks column. Be sure to supply all of the other information (including date and time, magnitude method, stellar-magnitude reference,

and estimated DC), as usual. For coma diameter, estimate the size of the *minor* axis in the event that the object is not round, and then use the tail-length columns for the size of the *major* axis of the object. Please also give one comment line for *each* object, giving the positional coordinates (α, δ) to a precision of ($0^m.1$, $1'$) for equinox J2000.0 — or clearly state the equinox if not J2000.0 — so that this can be used as a check to be sure that the proper object was observed. (Please *do not* look the position up in a catalogue! This would defeat the purpose of providing a position, which is to provide a check. Rather, measure the rough position from a star atlas used at the telescope.) These observations of deep-sky objects will be published in a table following the tabulated comet observations, and will appear in various issues of the *ICQ* — depending on how many observations are received in a given time period (but at least once a year).

For the convenience of readers, we include (at the end of this issue) an author index to articles published in *The Comet*, *The Comet Quarterly*, and the *ICQ* — so that one can simply go to issue "Number 100" to find indexed material for the years 1973-1996. Indices have generally been published at 1- and 2-year intervals since 1976. The 1996 material will be indexed by title and by comet, as usual, with the 1997 material at the end of the October 1997 issue.

As a final note, it has been noted by one European comet observer that many "continental"-Europeans may elect not to opt for either a train ticket or a 'high-expense', peak-travel-season airline ticket to England (especially those from eastern Europe) for the second International Workshop on Cometary Astronomy (IWCA II), announced in the July issue (p. 103). However, the only invitation so far has been that by Jonathan Shanklin (and the B.A.A. Comet Section), who has secured a very nice location at Cambridge University for this meeting. After discussions with Shanklin, we have mutually decided to ask for further comments from *ICQ* readers regarding the site for IWCA II. We will still hold the meeting during 1999 August 14-16, beginning three days after the total solar eclipse whose path crosses west-central Europe, but we will consider other reasonable host offers from mainland Europe. It is hoped to make a firm decision on a site for IWCA II by early in 1997, at which time it will be announced in the *ICQ*. (Thus, the current site is Cambridge, England, until further notice.) We invite any comet observers or researchers with an interest in attending IWCA II to contact the *ICQ* Editor regarding preferences, either for or against Cambridge as the host site. — *D. W. E. Green*

Φ Φ Φ

Antonín Mrkos (1918–1996)*

It is with sadness that we record the death, on 1996 May 29 in Prague, of Antonín Mrkos, president of IAU Commission 6 during 1985–1988. I am indebted to Jana Tichá, director of the Kleť Observatory since 1992, for some biographical information from the Kleť archives.

The son of farmers, Tonda Mrkos was born in the Moravian village of Střemchoví on 1918 Jan. 27. He studied at several secondary schools, including an ecclesiastical gymnasium, before entering the Technical University in Brno in 1938. His studies were interrupted by the onset of World War II, and during 1939–1943 he taught at primary schools at Nové Město and Ždárec in Moravia.

After a short stay in Austria he took a position in 1945 under Director Antonín Bečvář at the Skalnaté Pleso Observatory in Slovakia. There he participated in the famous visual comet-hunting programme with 25 × 100 Somet-Binar binoculars, as well as in the photographic cometary astrometric programme with the 0.6-m reflector. Following his successful visual discovery of three comets (including 45P/Honda-Mrkos-Pajdušáková) in 1948, he made photographic recoveries of three periodic comets during 1949–1950. He was in fact the principal observer with the 0.6-m reflector during 1946–1956.

Noting that the location of the Skalnaté Pleso Observatory on the eastern slope of the second highest mountain, Lomnický Štít, in the High Tatras made it impossible to hunt for evening comets in the western sky, Mrkos decided also to observe from the 2634-m peak, to which he would regularly climb, shunning the more convenient cable cars. He also worked as a meteorologist for the weather station there. During a four-year interval beginning early in 1952, he visually discovered six more comets, including 18P/Perrine-Mrkos, an accidental rediscovery of a comet lost since the beginning of the century. With his private 0.5-m reflector he recovered the intermediate-period comet 13P/Olbers in 1956.

His most famous discovery, on 1957 Aug. 2, was of one of the century's brightest comets, which he detected initially by its tail while measuring night-sky glow at Lomnický Štít. Shortly after that he went to Antarctica for two years with the Third Soviet expedition there as part of the International Geophysical Year.

On his return to Slovakia he made his eleventh and final visual comet discovery in late 1959. During 1961–1963 he participated in another Soviet Antarctic expedition, working at Molodeznaya and Novolazarevskaya, after which he spent a year on the staff of the Geophysical Institute of the Czechoslovak Academy of Sciences in Prague, before taking a position (which he held until his retirement) in the astronomical department of Charles University. In addition, he was made director of the observatory at České Budějovice in southern Bohemia, and this soon led to the establishment of a planetarium there and of the new observatory he was to direct on Kleť Mountain.

Mrkos made the first photographic observations of comets with the 1-m reflector and 0.4-m Maksutov at Kleť in 1968, and the 1969 recovery of his comet 45P was an early success. The Kleť activity was extended to cover minor planets in 1977, and for many years it was the most regular contributor of data to the Minor Planet Center. It was Mrkos' habit to spend 20 days each month at the observatory and 10 days in Prague reducing and typing up the observations prior

* written also for the *Circular* of International Astronomical Union (IAU) Commission 6 (Astronomical Telegrams).

to mailing. Thanks to the dedication of Mrkos and assistants such as Růžena Petrovičová and Zdeňka Vávrová, the program was the most active in the world for cometary astrometry for more than a decade, and it ranks as the sixth most successful program ever for the discovery of minor planets that have so far been numbered. Mrkos is listed as the eleventh most prolific discoverer; two photographic discoveries of comets were credited to him at Kleť, bringing his lifetime total to 13. Among his more interesting discoveries of minor planets is the near-earth object (5797) 1980 AA, recently named "Bivoj".

Following his retirement on 1991 Dec. 31 Mrkos had hoped to be able to continue his photographic astrometric work from a site closer to Prague. He located a small camera at an abandoned geodetic observatory near Ondřejov and planned to put it to use. An extended stay in the hospital in 1994–1995 delayed these plans, and on his subsequently visiting the remote site he found that it had been vandalized. Particularly sad was the theft of his Somet-Binar binoculars, which had played a role in the visual discovery of eleven comets, and which he always had nearby when he was observing.

— *Brian G. Marsden*

Φ Φ Φ

The Life of S. K. Vsekhsvyatskij (1905-1984) as Seen by a Student and Colleague*

Klim I. Churyumov
Astronomical Observatory of Kiev University

Sergej Konstantinivich Vsekhsvyatskij[1] was born on 1905 June 20 in Moscow to the family of a famous Moscow priest, Rev. Konstantin Vsekhsvyatskij. In his early childhood, Sergej was carried away by the lure of astronomy. Then he read the well-known book by Meyer, *The Universe*, and decided to devote himself to studying celestial objects. Already in 1918, Sergej's working career began, with odd jobs as a courier, a newspaper salesman, a timekeeper, a building worker. But in the evenings, he regularly attended preparatory courses with the aim of entering Moscow University, as he had made up his mind to become an astronomer.

In 1922, he entered the Physics and Mathematics Faculty of Moscow University. While studying at the University, Vsekhsvyatskij simultaneously worked as calculator with the Southern Gravitational Division of the Special Commission on exploration of the Kursk magnetic anomaly. In 1924, he became a scientific collaborator at the Astrophysical Institute, which later became part of the State Sternberg Astronomical Institute of Moscow University.

Vsekhsvyatskij's first scientific work on his investigation of the spectra of comet 1P/Encke was published in 1923. Beginning in 1927, as a collaborator of the Astrophysical Institute, he delivered lectures in higher mathematics in the Moscow educational establishments. In 1930, he defended his thesis devoted to problems of evolution and origin of comets. From 1933 to 1935, he worked in the Narkompros (The National Committee on Education of the Russian Federal Socialist Republic).

In 1935, Vsekhsvyatskij was awarded the scientific degree of Doctor of Science (physics and mathematics), and in the same year (with other Soviet astronomers), he became a member of the International Astronomical Union (IAU). From 1935 to 1939, he worked first as a scientific collaborator and later Deputy Director of the Pulkovo Astronomical Observatory of the Academy of Sciences of the USSR. In 1939 Vsekhsvyatskij moved to Kiev, where he lived and worked to the end of his life. In Kiev, he became Head of the Department of Astronomy and Director of the Astronomical Observatory of Kiev University. Vsekhsvyatskij played an outstanding role in the development of Astronomy at Kiev University. Under his guidance, themes of scientific research were substantially expanded, and priority was given to the most urgent problems of astrophysics and physics of space. The material and technical base of astronomy considerably strengthened. Some well-known scientists were invited to Kiev, and the staff of the observatory considerably increased.

During the World War II years, Vsekhsvyatskij took an active part in the work of the Sun Service in Sverdlovsk on the base of three astronomical observatories evacuated there (the State Sternberg Astronomical Institute of Moscow University, Astronomical Observatory of Kiev University, and the Earth Magnetism and Propagation of Radiowaves Institute of the USSR Academy of Sciences), supplying military needs with long- and short-term prognoses of solar activity. After the war, Vsekhsvyatskij came back to Kiev and again he headed the Astronomical Observatory and the Department of Astronomy at Kiev University, and in 1946 he became Full Professor at Kiev University.

The basic written works of Vsekhsvyatskij deal with the physics of comets, the sun, problems of solar activity, and cosmogony. A lot af time and energy was devoted to observations of comets, minor planets, Jupiter, aurorae, and total solar eclipses. Vsekhsvyatskij was a pioneer of a unique experiment on exploration of the dynamics of the solar corona, based on observations made during the total solar eclipse in 1936 at remotely-located observational sites along

* Invited review, intended as a detailed obituary to the preliminary announcement of Vsekhsvyatskij's death in *ICQ* 7, 67.

[1] С. К. Всехсвяцкий in the cyrillic alphabet. One finds various different spellings of his name in western-European-language journals. However, the IAU has adopted transliteration conventions of 'j' for 'й' and 'kh' for 'x' [*cf.* "Astronomer's Handbook", 1971, *Trans. IAU* **14B**, 260, 371 (Dordrecht: D. Reidel Publ.)].

the solar-eclipse path. On the basis of exploration of the solar corona and using observations made during the eclipses, Vsekhsvyatskij discovered solid-body rotation of the solar corona as well as the existence of prolonged coronal streams that cause magnetic storms and disturbances in the earth's ionosphere. Vsekhsvyatskij's ideas were made the basis of the theory of the dynamic corona developed by him with colleagues of the Department of Astronomy (Drs. Gennady Nikolsky, Eugene Ponomaryov, and Vladimir Cherednichenko) during 1953-1957. This work anticipated the discovery of the solar wind.

Using this new basis, Vsekhsvyatskij developed the Lagrange hypothesis regarding ejections of comet nuclei and other minor bodies from surfaces of satellites of giant planets. Vsekhsvyatskij's monograph *Nature and Origin of Comets and Meteor Matter* (1967, Moscow) is widely known. In the preface to that book, Academician Victor Hambartsumyan writes: "The author is excellent in interpreting actual data related to comets, and he has worked out a courageous hypothesis on cometary origin that is of paramount importance. Many of the results that he obtained now become available to astronomers. His book is thus read with great interest."

It should be noted that Vsekhsvyatskij advanced ideas and conceptions of one who possessed great creative intuition, and very often went ahead the mode of thinking of his time. It is not surprising that they were often met with scepticism (without due enthusiasm) by the scientific community, and created hot criticism and misunderstanding from many of his colleagues. One needed great scientific courage, a specific mode of thinking, unbreakable stoicism and faith to struggle for and develop his own views.

In 1961-1962 Vsekhsvyatskij, when observing a rare event in the equatorial band on Jupiter, interpreted it as a shadow from a Jovian ring, and he made a guess as to the existence of rings near other giant planets. The discovery of a ring near Uranus in 1978, a weak ring near Jupiter (1979), and powerful volcanic activity on the Jovian satellite Io all became a confirmation of his remarkable predictions. As the existence of rings near giant planets had been confirmed, Vsekhsvyatskij was awarded the medal of the Astronomical Council of the USSR Academy of Sciences "for discovery of new astronomical objects". Many other ideas and predictions by Vsekhsvyatskij — such as stellar origin of planetary bodies, a volcanic model of their development, birth of comets in planetary systems, and others — are still awaiting potential development and confirmation.

During 1958-1974, Vsekhsvyatskij published a few fundamental monographs on physical characteristics of comets. The series contained the history of all comets from ancient times up to the present time, along with their orbits, magnitudes, and other data. The first part of the series was the largest, a book titled *Fizicheskie kharakteristiki komet* that was translated into English (as *Physical Characteristics of Comets*) via NASA funding as NASA publication *TT F-80* in 1964 (Jerusalem: Israel Program for Scientific Translations).[2] In 1978 for his works on exploration of the physical characteristics of comets, Vsekhsvyatskij was awarded the Bredichin Award of the USSR Academy of Sciences.

Vsekhsvyatskij considered that visual observations of comets played an important role in investigation of evolutionary processes in comets. He supported amateur astronomers who devoted themselves to observations of comets and always responded to their numerous letters. He himself observed the sky for almost 75 years with 12×50 binoculars (and other binoculars and telescopes) every good evening and night in the hope of discovering a new comet and to estimate magnitudes, coma diameters, tail lengths (and their position angles) of many bright comets, including comets 1P/1909 R1 and 1P/1982 U1 (Halley), C/1948 W1 (Bester), C/1956 R1 (Arend-Roland), C/1957 P1 (Mrkos), C/1962 C1 (Seki-Lines), C/1965 S1 (Ikeya-Seki), C/1969 Y1 (Bennett), C/1969 T1 (Tago-Sato-Kosaka), C/1970 N1 (Abe), C/1973 E1 (Kohoutek), C/1975 V1 (West), C/1983 H1 (IRAS-Araki-Alcock), C/1983 J1 (Sugano-Saigusa-Fujikawa), and others. His method of estimation of cometary magnitudes is discussed in the following two papers on the history of methodology by D. W. E. Green and myself in this issue of the *ICQ*. Vsekhsvyatskij used his observations of comets with other similar observations, introducing the needed reductions for constructing of cometary light curves, determination of photometric parameters, and investigation of influence of solar activity on fluctuations of cometary brightnesses. During his regular patrolling of the night sky, he was one of the first who discovered Nova Cygni 1975.

Vsekhsvyatskij devoted a lot of effort and attention to the education and training of young astronomers. The Department of Astronomy at Kiev University, founded in 1939, prepared over 350 specialists — many of whom them became prominent Soviet astronomers and geophysicists. Vsekhsvyatskij conducted numerous courses on different disciplines of astronomy, and supervised students' term and diploma papers, as well as a great number of postgraduate research projects.

According to the view of astronomers, Vsekhsvyatskij created the Kiev school of astronomy. On the initiative of Vsekhsvyatskij, in the village of Lisniki (near Kiev), an Astronomical station of Kiev University was organized, where a radio and two optical telescopes (AZT-8 and AZT-14) for observations of comets were installed. Vsekhsvyatskij expended much energy and time to the organization of observations within the IYQS (International Year of the Quiet Sun) program and other cometary projects in the USSR. Under his leadership and his immediate participation, more than 20 conferences, meetings, and schools on different problems of minor bodies of the solar system were organized. Vsekhsvyatskij also devoted a lot of effort and time to the activity in the "Znaniye" (Knowledge) society, he was permanent President of the scientific and methodological Council on Astronomy and Cosmonautics, and he worked in the All-Union Astronomical and Geodesics Society (AAGS). For a long time he was chairman of the astronomical section of the Kiev Division of the AAGS and member of the Central Council of the AAGS in Moscow. He was Chairman of the Comets Working Group of the Solar System section of the Astronomical Council of the USSR Academy of Sciences, as well as Deputy Chairman of the Astronomy section of the Scientific and Technical Council of Ministry of Education of Ukraine

[2] This book contained information on comets from ancient times up to 1957, and smaller monographs were published every few years up to 1974 to include the more recent comets. Some of the monograph material was published also in the Soviet publication *Astronomicheskii Zhurnal* and subsequently translated into English via the English-equivalent *Soviet Astronomy*; thus, extensions (and revisions) to his book may be found in English in *Sov. Astron.* **6**, 849; **8**, 429; **10**, 1034; and **15**, 310. — *Ed.*

and Member of the Special Commission of the Soviet Program on ground-based investigations of comet 1P/Halley in 1982-1984.

Vsekhsvyatskij published more than 300 papers, 3 manuals (in co-authorship), 10 monographs and books (some of them were translated into many foreign languages), and over 400 popular articles and brochures. He founded the *Kiev Comet Circular* in 1963 and was the *Circular*'s chief editor up to 1982 (since 1982, the chief editor of the *Comet Circulars* has been K. I. Churyumov). Vsekhsvyatskij was awarded the Order of Lenin, three medals, certificates of Honor of the Presidium of the Supreme Council of Ukraine. He was elected Doctor of Honor of the Debrecen Koshut University in Hungary, received two certificates of honor from INTERCOSMOS of the USSR Academy of Sciences, and the Gagarin medal of the Federation of Cosmonautics of the USSR.

Vsekhsvyatskij died on 1984 October 5 in Kiev. One of the minor planets of the solar system — asteroid (2721), discovered by N. S. Chernykh — was named in memory of S. K. Vsekhsvyatskij.

I made acquaintance with Sergej Vsekhsvyatskij in 1957 when studying at the Physics Faculty of Kiev University (and while starting to specialize in astronomy at the Astronomy Department). Professor Vsekhsvyatskij read courses of "General Astrophysics" and "Applied Astrophysics". It was during that time that the famous comet C/1957 P1 (Mrkos) was bright in the sky. But after the prediploma practical session in 1959 at Crimean Astrophysical Observatory, I began to display a considerable interest in the study of planetary nebulae, and my diploma paper was called "Radiation balance in the planetary nebula NGC 6572". My scientific supervisor was Prof. Aleksandr Phoedorovich Bogorodsky, at that time the director of the Astronomical Observatory of Kiev University. In 1957-1958, astronomers displayed a great enthusiasm for the International Geophysical Year (IGY), and Vsekhsvyatskij suggested that many students of the Astronomy Department and Astronomical Observatory of Kiev University should investigate aurorae. On the initiative of Vsekhsvyatskij, a group of graduates of the Department of Astronomy of Kiev University went to Tixi Bay in Yakutiya, where a Geophysical Polar Observatory was founded for making photographic, spectral, photoelectric, and visual observations of aurorae.

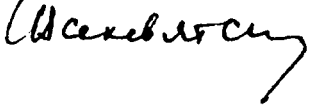
I graduated from the Department of Astronomy in 1960 and also went to this polar station in Yakutiya to work there, and I observed and investigated aurorae from 1960 to 1962. In 1962 I came back to Kiev and started work as an engineer-researcher at the Kiev "Arsenal" plant. My research was connected with creation of the navigation devices of cosmic and military rockets. During one year, I worked at cosmodroms Baikonur and Plesetsk. However, in 1965 I entered postgraduate study under the supervision of S. K. Vsekhsvyatskij and began to observe and explore comets. That very year, on the initiative of Prof. Vsekhsvyatskij, the special cometary project for observation and detection of comets was begun, lasting from 1966 to 1990. I took part in many such observations and in 1969 discovered my first comet (67P/Churyumov-Gerasimenko) with my colleague, Svetlana Ivanovna Gerasimenko. In 1972 I defended my Ph.D. thesis on the theme "Exploration of comets Ikeya-Seki (1967n), Honda (1968c), Tago-Sato-Kosaka (1969g) and new short-period comet Churyumov-Gerasimenko (1969h) on the basis of photographic methods". In 1986 I discovered my second comet by photographic method with Valentin Valentinovich Solodovnikov, known now as comet C/1986 N1 (Churyumov-Solodovnikov). [In 1992 I defended my second thesis (Doctor of Physics and Mathematics, Dr.Sc.) on the theme "Physical evolution of comets" in the Moscow Doctoral Council of the Space Exploration Institute of the Russian Academy of Sciences.]

For many years, Prof. Vsekhsvyatskij was Chairman of the Comet Workshop of the Astronomical Council of the Academy of Sciences of the USSR, and I was Scientific Secretary of the Workshop. For almost 20 years, from 1965 to 1984, Vsekhsvyatskij and I were editors of the *Comet Circular* (*Kometny Tsirkular*), in which we published information about new and old comets, which included many original observations of comets and other small bodies of the solar system. The *Comet Circulars* also comprised scientific papers. The Comet Workshop and the *Kiev Comet Circular* played a great role in coordination of amateur and professional observations of comets — not only in the former USSR, but in a number of countries around the world. Since 1982, I have been Chief Editor of the *Comet Circulars*, but because of recent financial difficulties (in the last 3-4 years), they have not been published recently. For 30 years, Prof. Vsekhsvyatskij and I produced 428 issues of the *Comet Circulars*. I am certain that printing of this publication is necessary for amateurs and professionals of the former USSR and other countries. Currently I am working to restart printing of the *Kiev Comet Circulars*.

◇ ◇ ◇

Below: ***A copy from Kiev Comet Circular No. 70, dated 1968 June 27, from the Harvard College Observatory Library, showing how S. K. Vsekhsvyatskij (and occasionally K. I. Churyumov) would sign the Circulars prior to 1974.***

Редакция: **С. К. ВСЕХСВЯТСКИЙ**



On the History of Total-Visual-Magnitude Estimation Methods

Daniel W. E. Green

Though we have sometimes discussed magnitude methods in the pages of the *ICQ*, we have not published anything detailed in sixteen years, when Charles Morris (1980) wrote his "Review of Visual Comet Observing Techniques". As it appears that no real history of comet brightness-estimation methods has ever been written, this paper will serve as a first attempt at just that. It is perhaps fitting that, as this history necessarily emphasizes the work of Vsekhsvyatskij and Bobrovnikoff, this paper appears both in the same issue as Churyumov's obituary of the former and in the centennial year marking the birth of the latter (*cf.* Meisel 1988). Furthermore, this also marks the centennial year of the publication of the first detailed study on cometary brightness (Holetschek 1896), and this paper somewhat fittingly appears in issue number 100 of *The Comet/The Comet Quarterly/International Comet Quarterly.*

Several recent incidents, including the contributed obituary of S. K. Vsekhsvyatskij[1] by Klim Churyumov (1996a) in this issue and the compilation of the *ICQ Guide to Observing Comets*, led me to look at some of the astronomical literature of the past century regarding extrafocal methods used for estimating the brightness of comets. In the course of my researching background information on methodology, I came across some very interesting information, and I provide here the results of my library searches for the benefit of readers (particularly those in the distant future who may be interested in this topic but may have difficulty in accessing the relevant literature). My searches took me chiefly through journals written in four primary languages — English, German, French, and Russian — which, as far as I can tell, are the main languages where such information on comet-magnitude methodology has been published in the last century. From all this research, it appears that — just as in the case of the degree of condensation (Morris and Green 1995) — the practice of certain methodologies took on local meanings for observers in different countries (and especially where languages differ).

A key remark by Churyumov in his original version of Vsekhsvyatskij's obituary, echoed by other (ex-)Soviet-Union astronomers to me in the past 10-12 years (*e.g.*, Ostapenko 1991), is the following: "[Vsekhsvyatskij's] method of estimation of cometary magnitudes has much in common with Bobrovnikoff's method, which is why we [in Ukraine and Russia] call it the Bakharev-Bobrovnikoff-Vsekhsvyatskij method." Having heard this remark previously — and having spent a decade of coding the (ex-)Soviet observers' data (for *ICQ* tabulated publication and archiving) with the code "B", for "Bobrovnikoff" method (*cf.* Ostapenko 1991) — I probably should have looked into this earlier. But my initial search of the literature now immediately suggested to me that Vsekhsvyatskij's method is what we have been calling the "In-Out" (or "Sidgwick") method for some 2-3 decades. So that encouraged me to look more closely at what Bobrovnikoff had written, and the results surprised me — for Bobrovnikoff actually *used* the "In-Out" method (*not* what we now call the "Bobrovnikoff method") for his own published observations of comets in the 1940s! It is perhaps ironic that we are speaking of extrafocal methodology, in which the very *use* of specific methods is often very blurry in terms of the historical record, and we should perhaps not be too surprised to see that Vsekhsvyatskij himself advocated the "In-Out" method as being "more precise" than the simple "Out-Out" method, but later used the "Out-Out" method himself. In the context of all this, it may be potentially useful to note that Vsekhsvyatskij and Bobrovnikoff had somewhat of an on-going feud, in which each regularly attacked (in print, over many years) the other's approaches to (and results from) the study of comet brightness; the feud was not over observing methods, but rather data reduction.

In my attempts to decipher the chronological development of various methods for determining comet brightness, I tried to place each observer in the context of what information may have been available to him (chiefly via the published literature) as a result of the experiences of others. Of course, unless the given observer was located at the same observatory as another observer (as happened in a couple of cases described below) — or unless the given observer specifically refers to the work of others — it can be difficult to know what experiences/recommendations (of other astronomers) he may or may not have been exposed to. It can probably be assumed, however, that if something was published in the *Astronomische Nachrichten (A.N.)* — still the most international (and arguably the most important) astronomical publication prior to the first World War — it was known to all players concerned. Furthermore, there were developments occurring in non-cometary astronomy that undoubtedly influenced comet-magnitude methodology, as the brightness of the distant nebulae — which we know today as the "deep-sky" objects called galaxies, star clusters, and various Milky-Way nebulae — were becoming interesting to professional astronomers. The determination of the total magnitude of such nebulae involves many of the same problems that surround the determination of total comet magnitudes, and numerous observers such as Holetschek and Beyer dove into both issues.

[1] С. К. Всехсвяцкий in the cyrillic alphabet. One finds various different spellings of his name in western-European-language journals. This is the IAU-adopted transliteration.

I. Defining the Problem: How to Obtain Total Brightness Estimates of Comets

It has long been recognized that comets present a complex situation with regard to their brightness because of their sizeable comae and because of the ever-changing brightness gradient of their comae, in which the brightness will peak at or near a typically bright central or near-central condensation before gradually (or sometimes rapidly) dropping off into the surrounding coma.

In the eighteenth and nineteenth centuries, the vast majority of energies regarding the observation of comets was placed in the measurement of their positions (astrometry), to aid in the computation of orbits. Thus, it should perhaps not be too surprising that during these two centuries, when one finds any brightness estimates at all, such estimates ususally refer to the "nucleus" if such a nuclear condensation was visible, for it was this condensation that was measured for position. It also may have been simply deemed too difficult to estimate the brightness of the extended coma.

The first efforts at regularly providing magnitude estimates of the head of the comet — as specifically distinguished from, or in addition, to the nuclear condensation — were made by observers at Vienna in the 1890s, particularly by R. Spitaler and Johann Holetschek, using the German term "*Gesammthelligkeit*" (*e.g.*, Weiss 1890, 1891; Holetschek 1892, 1894, 1899), or "total brightness". At one point, Holetschek (1892) interestingly wrote of the total magnitude of the coma as "*Totaleindruck der Helligkeit (Wahrnehmbarkeit) des Cometen etwa gleich dem eines Sterns* $10^{m}.5$", which might be translated as the "total impression of the brightness (visibility) of the comet [was] somewhat like that of a star of magnitude 10.5". It appears in this paper that Holetschek is trying to come to terms with the meaning of the brightness of a comet, and he speaks of the conspicuousness of the comet with respect to a certain star, noting that this "impression" or "conspicuousness" is not actually "equal to the magnitude of the [comparison] stars".

Exactly 100 years ago, Holetschek (1896) published a most impressive study of the brightness of comets under the title "Investigations of the Size and Brightness of Comets and Their Tails. I. The Comets up to the Year 1760"; this would be followed by additions that would ultimately take the detailed work to nearly 800 published pages (*e.g.*, Holetschek 1916). Holetschek undoubtedly influenced cometary photometrists that followed him, though he evidently did not use extrafocal procedures himself, as we shall see. I have elected not to delve deeply into the pre-Holetschek era regarding comet brightness, though some key studies were done in the 1880s on this topic (*e.g.*, Müller 1884a, 1884b, 1886; Wolff 1884; Berberich 1888). There may be some useful information published prior to 1890 that has important bearing on subsequent developments in cometary photometry, but I leave that for future researchers to investigate. In general, prior to Holetschek, astronomers tended to concentrate on the brightness of the comet's nucleus, and there were large problems with the magnitude scale and available catalogues of stellar magnitudes, so that observers frequently did not work in terms of stellar magnitudes but rather in terms of brightness as a percentage of brightness at some given epoch, or in terms of an object such as the "Andromeda nebula" (M31). A proper study of nineteenth-century comet brightness observations and perceptions will entail research into (a) the development of the modern magnitude scale and the astronomical significance of photometry, especially as perceived by astronomers of that time (*cf., e.g.*, Peirce 1878); (b) stellar magnitude catalogues, in which reference magnitudes were greatly improved upon; and (c) perceptions that astronomers then had of the true nature of comets. This paper focuses on the visual estimation of total magnitudes of extended celestial objects, with remarks on non-visual studies mainly in the light of the influence of such studies on visual work. For a good general early history of the problems of astronomical photometry (particularly concerning the development of the magnitude scale and of photographic and photoelectric photometry), I recommend the six-part series by Weaver (1946).

There has been some debate over whether the total magnitude (m_1) should include the comet's tail as well as coma. Steavenson (1942) remarked many years ago that "the tail must be ignored as it is impracticable to deal with it by visual means". Bobrovnikoff (1951) also noted that, regarding the total brightness of a comet, "the contribution made by the tail is neglected". However, Marsden and Roemer (1982) called m_1 "the integrated brightness of nucleus, coma, and tail". The *ICQ* Editorial Staff adopted in 1986 "the following definition for total visual magnitude of a comet: the integrated brightness of the comet's entire coma [but not the tail] that is visible above the sky background, determined with the smallest possible instrument needed to easily detect the comet" (Green *et al.* 1986; a similar definition was given by Merton 1956 and Milon 1968). Nonetheless, with bright comets (in particular) — such as C/1996 B2 (Hyakutake), which reached visual $m_1 \simeq 0$ in late March 1996 — a bright inner tail that fluctuates rapidly over hours (or even minutes), due to extensive inner-coma material being flung by the solar wind in the anti-solar direction, may be difficult to distinguish (or separate) from the coma itself in terms of magnitude estimation (Green 1996).

A sixth-magnitude comet is generally much harder to see than a sixth-magnitude star, because the same total brightness in a "point" of starlight is spread out over a significant area by way of the comet's coma. Because of the obvious difficulties of estimating the total brightness of a comet (or an extended deep-sky object such as a nebula or galaxy) from purely focal (in-focus) images of the comet and comparison objects, it was realized a century ago that some sort of extrafocal visual procedure would give a much better idea of the comet's true integrated brightness. But while it was frequently stated in the first two-thirds of the twentieth century that comparison with extrafocal comparison-star images was important, the specific choice of methodology was rarely remarked upon, with Max Beyer being the most prominent voice (see section V, below) for his own procedure. As far back as 1948, when Commission 15 (Physical Study of Comets) met at the General Assembly of the International Astronomical Union, it was agreed that observers "should in the final publication of their observations, state the methods by which the estimates were made" (Merton 1948). But such methods were rarely if ever published with observations (indeed, they were rarely even recorded by observers in archived, unpublished records of the various comet groups worldwide). For example, the Comets Section of the Association of Lunar and Planetary Observers (A.L.P.O.) in the United States, which was one of the leading observing groups worldwide during the 1960s and 1970s, never really made a strong point of observers recording their magnitude methods prior to the start-up of the *ICQ*.

It appears that extrafocal methods for comet magnitude estimation were not definitively 'named' in Soviet Union circles at the time of a meeting in Kiev in June 1964 (attended by such cometary photometrists as Vsekhsvyatskij and Dobrovol'skij), with the singular exception of "the Volokhov-Beyer method"; other methods were simply noted as various "extrafocal" methods of comparison (Konopleva 1966). Meanwhile, in Japan (Nakamura 1996), the amateur comet group known as Hoshino Hiroba began its observing records in their compiling of magnitude methods in 1968 — but did not mention magnitude-estimation methodology in their publications until the invited visits by John Bortle (in 1975) and Charles Morris (in 1978), at which time the two veteran comet observers introduced the two standard A.L.P.O. methods (namely, the "Sidgwick" or "In-Out" method and the "Bobrovnikoff" or simple "Out-Out" method). Even in Japan, however, emphasis was not given to the importance of recording magnitude methods until well into the 1980s.

And even for the first two years of the organized *ICQ* publication of magnitude data, the observer's "magnitude method" was not published with each observation; the January 1981 issue of the *ICQ* was the first issue to include magnitude method with each line of observation (Green 1981). The turning point thus was apparently the *ICQ*, via a combination of Morris' (1980) review article and the commencement of regular published tabulation of magnitudes with the methods used by observers to make the estimates. The "Morris", "Sidgwick", and "Bobrovnikoff" methods were now seemingly etched in stone, and these associated terms attained wide circulation with the return of Halley's comet in the mid-1980s (*e.g.*, *cf.* Edberg 1983; Green 1989).

It should also be noted that many (perhaps most) dedicated visual observers of cometary photometry have experimented with different methods and with variations of each method. What one observer actually does for what he/she calls the "Out-Out" method, for example, may be quite different from what another observer actually does when claiming to use the same method. Thus, methodology certainly accounts for some of the error inherent in visual estimation of comet magnitudes, sometimes to a significant fraction of a whole magnitude. It is not always clear from the old literature as to what specific methodology was used by a given observer, and this point must be understood in viewing the chronologies presented below. We will see that it was and is common for observers to develop and change their methodology practices as time passes, so that an observer may spend some years using chiefly one method and then change (gradually or suddenly) to using chiefly another method for obtaining the total visual magnitude of a comet.

In the headings to the following sections — which discuss the various methods individually — the "players" who chiefly *and clearly* advocated (or were responsible in some key manner for the development and use of) the given method are given in brackets, with italics used for the name that has been used to represent that method in the pages of the *ICQ* during the past 16 years; this listing of names in brackets is given solely for the convenience of readers, and is not intended to be a suggestion for a new, lengthy name for each method (such suggestions are discussed in the conclusion to this paper).

II. Early Observations of Total Magnitudes of Comets and Nebulae [Müller/Holetschek/Pickering/Nijland].

In the previous section, we have seen that the Vienna Observatory was notable for its regular use of the term "total brightness" regarding published observations of comets in the early 1890s. Edward Emerson Barnard evidently was recording such notes at Lick Observatory about the same time, where we find separate, distinctive estimates of the brightness of a comet's head and its nucleus as early as 1892 (Barnard 1913, pp. 22-23).

During several decades spanning the end of the eighteenth and the beginning of the nineteenth centuries, numerous observers at various observatories were cataloguing new observations of deep-sky "nebulae" — most with astrometry but many also with photometry. In this context, the meanings and determinations of the concepts "total magnitude" and "surface brightness" were discussed widely. Johann Holetschek at the Vienna Observatory produced concurrently catalogues of the visually-obtained total brightness of both nebulae and comets near the turn of the century. Holetschek, unfortunately, was frustratingly vague about how he obtained his total visual magnitudes of extended celestial objects. As we have noted, he was intrigued by the concepts of the "visibility" and "impression" that a comet's total brightness would have on the visual observer. Barnard (*op.cit.*) was also referring to such impressions, writing such notes as "[comet was] as *noticeable* as a sixth magnitude star" [italics mine].

Gustav Müller (1886) and A. Berberich (1888) may have been among the first to employ "extinction" observational methods to determine a comet's overall "visibility" or brightness. Müller used a darkened glass to see when a comet would become visible with respect to comparison stars. Berberich utilized a photometer in which an artificial light was brought into the comet's (or comparison star's) field-of-view, turning up the intensity of the artificial light until the comet was no longer visible (due to glare!), and comparing the points where the comet vs. comparison star disappeared to ascertain a brightness value for the comet (see also Dobrovol'skij 1954). But "extinction" procedures for general astronomical photometry evidently had been around for some years before this; for example, Harvard College Observatory Director Edward C. Pickering wrote in 1879: "The determination of the brightness of any object by means of its limit of visibility, or by the reduction in light required to make it barely visible, has been recommended by many astronomers for use in stellar photometry." — but he goes on to say that too many factors can introduce major errors to this procedure, including twilight or moonlight and condition of the telescope.

Holetschek evidently gave little thought in his early observations of comets (in the early 1890s, for example), which were chiefly for the purpose of measuring the positions of comets — a typical problem surrounding cometary photometry (particularly of faint comets) until the advent of the inexpensive CCD camera in the 1990s. By the mid-1890s, when we know that he was working on his mammoth study on cometary brightness, Holetschek's observational records of comets began including more and more details regarding the physical nature of the observed objects (*e.g.*, Holetschek 1900); such physical details regarding brightness and dimensions continue to increase into the new century, culminating with his

last big effort — Halley's comet at its 1909-1911 return (Holetschek 1907, 1912). But Holetschek's brightness estimates of a comet's total magnitude were obtained by what were evidently focal (in-focus) assessment's of the comet's visibility with respect to comparison stars; in order to accomplish this difficult feat, he advocated using the smallest available instruments needed to see the comet with certainty. One could not always have such "perfect" instruments, and he is not entirely clear how he got around that problem. One possibility might have been to use artificial "stops", in which a cover with a circular opening smaller than the objective lens is placed over the lens of a refracting telescope. T. E. R. Phillips (1909) experimented with such an aperture-stop procedure in estimating the brightness (or more specifically, the conspicuousness) of Halley's comet; Phillips stopped a 12.25-inch-aperture reflector down to considerably smaller apertures, including 3.5 and 4.5 inches on various nights, noting that at these considerably smaller apertures, the comet was near (or below) the limit of visibility. Meisel (1996) has remarked that this could be done today with a single telescope and a large, motorized iris diaphragm. Morris (1996) warns, however, that stopping down the aperture will change that *f*/-ratio of the instrument (and may thus change the instrument "response").

At the end of this paper (see Appendix 1, p. 203) is a translation from a passage describing Holetschek's methodology, taken from the first part (Holetschek 1896) of his historical archival study on comet brightness. He also used this methodology to produce a catalogue of total magnitudes of hundreds of deep-sky "nebulae" that would continue for years to have an effect both on researchers/observers of galaxies, star clusters, and nebulae and on comet observers. For this reason, Holetschek's concept of perceptibility regarding extended celestial objects had far-reaching influences. Though he observed through the 1910 return to perihelion of comet 1P/Halley, Holetschek curiously does not refer to some of the extrafocal work of the same period regarding brightness estimates of comets and nebulae by observers such as Pickering and Wirtz (whose ideas are discussed below). At any rate, it is easy to suppose that Holetschek must have gotten some of his ideas for his brightness "extinction" methodology from the published work of Müller and Berberich.

While Holetschek's work was heavily cited in the first half of the twentieth century, it is difficult to find other observers who actually reported using Holetschek's method. Walter Bernheimer (1929) was one such individual, and in his study of the total brightness of both comets and nebulae, he remarked that he did not feel that extrafocal methods were as good as Holetschek's direct "visibility" method (Bernheimer 1933). Hans Hermann Kritzinger (1914) advocated Lau's (1911) extrafocal methods (discussed in section IV, below), but discussed the use of averted vision (in which the observer does not look directly at the comet's image, but rather places it some distance from the eye's fovea) in a manner reminiscent of Holetschek's "visibility" paradigm. Holetschek's method may have been generally used by such comet observers as Barnard, Nijland (as discussed below), and Van Biesbroeck (when he was looking at very faint comets), and Beyer's Extrafocal-Extinction method was perhaps seen by Beyer as a way to link the Holetschek "edge of visibility" concept with the developing extrafocal methodologies. Curiously, Barnard (1913, p. 40) wrote regarding comet C/1894 G1 (Gale) on 1894 May 3, "Though not so bright intrinsically as the star BD $-3°2339$ ($3^m.7$) it was more conspicuous." — which ambiguously suggests that Barnard was employing a "visibility" concept similar to that of Holetschek.

The link between comets and deep-sky "nebulae" was discussed frequently from the turn of the century for several decades. In this connection, Gustav Müller (1897) discussed the concepts of "total light" and "surface intensity", in a chapter on comets and nebulae in his widely-read book on *The Photometry of Celestial Objects*. Another observatory that studied the brightness of both nebulae and comets was that at Harvard College in the United States, where Edward Pickering (1900a, 1900b) devised a special photometer to look at surface brightness of such objects.[2] Pickering's procedure was a bit unusual, in that he proposed to de-focus a star until its extrafocal disk covers a certain area — adopted as a circle $1'$ in diameter; the surface brightness of this $1'$ extrafocal star was then directly compared with *part of* an in-focus comet or nebula to get a reading of surface brightness. In no place does Pickering leave the suggestion that he was obtaining the "total magnitudes" of either nebulae or comets. From the table of comet brightness data (Pickering 1900b), it appears that comet brightness prior to 1892 was always determined with both comet and comparison star in focus — while beginning in 1892, stars were thrown out of focus only about a third of the time (and still kept in focus for most measurements). Pickering and his *Harvard Annals* were prominently known to observers, and one can find numerous observers actually referring to Pickering's method for brightness estimation of comets (*e.g.*, Orlov 1912; Vsekhsvyatskij 1925; Witkowski 1936; Bakharev 1947).

The American astronomers Harlow Shapley and Edwin Hubble were soon actively involved in studying the "extragalactic nebulae", and as such they both looked in detail at compilations of the total brightness of many galaxies — putting much emphasis on the visual survey by Holetschek some three decades earlier. Following a correction to Holetschek's *BD* magnitude scale by Hopmann (1921) — which highlights the problems with magnitude scales and availability of good stellar-magnitude catalogues at the turn of the century — Edwin Hubble (1926) made extensive use of the resulting total magnitudes of galaxies. Indeed, Hubble and Milton Humason (1931) complemented Holetschek thus: "In view of his long experience in the visual photometry of comets, Holetschek's measures form the most complete and homogeneous list of nebular magnitudes available at the present time." Harlow Shapley and Adelaide Ames (1932) concluded that the Hopmann correction was unnecessary — because Holetschek's comparison-star magnitudes were close to those adopted at Harvard — and they suggested that the reason that Holetschek's total visual magnitudes of galaxies were discordant with "modern" measures was that Holetschek was observing chiefly "the central portions of the sharply nucleated nebulae", possibly because Holetschek's 6-inch refractor had too long a focal length; Shapley and Ames concluded that "it appears probable that systematic deviations arise mainly from failure in the visual observations to integrate the total brightness of distended and nucleated spiral nebulae." (See Lundmark 1927 for an early historical review of total magnitudes of nebulae.) Beyer (1934) also conjectured that astrometric observers who obtained magnitude estimates of

[2] Pickering had already looked some years earlier at the brightnesses of planets showing disks, which he reduced to starlike points via a photometer for reading brightness data; *cf.* Pickering 1879, p. 10.

comets were getting fainter values because they were using larger apertures (and higher magnifications) to get a good positional assessment of the comet's nuclear condensation.

As the teens gave way to the 1920s and 1930s, there is a slowly- but obviously-growing trend toward specifying the general use of extrafocal procedures for estimating the brightness of comets, due perhaps chiefly to a few observers' insistence on prominently reporting such methodology in their data published in the *Astronomische Nachrichten* (Abetti and Beyer coming to mind immediately as prime examples). Indeed, Bernheimer (1933) noted the problem that "specialists" familiar with photometry were more likely to perform systematic estimations of the brightnesses of deep-sky objects (nebulae, galaxies, star clusters) — so that their magnitudes were fairly consistent and reliable — while most total magnitudes of comets published in those days were estimated by observers who had great interest in astrometry and only a passing interest in photometry. Despite this warning (duly noted by Beyer 1934), few observers put in the effort to obtain really consistent *total* magnitudes of large numbers of comets for another 30-40 years — the exceptions being observers such as George Van Biesbroeck, Max Beyer, and Albert Jones (and perhaps one or two Soviet observers such as Vsekhsvyatskij).

So comet observers such as Vorontsov-Velyaminov (1926a, b) and Beyer continued to make total magnitude estimates of deep-sky objects, and others such as Martinoff (1946) tried making total magnitude estimates of the moon during lunar eclipse. Observers seemed to have become eager to tackle the problem of determining the brightnesses of various types of extended celestial objects. At a Kiev conference in 1964, much attention was drawn to the desirability of giving more attention to making visual total magnitude estimates of comets, when Konopleva (1966) summarized, "Nebulae and star clusters listed in the catalogs of Messier and Holetschek are suggested as objects of comparison for some comets"; such methodology was prevalent from Müller's time until recently, but the *ICQ* has for nearly 18 years so openly and strongly discouraged the use of deep-sky objects as comparison sources for comet magnitudes — because even today, most deep-sky objects have poorly-determined visual magnitudes and the morphologies are so very different between comets and deep-sky objects as to create tremendous potential for additional error — that the practice is almost non-existent today.

It is frustrating that some observers who produced fairly large numbers of comet magnitudes over many years of observing — notably astronomers like Barnard and Albert Antoine Nijland — gave very little specific information about their methodologies. It is further frustrating to then see other observers refer to such prominent observers — as, for example, N. Rudski (1937) noted that he used Nijland's method in Rudski's own brightness estimates of comet C/1936 K1 (Peltier). Rudski did say that he "compared the brightness of the comet with [the known brightnesses] of extrafocal star images", *suggesting* that he used the "In-Out" method (but remaining a bit ambiguous). Nijland obtained brightness estimates of comets for a couple of decades near the beginning of the twentieth century, but he only occasionally mentioned methodology, and then it was rather vague — stating "extrafocal estimates" or "extrafocal observations of brightness" (Nijland 1911, 1926; Nijland and van der Bilt 1909, 1912). In one of his last publications on comets, Nijland (1926) remarked that "some time ago, at the request of Mr. Vsechsvjatsky, I inspected my ledgers for old observations, as yet unpublished, of the brightness of comets", and he included those data in that 1926 paper, without any more clear statement of methodology. Indeed, in a 1-page table that tabulated the estimated magnitudes of about a dozen comets spanning the period 1906-1922, Nijland created a note (No. 23) to specify "extrafocal estimation", and this note was used for only two observations! It could well be that Nijland generally used a procedure akin to that of Holetschek's, in which he made most estimates direct with relatively-small instruments.

While Nijland's lack of precise wording regarding specific extrafocal methodology may have been contagious for many observers [*e.g.*, Vorontsov-Velyaminov and Vsekhsvyatskij 1925; Vorontsov-Velyaminov 1926a; Krumpholz 1930; Gliese 1943; Vorontsov-Velyaminov 1943; Ginori 1943; Martinoff 1943; Weber 1943; Bakharev 1947; Vsekhsvyatskij 1959; and reports in the archives of the B.A.A. Comet Section, A.L.P.O. Comets Section, and Hoshino Hiroba up into the 1970s] — probably mostly because of a lack of realization that more specific wording might prove useful — there was some continuous thought put into methodology over the years via many individuals, as we shall now see. Some of these same individuals who gave vague information much of the time can also be found occasionally to give more precise information, as we will see with Vsekhsvyatskij, Vorontsov-Velyaminov, Bakharev, and others.

The call for using consistent methodology and instrumentation was stated early by Vsekhsvyatskij (1925), who noted that the use of low magnification and using the same method and instrument for as many observations of a comet as possible would yield much more consistent results. Also in this 1925 article, Vsekhsvyatskij noted that systematic errors are introduced into comet photometry by the type of instrument and magnification utilized, by the brightness of the sky and other observing conditions, and by peculiarities of the individual observer and his or her techniques. This theme of being careful and consistent — using the smallest instrument needed to easily see a comet when estimating its brightness — is one that was carried dutifully by Beyer, Bobrovnikoff, and the B.A.A. and A.L.P.O. Comet Sections prior to the *ICQ*. Another regular theme that one finds in the history of comet observing over the past century is that experienced observers are always saying that naked-eye estimation is to be preferred, whenever possible, over the use of any optical-enhancement instruments. Morris (1996) notes that he perfers binoculars over the naked eye for magnitude estimates, because one can do more in the way of defocussing; a compromise that was widely used with apparent success with comet C/1996 B2 (Hyakutake), when it was bright in March 1996, was the use of two binocular objective lenses (see April 1996 *ICQ*, p. 48).

III. The "In-Out" Method [Wirtz/Abetti/Voûte/Vsekhsvyatskij$_1$/Bobrovnikoff$_1$/Steavenson/*Sidgwick*].

The reader might be amused to see the names of seven astronomers listed in the heading to this section, but the reason will become clear as I detail the history of what has been commonly called the "In-Out" or "Sidgwick" method during the past two decades (Meisel 1970; Morris 1973; Meisel and Morris 1976; Morris 1980; Green 1981; Hendrie and Keitch 1981; Edberg 1983). The "In-Out" method involves memorizing the in-focus (focal) appearance of the comet's coma in terms of its brightness (and size), then de-focussing the comparison stars to the size of the focal comet, and comparing the brightness of the extrafocal star images to the focal comet image. Morris (1996) remarks that it should be noted that it is the comet's *average* surface brightness that is being compared with the defocused comparison stars; for sharply condensed objects, the determination of the average surface brightness may be difficult or impossible to obtain accurately. As with any magnitude-determination procedure for comets, this focal/extrafocal process needs to be repeated numerous times to get a respectable magnitude for the comet. This is one of only two magnitude methods in which the comet is kept in focus for the visual brightness estimation; the other (not covered in this article — except, of course, for the methodology used by Holetschek) is when both star and comet are in-focus, which is applicable under many circumstances with naked-eye viewing and telescopically when the comet is nearly-stellar in appearance (or has a very weak/faint coma).

As noted in section II, above, Pickering may have been among the first to employ a defocused star in comparison with an in-focus comet for brightness estimation, but that was not strictly for obtaining the comet's "total magnitude". As early as 1904, Wirtz wrote concerning his observations of comet C/1903 M1 (Borrelly): "By means of a slight shoving-in or shoving-out of the eyepiece, one easily succeeded in giving the comparison star a diffuse appearance, comparable with the appearance of the comet." This suggests that he was among the first to use what we now call the "In-Out" method. Wirtz made many total-brightness estimates of comets and deep-sky objects, and he later wrote of his brightness estimates of nebulae that he compared the focal image of a nebula to the extrafocal image of the comparison star (Wirtz 1923), confirming his use of the "In-Out" method.

Use of the "In-Out" method was clearly implied by Antonio Abetti (1910a) at Arcetri in his observations of comet 33P/Daniel on 1909 Dec. 9 and 11: "The comet was estimated on both dates as being of magnitude 11.5, through which, as a result of defocusing the [comparison] stars of this [same] magnitude, appearances similar to that of the comet were obtained."[3] Indeed, Abetti — who continued to obtain astrometry and photometry of comets while in his 60s and 70s — was one of the very few observers prior to Max Beyer who *regularly* gave magnitude estimates of comets along with a fairly clear picture of his methodology (*e.g.*, Abetti 1910b, 1910c, 1911, 1912, 1917, 1919, 1921). One might consider such frequent methodology statements as significant, because the more that an observer cites a procedure for making magnitude estimates, the more likely are other observers to take notice and possibly even use the same procedure themselves.

Though he did not make as many comet observations as did Abetti, Leiden astronomer J. G. E. G. Voûte made a series of observations of comets for several years around the 1910 return of Halley's comet, and he clearly stated that — for his brightness estimates — he compared the in-focus image of the comet to the extrafocal image of a comparison star (Voûte 1910, 1912).

In the spring of 1910, an expedition directed by Müller from Potsdam Observatory went to Tenerife (Canary Islands) to take numerous large-scale photographs of the tail of Halley's comet. Schwarzschild and Kron (1911) later took these photographs and specifically analyzed the surface brightness of the comet's tail as a function of "the blackening of the images on the plate", and they produced tables of relative intensity of brightness at various distances from the comet's head. What is interesting for this history of methodology is that Schwarzschild and Kron then attempt to reduce these intensities into actual magnitudes by comparing the catalogued brightnesses of various slightly-defocussed stars (also on the photographic plates) to sections of the comet's tail at various distances from the comet's head, by again looking at "their amount of blackening" on the plates. This method is similar to what Pickering was doing — comparing extrafocal star images to the in-focus surface brightness of various small *parts* of a comet.

Sergej K. Vsekhsvyatskij (1925) strongly advocated use of the "In-Out" method as being the procedure sure to give the best results regarding the brightness of a comet's coma; here he stated that the focused image of the coma should be compared with the extrafocal images of the stars — the latter images being defocused so as to be equal to the size of the (in-focus) coma. He also mentioned "Pickering or Pogson" as the (implied 'step') procedure to follow, though he may have been referring to Pickering's extrafocal procedure. In his best-known publication, *Physical Characteristics of Comets*, Vsekhsvyatskij (1958, p. 29; 1964, p. 22) outlines "the best current methods for visual estimation of cometary brightness", which he lists under two basic categories: the first in which the in-focus comet is compared with extrafocal star images ("In-Out" method), and the second in which extrafocal images of both comet and comparison stars are compared (this second category including both the standard "Out-Out" procedure and the Beyer "Extrafocal-Extinction" method). What we now call the "In-Out" method was listed first by Vsekhsvyatskij in this particular discussion, as if he still thought of this as his preferred method, and he cites his own 1925 article as the primary reference to the method; he continues, "This method is not widely used, apparently owing to certain difficulties in making the comparison, although it may be highly reliable if mnemonic rules and binocular instruments are used."

It appears that Vsekhsvyatskij (1928) was again describing the "In-Out" method when he wrote, "The observer is obliged to compare two objects: the weak light of the comet and the light of the extrafocal image of the comparison star. The [light of the comet] diminishes rapidly across the disk of the comet from the inside outwards, while [the light of the

[3] *"La cometa fu giudicata in ambedue le date di 11^m.5, perchè sfocando le stelle di questa grandezza si ebbero delle apparenze ad essa molto somiglianti."*

extrafocal star] is uniform."[4] Since he specifically uses the term "extrafocal" with the "comparison star" and not with the comet, it would appear that this is also an early description of the "In-Out" method.

Nine years later, he wrote: "The method which consists in comparing the focal image of the comet with extrafocal images of stars, proposed by the present author some years ago, appears to be the most advantageous one in the sense that it eliminates very radically the systematic errors as . . . was shown by special observations of comet 1925 I" (Vsekhsvyatskij 1937). In the same paper, Vsekhsvyatskij notes that Wirtz (among others) observed "a considerable number of comets", so it is curious that Vsekhsvyatskij here says that the method was "proposed by the present author". Eleven years after this, Vsekhsvyatskij (1946) gave advice as to how to obtain total visual magnitude estimates of comets, first noting that the easiest general method "consists of comparison of the brightness of extrafocal images of both the comet and surrounding stars", but then noting that a "more precise" method that "requires more experience" (but is to be recommended) is that of "comparison of the focal image of the comet with extrafocal images of stars". Oddly — in a strange parallel with Bobrovnikoff regarding recommended methods and actual usage (see below) — Vsekhsvyatskij appears to have begun using the simple "Out-Out" method at some point, for at least some of his observations (*e.g.*, Vsekhsvyatskij 1948, 1959, 1966; Konopleva 1948). Vsekhsvyatskij had considerable influence both in and outside of the Soviet Union as perhaps the most prominent Soviet cometary scientist of his era. But while this fact probably produced many observers of comet magnitudes in the Soviet Union who used extrafocal methods, they were usually rather vague about the specific method employed. Occasionally the observer would say a little more than merely "extrafocal comparison", but it tended to be along the lines of "visual comparison with extrafocal star images" (*e.g.*, Vorontsov-Velyaminov 1926; Lange 1943; Bakharev 1947a, b), which *implies* the "In-Out" method but does not absolutely confirm that the comet was not *also* thrown out of focus.

At Wiesbaden (Germany), K. Himpel (1936) made it clear that — to obtain the total magnitude of comet C/1936 K1 (Peltier) — he moved the eyepiece in and out of the telescope tube to carefully make measurements of the focal images of the comet as compared with the brightness of extrafocal star images, noting that a single observation may be the average of "as many as 12-15 readings"!

Nicholas T. Bobrovnikoff made clear use of the "In-Out" method in his own (apparently limited[5]) observations of comets over a few years in the early 1940s. In his paper titled "Observations of Brightness of Comets 1940d, 1941c, 1941d, and 1942a", Bobrovnikoff (1942) remarked, "The comparisons were made by . . . putting *the stars out of focus* until they looked somewhat like the comet and comparing them several times with the *focal images of the comet*" [italics mine]; note that this declared, on-going use of the "In-Out" method appeared in the June 1942 issue of *Popular Astronomy*, some six months *after* the appearance of his article advocating the use of what is evidently the simple "Out-Out" method (see section IV, below). Two years later, in two published papers detailing and explaining his observations of comet C/1942 X1 (Whipple-Fedtke-Tevzadze; 1943 I), Bobrovnikoff (1943a, 1943b) was still clear about the use of the "In-Out" method: "These observations were made by the extrafocal method in which the focal image of the comet is compared with images of the comparison stars outside of focus" (p. 5) and ". . . the extra-focal images of the stars were made of approximately the same apparent size as the focal image of the comet" (p. 6). Curiously, in the sentence immediately following the sentence from page 5, he remarks that "for the sake of uniformity I adhered to the established practice"; it is not clear, however, if this "established practice" is his *own* or somebody else's — though I suspect the former.

About the same time that Bobrovnikoff was making note of his own use of the "In-Out" method, Steavenson (1942) was describing this procedure to the members of the British Astronomical Association when he tutored them on how to make a brightness estimate of a comet: "When the comet has been carefully looked at, the eyepiece should be racked out until the images of the stars in the field are enlarged to about the same diameter", but noted the "difference in appearance between a diffuse object and a sharply defined extra-focal star image." Steavenson was evidently not aware of Bobrovnikoff's simple "Out-Out" method (see section IV, below). Steavenson may have written this paper on cometary photometry partly as a result of observations of the naked-eye comet C/1941 B2 that were published, also in the *J.B.A.A.*, by H. E. Wood (1941). From his description, Wood was certainly comparing the focal image of the comet with extrafocal star images as seen in his 2-inch telescope. His comparison of extrafocal telescopic magnitudes with focal naked-eye magnitudes may have stirred Steavenson to write his photometry paper a few months later.

Albert Jones (1996), a New Zealand observer who has been obtaining visual comet photometry of comets for a full half-century now, writes that he was sent a copy of a booklet entitled "The British Astronomical Association, Its Nature, Aims and Methods" (dated 1948 June) a few years after Jones joined the B.A.A. (which was in 1945). In that booklet, Merton described the Comet Section of the B.A.A., and wrote the following: "The most reliable procedure for estimating the total light in a comet is to compare it in a low power eyepiece (say ×5 to the inch of aperture) with stars of the same brightness when put out of focus so as to represent the comet as nearly as possible. The usual procedure is to use nearby stars for the purpose, trusting to be able to obtain reliable magnitude values for them later; alternately one must compare

---

[4] *"L'observateur est obligé de comparer deux objets: le faible éclat de la comète et l'éclat del'image extrafocale de l'étoile de comparaison. Le premier se diminue rapidement envers les extrémités du disque de la comète; le second est uniforme."*

[5] His mammoth study of comet magnitudes obtained through 1937 (Bobrovnikoff 1941a) contains none of his own estimates. It is interesting that he may himself have made (as assessed from the literature) only a couple of dozen magnitude estimates of comets by the time of publishing this great study of cometary brightness; this may help to explain Bobrovnikoff's lack of remarks on specific estimation methods in this first part of his "Investigation of the Brightness of Comets".

with stars of known magnitude in some nearby variable star field or in a standard sequence such as the North Polar Sequence." Merton goes on to mention the paper by Steavenson (1942). Earlier, Frank Bateson (Royal Astronomical Society of New Zealand) had lent some issues of the *Journal of the B.A.A.* to Jones, and Jones thinks "it is quite likely that I saw the 1942 July issue, and read of the method there. I recall always attributing the method to Steavenson." Jones brought his variable-star observing experience to his comet observing, and being familiar with estimating star brightnesses, had some variable-star charts for comet magnitude comparison. Jones further remarks that, in his own advice to observers over the years, he has always recommended the In-Out method, noting that those advice-recipients who did make magnitude estimates appeared to have followed his advice.

What John Benson Sidgwick (1955) did — to earn his name's popular attachment to the "In-Out" method in recent decades — was to clearly describe the method in a popular book on observational astronomy: "(*i*) Observe the comet, memorising its brightness and angular size. (*ii*) Rack out the drawtube till the images of the field stars are of the same size as the focused image of the comet. (*iii*) Attempt to find one or more nearby stars, as nearly as possible at the same altitude as the comet, the brightness of whose expanded images matches that of the comet." Sidgwick never claimed this method as his idea (but neither did he cite its origins), and indeed his obvious knowledge of the Comet Section of the B.A.A. (*op.cit.*, p. 234) suggests that he was simply quoting the procedure recommended by Steavenson, Merton, and others associated with the B.A.A.

IV. The Standard "Out-Out" Method [Archenhold/Van Biesbroeck/*Bobrovnikoff*$_2$/Vsekhsvyatskij$_2$/Meisel].

The so-called "Out-Out" method is the simplest to use, because one de-focuses the star and comet by the same amount (or as close as can be apparently determined) so that they can be compared in the same field at the same time with no memorization (if there are useful comparison stars nearby). Morris (1996) adds that it should be noted that the comet, unless stellar in appearance, will always have a larger angular size than the comparison stars when both are defocused by the same amount; the comet and comparison stars can look similar in size when defocused because the fractional difference in size becomes smaller as they are defocused and the comet's outer coma may fall below the sky brightness. One of the earliest descriptions of this method appears to be that by Friedrich Simon Archenhold (1911), who wrote regarding binocular magnitude estimates of comet C/1911 O1 (Brooks; O.S. 1911 V = 1911c): "the extrafocal images of the comet and the comparison stars were made as much as possible to be the same size" (loose translation). Hans Emil Lau, an experienced variable-star and planetary observer who published often in the *Astronomische Nachrichten*, evidently observed comet C/1911 O1 with Archenhold — both observing on the same nights at the same location (Treptow Observatory, near Berlin; *cf.* Lau 1911). Lau's extrafocal method was described in a more ambiguous manner: "During the observations with the opera glass, the eyepiece was so greatly adjusted that the defocused disk of the star was much greater than the head of the comet." This makes one think of Pickering's method; the implication in the following sentences, however, is that Lau was using some form of the "Out-Out" method, defocusing both comet and star. Indeed, it is likely that Archenhold and Lau would have used the same method if they were observing together.

The simple "Out-Out" method also appears to be that used by Sergej Vladimirovich Orlov (1912) in Moscow for his own observations of comet C/1911 O1, in which he "compared the brightness of the comet and the brightness of the stars" by "slightly displacing" (defocusing) the oculars of the binoculars — though, as we noted earlier (section II, above), Orlov referenced Pickering's method, which is more akin to the "In-Out" method. Lau (1912) compared his magnitude estimates with those of Orlov and concluded that extrafocal total-visual-magnitude estimation produces fairly good accuracy (generally within 0.1-0.2 mag). Kritzinger (1914) concurred with Lau that such extrafocal methodology would yield good results for the total brightness of comets.

It appears that this is also the method used by prolific comet observer George Van Biesbroeck, and he may in turn have given the idea to Bobrovnikoff one or more decades after he first described the method in print. When describing his photometric observations in the *Annals* of the Royal Observatory of Belgium in 1914, he specifically noted that he compared the extrafocal image of the comet with that of a comparison star (Van Biesbroeck 1914b, p. 586) and stated that he made the extrafocal image of the star the same size as that of the comet's head (*op.cit.*, pp. 566, 573, 579). However, this collection of cometary observations centers on Van Biesbroeck's tables of astrometric positions, comet by comet, with notes given after each table. For comets observed from 1907 until mid-1911, Van Biesbroeck placed all of the magnitude information (total and "nuclear" magnitudes) in the notes, and he makes no specific mention of the methodology — with the exception of "Estimation directe" a few times (*e.g.*, 1909 observations) until he comes to observations made in 1911 July and August; the comment on page 566 accompanies these 1911 observations, in which total magnitudes from here on are *tabulated* (with nuclear magnitudes given as textual notes).

To see if this pattern was indicative of Van Biesbroeck's thought development regarding methodology, I scanned his many observations of comets that appeared in *Astronomische Nachrichten* in the years prior to his 1914 *Annals* publication. I found that, during the five years prior to 1914 in which many observations of his appeared in the *A.N.*, never once was there a comment about methodology (though total brightness is noted many times). It was not until January 1914 that an *A.N.* publication of comet observations by Van Biesbroeck (1914a) notes his use of an extrafocal method, here for obtaining magnitudes of comet 20D/Westphal (1913 VI = 1913d): the "total brightness was found through comparison of the comet with the extrafocal images of the stars" (which could be construed as referring to the In-Out method). What all this shows, at any rate, is evidently a development in Van Biesbroeck's way of thinking about comet magnitudes and their estimation: little information is given in his early years of observing comets, and it appears that he may have obtained many of his early magnitudes by direct focal estimation; by 1914, however, he has evidently come to believe that it is important or potentially significant not only to give the cometary total magnitudes, but also to describe *how* he obtains those magnitudes. After Van Biesbroeck left the Royal Observatory in Belgium, H. Vanderlinden

(1920) took over the observations of comets, and he continued Van Biesbroeck's extrafocal method of comparing comet to comparison star to obtain the comet's brightness.

Later, after moving permanently to the United States, he wrote (Van Biesbroeck 1935a) of the brightness of comets: "The estimations of brightness are necessarily uncertain on [a large, diffuse comet] of this kind. At the end of February, when the maximum brightness [of C/1935 A1 (Johnson; 1935 I = 1935a)] was attained, some observers called the magnitude 10 while others, including the writer, made it 8.5. This was obtained by visual extrafocal comparison with neighboring stars, the eyepiece being moved out of focus so much that the star's image is spread out in a circle about as large as the comet. Thus the integrated light of the latter is obtained and this is of course brighter than the focal estimation which refers mostly to the central part."

Van Biesbroeck frequently made known over the years (in his many papers on observations of comets) that he was obtaining magnitudes by extrafocal means, though he was sometimes very vague about details. Thus, for example, he would write (regarding his total-magnitude estimates) notes such as "Total extrafocal magnitude 8.4", "Total extrafocal brightness mag 9.2", and "With binocular the total brightness is estimated as mag 6.5 extrafocally" (Van Biesbroeck 1930); "Its total brightness estimated extrafocally in the finder", "Extrafocal comparison shows a total brightness equal to Cord. DM −23°441", "Extrafocally 0.2 mag fainter than BD 28°197", and "Total extrafocal brightness" (Van Biesbroeck 1935b); "Extrafocally in 24-inch" (Van Biesbroeck 1945); "The following estimates are from extrafocal comparisons at the 24-inch reflector" and "Too many faint stars near comet for extrafocal comparison" (Van Biesbroeck 1947); "In 4-inch finder extrafocally", "Extrafocally in 24-inch reflector from here on", and "With binocular out of focus" (Van Biesbroeck 1950); or "The brightnesses are from direct estimates on the [photographic] plates or from extrafocal visual comparisons" (Van Biesbroeck 1948, 1950). Still later (Van Biesbroeck 1953), he remarked: "When the objects are bright enough the integrated magnitude is obtained visually by comparing extrafocally the spot of the comet with that of surrounding stars." It would be difficult to explain this evidence as relating to anything but the "Out-Out" method, and indeed it can be seen that all of his comments individually can be seen as consistent with this method — though it is necessary to look at them in their entirety to realize that Van Biesbroeck was indeed using and promoting the "Out-Out" method.

Around the time that Van Biesbroeck was starting to publish his magnitude estimates of comets, H. H. Kritzinger (1914) wrote a paper that discussed the manner and meaning of obtaining brightness estimates of comets. In that paper, he spoke of estimating the "blurred" or "extrafocal" images of both comet and comparison star with averted vision (*i.e.*, away from the direct line-of-sight vision via the eye's optic nerve and fovea), and suggested that the further one placed the extrafocal images from the fovea, the easier it was to make a magnitude estimate.

Hubble and Humason (1931) discussed — prominently in the *Astrophysical Journal* — their own observational procedure whereby they took photographic plates and exposed them out-of-focus to obtain magnitudes of galaxies with respect to comparison stars that are "then independent of exposure". The plate was placed out of focus so much that the extrafocal images were "larger than the focal dimensions of the nebulae" — certainly a form of the "Out-Out" method for photographic photometry. At about the same time, Per Collinder (1931) submitted his doctoral dissertation at Lund University, in which he wrestled with the problem of obtaining total magnitudes of open star clusters and suggested that "the most evident method" for concentrated clusters was "to compare the cluster with a star of known and approximately the same magnitude, using extra-focal images in a magnifying glass", for use with photographs. Later, various observers, including F. Baldet (1953) at Meudon and D. A. Rozhkovskii (1966), would continue to use photographic plates that were either exposed out-of-focus or later developed as out-of-focus prints in the darkroom, for the derivation of total brightness estimates of comets.

From Tashkent in the former Soviet Union, G. Zaharov (1930) observed comet C/1929 Y1 (Wilk) with a "135-mm cometseeker", estimating the total brightness via comparison of "the extrafocal images of the comet and of the stars of comparison". Zaharov argued that the error introduced by such methodology would not be considerable, and was certainly less than the error introduced by other inescapable observing conditions (such as brightness of the sky background). In Athens in the mid-1930s, G. Adamopoulos (1933, 1934, 1935) estimated the brightness of various comets via "*images extra-focales*", written in a slightly-ambiguous manner that nonetheless strongly suggests that he was de-focusing both comet and comparison star. Observing from Prague, E. Buchar (1936, 1938) carefully noted that he drew out the eyepiece of his binoculars to produce extrafocal disks of the comparison stars, at least part of the time for comparison with extrafocal images of the comet; Buchar was not always clear, however, inferring later that he may have used the In-Out method at least for some later comet observations (Buchar 1943). Witkowski (1936) also compared extrafocal images of a comet and comparison stars.

The method that has been called the "Bobrovnikoff method" in the United States for some three decades (Meisel 1970) was evidently mentioned only once in print by N. T. Bobrovnikoff (1941b), that being in the December 1941 issue of *Popular Astronomy* where he gave "a few suggestions for the observations of the total brightness of comets based mostly on *my own experience*" [italics mine], one of them being the following: "The comparison of the star and the head of the comet should be made by putting the binocular or telescope out of focus until both objects appear to be of about the same diameter." I would argue that Bobrovnikoff was not as clear on this procedure as was Van Biesbroeck, because this last sentence is missing the word "simultaneously" at the end; while, according to Bobrovnikoff's graduate student David Meisel, this did indeed mean that comet and comparison star(s) were to be viewed "simultaneously", it is possible to read this sentence — as Vsekhsvyatskij possibly did, combined with Bobrovnikoff's clear remarks about his own use of the "In-Out" method, as noted above — as making the extrafocal comparison star the same diameter as the focal comet

image. Indeed, if it were not for the corroboration of this statement by Meisel (see below), I was tempted to dismiss this remark by Bobrovnikoff as an anomaly — because this is the only place I can find that Bobrovnikoff ever really stated this method.

In fact, the closest wording elsewhere by Bobrovnikoff that I can find to this "Out-Out" procedure is possibly that in his landmark research paper on cometary brightness (Bobrovnikoff 1941a, p. 65), where he says, "Probably the most widely used method is that of extra-focal comparison so that the stars have an apparent diameter of the same order of magnitude as the comet." Now, he does not state unambiguously whether the comet in this scenario is placed out-of-focus, so it could be read either way. But in the immediately-following sentence Bobrovnikoff says, "It is obvious that such a procedure may result in a different apparent magnitude of the comet as contrasted with the comparison of the comet with *focal images of the stars*" [italics mine] — in which he seems to say that he is comparing the different scenarios arising from *extrafocal* images of the comparison stars *vs. focal* images of the comparison stars; in other words, he conspicuously did *not* say "focal image of the comet", suggesting that he was not advocating the de-focussing of the comet at all for magnitude estimation.

Furthermore, in total visual magnitude estimates of comets made from 1940 through 1942 by Bobrovnikoff himself of several comets, he clearly used the *In-Out* method (and in no case can I find a published mention of his use of the *Out-Out* method that has carried his name during the past 2-3 decades); these cases are discussed above (see section III). Nevertheless, Meisel (1996) has told me that, after he told Bobrovnikoff (in the 1960s) that he had been using the "In-Out" (Sidgwick) method to obtain cometary magnitudes, Bobrovnikoff replied that he thought that Meisel "could get 'better' results" if he used a different method — and then took Meisel "to the Perkins Observatory reprint archives and dug out the *Pop. Astron.* **49**, 478 [paper] . . . [and] pointed to this statement [quoted above] explicitly and said that is 'the way you should do things'". (Bobrovnikoff's hunch that the "In-Out" and simple "Out-Out" methods would not produce identical results was quantitatively verified for the first time in Meisel and Morris 1976.)

Bobrovnikoff (1941b) probably got the idea to mention this method from Van Biesbroeck[6], as they knew each other from Bobrovnikoff's graduate-student days in the 1920s at Yerkes Observatory (see, *e.g.*, Van Biesbroeck 1927), when among other things, they observed visually the Swan bands through a spectroscope while viewing together the unusual comet C/1927 E1 (Stearns) when it was at a heliocentric distance of 3.7 AU! Also, Bobrovnikoff utilized hundreds of Van Biesbroeck's observations in his mammoth study of comet brightness (Bobrovnikoff 1941a, p. 70), and so obviously had respect for Van Biesbroeck's dedication — to what eventually amounted to a half-century's worth of comet magnitude estimations by a single observer (*cf.*, *e.g.*, Van Biesbroeck 1914b, 1961). Unfortunately, Bobrovnikoff (1941a) did not state the source (if any) for his "Out-Out" methodology.

Bobrovnikoff's note on the "Out-Out" method in *Popular Astronomy* had probably not been read by Steavenson when the latter wrote his paper on cometary photometry that appeared half a year later in the *Journal of the B.A.A.*, but Steavenson (1942) clearly did not consider the "Out-Out" method to be logical: "Simultaneous comparison of star and comet is impossible owing to the necessity of changing the focus during the observation." Vsekhsvyatskij (1958, 1964) defers to Dobrovol'skij (1954) regarding this method, though Vsekhsvyatskij evidently used the "Out-Out" method for many of his own observations and therefore deemed it generally acceptable. Dobrovol'skij (1954), in his tutorial on comet photometry, acknowledged that most observers evidently use the simple "Out-Out" — noting, however, that this method will lead to erroneous results for various reasons, and he went on to recommend use of the Volokhov/Beyer "Extrafocal-Extinction" method (see section V, below).

So we are left with a real puzzle regarding the methods as viewed by Bobrovnikoff. Bobrovnikoff used the "In-Out" method (section III, above) and tried Beyer's method (section V, below), but evidently never published any possible attempt at using the simple "Out-Out" method. Bobrovnikoff was certainly aware of the various methods, and his research skills and mastery of several languages (Osterbrock 1986; Meisel 1996) suggest that he may have been aware of various discussions in the literature regarding methodology (including, in particular, what was being written in the Soviet astronomical journals — material that may have been overlooked by other American and European researchers lacking a reading knowledge of, or access to, the Russian literature).

It is understandable that — following Meisel's (1970) lead — we have referred to the simple "Out-Out" method as Bobrovnikoff's, because he stated the method clearly (Bobrovnikoff 1941b) and he told his student (Meisel), who in turn was founder of the Comets Section of the A.L.P.O. in 1957 (Green *et al.* 1991) and greatly influenced the use of the simple "Out-Out" (or what, outside of the former Soviet Union, has been called increasingly since 1970 the "Bobrovnikoff") method — beginning with the A.L.P.O. observers (*cf.* Milon 1968, who described the method but did not give it a name). Gradually the use of the terms "Sidgwick and Bobrovnikoff methods" took hold — partly through Meisel's discussion with, and advice to, the 1978 founders of the *ICQ* (D. W. E. Green and C. S. Morris) over the years.

I noted earlier some references to A. M. Bakharev's published observations, in which Bakharev was rather ambiguous about his methodology. A decade later, Bakharev (1959) clearly stated that he defocused both comet and comparison stars to obtain his brightness estimates of comet 21P/Giacobini-Zinner — but he does not say precisely how much he defocused the images, so it is uncertain if he was employing the simple "Out-Out method" by making star and comet images about the same size. Though (ex-)Soviet astronomers in the past decade or more have called this procedure the "Bakharev-Bobrovnikoff-Vsekhsvyatskij" method, I cannot locate solid references or reviews in the Russian literature

[6] Bobrovnikoff (1941a) states on page 72 that all of Van Biesbroeck's "estimates refer to the integrated light of the comet compared with the stars extra-focally", and in a footnote, Bobrovnikoff cites "Private letter of June 16, 1940." I have tried unsuccessfully to locate this letter from various sources, including Ohio State University and Lick Observatory — the two institutions with which Bobrovnikoff was associated following graduate school. I suspect that, if this letter can ever be located, it may shed some light on this whole issue of methodology with regard to these two men.

to give Bakharev enough credit for this method. (However, note the remarks regarding Bakharev's methodology by Churyumov 1996b, in the following paper.)

Given all of the evidence, I now suggest that (for the sake of clarity) we call this the "Van Biesbroeck-Bobrovnikoff$_2$-Meisel" or "VBM" method, for a variety of reasons: (a) Van Biesbroeck was rare (together with Max Beyer) in *regularly* commenting on the use of extrafocal procedures for obtaining the estimates; (b) Van Biesbroeck was one of the most prolific and important observers in history (in terms of the shear number of cometary magnitude estimates published); (c) partly because Bobrovnikoff's remarks in print in the early 1940s are not consistent; (d) Bobrovnikoff was more of a compiler of other observers' comet magnitudes than he was an observer; and (e) Meisel probably did the most to revive and promote this method. Ultimately, Van Biesbroeck gave us enough information to attach the simple "Out-Out" method to his long career of observing comets, and Meisel assured that this method would be frequently used into the last few decades of the twentieth century.

V. The "Extrafocal-Extinction" Method [Volokhov/*Beyer*/Dobrovol'skij].

Dobrovol'skij (1954) clearly notes (in an article discussing the various methodologies for obtaining magnitudes of comets) that this method, in which both comet and comparison star are defocused until they disappear into the sky background, is the preferred method. He ascribes the method to Volokhov (1918), which I was only able to locate after an extensive search of astronomy libraries in the U.S. and Europe. Volokhov's article appeared in a St. Petersburg journal known as *Mirovedenie*; it was written to promote a new procedure for visually estimating the brightness of problem objects such as a nova that becomes brighter than most of the available comparison stars, and he suggests using the combination of a darkened glass over the telescope objective and a circular diaphragm (with a small opening) near the eyepiece ocular to look at the surface brightness of a defocussed star. The stars are defocussed to the limit of "extinction", but he is not very clear how he deduces his final estimated magnitudes. Volokhov does not speak of comets at all, and I cannot find a Russian reference to this procedure *applied to comets* within 20 years of Beyer's first discussions of it. Konopleva (1966) restated Dobrovol'skij's preference at a Kiev conference in 1964 as one of the recommended methods for visual m_1 determination, calling it "the Volokhov-Beyer method (where the system is unfocused until the image vanishes)". While I have not found plentiful references to Volokhov, the term "Volokhov-Beyer method" persists in the former Soviet Union (*e.g.*, Ostapenko 1991).

The German amateur astronomer Max Beyer made careful total visual magnitude estimates of comets for more than four decades, spanning from the 1930s until 1970. Beyer (1969) published his data in the *Astronomische Nachrichten* in a series of papers that spanned the course of his observational career, and his data are extremely valuable because of their consistency and shear quantity. Beyer's method is different from that described by Volokhov (1918), in that Beyer used comparison stars both brighter and fainter than the comet (and did not use a darkened glass), though the extinction concept is the same; as I cannot find any references in Beyer's papers to Volokhov, it is quite possible that Beyer was unaware of Volokhov. (Indeed, it appears that astronomers of the Soviet Union were much more aware of comet-observing techniques outside of the Soviet Union than non-Soviet Union astronomers were of technique discussions published in Russian — undoubtedly due to the "language barrier".) This "Extrafocal-Extinction" method is an extension of the simple "Out-Out" method and has been criticized over the years as needlessly leading to problems in brightness estimation (*e.g.*, Bobrovnikoff 1943a, p. 5; Meisel and Morris 1976; Morris 1980). Beyer (1953) described the procedure thus: "I have always used the technique of bringing the comet and two comparison stars — one of lower and the other of higher brightness — to the point of disappearing on the background of the sky."

Baldet (1939) referred to Beyer's method as being one of "extinction", so this might indeed best be thought of as the "Extrafocal-Extinction" method (and, fortuitously, the *ICQ* tabulates observations employing this method with the letter 'E'). The one key reference that we find in Beyer's early writings on his methodology is to the paper by Bernheimer (1933), in which Bernheimer speaks extensively of Holetschek's observations of the brightness of both comets and nebulae (along with remarks about related studies by Wirtz and Shapley). The concept certainly has parallels to Holetschek's "magnitude of extinction" method (see Appendix 1), and Beyer was probably heavily influenced by his knowledge of what Holetschek had done. Indeed, Meisel (1996) observes that Beyer's "Extrafocal-Extinction" procedure can be shown to be equivalent in transform space (*cf.* Meisel and Morris 1976) to Holetschek's focal "visibility extinction" procedure of effectively reducing the instrumental aperture. One might also think of this as an "Extreme Out-Out" method via comparison with the simple "Out-Out" method (section IV, above). The good-humored term "Way-Out method" has also been coined recently.

Curiously, Bobrovnikoff (1943a, p. 5) stated that he actually tried Beyer's method (but found that he could not defocus the images of a bright comet far enough out of focus for their disappearance), though he never actually describes an attempt at using the simple "Out-Out" method that he once advocated (see section IV, above). Not many other observers (outside of the Soviet Union, at any rate) besides Beyer seem to have used his method prior to some limited use in the 1970s and later, but Model (1943) reported making observations using Beyer's method (as outlined in Beyer 1934). In this issue of the *ICQ*, Churyumov (1996b) discusses a modification of the "Extrafocal-Extinction" method.

VI. Recent History: the "Morris" or "Modified-Out" Method [*Morris*/O'Meara].

Other than the work by professional astronomers such as Pickering, Van Biesbroeck, and Bobrovnikoff regarding visual methods for obtaining total visual magnitudes, not much else real effort appears to have occurred in the United

States — by either professional or amateur astronomers — until the activity of the Comets Section of the A.L.P.O. in the 1960s and (especially the first half of the) 1970s. Indeed, after Bobrovnikoff's publications in the early 1940s, there was little discussion at all of such magnitude-estimation methodology in the U.S. for some 25 years, except for Van Biesbroeck's occasional brief notes accompanying his observations of comets in the *Astronomical Journal.* In this 25-year period, most discussions of m_1 methodology occurred in Europe, in the writings of Beyer, Vsekhsvyatskij, Merton, Sidgwick, and others.

The increased activity in the United States — largely coordinated and encouraged through the publication of observations in the *Journal of the A.L.P.O.* and in *Sky and Telescope* via the efforts of David Meisel, Dennis Milon, John Bortle, and Charles Morris (*cf.* Green *et al.* 1991) — led to considerable discussion in the 1970s about magnitude-estimation methodology. Beginning with the apparition of comet C/1973 F1 (Kohoutek), Charles S. Morris began looking at the primary comet magnitude-estimation techniques and contemplating the problems of methodology (*cf.* Meisel and Morris 1976). During 1973-1978, he not only evaluated the differences in these methods, but began to develop an alternate method that resolved the major problems associated with the In-Out and Out-Out methodologies. Because the observer must estimate the "average" surface brightness of the comet, the In-Out method works best on comets that are diffuse, without a significant brightness gradient. When a comet is strongly condensed, accurately estimating the comet's average surface brightness becomes difficult. In such situations, the observer is likely to overestimate the comet's average surface brightness because of the natural tendency to concentrate on the brightest part of the coma (Morris 1996). In contrast, the Out-Out method works best on strongly condensed comets with small angular size. However, the Out-Out method has flaws as a comet becomes large and diffuse. First, defocusing the comet causes the surface brightness of the outer coma to fall below the sky brightness. This allows the observer to make the defocused comet and comparison stars to appear to be about the same size; unfortunately, this also results an underestimate of the comet's brightness. Second, if the coma is defined sharply enough, so that the outer coma is not lost, the defocused comet will always be larger than the equally-defocused comparison stars because the comet has an apparent size when in focus. These problems led Morris to develop what is known as the "Morris" method — so named by Joesph Marcus, then editor of *Comet News Service* (Morris 1996) — to handle comets with moderate to strong condensations. Morris announced the new method in connection with a 1978 visit to Hoshino Hiroba in Japan as the best method in theory (*cf.* Morris 1979, 1980). It is now suggested that this method can also be rather appropriately referred to as the "Modified-Out" method.

With this Modified-Out method, the observer defocuses the comet just enough so that the extrafocal comet's "disk" becomes rather uniform in brightness, erasing the generally-steep brightness gradient present in most comets from outer coma to central condensation; the size and surface brightness of the defocused comet image is memorized, and the comparison stars are then defocused to the same size as this extrafocal comet image. It is these two extrafocal images (comet *vs.* comparison star) that are directly compared — moving back and forth numerous times through careful defocussing of the comet and star images by the appropriate amounts, thereby deducing a magnitude for the comet. This method solves the problems that limit the accuracy of the In-Out and the Out-Out methods. The Modified-Out method also has the useful properties that, when the comet becomes very diffuse, the method essentially becomes the In-Out method, and when the comet is small and very condensed, it essentially becomes the Out-Out method. Thus, it bridges the gap between those standard methods.

Stephen J. O'Meara of Cambridge, Massachusetts, independently conceived this "Modified-Out" method during the mid-1970s while trying to determine the best method to use in obtaining magnitude estimates of comets from light-polluted urban sites. O'Meara had evidently learned the Out-Out ("Bobrovnikoff") method from his fellow observer Peter Collins (who in turn had used it as the standard A.L.P.O. method of the early 1970s), but O'Meara realized that the method had severe limitations and began to experiment with other procedures. After the initial publication of the method by Morris, O'Meara noted that it was the same method that he had been using for several years (O'Meara, private communication).

Many observers believe that the Modified-Out method is more difficult to use in practice than the In-Out and Out-Out methods. While this is true when the comparison stars are in the same field of view as the comet, this problem lessens when the comparison stars are not in the same field of view. Having to jump from the comet's field to the comparison stars' field (which is typically the case with telescopic comets) makes all of the methods more difficult. The Modified-Out method also tends to be more troublesome for use with hand-held binoculars when a comet's coma is $\ll 1^\circ$ in diameter; tripod-mounted binoculars (even with apertures smaller than 80 mm) will certainly help, but this method is generally much easier to use with telescopes than binoculars. Given its advantages, the Modified-Out method should be at least tried by experienced observers who are attempting to estimate the total visual magnitude of a moderate- to well-condensed (DC = 3-7 is recommended by Morris) comet.

David Meisel (1996) further notes that — while he modelled "In-Out", simple "Out-Out", and "Extrafocal-Extinction" methods (for a power-law coma) in Meisel and Morris 1976, and also the reflector-refractor difference for Morris in 1980 (though never published explicitly anywhere) — the "Morris" method has not even been studied using the power-law assumption. Likewise, the Haser coma model has (to Meisel's knowledge) never been used in an exact theory of any of these methodologies. But given the degree of sophistication of modern computer mathematical modelling software, such a study is long overdue.

VII. Conclusions Drawn from this History.

I have noted that observers experience an evolution of their magnitude-estimation methodology when observing comets over a period of time, this evolution being a tendency inherent in the natural "learning curve" of trying to estimate the brightness of an extended, diffuse object with respect to a pointlike comparison star of known brightness. There are, of course, many other problems regarding the obtaining of cometary magnitudes that are discussed appropriately

elsewhere (including the *ICQ Guide to Observing Comets*), but it should be stated here that observers should never use only one method for observing comets, unless it is Morris' Modified-Out method (which essentially becomes the simple Out-Out or In-Out methods under certain conditions that are tied to the morphology of the comet). Observers need to stay away from using the simple Out-Out method whenever a comet has significant size and diffuseness, in particular, because estimates will invariably give magnitudes that are too faint under those siuations.

What is seen then, in the developing history presented in this paper, is that some very preliminary thought to total-magnitude methodology of comets and deep-sky objects was introduced toward the end of the last century and beginning of the present century, chiefly by individuals such as Johann Holetschek, Edward Pickering, Gustav Müller, Carl W. Wirtz, F. S. Archenhold and H. E. Lau, and H. H. Kritzinger. Such early ideas began from a realization of both the importance of obtaining good brightness estimates of such objects and the problems of estimating the brightness of an extended, diffuse object in comparison to a pointlike star of known brightness. Gradually, extrafocal methodologies would be adopted and discussed increasingly as the twentieth century progressed, by ultimately-influential observers and data-compilers such as George Van Biesbroeck, Sergej Vsekhsvyatskij, Max Beyer, and Nicholas Bobrovnikoff. But specific extrafocal methodologies were not stressed — with the notable exception of Max Beyer's efforts — as being important enough to be mentioned with the *routine* reporting of *all* magnitude observations until 1980-1981, when the *ICQ* established methodology as one of the criteria necessary for archiving observations, via an implementation of standards on an international basis that ultimately would increase the value of observational data. This fact makes it not only difficult to ascertain how many older magnitude data fit in with present-day data, but also difficult to determine the thinking of various astronomers during the past century on the issue of methodology for brightness estimation.

The first attempts at total magnitude estimation of comets were apparently done *focally* by observers such as Holetschek, and indeed observers occasionally do this today via naked eye or when comet's are need the visibility limit of their telescope; *ICQ* contributors who observed bright comets in recent years have divulged other peculiar, personal, naked-eye magnitude-estimation techniques that are related to Holetschek's "perceptibility" concept — involving reflections of comet and star images from windows or even Christmas-tree ornaments! The births of the *extrafocal* visual methods for estimating cometary brightness that have been referred to in the pages of the *ICQ* for the past 16 years might be considered to have occurred roughly as follows: "In-Out" or "Sidgwick", *ca.* 1900-1904 (Pickering, Wirtz); simple "Out-Out" or "Bobrovnikoff", *ca.* 1911-1914 (Archenhold, Lau, Van Biesbroeck); "Extrafocal-Extinction" or "Beyer", *ca.* 1918 (Volokhov) and early 1930s (Beyer); "Modified Out" or "Morris", *ca.* 1977-1979 (O'Meara, Morris). But these methods all had roots in nineteenth-century work undertaken by Holetschek, Berberich, Müller, Pickering, and others. The earliest statement that I could find regarding the use of extrafocal star images as a tool for determining total brightness of extended celestial objects such as comets and nebulae is that by Harvard astronomer Edward Pickering (1900a, b), but those who delve more deeply into the historical records may indeed find that Pickering was not the first.

Regarding the employment in the (then-)Soviet Union of the term "Bakharev-Bobrovnikoff-Vsekhsvyatskij method" — which they have tended to say is the same as the simplest "Out-Out" method — my research suggests that Vsekhsvyatskij claimed only the "In-Out" method as his own (though he himself at times used the simple "Out-Out" method), and he made this claim numerous times in print. Because Vsekhsvyatskij always said that (what we now call) the "In-Out" method was the preferred method, and in any list of methods he would give the "In-Out" method first, it really is not correct to assign Vsekhsvyatskij's name to any methodology other than the "In-Out" method. I am also somewhat surprised that Bakharev's name is attached to any methodology in the former Soviet Union, because Bakharev tended to be vague in print about the specific extrafocal methodology that he employed — though he did specify upon occasion that he used the "Out-Out" method without saying if the apparent comet and star images were made to be approximately the same size extrafocally — and because few reviews in the Russian-language literature seem to mention Bakharev at all. Nobody in the Soviet Union discussed specific comet magnitude-estimation methodologies more in print than did Vsekhsvyatskij, with Dobrovol'skij perhaps falling a distant second place in this respect. But Vsekhsvyatskij's impact was significant — both inside and outside of the former U.S.S.R. — and it is entirely appropriate to begin thinking of the "In-Out" method as the method most ardently championed by Vsekhsvyatskij, Steavenson, and Sidgwick. Furthermore, the attachment of Sidgwick's name to the "In-Out" method is the most "accidental" such attachment, because Sidgwick merely had the best medium in which to state that particular method — his medium being in the form of a widely-read general treatise on amateur astronomical observation; it is not clear that Sidgwick ever did much comet observing himself!

In closing, I note that there is no problem with any name scheme *if* there is a clear understanding of the proper method used. My readings of procedural suggestions over the past several decades show that many writers merely cite references that others have cited, and that such references are frequently erroneous (in terms of either content/context or the actual source of publication); Beyer's 1953 reference, for example, is often mis-cited (the same erroneous year and/or page number being copied from paper to paper!), and the source for "Bobrovnikoff's" simple Out-Out method is frequently cited as his "Investigations" paper(s) in *Contributions of the Perkins Observatory* (but Bobrovnikoff only really states the method in an article in *Popular Astronomy*). When any writers cite the literature without actually looking at the cited literature, their statements regarding the cited information can ultimately end up in confusion, and this has led to some of the misunderstandings that have occurred regarding the methodology of total-visual-magnitude estimation. Undoubtedly, some observers may wish to continue using the currently-common names for the four visual magnitude-estimation methods mentioned here — namely, the "Beyer", "Bobrovnikoff", "Sidgwick", and "Morris" methods. But I have shown that there clearly has been some confusion regarding methodology in international circles, and credit has not

always been given to the proper individuals (possibly because no history of comet magnitude-estimation methodology has ever been undertaken in this manner before, to make clear the chronologies involved).

So, from the view of international communication, clarity, and respect, I propose that observers try to begin using, in particular, the terms "Van Biesbroeck-Bobrovnikoff$_2$-Meisel" (or "VBM" for simplicity) and "Vsekhsvyatskij$_1$-Steavenson-Sidgwick" (or "VSS") methods in place of the names of the respective "Bobrovnikoff" and "Sidgwick" methods. The names that I have chosen reflect the efforts of those individuals who ultimately had the most to do with the promoting of the respective methods; the abbreviated acronyms "VBM" and "VSS" have the advantage of sharing middle letters each of the identical *ICQ* code letters ("B" and "S", respectively), to help avoid confusion. As noted in section IV (above), Meisel also had quite a bit to do with the revival of the VBM method in the final four decades of the twentieth century — as a student of Bobrovnikoff, with full credit to Bobrovnikoff. Primary credit has frequently gone to the person most responsible for publicizing a given idea (as with Sidgwick, Beyer and Morris); indeed, Meisel and Sidgwick can be thought of in the same terms, perhaps, as Beyer and Morris, in that these four men were the ones *most* responsible for promoting the four respective chief extrafocal magnitude methods in use today. I also suggest that the terms "Beyer" and "Morris" methods are aptly named because: (a) Beyer and Morris were the observers who most actively and appropriately promoted the respective methods to wide audiences, (b) there is no ambiguity regarding what these procedures mean, and thus (c) there is no need to consider a change in how one refers to these two methods. I have not taken lightly the decision to suggest the usage of the terms "VBM" and "VSS" methods; indeed, mild concern over this decision was one comment mentioned by the referees of this paper — but chiefly for reasons of confusion. The avoidance of confusion is a paramount concern to me, as an archivist of visual magnitude data on comets, but with considerable thought as to how to suggest proper names, I have also settled on a scheme that incorporates the familar names (Sidgwick, Bobrovnikoff) and the familiar *ICQ*-tabulated codes (S, B). I am confident that observers will quickly find the new, historically-appropriate terminology to be non-confusing, practical, and fair.

While this paper may be the most comprehensive history ever written on the subject of visual total-magnitude-estimation methodology for comets, my search of the literature and interviews of various astronomers worldwide were necessarily incomplete due to time constraints (that prevented me, for example, from searching through even an entire set of appropriate journals for comet observations and potential information on methodology accompanying those observations) and to a lack of access to various published and unpublished papers. At some point, some researcher may find it instructive to look in more detail at observations (and complementary information regarding methodology) published in the astronomical literature — especially that produced in Europe — between 1850 and 1920 (in particular), beginning with the "limit of visibility" and "extinction" photometry discussed by Pickering, Müller, Berberich, and Holetschek. One might also find it productive to look at correspondence (in relevant archives) that may have exchanged between some of the key players — such as Van Biesbroeck, Bobrovnikoff, Vsekhsvyatskij, and Beyer. This paper will, however, serve as a useful jumping board for future researches in this area.

Acknowledgements. As can often happen when one is as fortunate as I am in being close to a good astronomical library (that of Harvard College Observatory, in my case), such a foray into the literature can lead from one source to another for hours (and even days!). But my library searches also raised questions that required the assistance of others, both via first-hand experiences and in the way of searching libraries containing information to which I did not have access. I extend my thanks to David D. Meisel, John E. Bortle, Peter Collins, Charles S. Morris, Stephen J. O'Meara, Albert Jones, Klim I. Churyumov, Akimasa Nakamura, Philip C. Keenan (Ohio State University), and Donald E. Osterbrock (Lick Observatory) for help in researching various aspects of magnitude methodology, historical information, and commenting on directions that I might turn to for further information. I am thankful for the efforts of various librarians who helped me in my attempts to locate various items from the literature, including Jane Holmquist (Princeton University) and Dorothy Schaumberg (Lick Observatory). I particularly thank the researchers of the Institute of Theoretical Astronomy (St. Petersburg) and the staff of its Scientific Library, headed by M. V. Lapteva, for kindly e-mailing scanned images of pages from Volokhov's 1918 article; I also thank Vladimir N. Frolov (Pulkovo Observatory) for help with this same article. I asked several people for help and advice in translating various texts from the literature, and I gratefully acknowledge special help from Michail I. Petaev (Harvard-Smithsonian Center for Astrophysics) for his translation of various Russian texts, and from Lowell C. Green (my father, who is with the University of Buffalo), Andreas Kammerer (Ettlingen, Germany), and Zdenek Sekanina (Jet Propulsion Laboratory) for their help in reading various difficult, rambling passages from Johann Holetschek's publications. For help in trying to obtain Russian texts unavailable to me, I also thank Jonathan Shanklin. In my attempts to learn the subtle meanings of descriptions about obtaining magnitudes from texts written in other languages, I sometimes found various odd sentences difficult to translate on my own, and I must thank the following for their help in such cases: Angela Chiarappa Green (Italian); L. C. Green and A. Kammerer (German); Brian G. Marsden (French, German); Jean-Claude Merlin, Stephane Garro, Owen Gingerich, and Gareth V. Williams (French). And last but not least, I thank David Meisel, John Bortle, Klim Churyumov, and Charles Morris for their critical reading of the manuscript prior to publication; they provided some useful suggestions in the way of comments, revisions and additions, which led to a better paper.

REFERENCES

Abetti, A. (1910a). "Beobachtungen des Kometen 1909e (Daniel)", *A.N.* **183**, 204.
Abetti, A. (1910b). "Cometa 1910a", *A.N.* **184**, 264.
Abetti, A. (1910c). "Cometa 1909c (Halley)", *A.N.* **185**, 26.
Abetti, A. (1911). "Cometa 1910b (Metcalf)", *A.N.* **187**, 171.

Abetti, A. (1912). "Comete osservate in Arcetri nel 1911", *A.N.* **191**, 269.
Abetti, A. (1917). "Comete osservate in Arcetri", *A.N.* **205**, 169.
Abetti, A. (1919). "Cometa Wolf 1918b", *A.N.* **209**, 59.
Abetti, A. (1921). "Comete osservate in Arcetri nel 1919", *A.N.* **214**, 254.
Adamopoulos, G. (1933). "Observations de la comète Peltier-Whipple (1932k) faites à l'équat. Doridis (40 cm) de l'Observatoire National d'Athènes", *J. des Observateurs* **16**, 44.
Adamopoulos, G. (1934). "Observations de la comète d'Encke faites à l'équatorial Doridis (40 cm) de l'Observatoire National d'Athènes", *J. des Observateurs* **17**, 195.
Adamopoulos, G. (1935). "Observations de la comète 1935a (Johnson)", *A.N.* **257**, 63.
Archenhold, F. S. (1911). "Helligkeitsschätzungen und Spektrum des Kometen 1911c (Brooks)", *A.N.* **190**, 103.
Bakharev, A. M. (1947a). "Наблюдения интегральной яркости комет Ван-Гента (Van-Gent, 1941d) и Пайдушаковой-Ротбарт (Pajdušáková-Rotbart, 1946d)", Астрон. Цирк. (*Astron. Circ.*) No. 58, p. 7
Bakharev, A. M. (1947b). "Наблюдения кометы Encke 1947i", Астрон. Цирк. (*Astron. Circ.*) No. 68, p. 1.
Bakharev, A. M. (1959). "Integral Brightness of Comet Giacobini-Zinner 1959b", Астрономическии Цирк. (*Astron. Circ.*) No. 207, p. 4.
Baldet, F. (1939). "Travaux Généraux. Magnitudes", in report of IAU Commission 15 ("l'Étude Physique des Comètes"), *Trans. IAU* **6**, 105.
Baldet, F. (1953). "La Photométrie Photographique des Comètes", *Mémoires de la Société Royale des Sciences de Liège*, Quatrième Série, **13**, 61.
Barnard, E. E. (1913). "Photographs of the Milky Way and of Comets made with the Six-inch Willard Lens and Crocker Telescope during the years 1892 to 1895", *Publ. Lick Obs.* **11**, 4.
Berberich, A. (1888). "Die Helligkeit des Encke'schen Cometen", *A.N.* **119**, 49.
Bernheimer, W. E. (1931). "On the integrated magnitude of comet 1929d (Wilk)", *Lund Obs. Circ.* No. 1, 16.
Bernheimer, W. E. (1933). "Über die Totalhelligkeit des Kometen 1932k (Peltier-Whipple)", *A.N.* **248**, 195.
Beyer, M. (1933). "Physische Beobachtungen von Kometen", *A.N.* **250**, 233.
Beyer, M. (1934). "Photometrische Kometenbeobachtungen", *Die Sterne* **14**, 47.
Beyer, M. (1937). "Physische Beobachtungen von Kometen. II.", *A.N.* **262**, 217.
Beyer, M. (1947). "Physische Beobachtungen von Kometen. VI.", *A.N.* **275**, 237.
Beyer, M. (1953). "Brightness of Comets and Solar Activity", *Mémoires de la Société Royale des Sciences de Liège*, Quatrième Série, **13**, 276.
Beyer, M. (1969). "Nachweis und Ergebnisse von Kometen-Beobachtungen aus den Jahren 1921-1968", *A.N.* **291**, 257.
Bobrovnikoff, N. T. (1941a). "Investigations of the Brightness of Comets, Part I", *Contrib. Perkins Obs.* No. 15.
Bobrovnikoff, N. T. (1941b). "Observation of the Brightness of Comets", *Pop. Astron.* **49**, 467-479.
Bobrovnikoff, N. T. (1942). "Observations of Brightness of Comets 1940d, 1941c, 1941d, and 1942a", *Pop. Astron.* **50**, 306.
Bobrovnikoff, N. T. (1943a). "On Systematic Errors in the Photometry of Comets", *Contrib. Perkins Obs.* No. 19.
Bobrovnikoff, N. T. (1943b). "The Brightness of comet 1942g (Whipple)", *Pop. Astron.* **51**, 481.
Bobrovnikoff, N. T. (1951). "Comets", in *Astrophysics: A Topical Symposium*, ed. by J. A. Hynek (New York: McGraw-Hill Book Co.), p. 327.
Bortle, J. E. (1996). Personal communication, e-mail and telephone.
Buchar, E. (1936). "Beobachtungen des Kometen 1936a (Peltier)", *A.N.* **260**, 427.
Buchar, E. (1938). "Beobachtungen der Gesamthelligkeit des Kometen 1937f (Finsler)", *A.N.* **265**, 98.
Buchar, E. (1943). "Komet 1942g (Whipple-Fedtke)", *A.N.* **274**, 126.
Churyumov, K. I. (1996a). "The Life of S. K. Vsekhsvyatskij (1905-1984) as Seen by a Student and Colleague", *ICQ* **18**, 183.
Churyumov, K. I. (1996b). "On Techniques of Visual Cometary Magnitude Estimations in the Countries of the former Soviet Union", *ICQ* **18**, 204.
Collinder, P. (1931). "On Structural Properties of Open Galactic Clusters and their Spatial Distribution", *Lund Obs. Annals* **2**, A25.
Dobrovol'skij, O. V. (1954). "К Фотометрии Комет", Бюлл. Сталинабадской Астрон. Обс. (*Byull. Stalinabad. Obs.*) No. 9, 3.
Edberg, S. J. (1983). *International Halley Watch Amateur Observers' Manual for Scientific Comet Studies* (Cambridge, MA: Sky Publishing Corp.), 5-1.
Gliese, W. (1943). "Komet 1942g (Whipple-Fedtke)", *A.N.* **274**, 125.
Ginori, N. V. (1943). "Komet 1942g (Whipple-Fedtke)", *A.N.* **274**, 125.
Green, D. W. E. (1981). "Tabulation of Comet Observations", *ICQ* **3**, 15.
Green, D. W. E. (1989). "Comets", in *Norton's 2000.0 Star Atlas and Reference Handbook*, ed. by I. Ridpath (Burnt Mill, Harlow, England: Longman Scientific & Technical), 117.
Green, D. W. E. (1996). "News Concerning Recent Comets", *ICQ* **18**, 47.
Green, D. W. E.; D. D. Meisel; and D. Milon (1991). "The First 25 Years of the A.L.P.O. Comets Section", *J.A.L.P.O.* **35**, 145.

Green, D. W. E.; T. L. Rokoske; and C. S. Morris (1986). "The *ICQ* Archive for P/Halley and Other Comets", in *Proc. 20th ESLAB Symposium on the Exploration of Halley's Comet*, ESA SP-250 (Noordwijk, The Netherlands: ESTEC, European Space Agency), **3**, 249.
Hendrie, M. J.; and G. S. Keitch (1981). "Comet Kohler 1977 XIV", *J.B.A.A.* **91**, 254.
Himpel, K. (1936). "Beobachtungen des Kometen 1936a (Peltier)", *A.N.* **260**, 425.
Holetschek, J. (1892). "Beobachtungen von Cometen", *A.N.* **130**, 70.
Holetschek, J. (1894). "Ueber die Berechnung von Cometenhelligkeiten, insbesondere für periodische Cometen", *A.N.* **135**, 378.
Holetschek, J. (1896). "Untersuchungen über die Grösse und Helligkeit der Kometen und Ihrer Schweife. I. Die Kometen bis zum Jahre 1760" (Wien: Kaiserlich-Königlichen Hof- und Staatsdruckerei), *Denkschriften der mathem.-naturw. Klasse* **63**, 1.
Holetschek, J. (1899). "Beobachtungen der Helligkeit des Cometen 1899a (Swift)", *A.N.* **149**, 399.
Holetschek, J. (1900). "Kometen-Beobachtungen", *Annalen Wien. Sternw.* **14**, 20.
Holetschek, J. (1907). "Kometen-Beobachtungen", *Annalen Wien. Sternw.* **20**, 21.
Holetschek, J. (1912). "Planeten- und Kometen-Beobachtungen am Fraunhofer'schen Refraktor von 16.2-cm Öffnung (6 par. zoll) von 1903 bis ende Juni 1910", *Annalen Wien. Sternw.* **22**, 59.
Holetschek, J. (1916). "Untersuchungen über die Grösse und Helligkeit der Kometen und Ihrer Schweife", *Denkschriften der mathem.-naturw. Klasse* **94**, 375.
Hopmann, J. (1921). "Photometrische Untersuchungen von Nebelflecken", *A.N.* **214**, 425.
Hubble, E. (1926). "Extra-Galactic Nebulae", *Contrib. Mt. Wilson Obs.* No. 324; also *Ap.J.* **64**, 321.
Hubble, E.; and M. L. Humason (1931). "The Velocity-Distance Relation Among Extra-Galactic Nebulae", *Contrib. Mt. Wilson Obs.* No. 427; also *Ap.J.* **74**, 43.
Jones, A. (1996). Communication via e-mail, Oct. 1 and 3.
Konopleva, V. P. (1948). "Общая яркость и особенности внешнего вида кометы 1947к Бестера", Астроном. Циркуляр (*Astron. Circ.*) No. 75, p. 4.
Konopleva, V. P. (1966). "The Kiev Seminar on Cometary Photometry", in *Physics of Comets and Meteors*, NASA publication No. TT F-430 (Jerusalem: Israel Program for Scientific Translations), p. 91. [Trans. by Z. Lerman from the Russian monograph *Fizika komet i meteorov* (Kiev: Izdatel'stvo 'Naukova Dumka', 1965).]
Kritzinger, H. H. (1914). "Gesetzmäßigkeiten in der Helligkeitsänderung und Schweifentfaltung der großen Kometen", *A.N.* **199**, 121.
Krumpholz, H. (1930). "Beobachtungen des Kometen 1929d (Wilk)", *A.N.* **238**, 384.
Lange, G. A. (1943). "Оценки яркости. Estimates of brightness", Астрон. Цирк. (*Astron. Circ.*) No. 13, p. 2.
Lau, H. E. (1911). "Helligkeitsschätzungen und Spektrum des Kometen 1911c (Brooks)", *A.N.* **190**, 99.
Lau, H. E. (1912). "Über die Helligkeit der Kometen 1911f (Quénisset) und 1911c (Brooks)", *A.N.* **191**, 30.
Lundmark, K. (1927). "Estimates of integrated magnitudes of nebulae and clusters", *Arkiv för Matematik, Astronomi och Fysik* **20A**, No. 13.
Marsden, B. G.; and E. Roemer (1982). "Basic Information and References", in *Comets*, ed. by L. L. Wilkening (Tucson: University of Arizona Press), 726.
Martinoff, D. J. (1943). "Оценки яркости. Estimates of brightness", Астрон. Цирк. (*Astron. Circ.*) No. 16, p. 2.
Martinoff, D. J. (1946). "Integral Brightness of the Eclipsed Moon" Астрон. Цирк. (*Astron. Circ.*) No. 51, p. 4.
Meisel, D. D. (1970). "An Investigation of the Brightness of Two Comets", *A.J.* **75**, 252.
Meisel, D. D. (1988). "N. T. Bobrovnikoff (1896-1988)", *ICQ* **10**, 66.
Meisel, D. D. (1996). Personal communication, numerous e-mail messages.
Meisel, D. D.; and C. S. Morris (1976). "Comet Brightness Parameters: Definition, Determination, and Correlations", in *The Study of Comets*, ed. by B. Donn *et al.*, NASA SP-393 (Washington, DC: NASA Scientific and Technical Information Office), **1**, 410.
Merton, G. (1948). "Comet Notes", *The Observatory* **68**, 197.
Merton, G. (1956). in "Report of the Ordinary General Meeting of the Association", *J.B.A.A.* **66**, 158.
Milon, D. (1968). "Comet Observing", *J.A.L.P.O.* **20**, 200.
Model, A. (1943). "Komet 1942g (Whipple-Fedtke)", *A.N.* **274**, 129.
Morris, C. S. (1973). "The Reduction of Comet Magnitude Estimates and Comet Observing", *J.A.L.P.O.* **24**, 154.
Morris, C. S. (1979). "A New Method for Estimating Cometary Brightness", *Comet News Service* No. 79-1, p. 2.
Morris, C. S. (1980). "A Review of Visual Comet Observing Techniques – I", *ICQ* **2**, 69.
Morris, C. S. (1996). Private communication (various e-mail messages and telephone conversations).
Morris, C. S.; and D. W. E. Green (1995). "Estimation of the Degree of Condensation: Recommended *ICQ* Methodology", *ICQ* **17**, 87.
Müller, G. (1884a). "Ueber einen zweiten merkwürdigen Lichtausbruch an dem Cometen Pons-Brooks", *A.N.* **107**, 382.
Müller, G. (1884b). "Photometrische Beobachtungen des Cometen Pons-Brooks", *A.N.* **108**, 161.
Müller, G. (1886). "Ueber die Helligkeit der Cometen 1886... (Fabry und Barnard)", *A.N.* **114**, 361.
Müller, G. (1897). *Die Photometrie der Gestirne* (Leipzig: Verlag von Wilhelm Engelmann), pp. 407*ff.*
Nakamura, A. (1996). Private communication via e-mail.
Nijland, A. A. (1911). "Komet 1911c (Brooks). Helligkeitsschätzungen", *A.N.* **189**, 257.
Nijland, A. A. (1926). "Observations of Comets", *Bull. Astron. Inst. Neth.* **3**, 165.
Nijland, A. A.; and J. van der Bilt (1909). "Beobachtungen des Halleyschen Kometen 1909c", *A.N.* **183**, 175.
Nijland, A. A.; and J. van der Bilt (1912). "Beobachtungen von Kometen am Utrechter Refraktor", *A.N.* **191**, 137.

Orlov, S. (1912). "L'éclat des comètes 1911b et 1911c", *A.N.* **190**, 157.
Ostapenko, A. Yu. (1991). "Справочник наблюдателя: Наблюдателям комет", Земля и Вселенная 1/91, p. 73.
Osterbrock, D. E. (1986). "Nicholas T. Bobrovnikoff and the Scientific Study of Comet Halley 1910", *Int. Halley Watch Newsletter*, No. 9, 26.
Peirce, C. S. (1878). "Photometric Researches Made in the Years 1872-1875", *Annals Harvard Coll. Obs.* **9**, 1.
Phillips, T. E. R. (1909). "Note on Variations in Brightness of Halley's Comet", *MNRAS* **70**, 183.
Pickering, E. C. (1879). "Photometric Observations", *Annals Harvard Coll. Obs.* **11**, Part I, pp. iii and 10.
Pickering, E. C. (1900a). "Observations of Nebulae", *Annals Harvard Coll. Obs.* **33**, 135.
Pickering, E. C. (1900b). "Observations of Comets", *Annals Harvard Coll. Obs.* **33**, 149.
Rozhkovskii, D. A. (1966). "Photometry of Comets Using 1963-1964 Patrol Photographs", in *Physics of Comets and Meteors*, ed. by V. P. Konopleva, NASA publication No. TT F-430 (Jerusalem: Israel Program for Scientific Translations), p. 1. [Trans. by Z. Lerman from the Russian monograph *Fizika komet i meteorov* (Kiev: Izdatel'stvo 'Naukova Dumka', 1965).]
Rudski, N. (1937). "Physische Beobachtungen des Kometen 1936a (Peltier)", *A.N.* **262**, 89.
Schwarzschild, K.; and E. Kron (1911). "On the Distribution of Brightness in the Tail of Halley's Comet", *Ap.J.* **34**, 342.
Shapley, H.; and A. Ames (1932). "A Survey of the External Galaxies Brighter than the Thirteenth Magnitude", *Annals Harvard Coll. Obs.* **88**, 47.
Sidgwick, J. B. (1955). *Observational Astronomy for Amateurs* (London: Faber and Faber Ltd.), 248-253.
Steavenson, W. H. (1942). "Note on the Photometry of Comets", *J.B.A.A.* **52**, 189.
Van Biesbroeck, G. (1914a). "Beobachtungen der vier Herbstkometen des Jahres 1913", *A.N.* **197**, 85.
Van Biesbroeck, G. (1914b). "Observations faites a l'Équatorial de 38 centimètres d'Ouverture de 1907 a 1912", *Annales de l'Observatoire Royal de Belgique* **13**, 526, 566, 573, 579, 586, and 589.
Van Biesbroeck, G. (1917). "Observations of Comets Made with the 10-inch Refractor of the University Observatory, Utrecht, Holland", *MNRAS* **78**, 179.
Van Biesbroeck, G. (1927). "Comet Notes", *Pop. Astron.* **35**, 352.
Van Biesbroeck, G. (1930). "Observations of Comets at the Yerkes Observatory", *A.J.* **41**, 4.
Van Biesbroeck, G. (1935a). "Comet Notes", *Pop. Astron.* **43**, 254.
Van Biesbroeck, G. (1935b). "Observations of Comets with the 24-inch Reflector of the Yerkes Observatory", *A.J.* **45**, 19-20.
Van Biesbroeck, G. (1945). "Observations of Comets and Pluto with the 24-inch Reflector of the Yerkes Observatory", *A.J.* **51**, 115.
Van Biesbroeck, G. (1947). "Observations of Comets", *A.J.* **52**, 204.
Van Biesbroeck, G. (1948). "Observations of Comets", *A.J.* **54**, 81.
Van Biesbroeck, G. (1950). "Observations of Comets", *A.J.* **55**, 53-60.
Van Biesbroeck, G. (1961). "Comet Observations", *A.J.* **66**, 96.
Vanderlinden, H. (1920). "Observations de Comètes", *Ann. l'Observ. Royal de Belg.* **14**, 36.
Volokhov, A. (1918). "Новый способъ определения яркости звезд", Мироведение **7**(35), 272.
Vorontsov-Velyaminov, B. (1926a). "Catalogue of integrated magnitudes of star clusters", *A.N.* **226**, 196.
Vorontsov-Velyaminov, B. (1926b). "Integral magnitudes of south star clusters", *A.N.* **228**, 326.
Vorontsov-Velyaminov, B. A. (1943). "Astrophysical Observations of the Comet Tevsadse 2", Астрон. Цирк. (*Astron. Circ.*) No. 16, p. 2.
Vorontsov-Velyaminov, B.; and S. Vsechsviatsky (1925). "Enckescher Comet 1924b", *A.N.* **225**, 88.
Voûte, J. (1910). "Beobachtungen des Halleyschen Kometen 1909c", *A.N.* **184**, 171.
Voûte, J. (1912). "Kometenbeobachtungen", *A.N.* **191**, 7.
Vsekhsvyatskij, S. K. (1925). "О наблюдении комет", бюллетень Коллектива Наблюдателей Московского Общества Любителей Астрономии (*Bull. Observing Corp. of Soc. Amateur-Astronomers of Moscow*), No. 4, p. 17 (this reference is given erroneously in Vsekhsvyatskij 1958 and 1964, where what appears to be "[page] 125" *should read* "[year] 1925")
Vsekhsvyatskij, S. K. (1928). "Sur l'Éclat des Comètes", *Russian Astron. J.* **5**, 40.
Vsekhsvyatskij, S. K. (1930). "On the Disintegration of Short-Period Comets: Some Remarks on the Question of their Origin", *MNRAS* **90**, 711.
Vsekhsvyatskij, S. K. (1937). "On the Variation of Comet's Brightness", *Poulkovo Obs. Circ.* Nos. 22-23, pp. 25*ff.*
Vsekhsvyatskij, S. K. (1946). "К Вопросу о Наблюдательной Службе Слабых Комет" ("On the Problems of the Observational Service of Telescopic Comets"), *Publ. Kiev Astron. Obs.* **1**, 146.
Vsekhsvyatskij, S. K. (1948). "Наблюдения общей яркости кометы 1947к Бестера", Астрономическии Цирк. (*Astron. Circ.*) No. 74, p. 4.
Vsekhsvyatskij, S. K. (1958). Физические Характеристики Комет (Moscow: Государственное Издательство Физико-Математической Литературы), 575 pages. Most of the references to this book may be found in Глава II (pp. 25-36).

Vsekhsvyatskij, S. K. (1959). "Brightness of comet Giacobini-Zinner 1959b", Астрономическии Цирк. (*Astron. Circ.*) No. 207, p. 2.
Vsekhsvyatskij, S. K. (1964). *Physical Characteristics of Comets*, NASA publication TT F-80 (Jerusalem: Israel Program for Scientific Translations). This is the English translation of Vsekhsvyatskij's 1958 monograph in Russian (see reference above). Most of the references to this book may be found in Chapter II (pp. 19-30).
Vsekhsvyatskij, S. K. (1966). "Intrinsic Brightness of Comet Ikeya 1963a", in *Physics of Comets and Meteors*, ed. by V. P. Konopleva, NASA publication No. TT F-430 (Jerusalem: Israel Program for Scientific Translations), p. 35. [Trans. by Z. Lerman from the Russian monograph *Fizika komet i meteorov* (Kiev: Izdatel'stvo 'Naukova Dumka', 1965).]
Weaver, H. F. (1946). "The Development of Astronomical Photometry", *Pop. Astron.* **54**, 211, 287, 339, 389, 451, and 504.
Weber, A. (1943). "Komet 1942g (Whipple-Fedtke)", *A.N.* **274**, 128.
Weiss, E. (1890). "Planeten- und Cometen-Beobachtungen im Jahre 1889", *A.N.* **125**, 268.
Weiss, E. (1891). "Beobachtungen auf der k. k. Wiener Sternwarte im Jahre 1890", *A.N.* **127**, 337.
Wirtz, C. W. (1904). "Die Helligkeit des Kometen 1903 IV nach Beobachtungen auf der Kaiserlichen Universitätssternwarte zu Straßburg", *Astron. Nach.* **164**, 185.
Wirtz, C. (1923). "Flächenhelligkeiten von 566 Nebelfiecken und Sternhauffen", *Meddelanden Från Lunds Astron. Obs.*, Ser. II, No. 29, p. 8.
Witkowski, J. (1936). "Beobachtungen des Kometen 1936a (Peltier)", *A.N.* **260**, 427.
Wolff, T. (1884). "Photometrische Beobachtungen des Cometen Pons-Brooks", *A.N.* **108**, 272.
Wood, H. W. (1941). "Visual Observations of Comet 1941c", *J.B.A.A.* **51**, 284.
Zaharov, G. (1930). "The Brightness of Comet 1929d (Wilk)", *A.N.* **238**, 367.

◇ ◇ ◇

Appendix 1. Translation of Holetschek

Johann Holetschek (1846-1923) was quite influential in the history of cometary brightness. He was the first both to systematically work toward the estimation of comet magnitudes for a large number of comets and to compile a catalogue of comet brightness from historical records. The following passages regarding his brightness-estimation methodology are taken from page 8 of Holetschek's first large catalogue publication on cometary brightness, published exactly 100 years ago. This translation is provided in centennial observance of that publication, and also because many readers may not have access to the original text (which is written in rather difficult, complex German). What follows is an editing by Dan Green of various translations of this text from A. Kammerer, Z. Sekanina, L. C. Green, and D. W. E. Green.

Here, too, a statement about the brightness is all the more certain when a comet is closer to the threshold of visibility in the utilized telescope. The determination of the magnitude of extinction is possible for every telescopic comet, because it is always possible to find a telescope in which the comet (nucleus and coma) is comparable to the fainter celestial objects or is even at the threshold of visibility. Therefore, one can summarize the approach to brightness determination of telescopic and bright comets as follows:

Consider a comet or, in general, a nebulous celestial object that is as easy or difficult to detect in a particular telescope (or with the naked eye) as a star of a known magnitude: this value can be used to characterize the "perceptibility" of the comet or nebulous object. Through such a comparison, the impression of the total brightness of a comet will be found, and the closer that a comet and star are to the threshold of visibility in the utilized telescope (or with the naked eye), the more certain is the determination. The perceptibility (that is, the degree of visibility) of a comet can be described most readily if one looks at the comet with the smallest telescope (using the lowest magnification) in which it is still visible (or even with the naked eye, if possible), noting the magnitude of the star that is with the comet at the threshold of visibility. Because one does not easily get access to the appropriate set of telescopic apertures, one usually must be satisfied with a determination of the perceptiblity with only a few telescopes of different apertures — e.g., a refractor and its attached finderscope. But even in this case the method can give reasonable results if one takes care to make the comparison with at least two stars — of which one is more and the other less perceptible than the comet; using only one star for the comparison can result in great uncertainties, especially if the two objects differ significantly in their relative brightness.

If one fails to classify the comets with the same magnitude scale as that of the stars, one should leave the concept of "stellar magnitude" and replace it by another concept that also provides information on the comet's perceptibility. Though this alternative approach is different from the stellar magnitude, it is still linked to it, in that the magnitude of the stars that are just visible at low magnification with telescopes of different apertures (down to the naked eye) define the scale from which the perceptibility of comets or nebulae can be determined. Whereas for detailed studies of a comet, it is necessary to use larger instruments and high magnifications to penetrate ever closer to the nucleus (cf. the statement by [George] Bond, cited above)[7] — whereby the nuclear condensation is ever more dissolved [into

[7] he refers to Bond's treatise on Donati's comet in 1858, published in 1862 in the *HCO Annals* 3.

nebulosity(?)] — the opposite approach is used to determine the impression of the comet's total brightness, in that by using low magnifications, one increasingly achieves an apparent concentration of the coma nebulosity closer to the nucleus, and one strives to observe it, in general, with as modest optical means as possible.

Φ Φ Φ

On Techniques of Visual Cometary Magnitude Estimations in the Countries of the former Soviet Union*

Klim I. Churyumov
Astronomical Observatory of Kiev University

Professor S. K. Vsekhsvyatskij, in his instruction for observers of comets made in the 1920s (*Bull.* of the Observers Group of the Moscow Society of Amateur Astronomers), describes three methods that were used in Russia (and then in the former USSR) by amateur astronomers — already at the time of the outstanding comet investigator, Academician Fedor Aleksandrovich Bredikhin (1831-1904) — and by Bredikhin's followers, and member-correspondents of the Russian Academy of Sciences, Pokrovsky Konstantin Dormedontovich (1868-1945) and Sergej Vladimirovich Orlov (1880-1958). The first method (called Sidgwick's method recently in the USA) was described by Vsekhsvyatskij in the above-mentioned instructions much earlier than Sidgwick's 1955 publication. I completely support the proposition of D. W. E. Green[1] to call this method the "Vsekhsvyatskij-Steavenson-Sidgwick (VSS) method". The method consists of comparing the extrafocal image of a star with an in-focus image of a comet. The star is defocused into an extrafocal circle with a diameter equal to the diameter of the comet's coma and then is compared with the focal image of the comet. To do this, one needs to remember the comet's mean brightness and keep it in his mind when looking at the extrafocal image of the star. A few stars (two as a minimum) are selected — some of them a little bit brighter, the others fainter than the comet — and the comet magnitude is found through interpolation of the magnitude interval between the reference stars by the method of Neiland-Blazhko. This method implies the following. We use two (or more) stars for comparision: one of them brighter, the other one fainter than the comet. Let stars 'a' and 'b' have magnitudes m_a and m_b, and let the comet 'k' have magnitude m_k. Here, $m_a < m_k < m_b$, so that star 'a' is brighter than star 'b'. In the observer's mind, the observer must divide the known interval into several "grades" (3, 4, ...), and, by comparing one-by-one the images of the comet and the reference stars, we determine the number of similar grades between the comet and each star. If (for example) the interval is divided into 5 grades, then the record 'a5b' means that star 'a' is five grades brighter than star 'b'. Then taking $\Delta m = m_b - m_a$, we obtain the number of magnitudes (or, more likely, the fraction of a magnitude) that each grade represents, $p = \Delta m/G$, where G is the number of grades selected. Additionally, assume that in the estimation of the magnitude of comet 'k', it appears that it is 2 grades brighter than star 'b' and 3 grades fainter than star 'a', which is written as 'a3k2b'. Then the magnitude of the comet in this 5-grade scheme is

$$m_k = m_a + 3p = m_a + 0.6\Delta m, \text{ or}$$
$$m_k = m_b - 2p = m_b - 0.4\Delta m$$

This method gives good results (consistent cometary magnitudes) via persistent training and care, as the procedure becomes almost automatic for memorizing the brightnesses of an extrafocal star and a focal comet.

Prof. Vsekhsvyatskij himself sometimes used this VSS method — I believe up to 1941, when he visually observed the bright comet C/1940 R2 (Cunningham; O.S. 1941 I) — but more often, especially after visual observations of comet C/1942 X1 (Whipple-Fedtke-Tevzadze; O.S. 1943 I), he used the method that D. W. E. Green now proposes be called the "Van Biesbroeck-Bobrovnikoff-Meisel (VBM) method" (see previous paper in this issue). Vsekhsvyatskij's advice to us was to apply this "Out-Out" method.

Besides Vsekhsvyatskij in the former USSR, astronomer Anatoliy Bakharev also obtained a long series of photometric estimates of magnitudes of many comets using the "Out-Out" method. (I observed visually with Bakharev the comets C/1996 P1 Kilston and C/1996 P2 Barbon in the summer of 1966 near Ashgabad.) Thus, in our country, this method is called the Bakharev-Bobrovnikoff-Vsekhhsvyatskij method (the names being placed in alphabetical order). However, I think that Green's proposition to call this method the "Van Biesbroeck-Bobrovnikoff-Meisel" method may be better grounded.

This VBM method has been used in the former Soviet Union as follows. Images of the comet and a reference star are drawn out-of-focus with a telescope or a binocular, until their extrafocal images have approximately similar diameters (it is impossible to achieve complete equality of diameter of these objects because the diameter of the comet image is always bigger than that of the star). It is necessary to take into account the fact that brightness of the extrafocal image of the star is approximately the same across its disk, but the comet appears like a spot of a nonhomogeneous brightness. The observer finds the mean brightness of the comet throughout its extrafocal disk, and this mean brightness is compared to

* written as a result of questions that arose regarding the preceding article by D. W. E. Green

[1] see preceding article (*ICQ* 18, 186).

the brightnesses of extrafocal images of reference stars. By selecting several pairs of reference stars, we can determine the mean magnitude of a comet with a precision up to 0.1 mag.

The third method that Vsekhsvyatskij recommended in his instruction was widely used over the course of 40-50 years, which American and European amateurs call the "Beyer method". But actually this method was proposed in 1918 by amateur astronomer A. N. Volokhov in Moscow in the journal *Mirovedenie*. Its essence lies in the following: Images of a comet and a reference star are drawn one-by-one out of focus in the telescope until their complete disappearance on the sky background is seen. To do this, three or more reference stars are selected in such a way that the comet has a magnitude placed intermediate between the star magnitudes such that some reference stars would be a little brighter than the comet and the others fainter. For comparison of the magnitudes of comet and stars, it is necessary to select the weakest ocular with the biggest field of view, and to then direct telescope at the comet and withdraw the ocular from focus until full disappearance of the comet image on the sky background is observed. After this, it is necessary to obtain a reading of n_k from the ocular scale or rack-and-pinion gear of the ocular tube (if such a scale does not exist, an observer can make it by himself). Then the telescope is directed toward each of the comparison stars, and in the same way the ocular is withdrawn out of focus until full disappearance of the stars against the sky background, with similar readings n_a, n_b, *etc.*, obtained from the linear scale of the ocular tube. On the basis of these readings, a graph is built with $m = f(n)$ and a comet magnitude is determined.

The Volokhov-Beyer method (as this procedure is called in the former Soviet Union) diminishes the contribution of coma in the integral magnitude of the comet and factually it gives the magnitude of the near nuclear condensation having frequently starlike form. Estimation of magnitudes found by this method is 3-4 magnitudes fainter than same magnitude determined with other methods. Therefore, along with Vyacheslav Mamedov from Krasnovodsk (Turkmenistan), I proposed[2] the following modification of this method:

Comparison-star images are drawn out-of-focus to a size comparable with the diameter of the coma. Further defocusing for comparison stars begins with these readings until complete disappearance of the stars on the sky background and the readings are defined (for example, a bright star will have a reading of n_a, and a weak star will be n_b). Let a reading for a comet, after defocusing it to complete disappearance on the sky background, be n_k. These readings are put on the graph and, using n_k, we determine the comet magnitude, m_k.

In 1984, in the framework of the SOPROCH (Soviet Program of Comet Halley), I worked out "Instruction for amateur observations of comet Halley".[3] In this instruction, I listed methods for the estimation of the comet's magnitude, the coma diameter, and degree of condensation, and suggested a classification scheme for the type of visible comet head based on morphological characteristics such as shape, visible jets, jets, hoods, and fans, *etc.*. As to the tail, besides its length and position angle, we defined tail types as follows: Type I — straight tails, directed along the prolonged radius-vector of a comet (or near the radius vector); these are gaseous and plasma tails, and are blue; sometimes they have a helix and spiral structure and consist of individual jets or rays. Type II — a broad, curved tail, extremely declined from the prolonged radius-vector of a comet; these are gaseous-dusty tails, and as a result of high concentration of dust in them, they are yellow. Type III — not-so-broad, short, curved tail, directed almost perpendicular to the prolonged radius-vector of a comet (creeping along the cometary orbit). Type IV — anomalous (yellow) tails directed towards the sun; not-so-broad, short tails, consisting of large dust particles that are almost non-repulsed by light pressure. Type V — disconnected tails, directed along the prolonged radius-vector or near to it, being blue, as they are plasma formations.

Φ Φ Φ

Comets for the Visual Observer in 1997

Alan Hale

Southwest Institute for Space Research

Comet C/1995 O1 (Hale-Bopp), discovered by the author at $m_1 \sim 10.5$ on 1995 July 23, has brightened more or less "on schedule" throughout 1996. Recent observations by the author (mid-August 1996) have given a brightness slightly fainter than $m_1 \sim 5.0$ and a tail approximately 1° long. These observations continue to be consistent with an absolute magnitude $H_{10} \sim -2$, and the brightness forecasts below are based upon the assumption that this trend will be maintained. Observers should keep in mind that cometary brightnesses, especially those of long-period objects not observed previously, can be especially difficult to predict, and consequently the comet could be dramatically fainter (or, conceivably, brighter) than the predictions below. (See Green 1995 for a discussion of this topic.)

[2] Churyumov also writes that he has recently thought of a magnitude-estimation procedure for use with comets having bright inner tails, in which one determines the magnitude of a comet's nuclear condensation via the "Extrafocal-Extinction" method, then estimates the magnitude of the average surface brightness of the coma (trying to ignore the central condensation) and inner bright tail area via the "In-Out" method, and adding these two magnitudes together. – *Ed.*

[3] in "Recommendations for observations of comet Halley", *Communication of Information* No. 2, Kiev, Main Astronomical Observatory of the Ukraine Academy of Sciences, 1984, pp. 25-45.

The comet is in conjunction with (28° north of) the sun at the end of 1996, and becomes visible in the morning sky shortly thereafter. It is well placed in the northern hemisphere's predawn sky from early January through late March, potentially brightening from $m_1 \sim 2.0$ in mid-January to $m_1 \sim 0.0$ in mid-February, and to $m_1 \sim -1.5$ in mid-March. It is in conjunction again (45° north of the sun) on March 22, when it is also closest to the earth ($\Delta = 1.315$ AU). At that time, the comet's declination will be +45° and it will be circumpolar from latitudes north of +45°.

Following conjunction, the comet is well placed in the northern hemisphere's evening sky, and should be near its peak brightness ($m_1 \sim -1.5$ to -2.0). Perihelion (according to the orbit on *MPC* 27541) occurs on April 1.13 UT, at $q = 0.914$ AU. After perihelion, the comet's elevation above the western horizon will gradually decrease, and the comet will also (presumably) begin fading. By the time the northern hemisphere loses sight of the comet during the latter part of May, it will probably have faded to $m_1 \sim 1.0$.

Southern-hemisphere observers should be able to pick up the comet low above the northwestern horizon about the beginning of May, and will not lose it thereafter. It is in conjunction (26° south of the sun) in early July, perhaps at $m_1 \sim 3.0$, and remains in the morning sky through the rest of the year, being at opposition in late December. Observers in mid-northern latitudes may succeed in viewing the comet in the morning sky low above the southeastern horizon during September and October ($m_1 \sim$ 5-6), but after mid-November it enters southern-circumpolar skies, where it will remain for the duration of the outbound leg of its orbit. The brightness at the end of December should be near $m_1 \sim 7.0$.

In addition to this object, several short-period comets are expected to be visible during 1997, with one approaching naked-eye visibility, three or four more being visible in small-aperture telescopes, and several others requiring larger-aperture instruments. Ephemerides for all of these objects, including comet C/1995 O1 (Hale-Bopp), are given in the *ICQ 1997 Comet Handbook* (Nakano and Green 1996).

The Brighter Comets

2P/Encke

This well-known object is at perihelion at $T =$ 1997 May 23 ($q = 0.331$ AU). Prior to perihelion, it is in the evening sky but impossibly placed for observation by the time it becomes bright enough for visual observations. By mid-June, the comet becomes accessible from the southern hemisphere, at $m_1 \sim$ 6-7 and located in the evening sky. At that time, it is rapidly approaching the earth, and by the end of June it is traveling over $4\frac{1}{2}^\circ$ per day to the southeast. On July 5 it passes closest to the earth at $\Delta = 0.19$ AU, which is 2P/Encke's closest approach to the earth since its original discovery. Presumably still close to $m_1 \sim 7$ at that time, it will likely fade rapidly afterward, becoming lost to visual observations sometime in August.

On June 15, 2P/Encke will be located $3\frac{1}{2}^\circ$ east of comet C/1995 O1 (Hale-Bopp). Depending upon the length and curvature of the latter's tail, 2P/Encke should transit that tail sometime around this date.

46P/Wirtanen

This object's 1997 return ($T =$ March 14, $q = 1.064$ AU) is very similar to that in 1986, the respective perihelion times being 5 days apart. The comet reached a peak brightness of $m_1 \sim 10$ in 1986, and consequently a similar peak brightness should be expected in 1997 — although, in his comparison of the 1986 and 1991 returns, Morris (1994) noted that the comet appeared to be approximately one-half magnitude fainter intrinsically in 1991 than it was in 1986; thus, a peak brightness closer to $m_1 \sim 11$ in 1997 is not out of the question. Using the 1986 return as a rough guide, the comet should become visually observable at $m_1 \sim 12$ in January, reach its peak brightness in March around perihelion, and remain observable through late May or early June. It will remain in the evening sky, at an elongation of 45°-50° throughout its period of visibility, and is better placed for viewers in the northern hemisphere.

On April 26, 46P/Wirtanen will be located 15° east of comet C/1995 O1 (Hale-Bopp), and if the latter object's tail is long enough, 46P/Wirtanen will be visible in transit across it sometime around that date.

81P/Wild 2

This comet, the planned destination for the *Stardust* spacecraft mission to be launched in 1999, passes perihelion on 1997 May 6 at $q = 1.573$ AU. This is the comet's most favorable return since its original discovery in 1978. Historically, the comet has exhibited a consistent light curve both before and after perihelion, and consequently in 1997 its period of visual observability may last almost a full year.

Based upon Bortle's (1978) analysis of 81P/Wild 2's discovery apparition and the observations at subsequent returns, the comet should be visible at $m_1 \sim$ 11-12 at the beginning of 1997, brightening perhaps a half magnitude by the time it is at opposition in mid-January. It should brighten another half to full magnitude by late February and remain near this peak brightness through May. Gradual fading should commence after that, but visual observers should be able to follow it until about August, by which time it will probably have faded to $m_1 \sim$ 12-13.

103P/Hartley 2

This object makes its second predicted return to perihelion on 1997 December 21, at $q = 1.032$ AU. At its 1991 return, this comet became an easily observable object of $m_1 \sim 8$; the 1997 return is not quite as favorable, but it should nevertheless reach a peak brightness near $m_1 \sim 10$.

Following opposition in mid-July, the comet should become visually accessible in the evening sky around September,

at $m_1 \sim$ 12-13. It should brighten gradually, reaching $m_1 \sim 11$ in mid-November and its peak brightness near the end of December. The comet should begin fading after that but should remain accessible to visual observers until February or March 1998.

55P/Tempel-Tuttle

The parent comet of the Leonid meteor stream is predicted to make its next perihelion passage on 1998 February 28, at $q = 0.977$ AU. The return is a relatively favorable one, and the comet will pass 0.36 AU from the earth in mid-January 1998.

Brightness predictions for the 1998 return are problematical, since the comet has not been observed visually since 1866. (The returns in 1899 and 1932 were missed, and in 1965 it was only observed photographically as a faint object.) Vsekhsvyatskii (1964) derived an absolute magnitude of $H_{10} = 8.0$ from the 1866 observations; under the assumption that this value holds for the 1998 return, the comet should become visually observable in the morning sky in November 1997 at $m_1 \sim$ 12-13, brightening to $m_1 \sim$ 9-10 by the end of the year. A peak brightness of $m_1 \sim 7$ should be reached when the comet is closest to the earth.

The Fainter Comets

29P/Schwassmann-Wachmann 1

This object emerges into the morning sky near the beginning of November 1996, enroute to opposition during the latter part of March 1997. It is subsequently visible in the evening sky before disappearing into sunlight during August. It once again emerges into the morning sky in late November, enroute to its next opposition in April 1998.

Comet 29P/Schwassmann-Wachmann 1 is prone to unpredictable outbursts and should be monitored for such on a regular basis. It remained in a state of almost continuous outburst throughout the 1995-96 viewing season, including a dramatic flare to $m_1 \sim 11$ in mid-February 1996. A repeat of this type of activity is theoretically possible during the 1996-97 viewing season.

The comet is at aphelion ($Q = 6.278$ AU) in January 1997. The last perihelion passage occurred in October 1989, and it will pass perihelion again in mid-2004.

95P/Chiron = (2060) Chiron

Now outbound following its recent perihelion passage in February 1996, 95P/Chiron is accessible in the morning sky beginning about December 1996 and is at opposition in mid-April 1997. It is subsequently accessible in the evening sky until about August, and once again in the morning sky at the end of the year, enroute to its next opposition in May 1998. Visual observations at the previous two oppositions suggest that Chiron should be near $m_1 \sim 15.0$, or perhaps slightly fainter, when near opposition in 1997. The visual appearance will probably be entirely stellar.

121P/Shoemaker-Holt 2

This comet, having already passed perihelion on 1996 August 19 ($q = 2.664$ AU), enters the morning sky during the last few months of 1996 and is at opposition in mid-February 1997. Based upon the brightness exhibited at the comet's discovery apparition in 1988-89, a peak brightness of $m_1 \sim 13.5$ should be obtained during the first two to three months of 1997.

118P/Shoemaker-Levy 4

This comet was already seven months past perihelion when originally discovered as a faint object in February 1991. The 1997 return (perihelion on January 12, at $q = 2.021$ AU) is geometrically very favorable, with opposition occurring in mid-December 1996. Brightness predictions are necessarily very uncertain, but a peak brightness of $m_1 \sim$ 13-14 in December and January would not seem out of the question.

94P/Russell 4

At its discovery apparition in 1984, this object was reported photographically as being at $m_1 \sim$ 13-14. The 1997 return, with perihelion occurring on February 3 ($q = 2.229$ AU) and opposition occurring in mid-March, is slightly more favorable geometrically than that of 1984, and a peak visual brightness in this same range would appear to be reasonable.

100P/Hartley 1

This comet's 1997 return ($T =$ May 28, $q = 1.819$ AU) is almost identical to that of 1991, the respective perihelion dates being eleven days apart. A handful of visual observations at $m_1 \sim 14$ were obtained in 1991, and a similar peak brightness in 1997 would seem likely. The comet is at opposition in early April and will probably be most accessible to visual observers around that time.

43P/Wolf-Harrington

This comet is at perihelion on September 29 ($q = 1.582$ AU), only seven days later than the corresponding perihelion date in 1984, when a peak brightness near $m_1 \sim$ 12-12$\frac{1}{2}$ was observed; a similar peak brightness would be expected in 1997. The comet becomes accessible in the morning sky by July or August, and remains in the morning sky through the end of the year, by which time it will probably have faded to $m_1 \sim 13$. Opposition occurs in late February 1998.

P/1989 U1 (Helin-Roman-Alu 2)

Predicted perihelion passage for this comet is on 1997 November 10, at $q = 1.910$ AU. This return is very similar to the discovery apparition in 1989, the respective perihelion dates being ten days apart, and the geometrical circumstances are very favorable, with opposition occurring in late October. The author searched unsuccessfully for the comet in 1989 (m_1 [13.5:), but due to the recurring favorable circumstances, and to the fact that the 1997 perihelion distance is slightly closer (0.02 AU) than in 1989, search attempts should again be worthwhile.

128P/Shoemaker-Holt 1

Like the above comet, this object makes its first predicted return in 1997; perihelion passage is predicted for November 21, at $q = 3.047$ AU. The discovery brightness in 1987 was given as photographic $m_1 \sim 14\frac{1}{2}$-15; the author subsequently made numerous unsuccessful searches for the comet at that apparition. The geometrical circumstances in 1997 are significantly more favorable, however, with opposition occurring in late November, and additional search attempts would appear to be worthwhile.

REFERENCES

Bortle, J. E. (1978). *Sky Tel.* **56**, 121.
Green, D. W. E. (1995). *ICQ* **17**, 168.
Nakano, S. and D. W. E. Green (1996). *ICQ* **18**(2a), H1.
Morris, C. S. (1994). *ICQ* **16**, 178.
Vsekhsvyatskij, S. K. (1964). *Physical Characteristics of Comets*, Israel Program for Scientific Translations, Jerusalem.

Φ Φ Φ

DESIGNATIONS OF RECENT COMETS

Listed below, for handy reference, are the last 25 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. [This list updates that in the April 1996 issue, p. 48.]

	New-Style Designation	*P*	*T*	*q*	*IAUC*
⋆	C/1995 O1 (Hale-Bopp)		4/1/97	0.91	6187
	120P/1995 O2 (Mueller 1)	8.4	4/24/96	2.7	6199
⋆	C/1995 Q1 (Bradfield)		8/31/95	0.44	6206
⋆	C/1995 Q2 (Hartley-Drinkwater)		8/2/95	1.9	6217
	121P/1995 Q3 (Shoemaker-Holt 2)	8.1	8/19/96	2.7	6219
#	122P/1995 S1 (de Vico)	74.4	10/6/95	0.66	6228
	123P/1995 S2 (West-Hartley)	7.6	5/12/96	2.1	6249
	124P/1995 S3 (Mrkos)	5.6	11/9/96	1.4	6250
⋆	C/1995 Y1 (Hyakutake)		2/24/96	1.05	6279
⋆	P/1996 A1 (Jedicke)	19.3	8/15/95	4.1	6287
⋆	C/1996 B1 (Szczepanski)		2/6/96	1.45	6296
⋆	C/1996 B2 (Hyakutake)		5/1/96	0.23	6299
⋆	C/1996 E1 (NEAT)		7/27/96	1.36	6341
	125P/1996 F1 (Spacewatch)	5.6	7/14/96	1.54	6349
⋆	C/1996 J1 (Evans-Drinkwater)		12/30/96	1.30	6397
⋆	C/1996 N1 (Brewington)		8/3/96	0.93	6428
⋆	P/1996 N2 (Elst-Pizarro)	5.6	4/18/96	2.63	6456
	126P/1996 P1 (IRAS)	13.3	10/29/96	1.70	6446
⋆	C/1996 P2 (Russell-Watson)		3/1/96	2.01	6448
⋆	C/1996 Q1 (Tabur)		11/3/96	0.84	6455
⋆	C/1996 R1 (Hergenrother-Spahr)		8/29/96	1.90	6470
⋆	P/1996 R2 (Lagerkvist)	7.3	1/18/97	2.62	6473
	127P/1996 S1 (Holt-Olmstead)	6.3	2/6/97	2.15	6475
	128P/1996 S2 (Shoemaker-Holt 1)	9.5	11/20/97	3.05	6477
	129P/1996 U1 (Shoemaker-Levy 3)	7.2	3/4/98	2.82	6494

Infrared Observations of C/1995 O1

Stephen O'Meara[1] and Francois Rigaut[2]

[1] *Sky & Telescope;* [2] *Canada-France-Hawaii Telescope*

High-resolution near-infrared images of comet C/1995 O1 (Hale-Bopp) were taken on 1996 Sept. 30.25 UT using the 3.6-m Canada-France-Hawaii Telescope. We used the newly-commissioned adaptive optics system PUEO and the University of Montreal's infrared camera MONICA. The images are diffraction limited at H (1.65μm) and K (2.2μm) — that is, 0″.10 and 0″.13, respectively. We also obtained J-band images (1.25μm) at 0″.10 resolution. The images have been processed to remove the fuzzy component probably due to sunlight scattering off a halo of dust particles in the comet's coma.

The processed J, H, and K images of C/1995 O1 reveal a very active inner coma. Seven prominent jets extend radially from the nucleus and cross the instrument's 9″ field-of-view; some of the jets appear to splinter into sub-jets. The most prominent jet activity lies to the northeast and east of the nucleus. All of the jets flow from an elongated cloud of dust (oriented north-south), which surrounds the comet's starlike nucleus. This dense region is more extended to the north in the H image than in the J or K images. A deconvolved image of the starlike core reveals a knot of material 0″.15 north of the nucleus, corresponding to a distance of ~ 340 km at the comet's distance of 2.9 AU. The nucleus itself is diffraction limited; an upper limit for its diameter was calculated to be 200 km.

The high-resolution processed J, H, and K images of the comet's inner nuclear region are available on the World Wide Web at `http://www.cfht.hawaii.edu/manuals/aob/ao.html`.

Φ Φ Φ Φ Φ

Tabulation of Comet Observations

Descriptive Information (to complement the Tabulated Data):

◇ *Comet C/1995 O1 (Hale-Bopp)* ⟹ 1996 May 13.35-Oct. 1.07: for all obs., coma was fan-shaped, opening to the N [MOD]. May 21.04: w/ 25×150 B, broad fan tail in p.a. 340° [ZAN]. May 25.23: very bright nuclear region of dia. 30″ (not quite stellar) [DID]. May 26.27: very bright, small (30″) nuclear region located at the SW region of a fan-shaped coma; tail fan spans p.a. 310°-65° w/ a brighter region being centered at p.a. 5° [DID]. June 10.96 and 14.00: w/ 25×150 B, broad fan tail in p.a. 350° [ZAN].

July 3.40: comet has brightened a great deal since last obs.; the tail is also brighter, being a wide diffuse fan [CAM03]. July 6.55: w/ 20.3-cm L, the coma is very condensed w/ a strong starlike cond. of mag 10; the tail is a very broad fan that seems to be brighter and more defined on the W edge; w/ finderscope (5.0-cm f/4 R, 8×), 15′ coma, DC = 4 [CAM03]. July 7.18, 21.22, Aug. 10.18, 18.20, and Sept. 11.08: very diffuse tail, as wide as coma [MOD]. July 7.45: tail is brighter and more defined on W edge of the fork-like tail [CAM03]. July 7.57: coma strongly condensed with faint outer coma [PEA]. July 7.91, 8.87, Aug. 8.85, and 10.90: m_2 = 9.0; coma quite asymmetrical [KOS]. July 8.43: tails in p.a. 320° (broad) and 30°, w/ a broad skirt of material fanning between the two (all to lengths of ~ 20′ from the nucleus) [CAM03]. July 8.91: bright starlike nuclear cond. of mag 7.1 [BOR04]. July 9.91: in 20×80 B, star-like nuclear region suspected [ZAN]. July 10.90: comet seen w/ naked eye for first time; w/ 25×150 B, strange looking object; w/in oval diffuse outer parts lies the inner coma (central cond., nearly-starlike nuclear region and a short, bifurcated ray feature at p.a. 355°), which looks like a small comet itself [ZAN]. July 11.21: tail fan spans p.a. 0°-100° [DID]. July 12.95: w/6.7-cm f/4.5 A, 13-min exp. on x-ray 1000 film (13×18-cm format) shows narrow jet 8′ long in p.a. 355° [FIL05]. July 13.94: w/ 30-cm L (60×), clear central cond. and small tail (~ 2′ long in p.a. 13°) [SCH04]. July 14.95: w/6.7-cm f/4.5 A, 13-min exp. on x-ray 1000 film (13×18-cm format) shows two jets (a narrow 11′ jet in p.a. 350° w/ bend to the right; second 4′ jet in p.a. 280°) [FIL05]. July 17.93: w/ 20-cm L (80×), clear central cond. and broad fan-like tail (5′ long in p.a. ~ 340°-10°) [SCH04]. July 17.94 and 21.91: m_2 = 8.5; coma quite asymmetrical [KOS]. July 18.24: central cond. of dia. 4″ and mag 10.9; coma (especially brighter, inner portions) continued to present a strong asymmetry toward p.a. 349° [ROQ]. July 18.95: significantly smaller coma than two days before [KAM01]. July 20.26: bright but small, elongated nuclear region located at the SW apex of a fan-shaped coma (the fan spanning p.a. 0°-70°) [DID]. July 21.15: w/ 10×50 B, tail at least as wide as coma's dia.; w/ 41-cm L (70×), impression is that cometary material initially leaves the nucleus in a northerly direction, then spirals around counter-clockwise to the SE; bright nucleus of mag ~ 11.0; w/ 40.6-cm f/5 L (70×), 8′.6 coma, DC = 7, tail in p.a. 0° [BOR]. July 21.22: star of mag 4.7 (1° away) interfered somewhat with comet's visibility [MOD]. July 22.89: w/ 11.0-cm f/7 L (32×), 13′ coma, DC = S6 [VEL03]. July 23.22: w/ 20.0-cm f/5 L (35×), m_2 = 10.1 (~ 5″ cond.); at 169×, m_2 = 11.6 (1″-1″.5 cond.) [MOD]. July 23.89: w/ 11.0-cm f/7 L (32×), 16′ coma, DC = S6

[VEL03]. July 23.92: 35-min exp. w/ 20-cm *f*/22 A (+ ZU 21 plate) shows that coma has 'droplet' shape w/ two tails (main tail 3.'2 long in p.a. 355°, small tail 2.'4 in p.a. 330°); three jets in p.a. 220°, 310°, 50°; central cond. asymmetrical; S border of coma more sharp [BOR04]. July 24.93: w/ 16×70 B, 7.'5 coma, DC = 2 [TAY]. July 27.27: comet seen w/ difficulty under strong moonlight; when viewed through 0.20-m T (64×), comet shows a distinct 'fan-shape', w/ the SW side much brighter and showing a ray-like extension at p.a. 335° extending for 10′ [SPR].

Aug. 2.84: photometry obtained w/ 20-cm *f*/2 Baker-Schmidt camera (+ *V* filter + ST-6 CCD); fan-like tail at least ~ 1° long [MIK]. Aug. 2.89: w/ 20-cm L (80×), central cond. and broad fan-like tail (p.a. 10°-40°) [SCH04]. Aug. 3.42: w/ 25×100 B, broad tail ~ 0.°7 long spanning p.a. ~ 135°-170°, curving back from strongly-fan-shaped coma [SEA]. Aug. 3.93: in 25×150 B, fan tail spans p.a. 35°-115°; the fan is embraced by a couple of slightly brighter tail rays (the main one at p.a. 35°, straight and quite narrow, starting at the central cond. that surrounds starlike nuclear region); central cond. offset w/in oval outer coma [ZAN]. Aug. 4.52: broad, diffuse, fan-shaped tail centered on p.a. 70° [PEA]. Aug. 5.53: CCD image taken w/ 60-cm Y (two 30-sec exposures co-added), and enhanced by the Rotational Gradient method (S. M. Larson and Z. Sekanina 1984, *A.J.* **89**, 571) shows a broad fan-like jet in p.a. 16°-328° and four narrow jets in p.a. 37°, 69°, 145°, 275° [NAK01]. Aug. 5.54: w/ 15×80 B, a well-defined tail was visible to 1° in p.a. 220° [SEA]. Aug. 6.89: broad fan-like tail at least ~ 1° long in p.a. ~ 130° [MIK]. Aug. 6.95: cloud interference [GRA04]. Aug. 7.23: central cond. of dia. 2″ and mag 10.9; in addition to the tabulated diffuse tail, there was a jet extending 38″ at p.a. 26°; both of these features, although well-defined in *V* (550 nm) and *R* (800 nm), were not observed in *B* (400 nm); extended coma, as well as its inner portions, were strongly asymmetrical toward p.a. 10° [ROQ]. Aug. 7.45: comet noticeably brighter than last month; 10′ tail in p.a. 30°; w/ 20-cm L (56×), starlike nuclear cond. similar to that of C/1996 B2 last Mar. [CAM03]. Aug. 8.83: nucleus more prominent [LOO01]. Aug. 9.60: broad, diffuse tail with a distinct curvature as it progressed away from the coma; N outer edge started out from the coma at p.a. 117° and the tail extended in an anticlockwise direction until the S outer edge of the tail was at p.a. 149°, at 0.°75 from the coma (a most unusual but impressive sight) [PEA]. Aug. 9.85: w/ 11.0-cm *f*/7 L (96×), 0.°5 tail in p.a. 60° [VEL03]. Aug. 10.10: very bright 1′ disk-shaped nuclear region w/ a small ion tail extending toward p.a. 20° for about 1′ from the disk; fan tail spans p.a. 340°-50° (longest at p.a. 50°) [DID]. Aug. 10.40: very sharp pseudonucleus visible in 25×100 B; tail visible to ~ 1° in somewhat hazy sky [SEA]. Aug. 10.58: tail again appeared broad and diffuse (outer edges at p.a. 118° and 135°) [PEA]. Aug. 10.59: CCD image taken w/ 60-cm Y (two 120-sec exposures co-added), and enhanced by the RG method (see obs. for Aug. 5.53, above) shows a broad fan-like jet in p.a. 10°-327° and four narrow jets in p.a. 36°, 66°, 146°, 279° [NAK01]. Aug. 10.83: w/ 20×70 B, 0.°7 tail in p.a. 107° [TAN02]. Aug. 11.10: w/ 20×100 B, quite clearly tail material initially directed almost due N from nuclear region, then dramatically curves around to the SE [BOR]. Aug. 11.51: w/ 20.3-cm L (56×), coma has very strong, almost-starlike cond. of mag ~ 8; tail seems to start to the N of the coma and then curve around to the E or E/SE [CAM03]. Aug. 12.89: in 25×150 B, easy starlike nuclear region w/in disklike central cond. [ZAN]. Aug. 13.97: star HD 163153 was involved in coma [GRA04]. Aug. 14.07: w/ 40.6-cm *f*/5 L (70×), 6.'1 coma, DC = 7 [BOR]. Aug. 14.42: nearby star of mag 6.7 may have influenced est. [SEA]. Aug. 15.29: w/ 10.2-cm *f*/5 R (23×, 174×), comet has diffuse, faint, fuzzy cond.; coma dia. 20′; faint 2° tail in p.a. 135°; coma asymmetrical toward N-NE; inner coma has a parabolic hood; there are two jets visible coming out of nuclear region, the brighter one being 10′ long and appearing like a cone or searchlight beam coming out at p.a. 10° and curving strongly eastward into the main tail [OME]. Aug. 15.89: w/ 25×125 B, 1.°5 fan SE of coma [COM]. Aug. 15.92: hazy sky [GRA04].

Aug. 16.25: w/ 10.2-cm *f*/5 R (23×, 174×), tail more broad and much more obvious then previously (see Aug. 15.29); on previous night, cond. was ill-defined and diffuse, but tonight it was starlike and of mag ~ 11-12; w/ 7×35 B, tail 2° long in p.a. 135° [OME]. Aug. 16.55: broad, diffuse tail with a distinct curvature of the N edge as it progressed away from the coma; S outer edge is straight in p.a. 145°, whereas the N outer edge is distinctly curved (starting at p.a. 98° near the coma and ending at p.a. 130°, ~ 1.°1 away from the coma); coma also possessed an intense central cond. [PEA]. Aug. 16.83: curved tail starts in p.a. 95°, ends in p.a. 125°; w/ 10×50 B, tail 0.°33 long [HAV]. Aug. 16.87 and 17.88: w/ 25×150 B, main tail is a narrow, straight spike; also 0.°4-long narrow, straight tail at p.a. 15° starts from ellipsoidal central cond. that surrounds starlike nuclear region; fan tail spans p.a. 80°-135°; central cond. offset sunward w/in diffuse outer coma [ZAN]. Aug. 16.89 and 20.88: broad fan-like tail at least ~ 1° in p.a. ~ 120° [MIK]. Aug. 17.26: tail now visible to naked eye out to 1°; w/ 7×35 B, tail 2° long in p.a. 135° [OME]. Aug. 17.90: fan-shaped tail spans ~ 45°; w/ 20.3-cm T (161×), false nucleus of mag ~ 9.5 [KAM01]. Aug. 18.20: w/ 50.5-cm *f*/5 L (87×), fan-coma opens to N, then turns to E-SE to form tail [MOD]. Aug. 18.29: w/ 10.2-cm *f*/5 R (23×, 174×), tail 150′ long in p.a. 135° [OME]. Aug. 18.82: w/ 11.0-cm *f*/7 L (32×), DC = S5, 0.°3 tail in p.a. 30° [VEL03]. Aug. 18.88: w/ 20.3-cm T (161×), false nucleus of mag ~ 9.0 [KAM01]. Aug. 18.89: w/ 20-cm L (42×), weak central cond. and broad fan-like tail (p.a. 330°-60°, 5′ long in p.a. 15°) [SCH04]. Aug. 19.10: w/ 41-cm L (70×), bright stellar nucleus of mag ~ 10.0 [BOR]. Aug. 19.45: w/ 20.3-cm L (56×), comet has starlike cond. in center of coma; tail seems to flow N for ~ 30′ and then swing back and blend into main tail, flowing SE [CAM03]. Aug. 19.50: image taken w/ 60-cm Y + CCD (120-sec exposure), and enhanced by the RG method (see obs. for Aug. 5.53, above) shows six jets in p.a. 38°, 68°, 116°, 145°, 277°, and 345° [NAK01]. Aug. 19.85, 20.86, and 21.80: $m_2 = 9.5$; coma quite asymmetrical [KOS]. Aug. 19.86: w/ 15×80 B, broad tail p.a. 40°-100° [SCH04]. Aug. 20.05: two jets extending from the central cond. in p.a. 320° and 45°; third suspected jet at p.a. 125° [DID]. Aug. 20.83: w/ 8×30 B, 0.°25 tail in p.a. 85° [CSU]. Aug. 25.20: in very strong moonlight; w/ 0.10-m refractor (27×), comet is brighter w/ Lumicon Premium Deep-Sky filter, showing the comet's distinctive 'fan-shaped' coma despite the moon [SPR]. Aug. 25.20: w/ 20.0-cm *f*/5 L (169×), $m_2 = 11.0$ [MOD]. Aug. 28.20: central cond. of

dia. 5″ and mag 10.4; tail appeared bifurcated w/ brighter component tabulated at p.a. 42°; a secondary, more diffuse component of this bifurcation readily apparent at p.a. 340°; diffuse extensions of coma also at p.a. 114° and p.a. 240°; all of these features were recorded at 650, 550, and (to a lesser extent) 440 nm; brighter inner portions of coma showed a general asymmetry that was aligned w/ main element of bifurcated tail [ROQ]. Aug. 29.80: w/ 25.4-cm *f*/6.3 T (89×), 1′ coma, DC = 2/ [TAN02]. Aug. 29.86 and 30.86: strong moonlight; w/ 15.5-cm L (125×), inner coma shows bright starlike nuclear region w/in a small disklike central cond. surrounded by a parabolic envelope, tangent to the sunward side of the central cond.; N envelope sector is brighter than E one; straight, stubby, cone-shaped feature at p.a. 40° [ZAN]. Aug. 31.05: w/ 41-cm L (70×), intense, nearly-stellar nucleus close to apex of fan-shaped coma; at 114×, nucleus intense but non-stellar [BOR]. Aug. 31.86: w/ 25×150 B, disklike central cond. of dia. 2′; features w/in inner coma noted on Aug. 29.86 still present and visible at 25× (low power shows them all pointing toward the false nucleus, while the N one is the beginning of a huge fountain or curved tail 0°.7 in length; the fountain starts to the N of the false nucleus and curves to p.a. 85° at the end (it is the brightest of the tail's features); fan tail spans p.a. 355°-110° [ZAN].

Sept. 1.04: w/ 41-cm L (70×), extraordinarily intense stellar nucleus of mag ~ 9.5 totally dominated coma; at 114×, nucleus still brilliant but probably not quite stellar (*i.e.*, < 5″ in dia.) [BOR]. Sept. 1.87, 5.83, 6.86: w/ 25×150 B, as on Aug. 31.86 [ZAN]. Sept. 2.51: image taken w/ 60-cm Y + CCD (two 60-sec exp. frames co-added), and enhanced by the RG method (see obs. for Aug. 5.53, above) shows six jets in p.a. 34°, 66°, 110°, 144°, 273°, and 351° [NAK01]. Sept. 2.86: w/ 20.3-cm T (50×), very conspicuous false nucleus of mag ~ 8.5 [KAM01]. Sept. 2.86: alt. ~ 20° [GRA04]. Sept. 2.87: m_2 derived from the BAA/VSS sequence for RS Oph [GRA04]. Sept. 2.89: w/ 25.6-cm *f*/5 L (169×), bright nuclear cond. of mag 10.3 [BIV]. Sept. 3.05: w/ 41-cm L (70×), intensely bright nucleus of mag 9.5 totally dominates coma [BOR]. Sept. 4.06: w/ 41-cm L (70×), nucleus clearly non-stellar, now being a small, very bright cond. that condenses sharply at the center [BOR]. Sept. 4.42 and 5.49: w/ 25.4-cm L (71×, 114×), coma had a remarkable comma (,) shape [SEA]. Sept. 4.84: w/ 25.6-cm *f*/5 L (169×), bright 0′.7 feature surrounding stellar nucleus of mag 10.8, extending N (p.a. 330°-50°) [BIV]. Sept. 4.86: comet appeared slightly dimmer than M11 [GRA04]. Sept. 5.75: strong central cond. [SCH04]. Sept. 5.82: broad fan-like tail at least ~ 1° in p.a. ~ 115°; jet-like feature ~ 5′ long, extending from nuclear region in p.a. 47° [MIK]. Sept. 6.85: visibility of comet in 10×50 B was comparable with M11, but it appeared larger and more diffuse; a star of mag 7 was involved in coma [GRA04]. Sept. 7.82: w/ 25×150 B, Aug. 31.86 description still adequate; new spike at p.a. 355° (0°.4 long) [ZAN]. Sept. 7.85: comet significantly weaker than five nights before, w/ 20.3-cm T (77×), false nucleus of mag ~ 9.5-10.0 [KAM01]. Sept. 7.85-7.86: some clouds in area [GRA04]. Sept. 8.81, 10.78, and 15.77: m_2 = 9.5 [KOS]. Sept. 9.42: w/ 20.3-cm L (56×), central cond. is still small and bright (mag ~ 8); comet still has short tail extending ~ 10′ from N of the coma and then bending back into the main tail E of the coma; w/ 20×80 B, the short tail to the N is 10′ long [CAM03]. Sept. 9.80: coma ~ 18′×25′; broad fan-like tail at least ~ 1° in p.a. ~ 115°; conspicuous jet (probably ion tail) ~ 5′ long, extending from nuclear region in p.a. 47° [MIK]. Sept. 10.47: image taken w/ 60-cm Y + CCD (two 30-sec exp. frames co-added), and enhanced by the RG method (see obs. for Aug. 5.53, above), shows eight jets in p.a. 33°, 63°, 108°, 140°, 182°, 225°, 272°, and 348° [NAK01]. Sept. 11.05: w/ 25.5-cm *f*/4.5 L (46×), 10′ coma, DC = S3/; at 91×, stellar cond. of mag 11 at the SW portion of a planetary-type shell; no m_1 because of the arrival of a skunk [DID]. Sept. 11.06: distinct drop in comet's brightness; w/ 41-cm L (70×), tail in p.a. 355°, and the nearly-stellar nucleus has been replaced by a small, dense cond.; at 114×, cond. is ~ 0′.4 in dia. [BOR]. Sept. 11.84: w/ 25.6-cm *f*/5 L (169×), well-defined bright feature surrounding stellar nucleus of mag 11.1, extending 0′.8 N (p.a. 320°-40°); main jets in p.a. 330°, 350°, and 40° (as for several weeks) [BIV]. Sept. 12.47 and 15.40: sky conditions poor [CAM03]. Sept. 13.84: in 25×150 B, diffuse oval outer coma w/ strong, starlike nuclear region surrounded by a 2′.5 disklike central cond.; small but easy features w/in inner coma as never seen in other comets before in a 25× scope — spikes nearly 3′ long at p.a. 0° and 30°; spike nearly 5′ long at p.a. 135° and 305°; broad fan tail centered at p.a. 105°; curved huge fountain/tail starts to the N and bends toward E [ZAN]. Sept. 14.41: central cond. not as sharp as it had been on Sept. 10; comet also observed (but no estimate taken) on Sept. 12, at which time the central cond. also seemed 'softer' than it had on Sept. 10 [SEA]. Sept. 14.80: in 41-cm *f*/4.5 L (188×), oval outer coma w/ 2′ disklike central cond. and prominent starlike false nucleus; features as for Sept. 13.84 — those at p.a. 30° (now bigger and brighter) and 135° are curved, while the other two are straight and narrow (jet-like) [ZAN]. Sept. 14.85: comet was barely visible to the naked eye [SKI]. Sept. 14.85: broad tail; comet was nearly as bright as M11 [GRA04]. Sept. 15.04: w/ 41-cm L (114×), small, dense cond. contains a 'star' of mag ~ 12.7 at its center; Lumicon Swan-band filter leaves comet unchanged in appearance; long, curved ray in tail; at 57×, tail in p.a. 350° [BOR]. Sept. 15.82: in 25×150 B, the fountain/dust tail feature looks broader, brighter and more curved than on previous nights; small details in the inner coma still visible [ZAN]. Sept. 15.84: strong central cond. [COM]. Sept. 15.85: comet seen w/ naked eye [SKI]. Sept. 15.86 and 16.85: w/ 15.0-cm R (30×), 14′ coma, DC = 7, 0°.15 [DIE02].

Sept. 16.84: w/ 20.3-cm T (77×), false nucleus of mag ~ 9.5 [KAM01]. Sept. 17.49: moonlight interfered w/ visibility of short tail; w/ 20.3-cm L (56×), coma very condensed, w/ the short tail extending to the N and swinging back around into the main tail (which has now appeared to have swung back to the N slightly from its easterly position over the past few days); the coma cond. seems to have become a little softer over the past 24 hr as seen through 20×80 B [CAM03]. Sept. 18.41: hazy sky and moonlight [SEA]. Sept. 19.76: fan-shaped coma, brighter in the W side [BAR06]. Sept. 20.05: w/ 41-cm L (70×), stellar or nearly-stellar nucleus of mag 11.3 w/in bright surrounding cond. [BOR]. Sept. 20.12: 7-day-old Moon ~ 10° away from comet [MOD]. Sept. 21.05: w/ 40.6-cm *f*/5 L (70×), tail in p.a. 15°, $m_2 \simeq 10.5$ [BOR]. Sept. 22.81: central cond. of dia. 3″ and mag 10.3; in addition to main tail, as tabulated, various radial projections, creating a 'sunburst effect' were located at position angles 67°, 108°, 247°, and 323°; all of these features maintained their relative

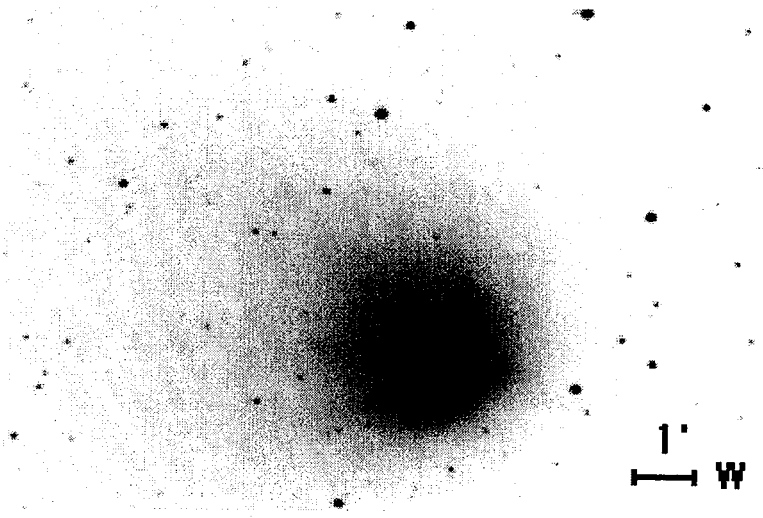
intensities at observed wavelengths of 650, 550, and 440 nm [ROQ]. Sept. 24.01: from Metro Toronto; moonlight and light pollution interfered significantly with the obs. [DAH]. Sept. 24.83: apparently-stellar nucleus was surrounded by a small bright disk, at integrated mag ~ 8.0 (ref: BAA/VSS seq. for RS Oph) and dia. ~ 15″; it looked like a small planetary nebula and resembled comet 29P during its outburst last Feb.; the disk was surrounded by a much fainter coma [GRA04]. Sept. 28.78: diffuse oval outer coma w/ sharp starlike nuclear region surrounded by 2′.5 disklike central cond.; fan tail spans p.a. 0°-90°; curved tail/fountain starts N of false nucleus and ends at p.a. 70°; also ~ 1° tail at p.a. 90° [ZAN]. Sept. 30.02: w/ 41-cm L (70×), bright cond. once again present, faint stellar nucleus of mag ~ 12.3 at its center; near the head, the tail spans 50°-60° in p.a., initiating in a northerly direction, then spiraling around to the E-SE [BOR]. Sept. 30.79: broad fan-like tail at least ~ 1° in p.a. ~ 115°; conspicuous jet (probably ion tail) ~ 7′ long, extending from nuclear region in p.a. 50°; two other jets ~ 5′ long in p.a. 90° and 105° [MIK].

Oct. 1.01: w/ 41-cm L (70×), tail initially directed toward p.a. 0°, but spirals around counter-clockwise, ending up pointed toward p.a. 105°, DC = 7 [BOR]. Oct. 1.43: w/ 25×100 B, comet was a fine sight, not unlike 73P 1 year before; wide tail visible to at least 1°.3 in p.a. 105°, and the central cond. appeared somewhat 'softer' than at the previous obs. (Sept. 18) — more like a small nebulous disk rather than a star-like point [SEA]. Oct. 1.83 and 4.80: w/ 15.0-cm R (30×), 17′ coma, DC = 7, 0°.15 [DIE02]. Oct. 2.02: w/ 41-cm L (70×), strong stellar nucleus of mag ≃ 11.2; one very long ray visible in tail — others suspected; 2′.2 coma, DC = 7, tail in p.a. 35° [BOR]. Oct. 2.40: w/ 25×100 B, three tail components distinguished, although they were not necessarily separate tails as such; main component 1°.3 in length in p.a. 115° and spreading into a fan shape w/ distance from the coma; other components 0°.7 in p.a. 90° (which appeared curved toward N) and 0°.2 in p.a. 45° [SEA]. Oct. 2.81 and 3.81: in 25×150 B, diffuse oval outer coma w/ sharp starlike nuclear region surrounded by 2′.5 disklike central cond.; small jet-like features w/in inner coma suspected but not as easily visible as in Sept.; curved tail/fountain ends at p.a. 70° and could reach 2° in length; also 1°.5 tail (possibly type I) at p.a. 90°; spike nearly 0°.5 long at p.a. 110°; fan tail spans p.a. 0°-90° [ZAN]. Oct. 3.38: w/ 10×50 B, tail could be traced for ~ 2°.3, w/ longest and brightest segment in p.a. 90°-100° [SEA]. Oct. 4.00: w/ 41-cm L (70×), main initial outflow of bright material from nucleus is directed toward p.a. 30°; nucleus of mag ≃ 10.0 [BOR]. Oct. 4.09: central cond. of dia. ≃ 3″ and mag 10.0; group of three jets at p.a. 39°, 73°, and 102° of similar intensity and extent (~ 2′); a short, brighter jet was located at p.a. 256° w/ a diffuse asymmetry centered at p.a. 349° [ROQ]. Oct. 4.42: image taken w/ 60-cm Y + CCD (two 30-sec exp. frames co-added), and enhanced by the RG method (see obs. for Aug. 5.53, above) shows six jets in p.a. 28°, 61°, 104°, 134°, 286°, and 337° [NAK01]. Oct. 4.83: fan-like coma open to p.a. 0°-130° [BAR06]. Oct. 6.01: w/ 41-cm L (70×), m_2 = 9.2; bright tail ray comes off nucleus at p.a. 25°; S edge of tail seems sharper than N edge; tail remains very strongly curved; 2′.6 coma, DC = 7 [BOR]. Oct. 7.00: w/ 41-cm L (70×), stellar nucleus of mag ~ 9.4; brightest outflow from nucleus directed toward p.a. ~ 35°; 2′.7 coma, DC = 7 [BOR]. Oct. 8.39: tail very conspicuous in 25×100 B and quite obvious in 10×50 B; intensity of the tail has increased in recent weeks [SEA]. Oct. 8.41: through cloud [SEA01]. Oct. 9.09: central cond. of dia. slightly > 3″ and mag 10.1; distribution and physical appearance of three grouped jets (tails?) has remained essentially as obs. on Oct. 4.09; three main jets are grouped at p.a. 34°, 74°, and 115° w/ a strong but short jet at p.a. 252°; general diffuse asymmetry remains centered at p.a. 352° [ROQ]. Oct. 9.41: image taken w/ 60-cm Y + CCD (two 30-sec exp. frames co-added), and enhanced by the RG method (see obs. for Aug. 5.53, above) shows six jets in p.a. 29°, 59°, 104°, 131°, 284°, and 341° [NAK01]. Oct. 11.76: bright fan-like tail open to p.a. 60°-110°, more extended in p.a. 95°, w/ sharp E border [BAR06]. Oct. 12.00: w/ 41-cm L (70×), nucleus a little fainter,

(text continued on next page)

◇ ◇ ◇

Below: ***Unfiltered CCD image of C/1995 O1 (Hale-Bopp) taken by Akimasa Nakamura (Kuma, Ehime, Japan) with a 60-cm reflector on 1996 Oct. 9. Note the numerous jets that are visible to the left and right of the coma's center.***



◇ *Comet C/1995 O1 (Hale-Bopp) [descriptive information cont. from previous page]* ⟹
$m_2 \sim 10.6$ and $\sim 0'.2$ in dia.; outflow of brightest material coming off it is toward p.a. 30°; leading (N) edge of tail seems brighter than S edge tonight [BOR]. Oct. 12.39: w/ 25×100 B, coma diameter $\sim 8'$, DC = 7, tail length 1°.4 in p.a. 85°-100°, forming a spreading fan; tail quite intense near coma [SEA]. Oct. 12.76: elliptical coma $\sim 30' \times 20'$; at least $\sim$ 1° broad tail spans $\sim$ p.a. 100°-135° [MIK]. Oct. 13.40: tail $\sim 2°$ in 10×50 B [SEA]. Oct. 14.42: "coma well condensed w/ jets of material flowing out of the central cond. back into the main tail; w/ 8×50 finderscope, comet looked like a short edge-on spiral galaxy (a much more interesting sight than last month)"; w/ 20.3-cm *f*/7 L (56×), 6′ coma, DC = s7, tail in p.a. 80° [CAM03]. Oct. 14.73: w/ 11.0-cm *f*/7 L (32×), DC = S6 [VEL03]. Oct. 15.40: comet was a beautiful sight in 25×100 B; tail intensity quite high near coma, w/ strong convex curvature throughout length of tail, from p.a. $\sim$ 105° close to coma to p.a. $\sim$ 120° at extremity of tail, where width $\sim 0°.5$; length of tail 2° in 25×100B and strongly suspected to 2°.7 in 10×50B [SEA]. Oct. 15.70: w/ 11.0-cm *f*/7 L (32×), 10′ coma, DC = S6, 2°.5 tail in p.a. 88° [VEL03].

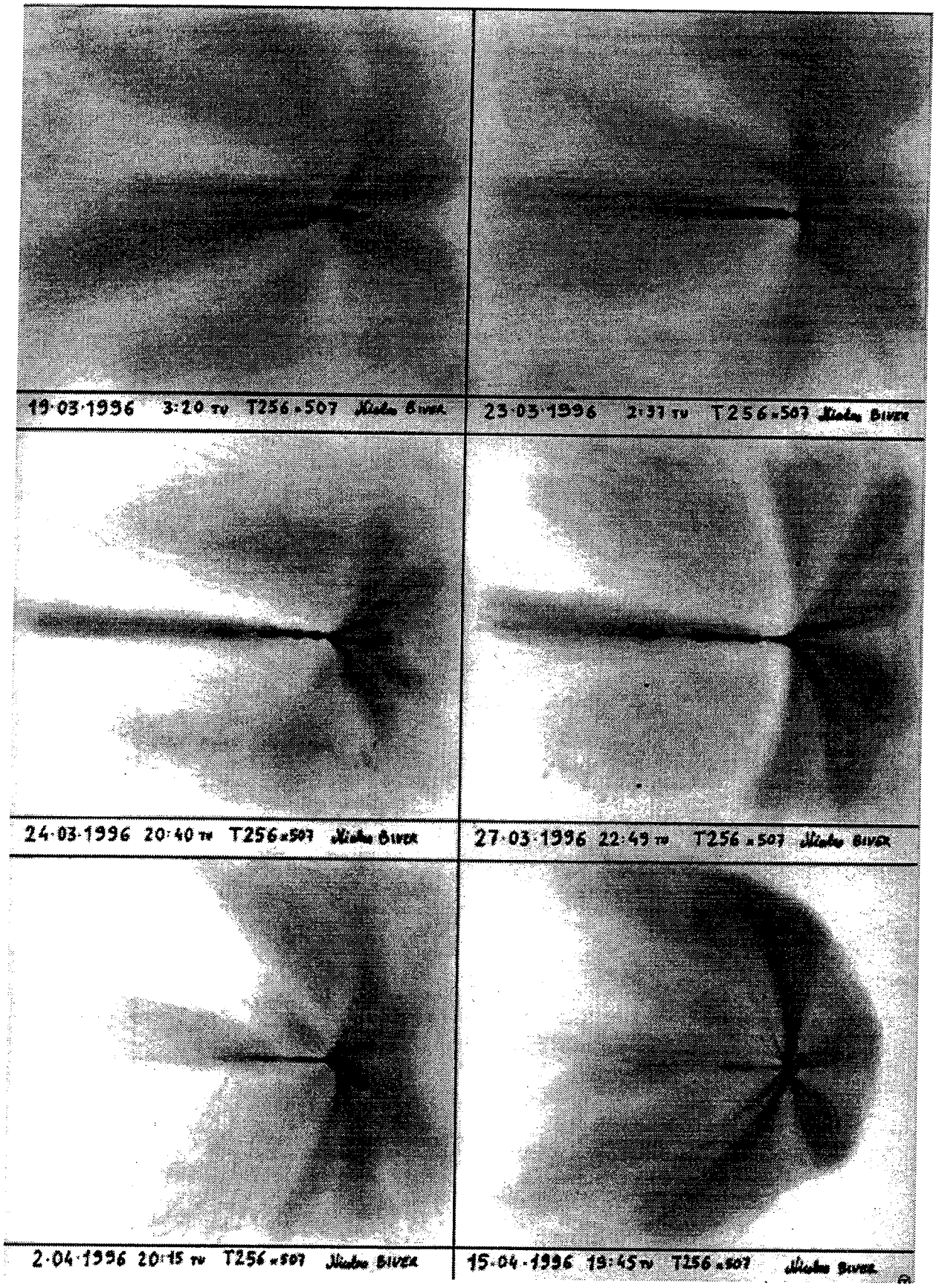
Oct. 16.08: central cond. of dia. 4″ w/ mag 10.0; tail direction and length, as tabulated, defined the central member of three distinct components distributed from p.a. 40° to 98° — all w/ comparable lengths giving appearance of a fan tail when viewed at very low magnification; bright, short sunward projection located at p.a. 248°; several small, faint jets were also recorded to its SW [ROQ]. Oct. 16.40 and 17.40: moonlight interference [SEA01]. Oct. 16.41: image taken w/ 60-cm Y + CCD (two 30-sec exp. frames co-added), and enhanced by the RG method (see obs. for Aug. 5.53, above), shows six jets in p.a. 29°, 58°, 102°, 134°, 284°, and 335° [NAK01]. Oct. 19.72: w/ 10x50 B, curved dust tail $\sim$ 1° long in p.a. $\sim$ 80°; moonlight [SAR02]. Oct. 19.74: first-quarter moon; small disk/starlike central cond.; straight tail w/ N boundary sharper than S one; small binoculars show type-II tail as the 'main tail', while for larger binoculars (see Oct. 19.76) the opposite is true; w/ 25×150 B, a nice sight, w/ several details in the coma and complex tail structure; coma dominated by a bright starlike nucleus ($m_2 = 8.5$); disklike central cond., easily seen for nearly three months, is now faint, difficult, and nearly 1′.2 in dia.; diffuse coma parts have very slight brightness gradient and irregular boundaries, and the nucleus is offset w/ respect to geometric center; w/in inner coma, several spikes are seen (at p.a. 40° and 60°, nearly 5′ long — parabolic shape w/ nucleus at the focus and axis at p.a. 50°; at p.a. 105°, nearly 4′ long; curved fountain starts at p.a. 340°; at p.a. 300° nail-like, 9′ long feature suspected); main tail at p.a. 70° marks the end of the fountain and looks sharp compared to the type-II, very broad, diffuse, sharply curved, and at least 0°.75-long tail at p.a. 100° [ZAN]. Oct. 23.74: elliptical coma $\sim 25' \times 20'$; broad tail at least $\sim$ 1° long spans p.a. $\sim$ 95°-125° [MIK]. Oct. 30.23: w/ 7×50 B, 2° tail in p.a. 55° [OME]. Oct. 30.45: comet slightly brighter than last obs.; tail a little broader than last obs.; w/ 20-cm L (56×), DC = s7, coma has a very strong, almost-starlike nucleus of mag $\sim$ 8; secondary tail 15′ long in p.a. 10° [CAM03]. Oct. 30.76: elliptical coma $\sim 25' \times 20'$; broad tail at least $\sim$ 1° long spans p.a. $\sim$ 80°-125° [MIK]. Oct. 31.08: central cond. of dia. 4″ and mag 9.6; triple-tailed complex, w/ components of similar length (averaging $\sim 4'$), remained essentially as observed and noted in mid-Oct. w/ p.a. 34°, 69°, and 97°; the short, bright sunward jet recorded at that time near p.a. 266° has now developed a fainter extension toward sun [ROQ]. Oct. 31.45: w/ 20-cm L (112×), central cond. of dia. $\sim$ 20″ w/ several small jets coming out into main tail; at 56×, DC = s7 [CAM03].

◇ *Comet C/1996 B2 (Hyakutake)* ⟹ 1996 Feb. 25.12: w/ 25.4-cm *f*/6.3 T (62×), comet much brighter than on Feb. 19, but mag est. not made (clouds); 2′.6 coma, DC = 6 [TAN02]. Mar. 1.75: w/ 10×50 B, 15′ coma, DC = 6, 0°.3 tail [GAR01]. Mar. 4.42, 10.42, 11.42, 19.25, 25.16, 26.12, 26.43, 28.10, 31.05, Apr. 2.07, 4.05, 7.08, 9.08, and 15.07: obs. made from a suburban location having moderate light pollution [MOD]. Mar. 4.42: 14-day-old Moon $\sim$ 75° away from comet [MOD]. Mar. 10.38: w/ 20.0-cm *f*/5 L (35×), $m_2 = 9.5$ [MOD]. Mar. 10.42: 20-day-old Moon 6° away [MOD]. Mar. 11.42: 21-day-old Moon $\sim$ 20° away [MOD]. Mar. 11.42, 16.37, 23.20, 25.16, 26.12, 28.10, 30.05, 31.05, Apr. 2.07, and 8.09: tail as wide as coma [MOD]. Mar. 12.13: streamers on N side of main tail 0°.6 in p.a. 304° [TAN02]. Mar. 12.28 and 12.30: 22-day-old Moon $\sim$ 35° away [MOD]. Mar. 12.30: tail half as wide as coma [MOD]. Mar. 13.35: 23-day-old Moon $\sim$ 35° away [MOD]. Mar. 15.59: w/ 10×50 B, 30′ coma, DC = 7, 6° tail [GAR01].

Mar. 16.11: bright 0°.4 appendage S of main tail in p.a. 244°; comet an easy naked-eye object [TAN02]. Mar. 17.06: w/ 12×80 B, 32′ coma, 4° tail in p.a. 272° [BAR06]. Mar. 17.10: delicate streamers on both sides of main tail up to 1°.5 long; bright 0°.3 appendage S of main tail in p.a. 246°; w/ 20×70 B, 25′ coma, DC = 5 [TAN02]. Mar. 17.69: w/ 10×50 B, 50′ coma, DC = 7, 9° tail [GAR01]. Mar. 19.16: w/ 12×50 B, 10° tail in p.a. 259° [TAN02]. Mar. 20.14: w/ 20×70 B, 36′ coma, DC = 6 [TAN02]. Mar. 21.11: w/ naked eye, 6° tail in p.a. 253° [TAN02]. Mar. 21.92: w/ 20×110 B, 40′ coma, DC = S6, tail in p.a. 240° [FIL05]. Mar. 23.20, 24.29, 26.12, and 27.38: naked-eye estimates made w/ glasses removed (MM: B) resulting in stars of dia. $\sim$ 3° and the defocused coma perhaps slightly larger than this (dia. $\sim$ 3°.25); all naked-eye estimates (w/ MM=M) were made by pulling glasses forward slightly [MOD]. Mar. 23.20: $m_2 = 2.7$; coma has pale blue-white color [MOD]. Mar. 23.21: w/ 10×50 B, tail 1/3 as wide as coma near coma and 2/3 as wide as coma near end of tail; N edge of tail is sharper than S edge; a second component branches off from the main tail 4° from the coma and extends 3°, curving slightly to p.a. 235°; w/ 20.0-cm *f*/5 L (35×), $m_2 = 6.4$ ($\sim$ 5″ cond.); along axis of main tail, a "spike" 0′.2 wide by 5′ long extends from cond. in anti-solar direction (the cond. and spike resemble a miniature comet w/in a much larger one); a faint $\sim$ 2″ cond. suspected ($\sim$ 10″ tailward of main cond.) [MOD]. Mar. 23.83: w/ 10×50 B, 63′ coma, DC = 4 [HAS02]. Mar. 24: low on N horizon [GAR01]. Mar. 24.02: w/ 7×42 B, strong 12′ central cond., DC = 5; total coma dia. 78′ [FIE]. Mar. 24.29: $m_2 = 2.6$; tail as wide as coma near coma and $\sim$ 1.5× as wide as coma near end of tail [MOD]. Mar. 24.31: w/ 10×50 B, main ion tail is 1/3 as wide as coma $\sim$ 3° from coma and 2/3 as wide as coma near end of tail; 3°.2 dust tail (as wide as coma) seen in p.a. 227° (superimposed on ion tail) [MOD]. Mar. 24.88: w/ 12×50 B, 58′ coma, DC = 8-9 [TAN02].

(text continued on page 115)

Below: *Six drawings of comet C/1996 B2 (Hyakutake) by Nicolas Biver in France with a 25.6-cm reflector, on (from left to right and top to bottom) 1996 Mar. 19.14, 23.11, 24.86, 27.95, Apr. 2.84, and 15.82 UT.*



Above: *Drawing of comet C/1996 B2 by Nicolas Biver on 1996 Mar. 28.*

◇ ◇ ◇

◇ *Comet C/1996 B2 (Hyakutake) [text continued from page 113]* ⟹

Mar. 25.16: $m_2 = 2.6$; 6-day-old Moon ~ 90° away [MOD]. Mar. 25.86: dust tail ~ 0°.5 [COM]. Mar. 26.12: $m_2 = 2.7$; 7-day-old Moon ~ 70° away [MOD]. Mar. 26.45: w/ 20.0-cm $f/5$ L (35×), $m_2 = 6.9$ (2″-3″ cond.), ~ 3′ tailward spike is perhaps brighter than two days ago, 1′ sunward fan subtending ~ 120° also prominent [MOD]. Mar. 27.38: tail as wide as coma near coma and twice as wide as coma near end of tail [MOD]. Mar. 27.40: w/ 10×50 B, 36° ion tail and 3°.5 dust tail, both in p.a. 87°; w/ 20.0-cm $f/5$ L (35×), sunward fan subtends ~ 150°, two edges of fan curve tailward to form a parabolic coma; narrow spike or streamer seen on previous nights is now 0°.6 long running exactly down middle of tail [MOD]. Mar. 27.42: w/ naked eye, $m_2 = 2.8$ [MOD]. Mar. 28.10: $m_2 = 2.8$; very light cirrus; w/ 20.0-cm $f/5$ L (35×), sunward fan now brighter than tailward spike, inner coma on either side of spike appears darker or shadowed by sunward fan [MOD]. Mar. 30.05: w/ 35.9-cm f/7 L (85×), $m_2 = 6.9$ (~ 5″ cond.), sunward fan much brighter than two nights ago, ~ 5′ tailward spike much fainter than two nights ago [MOD]. Mar. 30.15: w/ naked eye, $m_2 = 2.9$ [MOD]. Mar. 31.05: $m_2 = 3.0$; 11-day-old Moon ~ 80° away [MOD]. Apr. 2.07: $m_2 = 3.2$; 13-day-old Moon ~ 95° away [MOD]. Apr. 2.09: w/ 20.0-cm $f/5$ L (35×), $m_2 = 6.9$ (3″-5″ cond.), bright sunward fan has fountain-like appearance, tailward spike not seen [MOD]. Apr. 4.05: $m_2 = 2.9$; 15-day-old Moon (partially eclipsed, mag −7 to −8) ~ 115° away [MOD]. Apr. 7.07: w/ 20.0-cm $f/5$ L (35×), $m_2 = 6.7$ (~ 5″ cond.); cond. surrounded by bright inner coma of 10″-15″ dia., most of this bright material is inside a sunward fan [MOD]. Apr. 7.08, 08.09, and 18.07: naked-eye estimates (made w/ MM = B) were done with glasses pulled forward 1/2 to 1 inch; defocused stars and coma were roughly the same size (however, the defocused coma contained some light from the tail) [MOD]. Apr. 8.07: w/ 35.9-cm $f/7$ L (85×), $m_2 = 6.6$ (4″-5″ cond.); bright sunward fan, subtending ~ 180°; faint streamer seen down spine of tail [MOD]. Apr. 9.08: tail as wide as coma near coma, but quickly widens to ~ 2.5× the coma dia., ~ 1° from coma, and holds that width for the rest of the tail; this appearance was also true for other tail obs. made during the past week [MOD]. Apr. 9.79: w/ 7×50 B, 5° tail in p.a. 46° [VEL03]. Apr. 11.12: 11° alt. [MOD]. Apr. 15.07: w/ 20.0-cm $f/5$ L (35×), $m_2 = 4.9$ (~ 5″ cond. dominates coma) [MOD]. Apr. 18.07: 12° alt.; very light cirrus [MOD]. Apr. 18.08: 10° alt.; very light cirrus; $m_2 = 4.5$; S edge of tail is sharper than N edge; w/ 20.0-cm $f/5$ L (35×), $m_2 = 4.9$ (~ 3″ cond. almost at tip of parabolic coma/tail) [MOD]. Apr. 21.07: 10° alt.; $m_2 = 4.2$ [MOD]. Apr. 23.80: w/ 3.0-cm R (6×), 6′ coma, DC = S8, tail ~ 3° long [BAR06]. May 9 and 10: very strong twilight interference [GAR01]. May 19.25: w/ 10×50 B, 5° tail [GAR01]. June 26.75: w/ 31.7-cm $f/5$ L (64×), DC = 6, 0°.3 tail in p.a. 200° [JON]. July 2.35: at low alt. and not as easy to observe as the tabulated obs. suggests [CAM03]. Aug. 7.43: has faded quite a lot over the past month; comet is more diffuse; no tail and little cond. [CAM03]. Oct. 24.445 and 24.449: 120- and 300-sec exposures, respectively (the shorter exposure yielding unfiltered CCD mag 17.5); comet at alt. < 20°; no obvious coma; photometry using Mips image-processing (aperture photometry) software and HI-SIS22 CCD [GAR01].

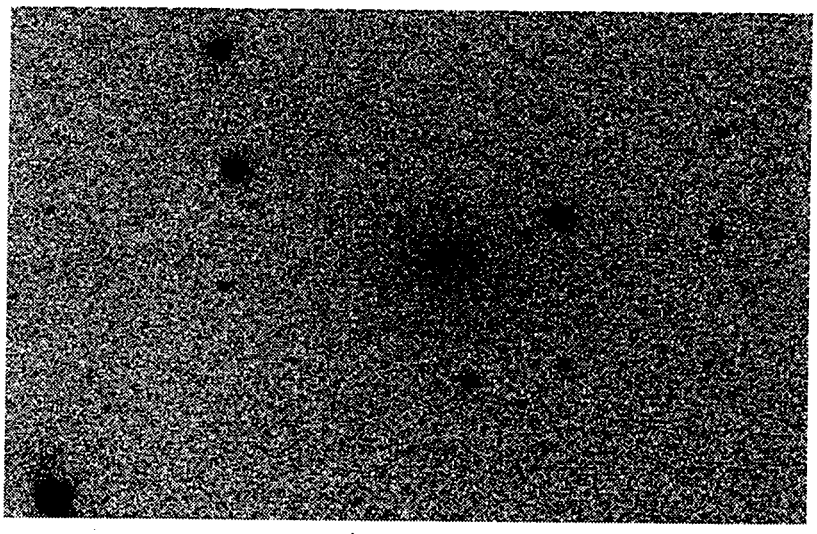
◇ *Comet C/1996 E1 (NEAT)* ⟹ 1996 July 20.00: much brighter w/ a Lumicon Swan Band Filter [MEY]. July 20.97: comet in close proximity to star of mag 6 [MEY]. July 27.03 and Aug. 19.89: comet near star of mag 11 [MEY]. Aug. 11.28: very difficult object; just suspected at 185× w/ Lumicon Premium Swan-Band filter [SPR]. Aug. 17.16: haze [MOD]. Aug. 25.39: obs. rushed due to onset of twilight [MOD]. Sept. 3.86: comet was an irregular patch of light [MEY]. Oct. 3.91: faint, diffuse object w/ slight cond. [MIK].

◇ *Comet C/1996 N1 (Brewington)* ⟹ 1996 July 19.42: central cond. of dia. 3″ and mag 13.8; coma appeared radially symmetrical at all imaged intensity levels [ROQ]. July 20.92: comet moderately brighter w/ a Lumicon Swan Band Filter [MEY]. July 27.27: under strong moonlight conditions; comet brighter when Lumicon Swan-Band filter is used [SPR]. Aug. 3.88: starlike nuclear region [ZAN]. Aug. 6.86 and 16.84: photometry obtained w/ 20-cm $f/2$ Baker-Schmidt camera (+ V filter + ST-6 CCD) shows a dense circular coma [MIK]. Aug. 7.15: central cond. of dia. 5″ and mag 12.5; coma exhibited a high degree of symmetry at all radial intensity levels; no apparent jet or tail activity [ROQ]. Aug. 7.83: UBV magnitudes obtained used HD 114778 ($V = 8.42$, $B–V = +0.46$, $U–B = -0.04$) as the standard star [PAV]. Aug. 8.91: at 161×, false nucleus of mag ∼ 12 [KAM01]. Aug. 11.13: comet much brighter than previously — very obvious w/ binoculars [BOR]. Aug. 11.24: surprisingly bright!; interesting structures (veils or hoods) in coma [SPR]. Aug. 12.24: interesting structures (veils or hoods) in coma [SPR]. Aug. 14.06: w/ 40.6-cm $f/5$ L (70×), 5′.4 coma, DC = 5/ [BOR]. Aug. 16.86: in 25×150 B, slight disklike cond. [ZAN]. Aug. 17.12: haze; extinction correction made by doubling the correction of table Ic [MOD]. Aug. 17.87: w/ 41-cm $f/4.5$ L (114×), starlike nuclear region suspected [ZAN]. Aug. 17.88: at 161×, no false nucleus brighter than mag 13, but dense inner coma of dia. ∼ 40″ [KAM01]. Aug. 19.06: w/ 40.6-cm $f/5$ L (70×), 3′.4 coma, DC = 5/ [BOR]. Aug. 19.85: wide and faint outer halo [MEY]. Aug. 21.95: due to haze, not much brighter than the sky background [GRA04]. Aug. 21.96: comet also visible in 7×50 B [SKI]. Aug. 24.21: in very strong moonlight; comet much brighter w/ #8 filter at 60× [SPR]. Aug. 25.20: very strong moonlight; comet much brighter in Lumicon Premium Swan-Band filter at 60× [SPR]. Aug. 28.16: central cond. of dia. 3″ and mag 12.3; inner regions of coma were generally symmetrical, but coma was progressively more asymmetrical in direction of p.a. 190° as distance from central cond. increased [ROQ].

Sept. 2.85: at 111×, false nucleus of mag ∼ 13 suspected [KAM01]. Sept. 3.06: w/ 40.6-cm $f/5$ L (70×), 3′.8 coma, DC = 5 [BOR]. Sept. 4.87: comet close to a star [COM]. Sept. 7.84: significantly more diffuse than five nights before, no false nucleus discernible [KAM01]. Sept. 8.13: central cond. had dia. 5″ and mag 13.6; tail, as tabulated, was faint and quickly narrowed w/ increasing distance from central coma region [ROQ]. Sept. 11.12: cirrus, some differential extinction [MOD]. Sept. 13.99: mag ref AAVSO R Dra [GRA04]. Sept. 15.06: mag ref AAVSO AG Dra [GRA04]. Sept. 17.01: mag ref AAVSO AG Dra; comet only barely visible [GRA04]. Sept. 19.90: ill-defined coma [MEY]. Sept. 28.12: central cond. had dia. ∼ 4″ and mag 15.8; coma was symmetrical w/ no apparent tail or jet activity [ROQ]. Oct. 1.02: comet exceedingly faint and diffuse [BOR]. Oct. 13.78: CCD photometry w/ 36-cm $f/6.8$ T (+ V filter) shows diffuse object w/ some cond. [MIK].

◇ ◇ ◇

Below: ***Unfiltered CCD image of comet C/1996 Q1 (Tabur) taken on 1996 Aug. 21 by Warren Offutt, W & B Observatory, Cloudcroft, NM, taken with a 60-cm reflector (+ SBIG ST-6 CCD). North is up and east is to the left, with the field size being 7′.04 × 5′.32.***



◇ ◇ ◇

◇ *Comet C/1996 Q1 (Tabur)* ⟹ 1996 Aug. 24.09: comet moderately brighter w/ a Lumicon Swan Band Filter [MEY]. Aug. 24.50: morning twilight made observing difficult [SPR]. Aug. 25.28 and 26.31: comet slightly brighter w/ Swan-band filter [DEA]. Aug. 26.39: comet involved w/ mag ∼ 10 star, difficult obs. (m_1 may be brighter, coma dia. larger) [MOD].

(text continued on next page)

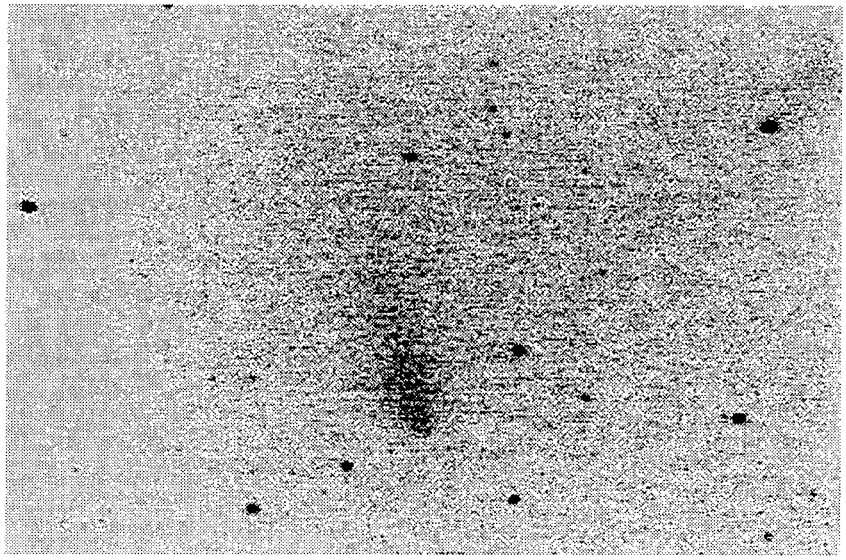
◇ *Comet C/1996 Q1 (Tabur) [cont. from previous page]* ⟹ Sept. 5.09: astronomical twilight [GRA04]. Sept. 8.75: obs. hurried due to only very short gap in cloud cover (good mag est. not possible) [CAM03]. Sept. 9.08: comet was clearly visible in 10×50 B; $m_1 = 8.0$ (ref: S); other sources gave conflicting results [GRA04]. Sept. 10.65: comet strongly enhanced w/ Swan Band filter [SEA]. Sept. 10.75: short 5′ tail in p.a. 290° [CAM03]. Sept. 11.08: fine sight in the telescope, appeared somewhat elongated in E-W direction [GRA04]. Sept. 14.04, 15.12, and 16.12: strong compact inner coma w/ boundaries exceedingly definite for a 'normal' comet [ZAN]. Sept. 15.36-Oct. 12.37: "(in general) the comet seems to exhibit strong, short-term fluctuations in brightness; the most dramatic change occurs between Oct. 6 and 12, when the comet fades unexpectedly by nearly a magnitude (but this sort of thing has been noticed throughout its apparition)" [BOR]. Sept. 17.02: comet appeared fainter than the open clusters M36, M37, and M38 in Auriga; its surface brightness was comparable to M38 [GRA04]. Sept. 17.12: surprisingly easy, well-defined object; w/ 20.3-cm T (50×), bright inner coma; at 161×, false nucleus of mag ~ 13.5 suspected [KAM01]. Sept. 17.77: comet larger and a little more condensed; coma elongated towards the NW [CAM03]. Sept. 19.40, 19.41, 25.43, 29.38, and Oct. 1.38: obs. made from a suburban location w/ moderate light pollution [MOD]. Sept. 23.06: w/ 11-cm R (50×), bright disk-like inner coma, faint outer coma [BAR06]. Sept. 24.05: somewhat smaller and fainter than the open clusters M36 and M37 [GRA04]. Sept. 25.99: clearly seen despite bright moonlight [GRA04]. Sept. 26.08: estimated in strong moonlight [PAL02]. Sept. 27.09: well-condensed object [KAM01]. Sept. 27.097-27.145: Moon in total eclipse. Sept. 27.12: first time comet seen w/ naked eye; diffuse coma w/ 2′ disklike central cond.; comet looks completely different from previous obs. (Sept. 16.12) when coma was sharp and compact; hints of sunward tail or coma extension; naked-eye coma dia. ~ 15′; w/ 7×42 B, coma dia. 13′, DC = 5; w/ 25×150 B, coma dia. 10′, DC = 3 [ZAN]. Sept. 27.15: photometry w/ 20-cm $f/2$ Baker-Schmidt camera (+ V filter + ST-6 CCD) shows circular coma w/ short extension in direction of an ion tail; trace of a delicate ion tail ~ 0°.5 in p.a. ~ 275° [MIK]. Sept. 29.03: w/ binoculars, comet appeared somewhat larger and brighter than the open clusters M36 and M37; easily visible despite bright moonlight [GRA04]. Sept. 29.38: 17-day-old Moon ~ 60° away [MOD].

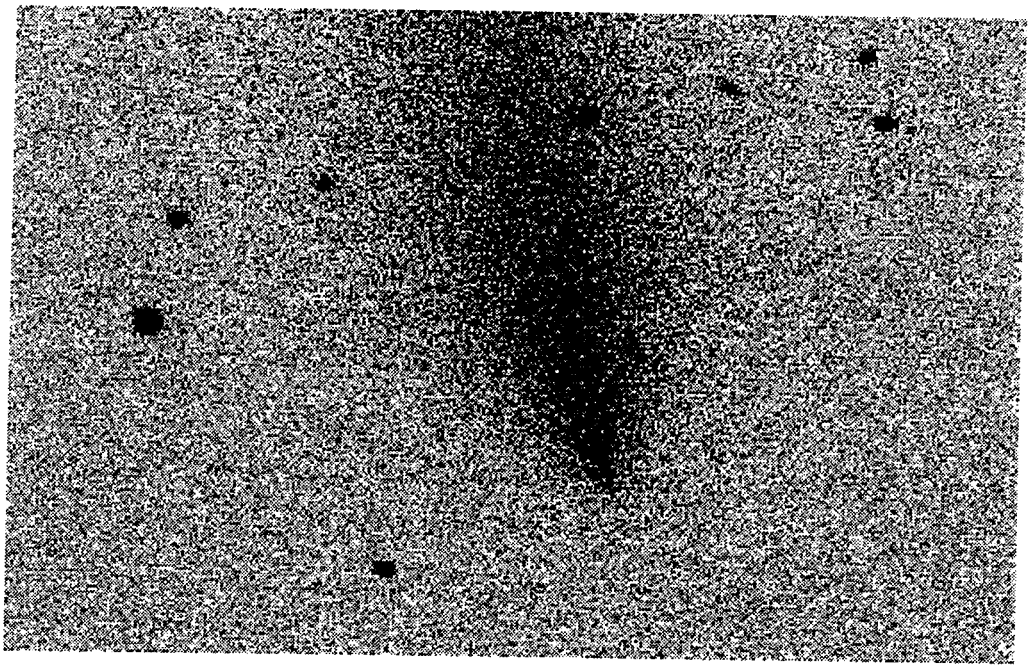
Oct. 1.38: 19-day-old Moon ~ 40° away [MOD]. Oct. 6.38: w/ 40.6-cm $f/5$ L (57×), 7′.6 coma, DC = 6, 0°.65 tail in p.a. 310° [BOR]. Oct. 12.07: coma elongated (18′×12′); straight ion tail [BAR06]. Oct. 12.16, 13.15, and 14.14: photometry obtained w/ 7.1-cm $f/3.5$ lens (+ V filter + ST-6 CCD) shows a diffuse tail at least ~ 1° long clearly present [MIK]. Oct. 13.03: w/ 15×80 B, weak tail 0°.5 long in p.a. 328° [SCH04]. Oct. 13.15: two 5-min wide-field CCD images w/ the 180-mm $f/2.8$ lens (+ H_2O^+ filter, which is centered at 620 nm, FWHM = 10 nm) shows at least 2° straight ion tail in p.a. 333° [MIK]. Oct. 14.72: w/ 11.0-cm $f/7$ L (32×), DC = s3, 1°.0 tail in p.a. 358° [VEL03]. Oct. 19.17 and 20.20: faintly visible w/ naked eye; w/ 25×150 B, type-I narrow, straight tail; broad, short coma extension or anti-tail at p.a. 130° [ZAN]. Oct. 23.75: elliptical coma ~ 11′×6′ w/ the major axis continuing in the gas tail; in spite of moonlight conditions, gas tail at least 1° long is visible on the 60-sec exp. w/ R filter [MIK]. Oct. 24.15: w/ 15×80 B, weak tail 0°.2 (p.a. 3°); w/ 20-cm L (42×), strong elongated coma (tail) [SCH04]. Oct. 30.74: streak-like coma ~ 13′×5′ w/ the major axis in p.a. ~ 10°-190°; straight tail at least 1°.2 long is present on 5-min exp. w/ V and R filters; the inner coma is almost uniform (*e.g.*, w/o the central cond.) [MIK].

(Descriptive Information continued on next page)

◇ ◇ ◇

Below: ***Around Oct. 20, comet C/1996 Q1 (Tabur) began to fade rapidly (cf. IAUC 6499). This is an unfiltered CCD image of the comet taken on 1996 Oct. 29.41 UT (100-sec exposure), taken by Toru Yusa at Kogota, Japan, with a 20-cm f/5.9 Schmidt-Cassegrain telescope (+ SBIG ST-6 CCD). North is up and east is to the left; field of view is 25′ × 18′. Note the lack of a nuclear condensation.***





Above: *Unfiltered CCD image of comet C/1996 Q1 (Tabur) taken on 1996 Oct. 31.064 UT (50-sec exposure) by Warren Offutt, W & B Observatory, Cloudcroft, NM, taken with a 60-cm reflector (+ SBIG ST-6 CCD). North is up and east is to the left, with the field size being 7.04 × 5.32. GSC 3047.657 is the brightest star at left center. (See also Yusa's image on the previous page.)*

◇ ◇ ◇

◇ *Comet C/1996 R1 (Hergenrother-Spahr)* ⟹ 1996 Sept. 11.06: ref. AC (RX And); comet was faint but better seen with averted vision; no bright object appeared at the appropriate position on the Digitized Sky Survey [GRA04]. Sept. 13.92 and 14.92: tail at p.a. ~ 100° suspected [ZAN]. Sept. 15.09: mag ref AAVSO RX And [GRA04]. Sept. 15.24: central cond. of dia. 4″ and mag 14.1; coma appeared symmetrical w/ no readily-apparent tail [ROQ]. Sept. 19.84: no enhancement w/ a Lumicon Swan Band Filter [MEY]. Sept. 23.11: central cond. of dia. 3″ and mag 14.3; coma basically symmetrical, but exhibited a hint of asymmetry at p.a. 279° [ROQ]. Sept. 30.11: central cond. of dia. ≃ 2″ and mag 14.1; direction of asymmetry of coma merged into a short, faint, diffuse tail at p.a. 90° [ROQ]. Oct. 11.10: central cond. of dia. ≃ 4″ and mag 15.4; coma asymmetrical at p.a. 57°, merging into tail at that location; tail, although generally diffuse, showed a sharper and slightly brighter core at its center [ROQ]. Oct. 23.11: central cond. of dia. 2″ and mag 15.5; small coma appeared weak, as did associated diffuse tail [ROQ].

◇ *Comet 22P/Kopff* ⟹ 1996 June 19.00: diffuse w/ 2.′5 central cond. [HAV]. July 6.56: was involved w/ star of mag 9 that made mag est. very difficult and may have affected the resulting obs. [CAM03]. July 7.14: fairly bright (but very diffuse) central cond. w/ a very faint extended outer coma toward the E-NE [DID]. July 7.20: light haze; extinction correction made by doubling the correction of table Ic [MOD]. July 12.19: fairly bright but diffuse central cond. in the SW region of a very diffuse coma [DID]. July 12.92: diffuse w/ fan-shaped coma [HAV]. July 18.20: dia. of central cond. 3″ (mag 13.1); coma appeared symmetrical at all radial-intensity levels [ROQ]. July 18.95 and 22.93: at 161×, false nucleus of mag ~ 13.0 [KAM01]. July 20.14: w/ 20×80 B, 9.′5 coma, DC = 2 [BOR]. July 21.16: w/ 40.6-cm *f*/5 L (70×), 2.′9 coma, DC = 5 [BOR]. July 23.15: w/ 40.6-cm *f*/5 L (70×), 3.′1 coma, DC = 5 [BOR]. July 27.28: comet difficult under strong moonlight conditions [SPR]. Aug. 7.19: dia. of central cond. 5″ (mag 12.9); no tail recorded [ROQ]. Aug. 7.25: comet not much brighter in Lumicon Premium Deep-Sky filter (51×) [SPR]. Aug. 7.91: w/ 14×100 B, m_1 = [8.5 (ref. AA, MM: S) [SHA02]. Aug. 10.23: comet ~ 2′ from star of mag ~ 9 and surrounded by seven stars of mag ~ 11 (difficult obs.) [MOD]. Aug. 10.40: diffuse and difficult to observe, involved w/ star of mag 8, so no DC estimate was possible [CAM03]. Aug. 10.60: comet located between a pair of 9th-mag stars [PEA]. Aug. 14.13: w/ 40.6-cm *f*/5 L (70×), 3.′1 coma, DC = 2 [BOR]. Aug. 15.22: brighter in Lumicon Premium Deep-Sky filter, but much fainter in Lumicon Premium Swan-Band filter [SPR]. Aug. 19.08: w/ 40.6-cm *f*/5 L (70×), 4.′2 coma, DC = 2 [BOR]. Aug. 19.85: very diffuse, at limit of detection [HAV]. Aug. 31.15: central cond. of dia. 3″ and mag 13.6; coma appeared generally symmetrical; no suggestion of a tail [ROQ]. Sept. 4.13: central cond. of dia. 4″ and mag 14.1; inner coma was irregularly asymmetrical by 27″ toward p.a. 82° [ROQ]. Sept. 9.40: small and diffuse w/ little cond. [CAM03]. Sept. 13.88, 14.88, 15.88: comet completely diffuse w/o hints of cond.; very difficult [ZAN]. Sept. 16.12: central cond. of dia. 5″ and mag 14.0; tail appeared as a broad, diffuse extension of highly-asymmetrical coma [ROQ]. Sept. 20.19: 13° alt. [MOD].

◇ *Comet 29P/Schwassmann-Wachmann 1* ⟹ 1996 Feb. 17.23: obs. rushed due to very cold temp. [MOD]. Feb. 25.31: w/ 35.9-cm f/7 L (164×), m_2 = 14 [MOD]. Mar. 9.99-13.89: observations by J. Sanner and J. Schmoll; reduction by A. Dieball, U. Grünewald, Sanner, and M. Geffert; used 1-m telescope at Hoher List observatory w/ a focal reducer and 2000×2000 CCD; aperture photometry done w/ DAOPHOT-II software running under IRAF; comparison-star magnitudes from GSC 1.2; exposures ranged from 30 to 600 sec, but there was no obvious correlation between exposure time and derived magnitude; aperture of 120 pixels (96″) just covered the coma [SAN08]. Mar. 12.27: m_2 = 12.8 (cond. of size ~ 1″) [MOD]. Mar. 13.22: m_2 = 13.0 (cond. of size ~ 3″-4″) [MOD]. Mar. 16.31: m_2 = 13.0 (cond. of size ~ 10″-15″ surrounds stellar cond. of mag mag ~ 13.5-14.0) [MOD]. Apr. 11.24: comet involved w/ star of mag ~ 13.5 [MOD]. Apr. 21.21: comet ~ 0′.5 from star of mag ~ 12, difficult obs. [MOD].

◇ *Comet 57P/du Toit-Neujmin-Delporte* ⟹ 1996 Aug. 13.33 and 15.33: obs. w/ a KAF CCD + *V* filter, attached to a 12-cm astrograph [FER]. Aug. 21.07: CCD photometry w/ 36-cm *f*/6.8 T (+ *V* filter) shows fan-like tail ~ 6′ long in p.a. ~ 250° [MIK]. Aug. 25.07: interference from star of mag 12 [SAR02].

◇ *Comet 65P/Gunn* ⟹ 1996 June 15.21: light haze and fog; extinction correction made by doubling the correction of table Ic [MOD]. July 11.17: m_2 = ~ 14.5 [MOD]. Aug. 18.10: ~ 13° alt. [MOD].

◇ *Comet 116P/Wild 4* ⟹ 1996 Apr. 18.17: m_2 = 13.4 (cond. of size 2″-3″) [MOD]. Apr. 21.14: m_2 = 13.8 (cond. of size 2″-3″) [MOD].

◇ *Comet 126P/IRAS* ⟹ 1996 Sept. 16.54: observed as a faint, small, moderately-condensed object of mag 12.0 [CAM03]. Sept. 17.47: tonight's obs. confirms last night's obs. [CAM03].

◇ *Comet P/1996 N2 (Elst-Pizarro)* ⟹ 1996 Sept. 2.53: tail p.a. 252°.5 ± 0°.5 [NAK01]. Sept. 14.58: tail p.a. 254°.1 ± 0°.5 [NAK01]. Oct. 4.51: tail p.a. 255°.0 ± 0°.5, short anti-solar tail in p.a. 72° [NAK01]. Oct. 16.50: tail p.a. 255°.9 ± 0°.5, short anti-solar tail in p.a. 69° [NAK01].

◇ ◇ ◇

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 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].

"MM" = the method employed for estimating the total (visual) magnitude; see article on page 186 of this issue [B = VBM method, M = Morris method, S = VSS 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 page 60 of the April 1993 issue, for all of the 1- and 2-letter codes). "AP." = aperture in centimeters of the instrument used for the observations, usually given to tenths. "T" = type of instrument used for the observation (R = refractor, L = Newtonian reflector, B = binoculars, C = Cassegrain reflector, A = camera, T = Schmidt-Cassegrain reflector, S = Schmidt-Newtonian reflector, E = naked eye, *etc.*). "F/" and "PWR" are the focal ratio and power or magnification, respectively, of the instrument used for the observation — given to nearest whole integer (round even).

"COMA" = estimated coma diameter 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). *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.

◇ ◇ ◇

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.; 16 = Japanese observers (c/o Akimasa Nakamura, Kuma, Japan); 23 = Czech group (c/o P. Pravec and V. Znojil); 32 = Hungarian group (c/o K. Sárneczky); 37 = Ukrainian Comet Section (c/o A. R. Baransky and K. I. Churyumov); 41 = Russian observers, c/o O. N. Pomogaev, Klimovsk; 42 = Belarus observers, c/o V. S. Nevski, Vitebsk; 43 = Slovenian observers, c/o Herman Mikuž, Ljubljana; 44 = comm. by Victor D. Bychkov, Special Astrophyzical Observatory; etc.]. Those with asterisks (*) preceding the 5-character code are new additions to the Observer Key:*

ABB	07	James Abbott, Witham, England
AND03	17	Krasimir Andreev, Bulgaria
ANT03	34	Anton Antonov, Bulgaria
ANZ		Fabio Anzellini, Italy
APF	23	Ladislav Apfelthaler, Czech Rep.
*ASP	11	J. W. van Asperen, Netherlands
BAE	34	Valia Baeva, Bulgaria
BAK01	32	Gáspár Bakos, Budapest, Hungary
BAL03	42	Igor I. Baluk, Gomel, Belarus
BAN	18	Jaroslaw Bandurowski, Poland
BAR		Sandro Baroni, Italy
BAR06	37	Alexandr R. Baransky, Ukraine
BEA	07	Sally Beaumont, England
BEC01		Stefan Beck, Stuttgart, Germany
BEN04	18	Leszek Benedyktowicz, Poland
BIV		Nicolas Biver, France
*BON	07	Neil Bone, W. Sussex, U.K.
BOR		John E. Bortle, NY, U.S.A.
BOR04	37	Sergiy A. Borysenko, Ukraine
BOU		Reinder J. Bouma, The Netherland
*BUR04	18	Wojciech Burzynski, Poland
BUS04	32	Sándor Busa, Hungary
CAM03	14	Paul Camilleri, Australia
CHE03	33	Kazimieras T. Cernis, Lithuania
CHM	18	Wladyslaw Chmielewski, Poland
CHO01	18	Franciszek Chodorowski, Poland
CHU		Klim Churyumov, Kiev, Ukraine
*CHU04	37	Alexey V. Chugaenko, Ukraine
CIU	18	Grzegorz Ciura, Poland
CNO	18	Ryszard Cnota, Poland
COM	11	Georg Comello, The Netherlands
CSU	32	Mátyás Csukás, Salonta, Romania
*CZE	18	Grzegorz Czepiczek, Poland
*CZE01	18	Waclaw Czerniewski, Poland
*CZE02	18	Grzegorz Czerepko, Monki, Poland
DAH	24	Haakon Dahle, Norway
DAN01	18	Jorgen Danielsson, Sweden
DEA		Vicente F. de Assis Neto, Brazil
*DEG	42	Vladimir A. Degterev, Belarus
DER	18	Oskar Deren, Poland
DES01		Jose G. de Souza Aguiar, Brazil
DID		Richard Robert Didick, MA, U.S.A
DIE02		Alfons Diepvens, Belgium
DIJ		Edwin van Dijk, The Netherlands
DIN01	07	E. L. Dinham, Devon, England
DOC	34	Doichin Docinski, Bulgaria
DON	34	Zahari Donchev, Bulgaria
DRE	23	Radek Dřevěný, Czech Republic
DUS	18	Grzegorz Duszanowicz, Sweden
DVO	23	Denisa Dvorakova, Czech Republic
*FAJ	18	Tomasz Fajfer, Torun, Poland
FEI	11	Henk Feijth, The Netherlands
FER		Ignacio Ferrin, Venezuela
FIE		Marsilio Fierimonte, Italy
FIL05	37	Alexander V. Filatov, Ukraine
GAM	18	Mariusz Gamracki, Poland
GAR01		Gordon Garradd, Australia
GEE	11	J. J. Geenen, The Netherlands
GER	37	A. Gerasimov, Ukraine
*GER01	37	O. N. Geraschenko, Ukraine
GIL01	11	G. Gilein, The Netherlands
*GNI	18	Katarzyna Gniazdowska, Poland
GOL	19	V. A. Golubev, Vitebsk, Belarus
*GOU	16	Hiroshi Goubara, Japan
GRA04	24	Bjoern Haakon Granslo, Norway
GRE		Daniel W. E. Green, U.S.A.
GRO03	18	Radoslaw Grochowski, Poland
*GRO04	18	Jaroslaw Grolik, Poland
*GRZ01	18	Pawel Grzywak, Poland
*GUL01	32	Krisztián Gulyás, Hungary
GUR	19	S. Guryanov, Krasnoyarsk, Russia
HAR08	34	Ema Harieva, Bulgaria
HAS02		Werner Hasubick, Germany
HAS08	16	Yuji Hashimoto, Hiroshima, Japan
HAV		Roberto Haver, Italy
HEG	07	Douglas C. Heggie, U.K.
HOM	37	Vasyl M. Homyak, Ukraine
HOR	12	Tibor Horváth, Hungary
HOR02	23	Kamil Hornoch, Czechoslovakia
ISH03	37	Andriy S. Ishchenko, Ukraine
*JAN04	18	Ireneusz Janicki, Poland
JAR01	18	Marcin Jarski, Poland
JOH01		C. Johannink, The Netherlands
JON	07	Albert F. Jones, New Zealand
KAM01		Andreas Kammerer, Germany
KAR02	18	Timo Karhola, Sweden
KAT01	16	Taichi Kato, Kyoto, Japan
*KER01	32	János Kernya, Hungary
KES01		Sándor Keszthelyi, Hungary
KHA01	37	Vadim P. Khanacuyk, Ukraine
KID01	18	Krzysztof Kida, Poland
KIE	18	Grzegorz Kieltyka, Poland
KIN	16	Kazuo Kinoshita, Japan
KOB01	16	Juro Kobayashi, Japan
*KOD01	18	Michal Kodczak, Poland
KOL03	18	Szymon Kolodziej, Poland
KOL04	42	Kirill Koloskov, Belarus
KON06	23	Jiří Konečný, Czech Republic
KOS		Attila Kósa-Kiss, Romania
KOS01	18	Janusz Kosinski, Poland

KOS04	37	Denis S. Kosenkov, Russia
*KOW01	18	Piotr Kowal, Krakow, Poland
*KOW02	18	Tomasz Kowalczyk, Poland
*KOZ	37	Vladimir A. Kozlov, Ukraine
*KRA04	23	Lukaš Král, Czech Republic
KRY01	17	Timur V. Kryachko, Russia
*KRZ	18	Tomasz Krzyt, Warszawa, Poland
*KWI	18	Maciej Kwinta, Krakow, Poland
KYS	23	J. Kysely, Czech Republic
LAA		T. A. van der Laan, Netherlands
LAN03	07	James A. Lancashire, England
LOO01		Frans R. van Loo, Belgium
LOU	35	Romualdo Lourencon, Brazil
LUB01	34	Marlena Lubenova, Bulgaria
*LUK04	37	Igor Lukyanyk, Ukraine
*LUK05	42	Viktor V. Luk'yanov, Belarus
MAI	37	Alexander S. Maidic, Ukraine
MAR02	13	Jose Carvajal Martinez, Spain
MAR12	18	Leszek Marcinek, Poland
MAR13	18	Jerzy Marcinek, Poland
MAT06	18	Leslaw Materniak, Poland
*MAT07	44	Ilya M. Matyash, Russia
*MEN03	07	Haldun I. Menali, Turkey
MEY	28	Maik Meyer, Germany
MIK		Herman Mikuž, Slovenia
MIL02		Giannantonio Milani, Italy
MIY01	16	Osamu Miyazaki, Ibaraki, Japan
MOD		Robert J. Modic, OH, U.S.A.
MOE		Michael Moeller, Germany
MOR04	37	Vladimir G. Mormyl, Ukraine
MOR06	16	Masayuki Moriyama, Japan
*MOR08	37	Alexandra M. Mormyl, Ukraine
MOS03	37	Yurij A. Moskalenko, Ukraine
*MUS01	18	Pawel Musialski, Poland
NAG02	16	Takashi Nagata, Hyogo, Japan
NAG08	16	Yoshimi Nagai, Nagano, Japan
*NAG09	32	Miklós Nagy, Csenger, Hungary
NAK01	16	Akimasa Nakamura, Ehime, Japan
NEK		Andrey Nekrasov, Baran, Belarus
NEV	42	Vitali S. Nevski, Belarus
NOW		Gary T. Nowak, VT, U.S.A.
OGA01	37	Sergei A. Ogarkov, Kiev, Ukraine
OKA05	16	Takuma Oka, Tokyo, Japan
OKS	07	Gabriel Oksa, Slovak Republic
OLE	18	Arkadiusz Olech, Poland
*OLE01	18	Robert Olech, Poland
OME		Stephen O'Meara, MA, U.S.A.
*PAL02	43	Rok Palcic, Kamnik, Slovenia
PAR03	18	Mieczyslaw L. Paradowski, Poland
PAV		Hristo Pavlov, Karlovo, Bulgaria
*PAV01	44	Eugeny J. Pavlenko, Russia
PEA	14	Andrew R. Pearce, Australia
PER01		Alfredo J. S. Pereira, Portugal
*PIO01	18	Marek Piotrowski, Poland
PLE01	18	Janusz Pleszka, Poland
PLS	23	Martin Plšek, Czech Republi
POD	23	M. Podzorny, Czech Republic
POM	41	Oleg N. Pomogaev, Russia
POR02	34	Diliana P. Antonova, Bulgaria
POR04	34	Lilia Porojanova, Bulgaria
*POR05	40	Joao Porto, Azores Is., Portugal
PRA01	23	Petr Pravec, Czech Republic
RAD01	17	Veselka Radeva, Bulgaria
RAF	18	Jerzy Rafalski, Poland
RED	37	Sergei Red'ko, Kiev, Ukraine
RES	18	Maciej Reszelski, Poland
RIP	13	Jose Ripero Osorio, Spain
ROM	42	Aleksandr M. Romancev, Belarus
ROQ		Paul Roques, AZ, U.S.A.
RYZ	37	Igor V. Ryzhkov, Ukraine
SAN02	18	Artur Sankowski, Poland
SAN04	38	Juan Manuel San Juan, Spain
SAN07	32	Gábor Sánta, Hungary
*SAN08		Joerg Sanner, Bonn, Germany
*SAN09	18	Lukasz Sanocki, Poland
SAR02	32	Krisztián Sárneczky, Hungary
SCH04		Alex H. Scholten, Netherlands
SCH07	21	Paul Schlyter, Sweden
SCI		Tomasz Sciezor, Poland
SCO04	37	Borys Skorichenko, Ukraine
SEA	14	David A. J. Seargent, Australia
SEA01	14	John Seach, Australia
*SEM	42	Ruslan V. Semyonov, Belarus
SER	42	Ivan M. Sergey, Belarus
SHA02	07	Jonathan D. Shanklin, England
SHI	16	Hiroyuki Shioi, Chiba, Japan
SHU	42	Sergey A. Shurpakov, Belarus
SIM		Karl Simmons, FL, U.S.A.
SIM01		Wanda Simmons, FL, U.S.A.
SIW	18	Ryszard Siwiec, Poland
SIW01	18	Michal Siwak, Tuchow, Poland
SKI	24	Oddleiv Skilbrei, Norway
*SKO03	18	Krzysztof Skowron, Poland
SLO01	18	Wieslaw Slotwinski, Poland
SOC	18	Krzysztof Socha, Poland
SOW	16	Toshihide Sowa, Wakayama, Japan
SPE01	18	Jerzy Speil, Poland
SPR		C. E. Spratt, BC, Canada
STA01	34	Stefen Stajkov, Bulgaria
SWI	18	Mariusz Swietnicki, Poland
SZA		Sándor Szabó, Sopron, Hungary
SZA02	32	Levente Szarka, Hungary
*SZC01	18	Robert Szczerba, Poland
*SZE03	18	Maciej Szelagawski, Poland
*SZU01	18	Stanislaw Szumowicz, Poland
TAK05	16	Kesao Takamizawa, Nagano, Japan
TAN02		Tony Tanti, Malta
TAY	07	Melvyn D. Taylor, England
*TOD	16	Hiroyuki Toda, Okayama, Japan
TRI		Josep M. Trigo Rodriguez, Spain
TSU02	16	Mitsunori Tsumura, Japan
*TSU03	16	Hiroaki Tsutiyama, Japan
TUB	12	Vince Tuboly, Hungary
VEL03	37	Peter Velestschuk, Ukraine
VIT01	40	Catarina Vitorino, Portugal
WAR01	18	Johan Warell, Sweden
WES04	18	Tomasz Weselak, Poland
WIL02		Peter F. Williams, Australia
*WLO	18	Robert Wlodarczyk, Poland
YOS02	16	Katsumi Yoshimoto, Japan
YOS04	16	Seiichi Yoshida, Ibaraki, Japan
ZAN		Mauro Vittorio Zanotta, Italy
ZAN01		W. T. Zanstra, The Netherlands
ZBR	18	Mariusz Zbrzezniak, Poland
ZNO	23	Vladimír Znojil, Czech Republic

◇ ◇ ◇

Comet C/1988 A1 (Liller)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1988 05 23.93		S	6.3	AA	3.4	B		9	& 5	4/			PER01
1988 05 24.91		S	6.2	AA	3.4	B		9	&10	6			PER01
1988 05 27.96		S	6.7	AA	15.0	L	4	26	& 5.5	4			PER01

Comet C/1993 Y1 (McNaught-Russell)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1994 04 01.85		B	7.2	S	33.3	L	5	75	5				RIP
1994 04 02.85		B	7.0	S	33.3	L	5	75	3				RIP
1994 04 08.86		B	7.5	S	33.3	L	5	75	3				RIP
1994 04 14.85		B	8.5	S	33.3	L	5	75	2.0				RIP

Comet C/1995 O1 (Hale-Bopp)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 03 23.43	&	M	9.4	GA	20.0	L	5	35	2.0	s6			MOD
1996 04 18.39		M	8.8	NO	20.0	L	5	35	3.0	s4/			MOD
1996 04 21.11		S	8.5	AA	25.4	T	6	62	2.3	5			TAN02
1996 04 22.35		S	8.0	SC	6.0	R		44	5	0			DID
1996 04 23.10		S	7.9	HS	10.0	B		25	3.2	5			HAS02
1996 04 25.35		S	8.0	SC	6.0	R		44	5	0			DID
1996 04 28.29		S	8.0	SC	25.4	L	4	46	5	s2		330	DID
1996 05 11.06		S	7.8	AA	6.3	R	13	52	12	4			KOS
1996 05 13.35	s	M	8.6	NO	20.0	L	5	35	2.3	s6			MOD
1996 05 15.14		S	8.0:	AA	10	T	10	40	5	1			DIN01
1996 05 15.20		S	7.6	AA	7.0	B		20	2.8	5			HAS02
1996 05 16.09		S	7.3	AA	7.0	B		20	9	5			TAN02
1996 05 16.98	&	S	7.5:	AA	6.0	B		20					CHE03
1996 05 17.06		S	7.1	AA	5.0	B		12	7.5	4			TAN02
1996 05 17.07		S	7.3	AA	7.0	B		20	5	4/	7.5m	351	TAN02
1996 05 17.15		S	8.0:	AA	6.3	B		9	6	0			DIN01
1996 05 18.23		S	7.2	SC	25.4	L	4	46	5	d4	0.06	10	DID
1996 05 19.02		S	7.5:	HD	5.0	B		10	8	3			NAG09
1996 05 19.04		S	7.4	AA	6.3	R	13	52	16	5			KOS
1996 05 19.06		O	7.9	TI	11	L	7	32	3	4			KYS
1996 05 19.99		S	7.3	HD	5.0	B		10	9	4			NAG09
1996 05 20.12		S	8.0:	AA	10	T	10	40	6	1			DIN01
1996 05 21.02		S	7.2	AA	6.3	R	13	52	16	5			KOS
1996 05 21.04		S	6.8	AA	4.2	B		7	7	3			ZAN
1996 05 21.25		S	7.5:	SC	20.3	L	5	80	12	4	0.4	35	POR05
1996 05 22.11		S	8.0:	AA	10	T	10	40	5	1	0.08		DIN01
1996 05 23.00		B	7.2	SC	5.0	B		7	10	3			MOR04
1996 05 23.03		S	7.1	AA	6.3	R	13	52	18	s6			KOS
1996 05 23.07		S	7.1	AA	7.0	B		20	7.5	5			TAN02
1996 05 24.00		B	7.2	SC	5.0	B		7	10	3			MOR04
1996 05 24.15		S	7.5:	AA	10	T	10	40	6	1	0.08		DIN01
1996 05 24.98		S	7.5	AA	8.0	R	10	28		6/			GER01
1996 05 25.00		B	7.2	SC	5.0	B		7	12	s3			MOR04
1996 05 25.07		S	7.1	AA	7.0	B		20	7	5			TAN02
1996 05 25.09		S	7.1	AA	5.0	B		12	6	4			TAN02
1996 05 25.23		S	7.0	SC	25.4	L	4	46	10	S4		45	DID
1996 05 25.98		S	7.2	HD	5.0	B		10	8.5	s4			NAG09
1996 05 26.10		S	7.5:	AA	10	T	10	40	6	1	0.08		DIN01
1996 05 26.13		S	7.0	SC	25.4	L	4	46	10	S4		5	DID
1996 05 26.97		B	7.1	SC	5.0	B		7	12	s3			MOR08
1996 05 26.97		S	7.3	AA	8.0	B	10	28		6/			GER01
1996 05 27.03		S	6.9	AA	6.3	R	13	52	20	s6			KOS
1996 05 27.07		S	7.1	AA	7.0	B		20	9	5			TAN02
1996 05 27.09		S	7.0	AA	5.0	B		12	9	4			TAN02
1996 05 27.11		S	7.5:	AA	10	T	10	103	6	1	0.08		DIN01
1996 05 27.97		B	7.1	SC	5.0	B		7	12	3/			MOR04
1996 05 28.07		S	7.0	AA	5.0	B		12	9	4/	13.0m	210	TAN02
1996 05 28.09		B	7.2	S	5.0	B		7	10	6			BIV
1996 05 28.97		B	7.0	SC	5.0	B		7	13	4			MOR04
1996 05 29.07		S	7.5:	AA	10	T	10	40	3	0			DIN01

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 05 29.08		B	7.1	S	5.0	B		7	12	5			BIV
1996 05 30.00		B	7.1:	AC	20.3	T	10	40	&12				ANZ
1996 05 30.09		S	7.0	AA	5.0	B		12	12	4/			TAN02
1996 05 31.08		S	7.0	AA	7.0	B		20		4			TAN02
1996 05 31.99	&	S	7.0:	AA	12	R	5	25	& 5	5			CHE03
1996 06 03.97	&	S	6.8:	AA	12	R	5	25		5			CHE03
1996 06 05.91		S	6.8	HD	5.0	B		10	12				SAN07
1996 06 05.97	&	S	6.4:	AA	12	R	5	25	& 5	5			CHE03
1996 06 06.81		B	6.7	SC	5.0	B		7	15	4			MOR04
1996 06 06.89		M	7.8	SC	5.0	B		10		3			AND03
1996 06 06.91		S	6.8	HD	5.0	B		10	12	3			SAN07
1996 06 06.94	&	S	6.8:	AA	12	R	5	25					CHE03
1996 06 06.98		B	7.3	S	5.0	B		7	12	5			BIV
1996 06 07.81		B	6.6	SC	5.0	B		7	14	4			MOR08
1996 06 07.92		S	6.7	HD	5.0	B		10	10	3			SAN07
1996 06 07.97		S	6.6	SC	8.0	B		20	8	4	0.13	320	OKS
1996 06 08.03		S	6.9	AA	6.0	B		20	10	5			CSU
1996 06 08.81		B	6.6	SC	5.0	B		7	14	4			MOR04
1996 06 08.92		S	6.7	HD	5.0	B		10	10	3			SAN07
1996 06 09.96		B	6.5	SC	5.0	B		7	14	4			MOR04
1996 06 09.99		B	7.1	S	5.0	B		7	12	6			BIV
1996 06 09.99		S	6.9	AA	6.0	B		20	10	5			CSU
1996 06 09.99		S	6.9	AA	7.0	B		20	7	5			TAN02
1996 06 10.96		B	6.5	SC	5.0	B		7	15	4			MOR04
1996 06 10.96		S	6.1	AA	4.2	B		7	14	4			ZAN
1996 06 11.02		S	6.7	AA	5.0	B		12	13	5			TAN02
1996 06 11.22		S	6.5:	SC	20.3	L	5	40	& 5	7			POR05
1996 06 11.94	&	S	6.8:	AA	12	R	5	25					CHE03
1996 06 11.96		B	6.4	SC	5.0	B		7	15	4			MOR04
1996 06 11.96		B	6.4	SC	5.0	B		7	15	4			MOR08
1996 06 12.00		S	7.0:	AA	10	T	10	40	4	1			DIN01
1996 06 12.04		S	6.6	AA	5.0	B		12	13	4/			TAN02
1996 06 12.96		B	6.4	SC	5.0	B		7	15	4			MOR04
1996 06 12.96		S	6.7	AA	6.5	L	8	33					RYZ
1996 06 12.98		S	7.9	S	7.0	B		16	6	3			TAY
1996 06 13.01		S	7.0:	AA	6.3	B		9	4	1			DIN01
1996 06 13.06		S	6.6	AA	5.0	B		12	11	4/			TAN02
1996 06 13.72		S	7.1	SC	4.5	R	6	13	6	6			JON
1996 06 13.96		B	6.4	SC	5.0	B		7	15	4			MOR04
1996 06 14.00		S	6.1	AA	4.2	B		7	14	4			ZAN
1996 06 14.05		B	7.0	S	5.0	B		7	15	5			BIV
1996 06 14.72		S	7.1	SC	4.5	R	6	13	6				JON
1996 06 14.91		S	6.6	HD	5.0	B		10	12	3			SAN07
1996 06 14.94	&	S	6.6:	AA	11.0	B		20		5			CHE03
1996 06 14.96		B	6.3	SC	5.0	B		7	16	4			MOR08
1996 06 14.96		S	5.9	SC	8.0	B		20	8	6	0.13	320	OKS
1996 06 15.00		S	6.5	AA	6.3	R	13	52	24	s6			KOS
1996 06 15.03		B	6.8	S	5.0	B		7	15	6			BIV
1996 06 15.04		S	7.0:	AA	12.5	R	5	20	5	1			BEA
1996 06 15.05		S	6.3	AA	5.0	B		12		4/			TAN02
1996 06 15.18		S	6.5:	SC	20.3	L	5	40	& 5	7			POR05
1996 06 15.28		M	6.9	SC	5.0	B		10	6.9	s5			MOD
1996 06 15.90		E	7.0	AA	13.3	R	5	33	4.8	6	0.12	350	SCO04
1996 06 15.95	&	S	6.4:	AA	11.0	B		20		5			CHE03
1996 06 15.96		B	6.3	SC	5.0	B		7	16	4			MOR04
1996 06 15.98		S	6.2	AA	8.0	B		15	8	6	0.2	330	HAV
1996 06 16.07		B	6.6	S	5.0	B		7	15	6			BIV
1996 06 16.17		S	6.2:	SC	20.3	L	5	40	& 5	7			POR05
1996 06 16.30		M	6.8	SC	5.0	B		10	7.7	s5			MOD
1996 06 16.71		S	7.2	SC	4.5	R	6	13	5				JON
1996 06 16.90		S	6.5	HD	5.0	B		10	14	3			SAN07
1996 06 16.96		B	6.3	SC	5.0	B		7	16	4			MOR04
1996 06 17.03		S	6.3	AA	5.0	B		12	13	5			TAN02
1996 06 17.13		B	6.5	S	5.0	B		7	15	6			BIV
1996 06 17.72		S	7.0	SC	4.5	R	6	13	8				JON

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 06 17.90		S	6.5	HD	5.0	B		10	15	4			SAN07
1996 06 17.93		S	6.2	AA	10.0	B		25	5.2	4			HAS02
1996 06 17.94		S	6.5	AA	6.5	L	8	33					RYZ
1996 06 17.96		B	6.3	SC	5.0	B		7	17	4			MOR04
1996 06 18.13		S	6.3:	SC	20.3	L	5	40	& 5	7			POR05
1996 06 18.76		S	6.9	SC	4.5	R	6	13	6				JON
1996 06 18.90		S	6.4	HD	5.0	B		10	13	s4			SAN07
1996 06 18.95		S	7.0:	AA	6.3	B		9	4	1			DIN01
1996 06 18.96		B	6.2	SC	5.0	B		7	17	4			MOR08
1996 06 18.97		S	6.9	AA	6.0	B		20	11	5/			CSU
1996 06 19.00		S	6.2	AA	8.0	B		15	11	6			HAV
1996 06 19.03		S	6.2	AA	5.0	B		12	11	5			TAN02
1996 06 19.06		S	6.6	HD	5.0	B		10	11	d3			BUS04
1996 06 19.95		S	7.0:	AA	6.3	B		9	6	1			DIN01
1996 06 19.96		B	6.2	SC	5.0	B		7	17	4			MOR04
1996 06 20.02		S	6.2	AA	5.0	B		12	10	4/			TAN02
1996 06 20.96		B	6.2	SC	5.0	B		7	17	4			MOR04
1996 06 21.02		S	6.2	AA	5.0	B		12	10	4/			TAN02
1996 06 21.10		S	7.0:	AA	10	T	10	40	6	1	0.08	30	DIN01
1996 06 21.96		B	6.1	SC	5.0	B		7	17	4			MOR04
1996 06 21.96		S	7.0:	AA	6.3	B		9	6	1			DIN01
1996 06 22.00		S	6.8	SC	8.0	B		15	10	6			SCH04
1996 06 22.88		S	6.5	AA	8.0	B		12	20	4			MEN03
1996 06 22.96		B	6.1	SC	5.0	B		7	18	4			MOR04
1996 06 22.96		S	6.2	AA	5.0	B		7	33	6			KOS
1996 06 23.03		S	6.1	AA	5.0	B		12	11	5			TAN02
1996 06 23.90		S	6.4	HD	5.0	B		10	12	4			SAN07
1996 06 23.93		S	6.5:	AA	6.3	B		9	6	1			DIN01
1996 06 23.96		B	6.1	SC	5.0	B		7	18	4			MOR08
1996 06 24.00		S	7.0	SC	8.0	B		15	6	5			FEI
1996 06 24.11		S	6.0:	SC	20.3	L	5	40	& 5	6/			POR05
1996 06 24.96		B	6.1	SC	5.0	B		7	18	4			MOR04
1996 06 25.96		B	6.1	SC	5.0	B		7	18	4			MOR04
1996 06 26.03		M	6.2	AA	5.0	B		12	10	5			TAN02
1996 06 26.03		S	6.0:	SC	20.3	L	5	40	& 5	6			POR05
1996 06 26.30		M	6.5	SC	5.0	B		10	7.7	s5			MOD
1996 06 26.72		S	6.6	SC	4.5	R	6	13	6	3			JON
1996 06 26.96		B	6.1	SC	5.0	B		7	18	4			MOR04
1996 06 27.04		M	6.1	AA	5.0	B		12	8	5/			TAN02
1996 06 27.17		S	6.3	SC	25.4	L	4	46	10	S5		0	DID
1996 06 28.03		S	6.1	AA	5.0	B		7	26	6			KOS
1996 06 28.73		S	6.5	SC	4.5	R	6	13	8	3			JON
1996 07 02.00		S	6.8:	AA	20.3	L	5	40	& 6	5/	&0.12	20	POR05
1996 07 02.82		B	6.1	SC	5.0	B		7	18	4			MOR04
1996 07 02.82		B	6.1	SC	5.0	B		7	18	4			MOR08
1996 07 02.90		S	6.2:	AA	12	R	5	25	& 5	3			CHE03
1996 07 03.04		S	6.8:	SC	20.3	L	5	40	& 6	5/	&0.12	25	POR05
1996 07 03.40		I	5.8	SC	0.7	E		1					CAM03
1996 07 03.40		S	5.7	SC	8.0	B		20	15	6	0.5	360	CAM03
1996 07 03.82		B	6.1	SC	5.0	B		7	19	4			MOR04
1996 07 03.93		S	6.5:	AA	12	R	5	25		4			CHE03
1996 07 04.41		S	5.8	AA	5.0	B		10	12	5			SEA01
1996 07 04.82		B	6.0	SC	5.0	B		7	19	4			MOR04
1996 07 04.82		M	7.0	SC	5.0	B		10	6	3			AND03
1996 07 04.85		S	5.9	AA	5.0	B		12		4/			TAN02
1996 07 04.86		B	6.2	AA	5.0	B		7	11	D4			VEL03
1996 07 04.88		S	5.7	SC	5.0	B		10	13	4			OKS
1996 07 04.88		S	6.1	HD	6.0	B		20	10	5	0.25	10	TUB
1996 07 04.88		S	6.1	HD	8	R	11	60	5	5	0.5	340	GUL01
1996 07 04.88		S	6.3	HD	6.0	B		20	20		0.3	45	HOR
1996 07 04.88		S	6.9	AA	6.0	B		20	15	5/		180	CSU
1996 07 04.94		S	5.5	AA	5.0	B		7		3			DIJ
1996 07 04.99		S	6.7	SC	20.3	L	5	40	& 7	s5/	&0.15	25	POR05
1996 07 05.06		S	6.8	SC	20.3	L	5	40	& 8	s5/	&0.20	30	POR05
1996 07 05.41		S	5.7	AA	5.0	B		10	9	5			SEA01

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 05.54		M	5.7	S	4.2	B		7	&10	6			YOS02
1996 07 05.84		B	6.0	SC	5.0	B		7	19	4			MOR04
1996 07 05.86		B	6.0	AA	5.0	B		7	11	D4			VEL03
1996 07 05.89		S	6.0	AA	5.0	B		12	11	4/			TAN02
1996 07 05.89		S	6.5	AA	6.5	L	8	33					RYZ
1996 07 05.97		S	7.1	S	7.0	B		16	6	3			TAY
1996 07 06.18		M	6.6	SC	5.0	B		10	6.0	s5/			MOD
1996 07 06.45		S	5.7	AA	5.0	B		10	11	5			SEA01
1996 07 06.55		I	5.5	SC	0.7	E		1					CAM03
1996 07 06.55		S	5.7	SC	20.3	L	7	56	6	s7	0.25	360	CAM03
1996 07 06.82		B	6.0	SC	5.0	B		7	19	4			MOR04
1996 07 06.83		S	6.1	AA	20.3	L	6	60	10	4	0.05	350	MEN03
1996 07 06.86		S	6.6:	AA	8	R	10	28		6/			GER01
1996 07 06.86		S	6.8:	AA	8	R	10	28		6/			GER01
1996 07 06.87		S	6.5:	AA	8.0	B		20	8	4			MIL02
1996 07 06.88		M	6.8	TI	11	L	7	32	7	5			KYS
1996 07 06.89		B	6.1	AA	5.0	B		7	14	D4			VEL03
1996 07 06.89		M	6.2	TI	5.0	B		7	7	4			KYS
1996 07 06.91		S	5.9	AA	5.0	B		12	11	4/			TAN02
1996 07 06.93		S	6.3	AA	5.0	B		10	6	4			MEY
1996 07 06.94		M	6.4	AA	13.0	L	6	36	5.5	D5/			MEY
1996 07 06.96		S	6.4	SC	4.0	B		8	14	5/			SCH04
1996 07 06.97		S	7.5	S	7.6	R	12	43	1.8	3	0.08	345	TAY
1996 07 06.99		S	6.7	SC	20.3	L	5	40	& 8	5/	&0.20	30	POR05
1996 07 07.13		S	5.7	SC	25.4	L	4	46	10	D6	0.25	40	DID
1996 07 07.18		B	7.1	SC	20.0	L	5	35	4.0	s6	0.6	167	MOD
1996 07 07.20		M	6.5	SC	5.0	B		10	6.3	s5/			MOD
1996 07 07.41		I	5.5	SC	0.7	E		1					CAM03
1996 07 07.41		S	5.6	AA	5.0	B		10	12	5			SEA01
1996 07 07.41		S	5.7	SC	8.0	B		20	15	7			CAM03
1996 07 07.42		S	6.3	VN	5.0	B		10		4			WIL02
1996 07 07.43		S	5.6	SC	20.3	L	7	56	6	s7	0.25	360	CAM03
1996 07 07.57		M	5.9	AA	8.0	B		20					PEA
1996 07 07.57		S	5.9	AA	8.0	B		20	8.5	7			PEA
1996 07 07.84		B	6.0	SC	5.0	B		7	19	4			MOR04
1996 07 07.86		S	5.3	AA	5.0	B		7		3/			DIJ
1996 07 07.87		M	7.0	SC	5.0	B		10	8	3			AND03
1996 07 07.91		S	6.0	AA	6.3	R	13	52	12	6	6 m	350	KOS
1996 07 07.91		S	6.7	AA	6.0	B		20	15	6		180	CSU
1996 07 07.92		S	6.5:	AA	6.0	B		20	& 6	5			CHE03
1996 07 07.93		S	6.3	SC	4.0	B		8	&12				SCH04
1996 07 07.94		S	6.5:	AA	6.3	B		9	6	2			DIN01
1996 07 07.99		S	5.8	AC	3.4	B		9	&12	5			PER01
1996 07 08.43		I	5.5	SC	0.7	E		1					CAM03
1996 07 08.43		S	5.6	SC	20.3	L	7	56	6	s7	0.35	360	CAM03
1996 07 08.83		S	6.6:	AA	8	R	10	28		6/			GER01
1996 07 08.84		B	6.0	SC	5.0	B		7	19	4			MOR04
1996 07 08.84		M	6.9	SC	5.0	B		10	8	3			AND03
1996 07 08.87		S	5.9	AA	6.3	R	13	52	18	6	6 m	350	KOS
1996 07 08.88		S	6.0	S	11.0	B	5	20	24	s4			BOR04
1996 07 08.91		S	5.6	AA	5.0	B		7	9	4			SHA02
1996 07 08.91		S	5.9:	S	24	R	18	40	8	S5			BOR04
1996 07 08.95		M	6.0	AA	5.0	B		12	15	5			TAN02
1996 07 08.96		S	6.4	AA	6.5	L	8	33					RYZ
1996 07 08.99		S	5.8	AC	3.4	B		9	>12	4			PER01
1996 07 09.04		B	6.1	AA	3.0	O		8	&12	3	0.4		ROM
1996 07 09.41		S	5.5	AA	5.0	B		10	11	6			SEA01
1996 07 09.82		M	6.9	SC	5.0	B		10	8	3			AND03
1996 07 09.84		B	6.0	SC	5.0	B		7	19	4			MOR04
1996 07 09.85		S	6.6:	AA	8	R	10	28	&10	5/			GER01
1996 07 09.87		S	6.2	AA	6.0	B		20	& 5	5			CHE03
1996 07 09.88		B	6.1	AA	5.0	B		7	18	D4			VEL03
1996 07 09.89		S	6.4	AA	6.5	L	8	33					RYZ
1996 07 09.90		S	5.9	AA	5.0	B		7	22	6			KOS
1996 07 09.90		S	6.0	HD	6.0	B		20	15	6	0.3	10	TUB

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 09.91		S	5.8	AA	4.2	B		7	15	5			ZAN
1996 07 09.91		S	6.8	HD	16.2	L		42	10	D4	0.2	0	SZA02
1996 07 09.92		S	6.1	AA	3.0	B		8	15	6		180	CSU
1996 07 09.92		S	6.2	AA	15.2	L	5	42	6.5	4	0.2	120	MOE
1996 07 09.96		S	6.1	HD	5.0	B		10	15	s5			BUS04
1996 07 09.99		I	5.6	AA	0.0	E		1		1			PER01
1996 07 09.99		M	5.6	AA	3.4	B		9	&14	4			PER01
1996 07 09.99		S	5.6	AA	3.4	B		9	&14	4			PER01
1996 07 10.00		M	5.6	AA	3.4	B		9	&12	4			VIT01
1996 07 10.06		B	6.1	AA	5.0	O		16	&12	3	0.4		ROM
1996 07 10.84		B	5.9	SC	5.0	B		7	19	4			MOR04
1996 07 10.87		M	5.7	S	8.0	B		10	11	4			HOR02
1996 07 10.90		I	5.7	AA	0.0	E		1					ZAN
1996 07 10.91		S	5.8	AA	4.2	B		7	15	5			ZAN
1996 07 10.94		M	6.0	AA	5.0	B		12	14	5			TAN02
1996 07 10.94		S	6.0:	AA	6.0	B		20	&10	5			CHE03
1996 07 10.98		M	5.6	AA	3.4	B		9	&13	4			VIT01
1996 07 10.99		I	5.7	AA	0.0	E		1		0			PER01
1996 07 10.99		M	5.7	AA	3.4	B		9	&12	5			PER01
1996 07 10.99		S	5.8	AA	3.4	B		9	&12	5			PER01
1996 07 11.02		S	6.8	SC	20.3	L	5	40	& 8	s5/	&0.18	345	POR05
1996 07 11.05		B	6.0	AA	5.0	O		16	13	3	0.3		ROM
1996 07 11.21		S	5.7	SC	25.4	L	4	46	10	s6		45	DID
1996 07 11.31		M	6.6	SC	5.0	B		10	6.6	s5/			MOD
1996 07 11.41		M	5.2	AA	8.0	B		15	10	6			SEA01
1996 07 11.74		M	5.0	AA	5.0	B		10	10	6			SEA01
1996 07 11.83		M	6.8	SP	10	R	4	18	& 5	3			BAL03
1996 07 11.84		B	5.9	SC	5.0	B		7	19	4			MOR08
1996 07 11.88		S	5.7	AA	0.0	E		1					ZAN
1996 07 11.88		S	5.8	AA	4.2	B		7	15	5			ZAN
1996 07 11.92		S	6.2	AA	15.2	L	5	42	7	4	0.1	120	MOE
1996 07 11.98		I	5.6	AA	0.0	E		1					PER01
1996 07 11.98		M	5.6	AA	3.4	B		9	&14	5			PER01
1996 07 11.98		S	5.7	AA	3.4	B		9	&14	5			PER01
1996 07 11.99		B	5.8	AA	3.4	B		9	&13	5			VIT01
1996 07 11.99		M	5.5	AA	3.4	B		9	&13	5			VIT01
1996 07 11.99		S	5.6	AA	3.4	B		9	&13	5			VIT01
1996 07 12.17		S	5.5	SC	25.4	L	4	46	10	d5			DID
1996 07 12.60		P	5.6	HS	10.0	R	4			8			TAK05
1996 07 12.69		M	5.8	S	4.2	B		7	&10	6			YOS02
1996 07 12.87		S	6.0	AA	3.0	B		8	14	6		180	CSU
1996 07 12.89		S	5.8	AA	8.0	B		15	12	6	0.5	160	HAV
1996 07 12.90		S	5.4	AA	0.0	E		1					HAV
1996 07 12.90		S	5.6	AA	5.0	B		10	14	5	0.5	160	HAV
1996 07 12.92		S	6.3	VF	6.8	R	10	20	13	2			FIL05
1996 07 12.96		B	5.9	SC	5.0	B		7	20	4			MOR04
1996 07 12.96		M	6.1	AA	5.0	B		12	15	5			TAN02
1996 07 12.98		S	5.5	HD	6.0	B		20	20	6			TUB
1996 07 13.03		B	7.4	AA	5.0	B		7	3	0			SIM
1996 07 13.05		B	6.0	AA	6.0	R	10	24	13	3	0.3		ROM
1996 07 13.67		M	5.5	AA	5.0	B		10	10	6			SEA01
1996 07 13.70		M	5.8	S	10.0	B		20	8	6	9 m	10	YOS02
1996 07 13.84		B	5.9	SC	5.0	B		7	20	4			MOR04
1996 07 13.86		B	5.8	AA	5.0	B		7	15	D4			VEL03
1996 07 13.87		S	5.9	AA	5.0	B		7	16	6			KOS
1996 07 13.88		M	5.7	S	8.0	B		10	13	4			HOR02
1996 07 13.88		S	6.0	HD	5.0	B		10	15	5			SAN07
1996 07 13.89		M	5.6	TI	10	B		25	14	4			ZNO
1996 07 13.91		B	6.4	SC	6.3	B		8	13	3			GEE
1996 07 13.91		M	6.2	TI	5.0	B		7	10.5	4			KYS
1996 07 13.91		S	6.2	VF	6.0	R	4	8	20	4			FIL05
1996 07 13.92		B	6.1	AA	6.0	R	10	8	11	2			SER
1996 07 13.92		B	6.2	AA	5.0	B		10	9.3	4			HAS02
1996 07 13.92		S	5.6	SC	8.0	B		20	10	5/	0.1	355	OKS
1996 07 13.92		S	5.9	AA	3.0	B		8	10	6		180	CSU

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 13.93		S	6.3	SC	8.0	B		20	11	3			GIL01
1996 07 13.94		S	5.5	SC	5.0	B		10	15	4/			OKS
1996 07 13.94		S	5.8	AA	5.0	B		10	9	4			ABB
1996 07 13.94		S	6.1	SC	4.0	B		8	17	5/			SCH04
1996 07 13.95		B	6.0	AA	6.0	B		20	&12	6			CHE03
1996 07 13.96		B	6.0	AA	10	B		14	10	6	0.1	45	SHA02
1996 07 13.96		S	5.9	AA	5.0	B		7	12	6			SHA02
1996 07 13.96		S	6.1	SC	4.0	B		12	11	5			FEI
1996 07 13.97		B	6.0	S	10	R	4	25	15	4/			KON06
1996 07 13.99		S	6.2	AC	5.0	B		10	&10	4			COM
1996 07 14.00		S	5.8	S	6.0	B		12	15	3			KRA04
1996 07 14.02		S	6.4	AA	5.0	O		7	5				LUK05
1996 07 14.02		S	6.5	HD	16.2	L		42	10	D3	0.2	10	SZA02
1996 07 14.42		M	5.6	AA	8.0	B		15	11	4			SEA01
1996 07 14.74		M	5.3	AA	8.0	B		15	10	6			SEA01
1996 07 14.81		M	6.5	SP	10	R	4	18	& 5.3	3			BAL03
1996 07 14.84		B	5.9	SC	5.0	B		7	20	4			MOR04
1996 07 14.85		S	6.2	VF	6.0	R	4	8					FIL05
1996 07 14.87		B	5.9:	AA	5.0	B		7	13	D4			VEL03
1996 07 14.89		M	5.6	S	5	R	3	11	14	2/			PLS
1996 07 14.90		M	6.1	TI	5.0	B		7	12.5	4			KYS
1996 07 14.90		S	5.4	AA	0.0	E		1					HAV
1996 07 14.90		S	5.9	AA	3.0	B		8	12	6		180	CSU
1996 07 14.90		S	6.0	HD	5.0	B		10	15	s7			SAN07
1996 07 14.90		S	6.0	HD	8.0	B		10	25		0.3	15	HOR
1996 07 14.91		B	6.2	S	5.0	B		7	13				APF
1996 07 14.92		S	6.1	AA	15.2	L	5	42	7.5	4	0.1	120	MOE
1996 07 14.96		B	5.9	S	10	R	4	25	18	4/			KON06
1996 07 14.96		M	5.8	AA	5.0	B		12	12	4/			TAN02
1996 07 14.96		S	6.0	SC	4.0	B		12	8	5			FEI
1996 07 14.96		S	6.4	AA	12.5	R	5	20	5	2		270	BEA
1996 07 14.98		S	7.1	S	7.0	B		16	4.6	4			TAY
1996 07 15.06		B	6.0	AA	6.0	R	10	16	14	4	0.3		ROM
1996 07 15.20		S	6.0:	SC	20.3	L	5	40	&10	s6/	&0.18	10	POR05
1996 07 15.43		M	5.3	AA	5.0	B		10	12	5			SEA01
1996 07 15.55		M	6.1	AA	6	R		20	12	4			KAT01
1996 07 15.59		M	5.7	AA	3.5	B		7					TSU02
1996 07 15.76		M	5.5	AA	8.0	B		15	10	6			SEA01
1996 07 15.83		M	6.5	SP	10	R	4	18	& 5.5	4			BAL03
1996 07 15.84		B	5.9	SC	5.0	B		7	21	4			MOR04
1996 07 15.91		S	6.0	AA	3.0	B		8	11	6		180	CSU
1996 07 15.92		S	6.1	AA	15.2	L	5	42	8	4	0.2	110	MOE
1996 07 15.92		S	6.1	SC	4.0	B		8	&15	5/			SCH04
1996 07 15.93		S	6.4	AA	12.5	R	5	20	5	2		270	BEA
1996 07 15.94		S	5.8	AA	5.0	B		10	21	6			LOO01
1996 07 15.95		B	5.7	AA	10	B		14	13	6			SHA02
1996 07 15.95		S	5.8	AA	5.0	B		7	13	5			SHA02
1996 07 15.95		S	6.8	S	7.0	B		16	6.2	3			TAY
1996 07 15.96		S	5.5:	AA	0.8	E		1	12	3			SHA02
1996 07 15.97		B	6.3	S	5.0	B		7	13	7			BIV
1996 07 16.00		S	6.6	SC	20.3	L	5	40	& 8	s6/	&0.15	10	POR05
1996 07 16.07		B	6.0	AA	6.0	R	10	40	14	5	0.3		ROM
1996 07 16.44		S	5.4	AA	5.0	B		10	11	6			SEA01
1996 07 16.45		S	5.6	VN	5.0	B		10		6			WIL02
1996 07 16.52		B	5.8	AA	5.0	B		7	10	6			SOW
1996 07 16.58		S	5.3	S	15.0	R	5	25	7	6	0.11		NAG02
1996 07 16.63		M	6.1	AA	6	R		20	12	4			KAT01
1996 07 16.84		B	5.9	SC	5.0	B		7	21	4			MOR04
1996 07 16.88		S	5.6	SC	5.0	B		10	13	4			OKS
1996 07 16.89		B	6.3	AA	6.0	R	10	30	8	3	0.13		SER
1996 07 16.89		M	5.7	S	8.0	B		10	16	4	0.3	25	HOR02
1996 07 16.90		M	5.8	S	5	R	3	11	14	3/	0.5	20	PLS
1996 07 16.90		M	5.9	TI	11	L	7	32	9	6			KYS
1996 07 16.91		S	5.7	AA	5.0	B		10	21	4			LOO01
1996 07 16.91		S	6.0	AA	15.2	L	5	42	8	4	0.2	110	MOE

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 16.93		S	5.7	AA	5.0	B		7	15	5			SHA02
1996 07 16.93		S	6.1	SC	5.0	B		10	16	5			ZAN01
1996 07 16.94		B	6.1	AA	5.0	B		10	9.3	4			HAS02
1996 07 16.94		B	6.1	S	5.0	B		7	13	6			BIV
1996 07 16.95		M	5.9	AA	5.0	B		12	15	5			TAN02
1996 07 16.95		M	6.8	SC	5.0	B		10	8	4			AND03
1996 07 17.02		S	6.4	AA	12.5	R	5	20	10	4		310	BEA
1996 07 17.42		S	5.5	AA	5.0	B		10	12	5			SEA01
1996 07 17.67		B	6.0	HJ	5.0	B		7	&12	6			KIN
1996 07 17.75		S	5.5	AA	8.0	B		15	10	5			SEA01
1996 07 17.84		B	5.8	SC	5.0	B		7	20	4			MOR04
1996 07 17.87		S	5.9	HD	5.0	B		10	15	s7			SAN07
1996 07 17.89		B	6.4:	AA	6.0	R	10	15	12	1			SER
1996 07 17.90		M	6.7	AA	30	L	5	60	7	7			NEV
1996 07 17.93		S	6.0	SC	4.0	B		8	18	6			SCH04
1996 07 17.94		S	5.8	AA	4	R	8	8	20	6			L0001
1996 07 17.94		S	5.8	AA	6.3	R	13	52	25	6	36 m	125	KOS
1996 07 17.94		S	6.1	SC	8.0	B		20	16	4			GIL01
1996 07 17.94		S	6.3	AA	12.5	R	5	20	10	4		310	BEA
1996 07 17.94		S	7.1	S	7.0	B		16	5	5			TAY
1996 07 17.95		S	5.7	AA	5.0	B		7	15	5	0.1	30	SHA02
1996 07 17.96		B	6.1	S	5.0	B		7	16		0.4	130	BIV
1996 07 17.97		B	5.9	AA	5.0	B		7	16	D4			VEL03
1996 07 17.98		S	6.0	SC	5.0	B		10	16	5			ZAN01
1996 07 17.99		S	6.6:	SC	20.3	L	5	40	&12	s6/	&0.23	330	POR05
1996 07 18.02		S	5.3	S	0.8	E		1	18	3			SHA02
1996 07 18.10		B	6.0	AA	6.0	R	10	24	14	4	0.3		ROM
1996 07 18.24	!	J	5.9	SC	25.4	T	4		12.6	s5	5.4s	336	ROQ
1996 07 18.42		S	5.4	AA	5.0	B		10	12	5			SEA01
1996 07 18.56		M	6.0	AA	6	R		20	12	4			KAT01
1996 07 18.75		M	5.5	AA	8.0	B		15	10	5			SEA01
1996 07 18.84		B	5.8	SC	5.0	B		7	20	4			MOR04
1996 07 18.89		M	5.7	S	8.0	B		10	15	4	0.4	25	HOR02
1996 07 18.90		M	5.8	S	5.0	B		10	17	4	0.5	20	PLS
1996 07 18.91		B	6.4	S	5.0	B		7	14				APF
1996 07 18.91		M	5.9	TI	5.0	B		7	10	3			KYS
1996 07 18.91		S	6.0	SC	5.0	B		10	16	5			ZAN01
1996 07 18.91		S	6.1	AA	15.2	L	5	42	9	4	0.2	110	MOE
1996 07 18.92		B	5.6	AA	5.0	B		10					HAS02
1996 07 18.93		S	5.6	AA	6.3	B		9	12	6/			KAM01
1996 07 18.93		S	6.2	TI	5.0	B		7	13	2			DRE
1996 07 18.95		S	5.8	SC	4.0	B		12	10	6			FEI
1996 07 18.97		B	5.8:	S	10	R	4	25	20	4/	0.3		KON06
1996 07 18.97		B	6.1	S	5.0	B		7	13	6			BIV
1996 07 19.01		S	5.8	SC	5.0	B		10	&12	5			COM
1996 07 19.30		S	5.8	AA	8.0	B		20		7			PEA
1996 07 19.52		S	5.7	VN	5.0	B		10		5			WIL02
1996 07 19.58		S	5.5	AA	2.5	B		2					SEA
1996 07 19.62		S	5.9	VG	5.0	B		7	15	5			NAG08
1996 07 19.71		M	5.6	AA	8.0	B		15	10	5			SEA01
1996 07 19.81		M	6.2	SP	10	R	4	18	& 6	4			BAL03
1996 07 19.84		B	5.8	SC	5.0	B		7	20	4			MOR04
1996 07 19.86		M	5.9	TI	8.0	B		10	11	4			KYS
1996 07 19.88		M	5.7	S	8.0	B		10	18	4	0.4	25	HOR02
1996 07 19.88		S	5.8	AA	3.0	B		8	14	6			CSU
1996 07 19.90		S	5.5	SC	5.0	B		10	15	5			OKS
1996 07 19.90		S	5.8	HD	5.0	B		10	20	s7			SAN07
1996 07 19.90		S	6.2	HD	16.2	L		42	12	D3			SZA02
1996 07 19.91		M	5.8	TI	5.0	B		10	17	4			PLS
1996 07 19.91		O	5.8:	TI	0.0	E		1					KYS
1996 07 19.91		S	6.1	AA	15.2	L	5	42	9	4	0.2	100	MOE
1996 07 19.91		S	6.3	TI	5.0	B		7	13	1/			DRE
1996 07 19.94		S	6.0	SC	5.0	B		10	16	5			ZAN01
1996 07 19.95		B	5.9	S	10	R	4	25	20	4/	0.3		KON06
1996 07 19.95		B	6.2	S	5.0	B		7	14	6			BIV

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 19.95		S	5.7	AA	5.0	B		7	15	5			SHA02
1996 07 19.96		S	6.0	AA	5.0	B		10	13	4			MEY
1996 07 19.97		S	6.1	SC	5.0	B		10	17	5/			SCH04
1996 07 19.98		S	5.6	AA	8.0	B		11	16	6	1.2	295	DES01
1996 07 20.00		M	6.0	AA	5.0	B		12		5			TAN02
1996 07 20.01		S	5.7	SC	5.0	B		10	&10	4/			COM
1996 07 20.06		S	6.0:	SC	20.3	L	5	40	&15	s7	&0.20	350	POR05
1996 07 20.11		S	5.7	HP	5.0	B		10	14	5/			BOR
1996 07 20.26		S	5.2	SC	25.4	L	4	46	10	D5			DID
1996 07 20.30		M	6.3	SC	5.0	B		10	7.4	s5/			MOD
1996 07 20.31		S	5.8	AA	8.0	B		20	12	7	0.33	106	PEA
1996 07 20.55		M	5.7	S	10.0	B		20	12	7	9 m	20	YOS02
1996 07 20.61		M	6.0	AA	6	R		20	10	3			KAT01
1996 07 20.71		M	5.5	AA	8.0	B		15	11	5			SEA01
1996 07 20.84		B	5.8	SC	5.0	B		7	20	4			MOR08
1996 07 20.85		M	5.4	S	10	B		25	20	4			ZNO
1996 07 20.86		M	6.8	SC	5.0	B		10	6	4			AND03
1996 07 20.88		B	5.9	AA	5.0	B		7	20	D4			VEL03
1996 07 20.89		M	5.7	S	8.0	B		10	16	4	0.4	25	HOR02
1996 07 20.89		M	5.8	S	5.0	B		10	17	4	0.3	25	PLS
1996 07 20.89		S	6.0	AA	15.2	L	5	42	9	4	0.2	100	MOE
1996 07 20.90		M	6.0	TI	8.0	B		10	12	3/			KYS
1996 07 20.90		S	5.7	HD	5.0	B		10	20	6/			SAN07
1996 07 20.93		S	5.5	AA	5.0	B		7	13	3			SHA02
1996 07 20.93		S	5.8	AA	7.5	R	4	30	6				LUK05
1996 07 20.94		B	5.7	S	10	R	4	25	20	4/	0.4		KON06
1996 07 20.94		B	5.9	AA	5.0	B		7		5			CHE03
1996 07 20.94		M	6.1	AA	5.0	B		12	15	5			TAN02
1996 07 20.95		S	6.0	AA	5.0	B		10	11	D4			MEY
1996 07 20.96		B	6.0	S	5.0	B		7	14	7	0.4	130	BIV
1996 07 20.96		S	5.7	SC	5.0	B		7	&10	4/			COM
1996 07 20.96		S	6.3:	AA	3.5	B	8	7					RYZ
1996 07 20.97		S	5.6	AA	8.0	B		11	16	6/	1.2	295	DES01
1996 07 20.97		S	6.0	SC	5.0	B		10	16	5			ZAN01
1996 07 21.06		S	5.8:	SC	20.3	L	5	40	&15	s7	&0.25	350	POR05
1996 07 21.10		B	6.0	AA	6.0	R	10	16	14	5	0.3		ROM
1996 07 21.15		S	5.7	HP	5.0	B		10	13	6	0.8	150	BOR
1996 07 21.22		M	6.2	SC	5.0	B		10	9	s6	0.5	130	MOD
1996 07 21.22		S	5.3:	SC	0.8	E		1	&18	2			MOD
1996 07 21.46		S	5.5	AA	2.5	B		2					SEA
1996 07 21.50		S	6.0	VG	5.0	B		7	15	5			NAG08
1996 07 21.52		S	5.2	S	15.0	R	5	25	5	6/	0.10		NAG02
1996 07 21.56		S	5.4	AA	0.0	E		1					SEA
1996 07 21.71		M	5.4	AA	8.0	B		15	11	4			SEA01
1996 07 21.83		M	7.0	SC	5.0	B		10	8	4			AND03
1996 07 21.86		M	6.0	TI	20	L	4	34	10	4/			KYS
1996 07 21.88		M	5.6	S	5.0	B		10	17	4			PLS
1996 07 21.89		M	5.6	S	8.0	B		10	12	4			HOR02
1996 07 21.89		S	5.8	AA	3.0	B		8	13	6			CSU
1996 07 21.90		M	5.7	SC	8.0	B		20	10	6			OKS
1996 07 21.90		S	6.1:	VF	6.0	R	4	8		3			FIL05
1996 07 21.91		B	6.0	S	5.0	B		7	15	5			BIV
1996 07 21.91		S	5.5	SC	5.0	B		10	14	5			OKS
1996 07 21.91		S	5.8	AA	6.3	R	13	52	23	6	51 m	120	KOS
1996 07 21.91		S	6.0	AA	15.2	L	5	42	10	4	0.3	100	MOE
1996 07 21.92		M	5.8	AA	5.0	B		12	13	5			TAN02
1996 07 21.93					7.0	B		20	16	6	0.5	49	TAN02
1996 07 21.93		B	5.9	AA	5.0	B		7	20	D4			VEL03
1996 07 21.93		S	5.5	AA	4.0	B		3	12	4			SHA02
1996 07 21.93		S	6.1	AA	5.0	B		10	11	D5			MEY
1996 07 21.94		S	5.5	AA	5.0	B		7	18	5			SHA02
1996 07 21.94		S	6.8	S	7.0	B		16	7.5	2			TAY
1996 07 21.95		S	5.2	AA	0.0	E		1					HAV
1996 07 21.95		S	5.5	AA	5.0	B		10	13	5/	0.4	143	HAV
1996 07 21.95		S	5.9	SC	5.0	B		10	20	5			ZAN01

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 21.96		S	5.7	AA	8.0	B		11	15	6/	1.2	295	DES01
1996 07 22.47		S	5.7	VN	5.0	B		10		5			WIL02
1996 07 22.70		M	5.4	AA	8.0	B		10	10	5			SEA01
1996 07 22.71		M	5.5	AA	5.0	B		10	10	5			SEA01
1996 07 22.85		S	5.8	AA	3.0	B		8	14	6			CSU
1996 07 22.86		M	5.5	S	10	B		25	20	4			ZNO
1996 07 22.86		M	5.6	S	5.0	B		10	17	4			PLS
1996 07 22.88		B	6.7	AA	6.0	R	10	30	13	5	0.1		SER
1996 07 22.89		S	6.1	AA	15.2	L	5	42	9	4			MOE
1996 07 22.90		B	6.0	AA	5.0	B		7	19	D4			VEL03
1996 07 22.90		B	6.6	SC	6.3	B		8	12	1/			GEE
1996 07 22.90		M	5.3	S	0.0	E		1	25	3			HOR02
1996 07 22.90		M	6.0	TI	20	L	4	34	12	5			KYS
1996 07 22.90		S	5.8	HD	5.0	B		10	20	6			BUS04
1996 07 22.91		O	5.5	TI	0.0	E		1	15	3			KYS
1996 07 22.92		B	5.7	AA	5.0	B		10	8.4	4			HAS02
1996 07 22.92		B	5.9	AA	5.0	B		7	&15	5			CHE03
1996 07 22.92		S	5.8	SC	4.0	B		8	16	5/			SCH04
1996 07 22.93		B	6.3	S	5.0	B		7	14				APF
1996 07 22.93		S	5.5	AA	6.3	B		9	12	6/			KAM01
1996 07 22.94		B	5.7	S	10	R	4	25	22	4	0.4		KON06
1996 07 22.94		B	5.8	SC	5.0	B		7	20	4			MOR04
1996 07 22.94		S	5.1	AA	0.8	E		1	24	3			SHA02
1996 07 22.94		S	5.5	AA	5.0	B		7	15	6			SHA02
1996 07 22.95		S	5.7	AA	8.0	B		11	15	6/	1.2	295	DES01
1996 07 22.96		S	6.0	AA	4	R	8	8	20	6			LOO01
1996 07 22.97		B	6.1	S	5.0	B		7	15	5			BIV
1996 07 22.99		S	5.6	AA	5.0	B		12	15	4/			TAN02
1996 07 23.10		B	5.9	AA	6.0	R	10	16	15	6	0.3		ROM
1996 07 23.15		M	6.4	SC	5.0	B		10	7.0	s5			MOD
1996 07 23.15		S	5.7	HP	5.0	B		10	15	6	0.8	150	BOR
1996 07 23.68		B	6.0	S	7.6	R	5	15		6			TSU03
1996 07 23.68		S	6.3	S	7.6	R	5	15		6			TSU03
1996 07 23.71		M	5.5	AA	8.0	B		15	12	4			SEA01
1996 07 23.87		B	6.9	AA	6.0	R	10	8	15	4	0.13		SER
1996 07 23.89		B	5.9	AA	5.0	B		7	19	D4			VEL03
1996 07 23.89		S	5.8	AA	3.0	B		8	12	6			CSU
1996 07 23.92					20	A	22		2.8	S5	0.06	355	BOR04
1996 07 23.92		E	5.5	AA	7.5	R	4	30	6				LUK05
1996 07 23.92		S	5.9	AA	4	R	8	8	21	6			LOO01
1996 07 23.94		S	5.8:	AC	20.3	T	10	50	&15				ANZ
1996 07 23.96		B	5.8	SC	5.0	B		7	20	4			MOR04
1996 07 23.96		S	5.6	AA	8.0	B		11	17	6/			DES01
1996 07 24.00		B	6.2	S	5.0	B		7	13	5			BIV
1996 07 24.10		B	5.9:	AA	6.0	R	10	40	&15	5	0.4		ROM
1996 07 24.26		M	6.4	SC	5.0	B		10	8	s5/			MOD
1996 07 24.43		S	5.7	VN	5.0	B		10		5			WIL02
1996 07 24.53		S	5.2	S	15.0	R	5	25	6	6	0.1		NAG02
1996 07 24.54		S	5.4	AA	2.5	B		2					SEA
1996 07 24.54		S	5.8	AA	8.0	B		20	12.5	7			PEA
1996 07 24.64		M	5.7	S	3.5	B		7					TSU02
1996 07 24.70		M	5.3	AA	5.0	B		10	10	4			SEA01
1996 07 24.70		M	5.5	AA	8.0	B		15	10	4	0.1	265	SEA01
1996 07 24.86		M	5.6	S	6.0	B		12	22	4	0.4		KON06
1996 07 24.90		S	5.8	AA	4	R	8	8	21	6			LOO01
1996 07 24.90		S	5.9	SC	5.0	B		10	20	5			ZAN01
1996 07 24.92		B	6.2	S	5.0	B		7	14	5			BIV
1996 07 24.96		B	5.8	SC	5.0	B		7	21	4			MOR04
1996 07 24.96		S	5.6	AA	8.0	B		11	17	7			DES01
1996 07 24.98		M	5.6	AA	5.0	B		12	16	4/			TAN02
1996 07 24.99					7.0	B		20	16	4	0.5	41	TAN02
1996 07 25.74		M	5.4	AA	8.0	B		15	10	4			SEA01
1996 07 25.81		M	6.3	SP	10	R	4	18	6	4	0.2		BAL03
1996 07 25.89		S	6.1	AA	15.2	L	5	42	9	4			MOE
1996 07 26.00		S	5.9	AA	5.0	B		7	15	s4			SHA02

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 26.89		B	5.9:	AA	6.0	B		20		4			CHE03
1996 07 26.95		B	5.8	AA	11	L	7	32	11	4			BAR06
1996 07 26.97		B	5.9	AA	5.0	B		7	15	d3			VEL03
1996 07 26.99		S	5.6	AA	5	R		20	16	3			BAR06
1996 07 27.27		S	5.7	AA	8.0	B		11	10	4/			SPR
1996 07 27.82		S	5.7	AA	20.3	L	6	38	15	7	0.08	30	MEN03
1996 07 27.87		S	6.0:	AA	11.0	B		20	&10	4			CHE03
1996 07 29.08		S	5.8:	SC	20.3	L	5	40		7	&0.12	20	POR05
1996 07 30.85		O	5.4	S	0.0	E		1	15	5			ZNO
1996 07 30.89		M	5.6	S	8.0	B		10	12	4			HOR02
1996 07 30.90		S	6.0:	AA	15.2	L	5	42	9	4			MOE
1996 07 30.98		S	6.2:	SC	20.3	L	5	40		6	&0.12	25	POR05
1996 07 31.35		M	5.3	AA	5.0	B		10	10	4			SEA01
1996 07 31.50		S	5.1	S	15.0	R	5	25	7	6	0.1		NAG02
1996 07 31.81		M	6.2	SP	10	R	4	18	6.5	4	0.3		BAL03
1996 07 31.85		B	5.7	AA	11	L	7	56	20	4			BAR06
1996 07 31.86		S	6.0:	AA	6.0	B		20		4			CHE03
1996 07 31.93		S	5.9	AA	8.0	B		10	9	4			SHA02
1996 07 31.93		S	6.0	AA	5.0	B		7	9	3			SHA02
1996 07 31.95		S	5.6	AA	8.0	B		11	18	6	1		DES01
1996 07 31.96		S	5.8	SC	20.3	L	5	40	&15	s7	&0.25	40	POR05
1996 08 01.00		S	6.0	AA	4	R	8	8	12	6			LOO01
1996 08 01.27		S	5.6	AA	8.0	B		11	15	4/			SPR
1996 08 01.37		M	5.2	AA	5.0	B		10	13	3			SEA01
1996 08 01.38		M	5.3	AA	8.0	B		15	12	4	0.1	310	SEA01
1996 08 01.78		B	5.8	SC	5.0	B		7	20	4			MOR04
1996 08 01.82		S	5.6	AA	5.0	B		12		4			TAN02
1996 08 01.84		S	5.8	HD	5.0	B		10	>10	S6			SAN07
1996 08 01.84		S	6.0	HD	6.0	B		20	20	6			TUB
1996 08 01.85		B	6.3:	AA	6.0	R	10	15	9	3			SER
1996 08 01.86		M	5.5	S	8.0	B		10	16	4/			PLS
1996 08 01.86		O	5.3	S	0.0	E		1	15	4/			ZNO
1996 08 01.87		M	5.5	S	8.0	B		10	11	4			HOR02
1996 08 01.87		S	5.7	AA	11	L	7	56	20	4			BAR06
1996 08 01.88		M	5.8	AA	3.4	B		9	&12	7			PER01
1996 08 01.88		S	5.6	SC	5.0	B		7	13	5			OKS
1996 08 01.88		S	5.8	AA	3.4	B		9	&12	7			PER01
1996 08 01.89		M	5.8	AA	3.4	B		9	&10	5			VIT01
1996 08 01.90		M	6.6	SC	5.0	B		10	9	4			AND03
1996 08 01.91		S	6.1	S	4.0	B		8	9.6	3			TAY
1996 08 01.92		B	5.9:	AA	6.0	R	10	40	&12	4	0.4		ROM
1996 08 01.92		M	5.1	TI	5.0	B		7	12	3/			KYS
1996 08 01.95		S	5.6	AA	8.0	B		11	18	6	1		DES01
1996 08 01.96		S	5.5	AA	8.0	B		20	20	5	1.0	355	LOU
1996 08 01.96		S	5.8:	SC	20.3	L	5	40	&15	s7	&0.20	25	POR05
1996 08 01.98		B	5.9	S	5.0	B		7	12	3			TRI
1996 08 02.36			5.8	SC	0.0	E		1					SEA01
1996 08 02.37		M	5.4	AA	5.0	B		10	12	4			SEA01
1996 08 02.43		S	5.4	AA	2.5	B		2					SEA
1996 08 02.66		M	6.0	AA	6	R		20	10	4			KAT01
1996 08 02.76		B	6.5	SC	6.0	R	5	6	15	s5			KRY01
1996 08 02.80		B	5.8	SC	5.0	B		7	20	4			MOR04
1996 08 02.82		S	5.6	AA	5.0	B		12	13	6			TAN02
1996 08 02.82		S	6.3:	VF	6.0	R	4	8		3			FIL05
1996 08 02.84	!	V	6.1	YF	20.0	T	2		&22	7	&1	140	MIK
1996 08 02.85		M	6.7	SC	5.0	B		10	8	3			AND03
1996 08 02.85		S	5.8	AA	11	L	7	56	19	4			BAR06
1996 08 02.88		S	5.7	AA	3.4	B		9	&15	5			PER01
1996 08 02.89		S	5.8	SC	5.0	B		10	&20	5			SCH04
1996 08 02.89		S	5.9	AA	15.2	L	5	42	11	4	0.6	90	MOE
1996 08 02.90		B	6.8	SC	6.3	B		8	10	1			GEE
1996 08 02.90		S	6.5	SC	5.0	B		10	5	4			LAA
1996 08 02.92		S	6.4	S	7.0	B		16	7.2	3			TAY
1996 08 02.93		S	5.5	AA	5.0	B		10	15	5			BOU
1996 08 02.95		B	5.8:	AA	6.0	R	10	24	&12	3	0.4		ROM

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 02.96		B	5.8	S	5.0	B		7	18	4			TRI
1996 08 02.96		S	5.7	AA	8.0	B		11	18	6	1		DES01
1996 08 02.97		S	5.5	AA	8.0	B		20	20	5	1.0	355	LOU
1996 08 03.35		M	5.5	AA	5.0	B		10	11	4			SEA01
1996 08 03.42		S	5.5	AA	2.5	B		2					SEA
1996 08 03.48		M	5.5	AA	3.5	B		10	&15	4/			NAK01
1996 08 03.50		S	5.1	S	15.0	R	5	25	6	6	0.11		NAG02
1996 08 03.53		M	5.6	AA	10.0	B		20	12	7	15 m	120	YOS02
1996 08 03.86		B	5.7	S	5.0	B		7	20	4	0.45	130	TRI
1996 08 03.86		S	5.7	AA	5.0	B		10	13	d4			MEY
1996 08 03.87		B	6.4	AA	6.0	R	10	15	12	3	0.1		SER
1996 08 03.88		S	5.6	AA	5.0	B		12	13	5			TAN02
1996 08 03.89		S	5.3:	S	0.0	E		1		5			MAR02
1996 08 03.89		S	5.7	AA	3.4	B		9	&17	4			PER01
1996 08 03.90		B	5.9	AA	5.0	B		7	&13	5			CHE03
1996 08 03.90		M	5.5	AA	5.0	B		7	16	5/			BOU
1996 08 03.90		M	5.5	S	7.0	B		10	13	7	0.8	140	MAR02
1996 08 03.90		S	5.5:	SC	5.0	B		7	15	s4			OKS
1996 08 03.90		S	5.8	AA	5.0	B		10	&12	5			COM
1996 08 03.90		S	5.9	AA	3.4	B		9	&11	3			VIT01
1996 08 03.91		S	5.8	SC	5.0	B		10	15	5			ZAN01
1996 08 03.92		S	5.5	AA	5.0	B		7	9	4	0.75	60	SHA02
1996 08 03.93					15.0	B		25	9.5	5	0.3	35	ZAN
1996 08 03.93		S	5.6	AA	4.2	B		7	14	5	0.2	100	ZAN
1996 08 03.96		S	5.6	AA	8.0	B		11	16	6	1		DES01
1996 08 03.97		S	5.9	AA	5.0	B		10	12	5	0.5	80	MOE
1996 08 04.36		M	5.6	AA	8.0	B		15	12	4	12 m	265	SEA01
1996 08 04.52		S	5.6	AA	8.0	B		20	14	6		70	PEA
1996 08 04.54		P	5.3	AA	10.0	R	4			7			TAK05
1996 08 04.63		S	6.2	S	7.0	B		10		4			TSU03
1996 08 04.76		B	6.2	SC	8.0	B		10	15	s4	0.5	115	KRY01
1996 08 04.76		S	6.0	AA	8.0	B		10	13	s4	1.1	130	MAT07
1996 08 04.85		S	5.7	AA	5.0	B		12	11	4/			TAN02
1996 08 04.86		S	5.8	HD	6.0	B		20	40	6	1.5	80	TUB
1996 08 04.87		B	6.6	AA	6.0	R	10	15	10	4	0.1		SER
1996 08 04.88		B	5.6	AA	5.0	B		7		5			CHE03
1996 08 04.88		B	6.9	SC	6.3	B		8	10	1			GEE
1996 08 04.89		B	5.9	S	5.0	B		7	12	5			BIV
1996 08 04.89		S	5.9	AA	4	R	8	8	13	6			LOO01
1996 08 04.90		S	5.6	AA	5.0	B		7	15	5			BOU
1996 08 04.90		S	5.6	AA	5.0	B		10	&10	5			COM
1996 08 04.90		S	5.9	AA	15.2	L	5	42	13	5	0.7	80	MOE
1996 08 04.92		M	5.8	AA	3.4	B		9	&15	6			PER01
1996 08 04.92		S	5.8	AA	3.4	B		9	&15	6			PER01
1996 08 04.92		S	6.5	SC	5.0	B		10	5	5			LAA
1996 08 04.93					15.0	B		25	9.5	5	0.3	35	ZAN
1996 08 04.93		S	5.5	AA	4.2	B		7	14	5	0.2	100	ZAN
1996 08 04.93		S	5.8	AA	3.4	B		9	&12	3/			VIT01
1996 08 04.94					10	B		14	15	s5	0.75	60	SHA02
1996 08 04.94		S	5.5	AA	5.0	B		7	12	5			SHA02
1996 08 04.95		S	5.6	AA	8.0	B		11	18	6	>1		DES01
1996 08 04.95		S	5.8	SC	5.0	B		10	15	5			ZAN01
1996 08 04.96		S	5.8	SC	20.3	L	5	40	&15	s7	&0.25	5	POR05
1996 08 04.97		S	5.7	SC	4.0	B		8	&15	4			SCH04
1996 08 04.98		S	5.6	AA	5.0	B		7	25	5			DIE02
1996 08 05.02		S	5.4	AA	8.0	B		20	18	5/	1.2	355	LOU
1996 08 05.47		M	5.7	AA	6	R		20	12	4			KAT01
1996 08 05.48		S	5.1	S	15.0	R	5	25	7	6	0.10		NAG02
1996 08 05.50		M	5.5	AA	5.0	B		10	13	4			SEA01
1996 08 05.50		S	6.0	VG	5.0	B		7	15	6	0.3	110	NAG08
1996 08 05.54		C	6.1:	GA	8.0	R	6		19.5		>51 m	125	NAK01
1996 08 05.54		S	5.4	AA	0.0	E		1					SEA
1996 08 05.80		B	5.9	SC	5.0	B		7	22	4			MOR08
1996 08 05.84		B	6.3	SC	6.0	R	5	6	15	s4			KRY01
1996 08 05.85		S	6.0	AA	3.0	B		8	12	6	0.17	75	CSU

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 05.88		S	5.8	AA	15.2	L	5	42	13	5	0.7	80	MOE
1996 08 05.89		B	5.6	AA	5.0	B		7	&14	5			CHE03
1996 08 05.89		B	7.0	SC	6.3	B		8	9	1			GEE
1996 08 05.90		M	5.6	AA	5.0	B		10	15	5			BOU
1996 08 05.90		S	5.6	SC	5.0	B		10	&12	5			COM
1996 08 05.92		S	7.0	SC	5.0	B		10	5	6			LAA
1996 08 05.93		S	5.4	AA	8.0	B		20	18	6	1.2	355	LOU
1996 08 05.93		S	5.7	SC	4.0	B		8	&20	4			SCH04
1996 08 05.93		S	5.8	AA	4	R	8	8	12	4			LOO01
1996 08 05.96		S	5.6	AA	8.0	B		11	18	5/	>1		DES01
1996 08 05.98		S	5.8	SC	20.3	L	5	40	&20	s7	&0.30	5	POR05
1996 08 06.25		S	5.6	AA	8.0	B		11	15	4/			SPR
1996 08 06.40		M	5.5	AA	8.0	B		15	10	5			SEA01
1996 08 06.48		S	5.8	SC	3.0	B		10	15	D4			SHI
1996 08 06.51		M	5.6	AA	3.5	B		10	16	5			NAK01
1996 08 06.84		S	6.2	AA	5.0	B		7	16	6	1.2	115	KOS
1996 08 06.85		S	6.3	NP	6.0	O		20	12	5			SHU
1996 08 06.88		M	6.8	AA	30	L	5	60	6	6	0.25		NEV
1996 08 06.89	!	V	5.9	YF	20.0	T	2		&24	7	&1	130	MIK
1996 08 06.90		B	5.6	S	5.0	B		7	15	3			TRI
1996 08 06.91		B	5.8	AA	6.0	B		20	&15	5			CHE03
1996 08 06.94		S	5.6	S	6.0	B		10	9	5			SAN04
1996 08 06.94		S	5.7	HI	5.0	B		10	10	5			GRA04
1996 08 06.96		S	5.6	AA	8.0	B		11	18	5/	>1		DES01
1996 08 06.96		S	5.8:	SC	20.3	L	5	40	&20	s7	&0.25	20	POR05
1996 08 07.00		S	5.5	SC	20.3	L	5	40	&25	s7	&0.30	5	POR05
1996 08 07.23	!	J	5.4	SC	25.4	T	4		26	s5	42.0s	350	ROQ
1996 08 07.25		S	5.6	AA	8.0	B		11	12	4/			SPR
1996 08 07.42			5.5	SC	0.0	E		1					SEA01
1996 08 07.44		M	5.8	SC	8.0	B		15	9	4	16 m	275	SEA01
1996 08 07.45		I	5.0	SC	0.7	E		1					CAM03
1996 08 07.45		S	5.2	SC	8.0	B		20	15	s6	1.5	110	CAM03
1996 08 07.64		S	6.0	S	5.6	B		8	9.2	5			OKA05
1996 08 07.83		B	6.8	AA	6.0	R	10	15	9	4	0.1		SER
1996 08 07.85		S	6.3	NP	6.0	O		20	13	6			SHU
1996 08 07.85		S	6.5	AA	7	R	6	26	10	7			NEK
1996 08 07.86		B	6.3	S	8.0	B	10	10	9.4	7	0.23		PAV
1996 08 07.88		S	5.7	AA	5.0	B		12	17	4/			TAN02
1996 08 07.89		B	5.8:	AA	6.0	B		20	&15	5			CHE03
1996 08 07.89		M	5.7	AA	3.4	B		9	&15	5			PER01
1996 08 07.89		S	5.6	AA	3.4	B		9	&15	5			PER01
1996 08 07.89		S	6.0	AA	5.0	B		7	9	s3			SHA02
1996 08 07.90		S	5.6	AA	3.4	B		9	&14	4/			VIT01
1996 08 07.90		S	5.7	SC	5.0	B		10	18	5			ZAN01
1996 08 07.91		S	5.5	SC	6.8	L	11	38					ASP
1996 08 07.92		B	6.0	S	5.0	B		7	11	5			BIV
1996 08 07.92		E	6.4	AA	7.5	R	4	30	7				LUK05
1996 08 07.95		S	5.5	AA	8.0	B		11	18	6	>1		DES01
1996 08 08.25		S	5.5	AA	5.0	B		7	12	4/			SPR
1996 08 08.47		I	5.0	SC	0.7	E		1					CAM03
1996 08 08.47		M	5.9	AA	6	R		20	10	4			KAT01
1996 08 08.47		S	5.2	SC	8.0	B		20	15	5	1.5	110	CAM03
1996 08 08.55		S	5.9	VG	5.0	B		7	15	6	0.3	110	NAG08
1996 08 08.76		B	5.8	SP	6.0	R	5	20	15	s4	0.8	125	KRY01
1996 08 08.84		M	6.0	NP	19	L	5	50	14	6	0.37	65	SHU
1996 08 08.85		S	6.1	AA	6.3	R	13	52	15	6	0.7	115	KOS
1996 08 08.85		S	6.1	AA	7	R	6	26	13	7	0.33	65	NEK
1996 08 08.87		B	5.9	AA	3.2	B		8	10.9	4			HAS02
1996 08 08.87		M	5.8	AA	5.0	B		12	17	4/			TAN02
1996 08 08.87		O	5.5	S	0.0	E		1	16	4			ZNO
1996 08 08.88		M	5.6	AA	3.4	B		9	&16	5/			PER01
1996 08 08.88		S	5.6	AA	3.4	B		9	&16	5/			PER01
1996 08 08.88		S	5.7	HD	4.8	R	4	7	>10	6			SAR02
1996 08 08.88		S	6.0	AA	3.0	B		8	12	6			CSU
1996 08 08.89		S	5.6	AA	3.4	B		9	&14	4/			VIT01

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 08.90		S	5.8:	AA	5.0	B		10	12	4			MOE
1996 08 08.93		S	5.7	SC	5.0	B		10	18	5			ZAN01
1996 08 08.93		S	6.0	AA	4	R	8	8	9	4			L0001
1996 08 08.94		S	5.5	AA	8.0	B		11	18	5/	>1		DES01
1996 08 08.95		S	5.5	SC	6.8	L	11	38					ASP
1996 08 08.97		B	5.7	S	8.0	B		8	21	4	0.65	130	TRI
1996 08 09.25		S	5.5	AA	5.0	B		7	14	4/			SPR
1996 08 09.40		M	5.6	AA	8.0	B		15	13	5	8 m		SEA01
1996 08 09.50		M	5.7	AA	6	R		20	12	4			KAT01
1996 08 09.50		S	5.4	AA	2.5	B		2					SEA
1996 08 09.60		S	5.7	AA	8.0	B		20	11.5	6	0.75	133	PEA
1996 08 09.80		B	5.9	SC	5.0	B		7	21	5	0.5	135	MOR04
1996 08 09.81		S	5.4	S	3	R	7	10	23	2			BOR04
1996 08 09.83		M	6.0	NP	19	L	5	50	25	5	0.66	107	SHU
1996 08 09.83		M	6.0	SP	10	R	4	18	7.5	5	0.5		BAL03
1996 08 09.83		S	5.6	S	5	R	8	20	18	4			BOR04
1996 08 09.85		B	5.8	AA	5.0	B		7	19	S5			VEL03
1996 08 09.85		M	4.9	TI	5.0	B		7	19	3/			KYS
1996 08 09.85		M	6.5	SC	5.0	B		10	8	4			AND03
1996 08 09.85		S	6.1	AA	7	R	6	26	15	6	0.38		NEK
1996 08 09.85		S	6.1:	VF	6.0	R	4	8	10				FIL05
1996 08 09.86		K	6.2	AA	11.0	B		20	10	6	0.8	132	NEV
1996 08 09.87		M	5.3	S	0.0	E		1	20	3			HOR02
1996 08 09.87		M	5.7	HD	5.0	B		10	30	s6	1.5	130	SAN07
1996 08 09.89		B	5.7	AA	6.0	B		20		4			CHE03
1996 08 09.89		M	5.5	S	10	B		25	22	3/	1.2	110	ZNO
1996 08 09.89		S	5.6	AA	5.0	B		7	25	5			DIE02
1996 08 09.90		M	5.7	AA	3.4	B		9	&15	6			PER01
1996 08 09.90		M	5.7	SC	8.0	B		20	11	5/	0.3	40	OKS
1996 08 09.90		S	5.5	AA	3.4	B		9	&15	6			PER01
1996 08 09.90		S	5.6	SC	5.0	B		10	10	5			FEI
1996 08 09.90		S	5.7	SC	5.0	B		10	&20	5			COM
1996 08 09.91		O	5.3	S	0.0	E		1	18	4			ZNO
1996 08 09.91		S	5.6	AA	3.4	B		9	&15	4/			VIT01
1996 08 09.92		M	5.7	AA	3.4	B		9	&14	4			VIT01
1996 08 09.93		S	5.3	SC	6.8	L	11	38					ASP
1996 08 09.93		S	6.1	AA	4	R	8	8	7	3			L0001
1996 08 09.94		B	5.7	AA	6.0	R	10	16	18	4	0.3		ROM
1996 08 09.94		S	5.7	SC	5.0	B		10	18	5			ZAN01
1996 08 09.95		B	5.8	S	8.0	B		8	23	4	0.75	140	TRI
1996 08 09.95		S	5.5	AA	8.0	B		11	18	5/	>1		DES01
1996 08 10.01		S	5.6	S	7.0	B		10	13	7	0.5	140	MAR02
1996 08 10.09		S	5.4	SC	6.0	R		16	15	s1		35	DID
1996 08 10.10		S	5.4	SC	25.4	L	4	46	15	D5		25	DID
1996 08 10.18		M	6.3	SC	5.0	B		10	10	s6	0.8	135	MOD
1996 08 10.40		S	5.3	AA	2.5	B		2					SEA
1996 08 10.42		I	5.0	SC	0.7	E		1					CAM03
1996 08 10.42		S	5.2	SC	8.0	B		15		5	1.5	110	CAM03
1996 08 10.58		S	5.7	AA	0.0	E		1					PEA
1996 08 10.58		S	5.7	AA	8.0	B		20	14	6	1.1	126	PEA
1996 08 10.60		S	6.0	S	5.6	B		8	11.5	6			OKA05
1996 08 10.80		B	5.8	SC	5.0	B		7	15	5	0.5	135	MOR04
1996 08 10.82		M	5.8	AA	5.0	B		12	15	5			TAN02
1996 08 10.83		B	6.7	AA	6.0	R	10	15	12	5	0.1		SER
1996 08 10.84		O	5.2	S	0.0	E		1	20	4			ZNO
1996 08 10.84		S	6.0	VF	6.0	R	4	8					FIL05
1996 08 10.85		K	6.4	AA	11.0	B		20	9	6	0.4	126	NEV
1996 08 10.85		M	5.5	S	10	B		25	22	3/	0.9	115	ZNO
1996 08 10.87		M	6.0	NP	19	L	5	38	22	6	0.91	114	SHU
1996 08 10.87		S	5.8	AA	5.0	B		10	13	d4/			MEY
1996 08 10.88		M	5.6	HD	5.0	B		10	25	S7	2	130	SAN07
1996 08 10.88		M	5.7	AA	3.4	B		9	&14	5/			PER01
1996 08 10.88		S	5.5	AA	5.0	B		7	9	s4			SHA02
1996 08 10.88		S	5.6	AA	3.4	B		9	&14	5/			PER01
1996 08 10.89		M	5.8	AA	3.4	B		9	&14	4/			VIT01

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 10.89		S	5.4	SC	6.8	L	11	38					ASP
1996 08 10.89		S	5.7	AA	3.4	B		9	&14	4/			VIT01
1996 08 10.90		B	5.6	S	8.0	B		8	24	4	0.65	135	TRI
1996 08 10.90		O	5.3	S	0.0	E		1		5/			KON06
1996 08 10.90		S	5.7	HI	5.0	B		10	13	4			GRA04
1996 08 10.90		S	6.0	AA	6.3	R	13	52	15	6	0.8	115	KOS
1996 08 10.92		B	5.7	AA	6.0	R	10	24	18	4	0.3		ROM
1996 08 10.92		M	5.5	S	8.0	B		10	14	3/			HOR02
1996 08 10.94		S	6.2	S	2.1	B		8	13	2			TAY
1996 08 10.99		B	5.6	AA	6.0	B		20	&15	5			CHE03
1996 08 11.02		S	5.5	S	7.0	B		10	12	7	0.35	120	MAR02
1996 08 11.02		S	5.5	S	7.0	R	7	12	11	6	0.5	110	SAN04
1996 08 11.10		S	5.6	HP	5.0	B		10	13	5/	1.8	130	BOR
1996 08 11.25		S	5.5	AA	5.0	B		7	14	4/			SPR
1996 08 11.40			5.6	SC	0.0	E		1					SEA01
1996 08 11.40		M	5.4	AA	8.0	B		15	15	4	40 m		SEA01
1996 08 11.40		S	5.7	AA	8.0	B		20	11	6	0.55	127	PEA
1996 08 11.47		M	5.7	AA	6	R		20	12	4			KAT01
1996 08 11.50		S	5.9	VG	5.0	B		7	15	6	0.3	110	NAG08
1996 08 11.51		I	5.0	SC	0.7	E		1					CAM03
1996 08 11.51		M	5.6	AA	10.0	B		20	13	6	0.5	110	YOS02
1996 08 11.51		S	5.1	SC	8.0	B		20	15	s6	2	120	CAM03
1996 08 11.53		S	5.6	SC	3.0	B		10	15	D4	1.5	120	SHI
1996 08 11.57		S	5.3	AA	2.5	B		2					SEA
1996 08 11.58		B	5.8	S	5.6	B		8	15	7			OKA05
1996 08 11.80		B	5.7	SC	5.0	B		7	15	4	0.5	135	MOR04
1996 08 11.80		S	5.6	S	3	R	7	10	23	s3			BOR04
1996 08 11.80		S	6.0	VF	6.0	R	4	8		4		350	FIL05
1996 08 11.81		S	5.7	S	5	R	8	20	16	s4			BOR04
1996 08 11.83		M	5.8	NP	19	L	5	38	25	5	0.83	117	SHU
1996 08 11.84		B	5.8	AA	5.0	B		7	17	S4			VEL03
1996 08 11.84		M	5.6	S	10	B		25	20	4			ZNO
1996 08 11.85		K	6.3	AA	11.0	B		20	9	5	0.33		NEV
1996 08 11.85		O	5.2	S	0.0	E		1	20	4/			ZNO
1996 08 11.87		S	5.5	AA	3.5	R		7	22	3			BAR06
1996 08 11.87		S	5.6	SC	5.0	B		10	10	5			FEI
1996 08 11.88		B	5.6	AA	6.0	B		20		5			CHE03
1996 08 11.88		M	5.6	AA	3.4	B		9	&16	5			VIT01
1996 08 11.88		S	5.6	AA	3.4	B		9	&16	5			VIT01
1996 08 11.89		M	5.6	AA	5.0	B		12	21	4/			TAN02
1996 08 11.89		M	5.7	AA	3.4	B		9	&15	4/			PER01
1996 08 11.89		S	5.6	AA	3.4	B		9	&15	4/			PER01
1996 08 11.90		B	5.6	AA	6.0	R	10	16	19	5	0.3		ROM
1996 08 11.90		S	5.6	AA	5.0	B		10	16	5			BOU
1996 08 11.91		E	6.0	AA	7.5	R	4	30	8				LUK05
1996 08 11.93		S	5.8	YF	5.0	B		10	11	4			GRA04
1996 08 11.94		S	5.6	AA	5.0	B		8	20	4			BEA
1996 08 11.95		S	5.7	SC	4.0	B		8	&17	4			SCH04
1996 08 11.98		M	5.4	S	7.0	B		10	10	7	0.35	120	MAR02
1996 08 11.98		S	5.5:	SC	20.3	L	5	40	&20	6/	&0.30	45	POR05
1996 08 12.00		B	5.4	S	7.0	R	7	12	9	6	0.2	110	SAN04
1996 08 12.06		S	5.4	SC	25.4	L	4	46	10	D5		35	DID
1996 08 12.25		S	5.5	AA	5.0	B		7	15	4/			SPR
1996 08 12.46			5.4	AA	0.0	E		1					SEA01
1996 08 12.46		M	5.2	SC	0.0	E		1					OME
1996 08 12.46		M	5.6	AA	8.0	B		15	14	4	70 m	230	SEA01
1996 08 12.47		S	5.3	AA	2.5	B		2					SEA
1996 08 12.48		B	5.9	S	5.6	B		8	15	7			OKA05
1996 08 12.80		B	5.7	SC	5.0	B		7	20	4	0.5	135	MOR08
1996 08 12.81		E	5.8	S	5	R	8	20	16	s4			BOR04
1996 08 12.81		S	5.6	S	5	R	8	20	16	s4			BOR04
1996 08 12.83		B	5.6	AA	11	L	7	56	15	4			BAR06
1996 08 12.83		B	5.9:	AA	5.0	B		7	12	d3			VEL03
1996 08 12.85		B	5.6	AA	5.0	B		10	9.6	4			HAS02
1996 08 12.86		M	6.4	SC	5.0	B		10	8	4			AND03

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 12.87		S	5.7	AA	5.0	B		10	13	3/			HAV
1996 08 12.88		S	5.4	SC	5.0	B		10	&20	5			COM
1996 08 12.89					15.0	B		25	10	4	0.5	110	ZAN
1996 08 12.89		B	5.4	AA	3.5	B		7	20	5			CHU
1996 08 12.89		S	5.4	AA	4.2	B		7	16	4/	0.4	110	ZAN
1996 08 12.90		S	5.5	AA	3.4	B		9	&17	4			PERO1
1996 08 12.90		S	5.8	AA	5.0	O		7	8				LUKO5
1996 08 12.91		B	5.7	AA	6.0	B		20	&15	5			CHEO3
1996 08 12.91		M	5.6	AA	3.4	B		9	&15	5			VITO1
1996 08 12.91		S	5.6	AA	3.4	B		9	&15	5			VITO1
1996 08 12.93		B	5.5	AA	6.0	R	10	16	20	6	0.2	270	ROM
1996 08 12.93		S	5.7	YF	5.0	B		10	13	4			GRAO4
1996 08 12.95		S	5.5:	SC	20.3	L	5	40	&20	6/	&0.30	55	PORO5
1996 08 13.25		S	5.5	AA	5.0	B		7	15	4/			SPR
1996 08 13.43			5.2	AA	0.0	E		1					SEAO1
1996 08 13.43		M	5.5	AA	5.0	B		10	14	6	80 m	225	SEAO1
1996 08 13.43		S	5.3	AA	2.5	B		2					SEA
1996 08 13.48		S	5.8	VG	5.0	B		7	15	6	0.5	110	NAGO8
1996 08 13.79		E	5.5	S	5	R	8	16	16	s3			BORO4
1996 08 13.80		B	5.7	SC	5.0	B		7	20	4	1.0	130	MORO4
1996 08 13.83		M	5.5	S	10	B		25	21	4	1.4	110	ZNO
1996 08 13.83		M	6.5	SC	5.0	B		10	8	5			ANDO3
1996 08 13.83		O	5.1	S	0.0	E		1	20	4/			ZNO
1996 08 13.84		B	6.4	AA	6.0	R	10	15	10	5	0.1		SER
1996 08 13.85		M	6.4	AA	6	R	10	30	8	3			NEV
1996 08 13.86		M	5.4	S	7.0	B		10	20	6/	0.65	150	MARO2
1996 08 13.86		M	5.5	S	7.0	B		10	15	6	0.75	120	SANO4
1996 08 13.87		S	6.8	A	11	L	7	32	5	4			POM
1996 08 13.88		S	5.4	SC	5.0	B		10	&15	5/			COM
1996 08 13.89		M	5.6:	AA	3.4	B		9	>13	4			PERO1
1996 08 13.89		S	5.4	AA	3.4	B		9	>13	4			PERO1
1996 08 13.90		B	5.3	AA	3.5	B		7	20	4			CHU
1996 08 13.92		S	5.6	AA	5.0	B		8	20	3			BEA
1996 08 13.92		S	5.7	AA	5.0	B		10	14	5			MOE
1996 08 13.94		B	6.1	SC	5.0	B		7	15	6	0.5	120	BIV
1996 08 13.97		S	5.7	HI	5.0	B		10	12				GRAO4
1996 08 13.98		S	5.4:	SC	20.3	L	5	40	&20	6/	&0.30	55	PORO5
1996 08 14.07		S	5.8	HP	5.0	B		10	9	6	1.0	130	BOR
1996 08 14.22		S	5.5	AA	5.0	B		7	14	4/			SPR
1996 08 14.41			5.0	AA	0.0	E		1					SEAO1
1996 08 14.41		M	5.2	AA	5.0	B		10	12	6			SEAO1
1996 08 14.42		S	5.1	AA	0.0	E		1					SEA
1996 08 14.51		I	5.0	SC	0.7	E		1					CAMO3
1996 08 14.51		S	5.1	SC	8.0	B		20	15	s6	1.5	120	CAMO3
1996 08 14.77		B	6.2	AA	6.0	R	5	20	12	s4			KRYO1
1996 08 14.80		B	5.7	SC	5.0	B		7	20	4	1.0	130	MORO4
1996 08 14.80		S	5.6	S	5	R	8	20	18	3			BORO4
1996 08 14.81		M	6.0	SP	10	R	4	18	7.5	5	0.5		BALO3
1996 08 14.81		S	6.0	AA	8.0	B		10	13	s4	1.5	110	MATO7
1996 08 14.83		K	6.5	AA	11.0	B		20	8	5	0.25		NEV
1996 08 14.83		M	6.5	SC	5.0	B		10	8	4			ANDO3
1996 08 14.84		S	6.6	A	11	L	7	32	6	3			POM
1996 08 14.85		S	5.7	SC	5.0	B		7	15	4			OKS
1996 08 14.86		M	5.6	HD	5.0	B		10	25	S7	1	130	SANO7
1996 08 14.86		M	6.5	HD	15	L	3	26	5	3	0.4	70	KESO1
1996 08 14.86		S	5.7	AA	3.0	B		8	12	6	0.75	116	CSU
1996 08 14.89		O	5.3	S	0.0	E		1		5/			KONO6
1996 08 14.89		S	6.5	S	7.0	B		16	14.8	3	0.33	20	TAY
1996 08 14.92		B	5.4	AA	3.5	B		7	20	5			CHU
1996 08 14.95		S	5.5	AA	8.0	B		11	20	5/	>1		DESO1
1996 08 14.97		M	5.3	SC	5.0	B		10	&18	5/	&0.30	55	PORO5
1996 08 15.22		S	5.5	AA	5.0	B		7	14	4/			SPR
1996 08 15.29		M	5.2	SC	0.0	E		1	&30				OME
1996 08 15.37			5.0	AA	0.0	E		1					SEAO1
1996 08 15.37		M	5.2	AA	5.0	B		10	12	5	30 m		SEAO1

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 15.52		S	5.8	AA	5	R		8	15	5			YOS04
1996 08 15.53		B	5.8	AA	5.0	B		7	10	7			SOW
1996 08 15.53		S	5.8	VG	5.0	B		7	15	6	0.3	110	NAG08
1996 08 15.54		S	5.3	S	7.0	B		10		5			TSU03
1996 08 15.55		M	5.6	AA	3.5	B		10	18	4			NAK01
1996 08 15.79		B	6.2	AA	8.0	B		10	15	s4			KRY01
1996 08 15.79		M	6.0	SP	10	R	4	18	7.5	5	0.5		BAL03
1996 08 15.80		B	5.7	SC	5.0	B		7	20	4	0.5	120	MOR04
1996 08 15.81		M	5.8	AA	5.0	B		12		5			TAN02
1996 08 15.81		S	6.1	AA	8.0	B		10	14	s5	1.2	95	MAT07
1996 08 15.88		B	5.3	AA	3.5	B		7	20	4			CHU
1996 08 15.89		S	5.4	SC	5.0	B		10	&25	6			COM
1996 08 15.92		M	5.1	S	5.0	B		10	20	4			HOR02
1996 08 15.92		S	5.6	AA	5.0	B		10	15	5			MOE
1996 08 15.92		S	5.6	HI	5.0	B		10	13	4			GRA04
1996 08 15.93		S	5.8	AA	8.0	B		10	9	s3			SHA02
1996 08 15.96		S	5.4	AA	8.0	B		11	20	5	>1		DES01
1996 08 15.99		B	5.8	SC	5.0	B		7	15	6	0.6	110	BIV
1996 08 16.22		S	5.4	AA	5.0	B		7	14	4/			SPR
1996 08 16.25		M	5.2	SC	0.0	E		1					OME
1996 08 16.54		S	5.5	AA	0.0	E		1					PEA
1996 08 16.55		S	5.6	AA	8.0	B		20	12	7	1.1	129	PEA
1996 08 16.78		S	6.2	AA	8.0	B		10	15	s5	1.8	90	MAT07
1996 08 16.79		B	6.0	SP	8.0	B		10	15	s4/			KRY01
1996 08 16.80		B	5.7	SC	5.0	B		7	20	4	0.5	110	MOR04
1996 08 16.82		S	6.2	AA	11.0	B		20	9	6	0.25		NEV
1996 08 16.83		S	5.4	S	5	R	8	20	22	4/	0.5	75	BOR04
1996 08 16.83		S	5.7	AA	0.0	E		1	12				HAV
1996 08 16.85		B	5.7:	AA	5.0	B		7	14	S5			VEL03
1996 08 16.87					15.0	B		25	10	4/	0.7	115	ZAN
1996 08 16.87		B	5.8	SC	5.0	B		7	16	6	1.0	115	BIV
1996 08 16.87		S	5.4	AA	4.2	B		7	16	5	0.4	110	ZAN
1996 08 16.89	!	V	5.8	YF	20.0	T	2		&25	7	&1	120	MIK
1996 08 16.90		S	5.6	AA	5.0	B		7	10	6			DIE02
1996 08 16.92		B	5.6	S	7.0	B		10	11	7	0.55	125	MAR02
1996 08 16.93		S	5.5	AA	5.0	B		7	14	4	0.2	80	SHA02
1996 08 16.96		B	5.4	S	7.0	B		10	10	6	0.5	130	SAN04
1996 08 16.96		S	5.4	AA	8.0	B		11	20	5	>1		DES01
1996 08 16.98		M	5.4:	SC	20.3	L	5	40	&18	5/	&0.30	25	POR05
1996 08 16.98		S	5.6	SC	5.0	B		10	&20	6			COM
1996 08 17.22		S	5.4	AA	5.0	B		7	14	5/			SPR
1996 08 17.26		M	5.2	SC	0.0	E		1			1	135	OME
1996 08 17.42		S	5.2	AA	0.0	E		1					SEA
1996 08 17.77		B	6.1	AA	8.0	B		10	15	s4	1.0	125	KRY01
1996 08 17.79		B	6.0	AA	8.0	B		10	16	s4/	1.5	110	MAT07
1996 08 17.80		B	5.7	SC	5.0	B		7	20	4	0.5	110	MOR04
1996 08 17.80		S	6.0	AA	15.0	L	4	20	18	s5	1.7	115	MAT07
1996 08 17.82		K	6.3	AA	11.0	B		20	10	6	0.35		NEV
1996 08 17.82		M	5.5	NP	19	L	5	38	21	5	1	136	SHU
1996 08 17.83		S	5.5	AA	20.3	L	6	80	10	7	0.17	325	MEN03
1996 08 17.84		B	6.5	AA	6.0	R	10	15	16	6	0.1		SER
1996 08 17.85		S	5.6	AA	5.0	B		7	16	S5			VEL03
1996 08 17.85		S	5.9	HD	4.0	B		10	15	5			SAR02
1996 08 17.87		S	6.3	AA	5.0	O		7	8				LUK05
1996 08 17.88					15.0	B		25	10	4/	0.7	115	ZAN
1996 08 17.88		S	5.3	AA	4.2	B		7	16	5	0.4	110	ZAN
1996 08 17.89		B	5.6	AA	5.0	B		10	13.3	4			HAS02
1996 08 17.89		S	5.5	SC	5.0	B		10	&25	6			COM
1996 08 17.89		S	5.6	SC	5.0	B		10	10	5			FEI
1996 08 17.90		S	5.5	AA	4.0	B		2	14	3			SHA02
1996 08 17.90		S	5.5	AA	5.0	B		7	12	s5	0.8	100	SHA02
1996 08 17.90		S	5.8	AA	6.3	B		9	11	5	0.3		KAM01
1996 08 17.92		B	5.2	AA	3.5	B		7	25	5			CHU
1996 08 17.93		B	5.8	SC	5.0	B		7	15	6	1.1	120	BIV
1996 08 17.96		B	5.3	S	7.0	B		10	9	7	0.5	125	MAR02

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 17.96		S	5.4	AA	8.0	B		11	20	5	>1		DES01
1996 08 17.98		B	5.5	S	7.0	B		10	10	6/	0.55	135	SAN04
1996 08 18.01		M	5.5:	SC	20.3	L	5	40	&20	6	&0.30	25	POR05
1996 08 18.07		S	5.5	SC	25.4	L	4	46	12	d5			DID
1996 08 18.20		M	6.4	SC	5.0	B		10	9	s5/	0.7	112	MOD
1996 08 18.21		B	6.3	AA	5.0	B		7		5			SIM
1996 08 18.23		B	6.5	AA	5.0	B		7					SIM01
1996 08 18.23		S	5.4	AA	5.0	B		7	13	5/			SPR
1996 08 18.29		M	5.2	SC	0.0	E		1					OME
1996 08 18.49		S	5.7	VG	5.0	B		7	15	6	0.1	110	NAG08
1996 08 18.50		M	5.7	AA	10.0	R	8	20	19	6			GOU
1996 08 18.52		M	5.2	AA	5.0	B		10	12	5	40 m		SEA01
1996 08 18.54			5.0	AA	0.0	E		1					SEA01
1996 08 18.81		M	6.4	SC	5.0	B		10	10	4			AND03
1996 08 18.82		S	5.7	AA	5.0	B		7	18	S4			VEL03
1996 08 18.83		B	6.5	AA	6.0	R	10	15	12	6	0.1		SER
1996 08 18.84		B	5.7	AA	6.0	B		20	&14	5			CHE03
1996 08 18.84		M	5.3	TI	5.0	B		7	19	4			KYS
1996 08 18.84		O	5.3	S	0.0	E		1		4/			KON06
1996 08 18.85		M	5.1	S	0.0	E		1	25	3			HOR02
1996 08 18.85		S	5.5	SC	5.0	B		10	&25	6			COM
1996 08 18.86		O	5.1	S	0.0	E		1	15	4			ZNO
1996 08 18.87		M	5.4	AA	5.0	B		7	17	5/			BOU
1996 08 18.88		B	5.3	S	7.0	B		10	9	7	0.65	120	MAR02
1996 08 18.88		B	5.4	S	7.0	R	7	12	11	6/	0.65	120	SAN04
1996 08 18.88		B	5.7	AA	5.0	B		10	13.3	4			HAS02
1996 08 18.88		S	5.0	AA	0.0	E		1	30	5			CHU
1996 08 18.88		S	5.8	AA	6.3	B		9	10	6	0.3	105	KAM01
1996 08 18.88		S	5.8:	AA	5.0	B		10	15	3			MOE
1996 08 18.88		S	6.3	AA	5.0	O		7	8				LUK05
1996 08 18.89		B	6.8	SC	5.0	B		10					BON
1996 08 18.89		S	5.4	AA	3.5	R		7	20	3			BAR06
1996 08 18.89		S	5.4	AA	5.0	B		7	12	5	1.3	95	SHA02
1996 08 18.89		S	5.7	SC	4.0	B		8	&15	4			SCH04
1996 08 18.90		B	5.7	AA	11	L	7	32	21	4	0.7		BAR06
1996 08 18.90		M	5.5	AA	5	R		20	22	4	0.8		BAR06
1996 08 18.90		S	5.6	AA	5.0	B		10	9.5	D4	0.3		MEY
1996 08 18.92		B	5.8	SC	5.0	B		7	15	6	1.0	110	BIV
1996 08 18.93		S	5.6:	AA	5.0	B		10	17	3			ABB
1996 08 18.95		M	5.4	SC	5.0	B		10	&20	6/	&0.30	50	POR05
1996 08 18.95		S	5.4	AA	8.0	B		11	18	5/	>1		DES01
1996 08 18.97		S	5.9	VF	6	R	4	18		4		190	OGA01
1996 08 19.10		S	5.7	HP	5.0	B		10	11	6	1.0	140	BOR
1996 08 19.35		M	5.0	AA	5.0	B		10	13	4			SEA01
1996 08 19.45		I	5.0	SC	0.7	E		1					CAM03
1996 08 19.45		S	5.1	SC	8.0	B		20	12	s6	2	130	CAM03
1996 08 19.50		C	6.1:	GA	8.0	R	6		18.5		>51 m	119	NAK01
1996 08 19.50		M	5.7	AA	6	R		20	14	4			KAT01
1996 08 19.54		S	5.4	AA	0.0	E		1					SEA
1996 08 19.82		B	5.7	AA	5.0	B		7	24	S4			VEL03
1996 08 19.82		K	6.4	AA	11.0	B		20	9	6			NEV
1996 08 19.82		M	5.4	TI	5.0	B		7	17	4			KYS
1996 08 19.82		S	6.8	A	11	L	7	32	6	3			POM
1996 08 19.83		B	5.8	AA	11	L	7	32	15	4			BAR06
1996 08 19.83		B	6.4	AA	6.0	R	10	15	13	5	0.1		SER
1996 08 19.83		S	5.6	AA	5	R		20	18	4			BAR06
1996 08 19.83		S	6.0:	VF	6.0	R	4	8					FIL05
1996 08 19.84		S	5.6	AA	5.0	B		10	12	4/	0.5	105	HAV
1996 08 19.85		O	5.3	S	0.0	E		1	15	5			ZNO
1996 08 19.85		S	5.9	HD	4.0	B		10	>10	5	1	120	SAR02
1996 08 19.85		S	6.0	AA	6.3	R	13	52	14	6	1.2	100	KOS
1996 08 19.86		M	5.3	SC	8.0	B		20	17	D4	0.8	120	OKS
1996 08 19.86		M	5.5	TI	5.0	B		10	20	3	1	90	DVO
1996 08 19.86		S	5.7	AA	5.0	B		10	9	D5	0.3		MEY
1996 08 19.86		S	5.8	SC	4.0	B		8	&17	4/			SCH04

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 19.87		B	5.8	AA	5.0	B		10	9.6	4			HAS02
1996 08 19.87		B	5.8	AA	6.0	B		20	&15	5			CHE03
1996 08 19.87		M	5.1	S	0.0	E		1	25	3			HOR02
1996 08 19.87		M	5.3	AA	5.0	B		7	19	5/	1.8	115	BOU
1996 08 19.87		S	5.5	SC	5.0	B		10	25	5			ZAN01
1996 08 19.88		M	5.5	NP	19	L	5	38	20	5	1	153	SHU
1996 08 19.89		B	6.6	SC	5.0	B		10					BON
1996 08 19.89		S	5.7	AA	5.0	B		10	16	4			MOE
1996 08 19.90		I	5.8	AA	0.8	E		1					HAS02
1996 08 19.90		S	5.7	AA	5.0	B		7	10	7			DIE02
1996 08 19.91		S	5.4	AA	5.0	B		7	9	5	1.4	110	SHA02
1996 08 19.93		B	5.2	S	7.0	B		10	9	7	0.55	110	MAR02
1996 08 19.93		B	5.2	S	7.0	R	7	12	10	7	0.65	140	SAN04
1996 08 19.95		M	5.5	SC	5.0	B		10	&15	5/	&0.30	55	POR05
1996 08 19.95		S	5.4	AA	8.0	B		11	18	5/	>1		DES01
1996 08 20.05		S	5.4	SC	25.4	L	4	46	12	D6			DID
1996 08 20.13		S	5.7	HP	5.0	B		10	11	6	1.0	130	BOR
1996 08 20.51		M	5.2	AA	5.0	B		10	12	4	50 m	290	SEA01
1996 08 20.52			5.0	AA	0.0	E		1					SEA01
1996 08 20.53		M	5.7	AA	10.0	R	8	20	19	6			GOU
1996 08 20.80		S	5.3	S	5	R	8	20	24	S5	0.4	75	BOR04
1996 08 20.81		M	5.6	AA	5.0	B		12	10	5			TAN02
1996 08 20.81		S	5.6	NP	7	R	6	26	15	4	0.6		NEK
1996 08 20.82		S	5.5:	S	3	R	7	10	30	s3	0.4	75	BOR04
1996 08 20.83		O	5.3	S	0.0	E		1	15	4			ZNO
1996 08 20.83		S	5.8	AA	3.0	B		8	12	6	0.75	129	CSU
1996 08 20.83		S	6.3	A	11	L	7	32	7	4			POM
1996 08 20.84		M	5.0	S	0.0	E		1	25	3			HOR02
1996 08 20.85		M	5.2	TI	5.0	B		10	22	3			DVO
1996 08 20.85		S	5.7	AA	15.2	L	5	42	16	5	0.4	100	MOE
1996 08 20.86		B	6.4	AA	6.0	R	10	15	12	5	0.1		SER
1996 08 20.86		S	6.0	AA	6.3	R	13	52	15	6	1.4	100	KOS
1996 08 20.86	!	M	5.3	NP	7	R	6	26	17	4	0.6		SHU
1996 08 20.88		B	5.7	SC	5.0	B		7	20	4	0.5	100	MOR04
1996 08 20.88		M	5.2	S	5.0	B		10	23	3/			PLS
1996 08 20.88		M	5.3	AA	5.0	B		7	18	6	2.0	114	BOU
1996 08 20.88		S	6.0	AA	5.0	O		7	& 8				LUK05
1996 08 20.88	!	V	5.7	YF	20.0	T	2		&25	7	&1	120	MIK
1996 08 20.90		S	5.5	SC	5.0	B		10	13	5			FEI
1996 08 20.93		S	5.5	SC	5.0	B		10	25	5			ZAN01
1996 08 20.95		S	5.4	AA	8.0	B		11	18	5	>1		DES01
1996 08 20.97		S	5.9	VF	6	R	4	18		4		200	OGA01
1996 08 20.98		M	5.5	SC	5.0	B		10	&15	5/	&0.30	60	POR05
1996 08 21.22		S	5.4	AA	5.0	B		7	14	5/			SPR
1996 08 21.50		S	5.3	AA	0.0	E		1					SEA
1996 08 21.78		S	6.7	A	11	L	7	32	7	3			POM
1996 08 21.79		M	6.6	SC	5.0	B		10	8	5			AND03
1996 08 21.80		S	6.0	AA	6.3	R	13	52	15	6	1.0	100	KOS
1996 08 21.84		M	5.4	S	10	B		25	14	3/			ZNO
1996 08 21.84		M	5.6	TI	5.0	B		7	15	4			KYS
1996 08 21.88		M	5.1	S	0.0	E		1	25	2/			HOR02
1996 08 21.90		S	5.6	AA	5.0	B		7	9	6	1.5	100	SHA02
1996 08 21.91		S	5.1	AA	0.8	E		1	18	3			SHA02
1996 08 21.91		S	5.3	AA	4.0	B		2	14	s3			SHA02
1996 08 21.96		S	5.8	VF	6	R	4	18		5		205	OGA01
1996 08 21.97		M	5.5	SC	5.0	B		10	&15	5/	&0.30	55	POR05
1996 08 22.22		S	5.4	AA	5.0	B		7	14	5/			SPR
1996 08 22.49		M	5.3	AA	10.0	R	8	20	19	6			GOU
1996 08 22.83		B	6.6	AA	6	R	10	15	10	3			SER
1996 08 22.83		S	6.0:	VF	6.0	R	4	8					FIL05
1996 08 22.88		S	5.8	AA	5.0	B		10	14	4			MOE
1996 08 23.22		S	5.4	AA	8.0	B		11	12	5/			SPR
1996 08 23.87		S	5.6	AA	3.4	B		9	&10	5			PER01
1996 08 23.89		O	5.7:	TI	5.0	B		7	15	3			KYS
1996 08 23.97		S	5.5	AA	5.0	B		7	9	3			SHA02

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 24.21		S	5.3	AA	8.0	B		11	11	5/			SPR
1996 08 24.87		B	5.4	S	21.0	L	6	60		7/			MAR02
1996 08 24.87		S	5.6	AA	3.4	B		9	&13	4/			PER01
1996 08 25.20		S	5.6	AA	8.0	B		11	10	5/			SPR
1996 08 25.71		M	6.0:	SP	10	R	4	18	& 4	2			BAL03
1996 08 25.83		S	5.5	TI	5.0	B		7	15	3			KYS
1996 08 25.84		M	5.0	S	8.0	B		10	15	4			HOR02
1996 08 26.86		S	5.9:	AA	5.0	B		10	12	3			MOE
1996 08 27.87		S	5.6	AA	3.4	B		9	&12	4			PER01
1996 08 28.20	!	J	5.1	SC	25.4	T	4		17.21	D6	46.8s	42	ROQ
1996 08 28.87		S	5.6	AA	3.4	B		9	&14	3			PER01
1996 08 29.74		S	5.6	SC	4.0	B		8	&20	4/			SCH04
1996 08 29.81		M	6.8	SC	5.0	B		10	8	4			AND03
1996 08 29.84		S	5.6	TI	5.0	B		7	12	4			KYS
1996 08 29.86		S	5.6	AA	8.0	B		20	10	4/			ZAN
1996 08 29.87		S	5.7	AA	3.4	B		9	&13	5			PER01
1996 08 29.91		S	6.7	SC	7.0	B		16	36	2	0.60	45	TAY
1996 08 30.73		B	5.7	SC	5.0	B		7	20	4	0.5	95	MOR08
1996 08 30.74		M	6.9	SC	5.0	B		10	8	4			AND03
1996 08 30.76		S	5.9:	VF	6.0	R	4	8	10	2			FIL05
1996 08 30.81		B	6.5	AA	6	R	10	15	11	5			SER
1996 08 30.86		S	5.6	AA	8.0	B		20	10	4/			ZAN
1996 08 31.05		S	5.6	HP	5.0	B		10	12	6			BOR
1996 08 31.46		M	5.6	AA	3.5	B		7					TSU02
1996 08 31.75		B	5.7	SC	5.0	B		7	18	4	0.5	95	MOR04
1996 08 31.75		S	5.7	SC	4.0	B		8	&20	3	0.3		SCH04
1996 08 31.76		S	5.8:	VF	6.0	R	4	8					FIL05
1996 08 31.80		B	6.4	AA	6	R	10	15	11	4			SER
1996 08 31.83		S	5.4	S	5.0	B		8	21				MAR02
1996 08 31.86					15.0	B		25	8	4/	1	110	ZAN
1996 08 31.86		S	5.4	AA	4.2	B		7	14	5	1	90	ZAN
1996 08 31.87		I	5.6	AA	0.0	E		1					PER01
1996 08 31.87		S	5.5	AA	3.4	B		9	&22	4/	&1		PER01
1996 08 31.87		S	5.6	AA	3.4	B		9	&15	5			VIT01
1996 08 31.88		S	5.6	AA	8.0	B		10	9	4			SHA02
1996 08 31.91		S	5.5	AA	8.0	B		11	20	4	>1	270	DES01
1996 09 01.04		S	5.6	HP	5.0	B		10	11	6	0.6	131	BOR
1996 09 01.05		S	5.4	SC	25.4	L	4	46	30	d5			DID
1996 09 01.20		S	5.2	AA	5.0	B		7	16	5/			SPR
1996 09 01.75		M	6.7	SC	5.0	B		10	12	5			AND03
1996 09 01.81		B	6.2	AA	6	R	10	15	11	6	0.1		SER
1996 09 01.87					15.0	B		25	8	4/	1	110	ZAN
1996 09 01.87		I	5.7	AA	0.0	E		1					PER01
1996 09 01.87		M	5.6	AA	3.4	B		9	&20	5			VIT01
1996 09 01.87		M	5.8	AA	3.4	B		9	&15	4/			PER01
1996 09 01.87		S	5.3	AA	0.0	E		1	&20				ZAN
1996 09 01.87		S	5.4	AA	4.2	B		7	14	5	1	90	ZAN
1996 09 02.39			4.8	AA	0.0	E		1					SEA01
1996 09 02.39		M	5.0	AA	5.0	B		10	14	6	1.0		SEA01
1996 09 02.50		C	6.1	GA	8.0	R	6		19		>52 m	110	NAK01
1996 09 02.50		M	5.7	AA	3.5	B		7					TSU02
1996 09 02.50		S	5.0	S	15.0	R	5	25	20	5			NAG02
1996 09 02.50		S	5.8	VG	5.0	B		7	15	6	0.4	100	NAG08
1996 09 02.54		S	5.7	AA	5.0	B		7	13		0.4	90	KOB01
1996 09 02.77		B	5.5	SC	5.0	B		10		2			RAD01
1996 09 02.81		B	6.2	AA	6	R	10	15	13	7	0.1		SER
1996 09 02.85		M	5.6	AA	5.0	B		7	15	6			BOU
1996 09 02.86		M	5.8	SC	5.0	B		10	13	5			GRA04
1996 09 02.86		S	5.8	AA	6.3	B		9	11	S6/	0.4	105	KAM01
1996 09 02.87		B	5.9	SC	5.0	B		7	15	5	0.8	120	BIV
1996 09 02.87		N	10.3	VB	20.3	T	10	80		6/			GRA04
1996 09 02.88		I	5.7	AA	0.0	E		1					PER01
1996 09 02.88		S	5.8	AA	12.5	R	5	20	20	5		20	BEA
1996 09 02.89		B	5.8	S	7.0	B		10	10	6/	0.40	130	MAR02
1996 09 02.89		M	5.8	AA	3.4	B		9	&15	5			PER01

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 02.89		S	5.6	AA	3.4	B		9	&17	4/			VIT01
1996 09 03.05		S	5.6	HP	5.0	B		10	11	6	1.4	132	BOR
1996 09 03.17		S	5.2	AA	8.0	B		11	15	4/			SPR
1996 09 03.39			4.8	AA	0.0	E		1					SEA01
1996 09 03.39		M	4.9	AA	5.0	B		10	12	5	1.0		SEA01
1996 09 03.44		M	5.5	AA	6	R		20	12	4			KAT01
1996 09 03.50		M	5.5	AA	10.0	B		20	12	6	0.8	110	YOS02
1996 09 03.52		M	5.6	AA	5.0	B		7	19	6			GOU
1996 09 03.60		S	5.9	AA	8.0	B		11	13	4			MOR06
1996 09 03.75		B	5.6	SC	5.0	B		7	18	4	0.5	90	MOR04
1996 09 03.79		B	6.3	AA	6	R	10	15	& 6				SER
1996 09 03.80		K	6.3	AA	11.0	B		20	15	7	0.4		NEV
1996 09 03.84		M	5.5	AA	5.0	B		7	16	5/	2.0	116	BOU
1996 09 03.85		B	5.8	AA	5.0	B		10	10	S5/	0.4		MEY
1996 09 03.85		B	5.9	AA	5.0	B		10					HAS02
1996 09 03.85		B	7.0	SC	6.3	B		8	14	2			GEE
1996 09 03.86		S	5.6	AA	5.0	B		7	12	6			DIE02
1996 09 03.86		S	5.7	SC	8.0	B		15	&15	5			COM
1996 09 03.87		B	5.8	S	3.0	B		6	10	6/	0.25	150	SAN04
1996 09 03.87		B	6.0	S	3.0	B		6	12	6	0.30	130	MAR02
1996 09 04.06		S	5.6	HP	5.0	B		10	12	6	1.3	133	BOR
1996 09 04.18		S	5.3	AA	5.0	B		7	12	4/			SPR
1996 09 04.40			4.8	AA	0.0	E		1					SEA01
1996 09 04.40		M	4.9	AA	5.0	B		10	11	4	1.7		SEA01
1996 09 04.42		S	5.3	AA	0.0	E		1					SEA
1996 09 04.82		M	5.4	S	8.0	B		10	16	5	0.4	130	HOR02
1996 09 04.83		B	5.5	AA	8.0	B		12	12	3			BAR06
1996 09 04.84		S	5.6	AA	5.0	B		7	15	5/			BOU
1996 09 04.85		S	6.4	SC	5.0	B		10	4	5			LAA
1996 09 04.86		M	5.6	SC	8.0	B		15	&15	5			COM
1996 09 04.86		M	5.8	SC	5.0	B		10	13	5			GRA04
1996 09 04.86		S	5.5:	AC	20.3	T	10	77	&20				ANZ
1996 09 04.87		S	5.8	SC	5.0	B		10	9	5			ZAN01
1996 09 04.88		B	6.0	SC	5.0	B		7	13	5	0.8	120	BIV
1996 09 05.40			4.8	AA	0.0	E		1			0.5		SEA01
1996 09 05.40		M	4.8	AA	5.0	B		10	14	6	1.6		SEA01
1996 09 05.49		S	5.2	AA	0.0	E		1					SEA
1996 09 05.75		S	5.8	SC	4.0	B		8	&15	7			SCH04
1996 09 05.82	!	V	6.1	YF	20.0	T	2		&25	7	&1	115	MIK
1996 09 05.83					15.0	B		25	8	4/	1	110	ZAN
1996 09 05.83		B	6.9	SC	6.3	B		8	14	3			GEE
1996 09 05.83		S	5.4	AA	4.2	B		7	14	5	1	90	ZAN
1996 09 05.84		M	5.7	AA	8.0	B		15	13	6/			BOU
1996 09 05.84		S	5.6	SC	3.5	B		7	10	5			FEI
1996 09 05.85		B	5.8	AA	5.0	B		10	8.0	4			HAS02
1996 09 05.85		M	5.4	S	8.0	B		10	14	5	0.6	125	HOR02
1996 09 05.85		M	5.5	SC	5.0	B		10	&15	4/			COM
1996 09 05.85		S	5.6	SC	8.0	B		20	16	4			GIL01
1996 09 05.85		S	6.6	SC	5.0	B		10	5	5			LAA
1996 09 05.87		S	5.5:	AA	5.0	B		7	12	3			SHA02
1996 09 05.88		S	5.6	AA	5.0	B		7	12	7			DIE02
1996 09 05.88		S	5.8	AA	12.5	R	5	20	20	5		20	BEA
1996 09 05.89		S	5.8	SC	5.0	B		10	9	5			ZAN01
1996 09 05.94		M	5.3	AA	4.0	B		8	&12	7			PAL02
1996 09 06.41			4.8	AA	0.0	E		1			0.3		SEA01
1996 09 06.41		M	4.8	AA	5.0	B		10	12	6	1.8		SEA01
1996 09 06.81		O	5.2	S	0.0	E		1		4/			KON06
1996 09 06.82		B	5.7	AA	5.0	B		10	8.0	4			HAS02
1996 09 06.82		M	5.4	S	0.0	E		1	20	3/			HOR02
1996 09 06.82		S	5.6	HD	3.2	B		8	15	5			SAR02
1996 09 06.84		O	5.2	S	0.0	E		1	12	4	0.7	120	ZNO
1996 09 06.85		B	5.4	SC	5.0	B		7		3			JOH01
1996 09 06.85		M	5.6	SC	5.0	B		10	15	6			GRA04
1996 09 06.86					15.0	B		25	8	4/	1	110	ZAN
1996 09 06.86		S	5.4	AA	4.2	B		7	14	5	1	85	ZAN

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 06.86		S	5.7	AA	3.4	B		9	&12	6			PER01
1996 09 06.87		S	5.7	AA	3.4	B		9	&15	5/			VIT01
1996 09 06.88		B	5.8	SC	5.0	B		7	15	5	0.8	120	BIV
1996 09 06.88		B	6.0	S	5.0	B		7	15	6			TRI
1996 09 07.39		S	5.1	AA	2.5	B		2					SEA
1996 09 07.40			4.8	AA	0.0	E		1			0.2		SEA01
1996 09 07.40		M	4.8	AA	5.0	B		10	10	4	1.0		SEA01
1996 09 07.46		S	5.5	S	15.0	R	5	25	18	5/			NAG02
1996 09 07.47		S	5.6	VG	5.0	B		7	17	7	0.5	100	NAG08
1996 09 07.74		S	5.9	VF	6.0	R	4	8					FIL05
1996 09 07.75		B	5.7	SC	5.0	B		7	18	4	0.5	90	MOR04
1996 09 07.78		B	6.0	AA	11	L	7	32	10	4			BAR06
1996 09 07.78		K	6.0	AA	8.0	B		12	10	s4/			LUK04
1996 09 07.78		M	5.8	AA	8.0	B		12	11	s4			BAR06
1996 09 07.78		S	5.7	AA	3.0	R		6	16	3			BAR06
1996 09 07.79		B	5.8	AA	8.0	B		12		4/			KHA01
1996 09 07.80		B	6.1	AA	8	M	16	31	12	6	0.3		ROM
1996 09 07.82					15.0	B		25	8	4/	1	110	ZAN
1996 09 07.82		S	5.4	AA	4.2	B		7	14	5	1	85	ZAN
1996 09 07.83		B	5.6	AA	5.0	B		7	8	S4			VEL03
1996 09 07.84		M	5.6	AA	5.0	B		10	13	6			BOU
1996 09 07.85		N	10.2	VB	20.3	T	10	80	5	6/	0.25	30	GRA04
1996 09 07.85		S	5.8	SC	5.0	B		10	&12	5			COM
1996 09 07.85		S	6.2	AA	6.3	B		9	10	S7/			KAM01
1996 09 07.86		M	5.8	SC	5.0	B		10	13	5			GRA04
1996 09 07.87		B	5.8	S	7.0	B		10	12	6/	0.30	95	SAN04
1996 09 07.87		B	5.9	S	7.0	B		10	9	6/	0.25	80	MAR02
1996 09 07.89		B	6.1	S	5.0	B		7	10	6			TRI
1996 09 07.89		S	5.5	AA	3.4	B		9	&15	5			PER01
1996 09 07.89		S	5.7	AA	3.4	B		9	&15	6			VIT01
1996 09 07.90		S	5.8	AA	12.5	R	5	20	20	5		20	BEA
1996 09 08.44			4.6	AA	0.0	E		1			35 m		SEA01
1996 09 08.44		M	4.8	AA	5.0	B		10	11	4	50 m		SEA01
1996 09 08.77					15.0	B		25	8	4/	1	110	ZAN
1996 09 08.77		S	5.4	AA	4.2	B		7	14	5	1	80	ZAN
1996 09 08.81		S	6.3	AA	6.3	R	13	52	8	5	0.9	95	KOS
1996 09 08.82		S	5.7	SC	4.0	B		8	12	6			SCH04
1996 09 08.84		S	5.6	AA	5.0	B		10	13	5			MOE
1996 09 08.86		S	5.7	SC	5.0	B		10	12	5			GRA04
1996 09 08.87		B	6.0	S	5.0	B		7	8	6			TRI
1996 09 08.89		S	5.3	AA	8.0	B		10	9	4	0.6	75	SHA02
1996 09 08.89		S	5.6	AA	5.0	B		7	12	4			SHA02
1996 09 09.41			4.7	AA	0.0	E		1			25 m		SEA01
1996 09 09.41		M	4.8	AA	5.0	B		10	13	4	35 m		SEA01
1996 09 09.42		I	5.1	SC	0.7	E		1					CAM03
1996 09 09.42		S	5.4	SC	8.0	B		20	15	s5	2	110	CAM03
1996 09 09.78		M	6.6	SC	5.0	B		10	10	4			AND03
1996 09 09.80	!	V	6.0	YF	20.0	T	2		&25	7	&1	115	MIK
1996 09 09.81		S	5.8	AA	48.5	L	4	58	12	3			MOE
1996 09 09.82		M	5.7	AA	5.0	B		7	13	6			BOU
1996 09 09.87		S	5.9	SC	5.0	B		10	9	5			ZAN01
1996 09 09.87		S	6.3	AA	4.0	B		8	9	3	0.15	12	TAY
1996 09 09.88		S	5.5:	AC	8.0	B		20	&22				ANZ
1996 09 09.90		B	5.8	AA	5.0	B		7	11.4	5			HOM
1996 09 10.17		S	5.9	AA	5.0	B		7	10	4/			SPR
1996 09 10.25		M	5.9	SC	3.5	B		7					OME
1996 09 10.40		S	5.2	AA	2.5	B		2					SEA
1996 09 10.41			4.6	AA	0.0	E		1			25 m		SEA01
1996 09 10.41		M	4.7	AA	5.0	B		10	12	3	35 m	270	SEA01
1996 09 10.43		I	5.1	SC	0.7	E		1					CAM03
1996 09 10.43		S	5.4	SC	8.0	B		20	15	s5	2	110	CAM03
1996 09 10.47		C	5.9	GA	8.0	R	6		20.5		>70 m	105	NAK01
1996 09 10.50		M	5.5	AA	10.0	B		20	10	7	0.5	105	YOS02
1996 09 10.57		S	5.7	AA	8.0	B		11	15	6			MOR06
1996 09 10.74		M	6.5	SC	5.0	B		10	10	4			AND03

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 10.75		B	5.7	SC	5.0	B		7	15	5	0.5	90	MOR04
1996 09 10.76		B	6.6	SC	5.0	B		10		3			RAD01
1996 09 10.78		S	6.3	AA	6.3	R	13	52	8	5	1.3	95	KOS
1996 09 10.80		B	6.5	AA	6	R	10	16	12	6	0.3		ROM
1996 09 10.83		S	5.6	AA	5.0	B		10	13	4			MOE
1996 09 10.87		M	5.4	AA	4.0	B		8	&12	7			PAL02
1996 09 10.87		S	5.9	AA	8.0	B		10	9	6	0.7	70	SHA02
1996 09 10.89		S	5.9	AA	5.0	B		7	12	4			SHA02
1996 09 11.06		S	5.9	HP	5.0	B		10	11	6/	0.3	90	BOR
1996 09 11.08		M	6.4	SC	5.0	B		10	7	s6	0.3	90	MOD
1996 09 11.18		S	5.9	AA	5.0	B		7	11	4/			SPR
1996 09 11.40			4.7	AA	0.0	E		1					SEA01
1996 09 11.40		M	4.8	AA	5.0	B		10	10	3			SEA01
1996 09 11.75		B	5.7	SC	5.0	B		7	12	S5	0.3	90	MOR08
1996 09 11.75		B	6.6	SC	5.0	B		10		3			RAD01
1996 09 11.81		M	6.6	SC	5.0	B		10	10	5			AND03
1996 09 11.84		S	5.7	AA	3.4	B		9	&12	5			PER01
1996 09 11.84		S	5.9	AA	3.4	B		9	&10	4/			VIT01
1996 09 11.85		B	6.1:	SC	5.0	B		7	10	6			BIV
1996 09 11.86		S	6.3	AA	4.0	B		8	9	3	0.15	50	TAY
1996 09 11.88		S	5.8	AA	5.0	B		8	20	5		20	BEA
1996 09 11.92		S	5.6	AA	8.0	B		11	15	4	>1		DES01
1996 09 12.47		S	5.4	SC	8.0	B		20	10	s5			CAM03
1996 09 12.81		B	5.8	S	5.0	B		7		6			TRI
1996 09 12.82		S	5.9	SC	5.0	R		8	&15	3/			COM
1996 09 12.84		S	5.9	AA	3.4	B		9	& 8	6			VIT01
1996 09 12.85		S	5.7	AA	3.4	B		9	& 8	5			PER01
1996 09 12.85		S	6.4	AA	4.0	B		8	9	3	0.15	12	TAY
1996 09 12.86		S	5.8	AA	5.0	B		8	20	5		20	BEA
1996 09 12.87		S	5.9	AA	8.0	B		10	9	5	0.25	70	SHA02
1996 09 12.88		S	5.5	SC	5.0	B		7	12	5	0.30	70	OKS
1996 09 12.92		S	5.7	AA	8.0	B		11	15	4	>1		DES01
1996 09 12.92		S	5.9	AA	6.3	B		11	5.3	4			LAN03
1996 09 13.38			4.8	AA	0.0	E		1					SEA01
1996 09 13.38		M	4.8	AA	5.0	B		10	11	4			SEA01
1996 09 13.75		B	5.7	SC	5.0	B		7	12	S5	0.3	90	MOR04
1996 09 13.82		M	5.3	S	3	R		2	15	4/			HOR02
1996 09 13.83		S	5.4	AA	0.0	E		1	&15				ZAN
1996 09 13.83		S	5.6	AA	4.2	B		7	11	5	0.75	70	ZAN
1996 09 13.84					15.0	B		25	8	4/	0.75	105	ZAN
1996 09 13.84		B	5.7	S	5.0	B		7	30	6	0.35	130	TRI
1996 09 13.85		B	6.1	S	7.0	B		10	9	6	0.25	70	MAR02
1996 09 13.87		S	5.8	AA	8.0	B		10	9	5	0.3	80	SHA02
1996 09 13.88		B	5.9	SC	5.0	B		7	9	6	0.8	100	BIV
1996 09 13.89		S	5.7	AA	5.0	B		7	12	4			SHA02
1996 09 13.92		S	5.7	AA	8.0	B		11	20	4/	>1		DES01
1996 09 14.36		M	4.8	AA	5.0	B		10	10	4			SEA01
1996 09 14.41		S	5.3	AA	2.5	B		2					SEA
1996 09 14.44		M	5.7	S	3.5	B		10	15	6			NAK01
1996 09 14.49		M	5.7	AA	5.0	B		7	15	4			KAT01
1996 09 14.50		B	5.6	AA	3.5	B		7					TSU02
1996 09 14.73		B	5.7	SC	5.0	B		7	12	5	0.34	90	MOR04
1996 09 14.80		M	5.5	S	3	R	4	2	15	4/	1	115	HOR02
1996 09 14.80		M	5.7	S	8.0	B		10	13	4/	1.5	120	HOR02
1996 09 14.81		M	5.6	AA	5.0	B		7	13	6			BOU
1996 09 14.81		S	5.2:	AC	8.0	B		20	&22				ANZ
1996 09 14.82					15.0	B		25	8	4/	0.75	105	ZAN
1996 09 14.82		S	5.4	AA	0.0	E		1	&15				ZAN
1996 09 14.82		S	5.6	AA	4.2	B		7	11	5	0.75	70	ZAN
1996 09 14.83		B	6.2	S	7.0	B		10	9	6/	0.35	75	MAR02
1996 09 14.83		S	5.5	AA	3.4	B		9	&14	5/			PER01
1996 09 14.83		S	5.7	AA	3.4	B		9	&10	5/			VIT01
1996 09 14.85		M	5.7	SC	5.0	B		7	14	5			SKI
1996 09 14.85		M	5.8	SC	5.0	B		10	13	6	0.4	80	GRA04
1996 09 14.85		S	6.3	AA	4.0	B		8	9	4	0.15	12	TAY

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 14.87		S	5.8	AA	6.3	B		11	6.5	2			LANO3
1996 09 14.89		M	5.7	AA	4.0	B		8	&13	6			PALO2
1996 09 14.95		S	5.6	AA	8.0	B		11	20	4/	>1		DESO1
1996 09 15.04		S	5.9	HP	5.0	B		10	11	7			BOR
1996 09 15.39		M	4.8	AA	5.0	B		10	12	4			SEAO1
1996 09 15.40		S	5.4	SC	8.0	B		20	12	s5			CAMO3
1996 09 15.45		S	5.7	VG	5.0	B		7	14	6	0.5	90	NAGO8
1996 09 15.46		S	5.4	S	15.0	R	5	25	15	6	0.33		NAGO2
1996 09 15.50		M	5.6	AA	10.0	R	8	20	19	6			GOU
1996 09 15.54		S	6.2	AA	25.4	T	6	32	10	S3			YOSO4
1996 09 15.73		B	5.8	SC	5.0	B		7	10	5	0.3	90	MORO4
1996 09 15.73		B	6.5	SC	5.0	B		10		2			RADO1
1996 09 15.74		M	6.5	SC	5.0	B		10	10	5			ANDO3
1996 09 15.77		B	5.8	AA	5.0	B		7	16	S4			VELO3
1996 09 15.77		S	6.2	AA	6.3	R	13	52	15	5	1.2	95	KOS
1996 09 15.81		M	5.6	AA	5.0	B		7	14	6			BOU
1996 09 15.82					15.0	B		25	8	4/	0.75	105	ZAN
1996 09 15.82		S	5.4	AA	0.0	E		1	&15				ZAN
1996 09 15.82		S	5.6	AA	4.2	B		7	11	5	0.75	70	ZAN
1996 09 15.83		S	6.0	AA	8.0	B		10	9	4			SHAO2
1996 09 15.84		B	6.0	SC	5.0	B		7	10	6			BIV
1996 09 15.84		M	5.9	SC	5.0	R		8	&15	4			COM
1996 09 15.85		M	5.6	SC	5.0	B		7	15	5/			SKI
1996 09 15.85		S	5.8	SC	5.0	B		7	9	6			OKS
1996 09 15.86		S	5.7	AA	5.0	B		7					DIEO2
1996 09 15.88		S	6.3	SC	5.0	B		10	5	5			LAA
1996 09 15.89		S	5.7	SC	5.0	B		10	12	5			ZANO1
1996 09 15.96		S	5.6	AA	8.0	B		11	20	4	>1		DESO1
1996 09 16.41			4.8	AA	0.0	E		1					SEAO1
1996 09 16.41		M	4.9	AA	5.0	B		10	10	4	30 m		SEAO1
1996 09 16.43		S	6.4	AA	25.4	T	6	32	8	S3			YOSO4
1996 09 16.53		S	6.0	AA	8.0	B		11	7	4			MIYO1
1996 09 16.73		B	6.3	SC	5.0	B		10		2			RADO1
1996 09 16.74		M	6.3	SC	5.0	B		10	10	5			ANDO3
1996 09 16.75		B	5.8	SC	5.0	B		7	10	5	0.3	90	MORO4
1996 09 16.81		B	6.0	AA	5.0	B		10	5.2	4			HASO2
1996 09 16.81		M	5.5	AA	5.0	B		7	15	6			BOU
1996 09 16.83		S	5.9	AA	8.0	B		10	9	5	0.4	78	SHAO2
1996 09 16.84		B	6.0	SC	5.0	B		7	12	6	0.6	110	BIV
1996 09 16.84		S	5.9	AA	5.0	B		7	12	4			SHAO2
1996 09 16.84		S	6.0	AA	6.3	B		9	12	s7	0.3	90	KAMO1
1996 09 16.84		S	6.1	SC	5.0	B		10	&15	4			COM
1996 09 16.85		S	5.4	AA	3.4	B		9	&14	5			PERO1
1996 09 16.85		S	5.6	AA	5.0	B		7					DIEO2
1996 09 16.86		S	5.7	SC	5.0	B		10	13	5			GRAO4
1996 09 16.88		S	5.6	SC	5.0	B		7	11	6			OKS
1996 09 17.43		M	4.9	AA	4.0	B		8	13	3			SEAO1
1996 09 17.43		M	5.5	AA	5.0	B		7	15	4			KATO1
1996 09 17.49		I	5.0	SC	0.7	E		1					CAMO3
1996 09 17.49		S	5.4	SC	8.0	B		20	12	5			CAMO3
1996 09 17.78		B	5.7:	AA	5.0	B		7	16	S4			VELO3
1996 09 17.80		B	5.8	SC	5.0	B		7	10	5	0.3	90	MORO4
1996 09 17.84		S	5.6	SC	4.0	B		8	14	4	0.5	90	SCHO4
1996 09 17.84		S	6.0	AA	5.0	B		7	12	4			SHAO2
1996 09 17.85		S	5.7	SC	5.0	B		7	9	6	0.25	80	OKS
1996 09 17.85		S	6.2	AA	7.0	B		16	9	4	0.33	45	TAY
1996 09 17.88		M	6.6	SC	5.0	B		10	10	3			ANDO3
1996 09 17.89		B	5.6	S	5.0	B		7	22	6	0.35	120	TRI
1996 09 17.95		S	5.4	AA	8.0	B		11	25	4	>1.5		DESO1
1996 09 18.41		S	5.5:	AA	5.0	B		10					SEA
1996 09 18.51		M	5.9	AA	3.5	B		7					TSUO2
1996 09 18.78		M	6.0	AA	4.5	R	5	10	15	5	0.7	110	NEV
1996 09 18.79		K	6.1	AA	3.0	B		8	15	4			SEM
1996 09 18.79		S	6.0	AA	3.0	B		8	15	4			GOL
1996 09 18.81		M	5.6	AA	5.0	B		7	14	5			BOU

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 18.81		S	5.8	AA	15.2	L	5	42	13	4	0.6	95	MOE
1996 09 18.82		S	6.3	SC	5.0	B		10	&12	4			COM
1996 09 18.85		B	5.5	S	5.0	B		7	16	6			TRI
1996 09 18.86		M	5.7	SC	5.0	B		10	13	5			GRA04
1996 09 18.88		S	5.7	SC	5.0	B		10	12	5			ZAN01
1996 09 18.90		S	6.3	AA	5.0	B		7	11.8	6			HOM
1996 09 18.95		S	5.4	AA	8.0	B		11	25	4	>1.5		DES01
1996 09 19.75		K	6.0	AA	11.0	B		20	&17	6	&0.8		NEV
1996 09 19.75		M	5.8	AA	8.0	B		12	12	s4	0.2	20	BAR06
1996 09 19.75		S	6.5	AA	3.5	B		7	15				KOL04
1996 09 19.76		S	6.1	AA	11	L	7	50	10	4			BAR06
1996 09 19.77		M	5.9	S	10	B		25	16	4			ZNO
1996 09 19.81		S	5.8	AA	15.2	L	5	42	12	4	0.5	100	MOE
1996 09 19.89		B	5.5	S	5.0	B		7	15	6			TRI
1996 09 20.05		S	5.8	HP	5.0	B		10	11	6			BOR
1996 09 20.08		S	5.1	SC	5.0	B		10	10	4			DAH
1996 09 20.12	&	M	6.4	SC	5.0	B		10	8	s5			MOD
1996 09 20.79		B	5.7	S	5.0	B		7	15	6			TRI
1996 09 20.80		B	6.2:	SC	5.0	B		7	8	5	0.2		MOR04
1996 09 21.05		S	5.8	HP	5.0	B		10	11	6			BOR
1996 09 21.74		S	6.0:	VF	6.0	R	4	8					FIL05
1996 09 21.75		E	6.0:	VF	6.0	R	4	8					FIL05
1996 09 21.80		B	6.2:	SC	5.0	B		7	7	5	0.15		MOR04
1996 09 21.82		B	5.6	S	5.0	B		7	14	6			TRI
1996 09 22.50		S	6.1	S	5.6	B		8	7	6			OKA05
1996 09 22.79		B	5.5	S	5.0	B		7	12	6			TRI
1996 09 22.80		B	6.2:	SC	5.0	B		7	7	5	0.15		MOR04
1996 09 22.80		S	5.9	AA	15.2	L	5	42	12	4			MOE
1996 09 22.81		J	5.6	SC	25.4	T	4		8.29	s5	5.0m	39	ROQ
1996 09 23.76		M	6.2	AA	3.0	B		8	&15	2			NEV
1996 09 23.80		B	5.5	S	5.0	B		7	10	6			TRI
1996 09 24.01		S	5.4	SC	5.0	B		10	10	6			DAH
1996 09 24.76		M	6.4	SC	5.0	B		10	9	5			AND03
1996 09 24.82		S	5.6	SC	5.0	B		10	13	5			GRA04
1996 09 24.83		B	5.5	S	5.0	B		7	10	6			TRI
1996 09 24.83		N	10.0:	VB	20.3	T	10	123		6/			GRA04
1996 09 26.45		M	5.6	AA	10.0	R	8	20	19	6			GOU
1996 09 27.85		S	5.9	AA	5.0	B		7	9	3			SHA02
1996 09 27.85		S	6.0	AA	8.0	B		20	8	5	0.5	85	SHA02
1996 09 28.73		M	6.2	AA	4.5	R	5	10	&17	5			NEV
1996 09 28.78		S	5.7	AA	8.0	B		20	8	6	&1	70	ZAN
1996 09 28.80		M	5.5	SC	5.0	B		10	13	6			GRA04
1996 09 29.78		M	5.6	AA	4.2	B		7	11				ZAN
1996 09 29.78		S	5.6	AA	4.2	B		7	11	6/	&1.2	70	ZAN
1996 09 29.79					15.0	B		25	9	6	1.3	70	ZAN
1996 09 30.02		B	5.7	HP	5.0	B		10					BOR
1996 09 30.02		S	5.6	HP	5.0	B		10	9	7	1.0	110	BOR
1996 09 30.41			4.7	AA	0.0	E		1			2.0		SEA01
1996 09 30.41		M	4.6	AA	5.0	B		10	10	3	1.5		SEA01
1996 09 30.75		M	5.5	AA	4.0	B		8	&13	6	&0.5	120	PAL02
1996 09 30.76		M	5.7	TI	5.0	B		7	9	4	1.0	80	KYS
1996 09 30.77		M	5.4	S	8.0	B		10	9	6	1.5	110	HOR02
1996 09 30.78		M	6.3	SC	5.0	B		10	8	4			AND03
1996 09 30.79	!	V	5.3	YF	20.0	T	2		&20	7	&1	115	MIK
1996 09 30.81		B	5.9	SC	5.0	B		7	10	7			BIV
1996 10 01.01		B	5.7	HP	5.0	B		10					BOR
1996 10 01.01		S	5.0	SC	25.4	L	4	46	20	D6	1.0	90	DID
1996 10 01.01		S	5.6	HP	5.0	B		10	8	7	1.0	110	BOR
1996 10 01.07	a	M	6.2	SC	5.0	B		10	5.7	S7			MOD
1996 10 01.41			4.7	AA	0.0	E		1			1.5		SEA01
1996 10 01.41		M	4.7	AA	5.0	B		10	10	3	1.6		SEA01
1996 10 01.43		S	5.2	AA	3.0	B		2					SEA
1996 10 01.44		M	5.5	AA	3.5	B		7	18	6	0.5	105	YOS02
1996 10 01.80		M	5.4	AA	5.0	B		7	17	6/			BOU
1996 10 01.83		S	5.9	AA	5.0	B		7					DIE02

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 01.89		S	5.9	AA	8.0	B		20	8	5	0.5	79	SHA02
1996 10 02.02		B	5.7	HP	5.0	B		10					BOR
1996 10 02.02		S	5.7	HP	5.0	B		10	9	7/			BOR
1996 10 02.40		S	5.1	AA	3.0	B		2					SEA
1996 10 02.41			4.8	AA	0.0	E		1			1.4		SEA01
1996 10 02.41		M	4.7	AA	5.0	B		10	11	3	1.5		SEA01
1996 10 02.74		B	5.4	S	5.0	B		7	15	5			TRI
1996 10 02.74		S	5.6	A	11	L	7	32	9	3			POM
1996 10 02.78		M	5.4	AA	5.0	B		7	16	6/	1.0	94	BOU
1996 10 02.79		S	5.7	AC	5.0	B		10	19	5			GIL01
1996 10 02.80		S	5.3	SC	5.0	B		7	& 6	2			JOH01
1996 10 02.80		S	5.6	AA	5.0	B		7	9	4	0.5	85	SHA02
1996 10 02.80		S	5.8	AA	8.0	B		10	9	5	1.0	80	SHA02
1996 10 02.81					15.0	B		25	10	6	1.5	70	ZAN
1996 10 02.81		S	5.4	AA	0.0	E		1					ZAN
1996 10 02.81		S	5.5	AA	4.2	B		7	13	6/	1.5	70	ZAN
1996 10 02.81		S	5.7	AA	5.0	B		10	10	5	0.4	80	MOE
1996 10 02.82		B	5.9	SC	5.0	B		7	10	7	0.7	100	BIV
1996 10 02.83		M	6.0	SC	5.0	B		10	&15	5			COM
1996 10 02.88		S	5.7	SC	8.0	B		15	&15	6			SCH04
1996 10 03.38		S	5.1	AA	0.0	E		1					SEA
1996 10 03.39		M	4.9	AA	5.0	B		10	12	4	1.4		SEA01
1996 10 03.40			4.7	AA	0.0	E		1			1.0		SEA01
1996 10 03.48		S	5.3	SC	8.0	B		20	10	4			CAM03
1996 10 03.76		B	5.6	AA	5.0	B		7	17	S5			VEL03
1996 10 03.76		M	5.2	S	2.4	B		3	16	4	1	90	PLS
1996 10 03.76		M	5.2	S	3	R	4	2	11	6	1.5	115	HOR02
1996 10 03.76		M	5.8	TI	5.0	B		7	10	4			KYS
1996 10 03.79		B	5.5	AA	5.0	B		10	16.8	4			HAS02
1996 10 03.80		B	5.4	S	5.0	B		7	16	5			TRI
1996 10 03.80	!	V	5.3	YF	20.0	T	2		&20	7	&1	115	MIK
1996 10 03.81					15.0	B		25	10	6	1.5	70	ZAN
1996 10 03.81		M	5.5	AA	4.2	B		7	13				ZAN
1996 10 03.81		S	5.4	AA	0.0	E		1					ZAN
1996 10 03.81		S	5.5	AA	4.2	B		7	13	6/	1.5	70	ZAN
1996 10 03.83		M	5.3	AA	6	R		20	20	4	0.5	95	BAR06
1996 10 04.00		B	5.8	HP	5.0	B		10					BOR
1996 10 04.00		S	5.7	HP	5.0	B		10	8	7	1.0	120	BOR
1996 10 04.09		J	5.5	SC	25.4	T	4		7.66	S6/			ROQ
1996 10 04.52		S	5.4	AA	8.0	B		11	15	6			MOR06
1996 10 04.73		B	5.6	AA	5.0	B		7	17	S5	0.4	97	VEL03
1996 10 04.73		M	6.0	AA	4.5	R	5	12	15	5	0.88	110	NEV
1996 10 04.75		B	5.4	AA	5.0	B		10					HAS02
1996 10 04.76		M	5.1	S	3	R	4	2	13	6	1	115	HOR02
1996 10 04.76		M	5.5	TI	8.0	B		10	15		1.0		POD
1996 10 04.77		S	5.9	SC	5.0	B		10	&12	5	0.5		COM
1996 10 04.80		S	5.7	AA	5.0	B		7					DIE02
1996 10 04.83		M	5.4	AA	6	R		20	18	5	0.5	100	BAR06
1996 10 04.85		B	5.3	S	5.0	B		7	18	5			TRI
1996 10 04.85		M	5.2	S	7.0	B		10	9	5/	0.7	100	MAR02
1996 10 04.88		M	5.6	S	7.0	B		10	10	6/	0.5	120	SAN04
1996 10 05.00		B	6.0	AA	3.5	B		7	&16	6			GRE
1996 10 05.01		S	5.4	AA	3.5	B		7	&16	6			GRE
1996 10 05.02		S	5.6	AA	5.0	B		12	&14	5/			GRE
1996 10 05.17		S	5.5	AA	8.0	B		11	11	6/			SPR
1996 10 05.41		S	5.8	VG	5.0	B		7	15	5	0.5	80	NAG08
1996 10 05.43		M	5.6	AA	10.0	R	8	20	19	6			GOU
1996 10 05.45		B	5.8	HJ	5.0	B		7	16	5	&0.7	80	KIN
1996 10 05.71		K	5.8	AA	11.0	B		20	12	6	1.3	100	NEV
1996 10 05.77		M	5.3	AA	5.0	B		7	15	7	1.2	97	BOU
1996 10 05.82		S	5.2	AA	0.8	E		1	&15	3			SHA02
1996 10 05.82		S	5.2	AA	5.0	B		7	9	5	1.2	96	SHA02
1996 10 05.84		M	5.3	AA	6	R		20	22	4			BAR06
1996 10 05.87		S	5.8	SC	4.0	B		8	&12	5/			SCH04
1996 10 06.01		S	5.7	HP	5.0	B		10	8	6/	1.0	100	BOR

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 06.77		M	5.3	AA	5.0	B		7	16	7			BOU
1996 10 06.78		S	5.3	AA	15.2	L	5	42	12	4	1.2	85	MOE
1996 10 06.79		S	5.8	SC	4.0	B		8	16	5			SCH04
1996 10 06.84		M	5.3	AA	6	R		20	21	4			BAR06
1996 10 07.00		B	5.7	HP	5.0	B		10					BOR
1996 10 07.00		S	5.6	HP	5.0	B		10	11	7	1.3	120	BOR
1996 10 07.46		S	5.3	SC	8.0	B		20	10	5			CAM03
1996 10 07.71		S	5.4	A	11	L	7	32	10	4			POM
1996 10 07.72		M	5.8	AA	7	R	4	10	13	5	1	98	NEV
1996 10 07.72		S	5.5	A	11	L	7	32	10	4			POM
1996 10 07.74		B	5.6	AA	5.0	B		7	16	S5			VEL03
1996 10 07.76		S	5.4	AA	15.2	L	5	42	11	5	1.1	85	MOE
1996 10 07.77		M	5.3	S	8.0	B		10	13	5	0.7	105	HOR02
1996 10 07.77		M	5.4	AA	5.0	B		7	15	6/			BOU
1996 10 07.84		M	5.4	AA	6	R		20	16	s4			BAR06
1996 10 07.84		M	5.5	AA	3.0	B		4	18	s4			BAR06
1996 10 08.02		B	5.8	AA	3.5	B		7	&12	6/			GRE
1996 10 08.03		B	5.7	AA	5.0	B		12	&14	5/			GRE
1996 10 08.03		S	5.2	AA	5.0	B		12	&14	5/			GRE
1996 10 08.03		S	5.5	AA	3.5	B		7	&12	6/			GRE
1996 10 08.18		S	5.4	AA	8.0	B		11	10	5/			SPR
1996 10 08.39		S	5.0	AA	0.0	E		1					SEA
1996 10 08.41		S	4.9	AA	5.0	B		10					SEA01
1996 10 08.72		B	5.5:	AA	5.0	B		7	15	D4			VEL03
1996 10 08.72		K	5.7	AA	11.0	B		20	10	6	1.05	101	NEV
1996 10 08.77		S	5.3	AA	15.2	L	5	42	10	5	0.8	85	MOE
1996 10 08.80		B	5.4	S	5.0	B		7	20	5			TRI
1996 10 08.84		M	5.4	AA	6	R		20	16	s4			BAR06
1996 10 09.09		J	5.4	SC	25.4	T	4		10.15	S5/			ROQ
1996 10 09.17		S	5.4	AA	5.0	B		7	10	6/			SPR
1996 10 09.39			4.6	AA	0.0	E		1			20 m		SEA01
1996 10 09.39		M	4.9	AA	5.0	B		10	11	5	1.3		SEA01
1996 10 09.44		M	5.7	AA	3.5	B		7					TSU02
1996 10 09.83		B	5.3	S	5.0	B		7	20	5			TRI
1996 10 09.84		M	5.5:	AA	6	R		20	16	4			BAR06
1996 10 10.17		S	5.3	AA	5.0	B		7	11	6/			SPR
1996 10 10.40			4.7	AA	0.0	E		1					SEA01
1996 10 10.40		M	4.8	AA	5.0	B		10	10	4	1.3		SEA01
1996 10 10.40		S	5.7:	VG	5.0	B		7	12	6	0.8	80	NAG08
1996 10 11.40			4.7	AA	0.0	E		1			0.8		SEA01
1996 10 11.40		M	4.9	AA	5.0	B		10	9	5	1.3		SEA01
1996 10 11.70		K	5.8	AA	11.0	B		20	10	6	0.68	94	NEV
1996 10 11.72		B	5.4	AA	5.0	B		7	17	s5	0.5	106	VEL03
1996 10 11.74		S	5.3	AA	3.0	B		4	22	s3			BAR06
1996 10 11.76		S	5.2	AA	6	R		20	12	s5	0.7		BAR06
1996 10 11.77		M	5.3	S	5.0	B		7	13	5/	1	105	HOR02
1996 10 11.78		M	5.4	S	5.0	B		10	20	4	1.8	120	PLS
1996 10 11.88	w	M	5.2	S	7.0	B		10	8	6	0.5	100	SAN04
1996 10 11.88	w	M	5.2	S	7.0	B		10	8	7	0.4	85	MAR02
1996 10 12.00		B	5.7	AA	3.5	B		7	&15	6/	<1		GRE
1996 10 12.00		B	5.7	HP	5.0	B		10					BOR
1996 10 12.00		S	5.6	HP	5.0	B		10	8	7	1.7	125	BOR
1996 10 12.01		S	5.2	AA	3.5	B		7	&15	6/			GRE
1996 10 12.01		S	5.4	AA	5.0	B		12	&15	6	&0.5		GRE
1996 10 12.39		S	4.9	AA	0.0	E		1					SEA
1996 10 12.71		S	5.7	VF	6.0	R	4	8	15	s4	0.3		FIL05
1996 10 12.74		M	5.3	S	5.0	B		10	13	5/	1	110	HOR02
1996 10 12.74		S	5.2	HD	5.7	R	4	8	15	6	1.5	70	SAR02
1996 10 12.75		P	5.9:	SC	6.7	A	4	.5	10		0.3	275	FIL05
1996 10 12.75		S	5.0:	HD	6.0	B		20	12	6	1.5	75	SAR02
1996 10 12.76		S	5.3	AA	6	R		20	16	4			BAR06
1996 10 12.76	!	V	5.0	YF	20.0	T	2		&25	7	&1	120	MIK
1996 10 13.40			4.8	AA	0.0	E		1					SEA01
1996 10 13.40		M	4.9	AA	5.0	B		10	9	3	1.2		SEA01
1996 10 13.40		S	4.9	AA	0.0	E		1					SEA

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 13.73		0	5.2	S	0.0	E		1	15	5			ZNO
1996 10 13.73		S	5.3	AA	6	R		20	17	3/			BAR06
1996 10 13.74		M	4.9	S	5.0	B		10	17	4/			PLS
1996 10 13.74		M	5.3	S	8.0	B		10	11	5/	1	110	HOR02
1996 10 13.74		S	5.2	HD	5.7	R	4	8	15	5/	2.5	70	SAR02
1996 10 13.76		M	5.5	S	5.0	B		7	10		1.0		POD
1996 10 13.78		S	5.2	AA	8.0	B		10	9	5	0.5	80	SHA02
1996 10 13.78		S	5.4	AA	15.2	L	5	42	10	5	0.7	80	MOE
1996 10 14.40		S	4.9	AA	0.0	E		1					SEA
1996 10 14.41		M	5.6	AA	3.5	B		7	&15	6			YOS02
1996 10 14.42		S	5.2	SC	5.0	R		8	10	5	2	80	CAM03
1996 10 14.73		B	5.4:	AA	5.0	B		7		D5			VEL03
1996 10 14.76		M	5.3	AA	6	R		20	17	4	0.5		BAR06
1996 10 14.76		S	5.5:	AA	5.0	B		10	10	5	0.5	80	MOE
1996 10 14.77		M	5.2	S	8.0	B		10	11	5/	0.5	110	HOR02
1996 10 14.79		B	5.4	AA	5.0	B		10	12.5	4			HAS02
1996 10 14.99		B	5.8	AA	3.5	B		7					GRE
1996 10 14.99		S	5.2	AA	3.5	B		7	&15	6/			GRE
1996 10 15.00		B	5.7	AA	5.0	B		12					GRE
1996 10 15.00		S	5.0	AA	5.0	B		12	&13	6	&1		GRE
1996 10 15.17		S	5.2	AA	8.0	B		11	15	6/			SPR
1996 10 15.40		S	4.9	AA	0.0	E		1					SEA
1996 10 15.40		S	6.0:	VG	5.0	B		7	15	5			NAG08
1996 10 15.70		B	5.4:	AA	5.0	B		7	14	D5			VEL03
1996 10 15.70		K	5.6	AA	11.0	B		20	12	7	1	95	NEV
1996 10 15.75		M	5.2	AA	6	R		20	18	4	0.6		BAR06
1996 10 15.75		S	5.1	AA	3.0	B		4	22	s3			BAR06
1996 10 15.75		S	5.4:	AA	5.0	B		10	10	5			MOE
1996 10 15.78		S	5.1	AA	8.0	B		10	9	6	0.9	84	SHA02
1996 10 15.79		S	5.1	AA	5.0	B		7	12	5			SHA02
1996 10 16.08		J	5.4	SC	25.4	T	4		7.57	S5/	3.5m	75	ROQ
1996 10 16.40		M	4.8	AA	4.0	B		8	12	3	25 m		SEA01
1996 10 16.42		S	5.8	AA	10.0	R	8	20	18	5			GOU
1996 10 16.42		S	5.9	VG	8.0	B		11	16	6	0.3	100	NAG08
1996 10 16.43		M	5.6	AA	3.5	B		7					TSU02
1996 10 16.43		S	5.8	AA	8.0	B		11	15	6			MOR06
1996 10 16.73		M	5.6	TI	5.0	B		7	18	5			DVO
1996 10 16.74		M	5.3:	AA	6	R		20	17	3			BAR06
1996 10 16.75		M	5.2	S	5.0	B		10	15	5	1.5	100	HOR02
1996 10 16.77		B	5.6	S	5.0	B		7	25	5			TRI
1996 10 16.80		S	4.8	AA	0.8	E		1	15	3			SHA02
1996 10 16.80		S	5.1	AA	5.0	B		7	9	5	0.80	87	SHA02
1996 10 16.92		S	5.1	AA	8.0	B		20	12	6			LOU
1996 10 17.17		S	5.4	AA	8.0	B		11	11	6/			SPR
1996 10 17.40		M	4.6	AA	4.0	B		8	12	2			SEA01
1996 10 17.43		S	6.4	AA	8.0	B		11	6	3			MIY01
1996 10 17.74		S	4.8	AA	8.0	B		20	9	6/			BAR
1996 10 17.78		S	4.5	AA	0.8	E		1	15	3			SHA02
1996 10 17.78		S	4.9	AA	8.0	B		10	9	5	0.70	73	SHA02
1996 10 17.82		S	5.5	SC	8.0	B		15	&15	4/	0.5	80	SCH04
1996 10 17.93		S	5.3	AA	8.0	B		20	12	6/			LOU
1996 10 18.78		B	5.5	AA	5.0	B		10	10.4	4			HAS02
1996 10 18.97		S	4.8	SC	25.4	L	4	46	20	D6			DID
1996 10 19.16		S	5.2	AA	8.0	B		11	13	5/			SPR
1996 10 19.72		S	5.4	HD	5.0	B		10	10	5	2	55	SAR02
1996 10 19.74		S	5.1	AA	4.2	B		7	13	6/	2	100	ZAN
1996 10 19.76					15.0	B		25	9	6	1.5	70	ZAN
1996 10 19.76		S	5.2	AA	15.2	L	5	42	11	5	0.8	80	MOE
1996 10 19.80		S	5.3	SC	8.0	B		15	12	4	0.5	81	SCH04
1996 10 20.42		S	5.4	AA	5	R		8	18	3			YOS04
1996 10 21.40		S	5.8	AA	10.0	R	8	20	18	5			GOU
1996 10 22.75		S	5.2	AA	5.0	B		10	9	5			MOE
1996 10 22.76		B	5.4	AA	5.0	B		10					HAS02
1996 10 23.73		M	5.0	S	5.0	B		10	15	4/			HOR02

Comet C/1995 O1 (Hale-Bopp) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 23.74		S	5.2	AA	5.0	B		10	9	5			MOE
1996 10 23.74	!	V	5.0	YF	20.0	T	2		&25	7	&1	110	MIK
1996 10 23.77		S	5.5	SC	4.0	B		8	&15	6			SCH04
1996 10 24.38		S	5.8	AA	10.0	R	8	20	18	5			GOU
1996 10 24.75		S	5.1	AA	15.2	L	5	42	9	5	0.8	80	MOE
1996 10 25.76		S	4.9	AA	5.0	B		7	9	5			SHA02
1996 10 25.76		S	5.2	AA	8.0	B		20	8	5	1	78	SHA02
1996 10 28.39		S	4.8	AA	0.0	E		1					SEA
1996 10 28.75		S	5.2	SC	4.0	B		8	&15	5			SCH04
1996 10 29.74		M	5.2	AA	5.0	B		7	17	5/	0.8	80	BOU
1996 10 29.75		S	5.1	AA	8.0	B		10	7	6	1.2	91	SHA02
1996 10 29.96		B	5.4	AA	3.5	B		7					GRE
1996 10 29.96		S	5.0	AA	3.5	B		7	&20	7			GRE
1996 10 29.97		B	5.6	AA	5.0	B		12					GRE
1996 10 29.97		M	5.2:	AA	5.0	B		12					GRE
1996 10 29.97		S	5.0	AA	5.0	B		12	&13	6/			GRE
1996 10 30.23		M	4.4	SC	0.0	E		1					OME
1996 10 30.45		S	5.1	SC	8.0	B		20	10	7	2	70	CAM03
1996 10 30.76	!	V	5.2	YF	20.0	T	2		&25	7	&1	100	MIK
1996 10 31.08		J	4.8	SC	25.4	T	4		10.09	S6			ROQ
1996 10 31.45		S	5.1	SC	8.0	B		20	10	7	2	70	CAM03

Comet C/1995 Q1 (Bradfield)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1995 10 02.17		S	8.0	AA	8.0	B		15		5/			DIJ
1995 10 06.17		S	8.3	AA	8.0	B		15		6			DIJ

Comet C/1995 Y1 (Hyakutake)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 01 31.17		S	9.5	AA	6.3	R	13	52	3	3			KOS
1996 01 31.17		S	9.6	AA	6.3	R	13	52	3	2/			CSU
1996 02 11.21	&	B	8.8	S	6.6	B		20	8	s1/			PLE01
1996 02 13.19	&	B	8.9	S	10.0	B		25	7	s2			PLE01
1996 02 25.41		M	9.1	NO	20.0	L	5	35	2.4	3			MOD
1996 02 26.17		S	9.0	AC	6.3	R	13	52	2	2			KOS
1996 02 26.22		S	9.0	S	10.0	B		25	8	s1/			PLE01
1996 02 27.14		B	8.5	S	25	L	6	100	4	1			SWI
1996 02 27.16		M	9.0	S	14.7	L	6	26	3	2			SIW01
1996 02 27.18		B	8.9	S	10.0	B		25	10	s2			PLE01
1996 02 28.18		B	8.8	S	10.0	B		25	12	s2			PLE01
1996 02 28.20		M	8.7	S	14.7	L	6	26	3	2			SIW01
1996 02 29.19		B	8.8	S	6.6	B		20	10	s2			PLE01
1996 03 09.10		S	9.0	S	6.6	B		20	10	s2			PLE01
1996 03 10.08		S	9.0	S	6.6	B		20	9	s1/			PLE01
1996 03 15.09		S	8.9	S	6.6	B		20	8	s1/			PLE01
1996 03 18.11		B	9.5:	S	25	L	6	100	& 3	0			SWI
1996 03 20.07		S	9.0	S	10.0	B		25	10	s1/			PLE01
1996 03 20.10		B	9.1	S	25	L	6	100	& 3	0			SWI
1996 03 22.09		B	9.1:	S	25	L	6	100	& 3	0			SWI
1996 03 23.42		M	9.6	GA	20.0	L	5	35	1.8	3			MOD
1996 06 26.34		S[	13.7	GA	35.9	L	7	164	! 0.5				MOD
1996 07 16.78		C	17.0:	GA	60.0	Y	6		0.5				NAK01
1996 07 16.96		O[	14.2	HS	35	L	5	237	! 0.6				HOR02
1996 07 24.76		C	17.3	GA	60.0	Y	6		0.55				NAK01
1996 07 26.74		C	17.7	GA	60.0	Y	6		0.45				NAK01
1996 08 10.72		C	17.7:	GA	60.0	Y	6		0.45				NAK01
1996 08 19.67		C	18.0	GA	60.0	Y	6		0.35				NAK01
1996 08 21.08		C	18.3	HS	65	L	4		0.2				PRA01
1996 09 15.68		C	18.5	GA	60.0	Y	6		0.25				NAK01
1996 10 05.63		C	19.1	GA	60.0	Y	6		0.25				NAK01

Comet C/1996 B1 (Szczepanski)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 02 08.90		B	8.5:	S	5.0	B		12	8	d1			FAJ
1996 02 09.84		0	8.3:	S	5.0	B		10	&10	S2/			FAJ
1996 02 10.99		B	8.5	S	6.6	B		20	8	s1/			PLE01
1996 02 12.85		S	8.3	AA	6.3	R	13	52	12	1			KOS
1996 02 12.85		S	8.7	S	14.7	L	6	26	3	s2			SIW01
1996 02 12.88		B	8.5	S	10.0	B		25	14	s1/			PLE01
1996 02 13.03	!	B	8.1:	S	15	L	6	30		D6/			PIO01
1996 02 17.20		M	9.3	NO	20.0	L	5	35	4.0	2			MOD
1996 02 18.81		S	9.0	S	14.7	L	6	26	6	2/			SIW01
1996 02 18.84		S	9.0:	S	11.0	B		20	10	d3			DUS
1996 02 18.92		B	8.8	S	10.0	B		25	16	s2			PLE01
1996 02 19.97		S	9.2:	S	11.0	B		20	10	d2			DUS
1996 02 20.91		S	8.5	S	14.7	L	6	26	8	s2/			SIW01
1996 02 20.91		S	9.2:	S	11.0	B		20	10	d2			DUS
1996 02 21.78		B	8.7	S	6.6	B		20	16	s2			PLE01
1996 02 21.82		S	9.2:	S	11.0	B		20	12	d2			DUS
1996 02 23.87		S	9.2:	S	11.0	B		20	8	d2			DUS
1996 02 25.34		S	8.4	SC	5.0	B		10	12	1/			MOD
1996 02 25.40		M	9.1	GA	20.0	L	5	35	6.5	3			MOD
1996 02 25.88		S	9.0	S	10.0	B		25	12	s2			PLE01
1996 02 26.37	!	B	7.7	S	15	L	6	80		S8			PIO01
1996 02 26.89		S	8.9	S	14.7	L	6	56	4	2			SIW01
1996 02 26.93		B	8.2	S	5.0	B		12	18	d0/			FAJ
1996 02 27.09		B	8.7	S	25	L	6	100	4	3			FAJ
1996 02 27.15		B	8.8	S	10.0	B		25	12	s2			PLE01
1996 02 27.94		S	9.2	S	14.7	L	6	56	4	1/			SIW01
1996 02 28.08		B	8.9	S	6.6	B		20	10	s2/			PLE01
1996 03 07.85		B	8.3:	S	5.0	B		10	&16	d0/			FAJ
1996 03 08.79		S	9.0	S	6.6	B		20	16	s3			PLE01
1996 03 08.81		S	8.9	S	14.7	L	6	26	7	3			SIW01
1996 03 08.85		S	8.2	AA	6.3	R	13	52	8	1			KOS
1996 03 09.80		S	9.1	S	6.6	B		20	15	s3			PLE01
1996 03 09.81		S	9.2	S	14.7	L	6	26	7	2/			SIW01
1996 03 09.86		0	8.1	S	5.0	B		12	10	d1			FAJ
1996 03 11.77		S	9.0	S	10.0	B		25	20	s2/			PLE01
1996 03 11.81		B	8.3:	S	5.0	B		10	10	d0			FAJ
1996 03 11.86		S	8.4	AA	6.3	R	13	52	8	1			KOS
1996 03 11.86		S	9.0	S	14.7	L	6	26	10	s3			SIW01
1996 03 13.27		S	8.9	GA	5.0	B		10	7.0	1			MOD
1996 03 13.79		B	9.4	S	6.0	R	5	20	16	3			KRY01
1996 03 14.76		S	9.1	S	6.6	B		20	19	s2			PLE01
1996 03 14.80		S	8.5	AA	6.3	R	13	52	6	2			KOS
1996 03 14.81		S	9.1	S	14.7	L	6	26	6	2/			SIW01
1996 03 16.24		M	10.0	GA	20.0	L	5	35	5.5	2/			MOD
1996 03 18.85		B	8.5	S	5.0	B		10	6	d0			FAJ
1996 03 18.98		S	9.3:	S	14.7	L	6	26	10	2			SIW01
1996 03 18.99	!	B	7.2:	S	15	L	6	30		S9			PIO01
1996 03 19.78	&	S	9.1	S	10.0	B		25	20	s2			PLE01
1996 03 19.89		S	8.6	AC	10.0	B		25		2			HAS02
1996 03 26.75	&	S	9.2	S	10.0	B		25	25	s2			PLE01
1996 03 28.72	&	S	9.2	S	10.0	B		25	14	s1/			PLE01
1996 04 06.85	!	B	8.4	S	15	L	6	30	6	S9			PIO01
1996 04 08.90	!	B	8.6	S	15	L	6	80	3	S9	0.1	34	PIO01

Comet C/1996 B2 (Hyakutake)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 02 14.13		M	9.3	AA	25.4	T	6	62	2.7	5			TAN02
1996 02 19.14		M	8.8	AA	25.4	T	6	62	2.5	5			TAN02
1996 02 25.45		M	7.4	SC	5.0	B		10	6.2	4			MOD
1996 02 26.08	$	B	7.0	S	6.6	B		20	8	s4			PLE01
1996 02 27.08	&	0	7.1:	S	6.0	B		20	&13	d5			SKO03
1996 02 27.09		B	7.4	S	25	L	6	100	6	6			SWI
1996 02 27.09	!	B	6.9	S	10.0	B		25	10	s4			PLE01
1996 02 27.09	&	B	6.8	S	5.0	B		10	9	6			SIW01

Comet C/1996 B2 (Hyakutake) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 02 27.09	&	M	7.2	S	8	R	8	35	5	7			KWI
1996 02 28.10	&	M	7.1	S	8	R	8	35	5	7			KWI
1996 02 28.11	!	B	6.7	S	10.0	B		25	12	s4/			PLE01
1996 02 28.19	&	B	6.9	S	5.0	B		10	9	5/			SIW01
1996 03 01.24		O	6.5	S	8.0	B		20	3	S4			SCH07
1996 03 01.75		S	5.9	AA	0.0	E		1					GAR01
1996 03 02.78		S	5.8	AA	0.0	E		1					GAR01
1996 03 03.78		S	5.7	AA	0.0	E		1					GAR01
1996 03 04.42	s	M	6.3	SC	5.0	B		10	8	3			MOD
1996 03 06.15		S	5.5	AA	5.0	B		12		2			TAN02
1996 03 08.10	!	B	5.5	S	6.6	B		20	12	s5	0.7	270	PLE01
1996 03 09.10	&	S	5.5:	S	5.0	B		10	& 6	S			OLE
1996 03 10.42		M	5.7	SC	5.0	B		10	6.5	s5			MOD
1996 03 11.14		B	6.1:	S	6.0	B		20	&10	1			KID01
1996 03 11.42	a	M	5.4	SC	5.0	B		10	7	s6	0.11	270	MOD
1996 03 11.73		S	4.6	AA	0.0	E		1					GAR01
1996 03 12.02		S	4.3	AA	5.0	B		7	17	6/			DIJ
1996 03 12.04		B	5.3	AA	11	L	7	32	5.5	6		270	KOS04
1996 03 12.08		M	5.4	S	4.5	B		12	4	3			GAM
1996 03 12.08	!	B	4.7	S	6.6	B		20	15	S6	1.2	270	PLE01
1996 03 12.08	&	M	4.8	S	8	R	8	35	6	7			KWI
1996 03 12.09	!	B	4.5	S	5.0	B		7	18	S6/	1.5	270	PLE01
1996 03 12.10		S	5.3	AA	6.0	B		20	11	5			CSU
1996 03 12.13		M	5.0	AA	5.0	B		12	20	5	1.0	291	TAN02
1996 03 12.28		S	4.7	SC	0.8	E		1	12	2			MOD
1996 03 12.30		M	5.2	SC	5.0	B		10	9.2	s6/	0.70	277	MOD
1996 03 12.68		M	4.4	AA	0.0	E		1					GAR01
1996 03 12.95		B	5.2:	AA	11	L	7	32	6	5			KOS04
1996 03 13.02		S	4.5	AA	5.0	B		7		7			DIJ
1996 03 13.12		M	4.8	AA	5.0	B		12	21	5/	1.1	283	TAN02
1996 03 13.35		S	4.6	SC	0.8	E		1	12	3			MOD
1996 03 13.58		M	4.1	AA	0.0	E		1	&25				GAR01
1996 03 13.81		S	5.3	AA	5	R	4	10	15	6			GUR
1996 03 14.00		B	4.7	AA	11	L	7	32	6	6	0.08	270	KOS04
1996 03 14.01					44.5	L	5	63	10	6	0.3	220	WAR01
1996 03 14.14		B	4.5:	S	5.0	B		7	&17	d3			SZU01
1996 03 14.98		B	4.9	S	5.0	B		10	19	7	1.2		SIW01
1996 03 15.01		M	3.8	AA	3	R	5	7	20	5	0.4	280	MAI
1996 03 15.08		B	4.7	S	5.0	B		10	4	6			MAT06
1996 03 15.09		B	4.1	S	5.0	B		10	&15	6			SWI
1996 03 15.13		O	4.2	S	0.0	E		1	18	3			SZU01
1996 03 15.59		M	3.2	AA	0.0	E		1					GAR01
1996 03 15.92		M	3.7	AA	3	R	5	7	20	5	0.4		MAI
1996 03 16.00		B	4.3	AA	6.0	B		20	5.4	6	0.16	280	KOS04
1996 03 16.11		M	4.0	AA	5.0	B		12	21	5/	2.5	282	TAN02
1996 03 16.12		M	4.1	AA	7.0	B		20	20	6			TAN02
1996 03 16.37	a	B	3.9	SC	5.0	B		10	10	s6/	2.1	277	MOD
1996 03 16.39	a	M	3.5	SC	0.8	E		1	30	3/			MOD
1996 03 16.91		M	3.5	AA	3	R	5	7	20	5	0.5		MAI
1996 03 16.93		S	3.9	Y	6.0	R	15	20	22	3	2.5	277	PAV01
1996 03 16.95		B	3.9	AA	6.0	B		20		7			KOS04
1996 03 17.00		P	4.5:	SC	2.5	A	4		6				FIL05
1996 03 17.00		P	4.5:	SC	2.5	A	4		26			272	FIL05
1996 03 17.00		S	4.0	Y	6.5	L	8	33	6	8		275	MOS03
1996 03 17.07		B	3.9	Y	3.0	B		3		7			KOZ
1996 03 17.10		M	3.5	AA	5.0	B		12	28	6	4.3	275	TAN02
1996 03 17.69		M	2.7	AA	0.0	E		1					GAR01
1996 03 17.89		B	4.4:	S	4.0	B		12	&25	D7			KOL03
1996 03 17.93		B	4.6:	AA	6.5	L	8	33	5.4	S6			RYZ
1996 03 17.93		B	4.6:	AA	6.5	L	8	33	13.6	S6		270	RYZ
1996 03 17.94		B	3.5	S	5.0	B		10	26	S6/			OLE
1996 03 17.94	&	M	4.1	S	3.0	B		8	&20	2			KOS01
1996 03 17.95		B	3.5	AA	11	L	7	32		6	0.16	280	KOS04
1996 03 17.96		I	3.0	SC	0.0	E		1		7			ISH03
1996 03 17.96		I	3.0	SC	0.0	E		1	20	7			ISH03

Comet C/1996 B2 (Hyakutake) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 03 17.96		I	3.6	SC	0.0	E		1	50	5	3	268	MOR04
1996 03 17.96		P	4.5:	SC	2.5	A	4		12	4			FIL05
1996 03 17.96		P	4.5:	SC	2.5	A	4		50	4			FIL05
1996 03 17.98		S	3.8	AA	4.0	B		8	&17	s3/			MAR13
1996 03 17.99		B	4.4	S	6.0	B		20	&30	5			RAF
1996 03 17.99		M	3.2	AA	3	R	4	7	20	5	3		MAI
1996 03 18.03		I	2.8	SC	0.0	E		1	60				BAR06
1996 03 18.03		I	2.8	SC	0.0	E		1	60			280	BAR06
1996 03 18.04		B	3.5	S	5.0	B		10	40	S7	4.3		SIW01
1996 03 18.04		B	3.7	Y	3.0	B		3		7			KOZ
1996 03 18.05		B	3.4	S	25	L	6	100	30	S6			SWI
1996 03 18.05		B	3.7	AA	5.0	B		10	&20	S5	&0.1	270	MAR12
1996 03 18.05		B	4.3	S	6.0	B		20	25	3			KID01
1996 03 18.06		B	4.2	S	5	R	8	20	23	3			KID01
1996 03 18.07		I	3.5:	SC	0.0	E		1	60	5	7	270	MOR04
1996 03 18.08		B	3.2	S	9	R	6	16	&30	D4	4	270	PAR03
1996 03 18.08		B	3.7	S	5.0	B		7	&20	S5	&4	270	CNO
1996 03 18.08		M	3.0	S	4.5	B		12	17	6			GAM
1996 03 18.09		G	2.9	S	0.0	E		1	17				GAM
1996 03 18.10		B	4.1	S	5.0	B		10	12	6			MAT06
1996 03 18.11		B	3.6:	S	5.0	B		10	20	S4	0.3	280	FAJ
1996 03 18.12		B	3.4	S	0.0	E		1	16	5/			SAN09
1996 03 18.12		O	3.5	S	0.0	E		1	&22	3/			SZU01
1996 03 18.13		B	3.1	S	5.0	B		7	&30	D5	7	270	PAR03
1996 03 18.14		B	4.3	S	3.5	B		7		4/			KOD01
1996 03 18.86		S	3.9	AA	5	R	4	10	20	4	>1	260	GUR
1996 03 18.87		S	3.7	AA	0.0	E		1					GUR
1996 03 18.88		B	3.6	S	5.0	B		10	16	4	10		KIE
1996 03 18.90		S	3.6	AA	4.0	B		8	17	s5			MAR13
1996 03 18.92		S	3.5	AA	4.0	B		8	18	s5/			MAR13
1996 03 18.92	&	S	3.7	S	5.0	R	6	10	25	5/			RES
1996 03 18.93	&	M	3.9	S	3.0	B		8	&20	2			KOS01
1996 03 18.94		B	4.0	S	3.0	B		8	&25	5			KRZ
1996 03 18.95		B	4.4	S	6.5	L	8	33	&25	6			KRZ
1996 03 18.95		M	3.9	AA	5.0	B		10	21	s5/			KOS01
1996 03 18.96		B	3.5	S	8.0	B		40	&30	D7	&3	270	SOC
1996 03 18.96		S	3.2	S	5.0	B		10	&25	S7	&0.7	300	OLE
1996 03 18.97		B	3.1:	AA	11	L		32	10	7		280	KOS04
1996 03 18.98		S	2.9	S	5.0	R	6	10	25	4/			RES
1996 03 18.99		B	3.5	S	4.0	B		12	& 8	3/			WLO
1996 03 18.99		M	2.8	AA	3	R	4	7	25	5	3.3	275	MAI
1996 03 18.99	!	B	2.5	S	5.0	B		7	20	S6/	2.5	265	PLE01
1996 03 19.00		I	2.9	SC	0.0	E		1	60	5	5	280	MOR04
1996 03 19.01		B	3.0	S	5.0	B		10	24	S5	&0.8	290	FAJ
1996 03 19.02		B	3.4	S	5.0	B		10	40	S7	5.2		SIW01
1996 03 19.02		S	2.8	SC	0.0	E		1	18	5	6	275	MOR04
1996 03 19.04		O	3.2:	S	15.0	L	6	30		d2			PIO01
1996 03 19.05		S	2.4	S	8.0	B		20	60	S6	5	280	DAN01
1996 03 19.06		B	2.0	S	0.0	E		1	30	S7	5	260	PLE01
1996 03 19.06		B	2.9	S	5.0	B		5		d6	0.6		SAN02
1996 03 19.06		S	2.3	S	0.0	E		1	20	7		270	KWI
1996 03 19.07		B	4.1	S	6.0	B		20	20	3			KID01
1996 03 19.07		M	2.5	S	8	R	8	35	18	6/		270	KWI
1996 03 19.08		B	3.0	AA	5.0	B		10	&25	S6	&2	270	MAR12
1996 03 19.08		B	4.0	S	5	R	8	20	22	2/			KID01
1996 03 19.08		B	4.0	S	6.6	R	5	12	20	3			KID01
1996 03 19.08		B	4.2:	S	4.0	B		12	&25	D7			KOL03
1996 03 19.09					8.0	B		11	50	7	4	270	WAR01
1996 03 19.09		B	3.4	S	4.0	B		12	& 8	3/			WLO
1996 03 19.09		B	4.2	S	3.5	B		7	&20	D5/			CIU
1996 03 19.09		G	2.8	YF	0.0	E		1	&20	S7	&1.7	260	SCI
1996 03 19.09		S	2.4	SC	0.0	E		1	30	7	2.5	270	WAR01
1996 03 19.10		B	3.1	S	0.0	E		1	35	6	&1		SAN09
1996 03 19.10	!	S	3.5	AA	7.5	R	4	30	20	7			LUK05
1996 03 19.10	&	B	3.5	S	6.0	B		20	35	8	0.8	280	CZE

Comet C/1996 B2 (Hyakutake) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 03 19.10	&	0	2.7:	S	0.0	E		1	&17	D8	&2.5	270	SK003
1996 03 19.11		M	2.9	AA	3	R		6	24	5			TAN02
1996 03 19.11		S	2.7	S	25.0	L	6	50	20	s6	0.2	180	RES
1996 03 19.12		B	3.7	S	5.0	B		7	&20	S4	&4		CNO
1996 03 19.12		B	3.9	S	3.5	B		7		5			KOD01
1996 03 19.12		0	3.1	S	0.0	E		1	23	D4			SZU01
1996 03 19.13		B	3.7	S	3.0	B		8	&40	5			BEN04
1996 03 19.14		B	3.4	S	0.0	E		1					RAF
1996 03 19.14		B	3.5	S	5.0	B		10	16	6			MAT06
1996 03 19.15		B	4.0:	S	6.0	B		20	&20	6	&1.5	280	RAF
1996 03 19.25		M	2.7	SC	0.8	E		1	33	3			MOD
1996 03 19.25		S	2.6	SC	0.8	E		1					MOD
1996 03 19.63		S	2.6	AA	0.0	E		1					GUR
1996 03 19.71		M	2.3	AA	0.0	E		1	50		6.0		GAR01
1996 03 19.90		B	2.8	S	6.0	B		20	12	6			BAN
1996 03 19.91		B	3.9:	S	0.0	E		1	20				GNI
1996 03 19.91		M	3.8:	S	0.0	E		1	&20	4			KOS01
1996 03 19.91	&	M	3.4:	S	6.7	L	6	30	9	6	&0.3		GR004
1996 03 19.92		B	3.2	S	5.0	B		10	22	4			KIE
1996 03 19.92		0	2.8	S	0.0	E		1	25	5	&1.5		SZU01
1996 03 19.94		B	2.7	AA	5.0	B		10	40	4	3.5	250	HAS02
1996 03 19.94	&	0	2.8	S	6.0	B		20	30	S3	45		SIW
1996 03 19.95		B	3.3	S	5.0	B		10	26	S7			SIW01
1996 03 19.95		B	4.0:	Y	5	R		20	&10	3			MUS01
1996 03 19.95		B	4.1	S	6.0	B		20	&13	7/			JAN04
1996 03 19.96		S	2.8	S	5.0	B		10	&42	S7		285	OLE
1996 03 19.96	&	B	3.3	S	5.0	B		10	40	8	1	280	CZE
1996 03 19.98		B	2.4	S	0.0	E		1	35	6	&2		SAN09
1996 03 19.98		B	2.8	S	3.5	B		7	&30	D5			PAR03
1996 03 19.98		B	3.4	AA	4.0	B		8	&18	S6			MAR13
1996 03 20.00		B	2.8:	AA	6.0	B		20	18	7	0.5	270	KOS04
1996 03 20.00		B	3.5	SC	5.0	B		10	25	S8	&1.2	250	FAJ
1996 03 20.02		B	3.4	AA	4.0	B		8	&18	S5/			MAR13
1996 03 20.03		B	3.6	S	6.0	B		20	25	3/			KID01
1996 03 20.03		M	2.4	AA	3	R	4	7	30	5	3.5	265	MAI
1996 03 20.04		B	2.7	S	5.0	B		5		d6	1.0		SAN02
1996 03 20.04		B	3.5	S	6.6	R	5	12	28	3			KID01
1996 03 20.04		B	3.6	S	5	R	8	20	25	3			KID01
1996 03 20.05		B	2.5	S	25	L	6	100	33	S6			SWI
1996 03 20.05		S	2.0	S	0.0	E		1	20	7		270	KWI
1996 03 20.05		S	2.2	S	8.0	B		20	60	S6	5	255	DAN01
1996 03 20.05	&	0	2.1:	S	0.0	E		1	&25	D8	&5	270	SK003
1996 03 20.06		B	3.3	S	5.0	B		7	22	4			GR003
1996 03 20.06		B	3.5	AA	5.0	B		10	&20	S6	&1	270	MAR12
1996 03 20.06		I	3.1:	S	7	L	11	35	&10	4			WLO
1996 03 20.06		M	2.2	S	8	R		35	19	6/		270	KWI
1996 03 20.07					5.0	B		12	36	5/	11	258	TAN02
1996 03 20.07		B	2.0	S	5.0	B		7	25	D7	6	260	PLE01
1996 03 20.07		B	3.5	S	6.0	B		20	&13	7			JAN04
1996 03 20.07		G	2.4:	YF	0.0	E		1	&16	S7	&0.7	260	SCI
1996 03 20.07		M	2.5	AA	3	R		6					TAN02
1996 03 20.08		B	1.9	S	0.0	E		1	30	S7	7	260	PLE01
1996 03 20.08		B	3.2	S	3.0	B		8		5			BEN04
1996 03 20.08		B	3.2	S	6.0	B		20	&45	5		270	BEN04
1996 03 20.10		B	3.0	S	8.0	B		40	&30	D7	&3	270	SOC
1996 03 20.10		B	3.2	S	5.0	B		10	20	6			MAT06
1996 03 20.10		S	2.1	AA	7.5	R	4	30	30	7			LUK05
1996 03 20.12		B	2.7	S	0.0	E		1	&20				RAF
1996 03 20.12		B	3.4	S	5.0	B		7	&20	5			CNO
1996 03 20.13		B	2.7	S	6.0	B		20	20	5	&1.5	250	RAF
1996 03 20.13		B	3.0	S	3.5	B		7		5/			KOD01
1996 03 20.14		B	3.0:	S	4.0	B		12	& 9	3/			WLO
1996 03 20.84		B	3.0	S	5.0	B		10	50	7	1.5	280	CZE
1996 03 20.88		S	2.3	S	5.0	R	6	10	18	5			RES
1996 03 20.89		B	3.1:	S	6.0	B		20		6			BAN

Comet C/1996 B2 (Hyakutake) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 03 20.91		B	2.7	SC	5.0	B		10					HAR08
1996 03 20.91		B	3.2	S	5.0	B		10	25	4			DER
1996 03 20.91		O	2.4	S	0.0	E		1	26	D6	2		SZU01
1996 03 20.94		B	3.7	S	4.0	B		12	23	4			GNI
1996 03 20.94		B	4.0:	AA	5.0	B		10	&26	4	0.5	250	WES04
1996 03 20.94		M	3.5	S	4.0	B		11	23	4			KOS01
1996 03 20.96		O	2.8	S	0.0	E		1	&25	D4/			CIU
1996 03 20.98		B	2.0	S	0.0	E		1		6/	&4.2		SAN09
1996 03 20.98		G	2.2	YF	0.0	E		1	&16	S7	&4	255	SCI
1996 03 20.98	&	S	2.0	S	0.0	E		1	&20	S5	&3		CHO01
1996 03 20.99		G	2.5	AA	0.8	E		1					HAS02
1996 03 21.00		B	2.5	AA	6.0	B		20	18	7	0.7	265	KOS04
1996 03 21.02		B	2.3	Y	5.0	B		5	47	s7	4.3	242	SAN02
1996 03 21.02	&	S	2.0	S	0.0	E		1	&20	S5	&5		CHO01
1996 03 21.03		B	2.1:	AA	0.0	E		1	&36	S7	&1.0	270	SPE01
1996 03 21.05		B	1.7	S	5.0	B		7	30	D7	6	255	PLE01
1996 03 21.05		S	1.9	S	0.0	E		1	&20	S7	&2	270	KWI
1996 03 21.06		B	1.5	S	0.0	E		1	35	S7	9	255	PLE01
1996 03 21.06		B	2.6:	S	4.0	B		12	&12	4			WLO
1996 03 21.06		M	2.0	S	8	R	8	35	21	S6/		270	KWI
1996 03 21.07		S	2.1	S	5.0	B		10	&55	S5/	&2.4	250	OLE
1996 03 21.09		B	2.6	S	8.0	B		40	&35	D7	&3	260	SOC
1996 03 21.10					5.0	B		12	35	6/	7	252	TAN02
1996 03 21.10		B	2.5	OH	5.0	B		7	25	4/			GRO03
1996 03 21.10		M	1.9	AA	3.0	B		6					TAN02
1996 03 21.13		B	2.6	S	5.0	B		10	20	6			MAT06
1996 03 21.13		B	2.9	S	5.0	B		7	&25	5		260	CNO
1996 03 21.13		I	2.5:	S	7	L	11	35	&15	4			WLO
1996 03 21.65		S	2.0	AA	0.0	E		1	60	6		257	GUR
1996 03 21.71		M	1.1	AA	0.0	E		1	60	7	20		GAR01
1996 03 21.77		I	1.8	SC	0.0	E		1	60	5	6	250	MOR04
1996 03 21.83		S	1.6	SC	0.0	E		1	90	5	9	245	MOR04
1996 03 21.84		B	2.4	S	5.0	B		10	50	7	2	200	CZE
1996 03 21.89		B	2.3	S	5.0	B		10	31	S7			SIW01
1996 03 21.89		B	2.6	SC	5.0	B		10	35	S6/	&1	290	FAJ
1996 03 21.89		B	2.8:	AA	4.0	B		8	&25	S6			MAR13
1996 03 21.89		S	2.3	S	5.0	B		10	36	s6/	0.7	260	RES
1996 03 21.90		B	2.2:	S	5.0	B		7	&35	5			CNO
1996 03 21.90		B	3.2	S	5.0	B		10	25	3			DER
1996 03 21.91		B	3.0:	S	0.0	E		1	30				GNI
1996 03 21.91		M	3.0:	S	0.0	E		1	&30	4			KOS01
1996 03 21.91		S	1.2	S	5.0	B		10	61	S5/	5.2	255	OLE
1996 03 21.92					11.0	B		20	40	S6	12	240	FIL05
1996 03 21.93		B	2.1:	AA	0.0	E		1	26	3/	4	252	WES04
1996 03 21.93		B	2.2	S	3.0	B		8	&30	6			KRZ
1996 03 21.93		G	1.4	S	0.0	E		1	25				GAM
1996 03 21.93		S	1.7	S	4.5	B		12	25	5			GAM
1996 03 21.94		B	3.0	S	6.5	L	8	33	&30	7			KRZ
1996 03 21.94		O	1.9:	S	5.0	B		7	&28	S6/	2.5		SZU01
1996 03 21.95		I	2.0	S	0.0	E		1	&50	5/			KRZ
1996 03 21.96		B	2.0	S	5.0	B		10	28	5	10		KIE
1996 03 21.98		O	2.0	S	0.0	E		1	&12	D6	&0.8		BUR04
1996 03 21.99		S	2.2	S	5.0	R	6	10	30	s5	0.5	250	RES
1996 03 22.01		B	2.1:	S	4.0	B		12	&16	4			WLO
1996 03 22.02		I	0.8	Y	0.0	E		1	60	8	4.5	240	MOS03
1996 03 22.03		B	2.2:	S	5.0	B		10		D4			PIO01
1996 03 22.04		I	1.5	SC	0.0	E		1	60	5	10		MOR04
1996 03 22.05		B	1.1	S	8.0	B		40	&50	D7	&9	260	SOC
1996 03 22.05		B	1.4	S	25	L	6	100	40	S6			SWI
1996 03 22.05		B	1.8	Y	5.0	B		5	58	s	7.6	248	SAN02
1996 03 22.06		B	1.7	S	5	R	8	20	&35	2	2.3	239	KID01
1996 03 22.07		I	2.0:	S	5	R	6	25	&18	4/			WLO
1996 03 22.08		M	1.6	AA	3	R	4	7	40	6	3	270	MAI
1996 03 22.12			1.3	AA	0.0	E		1			9	245	TAN02
1996 03 22.12		B	1.5	S	0.0	E		1	&40	5	&2.5	240	RAF

Comet C/1996 B2 (Hyakutake) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 03 22.12		B	2.0	S	5.0	B		10	25	6			MAT06
1996 03 22.12		B	2.1	S	3.5	B		7		5/			KOD01
1996 03 22.13					5.0	B		12	63	8	10	245	TAN02
1996 03 22.56		M	0.5	AA	0.0	E		1	108		30		GAR01
1996 03 22.75		S	1 :	AA	0.0	E		1	78	6	>20	241	GUR
1996 03 22.79		I	1.3	SC	0.0	E		1	90	5	10		MOR04
1996 03 22.79		S	1.1	SC	11	L	7	32	45	4	17	270	BOR04
1996 03 22.79		S	1.1	SC	11	L	7	32	90	4			BOR04
1996 03 22.82		M	1.4	AA	3	R	4	7	40	6	5		MAI
1996 03 22.87		B	1.0:	S	0.0	E		1	60	S5	20	225	DUS
1996 03 22.89		B	1.8	S	5.0	B		10	40	3/			DER
1996 03 22.90		B	1.3	AA	6.0	B		20	70	7	2	255	KOS04
1996 03 22.90		B	1.5	S	0.0	E		1	28	7	3.5		SZU01
1996 03 22.90		S	1.0	S	8.0	B		20	75	S7	10	260	DAN01
1996 03 22.91		B	1.9	AA	4.0	B		8	&40	S6/			MAR13
1996 03 22.91		S	1.3	SC	0.0	E		1	120	6	20	250	WAR01
1996 03 22.92		S	1.2	S	3.5	B		7	&30	D5	3	270	PAR03
1996 03 22.95		B	1.3	S	8.0	B		40	&40	D6	&2	270	SOC
1996 03 22.96		B	1.5	S	5.0	B		10	25	5			KIE
1996 03 22.96		B	1.5:	S	0.0	E		1	&60	4	&2.5	240	RAF
1996 03 22.96		G	1.3	S	0.0	E		1	30	5			GAM
1996 03 22.98		B	1.5	SC	0.0	E		1	37	S7/	5.5	265	FAJ
1996 03 22.98		B	1.6	S	6.0	B		20	35	5	3		GNI
1996 03 22.98		M	1.8	S	4.0	B		11	35	s5/	10	255	KOS01
1996 03 22.98		S	1.0	S	0.0	E		1	47	S7	4	250	RES
1996 03 22.98		S	1.4	S	5.0	R	6	10	42	S6/	6	250	RES
1996 03 23.00		B	2.2	AA	5.0	B		10	&40	S6	&3	240	MAR12
1996 03 23.00		G	1.3:	Y	0.0	E		1	45	7	1.5	250	MOS03
1996 03 23.01		B	1.2	S	5.0	B		7	45	D7	10	230	PLE01
1996 03 23.03		B	1.8	S	5.0	B		7	&50	S5	&7	230	CNO
1996 03 23.03		B	2.1:	S	5.0	B		10		D8		265	PIO01
1996 03 23.03		M	1.2	AA	3	R	4	7	45	6	7	233	MAI
1996 03 23.06		B	1.8	S	5.0	B		10	25	6			MAT06
1996 03 23.08					3.0	B		6	78	7	13	244	TAN02
1996 03 23.08			0.7	AA	0.0	E		1			21	239	TAN02
1996 03 23.08		B	0.9:	AA	0.0	E		1	&50	S7	&4.0	245	SPE01
1996 03 23.12		B	0.8	S	0.0	E		1	70	S7	18	225	PLE01
1996 03 23.13		G	0.9:	OH	0.0	E		1	71	S5	9.5	244	GRO03
1996 03 23.16		B	1.7	S	3.5	B		7		5			KOD01
1996 03 23.20	a	B	0.5	SC	0.8	E		1	54	s6	14	241	MOD
1996 03 23.75		S	1.3	AA	7.5	R	4	30	60	9	10	230	LUK05
1996 03 23.79		I	0.6	SC	0.0	E		1	90	5	30	233	MOR04
1996 03 23.81	&	B	2.2	Y	5.0	B		7	&20	5			CZE01
1996 03 23.84		B	1.4	S	5.0	B		7	&50	S5	&7	220	CNO
1996 03 23.84		M	1.0	AA	3	R	4	7	45	6	8	232	MAI
1996 03 23.84		O	1.2	S	0.0	E		1	30	s7	4		SZU01
1996 03 23.86		B	2.0:	SC	0.0	E		1	35	S6	&2	190	FAJ
1996 03 23.86		S	0.2:	S	5.0	B		10	&40	S6			OLE
1996 03 23.87		B	1.3	S	8.0	B		40	&50	D6	&5	280	SOC
1996 03 23.88		B	0.2	S	0.0	E		1					SAN09
1996 03 23.88		B	2.3	SC	0.0	E		1		7			BAE
1996 03 23.88		M	1.3	S	3.0	B		8	45	s5/	15	255	KOS01
1996 03 23.89		B	1.2	S	6.0	B		20	45	5	3		GNI
1996 03 23.89		B	1.3	AA	6.0	B		20	70	7	6	232	KOS04
1996 03 23.89		B	1.5	AA	0.0	E		1	30	3	3	230	WES04
1996 03 23.89		O	1.8	S	6.7	L	6	30	& 3				CZE02
1996 03 23.90		O	2.4	Y	5.0	B		20	55	8	4		JAR01
1996 03 23.91		O	0.4	SC	0.0	E		1	150	7	25	250	WAR01
1996 03 23.91		S	0.5	SC	0.0	E		1	180	5	30	233	MOR04
1996 03 23.93		B	1.1	S	5.0	B		10	30	5	5		KIE
1996 03 23.93		B	2.0	AA	5.0	B		10	&40	S6	&6	220	MAR12
1996 03 23.94		S	1.2	S	0.0	E		1	28	S7			KWI
1996 03 23.95		M	1.4	S	8	R	8	35	25	S6/			KWI
1996 03 23.96		B	0.9	S	5	R	8	20	40	2	3.7	227	KID01
1996 03 23.96		G	0.6	S	0.0	E		1	35	5	8		GAM

Comet C/1996 B2 (Hyakutake) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 03 23.96		N	3.5:	S	0.0	E		1	60	S6	7		GER
1996 03 23.96		O	0.1	S	0.0	E		1	80	S8	34		KAR02
1996 03 23.97		S	0.3	AA	0.0	E		1	92	D4	19.5	223	FIE
1996 03 23.97		S	1.3	AA	3.0	B		8	35	S5	8	218	CSU
1996 03 23.97	&	S	1.0	S	0.0	E		1	&30	S7	30		CHO01
1996 03 23.98		B	1.2	S	3.5	B		7	26	4/			KOD01
1996 03 23.98		I	1.0	S	0.0	E		1	&50	4			KID01
1996 03 23.99		B	0.8	S	25	L	6	100	55	S6			SWI
1996 03 23.99		B	1.6	S	5	R		20		4			SZC01
1996 03 24.00		G	1.0	Y	0.0	E		1	180	7	8	220	MOS03
1996 03 24.01		S	0.2	S	0.0	E		1	60	S7	30	240	PAR03
1996 03 24.03			0.5	AA	0.0	E		1			35	219	TAN02
1996 03 24.04		B	1.2	Y	5.0	B		5		4			SAN02
1996 03 24.04		I	0.5	SC	0.0	E		1	180	5	35		MOR04
1996 03 24.04		O	0.0	S	0.0	E		1	90	S6	15	220	SCH07
1996 03 24.06		B	1.8:	AA	4.0	B		8	&45	S7	&7.5	205	MAR13
1996 03 24.06		M	0.9	AA	3	R	4	7	50	6	10	213	MAI
1996 03 24.07		B	1.2:	S	6.0	B		20	&20	d3	&0.6	240	KOW01
1996 03 24.08		G	0.5	AA	0.8	E		1			29	232	HAS02
1996 03 24.08		G	-0.1:	YF	0.0	E		1	&60	S7	&5	235	SCI
1996 03 24.10		B	1.5	S	5.0	B		10	25	6			MAT06
1996 03 24.29	a	B	0.3	SC	0.8	E		1	60	s7	24	227	MOD
1996 03 24.67		M	0.0	AA	0.0	E		1			45		GAR01
1996 03 24.73		S	0.5	AA	0.0	E		1	102	6	>34	217	GUR
1996 03 24.76		M	0.8	AA	3	R	4	7	50	6	12	208	MAI
1996 03 24.81		O	0.9	S	4.6	B		10	&15	S7	&1	230	BUR04
1996 03 24.88			-0.1	AA	0.0	E		1			34	211	TAN02
1996 03 24.92		O	0.0	S	0.0	E		1	90	S6	25	220	SCH07
1996 03 24.92		O	1.0	S	6.7	L	6	30	&77		&4	200	CZE02
1996 03 24.93		B	0.8	AA	6.0	B		20	70	7	17	208	KOS04
1996 03 24.95		B	0.0:	S	0.0	E		1	50	S5	25	220	DUS
1996 03 24.95		I	0.4	SC	0.0	E		1	180	5	35	215	MOR04
1996 03 24.96		B	0.6	S	5.0	B		10	30	5			KIE
1996 03 24.96		N	3.5	S	0.0	E		1	60	S5			GER
1996 03 24.99	&	S	-0.5	S	0.0	E		1	&30	S7	45		CHO01
1996 03 25.00		B	0.0	Y	3.0	B		3		S4	25		KOZ
1996 03 25.00		G	0.7	Y	0.0	E		1	60	6	17	210	MOS03
1996 03 25.00		O	0.2	SC	0.0	E		1	150	7	50	230	WAR01
1996 03 25.02		O	1.5	AE	5.0	B		7	90	8	31	150	CHM
1996 03 25.05	&	S	0.0	S	0.0	E		1	&30	S7	30		CHO01
1996 03 25.08		S	0.8	PA	5.0	O		10		8	15	225	DEG
1996 03 25.09		I	0.8	S	0.0	E		1	75	4	28	205	KID01
1996 03 25.10		B	0.9	S	5	R	8	20	70	3			KID01
1996 03 25.11		O	-0.2	S	0.0	E		1	60	S8	48		KAR02
1996 03 25.16	s	M	0.2	SC	0.8	E		1	45	s7	6	216	MOD
1996 03 25.75		O	0.7	S	4.6	B		10	&40	S7	&1	230	BUR04
1996 03 25.77		O	0.6	S	7	R	10	30	&40	S6/	&1	230	BUR04
1996 03 25.77		S	0.5	S	0.0	E		1	48	S7	2	250	RES
1996 03 25.77		S	0.7	S	5.0	B		10	52	S7	3	240	RES
1996 03 25.78		S	0.3	AA	0.0	E		1	108	6	>35	208	GUR
1996 03 25.80		B	0.5:	S	0.0	E		1	&80	5	10	210	RAF
1996 03 25.80		B	1.1:	S	5.0	B		7	&60	S6	10	190	CNO
1996 03 25.80		B	1.4	S	0.0	E		1	& 5	S9			SOC
1996 03 25.81		B	0.8:	S	4.0	B		12	&20	4/			WLO
1996 03 25.81		B	1.0:	Y	5	R		30	&16	5			MUS01
1996 03 25.81		B	3.2	S	6.5	L	8	33	&50	7			KRZ
1996 03 25.81		I	0.7	S	0.0	E		1	70	4			KID01
1996 03 25.82		B	1.7	S	3.0	B		8	&60	6	&4	145	KRZ
1996 03 25.82		B	2.0	Y	5.0	B		7	&30	5			CZE01
1996 03 25.83		B	0.2:	AA	0.0	E		1	&41	S6	&3.6	215	SPE01
1996 03 25.83		I	1.3	S	0.0	E		1	&80	5			KRZ
1996 03 25.84		B	0.7	S	5	R		20		5			SZC01
1996 03 25.84		B	1.0	AA	5.0	B		10	&50	S6	&3	210	MAR12
1996 03 25.84		S	0.0	AA	0.7	E		1	120	7/	25		DIJ
1996 03 25.85		B	1.9	S	5.0	B		10	40	4/			DER

Comet C/1996 B2 (Hyakutake) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 03 25.85		O	-0.4	S	0.0	E		1	60	S7	34		KAR02
1996 03 25.85		S	0.2	S	8.0	B		10	60	S7	5	210	PAR03
1996 03 25.86		B	1.1:	AA	4.0	B		8	&45	S7	&8.0	197	MAR13
1996 03 25.86		M	0.1	AA	0.0	E		1	&30	7	15	180	COM
1996 03 25.86		M	1.0	AA	3.0	B		8	60	S6	38	220	KOS01
1996 03 25.87		B	1.2:	S	6.0	B		20	&22	d5/	0.6	245	KOW01
1996 03 25.88		B	0.7	S	6.0	B		20	60	5	20	200	CZE
1996 03 25.88		M	1.1:	S	0.0	E		1	&60	6	38	220	KOS01
1996 03 25.89		B	0.1	SC	0.0	E		1	42	S8	&6.5	170	FAJ
1996 03 25.89		B	0.3	S	6.0	B		20	60	6	5.5		GNI
1996 03 25.89		B	0.4	AA	0.0	E		1	35	4/	16	198	WES04
1996 03 25.89		O	2.3	Y	5.0	B		20	45	9	6		JAR01
1996 03 25.90		S	-0.2	S	5.0	B		10	&56	S5/	&3	205	OLE
1996 03 25.91		O	1.0	S	6.7	L	6	30	&88		&3	223	CZE02
1996 03 25.91		S	0.8	S	5.0	R	6	10	57	S7	6	240	RES
1996 03 25.92		B	0.1	S	5.0	B		7	60	D7	35	210	PLE01
1996 03 25.92		S	0.5	S	0.0	E		1	40	S7/	20	210	KWI
1996 03 25.93		B	0.0	S	0.0	E		1	70	D7	45	210	PLE01
1996 03 25.93		M	0.7	S	8	R	8	35	34	S7		210	KWI
1996 03 25.94		B	1.0:	S	2.5	B		3	60	D3/			ZBR
1996 03 25.94		B	-0.5:	S	5.0	B		10	&90	D4			ZBR
1996 03 25.95		G	-0.2	AA	0.8	E		1	48	6	50	207	HAS02
1996 03 25.98		G	0.8	OH	0.0	E		1	103	S5	51	210	GR003
1996 03 25.98		N	4.0	S	0.0	E		1	60	S5			GER
1996 03 26.00		G	0.1	YF	0.0	E		1	100	S6	60	203	SCI
1996 03 26.01		B	0.7:	S	4.0	B		12	&25	4/			WL0
1996 03 26.04		S	0.5	S	0.0	E		1	76	S7	5	170	RES
1996 03 26.06		B	0.1:	S	0.0	E		1	&58	S6/	16	210	SPE01
1996 03 26.07		B	0.0	S	5.0	B		7	70	D7	50	205	PLE01
1996 03 26.08		B	0.5	S	6.0	B		20	70	5	30	200	CZE
1996 03 26.08		O	1.8:	S	0.0	E		1		8			KOL03
1996 03 26.09		B	-0.2	S	0.0	E		1	90	D7	75	205	PLE01
1996 03 26.10		I	0.6	S	7	L	11	35	&25	5			WL0
1996 03 26.12		B	0.3	SC	0.8	E		1					MOD
1996 03 26.12		M	0.2	SC	0.8	E		1	60	s7	9	206	MOD
1996 03 26.13		B	1.1	Y	5.0	B		5	175	3	37	208	SAN02
1996 03 26.43		M	0.4	SC	0.8	E		1	40	s7			MOD
1996 03 26.74		B	-0.1	Y	3.0	B		3		S4	5		KOZ
1996 03 26.75		G	0.6:	YF	0.0	E		1	&60	S6	&5	180	SCI
1996 03 26.76		B	0.9	YF	0.0	E		1	50	S8	15		SIW01
1996 03 26.77		B	1.1:	S	6.0	B		20	&25	D5/	0.6	280	KOW01
1996 03 26.78		B	1.0	AA	5.0	B		10	&30	S6	&4	180	MAR12
1996 03 26.79		B	0.4	S	5.0	B		10	35	5			MAT06
1996 03 26.80		B	0.7:	S	0.0	E		1	95				GNI
1996 03 26.80		O	0.9	S	4.6	B		10	&25	S6	&1.5	300	BUR04
1996 03 26.80		O	-0.1	S	0.0	E		1	50	S7/	40		KAR02
1996 03 26.81		S	0.5	S	0.0	E		1	40	S7/	21	180	KWI
1996 03 26.82		S	0.0	Y	3.0	B		3		S4	8		KOZ
1996 03 26.83		B	1.0	S	5.0	B		10	&35	S6/			SWI
1996 03 26.83		M	0.8:	S	0.0	E		1	&95	s5/	35	200	KOS01
1996 03 26.83	&	O	1.0:	S	0.0	E		1					SK003
1996 03 26.84		S	0.0	AA	3.0	B		8	38	S5/	20	182	CSU
1996 03 26.85		O	0.9	S	0.0	E		1	30	8	5		SZU01
1996 03 26.86		O	2.0	AE	5.0	B		7	50	8	45	155	CHM
1996 03 26.87		O	1.6:	S	6.7	L	6	30	&34				CZE02
1996 03 26.90		O	2.0	AE	5.0	B		7	40	8	10	180	CHM
1996 03 26.95		N	4.1	S	0.0	E		1	60	S5			GER
1996 03 26.96		S	-0.5	AA	0.7	E		1	120	8	55		DIJ
1996 03 26.98		B	0.6	SC	0.0	E		1		6	50		POR04
1996 03 27.00		B	0.6	SC	0.0	E		1	60	4	50		POR02
1996 03 27.00		B	0.9	SC	8.0	B		8	54	6	35		BAE
1996 03 27.00		B	1.1	SC	8.0	B		8	60	4	45		POR02
1996 03 27.01		B	0.6	SC	0.0	E		1					DON
1996 03 27.02		B	1.0	SC	0.0	E		1	30	6	50		ANT03
1996 03 27.03		B	1.0	SC	0.0	E		1		5	35		POR04

Comet C/1996 B2 (Hyakutake) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 03 27.07		B	0.8	SC	0.0	E		1	48	6	35		BAE
1996 03 27.07		B	1.1	SC	0.0	E		1	48	5	43		DOC
1996 03 27.07		S	0.8	PA	5.0	O		10		9	30	220	DEG
1996 03 27.08		O	0.7	SC	0.0	E		1	100	7	65	210	WAR01
1996 03 27.08		S	-0.2	AA	0.7	E		1	120	7	75	127	DIJ
1996 03 27.09		B	0.9:	S	15.0	L	6	30		D9	10	209	PIO01
1996 03 27.15		O	0.8	S	6.0	B		20	45	S2	10		SIW
1996 03 27.37		G	0.8	YF	0.0	E		1	&60	S6	30	70	SCI
1996 03 27.38	a	B	0.8	SC	0.8	E		1					MOD
1996 03 27.38	a	M	0.6	SC	0.8	E		1	48	s7	57	87	MOD
1996 03 27.75		S	1.5	S	0.0	E		1	51	S6	5	230	RES
1996 03 27.76		B	0.6	S	5.0	B		10	20	4/	6	100	DER
1996 03 27.76		B	1.0	S	5.0	B		7	&60	S7	10	50	CNO
1996 03 27.76		I	1.1	S	0.0	E		1	35	5	12	64	KID01
1996 03 27.79		B	0.0	S	6.0	B		20	95	5			GNI
1996 03 27.79		S	1.5	AA	7.5	R	4	30	40	6	15		LUK05
1996 03 27.80		B	0.5	SC	0.0	E		1	28	S8/	12	135	FAJ
1996 03 27.80		B	1.8	S	0.0	E		1	& 5	S9	&2	50	SOC
1996 03 27.80		M	1.0	S	8	R	8	35	27	S7		59	KWI
1996 03 27.80	&	O	1.5:	S	0.0	E		1	&30	D8	10	40	SK003
1996 03 27.81		B	0.5:	S	0.0	E		1	100	6	15	75	RAF
1996 03 27.81		M	0.9:	SC	6.7	L	6	30	13	7	&0.5		GRO04
1996 03 27.82		B	0.8	S	5.0	B		7	45	D7	30	60	PLE01
1996 03 27.82		M	1.4:	S	0.0	E		1	&95	5	31	90	KOS01
1996 03 27.83		B	1.0	S	6.0	B		20	25	D6	1.3	320	KOW01
1996 03 27.83		O	0.9	S	4.6	B		10	&20	S6/	&2	330	BUR04
1996 03 27.83		O	1.7:	S	6.7	L	6	30	&36				CZE02
1996 03 27.83		S	1.7	Y	3.0	B		3		4	9		KOZ
1996 03 27.84		B	1.9:	Y	5	R		30	&25	6	&0.3	55	MUS01
1996 03 27.84		B	2.1	S	6.0	B		20	&17	8/	&5.9		JAN04
1996 03 27.85		B	0.8	AA	5.0	B		10	&25	S6	&8	60	MAR12
1996 03 27.85		B	1.4	S	5	R		20		4			SZC01
1996 03 27.85		G	1.0	OH	0.0	E		1	42	S6	30	60	GRO03
1996 03 27.85		S	0.8	S	0.0	E		1	65	S5/	33	230	RES
1996 03 27.85		S	1.1	S	5.0	R	6	10	57	S6	6	210	RES
1996 03 27.86		B	1.1	S	5.0	B		7			&3		BAN
1996 03 27.86		S	0.4	S	5.0	B		10	&42	S5/	10.3		OLE
1996 03 27.87		B	1.6	S	3.0	B		8		5			BEN04
1996 03 27.87		S	0.5	S	0.0	E		1	&30	S7	15	60	PAR03
1996 03 27.88		B	0.7:	S	0.0	E		1	&50	S7	&9.5	58	SPE01
1996 03 27.88		B	0.8	S	6.0	B		20	60	5	30	190	CZE
1996 03 27.88		O	1.0	S	0.0	E		1	30	S8/	6		SZU01
1996 03 27.88		O	2.2	S	3.0	B		8	&38	d3/	&2.1	35	SZE03
1996 03 27.89		B	1.6	Y	5.0	B		7	&36	6	&1.7	70	CZE01
1996 03 27.89		S	0.8	S	0.0	E		1	30	S7/	20	55	KWI
1996 03 27.90		S	1.1	S	8	R	8	35	27	S7		55	KWI
1996 03 27.91		S	1.3	S	5.0	R	6	10	57	S7	13	200	RES
1996 03 27.92		B	0.3	S	5.0	B		10	20	6			MAT06
1996 03 27.92		B	1.0	AA	4.0	B		8	&40	S6/	&7.0	189	MAR13
1996 03 27.93		O	0.8	S	6.0	B		20	45	S2	10		SIW
1996 03 27.93		O	2.5	Y	5.0	B		20	30	7	9		JAR01
1996 03 27.94		B	0.8	S	3.6	B		4		D9	11	60	PIO01
1996 03 27.94		B	1.0:	S	0.0	E		1	30	d2			ZBR
1996 03 27.95		G	-0.2	AA	0.8	E		1			30	50	HAS02
1996 03 27.95		N	4.5	S	0.0	E		1	40	S5			GER
1996 03 27.96		M	0.8	SC	5.0	B		10	13	8	&4		GRO04
1996 03 27.96		O	2.0	AE	5.0	B		7	40	8		70	CHM
1996 03 28.04		S	0.9	SC	0.0	E		1	30	5	55	52	MOR04
1996 03 28.05		B	1.2	S	4.0	B		12	&25	4/			WLO
1996 03 28.05		B	1.6	Y	5.0	B		5	75	5	30	64	SAN02
1996 03 28.05		B	2.2	S	3.0	B		8	&50	7	&7	290	KRZ
1996 03 28.06		B	1.1	YF	0.0	E		1	60	S8	30		SIW01
1996 03 28.06		I	1.9	S	0.0	E		1	&60	6			KRZ
1996 03 28.08		B	1.0	S	6.0	B		20	60	5	30		CZE
1996 03 28.09		O	1.7	S	0.0	E		1	&87	D4	36		CIU

Comet C/1996 B2 (Hyakutake) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 03 28.09		S	1.5	S	0.0	E		1	76	S6/	57	250	RES
1996 03 28.10		B	0.4	S	0.0	E		1	75	D7	48	58	PLE01
1996 03 28.10		B	0.9:	AA	0.0	E		1	&58	S7	22.5	50	SPE01
1996 03 28.10		B	1.1	S	0.0	E		1	32	S9	10		SZU01
1996 03 28.10		M	0.9	SC	0.8	E		1	38	s7	10	50	MOD
1996 03 28.11		S	1.8	S	5.0	R	6	10	64	S6	12	250	RES
1996 03 28.12	&	S	0.5	S	0.0	E		1	&20	S6	10		CHO01
1996 03 28.54		B	1.5	S	5.0	B		10	25	5	7		SL001
1996 03 28.64		S	1.8	AA	5	R	4	10	30	6	>9	35	GUR
1996 03 28.77		B	1.7:	S	0.0	E		1	&60				GNI
1996 03 28.78		S	1.5	S	0.0	E		1	45	S			RES
1996 03 28.80		B	1.0	AA	5.0	B		10	&25	S6	&3	48	MAR12
1996 03 28.80		B	1.0	SC	5.0	B		7	30	6	3.3		BAN
1996 03 28.80		B	1.2	S	5.0	B		7	45	D7	40	50	PLE01
1996 03 28.80		B	1.5:	S	4.0	B		12	&20	4/			WLO
1996 03 28.80		B	1.8	Y	5.0	B		7	&30	5	&2		CZE01
1996 03 28.81		B	1.0	S	6.0	B		20	27	D5/	1.3	330	KOW01
1996 03 28.81		S	0.8	S	5.0	B		10	&22	S6			OLE
1996 03 28.81		S	1.2	S	0.0	E		1	25	S7/	28	50	KWI
1996 03 28.81	&	O	1.7:	S	0.0	E		1	&30	D8	10	30	SK003
1996 03 28.82		B	0.9	S	0.0	E		1	55	D7	48	49	PLE01
1996 03 28.82		B	1.4	S	5.0	B		7	&50	S7	&7	50	CNO
1996 03 28.82		B	1.5	S	25	L	6	100	&28	S6/			SWI
1996 03 28.82		M	1.4	S	8	R	8	35	27	S7		46	KWI
1996 03 28.82		M	1.5:	S	3.0	B		8	&30	5/	&4	70	KOS01
1996 03 28.82		O	1.1	SC	0.0	E		1					BAN
1996 03 28.82		O	2.6	Y	5.0	B		20	30	8	6		JAR01
1996 03 28.82		S	0.5	S	0.0	E		1	&30	S7	15	55	PAR03
1996 03 28.83		B	0.5	S	5.0	B		10	20	6			MAT06
1996 03 28.83		B	1.8:	S	0.0	E		1					SAN09
1996 03 28.84		B	2.2	S	3.0	B		8	&40	7			KRZ
1996 03 28.84		B	2.8	S	6.0	B		20	&16	8/	&3.0		JAN04
1996 03 28.85		I	2.1	S	0.0	E		1	&50	6			KRZ
1996 03 28.86		O	1.2	S	0.0	E		1	28	8	7		SZU01
1996 03 28.87		B	1.3	YF	0.0	E		1	60	S8			SIW01
1996 03 28.88		B	0.0:	S	5.0	B		10	&90	D3			ZBR
1996 03 28.88		B	1.0:	S	0.0	E		1	30	d3			ZBR
1996 03 28.92		G	1.1	YF	0.0	E		1	&40	S6	25	50	SCI
1996 03 28.93		M	1.0	S	6.7	L	6	30	12	7	&4		GR004
1996 03 28.94		B	1.6	S	0.0	E		1					SAN02
1996 03 28.96		B	1.0:	S	3.6	B		4		D9	8	66	PI001
1996 03 28.96		O	1.3	S	4.6	B		10	&20	5/	&2	48	BUR04
1996 03 28.96		O	2.5:	S	0.0	E		1	&45	s8	15	45	KOL03
1996 03 28.98		B	1.2:	AA	4.0	B		8	&36	S6	&5.6	69	MAR13
1996 03 29.10	&	S	1.0	S	0.0	E		1	&20	S5	&5		CHO01
1996 03 29.80		S	2.0	S	0.0	E		1	57	S5/	12	285	RES
1996 03 29.80		S	2.1	S	5.0	R	6	10	46	S7	5	285	RES
1996 03 29.82		B	1.5	S	5.0	B		7	35	D7	21	46	PLE01
1996 03 29.83		B	1.8	S	5.0	B		10	16	6			MAT06
1996 03 29.83		O	1.4	S	0.0	E		1	25	S8	5.5		SZU01
1996 03 29.83		S	1.7	S	0.0	E		1	25	S7/	&8	45	KWI
1996 03 29.84		M	1.9	S	8	R	8	35	21	S7		45	KWI
1996 03 29.85		B	1.3	S	0.0	E		1	45	D7/	28	45	PLE01
1996 03 29.85		S	2.0	AA	3.0	B		8	17	S6	4	45	CSU
1996 03 29.87		B	1.5:	S	0.0	E		1	&20	S7	&2.0	48	SPE01
1996 03 29.87		B	2.4	S	0.0	E		1		S9			SOC
1996 03 29.87		S	2.0	AA	0.0	E		1	50	6	17	42	GUR
1996 03 29.88		B	1.1	S	5.0	B		10	25	5	7		SL001
1996 03 29.88		B	1.7:	YF	5.0	B		10	&20	s5	&2.2	43	SCI
1996 03 29.90		B	1.2	S	6.0	B		20	50	5	30		CZE
1996 03 29.90		B	2.4:	Y	5.0	B		7	&20	4			CZE01
1996 03 29.91		M	2.3	AA	5.0	B		12	36	7/	9	51	TAN02
1996 03 30.05		M	1.4	SC	0.8	E		1	35	s7	8	47	MOD
1996 03 30.14		O	1.3	S	6.0	B		20	30	S3	&6		SIW
1996 03 30.78		S	1.8	S	5.0	R	6	10	34	S6	3	200	RES

Comet C/1996 B2 (Hyakutake) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 03 30.78		S	1.9	S	0.0	E		1	46	S5	8	200	RES
1996 03 30.80		B	1.1	S	5.0	B		10	20	5	4	80	DER
1996 03 30.81		B	2.0	AA	5.0	B		10	&12	S6	&1	48	MAR12
1996 03 30.81		S	2.0	AA	3.0	B		8	17	S6	2	45	CSU
1996 03 30.82		B	1.8:	S	5.0	B		7	&22	S7	&2.8	49	SPE01
1996 03 30.83		B	1.8:	AA	4.0	B		8	&20	s5/	&1.2	66	MAR13
1996 03 30.83		B	1.8:	S	5	R		20		4			SZC01
1996 03 30.83		B	2.7	SC	0.0	E		1					LUB01
1996 03 30.85		S	1.0	AA	0.7	E		1	90	7	30		DIJ
1996 03 30.88		S	1.8	S	0.0	E		1	&20	S6			PAR03
1996 03 30.90		B	1.6	S	3.5	B		7		5			KOD01
1996 03 30.96		S	1.8	S	0.0	E		1	64	S6	5	180	RES
1996 03 31.05		M	1.8	SC	0.8	E		1	32	s7	3.0	41	MOD
1996 03 31.79		B	2.3	AA	4.0	B		8	&21	s5	&0.8	60	MAR13
1996 03 31.79		B	2.8	AA	5.0	B		10	&10	S7	&0.4	35	MAR12
1996 03 31.80		B	2.3:	SC	5.0	B		15	&16	D6/	&3	130	FAJ
1996 03 31.80		B	3.0:	Y	5.0	B		7	&20	4			CZE01
1996 03 31.80		M	2.1:	S	3.0	B		8	&50	5/	&3	43	KOS01
1996 03 31.83		S	1.2	AA	0.7	E		1	90	7	20		DIJ
1996 03 31.93		B	2.5	S	5.0	B		5	39	4			SAN02
1996 03 31.96		S	2.0	AA	3.0	B		8	20	S6/	5	40	CSU
1996 03 31.98		O	1.8	AE	5.0	B		7	25	8	2.5	50	CHM
1996 04 01.58		S	2 :	AA	5	R	4	10	18	6/	>9	46	GUR
1996 04 01.77		B	2.1	SC	12.0	B		40					STA01
1996 04 01.77		B	2.6	AA	5.0	B		10	&10	S7	&0.4	55	MAR12
1996 04 01.79		B	2.6	S	8.0	B		40	&15	D7	&3	10	SOC
1996 04 01.79		B	2.8	S	5.0	B		7	&20	S7	&4	30	CNO
1996 04 01.80		B	2.1	S	3.6	B		4		D8	11	49	PIO01
1996 04 01.80		B	2.2	S	5.0	B		10	20	3	2.5	50	DER
1996 04 01.80		B	2.2	SC	5.0	B		7	&15	6			BAN
1996 04 01.80		B	2.7:	S	5.0	B		7	&11	S6	&1.4	50	SPE01
1996 04 01.81		B	2.0:	S	4.0	B		12	&15	4/			WLO
1996 04 01.81		B	2.5	SC	5.0	B		15	20	D6	&2.5	135	FAJ
1996 04 01.81		B	2.7	OH	0.0	E		1	18			44	GRO03
1996 04 01.81		B	2.8	AA	4.0	B		8	&19	s5	&2.0	60	MAR13
1996 04 01.81		M	2.2:	S	3.0	B		8	&45	5	&4	40	KOS01
1996 04 01.81		S	2.4	S	0.0	E		1	46	S7/	12	200	RES
1996 04 01.81		S	2.7	S	5.0	R	6	10	23	S6/	3	200	RES
1996 04 01.82		B	2.5	S	6.0	B		20	50	7	25		CZE
1996 04 01.82		B	3.2	Y	5.0	B		7	&20	4	&0.5		CZE01
1996 04 01.83		B	2.1:	S	0.0	E		1	60				GNI
1996 04 01.84		B	2.5:	YF	5.0	B		10	&24	s6	&4	48	SCI
1996 04 01.84		B	2.7	S	0.0	E		1	&15	7			RAF
1996 04 01.84		O	2.9	AE	5.0	B		7	25	8	3	55	CHM
1996 04 01.84		O	3.1:	S	0.0	E		1	&20	s8		40	KOL03
1996 04 01.84		S	1.8	S	3.5	B		7	&20	S6	4	40	PAR03
1996 04 01.85		B	2.2	S	5.0	B		7	25	D7/	12	45	PLE01
1996 04 01.85		B	2.4:	S	5	R		20		3			SZC01
1996 04 01.85		B	2.7:	S	6.0	B		20	&20	7	&1.5	30	RAF
1996 04 01.86		B	2.0	S	0.0	E		1	30	S7/	18	45	PLE01
1996 04 01.86		B	2.5	S	10.0	B		25	22	S7/	10	45	PLE01
1996 04 01.86		S	2.0	S	0.0	E		1	20	S7/	&7	45	KWI
1996 04 01.87		B	2.3	S	6.6	B		20	20	S7/	8	45	PLE01
1996 04 01.87		M	2.3	S	8	R	8	35	19	S7		45	KWI
1996 04 01.88		O	2.7	Y	5.0	B		20	10	7	2		JAR01
1996 04 01.91		B	2.5	S	5.0	B		5	24	5	8.3	62	SAN02
1996 04 01.92		M	1.8:	S	6.7	L	6	30	8	6	&3		GRO04
1996 04 01.97		B	2.8	S	6.0	B		20	&13	8	&0.7		JAN04
1996 04 02.07		M	1.9	SC	0.8	E		1	26	S7/	2.0	41	MOD
1996 04 02.08		S	2.5	S	0.0	E		1	41	5			RES
1996 04 02.08		S	2.7	S	5.0	R	6	10	34	6/	0.4	230	RES
1996 04 02.61		S	2.6	AA	5	R	4	10	14	7	>7	45	GUR
1996 04 02.75		B	2.2:	S	5.0	B		10	15	S6	3	45	DUS
1996 04 02.75		B	2.6	S	6.0	B		20	50	7	20		CZE
1996 04 02.80		S	2.3	S	0.0	E		1	23	7/	8	280	RES

Comet C/1996 B2 (Hyakutake) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 04 02.80		S	2.4	S	5.0	R	6	10	21	5/	3	280	RES
1996 04 02.94		O	2.9	AE	5.0	B		7	25	8	2	45	CHM
1996 04 04.00		B	3.2:	S	0.0	E		1	15	S6	5	45	DUS
1996 04 04.00		S	2.0	AA	0.7	E		1	36	7	15		DIJ
1996 04 04.05		M	2.5	SC	0.8	E		1	26	S7			MOD
1996 04 04.07		O	1.8	S	5.0	B		7	10	S8	5	50	SCH07
1996 04 04.08		S	2.2	SC	0.0	E		1	20	7/	14	40	WAR01
1996 04 04.79		S	1.8	S	7.0	B		25	&23	S6/	&1.3		OLE
1996 04 04.80		B	2.8:	Y	3.0	B		3		4			KOZ
1996 04 04.81		B	3.1	S	3.5	B		7	&16	D6			CIU
1996 04 04.83		B	2.5	S	5.0	B		7	20	S7/	25	46	PLE01
1996 04 05.78		B	3.1	AA	5.0	B		10	& 4	S7	&3.5	45	MAR12
1996 04 05.78		B	3.4	Y	5.0	B		7	&30	6	&1.8		CZE01
1996 04 05.79		B	2.7	YF	5.0	B		10	13	S8	6.1		SIW01
1996 04 05.79		B	3.1	S	6.0	B		20	&15	D7	&5	10	SOC
1996 04 05.80		B	2.3:	S	4.0	B		12	&10	4/			WLO
1996 04 05.80		B	3.1	S	5.0	B		7	&15	S7	&5	55	CNO
1996 04 05.80		B	3.4:	AA	4.0	B		8	&10	S5/	&3.0	55	MAR13
1996 04 05.80		M	2.8	S	3.0	B		8	17	5	3.3	30	KOS01
1996 04 05.80		S	2.6	AA	3.0	B		8	20	S5	10	47	CSU
1996 04 05.81		B	3.0	S	5.0	B		10	& 5	S7			SWI
1996 04 05.81		B	3.0:	S	4.0	B		12	&13	s8	&3	47	KOL03
1996 04 05.81		O	3.1:	S	0.0	E		1	&10	s8	&5	48	KOL03
1996 04 05.81		S	1.8	S	7.0	B		25	&21	S6/	&1.6		OLE
1996 04 05.81		S	2.3	S	0.0	E		1	11	5			RES
1996 04 05.81		S	2.4	S	5.0	R	6	10	16	4	4	250	RES
1996 04 05.82		B	2.4	S	0.0	E		1	20	7	4		SZU01
1996 04 05.82		B	2.8	Y	3.0	B		3		4	14		KOZ
1996 04 05.82		B	3.3:	S	3.6	B		4		8			SAN09
1996 04 05.82		O	3.2	Y	5.0	B		20	7	7	3		JAR01
1996 04 05.83		B	2.5	S	5.0	B		7	20	S7/	29	46	PLE01
1996 04 05.83		B	2.5	SC	5.0	B		15	18	D6	1.5	35	FAJ
1996 04 05.83		B	3.6	S	5.0	B		10	8	7			MAT06
1996 04 05.84		B	3.2:	S	0.0	E		1	12	S6	1	45	DUS
1996 04 05.84		S	2.2	SC	0.0	E		1	20	7/	20	40	WAR01
1996 04 05.85		B	2.6	S	3.6	B		4		d8	9	45	PIO01
1996 04 05.85		B	3.3	S	5	R		20		3			SZC01
1996 04 05.85		B	3.5:	S	6.0	B		20	&10		&1	50	RAF
1996 04 05.88	$	S	4.0	S	3.0	B		6	& 5	S5	&1		CHO01
1996 04 05.91		B	2.9	AA	0.0	E		1	14	5/	7	34	WES04
1996 04 05.95		B	2.4	S	3.5	B		7		5			KOD01
1996 04 06.76		B	2.6	S	3.5	B		7		6			KOD01
1996 04 06.78		B	3.3:	AA	4.0	B		8	&10.5	S6	&3.1	55	MAR13
1996 04 06.79		B	3.1	S	25	L	6	100	8	S6/			SWI
1996 04 06.79		B	3.2:	S	5.0	B		10	25	5	3.5	180	DER
1996 04 06.79		B	3.3	AA	5.0	B		10	& 3	S7	&3.5	48	MAR12
1996 04 06.79		B	3.4	Y	5.0	B		7	&24	6	&1.6	50	CZE01
1996 04 06.80		B	2.4	S	4.0	B		12	& 9	4/			WLO
1996 04 06.80		B	2.9	S	5.0	B		7	& 9		1.4	38	BAN
1996 04 06.80		B	2.9	YF	5.0	B		10	&10	s7	&6	50	SCI
1996 04 06.80		B	3.2	S	5.0	B		10	10	5			KIE
1996 04 06.80		B	3.3	S	8.0	B		40	&10	D8	&4	10	SOC
1996 04 06.81		B	3.1	S	4.0	B		12	10	D7/	&6	48	KOL03
1996 04 06.81		B	3.2	Y	3.0	B		8					GRZ01
1996 04 06.81		M	3.2	AA	5.0	B		12	9	7	4	50	TAN02
1996 04 06.81		O	3.2	Y	3.0	B		8	& 8		&2.5	50	KOW02
1996 04 06.81		S	2.5	AA	3.0	B		8	20	S5	17	45	CSU
1996 04 06.81		S	2.5	S	0.0	E		1	28	6	12	250	RES
1996 04 06.81		S	2.6	S	5.0	R	6	10	34	6/	5	250	RES
1996 04 06.82		B	2.1	S	6.0	B		20	&16	D5	&1.1	43	KOW01
1996 04 06.82		B	2.4	AA	5.0	B		10	9.6	5	5.0	60	HAS02
1996 04 06.82		M	3.0	S	3.0	B		8	16	5/	3	30	KOS01
1996 04 06.82		O	3.2	Y	5.0	B		20	10	7	3		JAR01
1996 04 06.82		S	1.9	S	7.0	B		25	&15	D7	&2.7	60	OLE
1996 04 06.82		S	2.8	S	0.0	E		1	20	S7/	35	45	KWI

Comet C/1996 B2 (Hyakutake) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 04 06.82	w	S	2.1	AA	0.0	E		1		S7			FIE
1996 04 06.82	w	S	2.2	AA	4.2	B		7	17	S6/	1.7	47	FIE
1996 04 06.83		B	2.8	YF	5.0	B		10	12	S8	6.6		SIW01
1996 04 06.83		B	3.3	OH	5.0	B		7	12	6	11	47	GR003
1996 04 06.83		B	3.3	S	5.0	B		10	7	7			MAT06
1996 04 06.83		B	3.3:	S	3.6	B		4	11	7	&5		SAN09
1996 04 06.83		M	2.9	S	8	R	8	35	16	S7	&5	47	KWI
1996 04 06.83		M	3.0:	S	0.0	E		1	&15	5	3.5		KOS01
1996 04 06.84		B	1.8	SC	5.0	B		15	20	D6	2.0	30	FAJ
1996 04 06.84		B	2.2	S	7.0	B		25	&20	6	&2.7		OLE01
1996 04 06.84		B	2.5	S	5.0	B		7	20	S7/	26	48	PLE01
1996 04 06.84		B	2.7	S	0.0	E		1	&20	7	&3	50	RAF
1996 04 06.84		B	2.9	S	5.0	B		7	& 6.6	S7	3.5	45	SPE01
1996 04 06.84		B	3.0	AA	0.0	E		1	12	7	20	42	WES04
1996 04 06.84		M	2.8	S	5.0	B		7	&20	S7	10	45	PAR03
1996 04 06.84	!	B	2.3	S	0.0	E		1	25	s8	38	48	PLE01
1996 04 06.85		B	2.6	S	3.6	B		4		D8/	11	43	PI001
1996 04 06.85		B	2.8:	Y	5	R		30	&19	6	&0.3	39	MUS01
1996 04 06.85		B	3.0:	S	0.0	E		1	12	S6	3	45	DUS
1996 04 06.85		B	3.4	S	3.0	B		8	&15	7/	&3		KRZ
1996 04 06.85		O	2.2	S	5.0	B		7	10	S8	5	50	SCH07
1996 04 06.85		O	2.5	S	0.0	E		1	19	s7	&4		SZU01
1996 04 06.85	$	S	3.5	S	3.0	B		6	& 7	S5	&2		CH001
1996 04 06.86		B	3.2	S	5	R		20		3			SZC01
1996 04 06.86		M	1.6	S	6.7	L	6	30	10	7	&4		GR004
1996 04 06.88		O	2.9	S	4.6	B		10	&18	s5/	7	47	BUR04
1996 04 06.90	&	O	3.3:	S	0.0	E		1	&20	D8	&3	30	SK003
1996 04 06.92		B	3.3	S	6.0	B		20	&14	9	&2.6		JAN04
1996 04 07.01		B	3.0	S	0.0	E		1	20	d6	6.3	34	SAN02
1996 04 07.04		S	2.6	PA	5.0	O		10	13		14		DEG
1996 04 07.08	s	B	2.8	SC	0.8	E		1	19	S8			MOD
1996 04 07.08	s	B	3.1	SC	5.0	B		10	7.1	S8	2.7	47	MOD
1996 04 07.77		B	3.0	S	6.0	B		20	40	7	15		CZE
1996 04 07.78		B	2.7	S	3.5	B		7		6/			KOD01
1996 04 07.78		S	2.5	AA	3.0	B		8	20	S5	14	41	CSU
1996 04 07.79		B	2.9	YF	5.0	B		10	&10	s7/	&7	45	SCI
1996 04 07.79		B	3.2	S	6.5	R	6	28	8	S6/			SWI
1996 04 07.79		B	3.3	S	5.0	B		10	8	7			MAT06
1996 04 07.79		B	3.3	S	6.0	B		20	& 6	D8	&4	5	SOC
1996 04 07.79		B	3.4	AA	5.0	B		10	& 4	S7	&5	48	MAR12
1996 04 07.79		B	3.4	S	5.0	B		10	25	5	3.5	160	DER
1996 04 07.79		O	3.1	S	0.0	E		1					BAN
1996 04 07.80		B	2.2	S	6.0	B		20	&15	D6	&2.4	40	KOW01
1996 04 07.80		B	2.5	S	4.0	B		12	& 8	4/			WLO
1996 04 07.80		B	3.1	YF	5.0	B		10	10	S8	9.1		SIW01
1996 04 07.80		B	3.4	Y	3.0	B		8					GRZ01
1996 04 07.80		B	3.4:	Y	5.0	B		7	&20	6	&2.4		CZE01
1996 04 07.80		M	2.8	S	5.0	B		7	&20	S7	15	45	PAR03
1996 04 07.80		O	3.4	Y	3.0	B		8	& 8		&3	45	KOW02
1996 04 07.80		S	1.8	S	7.0	B		25	&12	D7/	&3	57	OLE
1996 04 07.81		B	3.2	S	4.0	B		12	10	D7/	7.5	48	KOL03
1996 04 07.81		B	3.4	S	5.0	B		7	& 8.5				GR003
1996 04 07.81		I	2.5	S	5	R	6	25	& 9	5			WLO
1996 04 07.81		I	3.1	S	0.0	E		1	&15	7	5.8	47	KID01
1996 04 07.82		B	2.4	S	7.0	B		25	&15	8	&3.1		OLE01
1996 04 07.82		B	3.0	S	5.0	B		7	& 6.8	S8	3.9	43	SPE01
1996 04 07.82		B	3.1	AA	4.0	B		8	9.8	S6	&3.4	54	MAR13
1996 04 07.82		B	3.3	S	6.0	B		20	9	5	4.8	44	KID01
1996 04 07.82		I	2.5	S	7	L	11	35	& 9	5			WLO
1996 04 07.83		B	2.5	S	5.0	B		7	20	S7/	18	48	PLE01
1996 04 07.83		B	3.4	S	5.0	B		7	&12	S7	&6	45	CNO
1996 04 07.83		M	1.7	S	6.7	L	6	30	11	7	&6		GR004
1996 04 07.83		M	3.0:	S	0.0	E		1	&15	5	3	30	KOS01
1996 04 07.83		S	2.9	S	0.0	E		1	18	S7/	30	50	KWI
1996 04 07.84		B	3.2	S	3.6	B		4	8	8	&5		SAN09

Comet C/1996 B2 (Hyakutake) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 04 07.84		M	3.0	S	8	R	8	35	15	S7	&4	47	KWI
1996 04 07.84		S	2.6	S	5.0	R	6	10	14	6/	6	240	RES
1996 04 07.84		S	2.7	S	0.0	E		1	23	6	8	240	RES
1996 04 07.84	$	S	3.5	S	0.0	E		1	& 7	S5	&2		CH001
1996 04 07.85		B	2.6	S	3.6	B		4		D9	12	38	PI001
1996 04 07.85	&	O	3.5:	S	0.0	E		1	&18	D8	&5	45	SK003
1996 04 07.86		B	3.0	S	0.0	E		1					RAF
1996 04 07.86		B	3.4:	S	0.0	E		1	15	S6	4	45	DUS
1996 04 07.87		B	3.1:	AA	0.0	E		1	11	7	15	48	WES04
1996 04 07.87		B	3.4	S	5	R		20		4			SZC01
1996 04 07.87		O	2.6	S	0.0	E		1	18	6/	3.5		SZU01
1996 04 07.87		S	2.3	AA	7.5	R	4	30		6	5		LUK05
1996 04 07.88		B	1.8	SC	5.0	B		15	18	D6/	1.8	40	FAJ
1996 04 07.88		B	2.0:	S	5.0	B		10	33	D4	2.7	50	ZBR
1996 04 07.88		B	2.6	S	5.0	B		5	15	s6	6.1	45	SAN02
1996 04 07.88		O	2.6	S	5.0	B		7	8	S8	5	50	SCH07
1996 04 07.90		O	2.2	S	6.0	B		20	20	S3/	&5		SIW
1996 04 07.91		B	3.4	S	6.0	B		20	&11	9	&6.1		JAN04
1996 04 07.91		O	2.9	S	4.6	B		10	&15	s5/	18.5	45	BUR04
1996 04 08.04		S	2.3	PA	5.0	O		10	20		15		DEG
1996 04 08.09		B	2.5	SC	0.8	E		1	22	S8	5.1	47	MOD
1996 04 08.11		B	2.8	SC	5.0	B		10	6.3	S8	7.5	47	MOD
1996 04 08.79		B	2.8	YF	5.0	B		10	& 7	s7/	&5	44	SCI
1996 04 08.79		B	2.9	S	5.0	B		10	8	5			KIE
1996 04 08.79	&	B	3.5	S	6.0	B		20	40	7	10		CZE
1996 04 08.80		B	3.1	AA	5.0	B		10	& 5	S6	&3.5	48	MAR12
1996 04 08.80		B	3.1	S	6.5	R	6	28	8	S6/			SWI
1996 04 08.80		B	3.5	Y	5.0	B		7	&20	6	&2.4		CZE01
1996 04 08.81		B	2.5	S	4.0	B		12	& 8	5			WLO
1996 04 08.81		B	2.8	AA	4.0	B		8	9.7	S6	5.1	54	MAR13
1996 04 08.81		B	3.2	S	5.0	B		10	7	6			SL001
1996 04 08.81		B	3.2	S	6.0	B		20	10	5	3.7	44	KID01
1996 04 08.81		B	3.3	OH	5.0	B		7	8.5	6	7.6	43	GR003
1996 04 08.81		B	3.3	S	5.0	B		10	8	7			MAT06
1996 04 08.81		M	2.5	S	5.0	B		7	&15	S7	7	45	PAR03
1996 04 08.82		B	2.6	S	3.5	B		7		6/			KOD01
1996 04 08.82		B	2.9	S	3.0	B		8	&15	8	&2.5		KRZ
1996 04 08.82		B	3.5	S	5.0	B		10	20	3	1.5	120	DER
1996 04 08.82		S	1.7	S	7.0	B		25	&14	D7	&3.4	50	OLE
1996 04 08.83		B	2.8	S	0.0	E		1					RAF
1996 04 08.83		B	3.1	S	5.0	B		7	& 8	S8	3.0	44	SPE01
1996 04 08.83		B	3.1	S	6.0	B		20	& 6	D8	&4	5	SOC
1996 04 08.83		I	2.9	S	0.0	E		1	&20	6/			KRZ
1996 04 08.83		S	2.9	S	0.0	E		1	15	S7/		50	KWI
1996 04 08.83	&	M	1.7	S	6.7	L	6	30	15	7	&7.5		GR004
1996 04 08.84		B	1.8	SC	5.0	B		15	17	D7/	3.5	45	FAJ
1996 04 08.84		B	2.2:	S	6.0	B		20	&14	D5	&2.3	43	KOW01
1996 04 08.84		B	2.5	S	0.0	E		1	18	s6/	3.5		SZU01
1996 04 08.84		B	2.6	S	5.0	B		7	18	S8	22	49	PLE01
1996 04 08.84		B	2.8	S	6.0	B		20	20	7	&3	50	RAF
1996 04 08.84		B	3.0:	Y	5	R		30	&15	7	&0.4	36	MUS01
1996 04 08.84		B	3.2	S	3.6	B		4	9	7/			SAN09
1996 04 08.84		B	3.2:	AA	0.0	E		1	13	7/	20	46	WES04
1996 04 08.84		S	2.6	S	5.0	R	6	10	29	7	10	230	RES
1996 04 08.84		S	2.7	S	0.0	E		1	21	5	19	230	RES
1996 04 08.86		B	3.0	S	5	R		20		4			SZC01
1996 04 08.86		B	3.1	YF	5.0	B		10	8	S8	8.0		SIW01
1996 04 08.86		M	3.1:	S	0.0	E		1	&15	6	3.5	30	KOS01
1996 04 08.87		M	3.1	S	3.0	B		8	13.5	6/	3.5		KOS01
1996 04 08.87	&	O	3.6:	S	0.0	E		1	&13	D8	&7	70	SK003
1996 04 08.88		B	2.0:	S	5.0	B		10	30	D4	2.5	50	ZBR
1996 04 08.88		B	2.8:	S	0.0	E		1	12	S7	4	45	DUS
1996 04 08.88	!	S	2.5	AA	7.5	R	4	30		6	3		LUK05
1996 04 08.90		B	2.5:	S	3.6	B		4		D8/	10	30	PI001
1996 04 08.91		B	3.4	S	6.0	B		20	&10	9	&3.8		JAN04

Comet C/1996 B2 (Hyakutake) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 04 08.95		S	2.5	SC	0.0	E		1	>10				WAR01
1996 04 09.08		B	2.7	SC	5.0	B		10	6.3	S8	2.1	47	MOD
1996 04 09.61		S	2.4	AA	5	R	4	10	10	8	>6	45	GUR
1996 04 09.77		B	3.0:	AA	4.0	B		8	& 9.0	S6	4.3	52	MAR13
1996 04 09.77		B	3.1	AA	5.0	B		10	& 3	S6	&3.0	48	MAR12
1996 04 09.77	&	B	3.5	S	6.0	B		20	40	7	10	30	CZE
1996 04 09.79		B	2.2	S	5.0	B		10	& 9	S7/	&2.2	45	OLE
1996 04 09.79		B	3.0:	YF	5.0	B		10	& 7	s7	&4	45	SCI
1996 04 09.80		B	2.5:	S	5.0	B		7	&17	6	3.0		SZU01
1996 04 09.80		B	3.3	Y	3.0	B		8					GRZ01
1996 04 09.80		O	3.3	Y	3.0	B		8					KOW02
1996 04 09.81		B	2.4:	S	4.0	B		12	& 8	5			WLO
1996 04 09.81		S	2.9	S	0.0	E		1	15	S7/	20	50	KWI
1996 04 09.82		B	2.1	S	7.0	B		25	&16	7	&2.4		OLE01
1996 04 09.82		B	2.7	S	5.0	B		7	17	S8	16	50	PLE01
1996 04 09.82		B	3.1	S	5.0	B		7	& 6.5	S8	4.3	44	SPE01
1996 04 09.82		B	3.1	YF	5.0	B		10	7	S8	5.0		SIW01
1996 04 09.82		B	3.5	S	5.0	B		7	7	6			GRO03
1996 04 09.82		M	3.0	S	8	R	8	35	12	S7	&3	50	KWI
1996 04 09.82		O	3.5	Y	5.0	B		20	8	7	2.5		JAR01
1996 04 09.82		S	2.6	S	0.0	E		1	14	6	12	240	RES
1996 04 09.82		S	2.6	S	5.0	R	6	10	17	7	8	240	RES
1996 04 09.83	&	M	1.9:	S	5.0	B		10	13	7	&5.5		GRO04
1996 04 09.84		B	3.4	AA	0.0	E		1	10	7/	8	47	WES04
1996 04 09.84		M	2.8	S	5.0	B		7	&15	S7	7	45	PAR03
1996 04 09.85		M	3.1	S	5.0	B		10	12	6	3.5	31	KOS01
1996 04 09.88		O	3.0	S	4.6	B		10	&11	S6	5.5	45	BUR04
1996 04 09.89		O	3.0	S	7	R	10	30	&11	S6	&2.5	45	BUR04
1996 04 09.91		B	3.4	S	6.0	B		20	&10	9	&2.5		JAN04
1996 04 09.95		B	1.9	SC	5.0	B		15	18	D7	3.5	30	FAJ
1996 04 10.62		S	2.6	AA	5	R	4	10	10	7	6	45	GUR
1996 04 10.78		B	2.4	S	3.5	B		7	13	6/			KOD01
1996 04 10.79		B	2.8	YF	5.0	B		10	& 5	s7	&2.5	45	SCI
1996 04 10.80		B	3.0:	AA	4.0	B		8	& 7.0	S6/	&2.0	50	MAR13
1996 04 10.80		B	3.2	AA	5.0	B		10	& 3	S6	&2.0	44	MAR12
1996 04 10.81		B	2.3:	S	4.0	B		12	& 7	5			WLO
1996 04 10.81		B	3.6	S	6.0	B		20	& 5	d5	&3	5	SOC
1996 04 10.81		B	3.7:	Y	5.0	B		7	&15	4	&1		CZE01
1996 04 10.81		S	2.8	S	5.0	R	6	10	12	6/	3	240	RES
1996 04 10.81		S	2.9	S	0.0	E		1	17	5	2	240	RES
1996 04 10.82		B	3.4:	S	5.0	B		7	& 5.6	S8	3.1	45	SPE01
1996 04 10.82		B	3.7	S	5.0	B		10	12	3/	2	120	DER
1996 04 10.82		M	2.8	S	5.0	B		7	&15	S8	15	50	PAR03
1996 04 10.82		O	2.4	S	0.0	E		1	15	s6	3.0		SZU01
1996 04 10.82		S	2.9	S	0.0	E		1	12	S7/	25	50	KWI
1996 04 10.82	&	M	2.1:	S	6.7	L	6	30	10	6	&3		GRO04
1996 04 10.83		M	3.0	S	8	R	8	35	11	S7	&3	50	KWI
1996 04 10.83		O	2.6	S	5.0	B		7	7	S8	15	50	KAR02
1996 04 10.83		O	3.4	Y	5.0	B		20	7	6	3		JAR01
1996 04 10.84		B	2.4	S	3.6	B		4	32	D8/	8	45	PIO01
1996 04 10.84		B	2.8	S	5.0	B		7	15	S8	19	50	PLE01
1996 04 10.85		B	2.9	S	5	R		20		4/			SZC01
1996 04 10.85		B	3.1:	S	0.0	E		1	10	S7	7.5	46	DUS
1996 04 10.85		M	3.1:	S	0.0	E		1	&10	6	3	33	KOS01
1996 04 10.85	!	B	2.6	S	0.0	E		1	18	s8	28	50	PLE01
1996 04 10.88		B	3.1	S	5.0	B		5	19	d6	5.8	44	SAN02
1996 04 10.91		B	3.5	S	6.0	B		20	&10	9	&3.7		JAN04
1996 04 11.03	&	M	2.5:	SC	6.7	L	6	30	8	6	&2.5		GRO04
1996 04 11.12	s	B	2.8	SC	5.0	B		10	5.8	S8	10	46	MOD
1996 04 11.60		S	2.7	AA	5	R	4	10	8	7	>4	45	GUR
1996 04 11.80		B	3.3	S	6.5	R	6	28	& 5	S6			SWI
1996 04 11.80		O	2.3	S	0.0	E		1	14	5/	2.5		SZU01
1996 04 11.81		S	2.5	S	5.0	R	6	10	20	7	9	230	RES
1996 04 11.81		S	2.6	S	0.0	E		1	24	5/	6	230	RES
1996 04 11.82	!	B	3.0	S	5.0	B		7	12	S8	12	50	PLE01

Comet C/1996 B2 (Hyakutake) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 04 11.87		S	2.8	AA	0.7	E		1	30	8	14	42	DIJ
1996 04 12.79		B	2.7	S	5.0	B		10	& 9	S8	&0.9	47	OLE
1996 04 12.80		B	3.4:	S	5.0	B		7	& 5.6	S8	4.0	43	SPE01
1996 04 12.80	&	B	3.5:	Y	5.0	B		7	&15	4	&1.3		CZE01
1996 04 12.81		B	1.8	SC	5.0	B		15	14	D6	3.0	28	FAJ
1996 04 12.81		B	3.1	S	5.0	B		7	&15	S8	&4	60	CNO
1996 04 12.81		B	3.6	S	6.0	B		20	& 5	d6	&6	7	SOC
1996 04 12.81	!	B	3.2	S	5.0	B		7	10	S8	12	49	PLE01
1996 04 12.82		B	2.3:	S	4.0	B		12	& 6	5			WLO
1996 04 12.82	!	B	3.2:	YF	5.0	B		10	& 5	s7	&2	45	SCI
1996 04 12.82	&	B	3.8	S	5.0	B		7	7	6		40	GRO03
1996 04 12.83		O	3.7	Y	5.0	B		20	6	7	3.5		JAR01
1996 04 12.83	&	B	3.5	S	6.0	B		20	40	7	7	40	CZE
1996 04 12.83	&	M	2.8:	S	6.7	L	6	30	7	5	&1		GRO04
1996 04 12.84		M	3.1	S	3.0	B		8	8	6	3	35	KOS01
1996 04 12.85		B	3.1:	S	0.0	E		1	10	S7	6.5	47	DUS
1996 04 12.87		B	3.6	AA	0.0	E		1	6	7	25	48	WES04
1996 04 12.87		S	2.9	AA	5.0	B		7	30	8	11	42	DIJ
1996 04 12.88		O	3.4	AE	5.0	B		7	20	6	7	45	CHM
1996 04 12.89		B	3.2	S	5.0	B		5	13	s7	5.4	47	SAN02
1996 04 12.92		B	3.5:	S	6.0	B		20	& 9	8/	&3.9		JAN04
1996 04 13.04	&	M	3.0:	S	6.7	L	6	30	8	5	&2		GRO04
1996 04 13.63		S	2.8	AA	5	R	4	10	7	7	>5	43	GUR
1996 04 13.78		B	3.5	AA	5.0	B		10	& 3	S6	&1.2	44	MAR12
1996 04 13.78	&	M	2.8	S	5.0	B		7	&10	S8	3	50	PAR03
1996 04 13.80	!	B	3.4	S	5.0	B		7	10	S8	10	48	PLE01
1996 04 13.81		O	2.3:	S	0.0	E		1	&14	s5	2		SZU01
1996 04 13.82		B	2.0	SC	5.0	B		15	13	D6	&3	27	FAJ
1996 04 13.83		B	3.4:	AA	4.0	B		8	& 6.5	S6/	&1.3	50	MAR13
1996 04 13.83		B	3.6	S	6.0	B		20	& 3	s2	&0.5	10	SOC
1996 04 13.84		S	3.0	AA	5.0	B		7	24	7	12	42	DIJ
1996 04 13.85		B	2.8:	S	0.0	E		1	10	S8			DUS
1996 04 13.89		O	2.9	AE	5.0	B		7	15	6	8.5	45	CHM
1996 04 14.62		S	2.7	AA	5	R	4	10	7	7	>7	43	GUR
1996 04 14.75		S	3.3	SC	8.0	B		20	15	S7	10	45	DAN01
1996 04 14.79		B	2.7	YF	5.0	B		10	& 7	s7	&2	45	SCI
1996 04 14.79		B	2.8:	S	3.6	B		4	19	D8	5	37	PIO01
1996 04 14.79		B	3.4:	AA	4.0	B		8	& 6.0	S6/	&2.0	48	MAR13
1996 04 14.79		B	3.6	S	6.0	B		20	& 3	s4	&3	10	SOC
1996 04 14.79	&	B	3.5	AA	5.0	B		10	& 2	S7	&2.5	40	MAR12
1996 04 14.80	!	B	2.8	S	5.0	B		7	8	S8	8	47	PLE01
1996 04 14.80	&	B	3.5:	Y	5.0	B		7	&12	3			CZE01
1996 04 14.80	&	M	3.4:	S	6.7	L	6	30	6	6	&4		GRO04
1996 04 14.81	&	M	2.4	S	5.0	B		7	& 8	S8	7	50	PAR03
1996 04 14.81	&	S	2.7	S	0.0	E		1	10	S8	&8	50	KWI
1996 04 14.82	&	B	3.7:	S	6.0	B		20	6	7	3.6	42	KID01
1996 04 14.82	&	M	2.9	S	8	R	8	35	10	S7/	&3.5	46	KWI
1996 04 14.91		B	3.8	S	6.0	B		20	& 5	8/	&5.0		JAN04
1996 04 15.07	s	B	3.1	SC	5.0	B		10	5	S8/	3.4	39	MOD
1996 04 15.63		S	1.8	AA	0.0	E		1	8	8	12	43	GUR
1996 04 15.79		B	3.0	AA	4.0	B		8	& 6.0	S6/	&2.4	46	MAR13
1996 04 15.80		M	3.2:	S	0.0	E		1	& 6	6/	3.5	38	KOS01
1996 04 15.80	&	B	2.7:	AA	5.0	B		10	& 1.5	S8	&1.0	40	MAR12
1996 04 15.80	&	M	3.9:	S	6.7	L	6	30	6	5	&0.5		GRO04
1996 04 15.81		B	2.7	Y	3.0	B		8					GRZ01
1996 04 15.81		B	3.0	S	0.0	E		1		9			SOC
1996 04 15.81		B	3.0	S	5.0	B		10	10	5/	2.5	180	DER
1996 04 15.81		O	2.7	Y	3.0	B		8					KOW02
1996 04 15.81	!	B	2.6	S	5.0	B		7	6	S8	6	48	PLE01
1996 04 15.82		B	2.3:	S	5.0	B		7	& 3.8	S8/	5.3	40	SPE01
1996 04 15.82		M	2.2	Y	5.0	B		7	5	9	15	50	KYS
1996 04 15.82	!	S	4.2	S	35	M	10	90	4	S8/	3.5	46	PLE01
1996 04 15.82	a	B	2.4	AA	5.0	B		10			6.0	40	HAS02
1996 04 15.82	a	I	2.4	AA	0.8	E		1					HAS02
1996 04 15.83		B	2.2	Y	0.0	E		1	5		40	50	KYS

Comet C/1996 B2 (Hyakutake) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 04 15.83		S	2.3	S	5.0	R	6	10	14	7/	3	230	RES
1996 04 15.83	&	B	2.2:	S	5.0	B		10	& 7	S9	&0.6		OLE
1996 04 15.83	&	B	2.6	OH	5.0	B		7	6	D7	12	40	GR003
1996 04 15.84		B	1.3	SC	5.0	B		15	17	D7/	9	30	FAJ
1996 04 15.84		B	2.0	S	5	R		20		5/			SZC01
1996 04 15.84		B	2.3	S	7.0	B		25	&15	5/	&1.6		OLE01
1996 04 15.84		B	2.4:	S	0.0	E		1		8	&2		RAF
1996 04 15.84	$	S	2.0:	YF	5.0	B		10	& 6	s7	&1	45	SCI
1996 04 15.87		O	2.7:	S	4.6	B		10	& 8	5/	&2.5		BUR04
1996 04 15.94		B	2.5	S	5.0	B		5	16	s6	3.7		SAN02
1996 04 16.62		S	2.1	AA	0.0	E		1	6	7	>6	42	GUR
1996 04 16.79		B	2.1	S	5.0	B		10	& 8	S8	&1.9	48	OLE
1996 04 16.79		B	2.2	S	5.0	B		7	&10	S8	&5	60	CNO
1996 04 16.79		B	3.3	S	0.0	E		1		9			SOC
1996 04 16.79	&	B	2.8	AA	5.0	B		10	& 1.0	S8	&3.5	40	MAR12
1996 04 16.80		B	2.9	AA	5.0	B		10	6.0	S7	3.5	44	MAR13
1996 04 16.81		I	2.5	Y	0.0	E		1	5				KYS
1996 04 16.81		M	2.5	Y	5.0	B		7	5	9	5	50	KYS
1996 04 16.81		O	3.4	Y	5.0	B		20	5	8	3		JAR01
1996 04 16.81	&	B	3.5:	Y	5.0	B		7	&20	4	&2.3		CZE01
1996 04 16.82		B	2.3	S	5	R		20		5			SZC01
1996 04 16.82		B	2.4	S	7.0	B		25	&22	5	&3.0		OLE01
1996 04 16.82		B	2.6	S	3.6	B		4	14	D8/	5	34	PIO01
1996 04 16.82		B	2.9	Y	3.0	B		8					GRZ01
1996 04 16.82		M	3.2:	S	0.0	E		1	& 6	7	&4		KOS01
1996 04 16.82		O	2.9	Y	3.0	B		8	& 6		&3	40	KOW02
1996 04 16.82		S	2.1	S	0.0	E		1	18	6			RES
1996 04 16.82		S	2.2	S	5.0	R	6	10	&10	8	&2	250	RES
1996 04 16.83		B	2.1:	S	5.0	B		7	& 2.7	S8/	4.7	38	SPE01
1996 04 16.83		M	3.2	AA	3.0	B		8	8	7	4.6	37	KOS01
1996 04 16.83	&	B	2.4	OH	5.0	B		7	6	D			GR003
1996 04 16.83	&	B	2.8	S	6.0	B		20	5	8	3.7	38	KID01
1996 04 16.83	a	B	2.3	AA	5.0	B		10			21	40	HAS02
1996 04 16.83	a	I	2.3	AA	0.8	E		1					HAS02
1996 04 16.84		B	1.7	SC	5.0	B		15	14	D7	5	35	FAJ
1996 04 16.87		O	2.8	S	4.6	B		10	&10	S7	&3.5	60	BUR04
1996 04 16.89	!	S	2.6	AA	7.5	R	4	30		6	3		LUK05
1996 04 17.61		S	2.0	AA	0.0	E		1	6	7	>6	40	GUR
1996 04 17.78		B	1.7	S	3.5	B		7	11	5/			KOD01
1996 04 17.79		B	2.1	S	6.0	B		20	& 8	D6	&2.1	40	KOW01
1996 04 17.79		B	2.3	S	5.0	B		10	& 7	S8/	&2.3	48	OLE
1996 04 17.79		B	2.8	AA	4.0	B		8	5.5	S7	&3.0	41	MAR13
1996 04 17.79	&	B	3.0:	AA	5.0	B		10	& 1.0	S8	&3.0	40	MAR12
1996 04 17.80		I	3.4	Y	0.0	E		1	4				KYS
1996 04 17.80		M	2.7	Y	5.0	B		7	4	9	7	50	KYS
1996 04 17.80		O	2.1	S	0.0	E		1	13	5	2		SZU01
1996 04 17.80	&	B	3.6:	Y	5.0	B		7	&12	3	&0.5		CZE01
1996 04 17.80	&	M	3.5	S	6.7	L	6	30	10	5	&4.5		GR004
1996 04 17.81		B	3.1	S	5.0	B		10	8	7			MAT06
1996 04 17.81		B	3.2	Y	3.0	B		8					GRZ01
1996 04 17.81		B	3.4	S	0.0	E		1		9			SOC
1996 04 17.81		M	3.2	S	5.0	B		7		8	7		DV0
1996 04 17.81		O	3.2	Y	3.0	B		8	& 6		&3.5	40	KOW02
1996 04 17.81	!	B	1.8:	YF	5.0	B		10	& 8	s7/	12	38	SCI
1996 04 17.81	&	B	2.4	YF	5.0	B		10	2	S8	7.6		SIW01
1996 04 17.81	&	M	2.2	S	3.5	B		7	& 5	S8	8	45	PAR03
1996 04 17.81	&	S	2.6	S	0.0	E		1	10	S8	&8	45	KWI
1996 04 17.82		B	1.8:	S	4.0	B		12	& 6	5			WL0
1996 04 17.82	!	B	2.7	S	5.0	B		7	8	S8	10	44	PLE01
1996 04 17.82	&	M	2.7	S	8	R	8	35	8	S7/	&3.5	43	KWI
1996 04 17.83		S	1.8	S	5.0	R	6	10	7	8	8	250	RES
1996 04 17.83	&	B	2.5	OH	5.0	B		7	5	6	8.7	39	GR003
1996 04 17.85	&	M	3.3	AA	15	M	15	60	8	s7			KOS01
1996 04 17.87	&	M	3.3:	S	0.0	E		1	& 6	7	3.2	37	KOS01
1996 04 17.88		O	2.8	S	4.6	B		10	& 8	S8	&3		BUR04

Comet C/1996 B2 (Hyakutake) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 04 17.88		S	2.3	PA	5.0	O		10	12	8			DEG
1996 04 18.07	s	B	2.0	SC	0.8	E		1	13	S8/	10		MOD
1996 04 18.08	$	B	2.5	SC	5.0	B		10	4.8	S8/	12	39	MOD
1996 04 18.76		O	2.0	S	0.0	E		1	30		7		KON06
1996 04 18.78		B	1.6	S	3.5	B		7	10	5			KOD01
1996 04 18.79		B	2.1:	YF	5.0	B		10	& 5	s7/	&3	32	SCI
1996 04 18.79	&	B	3.2	AA	5.0	B		10	& 1.0	S8	&2.0	40	MAR12
1996 04 18.80		B	3.0	AA	4.0	B		8	& 5.0	S7	3.6	40	MAR13
1996 04 18.80	&	B	3.8:	Y	5.0	B		7	&10	3			CZE01
1996 04 18.81		B	1.0:	SC	5.0	B		15	13	D7	&3	25	FAJ
1996 04 18.81		B	2.2:	S	5.0	B		10	& 5	S9	&1.9		OLE
1996 04 18.81		B	3.4	S	5.0	B		10	8	7			MAT06
1996 04 18.81	!	B	2.8	S	5.0	B		7	7	S8	11	43	PLE01
1996 04 18.81	&	B	2.2	YF	5.0	B		10	2	S8			SIW01
1996 04 18.82	&	S	2.5	S	0.0	E		1	& 6	8	&8	45	KWI
1996 04 18.83		B	2.5	S	5.0	B		10	1.2	6	12		SL001
1996 04 18.83		B	2.9	Y	5.0	B		7	4	9	4	50	KYS
1996 04 18.83		I	3.0	Y	0.0	E		1	4				KYS
1996 04 18.83		S	1.9	S	0.0	E		1	7	6	2	250	RES
1996 04 18.83		S	2.0	S	5.0	R	6	10	5	8/	6	250	RES
1996 04 18.83	&	M	2.3	S	3.5	B		7	& 5	S8	6	45	PAR03
1996 04 18.83	&	M	3.4	S	3.0	B		8	& 6	7	3	37	KOS01
1996 04 19.78	&	M	3.0	S	5.0	B		10	8	5	&2.5		GR004
1996 04 19.79		B	2.6:	YF	5.0	B		10	& 5	s7/	&4	32	SCI
1996 04 19.79		B	3.6	S	5.0	B		10	8	7			MAT06
1996 04 19.79		B	3.8	S	5.0	B		10	6	7			KIE
1996 04 19.79	&	B	3.4	AA	5.0	B		10	& 1.0	S8/	&2.5	40	MAR12
1996 04 19.80		B	2.3	S	5.0	B		10	& 7	S9	&2.4	38	OLE
1996 04 19.80		B	3.5	S	6.5	R	6	28	& 3	S7			SWI
1996 04 19.80		S	3.2:	AA	4.0	B		8	& 4.0	S7	&2.0	40	MAR13
1996 04 19.80		S	3.4	AA	3.0	B		8	20	S8	2	30	CSU
1996 04 19.80	!	B	2.9	S	5.0	B		7	7	S8	9	42	PLE01
1996 04 19.80	&	B	4.2:	Y	5.0	B		7	&10	3			CZE01
1996 04 19.80	&	S	2.7	S	0.0	E		1	& 6	8	&7	45	KWI
1996 04 19.81		B	1.5:	S	4.0	B		12	& 5	5/			WLO
1996 04 19.81		B	1.8	S	0.0	E		1	12	D5	2		SZU01
1996 04 19.81		B	3.3	Y	5.0	B		7	4	8	8	50	KYS
1996 04 19.81	&	B	2.5	YF	5.0	B		10	2	S8			SIW01
1996 04 19.81	&	M	2.9	S	8	R	8	35	7	7/	&3.5	43	KWI
1996 04 19.81	a	B	2.7	AA	5.0	B		10	2.2	8	2.5	48	HAS02
1996 04 19.82		I	3.4	Y	0.0	E		1	4				KYS
1996 04 19.82	&	M	2.2	S	5.0	B		7	& 8	S8/	25	40	PAR03
1996 04 19.82	&	M	3.5	S	3.0	B		8	& 5	7	2	37	KOS01
1996 04 20.78	&	B	3.5	AA	5.0	B		10	& 1.0	S7	&1.7	40	MAR12
1996 04 20.79		B	3.8	S	5.0	B		10	7	7			MAT06
1996 04 20.79	!	B	2.8	YF	5.0	B		10	& 6	s8	&3	30	SCI
1996 04 20.79	&	M	3.5:	S	5.0	B		10	& 5	7	2	37	KOS01
1996 04 20.79	&	S	2.8	S	0.0	E		1	& 6	8	&6	45	KWI
1996 04 20.80		B	3.5	S	6.5	R	6	28	& 2	S7/			SWI
1996 04 20.80		O	1.7	S	0.0	E		1	11	5	1.5		SZU01
1996 04 20.80	!	B	2.8	S	5.0	B		7	8	S8	10	40	PLE01
1996 04 20.80	&	B	2.3:	S	5.0	B		10	& 5	S9			OLE
1996 04 20.80	&	M	3.0	S	8	R	8	35	7	7/	&3	42	KWI
1996 04 20.81		B	1.3:	S	4.0	B		12	& 5	5/			WLO
1996 04 20.81		B	3.1	S	5.0	B		10	1.2	5	10		SL001
1996 04 20.81		I	3.0:	Y	0.0	E		1					KYS
1996 04 20.81		M	3.3	S	5.0	B		7		8/	3		DVO
1996 04 20.81	$	B	2.6	S	0.0	E		1	8	s8/	8	40	PLE01
1996 04 20.81	&	B	2.5	YF	5.0	B		10	2	S8			SIW01
1996 04 20.82	&	M	2.1	S	5.0	B		7	&10	S8	7	40	PAR03
1996 04 20.82	a	B	2.7	AA	5.0	B		10	2.2	8	5.0	30	HAS02
1996 04 20.83		S	3.4:	AA	5.0	B		10	& 3.0	S7/	1.7	39	MAR13
1996 04 21.07	$	B	2.9	SC	5.0	B		10	4.8	S8/	3.0	36	MOD
1996 04 21.77		O	1.9	S	0.0	E		1	30		10		KON06
1996 04 21.78		B	3.8	S	5.0	B		10	6	7			KIE

Comet C/1996 B2 (Hyakutake) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 04 21.79		B	3.2	S	25	L	6	100	2	S7			SWI
1996 04 21.79		B	4.1	S	5.0	B		10	5	7			MAT06
1996 04 21.79	$	B	2.7	S	5.0	B		7	7	S8	4.2	40	PLE01
1996 04 21.79	$	B	3.0	YF	5.0	B		10	& 7	s7/	&4	30	SCI
1996 04 21.80		B	4.3	S	6.0	B		20	& 2	s3	&1.5	10	SOC
1996 04 21.80		M	3.5	S	5.0	B		7		8/	2		DV0
1996 04 21.80		0	1.5	S	0.0	E		1	11	d4/	1		SZU01
1996 04 21.80	&	M	3.1	S	8	R	8	35	7	8	&3	40	KWI
1996 04 21.81		B	1.0:	S	4.0	B		12	& 5	5/			WL0
1996 04 21.81		S	1.6	S	0.0	E		1	14	6	1.4	260	RES
1996 04 21.81		S	1.7	S	5.0	R	6	10	6	6	1.9	260	RES
1996 04 21.81	&	B	2.6	YF	5.0	B		10	1	S8			SIW01
1996 04 21.82		0	3.3:	Y	5.0	B		7	3		3	50	KYS
1996 04 21.82	a	B	2.5	AA	5.0	B		10	2.2	8	5.0	30	HAS02
1996 04 21.83	$	B	2.8	OH	5.0	B		7	& 3	7/	&3.9	35	GR003
1996 04 22.73		B	2.4	Y	3.0	B		3		4	5		K0Z
1996 04 22.78		B	3.0	S	5.0	B		10	& 2	S7			SWI
1996 04 22.78		B	3.6	S	5.0	B		10	6				KIE
1996 04 22.79		B	4.1	S	5.0	B		10	4	7			MAT06
1996 04 22.79	$	B	2.8	S	5.0	B		7	7	S8	3.5	39	PLE01
1996 04 22.80		0	1.3	S	0.0	E		1	10	4	1		SZU01
1996 04 22.80		S	3.4	AA	3.0	B		8	20	S8	2	27	CSU
1996 04 22.80	$	B	2.8	YF	5.0	B		10	& 6	s8	&5	28	SCI
1996 04 22.80	&	B	2.4:	S	5.0	B		10	& 4	S9			OLE
1996 04 22.80	&	M	3.2	S	5.0	B		7	7	8	&4.5	40	KWI
1996 04 22.81		B	4.2	S	5.0	B		10	1	5	7		SL001
1996 04 22.81		M	3.5	S	5.0	B		7		9	2		DV0
1996 04 22.81	!	M	2.9:	OH	5.0	B		7	& 2.5	7		34	GR003
1996 04 22.81	&	B	2.9	YF	5.0	B		10	1	S8			SIW01
1996 04 22.82		0	3.4:	Y	5.0	B		7	4				KYS
1996 04 22.82		S	3.6:	AA	4.0	B		8	& 2.0	S7/	2.0	39	MAR13
1996 04 23.70		0	0.8	S	0.0	E		1	90	S7	20	230	DAN01
1996 04 23.78		B	3.0	S	5.0	B		10	& 1	S7			SWI
1996 04 23.78	$	B	3.0	S	5.0	B		7	6	S8	4	38	PLE01
1996 04 23.79		B	5.0	S	5.0	B		10	0.8	5			SL001
1996 04 23.80		B	4.5	S	6.0	B		20	& 1	s3	&1.5	5	SOC
1996 04 23.80		0	1.2:	S	0.0	E		1	&10	d4	0.5		SZU01
1996 04 23.80	$	B	2.6	YF	5.0	B		10	& 6	s8	&6	28	SCI
1996 04 23.80	&	M	1.8	S	3.5	B		7	& 8	S8	3	35	PAR03
1996 04 23.81		0[	2.5	Y	5.0	B		7					KYS
1996 04 23.81	$	M	3.3:	OH	5.0	B		7					GR003
1996 04 23.81	&	M	3.3	S	5.0	B		7	7	8	&2.5	39	KWI
1996 04 23.82		S	1.3	S	5.0	R	6	10	9	4	1.4	260	RES
1996 04 23.82		S	1.4	S	0.0	E		1	14	5			RES
1996 04 24.78	$	B	3.2:	S	10.0	B		25	6	S8/	3.2	38	PLE01
1996 04 24.80		0	1.0:	S	0.0	E		1	&10	4	0.5		SZU01
1996 04 25.78	$	B	3.0:	S	10.0	B		25	5	s8/	2.8	39	PLE01
1996 04 26.85		0	1.1	S	8.0	B		20	2	S9	0.4		KAR02
1996 05 09.82		S	3 :	AA	5.0	B		10	2.0				GAR01
1996 05 10.82		S	3 :	AA	5.0	B		10			0.3		GAR01
1996 05 13.81		S	3.5	AA	5.0	B		10			3.0		GAR01
1996 06 13.75		S	5.9	SC	5.0	B		7	12		1	205	JON
1996 06 14.74		S	6.2	SC	4.5	R	6	13	5	6	1	205	JON
1996 06 16.77		S	6.8	SC	4.5	R	6	13	5				JON
1996 06 17.76		S	6.4	SC	5.0	B		7	10				JON
1996 06 18.77		S	6.6	SC	4.5	R	6	13	5				JON
1996 06 19.76		S	6.7	SC	4.5	R	6	13	7				JON
1996 06 23.72		S	6.5	SC	4.5	R	6	13	6				JON
1996 06 26.75		S	6.9	SC	4.5	R	6	13	6				JON
1996 06 27.77		S	6.7	SC	4.5	R	6	13	6				JON
1996 06 28.76		S	7.0	SC	4.5	R	6	13	7		0.5	215	JON
1996 07 02.30		S	8.5:	SC	31.7	L	5	64	1.5	4/			JON
1996 07 02.35		S	6.4	SC	8.0	B		20	4	4	1.5	180	CAM03
1996 07 03.36		S	6.5	SC	8.0	B		20	4	4	1	180	CAM03
1996 07 07.39		S	6.9	SC	8.0	B		20	5	4	0.5	180	CAM03

Comet C/1996 B2 (Hyakutake) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 11.73		B	8.0	AA	8.0	B		15	5	7	0.2	205	SEA01
1996 07 13.67		S	8.0	AA	5.0	B		10	3	3			SEA01
1996 07 14.74		S	8.1	AA	8.0	B		15	3	7	1.0	140	SEA01
1996 07 15.76		S	8.2	AA	8.0	B		15	3	7	0.1		SEA01
1996 07 16.78		S	8.2	AA	8.0	B		15	3	5	0.1	140	SEA01
1996 07 17.76		S	8.3	AA	8.0	B		15	3	4			SEA01
1996 07 18.75		S	8.5	AA	8.0	B		15	2	4			SEA01
1996 07 19.29		S	7.6	AA	8.0	B		20					PEA
1996 07 19.71		S	8.5	AA	8.0	B		15	2	3			SEA01
1996 07 20.30		S	7.6	AA	8.0	B		20	7	4	0.25	180	PEA
1996 07 21.73		S	8.6	AA	8.0	B		15	2	3			SEA01
1996 07 22.70		S	8.6	AA	8.0	B		15	2	2			SEA01
1996 07 22.71		S	8.4	AA	5.0	B		10	2	3			SEA01
1996 07 23.72		S	8.6	AA	8.0	B		15	2	2			SEA01
1996 07 24.70		S	8.7	AA	5.0	B		10	2	2			SEA01
1996 07 24.70		S	8.7	AA	8.0	B		15	2	2			SEA01
1996 07 24.83		S	8.3	AA	8.0	B		20	5	2			PEA
1996 07 25.74		S	8.7	AA	8.0	B		15	2	2			SEA01
1996 08 07.43		S	9.5	SM	20.3	L	7	56	1.5	4			CAM03
1996 08 07.44		S	9.4	SM	8.0	B		20	3	2			CAM03
1996 08 08.48		S	9.5	SM	8.0	B		20	2	2			CAM03
1996 08 09.59		S	9.5	AA	8.0	B		20	4	3			PEA
1996 08 10.41		S	9.5	SM	8.0	B		20	3	2			CAM03
1996 08 10.58		S	9.6	AA	8.0	B		20	5	3			PEA
1996 08 11.52		S	9.6	SM	8.0	B		20	2	2			CAM03
1996 08 14.50		S	9.6	SM	8.0	B		20	3	3			CAM03
1996 08 16.53		S	10.0	AA	8.0	B		20	4	3			PEA
1996 08 19.47		S	10.2	SM	20.3	L		56	2	1			CAM03
1996 09 09.39		S	12.0	SM	20.3	L	7	56	1				CAM03
1996 09 16.52		S	12.0	SM	20.3	L	7	56	1	2			CAM03
1996 10 24.45		C	16.8	HS	25	L	4			9			GAR01

Comet C/1996 E1 (NEAT)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 06 07.07		B	9.7	AC	10.0	B	4	20	2	1			NOW
1996 07 19.94		M	10.4	TI	35	L	5	92	2.7	2			KYS
1996 07 19.95		M	10.2	TI	35	L	5	92	4.5	2/			HOR02
1996 07 20.00		S	12.4	AC	25.4	L	5	65	2	1/			MEY
1996 07 20.97		S	12.3:	AC	25.4	L	5	65	2.5	2			MEY
1996 07 21.06		O	10 :	TI	35	L	5	158					KYS
1996 07 21.88		S	9.8	TI	20	L	4	57	3	1/			KYS
1996 07 21.89		M	10.5	HS	35	L	5	92	2.6	2			PLS
1996 07 21.90		M	10.0	TI	35	L	5	92	3.5	2			HOR02
1996 07 21.95		S	12.2	AC	25.4	L	5	65	2	2/			MEY
1996 07 22.85		M	11.3:	TI	15	R	13	80	3.5	3			ZN0
1996 07 22.88		M	10.2	HS	35	L	5	92	3	2/			PLS
1996 07 22.89		S	9.9	TI	20	L	4	57	2.5	2			KYS
1996 07 27.03		S	11.8	AC	25.4	L	5	65	2	2			MEY
1996 07 27.05		S	11.2	HS	44.5	L	5	72	4	1			SAR02
1996 08 04.91		S	11.3	AC	25.4	J	6	58	2.5	1			BOU
1996 08 05.91		S	11.4	AC	25.4	J	6	72	2.5	1			BOU
1996 08 06.88		S	11.5:	TI	25	L	6	60	2.7	2			HOR02
1996 08 08.26		S	11.5	AC	20.0	T	10	185	2.0	2/			SPR
1996 08 08.81		B	11.1	HS	35.0	L	5	56	2.8	3			KRY01
1996 08 09.26		S	11.6	AC	20.0	T	10	185	2.0	2/			SPR
1996 08 09.82		M	11.2	HS	10	B		25	2.5	3			ZN0
1996 08 09.85		M	11.3	TI	35	L	5	92	2.5	2			HOR02
1996 08 10.00		S	11.1	HS	44.5	L	5	72	6	0			BAK01
1996 08 10.00		S	11.3	HS	44.5	L	5	72	4	1			SAR02
1996 08 10.88		S	11.2	HS	10	B		25	2.2	2/			ZN0
1996 08 11.01		S	10.3	NP	44.5	L	5	167	4	2			SAN04
1996 08 11.01		S	10.7	NP	44.5	L	5	167	2	2			MAR02
1996 08 11.28		S	11.9	AC	20.0	T	10	225	1.5	2/			SPR
1996 08 11.93		S	11.4	AC	25.4	J	6	72	2.6	1/			BOU

Comet C/1996 E1 (NEAT) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 12.10		S	10.7	NP	21.0	L	6	60	3	1			MAR02
1996 08 15.92		S	12.3:	HS	20	R	14	185	1.8	3			SHA02
1996 08 17.10		S	10.8	NP	44.5	L	5	100	2	1/			MAR02
1996 08 17.10		S	11.0	NP	44.5	L	5	100	4	1			SAN04
1996 08 17.16		S	13.2	GA	50.5	L	5	167	0.8	1			MOD
1996 08 17.26		S	11.1	AC	20.0	T	10	185	2.0	2			SPR
1996 08 17.92		S	10.8	NP	44.5	L	5	100	1.5	1			MAR02
1996 08 17.92		S	11.8	NP	30	L	5	60	3	1			NEV
1996 08 17.93		S	10.8	NP	44.5	L	5	100	2	2			SAN04
1996 08 18.14		S	12.3	HS	20.3	T	10	133	1.5	1			BIV
1996 08 18.26		S	11.4	AC	20.0	T	10	185	2.0	2			SPR
1996 08 18.84		M	11.1	TI	25	L	6	60	3.3	2			HOR02
1996 08 18.87		S	11.4	AC	25.4	L	5	65	2.5	2			MEY
1996 08 18.88		S	10.5	NP	44.5	L	5	100	5	1			SAN04
1996 08 18.88		S	11.0	NP	44.5	L	5	100	4	1			MAR02
1996 08 18.90		S	11.3	GA	25.4	J	6	72	2.6	1			BOU
1996 08 19.89		S	11.4	AC	25.4	L	5	65	2.5	2			MEY
1996 08 19.90		S	12.1	HS	20.3	T	10	93	1.0	2			HAS02
1996 08 19.91		S	11.4	GA	25.4	J	6	58	3.1	0/			BOU
1996 08 19.92		S	11.0	NP	44.5	L	5	100	2	1			MAR02
1996 08 19.93		S	10.8	NP	44.5	L	5	100	3	1			SAN04
1996 08 19.96		S	10.6	AA	11	L	7	56	3	2			BAR06
1996 08 20.00		S	12.5:	NP	30	L	5	60	2	0			NEV
1996 08 20.91		S	11.3	GA	25.4	J	6	72	3.0	1			BOU
1996 08 22.23		S	11.1	AC	20.0	T	10	125	3.0	2			SPR
1996 08 24.04		S	11.3	AC	25.4	L	5	65	2.5	2			MEY
1996 08 24.09	!	V	13.1	YF	20.0	T	2		& 2	3			MIK
1996 08 25.06		S	11.4	HS	44.5	L	5	72	4.5	2/			SAR02
1996 08 25.39		S	13.3:	GA	50.5	L	5	87	1.6	1/			MOD
1996 08 26.10		M	11.3	TI	35	L	5	92	2	1/			HOR02
1996 08 26.36		S	13.3	GA	50.5	L	5	87	1.4	1/			MOD
1996 09 02.49	a	C	12.6	GA	8.0	R	6		5.5				NAK01
1996 09 02.83		S	11.4	TI	35	L	5	92	3	1/			PLS
1996 09 02.83		S	11.7	TI	35	L	5	92	2	1/			HOR02
1996 09 03.81		I	[12.5:	NP	30	L	5	60					NEV
1996 09 03.86		S	11.4	AC	25.4	J	6	72	3.5	0/			BOU
1996 09 03.86		S	11.6	AC	25.4	L	5	65	2.5	1			MEY
1996 09 04.84		S	11.4	TI	35	L	5	92	2.3	1			HOR02
1996 09 04.85		S	11.4	TI	35	L	5	92	2	1/			PLS
1996 09 04.87		S	10.6	AC	6.3	R	13	52	3	1			KOS
1996 09 04.90		S	11.5	AC	25.4	J	6	72	3.5	0/			BOU
1996 09 05.85		S	11.5	AC	25.4	J	6	88	3.0	1			BOU
1996 09 05.87		S	12.8:	HS	33	L	5	150	1.7	2			SHA02
1996 09 06.86		M	11.8	TI	35	L	5	92	1.8	1/			HOR02
1996 09 06.86		S	11.8	HS	44.5	L	5	72	4	1			SAR02
1996 09 07.16		E	10.8	NP	17.3	L	6	84	3	3			TRI
1996 09 07.85		S	11.4	AC	25.4	J	6	72	3.0	0/			BOU
1996 09 07.89		S	11.7:	AC	30.5	T	10	55	>10	0			COM
1996 09 07.91		S	10.9	AC	11	L	7	50	2.5	2			BAR06
1996 09 08.18		E	11.0	NP	17.3	L	6	84	3	3			TRI
1996 09 09.84		S	11.7	AC	25.4	J	6	72	3.2	0			BOU
1996 09 09.98		S	12.5:	AC	30.5	T	10	55	>10	0			COM
1996 09 10.80		S	10.6	AC	6.3	R	13	52	4	1			KOS
1996 09 10.87	!	V	10.3	YF	36.0	T	7		& 4	3			MIK
1996 09 10.92		S	12.5	NP	33	L	5	150	1.0	2			SHA02
1996 09 11.88		M	12.3	HS	35	L	5	104	1.3	2/			HOR02
1996 09 11.88		M	12.3:	TI	35	L	5	104	2	2			PLS
1996 09 12.92		B	11.4	NP	17.3	L	6	84	3	3			TRI
1996 09 12.92		S	12.8	NP	33	L	5	150	1.0	1			SHA02
1996 09 13.87		S	12.2	NP	41.0	L	4	208	1.5	3/			ZAN
1996 09 13.94		S	12.8:	NP	33	L	5	100	1.4	1			SHA02
1996 09 14.83		S	12.0	TI	35	L	5	104	2.2	1/			HOR02
1996 09 14.94		S	11.5	NP	21.0	L	6	60	1.8	1			MAR02
1996 09 15.02		S	[10.5	HS	10	B		14					SHA02
1996 09 15.90		S	12.6:	NP	33	L	5	100	2.0	1			SHA02

Comet C/1996 E1 (NEAT) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 16.12		M	11.9	TI	35	L	5	104	2	2			HOR02
1996 09 16.88		S	12.7:	NP	33	L	5	75	1.3	1			SHA02
1996 09 18.84		S	12.0	NP	25.4	J	6	72	3.5	0			BOU
1996 09 19.88		S	11.8	AC	25.4	L	5	65	2	1			MEY
1996 09 21.96		S	10.8	AC	11	L	7	50	3	3/			BAR06
1996 09 23.01		S	10.9	AC	11	L	7	50	3	2			BAR06
1996 10 02.87		S	12.4:	NP	33	L	5	75	1.3	1			SHA02
1996 10 03.82		S	13.0:	HS	35	L	5	158	1.5	1			HOR02
1996 10 03.91	!	V	14.5	GA	36.0	T	7		& 1	3			MIK
1996 10 04.46		C	14.1	GA	60.0	Y	6		2.2				NAK01
1996 10 04.97		S	12.4:	NP	33	L	5	75	1.3	2			SHA02
1996 10 09.46		C	14.0	GA	60.0	Y	6		2.4				NAK01
1996 10 12.92		S[	13.5	HS	44.5	L	5	230	1				SAR02
1996 10 13.80		S	13.5	HS	44.5	L	5	146	1	1			SAR02

Comet C/1996 N1 (Brewington)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1096 09 07.83		S	8.0	AA	11	L	7	32	9	2/			BAR06
1096 09 07.84		S	8.1	AA	11	L	7	32	8	3			CHU04
1096 09 07.85		S	8.2	AA	11	L	7	32		3			KHA01
1096 09 07.86		B	8.2	AA	11	L	7	32		3			RED
1996 07 06.87		S	9.2:	TI	11	L	7	54	2	2			KYS
1996 07 07.13	s	S	11.0	GA	20.0	L	5	68	1.7	2			MOD
1996 07 07.38		S	10.0	GA	20.3	L	7	56	3	2			CAM03
1996 07 07.40		S	10.0	GA	8.0	B		20	5	1			CAM03
1996 07 10.87		S	9.8:	TI	25	L	6	143	3	1/			HOR02
1996 07 10.91		S	9.7	AA	25.3	L	6	58	& 3	3/			PER01
1996 07 10.91		S	10.2:	AA	25.3	L	6	58	& 1	1			VIT01
1996 07 11.13	a	S	10.8	GA	20.0	L	5	68	1.5	2/			MOD
1996 07 11.14	a	S	10.2:	GA	20.0	L	5	35	1.7	1/			MOD
1996 07 11.40		S	9.2	AA	8.0	B		15	3	2			SEA01
1996 07 11.90		S	9.6	AA	25.3	L	6	58	& 5	4			PER01
1996 07 11.90		S	9.8	AA	25.3	L	6	58	& 2.5	3			VIT01
1996 07 12.87	s	S	9.1	AA	8.0	B		15	4	3			HAV
1996 07 13.84		S	9.9	AA	6.3	R	13	52	5	1			KOS
1996 07 13.86		M	9.3	TI	10	B		25	5.5	2/			ZNO
1996 07 13.87		S	9.1	TI	25	L	6	60	4	1/			HOR02
1996 07 14.86	s	S	8.9	AA	8.0	B		15	4	2/			HAV
1996 07 15.94		S	9.3	AA	10	B		14	7	2			SHA02
1996 07 16.87		M	8.4	TI	25	L	6	60	6	2/			HOR02
1996 07 16.87		S	9.9	TI	20	L	4	34	3	3/			KYS
1996 07 16.88		M	9.5	TI	25	L	6	60	3	2			PLS
1996 07 16.94		S	10.4	HS	10	B		14	4	3			SHA02
1996 07 17.49		C	9.9:	GA	8.0	R	6		10.2				NAK01
1996 07 17.83		S	9.8	AA	6.3	R	13	52	4	1			KOS
1996 07 17.92		B	9.7	HS	25.6	L	5	42	4	5			BIV
1996 07 17.93		S	8.8:	AC	20.0	L	4	80	& 3	0			SCH04
1996 07 17.94		S	9.2	AA	10	B		14	5	3			SHA02
1996 07 18.87		M	8.7	TI	25	L	6	60	5.5	2			PLS
1996 07 18.88		M	8.6	TI	25	L	6	60	8	3			HOR02
1996 07 18.89		S	9.3	AC	10.0	B		25	2.9	4			HAS02
1996 07 18.90		S	8.4	S	20.3	T	10	50	2.4	3			KAM01
1996 07 19.42	!	J	9.7	SC	25.4	T	4		5.05	s4			ROQ
1996 07 19.88		M	8.6	TI	25	L	6	60	6.5	3			HOR02
1996 07 19.88		M	9.6	TI	25	L	6	60	2.3	2/			KYS
1996 07 19.94		S	8.9	AA	10	B		14	6	3			SHA02
1996 07 20.51		S	8.3	S	10.0	B		20	5	4			YOS02
1996 07 20.84		M	8.6	TI	10	B		25	7	3			ZNO
1996 07 20.87		M	8.5	TI	25	L	6	60	6	3			PLS
1996 07 20.88		M	8.5	TI	25	L	6	60	7	3			HOR02
1996 07 20.89		M	8.6	TI	25	L	6	60	2.4	3			KYS
1996 07 20.91		B	9.3	S	25.6	L	5	42	5	5			BIV
1996 07 20.92	a	S	8.7	AA	25.4	L	5	65	& 4	4			MEY
1996 07 21.09		S	8.9	AC	40.6	L	5	70	2.5	4			BOR

Comet C/1996 N1 (Brewington) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 21.84		S	9.7	AA	6.3	R	13	52	6	1			KOS
1996 07 21.87		M	8.5	TI	25	L	6	60	4.5	3			HOR02
1996 07 21.90	a	S	8.5	AA	25.4	L	5	65	3	4			MEY
1996 07 22.85		M	8.7	TI	10	B		25	6.5	3			ZNO
1996 07 22.87		M	9.2	TI	20	L	4	57	2.5	3/			KYS
1996 07 22.90		S	9.3	AC	10.0	B		25	2.1	4			HAS02
1996 07 22.91		S	8.7	AA	20.3	T	10	50	2.5	2/			KAM01
1996 07 22.93		S	9.2	AA	10	B		14	5	3			SHA02
1996 07 23.09		S	8.8	AC	40.6	L	5	70	3.5	4			BOR
1996 07 27.27		S	8.8	AA	20.0	T	10	64	3.5	3			SPR
1996 07 27.87		M	8.3	TI	35	L	5	92	4.5	2/			HOR02
1996 07 30.88		M	8.3	TI	25	L	6	60	4.5	3			HOR02
1996 08 01.36		S	8.9	AA	8.0	B		15	2	3			SEA01
1996 08 01.85	!	V	9.3	YF	20.0	T	2		& 8	7			MIK
1996 08 01.86		M	8.1	TI	25	L	6	60	4.2	3			HOR02
1996 08 01.87		M	8.0	TI	25	L	6	60	3.5	2			PLS
1996 08 01.87		S	8.7	AA	15.0	R	8	30	5	3			DIE02
1996 08 02.85	!	V	9.1	YF	20.0	T	2		& 8	7			MIK
1996 08 02.87		S	9.0	AA	25.4	T	6	62	2.8	1/			TAN02
1996 08 02.89		S	9.3	AC	15.2	L	5	42	4	2			MOE
1996 08 03.46		S	8.2	S	15.0	R	5	25	7	4			NAG02
1996 08 03.84		S	8.9	AA	25.4	T	6	62	2.8	4			TAN02
1996 08 03.88		S	8.5	AA	15.0	B		25	& 5	5			ZAN
1996 08 03.88	s	S	8.7	AC	25.4	L	5	65	2	4			MEY
1996 08 03.89		S	8.4	AA	7.0	B		10	8	3			MAR02
1996 08 03.90		S	9.4	S	20	R	14	40	2.2	3			SHA02
1996 08 04.82		S	9.1	AA	25.4	T	6	62	2.6	4			TAN02
1996 08 04.87		S	8.2	AA	11.0	B		20	& 3	4			CHE03
1996 08 04.88		S	9.2	AA	25.2	L	4	53	2.5	5			LOO01
1996 08 04.89		S	8.0	AA	15.0	R	8	30	5	5			DIE02
1996 08 04.90		M	8.6	HI	25.4	J	6	47	4.5	3/			BOU
1996 08 04.90		S	8.7	AC	15.2	L	5	42	4.5	3			MOE
1996 08 04.95		S	8.9	S	10	B		14	5	4			SHA02
1996 08 05.08		B	9.5	AC	10.0	B	4	20	4	3			NOW
1996 08 05.47		S	8.2	S	15.0	R	5	25	7	3/			NAG02
1996 08 05.81		S	9.0	AA	25.4	T	6	62	3.1	4			TAN02
1996 08 05.84		S	8.2	NP	8.0	B		20	7	3			OKS
1996 08 05.84		S	9.2	AA	6.3	R	13	52	6	4			KOS
1996 08 05.85		S	9.3	TI	15	L	6	40	2.5	1/			DRE
1996 08 05.88		S	8.3	AA	11.0	B		20	& 3	5			CHE03
1996 08 05.89		M	9.1	AC	30.5	T	10	56	& 5	3			COM
1996 08 05.89		S	8.0	AA	15.0	R	8	30	5	3			DIE02
1996 08 05.89		S	9.3	AA	25.2	L	4	53	2.5	6			LOO01
1996 08 05.90		M	8.6	HI	25.4	J	6	47	4.4	3/			BOU
1996 08 06.24		S	8.4	AA	20.0	T	10	64	4.5	4/			SPR
1996 08 06.83		S	8.6	S	15.0	L	4	20	6	5			KRY01
1996 08 06.85		M	8.6	TI	8.0	B		10	8	3/			HOR02
1996 08 06.86		S	8.5	AA	6.0	B		20	& 3	5			CHE03
1996 08 06.86	!	V	9.0	YF	20.0	T	2		& 8	8			MIK
1996 08 07.15	!	J	8.2	SC	25.4	T	4		5.9	d3			ROQ
1996 08 07.24		S	8.2	AA	20.0	T	10	64	4.5	4			SPR
1996 08 07.82		S	8.9	AA	25.4	T	6	62	3.5	4			TAN02
1996 08 07.83	!	L	11.4	NO	60	C	12		+ 1.47				PAV
1996 08 07.83	!	U	10.6	NO	60	C	12		+ 1.47				PAV
1996 08 07.83	!	V	10.1	NO	60	C	12		+ 1.47				PAV
1996 08 07.88		S	8.4	AA	6.0	B		20	& 3	5			CHE03
1996 08 07.90		S	9.0	NP	10	B		14	4	4			SHA02
1996 08 08.24		S	8.0	AA	20.0	T	10	64	5.5	4/			SPR
1996 08 08.40		S	9.8	GA	20.3	L	7	56	3	1			CAM03
1996 08 08.79		B	8.6	S	6.0	R	5	20	4	5/			KRY01
1996 08 08.81		S	9.0	AA	25.4	T	6	62	3.0	4/			TAN02
1996 08 08.86		M	8.4	TI	10	B		25	5	4			ZNO
1996 08 08.86		M	8.5	HD	6.0	B		20	5	5/			SAR02
1996 08 08.91		S	7.9	S	20.3	T	10	50	2.7	4/			KAM01
1996 08 08.97		S	8.7	AA	6.3	R	13	52	6	3			KOS

Comet C/1996 N1 (Brewington) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 09.24		S	7.9	AA	20.0	T	10	64	5.5	4/	0.15	10	SPR
1996 08 09.83		M	8.2	TI	10	B		25	7	5			ZNO
1996 08 09.84		M	8.3	HD	6.0	B		20	6	6			SAR02
1996 08 09.84		S	7.7:	TI	7.5	R	4	16	6	1/			DRE
1996 08 09.84		S	8.5	AC	5.0	B		10	5				SAN07
1996 08 09.85		M	7.9	NP	8.0	B		20	7	4			OKS
1996 08 09.85		S	8.6	AA	25.2	L	4	53	5	6			LOO01
1996 08 09.86		M	8.2	TI	8.0	B		10	7	3/			HOR02
1996 08 09.86		M	8.4	HD	6.0	B		20	6	5			BAK01
1996 08 09.89		B	7.9	S	11.0	B		20	& 3	5			CHE03
1996 08 09.89		S	7.0	AA	15.0	R	8	30	5	7			DIE02
1996 08 09.89		S	8.5	AC	20.0	T	10	78	& 5	4			COM
1996 08 10.16	a	M	8.7	NO	20.0	L	5	35	2.2	5			MOD
1996 08 10.84		M	8.0	TI	10	B		25	6.5	5/			ZNO
1996 08 10.84		S	8.5	AC	5.0	B		10	7				SAN07
1996 08 10.86		S	8.5	AC	25.4	L	5	65	4	5			MEY
1996 08 10.87		B	7.9	S	11.0	B		20	& 3	5			CHE03
1996 08 10.91		M	8.0	TI	8.0	B		10	9	3/			HOR02
1996 08 10.93		B	7.4	S	44.5	L	5	100	5	5/			SAN04
1996 08 10.93		S	7.8	HI	20.3	T	10	80	3.5	3			GRA04
1996 08 10.93		S	7.8	S	7.0	R	7	12	6	5			MAR02
1996 08 11.10		B	8.0	AC	10.0	B	4	20	6	4			NOW
1996 08 11.13		S	8.0	AC	5.0	B		10	7.5	5/			BOR
1996 08 11.24		S	7.8	AA	20.0	T	10	64	5.5	5	0.10	5	SPR
1996 08 11.48		S	8.1	VG	8.0	B		11	8	5			NAG08
1996 08 11.48		S	8.2	HS	10.0	B		20	4	4			YOS02
1996 08 11.53		B	8.8	HS	31.7	L	6	60	6	4			MIY01
1996 08 11.86		M	7.9	TI	10	B		25	7	5/			ZNO
1996 08 11.87		B	7.6	S	6.0	B		20		5			CHE03
1996 08 11.90		S	7.6	AA	8.0	B		15	6.7	5			BOU
1996 08 11.92		M	7.5	S	7.0	B		10	5	5			MAR02
1996 08 11.92		M	7.9	S	7.0	R	7	12	7	6			SAN04
1996 08 11.99		S	7.1	AA	15.0	R	8	30	6	7			DIE02
1996 08 12.10		S	7.9	SC	25.4	L	4	46	6	5	?	245	DID
1996 08 12.24		S	7.6	AA	10.0	R	5	27	5.5	5			SPR
1996 08 12.47		C	9.1:	GA	8.0	R	6		11.5				NAK01
1996 08 12.85		S	7.5	AA	4.2	B		7	6	2			ZAN
1996 08 12.85		S	7.6	AA	8.0	B		20	5	3/	?	200	ZAN
1996 08 12.85		S	7.9	AC	25.8	J	5	51	3	5			FEI
1996 08 12.91		B	7.9	S	6.0	B		20	& 3	5			CHE03
1996 08 12.96		S	8.0	HI	20.3	T	10	80	4.0	3			GRA04
1996 08 13.24		S	7.4	AA	10.0	R	5	27	5.0	5/			SPR
1996 08 13.47		S	8.1	VG	8.0	B		11	8	5			NAG08
1996 08 13.53		B	9.4	HS	31.7	L	6	60	6	5			MIY01
1996 08 13.84		M	7.8	S	10	B		25	6.5	5			ZNO
1996 08 13.87		M	7.5	S	7.0	B		10	5	4			SAN04
1996 08 13.87		M	7.5	S	7.0	B		10	5	4/			MAR02
1996 08 13.88		S	8.1	AC	10.2	R	9	26	&10	3/			COM
1996 08 13.91		B	8.7	S	20.3	T	10	77	6	6			BIV
1996 08 13.98		S	8.1	HI	20.3	T	10	80	3.5	4			GRA04
1996 08 14.06		S	8.2	AC	8.0	B		20	5.8	5			BOR
1996 08 14.21		S	7.5	AA	10.0	R	5	27	5.0	5			SPR
1996 08 14.78		B	8.5	S	6.0	R	5	20	7	5/			KRY01
1996 08 14.83		S	8.3	AC	5.0	B		10	6	7			SAN07
1996 08 14.85		S	8.2	AC	15	L	3	26	2.5	1			KES01
1996 08 15.07		B	7.9	AC	6.3	B	4	9	4	4			NOW
1996 08 15.21		S	7.6	AA	20.0	T	10	64	5.0	5			SPR
1996 08 15.50		B	9.0	HS	31.7	L	6	60	4	5			MIY01
1996 08 15.50		S	8.5	HS	25.4	T	6	60	5	5			YOS04
1996 08 15.51		S	8.2	VG	8.0	B		11	7	5			NAG08
1996 08 15.81		B	8.1	S	8.0	B		10	8	5			KRY01
1996 08 15.82		S	8.2	S	8.0	B		10	6	7			MAT07
1996 08 15.84		M	8.3	TI	5.0	B		10	9	4/			HOR02
1996 08 15.85		S	9.0	TI	15	L	6	40	3	1			DRE
1996 08 15.87		S	8.7:	TI	7.5	R	4	25	3	1			DRE

Comet C/1996 N1 (Brewington) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 15.88		S	8.1	AC	10.2	R	9	26	& 8	3/			COM
1996 08 15.91		S	8.0	AC	25.8	J	5	51	3	6			FEI
1996 08 15.93		S	7.8	HI	20.3	T	10	80	4.0	4			GRA04
1996 08 16.21		S	7.7	AA	20.0	T	10	51	4.0	5/			SPR
1996 08 16.80		S	8.3	S	15.0	L	4	20	7	4			MAT07
1996 08 16.81		S	7.7	AA	7.0	B		20	5	1/			TAN02
1996 08 16.83		S	8.1	AA	8.0	B		15	5.5	4/			HAV
1996 08 16.84	!	V	8.5	YF	20.0	T	2		& 8	7/			MIK
1996 08 16.85		B	8.2	S	20.3	T	10	77	6	5			BIV
1996 08 16.85		M	8.2	AC	6.0	B		20	6	5			SAR02
1996 08 16.86		S	7.5	AA	4.2	B		7	6	2			ZAN
1996 08 16.86		S	7.6	AA	8.0	B		20	7	4			ZAN
1996 08 16.89		M	7.7	S	7.0	B		10	4	4			MAR02
1996 08 16.90		M	7.8	S	7.0	B		10	5	4			SAN04
1996 08 16.90		S	8.2	AC	10.2	R	9	26	8	4			COM
1996 08 16.90		S	8.3	AA	15.0	R	8	30	3	3			DIE02
1996 08 17.06		S	7.8	SC	25.4	L	4	46	5	s5	?	45	DID
1996 08 17.12	!	M	9.0	GA	20.0	L	5	35	2.7	5/			MOD
1996 08 17.22		S	7.8	AA	20.0	T	10	51	4.7	4/			SPR
1996 08 17.78		B	8.1	S	8.0	B		10	6	6			KRY01
1996 08 17.80		B	8.2	S	8.0	B		10	8	3			MAT07
1996 08 17.86		S	7.8	AC	25.4	L	5	65	3	5			MEY
1996 08 17.87		B	8.2	S	5.0	B		7	6				BIV
1996 08 17.87		S	7.6	AA	4.2	B		7	5	2			ZAN
1996 08 17.87		S	7.7	AA	8.0	B		20	7	4			ZAN
1996 08 17.88		S	8.0	AC	25.8	J	5	51	5	3			FEI
1996 08 17.88		S	8.0	S	20.3	T	10	50	3.2	5			KAM01
1996 08 17.89		E	8.7	AA	30	L	5	60	6	3	0.08		NEV
1996 08 17.89		S	8.4	S	10.0	B		25	2.5	4			HAS02
1996 08 17.89		S	8.5	NP	10	B		14	3	s5			SHA02
1996 08 17.9		S	8.5	AA	10.0	B		14	5	6			LOO01
1996 08 17.90		S	8.3	AC	10.2	R	9	26	& 6	4			COM
1996 08 17.94		M	7.8	S	7.0	B		10	6	4			SAN04
1996 08 17.94		M	7.9	S	7.0	B		10	4	4/			MAR02
1996 08 18.01		S	8.5	S	5.0	B		7	4	4			SKI
1996 08 18.06		S	7.8	SC	25.4	L	4	46	6	s5			DID
1996 08 18.23		S	7.9	AA	20.0	T	10	51	4.5	4/			SPR
1996 08 18.83		M	8.2	TI	5.0	B		10	7	4/			HOR02
1996 08 18.84		B	8.0	S	11.0	B		20	& 4	4			CHE03
1996 08 18.85		M	8.8	TI	20	L	4	34	4	3			KYS
1996 08 18.85		S	7.7	AC	25.4	L	5	65	4	d5			MEY
1996 08 18.86		S	7.7	AA	15.2	L	5	42	5	5			MOE
1996 08 18.86		S	8.9	TI	15	L	6	40	5	1/			DRE
1996 08 18.87		B	8.2	S	5.0	B		7	7	5			BIV
1996 08 18.87		M	7.7	S	7.0	B		10	3	4			SAN04
1996 08 18.87		M	7.7	S	7.0	B		10	5	4/			MAR02
1996 08 18.87		S	8.0	S	20.3	T	10	50	3.3	5			KAM01
1996 08 18.87		S	8.2	AC	20.0	L	4	42	6	5/			SCH04
1996 08 18.87		S	8.4	S	10.0	B		25	2.5	4			HAS02
1996 08 18.88		M	8.4	HI	25.4	J	6	47	4.6	4			BOU
1996 08 18.88		S	8.6	NP	10	B		14	3	4			SHA02
1996 08 18.89		S	8.0	AA	15.0	R	8	30	4	3			DIE02
1996 08 18.9		S	8.5	AA	10.0	B		14	5	6			LOO01
1996 08 19.06		S	7.8	SC	25.4	L	4	46	5	5			DID
1996 08 19.06		S	8.1	AC	8.0	B		20	4.5	5/			BOR
1996 08 19.47		C	9.6	GA	8.0	R	6		9.7				NAK01
1996 08 19.83		S	8.1	AA	8.0	B		15	5.5	4/			HAV
1996 08 19.85		E	8.7	AA	30	L	5	60	5	3			NEV
1996 08 19.85		M	7.7	NP	8.0	B		20	5	4/			OKS
1996 08 19.85		S	7.7	AC	25.4	L	5	65	2.5	D5			MEY
1996 08 19.86		M	8.3	AC	6.0	B		20	6	s6			SAR02
1996 08 19.86		M	8.4	TI	20	L	5	48	8	4/			PLS
1996 08 19.86		S	7.6	AA	15.2	L	5	42	5.5	4			MOE
1996 08 19.86		S	8.3	S	10.0	B		25	2.0	4			HAS02
1996 08 19.87		S	9.0	NP	19	L	5	38	6	4			SHU

Comet C/1996 N1 (Brewington) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 19.88		B	8.1	S	11.0	B		20	& 4	4			CHE03
1996 08 19.88		M	7.8	TI	5.0	B		10	9	4/			HOR02
1996 08 19.89		M	8.1	HI	25.4	J	6	47	5.0	5			BOU
1996 08 19.89		M	8.1	TI	5.0	B		10		6/			DVO
1996 08 19.89		S	8.1	HI	5.0	B		7	6.5	3			BOU
1996 08 19.89		S	8.3	AC	8.0	B		15	5	6			SCH04
1996 08 19.89		S	9.3:	TI	15	L	6	80	5	1/			DRE
1996 08 19.90		M	7.8	S	7.0	B		10	4	5			MAR02
1996 08 19.90		S	8.4	NP	10	B		14	3	5			SHA02
1996 08 19.90		S	8.8	AA	15.0	R	8	30	4	4			DIE02
1996 08 19.91		M	7.7	S	7.0	B		10	5	4			SAN04
1996 08 19.93		S	7.5	AA	11	L	7	56	6	3			BAR06
1996 08 20.79		S	8.3	AA	7.0	B		20	4	5			TAN02
1996 08 20.83		M	7.9	TI	5.0	B		10	9	4/			HOR02
1996 08 20.86		S	7.9	AA	15.2	L	5	42	5.5	4	0.7	80	MOE
1996 08 20.89		M	8.1	HI	8.0	B		15	6.5	4/			BOU
1996 08 20.89		M	8.5	TI	20	L	5	48	6.5	4			PLS
1996 08 21.02		S	7.8	SC	25.4	L	4	46	6	5			DID
1996 08 21.21		S	7.9	AA	20.0	T	10	51	4.0	4/			SPR
1996 08 21.80		S	8.9	AA	6.3	R	13	52	3	2			KOS
1996 08 21.83		M	8.3	TI	8.0	B		10	11	3/			HOR02
1996 08 21.84		S	8.9	AA	7	R	6	26	5	3			NEK
1996 08 21.84		S	8.9	NP	7	R	6	26	4	3			SHU
1996 08 21.85		S	9.0:	TI	15	L	6	40	3	2			DRE
1996 08 21.86		M	7.9	S	10	B		25	5	4			ZNO
1996 08 21.89		S	8.5	NP	10	B		14	3	6			SHA02
1996 08 21.95		S	8.0	HI	20.3	T	10	80	3.2	3			GRA04
1996 08 21.96		B	8.6	S	10.2	R	15	60	4	4			SKI
1996 08 22.21		S	7.9	AA	20.0	T	10	51	5.5	4			SPR
1996 08 22.85		M	7.9	TI	5.0	B		10	7	3			HOR02
1996 08 22.85		S	8.3	AC	20.0	L	4	42	4	6/			SCH04
1996 08 22.85		S	8.4	AA	15.2	L	5	42	4.5	3			MOE
1996 08 22.89		S	8.4	AA	15.0	R	8	30	4	4			DIE02
1996 08 23.21		S	8.2	AA	10.0	R	5	27	3.5	4			SPR
1996 08 23.82		S	8.2	NP	8.0	B		10	4	3			OKS
1996 08 23.86		S	7.5	AA	15.0	L	4	26	& 7	5			PER01
1996 08 23.87		S	8.4	AA	15.0	R	8	30	4	4			DIE02
1996 08 23.95		S	8.6	NP	10	B		14	3	5			SHA02
1996 08 24.21		S	8.0	AA	10.0	R	5	27	3.5	4/			SPR
1996 08 24.86		S	8.0	AA	15.0	L	4	26	& 4	4/			PER01
1996 08 24.88		M	7.6	S	21.0	L	6	60	3.5	3			MAR02
1996 08 25.20		S	8.0	AA	10.0	R	5	60	3.0	4/			SPR
1996 08 26.84		S	8.7	AA	15.2	L	5	42	3.5	3			MOE
1996 08 28.16	!	J	7.9	SC	25.4	T	4		5.62	s5			ROQ
1996 08 31.87		S	8.4	AA	15.0	B		25	4	3			ZAN
1996 08 31.87		S	10.1	HS	20	R	14	40	1.3	3			SHA02
1996 09 01.02		S	7.8	SC	25.4	L	4	46	6	5			DID
1996 09 01.05		S	8.4	AC	8.0	B		20	5.2	5			BOR
1996 09 01.20		S	8.3	AA	10.0	R	5	60	3.6	4			SPR
1996 09 01.86		M	7.9	AA	25.3	L	6	58	& 4	4			PER01
1996 09 01.86		M	8.5	AA	25.3	L	6	58	& 4	5			VIT01
1996 09 01.86		S	8.0	AA	3.4	B		9	& 7	6/			PER01
1996 09 01.86		S	8.2	AA	25.3	L	6	58	& 4	4			PER01
1996 09 01.86		S	8.2	AA	25.3	L	6	58	& 4	5			VIT01
1996 09 01.98		S	8.6	HI	20.3	T	10	80	4.3	3			GRA04
1996 09 02.48		C	9.8	GA	8.0	R	6		10.0				NAK01
1996 09 02.48		M	8.8	S	12.5	L	6	23	7	3			TSU02
1996 09 02.49		S	8.5	S	15.0	R	5	25	6	4			NAG02
1996 09 02.81		M	8.4	TI	8.0	B		10	9	3/			HOR02
1996 09 02.82		S	8.2	TI	8.0	B		10	10	4			PLS
1996 09 02.84		B	8.7	S	25.6	L	5	42	6	3			BIV
1996 09 02.85		M	8.4	HI	25.4	J	6	47	4.8	4			BOU
1996 09 02.85		S	8.5	S	20.3	T	10	50	3.8	3/			KAM01
1996 09 02.86		B	8.5	S	5.0	B		7	5	4			BIV
1996 09 02.86		M	8.5	AA	25.3	L	6	58	& 4	4			PER01

Comet C/1996 N1 (Brewington) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 02.86		S	8.0	AA	3.4	B		9	& 8	6/			VIT01
1996 09 02.86		S	8.4	AA	25.3	L	6	58	& 4	4			PER01
1996 09 02.86		S	8.4	HI	8.0	B		15	5.5	3			BOU
1996 09 02.87		S	8.1	AA	3.4	B		9	& 4.5	7			PER01
1996 09 02.87		S	8.5	AA	25.3	L	6	58	& 3	4			VIT01
1996 09 02.88		M	8.4	AA	25.3	L	6	58	& 3	4			VIT01
1996 09 02.88		S	8.1	S	7.0	B		10	6	3			MAR02
1996 09 02.90		S	8.8	HI	20.3	T	10	80	3.7	3			GRA04
1996 09 03.06		S	8.5	AC	8.0	B		20	6.5	4			BOR
1996 09 03.17		S	8.7	AA	8.0	R	4	19	3.0	3/			SPR
1996 09 03.47		S	9.2	HS	10.0	B		20	6	4			YOS02
1996 09 03.79		E	9.2	AA	30	L	5	60	4	3			NEV
1996 09 03.83		S	8.3	AC	25.4	L	5	65	4.5	4			MEY
1996 09 03.84		M	8.2	S	21.0	L	6	60	6	5			MAR02
1996 09 03.84		M	8.6	HI	8.0	B		15	6.0	2/			BOU
1996 09 03.84		S	7.9	S	21.0	L	6	60	6	5			SAN04
1996 09 03.85		S	8.3	AC	30.5	T	10	55	& 8	2/			COM
1996 09 03.86		S	8.6	AA	15.0	R	8	30	4	3			DIE02
1996 09 04.18		S	8.8	AA	20.0	T	10	64	3.4				SPR
1996 09 04.81		M	8.3	TI	8.0	B		10	10	4			HOR02
1996 09 04.84		S	8.2	TI	8.0	B		10	10	3/			PLS
1996 09 04.84		S	8.6	HI	8.0	B		15	5.7	3/			BOU
1996 09 04.85		S	9.3	AA	6.3	R	13	52	4	2			KOS
1996 09 04.87		S	8.7:	AC	30.5	T	10	55	> 3	3			COM
1996 09 04.89		B	9.1	S	25.6	L	5	42	5	3			BIV
1996 09 04.91		B	8.4	AA	11	L	7	54	5	1			ISH03
1996 09 04.91		S	7.9	AA	11	L	7	32	6	2			BAR06
1996 09 04.93		S	8.9	HI	20.3	T	10	80	4.2	4			GRA04
1996 09 05.84		M	8.5	TI	8.0	B		10	8	4			HOR02
1996 09 05.84		M	8.6	HI	8.0	B		15	6.0	3/			BOU
1996 09 05.86		S	8.6	AC	10.0	B		25	2.3	4			HAS02
1996 09 05.87		S	8.6	AC	8.0	B		15	& 5	3			COM
1996 09 05.88		S	8.4	AA	15.0	R	8	30	4	4			DIE02
1996 09 05.88		S	10.1:	HS	33	L	5	75	2.9	4			SHA02
1996 09 06.80		S	8.8	HD	6.0	B		20	4	3			SAR02
1996 09 06.82		M	9.1	TI	8.0	B		10	7	4/			HOR02
1996 09 06.85		S	8.4	AA	15.0	R	8	30	5	4			DIE02
1996 09 06.85		S	8.7	HI	8.0	B		15	6.0	3			BOU
1996 09 06.93		B	8.9	S	25.6	L	5	42	6	5			BIV
1996 09 07.06		S	8.7	AC	10.0	B		25	2.3	3			HAS02
1996 09 07.10		M	7.5	TI	8.0	B		10	8	4			HOR02
1996 09 07.44		S	8.4	S	15.0	R	5	25	7	4			NAG02
1996 09 07.49		S	9.2	VG	10.0	B		20	6	4			NAG08
1996 09 07.82		B	8.1	AA	11	L	7	32	7	1			ISH03
1996 09 07.84		S	8.6	S	20.3	T	10	50	3.6	2			KAM01
1996 09 07.84		S	9.0	AA	8.0	B		20	5	2/			ZAN
1996 09 07.84		S	9.2	NP	7.0	B		10	5	2			MAR02
1996 09 07.85		S	8.7	HI	8.0	B		15	6.5	3			BOU
1996 09 07.85		S	9.2	NP	21.0	L	6	60	5	3			SAN04
1996 09 07.86		S	8.7	AC	30.5	T	10	55	& 4	2/			COM
1996 09 07.92		S	8.8	AA	25.3	L	6	58	& 5	3			PER01
1996 09 07.92		S	8.8	AA	25.3	L	6	58	& 6	3			VIT01
1996 09 08.13	!	J	9.1	SC	25.4	T	4		7.8	s6	34.8s	70	ROQ
1996 09 08.78		S	10.3	AC	6.3	R	13	52	3	1			KOS
1996 09 08.81		S	9.0	AA	8.0	B		20	5	2/			ZAN
1996 09 08.81		S	9.2	AA	15.0	B		25	4	3			ZAN
1996 09 08.82		S	8.7	AA	15.2	L	5	42	3.5	5			MOE
1996 09 08.89		S	8.8	AA	15.0	R	8	30	5	3			DIE02
1996 09 09.83		S	8.8	HI	8.0	B		15	6.0	3			BOU
1996 09 09.97		S	9.1	AC	30.5	T	10	55	& 4	2			COM
1996 09 10.17		S	8.9	AA	20.0	T	10	64	3.2				SPR
1996 09 10.48		S	9.2	HS	10.0	B		20	6	3			YOS02
1996 09 10.78		S	10.4	AC	6.3	R	13	52	4	1			KOS
1996 09 10.82		S	8.8	AA	15.2	L	5	42	3.5	3			MOE
1996 09 10.84		S	8.9	AC	10.0	B		25	3.2	3			HAS02

Comet C/1996 N1 (Brewington) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 10.89		S	9.1	S	15.0	L	5	72	3	4			BEC01
1996 09 10.89		S	9.5	AA	33	L	5	45	3.6	3			SHA02
1996 09 11.01		S	9.4:	AA	10	B		14	4	3			SHA02
1996 09 11.12		M	10.0:	GA	20.0	L	5	35	3.6	3			MOD
1996 09 11.17		S	9.2	AA	20.0	T	10	64	3.0	2/			SPR
1996 09 11.81		S	9.1	TI	8.0	B		10	10	3/			PLS
1996 09 11.85		M	9.0	TI	8.0	B		10	10	3			HOR02
1996 09 12.83		B	8.8	S	5.0	B		7	5	2			TRI
1996 09 12.83		S	9.1	AC	30.5	T	10	122	& 4	2			COM
1996 09 12.88		S	9.3	AA	33	L	5	45	4.5	2			SHA02
1996 09 12.91		S	9.5	S	15.0	L	5	42	3	4			BEC01
1996 09 13.00		S	9.9	AA	10	B		14	4	2			SHA02
1996 09 13.85		B	9.0	S	17.3	L	6	42	5	5			TRI
1996 09 13.86		S	9.4	AA	15.0	B		25	4	2/			ZAN
1996 09 13.88		S	9.2	NP	21.0	L	6	60	3	3			MAR02
1996 09 13.89		S	9.2	AA	15.0	R	8	30	3	2			DIE02
1996 09 13.90		S	9.9	AA	33	L	5	45	3.6	2			SHA02
1996 09 13.93		B	9.8	S	25.6	L	5	42	5.5	4			BIV
1996 09 13.99		S	9.9	AC	20.3	T	10	82	4.0	3/			GRA04
1996 09 14.00		S	9.9	AA	10	B		14	4	3			SHA02
1996 09 14.49		M	9.3:	HS	12.5	L	6	60	7	3			TSU02
1996 09 14.82		S	9.3	HI	25.4	J	6	58	4.5	2			BOU
1996 09 14.82		S	9.4	HI	8.0	B		15		1/			BOU
1996 09 14.83		M	9.0	TI	8.0	B		10	7	3			HOR02
1996 09 14.83		S	9.5	AA	15.0	B		25	4	2/			ZAN
1996 09 14.92		M	9.2	NP	21.0	L	6	60	3	4			MAR02
1996 09 15.04		S	9.8	AC	40.6	L	5	70	2.6	3			BOR
1996 09 15.04		S	10.1	AA	10	B		14	3	2			SHA02
1996 09 15.06		S	10.1	AC	20.3	T	10	80	4.5	3			GRA04
1996 09 15.45		S	8.9	S	15.0	R	5	25	5	3/			NAG02
1996 09 15.83		S	9.5	AA	15.0	B		25	4	2/			ZAN
1996 09 15.83		S	9.5	NP	25.4	J	6	47	4.5	2			BOU
1996 09 15.85		S	10.3	NP	33	L	5	45	3.4	2			SHA02
1996 09 15.86		S	9.3	AC	30.5	T	10	122	& 5	1			COM
1996 09 16.82		S	9.0	AC	10.0	B		25	2.2	4			HAS02
1996 09 16.82		S	9.1	S	20.3	T	10	50	3.7	1/			KAM01
1996 09 16.84		S	9.5	NP	25.4	J	6	47	4.2	2			BOU
1996 09 16.85		S	9.3	AC	30.5	T	10	55	& 5	1/			COM
1996 09 16.85		S	10.2	NP	33	L	5	45	3.1	2			SHA02
1996 09 16.89		B	9.9	HS	25.6	L	5	42	5	3			BIV
1996 09 17.01		S	10.4	AC	20.3	T	10	80	3.6	2			GRA04
1996 09 17.92		B	9.2	S	17.3	L	6	42	5	6			TRI
1996 09 18.79		S	9.3	AA	15.2	L	5	42	3	1			MOE
1996 09 18.82		S	9.3	TI	8.0	B		10	6.5	2			HOR02
1996 09 18.82		S	9.5	AC	30.5	T	10	122	& 3	1			COM
1996 09 18.83		S	9.7	NP	25.4	J	6	47	4.5	1/			BOU
1996 09 19.78		M	9.2	TI	10	B		25	3.5	3			ZNO
1996 09 19.79		S	9.5	AA	15.2	L	5	42	3	2			MOE
1996 09 19.81		S	11.7	NP	30	L	5	60	2.5	2			NEV
1996 09 19.83		S	9.3	TI	8.0	B		10	7	2			HOR02
1996 09 19.90		S	10.0	AC	25.4	L	5	65	3.5	2/			MEY
1996 09 19.94		B	9.9	AA	11	L	7	50	5	1			ISH03
1996 09 19.96		S	9.9	AC	11	L	7	50	6	1/			BAR06
1996 09 20.93		S	9.8	NP	15.6	L	5	29	4.7	1			BOU
1996 09 20.94		S	10.0	AC	30.5	T	10	122	> 3	0/			COM
1996 09 21.95		S	10.3	AC	11	L	7	50	4.5	2			BAR06
1996 09 22.99		S	10.3	AC	11	L	7	50	3	3			BAR06
1996 09 28.12		J	11.5	SC	25.4	T	4		4.96	s2			ROQ
1996 09 30.00		S	11.5	AC	40.6	L	5	70	1.5				BOR
1996 09 30.78		M	11.0	TI	35	L	5	92	2	2			HOR02
1996 10 01.02		S	11.6	AC	40.6	L	5	70	1.5	0			BOR
1996 10 01.91		S	11.7:	NP	33	L	5	75	1.8	1			SHA02
1996 10 02.84		S	12.2:	NP	33	L	5	75	2.2	1			SHA02
1996 10 02.87		S	11.4	HS	25.6	L	5	84	2.5	4			BIV
1996 10 02.88		S	10.2:	HS	20	L	6	38	6	2			GIL01

Comet C/1996 N1 (Brewington) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 03.83		M	10.1	TI	35	L	5	92	5	1/			HOR02
1996 10 03.83		S	10.4	TI	35	L	5	92	7	1			PLS
1996 10 04.90		S	10.6	NP	21.0	L	6	60	4	1			MAR02
1996 10 04.95		S	12.2:	NP	33	L	5	75	1.8	1			SHA02
1996 10 05.80		I	[13.0:	NP	30	L	5	100					NEV
1996 10 05.81		S	11.2:	NP	25.4	J	6	47	3.5	0			BOU
1996 10 06.78		S	11.4	AC	15.2	L	5	42	2.0	2			MOE
1996 10 06.80		S	11.2:	NP	25.4	J	6	47	3.5	0			BOU
1996 10 07.77		S	11.0	TI	35	L	5	92	3	1/			HOR02
1996 10 07.78		S	11.5	AC	15.2	L	5	42	2.0	1			MOE
1996 10 08.76		S	11.5	AC	15.2	L	5	42	2.0	2			MOE
1996 10 10.82		S	11.7	AC	15.2	L	5	42	2.0	1			MOE
1996 10 11.82		S	11.4	TI	35	L	5	92	2.5	1			HOR02
1996 10 12.79		M	10.8	TI	10	B		25	2.5	4			ZNO
1996 10 12.94		S	11.7	HS	44.5	L	5	146	2	1			SAR02
1996 10 12.94		S	12.0	HS	44.5	L	5	146	2	1			BAK01
1996 10 13.78	!	V	14.0	GA	36.0	T	7		2.5	3			MIK
1996 10 13.79		S	11.9	TI	35	L	5	92	2	1/			HOR02
1996 10 13.85		S	12.3	HS	44.5	L	5	72	2	1			SAR02
1996 10 20.04		S	13.8:	NP	44.5	L	5	167	0.5	1/			MAR02

Comet C/1996 P2 (Russell-Watson)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 17.13		S	12.2	NP	44.5	L	5	200	2	1			SAN04
1996 08 17.13		S	12.8	NP	44.5	L	5	200	1.5	1			MAR02
1996 08 19.08		S	12.8	NP	44.5	L	5	200	1	1			MAR02
1996 08 25.02	&	S	12.3	HS	44.5	L	5	230	1.5	1/			SAR02
1996 10 15.50		S	13.1	GA	25.4	L	4	71					SEA

Comet C/1996 Q1 (Tabur)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 23.09		S	9.7:	TI	20	L	5	125	2.5	2			PLS
1996 08 24.09		S	9.5:	S	25.4	L	5	65	2.5	2/			MEY
1996 08 24.11	!	V	10.7	YF	20.0	T	2		4.5	6			MIK
1996 08 24.50		S	10.2	AC	20.0	T	10	102	3.2	3			SPR
1996 08 25.08		S	9.8	HS	44.5	L	5	72	5	4			SAR02
1996 08 25.09		S	9.3	AC	6.0	B		20	8	2			SAR02
1996 08 25.28		S	8.7	S	7.0	B		10	5.1	3			DEA
1996 08 25.48		S	10.2	AC	20.0	T	10	102	3.0	3			SPR
1996 08 26.08		M	9.6	TI	20	L	5	48	5	1/			PLS
1996 08 26.08		M	9.7	TI	35	L	5	92	4.3	2			HOR02
1996 08 26.10		S	9.6	TI	20	L	4	34	3.7	1			KYS
1996 08 26.14		S	12.1	HS	33	L	5	100	1.1	3			SHA02
1996 08 26.31		S	8.6	S	7.0	B		10	5.1	3			DEA
1996 08 26.39		S	11.0	GA	20.0	L	5	35	1.8	1/			MOD
1996 09 05.09		S	8.3	HI	20.3	T	10	80	5.0	3			GRA04
1996 09 06.09		S	8.4	AA	15.0	B		25	5	4			ZAN
1996 09 06.63		S	8.3	AA	8.0	B		15	5	2			SEA01
1996 09 06.72		S	9.0	S	7.8	R	8	30	2				JON
1996 09 07.05		S	8.8	AA	10.0	B		25	3.0	4			HAS02
1996 09 07.09		M	8.4	TI	20	L	5	48	4.8	3			PLS
1996 09 07.10		B	8.7	GA	25.6	L	5	42	4	5			BIV
1996 09 07.10		S	8.2	AA	15.0	B		25	5	4			ZAN
1996 09 07.11		E	9.3	NP	17.3	L	6	42	4	3			TRI
1996 09 07.11		S	8.0	HI	25.4	J	6	47	4.6	4			BOU
1996 09 07.12		S	8.4	AC	30.5	T	10	55	& 5	3/			COM
1996 09 07.13		S	7.9	AA	15.0	R	8	30	5	5			DIE02
1996 09 07.65		S	8.3	AA	8.0	B		15	6	2			SEA01
1996 09 07.68		S	8.5	VG	10.0	B		20	7	4			NAG08
1996 09 07.77		S	8.5	S	15.0	R	5	25	6	5			NAG02
1996 09 07.99		S	8.0	AA	11	L	7	32	11	2			BAR06
1996 09 08.00		B	8.2	AA	11	L	7	32	10	2			ISH03
1996 09 08.09		S	7.9	AA	15.0	R	8	30	5	6			DIE02

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 08.10		S	8.1	AA	15.0	B		25	5	4			ZAN
1996 09 08.11		M	7.8	HI	8.0	B		15	6.2	3/			BOU
1996 09 08.16		S	8.6	GA	25.6	L	5	42	3.5	4			BIV
1996 09 08.19		E	9.1	NP	17.3	L	6	42	3.5	3			TRI
1996 09 08.70		S	8.4	AA	8.0	B		15	7	2			SEA01
1996 09 08.75		S	8.5:		8.0	B		20	3	4			CAM03
1996 09 09.08		S	7.7	SC	20.3	T	10	80	5.3	3			GRA04
1996 09 09.09		S	7.5	SC	5.0	B		10	6	3			GRA04
1996 09 09.15		S	9.5	S	10.0	R	10	34	2.0	3			BEC01
1996 09 09.67		S	8.4	AA	8.0	B		15	6	1			SEA01
1996 09 10.65		S	7.3	AA	10.0	B		25					SEA
1996 09 10.69		S	8.1	AA	8.0	B		15	7	2			SEA01
1996 09 10.71		S	7.9	SC	7.8	R	8	30	2.5	1			JON
1996 09 10.75		S	8.3	MM	8.0	B		20	3	3	5	m 290	CAM03
1996 09 10.80		S	8.0	S	10.0	B		20	8	3			YOS02
1996 09 10.81		C	8.0	HI	8.0	R	6		14.8				NAK01
1996 09 11.08		M	7.3	HI	20.3	T	10	80	6	4			GRA04
1996 09 11.08		S	7.4	HI	5.0	B		10	6	3			GRA04
1996 09 11.09		S	8.6:	S	10	B		14	5	2			SHA02
1996 09 11.20		S	8.0	AA	8.0	B		11	6	4			DES01
1996 09 11.40		M	8.4	GA	20.0	L	5	35	3.4	3/			MOD
1996 09 11.72		S	8.0	AA	8.0	B		15	7	2			SEA01
1996 09 12.11		S	7.3	AA	6.3	R	13	52	15	2			KOS
1996 09 12.21		S	7.7	AA	8.0	B		11	6	4/			DES01
1996 09 12.73		S	7.1	HS	25.4	T	6	32	7	5			YOS04
1996 09 12.74		S	8.0	AA	8.0	B		15	6	3			SEA01
1996 09 12.75		S	8.0	MM	8.0	B		20	3	2	5	m 290	CAM03
1996 09 13.15		B	7.6	S	5.0	B		7	8	5			BIV
1996 09 13.20		S	7.5	AA	8.0	B		11	5	4/			DES01
1996 09 13.21		S	8.4	S	15.0	L	5	42		5			BEC01
1996 09 13.27		B	7.8	S	5.0	B		7	5	4			TRI
1996 09 13.73		S	8.1	AA	8.0	B		15	6	2			SEA01
1996 09 14.04		S	7.0	AA	4.2	B		7	9	6			ZAN
1996 09 14.04		S	7.2	SC	5.0	B		10	6	3/			GRA04
1996 09 14.09		S	7.4	AA	10	B		14	9	4			SHA02
1996 09 14.10		B	7.3	S	5.0	B		7	9	5			BIV
1996 09 14.10		S	7.3	AA	5.0	B		7	9	4			SHA02
1996 09 14.17		B	7.5	S	17.3	L	6	42	8	6	0.05	315	TRI
1996 09 14.20		S	7.5	AA	8.0	B		11	5	3	<0.10		DES01
1996 09 14.50		M	7.3	SC	3.5	B		7					OME
1996 09 14.74		S	7.0	S	3.5	B		7	& 8	4			YOS02
1996 09 14.77		M	7.5	S	3.5	B		7					TSU02
1996 09 15.02		S	7.0	AA	10	B		14	6	4			SHA02
1996 09 15.04		S	7.0	SC	5.0	B		10	9	3/			GRA04
1996 09 15.05		S	7.0	AA	5.0	B		7	11	4			SHA02
1996 09 15.06		M	6.6	S	7.0	B		10	7	5			MAR02
1996 09 15.10		M	6.7	HI	8.0	B		15	7.5	6			BOU
1996 09 15.10		S	6.5	HI	5.0	B		7	8	3/			SKI
1996 09 15.10		S	8.0:	AC	20.3	T	10	77	& 7				ANZ
1996 09 15.12		S	6.9	AA	4.2	B		7	9	6			ZAN
1996 09 15.19		S	7.0	AA	8.0	B		11	6	4			DES01
1996 09 15.36		S	6.7	HR	5.0	B		10	9	5			BOR
1996 09 15.70		S	7.0	HS	25.4	T	6	32	8	2/			YOS04
1996 09 15.72		S	6.6	VG	5.0	B		7	12	4			NAG08
1996 09 15.74		S	6.6	S	3.5	B		7	& 8	4			YOS02
1996 09 15.74		S	7.5	AA	8.0	B		15	8	2			SEA01
1996 09 15.78		S	8.2	S	15.0	R	5	25	6	5	0.06		NAG02
1996 09 15.79		M	6.9	AA	5.0	B		7	8	5			KAT01
1996 09 15.82		S	6.8	AA	5.0	B		7	9				KOB01
1996 09 16.08		M	6.4	S	8.0	B		10	9	4			HOR02
1996 09 16.08		S	7.0	AA	10	B		14	8	5	0.50	204	SHA02
1996 09 16.09		S	6.9	AA	5.0	B		7	9	4			SHA02
1996 09 16.10		S	6.5	HI	5.0	B		7	9	3/			SKI
1996 09 16.12		S	6.7	AA	6.3	R	13	52	18	2			KOS
1996 09 16.12		S	6.8	AA	4.2	B		7	9	6			ZAN

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 16.14		S	6.3	TI	5.0	B		7	10	3			KYS
1996 09 16.14		S	6.9	AA	5.0	B		10	10	4			GIL01
1996 09 16.15		S	7.1	SC	5.0	B		10	10	4			GIL01
1996 09 16.18		B	7.4	S	5.0	B		7	7	5			BIV
1996 09 16.20		S	6.9	AA	8.0	B		11	6	4/			DES01
1996 09 16.27		B	7.1	S	5.0	B		7	7	6			TRI
1996 09 16.66		S	6.6	AA	10.0	B		25					SEA
1996 09 16.70		S	7.8	SC	4.5	R	6	13	4				JON
1996 09 16.70		S	7.8	SC	7.8	R	8	30	3.5	3			JON
1996 09 16.75		S	7.2	AA	8.0	B		15	8	1			SEA01
1996 09 16.80		M	6.7	AA	5.0	B		7	10	5			KAT01
1996 09 17.02		S	7.0	HI	5.0	B		10	8	3/			GRA04
1996 09 17.11		M	6.5	AA	8.0	B		15	8	5/			BOU
1996 09 17.11		S	7.1	AA	8.0	B		15	&10	3/			COM
1996 09 17.12		S	6.9	S	6.3	B		9	8.5	5			KAM01
1996 09 17.14		B	6.0	AA	10.0	B		25	7.3	4			HAS02
1996 09 17.14		B	7.1	S	5.0	B		7	10	5			BIV
1996 09 17.14		S	6.7	AA	3.4	B		9	& 8	4			PER01
1996 09 17.15		S	7.0	AA	8.0	B		20	5	3			SHA02
1996 09 17.21		B	6.6	S	5.0	B		7	6	6			TRI
1996 09 17.67		S	6.5	AA	5.0	B		10					SEA
1996 09 17.73		S	6.4	VG	5.0	B		7	15	4			NAG08
1996 09 17.75			6.2	AA	0.0	E		1	10	2			SEA01
1996 09 17.75		S	6.4	AA	8.0	B		15	9	2			SEA01
1996 09 17.77		S	6.3	AA	5.0	B		7	12	3			MOR06
1996 09 17.77		S	7.3	SC	8.0	B		20	7	3			CAM03
1996 09 17.78		M	6.6	AA	5.0	B		7	10	5			KAT01
1996 09 17.80		M	6.5	S	3.5	B		7	&10	3			YOS02
1996 09 18.03		S	6.2	HI	5.0	B		10	7	4			GRA04
1996 09 18.11		M	6.3	AA	8.0	B		15	9	5	0.9	279	BOU
1996 09 18.12		M	6.4	AA	5.0	B		7	10	3/			BOU
1996 09 18.19		S	6.7	AA	8.0	B		11	8	4/			DES01
1996 09 18.25		B	6.2	S	5.0	B		7	8	6			TRI
1996 09 18.70		S	6.8	SC	4.5	R	6	13	3				JON
1996 09 18.71		S	6.5	AA	8.0	B		15	8	2			SEA01
1996 09 18.77		S	7.4	SC	20	L	5	36	8	5	20	m 250	SHI
1996 09 18.78		B	6.1	GA	8.0	B		11	6	4			MIY01
1996 09 18.81		S	6.5	AA	5.0	B		7	12	5			KOB01
1996 09 19.04		B	6.6	TI	5.0	B		10	9	4/			PLS
1996 09 19.08		M	6.5	S	8.0	B		10	12	3/			HOR02
1996 09 19.12		M	6.3	AA	8.0	B		15	8.5	5			BOU
1996 09 19.12		S	6.9	AC	8.0	B		15	& 8	3/			COM
1996 09 19.19		S	6.5	AA	8.0	B		11	8	4/			DES01
1996 09 19.26		B	6.3	S	5.0	B		7	13	5			TRI
1996 09 19.40		M	7.4	SC	5.0	B		10	7	3			MOD
1996 09 19.41		M	7.6	SC	20.0	L	5	35	3.0	4/			MOD
1996 09 20.00		B	6.7	AA	8.0	B		12	14	3			ISH03
1996 09 20.01		S	6.5	VF	8.0	B		12	10	d2			BAR06
1996 09 20.07		M	6.3	TI	5	R	4	11	20	4			PLS
1996 09 20.08		S	6.2	AA	10.0	B		25	5.0	4			HAS02
1996 09 20.10		S	6.4	AA	25.4	L	5	40	5.5	D5	0.05		MEY
1996 09 20.10		S	7.1	AC	8.0	B		15	& 7	3			COM
1996 09 20.11		M	6.3	S	8.0	B		10	12	3/			HOR02
1996 09 20.11		S	6.6	AA	5.0	B		10	7.5	3			MEY
1996 09 20.12		M	6.2	AA	8.0	B		15	9	5	0.7	281	BOU
1996 09 20.12		S	6.2	AA	5.0	B		7	8	4			BOU
1996 09 20.12		S	6.6	AA	5.0	B		20	10	8			DIE02
1996 09 20.14		S	6.1	TI	5.0	B		7	10	3			KYS
1996 09 20.27		B	6.1	S	5.0	B		7	12	5			TRI
1996 09 20.37		S	7.1	HR	5.0	B		10	8	5			BOR
1996 09 20.70		S	7.3	SC	4.5	R	6	13	4	1			JON
1996 09 20.77		S	6.4	SC	8.0	B		20	5	3			CAM03
1996 09 21.12		S	7.0	AC	8.0	B		15	& 8	4			COM
1996 09 21.22		B	6.1	S	5.0	B		7	12	5			TRI
1996 09 21.37		S	6.9	HR	5.0	B		10	7	5			BOR

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 21.82		S	6.0	AA	5.0	B		7	10	5			KOB01
1996 09 21.98		M	6.2	VF	8.0	B		12	10	4			BAR06
1996 09 22.00		K	6.2	VF	8.0	B		12	10	4			LUK04
1996 09 22.03		B	6.5	AA	5.0	B		7	11	D4			VEL03
1996 09 22.25		B	6.0	S	5.0	B		7	13	5			TRI
1996 09 22.69		S	6.1	SC	8.0	B		20	10	3			CAM03
1996 09 22.70		S	6.1	VG	5.0	B		7	12	5			NAG08
1996 09 22.71		S	6.2	HS	25.4	T	6	32	7	5			YOS04
1996 09 22.72		S	6.1	HS	5	R		8	8	5			YOS04
1996 09 22.74		S	7.2	S	5.6	B		8	5	4			OKA05
1996 09 22.75		S	6.5	AA	4.0	B		8	7	2			SEA01
1996 09 22.78		M	6.4	S	3.5	B		7	10	4			YOS02
1996 09 22.83		S	6.0	S	15.0	R	5	25	8	6	0.08		NAG02
1996 09 23.06		M	6.1	VF	8.0	B		12	14	4/			BAR06
1996 09 23.06		M	6.3:	VF	8.0	B		12	12	4			KHA01
1996 09 23.08		B	5.9	S	5.0	B		7	15	5			TRI
1996 09 23.75		M	6.2	AA	5.0	B		10	7	4			SEA01
1996 09 24.05		S	6.3	HI	5.0	B		10	10	4			GRA04
1996 09 24.18		S	5.9	AA	5.0	B		7	11	4			SHA02
1996 09 24.20		B	5.9	S	5.0	B		7	10	5			TRI
1996 09 24.37		S	5.9	HP	5.0	B		10	11	5			BOR
1996 09 24.73		M	6.4	AA	5.0	B		7	7	5			GOU
1996 09 24.75		M	6.3	AA	5.0	B		10	7	3			SEA01
1996 09 25.15		B	5.8	S	5.0	B		7	8	5			TRI
1996 09 25.43		M	6.5	SC	5.0	B		10	6.3	3			MOD
1996 09 25.43		M	7.0	SC	20.0	L	5	35	3.6	4			MOD
1996 09 25.99		S	6.4	SC	5.0	B		10	10	4			GRA04
1996 09 26.08	!	M	6.4	AA	10.0	M	10	33	&10	5			PAL02
1996 09 26.13		S	6.9	S	15.0	L	5	42	4	5			BEC01
1996 09 26.20		S	6.0	PA	5.0	B		7	10	4			OKS
1996 09 27.07		S	5.8	AA	8.0	B		10	6	4	0.50	30	SHA02
1996 09 27.09		S	5.9	AA	6.3	B		9	11	5/			KAM01
1996 09 27.10		M	5.5	S	8.0	B		10	13	3/			HOR02
1996 09 27.10		S	5.8	HD	6.0	B		20	15	6	2	300	SAR02
1996 09 27.11		M	5.7	TI	8.0	B		10	18	4			PLS
1996 09 27.12		B	5.8	S	5.0	B		7	10	5			TRI
1996 09 27.12		S	5.7	AA	0.0	E		1	&15				ZAN
1996 09 27.12		S	5.9	AA	4.2	B		7	13	5			ZAN
1996 09 27.13					15.0	B		25	10	3	?	130	ZAN
1996 09 27.13		S	5.8	PA	5.0	B		7	8	5/	0.50	300	OKS
1996 09 27.14		S	5.7	AA	5.0	B		7	11	4			SHA02
1996 09 27.15	!	V	6.0	YF	20.0	T	2		&30	7	&0.5	275	MIK
1996 09 27.18		M	6.0	AA	4.0	B		8	&17	5			PAL02
1996 09 28.27		B	5.7	S	5.0	B		7	&15	5			TRI
1996 09 29.03		M	5.8	SC	5.0	B		10	16	4/			GRA04
1996 09 29.23		B	5.6	S	5.0	B		7	&15	5			TRI
1996 09 29.38		M	6.3	SC	5.0	B		10	6.5	4			MOD
1996 09 29.99		S	5.3	AA	8.0	B		20	6	4			SHA02
1996 09 30.16		B	5.4	AA	5.0	B		10	9.6	4			HAS02
1996 10 01.21		B	5.5	S	5.0	B		7	<18	5			TRI
1996 10 01.38		M	6.2	SC	5.0	B		10	6.6	4			MOD
1996 10 01.39		S	5.3	HP	5.0	B		10	11	5			BOR
1996 10 02.00		S	5.3	AA	8.0	B		10	8	3			SHA02
1996 10 02.01		S	5.7	AA	4.0	B		8	14	7			SCH04
1996 10 03.13		M	5.3	AA	5.0	B		7	14	5			BOU
1996 10 03.14		S	5.4	AA	5.0	B		10	13	4			MOE
1996 10 03.15		S	5.4	AA	4.0	B		8	14	6			SCH04
1996 10 03.18		B	5.3	S	5.0	B		7	15	6			TRI
1996 10 03.72		S	5.0:	VG	5.0	B		7	&15	5			NAG08
1996 10 03.89		M	5.0	S	5.0	B		10	17	4			HOR02
1996 10 03.97		M	5.4	SC	6	R		20	16	4			BAR06
1996 10 03.97		M	5.5	VF	6	R		20	16	4			BAR06
1996 10 04.00		M	5.6	AA	4.0	B		8	&17	5			PAL02
1996 10 04.06		M	5.0	TI	5.0	B		7	10	2			KYS
1996 10 04.06		S	5.1	AA	5.0	B		7	8	6			SHA02

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 04.06		S	5.4	AA	8.0	B		20	8	5	0.17	285	SHA02
1996 10 04.07		O	4.8	TI	0.0	E		1	10	1			KYS
1996 10 04.10		B	5.8:	AA	5.0	B		7	17	d3			VEL03
1996 10 04.11		M	5.3	TI	2.4	B		3	16	5/	0.3	280	PLS
1996 10 04.20		B	5.3	S	5.0	B		7	18	6			TRI
1996 10 04.39		S	5.3	HP	5.0	B		10	11	5			BOR
1996 10 04.92		M	4.7:	S	5.0	B		10	20	3/			HOR02
1996 10 04.93	!	S	4.8	AA	8.0	B		10	9	5	0.3	260	SHA02
1996 10 04.93		S	5.7	AA	5.0	B		7	18	7			DIE02
1996 10 04.94		M	5.8:	AA	4.5	R	5	12	&15	3			NEV
1996 10 04.94		S	6.3	SC	5.0	B		10					HEG
1996 10 04.97		M	5.0	AA	5.0	B		7	16	4/			BOU
1996 10 04.99		S	5.2	AA	4.0	B		8	20	4/			SCH04
1996 10 04.99		S	5.6:	VF	5.0	B	6	7	12	d3			FIL05
1996 10 05.00		B	5.7:	VF	5.0	B	6	7	12	d3			FIL05
1996 10 05.02		B	5.8:	AA	5.0	B		7	20	d2			VEL03
1996 10 05.02		M	5.5	VF	6	R		20	18	4			BAR06
1996 10 05.06		S	6.2	SC	6.3	B		11	12	3			LAN03
1996 10 05.18		B	5.2	S	5.0	B		7	18	6			TRI
1996 10 05.66		S	5.0	VG	5.0	B		7	15	5			NAG08
1996 10 05.68		S	5.2	VG	10.0	B		20	12	5	1.0	280	NAG08
1996 10 05.80		S	5.3	S	15.0	R	5	25	10	5/	0.12		NAG02
1996 10 05.82		K	5.7	AA	11.0	B		20	12	4	0.68	279	NEV
1996 10 05.87		S	5.6	VF	5.0	B	6	7	13	d2			FIL05
1996 10 05.91		S	5.0	AA	4.0	B		8	12	5/			SCH04
1996 10 05.95		M	5.1	AA	5.0	B		7	15	6	1.5	288	BOU
1996 10 06.02		M	5.3	VF	6	R		20	20	d4			BAR06
1996 10 06.08		S	5.5	AA	5.0	B		10	& 8	5			COM
1996 10 06.38					40.6	L	5	57	7.6	6	0.65	31	BOR
1996 10 06.38		S	4.9	HP	5.0	B		10	12	6			BOR
1996 10 06.69		S	5.2:	S	3.5	B		7	&12	4			YOS02
1996 10 06.80		S	5.0	AA	15.2	L	5	42	16	5			MOE
1996 10 07.05		B	5.4	VF	3.0	B		4	17	S7			BAR06
1996 10 07.05		M	5.3	VF	6	R		20	20	d4/	1.0	280	BAR06
1996 10 07.11		B	5.4	AA	5.0	B		7	20	d2			VEL03
1996 10 07.11		S	5.3	AA	0.0	E		1		d2			VEL03
1996 10 07.13		S	4.8	AA	4.0	B		8	20	6/	0.3	298	SCH04
1996 10 07.20		M	5.1	S	5.0	B		7	25	6	0.5	290	TRI
1996 10 07.79		S	5.0	AA	15.2	L	5	42	15	4			MOE
1996 10 07.82		S	5.7	AA	7	R	4	10	14	3			NEV
1996 10 07.95		S	5.6:	VF	5.0	B	6	7	15	d2			FIL05
1996 10 07.97		S	5.6	AA	5.0	B		7	18	7			DIE02
1996 10 08.03		M	5.3:	VF	6	R		20	20	4	1.0	280	BAR06
1996 10 08.13		S	5.0	AA	4.0	B		8	18	6/	0.5	302	SCH04
1996 10 08.18	!	S	5.2	AA	8.0	B		11	12	6			SPR
1996 10 08.20		M	5.0	S	5.0	B		7	30	6	0.5	290	TRI
1996 10 08.23		B	6.5	AA	5.0	B		12					GRE
1996 10 08.23		S	5.5	AA	5.0	B		12	&15	4/			GRE
1996 10 08.74		K	5.9	AA	11.0	B		20	&12	4			NEV
1996 10 08.79		S	5.0	AA	15.2	L	5	42	13	4	0.3	340	MOE
1996 10 08.92		K	5.8	AA	11.0	B		20	15	4	0.81	289	NEV
1996 10 08.93		M	4.5:	S	8.0	B		10	15	3/			HOR02
1996 10 09.04		M	5.3:	VF	6	R		20	15	4	0.5	285	BAR06
1996 10 09.10		B	5.6	AA	5.0	B		7	17	d3			VEL03
1996 10 09.18	!	S	5.2	AA	5.0	B		7	14	5/			SPR
1996 10 09.20		B	5.0	S	5.0	B		7	35	6			TRI
1996 10 09.67		S	5.7	AA	10.5	R	7	28	9	4			HAS08
1996 10 09.76		S	5.9:	VG	5.0	B		7	&10	4			NAG08
1996 10 09.78		S	5.7	S	15.0	R	5	25	8	5	0.17		NAG02
1996 10 09.79		M	5.9	AA	3.5	B		7					TSU02
1996 10 09.95		S	5.4	AA	5.0	B		10	& 8	4			COM
1996 10 09.97		S	5.5	AA	5.0	B		7	15	4			BOU
1996 10 10.18	!	S	5.2	AA	5.0	B		7	11	4/			SPR
1996 10 10.20		B	5.0	S	5.0	B		7	35	6	1	270	TRI
1996 10 10.80		S	5.6	AA	5.0	B		7	20				TOD

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 10.96		S	5.3	AA	5.0	B		10	14	5			MOE
1996 10 11.71		B	5.9	AA	5.0	B		7	14	d3	1.0	308	VEL03
1996 10 11.73		S	5.5	SC	6	R		20	17	4	0.9	320	BAR06
1996 10 11.76		K	5.9	AA	11.0	B		20	13	4	0.81	315	NEV
1996 10 11.76		M	5.3	TI	5.0	B		10	30	3/	1.5	315	PLS
1996 10 11.77		M	4.9	S	3	R	4	2	25	4			HOR02
1996 10 11.79		M	5.5	TI	5.0	B		7	16	3			KYS
1996 10 12.01		K	5.9	AA	11.0	B		20	15	5	0.82	317	NEV
1996 10 12.07		S	5.6	SC	6	R		20	17	d4/	0.8	323	BAR06
1996 10 12.07	w	M	5.1	S	7.0	B		10	8	5/			SAN04
1996 10 12.07	w	M	5.3	S	7.0	B		10	8	6	0.25	315	MAR02
1996 10 12.08		B	5.9	AA	5.0	B		7	22	d3	1.0	312	VEL03
1996 10 12.08		S	5.6	AA	5.0	B		10	14	5			MOE
1996 10 12.12					11.0	L	7	32	18	s4	1.1	312	VEL03
1996 10 12.14		M	5.7	TI	5.0	B		7	14	3			KYS
1996 10 12.15		O	5.7	TI	0.0	E		1	&10	2			KYS
1996 10 12.16	!	V	6.3	YF	7.1	A	4		&17	7	&1	320	MIK
1996 10 12.37		S	5.7	HP	5.0	B		10	10	5			BOR
1996 10 12.74		B	5.8:	AA	5.0	B		7	18	d3			VEL03
1996 10 12.75		M	5.0	S	5.0	B		10	15	4	1.5	320	HOR02
1996 10 12.77		S	5.5	SC	6	R		20	18	4			BAR06
1996 10 12.78		M	5.3:	TI	10	B		25	13	3/	0.5	320	ZNO
1996 10 12.93		S	5.8:	VF	6.8	R	10	20	&12	d2			FIL05
1996 10 12.98		M	5.1	S	5.0	B		10	14	4	1	315	HOR02
1996 10 12.99		S	5.5	AA	5.0	B		7	9	4			SHA02
1996 10 13.00		S	5.6	AA	8.0	B		20	9	4	0.50	10	SHA02
1996 10 13.01		S	5.8	AA	5.0	B		10	12	4			MOE
1996 10 13.03		S	5.6	AA	4.0	B		8	11	6/			SCH04
1996 10 13.07		S	5.6	SC	6	R		20	17	4	0.7		BAR06
1996 10 13.08		M	6.1	S	8.0	B		10	10		0.75		POD
1996 10 13.08		S	5.4	AA	0.8	E		1	12	4			SHA02
1996 10 13.12		S	5.2	HD	0.0	E		1					SAR02
1996 10 13.13		S	5.4	HD	6.0	B		20	10	6	4.5	300	SAR02
1996 10 13.16	!	V	6.3	YF	20.0	T	2		&22	7	&1	330	MIK
1996 10 13.40		S	4.8	S	15.0	R	5	25	15	5/	0.33		NAG02
1996 10 13.74		B	5.5:	AA	5.0	B		7	15	d3			VEL03
1996 10 13.74		S	5.5	SC	6	R		20	20	4			BAR06
1996 10 13.75		M	5.2	TI	5.0	B		7	25	4			PLS
1996 10 13.75		M	5.4	S	5.0	B		10	14	4	2	325	HOR02
1996 10 13.75		S	5.8	AA	15.2	L	5	42	12	4	0.5	350	MOE
1996 10 13.78		B	5.7	AA	5.0	B		10	7.5	4			HAS02
1996 10 13.81		S	5.5	AA	5.0	B		7	12	4/	1.4	332	BOU
1996 10 14.02		S	5.5	SC	6	R		20	17	4			BAR06
1996 10 14.08		S	5.1	HD	0.0	E		1	15				SAR02
1996 10 14.08		S	5.4	HD	6.0	B		20	10	6	3.5	310	SAR02
1996 10 14.10		B	5.6	AA	5.0	B		7	17	d3	0.5	327	VEL03
1996 10 14.11		M	5.6	S	5.0	B		10	14	4/	1.5	325	HOR02
1996 10 14.14	!	V	6.3	YF	20.0	T	2		&22	7	&1	337	MIK
1996 10 14.72		B	5.5:	AA	5.0	B		7	13	d3			VEL03
1996 10 14.74		M	5.4	S	5.0	B		10	15	3/			HOR02
1996 10 14.75		S	5.8	AA	15.2	L	5	42	12	4	0.4	355	MOE
1996 10 14.76		M	5.5	SC	6	R		20	14	4			BAR06
1996 10 14.76		M	5.6	S	8.0	B		10	10		0.75		POD
1996 10 14.76		S	5.9	AA	10	R	4	16	9	5			HAS08
1996 10 14.78		B	5.8	AA	5.0	B		10	7.4	4			HAS02
1996 10 14.79		S	5.2	S	15.0	R	5	25	13	5	0.5		NAG02
1996 10 14.89		M	5.5	AA	5.0	B		7	12	4/			BOU
1996 10 14.90		S	5.0:	AA	4.0	B		8	&15	6	0.8	338	SCH04
1996 10 15.11		B	5.6	AA	5.0	B		7	20	s3	1.5	320	VEL03
1996 10 15.11		S	5.3	S	0.0	E		1	20	2/			HOR02
1996 10 15.12		M	5.4	S	5.0	B		10	15	4	1.8	325	HOR02
1996 10 15.17		S	5.0	AA	8.0	B		11	10	5/			SPR
1996 10 15.25		B	5.7	AA	3.5	B		7	& 7	6			GRE
1996 10 15.26		B	5.6	AA	5.0	B		10					HAS02
1996 10 15.27		S	5.1	AA	5.0	B		12	&10	5			GRE

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 15.41		S	5.8	VG	5.0	B		7	12	4			NAG08
1996 10 15.71					11.0	L	7	32	11	S4	1.0	342	VEL03
1996 10 15.71		B	5.5	AA	5.0	B		7	15	d3			VEL03
1996 10 15.75		S	5.9	AA	15.2	L	5	42	11	4	0.3	0	MOE
1996 10 15.76		K	5.9	AA	11.0	B		20	16	5	0.75	333	NEV
1996 10 15.76		M	5.5	SC	6	R		20	18	3/			BAR06
1996 10 15.79		S	5.9	VB	8.0	B		10	8	5	0.8	66	SHA02
1996 10 15.80		S	5.7	VB	5.0	B		7	7	4			SHA02
1996 10 15.81		S	5.9	VG	5.0	B		7	10	4			NAG08
1996 10 15.82		S	5.6	Y	3.5	B		7	&15	3			YOS02
1996 10 15.83		S	6.0	AA	5.0	B		7	15				TOD
1996 10 16.08		M	5.6	SC	6	R		20	13	d4	0.7	340	BAR06
1996 10 16.09		S	5.7	VB	5.0	B		7	9	5	0.25	331	SHA02
1996 10 16.12		B	5.7	AA	5.0	B		7	20	d3	1.0	332	VEL03
1996 10 16.17		S	5.5	VB	0.8	E		1	12	3			SHA02
1996 10 16.41		S	6.4	VG	8.0	B		11	9	4			NAG08
1996 10 16.73		B	5.8:	AA	5.0	B		7	15	d3			VEL03
1996 10 16.74		M	5.5	SC	6	R		20	13	4	0.5	345	BAR06
1996 10 16.75		M	5.5	S	5.0	B		10	14	4/			HOR02
1996 10 16.75		M	5.6	TI	5.0	B		7	10	4/			PLS
1996 10 16.77		S	5.7	SC	3	R		6	20	5	30 m	345	SHI
1996 10 16.78		S	6.5	VG	8.0	B		11	9	4	0.3	330	NAG08
1996 10 16.79		B	5.5	S	5.0	B		7	40	6			TRI
1996 10 16.79		S	5.7:	AA	8.0	B		20	20	4	1	340	GIL01
1996 10 16.80		S	5.8	VB	5.0	B		7	7	4			SHA02
1996 10 16.80		S	5.9	AA	10	R	4	16	9	5			HAS08
1996 10 16.81		M	5.8	AA	3.5	B		7					TSU02
1996 10 16.82		B	6.0	YG	8.0	B		11	5	4			MIY01
1996 10 16.82		S	5.8	AA	5.0	B		7	10	5			GOU
1996 10 16.82		S	6.1	AA	5.0	B		7	15				TOD
1996 10 16.85		M	5.6	AA	5.0	B		7	11	5	1.8	348	BOU
1996 10 17.06		M	5.5:	SC	6	R		20	15	4	&0.5	350	BAR06
1996 10 17.17		S	5.4	AA	5.0	B		10	20	5			GIL01
1996 10 17.17		S	5.4	AA	8.0	B		11	8	4/			SPR
1996 10 17.75		S	5.7	AA	8.0	B		20	9	4			BAR
1996 10 17.79		S	5.6	VB	8.0	B		10	8	5	0.50	22	SHA02
1996 10 18.11		S	6.1	AC	4.0	B		8	12	6	0.8	350	SCH04
1996 10 18.77		B	5.9	AA	5.0	B		10	10.8	4			HAS02
1996 10 18.83		S	5.9	VB	5.0	B		7	5	4			SHA02
1996 10 19.11		S	5.8	VB	5.0	B		7	7	5	1.6	320	SHA02
1996 10 19.15		M	6.0	S	5.0	B		10	9	5	0.8	335	HOR02
1996 10 19.16		S	5.6	AA	8.0	B		11	8	4/			SPR
1996 10 19.17					15.0	B		25	6	6/	1	355	ZAN
1996 10 19.17		S	5.3	AA	4.2	B		7	12	7	1.5	355	ZAN
1996 10 19.18		S	5.8	VB	0.8	E		1	12	4			SHA02
1996 10 19.20		B	5.6	S	5.0	B		7	40	6			TRI
1996 10 19.73		S	5.7	HD	5.0	B		10	9	3/	1	0	SAR02
1996 10 19.75		S	5.9	AA	15.2	L	5	42	12	3	0.6	5	MOE
1996 10 19.76		S	5.8	AA	5.0	B		7	12	2/			BOU
1996 10 19.76		S	6.5:	VF	6.0	R	4	8	&10	d2			FIL05
1996 10 19.78		S	5.6	AA	4.2	B		7	10	6	0.75	355	ZAN
1996 10 19.79		S	6.0	AA	5.0	B		15	&10	3			COM
1996 10 19.81		S	5.8	S	15.0	R	5	25	10	5	0.7		NAG02
1996 10 19.81		S	6.5	AC	8.0	B		15	11	6/	0.2	357	SCH04
1996 10 20.15		M	6.0	S	5.0	B		10	15	4	0.7	345	HOR02
1996 10 20.18		M	6.4:	S	7.0	B		10	7	5	0.2	350	MAR02
1996 10 20.20					15.0	B		25	6	6/	1	355	ZAN
1996 10 20.20		S	5.4	AA	4.2	B		7	12	6/	1.5	355	ZAN
1996 10 20.74		S	6.1	AA	15.2	L	5	42	10	3	0.2	0	MOE
1996 10 20.80		S	7.5	HS	25.4	T	6	32	8	2			YOS04
1996 10 20.81		S	7.7	VG	8.0	B		11	4	4/	10 m	350	NAG08
1996 10 21.15		M	6.6	S	5.0	B		10	12	3/	0.6	350	HOR02
1996 10 22.79		S	6.5	AA	15.2	L	5	42	9	2			MOE
1996 10 23.14		M	7.3	S	5.0	B		10	13	2/			HOR02
1996 10 23.17		S	7.6	AA	5.0	B		7	& 6	3			MIK

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 23.75	!	V	8.2	YF	20.0	T	2		&11	7/	&1	5	MIK
1996 10 24.15		S	6.4	AA	5.0	B		15	& 8	2			COM
1996 10 24.16		S	6.9	SC	4.0	B		8	15	5			SCH04
1996 10 24.18		S	7.2	S	6.3	B		9	9	2			KAM01
1996 10 24.73		S	6.9	AA	15.2	L	5	42	8	2			MOE
1996 10 29.76		S	8.1	HI	8.0	B		15	7	1			BOU
1996 10 29.77		S	7.6	VB	8.0	B		10	12	1			SHA02
1996 10 30.74	!	V	8.5	YF	20.0	T	2		&13	7	&1.2	10	MIK
1996 10 31.76	!	V	8.7	YF	20.0	T	2		&12	7	&1.2	12	MIK

Comet C/1996 R1 (Hergenrother-Spahr)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 09.88		S	11.8	NP	25.4	J	6	72	2.1	5			BOU
1996 09 09.98		S	10.5:	AC	20.3	T	10	77					ANZ
1996 09 10.09		S	10.5:	AC	20.3	T	10	77					ANZ
1996 09 10.57		C	12.4	GA	60.0	Y	6		2.3				NAK01
1996 09 10.83		S	11.9:	AC	15.2	L	5	76	2.5	1			MOE
1996 09 10.84		S	12.6	HS	30	R	18	170	0.9	3			SHA02
1996 09 10.84	!	V	12.9	GA	36.0	T	7		& 1	7	& 2	m 145	MIK
1996 09 10.85		S	11.6	AC	30.5	T	10	122	& 2	3/			COM
1996 09 11.06		S	11.7	AC	20.3	T	10	80	2	3			GRA04
1996 09 11.85		M	11.9	TI	35	L	5	92	1.5	4/			PLS
1996 09 11.85		M	12.1	TI	35	L	5	92	1.8	5			HOR02
1996 09 12.85		S	11.5	AC	30.5	T	10	122	& 2	3/			COM
1996 09 12.90		S	11.0	NP	33	L	5	100	2.9	2			SHA02
1996 09 13.85		M	11.4	TI	35	L	5	92	1.5	5			HOR02
1996 09 13.86		M	11.6:	TI	35	L	5	92	1.6	4/			PLS
1996 09 13.92		S	11.1	NP	33	L	5	75	1.7	1			SHA02
1996 09 13.92		S	11.7	NP	41.0	L	4	208	2	4			ZAN
1996 09 13.99		B	12.2	HS	25.6	L	5	84	1.5	7			BIV
1996 09 14.07		B	11.5	NP	17.3	L	6	42	4	2			TRI
1996 09 14.79		M	11.1	TI	35	L	5	92	2.1	4/			HOR02
1996 09 14.83		M	11.7	NP	25.4	J	6	72	2.0	4/			BOU
1996 09 14.92		S	11.7	NP	41.0	L	4	208	2	4			ZAN
1996 09 15.07		S	10.4:	AC	20.3	T	10	77	& 4				ANZ
1996 09 15.09		S	12.0	AC	20.3	T	10	80	2	4			GRA04
1996 09 15.24		J	10.7	SC	25.4	T	4		4.64	S6/			ROQ
1996 09 15.66		C	12.2	GA	60.0	Y	6		2.4				NAK01
1996 09 15.84		S	11.7	NP	25.4	J	6	72	2.0	5			BOU
1996 09 15.87		S	12.2	NP	33	L	5	100	1.3	1			SHA02
1996 09 15.89		S	11.6	AC	30.5	T	10	122	& 2	3			COM
1996 09 16.11		M	10.9	TI	35	L	5	92	2.2	4			HOR02
1996 09 16.6		S	11.9	SM	20.3	L	7	56	1	3			CAM03
1996 09 16.84		S	11.6	HS	20.3	T	10	93	0.5	4			HAS02
1996 09 16.85		S	11.7	NP	25.4	J	6	88	1.9	5			BOU
1996 09 16.85		S	12.1	NP	33	L	5	75	1.7	2			SHA02
1996 09 16.86		S	11.5	AC	30.5	T	10	122	& 3	2/			COM
1996 09 16.94		B	11.7	HS	25.6	L	5	84	1.6	6			BIV
1996 09 18.20		B	11.4	NP	17.3	L	6	42	5	3			TRI
1996 09 18.84		S	11.8	AC	15.2	L	5	76	1.5	1			MOE
1996 09 18.86		S	11.8	NP	25.4	J	6	72	2.0	4			BOU
1996 09 19.02		S	11.7	AC	30.5	T	10	122	& 3	2			COM
1996 09 19.82		S	11.9	AC	15.2	L	5	76	1.5	2			MOE
1996 09 19.84		S	11.2	AC	25.4	L	5	65	2	3/			MEY
1996 09 20.08		S	11.8	AC	30.5	T	10	122	3	2/			COM
1996 09 20.32		M	12.3	GA	50.5	L	5	87	0.8	s6			MOD
1996 09 20.94		S	11.6	AC	30.5	T	10	122	& 3	3			COM
1996 09 20.94		S	11.7	NP	15.6	L	5	72	2.2	4			BOU
1996 09 23.11		J	10.2	SC	25.4	T	4		4.05	S6			ROQ
1996 09 30.11		J	10.9	SC	25.4	T	4		1.62	s6/	0.5m	90	ROQ
1996 09 30.77		M	11.6	TI	35	L	5	92	2	3/			HOR02
1996 10 01.93		S	11.6:	NP	33	L	5	75	1.7	2			SHA02
1996 10 02.82		S	11.6:	NP	33	L	5	75	2.0	1			SHA02
1996 10 02.83	a	S	12.5	NP	25.4	J	6	88	1.7	0/			BOU

Comet C/1996 R1 (Hergenrother-Spahr) [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 02.85		S	12.0:	AC	30.5	T	10	122	& 3	1			COM
1996 10 02.89		S	11.5	HS	25.6	L	5	84	2	5			BIV
1996 10 02.90		S	12.6:	HS	30	R	18	170	0.9	1			SHA02
1996 10 03.76		M	12.1	TI	35	L	5	92	2.5	3			HOR02
1996 10 03.77		M	11.7	TI	35	L	5	92	1.6	2			PLS
1996 10 03.81		S	12.3	HS	44.0	L	5	156	0.7	3			HAS02
1996 10 03.88	!	V	13.3	GA	36.0	T	7		1.3	7	& 3 m	50	MIK
1996 10 04.96		S	12.4:	NP	33	L	5	75	1.2	2			SHA02
1996 10 05.82	a	S	12.6	NP	25.4	J	6	88	1.6	0/			BOU
1996 10 05.87		S	13.0:	HS	30	R	18	170	0.6	2			SHA02
1996 10 06.79		S	11.9:	AC	15.2	L	5	76	1.0	2			MOE
1996 10 06.81	a	S	12.6	NP	25.4	J	6	115	1.5	1			BOU
1996 10 07.78		S	11.9	AC	15.2	L	5	76	1.0	2			MOE
1996 10 07.80		S	11.9	TI	35	L	5	92	2.3	2			HOR02
1996 10 11.10		J	12.4	SC	25.4	T	4		1.17	s6	1.5m	57	ROQ
1996 10 11.79		M	12.3	HS	35	L	5	92	1.7	3			PLS
1996 10 11.80		M	12.2	TI	35	L	5	92	1.5	2/			HOR02
1996 10 12.76		M	12.0:	TI	35	L	5	104	1.6	3			HOR02
1996 10 12.84		S	12.4	HS	25.4	L	6	104	1.8	3			SAR02
1996 10 12.84		S	13.1	HS	25.4	L	6	104	1.5	4/			BAK01
1996 10 13.76		M	12.0	TI	35	L	5	104	1.4	2/			HOR02
1996 10 13.77		M	12.0:	TI	35	L	5	104	1.3	3			PLS
1996 10 13.80	!	V	13.8	GA	36.0	T	7		1.2	7/	& 3 m	50	MIK
1996 10 13.86		S	12.5	HS	44.5	L	5	146	1.5	1/			SAR02
1996 10 23.11	!	J	13.0	SC	25.4	T	4		0.67	d3	50.9s	63	ROQ

Comet 7P/Pons-Winnecke

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 26.77	a	C	18.7	GA	60.0	Y	6		0.35				NAK01

Comet 22P/Kopff

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1983 06 29.91		B	8.3	S	11.0	B		20	14	3			CHE03
1983 06 30.90		B	8.5:	S	11.0	B		20		3	0.09		CHE03
1983 07 01.88		B	8.1	S	11.0	B		20	10	4	0.1		CHE03
1983 07 08.87		B	8.1	S	11.0	B		20		3			CHE03
1983 07 12.92		B	7.9	S	11.0	B		20	12	3			CHE03
1983 07 27.93		B	8.0:	S	11.0	B		20	13	3			CHE03
1983 07 31.70		B	7.8	S	11.0	B		20		3			CHE03
1996 03 16.42		S	13.0	GA	35.9	L	7	85	1.0	2/			MOD
1996 03 30.40		S	13.0:	GA	35.9	L	7	85	0.8	1/			MOD
1996 04 18.37		M	11.3	GA	35.9	L	7	85	1.2	3/			MOD
1996 04 20.09		S	10.5	HS	10.0	B		25	0.9	4			HAS02
1996 05 13.33		M	10.3	GA	20.0	L	5	35	2.0	2			MOD
1996 05 15.20		S	8.5	S	7.0	B		20	2.8	4			HAS02
1996 05 18.21		S	10.0	GA	25.4	L	4	46	3	0			DID
1996 05 19.07		O	9.3	TI	11	L	7	54	2.5	2			KYS
1996 05 21.21		S	8.0:	SC	20.3	L	5	80	12	0			POR05
1996 05 21.97		S	9.2	AA	11	L	7	32	4.5	2			BAR06
1996 05 25.19		B	7.5	AA	8.0	B	4	15	4	0			NOW
1996 05 25.22		S	9.5	GA	25.4	L	4	46		0/			DID
1996 05 26.30		S	9.5	GA	25.4	L	4	46		0/			DID
1996 06 07.03		B	9.6:	S	25.6	L	5	42	3	3			BIV
1996 06 07.96		S	8.3	AA	8.0	B		20	5	2			OKS
1996 06 10.06		B	9.5	S	25.6	L	5	42	4.5	3			BIV
1996 06 11.23		S	7.3:	SC	20.3	L	5	40		0			POR05
1996 06 13.74		S	10.1	MS	31.7	L	5	64	3	1			JON
1996 06 14.03		S	8.6	AA	15.0	B		25	4	3			ZAN
1996 06 14.08		B	9.6	S	20.3	T	10	77	4	4			BIV
1996 06 14.74		S	10.3	MS	31.7	L	5	64	2	2			JON
1996 06 14.94	&	S	8.5:	AA	11.0	B		20	& 4	1			CHE03
1996 06 14.98		S	8.5	AA	8.0	B		20	2	2			OKS
1996 06 15.08		B	9.5	S	20.3	T	10	77	4	4			BIV

Comet 22P/Kopff [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 06 15.93		S	10.3	AC	6.3	R	13	52	4	2			KOS
1996 06 16.11		B	9.4:	S	20.3	T	10	77	5	3			BIV
1996 06 16.17		B	7.5	AA	10.0	B	4	20	4	0			NOW
1996 06 16.74		S	10.2	MS	31.7	L	5	64	3	3			JON
1996 06 17.06		S	8.5	AA	7.0	B		20	5	1			TAN02
1996 06 17.06		S	8.9	AA	8.0	B		11	5	3/			DES01
1996 06 17.13		B	9.2	S	20.3	T	10	77	4	5			BIV
1996 06 17.73		S	10.2	MS	31.7	L	5	64	3	1			JON
1996 06 18.06		S	8.8	AA	8.0	B		11	6	3			DES01
1996 06 18.74		S	9.8	MS	31.7	L	5	64	3	4			JON
1996 06 19.00		S	8.1	AA	8.0	B		15	7	2			HAV
1996 06 19.05		S	8.3	AA	7.0	B		20	6	1			TAN02
1996 06 19.05		S	9.0	AA	8.0	B		11	5	3/			DES01
1996 06 19.72		S	9.5	MS	31.7	L	5	64	1	3			JON
1996 06 20.04		S	8.3	AA	7.0	B		20	6	1			TAN02
1996 06 20.06		S	9.0	AA	8.0	B		11	5	3			DES01
1996 06 21.04		S	8.1	AA	7.0	B		20	6	1			TAN02
1996 06 21.10		S	8.7	AA	8.0	B		11	6	3			DES01
1996 06 22.11		S	8.7	AA	8.0	B		11	6	3			DES01
1996 06 23.05		S	8.5	AA	7.0	B		20	6	1			TAN02
1996 06 23.11		S	8.6	AA	8.0	B		11	6	3			DES01
1996 06 24.11		S	8.7	AA	8.0	B		11	6	3/			DES01
1996 06 25.13		S	8.6	AA	8.0	B		11	4	2			DES01
1996 06 26.05		S	7.9	AA	7.0	B		20	7	1			TAN02
1996 06 26.15		S	8.6	AA	8.0	B		11	4	2			DES01
1996 06 26.29	a	S	8.1	SC	5.0	B		10	5.7	2			MOD
1996 06 26.71		S	9.8	MS	31.7	L	5	64	1.5	4			JON
1996 06 27.05		S	8.1	AA	7.0	B		20	8	1/			TAN02
1996 06 28.72		S	10.1	MS	31.7	L	5	64	1	3			JON
1996 07 05.11		S	8.0:	SC	20.3	L	5	40	& 4	2	&0.06		POR05
1996 07 05.90		S	8.6	AA	20.3	T	10	77	4	5			KER01
1996 07 06.00		S	8.0:	SC	20.3	L	5	40	& 4	1/	&0.06		POR05
1996 07 06.17	a	S	8.3	GA	5.0	B		10	5.0	1			MOD
1996 07 06.56		S	8.5	SA	20.3	L	7	56	5	3			CAM03
1996 07 06.90		S	9.3	TI	11	L	7	54	3	2			KYS
1996 07 07.14		S	8.4	GA	25.4	L	4	46	5	3			DID
1996 07 07.20	!	S	8.5	GA	5.0	B		10	5.0	1			MOD
1996 07 07.22		S	9.4	GA	20.0	L	5	35	2.4	3			MOD
1996 07 07.41		S	8.0	SA	8.0	B		20	5	2			CAM03
1996 07 07.57		S	8.2	AA	8.0	B		20	5	3			PEA
1996 07 08.42		S	8.0	SA	20.3	L	7	56	4	3			CAM03
1996 07 09.91		S	7.8	AA	8.0	B		20	10	2/			ZAN
1996 07 09.93		S	7.9	AA	6.0	B		20	6	2			CSU
1996 07 09.96		S	8.4	AA	15	L	7	33	8	0			NAG09
1996 07 10.05		S	8.6	AA	25.3	L	6	58	> 3.5	4			PER01
1996 07 10.05		S	8.8	AA	25.3	L	6	58	& 2.5	2			VIT01
1996 07 10.06		S	7.8	AA	3.4	B		9	& 7	2			PER01
1996 07 10.30		S	8.5	AA	8.0	B		11	4	4			DES01
1996 07 10.58		M	8.5	S	12.5	L	6	23					TSU02
1996 07 10.92		S	7.7	AA	4.2	B		7	&10	2			ZAN
1996 07 10.92		S	7.9	AA	15.0	B		25	9	2/			ZAN
1996 07 10.99		S	7.2	TI	8.0	B		10	13	1/			HOR02
1996 07 11.07		S	8.7	AA	25.3	L	6	58	& 2.5	5			VIT01
1996 07 11.08		S	7.9	AA	3.4	B		9	& 5	3			PER01
1996 07 11.08		S	8.6	AA	25.3	L	6	58	& 3.5	4/			PER01
1996 07 11.22		S	8.2	GA	25.4	L	4	46	5	3			DID
1996 07 11.28	a	S	8.7	GA	5.0	B		10	6.0	1/			MOD
1996 07 11.30		S	8.0	AA	8.0	B		11	3	4/			DES01
1996 07 11.40		S	7.8	AA	8.0	B		15	5	4			SEA01
1996 07 11.89		S	7.7	AA	4.2	B		7	&10	2			ZAN
1996 07 11.89		S	7.9	AA	15.0	B		25	9	2/			ZAN
1996 07 11.90		S	8.3	AA	15	L	7	33	6	1			NAG09
1996 07 12.05		S	9.0	AA	25.3	L	6	58	& 2	4/			VIT01
1996 07 12.06		S	8.8	AA	25.3	L	6	58	& 3.5	4			PER01
1996 07 12.07		S	8.0	AA	3.4	B		9	& 5	2			PER01

Comet 22P/Kopff [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 12.19		S	8.2	GA	25.4	L	4	46	6	3			DID
1996 07 12.31		S	8.2	AA	8.0	B		11	3	4/			DES01
1996 07 12.71		S	8.8	S	10.0	B		20	5	2			YOS02
1996 07 12.92		S	7.9	AA	8.0	B		15	7	2			HAV
1996 07 12.98		S	8.1	AA	7.0	B		20	7	1			TAN02
1996 07 13.29		S	8.2	AA	8.0	B		11	3	4			DES01
1996 07 13.67		S	7.6	AA	5.0	B		10	4	2			SEA01
1996 07 13.86		S	8.0	AA	6.3	R	13	52	10	2			KOS
1996 07 13.89		S	7.8:	TI	10	B		25	9	1/			ZNO
1996 07 13.93		S	7.8	AA	8.0	B		20	7	2			OKS
1996 07 13.95		S	8.5	S	10	B		14	8	s1			SHA02
1996 07 14.05		S	8.8	AA	10.8	L		17	3.5	1			SZA
1996 07 14.30		S	8.0	AA	8.0	B		11	4	3/			DES01
1996 07 14.42		S	7.9	AA	8.0	B		15	3	3			SEA01
1996 07 14.74		S	8.1	AA	8.0	B		15	4	2			SEA01
1996 07 15.31		S	7.8	AA	8.0	B		11	4	3/			DES01
1996 07 15.43		S	8.0	AA	5.0	B		10	4	2			SEA01
1996 07 15.60		M	8.7	S	12.5	L	6	23					TSU02
1996 07 15.76		S	8.1	AA	8.0	B		15	3	2			SEA01
1996 07 15.95		S	8.7	AA	10	B		14	6	3			SHA02
1996 07 15.99		B	8.8	S	20.3	L	6	40	6	3			BIV
1996 07 16.44		S	7.9	AA	5.0	B		10	3	2			SEA01
1996 07 16.55		S	8.7	S	15.0	R	5	25	7	4			NAG02
1996 07 16.78		S	7.8	AA	8.0	B		15	4	3			SEA01
1996 07 16.88		M	9.2	TI	11	L	7	32	4.5	2			KYS
1996 07 16.93		S	7.8	TI	8.0	B		10	14	1			HOR02
1996 07 16.94		S	7.5	TI	8.0	B		10	14	1			PLS
1996 07 16.94		S	8.4	AA	10.0	B		25	2.6	3			HAS02
1996 07 16.99		S	7.9	AA	8.0	B		11	5	4			DES01
1996 07 17.42		S	7.9	AA	5.0	B		10	3	2			SEA01
1996 07 17.75		S	7.9	AA	8.0	B		15	4	3			SEA01
1996 07 17.89		S	8.0	AA	6.3	R	13	52	10	2			KOS
1996 07 17.92		E	9.1	AA	30	L	5	60	3	2			NEV
1996 07 17.95		S	8.7	AA	10	B		14	6	3			SHA02
1996 07 17.98		S	7.9	AA	8.0	B		11	5	4			DES01
1996 07 18.03		B	8.9	S	25.6	L	5	42	5	3			BIV
1996 07 18.20	!	J	8.6	SC	25.4	T	4		6.76	s5			ROQ
1996 07 18.42		S	7.9	AA	5.0	B		10	4	2			SEA01
1996 07 18.75		S	8.0	AA	8.0	B		15	4	2			SEA01
1996 07 18.90		S	7.8	TI	8.0	B		10	14	1			HOR02
1996 07 18.91		S	7.5	TI	8.0	B		10	13	1			PLS
1996 07 18.93		S	8.3	AA	10.0	B		25	5.8	3			HAS02
1996 07 18.95		S	8.7	AA	20.3	T	10	50	2.3	4			KAM01
1996 07 18.99		S	7.9	AA	8.0	B		11	5	3/			DES01
1996 07 19.07		S	9.3:	S	25.6	L	5	84	3	3			BIV
1996 07 19.30		S	8.0	AA	8.0	B		20					PEA
1996 07 19.71		S	8.0	AA	8.0	B		15	4	2			SEA01
1996 07 19.90		S	8.1	TI	8.0	B		10	13	1			HOR02
1996 07 19.90		S	8.3	TI	8.0	B		10	15	1/			KYS
1996 07 19.90		S	8.3:	AA	5.0	B		10	9	2			OKS
1996 07 19.94		S	8.4	AC	25.4	L	5	40	4	3/			MEY
1996 07 19.95		S	8.8	AA	10	B		14	6	2			SHA02
1996 07 19.99		S	8.0	AA	8.0	B		11	4	3/			DES01
1996 07 20.14		S	7.5	HR	5.0	B		10	11	1			BOR
1996 07 20.29	w	S	8.7	GA	5.0	B		10	6.5	1			MOD
1996 07 20.31		S	7.9	AA	8.0	B		20	9	2			PEA
1996 07 20.57		S	8.9	S	10.0	B		20	4	2			YOS02
1996 07 20.71		S	8.0	AA	8.0	B		15	4	3			SEA01
1996 07 20.86		S	8.4	TI	10	B		25	10	1			ZNO
1996 07 20.90		S	8.0	TI	8.0	B		10	15	1/			HOR02
1996 07 20.90		S	8.1	TI	8.0	B		10	14	0/			KYS
1996 07 20.91		S	8.1	TI	8.0	B		10	12	1/			PLS
1996 07 20.94		S	8.4	AC	25.4	L	5	65	4.5	4			MEY
1996 07 20.94	&	S	8.4	AA	11.0	B		20	& 5	1			CHE03
1996 07 20.99		S	8.0	AA	8.0	B		11	4	3/			DES01

Comet 22P/Kopff [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 21.01		B	8.9	S	25.6	L	5	42	5	4			BIV
1996 07 21.16		S	7.6	HR	5.0	B		10	10	1/			BOR
1996 07 21.23	w	S	8.9	GA	5.0	B		10	6.5	1			MOD
1996 07 21.54		S	8.8	S	15.0	R	5	25	6	3			NAG02
1996 07 21.71		S	8.0	AA	8.0	B		15	4	2			SEA01
1996 07 21.87		S	8.3	AA	6.3	R	13	52	12	1			KOS
1996 07 21.91		S	8.1	TI	8.0	B		10	12	1			HOR02
1996 07 21.92		S	8.4	AA	8.0	B		20	5	1			OKS
1996 07 21.92		S	8.5	AC	25.4	L	5	65	4.5	s4			MEY
1996 07 21.93		S	8.8	AA	10	B		14	6	2			SHA02
1996 07 21.95		S	7.9	AA	8.0	B		11	6	3/			DES01
1996 07 21.95		S	9.5	AA	10.8	L		44	7	1			SZA
1996 07 21.97		S	7.9	AA	8.0	B		15	7	2			HAV
1996 07 22.70		S	8.1	AA	8.0	B		15	3	1			SEA01
1996 07 22.71		S	8.0	AA	5.0	B		10	3	2			SEA01
1996 07 22.86		S	8.5	S	10	B		25	9	1			ZNO
1996 07 22.88		M	8.8	TI	20	L	4	34	6	1/			KYS
1996 07 22.88		S	8.5	AA	11.0	L	7	32	7.2	d2			VEL03
1996 07 22.90		S	7.9	TI	5.0	B		10	15	1/			HOR02
1996 07 22.93		S	8.4	AA	10.0	B		25	3.8	3			HAS02
1996 07 22.93		S	8.4	AA	20.3	T	10	50	3.2	3/			KAM01
1996 07 22.94		S	8.9	AA	10	B		14	6	1			SHA02
1996 07 22.97		S	7.9	AA	8.0	B		11	6	3/			DES01
1996 07 23.15		S	7.6	HR	5.0	B		10	11	1			BOR
1996 07 23.71		S	8.2	AA	8.0	B		15	3	2			SEA01
1996 07 23.89		S	8.5	AA	11.0	L	7	32	5.4	d2			VEL03
1996 07 23.98		S	8.0	AA	8.0	B		11	5	3/			DES01
1996 07 24.53		S	8.0	AA	8.0	B		20	6	2			PEA
1996 07 24.70		S	8.0	AA	5.0	B		10	2	2			SEA01
1996 07 24.70		S	8.2	AA	8.0	B		15	2	2			SEA01
1996 07 25.74		S	8.3	AA	8.0	B		15	2	2			SEA01
1996 07 26.01		S	8.8	AA	10	B		14	5	1			SHA02
1996 07 27.28		S	8.3	AA	20.0	T	10	64	6.5	2/			SPR
1996 08 02.37		S	8.5	AA	8.0	B		15	2	2			SEA01
1996 08 02.85		S	7.0	AA	11	L	7	56	6	2			BAR06
1996 08 03.91		S	9.2	NP	7.0	B		10	6	1			MAR02
1996 08 03.92		S	8.7	AA	20	R	14	40	2.9	2			SHA02
1996 08 04.39		S	8.5	AA	8.0	B		15	3	3			SEA01
1996 08 04.53		S	8.2	AA	8.0	B		20	5.5	3			PEA
1996 08 04.96		S	8.5	AA	10	B		14	6	2			SHA02
1996 08 05.50		S	8.5	AA	8.0	B		15	3	3			SEA01
1996 08 05.54		C	8.8:	GA	8.0	R	6		9.6		32	m 264	NAK01
1996 08 06.25		S	8.8	AA	20.0	T	10	64	5.0	2/			SPR
1996 08 06.40		S	8.6	AA	8.0	B		15	3	3			SEA01
1996 08 06.80		S	8.8	S	15.0	L	4	20	5	4			KRY01
1996 08 06.89	&	S	8.9	S	20.0	L	5	52	& 6	3			CHE03
1996 08 06.90		S	8.4	TI	8.0	B		10	10	1			HOR02
1996 08 06.91	!	V	9.2	YF	20.0	T	2		& 8	5			MIK
1996 08 07.19	!	J	8.7	SC	25.4	T	4		5.5	s5/			ROQ
1996 08 07.25		S	8.9	AA	20.0	T	10	102	5.5	2			SPR
1996 08 07.42		S	8.5	AA	8.0	B		15	3	3			SEA01
1996 08 07.52		S	8.6	SA	8.0	B		20	3	2			CAM03
1996 08 08.25		S	9.0	AA	20.0	T	10	102	6.0	2/			SPR
1996 08 08.49		S	8.5	SA	8.0	B		20	4	2			CAM03
1996 08 08.79		S	9.0	S	15.0	L	4	20	4	3/			KRY01
1996 08 08.90		S	8.7	TI	10	B		25	9	1/			ZNO
1996 08 09.25		S	9.1	AA	20.0	T	10	102	6.0	2/			SPR
1996 08 09.61		S	8.5	AA	8.0	B		20		2			PEA
1996 08 09.84		E	10.2:	AA	30	L	5	60	4	0			NEV
1996 08 09.88		S	8.5	TI	10	B		25	12	2/			ZNO
1996 08 09.88		S	8.6:	TI	25	L	6	60	4.5	0/			HOR02
1996 08 09.88		S	8.8:	AA	8	R	11	34	& 3	1			OKS
1996 08 09.98		S	8.8:	NP	21.0	L	6	60	5	2			MAR02
1996 08 10.23	a	S	10.1	GA	20.0	L	5	35	2.5	1/			MOD
1996 08 10.40		S	8.5	SA	8.0	B		20	3				CAM03

Comet 22P/Kopff [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 10.60		S	8.6	AA	8.0	B		20	6	2			PEA
1996 08 10.93		S	9.2	TI	10	B		25	11	1/			ZNO
1996 08 10.96		M	9.4	NP	44.5	L	5	100	3	4			MAR02
1996 08 10.96		S	9.3	NP	44.5	L	5	100	5	4			SAN04
1996 08 11.27		S	9.0	AA	20.0	T	10	102	5.0	2/			SPR
1996 08 11.50		S	8.6	SM	8.0	B		20	3	2			CAM03
1996 08 11.96		S	8.8	NP	21.0	L	6	60	4	3			MAR02
1996 08 11.96		S	9.4	NP	21.0	L	6	60	5	2			SAN04
1996 08 12.25		S	9.0	AA	10.0	R	5	27	5.5	2/			SPR
1996 08 12.46		S	8.5	AA	8.0	B		15	3	1			SEA01
1996 08 13.25		S	8.9	AA	10.0	R	5	27	5.5	2/			SPR
1996 08 13.44		S	8.1	AA	8.0	B		15	5	1			SEA01
1996 08 13.98		B	10.2	HS	20.3	T	10	77	4	3			BIV
1996 08 14.22		S	9.3	AA	10.0	R	5	27	4.5	2			SPR
1996 08 14.40		S	8.2	AA	8.0	B		15	4	1			SEA01
1996 08 14.83		S	9.0	AA	6.0	B		20	9	1			CSU
1996 08 14.85		E	10.3:	AA	30	L	5	60	3	0			NEV
1996 08 14.90		S	9.5	AA	15	L	3	26	15	0			KES01
1996 08 15.22		S	9.3	AA	20.0	T	10	102	5.7	2			SPR
1996 08 16.22		S	9.1	AA	20.0	T	10	51	4.5	2			SPR
1996 08 16.56		S	8.8	AA	8.0	B		20	6	3			PEA
1996 08 16.86		S	8.9	AA	15.0	B		25	5	1			ZAN
1996 08 16.91	!	V	10.3	YF	20.0	T	2		& 4	5			MIK
1996 08 16.92		B	10.0	HS	20.3	T	10	77	6	3			BIV
1996 08 16.92		S	8.8	NP	21.0	L	6	60	8	2			MAR02
1996 08 16.93		S	9.1	NP	21.0	L	6	60	8	1			SAN04
1996 08 17.23		S	9.0	AA	20.0	T	10	51	5.5	2			SPR
1996 08 17.88		S	9.0	AA	10	B		14	5	3			SHA02
1996 08 17.89		S	8.5	AA	10.0	B		25	4.4	3			HAS02
1996 08 17.96		S	9.1:	NP	44.5	L	5	100	3	1			MAR02
1996 08 17.96		S	9.3:	NP	44.5	L	5	100	2.5				SAN04
1996 08 18.24		S	9.2	AA	20.0	T	10	51	5.0	2			SPR
1996 08 18.86		M	9.4	NP	44.5	L	5	100	3	3			MAR02
1996 08 18.86		O	10.0:	TI	20	L	4	57	3	1			KYS
1996 08 18.86		S	9.1	NP	44.5	L	5	100	4	4			SAN04
1996 08 18.89		S	9.6	AC	25.4	L	5	65	3	3			MEY
1996 08 18.91		S	9.2	S	20.3	T	10	77	2.6	2			KAM01
1996 08 18.95		B	10.3	HS	20.3	T	10	77	5	4			BIV
1996 08 19.08		S	8.2:	HR	8.0	B		20	7	0			BOR
1996 08 19.85		S	8.8	AA	8.0	B		15	6	1			HAV
1996 08 19.85		S	9.4	AA	11	L	7	56	4	3			BAR06
1996 08 19.88		S	8.8	AA	10.0	B		25	4.2	3			HAS02
1996 08 19.88		S	9.3	AC	25.4	L	5	65	2.5	2/			MEY
1996 08 19.90		S	8.5	AA	10	B		14	4	3			SHA02
1996 08 19.96		S	8.9	NP	44.5	L	5	100	3.5	3			MAR02
1996 08 19.96		S	9.1	NP	44.5	L	5	100	5	3			SAN04
1996 08 20.53		S	8.5	AA	8.0	B		15	3	2			SEA01
1996 08 21.22		S	9.5	AA	20.0	T	10	51	3.7	1/			SPR
1996 08 21.89		S	9.4	AA	10	B		14	5	3			SHA02
1996 08 22.23		S	9.5	AA	20.0	T	10	64	4.0	2			SPR
1996 08 31.15	!	J	9.8	SC	25.4	T	4		3.7	s5/			ROQ
1996 09 02.52		M	9.6:	S	12.5	L	6	23		2			TSU02
1996 09 03.89		S	8.9	NP	21.0	L	6	60	3	2			MAR02
1996 09 03.89		S	8.9	NP	21.0	L	6	60	5	1			SAN04
1996 09 04.13	!	J	10.0	SC	25.4	T	4		4.1	s5/			ROQ
1996 09 06.89		S	10.4	HS	25.6	L	5	42	3	3			BIV
1996 09 07.89		S	9.3	NP	21.0	L	6	60	3	1			MAR02
1996 09 07.89		S	9.5	NP	21.0	L	6	60	4	2			SAN04
1996 09 08.90		S	9.3:	S	20	R	14	90	2.2	3			SHA02
1996 09 09.40		S	10.8	SM	20.3	L	7	56	2	1			CAM03
1996 09 10.48	a	C	10.4	GA	8.0	R	6		9.1				NAK01
1996 09 10.86		S	9.8	AA	20	R	14	90	2.3	2			SHA02
1996 09 10.91		S	10.0	GA	15.0	L	5	42		2			BEC01
1996 09 12.82		B	9.4	S	17.3	L	6	84	6	3			TRI
1996 09 12.86		S	10.7:	AA	20	R	14	140	1.2	1			SHA02

Comet 22P/Kopff [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 13.86		S	10.1	AA	20	R	14	90	2.5	1			SHA02
1996 09 13.88		S	9.8	AA	15.0	B		25	4	0			ZAN
1996 09 13.90		S	9.5	NP	21.0	L	6	60	2	2			MAR02
1996 09 13.90		S	11.1	HS	25.6	L	5	84	3	2			BIV
1996 09 14.85		S	9.6	NP	21.0	L	6	60	3.5	1/			MAR02
1996 09 14.88		S	9.8	AA	15.0	B		25	4	0			ZAN
1996 09 15.88		S	9.9	AA	15.0	B		25	4	0			ZAN
1996 09 16.12	!	J	11.3	SC	25.4	T	4		4.69	S6	67.8s	53	ROQ
1996 09 16.83		S	11.5	HS	20	R	14	90	1.3	1			SHA02
1996 09 16.89		S	11.2:	HS	25.6	L	5	42	3	2			BIV
1996 09 17.87		S	9.6	NP	17.3	L	6	84	5	3			TRI
1996 09 19.81		S[	10.6	AC	11	L	7	56	! 1				BAR06
1996 09 20.19	a	S	13.1	GA	50.5	L	5	87	0.8	3			MOD
1996 10 03.79		S	11.5	TI	35	L	5	104	2.1	1/			HOR02
1996 10 03.80		S	11.7	TI	35	L	5	92	2.1	1/			PLS
1996 10 30.47		S	12.0	GA	20.3	L	7	56	1	2			CAM03

Comet 29P/Schwassmann-Wachmann 1

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 02 17.23		S[	12.7:	GA	20.0	L	5	68	! 1.0				MOD
1996 02 25.31		M	11.9	GA	35.9	L	7	85	0.55	s5			MOD
1996 02 27.19		S	12.0	GA	20.0	L	5	169	0.45	2			MOD
1996 03 09.99		V	11.5	HS	100	C	3		+ 1.60				SAN08
1996 03 11.03		V	11.3	HS	100	C	3		+ 1.60				SAN08
1996 03 12.03		V	11.3	HS	100	C	3		+ 1.60				SAN08
1996 03 12.27		M	11.7	GA	35.9	L	7	85	1.0	S8			MOD
1996 03 13.22		M	12.0	GA	35.9	L	7	85	1.0	D8			MOD
1996 03 13.89		V	11.3	HS	100	C	3		+ 1.60				SAN08
1996 03 16.26		M	11.9	GA	20.0	L	5	68	1.0	D7			MOD
1996 03 16.31		M	12.0	GA	35.9	L	7	85	0.8	D7			MOD
1996 03 27.31	a	S	12.2	GA	20.0	L	5	68	1.1	3			MOD
1996 04 08.19		S	12.9	GA	35.9	L	7	85	1.1	2			MOD
1996 04 11.24	s	S	13.1	GA	35.9	L	7	85	0.7	1			MOD
1996 04 18.21	s	S	13.1	GA	20.0	L	5	68	1.1	1			MOD
1996 04 19.88		S	12.3	HS	44.0	L	5	100	0.8	2			HAS02
1996 04 21.21	a	S	13.6	GA	35.9	L	7	164	0.55	1			MOD
1996 06 15.11		S[	12.1	GA	35.9	L	7	164	! 0.5				MOD

Comet 45P/Honda-Mrkos-Pajdušáková

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1995 12 21.67		S	8.1	AC	6.3	R	13	52	3	6			KOS
1996 02 17.26		S	10.7	GA	20.0	L	5	35	3.5	0/			MOD
1996 02 22.77		S	8.8	GA	8.0	B		20	12	0			CAM03
1996 02 25.43		S	13.0	GA	35.9	L	7	85	2.1	0			MOD

Comet 46P/Wirtanen

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 16.71	a	C	19.3	GA	60.0	Y	6		0.25				NAK01
1996 08 10.68	a	C	18.9	GA	60.0	Y	6		0.25				NAK01
1996 08 19.61	a	C	18.9:	GA	60.0	Y	6		0.25				NAK01
1996 10 04.48	a	C	18.2	GA	60.0	Y	6		0.3				NAK01
1996 10 16.44	a	C	18.0	GA	60.0	Y	6		0.25				NAK01

Comet 57P/du Toit-Neujmin-Delporte

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 26.76	a	C	13.4	GA	60.0	Y	6		1.35		> 8.8m	251	NAK01
1996 07 27.04		S	11.7:	HS	25	L	6	143	1	2/			HOR02
1996 07 27.05		C	13.4	HS	65	L	4		0.8		0.11	253	PRA01
1996 07 27.05		S	11.9:	AC	25.4	L	5	65	2.5	1/			MEY
1996 07 28.04		S	11.9:	TI	35	L	5	158	1.2	3			PLS
1996 07 28.04		S	12.1:	TI	35	L	5	158	1.3	2/			HOR02

Comet 57P/du Toit-Neujmin-Delporte [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 10.02		S	12.6	HS	10	B		25	1	3			ZNO
1996 08 10.80		S[	12.5	AA	20.0	L		100					PEA
1996 08 11.04		S	12.4	HS	10	B		25	0.8	3			ZNO
1996 08 13.33		V	13.3	L	12.0	R	2				3.7m	260	FER
1996 08 15.33		V	13.3	L	12.0	R	2				3.7m	260	FER
1996 08 19.06		O	12.2	TI	20	L	4	57	1.5	2/			KYS
1996 08 21.07	!	V	15.4	YF	36.0	T	7		& 1	8	& 6 m	250	MIK
1996 08 21.10		C	14.7	HS	65	L	4		0.6		0.09	255	PRA01
1996 08 23.06		O[	12.2	HS	20	L	5	125	! 1.3				PLS
1996 08 24.75		C	14.9	GA	60.0	Y	6		1.2		> 7.0m	252	NAK01
1996 08 25.07		S	13.1:	HS	44.5	L	5	230	2	0			SAR02
1996 08 26.05		S	13.3:	HS	35	L	5	158	1.1	1/			HOR02
1996 08 26.09		O	11.8	TI	20	L	4	57	1.7	2			KYS
1996 08 26.13		S	13.3:	HS	33	L	5	100	0.6	3			SHA02
1996 09 10.77		C	14.9:	GA	60.0	Y	6		1.7		> 6.3m	255	NAK01
1996 09 10.97		S	13.6:	HS	30	R	18	290	0.3	2			SHA02
1996 10 14.01		S	14.0	HS	44.5	L	5	230	1.4	d3			SAR02

Comet 65P/Gunn

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 03 16.43		S[	13.8	GA	35.9	L	7	164	! 0.5				MOD
1996 05 12.72	a	C	12.8	GA	60.0	Y	6		1.6		5.6m	289	NAK01
1996 05 13.31		M	13.2	GA	40.6	L	7	190	0.5	4/			MOD
1996 05 22.68	a	C	12.4	GA	60.0	Y	6		1.8		7.4m	288	NAK01
1996 06 06.96		B	13.1	HS	25.6	L	5	84	1.5	6			BIV
1996 06 09.97		B	13.2	HS	25.6	L	5	84	1	7			BIV
1996 06 15.00		B	12.7	HS	20.3	T	10	133	1	6			BIV
1996 06 15.21	!	M	13.7	GA	35.9	L	7	164	0.40	s6/			MOD
1996 06 16.01		B	13.0	HS	20.3	T	10	267	1	5			BIV
1996 07 06.15	a	S	13.9	GA	35.9	L	7	164	0.40	3			MOD
1996 07 10.52		C	13.2:	GA	60.0	Y	6		1.4				NAK01
1996 07 11.17	a	S	14.1	GA	35.9	L	7	164	0.22	S6			MOD
1996 07 15.55	a	C	13.0	GA	60.0	Y	6		1.8				NAK01
1996 07 16.88		M	12.2	HS	35	L	5	158	1.2	2			HOR02
1996 07 18.87		S	12.2	HS	35	L	5	158	1	2			HOR02
1996 07 18.89		S	12.1	TI	35	L	5	158	1.2	2/			PLS
1996 07 19.88		S	12.3	HS	35	L	5	158	1.1	2			HOR02
1996 07 19.89		S	12.7	HS	35	L	5	158	0.7	3			KYS
1996 07 20.88		S	12.0	HS	35	L	5	158	1.2	2/			PLS
1996 07 20.88		S	12.6	HS	35	L	5	158	0.7	2			KYS
1996 07 20.89		S	12.2	HS	35	L	5	158	1	1/			HOR02
1996 07 21.13	w	S	14.3	GA	50.5	L	5	167	0.30	4			MOD
1996 07 21.88		S	12.1	HS	35	L	5	158	1.1	1/			HOR02
1996 08 09.58		S[	12.5	AA	20.0	L		100					PEA
1996 08 10.11	s	M	14.6	GA	50.5	L	5	167	0.33	2			MOD
1996 08 12.50		C	13.3:	GA	60.0	Y	6		1.35				NAK01
1996 08 18.10	s	S	14.0	GA	50.5	L	5	167	0.40	1			MOD
1996 08 19.49	a	C	13.8:	GA	60.0	Y	6		1.2				NAK01
1996 09 02.46	a	C	13.5:	GA	60.0	Y	6		1.7				NAK01

Comet 67P/Churyumov-Gerasimenko

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 03 12.11		M	12.8	GA	35.9	L	7	85	0.60	2/			MOD
1996 04 11.08		S[	13.7	GA	35.9	L	7	164	! 0.5				MOD

Comet 73P/Schwassmann-Wachmann 3

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1995 11 21.68		S	7.6	AA	6.3	R	13	52	14	2	5 m	67	KOS
1995 11 25.68		S	7.2	AA	6.3	R	13	52					KOS
1995 12 09.67		S	9.4	AA	6.3	R	13	52	5	1			KOS
1995 12 21.70		S	8.8	AA	6.3	R	13	52	8	3			KOS
1996 01 10.69		S	8.8	AA	6.3	R	13	52	6	2			KOS

Comet 73P/Schwassmann-Wachmann 3 [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 01 12.70		S	8.9	AA	6.3	R	13	52	6	1			KOS
1996 01 16.70		S	9.0	AA	6.3	R	13	52	6	1			KOS
1996 10 13.05		S	14.0	HS	44.5	L	5	230	0.8	4			BAK01
1996 10 13.05		S	14.5	HS	44.5	L	5	230	0.8	2/			SAR02
1996 10 14.03		S[	14	HS	44.5	L	5	230	0.5				SAR02

Comet 81P/Wild 2

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 10.82		C	16.5	GA	60.0	Y	6		0.5			265	NAK01
1996 10 13.11		S[	14	HS	44.5	L	5	230	1				SAR02
1996 10 14.10		S[	14	HS	44.5	L	5	230	1				SAR02
1996 10 20.82		C	15.0:	GA	60.0	Y	6		1.1			285	NAK01

Comet 95P/Chiron = (2060) Chiron

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 04 18.27		I	15.1	GA	35.9	L	7	164	0.0	9			MOD
1996 04 21.25		I	15.1	GA	35.9	L	7	164	0.0	9			MOD

Comet 116P/Wild 4

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 02 25.28		M	13.1	GA	35.9	L	7	85	0.65	3			MOD
1996 03 12.24		S	13.1	GA	35.9	L	7	85	0.50	2			MOD
1996 03 13.21		M	13.3	GA	35.9	L	7	85	0.60	4			MOD
1996 04 18.17		M	13.1	AC	20.0	L	5	68	0.5	D7			MOD
1996 04 19.85		S	12.7	HS	44.0	L	5	156	0.3	4			HAS02
1996 04 21.14		M	13.3	AC	35.9	L	7	85	0.4	D7			MOD
1996 06 13.90		B	12.6	HS	20.3	T	10	133	0.8	6			BIV

Comet 117P/Helin-Roman-Alu 1

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 04 11.70	a	C	18.3	GA	60.0	Y	6		0.25			297	NAK01
1996 04 21.76	a	C	17.9	GA	60.0	Y	6		0.25		1.8m	285	NAK01
1996 05 15.71	a	C	17.1	GA	60.0	Y	6		0.35		1.8m	289	NAK01
1996 05 22.63	a	C	16.9	GA	60.0	Y	6		0.35		2.8m	287	NAK01
1996 07 10.62		C	17.8	HS	28.0	T	6		0.3				KIN
1996 07 15.53	a	C	17.3	GA	60.0	Y	6		0.3				NAK01
1996 08 05.52		C	18.0:	GA	60.0	Y	6		0.25				NAK01

Comet 118P/Shoemaker-Levy 4

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 26.79		C	17.2	GA	60.0	Y	6		0.5		2.6m	253	NAK01
1996 08 24.77		C	16.4	GA	60.0	Y	6		0.85		2.4m	254	NAK01
1996 09 10.79		C	16.3	GA	60.0	Y	6		0.6		1.6m	260	NAK01
1996 10 10.74		C	15.3	GA	60.0	Y	6		0.8		2.2m	283	NAK01
1996 10 13.10		S[	14.4	HS	44.5	L	5	230	1				SAR02
1996 10 14.08		S	14.0	HS	44.5	L	5	230	0.8	2			SAR02
1996 10 22.75		C	14.8	GA	60.0	Y	6		1.1		3.2m	265	NAK01

Comet 119P/Parker-Hartley

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 13.12		S	14.5:	HS	44.5	L	5	230	1	2			SAR02
1996 10 14.09		S	14.4	HS	44.5	L	5	230	1	2			SAR02

Comet 122P/de Vico

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1995 09 25.14		S	5.6	AA	5.0	B		7		7			DIJ
1995 10 02.15		S	5.5	AA	8.0	B		15		7			DIJ
1995 10 06.14		S	5.4	AA	5.0	B		7		8			DIJ

Comet 122P/de Vico [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1995 10 24.74		S	6.2	AA	5.0	B		7		7			DIJ
1995 10 24.74		S	6.2	AA	5.0	B		10	3	8	1.5	350	MOE
1995 10 28.74		S	6.5	AA	5.0	B		10	3	8	1.1	0	MOE
1995 10 29.73		S	6.6	AA	5.0	B		10	2.5	8			MOE
1995 10 29.76		S	6.5	AA	8.0	B		15		7			DIJ

Comet 123P/West-Hartley

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 03 09.85		S	[13.8	HS	44.0	L	5	156					HAS02

Comet 125P/Spacewatch

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 04 07.55		C	16.9	GA	60.0	Y	6		0.3				NAK01
1996 04 10.62		C	17.0	GA	60.0	Y	6		0.3				NAK01
1996 04 22.57		C	16.9	GA	60.0	Y	6		0.3				NAK01
1996 05 15.55		C	16.6	GA	60.0	Y	6		0.35				NAK01
1996 05 22.51		C	16.7	GA	60.0	Y	6		0.3			135	NAK01
1996 06 06.52		C	16.6	GA	60.0	Y	6		0.3			125	NAK01
1996 07 10.50		C	15.7	GA	60.0	Y	6		0.4		1.5m	127	NAK01
1996 07 10.61		C	15.9	HS	28.0	T	6		0.4		?		KIN
1996 07 15.51		C	15.7:	GA	60.0	Y	6		0.4		1.3m	123	NAK01
1996 08 12.48		C	15.5:	GA	60.0	Y	6		0.5		1.2m	115	NAK01
1996 08 19.48	a	C	15.8:	GA	60.0	Y	6		0.5		1.5m	117	NAK01
1996 09 02.45	a	C	16.0	GA	60.0	Y	6		0.5		1.4m	104	NAK01

Comet 126P/IRAS

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 11.57		S	[12.0:		20.3	L	7	56	1				CAM03
1996 09 04.48		S	11.6	GA	25.4	L		71					SEA
1996 09 09.49		S	[12.0:		20.3	L	7	56	1				CAM03
1996 09 10.45		S	[12.0:		20.3	L	7	56	1				CAM03
1996 09 16.54		S	12.0	GA	20.3	L	7	56	1	3			CAM03
1996 09 17.47		S	12.0	GA	20.3	L	7	56	1	3			CAM03
1996 09 21.58		S	10.7	HS	41.0	L	6	80	3	4			KOB01
1996 10 11.91	w	S	11.7	NP	21.0	L	6	60	2	2			MAR02
1996 10 11.92	w	S	11.6	NP	21.0	L	6	60	3	2			SAN04
1996 10 12.76	!	S	11.9	HS	44.5	L	5	230	1.2	1			SAR02
1996 10 12.77	!	S	11.9	HS	44.5	L	5	230	0.7	3			BAK01
1996 10 13.78	!	S	12.3	HS	44.5	L	5	230	1.2	2			SAR02
1996 10 14.51		S	12.0	GA	20.3	L	7	56	2	1			CAM03
1996 10 14.58		S	11.8	GA	25.4	L	4	71					SEA
1996 10 15.47		S	11.8	GA	25.4	L	4	71					SEA
1996 10 30.46		S	12.0	GA	20.3	L	7	56	1	3			CAM03

Comet P/1996 N2 (P/Elst-Pizarro)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 02.53		C	17.5	GA	60.0	Y	6		0.25		4.9m	253	NAK01
1996 09 14.58		C	17.5	GA	60.0	Y	6		0.3		3.4m	254	NAK01
1996 10 04.51		C	18.0	GA	60.0	Y	6		0.25		2.1m	255	NAK01
1996 10 16.50		C	18.0	GA	60.0	Y	6		0.25		3.4m	256	NAK01

Comet P/1996 R2 (P/Lagerkvist)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 14.60		C	16.9	GA	60.0	Y	6		0.45				NAK01
1996 09 18.66		C	16.8	GA	60.0	Y	6		0.5				NAK01
1996 10 12.90		S	15.0	HS	44.5	L	5	230	0.7	5			BAK01
1996 10 12.90		S	15.1	HS	44.5	L	5	230	0.5	4			SAR02
1996 10 13.85		S	15.0:	HS	44.5	L	5	230	0.7	3			SAR02

AUTHOR INDEX TO The Comet; Comet Quarterly; AND ICQ: 1973-1996

Below is a list of the individual issues of the *ICQ*, 1979-1996:

Vol. 1, No. 1 (Whole No. 29): January 1979, pages 1-10
Vol. 1, No. 2 (Whole No. 30): April 1979, pp. 11-26
Vol. 1, No. 3 (Whole No. 31): July 1979, pp. 27-46
Vol. 1, No. 4 (Whole No. 32): October 1979, pp. 47-58
Vol. 2, No. 1 (Whole No. 33): January 1980, pages 1-20
Vol. 2, No. 2 (Whole No. 34): April 1980, pp. 21-40
Vol. 2, No. 3 (Whole No. 35): July 1980, pp. 41-64
Vol. 2, No. 4 (Whole No. 36): October 1980, pp. 65-88
Vol. 3, No. 1 (Whole No. 37): January 1981, pages 1-32
Vol. 3, No. 2 (Whole No. 38): April 1981, pp. 33-64
Vol. 3, No. 3 (Whole No. 39): July 1981, pp. 65-92
Vol. 3, No. 4 (Whole No. 40): October 1981, pp. 93-116
Vol. 4, No. 1 (Whole No. 41): January 1982, pages 1-36
Vol. 4, No. 2 (Whole No. 42): April 1982, pp. 37-52
Vol. 4, No. 3 (Whole No. 43): July 1982, pp. 53-76
Vol. 4, No. 4 (Whole No. 44): October 1982, pp. 77-112
Vol. 5, No. 1 (Whole No. 45): January 1983, pages 1-28
Vol. 5, No. 2 (Whole No. 46): April 1983, pp. 29-48
Vol. 5, No. 3 (Whole No. 47): July 1983, pp. 49-80
Vol. 5, No. 4 (Whole No. 48): October 1983, pp. 81-108
Vol. 6, No. 1 (Whole No. 49): January 1984, pages 1-32, I-1 to I-4
Vol. 6, No. 2 (Whole No. 50): April 1984, pp. 33-52
Vol. 6, No. 3 (Whole No. 51): July 1984, pp. 53-78
Vol. 6, No. 4 (Whole No. 52): October 1984, pp. 79-102
Vol. 7, No. 1 (Whole No. 53): January 1985, pages 1-28, I-1 to I-4
Vol. 7, No. 2 (Whole No. 54): April 1985, pp. 29-68
Vol. 7, No. 3 (Whole No. 55): July 1985, pp. 69-84
Vol. 7, No. 4 (Whole No. 56): October 1985, pp. 85-108
Vol. 8, No. 1 (Whole No. 57): January 1986, pages 1–40, I-1 to I-4
Vol. 8, No. 2 (Whole No. 58): April 1986, pp. 41–72
Vol. 8, No. 3 (Whole No. 59): July 1986, pp. 73–112
Vol. 8, No. 4 (Whole No. 60): October 1986, pp. 113–152
Vol. 9, No. 1 (Whole No. 61): January 1987, pages 1–56, I-1 to I-2
Vol. 9, No. 2 (Whole No. 62): April 1987, pp. 57–96
Vol. 9, No. 3 (Whole No. 63): July 1987, pp. 97–136
Vol. 9, No. 4 (Whole No. 64): October 1987, pp. 137–176
Vol. 9, No. 5: December 1987, pp. H1-H56 [*1988 Comet Handbook]*
Vol. 10, No. 1 (Whole No. 65): January 1988, pages 1–32
Vol. 10, No. 2 (Whole No. 66): April 1988, pp. 33–64
Vol. 10, No. 3 (Whole No. 67): July 1988, pp. 65–92
Vol. 10, No. 4 (Whole No. 68): October 1988, pp. 93–124
Vol. 10, No. 5: December 1988, pp. H1–H56 [*1989 Comet Handbook]*
Vol. 11, No. 1 (Whole No. 69): January 1989, pages 1–28
Vol. 11, No. 2 (Whole No. 70): April 1989, pp. 29–36
Vol. 11, No. 3 (Whole No. 71): July 1989, pp. H-1 to H-52 [*1990 Comet Handbook]*
Vol. 11, No. 4 (Whole No. 72): October 1989, pp. 37–56
Vol. 12, No. 1 (Whole No. 73): January 1990, pages 1–40
Vol. 12, No. 2 (Whole No. 74): April 1990, pp. 41–72
Vol. 12, No. 3 (Whole No. 75): July 1990, pp. 73–106
Vol. 12, No. 4 (Whole No. 76): October 1990, pp. 107–171
Vol. 13, No. 1 (Whole No. 77): January 1991, pages 1–66
Vol. 13, No. 2 (Whole No. 78): April 1991, pp. 67–86
Vol. 13, No. 3 (Whole No. 79): July 1991, pp. 87–142
Vol. 13, No. 4 (Whole No. 80): October 1991, pp. 143–184
Vol. 14, No. 1 (Whole No. 81): January 1992, pages 1–28
Vol. 14, No. 2 (Whole No. 82): April 1992, pp. 29–52

Vol. 14, No. 3 (Whole No. 83): July 1992, pp. 53–84
Vol. 14, No. 4 (Whole No. 84): October 1992, pp. 85–125
Vol. 15, No. 1 (Whole No. 85): January 1993, pages 1–56
Vol. 15, No. 2 (Whole No. 86): April 1993, pp. 57–102
Vol. 15, No. 3 (Whole No. 87): July 1993, pp. 103–138
Vol. 15, No. 4 (Whole No. 88): October 1993, pp. 139–182
Vol. 16, No. 1 (Whole No. 89): January 1994, pages 1–28
Vol. 16, No. 2 (Whole No. 90): April 1994, pp. 29–78
Vol. 16, No. 3 (Whole No. 91): July 1994, pp. 79–124
Vol. 16, No. 4 (Whole No. 92): October 1994, pp. 125–183
Vol. 17, No. 1 (Whole No. 93): January 1995, pages 1–46
Vol. 17, No. 2 (Whole No. 94): April 1995, pp. 47–82
Vol. 17, No. 3 (Whole No. 95): July 1995, pp. 83–158
Vol. 17, No. 4 (Whole No. 96): October 1995, pp. 159–220
Vol. 18, No. 1 (Whole No. 97): January 1996, pages 1–42
Vol. 18, No. 2 (Whole No. 98): April 1996, pp. 43–100
Vol. 18, No. 3 (Whole No. 99): July 1996, pp. 101–178
Vol. 18, No. 4 (Whole No. 100): October 1996, pp. 179–300

This index is intended to catalogue the main textual items (articles) published in this publication over the years; tabulated and descriptive individual observations of comets are generally not indexed here. This author index follows the style used in RECENT indices in the *ICQ*, using the format **(Volume)**:(page number); for example, [**10**:113] indicates page 113 of Volume **10**, which was in the October 1988 issue (ascertained from the listing at the top of this page). In the case of items published in *The Comet* and *The Comet Quarterly* (*i.e.*, before Vol. 1 of the *ICQ*), the Whole Number is specified parenthetically. Page numbers prefixed by "I-" indicate index pages, and those prefixed by "H-" indicate pages in the annual *Comet Handbook*. This index lists first authors alphabetically (and then chronologically); an alphabetical cross-reference list for co-authors (second and third authors) is given at the end. (Note that the indices to this journal, by the Editor, are not indexed below.) —D.W.E.G.

Co-author cross-reference list. Co-authors (those who are not the lead authors to a paper) are listed alphabetically below; the references are to the lead authors (refer to the list above). In some cases, there are numerous such references per co-author.