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— Table of Contents —

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

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Corrigendum

In the October 1996 issue, page 283, "Comet C/1996 Q1 (Tabur)", the observation on 1996 10 13.40 by observer NAGO2 is to be deleted.

A Large Comet Seen in 135 BC?

Gary Kronk
Troy, Illinois

A series of accounts published in both China and Rome during the 2nd century BC contain some descriptive details regarding apparent celestial objects that are remarkably similar. In all, there are accounts of four such objects seen in China and three objects seen in Europe. Although it is possible that the accounts refer to seven distinct objects, arguments are presented to suggest the descriptions refer to a spectacular comet that appeared around the summer and autumn of −134, as well as a nova in July −133.

Cometography

In the course of researching *Cometography*, I have encountered many interesting observations of ancient and medieval objects. The challenge has been in determining which were comets, which were novae, and which were figments of somebody's imagination.

for the most part, Chinese sources have a high degree of accuracy. If a comet or nova was reported, it probably existed; however, there are two notable problems. First, one celestial object reported by the Chinese throughout history was called the "po", which meant "sparkling star". The term was unfortunately applied to both comets and novae. Researchers hope that, when this term is encountered, it will be accompanied by multiple observations to indicate motion, but this is not always the case. The second problem is that the sources reporting these objects are rarely contemporary, and dating errors are always possible. For the period of time discussed in this paper (the 2nd century BC), the *Shih chi* and the *Han shu* are the oldest sources.

The *Shih chi* was compiled by Ssu-ma T'an and Ssu-ma Ch'ien and was finished around −90. The *Han shu* was completed around 100 and, although it was mostly compiled by Pan Ku (100), his death around 92 A.D. prompted Ma Hsu to complete the astronomical chapters. The *Han shu* reported most of the astronomical objects seen in ancient times, but an interesting problem arises: when the *Shih chi* reported an astronomical object, it rarely confirmed observations listed in the *Han shu*. There were historians who once thought that the *Han shu* was derived from the *Shih chi*, but these opinions have changed. The fact that the *Han shu* gives much information that is ignored by the *Shih chi* has prompted modern historians to believe either that the two texts were independently written or that a once-badly-damaged *Shih chi* might have been reconstructed from the *Han shu*.

While searching for astronomical objects reported in ancient Europe, most of the texts end up originating from Rome. Rome used their own calendar system that was based on the apparent year of its foundation, which was around −760. Unfortunately, even with a calendar system in place, most Roman writers were rarely concerned with giving exact dates for events. The Roman historian Titus Livy was one of the few to date events on a regular basis — but his work, the multiple-volume *History of Rome*, defines a new problem for researchers: the Romans were very superstitious and believed very strongly in astrological signs. Virtually none of Livy's celestial objects can be linked to objects that were reported in China. The Roman "celestial objects" were always reported as portents by Livy, and were considered a sign of some major event in Roman history. One must wonder how many of Livy's celestial objects were actually real and were moved to a more "appropriate" year to help bolster the significance of some Roman event. When looking through the texts of other ancient Roman writers, one cannot help but notice that celestial objects are nearly always said to be portents to notable events. This raises an important question: When dates are given for astronomical objects in Roman texts, should they be considered accurate?

A Clustering of Objects in the 2nd Century BC

Not long after I began examining the ancient Chinese accounts from Ho Peng Yoke (1962), it became obvious that an unusual group of comet and nova accounts existed in the 2nd century BC. Despite this, however, I refrained from making any rash assumptions until I was sure that I had all available observations for the objects. Subsequently, I found accounts referring to two comets and one nova in Roman texts that historians had dated around the same period of time.

Why does this clustering seem so suspicious? First, there were 12 celestial objects observed in China, Rome, and Babylon during the period −137 to −133. This is a significant number in light of the fact that no comets or novae were reported from any country during the eight years prior to −137 and during the 13 years following −133. Five of these objects, which will not be discussed in this paper, were reported by the Chinese and Babylonians during −137 and −136. These observations apparently account for three comets. Of the remaining seven objects, four were dated by lunar month and occurred during the summer and early autumn, representing the second point of curiosity about the clustering. There was also a third intriguing aspect of the clustering: four of the physical descriptions indicated a comet of immense size. Especially notable were the Chinese accounts of the comets of −134 and −133, which claimed that the comets were "stretching across the heavens." This phrase had previously been used by the Chinese for a comet in −237

and was not used again until over 250 years later, in 128. These points inspired me to concentrate on the years −134 and −133 to see if the four Chinese and three Roman reports were somehow related.

The Evidence

Four objects were recorded in China during the years −134 and −133, and these are listed below. All three of the Roman objects were not dated by the writers, but are included here because of their descriptions — and the fact that historians have placed them either in, or near, the years of the Chinese objects.

- −134 July 3 to August 1. The *Han shu* said that a "sparkling star" was "seen in the north" sometime during this, the sixth, lunar month.
- −134 August 31 to September 29. The *Han shu* said that a "long-tailed star" appeared sometime during this, the eighth, lunar month. The object "appeared in the east, stretching across the heavens. It lasted 30 days before leaving."
- −133 June 22 to July 21. The *Han shu* said that a "guest star" appeared sometime during this, the sixth, lunar month. It "appeared at the Fang [β, δ, π, and ρ Scorpii]."
- −133 August 21 to September 18. The Chinese text *T'ung chien kang mu* (1189) said that a "long-tailed star" appeared sometime during this, the eighth, lunar month. It "stretched across the heavens. Hence the reign-period was changed." The *Shih chi* said "The second reign-period was called Yuan-Kuang because of the appearance of a long-tailed star."
- The Roman historian Lucius Annaeus Seneca finished *Quaestiones Naturales* around 63. He wrote, "In the reign of Attalus a comet appeared, of moderate size at first. Then it rose up and spread out and went all the way to the equator, so that its vast extent equaled the region of the sky which is called the Milky Way." Seneca did not give a specific date (Corcoran 1972).
- The Roman scholar Pliny the Elder wrote *Natural History* around 77. He said Hipparchus of Nicaea "discovered a nova that came into existence in his lifetime" (Rackham 1938). The contemplation of this nova led Hipparchus to compile a catalogue of 850 stars, which was completed in −128. Hipparchus was born around −180 and died around −126.
- The Roman historian Marcus Junianus Justinus wrote *Epitome, an abridgment of the Historiae Philippicae et totius mundi origines et terrae situs by Pompeius Trogus* during the 3rd century (Yardley 1994). In one section, he stated that on the occasions of both the birth and death of Mithradates VI Eupator "a comet burned so brightly for 70 days that the entire sky seemed to be on fire. In its greatness it filled a quarter of the heavens, and with its brilliance it outshone the sun, while its rising and setting each took a period of four hours." Historians typically date the birth of Mithradates VI Eupator as having occurred sometime between −133 and −131.

Treatment by Astronomers of the Past

Knowledge of all of these accounts was apparently not available until the latter part of the 20th century, so when A. G. Pingré (1783) became the first person to consider some of these objects, he knew only of the two Chinese objects of −134, and the comets of Attalus III and Mithradates VI Eupator. The two Chinese objects were grouped together, the comet of Attalus III was placed in −136, and statements were made suggesting that the comet of Mithradates VI Eupator had come in either −136 or −134.

J. Williams (1871) dealt exclusively with Chinese comets. When he wrote *Observations of Comets: From 611 B.C. to A.D. 1640*, three of the Chinese objects were known: the object of −133 July, that of −134 July, and that of −134 September. Williams treated each of these objects separately, although he did make one mistake by claiming the object of −134 July was seen in the west, rather than the north.

Comets were not the subject of articles written by Knut Lundmark (1921) and Hsi Tse-Tsung (1958). These astronomers were interested in compiling lists of likely novae observed during ancient and medieval times. Both included the Chinese object of −133 July in their lists, but came to different conclusions as to what it may have been. Lundmark noted that the probability was low that it was a real nova and noted that arguments had previously been made to support its identity as a comet. On the other hand, Hsi Tse-Tsung considered that this was the "nova" that inspired Hipparchus to produce his famous catalogue of stars, adding, "This is the first nova recorded in both Chinese and Western histories."

Ho Peng Yoke (1962) produced a very important catalogue of comets and novae from Chinese historical texts; he did not rely on any previous translations and uncovered all four of the Chinese accounts given above. Ho Peng Yoke did not group any of the objects together but chose to list them as four separate objects. He did, however, state that when dealing with the September −133 comet, "There is some likelihood that the commentator of *TCKM* [*T'ung chien kang mu*] has confused this with the September −134 comet...."

Ichiro Hasegawa (1980) followed Ho Peng Yoke in listing the four Chinese accounts as separate objects. Interestingly, he placed the comets of Attalus III and Mithradates VI Eupator in −136 and listed them as separate objects. Hasegawa's sources were Pingre, Williams, and Ho Peng Yoke.

Finally, a large appendix entitled "Naked-Eye Comets Reported Through A.D. 1700" appears in the book by Donald Yeomans (1991); of the objects listed above, he mentions the Chinese comets of −134 July, −134 September, and −133 September, as well as the comets of Attalus III and Mithridates VI Eupator. The comet seen during the reign of Attalus III was listed with a Chinese comet seen in −136, and the comet that was seen when Mithridates VI Eupator was born was included with the Chinese comet of −133 September. Interestingly, despite the placement of Mithridates' comet

in −133, Yeomans cast doubt on the Chinese comet by reiterating Ho Peng Yoke's suggestion that the comet of −133 September might be a confused account of the comet of −134 September.

Discussion: The Chinese Objects

Before an analysis can take place, the various problems with each of the observations must be discussed. Since the Chinese observations are the only ones that provide dates, they seem the likely starting place.

At first glance, the Chinese observations are certainly suspicious. For both the years −134 and −133, we have objects reported during the 6th and 8th months. The objects seen during the 6th month were referred to as a "sparkling star" in −134 and a "guest star" in −133 — two terms frequently used to describe novae in Chinese historical texts. Meanwhile, the objects seen during the 8th months of −134 and −133 were both described as "long-tailed stars". The *Han shu* reports three of these objects, but the fourth — that of the 8th month of −133 — is reported by the *Shih chi*, as well as another Chinese text, the *TCKM*.

The *TCKM* gives most of the details for the "long-tailed star" of −133 September, but this book is hardly an original text; both Ho Peng Yoke (1962) and Christopher Cullen (1991) have said that it was heavily based on the *Tzu chih t'ung chien* (*TCTC*), yet another historical text, which was completed in 1084 by Ssu-ma Kuang. Cullen has stated that Kuang "was admired more for his moral and political stature than for his literary achievements." Although the latter years covered by the *TCTC* could have been original, the earlier years must have been derived from already-existing historical texts. This means that the *TCKM* was providing at least third-hand information when it came to its ancient astronomical accounts. There are numerous examples through ancient times where the *TCKM* was the only existing source of some astronomical accounts, many of which seem to fall within the last half of the 2nd century BC.

Ho Peng Yoke said that the comet of September −133 might have been a confused account of the comet seen in September −134. Certainly the descriptions are similar. Both were seen during the 8th lunar month of the year. Both were said to have "stretched across the heavens." Both were referred to as a "chhang-hsing", which translates to "long-tailed star". But what about the account given in the *Shih chi*? This text would have been completed only about 43 years after the appearance of this comet. Interestingly, the *Shih chi* gives no details of the comet of September −133; it simply said that the reign period changed from Chien-Yuan to Yuan-Kuang because of the appearance of a "long-tail star." It could be possible that the appearance of a spectacular comet during September −134 prompted the Chinese to change the reign period to Yuan Kuang as soon as the new year began on −133 January 26. Therefore, considering the likelihood that ancient dates could be in error in the *TCKM*, and since the *Shih chi* did not actually say a comet was seen in −133, it is probable that there was no comet in September of that year. We are now left with three Chinese objects: −134 July, −134 September, and −133 July.

It would be simple to suggest that the objects of −134 July and −133 July were identical, but the matter is not as clear-cut as with the September objects. First, they were both reported by the same source, the *Han shu*. Second, they were described differently: a "sparkling star" in −134 and a "guest star" in −133. Third, they were in different areas of the sky: the object of −134 was in the north, while that of −133 was in Scorpius, which was then near the southern horizon. Each point could be debated to some degree, but in this case, a much simpler approach would be to assume that the two accounts refer to two distinct objects. Thus, no further discussion is probably needed. We are still left with three Chinese objects: a comet or nova in −134 July, a comet in −134 September, and a nova in −133 July.

For the sake of completeness, there is one other investigation that should be pursued: could the object that was seen during the 6th month of −134 be the same as the object seen during the 8th month of the same year? It seems very unlikely that one account is a poorly copied version of the other, as too many errors would need explaining, but could the "sparkling star" of the 6th month be an early observation of the "long-tailed star" seen in the 8th month? With the evidence at hand, it would be impossible to say for certain, but such an assumption would indicate that the comet first appeared in the northern sky and would have last been seen in the east. The duration of the comet's visibility can be estimated. During −134, the sixth lunar month began on July 3 and ended on August 1, while the eighth lunar month began on August 31 and ended on September 29. The shortest possible duration indicated by these dates would be 31 days, and it would be achieved by assuming that the first object was seen on August 1, while the second object was first seen on August 31. The longest possible duration would be 89 days and would have been achieved by assuming that the first object was seen on July 3, while the second was seen on September 29. But the duration is actually longer than these dates, because the September object remained visible for 30 days. Thus, if the two objects were different observations of the same object, this comet's total duration of visibility would have been somewhere between 61 and 119 days.

Discussion: The Roman Objects

The Roman observations are more difficult to use. We have descriptions but no exact dates. Seneca provided the oldest somewhat-datable account of a comet around this period; he told of a comet that appeared during the reign of Attalus. Historians agree that Seneca was talking about Attalus III, king of Pergamum, who ruled from −137 until −132. Seneca's description mentioned how the comet increased from a moderate size to an extent that "equaled the region of the sky which is called the Milky Way" (Corcoran 1972). In dark skies the Milky Way can be seen stretching completely across the sky. Although A. A. Barrett (1978) dated this comet as −136 (which I have found is agreed to by other historians), it should be noted that the comet can not be dated through the use of Seneca's text. When looking at Chinese and Babylonian texts, we see that there were comets seen in −137 and possibly −136, but the descriptions do not indicate anything unusual. In fact, the three Chinese objects of −137 were all described as "sparkling stars", so the comet's tail was not even worthy of being discussed. Only the Chinese comet of −134 September is described in a way

that is similar to that for the spectacular object seen by Attalus III.

Pliny the Elder briefly discusses Hipparchus, a prominent astronomer and mathematician of ancient Greece. Hipparchus observed a nova at one point in his life, and as Pliny noted, "He was led to wonder with regard to this star, because of the change in the brightness with which it flared up, whether this happened quite frequently and whether the stars we think are fixed actually move" (Rackham 1938). This curiosity resulted in the creation of a catalogue containing 850 stars, listed with their positions and brightnesses. Although the birth-year of Hipparchus is not known, his year of death is commonly accepted as −126, and the star catalogue was among the final achievements in his life. Many astronomers have set the year of the star catalogue's completion as −128, so the nova that inspired this work must have been only a few years earlier. Although it was stated above that Hsi Tse-Tsung claimed that the nova of Hipparchus was the same as the Chinese object of −133 July, it should be noted that other sources list −133 as the year of Hipparchus' observation. It seems obvious that, if Hipparchus was inspired by an object to create a catalogue of fixed stars, then the object must have indeed been a non-moving object and was, in all liklihood, a real nova. Since the Chinese object of −133 July seems to have been a nova, and considering the date was only five years prior to the completion of the star catalogue of Hipparchus, it seems possible these objects were the same.

Justinus may have written his book during the 3rd century, but he acknowledged that it was a summary of an earlier work by Pompeius Trogus. Interestingly, even though Trogus' book no longer exists, it is known to have been based on a still-older work, also no longer existent, entitled *History of Kings*, which was written by Timagenes of Alexandria. Considering that Timagenes lived around −54, he must have borrowed from a yet-older text. Despite all of this, the material in the book of Justinus has proven valuable to students of the Hellenistic world, because it does give much information that has been proven accurate. Nevertheless, is this "comet" just another portent created or modified in order to raise the significance of Mithradates VI Eupator? Numerous facts are given, and for all practical purposes, only two seem suspicious and worthy of some discussion.

Justinus said that the comet "outshone the sun" (Yardley 1994). No comet has ever been proven to outshine the sun — not even comets of the sungrazing family, which have the potential of attaining among the greatest brightnesses among comets. But if it is assumed that this point was an exaggeration, does this make the comet any less significant? Hardly. Other portions of the description of Justinus continue to indicate that this was a great comet. After all, it was visible for 70 days, it filled a quarter of the sky, and it took four hours to rise and set! It is probably more accurate to state that this comet was certainly of exceptional brilliance!

The other potential point of debate is the fact that Justinus said that comets were seen at the birth and death of Mithradates VI Eupator (Yardley 1994). In fact, the same description was used for each comet. One of the points of this paper is to investigate whether the comet that was seen at the birth of Mithradates VI Eupator was the same as the Chinese comet of −134 — but was a comet seen at the time of his death? Yes, a comet was seen in both China and Babylon during the spring of −119. No special mention is made of the tail, but the Babylonians indicated that it remained visible for at least 56 days. What is the likelihood that a prominent person would have bright, long-duration comets in the sky at the time of their birth and death? Overall, it is not very likely, but certainly not impossible. The most famous example is perhaps that of Mark Twain, who was born when Halley's comet was in the sky in 1835 and then died upon the same comet's return in 1910.

Analysis

From the discussions above, it is obvious that problems and assumptions abound when the Chinese and Roman observations were looked at separately. What happens when they are looked at together?

Do the observations agree as to the duration of visibility? The only duration indicated by the Roman observations is the 70 days mentioned by Justinus, while the account of the Chinese comet of −134 September specifically states that the comet remained visible for 30 days. As stated earlier, if it is assumed that both objects seen by the Chinese in −134 were the same, then the total duration would be somewhere between 61 and 119 days. This would agree well with the account of Justinus (Yardley 1994).

Do the observations agree as to the location in the sky? No motion was indicated by the Chinese accounts — but, if it is once again assumed that the two Chinese objects of −134 were the same, then the apparent motion would be from the north to the east. The comet of Attalus III seems to indicate some motion via the statement that the comet "rose up," but there is no indication as to where it rose up from or where it went. The continuation of that statement was that it "spread out and went all the way to the equator," but is this an indication of motion or a description of the tail? If it represents the tail, then the comet had to have risen up from either the north or south, since the equator runs east to west. This is the only explanation for the tail's reaching the equator to have had any real significance. If it represents the motion, the comet would once again have risen from either the northern or southern horizons and then moved to the celestial equator. A location at the equator would, of course, indicate a declination of 0°, and, from Rome, a maximum southern altitude of about 48°. Finally, Justinus says nothing about the motion, but the statement "while its rising and setting each took a period of four hours" (Yardley 1994) could indicate one of two things: (1) the comet sustained its length, at one time taking four hours to rise and, later, four hours to set, or (2) the comet was north of the sun and took four hours to rise in the northeast in the morning sky and then four hours to set in the northwest in the evening sky. The way that the statement is phrased leads me to favor the latter scenario. The sun would have been a short distance north of the celestial equator during most of −134 September. If the comet were due north of the sun, it could very well have been in Virgo, with its tail extending into the region of Bootes, Coma Berenices, and Canes Venatici. The tail could have taken four hours to rise and set and still have had a length of 40° to 50°. The further north the comet was, the shorter the tail would have to be, in order to take four hours to rise and set. If the comet was north of declination +50°, if would never set. Thus, when all of the information is looked at, there is a strong indication that the comet was

first detected in the northern sky.

Do the observations agree as to the description of the comet? An interesting starting place would be the comet of Attalus III. Seneca said this comet was "of moderate size at first. Then it rose up and spread out . . . so that its vast extent equaled the . . . Milky Way" (Corcoran 1972). If the two Chinese observations of −134 are grouped together, we have an indication that the comet first appeared as a "sparkling star" and then grew to become a "long-tailed star," with the tail "stretching across the heavens." Thus, in both accounts, we have an indication that this comet increased in size as time passed and eventually developed a very long tail. To this information we can now add the comet reported by Justinus (see Yardley 1994), which exhibited a tail that "filled a quarter of the heavens . . . [and] took a period of four hours" to rise and set. If taken literally, a tail extending across a "quarter of the heavens" would subtend an angle of about 45°, assuming Justinus was talking about the visible heavens.

Conclusions

There are hundreds of comets reported in ancient and medieval texts. Although the vast majority are probably accurately described, there still exists a large number that are suspicious. The material presented above was an attempt to help sift through a group of suspicious observations reported during the 7th decade of the 2nd century BC. Arguments were presented that assigned the observations to two objects: a comet in −134 and a nova in −133. The assignment of the comets of Attalus III and Mithradates VI Eupator to the Chinese comet of −134 is certainly a delicate matter, considering that those objects were not precisely dated. But the comparison of the physical characteristics is at least intriguing, if not convincing.

What seems to emerge from these accounts is that a comet first appeared during −134 July and was last detected sometime during October. It was a relatively small, virtually tailless object when first detected in the north, but as the comet traversed the sky, the tail grew and probably stretched across at least 45° when at its greatest. Since none of the accounts indicated that the comet decreased in size after attaining its longest tail length, it is probably safe to assume that it remained a notable object until it was lost from sight. The Chinese indicate that the comet was in the eastern sky when displaying its long tail, so an entrance into morning twilight is certainly a possibility.

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ICQ Guide to Observing Comets

The first edition of the *ICQ*'s *Guide to Observing Comets* was finished, printed, and mailed in mid-February. Due to the extensive time taken to finish the first edition of this *Guide*, this January issue of the *ICQ* was necessarily delayed; we should be back on schedule with the April issue.

The first edition of the *Guide to Observing Comets (GOC)* contains 225 pages (with a Foreword by Fred L. Whipple, seven chapters, and eight appendices. The *Guide* is available to *ICQ* subscribers for US$8.00 each (and for $15.00 to non-subscribers); order via the standard *ICQ*-subscription procedures listed on page 2 of this issue. The *Guide*'s chapter titles are "Introduction", "Basic Information", "A Historical Overview of the Observation of Comets", "Visual Observing", "Non-visual Optical Observations", "Observations Outside the Visual Region", and "Astrometry of Comets". Some of the

appendices give full details (and *ICQ* abbreviation keys) for reporting observations to the *ICQ*. Additional contributions for a planned second edition later this summer will add a new chapter on spectroscopy and spectrophotometry.

We encourage readers to contact the *ICQ* Editor regarding any errors that they find in this first edition, for correcting in a planned second edition for September 1997. One such typographical error occurs on page 130, where "Tables x.2 and x.3" and "Tables x.2-x.6" should read "Tables F.2 and F.3" and "Tables F.2-F.6", respectively (meaning that they are in Appendix F).

About 75-80 percent of the *Guide* was written and compiled by D. W. E. Green, with about 20 comet experts contributing to the remaining 25-30 percent of the book. The following comet observers/scientists contributed some two or more pages to the first edition of the *Guide*: John E. Bortle (Stormville, NY), Jacques Crovisier (Observatoire de Paris, Meudon), Bojan Dintinjana (University of Ljubljana), Paul D. Feldman (Johns Hopkins University), Robert D. Gehrz (University of Minnesota), Brian G. Marsden (Harvard-Smithsonian Center for Astrophysics), Karen J. Meech (Institute for Astronomy, University of Hawaii), Herman Mikuž (Crni Vrh Observatory, Slovenia), Charles S. Morris (*ICQ* and Jet Propulsion Laboratory), Petr Pravec (Ondřejov Observatory, Czech Republic), F. Peter Schloerb (University of Massachusetts), and Fred L. Whipple and Gareth V. Williams (Harvard-Smithsonian Center for Astrophysics). Other contributors included Claude Arpigny, Konrad Dennerl, David W. Dunham, Stephen J. Edberg, Stephen M. Larson, Akimasa Nakamura, and Stephen J. O'Meara.

The article below was contributed by Paul Feldman for the *Guide*, provided here as a representative excerpt.

Φ Φ Φ

Ultraviolet Spectroscopy of Comets*

Paul D. Feldman

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The advent of space-borne platforms for astronomical observations in the vacuum ultraviolet has produced a wealth of new information about the volatile constituents of cometary comae over the past 25 years. Spectroscopic observation in this wavelength region, where cosmically abundant atoms and small molecules resonantly fluoresce solar photons, is an extremely powerful tool for determining the relative abundances of the vaporizing species and for studying the photochemical and physical processes acting in the densest region of the coma. The $A^2\Sigma^+$–$X^2\Pi$ (0,0) band of the hydroxyl radical at ~ 3085 Å was well known from ground-based spectroscopic observations, but as this wavelength lies very close to the edge of the atmospheric transparency window, the strength of this feature (relative to that of other species) was not appreciated until 1970, when comet C/1969 Y1 (Bennett) was observed from space by the *Orbiting Astronomical Observatory* (*OAO-2*). The *OAO-2* spectrum also showed a very strong, broadened H I Lyman-α emission (at 1216 Å) from hydrogen, the other principal dissociation product of H_2O. The broad shape of Lyman-α seen in the *OAO-2* objective grating spectrum is due to the large spatial extent of the atomic hydrogen envelope, the result of a high velocity acquired in the photodissociation process and a long lifetime against ionization.

Four years later, at the apparition of comet C/1973 E1 (Kohoutek), atomic oxygen and carbon were identified in the spectra, and direct ultraviolet images of the hydrogen coma (as well as of the O I and C I emissions) were obtained from sounding-rocket experiments. These experiments were repeated in March 1976 for comet C/1975 V1 (West) and led to the first detection of a "parent" molecule, CO, which fluoresces in the Fourth Positive system ($A^1\Pi_u$–$X^1\Sigma^+$) with its strongest bands between 1400 and 1600 Å [Feldman and Brune 1976].

Between 1978 and its shutdown in September 1996, over 50 comets [including, most recently, C/1996 B2 (Hyakutake) and C/1995 O1 (Hale-Bopp)] were observed spectroscopically over the wavelength range of 1200–3400 Å by the *International Ultraviolet Explorer* (*IUE*) satellite observatory [a review of the principal results through 1986 was given by Festou and Feldman 1987]. Most of the spectra were obtained at moderate resolution ($\Delta\lambda$ = 6-10 Å), although high-dispersion echelle spectra ($\Delta\lambda$ = 0.2-0.3 Å) are useful for some studies, particularly those of fluorescence equilibrium. For 1P/Halley alone, over 200 ultraviolet spectra were obtained over a period extending from September 1985 through July 1986, with the exception of a two-month period around perihelion due to the 45° solar avoidance requirement of the satellite's telescope [Feldman *et al.* 1987].

In addition to those observations made by the *IUE*, ultraviolet spectra of comet 1P/Halley were obtained by two different U.S. sounding rocket experiments [Woods *et al.* 1986; McCoy *et al.* 1986] and by the Soviet Union's *ASTRON* satellite [Feldman *et al.* 1993]. Two other spacecraft intended for other objectives were also able to obtain large-scale H I Lyman-α images of comet 1P/Halley, the *Pioneer Venus Orbiter*, in orbit around Venus since 1978 [Stewart 1987], and the *Dynamics Explorer-1* satellite, launched in 1981 [Craven and Frank 1987]. The ultraviolet spectrometer on *PVO* also measured the coma emissions of atomic oxygen and carbon. The results from all of these observations have been discussed in detail by Feldman [1991].

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* The following article appears in Chapter 6 of the new *ICQ Guide to Observing Comets*; it substantially updates an earlier review article on the same topic by Feldman [1985].

The launch of the *Hubble Space Telescope* (*HST*) in 1990, whose aberrated optics were corrected in December 1993, marks another advance in sensitivity as well as the ability to observe in a small field-of-view very close to the nucleus. Already this has yielded the first detection of CO Cameron band emission, a direct measure of CO_2 being vaporized from the nucleus [Weaver *et al.* 1994]. For an overview of a cometary spectrum, a composite spectrum of 103P/Hartley 2 (spanning the region from H I Lyman-α to 7000 Å), taken with the Faint Object Spectrograph (FOS) of *HST* using five separate gratings, is shown in Figure 1. This approach has the advantage of providing a complete inventory of the volatile species in the inner coma, including those regularly monitored from the ground, with a single aperture and over a short period of time. The figure illustrates the relative weakness of the ultraviolet emission features, due to the decreasing solar exciting flux towards shorter wavelengths, as well as the problem of long-wavelength grating scattered light inherent in ultraviolet spectrographs that do not use solar blind detectors.

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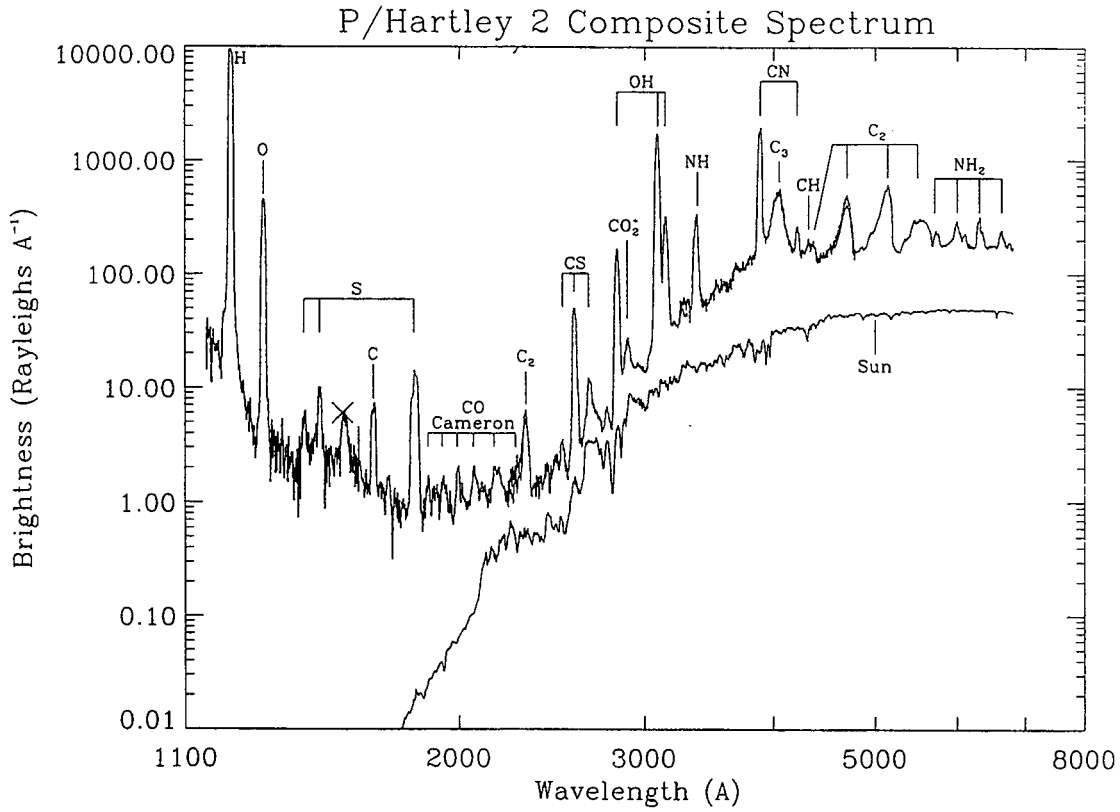

Figure 1. Composite FOS spectrum of comet 103P/Hartley 2. From Weaver and Feldman [1992].

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In addition to high resolution cometary imaging, which will not be discussed here, the primary use of *HST* is for ultraviolet spectroscopy, again in the range 1200–3100 Å. Both of the spectrographs on *HST*, the FOS and the Goddard High Resolution Spectrograph (GHRS) have significant advantages over *IUE* in terms of sensitivity and spatial resolution. For example, both D/1993 F2 (Shoemaker-Levy 9) and C/1995 O1 (Hale-Bopp) were observed at heliocentric distances greater than 5 AU. The detection of CO Cameron band ($a^3\Pi$–$X^1\Sigma^+$) emission in comet 103P/Hartley 2, as well as in comet C/1991 T2 (Shoemaker-Levy), has already been noted above. Perhaps the most important *HST* results were produced by the campaign to observe comet C/1996 B2 (Hyakutake) in April 1996. These will be summarized below.

However, we note that the next *HST* servicing mission, scheduled for February 1997, will see these two spectrographs replaced by two new scientific instruments — one of which, the Space Telescope Imaging Spectrograph (STIS), will provide long-slit ultraviolet spectroscopy with an unprecedented spatial resolution along the slit of 50 milliarcseconds. On the other hand, the timing of the servicing mission, together with the *HST* solar-avoidance angle of 50°, means that *HST* will not observe comet C/1995 O1 (Hale-Bopp) near its perihelion in March/April 1997.

The existence of a number of approved *HST* target-of-opportunity programs enabled an extensive campaign of imaging and both low- and high-resolution spectroscopy of comet C/1996 B2 (Hyakutake) in the period 1996 April 1–4. The rapid motion of this comet on the sky near closest approach (0.11 AU) on 1996 March 25 prohibited observations at this earlier date. Nevertheless, extremely good data were obtained, providing some of the highest signal-to-noise ratio ultraviolet spectra of a comet ever obtained, and allowing the region very close to the coma to be probed. The results include the most detailed spectra of CO Fourth Positive and Cameron band emission, the detection of S_2 for only the second time in a comet, as well as the discovery of several new and still-unidentified features. These spectra are still being analyzed and have not yet been published. Perhaps the most exciting result is the detection of S_2 in this comet.

S_2 was discovered serendipitously in comet C/1983 H1 (IRAS-Araki-Alcock) by A'Hearn *et al.* [1983] on 1983 May 11, when the comet (like C/1996 B2), made a close approach to Earth (0.032 AU). The close approach has a "zoom" effect for observers using a fixed field-of-view, allowing a detailed look at the coma closest to the nucleus. This is significant for S_2 because its photochemical lifetime is very short — and so the molecule, presumably evaporated from the nucleus, exists only within a few hundred km of the nucleus. For C/1983 H1, the deduced abundance of S_2 relative to H_2O was ~ 0.001 (comparable to the CS abundance), shortly after an outburst on May 11, and had all but disappeared 28 hours later. Until C/1996 B2, this was the only unambiguous reported detection of S_2 in any celestial object, and its discovery at the time prompted speculation that S_2 may serve as a unique indicator of the physical and chemical conditions at the site of comet formation in the primordial solar nebula. Even so, although the conditions for observing S_2 were unique to comet C/1983 H1 (*i.e.*, very small geocentric distance, Δ), it was also surprising that no trace of it had appeared in any *IUE* spectrum of comets at moderately small Δ, say $\sim$ 0.2-0.5 AU [Budzien and Feldman 1992], or in the spectrum of any comet observed by *HST*. The advantages of *HST* for spectroscopy are obvious from the spectra of comet C/1996 B2, which show the S_2 bands at very high signal-to-noise; yet the derived abundance relative to H_2O is only $\sim 3 \times 10^{-5}$.

There remain other species, still undetected, whose abundance in the cometary coma would provide new information about the origin and composition of the nucleus ice. Primary amongst these are the noble gases He, Ne, and Ar, whose resonance transitions all lie at wavelengths shortward of 1150 Å (the nominal short-wavelength limit of both *IUE* and *HST*). Upper limits on Ar and Ne were derived from spectra of comet C/1990 K1 (Levy) obtained by the Hopkins Ultraviolet Telescope, which flew on the space shuttle *Astro-1* mission in December 1990, but these are not particularly constraining when compared with the predictions of solar nebula models [Feldman *et al.* 1991; Owen and Bar-Nun 1995].

Molecular hydrogen has also been proposed as a possible ice constituent [Bar-Nun and Prialnik 1988], but the most sensitive observations to date near 1608 Å, assuming solar H I Lyman-β pumped fluorescence [Feldman and Fastie 1973], only give an upper limit that is higher than that expected from the H_2O dissociation channel into H_2 and $O(^1D)$. The other species of interest are atomic nitrogen, whose principal resonance transition at 1200 Å is masked by scattered radiation from the strong H I Lyman-α emission at 1216 Å, and O^+ at 834 Å, which should be the dominant ion-tail component in CO-deficient comets. Thus, there is still the expectation of significant new discoveries to be made by with new instrumentation such as STIS on *HST*, and for the spectral region below Lyman-α, with the *FUSE* mission scheduled for launch in late 1998.

Observations with the ROSAT satellite have now extended detections of cometary signatures into the extreme ultraviolet, at wavelengths of 6-14 nm (60-140 Å). Following an initial detection of C/1996 B2 (Hyakutake) in this wavelength region [Pye *et al.* 1996a] — spurred by the earlier x-ray detection at shorter wavelengths — a search of archival data led to the detections at 6-14 nm of comets C/1990 K1 (Levy) and C/1990 N1 (Tsuchiya-Kiuchi) [Pye *et al.* 1996b].

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Tabulation of Comet Observations

As this issue was delayed due to the completion of the *ICQ Guide to Observing Comets*, those observations contributed on paper will appear in the April issue, to allow this issue to be published as rapidly as possible. The April issue will be published on time, within about 6 weeks of this January issue.

A. Pereira reported discussion with Reinder J. Bouma regarding the comparison-star sequences for C/1996 Q1 (Tabur) in early November, suggesting a problem with the AAVSO sequence for RR Boo, with a systematic difference of $\simeq$ 0.8 mag between that sequence and the RT Boo + RR CrB sequence; a star listed as '89' in the RR Boo sequence was corrected to '83' in a later edition of the *Atlas*, but Pereira notes that this alone does not account for the systematic difference. It has been suggested that comet observers avoid using any AAVSO charts that were created between about 1960 and about 1994, unless it is known that the specific chart in question has a good sequence of star magnitudes; older charts and charts produced by the AAVSO in the last couple of years seem to have fewer problems. Considering comparison against the same stars, Pereira confirmed the impression that the comet was not then varying significantly (a conclusion that may have been drawn by switching from one sequence to another).

For bright comets, we have been informed by *ICQ* Japanese Observation Coordinator Akimasa Nakamura of another instrument that has proven useful to observer Osamu Miyazaki in making visual m_1 estimates. Miyazaki uses a 16-mm-f.l. $f/2.8$ wide-angle (fish-eye) camera lens, with the comet's image and comparison stars viewed on the camera screen (through the viewfinder of the SLR camera). Observers seeking to attempt this method with a bright comet such as C/1995 O1 (Hale-Bopp) should be careful to make sure that the camera screen matte is uniform, as some camera viewfinder screens have non-uniform grids and circles inlaid onto the field-of-view. When reporting photometry in tabulated format for the *ICQ* using such a camera/lens combination, the magnitude method should be given as with all other visual estimates (though this may generally be 'I' for in-focus), the instrument should be given as 'A' for camera, and the *aperture* (in cm, as usual) of the lens must be given (not the lens' focal length!), along with the $f/$-ratio; in the magnification column, please place a '0', which will indicate that this is a visual observation and not a photographic one.

Effective with the April issue, we will be instituting a new datum for all photometry of comets obtained via CCDs. Normally, the magnification columns are left blank for photographic and CCD photometry. We now ask all CCD contributors to submit exposure times for each frame that is used in photometric measurement, as contributed in the *ICQ* tabulated format. Thus, in place of the 4-column magnification, the exposure *in seconds* should be given in the same 4-column format (flush right); if the exposure is less than 1000 seconds long, a lower-case 'a' should be placed in the first column (which is column 44), to flag the fact that exposure time is given rather than magnification — whereas from 1000 seconds onward, the upper-case letters A, B, C, . . . should be used in column 44 to denote exposure times of 1000, 2000, 3000, . . . seconds. Thus, a CCD exposure of 8 seconds will be given as 'a 8', whereas an exposure of 18 minutes (or 1080 seconds) would be given as 'A080'. It is hoped that the catalogued exposure data from CCD exposures will help the attempts to correlate CCD magnitudes with visual data (and with other CCD data).

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

◇ *Comet C/1995 O1 (Hale-Bopp)* $\Longrightarrow$ 1996 Apr. 21.19-Sept. 14.83: comments refer to data tabulated in three previous issues of the *ICQ* for PER01. Apr. 21.19: AAVSO seq. for S Sgr, R Sgr; comet rather close to 8th-mag star [PER01]. Apr. 22.17: coma is definitely larger than 9′; prominent central cond. makes the comet easy in the binoculars; rather large, round outer coma [PER01]. Apr. 23.16: central cond. looks pretty much like a globular cluster superimposed on a weak diffuse coma [PER01]. Apr. 25.16: comet faint in the binoculars; slightly hazy sky [PER01]. May 4.17: comet very obvious in spite of full moon; not seen in 9×34 B; some tail suspected to the SE; faint starlike false nucleus seen [PER01]. May 12.14, June 19.07, and 24.04: comet faint in the binoculars [PER01]. May 22.11, Oct. 20.81, and 27.82: comet is an easy binocular object [PER01].

May 28.00, July 25.00, 30.9, and 31.9: unfiltered CCD frames of cumulative exposures 300, 600, 600, and 600 sec, respectively, taken w/ 33.5-cm reflector (+ Thomson 7895M chip) were process w/ Larson-Sekanina algorithm to show a well-defined anti-solar tail > 6′ long, along with three principal linear jets at p.a. 40°, 145°, and 270° and two more secondary jets emanating from the nuclear region toward the sun (the positions of the jets seem constant during the last week of July); on May 28 the jets were very faint; at the end of July, the luminosity of tail and of linear jets does not appear very different (jets are linear up to 60″-80″ from the nucleus and don't show any tendency to bend in a fountain shape (unlike the large number of fountain jets that we observed from the nuclear region of C/1996 B2 in 1996 Mar./Apr. w/ same equipment, the difference between the two comets' jets possibly linked to the differing heliocentric distances) [F. Manzini, R. Crippa, and C. Guaita, SAS Observatory, near Milano, Italy].

June 13.72: w/ 31.7-cm $f/5$ L (64×), strong cond. at apex of short fan-shaped tail [JON]. June 16-Oct. 21: 10.2-cm $f/10$ R and 41.0-cm $f/17.4$ C show always a nearly-stellar central cond. whose brightness varied around mag 10-11 during July 7 for several days thereafter, with a fade to $m_2 \simeq 11$ from Aug. 12 for 50 days; on Oct. 2 and 21, $m_2 \simeq 9.5$ [CIC01]. June 19.07: strongly condensed in 15-cm $f/4.25$ L (26×) [PER01]. June 23.94: w/ 25-cm $f/6$ L (100×), $m_1 = 6.5$ (MM = S, ref. WF), coma dia. 10′, DC = 4, tail 0°.25 long [TIR]. June 25.29: overall impression was of a globular coma w/ fan shape superimposed; fan-shaped coma spans p.a. $\sim$ 270° to $\sim$ 0°, w/ a central cond. offset to the SE (near the vertex); coma was $\sim$ 8′ wide at the vertex w/ extensions to $\sim$ 20′ along the edges of the fan [ADA03]. June 26.72: w/ 31.7-cm $f/5$ L (64×), small cond. [JON]. June 27.36, July 9.27, and July 23.31: comet also glimpsed w/ naked eye [ADA03].

July 6.20: comet involved w/ star SAO 161844 [ADA03]. July 6.88: w/ 25-cm f/6 L (100×), $m_1 = 6.3$ (MM = S, ref. WF), coma dia. 10′, DC = 4, tail 0°.25 long [TIR]. July 9.90: w/ 41.0-cm f/17.4 C (284×), $m_1 = 6.0$ (MM = M, ref. AC), coma dia. 4′, DC = 8, tail ~ 0°.2 long in p.a. 15° [CIC01]. July 10.92: w/ 25-cm f/6 L (100×), $m_1 = 6.2$ (MM = S, ref. WF), coma dia. 10′, DC = 4, tail 0°.25 long [TIR]. July 21.88 and 22.90: w/ 25-cm f/6 L (100×), $m_1 = 6.0$ (MM = S, ref. WF), coma dia. 10′, DC = 4 [TIR]. July 31.91: w/ 25-cm f/6 L (100×), $m_1 = 5.8$ (MM = S, ref. WF), coma dia. 10′, DC = 4 [TIR]. Aug. 3.44: w/ 31.7-cm f/5 L (64×), bright cond. at tip of fan-shaped tail [JON]. Aug. 4.89 and 13.84: w/ 25-cm f/6 L (100×), $m_1 = 5.8$ (MM = S, ref. WF), coma dia. 15′, DC = 4 [TIR]. Aug. 6.20: coma was slightly elongated w/ suggestion of faint 0°.5 tail extending outward from coma at p.a. ~ 115° [ADA03]. Aug. 13.89: comet very close to star of mag 6.7 [PER01]. Aug. 16: CCD images (taken as on May 28-July 31 — see above) show a great increase in the number and complexity of sunward jets, but also a clear modification of the tail (which now appears as double) [Manzini *et al.*]. Aug. 16.90: w/ 41.0-cm f/17.4 C (284×), $m_1 \approx 6.2$ (MM = M, ref. AC), coma dia. 5′, DC = 8/, tail ~ 0°.2 long in p.a. 5° [CIC01]. Aug. 23.87: strong moonlight, moon near comet; some comp. stars much closer to moon's glare than others [PER01]. Aug. 24.87: strong moonlight (moon ~ 15° from comet) [PER01]. Aug. 29.87: brighter inner coma is 7′; in 9×34 B, $m_2 = 7.5$-8 [PER01]. Aug. 31.79: w/ 25-cm f/6 L (100×), $m_1 = 6.0$ (MM = S, ref. WF), coma dia. 15′, DC = 5 [TIR]. Aug. 31.87: 1°-wide open fan spanning 40° centered nearly due E [PER01].

Sept. 4.86: elongated coma 6′ × 11′ [MAR21]. Sept. 6.86: 6th-mag star near comet, hampering est. [PER01]. Sept. 7.83: w/ 41.0-cm f/17.4 C (284×), $m_1 = 5.9$ (MM = M, ref. AC), coma dia. 7′, DC = 8, tail 0°.5 long in p.a. 5° [CIC01]. Sept. 7.89: thin high clouds possibly interfering [PER01]. Sept. 10.39: w/ 31.7-cm f/5 L (64×), bright cond. of mag 6.9 (MM = I) [JON]. Sept. 10.45: hint of a broad, diffuse tail in p.a. 83° [PEA]. Sept. 12.51: central cond. does not seem as intense as last month [PEA]. Sept. 14.83: starlike central cond. strongly offset towards W-SW [PER01]. Sept. 15.78: w/ 25-cm f/6 L (100×), $m_1 = 5.9$ (MM = S, ref. WF), coma dia. 15′, DC = 5 [TIR]. Sept. 16.84: w/ 41.0-cm f/17.4 C (284×), $m_1 = 5.8$ (MM = M, ref. AC), coma dia. 7′, DC = 8, tail ~ 0°.3 long in p.a. 5° [CIC01]. Sept. 17.41: broad, diffuse tail very faintly visible in p.a. 97° [PEA]. Sept. 18.52: broad, diffuse tail very faintly visible [PEA]. Sept. 21.83: moon nearby [PER01]. Sept. 22.83: strong moonlight; cirrus elesewhere in the sky; hint of a narrow tail to the E [PER01]. Sept. 26.76: w/ 25-cm f/6 L (100×), $m_1 = 5.5$ (MM = S, ref. WF), elongated coma 15′ × 20′ [TIR]. Sept. 28.82: tail is wide fan ~ 0°.4 long spanning p.a. 10°-60°; comet strongly condensed; star of mag 5.6 seen w/ naked eye but comet invisible [PER01]. Sept. 30.84: coma dia. could be 40′ to the naked eye; strongly bending counter-clockwise tail; edges of fan span p.a. 80°-130°, and are brighter than inner tail [PER01].

Oct. 2.43: broad, diffuse tail 0°.7 long in p.a. 97° [PEA]. Oct. 3.43: broad, diffuse tail 0°.9 long in p.a. 97° [PEA]. Oct. 6.05: tail as wide as coma [MOD]. Oct. 8.78: w/ 10×50 B, visibility of C/1995 O1 similar to M11 [GRA04]. Oct. 12.54: 15-cm f/4 L + ST-6 CCD shows fan-like tail opened to p.a. 72°-108°, w/ jets 10′, 5′, 4′, 2′, and 1′.5 long in p.a. 29°-36°, 71°, 101°, 281°, and ~ 334°, respectively [GUR]. Oct. 13.02: w/ 41-cm L (70×), almost-stellar nucleus of mag ~ 9.5 (ref: HS); at 170×, the "nucleus" is seen to be a tiny cond. not more than 0′.2 in dia. [BOR]. Oct. 13.54: 15-cm f/4 L + ST-6 CCD shows little or no rotation of jets from previous night (possible decrease in p.a. of ~ 1°-2° for jets 2, 4, and 5) [GUR]. Oct. 16.00: w/ 41-cm L (70×), nucleus has mag ≈ 9.2 (ref: HS); root of tail is initially directed toward p.a. 30° but curves dramatically toward the E until at right-angles to this value; tail is very broad, subtending perhaps 50° in p.a. [BOR]. Oct. 18.08: w/ 50.5-cm f/5 L (87×), $m_2 = 9.7 \pm 0.3$ [MOD]. Oct. 20.78: in twilight, moonlight and through thin cirrus, $m_1 = 5.0$ w/ VSS; $m_1 = 5.3$ w/ MM = M [PER01]. Oct. 20.81: moonlight; in between cirrus clouds; comet strongly condensed, some tail evident but not measured; alt. corrections smaller than 0.1 mag [PER01]. Oct. 21.20: moonlight; forked tail, separation ~ 20° [PER01]. Oct. 23.63: w/ 48.0-cm f/4.8 L (65×), curved dust tail ~ 1° long; nucleus is offset w/ respect to geometric center, $m_2 \sim 9$ [CHE03]. Oct. 27.59: w/ 102-cm f/13 C (540×), cond. of dia. 18″; nucleus of dia. 3″, $m_2 = 9.1$ [CHE03]. Oct. 27.82: through thin cirrus, moonlight; some tail evident [PER01]. Oct. 28.57: $m_2 = 9.1$; alt. 27° [CHE03]. Oct. 29.01, Nov. 1.01, 15.98, Dec. 7.97, and 14.97: obs. made from a suburban location w/ moderate light pollution [MOD]. Oct. 29.82: comp. stars w/in 1° of comet's alt. [PER01]. Oct. 29.60: $m_2 = 8.9$; w/ 5.6-cm f/4.5 A, 25-min exp. on Fuji 800 film shows bright curved tail 0°.7 long in p.a. 45°-100°, and coma dia. ~ 20′ [CHE03]. Oct. 29.98: w/ 41-cm L (70×), the nucleus has mag ≈ 9.3 (ref: HS); coma, at the latus rectum, is 3′.5 wide w/ DC = 7; tail leaves nucleus toward p.a. 39° but curves strongly around to at least p.a. 90° w/in the distance of just 1° [BOR]. Oct. 30.61: image taken w/ 7-cm f/6 instrument + CCD (three 300-sec exp.) shows three rays each 10′ long in p.a. 42°, 63°, and 85° and a short sunward ray 5′ long; elliptical coma of size ~ 25′ × 20′ [CHE03]. Oct. 30.73: comet appeared more condensed and slightly brighter than M11 in 10×50 B [GRA04]. Oct. 30.81: tail spans p.a. 85°-110° [PER01]. Oct. 31.99: w/ 41-cm L (70×), one immediately notices three long, bright jets extending from the 9.5-mag nucleus far out into the tail (these are initially directed toward p.a. 40°, 65°, and 110°; the first is by far the brightest); coma dia. 2′.9 w/ DC = 7-8; the brightest outflow of material from the nucleus is at p.a. 35°-40°; tail's leading edge is strongly curved, trailing edge seems almost linear [BOR].

Nov. 1.57: $m_2 = 9.1$; alt. 24° [CHE03]. Nov. 1.74: photometry obtained w/ 20-cm f/2 Baker-Schmidt A (+ V filter + ST-6 CCD) [MIK]. Nov. 1.75: w/ 7×42 B, straight type-I tail w/ N boundary sharper than S one; also 1°.0 type-II tail at p.a. 115° [ZAN]. Nov. 1.76, 2.76, and 3.75: w/ 25×150 B, coma dominated by a bright star-like nucleus; also present is a disk-like central cond., nearly 2′ in dia.; the sharp central part of the coma is offset lower-left w/ respect to geometric center of a diffuse outer coma that is flattened in sunward direction; w/in coma, there are short jets at p.a. 50°, 80°, 130°, and 330°; also 20′ spike at p.a. 20°; tabulated tail data refers to type-I, straight and quite faint one; type-II 1°.0 tail also present in p.a. 115°, looks very broad, sharply curved southward and diffuse but brighter than type-I one [ZAN]. Nov. 2.73: in 10×50 B, the comet was somewhat larger, brighter and more condensed than M11 [GRA04]. Nov. 2.77: the tail appeared fan-shaped, spanning p.a. 50-120°, w/ mean p.a. tabulated; three jets were seen at p.a. ≈ 50°, 80°, and 120°; an apparently-stellar nucleus was surrounded by a bright inner coma; m_2 ref. was BAA chart for RS Oph; comet was an impressive sight in the telescope [GRA04]. Nov. 3.58: $m_2 = 9.0$ [CHE03]. Nov. 3.99: w/ 41-cm L, ray or jet structure w/in the comet is similar to recent nights but w/ a fourth jet now evident toward the NNW; the slightly

curving brightest ray, originating at p.a. ≈ 40° can be traced at least 15′ out from the nucleus using 114×; the others are not more than ≈ 5′ long [BOR]. Nov. 4.70: w/ 5-cm R (20×), disk-like central cond., coma extended towards to tail; two bright border streamers (2° long in p.a. 92° and 1° long in p.a. 56°) [BAR06]. Nov. 5.70: w/ 11-cm *f*/7 L, star-like central cond.; wide parabolic tail open in p.a. 52°-103° w/ a brighter, narrower W extension 0°.8 long, a faint, wide center and an E side with two or three fairly bright, straight 2°-long streamers in p.a. 80° and 90° [BAR06]. Nov. 7.80: easy to naked eye using direct vision [PER01]. Nov. 8.39: observed through thin cloud [SEA01]. Nov. 8.58: w/ 102-cm *f*/13 C (540×), starlike nucleus of dia. 1″, m_2 = 8.9 [CHE03]. Nov. 8.75: w/ 25×150 B, type-II tail dominates the scene; also 1°.3 type-I faint tail at p.a. 55°; features noted on Nov. 3.75 are still present [ZAN]. Nov. 9.04: central cond. of mag 9.5 and dia. ≥ 3″; the tabulated tail was the central, and slightly brighter, member of a trio of diffuse tails traced to the edge of the field-of-view (≈ 5′.5 in length; the flanking tails were at p.a. 30° and 97°); sunward jet that was observed two weeks ago still remains near its earlier position w/ the faint, diffuse extension (as reported earlier), now curving northward; a recurring field of small jets was once again observed along the SW quadrant of the image; collectively, all of these minimal changes imply that rotation, if any, is very slow [ROQ]. Nov. 9.57: w/ 102-cm *f*/13 C (540×), disc-like nucleus of dia. 3″, m_2 = 8.8 [CHE03]. Nov. 9.73: elliptical coma ≈ 25′ × 15′; broad tail at least ~ 1° long in p.a. ≈ 80°-125°; inside the coma, there are three prominent streamers ≈ 12′, 8′, and 8′ long in p.a. ≈ 45°, 80°, and 100° [MIK]. Nov. 10.59: w/ 102-cm *f*/13 C (540×), nucleus of dia. 7″, m_2 = 8.9 [CHE03]. Nov. 11.39: observed in twilight [SEA01]. Nov. 11.58: w/ 102-cm *f*/13 C (540×), m_2 = 8.8 (≃ 7″ in dia.) [CHE03]. Nov. 11.96: w/ the 41-cm L (114×), a number of long rays are evident, some extending > 10′ from the nucleus; the brightest, originating near p.a. 40°, is curved toward the E and becomes broad and diffuse after a short distance, but the one near p.a. 65° seems linear and much finer in structure (both can be traced right up to the nucleus as fine threads); a "dark" interval or lane separates these two rays w/in the coma [BOR]. Nov. 12.97: "viewing comet w/ 41-cm L (114×), reveals many fine rays, giving the same overall impression as old, big Schmidt photos of comet C/1961 R1 (Humason) in 1961; w/ 70×, the leading edge of tail is near p.a. 40°, but after only a degree or so it is centered on p.a. 115°!" [BOR]. Nov. 14.40: observed in moonlight and through haze [SEA01]. Nov. 14.59: m_2 = 8.9 (6″ in dia.) [CHE03]. Nov. 14.97: w/ 41-cm L (70×), nucleus very sharp but fainter (mag ≈ 10.7, ref: HS); at 114×, several extremely fine jets extend tailward from the nucleus, quickly becoming the broad, bright tail rays; the region between each jet is clearly darker than elsewhere in the coma; rays very distinct tonite and position angles unchanged [BOR].

Nov. 15.39: image taken with 60-cm Y + CCD (three 30-sec co-added exp.), and enhanced with a Rotational Gradient filter, shows eight jets in p.a. 24°, 54°, 93°, 123°, 162°, 225°, 275°, and 341° [NAK01]. Nov. 15.58: m_2 = 8.8 [CHE03]. Nov. 19.71: elliptical coma ≈ 30′ × 18′; broad tail at least ≈ 1° long in p.a. ≈ 90°-135°; inside the coma are three prominent streamers of length ≈ 12′, 8′, and 6′ in p.a. ≈ 45°, 70°, and 92° [MIK]. Nov. 20.58: w/ 102-cm *f*/13 C, cond. is 20″ in dia.; nucleus is 5″ in dia., m_2 = 8.6 [CHE03]. Nov. 21.57: m_2 = 8.6 [CHE03]. Nov. 22.57: w/ 102-cm *f*/13 C, cond. is 15″ in dia.; nucleus is 3″ in dia., m_2 = 8.6 [CHE03]. Nov. 23.57: m_2 = 8.6; alt. 17° [CHE03]. Nov. 24.57: m_2 = 8.6; short tail; w/ 20-cm *f*/15 R (120×), coma asymmetrical w/ dia. 4′ [CHE03]. Nov. 24.70: elliptical coma ≈ 25′ × 15′; strong moonlight [MIK]. Nov. 25.38: image taken with 60-cm Y + CCD (three 30-sec co-added exp.), and enhanced with a Rotational Gradient filter, shows eight jets in p.a. 20°, 51°, 90°, 122°, 164°, 227°, 276°, and 335° [NAK01]. Nov. 26.68: possible tail in p.a. 45° [HEE]. Nov. 27.72: broad tail; comet was considerably brighter than M11, but fainter than M31; alt. 10° [GRA04]. Nov. 28.69: broad tail [GRA04].

Dec. 1.71: elliptical coma ≈ 35′ × 25′; fan-like tail ≈ 1° long in p.a. ≈ 55°-130° [MIK]. Dec. 1.72: very difficult to the naked eye; in 25×150 B, parabolic coma dominated by a bright star-like nucleus; main tail (probably type I) is bifurcated w/ border rays at p.a. 35° and 45° and has low surface brightness just behind the coma; type-II tail (which was the main one last month) is now very stubby and faint w/ hints of southward curvature; jets at p.a. 80°, 100°, and 355° [ZAN]. Dec. 3.71 and 4.71: elliptical coma ≈ 35′ × 25′; fan-like tail ≈ 1° long; in inner coma are jets ≈ 7′, 12′, 5′, and 3′ long in p.a. ≈ 40°, 62°, 90°, and 290° [MIK]. Dec. 6.71: comet visible via naked eye, now much brighter than M11 and only slightly weaker than M31; broad tail (mean p.a. tabulated); nice sight in binoculars; alt. 10°.5 [GRA04]. Dec. 7.02: a second tail of length ~ 1° was observed at p.a. ~ 97°; this tail was roughly fan-shaped, w/ some material at least partially filling the gap in p.a. between the two [ADA03]. Dec. 7.71, comet quite easy to the naked eye despite low alt.; in 25×150 B, parabolic coma dominated by a bright star-like nucleus; main tail (type I) is bifurcated (border rays at p.a. 35° and 45°) w/ low surface brightness just behind the coma; stubby, sharply-curved type-II tail at p.a. 80°; tail at p.a. 15° is nearly 0°.75 in length; at p.a. 275° is a curved jet nearly 15′ in length; also straight features w/in inner coma at p.a. 0°, 50° and 85° (nearly 4′ in length) [ZAN]. Dec. 7.74-1997 Jan. 26.25: no extinction corections for m_1, but comparison stars at same alt. [BIV]. Dec. 7.97: alt. 11° [MOD]. Dec. 12.71: tail very faint and broad [MEY]. Dec. 13.68: broad tail; alt. 13° during astronomical twilight; some cloud interference (comet also visible to naked eye); from our latitudes (60°-70° north) this comet remains visible in the evening sky until late April 1997 [GRA04]. Dec. 14.38: image taken with 60-cm Y + CCD (three 20-sec co-added exp.), and enhanced with a Rotational Gradient filter, shows eight jets in p.a. 22°, 47°, 88°, 114°, 177°, 230°, 276°, and 337° [NAK01]. Dec. 14.75: w/ 25.6-cm *f*/5 L (169×), nuclear cond. of mag 9.1; main jets at p.a. 0°, 45°-50° (tailward), 95°-105°, and 300° [BIV]. Dec. 14.97: alt. ~ 12° [MOD].

Dec. 15.69: alt. 12° [GRA04]. Dec. 16.01: a tail of length ~ 1° was seen, w/ faint extension to 2-3° suspected [ADA03]. Dec. 19.69: apparently stellar central cond. of mag ≈ 6.5 (ref. AAVSO R Sct) surrounded by a bright inner coma; tail still quite broad; there was a parabolic outline of the sunward part of coma; surface brightness of coma was considerably higher than the central part of M31; appearance of the coma in 10×50 B was comparable to the naked-eye view of C/1996 B2 (Hyakutake) during late March 1996; despite an alt. of 12°, the comet was a very fine object in binoculars [GRA04]. Dec. 23.71: interference from full Moon and cirrus clouds; despite its low alt. (7°), the comet was clearly visible in 10×50 B and only slightly less prominent than M31 [GRA04]. Dec. 25.71: straight 1°.7 gas tail in p.a. 20°; also slightly curved, rather broad and diffuse dust tail, 1°.4 long in p.a. ≈ 40° [BOU]. Dec. 26.66: disk-like inner

coma, fan-like outer coma open in p.a. 0°-120°; tails 1° and 0°.7 long in p.a. 64° and 8° [BAR06]. Dec. 26.71: from Mt. Ponna in twilight; comet only 10° above horizon but exceptional atm. transparency; in 7×42 B, parabolic coma dominated by a bright star-like nucleus; in 25×150 B, false nucleus at focus of a parabolic envelope; anti-solar straight feature also starts from the nucleus (inner coma looks like an arrow-point); hints of curved jet/anti-tail at p.a. ~ 280° [ZAN]. Dec. 26.77: comet's true alt. 4°.6; seen over the Atlantic; comp. w/ λ Aql and 12 Aql; also another tail extending a few arcmin to the N-NW [PER01]. Dec. 27.70: comet was a very fine object in 10×50 B and was also clearly visible to the naked eye as a diffuse spot; its alt. was 8°.5 when the m_1 estimates were made; apparently stellar central cond. of mag ~ 7 and a possible fan-shaped tail towards N; the comet's visibility was comparable to M31, but the comet had a considerably higher surface brightness [GRA04]. Dec. 28.71: straight 1°.7 gas tail in p.a. 14°; slightly curved, broad and diffuse dust tail, 2°.3 long in p.a. ≈ 40° [BOU]. Dec. 29.22: also fan tail 0°.5 long in p.a. 345°-15° [BAR]. Dec. 30.25: first obs. in morning sky; coma was clearly bluer than γ Aql (sp. K3); the coma showed an apparently steller central cond. of mag 6.0 (ref. YG); alt. 9° [GRA04]. Dec. 31.71: comet impressive in 15×80 B; broad fan-shaped tail > 1° long in p.a. ~ 0°-40° [BOU].

1997 Jan. 1.69-1.70: evening obs. from near Malm; the comet was easily visible to naked eye despite an alt. of 8°.5-7°.5; surface brightness of inner coma was clearly higher than M31 [GRA04]. Jan. 2.25: morning obs. from Malm; alt. 9°; w/ 15.2-cm L (49×), two tails visible; blue-white coma w/ an asymmetric intensity distribution [GRA04]. Jan. 2.67: evening obs. in twilight from near Malm [GRA04]. Jan. 5.26: morning obs. in twilight from Fjellhamar; alt. 13° [GRA04]. Jan. 5.70: evening obs. from Tryvann, Oslo; alt. 7° [GRA04]. w/ 20.3-cm T (50×), a jet ~ 10′ long in direction of tail [GRA04]. Jan. 6.72: evening obs.; alt. 5°; comet visible w/ 10×50 B until Jan. 6.739 UT, when its true alt. was only 0°.7 [GRA04]. Jan. 7.51: a tail of length ~ 1° was seen, w/ faint extension to ~ 3-4° suspected [ADA03]. Jan. 7.71: evening obs.; alt. 6°; despite the low alt. the naked-eye visibility of comet was comparable to M31 [GRA04]. Jan. 8.46: E edge of tail somewhat brighter and sharper than W; tail's edges at p.a. 4° and 320° [BOR]. Jan. 8.70 and 19.70: evening obs.; comet at alt. 7° [GRA04]. Jan. 9.24: comet at alt. 13° [GRA04]. Jan. 11.71: evening obs.; alt. 6° [GRA04]. Jan. 12.21: w/ 10×50 B, 0°.4 tail [VAN06]. Jan. 13.27: thin high clouds; comet's alt. ~ 10° [PER01]. Jan. 13.45: leading edges of tail at p.a. 25° [BOR]. Jan. 14-18: some Italian observers from dark-site locations (R. Haver, A. Dimai, E. Guidolin) report a 2°-2°.5 main tail more diffuse toward the SW (possibly an antitail) [MIL02]. Jan. 14.21: visually w/ 7x50 B, starlike central cond.; fan-like tail ~ 1° long in p.a. 355° [MIK]. Jan. 14.21: w/ 20×80 B, coma dia. 5′; 0°.3 tail in p.a. 360° [VAN06]. Jan. 14.22: w/ 9×63 B, broad dust tail (spanning ~ 30°), w/in which the gas tail was visible as a linear feature slightly brighter than the dust tail at p.a. 348° [KAM01]. Jan. 14.23: alt. 12°.5 [GRA04].

Jan. 15.22 and Jan. 17.22: preliminary analysis of CCD images obtained w/ RG695 filter and 20-cm f/4 L reveal the presence of a highly-elongated coma w/ a strong jet-emission toward p.a. 25° and 204°, (the former being longer and brighter); jets are observed also in p.a. 59°, 155°, 248°, 289°, and 241°, the last being the inner part of the ion tail; the coma shows two dark interruptions toward p.a. ≈ 140° and 320° (a fan-shaped feature lies between the jets in p.a. 155° and 248° and it is not yet clear if it is related to the presence of a possible anti-tail or to jet activity within the coma); a fan-shaped feature is also possible around the main jet in p.a. 25°; other images obtained around Jan. 17.22 w/ the same equipment confirm what seen on Jan. 15 and show the presence of two new jets, one approx. in the sunward direction, the other approx. in the opposite direction [MIL02]. Jan. 15.24: in 15×80 B, broad, near-parabolic dust fan, maybe 45° wide, centered in p.a. ≈ 345°; very strong cond. near focus of parabola [BOU]. Jan. 15.45: "20×80 B shows coma to be rather elliptical, major axis along p.a. 35°-215° w/ nucleus/cond. toward the latter; tail edges, when 0°.8 from coma, are at p.a. 343° and 312°; binocular view of comet very reminiscent of naked-eye appearance of comet C/1957 P1 (Mrkos) in early August 1957!" [BOR]. Jan. 15.72: evening obs.; alt. 4°.5 [GRA04]. Jan. 16.22: photometry obtained w/ 180-mm-f.l. f/2.8 lens + V filter + CCD; coma ≈ 50′ × 30′; diffuse dust tail ~ 2° long in p.a. ≈ 190°; ion tail ≈ 2° long in p.a. ≈ 345° [MIK]. Jan. 17.20: coma ≈ 50′ × 30′; diffuse dust tail ~ 2° long in p.a. ≈ 190°; ion tail ≈ 2° long in p.a. ≈ 345° [MIK]. Jan. 17.22: w/ 9×63 B, broad dust tail (spanning ~ 25°) ≈ 1°.0 long in p.a. 345°; ion tail 1°.7 long in p.a. 330° [KAM01]. Jan. 17.27: w/ 25.6-cm f/5 L (84×), nuclear cond. of mag 7.9; main jets in p.a. 170°, 200°, 220° (brightest), 30° (narrow, 2′ long), and 80° and 270° (broader), as for the four previous days [BIV]. Jan. 17.45: in 20×80 B, brightest outflow of material from nucleus is toward p.a. 18°, w/ entire coma somewhat elongated in p.a. 18°-198° w/ the area of greatest cond. offset noticeably toward the latter; while tail's leading edge may be said to be in p.a. 18° initially, after little more than 1° it has curved around to p.a. 350°; trailing edge, also strongly curved, is at p.a. 295°; anti-tail carefully looked for but nothing visible; overall, tail has a "warm" hue about it [BOR]. Jan. 17.50: tail appeared to have three components; one was a short, broad fan of ~ 0°.5 to 0°.75 length sweeping clockwise from p.a. ~ 30° to the "main" tail of length 1°.25 at ~ 316°; an antitail was suspected at p.a. ~ 220° [ADA03]. Jan. 18.21: very easy to the naked eye; in 7×42 B, parabolic coma dominated by a bright star-like nucleus, main tail quite broad w/ hints of rays; also faint, narrow, straight tail at least 3°.5 long in p.a. 305° [ZAN]. Jan. 19.21: w/ 400-mm-f.l. f/2.8 A, 25-min exp. on Fuji 800 SG film shows coma dia. 10′, 1°.3 tail in p.a. 350°, and secondary jets in p.a. 15° and 60° [CAN04]. Jan. 19.45: comet does not seem to the naked eye quite as bright as two mornings ago; w/ 20×80 B, brightest outflow of material from the nucleus is directed toward p.a. 25° but curves quickly back around through N to p.a. 350°; trailing edge of tail at p.a. 313° [BOR].

Jan. 20.24: alt. 18°; tail ~ 2° long in 10×50 B; comet was an easy naked-eye object [GRA04]. Jan. 21.45: 20×80 B shows the coma to be elongated in p.a. 30°-210°, w/ an intense stellar nucleus (mag 6.7, ref: HP) offset noticeably toward the SW, making the entire coma look lop-sided; brightest outflow of material from nucleus is toward p.a. 30°, forming the leading edge of the tail; however, almost immediately it curves around strongly to the N by some 50° in p.a., where it seems to become much less curved; the bright tail's trailing edge is near p.a. 315° but there is then a very faint component that continues on to p.a. 300° [BOR]. Jan. 23.19: color of comet was yellowish [BAR06]. Jan. 23.50: poor conditions (moonlight, light pollution, and some cirrus); because of this, the "a" extinction table was used [ADA03]. Jan. 23.71: evening obs.; alt. 5°.5 [GRA04]. Jan. 27.27: in 9×34 B, 1°.7 tail in p.a. 330°, could be as long as 3°.5; moonlight [PER01].

Jan. 28.26: the comet's presence dramatically changes Aquila; moonlight; also 1°-1°.5 tail near p.a. 345°, broad dust tail curving clockwise; still naked eye w/ the sun only 9° below horizon [PER01]. Jan. 28.26: w/ 20.3-cm T (123×), a lot of inner coma activity seen, including a bright sunward jet and a fainter and broader jet in the opposite direction [GRA04]. Jan. 28.71: evening obs.; alt. 6°; despite the low elevation, the comet was much more prominent than M31 (comet faintly seen w/ naked eye) [GRA04]. Jan. 29.20: photometry obtained w/ 90-mm-f.l. *f*/4 lens + *V* filter + ST-CCD; coma ≈ 1°; diffuse dust tail ~ 2° long in p.a. ≈ 218°; ion tail ≈ 2° long in p.a. ≈ 320°; moonlight; this *V* photometry is mean value, obtained from three images, having two YF standard stars < ≈ 2° from the comet (standard deviation of measurements is 0.05 mag) [MIK]. Jan. 29.44: "an extraordinary object w/ the 41-cm L!; at 56× and 70×, a brilliant fountain rises from the stellar nucleus, reaching 1'.1 in height; the fountain subtends 35°-40° in p.a. and is centered on p.a. 202°; it is probably the most intense such feature of this sort that I have observed in forty years; the fountain becomes a bright steam of material thereafter, curving back into the tail; opposite the fountain is a single, weaker, and linear jet toward p.a. 22°; it is the source of a second bright, arching streamer of material that becomes the tail's leading edge; the nucleus is a perfectly hard 'star' of mag 7.0 (ref: HS) that appears completely separate from the surrounding coma material (as is usually the situation w/ very bright comets); the entire coma and its features are distinctly tinged a yellow-orange hue; using a Lumicon Swan-band (C_2) comet filter wipes out the jets and dramatically suppresses both the nucleus and coma" [BOR]. Jan. 30.23: in 20.3-cm T (123×), two tails seen (W component strongly curved); heart of the coma contained a bright sunward fountain 1'-2' long and a fainter jet in the opposite direction; there were two distinct brightenings in the central cond., separated by 5"-10"; w/ 10×50 B, DC = 7-8, 3°.5 tail in p.a. 326° [GRA04]. Jan. 30.72: evening obs.; alt. 5° (comet faintly visible w/ naked eye) [GRA04]. Jan. 31.21: coma ≈ 1°; diffuse dust tail ~ 2° long in p.a. ≈ 218°; ion tail ≈ 2° long in p.a. ≈ 320°; moonlight [MIK]. Jan. 31.72: evening obs.; alt. 5° [GRA04]. Jan. 31.84: w/ 8×56 B, coma dia. 7', DC = 7, 1° tail [OKA05].

◇ *Comet C/1996 B2 (Hyakutake)* ⟹ 1996 Feb. 21.17: w/ 44.5-cm *f*/5 L (111×), 3' coma, tail in p.a. 210° [WAR01]. Mar. 10.25: comet was only 5°.6 from the moon [KRO02]. Mar. 12.23: w/ 20×80 B, 1°.5 tail in p.a. 280° [KRO02]. Mar. 16.27: w/ 20×80 B, 23' coma and 4° tail [KRO02]. Mar. 21.16: w/ 20×80 B, 4°.7 tail [KRO02]. Mar. 22.93: w/ 20×50 B, 45' coma, DC = 8, 2° tail [KAM05]. Mar. 22.98: w/ 10×50 B, $m_1 \simeq 1.5$ (MM = B, ref. UM) [KAM05]. Mar. 25.31: through clouds; the rough mag estimate should be considered less reliable than the other measurements, as there were not any comparison stars easily comparable to the comet [KRO02]. Mar. 26.02: w/ 20×50 B, 65' coma, DC = 8, 15° tail [JAR01]. Mar. 29.85: w/ 20×50 B, $m_1 \approx 3.3$ (MM = B, ref. UM), 15' coma, tail in p.a. 45° [KAM05]. Apr. 1.90: w/ 20×50 B, $m_1 \approx 2.7$ (MM = B, ref. UM), 12' coma, tail in p.a. 40° [KAM05]. Apr. 4.06: w/ naked eye, 15' coma [KRO02]. Apr. 6.86: w/ 20×50 B, $m_1 \approx 3.4$ (MM = B, ref. UM), 15' coma, tail in p.a. 30° [KAM05]. Apr. 7.86: w/ 20×50 B, $m_1 \approx 3.5$ (MM = B, ref. UM), 20' coma, tail in p.a. 25° [KAM05]. Apr. 8.85: w/ 20×50 B, $m_1 \approx 3.6$ (MM = B, ref. UM), 11' coma, tail in p.a. 45° [KAM05]. Apr. 9.86: w/ 20×50 B, $m_1 \approx 3.6$ (MM = B, ref. UM), 9' coma, tail in p.a. 40° [KAM05]. Apr. 17.82: w/ 20×50 B, $m_1 \approx 3.6$ (MM = B, ref. UM), 7' coma, tail in p.a. 30° [KAM05]. Apr. 22.82: w/ 20×50 B, 4' coma, DC = 7, 2° tail [JAR01]. Apr. 27.77: w/ 7×50 B, $m_1 > 0.5$: (MM = B, ref. S), coma dia. ~ 10', DC = 4/, 0°.3 tail [SZU01]. June 14.74: w/ 31.7-cm *f*/5 L (64×), 1° tail in p.a. 205° [JON]. June 26.74: w/ 31.7-cm *f*/5 L, DC = 6, 0°.3 tail in p.a. 200° [JON]. Aug. 24.79: coma very vague, diffuse and ill-defined; quite difficult to see in a fairly crowded star field [PEA]. Sept. 21.78: comet not seen; sky conditions excellent [PEA].

◇ *Comet C/1996 N1 (Brewington)* ⟹ 1996 Aug. 23.86: inner coma looks like a globular cluster, outer coma rather diffuse (tabulated data in Oct. 1996 *ICQ*) [PER01]. Oct. 14.81: comet involved w/ some stars of mag 13 [MEY].

◇ *Comet C/1996 Q1 (Tabur)* ⟹ 1996 Sept. 21.73: faint outer coma and reasonably-distinct brightening in central cond. since previous observations [PEA]. Sept. 27.10: during total lunar eclipse; comet is easy to the naked eye, but impossible to estimate due to three 6th-mag stars embedded [PER01]. Sept. 27.10: comet observed during total lunar eclipse [MEY]. Sept. 29.24: moonlight, obs. already past nautical twilight PER01]. Oct. 2.21: comet strikingly bright in spite of moonlight; seen between many low clouds [PER01]. Oct. 4.33, 5.43, 7.34, and 15.42: obs. made from a suburban location w/ moderate light pollution [MOD]. Oct. 4.33, 5.43, 6.38, and 7.34: 24–27-day-old Moon ~ 25°-37° away [MOD]. Oct. 6.20: moonlight; comet easy to the naked eye [PER01]. Oct. 6.36: tail half as wide as coma; w/ 50.5-cm *f*/5 L (87×), "flattened" elliptical coma elong. roughly ⊥ to tail, $m_2 \simeq 12$ [MOD]. Oct. 7.19: narrow tail, comet easy to the naked eye [PER01]. Oct. 9.23: hasty obs. due to many clouds; looks more diffuse [PER01]. Oct. 10.47: poor conditions; obs. rushed due to onset of twilight; also moonlight and light pollution [ADA03]. Oct. 12.77: coma is triangular form, possibly because there are jets 2' and 2'.5 long in p.a. 82° and ~ 235° [GUR]. Oct. 14.99: comet noticeably brighter than two nights ago [BOR]. Oct. 15.99: w/ 41-cm L (70×), a fairly obvious long, thin, and straight ion tail, much narrower than the coma's dia., is noted [BOR]. Oct. 20.23: alt. corr. smaller than 0.1 mag; comet not located w/ 9×34 B upon sweeping the general area, only seen via precise plot of position [PER01]. Oct. 21.04: coma elongated ≃ 15' × 5'; diffuse tail 10' long [CHE03]. Oct. 22.17: $m_1 = 7.4$ w/ ref. AAVSO V CVn [GRA04]. Oct. 22.18: strongly elongated coma w/ ratio of axes ≈ 2:1, major axis in direction of tail; comet was much fainter than expected; tail rather faint and narrow [GRA04]. Oct. 23.02 and 29.61: strongly elongated coma, short coma extension or anti-tail 5' long (w/ 12-cm R, 35×) [CHE03]. Oct. 29.81: comet easy, but extremely diffuse; elliptical coma NNE-SSW; edges of silky coma relatively-well-defined but coma uniform in brightness; RR Boo AAVSO seq. [PER01]. Oct. 30.00: "an extraordinary and abrupt change!; comet looks like a faint, narrow, very diffuse streak ≈ 0°.3 long w/ somewhat of a cond. toward the southern end; slightly brighter 'coma' region is elongated 2:1 or even 3:1 in p.a. 20°-200°; major axis of 'coma' is 4'.0, while minor axis is 1'.5-2'.0; the 'tail' is slightly narrower than the 'coma' and quite straight; comet looks like descriptions of comet C/1925 X1 (Ensor) near the time of its demise" [BOR]. Oct. 30.80: RR Boo AAVSO seq. [PER01]. Oct. 31.75–31.77: measurements of *R* images taken w/ the 65-cm CCD telescope at Ondřejov Observatory reveal that the structure reported on *IAUC* 6499 as a streak begins at (or within a few arcsec of) the comet nucleus' position computed using the orbit on *MPC* 28052,

and extends along a line in p.a. 14°; the maximum of light measured along this line is quite broad and flat — the area of nearly-constant surface brightness starts within several arcsec from the predicted nucleus position and extends along the line up to distance of 80″, w/ a shallow maximum around 30″ from the predicted nucleus position; no significant cond. at the nucleus position and/or in the streak is apparent; the width of the streak is $\leq 10''$; at greater distances from the nucleus position, the surface brightness fades gradually, still following the line in p.a. $\simeq$ 14°; the streak apparently "converts" into a normal tail at the greater distances; no coma is apparent around the nucleus position [PRA01]. Oct. 31.98: very diffuse, ill-defined object; main mass ("coma") is significantly brighter than "tail" but still very ill-defined; this feature is elongated roughly 3:1, its dimensions being $\approx$ 1′.6 × 4′.8; the "tail" is not quite as wide as the "coma" [BOR].

Nov. 1.76, 2.77, and 3.75: elliptical or bar-shaped, diffuse coma of size 7′ × 14′, w/ major axis at p.a. 10° w/o a specific center/nucleus; straight, very narrow type-I tail [ZAN]. Nov. 1.80: there seems to be a systematic difference of $\approx$ 0.8 mag between the RR Boo seq. and the RT Boo + RR CrB seq.; an '89' star in the RR Boo seq. was corrected to '83' in a later edition of *AAVSO Variable Star Atlas*, and we used this value, but this alone does not account for the systematic difference; the tabulated m_1 was obtained w/ the RT Boo + RR CrB seq.; w/ the RR Boo seq., $m_1 = 9.1$, so comp. against single stars confirms our impression that the comet is not varying significantly [PER01]. Nov. 1.80: tabulated value is w/ RT Boo + RR CrB seq. (see previous comment); w/ RR Boo seq. alone, $m_1 = 9.3$ [VIT01]. Nov. 1.98: vague, faint, diffuse, highly elongated object essentially w/o boundaries; "coma" only slightly brighter than the "tail", its dimensions being $\approx$ 2′.8 × 4′.4; "tail's" trailing (W) edge may be sharper than leading (E) edge; object remains quite linear [BOR]. Nov. 2.75: coma appeared strongly elongated (3′.5 × 7′), w/ major axis in direction of tail [GRA04]. Nov. 2.75: photometry obtained w/ 20-cm *f*/2 Baker-Schmidt A (+ *V* filter + ST-6 CCD) shows streak-like coma $\approx$ 14′ × 7′ w/ the major axis in p.a. $\approx$ 18°-198°; straight tail at least 1°.0 long in p.a. $\approx$ 18° present on 5-min exposures w/ *V* filter; another 5-min CCD image, taken on Nov. 2.729 w/ the 36-cm *f*/6.8 telescope (+ *R* filter) shows diffuse streak-like coma w/o the central cond.; recent CCD *V* photometry shows this comet brighter than m_1 results because only part of streak-like coma is detected by visual observers; apparently, the comet's fading has now stopped [MIK]. Nov. 2.79: RT Boo and RR CrB seq.; comet close to 10th-mag star [PER01]. Nov. 3.99: object extremely ill-defined and faint; S end, where coma should be, has only the slightest suggestion of any cond.; comet is just a long, vague, and ghostly streak; the "coma" region is roughly 2′.0 × 3′.6 [BOR]. Nov. 4.74: comet is elongated 16′ × 7′ in p.a. 10°/190°; similar to NGC 1499 via naked-eye [ZNO]. Nov. 4.98: comet difficult to detect — mainly an elongated brightening of the sky background at the ephemeris position; main mass is very approx. 1′.8 × 3′.5; Lumicon Swan-band comet filter slightly enhances comet's visibility [BOR]. Nov. 7.79: difficult object [PER01]. Nov. 8.70: coma elongated 12′ × 6′ in p.a. 4° [BAR06]. Nov. 8.73: irregular coma [MEY]. Nov. 8.76: bar-shaped, very diffuse coma of size 4′ × 10′, w/ major axis at p.a. 20°, w/o a specific center/nucleus; straight, very narrow type-I tail [ZAN]. Nov. 9.72: streak-like coma $\approx$ 12′ × 4′ w/ the major axis in p.a. $\approx$ 20°-200°; delicate tail $\approx$ 0°.7 long in p.a. $\approx$ 20° is present on a 5-min exp. w/ *V* filter; another 5-min CCD image taken on Nov. 9.709 w/ the 36-cm *f*/6.8 telescope (+ *R* filter) shows diffuse, completely uniform streak-like coma (w/o any central cond.) [MIK]. Nov. 9.76: coma faint and ill-defined but seen w/ certainty (motion was detectable w/in an hour), still appeared elongated; m_1 estimate derived from AAVSO seq. for S CrB; obs. somewhat affected by clouds [GRA04]. Nov. 12.96: at 70×, "something" is occasionally suspected at the predicted position; object far too vague for any meaningful determination of m_1 [BOR].

◇ *Comet 22P/Kopff* $\Longrightarrow$ 1996 June 14.74: diffuse coma w/ slight cond. [JON]. June 28.72: comet close to star of mag 3.9 [JON]. Aug. 3.45: comet among faint stars [JON]. Oct. 6.12: at 167×, $m_2 = 15.0$ [MOD].

◇ *Comet 29P/Schwassmann-Wachmann 1* $\Longrightarrow$ 1988 Sept. 12.254 and 12.288: films taken with the 46-cm Schmidt telescope at Palomar Mountain show a stellar nucleus comparable to asteroids of mag $B = 17.0$ or 17.2, offset to the NW side of nearly-circular 40″ coma; weak tail extends SE to 80″ length (from front of coma); dimensions refer to roughly the *B*-magnitude 25/arcsec^{-2} isophote [E. and C. Shoemaker]. 1996 Feb. 23, 24, and 25: on the TV guider for the spectrograph, the comet looked "kidney"-shaped w/ a sharp central cond. and a secondary "knot" at p.a. $\sim$ 350°; on the first night, we thought it was just a coincidental star, but it was there again the second and third nights; Mike Ward got an image with the 30-inch and PFC on Feb. 25 (through awful conditions), and it confirms the sharp cond., the secondary knot, and the asymmetric shape (missing material on the E side); however, there looks to be some fainter material w/ filaments on that side; not the "ring-tailed snorter" but quite interesting anyway [Anita Cochran, McDonald Observatory]. Nov. 7.37: CCD exp. w/ 1-m Schmidt telescope of the National Observatory of Venezuela shows a sharp nucleus embedded in a coma of dia. $\sim$ 33″; $m_1(R) = 14.5 \pm 0.1$; material is seen ejected at p.a. 115° (solar direction is 127°); comet shows a C-shaped coma (implying that the nucleus is rotating counterclockwise) [I. Ferrin, J. Mateu, and J. Canelon, University of the Andes, Merida, Venezuela]. 1997 Jan. 11, 13, 18, and 19: comet "was in a bright stage in mid-January, but it was NOT in outburst on Jan. 11, 13 and 18; it then had a small (and almost steller) 17th-mag central cond. and very faint large coma, which seems to have been ejected in the previous outburst (a couple of weeks ago??); as for this comet, it is difficult to say "in outburst" only from its magnitude — whereas it WAS in outburst on Jan. 19, when it had a very strong 14th-mag central cond. and it looked like an asteroid!" [NAK01]. Jan. 16.38: obs. as on 1996 Nov. 7.37 reveal a sharp nucleus of mag $R = 16.4 \pm 0.1$ embedded in a huge coma of maximum dia. 4′; total mag in 2′ radius is $R = 13.14 \pm 0.1$; coma is spherically symmetric (only if powerful image-streching techniques are applied is a very faint enhancement revealed in p.a. 45°); sharp nucleus may imply that the object is now decreasing in activity; the coma morphology is entirely different from that shown on Nov. 7 (*cf. IAUC* 6503), when a strong jet was visible (the difference could be explained if the current coma is due to a jet in the equatorial region, and the southern hemisphere of the comet is now visible, deduced from the counter rotation observed in Nov.) [I. Ferrin].

◇ *Comet 46P/Wirtanen* ⟹ 1996 Dec. 29.49: comet not seen despite good sky conditions w/ stars to mag 14.2 visible in the vicinity of the comet's location [PEA]. 1997 Jan. 3.49: comet not seen despite good sky conditions w/ stars to mag 14.2 visible in the vicinity of the comet's location [PEA].

◇ *Comet 73P/Schwassmann-Wachmann 3* ⟹ 1995 Oct. 15.02: w/ 33-cm *f*/4 L (58×), coma dia. 2′, DC = 6 [KRO02]. Oct. 15.70: excellent observing conditions w/ very dark skies; comet quite noticeable w/ naked eye, appearing as an elongated object w/ tail pointing in roughly E direction; coma very condensed and small; obs. made during a night out during safari at the Masaai Mara Game reserve in Kenya [PEA]. Oct. 16.02: w/ 33-cm *f*/4 L (58×), coma dia. 1′.1, DC = 6 [KRO02]. Oct. 17.01: w/ 33-cm *f*/4 L (58×), coma dia. 1′.1, DC = 5 [KRO02].

◇ *Comet 81P/Wild 2* ⟹ 1996 Dec. 12.94: no enhancement w/ a Lumicon Swan-band Filter [MEY]. Dec. 29.51: obs. made just prior to moonrise; coma large and diffuse [PEA]. 1997 Jan. 3.58: comet noticeably brighter and more condensed than obs. 5 days ago [PEA]. Jan. 9.14: coma sharply condensed w/ a faint outer halo; star-like nucleus of mag 13.2 at center of cond. [BOR]. Jan. 11.16: nucleus, of mag 13.3, not as sharply defined as two nights ago and more blended w/ surrounding coma [BOR]. Jan. 15.15: comet fainter when viewed with a Lumicon Premium Deep-Sky filter [SPR]. Jan. 15.83: fan-like tail ≈ 5′ long in p.a. ≈ 270°-320°; photometry obtained w/ 20-cm *f*/2 Baker-Schmidt A (+ *V* filter + ST-6 CCD) [MIK]. Jan. 29.06: coma suddenly sharply condensed near the center w/ a star-like nucleus of mag ≃ 13.0 at the center; very extensive, faint, outer halo; coma's extreme brightness gradient makes the determining of m_1 more difficult than usual [BOR].

◇ *Comet 96P/Machholz 1* ⟹ 1996 Aug. 24.80: comet not seen; excellent sky conditions; search area included arc between predicted position and $\Delta T \pm 1.0$ day; predicted position of comet was only 1°.7 from position of C/1996 B2 (Hyakutake) [PEA]. Sept. 21.79: comet not seen; comet position only 8° above horizon; search area included arc between predicted position and $\Delta T \pm 1.0$ day [PEA].

◇ *Comet 118P/Shoemaker-Levy 4* ⟹ 1996 Dec. 12.92: no enhancement w/ a Lumicon Swan-band Filter [MEY].

◇ *Comet 126P/IRAS* ⟹ 1996 Aug. 24.80: comet not seen; excellent sky conditions [PEA]. Nov. 2.79: w/ 36-cm *f*/6.8 T (+ *V* filter + CCD), fan-like tail ≈ 5′ long [MIK]. Nov. 9.81: fan-like tail ≈ 3′ long [MIK].

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TABULATED DATA

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

"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 or In-Out method, I = in-focus, C = unfiltered CCD, c = same as 'C', but for 'nuclear' magnitudes, V = electronic observations — usually CCD — with Johnson *V* filter, *etc.*]. "MAG." = total (visual) magnitude estimate; a colon indicates that the observation is only approximate, due to bad weather conditions, *etc.*; a left bracket ([) indicates that the comet was not seen, with an estimated limiting magnitude given (if the comet IS seen, and it is simply estimated to be fainter than a certain magnitude, a "greater-than" sign (>) must be used, not a bracket). "RF" = reference for total magnitude estimates (see pages 98-100 of the October 1992 issue, and Appendix C of the *ICQ Guide to Observing Comets*, for all of the 1- and 2-letter codes). "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); these Keys are also now available in the new *Guide to Observing Comets* and via the *ICQ*'s World Wide Web site. *Please note that data in archival form, and thus the data to be sent in machine-readable form, use a format that is different from that of the Tabulated data in the printed pages of the ICQ;* see pages 59-61 of the July 1992 issue, p. 10 of the January 1995 issue, and p. 100 of the April 1996 issue for further information [note correction on page 140 of the October 1993 issue]. Further guidelines concerning reporting of data may be found on pages 59-60 of the April 1993 issue, and in the *ICQ Guide to Observing Comets.*

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Key to observers with observations published in this issue, *with 2-digit numbers between Observer Code and Observer's Name indicating source [07 = Comet Section, British Astronomical Assn.; 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. Sarneczky); 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 Mikuz, 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
ADA03		Brian Adams, IA, U.S.A.
*ADA04	36	Gianluigi Adamoli, Italy
AND03	17	Krasimir Andreev, Bulgaria
ANT03	34	Anton Antonov, Bulgaria
ANZ		Fabio Anzellini, Italy
APF	23	Ladislav Apfelthaler, Czech Republic
BAR		Sandro Baroni, Italy
BAR06	37	Alexandr R. Baransky, Russia
BEA	07	Sally Beaumont, England
BIV		Nicolas Biver, France
BOR		John E. Bortle, NY, U.S.A.
BOR04	37	Sergiy A. Borysenko, Ukraine
*BOR05	34	Galin Borisov, Bulgaria
BOS01		J. G. Bosch, Switzerland
BOU		Reinder J. Bouma, The Netherlands
*CAN04		P. Candy, Viterbo, Italy
CAV	36	Marco Cavagna, Italy
CHE03		Kazimieras T. Cernis, Lithuania
*CIC01	36	Massimo Cicognani, Forli, Italy
COM	11	Georg Comello, The Netherlands
*CRE01		Phillip J. Creed, OH, U.S.A.
DEM	23	Eduard Demencik, Slovak Republic
DES01		Jose G. de Souza Aguiar, Brazil
DOC	34	Doichin Docinski, Bulgaria
FIE	36	Marsilio Fierimonte, Italy
FIL05	37	Alexander V. Filatov, Ukraine
FOG	36	Sergio Foglia, Italy
*FOU01	07	Michael Foulkes, England
*FUK01	16	Hiromi Fukushina, Japan
GER01	37	O. N. Geraschenko, Ukraine
GIL01	11	G. Gilein, The Netherlands
GLI		Gunnar Glitscher, West Germany
GOU	16	Hiroshi Goubara, Japan
GRA04	24	Bjoern Haakon Granslo, Norway
GRA07	34	Ivan Gradinarov, Bulgaria
GRE		Daniel W. E. Green, MA, U.S.A.
GUL01	32	Krisztian Gulyas, Hungary
GUR	37	S. Guryanov, Russia
HAR01	16	Shoji Harada, Japan
*HAR09	37	Sergiy V. Harchuk, Ukraine
HAS02		Werner Hasubick, Germany
HAS08	16	Yuji Hashimoto, Japan
HAV	36	Roberto Haver, Italy
HEE	24	Lars Trygve Heen, Norway
HER02		Carl Hergenrother, AZ, U.S.A.
HOM	37	Vasyl M. Homyak, Ukraine
HOR02	23	Kamil Hornoch, Czech Republic
*HRI	34	Svilen Hristov, Bulgaria
ISH02	16	Akiyoshi Ishikawa, Japan
ISH03	37	Andriy S. Ishchenko, Ukraine
*IVA02	34	Albena Ivanova, Bulgaria
*IVA03	37	Vladimir Ivanov, Russia
*JEL	34	Ralica Jeliaskova, Bulgaria
JON		Albert F. Jones, New Zealand
KAM01		Andreas Kammerer, Germany
KAT01	16	Taichi Kato, Kyoto, Japan
KIE01	07	Norman S. Kiernan, England
KON06	23	Jiri Konecny, Czech Republic
KOS04	37	Denis S. Kosenkov, Russia
KOZ	37	Vladimir A. Kozlov, Ukraine
KRO02		Gary W. Kronk, IL, U.S.A.
*KUC02	18	Lukasz Kuczkowski, Poland
KWI	18	Maciej Kwinta, Krakow, Poland
KYS	23	J. Kysely, Czech Republic
*LEH01	37	Kostayntyn S. Lehman, Ukraine
LOU	35	Romualdo Lourencon, Brazil
LUE		Hartwig Luethen, Germany
LUK04	37	Igor Lukyanyk, Ukraine
MAI	37	Alexander S. Maidic, Ukraine
*MAN01	37	Vladimir Man'ko, Ukraine
MAR02	13	Jose Carvajal Martinez, Spain
*MAR19	34	Alexander Marinov, Bulgaria
*MAR20	38	Fernando Martin, Madrid, Spain
*MAR21	36	Michele Martellini, Italy
MEY	28	Maik Meyer, Germany
MIK		Herman Mikuz, Slovenia
MIL02	36	Giannantonio Milani, Italy
MIY01	16	Osamu Miyazaki, Japan
MOD		Robert J. Modic, OH, U.S.A.
MOE		Michael Moeller, Germany
MOR04	37	Vladimir G. Mormyl, Ukraine
MOR08	37	Alexandra M. Mormyl, Ukraine
MOS03	37	Yurij A. Moskalenko, Ukraine
NAG02	16	Takashi Nagata, Japan
NAG08	16	Yoshimi Nagai, Japan
NAK01	16	Akimasa Nakamura, Japan
*NAU	37	Alexandr V. Naumov, Ukraine
*NIE01	07	Detlev Niechoy, Germany
OFE		Eran Ofek, Israel
OGA01	37	Sergei A. Ogarkov, Kiev, Ukraine
OHM	16	Fumihiko Ohmori, Japan
OKA05	16	Takuma Oka, Tokyo, Japan
OKS	07	Gabriel Oksa, Slovak Republc
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
PEA		Andrew R. Pearce, Australia
PER01		Alfredo J. S. Pereira, Portugal

PET	19	P. Petrov, Tuapse, U.S.S.R.
PLE01	18	Janusz Pleszka, Poland
PLS	23	Martin Plsek, Czech Republic
POD	23	M. Podzorny, Czech Republic
*POP01	34	Kostadin Popanastasov, Bulgaria
POR05	40	Joao Porto, Azores Is., Portugal
RAD01	17	Veselka Radeva, Bulgaria
RED	37	Sergei Red'ko, Kiev, Ukraine
ROD01	13	Diego Rodriguez, Spain
ROQ		Paul Roques, AZ, U.S.A.
SAN04	38	Juan Manuel San Juan, Spain
SAN07	32	Gabor Santa, Hungary
SAR02	32	Krisztian Sarneczky, Hungary
SCH04	11	Alex H. Scholten, Netherlands
SCI		Tomasz Sciezor, Poland
SCO04	37	Borys Skorichenko, Ukraine
SEA	14	David A. J. Seargent, Australia
SEA01	14	John Seach, Australia
SHA02	07	Jonathan D. Shanklin, England
SHI	16	Hiroyuki Shioi, Yachiyo, Japan
SIW01	18	Michal Siwak, Tuchow, Poland
SKI	24	Oddleiv Skilbrei, Norway
SOC	18	Krzysztof Socha, Poland
SPR		Chris E. Spratt, BC, Canada
SWI	18	Mariusz Swietnicki, Poland
SZA		Sandor Szabo, Sopron, Hungary
TAK05	16	Kesao Takamizawa, Japan
TAY	07	Melvyn D. Taylor, England
*TIR	36	Diego Tirelli, Sossano, Italy
TRI	38	Josep M. Trigo Rodriguez, Spain
TSU02	16	Mitsunori Tsumura, Japan
TSU03	16	Hiroaki Tsutiyama, Saga, Japan
TUB	12	Vince Tuboly, Hungary
VAN06	36	Gabriele Vanin, Italy
VEL02	17	Valentin Velkov, Bulgaria
VEL03	37	Peter Velestschuk, Ukraine
VET	07	J. C. Vetterlein, England
VIT01	40	Catarina Vitorino, Portugal
WAS	16	Shinsyo (Shinsho) Washi, Japan
YOS02	16	Katsumi Yoshimoto, Japan
YOS04	16	Seiichi Yoshida, Ibaraki, Japan
YUS	16	Toru Yusa, Kogota, Miyagi, Japan
ZAN		Mauro Vittorio Zanotta, Italy
ZAN01	11	W. T. Zanstra, The Netherlands
ZNO	23	Vladimir Znojil, Czech Republic

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Comet C/1995 O1 (Hale-Bopp)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 04 16.42		S	8.3	SC	8.0	B		20	4	2			KRO02
1996 05 21.38		S	7.1	HI	5.0	B		7	14	3/			ADA03
1996 05 22.07		S	7.3	WF	25	L	6	100	5	4	0.17		TIR
1996 05 22.36		S	7.2	HI	5.0	B		7	14	5			ADA03
1996 05 23.97		S	7.5	AA	11	L	7	32	1	3			IVA03
1996 05 29.06		S	6.7	AA	8.0	B		20	4	3			VAN06
1996 05 30.38		S	6.8	HI	5.0	B		7	12	5			ADA03
1996 06 07.98		S	6.4	AA	8.0	B		20	5	3			VAN06
1996 06 08.85		B	6.6:	AA	6.0	B		20	5.7	5			KOS04
1996 06 09.02		S	6.7	WF	20	T	10	150	5	4	0.17		TIR
1996 06 09.80		B	6.7:	AA	6.0	B		20	5.7	5			KOS04
1996 06 09.95		S	6.7	WF	25	L	6	166	5	4	0.17		TIR
1996 06 10.92		S	7.3	AA	11	L	7	80	1.5	7			IVA03
1996 06 11.00		S	6.4	AA	8.0	B		20	5	3			VAN06
1996 06 12.31		M	6.5	HI	5.0	B		7	13	6			ADA03
1996 06 14.05		B	7.3	SC	6.3	R	13	34		0			RAD01
1996 06 14.93		S	7.1	AA	11	L	7	80	2	7			IVA03
1996 06 15.26		S	6.4	YF	5.0	B		7	13	5/			ADA03
1996 06 15.88		B	6.6:	AA	6.0	B		20	5.9	4			KOS04
1996 06 15.92		S	6.6	WF	7.0	B		20	10	4	0.17		TIR
1996 06 15.99		S	7.5	SC	20.3	T	10	51					NIE01
1996 06 16.00		S	7.0	AA	5.0	B		7		5			KOZ
1996 06 16.94		S	7.0	AA	11	L	7	80	2	6			IVA03
1996 06 18.03		S	6.3	SC	8.0	B		15		1/			MAR21
1996 06 18.88		B	6.5	AA	6.0	B		20	6.0	5			KOS04
1996 06 19.25		S	6.3:	YF	5.0	B		7		6/			ADA03
1996 06 19.92		M	6.5	AA	4.0	R	4	12	10	3			MAI
1996 06 20.93		M	6.4	AA	4.0	R	4	12	11	3			MAI
1996 06 21.91		S	6.9	AA	11	L	7	80	2.5	5			IVA03
1996 06 22.96		M	6.3	AA	4.0	R	4	12	12	3			MAI
1996 06 23.91		B	6.3	AA	6.0	B		20	6.0	5			KOS04
1996 06 24.00		S	5.8:	AA	8.0	R	10	28	10	5	0.3	90	NAU
1996 06 24.90		B	6.4	AA	11	L	7	32	5.0	5			KOS04
1996 06 24.99		M	6.2	AA	4.0	R	4	12	12	3			MAI
1996 06 25.29		S	6.0	YF	5.0	B		7	16	6			ADA03
1996 06 25.92		M	6.2	AA	4.0	R	4	12	12	3			MAI

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 06 27.36		S	5.8	YF	5.0	B		7	&15	6/			ADA03
1996 07 02.80		S	5.8	S	5.0	B		10	10	4			LUE
1996 07 02.89		S	6.8	AA	11	L	7	32	4	5			IVA03
1996 07 03.80		S	5.7	S	5.0	B		10	10	4			LUE
1996 07 03.88		M	5.8	S	8.0	B		10	12	4			HOR02
1996 07 04.80		S	5.8	S	0.6	E		1					LUE
1996 07 04.80		S	5.9	S	5.0	B		10	10	4			LUE
1996 07 04.87		B	6.0:	AA	6.0	B		20		5			KOS04
1996 07 04.88		M	5.7	S	8.0	B		12	12	4			HOR02
1996 07 05.41		S	7.1	SC	4.5	R	6	13	3.5	5			JON
1996 07 05.75		S	5.7	S	5.0	B		10	12	4			LUE
1996 07 05.91		M	6.0	S	5.0	B		10	12	3/			HOR02
1996 07 06.20		M	5.8	YF	5.0	B		7	&15	7			ADA03
1996 07 06.85		S	5.9	S	5.0	B		10	12	5			LUE
1996 07 07.83		S	5.7	S	0.6	E		1	&10	3			LUE
1996 07 07.83		S	5.8	S	5.0	B		10	12	5			LUE
1996 07 07.97		M	6.1	AA	4.0	R	4	12	13	3			MAI
1996 07 08.83		M	6.0	AA	3.0	R	4	7	15	3			MAI
1996 07 08.83		S	5.8	S	0.6	E		1	12	3			LUE
1996 07 08.83		S	6.0	S	5.0	B		10	12	5			LUE
1996 07 08.98		M	7.5	AC	10.2	R	10	80	3	8/	&0.2	350	CIC01
1996 07 09.27		M	5.7	YF	5.0	B		7	17	7	&1.2	32	ADA03
1996 07 09.83		S	5.8	S	5.0	B		10	15	4			LUE
1996 07 09.86		B	6.0	AA	6.0	B		20	6	6			KOS04
1996 07 09.92		S	5.8	SC	8.0	B		15	9	3			MAR21
1996 07 10.84		M	6.0	AA	3.0	R	4	7	15	3			MAI
1996 07 10.87		B	6.1	AA	6.0	B		20	7.5	6			KOS04
1996 07 10.99		S	5.7	S	5.0	B		10	15	4	0.5	250	LUE
1996 07 11.74		S	5.7	S	5.0	B		10	15	6	0.5	250	LUE
1996 07 11.86		E	6.6	AA	13.3	R	5	33	5.7	6	0.14	355	SC004
1996 07 11.88		S	6.7	AA	11	L	7	32	5	5			IVA03
1996 07 12.90		E	6.6	AA	13.3	R	5	33	5.1	6	0.14	13	SC004
1996 07 12.91		S	5.7	S	5.0	B		10	15	7	0.5	250	LUE
1996 07 12.95		M	6.0	AA	3.0	R	4	7	16	3			MAI
1996 07 13.22		M	5.7:	YF	5.0	B		7		6/			ADA03
1996 07 13.79		S	5.7	S	5.0	B		10	20	7	0.5	250	LUE
1996 07 13.85		B	5.9	AA	6.0	B		20	7	6			KOS04
1996 07 13.93		M	6.7	SC	6.3	R	13	34	20	1			RAD01
1996 07 13.95		S	6.6	SC	6.3	R	13	34	20	2			RAD01
1996 07 13.96		B	6.6	SC	6.3	R	13	34		2			RAD01
1996 07 14.82		M	5.9	AA	3.0	R	4	7	16	3			MAI
1996 07 14.87		B	5.9:	AA	6.0	B		20	6	6			KOS04
1996 07 14.87		S	6.3	SC	8.0	B		15		2			MAR21
1996 07 14.88		B	6.6	SC	8.0	B		8					VEL02
1996 07 14.90		E	6.4	AA	13.3	R	5	33	3.6	6	0.17	6	SC004
1996 07 14.90		S	6.3:	S	5.6	R	14	40	7	5			DEM
1996 07 14.94		B	6.5	SC	6.3	B	13	34	22	2			RAD01
1996 07 14.94		S	6.4	SC	6.3	R	13	34		3			RAD01
1996 07 15.81		M	5.9	AA	3.0	R	4	7	17	3			MAI
1996 07 15.87		B	5.8	AA	6.0	B		20	7	6			KOS04
1996 07 15.90		S	5.7	S	5.0	B		10	25	7	1.0	250	LUE
1996 07 15.91		S	5.7	S	0.6	E		1	&20	3			LUE
1996 07 15.92		E	6.7	AA	13.3	R	5	33	4.4	7	0.15	8	SC004
1996 07 16.95		S	5.5	S	6.0	B		20	25	7	1.0	150	LUE
1996 07 17.87		B	5.7	AA	6.0	B		20	7.5	6			KOS04
1996 07 17.88		S	8.9	SC	20.3	T	10	51					NIE01
1996 07 18.85		M	5.9	AA	3.0	R	4	7	18	3			MAI
1996 07 18.87		S	6.3	SC	8.0	B		15		1/			MAR21
1996 07 19.19		M	5.6	YF	5.0	B		7	18	6/			ADA03
1996 07 19.83		M	6.0	AA	3.0	R	4	7	18	3			MAI
1996 07 19.87		B	5.7	AA	6.0	B		20	8.5	6			KOS04
1996 07 19.87		S	6.4:	AA	5.0	B		7		4			KOZ
1996 07 19.88		S	8.4	SC	20.3	T	10	51					NIE01
1996 07 20.55		S	5.9:	AA	7.0	B		10	&10	7			FUK01
1996 07 20.90		S	6.0	SC	20.3	T	10	51					NIE01

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 21.84		S	6.5:	AA	5.0	B		7		4			KOZ
1996 07 21.87		B	5.6	AA	11	L	7	32	9	7			KOS04
1996 07 21.88		E	6.6	AA	13.3	R	5	33	3.2	7	0.10	12	SC004
1996 07 22.84		S	6.6	AA	5.0	B		7		3			KOZ
1996 07 22.88		S	6.0	SC	20.3	T	10	51					NIE01
1996 07 22.92		E	6.7	AA	13.3	R	5	33	4.3	7	0.13	7	SC004
1996 07 23.31		M	5.7	YF	5.0	B		7	&17	6/	&0.75	125	ADA03
1996 07 23.48		S	6.6	SC	4.5	R	6	13	5.5				JON
1996 07 23.83		S	6.6	AA	5.0	B		7		3			KOZ
1996 07 23.85		M	5.9	AA	3.0	R	4	7	18	3			MAI
1996 07 23.90		B	5.6	AA	6.0	B	7	20	8	6			KOS04
1996 07 23.92		E	6.7	AA	13.3	R	5	33	7.9	7	0.15	13	SC004
1996 07 24.81		S	6.7	AA	5.0	B		7		3			KOZ
1996 07 24.89		S	6.5	AA	11	L	7	32	6	5			IVA03
1996 07 26.80		S	6.5	AA	5.0	B		7		3			KOZ
1996 08 02.80		B	5.5:	AA	6.0	B		20	8	6			KOS04
1996 08 03.44		S	6.3	SC	4.5	R	6	13	7	3			JON
1996 08 03.83		S	5.5	SC	20.3	T	10	51					NIE01
1996 08 03.84		S	5.7	AA	5.0	B		10	4	4			FOG
1996 08 04.83		S	5.5	SC	20.3	T	10	51					NIE01
1996 08 05.42		S	6.8	SC	4.5	R	6	13	6	3			JON
1996 08 05.83		S	7.5	SC	20.3	T	10	51					NIE01
1996 08 06.20		M	5.6	YF	5.0	B		7	14	6			ADA03
1996 08 06.75		S	6.5	AA	5.0	B		7		3			KOZ
1996 08 06.90		B	6.0	AA	3.0	B		8	6	4			ADA04
1996 08 07.79		S	6.4	AA	5.0	B		7		4			KOZ
1996 08 07.88		S	5.8	SC	8.0	B		15	7	2			MAR21
1996 08 08.23		M	5.5	YF	5.0	B		7	14	7			ADA03
1996 08 08.75		B	5.6	AA	6.0	B		20	9	7			KOS04
1996 08 08.86		S	6.3	AA	11	L	7	32	5	4			IVA03
1996 08 08.99		B	6.3	AA	3.0	B		8	9	4			ADA04
1996 08 09.83		M	5.7	AA	3.0	R	4	7	20	3			MAI
1996 08 09.86		S	6.3	AA	11	L	7	32	6	4			IVA03
1996 08 09.99		B	6.3	AA	3.0	B		8	9	2			ADA04
1996 08 10.75		B	5.6	AA	6.0	B		20	9	7			KOS04
1996 08 10.85		E	6.4	AA	13.3	R	5	40	7.0	S7	0.17	30	SC004
1996 08 10.87		S	6.2	AA	11	L	7	32	6	6			IVA03
1996 08 11.81		M	5.6	AA	3.0	R	4	7	22	3			MAI
1996 08 11.89		B	4.2	SC	6.3	R	13	34		5			RAD01
1996 08 12.79		B	6.8	AA	8.0	R	10	28	7.6	S6			GER01
1996 08 12.80		S	6.4	AA	5.0	B		7		4			KOZ
1996 08 12.81		M	5.5	AA	3.0	R	4	7	22	3			MAI
1996 08 12.87		E	6.7	AA	13.3	R	5	40	5.7	S7	0.14	12	SC004
1996 08 12.87		S	5.8	AA	4.2	B		7	13	S4			FIE
1996 08 12.88		B	6.3	AA	3.0	B		8	10	4			ADA04
1996 08 12.89		B	4.2	SC	6.3	R	13	34		5			POP01
1996 08 12.89		M	6.0	AA	5.0	B		10	7	3	0.3	90	VAN06
1996 08 12.90		B	4.3	SC	6.3	R	13	34		4			POP01
1996 08 12.91		B	4.3	SC	6.3	R	13	34		4			POP01
1996 08 12.91		B	4.3	SC	6.3	R	13	34	4	4			RAD01
1996 08 12.92		B	4.3	SC	6.3	R	13	34					HRI
1996 08 12.93		B	4.3	SC	6.3	R	13	34		4			POP01
1996 08 13.25		M	5.5	YF	5.0	B		7	14	5			ADA03
1996 08 13.77		S	6.4	AA	5.0	B		7		4			KOZ
1996 08 13.80		B	5.1	SC	6.3	R	13	34	10	6			RAD01
1996 08 13.83		E	6.7	AA	13.3	R	5	40	4.8	S7	0.16	26	SC004
1996 08 13.91		B	5.5	SC	6.3	R	13	34	3	5			ANT03
1996 08 13.92		B	4.2	SC	6.3	R	13	34	5	4			POP01
1996 08 13.92		B	5.7	SC	6.3	R	13	34	4	4			DOC
1996 08 14.84		S	5.8	AA	4.2	B		7	13	S4			FIE
1996 08 14.85		S	6.4	AA	5.0	B		7		4			KOZ
1996 08 14.87		B	5.1	SC	6.3	R	13	34	3	3			RAD01
1996 08 14.88		S	5.5	SC	8.0	B		15	7	3			MAR21
1996 08 14.88		S	6.3:	S	5.6	R	14	40	15	6			DEM
1996 08 14.90		E	6.7	AA	13.3	R	5	40	4.8	6	0.14	12	SC004

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 14.94		B	4.7	SC	6.3	R	13	34		4			POP01
1996 08 15.81		M	5.6	AA	3.0	R	4	7	20	4			MAI
1996 08 15.83		S	6.0	AA	11	L	7	32	7	5			IVA03
1996 08 15.83		S	6.2	AA	5.0	B		7		4			KOZ
1996 08 15.85		S	5.5	SC	8.0	B		15		3			MAR21
1996 08 15.86		B	5.5	SC	6.3	R	13	34	4	4			POP01
1996 08 15.87		B	5.2	SC	6.3	R	13	34	3	4			RAD01
1996 08 15.89		B	6.4	AA	3.0	B		8	9	2			ADA04
1996 08 15.91		B	5.5	SC	6.3	R	13	34	3	4			IVA02
1996 08 15.95		B	5.3	SC	8.0	B		8		7			GRA07
1996 08 16.42		S	6.6	SC	4.5	R	6	13	10				JON
1996 08 16.84		B	6.3	AA	3.0	B		8	10	4			ADA04
1996 08 16.84		S	6.0	AA	11	L	7	32	7	5			IVA03
1996 08 16.87		B	5.5	SC	6.3	R	13	34	4	4			POP01
1996 08 16.88		M	6.3	AA	5.0	B		10	4	3	0.2	70	VAN06
1996 08 17.83		S	6.0	AA	11	L	7	32	6	5			IVA03
1996 08 17.91		B	5.1	SC	8.0	B		8		6			GRA07
1996 08 18.81		S	6.0	SC	20.3	T	10	51					NIE01
1996 08 18.83		S	6.1	AA	11	L	7	32	6	5			IVA03
1996 08 18.90		B	5.1	SC	8.0	B		8		5			GRA07
1996 08 19.82		S	6.0	AA	11	L	7	32	6	5			IVA03
1996 08 19.91		B	5.1	SC	8.0	B		8		5			GRA07
1996 08 19.95		B	5.6	SC	8.0	B		8		5			JEL
1996 08 20.84		B	5.8	AA	6.0	B		20	&15	5			CHE03
1996 08 20.86		B	5.1	SC	8.0	B		8		6			GRA07
1996 08 20.86		B	6.4	AA	3.0	B		8	12	5			ADA04
1996 08 20.88		M	6.3	AA	5.0	B		10	5	3	0.3	95	VAN06
1996 08 21.76		S	5.9	AA	11	L	7	32	6	5			IVA03
1996 08 21.84		S	6.4	AA	5.0	B		7		4			KOZ
1996 08 24.82		B	5.6:	AA	6.0	B		20		5			CHE03
1996 08 28.80		B	5.7:	AA	6.0	B		20		5/			CHE03
1996 08 30.81		B	5.7	AA	6.0	B		20	&15	6			CHE03
1996 08 31.36		S	6.2	SC	4.5	R	6	13	8	2			JON
1996 09 02.86		B	5.8:	AA	6.0	B		20		5			CHE03
1996 09 03.79		B	5.7:	AA	6.0	B		20		5			CHE03
1996 09 04.75		S	6.4	AA	5.0	B		7		4			KOZ
1996 09 04.79		M	5.3	AA	5.0	B		10	20	S7	1.5	95	SAN07
1996 09 04.86		S	6.2	SC	8.0	B		15		3/			MAR21
1996 09 05.81		M	6.0	AA	30	L	3	25	15	5	2	114	TUB
1996 09 05.83		M	6.1	AA	5.0	B		10	4	3	0.2	65	VAN06
1996 09 05.87		S	5.8	AA	5.0	B		10	4	5	0.07	101	ABB
1996 09 06.29		S	6.1	SC	4.5	R	6	13	5	2			JON
1996 09 06.29		S	6.1	SC	5.0	R		7					JON
1996 09 06.79		S	6.0	WF	5.0	B		7					TIR
1996 09 06.82		M	5.9:	AC	10.2	R	10	40	10		0.58	12	CIC01
1996 09 08.77		S	5.4	AA	11	L	7	32	7	5			IVA03
1996 09 08.80		M	6.0	AA	30	L	3	25	15	5	2	116	TUB
1996 09 09.88		S	5.7	SC	8.0	B		15		3/			MAR21
1996 09 10.15		M	5.9	YF	5.0	B		7	7	6			ADA03
1996 09 10.39		S	6.3	SC	4.5	R	6	13	6				JON
1996 09 10.45		S	6.1	AA	8.0	B		20	8	6		83	PEA
1996 09 10.78		M	5.3:	AA	5.0	B		10	18	S8	0.5	90	SAN07
1996 09 10.82		S	6.1	S	5.6	R	14	40	21	6			DEM
1996 09 10.84		S	5.6	AA	5.0	B		10	8	5	0.13	75	ABB
1996 09 11.77		M	5.8	AA	3.0	R	4	7	14	5			MAI
1996 09 11.78		M	5.3	AA	5.0	B		10	15	S8	0.8	85	SAN07
1996 09 12.51		S	6.0	AA	8.0	B		20	9	6			PEA
1996 09 12.74		B	6.6	AA	8.0	R	10	28	&10	S5			GER01
1996 09 12.78		B	5.7	AA	6.0	B		20	&18	5/			CHE03
1996 09 13.77		S	6.0	WF	5.0	B		7					TIR
1996 09 13.90		S	5.7	AA	5.0	B		10	5	5	0.07	84	ABB
1996 09 14.12		M	5.9	YF	5.0	B		7	10	6			ADA03
1996 09 14.39		S	6.2	SC	4.5	R	6	13	6				JON
1996 09 14.76		B	5.7	AA	6.0	B		20	&15	5/			CHE03
1996 09 16.84		S	5.7	AA	5.0	B		10	8	5	0.27	86	ABB

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 17.41		B	6.0	AA	8.0	B		20					PEA
1996 09 17.41		S	6.0	AA	8.0	B		20	9	6		97	PEA
1996 09 18.52		B	6.0	AA	8.0	B		20					PEA
1996 09 18.52		S	5.9	AA	8.0	B		20	10	6	0.55	101	PEA
1996 09 18.82		S	5.4	AA	3.4	B		9	&13	5/			PER01
1996 09 18.84		S	5.4	S	5.6	R	14	40	20	7			DEM
1996 09 19.80		B	6.1	AA	3.0	B		8	13	7			ADA04
1996 09 19.81		S	6.5	AA	8.0	R	10	28	9	D4/			GER01
1996 09 21.75		B	6.2:	AA	5.0	B		7	8	5	0.15		MOR04
1996 09 21.77		S	6.7:	AA	11	L	7	32	&10	S8			MOS03
1996 09 21.80		B	5.6	AA	6.0	B		20		5/			CHE03
1996 09 21.83		S	5.2	AA	3.4	B		9	&17	3			PER01
1996 09 21.83		S	5.6	AA	3.4	B		9	&17	4			VIT01
1996 09 22.75		B	6.2:	AA	5.0	B		7	7	5	0.15		MOR04
1996 09 22.83		S	5.4	AA	3.4	B		9	> 8	6			PER01
1996 09 22.83		S	5.5	AA	3.4	B		9	&15	4			VIT01
1996 09 23.75		B	6.2:	AA	5.0	B		7	7	5	0.15		MOR04
1996 09 25.73		B	6.2:	AA	5.0	B		7	7	5	0.15		MOR04
1996 09 26.73		B	6.3:	AA	5.0	B		7	6	5			MOR04
1996 09 28.82		B	5.8	AA	3.4	B		9	&12	6/	&0.4	60	PER01
1996 09 28.82		M	5.5	AA	3.4	B		9	&12	6/	&0.4	60	PER01
1996 09 29.80		S	5.9	SC	7.0	B		16	10	4	0.17	40	TAY
1996 09 30.73		B	5.7	AA	5.0	B		7	8	5	0.5	92	MOR04
1996 09 30.76		M	5.3	AA	8.0	B		10	10	4			SZA
1996 09 30.76		M	5.5	AA	30	L	3	25	18	4	2	100	TUB
1996 09 30.80		M	5.6	SC	5.0	B		10	12	5/			GRA04
1996 09 30.81		O	4.9	S	0.0	E		1	25	5/			KON06
1996 09 30.83		M	5.4	AA	3.4	B		9	&17	5	&1.4	120	PER01
1996 09 30.84		I	5.7	AA	0.0	E		1					PER01
1996 09 30.84		M	5.2	AA	3.4	B		9	&26	5/	&1		VIT01
1996 09 30.94		S	5.3	AA	8.0	B		11	20	4/	>1.5		DES01
1996 10 01.73		B	5.7	AA	5.0	B		7	9	5	0.5	93	HAR09
1996 10 01.73		B	5.7	AA	5.0	B		7	10	5	0.5	92	MOR04
1996 10 01.74		S	6.5:	AA	6.5	L	8	33	& 5	6			MOS03
1996 10 01.75		M	5.0	AA	5.0	B		10	20	S8	0.8	75	SAN07
1996 10 01.82		S	5.3	SC	5.0	B		7	13	7			OKS
1996 10 01.83		M	5.5	AA	3.4	B		9	&14	5	&2.5	110	PER01
1996 10 01.84		I	5.3	AA	0.0	E		1					PER01
1996 10 01.84		I	5.6	AA	0.0	E		1					VIT01
1996 10 01.84		M	5.3	AA	3.4	B		9	&14	6	&1		VIT01
1996 10 01.94		S	5.3	AA	8.0	B		11	20	4/	>1.5		DES01
1996 10 01.98		M	5.5:	SC	5.0	B		10	&15	6	&0.3		POR05
1996 10 02.43		S	5.6	AA	8.0	B		20	12	7	0.7	97	PEA
1996 10 02.67		S	5.0	AA	15	R	10	60	7	4			IVA03
1996 10 02.73		B	5.6	AA	5.0	B		7	10	5	0.5	94	HAR09
1996 10 02.73		B	5.7	AA	5.0	B		7	10	5	0.5	94	MOR04
1996 10 02.76		M	5.9:	AC	10.2	R	10	40	10				CIC01
1996 10 02.79		S	5.7	SC	5.0	B		10	19	5			GIL01
1996 10 02.81		S	5.7	SC	5.0	B		10	12	5			ZAN01
1996 10 02.85		S	5.2	SP	5.0	B		10	10	0			KIE01
1996 10 02.90		M	5.5:	SC	5.0	B		10	&15	6/	&0.3		POR05
1996 10 03.40		S	6.0	SC	4.5	R	6	13	11	3			JON
1996 10 03.43		S	5.5	AA	8.0	B		20	12	6	0.9	97	PEA
1996 10 03.73		B	5.6	AA	5.0	B		7	10	5	0.5	94	MOR04
1996 10 03.73		B	5.7	AA	5.0	B		7	9	5	0.6	94	HAR09
1996 10 03.75		S	5.5	WF	5.0	B		20	20	6			TIR
1996 10 03.77		S	5.7	AA	5.0	B		10	10.5	5	0.5		MEY
1996 10 03.81		S	5.5	AA	5.0	B		19	18	4			FOG
1996 10 03.82		S	5.8	SC	7.0	B		16	10	4	0.17	40	TAY
1996 10 03.85		O	4.8	S	0.0	E		1	25	5/			KON06
1996 10 03.92		M	5.5:	SC	5.0	B		10	&15	6	&0.3		POR05
1996 10 04.34		S	5.8	SC	5.0	R		7	10	2			JON
1996 10 04.73		B	5.6	AA	5.0	B		7	10	5	0.6	94	HAR09
1996 10 04.73		B	5.6	AA	5.0	B		7	10	S5	0.7	94	MOR04
1996 10 04.75		M	5.0	Y	5.0	B		10	15	S8	1	85	SAN07

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 04.77		B	5.4	AA	5.0	B		7	10	7	0.4		HOM
1996 10 04.78		S	5.5	S	5.0	B		10	8	7			LUE
1996 10 04.82		S	5.8	SC	7.0	B		16	12	5	0.20	40	TAY
1996 10 04.83		0	4.8	S	0.0	E		1	25	5/			KON06
1996 10 05.03		M	6.1	SC	5.0	B		10	10	s6/			MOD
1996 10 05.36		S	6.0	SC	5.0	R		7	11	2			JON
1996 10 05.46		S	6.0	S	5.6	B		8		7			OKA05
1996 10 05.73		B	5.5	AA	5.0	B		7	12	5/	1.1	105	CHE03
1996 10 05.73		B	5.6	AA	5.0	B		7	10	6	0.66	95	HAR09
1996 10 05.73		B	5.6	AA	5.0	B		7	10	S6	0.7	94	MOR04
1996 10 05.74		B	5.2	AA	0.0	E		1		7			CHE03
1996 10 05.75		S	5.3	SC	8.0	B		12	15	s5	0.5	100	ISH03
1996 10 05.82		I	5.2:	AA	0.0	E		1					VIT01
1996 10 05.82		I	5.6	AA	0.0	E		1					PER01
1996 10 05.82		M	5.4	AA	3.4	B		9	&14	4/	&0.5		VIT01
1996 10 05.82		M	5.5	AA	3.4	B		9	&17	5	&2		PER01
1996 10 05.82		S	5.5	S	5.0	B		10	5	5			LUE
1996 10 06.05		M	6.0	SC	5.0	B		10	9	S7	0.8	123	MOD
1996 10 06.05		S	5.4	SC	0.8	E		1	20	1			MOD
1996 10 06.75		B	5.5	AA	5.0	B		7	& 4.5	3	0.2		HOM
1996 10 06.78		S	5.4	SC	5.0	B		10	18	5			ZAN01
1996 10 06.80		S	5.6:	SC	5.0	B		7	12	4			OKS
1996 10 06.81		I	5.4	AA	0.0	E		1					VIT01
1996 10 06.81		I	5.5	AA	0.0	E		1					PER01
1996 10 06.81		M	5.5	AA	3.4	B		9	&15	4/	&0.8		VIT01
1996 10 06.81		M	5.6	AA	3.4	B		9	&14	6	&2		PER01
1996 10 06.82		B	5.9	SC	5.0	B		7	12	5			BIV
1996 10 07.73		B	5.6	AA	5.0	B		7	10	5	0.7	94	MOR04
1996 10 07.73		B	5.6	AA	5.0	B		7	10	6	0.5	95	HAR09
1996 10 07.78		S	5.2	SC	8.0	B		12	15	s5/	0.5	100	ISH03
1996 10 07.81		I	5.5	AA	0.0	E		1					PER01
1996 10 07.81		M	5.6	AA	3.4	B		9	&11	5	&2		PER01
1996 10 07.93		S	5.3	AA	8.0	B		11	20	4	>1.8		DES01
1996 10 08.73		B	5.5	AA	5.0	B		7	10	5	0.5	95	MOR04
1996 10 08.73		B	5.6	AA	6.0	B		20		6			CHE03
1996 10 08.78		M	5.7	SC	5.0	B		10	12	6			GRA04
1996 10 08.81		B	5.9	AA	3.4	B		9	&11	6/			PER01
1996 10 08.81		I	5.6	AA	0.0	E		1					PER01
1996 10 08.81		M	5.6	AA	3.4	B		9	&11	6/	>2	120	PER01
1996 10 08.93		S	5.3	AA	8.0	B		11	20	4/	>1.8		DES01
1996 10 09.41		C	5.7	GA	8.0	R	6		20.5		>58 m	95	NAK01
1996 10 09.73		B	5.5	AA	5.0	B		7	11	6	0.5	95	HAR09
1996 10 09.73		B	5.6	AA	5.0	B		7	11	5	0.5	93	LEH01
1996 10 09.93		S	5.2	AA	8.0	B		11	20	4/	>1.8		DES01
1996 10 09.94		M	5.5:	SC	5.0	B		10	&15	6/	&0.3		POR05
1996 10 10.73		B	5.6	AA	5.0	B		7	11	5	0.5	95	MOR04
1996 10 10.89		M	5.4:	SC	5.0	B		10	&20	6/	&0.35		POR05
1996 10 11.10		M	5.4	YF	5.0	B		7	13	6/			ADA03
1996 10 11.10		S	5.2	YF	5.0	B		7	13	6/	&1	95	ADA03
1996 10 11.73		B	5.6	AA	5.0	B		7	11	5	0.5	95	LEH01
1996 10 11.74		S	5.6	AA	6.0	B		20		6			CHE03
1996 10 11.76		S	5.5	AA	5.0	B		10	11	d4/			MEY
1996 10 11.78		B	6.0:	AA	5.0	B		7	14	2	0.3		HOM
1996 10 12.54		S	5.3	HS	5	R	4	10	10	6	>1.0	90	GUR
1996 10 12.68		S	5.0	S	3	R	7	10	25	s3	0.6	80	BOR04
1996 10 12.69		S	4.9	S	5	R	8	20	18	4	0.6	80	BOR04
1996 10 12.73		B	5.5	AA	5.0	B		7	11	5	0.5	95	LEH01
1996 10 12.73		B	5.6	AA	5.0	B		7	11	5	0.5	95	MOR04
1996 10 12.75		M	4.7	Y	5.0	B		10	20	S8	2	80	SAN07
1996 10 12.75		S	5.2	WF	5.0	B		7	20	6			TIR
1996 10 12.76		S	5.4	AA	5.0	B		10	13.5	D5	0.4		MEY
1996 10 12.77		B	5.7	AA	5.0	B		7		2			HOM
1996 10 12.80		S	5.1	SC	8.0	B		12	15	s5/	0.6	95	ISH03
1996 10 12.82		B	5.8	SC	5.0	B		7	10	6			BIV
1996 10 12.82		M	5.8	AA	5.0	B		10			0.3	90	VAN06

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 13.02	a	B	5.7	HP	5.0	B		10					BOR
1996 10 13.02	a	S	5.6	HP	5.0	B		10	8	6/			BOR
1996 10 13.36		S	6.0	SC	5.0	R		7	9	1			JON
1996 10 13.40		S	4.8	S	15.0	R	5	25	15	5/	0.33		NAG02
1996 10 13.54		S	5.3	HS	5	R	4	10	10	6	>1.0	90	GUR
1996 10 13.72		S	5.4:	AA	6.0	B		20		6			CHE03
1996 10 13.73		B	5.5	AA	5.0	B		7	11	6	0.5	94	MOR04
1996 10 13.73		B	5.6	AA	5.0	B		7	12	5	0.5	96	LEH01
1996 10 13.75		M	4.8	AA	7.2	R	7	20	20	6	0.5	78	TUB
1996 10 13.77		M	5.4	AA	5.0	B		10	11	D5	0.8		MEY
1996 10 14.72		M	5.6	TI	5.0	B		7	10	3/			KYS
1996 10 14.73		B	5.4	AA	5.0	B		7	11	6	0.5	95	MOR04
1996 10 14.73		B	5.5	AA	5.0	B		7	13	5	>0.5	95	LEH01
1996 10 14.74		S	5.0	SC	8.0	B		12	16	s6	0.7	95	RED
1996 10 14.77		M	5.4	AA	5.0	B		10	11	D5/	0.8		MEY
1996 10 14.77		S	5.3	AA	0.6	E		1					MEY
1996 10 14.78		B	5.7	AA	5.0	B		7	11	3			HOM
1996 10 15.00	a	B	5.7	HP	5.0	B		10					BOR
1996 10 15.00	a	S	5.6	HP	5.0	B		10	8	6	1.7	134	BOR
1996 10 15.73		B	5.0	AA	0.0	E		1		7			CHE03
1996 10 15.73		B	5.4	AA	5.0	B		7	11	6	0.5	95	MOR04
1996 10 15.77		S	5.6	S	7.0	B		16	10	4	0.35	65	TAY
1996 10 15.78		B	6.0:	AA	5.0	B		7	11	3			HOM
1996 10 15.79		M	5.9	SC	5.0	B		10		4			AND03
1996 10 16.00	a	B	5.7	HP	5.0	B		10					BOR
1996 10 16.00	a	S	5.6	HP	5.0	B		10	8	7	1.3	123	BOR
1996 10 16.73		B	5.4	AA	5.0	B		7	10	6	0.5	95	MOR04
1996 10 16.73		B	5.4	AA	5.0	B		7	12	5	>0.5	96	LEH01
1996 10 16.77		S	5.6	S	7.0	B		16	8	3	0.33	65	TAY
1996 10 16.95		S	5.1	AA	8.0	B		11	25	5	>2.3		DES01
1996 10 17.73		B	5.4	AA	5.0	B		7	10	6	0.4	94	LEH01
1996 10 17.73		B	5.5	AA	5.0	B		7	10	6	0.4	95	MOR04
1996 10 17.78		S	5.1	SC	5.0	B		7	12	6			OKS
1996 10 17.95		S	5.1	AA	8.0	B		11	25	5	>2		DES01
1996 10 18.73		B	5.6	AA	5.0	B		7	9	6	0.3	95	MOR04
1996 10 18.75		S	4.7	AA	5.0	B		10	20	5			FOG
1996 10 18.75		S	5.0	WF	5.0	B		7	20	6			TIR
1996 10 18.77		M	5.2	AA	6	R		20	17	4			BAR06
1996 10 18.78		M	5.9	SC	5.0	B		10		4			AND03
1996 10 18.79		S	5.2	S	7.0	B		16	8	3	0.33	63	TAY
1996 10 18.80		S	5.3:	SC	5.0	B		7	10	5			OKS
1996 10 19.75		B	5.6	AA	5.0	B		7	8	6	0.3	95	MOR08
1996 10 19.75		S	4.6	AA	5.0	B		10	25	5			FOG
1996 10 20.65		B	5.6:	AA	7	R	6	12		5/			CHE03
1996 10 20.71		B	5.6	AA	5.0	B		7	8	6	0.25	95	MOR04
1996 10 20.81	a	B	5.8	AA	3.4	B		9	&12	6			PER01
1996 10 20.81	a	M	5.3	AA	3.4	B		9	&12	6			PER01
1996 10 20.81	a	S	5.1	AA	3.4	B		9	&12	6			PER01
1996 10 21.65		B	5.5:	AA	0.0	E		1		7			CHE03
1996 10 21.73		M	6.5	AC	10.2	R	10	40					CIC01
1996 10 21.77		S	5.6	AA	12.5	R	5	20	20	5			BEA
1996 10 21.80	a	M	5.3	AA	3.4	B		9	&15	5	&2.3	70	PER01
1996 10 21.81	a	S	5.4	AA	3.4	B		9	&17	3/	&0.7	70	VIT01
1996 10 22.40		S	4.7	AA	5.0	B		10	5	5	15 m		SEA01
1996 10 22.61		B	5.7:	AA	12	R	5	23	8	5/			CHE03
1996 10 22.78		S	5.7	HI	5.0	B		10	10	6			GRA04
1996 10 23.63		M	5.7:	AA	12	R	5	23		6	0.3	83	CHE03
1996 10 23.75		B	5.7	SC	5.0	B		7	12	6			BIV
1996 10 24.38		M	5.0	AA	5.0	B		10	9	4			SEA01
1996 10 24.60		B	5.5:	AA	8.0	B		10	7	6			CHE03
1996 10 25.58		B	5.4:	AA	8.0	B		10		6			CHE03
1996 10 25.78		S	4.8	SC	5.0	B		7	16	5			OKS
1996 10 26.59		B	5.6:	AA	8.0	B		10		6			CHE03
1996 10 27.40		S	5.3	AA	10	R	4	16		6			HAS08
1996 10 27.40		S	5.5	AA	10.0	R	8	20	18	6			GOU

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 27.41		M	5.3	AA	3.5	B		7	&15	7	0.6	90	YOS02
1996 10 27.59		B	5.6:	AA	8.0	B		10		6			CHE03
1996 10 27.82		M	5.3	AA	3.4	B		9	> 9	6/			PER01
1996 10 27.92		S	5.2	AA	8.0	B		11	25	5	>2.5		DES01
1996 10 28.42		M	5.1	AA	5.0	B		10	7	4	16 m		SEA01
1996 10 28.57		B	5.2	AA	8.0	B		10	10	6	0.5	85	CHE03
1996 10 28.74		S	5.1	SC	5.0	B		10	14	4			ZAN01
1996 10 28.85		M	5.4:	SC	5.0	B		10	&30	7	&0.6		POR05
1996 10 28.92		S	5.1	AA	8.0	B		11	25	5	2.5		DES01
1996 10 29.01	&	M	5.7	SC	5.0	B		10	8.2	s5			MOD
1996 10 29.42		I	4.9	AA	0.0	E		1					SEA01
1996 10 29.42		M	5.1	AA	5.0	B		10	11	4	50 m		SEA01
1996 10 29.59		B	5.2	AA	8.0	B		10		6			CHE03
1996 10 29.60		B	5.0	AA	0.0	E		1		7			CHE03
1996 10 29.70		M	4.9	S	5.0	B		10	15	5/			HOR02
1996 10 29.75		B	5.6	SC	5.0	B		7	12	7			BIV
1996 10 29.75		M	5.7	AA	7.0	B		16	8	6	0.50	60	TAY
1996 10 29.75		S	5.1	SC	5.0	B		10	14	4			ZAN01
1996 10 29.76		S	5.6	AA	12.5	R	5	20	18	5			BEA
1996 10 29.82		B	5.4	AA	3.4	B		9	&12	6	&2.3	90	PER01
1996 10 29.82		I	5.0	AA	0.0	E		1					PER01
1996 10 29.82		M	4.9	AA	3.4	B		9	&12	6	&2.3	90	PER01
1996 10 29.92		S	5.1	AA	8.0	B		11	25	5	2.5		DES01
1996 10 29.98	a	B	5.6	HP	5.0	B		10					BOR
1996 10 29.98	a	S	5.5	HP	5.0	B		10	9	7			BOR
1996 10 30.40		S	5.4	VG	5.0	B		7	12	6	40 m	70	NAG08
1996 10 30.61		M	5.1	AA	8.0	B		10		6	0.4	85	CHE03
1996 10 30.73		M	5.3	HI	5.0	B		10	12	6			GRA04
1996 10 30.73		S	4.7	WF	5.0	B		7	20	6			TIR
1996 10 30.74		M	5.0	S	5.0	B		10	15	5			HOR02
1996 10 30.75		M	4.6	Y	5.0	B		10	20		1	90	SAN07
1996 10 30.76		B	5.4	AA	5.0	B		10	12.7	4	0.33	95	HAS02
1996 10 30.76		M	4.6	AA	6.0	B		20	30	4	1.5	95	TUB
1996 10 30.81		I	5.4	AA	0.0	E		1					PER01
1996 10 30.81		M	5.2	AA	3.4	B		9	&13	6	&2.8	110	PER01
1996 10 30.82		M	5.4	AA	3.4	B		9	&15	5	&1.8	115	VIT01
1996 10 30.92		S	5.2	AA	8.0	B		11	25	4	>2.5		DES01
1996 10 31.72		M	5.0:	S	5.0	B		10	12	5			HOR02
1996 10 31.73		M	5.4	AA	5.0	B		10					VAN06
1996 10 31.99	a	B	5.4	HP	5.0	B		10					BOR
1996 10 31.99	a	S	5.4	HP	5.0	B		10	7	7	1.4	105	BOR
1996 11 01.01	&	M	5.7	SC	5.0	B		10	7.8	s5/			MOD
1996 11 01.41		M	5.1	AA	5.0	B		10	9	6	55 m	85	SEA01
1996 11 01.57		M	4.9	AA	8.0	B		10		6	0.4	85	CHE03
1996 11 01.71		B	5.4	AA	5.0	B		7	12	6	0.33	100	MOR04
1996 11 01.72		M	5.4	AA	5.0	B		10	4	4	0.4	75	VAN06
1996 11 01.74		M	5.1	AA	5.0	B		7	17	6/			BOU
1996 11 01.74		S	5.4	SC	8.0	B		15	&10	5	0.5		COM
1996 11 01.74	!	V	5.0	YF	20.0	T	2		&25	7	&1	100	MIK
1996 11 01.75		M	5.0	AA	4.2	B		7	13	S6/	1.5	70	ZAN
1996 11 01.75		S	4.8	AA	0.0	E		1	&15	s4/			ZAN
1996 11 01.76					15.0	B		25	11	S6/	1.5	60	ZAN
1996 11 01.82		I	5.3	AA	0.0	E		1					PER01
1996 11 01.82		M	5.0	AA	3.4	B		9	&12	6	&2.5	95	PER01
1996 11 01.82		M	5.3	AA	3.4	B		9	&14	5	&1	100	VIT01
1996 11 01.83	w	B	3.8	S	3.0	B		6	10	6/	0.4	60	SAN04
1996 11 01.83	w	S	3.8	S	0.0	E		1		4			MAR02
1996 11 01.84	w	M	4.0	S	7.0	B		10	7	7/	0.75	70	MAR02
1996 11 01.91		S	5.1	AA	8.0	B		11	25	4/	>2.5		DES01
1996 11 01.99	a	B	5.4	HP	5.0	B		10					BOR
1996 11 01.99	a	S	5.4	HP	5.0	B		10	8	7	1.3	104	BOR
1996 11 02.40		I	4.7	AA	0.0	E		1					SEA01
1996 11 02.40		M	4.9	AA	5.0	B		10	11	5	1.0	80	SEA01
1996 11 02.59		B	5.0:	AA	8.0	B		10		6			CHE03
1996 11 02.71	&	M	5.0	Y	6.0	B		20	15	s6	1	90	SAR02

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 11 02.73		M	5.2	HI	5.0	B		10	13	6	0.5	90	GRA04
1996 11 02.73		S	5.0:	AC	8.0	B		20	&30		1.2	75	ANZ
1996 11 02.73		S	5.0:	AC	8.0	B		20	&30		1.2	75	ANZ
1996 11 02.74		M	5.4	AA	5.0	B		10	6	4	0.4	80	VAN06
1996 11 02.74		M	5.6	AA	8.0	B		20	4	4	0.4	80	VAN06
1996 11 02.75		S	4.7	AA	0.0	E		1	&15	s4/			ZAN
1996 11 02.75		S	5.3	AA	4.0	B		8	8	3	0.13	60	TAY
1996 11 02.76					15.0	B		25	10	S6/	1.5	60	ZAN
1996 11 02.76		M	4.9	S	8.0	B		10	13	5/	1	90	HOR02
1996 11 02.76		M	5.0	AA	4.2	B		7	13	S6/	1.5	70	ZAN
1996 11 02.76		S	5.3	AA	7.0	B		16	6	3	0.10	60	TAY
1996 11 02.78		B	4.9	S	5.0	B		7	20	7			MAR20
1996 11 02.80		I	5.2	AA	0.0	E		1					PER01
1996 11 02.80		M	4.8	AA	8.0	B		20	5	5	1.0	76	SHA02
1996 11 02.80		M	5.0	AA	3.4	B		9	&12	5			PER01
1996 11 02.80		M	5.1	AA	3.4	B		9	&14	5			VIT01
1996 11 02.80	w	M	4.2	S	7.0	B		10	7	8	1	100	MAR02
1996 11 02.80	w	S	4.1	S	0.0	E		1		4			MAR02
1996 11 02.81		B	5.3	AA	3.4	B		9	&12	5			PER01
1996 11 02.81		B	5.4	AA	2.4	B		8	&12	6/			PER01
1996 11 02.81		I	5.3	AA	0.0	E		1					VIT01
1996 11 02.81		M	5.3	AA	2.4	B		8	&12	6/			PER01
1996 11 02.81	w	B	4.3	S	3.0	B		6	12	6/	0.4	80	SAN04
1996 11 03.03		S	5.0	YF	5.0	B		7	&15	6/	&1.25	80	ADA03
1996 11 03.38		S	4.6	S	15.0	R	5	25	10	7	1.0		NAG02
1996 11 03.38		S	5.4	VG	5.0	B		7	10	6/	0.8	70	NAG08
1996 11 03.40		M	5.0	AA	5.0	B		10	9	5	1.0	80	SEA01
1996 11 03.41		M	4.9	AA	3.5	B		7	&12	7	0.8	80	YOS02
1996 11 03.44		M	5.3	AA	3.5	B		7					TSU02
1996 11 03.58		M	5.0	AA	8.0	B		10		6	0.5	85	CHE03
1996 11 03.71		M	4.6	HD	5.0	B		10	15	s8	0.5	90	SAN07
1996 11 03.71		O	4.7	S	0.0	E		1	20	5			ZNO
1996 11 03.74		B	5.1	AA	5.0	B		10					HAS02
1996 11 03.74		I	5.1	AA	0.8	E		1					HAS02
1996 11 03.74		S	4.5	Y	7.2	R	7	20	30	4	1.5	70	TUB
1996 11 03.75					15.0	B		25	10	S6/	1.5	60	ZAN
1996 11 03.75		M	5.0	AA	4.2	B		7	13	S6/	1.5	70	ZAN
1996 11 03.75		S	4.7	AA	0.0	E		1	&15	s4/			ZAN
1996 11 03.77		M	5.3	AA	3.6	B		4	6	4	0.4	80	VAN06
1996 11 03.77		M	5.4	AA	5.0	B		10	6	4	0.4	80	VAN06
1996 11 03.99	a	B	5.4	HP	5.0	B		10					BOR
1996 11 03.99	a	S	5.3	HP	5.0	B		10	6	7	0.9	97	BOR
1996 11 04.38		S	5.4	VG	5.0	B		7	10	6/	0.8	70	NAG08
1996 11 04.58		M	4.9:	AA	8.0	B		10		6			CHE03
1996 11 04.70		M	4.6	AA	5	R		20	12	D5	2	88	BAR06
1996 11 04.71		B	5.1	AA	5.0	B		7	13	6	0.66	100	MOR04
1996 11 04.72		B	4.5	S	0.0	E		1	18	4			HOR02
1996 11 04.72		M	4.9	S	5.0	B		7	18		1.0		APF
1996 11 04.72		M	5.0	S	8.0	B		10	15	6	2.5	90	PLS
1996 11 04.72		M	5.1	TI	5.0	B		7	10	3	1.5	90	KYS
1996 11 04.73		M	4.6	HD	5.0	B		10	15	d8	1.5	90	SAN07
1996 11 04.73		M	4.9	S	8.0	B		10	18	5/	1.1	70	ZNO
1996 11 04.74		B	5.1	AA	5.0	B		10					HAS02
1996 11 04.75		M	4.8	AA	8.0	B		10	6	6	1.0	97	SHA02
1996 11 04.76		S	5.1	AA	7.0	B		16	7	4	0.30	61	TAY
1996 11 04.82		M	5.3:	SC	5.0	B		10	&25	7	&0.60		POR05
1996 11 04.98		B	5.4	HP	5.0	B		10					BOR
1996 11 04.98		S	5.3	HP	5.0	B		10	7	7	1.0	100	BOR
1996 11 05.64		M	4.8:	AA	8.0	B		10		6			CHE03
1996 11 05.66	a	B	5.3	S	8.0	B	6	10	9.5	6	>0.5	24	PAV
1996 11 05.70		B	4.9	AA	5.0	B		7	20	S6	0.5	85	VEL03
1996 11 05.70		B	5.1	AA	5.0	B		7	14	7	0.66	100	MOR04
1996 11 05.70		M	4.6	AA	5	R		20	14	D5	1.8	87	BAR06
1996 11 05.71		M	4.7	AA	5.0	B		7		3			BAR06
1996 11 05.72					11	L	7	32	16	S5	1.0	62	VEL03

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 11 05.72		M	4.6	HD	5.0	B		10	15	s8	1	90	SAN07
1996 11 05.73		M	4.9	AA	5.0	B		7	18	7	2.0	74	BOU
1996 11 05.73		M	5.2	SC	5.0	B		10	& 9	7	&0.5	80	GLI
1996 11 05.74		S	5.3	SC	5.0	B		10	&14	4	0.5	40	COM
1996 11 05.77		B	5.4	SC	5.0	B		7	10	7			BIV
1996 11 05.83		M	5.4:	SC	5.0	B		10	&20	6/	&0.55		POR05
1996 11 05.91		S	5.0	AA	8.0	B		11	20	4	>2		DES01
1996 11 06.42		M	5.0	AA	3.5	B		7	&12	6	0.6	80	YOS02
1996 11 06.57		M	5.2:	AA	8.0	B		10		6			CHE03
1996 11 06.70		M	4.7	AA	5	R		20	11	S5/	1.5	90	BAR06
1996 11 06.70		S	5.0:	VF	5.0	B		7	10	3			FIL05
1996 11 06.71		M	4.5	S	0.0	E		1	20	4			HOR02
1996 11 06.72		B	4.5	S	0.0	E		1	20	4/			PLS
1996 11 06.79		B	4.6	S	5.0	B		7	10	7			MAR20
1996 11 06.92		S	4.9	AA	8.0	B		11	20	4	>2		DES01
1996 11 07.66		S	4.6	S	5	R	8	20	22	3	0.6	80	BOR04
1996 11 07.73		M	4.9	SC	5.0	B		10	& 9	6/	&0.5	80	GLI
1996 11 07.75		B	5.5	SC	5.0	B		7	10	6			BIV
1996 11 07.75		S	4.8	AA	7.0	B		16	6	4	0.33	60	TAY
1996 11 07.80	a	B	5.4	AA	3.4	B		9	&12	6/			PER01
1996 11 07.80	a	I	4.9	AA	0.0	E		1					PER01
1996 11 07.80	a	M	4.9	AA	3.4	B		9	&12	6/			PER01
1996 11 08.39		M	5.0	AA	5.0	B		10	7	5	1.0	80	SEA01
1996 11 08.57		M	5.1	AA	12	R	5	23		6	0.6	88	CHE03
1996 11 08.59		M	4.9	AA	8.0	B		10	10	6	0.3	88	CHE03
1996 11 08.68		B	5.0	AA	5.0	B		7	9	S5	0.5	70	VEL03
1996 11 08.69					11	L	7	32	8	S5	2.5	60	VEL03
1996 11 08.69		B	5.0	AA	5.0	B		7	12	7	0.5	100	MOR04
1996 11 08.70		M	4.8	AA	5	R		20	11	S6	1.0	99	BAR06
1996 11 08.71		S	4.6	AA	8.0	B		20	7	6			BAR
1996 11 08.72		B	4.4	S	0.0	E		1	25	3/			HOR02
1996 11 08.73		B	5.0	AA	5.0	B		10	12.2	4			HAS02
1996 11 08.73		M	4.8	AA	5.0	B		7	18	6/			BOU
1996 11 08.73		M	5.1	HI	5.0	B		10	11	6			GRA04
1996 11 08.73		S	4.7	AA	15.2	L	5	42	9	5	1.2	90	MOE
1996 11 08.74		B	4.3	S	0.0	E		1	30	4/			PLS
1996 11 08.74		S	5.1	SC	8.0	B		15	12	4	0.6	75	SCH04
1996 11 08.74		S	5.2	AA	5.0	B		10	6	D5	0.4		MEY
1996 11 08.74		S	5.7	AA	5.0	B		10	4	4	0.07	70	TAY
1996 11 08.75					15.0	B		25	9	S6/	2.0	110	ZAN
1996 11 08.75		M	5.0	AA	4.2	B		7	15	S6/	2.0	85	ZAN
1996 11 08.75		S	4.6	AA	0.7	E		1	12	3			SHA02
1996 11 08.75		S	4.7	AA	0.0	E		1	&18	s4/			ZAN
1996 11 08.75		S	4.9	AA	8.0	B		10	5	6	1.1	95	SHA02
1996 11 08.76		B	5.4	SC	5.0	B		7	10	6			BIV
1996 11 08.86		M	5.3	SC	5.0	B		10		4			AND03
1996 11 09.04		J	4.6	SC	25.4	T	4		11.62	S6	5.5m	68	ROQ
1996 11 09.38		M	5.0	AA	25.4	T	6	40	6.5	6/			ISH02
1996 11 09.41		I	4.8	AA	0.0	E		1					SEA01
1996 11 09.57		M	4.8	AA	8.0	B		10		6			CHE03
1996 11 09.58		B	4.6	AA	0.0	E		1		7			CHE03
1996 11 09.70		M	4.7	AA	5	R		20	12	S5			BAR06
1996 11 09.71		M	5.0:	HD	5.0	B		10	10	s8	0.4	90	SAN07
1996 11 09.72	&	M	4.4	Y	0.0	E		1	15	S6			SAR02
1996 11 09.72	&	M	4.8	Y	6.0	B		20	12	s7	1.5	75	SAR02
1996 11 09.73		S	4.7	AA	15.2	L	5	42	9	5	0.9	90	MOE
1996 11 09.73	!	V	5.1	YF	20.0	T	2		&25	7	&1	100	MIK
1996 11 09.74		M	5.0	HI	5.0	B		10	12	6	0.8	90	GRA04
1996 11 09.74		S	5.1	SC	8.0	B		15	10	4	0.6	67	SCH04
1996 11 09.77		B	5.3	SC	5.0	B		7	15	6	0.8	90	BIV
1996 11 09.97	a	B	5.4	HP	5.0	B		10					BOR
1996 11 09.97	a	S	5.2	HP	5.0	B		10	7	7			BOR
1996 11 10.58		M	4.8	AA	8.0	B		10	12	6	0.4	90	CHE03
1996 11 10.59		B	4.6	AA	0.0	E		1		6			CHE03
1996 11 10.64		B	4.9	AA	5.0	B		7	13	7	0.5	100	MOR04

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 11 10.82		M	5.3:	SC	5.0	B		10	&25	6/	&0.60		POR05
1996 11 10.93		S	4.8	AA	5.0	B		7	15	7			LOU
1996 11 11.39		M	5.1	AA	5.0	B		10	5	S7	15 m	75	SEA01
1996 11 11.58		M	5.0	AA	8.0	B		10	13	6	0.4	90	CHE03
1996 11 11.69		B	5.0	AA	5.0	B		7	13	7	0.5	100	MOR04
1996 11 11.70		M	4.7	AA	5	R		20	13	5	1.0		BAR06
1996 11 11.77		M	5.1	SC	5.0	B		10		4			AND03
1996 11 11.96	a	B	5.1	HP	5.0	B		10					BOR
1996 11 11.96	a	S	5.1	HP	5.0	B		10	8	7			BOR
1996 11 12.41		I	4.5	AA	0.0	E		1		S1	10 m		SEA01
1996 11 12.41		M	4.6	AA	5.0	B		10	7	S7	50 m	75	SEA01
1996 11 12.67		B	4.8	AA	5.0	B		7	10	S5	0.5	60	VEL03
1996 11 12.69		B	4.9	AA	5.0	B		7	12	7	0.5	100	MOR04
1996 11 12.70		M	4.8	HD	5.0	B		10	10	S8	0.4	75	SAN07
1996 11 12.74		M	5.1	HD	8.0	B		10	10	7	0.25	80	SZA
1996 11 12.75		S	5.1	AA	7.0	B		16	7.5	4	0.25	60	TAY
1996 11 12.97	a	B	5.1	HP	5.0	B		10					BOR
1996 11 12.97	a	S	5.1	HP	5.0	B		10	8	7	0.9	105	BOR
1996 11 13.38		S	4.9	SC	3.0	B		10	18	5	40 m	90	SHI
1996 11 13.38		S	5.0	VG	5.0	B		7	12	6	0.7	70	NAG08
1996 11 13.39		B	5.9	AA	8.0	B		11	7	5			MIY01
1996 11 13.39		M	5.5:	AA	3.5	B		7					TSU02
1996 11 13.40		M	5.2	AA	5.0	B		10	5	S5	20 m	75	SEA01
1996 11 13.42		S	4.6	S	15.0	R	5	25	10	7	0.8		NAG02
1996 11 13.64		B	4.9	AA	5.0	B		7	13	7	0.5	100	MOR08
1996 11 13.72		M	4.8	AA	5.0	B		10		6/			BOU
1996 11 13.73		M	5.0	HI	5.0	B		10	10	6			GRA04
1996 11 13.73		S	4.6	AA	15.2	L	5	42	10	6	1.6	85	MOE
1996 11 13.74		S	5.1	AA	7.0	B		16	7.5	6	0.50	42	TAY
1996 11 13.82		M	5.4:	SC	5.0	B		10	&30	6/	&1.05		POR05
1996 11 13.96	a	B	5.1	HP	5.0	B		10					BOR
1996 11 13.96	a	S	5.0	HP	5.0	B		10	8	7	1.0	100	BOR
1996 11 14.38		M	5.2	AA	5.0	B		7	15	6	1.0	80	KAT01
1996 11 14.38		S	5.0	VG	5.0	B		7	12	6	0.7	70	NAG08
1996 11 14.39		B	5.9	AA	8.0	B		11	5	4			MIY01
1996 11 14.39		M	5.0	AA	3.5	B		7					TSU02
1996 11 14.40		M	5.2	AA	8.0	B		15	7	S2			SEA01
1996 11 14.58		M	5.0	AA	8.0	B		10	9	6	0.3	90	CHE03
1996 11 14.59		B	4.7	AA	0.0	E		1		7			CHE03
1996 11 14.70		B	4.9	AA	5.0	B		7	14	7	0.5	100	MOR04
1996 11 14.73		M	4.8	AA	5.0	B		7	16	6/	1.2	72	BOU
1996 11 14.73		S	5.0	SC	5.0	B		10	9	5	0.7	110	ZAN01
1996 11 14.75		S	4.7	SC	4.0	B		8	12	5	0.5	70	SCH04
1996 11 14.97	a	B	5.1	HP	5.0	B		10					BOR
1996 11 14.97	a	S	5.0	HP	5.0	B		10	8	7	0.9	90	BOR
1996 11 15.37		M	5.0	AA	5.0	B		7	15	6	0.5	90	KAT01
1996 11 15.39		S	4.5	S	15.0	R	5	25	12	7	1.0		NAG02
1996 11 15.42		M	5.0	AA	25.4	T	6	40	7.3	6			ISH02
1996 11 15.58		B	4.6	AA	0.0	E		1		7			CHE03
1996 11 15.58		M	4.8	AA	8.0	B		10		6	0.3	90	CHE03
1996 11 15.70		B	5.0	AA	5.0	B		7	12	7	0.33	100	MOR04
1996 11 15.72		S	4.6	AA	15.2	L	5	42	10	6	1.2	85	MOE
1996 11 15.74		M	4.8	AA	5.0	B		7	16	6			BOU
1996 11 15.76		S	5.0	SC	5.0	B		10	9	5			ZAN01
1996 11 15.82		M	5.4:	SC	5.0	B		10	&25	6/	&0.60		POR05
1996 11 15.97	a	B	5.0	HP	5.0	B		10					BOR
1996 11 15.97	a	S	5.0	HP	5.0	B		10	10	7	0.9	90	BOR
1996 11 15.98		M	5.5	SC	5.0	B		10	6.0	s6			MOD
1996 11 16.37		S	5.5	AA	25.4	T	6	32	10	6			YOS04
1996 11 16.38		S	4.9	VG	5.0	B		7	12	6	0.5	60	NAG08
1996 11 16.39		S	4.5	S	15.0	R	5	25	12	6/	1.0		NAG02
1996 11 16.40		M	4.9	AA	3.5	B		7	&10	7	0.7	70	YOS02
1996 11 16.59		M	4.9	AA	8.0	B		10		6			CHE03
1996 11 16.70		B	5.0	AA	5.0	B		7	11	7	0.25		MOR04
1996 11 16.96	a	B	4.9	HP	5.0	B		10					BOR

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 11 16.96	a	S	4.9	HP	5.0	B		10	10	7	0.5		BOR
1996 11 17.38		S	5.3	AA	25.4	T	6	32	12	5			YOS04
1996 11 17.77		B	5.6	SC	5.0	B		10		4			RAD01
1996 11 18.38		S	5.0:	VG	5.0	B		7	&10	5/	0.5	60	NAG08
1996 11 18.70		M	4.6	S	5.0	B		7	15				POD
1996 11 18.73		S	5.1	AA	7.0	B		16	3	3	0.20	83	TAY
1996 11 18.73		S	5.4	AA	4.0	B		10	5	4	0.33	83	TAY
1996 11 18.75		B	5.4	SC	5.0	B		7	10	5			BIV
1996 11 19.70		B	5.0	AA	5.0	B		7	11	7	0.25		MOR04
1996 11 19.71	!	V	4.7	YF	20.0	T	2		&30	7	&1	110	MIK
1996 11 19.72		S	4.6	AA	15.2	L	5	42	9	5	0.9	85	MOE
1996 11 20.58		M	4.8	AA	8.0	B		10		6	0.3	90	CHE03
1996 11 20.73		S	5.3	AA	7.0	B		16	6	4	0.17	84	TAY
1996 11 20.75		B	5.5	SC	5.0	B		10		4			RAD01
1996 11 20.82		M	5.2	SC	5.0	B		10	&25	6/	&1.05		POR05
1996 11 20.96	a	B	4.9	HP	5.0	B		10	9	7			BOR
1996 11 21.57		M	4.7	AA	8.0	B		10	8	6			CHE03
1996 11 21.68		B	5.1	AA	5.0	B		7	10	6	0.2		OGA01
1996 11 21.70		S	4.3	WF	15	L	6	45	&45	5	&1		TIR
1996 11 21.72		B	4.9	AA	5.0	B		10	7.4	4			HAS02
1996 11 21.72		S	4.3	AA	5.0	B		7	10	8	0.25	40	BAR
1996 11 21.74		S	4.8	AA	4.0	B		10	11	4	0.50	45	TAY
1996 11 21.82		M	5.2:	SC	5.0	B		10	&25	6/	&1.05		POR05
1996 11 22.57	&	M	4.7	AA	8.0	B		10	8	6			CHE03
1996 11 22.69		O	4.7	TI	11	L	7	32	8	5			KYS
1996 11 22.71		M	5.0	SC	5.0	B		10	& 6	7	&0.5	45	GLI
1996 11 22.74		K	4.6	AA	8	R		12	14	S6/	&1		BAR06
1996 11 22.74		M	4.8	AA	11	L	7	32	13	5/			BAR06
1996 11 22.75		B	4.9:	AA	8	R		12	12	6	&1		LUK04
1996 11 23.57	&	M	5.0:	AA	8.0	B		10		6			CHE03
1996 11 23.72		S	4.9	SC	4.0	B		8	12	6			SCH04
1996 11 24.37		S	4.5	S	15.0	R	5	25	10	6/	0.7		NAG02
1996 11 24.57	&	M	4.7:	AA	8.0	B		10		6			CHE03
1996 11 24.66		S	4.8	AA	4.2	B		7	9	S6/			ZAN
1996 11 24.69		S	4.3	WF	5.0	B		7	&45	5	0.5		TIR
1996 11 24.70	!	V	4.8	YF	20.0	T	2		&25	7	&1	110	MIK
1996 11 24.74		S	4.4:	AC	8.0	B		20	&18		1.8	73	ANZ
1996 11 25.39		C	4.8	HI	8.0	R	6		20.5				NAK01
1996 11 25.56	&	M	4.9	AA	12	R		23	6	6			CHE03
1996 11 26.57	&	M	4.9	AA	12	R		23	6	6			CHE03
1996 11 26.68		S	4.7	V	5.0	B		7	5	7			HEE
1996 11 26.74		B	5.2	SC	5.0	B		7	10	6			BIV
1996 11 27.02	a	M	4.6	YF	5.0	B		7	&15	s7			ADA03
1996 11 27.40		S	4.9	S	7.0	B		10		8			TSU03
1996 11 27.57	&	B	4.6	AA	0.0	E		1		7			CHE03
1996 11 27.68		B	4.5	AA	5.0	B		7	13	7	0.5		MOR04
1996 11 27.72		M	4.5	HI	5.0	B		10	12	6	0.6	65	GRA04
1996 11 27.96	a	B	4.8	HP	5.0	B		10					BOR
1996 11 27.96	a	S	4.7	HP	5.0	B		10	9	7			BOR
1996 11 28.38		M	4.6	AA	10.0	B		20	10.1	7	1.0		ISH02
1996 11 28.38		M	4.8	AA	25.4	T	6	40	8.9	7	0.5		ISH02
1996 11 28.39		M	4.5	AA	5.0	B		7	11	6			ISH02
1996 11 28.39		M	4.7	AA	3.5	B		7	&10	6	0.7	70	YOS02
1996 11 28.39		S	4.5	VG	5.0	B		7	13	6/	1.0	50	NAG08
1996 11 28.69		M	4.5	HI	5.0	B		10	10	6	0.3	70	GRA04
1996 11 28.70		S	4.6	AA	4.2	B		7	10	S7			ZAN
1996 11 28.75		B	5.0	SC	5.0	B		10		4			RAD01
1996 11 28.77	a	B	4.5	AA	3.4	B		9	&10	6	>1.2	80	PER01
1996 11 28.77	a	I	4.4	AA	0.0	E		1					PER01
1996 11 28.77	a	M	4.4	AA	3.4	B		9	&10	6	>1.2	80	PER01
1996 11 29.69		M	4.2	S	5.0	B		7	20				APF
1996 11 29.70	!	M	3.8	HD	10	B		25	8	7	0.4	80	SZA
1996 11 29.70	s	M	3.9	S	0.0	E		1	20	4			HOR02
1996 11 29.71		S	4.9	SC	5.0	B		10	9	4	0.5	70	ZAN01
1996 11 29.72		M	4.6	AA	5.0	B		7	14	6/	1.5	60	BOU

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 11 29.72		S	4.8	S	7.0	B		16	11	3	0.40	30	TAY
1996 11 29.76	w	M	4.2	S	3.0	B		6	15	7/	0.75	120	MARO2
1996 11 29.76	w	M	4.3	S	5.0	B		10	12	7	0.75	110	RODO1
1996 11 29.78	a	B	4.6	AA	3.4	B		9	& 9	6	&1.5	70	PERO1
1996 11 29.78	a	I	4.4	AA	0.0	E		1		4			PERO1
1996 11 29.78	a	M	4.4	AA	3.4	B		9	& 9	6	&1.5	70	PERO1
1996 11 30.38		M	4.5	AA	10.0	B		20	8	7	1.0		ISHO2
1996 11 30.38		M	4.7	AA	25.4	T	6	40	7	7	0.5		ISHO2
1996 11 30.68		M	4.5	HI	5.0	B		10	9	6			GRAO4
1996 11 30.71		S	4.5	SC	4.0	B		8	15	6	1	55	SCHO4
1996 11 30.72		M	4.6	AA	0.0	E		1					VANO6
1996 11 30.72		M	4.9	AA	5.0	B		10	8	5	0.3		VANO6
1996 11 30.72		S	4.7	S	7.0	B		16	9	4	0.42	30	TAY
1996 11 30.75		B	4.5	S	5.0	B		7	20		0.5	90	TRI
1996 12 01.36		M	4.6	AA	25.4	T	6	40	8	7	0.5		ISHO2
1996 12 01.37		M	4.4	AA	10.0	B		20	10	7	1.0		ISHO2
1996 12 01.37		S	4.3	S	15.0	R	5	25	10	6/	1.0		NAGO2
1996 12 01.37		S	4.8	S	5.6	B		8	12	6			OKAO5
1996 12 01.38		M	4.3	AA	5.0	B		7	10	6	1		ISHO2
1996 12 01.69		S	3.7	AA	5.0	B		10	30	5	0.08		FOG
1996 12 01.69		S	4.1	WF	5.0	B		20	20	5	0.5		TIR
1996 12 01.70	s	M	3.8	S	0.0	E		1	15	5			HORO2
1996 12 01.71	!	V	4.2	YF	20.0	T	2		&35	7	&1	110	MIK
1996 12 01.72					15.0	B		25	7	S7	&3	40	ZAN
1996 12 01.72		I	4.5	AA	0.0	E		1					ZAN
1996 12 01.72		M	4.6	AA	0.0	E		1					VANO6
1996 12 01.72		M	4.8	AA	5.0	B		10	8	5	0.5		VANO6
1996 12 01.72		S	4.6	AA	4.2	B		7	10	S7	&3.5	40	ZAN
1996 12 01.73		B	4.5	S	5.0	B		7	30		1.5	100	TRI
1996 12 01.78	a	B	4.5	AA	3.4	B		9	& 8	6/			VITO1
1996 12 01.78	a	B	4.5	AA	3.4	B		9	&10	6			PERO1
1996 12 01.78	a	I	4.4	AA	0.0	E		1					VITO1
1996 12 01.78	a	I	4.4	AA	0.0	E		1		4			PERO1
1996 12 01.78	a	M	4.3	AA	3.4	B		9	&10	6			PERO1
1996 12 01.78	a	M	4.5	AA	3.4	B		9	& 8	6/			VITO1
1996 12 02.36		M	4.7	AA	25.4	T	6	40	8.5	7	0.5		ISHO2
1996 12 02.37		B	5.5	AA	8.0	B		11	5	6	&10 m	60	MIYO1
1996 12 02.37		M	4.5	AA	10.0	B		20	9.0	7	0.7		ISHO2
1996 12 02.38		M	4.3	AA	5.0	B		7	10	6	0.8		ISHO2
1996 12 02.38		S	4.5	VG	5.0	B		7	15	7	1.0	50	NAGO8
1996 12 02.68		B	4.4	AA	5.0	B		7	14	7	0.5		MORO4
1996 12 02.71		S	4.4	SC	8.0	B		15		5			MAR21
1996 12 02.72		B	4.4	S	5.0	B		7	30		1.2	80	TRI
1996 12 02.72		M	4.6	AA	0.0	E		1					VANO6
1996 12 02.72		M	4.8	AA	5.0	B		10	6	6	0.4		VANO6
1996 12 02.72		S	5.4	S	7.0	B		16	6	4	0.17	34	TAY
1996 12 02.78	a	B	4.5	AA	2.4	B		8	&11	4/			VITO1
1996 12 02.78	a	B	4.5	AA	3.4	B		9	&10	6	&2.3	70	PERO1
1996 12 02.78	a	B	4.5	AA	3.4	B		9	&14	6/			VITO1
1996 12 02.78	a	I	4.4	AA	0.0	E		1					VITO1
1996 12 02.78	a	I	4.4	AA	0.0	E		1		5			PERO1
1996 12 02.78	a	M	4.2	AA	3.4	B		9	&10	6	&2.3	70	PERO1
1996 12 02.78	a	M	4.4	AA	3.4	B		9	&14	6/			VITO1
1996 12 02.78	a	M	4.5	AA	2.4	B		8	&11	4/			VITO1
1996 12 02.96	a	B	4.6	HP	5.0	B		10					BOR
1996 12 02.96	a	S	4.6	HP	5.0	B		10	9	7			BOR
1996 12 03.36		S	4.6	AA	10.0	R	8	20	18	6	0.9		GOU
1996 12 03.37		M	4.2	AA	5.0	B		7	9	7	0.5		ISHO2
1996 12 03.37		M	4.6	AA	10.0	B		20	8	7	0.5		ISHO2
1996 12 03.37		M	4.8	AA	25.4	T	6	40	7	7	0.4		ISHO2
1996 12 03.37		S	4.5:	VG	5.0	B		7	15	6/	0.7	50	NAGO8
1996 12 03.38		M	4.1	AA	3.5	B		7					TSUO2
1996 12 03.39		S	4.2	S	15.0	R	5	25	10	6/	0.8		NAGO2
1996 12 03.69		M	4.0	S	5.0	B		7	24				APF
1996 12 03.69	!	M	4.1	Y	6.0	B		20	&15	s5	1.5	50	SARO2

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 12 03.69	s	M	3.8	S	0.0	E		1	15	5			HOR02
1996 12 03.71	!	V	4.3	YF	20.0	T	2		&35	7	&1		MIK
1996 12 03.73		S	4.7	S	7.0	B		16	9	4	0.60	46	TAY
1996 12 03.74		B	4.3	S	5.0	B		7	25		1.5	90	TRI
1996 12 04.68		M	4.0	S	10	B		25	25	4	1.2	50	ZNO
1996 12 04.70		M	4.3	AA	5.0	B		10	10.5	D5	0.9		MEY
1996 12 04.70		S	4.0	AA	0.6	E		1					MEY
1996 12 04.71		B	4.6	AA	5.0	B		10	9.0	4			HAS02
1996 12 04.71	!	V	4.3	YF	20.0	T	2		&35	7	&1		MIK
1996 12 04.73		M	4.7	AA	5.0	B		10	6	7	0.5		VAN06
1996 12 05.21		M	4.0	SC	0.0	E		1					OME
1996 12 05.69	w	M	3.9	YG	5.0	B		7	&15	6	1		SKI
1996 12 05.71		B	4.6	AA	5.0	B		10	11.6	4	1.0	60	HAS02
1996 12 05.71		I	4.5	AA	0.8	E		1					HAS02
1996 12 06.36		M	4.4	AA	8.0	B		20	12	7	0.5		YUS
1996 12 06.36		S	4.2	AA	5.0	B		7	&15	6/	0.6	50	NAG08
1996 12 06.39		M	4.2	AA	3.5	B		7	&12	7	0.6	50	YOS02
1996 12 06.71	w	M	4.1	HI	5.0	B		10	9	7	1.1	60	GRA04
1996 12 07.02	$	M	4.2	YF	5.0	B		7	12	s8	1.75	60	ADA03
1996 12 07.37		S	4.1	S	15.0	R	5	25	8	7	1.0		NAG02
1996 12 07.71		S	4.1:	AC	8.0	B		20	&19		2.0	60	ANZ
1996 12 07.71		S	4.2	AA	0.0	E		1					ZAN
1996 12 07.71		S	4.3	AA	4.2	B		7	10	S7	&4	40	ZAN
1996 12 07.72					15.0	B		25	7	S7	&3	40	ZAN
1996 12 07.74		B	4.9	SC	5.0	B		7	10	6			BIV
1996 12 07.97	a	M	5.0	SC	5.0	B		10	7	s6			MOD
1996 12 08.37		S	4.1	AA	5.0	B		7	15	6/	1.0	50	NAG08
1996 12 08.95	a	B	4.8	HP	5.0	B		10					BOR
1996 12 08.95	a	S	4.6	HP	5.0	B		10	9	7		80	BOR
1996 12 10.68		M	4.0	S	5.0	B		7	20				POD
1996 12 11.37		S	4.0	AA	5.0	B		7	18	6	0.5	40	NAG08
1996 12 11.38		M	4.0:	AA	3.5	B		7					TSU02
1996 12 12.38		M	3.9	AA	3.5	B		7					TSU02
1996 12 12.68	a	M	3.8	S	5.0	B		7	20		1.0		POD
1996 12 12.71		M	4.2	AA	5.0	B		10	8	D5	0.9		MEY
1996 12 12.71		S	4.0	AA	0.6	E		1					MEY
1996 12 13.38		M	4.0:	AA	3.5	B		7	&10	6			YOS02
1996 12 13.68	w	M	4.2	HI	5.0	B		10	12	6	1.1	55	GRA04
1996 12 13.71		M	4.1	AA	5.0	B		7	17	6/			BOU
1996 12 13.71	w	M	4.0	YG	5.0	B		7	&15	6	0.5		SKI
1996 12 13.72		S	4.5	S	4.0	B		8	9	4	0.40	75	TAY
1996 12 14.36		S	3.9:	AA	5.0	B		7	&18	6	0.5	40	NAG08
1996 12 14.36		S	4.0	S	15.0	R	5	25	8	6/			NAG02
1996 12 14.39		M	4.0:	AA	3.5	B		7		6			YOS02
1996 12 14.65		B	3.8:	AA	5.0	B		7	6	6			CHE03
1996 12 14.70		M	4.2	SC	5.0	B		10	& 9	7	&0.6	50	GLI
1996 12 14.73		B	4.4	SC	5.0	B		7	10	7	1.3	45	BIV
1996 12 14.97	a	M	4.9	SC	5.0	B		10	7.4	s6			MOD
1996 12 15.36		S	3.8:	AA	5.0	B		7	&18	6			NAG08
1996 12 15.36		S	4.0	S	15.0	R	5	25	8	7	0.5		NAG02
1996 12 15.38		M	3.7:	AA	3.5	B		7					TSU02
1996 12 15.38		S	4.0:	AA	5.6	B		8		7			HAS08
1996 12 15.69		S	3.8	WF	5.0	B		20	20	5	0.5		TIR
1996 12 15.69	w	M	4.2	HI	5.0	B		10	11	6			GRA04
1996 12 15.71		M	4.1	AA	5.0	B		7	15	7			BOU
1996 12 15.75		B	3.8	S	5.0	B		7	25				TRI
1996 12 16.01	$	M	4.1	YF	5.0	B		7	9	8			ADA03
1996 12 16.66		B	3.9	AA	5.0	B		7	14	S6			VEL03
1996 12 16.68		B	4.0	AA	5.0	B		7	15	7	0.5		MOR04
1996 12 16.75		B	3.8	S	5.0	B		7	20				TRI
1996 12 19.66		B	3.7:	AA	5.0	B		7		6			CHE03
1996 12 19.69	w	M	4.0	HI	5.0	B		10	12	6/	0.7	35	GRA04
1996 12 20.36		S	3.8:	AA	5.0	B		7	&10	6	&0.2	20	NAG08
1996 12 20.71		M	3.9	AA	5.0	B		7	17	7	1.5	37	BOU
1996 12 20.94	a	S	4.2	HP	5.0	B		10	7	7			BOR

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 12 21.65		B	3.8:	AA	5.0	B		7	10	S6			VEL03
1996 12 21.69		S	3.8	S	6.0	B		20	20	6	3	15	LUE
1996 12 21.69		S	4.0	AA	15.2	L	5	42	14	6	1.6	15	MOE
1996 12 21.69	a	M	3.3	S	0.0	E		1	30	4	1.3	60	HOR02
1996 12 21.69	a	M	3.3	S	0.0	E		1	30	4	1.3	60	HOR02
1996 12 21.69	a	M	3.8	S	8.0	B		10	13	7			HOR02
1996 12 21.69	a	M	3.8	S	8.0	B		10	13	7			HOR02
1996 12 21.71		M	3.8	AA	5.0	B		7	13	7/	1.2	30	BOU
1996 12 21.72		S	3.9	S	7.0	B		16	8	4	0.25	42	TAY
1996 12 22.71		M	3.7	AA	5.0	B		7	12	7/	1.4	29	BOU
1996 12 22.73		S	4.0	S	7.0	B		16	6.5	D3	0.30	55	TAY
1996 12 23.36		S	4.0:	AA	8.0	B		11	& 8	7			NAG08
1996 12 23.68		S	3.9	S	6.0	B		20	15	6	1	15	LUE
1996 12 23.71		M	3.8	AA	5.0	B		10	12	7/	1.5	27	BOU
1996 12 23.71	w	M	4.0	HI	5.0	B		10	12	6			GRA04
1996 12 24.69	a	M	3.1	S	0.0	E		1	30	4			HOR02
1996 12 25.66	a	O	3.4:	S	0.0	E		1	20	4			ZNO
1996 12 25.66	a	O	3.4:	S	0.0	E		1	20	4			ZNO
1996 12 25.67		B	3.5	AA	5.0	B		7	12	6	0.25		MOR04
1996 12 25.68	a	M	3.1	S	0.0	E		1	25	4			HOR02
1996 12 25.68	a	M	3.6	S	8.0	B		10	11	6			HOR02
1996 12 25.69		S	3.8	S	5.0	B		10	12	6	3	20	LUE
1996 12 25.71		M	3.8	AA	5.0	B		10		7/	1.7	20	BOU
1996 12 25.72		B	4.2	SC	5.0	B		7	10	6			BIV
1996 12 26.19		B	3.9:	AA	5.0	B		7	10	S5			VEL03
1996 12 26.66		M	4.0	SC	8.0	B		12	15	5	1	64	BAR06
1996 12 26.68		O	3.8	S	0.0	E		1	25	5			KON06
1996 12 26.69		S	3.5	WF	8.0	B		20	20	5	0.8		TIR
1996 12 26.69	a	M	3.1	S	0.0	E		1	25	4/			HOR02
1996 12 26.69	a	M	3.6	S	8.0	B		10	12	6/	1.4	60	HOR02
1996 12 26.69	a	S	2.7	S	0.0	E		1	30	3/			PLS
1996 12 26.70		M	3.8	SC	5.0	B		10	& 8	6	&0.3	45	GLI
1996 12 26.70	w	S	4.0:	AA	6.3	B		9					KAM01
1996 12 26.71		S	3.7	AA	4.2	B		7	10	S7	4	35	ZAN
1996 12 26.77	$	B	3.8	AT	3.4	B		9	&12	6	&2.5	45	PER01
1996 12 26.77	$	M	3.8	AT	3.4	B		9	&12	6	&2.5	45	PER01
1996 12 26.77	$	S	3.8	AT	3.4	B		9	&12	6	&2.5	45	PER01
1996 12 27.36		S	3.9:	VG	8.0	B		11	&10	6/			NAG08
1996 12 27.67		B	3.5	AA	5.0	B		7	12	6	0.25		MOR04
1996 12 27.69		O	3.7	S	0.0	E		1	25	5			KON06
1996 12 27.69	!	M	2.9:	Y	6.0	B		20	&15	7	1	30	SAR02
1996 12 27.70	w	B	3.8	YG	5.0	B		10					GRA04
1996 12 27.70	w	M	3.5	YG	5.0	B		10	12	6/	0.8	25	GRA04
1996 12 27.70	w	S	3.6	YG	0.7	E		1					GRA04
1996 12 28.19		B	3.9:	AA	5.0	B		7	10	S5			VEL03
1996 12 28.66		S	3.8	SC	4	R		8	19	4			BAR06
1996 12 28.67		B	3.5	AA	5.0	B		7	12	6	0.25		MOR04
1996 12 28.70		S	3.7	AA	5.0	B		10	14	6	2.5	5	MOE
1996 12 28.70	w	M	3.7	SC	5.0	B		10	& 7	6/	&0.4	45	GLI
1996 12 28.71		M	3.7	AA	5.0	B		10	11	7/	1.7	14	BOU
1996 12 29.68	a	M	3.5	S	5.0	B		7	25		1.5		POD
1996 12 29.71	$	S	3.9	AA	6.3	B		9	&11	5			KAM01
1996 12 30.25	w	M	3.8	YG	5.0	B		10	11	6/			GRA04
1996 12 30.73	!	M	4.1	AA	5.0	B		7	7	6	0.3	17	SHA02
1996 12 30.74	!	M	3.9	AA	0.7	E		1	10	5			SHA02
1996 12 31.66		S	3.7:	SC	4	R		8	&15	3			BAR06
1996 12 31.66	$	B	3.3:	AA	5.0	B		7		6			CHE03
1996 12 31.71		M	3.5	AA	5.0	B		10	11	7/			BOU
1997 01 01.64		S	4.2:	SC	6.0	R	10	28	&30				MAN01
1997 01 01.66		S	3.7:	SC	4	R		8	&19	3			BAR06
1997 01 01.69		S	3.8:	S	6.0	B		20	10	6	0.8	17	LUE
1997 01 01.69	!	S	3.4	YG	0.7	E		1	&12	6			GRA04
1997 01 01.70	!	M	3.3	YG	5.0	B		10	13	6/	2.5	6	GRA04
1997 01 01.71		S	3.6	AA	5.0	B		10	13	5	2.0	10	MOE
1997 01 02.25	!	M	3.5	YG	5.0	B		10	10	6			GRA04

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1997 01 02.67	!	M	3.4	YG	5.0	B		10	&12	6			GRA04
1997 01 02.70		S	3.6	AA	5.0	B		10	12	5	1.3	15	MOE
1997 01 03.87		S	3.5:	AA	8.0	B		11	8	5			MIY01
1997 01 03.87		S	3.8:	AA	5.0	B		7		7			NAG08
1997 01 03.88		S	3.5	S	15.0	R	5	25	6	7	0.17		NAG02
1997 01 04.88		S	3.7	S	15.0	R	5	25	6	7	0.17		NAG02
1997 01 05.25		I	3.2	AA	0.7	E		1					BOU
1997 01 05.25		M	3.2	AA	5.0	B		7	10	8	2.0	3	BOU
1997 01 05.25	w	B	3.3	AA	3.0	R	5	6	17	D5		350	BOS01
1997 01 05.26	!	M	3.5	YG	5.0	B		10	11	6	0.5	16	GRA04
1997 01 05.64		S	4.0:	SC	8.0	R	10	28	&15				MAN01
1997 01 05.70	!	S	3.3	YG	0.7	E		1	&12				GRA04
1997 01 06.72	!	M	3.1	YG	5.0	B		10	12	6	2.5	7	GRA04
1997 01 06.88		S	3.8:	AA	5.0	B		7	&10	7	0.5	350	NAG08
1997 01 07.51	$	M	3.0	YF	5.0	B		7	&10	8			ADA03
1997 01 07.71					5.0	B		10	11	6	2.0	4	GRA04
1997 01 07.71	!	S	3.0:	YG	0.7	E		1	&12				GRA04
1997 01 07.88		B	3.0	HS	3.5	B		7					OHM
1997 01 08.46	a	B	3.4	TI	5.0	B		10	9	7	0.7	344	BOR
1997 01 08.46	a	S	3.2	TI	0.0	E		1					BOR
1997 01 08.65		S	3.0:	SC	8.0	R	10	28	&20	6			NAU
1997 01 08.66		S	3.5:	SC	4	R		8	&22	4			BAR06
1997 01 08.70	!	M	3.2	YG	5.0	B		10	10	6/	1.3	8	GRA04
1997 01 08.86		S	3.6:	AA	5.0	B		7	&10	7	0.5	340	NAG08
1997 01 08.88		M	3.3:	AA	10.0	B		20	8	7	20 m	30	YOS02
1997 01 09.24	!	S	3.2	YG	0.7	E		1	&12				GRA04
1997 01 09.44	w	B	3.0	Y	0.0	E		1					GRE
1997 01 09.71	!	M	3.0	YG	5.0	B		10	11	6	1.4	359	GRA04
1997 01 09.86		I	3.3:	AA	0.0	E		1		9			NAG08
1997 01 09.86		S	3.5	AA	5.0	B		7	11	7	0.5	340	NAG08
1997 01 09.88		S	3.2	S	15.0	R	5	25	7	7	0.17		NAG02
1997 01 10.86		S	3.4	AA	5.0	B		7		7	0.5	340	NAG08
1997 01 10.88		S	3.1	S	15.0	R	5	25	8	7	0.25		NAG02
1997 01 11.71	!	M	3.2	YG	5.0	B		10	10	6			GRA04
1997 01 11.86		S	3.4	AA	5.0	B		7		7	0.6	340	NAG08
1997 01 11.87		B	4.0:	AA	8.0	B		11	8	5			MIY01
1997 01 11.88		M	3.2	AA	3.5	B		7		6	0.4	20	YOS02
1997 01 11.89		S	3.5	AA	5.0	B		7	15	6			GOU
1997 01 12.21		M	3.3	AA	3.6	B		4					VAN06
1997 01 12.21		S	2.8	AA	5.0	B		20					TIR
1997 01 12.86		M	3.0	AA	3.5	B		7	8	7	1		WAS
1997 01 12.87		M	3.3	AA	3.5	B		7					TSU02
1997 01 12.87		S	3.2	S	15.0	R	5	25	7	7	0.33		NAG02
1997 01 13.20		S	3.6:	AA	0.0	E		1					ANZ
1997 01 13.20	!	S	3.0:	AA	8.0	B		20	&18	3/	1.8	340	ANZ
1997 01 13.21	w	S	2.8	AA	0.0	E		1					HAV
1997 01 13.27		B	3.5	SC	5.0	B		7	10	7			BIV
1997 01 13.27	a	I	3.1	AT	0.0	E		1					PER01
1997 01 13.45	a	B	3.3	TI	5.0	B		10					BOR
1997 01 13.45	a	S	3.1	TI	0.0	E		1					BOR
1997 01 13.45	a	S	3.1	TI	5.0	B		10	7	7	1.0	7	BOR
1997 01 13.47	w	M	2.9	SC	3.5	B		7	10	6/	1.5	350	CRE01
1997 01 14.21		M	3.0	AA	0.0	E		1					VAN06
1997 01 14.21	!	M	3.0	AA	5.0	B		7	&13	6	&1	355	MIK
1997 01 14.22					6.3	B		9	10	7/	1.0	5	KAM01
1997 01 14.22	w	B	3.0	AA	0.6	E		1					KAM01
1997 01 14.22	w	S	2.7	AT	0.0	E		1					MIL02
1997 01 14.23	!	M	2.9	YG	5.0	B		10	11	6	0.7	357	GRA04
1997 01 14.24		M	2.9	S	6.0	B		20	10	7	1.5	338	LUE
1997 01 14.24	a	M	3.0	AA	5.0	B		7	12	8	2.0	345	BOU
1997 01 14.24	a	S	2.9	AA	0.7	E		1					BOU
1997 01 14.27		B	3.5	SC	5.0	B		7	8	7			BIV
1997 01 14.28	a	I	3.3	AT	0.0	E		1					VIT01
1997 01 14.28	a	I	3.4	AT	0.0	E		1					PER01
1997 01 14.30		M	3.3	SC	5.0	B		10	25	6/	1.3	335	POR05

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1997 01 14.86		S	3.3	HS	2.4	B		10	25	s6			YOS04
1997 01 14.87		I	3.5	HS	0.0	E		1		9			YOS04
1997 01 14.87		S	3.2	S	15.0	R	5	25	7	7	0.40		NAG02
1997 01 15.21	w	S	2.6	AA	0.0	E		1	20				HAV
1997 01 15.21	w	S	2.8	AA	5.0	B		10	10		3.5		HAV
1997 01 15.23	w	S	2.8	AT	0.0	E		1					MIL02
1997 01 15.24					8.0	B		15	9	8	2.0	340	BOU
1997 01 15.24		M	3.0	S	5.0	B		10	11	7	1.5	340	LUE
1997 01 15.24		M	3.1	S	6.0	B		20	11	7	1.5	340	LUE
1997 01 15.24		S	3.2	S	0.6	E		1	11	5			LUE
1997 01 15.24	a	S	2.9	AA	0.7	E		1					BOU
1997 01 15.25	!	M	3.4	SC	5.0	B		10	&10	7	&0.5	20	GLI
1997 01 15.27		B	3.2	SC	0.0	E		1	10	8			BIV
1997 01 15.27		B	3.3	SC	5.0	B		7	10	7	1.3	340	BIV
1997 01 15.45	a	B	3.1	TI	5.0	B		10					BOR
1997 01 15.45	a	S	2.8	TI	0.0	E		1	20	5			BOR
1997 01 15.45	a	S	3.1	TI	5.0	B		10	7	7	0.8	328	BOR
1997 01 15.72	!	M	2.8:	YG	5.0	B		10	12	6	0.5	355	GRA04
1997 01 15.87		I	3.4	HS	0.0	E		1		8			YOS04
1997 01 15.87		S	3.2	AA	5.0	B		7	9	7	0.6	340	NAG08
1997 01 16.22	!	V	2.8	AA	6.4	A	3		&50	7	&2	345	MIK
1997 01 16.23		S	2.8	S	5.0	B		10	10	5	0.5	340	LUE
1997 01 16.24	a	B	3.1	AA	3.0	B		8		5	1.33	315	HAS02
1997 01 16.24	a	S	2.9	AA	0.7	E		1					BOU
1997 01 16.24	a	S	2.9	AA	0.7	E		1					BOU
1997 01 16.25	a	M	2.9	AA	5.0	B		7	11	8	2.3	335	BOU
1997 01 16.25	a	M	2.9	AA	5.0	B		7	11	8	2.3	335	BOU
1997 01 16.26		B	3.3	SC	0.0	E		1	10	8			BIV
1997 01 16.85		I	3.3	AA	0.0	E		1		9			NAG08
1997 01 16.85		S	3.1	AA	5.0	B		7	9	6/	0.6	340	NAG08
1997 01 16.85	&	M	3.0	AA	10.0	B		20	7.7	7	1.2		ISH02
1997 01 16.86		I	3.4	HS	0.0	E		1					YOS04
1997 01 16.86		I	3.4	HS	0.0	E		1		8			YOS04
1997 01 16.86		S	3.0	HS	2.4	B		10	25	7			YOS04
1997 01 16.86		S	3.3	AA	8.0	B		11	8	5			MIY01
1997 01 16.86	&	M	2.5	AA	0.0	E		1	8				ISH02
1997 01 16.86	&	M	2.9	AA	5.0	B		7	8	7	1		ISH02
1997 01 16.87		M	3.0	AA	3.5	B		7					TSU02
1997 01 16.88		M	3.3	AA	3.0	B		8	20	6			KAT01
1997 01 17.20	!	V	2.8	AA	6.4	A	3		&50	7	&2	345	MIK
1997 01 17.22					6.3	B		9	9	8	1.7	330	KAM01
1997 01 17.22	w	B	2.8	AA	0.6	E		1					KAM01
1997 01 17.23					5.0	B		10	6.7	4	0.53	335	HAS02
1997 01 17.23		M	3.0	S	5.0	B		10	10	5	1.0	340	LUE
1997 01 17.23	a	I	3.1	AA	0.8	E		1					HAS02
1997 01 17.24	a	M	2.9	AA	5.0	B		7	11	8	2.1	333	BOU
1997 01 17.24	a	M	2.9	AA	5.0	B		7	11	8	2.1	333	BOU
1997 01 17.24	a	S	2.8	AA	0.7	E		1					BOU
1997 01 17.24	a	S	2.8	AA	0.7	E		1					BOU
1997 01 17.26		B	3.3	SC	0.0	E		1	10	8			BIV
1997 01 17.29		B	2.8	S	5.0	B		7	50	6	2.0	25	TRI
1997 01 17.45	a	B	2.9	TI	5.0	B		10	7	7/	1.2	323	BOR
1997 01 17.45	a	S	2.7	TI	0.0	E		1					BOR
1997 01 17.49	$	B	2.6	YF	0.0	E		1	15	7/			ADA03
1997 01 17.50	$	M	2.8	YF	5.0	B		7	15	S7/	&1.25	316	ADA03
1997 01 18.19		S	2.5	SC	0.0	E		1	25	3	1.5		MAN01
1997 01 18.21	$	S	2.7	AA	0.0	E		1	&20	6			ZAN
1997 01 18.21	$	S	2.9	AA	4.2	B		7	12	S7	4	345	ZAN
1997 01 18.29		B	2.7	S	5.0	B		7	60	7			TRI
1997 01 18.29		B	2.9	S	5.0	B		7	50	6	2.0	20	TRI
1997 01 18.31		S	3.0	SC	5.0	B		10	35	7/	2.1	320	POR05
1997 01 18.44	w	B	2.5	AA	0.0	E		1		8/	&3		GRE
1997 01 18.85		S	3.3	SC	3.0	B		10	12	7	2.0	325	SHI
1997 01 18.86		I	3.5	HS	0.0	E		1	<30	S7			YOS04
1997 01 18.86		S	3.0	HS	2.4	B		10	20	s7	0.9	340	YOS04

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1997 01 18.86		S	3.0	S	15.0	R	5	25	9	7	0.66		NAG02
1997 01 19.45	a	B	3.0	TI	5.0	B		10					BOR
1997 01 19.45	a	S	2.9	TI	0.0	E		1					BOR
1997 01 19.45	a	S	2.9	TI	5.0	B		10	7	7/	1.2	331	BOR
1997 01 19.47	w	G	2.7	SC	0.0	E		1	15	7/			CRE01
1997 01 19.70	!	M	2.9:	YG	5.0	B		10	11	6/	0.5		GRA04
1997 01 19.85		S	2.9	AA	5.0	B		7	12	7	1.5	330	NAG08
1997 01 19.86		I	3.0	AA	0.0	E		1	&20	8			NAG08
1997 01 19.86		I	3.5	HS	0.0	E		1		8			YOS04
1997 01 19.86		S	3.1	HS	2.4	B		10	25	7			YOS04
1997 01 19.86		S	3.4	AA	5.0	B		7		7	0.8		HAR01
1997 01 19.87		M	3.0	AA	3.5	B		7			3.0	330	TSU02
1997 01 19.87		M	3.1	AA	3.5	B		7	12	7	1.2	340	YOS02
1997 01 19.88		M	2.9	AA	3.0	B		8	25	6			KAT01
1997 01 20.24	!	S	2.8	YG	0.7	E		1	12	6			GRA04
1997 01 20.84		S	3.1	SC	3.0	B		10	12	7	2.0	335	SHI
1997 01 20.86		I	3.3	HS	0.0	E		1		8			YOS04
1997 01 20.86		M	3.0	AA	3.5	B		7	12	7	1.5		WAS
1997 01 20.86		S	3.0	HS	2.4	B		10	20	6			YOS04
1997 01 20.87		M	2.8	AA	3.5	B		7					TSU02
1997 01 20.87		S	3.3	AA	5.0	B		7	18	6			GOU
1997 01 21.15		B	3.8	YF	5.0	B		7	> 4	6	>0.1	330	OFE
1997 01 21.45	a	B	2.9	TI	5.0	B		10					BOR
1997 01 21.45	a	S	2.9	TI	5.0	B		10	8	7/	1.6	318	BOR
1997 01 21.45	a	S	3.0	TI	0.0	E		1		6			BOR
1997 01 21.47	w	G	2.6	SC	0.0	E		1	20	8			CRE01
1997 01 22.28	a	I	3.0	AT	0.0	E		1		6			PER01
1997 01 22.86		I	2.9	YG	0.0	E		1	<30	7			YOS04
1997 01 22.86		S	2.9	HS	2.4	B		10	18	7	0.4	350	YOS04
1997 01 23.19		S	2.4	SC	11.0	B		20	25	4	&2		BAR06
1997 01 23.50	a	M	3.0:	YF	5.0	B		7	&10	6/			ADA03
1997 01 23.71	!	M	2.8:	YG	5.0	B		10	11	6			GRA04
1997 01 24.24		S	2.8	YG	0.7	E		1	12	6			GRA04
1997 01 24.85		S	2.9	S	15.0	R	5	25	9	7	0.83		NAG02
1997 01 25.15		B	3.7	YF	5.0	B		7	> 2	6	>0.4	330	OFE
1997 01 25.18		S	2.5	SC	11.0	B		20	22	4	&1.5		BAR06
1997 01 25.85		I	2.9	YG	0.0	E		1		8			YOS04
1997 01 25.86		S	3.0	YG	2.4	B		10	15	7	0.4	350	YOS04
1997 01 25.87		M	3.0	AA	3.5	B		7		7			YOS02
1997 01 26.19	a	B	3.0:	AA	5.0	B		7		6			CHE03
1997 01 26.22		M	2.6	S	3.0	B		9	10	7	2.0	315	LUE
1997 01 26.22		S	2.5	S	0.8	E		1	10	7	1.0	315	LUE
1997 01 26.25		B	3.0	SC	0.0	E		1	10	8			BIV
1997 01 26.25		B	3.0	SC	5.0	B		7	10	7	1.4	335	BIV
1997 01 26.84		S	2.7	SC	3.0	B		10	14	S8	2.8	335	SHI
1997 01 26.85		I	2.9	YG	0.0	E		1		8			YOS04
1997 01 26.86		S	2.9	YG	2.4	B		10	15	7	0.3	340	YOS04
1997 01 27.19	a	B	2.7	AA	0.0	E		1	10	7	1.5	325	CHE03
1997 01 27.19	a	B	2.9	AA	5.0	B		7	12	6			CHE03
1997 01 27.23		S	2.5	AA	0.7	E		1	15				BOU
1997 01 27.24		B	3.1	SC	5.0	B		10		6	0.5		BOR05
1997 01 27.24		M	2.6	AA	5.0	B		7		8	2.0	329	BOU
1997 01 27.25		B	2.9	SC	5.0	B		10		6			PET
1997 01 27.27	a	B	2.8	AT	0.0	E		1					PER01
1997 01 27.27	a	B	3.3	AT	3.4	B		9	& 9	7	&1.6	335	VIT01
1997 01 27.27	a	I	2.9	AT	0.0	E		1					PER01
1997 01 27.27	a	I	3.1	AT	0.0	E		1					VIT01
1997 01 27.85		I	3.0	YG	0.0	E		1		8			YOS04
1997 01 27.85		S	2.8	YG	2.4	B		10	15	7	0.3	330	YOS04
1997 01 28.22		M	2.6	YG	5.0	B		10	12	6/	1.0	326	GRA04
1997 01 28.24		B	2.4	SC	5.0	B		10		6	0.5		BOR05
1997 01 28.24		M	2.4	YG	0.7	E		1	15	6			GRA04
1997 01 28.26		B	3.1	SC	5.0	B		10		5	0.5		MAR19
1997 01 28.27	a	I	2.9	AT	0.0	E		1					PER01
1997 01 28.27	a	M	2.8	AT	3.4	B		9	& 8	6/	&3.5	330	PER01

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1997 01 28.71	!	M	2.5:	YG	5.0	B		10	11	6/	0.7		GRA04
1997 01 28.85		I	2.9	YG	0.0	E		1	<15	7/			YOS04
1997 01 28.86		S	2.7	YG	2.4	B		10	12	7	0.5	320	YOS04
1997 01 29.20		M	2.5	AA	4.0	B		8	&20	6	&1.5	270	PAL02
1997 01 29.20	!	V	2.2	YF	2.3	A	4		&60	7	&2	320	MIK
1997 01 29.22		S	2.5	AA	5.0	B		7	11	8	1	345	ZAN
1997 01 29.44	a	B	2.7	TI	5.0	B		10	8	8	2.1	321	BOR
1997 01 29.65		M	2.2	SC	0.0	E		1			1		OME
1997 01 29.72	!	M	2.6:	YG	5.0	B		10	10	6/			GRA04
1997 01 29.86		S	2.8	S	15.0	R	5	25	10	7	1.0		NAG02
1997 01 30.20		M	2.3	AA	4.0	B		8	&25	6	&2	250	PAL02
1997 01 30.23		M	2.4	YG	0.7	E		1	12	7			GRA04
1997 01 30.72	!	M	2.6:	YG	5.0	B		10	11	7			GRA04
1997 01 30.84		S	2.6	SC	3.0	B		10	20	S7	2.8	330	SHI
1997 01 30.85		I	2.8	YG	0.0	E		1		8			YOS04
1997 01 30.85		S	2.6:	YG	0.0	E		1	15	7/	1	300	NAG08
1997 01 30.85		S	2.7	YG	2.4	B		10	15	7	0.6	330	YOS04
1997 01 31.21	!	V	2.3	YF	2.3	A	4		&60	7	&2	320	MIK
1997 01 31.21	w	M	2.7	Y	0.0	E		1	15	D7	1.2	30	CAN04
1997 01 31.22		S	2.4	AA	5.0	B		10	10	7	2.0	320	MOE
1997 01 31.24					5.0	B		10	10	7/	3.0	328	GRA04
1997 01 31.24		M	2.3	YG	0.7	E		1	12	7			GRA04
1997 01 31.46	&	G	2.2:	SC	0.0	E		1	12	8			CRE01
1997 01 31.72		M	2.4:	YG	5.0	B		10	11	6/			GRA04
1997 01 31.84		B	2.4	AA	0.0	E		1					OKA05
1997 01 31.84		S	2.7	S	15.0	R	5	25	12	7	1.0		NAG02
1997 01 31.85		S	2.4	YG	0.0	E		1	15	7/	1	300	NAG08

Comet C/1995 Y1 (Hyakutake)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 21.19		k	19.1	EB	121.9	L	8						HER02

Comet C/1996 B1 (Szczepanski)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 02 06.25		S	10 :	HS	33.3	L	4	122	2	2			KRO02
1996 02 10.18		S	8.8	S	33.3	L	4	58	7	3			KRO02
1996 02 14.17		S	9.1	S	33.3	L	4	58	& 5	3			KRO02
1996 02 21.15		S	8.3	SC	33.3	L	4	58	& 6	4			KRO02
1996 02 21.32		S	8.1	SC	8.0	B		20	12	2			KRO02
1996 02 24.48		S	8.8	S	8.0	B		20	20	1			KRO02
1996 02 29.38		S	8.0	S	8.0	B		20	14	1			KRO02
1996 03 09.81		S	8.8	S	20.3	T	10	67	5	2			LUE
1996 03 14.15		S	8.6	S	8.0	B		20	9	5			KRO02
1996 03 14.15		S	9.0	S	33.3	L	4	58	7	3			KRO02
1996 03 16.12		S	8.9	S	33.3	L	4	58	5	5			KRO02
1996 03 16.14		S	8.6	S	8.0	B		20	10	2			KRO02

Comet C/1996 B2 (Hyakutake)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 02 02.83		S	10.8	AA	25.4	T	6	114	2.0	4			ISH02
1996 02 10.82		S	9.0	AA	25.4	T	6	50	3.0	5			ISH02
1996 02 18.82		M	8.0	AA	25.4	T	6	50	5.7	5			ISH02
1996 02 20.82		M	7.6	AA	25.4	T	6	50	5.1	6			ISH02
1996 02 21.30		S	7.1	SC	8.0	B		20	8	2			KRO02
1996 02 21.82		M	7.5	AA	25.4	T	6	40	6.3	6			ISH02
1996 02 22.83		M	7.3	AA	25.4	T	6	40	6.3	6	0.2	270	ISH02
1996 02 24.48		S	7.0	SC	8.0	B		20	12	3			KRO02
1996 02 27.81		M	7.0	AA	25.4	T	6	40	5.9	6	0.2	270	ISH02
1996 02 28.48		S	6.5	SC	8.0	B		20	13	5			KRO02
1996 02 28.81		M	6.8	AA	25.4	T	6	40	7.1	7	0.3	280	ISH02
1996 02 29.37		S	6.1	SC	8.0	B		20	15	4			KRO02
1996 03 02.82		M	6.3	AA	25.4	T	6	40	7.5	7	0.3	275	ISH02

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 03 02.84		S	6.2	AA	10.0	B		20	8.0	6			ISH02
1996 03 03.82		M	6.0	AA	25.4	T	6	40	7.8	7	0.5	270	ISH02
1996 03 03.84		S	5.8	AA	5.0	B		7	9.0	6			ISH02
1996 03 04.83		S	5.5	AA	5.0	B		7	12	6			ISH02
1996 03 05.82		M	5.5	AA	25.4	T	6	40	6.5	7	0.3	270	ISH02
1996 03 05.82		S	5.3	AA	5.0	B		7	10	6			ISH02
1996 03 05.83		M	5.5	AA	10.0	B		20	8.0	6	0.4	270	ISH02
1996 03 08.05		S	5.8	S	20.3	T	10	80	5	4			LUE
1996 03 09.72		S	5.0	AA	5.0	B		7	9.0	6			ISH02
1996 03 10.25		S	5.5	SC	8.0	B		20	11	5			KR002
1996 03 11.21		S	5.1	SC	8.0	B		20	22	4			KR002
1996 03 11.30		S	4.7	SC	8.0	B		20	22	5	0.83	280	KR002
1996 03 11.83		S	4.7	AA	5.0	B		7	11	6			ISH02
1996 03 12.27		S	4.6	SC	3.5	B		7	21	6	1	270	KR002
1996 03 12.31		S	4.4	SC	0.0	E		1					KR002
1996 03 13.62		S	4.6	AA	5.0	B		7	12	5			ISH02
1996 03 13.79		S	4.5	AA	5.0	B		7	15	6	1	255	ISH02
1996 03 14.25		N	9.1	S	33.3	L	4	200					KR002
1996 03 14.25		S	4.5	SC	3.5	B		7	24	5	1.3		KR002
1996 03 15.82		S	4.0	AA	5.0	B		7	17.8	7	1.5	275	ISH02
1996 03 15.83		B	3.6	AA	0.0	E		1	20	6			ISH02
1996 03 16.19		S	4.4	SC	3.5	B		7					KR002
1996 03 16.22		S	3.6	SC	0.0	E		1					KR002
1996 03 16.26		S	3.5	SC	0.0	E		1	50				KR002
1996 03 17.23		S	3.1	SC	0.0	E		1					KR002
1996 03 17.65		S	3.6	AA	5.0	B		7	20	7			ISH02
1996 03 18.23		S	2.7	SC	0.0	E		1	55	4	2.5		KR002
1996 03 18.71		S	3.1	AA	5.0	B		7	30.2	7	2	260	ISH02
1996 03 18.72		M	3.4	AA	10.0	B		20	25	7	1.5		ISH02
1996 03 18.73		M	3.6	AA	25.4	T	6	40	23.1	7	1		ISH02
1996 03 18.74		B	3.0	AA	0.0	E		1	35	5			ISH02
1996 03 21.08		B	1.6	S	0.8	E		1	50	6	18	260	LUE
1996 03 21.15		S	2.0	SC	0.0	E		1					KR002
1996 03 21.27		N	7	: SC	33.3	L	4	200				265	KR002
1996 03 21.27		S	1.9	SC	0.0	E		1	90	6	6.5	262	KR002
1996 03 22.27		S	1.5	SC	0.0	E		1	110	7	15.2	262	KR002
1996 03 22.57		S	1.9	AA	5.0	B		7	36	6	5	250	ISH02
1996 03 22.58		S	2.0	AA	10.0	B		20	30	7	4		ISH02
1996 03 22.62		B	1.5	AA	0.0	E		1	45	6	6		ISH02
1996 03 22.73		B	1.3	AA	0.0	E		1	50	6	10	250	ISH02
1996 03 22.73		M	1.7	AA	5.0	B		7	45	7	12	255	ISH02
1996 03 23.08		M	0.0:	AA	0.8	E		1	90	6	2	250	LUE
1996 03 23.12		M	0.3	AA	2.1	B		8	90	6	4	250	LUE
1996 03 23.23		S	0.6	SC	0.0	E		1	90	7	12		KR002
1996 03 24.13		S	0.1	SC	0.0	E		1	90	7	16		KR002
1996 03 24.26		S	-0.2	SC	0.0	E		1	100	7	35	233	KR002
1996 03 25.31		S	-1	: SC	0.0	E		1	90	6	12	212	KR002
1996 03 25.56		B	0.5	AA	0.0	E		1	70	7	30		ISH02
1996 03 25.57		S	1.0	AA	5.0	B		7	60	7	35	220	ISH02
1996 03 25.71		S	1.3	AA	10.0	B		20	45	8			ISH02
1996 03 25.74		M	0.0	AA	5.0	B		7	62	7	40	210	ISH02
1996 03 25.75		B	0.4	AA	0.0	E		1	95	7	45	210	ISH02
1996 03 26.14		S	0.1	SC	0.0	E		1	65	6	19		KR002
1996 03 26.28		S	0.2	SC	0.0	E		1	100	7	45	202	KR002
1996 03 26.54		B	0.0	AA	0.0	E		1	64	7	20		ISH02
1996 03 26.81		S	0.2	AA	0.0	E		1	70	7	30		ISH02
1996 03 26.82		S	0.6	LN	0.7	E		1	25		2		FOU01
1996 03 27.08		M	-0.1	S	0.8	E		1	120	7	67	142	LUE
1996 03 27.94		G	0.7	LN	0.7	E		1	30		3	90	FOU01
1996 03 29.90		G	0.8	LN	0.7	E		1	20		2.5		FOU01
1996 03 31.82		M	2.0	S	5.0	B		10	20	7	5	30	LUE
1996 04 01.88		G	1.9	LN	0.7	E		1	30		3.5		FOU01
1996 04 02.06		S	2.0	SC	0.0	E		1	30	5	6		KR002
1996 04 02.50		M	2.0	AA	5.0	B		7	20	7	5		ISH02
1996 04 02.51		M	2.1	AA	10.0	B		20	20	7	3		ISH02

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 04 02.52		S	1.8	AA	0.0	E		1	25	6	4		ISH02
1996 04 02.81		S	2.2	S	5.0	B		10	15	6	3	45	LUE
1996 04 02.85		G	1.9	LN	0.7	E		1	15		3		FOU01
1996 04 03.10		S	2.2	SC	0.0	E		1	20	5	3		KR002
1996 04 03.97		G	2.9	LN	0.7	E		1	15		3	45	FOU01
1996 04 04.81		S	2.3	S	5.0	B		10	15	6	3	45	LUE
1996 04 04.85		G	2.4	LN	0.7	E		1	12		>3		FOU01
1996 04 05.45		M	2.0	AA	5.0	B		7	35	7	6		ISH02
1996 04 05.47		M	2.1	AA	10.0	B		20	30	7	5		ISH02
1996 04 05.47		M	2.3	AA	25.4	T	6	40	25	8	2.5		ISH02
1996 04 05.47		S	1.8	AA	0.0	E		1	30	5	3		ISH02
1996 04 05.86		G	2.3	LN	0.7	E		1	12		1.5		FOU01
1996 04 09.06		S	2.6	SC	0.0	E		1	10	7	4		KR002
1996 04 09.86		G	2.3	LN	0.7	E		1	6		4		FOU01
1996 04 10.06		S	2.6	SC	0.0	E		1	10	7	8		KR002
1996 04 11.13		S	2.4	SC	0.0	E		1	8	7	9		KR002
1996 04 12.13		S	2.5:	SC	0.0	E		1			1		KR002
1996 04 12.42		S	2.5	AA	0.0	E		1	12	7	3		ISH02
1996 04 12.44		M	2.8	AA	5.0	B		7	10	8	6		ISH02
1996 04 12.45		M	2.8	AA	10.0	B		20	10	8	5		ISH02
1996 04 13.42		S	2.6	AA	0.0	E		1		6			ISH02
1996 04 13.43		M	2.8	AA	5.0	B		7	6	8	5		ISH02
1996 04 13.43		M	2.8	AA	10.0	B		20	5	8	3		ISH02
1996 04 13.44		M	3.0	AA	25.4	T	6	40	5	8	2		ISH02
1996 04 13.86		G	2.8	LN	0.7	E		1	<10				FOU01
1996 04 14.08		S	2.4	SC	0.0	E		1		9	4		KR002
1996 04 14.08		S	2.5	SC	3.5	B		7	7	8	4		KR002
1996 04 15.42		M	3.0	AA	10.0	B		20	5	9	3		ISH02
1996 04 15.43		M	3.0	AA	5.0	B		7	5	9	5		ISH02
1996 04 15.43		M	3.0	AA	25.4	T	6	40	4	8	2		ISH02
1996 04 16.08					8.0	B		20	7	9	5	40	KR002
1996 04 16.08		S	1.8	SC	0.0	E		1		9			KR002
1996 04 17.08					8.0	B		20	6	8	5	35	KR002
1996 04 17.08		S	2.0	SC	0.0	E		1		8			KR002
1996 04 18.08					33.3	L	4	58	5	8	10	35	KR002
1996 04 18.08		S	2.2	SC	0.0	E		1		8			KR002
1996 04 18.43		M	3.1	AA	5.0	B		7	5	9	5		ISH02
1996 04 18.43		M	3.3	AA	10.0	B		20	5	9	3		ISH02
1996 04 18.44		M	3.6	AA	25.4	T	6	40	4	8	2		ISH02
1996 04 19.08		S	2.3	SC	0.0	E		1					KR002
1996 04 20.43		M	3.1	AA	5.0	B		7	5	9	6		ISH02
1996 04 21.09		S	2.5	SC	3.5	B		7	4	9	5		KR002
1996 04 24.08		S	2.8	SC	3.5	B		7	3	8	3		KR002
1996 07 03.37		S	7.2	SC	4.5	R	6	13	6	1			JON
1996 07 03.37		S	8.3	S	31.7	L	5	64	3.5	6			JON
1996 07 04.76		S	7.5	SC	7.8	R	8	30	3				JON
1996 07 04.76		S	7.6	SC	4.5	R	6	13	3				JON
1996 07 08.17		S	6.8	S	5.0	B		10	5	5	1.5	190	LUE
1996 07 11.73		S	6.9	S	5.0	B		10	5	3			LUE
1996 07 12.77		S	7.1	S	5.0	B		10	5	3			LUE
1996 07 12.77		S	7.3	S	25	L	6	47	5	6	1.0	2	LUE
1996 07 13.75		S	7.3	S	5.0	B		10	7.5	3	1.0	160	LUE
1996 07 14.77		S	7.3	S	5.0	B		10	7.5	3	1.0	160	LUE
1996 07 15.76		S	7.3	S	5.0	B		10	5	3	1.0	160	LUE
1996 07 16.82		S	7.7	TI	6.0	B		20	5	2			LUE
1996 07 17.77		S	7.9	TI	6.0	B		20	6	2			LUE
1996 07 17.78		S	7.9	TI	25	L		47	6	6	0.5	150	LUE
1996 07 19.34		S	8.9	CS	31.7	L	5	64	2	3/			JON
1996 07 23.76		S	10.0	VN	31.7	L	5	64	1	4			JON
1996 07 27.75		S	9.6	VN	31.7	L	5	64	2	3			JON
1996 07 28.75		S	9.6	VN	31.7	L	5	64	1.5	3			JON
1996 08 24.79		S	10.6	AA	20.0	L	4	100	1.4	1			PEA
1996 09 21.78		S	[12.0	AA	20.0	L	4	100					PEA

Comet C/1996 E1 (NEAT)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 04 20.85		C	16.5	HS	50	Y	4						CAV
1996 10 06.19		S[	13.5	GA	50.5	L	5	87	! 1.0				MOD
1996 11 04.75		O[	13.3	HS	35	L	5	158	! 1				HOR02
1996 11 08.84	&	S[	13 :	HS	44.5	L	5	230					SAR02
1996 11 09.79		S	14.6	HS	44.5	L	5	230	0.8	2			SAR02

Comet C/1996 J1 (Evans-Drinkwater)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 12.80		S	13.1	HS	25	L		115	1.5	2			LUE
1996 07 16.85		S	12.9	HS	25	L		115	1	2			LUE
1996 07 17.80		S	12.9	HS	25	L		115	1	2			LUE

Comet C/1996 N1 (Brewington)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 16.81		S	8.9	TI	6.0	B		20	3	6			LUE
1996 07 17.76		S	8.7	TI	25	L		47	4	6			LUE
1996 08 06.16		S	8.4	HI	15	L		28	6	4			ADA03
1996 08 08.14		S	8.5	HI	15	L		28	7	5			ADA03
1996 08 18.91		S	8.2	S	6.7	B		20	& 4	3			SCI
1996 08 19.83		S	8.2	S	6.7	B		20	& 4	3/			SCI
1996 08 20.83		S	8.3	S	6.7	B		20	& 4	3			SCI
1996 08 21.82		S	8.1	S	6.7	B		20	& 4	3/			SCI
1996 08 23.83		S	8.1:	S	6.7	B		20	& 4	3/			SCI
1996 08 24.83		S	8.8:	S	6.7	B		20	& 4	3			SCI
1996 09 08.86		S	8.9	AC	30	L	3	25	10	1			TUB
1996 09 10.19		S	9.0	S	15	L		28	7	3			ADA03
1996 09 18.87		M	9.7	TI	5.6	R	14	40	2	1			DEM
1996 09 21.15		k	13.1	EB	121.9	L	8						HER02
1996 10 03.82		S	11.0	AC	25.4	L	5	65	3	1/			MEY
1996 10 05.08		S	13.3	GA	50.5	L	5	87	1.0	1			MOD
1996 10 06.16		S	13.4	GA	50.5	L	5	87	0.8	1			MOD
1996 10 06.90		S	12.1	HS	25.6	L	5	84	2	2			BIV
1996 10 09.44		C	14.0	GA	60.0	Y	6		2.2	0/			NAK01
1996 10 12.89		S	12.2	AC	25.4	L	5	65	3	1			MEY
1996 10 13.82		S	11.7:	AC	25.4	L	5	65	2.5	0/			MEY
1996 10 14.81		S	11.6	NP	25.4	L	5	65	3	0/			MEY
1996 10 16.44		C	14.1	GA	60.0	Y	6		2.6	0			NAK01
1996 11 03.79		S	13.0:	HS	35	L	5	158	1.3	1/			HOR02
1996 11 04.79		O[	13.1	HS	35	L	5	158	! 1				HOR02
1996 11 09.83		S[	14.5	HS	44.5	L	5	230	1				SAR02

Comet C/1996 P2 (Russell-Watson)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 24.75	a	C	13.8	GA	60.0	Y	6		1.3		5.4m	253	NAK01
1996 08 24.81		S	12.5	VN	20.0	L	4	100	1.3	2			PEA
1996 10 05.66	a	C	14.0	GA	60.0	Y	6		1.2		2.5m	285	NAK01
1996 10 09.62	a	C	13.9	GA	60.0	Y	6		1.7		3.5m	283	NAK01
1996 12 03.50	a	C	15.0	GA	60.0	Y	6		1.05				NAK01
1996 12 06.49	a	C	14.9	GA	60.0	Y	6		1.4				NAK01
1996 12 28.45	a	C	15.6	GA	60.0	Y	6		0.95				NAK01

Comet C/1996 Q1 (Tabur)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 23.79		S	10.0	AA	20.0	L	4	100		2			PEA
1996 08 24.77		S	10.0	AA	20.0	L	4	100	3	2			PEA
1996 09 10.78		S	7.7	AA	8.0	B		20	6	3			PEA
1996 09 15.06		S	7.4	SC	8.0	B		20	9	3			BAR
1996 09 16.10		S	6.5	AC	5.0	B		10	10	3/			SAN07
1996 09 16.78		S	7.2	AA	8.0	B		20	8	4			PEA
1996 09 17.78		S	7.1	AA	8.0	B		20	9	4			PEA
1996 09 19.04		S	6.8	AC	5.0	B		10	12	2			SAN07

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 21.73		S	6.4	AA	8.0	B		20	9	4/			PEA
1996 09 22.05		B	6.4	S	6.0	B		20	10	4			CHE03
1996 09 22.08		B	6.6:	AA	8.0	R	10	28	& 5.5	4			GER01
1996 09 23.06		B	6.5:	AA	8.0	R	10	40	& 6.0	4			GER01
1996 09 23.08		B	6.1	S	6.0	B		20	12	4			CHE03
1996 09 24.05		B	5.9	S	6.0	B		20		4			CHE03
1996 09 25.13		S	6.3	SC	8.0	B		20	9	4			BAR
1996 09 27.10		M	5.7	AA	3.4	B		9	&10	4/	&1	290	PER01
1996 09 27.10		S	6.1	AA	5.0	B		10	11.5	D5			MEY
1996 09 27.11		M	6.3	AA	3.4	B		9	&12	4			VIT01
1996 09 27.11		S	5.7	AC	6.3	R	13	40	4	3			GUL01
1996 09 27.11		S	6.0	AA	3.4	B		9	&12	4			VIT01
1996 09 27.14		S	7.2	SC	7.0	B		16					TAY
1996 09 28.07		M	5.8	AA	3.4	B		9	&12	6/			PER01
1996 09 28.07		S	5.8	AA	3.4	B		9	&12	6/			PER01
1996 09 29.24		M	5.7	AA	3.4	B		9		6			PER01
1996 09 29.24		S	5.7	AA	3.4	B		9		6			PER01
1996 09 30.05		M	5.7	SC	5.0	B		10	15	5			GRA04
1996 10 01.04		M	5.6	SC	5.0	B		10	15	5			GRA04
1996 10 02.00		M	5.3	SC	5.0	B		10	15	5			GRA04
1996 10 02.17		S	5.4	NP	5.0	B		7	11	4			OKS
1996 10 02.21		M	5.2	AA	3.4	B		9	&19	5			PER01
1996 10 02.97		M	5.5	SC	5.0	B		10	15	4/			GRA04
1996 10 03.03		S	5.4	AA	5.0	B		10	18	4			ZAN01
1996 10 03.85		S	6.1	SC	7.0	B		16					TAY
1996 10 03.88		B	5.3	S	5.0	B		7	13	4			CHE03
1996 10 04.33		M	5.9	SC	5.0	B		10	7.0	4			MOD
1996 10 04.92		S	5.2	S	5.0	B		10	10	6	1	350	LUE
1996 10 05.05		M	5.8	SC	5.0	B		10	15	5			GRA04
1996 10 05.08		B	6.3:	AA	5.0	B		7	12	1			HOM
1996 10 05.09		S	5.7	AA	11	L	7	32	10	4			MOS03
1996 10 05.18		S	6.1	SC	7.0	B		16					TAY
1996 10 05.36		S	5.4	YF	5.0	B		7	14	5/			ADA03
1996 10 05.43		M	5.9	SC	5.0	B		10	8.3	4			MOD
1996 10 05.62		S	5.9	S	5.6	B		8	8.7	6			OKA05
1996 10 05.94		B	5.0	S	0.0	E		1		6			CHE03
1996 10 05.94		B	5.2	S	6.0	B		20	13	5	0.5	280	CHE03
1996 10 05.95		S	5.1	SC	8.0	B		12	16	5			ISH03
1996 10 05.96		S	5.5	AA	11	L	7	32		3			IVA03
1996 10 05.97		S	5.3	AA	5.0	B		10	15	4			ZAN01
1996 10 06.14		B	5.6	SC	5.0	B		7	12	7	0.3	300	BIV
1996 10 06.20		B	5.4	AA	3.4	B		9	&12	6	&1.8	280	PER01
1996 10 06.20		I	5.3	AA	0.0	E		1					PER01
1996 10 06.20		I	5.4	AA	0.0	E		1					VIT01
1996 10 06.20		M	5.3	AA	3.4	B		9	& 8	4/			VIT01
1996 10 06.20		M	5.3	AA	3.4	B		9	&12	6	&1.8	280	PER01
1996 10 06.36		M	5.4	SC	5.0	B		10	8.3	5	0.20	284	MOD
1996 10 06.38		S	5.1	SC	0.8	E		1	17	1			MOD
1996 10 06.96		B	5.4	AA	5.0	B		7	11	3			HOM
1996 10 06.96		S	5.5	AA	11	L	7	32		4			IVA03
1996 10 07.03		B	5.5	SC	5.0	B		7	12	7	0.8	290	BIV
1996 10 07.04		M	5.7	AA	3.0	R	4	7	15	2			MAI
1996 10 07.19		I	5.4	AA	0.0	E		1					PER01
1996 10 07.19		M	5.3	AA	3.4	B		9	&12	4/	&1.2	290	VIT01
1996 10 07.20		B	5.7	AA	3.4	B		9					PER01
1996 10 07.20		I	5.2	AA	0.0	E		1					VIT01
1996 10 07.20		M	5.3	AA	3.4	B		9	&14	5	&3	290	PER01
1996 10 07.30		M	5.6:	SC	5.0	B		10	&20	3/	&0.25	340	POR05
1996 10 07.34		M	5.6	SC	5.0	B		10	8.5	4/			MOD
1996 10 08.04		M	5.7	AA	3.0	R	4	7	15	2			MAI
1996 10 08.04		S	4.9	SC	8.0	B		12	18	5			ISH03
1996 10 08.09		B	5.8	SC	5.0	B		7	10	5	0.7	290	BIV
1996 10 08.21		S	6.2	AA	5.0	B		8	25	3			BEA
1996 10 08.92		M	5.8	HI	5.0	B		10	17	5			GRA04
1996 10 08.97		B	6.0	AA	5.0	B		7	8	2			HOM

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 08.99		S	5.3	AA	11	L	7	32		3	0.16		IVA03
1996 10 09.04		B	5.6	AA	5.0	B		7	12	4			MOR04
1996 10 09.04		M	5.6	AA	3.0	R	4	7	16	2			MAI
1996 10 09.23		M	5.4	AA	3.4	B		9	&10	4			PER01
1996 10 09.64		B	6.0	Y	3.0	B		8	&10	4			OHM
1996 10 09.73		B	5.7	AA	5.0	B		7	10	4			MOR04
1996 10 09.98		B	5.6	AA	5.0	B		7	13	4			MOR04
1996 10 10.00		S	5.2	AA	11	L	7	32		3	0.16		IVA03
1996 10 10.03		M	5.9	HI	5.0	B		10	16	5	0.5	310	GRA04
1996 10 10.04		M	5.5	AA	3.0	R	4	7	18	2			MAI
1996 10 10.29		M	5.3:	SC	5.0	B		10	&20	3/	&0.25	355	POR05
1996 10 10.47		S	5.2:	YF	5.0	B		7		5			ADA03
1996 10 10.72		B	5.6	AA	5.0	B		7	12	3			LEH01
1996 10 10.98		B	5.6	AA	5.0	B		7	10	4	0.5	300	MOR04
1996 10 11.02		M	5.5	AA	3.0	R	4	7	18	2			MAI
1996 10 11.79		M	5.2	S	5.0	B		7	15				APF
1996 10 11.80		B	5.9	AA	5.0	B		7	11	3			HOM
1996 10 12.05		M	5.0	AC	5.0	B		10	15	6	1.5	290	SAN07
1996 10 12.09		M	5.5	AA	5.0	B		10	10.5	D5	0.6		MEY
1996 10 12.09		S	5.6	AA	0.6	E		1					MEY
1996 10 12.72		B	5.7	AA	5.0	B		7	10	4			LEH01
1996 10 12.73		B	5.7	AA	5.0	B		7	10	4			MOR04
1996 10 12.77		S	5.5	AC	7.2	R	7	20	15	4	0.2	358	TUB
1996 10 12.77		S	5.7	HS	5	R	4	10	8	2	>0.6	325	GUR
1996 10 12.83		M	6.3	AA	5.0	B		10	7	2			VAN06
1996 10 12.85		B	6.8	AA	5.0	B		7	10	1			HOM
1996 10 12.86		B	6.1	SC	5.0	B		7	15	4	0.4	320	BIV
1996 10 12.94		B	5.5	S	5.0	B		7	&11	5			CHE03
1996 10 12.97		S	5.1	SC	8.0	B		12	15	5	0.4	325	ISH03
1996 10 12.99		B	5.6	AA	5.0	B		7	10	4	0.5	320	MOR04
1996 10 13.01		B	4.9	AA	5.0	B		7	10	4			LEH01
1996 10 13.01		S	4.9	AA	11.0	B		20		4			IVA03
1996 10 13.01	a	S	5.5	HP	5.0	B		10	11	5			BOR
1996 10 13.06		S	5.9	AC	5.0	B		10	12	4	1.5	320	SAN07
1996 10 13.15		B	6.0	SC	5.0	B		7	12	5	0.4	315	BIV
1996 10 13.64		S	6.0	HS	5	R	4	10	8	2	>0.6	327	GUR
1996 10 13.73		B	5.7	AA	5.0	B		7	10	5			MOR04
1996 10 13.73		B	5.7	S	6.0	B		20	10	5			CHE03
1996 10 13.80		B	7.0	AA	5.0	B		7	10	1			HOM
1996 10 13.93		S	5.5	AA	5.0	B		10	20	4			ZAN01
1996 10 13.96		S	5.5	AA	11	L	7	32		3			IVA03
1996 10 13.96		S	5.5	AA	11	L	7	32		3			IVA03
1996 10 14.01		B	5.6	AA	5.0	B		7	10	5	0.5	325	MOR04
1996 10 14.73		B	5.5	AA	5.0	B		7	10	5	0.5	325	MOR04
1996 10 14.73		B	5.6	AA	5.0	B		7	11	4			LEH01
1996 10 14.73		S	5.2	AC	5.0	B		10	10	s7			SAN07
1996 10 14.73		S	5.6	TI	5.0	B		7	10	2			KYS
1996 10 14.76		M	5.4	AA	5.0	B		10	12	D6/	0.6		MEY
1996 10 14.76		M	5.4	S	5.0	B		7	16				APF
1996 10 14.79		B	7.0	AA	5.0	B		7	11	3			HOM
1996 10 14.98		S	5.5	AA	5.0	B		10	20	4			ZAN01
1996 10 14.99		S	5.3	HP	5.0	B		10	12	5/			BOR
1996 10 15.01		B	5.5	AA	5.0	B		7	10	6	0.5	330	MOR04
1996 10 15.02		S	5.3	SC	8.0	B		12	16	4/	0.3	330	ISH03
1996 10 15.03		B	5.3	SC	11	L	7	50	14	4/	0.3	330	ISH03
1996 10 15.08		M	5.3	AA	3.0	R	4	7	20	2			MAI
1996 10 15.14		M	5.2	AC	5.0	B		10	12	s7	2	315	SAN07
1996 10 15.40	a	S	5.4	HP	5.0	B		10	12	5/			BOR
1996 10 15.42		M	6.1	SC	5.0	B		10	6.8	4			MOD
1996 10 15.73		B	5.5	AA	5.0	B		7	10	5			MOR04
1996 10 15.73		B	5.5	AA	5.0	B		7	11	4			LEH01
1996 10 15.77		B	5.6	Y	3.0	B		8	&15	4			OHM
1996 10 15.84		S	5.7	SP	8.0	B		20	20				VET
1996 10 15.85		B	7.2	AA	5.0	B		7	10	1			HOM
1996 10 15.99					40.6	L	5	70	3.5	5/	0.4	340	BOR

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 15.99	a	S	5.4	HP	5.0	B		10	9	5			BOR
1996 10 16.01		B	5.6	AA	5.0	B		7	11	5	0.5	345	MOR04
1996 10 16.18		S	5.4	AA	5.0	B		10	20	5			GIL01
1996 10 16.22		S	5.8	AA	5.0	B		8	25	4			BEA
1996 10 16.25		S	5.5	SP	8.0	B		20					VET
1996 10 16.73		B	5.6	AA	5.0	B		7	9	5			MOR04
1996 10 16.80		B	7.2	AA	5.0	B		7	7	3			HOM
1996 10 16.86		S	5.8	AA	5.0	B		8	25	4			BEA
1996 10 17.03		B	5.6	AA	5.0	B		7	10	5	0.5	345	MOR04
1996 10 17.15		S	5.5	SP	8.0	B		20				16	VET
1996 10 17.73		B	5.6	AA	5.0	B		7	9	5			MOR04
1996 10 17.73		S	5.0	AC	5.0	B		10	10	s7			SAN07
1996 10 17.75		S	5.7	SC	8.0	B		20	5	4			BAR
1996 10 17.79		S	5.5	NP	5.0	B		7	10	4			OKS
1996 10 17.81		S	5.7	SP	8.0	B		20					VET
1996 10 18.73		B	5.6	AA	5.0	B		7	9	5			MOR04
1996 10 18.76		S	6.0	AA	5.0	B		10	&10	4			FOG
1996 10 18.79		S	6.0	AA	7.0	B		16	12				TAY
1996 10 18.81		S	5.4	NP	5.0	B		7	8	4			OKS
1996 10 18.83		S	5.9	SP	8.0	B		20	12			16	VET
1996 10 19.18		S	5.3	NP	5.0	B		7	8	4			OKS
1996 10 19.24		S	5.7	SP	8.0	B		20	20		0.8	18	VET
1996 10 19.75		S	5.8	AA	5.0	B		10	&10	5			FOG
1996 10 19.76		S	6.2	SC	8.0	B		20	6	3			BAR
1996 10 20.22		B	7.2:	S	5.0	B		7	5	5			BIV
1996 10 20.23	a	S	6.6	AA	3.4	B		9	& 8	5			PER01
1996 10 20.83		S	7.1	S	10.0	B		20	10	3	15 m	10	YOS02
1996 10 21.04		B	7.5	S	12	R	5	23	&10	3	0.2	350	CHE03
1996 10 21.18		S	6.3	SP	8.0	B		20			0.8	12	VET
1996 10 21.21	a	S	7.0	AA	3.4	B		9	&12	4			PER01
1996 10 21.79		S	7.0:	AA	12.5	R	5	20	10	2			BEA
1996 10 22.02		B	7.6	S	12	R	5	23		3			CHE03
1996 10 22.17		S	7.5	HI	5.0	B		10	6	4			GRA04
1996 10 22.18		S	7.6	HI	20.3	T	10	50	5	4/	0.6	5	GRA04
1996 10 22.22	a	S	7.5	AA	3.4	B		9	& 9	4			PER01
1996 10 22.22	a	S	7.6	AA	3.4	B		9	&14	1			VIT01
1996 10 22.78		M	7.8	HI	20.3	T	10	80	4.0	5			GRA04
1996 10 23.02		B	7.7	S	12	R	5	23		3			CHE03
1996 10 23.21		S	8.5:	S	25.6	L	5	42	4	3			BIV
1996 10 24.03		B	7.9	S	12	R	5	20		3			CHE03
1996 10 24.11		S	8.2	AC	8	R	11	60	3	0/			GUL01
1996 10 25.01		B	8.1	S	12	R	5	23		3			CHE03
1996 10 25.16		M	7.7	S	8.0	B		10	12	2			HOR02
1996 10 25.73		O	7.5:	TI	5.0	B		7	8	2			KYS
1996 10 26.03		B	8.1:	S	12	R	5	18		3			CHE03
1996 10 28.12		S	8.5	AC	8	R	11	60	3	0/			GUL01
1996 10 29.61		B	8.5:	S	12	R	5	23	8	3			CHE03
1996 10 29.81	a	S	9.1	AA	25.3	L	6	58	&10	0/	&0.2	15	PER01
1996 10 30.00	a	S	9.4	AC	40.6	L	5	70	1.8	2/	0.3	20	BOR
1996 10 30.80	a	S	9.3	AA	25.3	L	6	58	& 2.5	2			VIT01
1996 10 30.80	a	S	9.3	AA	25.3	L	6	58	& 5	1			PER01
1996 10 31.77		M	8.1	S	8.0	B		10	9	2			HOR02
1996 10 31.98	a	S	9.5	AC	40.6	L	5	70	1.6	2	0.35	26	BOR
1996 11 01.75		S	8.3	AC	30.5	T	10	55	& 8	1			COM
1996 11 01.76		S	8.5	AA	15.0	B		25	10	3	1	10	ZAN
1996 11 01.80	a	S	8.3	AA	25.3	L	6	58	&10	1/			PER01
1996 11 01.80	a	S	8.7	AA	25.3	L	6	58	& 4.5	2			VIT01
1996 11 01.81	w	S	7.5	S	7.0	B		10	3	1			MAR02
1996 11 01.82	w	S	7.5	S	7.0	B		10	3	2			SAN04
1996 11 01.98	a	S	9.5	AC	40.6	L	5	70	2.8	1	0.25	25	BOR
1996 11 02.75		S	9.2	AC	20.3	T	10	50	5	2	0.25	20	GRA04
1996 11 02.75	!	V	8.7	YF	20.0	T	2		&14	7	&1.0	18	MIK
1996 11 02.76		M	8.1	TI	8.0	B		10	10	2/			PLS
1996 11 02.77		M	8.3	TI	8.0	B		10	10	1/			HOR02
1996 11 02.77		S	8.5	AA	15.0	B		25	10	3	1	10	ZAN

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

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 11 02.79	a	S	8.4	AA	25.3	L	6	58	& 5	2			PER01
1996 11 02.79	a	S	8.4	AA	25.3	L	6	58	& 5	2			VIT01
1996 11 02.81	w	S	7.7	S	7.0	B		10	5	2			MAR02
1996 11 02.81	w	S	8.0	S	7.0	B		10	4	3			SAN04
1996 11 03.61		B	8.6	S	12	R	5	23	6	3			CHE03
1996 11 03.75		S	8.5	AA	15.0	B		25	10	3	1	10	ZAN
1996 11 03.77		S	8.3	TI	8.0	B		10	10	1/			HOR02
1996 11 03.99	a	S	9.5	AC	40.6	L	5	70	2.0	0/	0.2	20	BOR
1996 11 04.74		M	8.6	S	10	B		25	16	1			ZNO
1996 11 04.77		S	10.4	VB	20	R	14	90	2.2	2			SHA02
1996 11 04.98	a	S	10.1:	AC	40.6	L	5	70	1.8	0		5	BOR
1996 11 05.73		S	7.8	AA	11	L	7	32	11	2			VEL03
1996 11 05.73		S	7.8	AA	11	L	7	32	11	2			VEL03
1996 11 05.73		S	8.0	AA	11	L	7	32	6	2			BAR06
1996 11 05.73		S	8.6	AC	30.5	T	10	56	& 6	0/			COM
1996 11 05.75		S	9.2	AC	8.0	B		15	5	0			BOU
1996 11 06.70		M[	8.3	AA	5	R		20	! 4				BAR06
1996 11 06.71		S	8.4:	TI	8.0	B		10	10	2			PLS
1996 11 06.72		M	8.7	TI	8.0	B		10	7	2			HOR02
1996 11 07.79	a	S	8.5	AA	25.3	L	6	58	& 5	0/			PER01
1996 11 08.23		S	9.2	VB	10	B		14	6	3			SHA02
1996 11 08.71		S	8.0	AA	11	L	7	32	5	2	0.2	4	BAR06
1996 11 08.72		S	9.6	AC	15.2	L	5	42	4	2			MOE
1996 11 08.72		S	10.3:	HS	41	L		74	& 2	1			GLI
1996 11 08.73		S	9.5	AC	25.4	L	5	65	4	1			MEY
1996 11 08.73		S	9.6:	TI	8.0	B		10	12	1			HOR02
1996 11 08.75		S	9.6	AC	25.4	J	6	47	4.5	0/			BOU
1996 11 08.76		S	8.7	AA	15.0	B		25	7	2	0.7	20	ZAN
1996 11 08.77		S	10.4	VB	20	R	14	90	2.9	2			SHA02
1996 11 09.18		S	10.1	TI	11	L	7	32	5.5	2			KYS
1996 11 09.23	!	S	9.7	VB	8.0	B		20	4.4	2			SHA02
1996 11 09.71		S[	8.5	AA	5	R		20	! 6				BAR06
1996 11 09.72	!	V	9.3	YF	20.0	T	2		&12	6	&0.7	20	MIK
1996 11 09.73		S	9.7	AC	15.2	L	5	42	4	2			MOE
1996 11 09.73	&	S	9.3	AC	6.0	B		20	8	1			SAR02
1996 11 09.76		S	9.4	AC	20.3	T	10	80	4	1/			GRA04
1996 11 09.81		S	10.9:	HS	25.6	L	5	84	3	1			BIV
1996 11 12.96					40.6	L	5	70	& 3	0			BOR
1996 11 13.72		S	9.9:	AC	15.2	L	5	42	4	1			MOE
1996 11 14.74		S	10.4	AC	25.4	J	6	47	4.0	0			BOU
1996 11 15.72		S	10.0	AC	15.2	L	5	42	4.5	1			MOE
1996 11 23.01		B[	9.5	AA	12	R	5	35		3			CHE03
1996 11 23.18		S	9.4	TI	35	L	5	98	7	1			HOR02

Comet C/1996 R1 (Hergenrother-Spahr)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 21.25		k	12.7	EB	121.9	L	8						HER02
1996 10 03.83		S	11.8	AC	25.4	L	5	65	1.5	s4/			MEY
1996 10 04.54		C	12.9	GA	60.0	Y	6		1.75		3.4m	64	NAK01
1996 10 14.79		S	12.9	AC	25.4	L	5	104	1.1	2/			MEY
1996 10 16.48		C	13.4	GA	60.0	Y	6		1.9		5.0m	61	NAK01
1996 11 01.78		C	15.5	HS	50	Y	4						CAV
1996 11 01.85	w	S	14.0	NP	44.5	L	5	167	0.5	1			MAR02
1996 11 01.86	w	S	13.9	NP	44.5	L	5	167	1	2			SAN04
1996 11 04.73		S	12.9:	HS	35	L	5	158	1.4	2			HOR02
1996 11 04.75		S	13.5	HS	44.0	L	5	222	0.6	4			HAS02
1996 11 08.74	&	S[	13.5	HS	44.5	L	5	230	1				SAR02
1996 11 09.74	&	S	14.9	HS	44.5	L	5	230	0.6	4			SAR02
1996 12 03.40	a	C	16.0:	GA	60.0	Y	6		1.2				NAK01

Comet 2P/Encke

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1994 01 23.75		S	7.3	AA	8.0	B		20	3	3			PEA

Comet 2P/Encke [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1994 01 24.75		S	7.0	AA	8.0	B		20		4			PEA
1996 07 24.78		C	19.8	GA	60.0	Y	6		0.2				NAK01
1996 08 18.75		C	19.2	GA	60.0	Y	6			9			NAK01
1996 09 10.70		C	19.4	GA	60.0	Y	6			9			NAK01
1996 09 19.39		k	18.5	EB	121.9	L	8						HER02
1996 10 05.61		C	19.4	GA	60.0	Y	6			9			NAK01
1996 10 16.56		C	18.9	GA	60.0	Y	6		0.25				NAK01
1996 12 28.41		C	19.2	GA	60.0	Y	6		0.25				NAK01

Comet 6P/d'Arrest

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1995 07 26.00		S	9.9	HS	20.3	T	10	80	2	1			LUE
1995 07 30.00		S	9.4	HS	20.3	T	10	67	6	1			LUE

Comet 22P/Kopff

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 05 27.03		S	9.5:	S	10.0	B		25	8	1			PLE01
1996 06 06.92		B	10.0:	S	25	L	6	100	& 1	1			SWI
1996 06 07.96		S	9.2	S	10.0	M	10	32	& 4	s3			PAR03
1996 06 07.98		B	8.0:	S	7.0	B		25	& 3	d1			SOC
1996 06 07.99		B	9.0	S	10.0	B		25	8	1			PLE01
1996 06 09.93		B	8.0:	S	7.0	B		25	& 3	d1			SOC
1996 06 13.97		B	8.7	S	10.0	B		25	10	1/			PLE01
1996 06 13.97	&	M	9.5:	S	14.7	L	6	69	3	2/			SIW01
1996 06 17.99	&	M	9.4:	S	14.7	L	6	69	3				SIW01
1996 06 26.00	&	S	8.6	S	8	R	7	35	2	2			KWI
1996 06 27.33		S	8.2:	HI	5.0	B		7	&12	2			ADA03
1996 07 04.87		S	7.2	TI	8.0	B		10	15	1/			HOR02
1996 07 04.88		B	9.6:	S	25	L	6	100	& 3	0			SWI
1996 07 05.32		S	9.8	MS	31.7	L	5	64	1	4			JON
1996 07 05.90	&	S	8.7	S	8	R	7	35	3	2			KWI
1996 07 05.92		B	8.6	S	10.0	B		25	10	1/			PLE01
1996 07 05.94		S	8.7	S	9.0	R	6	16	& 5	s2			PAR03
1996 07 07.85		S	8.3	TI	5.0	B		10	2	2			LUE
1996 07 07.91		S	10.3	AA	11	L	7	80	1	2			IVA03
1996 07 08.83		S	8.3	TI	5.0	B		10	2	3			LUE
1996 07 08.92		S	10.2	AA	11	L	7	80	1	1			IVA03
1996 07 09.23		S	8.5	S	15	L	7	28	6	2/			ADA03
1996 07 09.91		S	10.1	AA	11	L	7	80	1	1			IVA03
1996 07 09.91	&	S	8.4	S	5.0	B		10	6				SIW01
1996 07 09.94		B	8.5	S	10.0	B		25	12	1/			PLE01
1996 07 10.90		E	8.5:	AA	13.3	R	5	33	4.8	3			SCO04
1996 07 11.74		S	8.6	TI	5.0	B		10	2	2			LUE
1996 07 11.75		S	8.7	TI	25	L	6	47	2	5			LUE
1996 07 11.85		E	9.3	AA	13.3	R	5	33	3.7	3			SCO04
1996 07 11.90		S	10.2	AA	11	L	7	80	1.5	1			IVA03
1996 07 12.78		S	8.6	TI	5.0	B		10	4	3			LUE
1996 07 12.78		S	8.7	TI	25	L	6	47	4.7	5			LUE
1996 07 12.89		E	9.7	AA	13.3	R	5	33	4	3			SCO04
1996 07 12.91		S	10.2	AA	11	L	7	80	1.5	1			IVA03
1996 07 13.96		B	8.2:	S	6.0	B		20	& 5	2			SCI
1996 07 13.97		S	9.1	S	10.0	M	10	20	& 5	d2			PAR03
1996 07 15.83		E	9.5	AA	13.3	R	5	33	3	3			SCO04
1996 07 15.91		S	8.7	TI	5.0	B		10	3.5	3			LUE
1996 07 16.82		S	8.7	TI	6.0	B		20	3.5	3			LUE
1996 07 17.83		S	8.4	TI	5.0	B		10	4	2			LUE
1996 07 17.87		B	7.5:	AA	6.0	B		20	5	2			KOS04
1996 07 17.92		B	8.8	S	10.0	B		25	15	s1/			PLE01
1996 07 19.22		S	8.6	AA	15	L	7	28	8	3			ADA03
1996 07 20.90		B	9.0	S	6.6	B		20	8	1/			PLE01
1996 07 20.91	&	M	8.9	S	14.7	L	6	69	3	2			SIW01
1996 07 20.92		S	9.1	S	10.0	M	10	32	& 5	d2			PAR03
1996 07 21.88		B	9.2	S	25	L	6	100	& 3	1			SWI

Comet 22P/Kopff [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 21.89	&	S	8.7	S	8	R	7	35	5	2			KWI
1996 07 21.92		E	10.4	AA	13.3	R	5	33	5.4	2			SC004
1996 07 22.93		E	10.5	AA	13.3	R	5	33	3	2			SC004
1996 07 22.95	&	S	8.7	S	5.0	B		10	4				SIW01
1996 07 23.25		S	8.5	AA	15	L	7	28		2/			ADA03
1996 07 23.49		S	10.1	MS	31.7	L	5	64	1.5	3			JON
1996 07 23.93		E	9.5	AA	13.3	R	5	33	5.1	1			SC004
1996 08 03.45		S	10.3	MS	31.7	L	5	64	1	2			JON
1996 08 05.45		S	10.4	MS	31.7	L	5	64	1	2			JON
1996 08 06.88		S	8.6:	S	6.0	B		20	& 3	2			SCI
1996 08 07.86		S	8.8:	S	6.0	B		20	& 3	1/			SCI
1996 08 07.89		B	9.2	S	10.0	B		25	8	s1			PLE01
1996 08 08.86		S	9.0	S	6.0	B		20	& 3	1/			SCI
1996 08 08.90		B	9.1	S	10.0	B		25	12	s1			PLE01
1996 08 08.91	&	I	10.0:	S	10.0	B		25	&20	s1/			KUC02
1996 08 09.85		S	9.2	S	6.0	B		20	& 3	1/			SCI
1996 08 09.88		B	9.2	S	10.0	B		25	12	s1			PLE01
1996 08 09.90	&	I	10.0:	S	10.0	B		25	&20	s2			KUC02
1996 08 10.91		B	9.3:	S	10.0	B		25	10	s1			PLE01
1996 08 11.54		S	12.0	HS	31.7	L	6	60	3	3			MIY01
1996 08 12.85		S	9.2	S	6.0	B		20	& 3	1			SCI
1996 08 13.84		S	9.2:	S	6.0	B		20	& 3	1			SCI
1996 08 14.93		S	9.1	S	6.0	B		20	& 3	1			SCI
1996 08 15.51		S	12.3	HS	31.7	L	6	60	2	2			MIY01
1996 08 16.44		S	10.5	MS	31.7	L	5	64	1	1			JON
1996 09 03.72		S	10.8:	S	35	M	10	90	7	s1			PLE01
1996 10 04.48	a	C	12.0	GA	60.0	Y	6		3.5				NAK01
1996 10 06.12		S	13.4	GA	50.5	L	5	87	0.8	3			MOD
1996 10 06.83		S	12.2	HS	25.6	L	5	84	2	2			BIV
1996 10 16.47	a	C	12.1	GA	60.0	Y	6		4.1				NAK01
1996 11 01.87	w	S	11.9	NP	44.5	L	5	167	1.5	3			MAR02
1996 11 01.88	w	S	12.6	NP	44.5	L	5	167	1.5	1			SAN04
1996 11 02.85	w	S	12.0	NP	44.5	L	5	100	1.5	2			MAR02
1996 11 02.86	w	S	12.3	NP	44.5	L	5	100	2	2			SAN04
1996 11 04.74		S	12.8:	TI	35	L	5	158	0.8	1			HOR02
1996 11 04.74		S	13.5	HS	44.0	L	5	156	0.3	2			HAS02
1996 11 04.75		S	13.0	HS	35	L	5	158	0.8	2			PLS
1996 12 03.45	a	C	13.6	GA	60.0	Y	6		2.8				NAK01

Comet 29P/Schwassmann-Wachmann 1

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 03 14.12		S	11.2	HS	33.3	L	4	58	1.8	6			KR002
1996 03 16.15		S	11.3	HS	33.3	L	4	58	2.0	5			KR002
1996 11 13.84		C	12.8:	GA	60.0	Y	6		4.0	8/			NAK01
1996 11 13.84		C	14.1	GA	60.0	Y	6		+ 0.25				NAK01
1996 11 22.16		O	[12.8	HS	35	L	5	237	! 0.6				HOR02
1996 11 23.20		S	12.6	HS	35	L	5	158	1.1	2/			HOR02
1997 01 11.77		C	13.2	GA	60.0	Y	6		3.3	s0/			NAK01
1997 01 11.77		c	17.2	GA	60.0	Y	6						NAK01
1997 01 13.82		C	13.4	GA	60.0	Y	6		3.4	s0/			NAK01
1997 01 13.82		c	17.0	GA	60.0	Y	6						NAK01
1997 01 18.82		C	13.1	GA	60.0	Y	6		3.9	s0/			NAK01
1997 01 18.82		c	17.1	GA	60.0	Y	6						NAK01
1997 01 19.83		C	13.0	GA	60.0	Y	6		4.0	8/			NAK01
1997 01 19.83		C	14.7	GA	60.0	Y	6		+ 0.25				NAK01

Comet 43P/Wolf-Harrington

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 21.17		k	21.1	EB	121.9	L	8						HER02
1996 09 21.18		k	20.7	EB	121.9	L	8						HER02

Comet 45P/Honda-Mrkos-Pajdušáková

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 03 09.85		S	10.1	HS	20.3	T	10	67	3	1			LUE

Comet 46P/Wirtanen

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 19.18		k	18.8	EB	121.9	L	8						HERO2
1996 12 03.42	a	C	15.6	GA	60.0	Y	6		0.7		1.8m	72	NAKO1
1996 12 28.39	a	C	14.3	GA	60.0	Y	6		1.5			75	NAKO1
1996 12 29.49		S[	12.5	VN	20.0	L	4	100					PEA
1997 01 03.49		S[	12.5	VN	20.0	L	4	100					PEA
1997 01 12.40	a	C	13.4	GA	60.0	Y	6		2.2		2.7m	69	NAKO1

Comet 57P/du Toit-Neujmin-Delporte

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 18.37		S	14.7	GA	50.5	L	5	167	0.5	1			MOD
1996 08 25.34		S	14.9	GA	50.5	L	5	167	0.5	2			MOD
1996 09 19.36		k	16.7	EB	121.9	L	8						HERO2
1996 09 19.37		k	16.3	EB	121.9	L	8						HERO2
1996 10 06.23		S[	14.8	GA	50.5	L	5	167	! 0.5				MOD
1996 10 10.64		C	15.2	GA	60.0	Y	6		1.5		7.1m	254	NAKO1
1996 11 06.71		C	15.0	GA	60.0	Y	6		1.5		> 5.7m	253	NAKO1
1996 11 09.92		S[	14.5	HS	44.5	L	5	230	1				SARO2
1996 11 16.63		C	15.4	GA	60.0	Y	6		1.4		5.7m	254	NAKO1
1996 12 03.59		C	15.8	GA	60.0	Y	6		1.3		4.6m	254	NAKO1
1997 01 09.48		C	18.1	GA	60.0	Y	6		0.6	0/			NAKO1
1997 01 12.44		C	18.0	GA	60.0	Y	6		0.6	0/			NAKO1

Comet 65P/Gunn

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 03.91		S	12.3	HS	25	L	6	214	1	2			HORO2
1996 07 04.89		S	12.2	HS	25	L	6	214	1.1	2			HORO2
1996 07 10.94		S	12.3	HS	25	L		115	2	2			LUE
1996 07 12.00		S	12.3	HS	25	L		115	2	2			LUE
1996 07 13.93		S	12.0	HS	25	L		115	2	2			LUE
1996 07 15.93		S	12.7	HS	25	L		115	2	2			LUE
1996 07 16.94		S	12.3	HS	25	L		115	2	2			LUE
1996 07 17.92		S	12.5	HS	25	L		115	2	2			LUE

Comet 67P/Churyumov-Gerasimenko

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 04 09.84		C	14.0	HS	50	Y	4						CAV

Comet 73P/Schwassmann-Wachmann 3

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1995 10 15.70		S	5.5:	AA	0.0	E		1		8	1		PEA
1996 09 20.45		k	23.1	EB	121.9	L	8						HERO2
1996 09 20.47		k	22.8	EB	121.9	L	8						HERO2
1996 09 21.45		k	22.5	EB	121.9	L	8						HERO2
1996 10 25.02	*	S	7.5	SC	33.3	L	4	58	2	5	0.27	65	KROO2
1996 10 26.02	*	S	7.7	SC	33.3	L	4	58	2	5			KROO2
1996 11 04.80		S[	13.5	HS	44.0	L	5	156					HASO2
1996 11 09.96		S[	15.0	HS	44.5	L	5	230	0.5				SARO2

Comet 74P/Smirnova-Chernykh

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 07 16.75	a	C	18.8	GA	60.0	Y	6		0.25				NAKO1
1996 07 24.71		C	18.7	GA	60.0	Y	6		0.2		1.9m	247	NAKO1
1996 08 18.71		C	18.1:	GA	60.0	Y	6		0.3		2.4m	253	NAKO1
1996 09 15.64		C	18.3	GA	60.0	Y	6		0.25				NAKO1
1996 10 05.57	a	C	18.2	GA	60.0	Y	6		0.3		2.6m	254	NAKO1

Comet 74P/Smirnova-Chernykh [cont].

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 16.53	a	C	18.1	GA	60.0	Y	6		0.35		2.3m	255	NAK01

Comet 78P/Gehrels 2

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 06 26.34		k	21.0	EB	121.9	L	8						HER02

Comet 81P/Wild 2

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 19.43		k	16.3	EB	121.9	L	8						HER02
1996 11 06.80		C	14.4	GA	60.0	Y	6		1.2		4.1m	279	NAK01
1996 11 09.18		S	13.8:	HS	44.5	L	5	230	0.8	4			SAR02
1996 11 13.81		C	14.3	GA	60.0	Y	6		1.45		4.4m	279	NAK01
1996 11 22.14		S	13.5:	HS	35	L	5	158	0.9	2/			HOR02
1996 12 12.94		S	12.3	AC	25.4	L	5	104	0.9	4			MEY
1996 12 14.74		B	12.2:	HS	25.4	T	6	60	1.2	6			YOS04
1996 12 21.09		S	11.7:	AC	20	L	5	55	3	2			BAR06
1996 12 22.08		S	11.5	AC	20	L	5	55	3.5	3			BAR06
1996 12 29.51		S	12.0	VN	20.0	L	4	100	2.0	2			PEA
1996 12 30.50		S	12.5	HS	40.0	L	6	200	0.7	6			NAG08
1996 12 31.90	a	S	12.0	AC	25.4	J	6	72	1.4	4			BOU
1997 01 03.56		S	10.5	HS	25.4	T	6	60	3.2	4/			YOS04
1997 01 03.58		S	11.5	VN	20.0	L	4	45	2.5	5			PEA
1997 01 03.61		P	10.8	HS	25.0	T	3			6			TAK05
1997 01 03.71		B	11.5	HS	31.7	L	6	63	2.5	5			MIY01
1997 01 04.54		S	10.8	HS	25.4	T	6	60	3.2	4			YOS04
1997 01 04.91	a	S	11.9	AC	25.4	J	6	72	1.6	3/			BOU
1997 01 07.81		B	11.0	HS	31.7	L	6	63	2	3			MIY01
1997 01 09.14		S	11.0	AC	40.6	L	5	70	1.5	7			BOR
1997 01 09.76		S	9.9	HS	25.4	T	6	60	3	4/			YOS04
1997 01 11.16		S	10.7	AC	40.6	L	5	70	1.4	7			BOR
1997 01 11.67		C	11.0	GA	60.0	Y	6		3.6		> 8.7m	289	NAK01
1997 01 12.70		S	9.6	HS	25.4	T	6	60	3.4	5/			YOS04
1997 01 13.15		S	10.7	AC	40.6	L	5	70	1.5	7			BOR
1997 01 13.16		M	10.4	AC	25.3	L	6	58	& 1.5	6/			PER01
1997 01 13.19		S	10.8	AC	20.0	T	10	102	2.1	2/			SPR
1997 01 14.17		S	10.8	AC	20.0	T	10	102	1.9	4/			SPR
1997 01 14.84		S	11.0	HS	44.0	L	5	100	0.5	4			HAS02
1997 01 14.99		M	10.9	AC	25.4	J	6	72	1.8	5/			BOU
1997 01 15.01		B	10.8	HS	25.6	L	5	42	3	7	0.1	290	BIV
1997 01 15.02		M	10.5	AC	25.3	L	6	58	& 1.5	7			PER01
1997 01 15.02		S	10.3	AC	25.3	L	6	58	& 1.5	7			PER01
1997 01 15.15		S	10.6	AC	20.0	T	10	102	2.5	4/			SPR
1997 01 15.61		B	10.8	HS	31.7	L	6	63	2	5			MIY01
1997 01 15.83	!	V	10.9	YF	20.0	T	2		& 2	8	& 5	m 290	MIK
1997 01 16.71		M	10.0	AA	25.4	T	6	56	3.1	5			ISH02
1997 01 16.75		B	10.9	HS	31.7	L	6	63	2	5			MIY01
1997 01 19.81		S	9.1	VG	10.0	B		20	5	4			NAG08
1997 01 20.75		S	9.8	HS	25.4	T	6	60	3.5	3			YOS04
1997 01 26.77		S	10.5	AC	15.2	L	5	42	3	3			MOE
1997 01 26.80		M	10.5	AC	25.4	J	6	58	2.0	4/			BOU
1997 01 27.75		S	10.6	AC	15.2	L	5	42	3	3			MOE
1997 01 28.83		B	10.6	HS	25.6	L	5	42	3	6			BIV
1997 01 28.85	!	V	10.1	YF	20.0	T	2		& 5	8			MIK
1997 01 28.95		S	10.5	AC	20.3	T	10	80	1.7	4			GRA04
1997 01 29.06		S	10.0	AC	40.6	L	5	70	1.8	7			BOR
1997 01 29.95		B	10.5	HS	25.6	L	5	42	3	6			BIV
1997 01 30.76		S	10.4	AC	15.2	L	5	42	3.5	3			MOE
1997 01 30.78	!	M	9.8	AA	25.4	T	6	50	1.0	8			PAL02
1997 01 31.77		S	10.5	AC	15.2	L	5	42	3.5	2			MOE

Comet 96P/Machholz 1

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 24.80		S	[12.5	VN	20.0	L	4	100					PEA
1996 09 21.79		S	[11.0	VN	20.0	L	4	100					PEA

Comet 111P/Helin-Roman-Crockett

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 19.47		k	21.6	EB	121.9	L	8						HER02
1996 09 19.48		k	21.8	EB	121.9	L	8						HER02

Comet 116P/Wild 4

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 02 10.08		S	12.8	HS	33.3	L	4	122	1.3	4			KR002
1996 02 11.06		S	12.8	HS	33.3	L	4	122	1.2	4			KR002
1996 02 14.18		S	12.9	HS	33.3	L	4	122	1.1	2			KR002
1996 02 21.17		S	12.7	HS	33.3	L	4	122	1.3	2			KR002
1996 03 14.10		S	12.8	HS	33.3	L	4	200	0.9	3			KR002
1996 03 16.10		S	12.6	HS	33.3	L	4	200	1.7	2			KR002
1996 04 11.06		S	12.1	HS	33.3	L	4	200	0.8	1			KR002
1996 07 11.76		S	11.1	HS	25	L		115	1	3			LUE

Comet 118P/Shoemaker-Levy 4

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 11 06.74		C	14.3	GA	60.0	Y	6		1.3			275	NAK01
1996 11 09.15		S	13.5	HS	44.5	L	5	230	1	5			SAR02
1996 11 10.02		S	13.8	HS	44.5	L	5	230	1.1	4			SAR02
1996 11 13.76		C	13.9	GA	60.0	Y	6		1.6		3.9m	278	NAK01
1996 11 22.13		S	13.7	HS	35	L	5	158	1.3	2			HOR02
1996 11 29.87		S	12.8	NP	44.5	L	5	100	1	2			MAR02
1996 11 29.87		S	12.8	NP	44.5	L	5	100	1	2/			ROD01
1996 12 01.89		S	12.5	HS	35	L	5	104	1.4	2/			HOR02
1996 12 03.62		C	12.9	GA	60.0	Y	6		2.6		4.6m	286	NAK01
1996 12 03.89		S	12.6	HS	35	L	5	104	1.6	1/			HOR02
1996 12 04.90		S	12.6	AC	25.4	L	5	104	0.7	3			MEY
1996 12 04.90		S	12.8	HS	35	L	5	158	1.2	2/			HOR02
1996 12 04.90		S	12.8	HS	35	L	5	158	1.2	2/			HOR02
1996 12 04.97		S	12.8	AC	25.4	J	6	115	1.0	2/			BOU
1996 12 12.92		S	12.4	AC	25.4	L	5	104	1.3	5			MEY
1996 12 13.94		S	12.7	AC	25.4	J	6	88	1.3	1/			BOU
1996 12 14.70		I	12.9	HS	25.4	T	6	60		9			YOS04
1996 12 29.50		S	12.7	VN	20.0	L	4	45	1.3	4			PEA
1996 12 30.44		S	12.9	HS	40.0	L	6	200	0.4	5			NAG08
1996 12 31.88		S	12.6	AC	25.4	J	6	88	1.5	1			BOU
1997 01 03.54		S	12.7	VN	20.0	L	4	100	1.3	3			PEA
1997 01 04.90		S	12.7	AC	25.4	J	6	88	1.4	1			BOU
1997 01 11.56		C	12.6	GA	60.0	Y	6		2.8				NAK01
1997 01 14.85		S	12.9	HS	44.0	L	5	156	0.2	4			HAS02
1997 01 14.98	a	S	12.8	AC	25.4	J	6	72	1.6	1			BOU
1997 01 26.79		S	12.9	AC	25.4	J	6	115	1.2	2			BOU

Comet 119P/Parker-Hartley

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 11 09.17		S	[14.5	HS	44.5	L	5	230					SAR02
1996 11 10.04		S	[14 :	HS	44.5	L	5	230	1				SAR02
1997 01 30.88	!	V	16.7	GA	36.0	T	7		& 0.5	7			MIK

Comet 121P/Shoemaker-Holt 2

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 20.83		C	16.0:	GA	60.0	Y	6		0.85			285	NAK01
1996 11 06.82		C	16.2	GA	60.0	Y	6		0.5			265	NAK01
1996 11 13.82		C	15.9	GA	60.0	Y	6		0.75		1.4m	284	NAK01
1997 01 11.74		C	15.0:	GA	60.0	Y	6		0.75				NAK01

Comet 121P/Shoemaker-Holt 2 [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1997 01 13.75		C	14.8	GA	60.0	Y	6		1.4		2.4m	278	NAK01

Comet 122P/de Vico

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1995 09 20.80		S	6.0	AA	10.0	B		20	4	7			ISH02
1995 09 20.80		S	6.2	AA	25.4	T	6	50	3.7	6			ISH02
1995 09 21.82		M	6.3	AA	25.4	T	6	40	3	6			ISH02
1995 09 22.14		S	5.2	S	6.0	B		20	5	5	0.5	3	LUE
1995 09 23.81		S	5.3	AA	10.0	B		20	4.5	7			ISH02
1995 09 24.80		M	5.4	AA	25.4	T	6	40	4	6	0.5		ISH02
1995 09 30.13		S	5.4	S	6.0	B		20	5.5	5	0.3	3	LUE
1995 10 01.13		S	5.2	S	0.6	E		1					LUE
1995 10 01.13		S	5.3	S	5.0	B		20	6	6	2	290	LUE
1995 10 01.13		S	5.4	S	6.0	B		20	6	6	2	290	LUE
1995 10 02.77		S	5.4	AA	10.0	B		20	5	7	0.4		ISH02
1995 10 02.78		M	5.5	AA	25.4	T	6	50	5	7	0.3		ISH02
1995 10 09.81		M	5.0	AA	25.4	T	6	40	4	7			ISH02
1995 10 10.14		S	5.4	S	6.0	B		20	3	3	0.2	3	LUE
1995 10 11.81		M	4.9	AA	25.4	T	6	56	4	6	0.3		ISH02
1995 10 19.80		S	5.6	AA	10.0	B		20	5	6	0.4		ISH02
1995 10 19.82		M	5.4	AA	25.4	T	6	40	6	6	0.3		ISH02
1995 10 20.82		M	5.4	AA	25.4	T	6	50	6	6	0.3		ISH02
1995 10 21.82		M	5.5	AA	25.4	T	6	40	6	6	0.3		ISH02
1995 10 25.80		S	5.7	AA	10.0	B		20	6.5	5			ISH02
1995 10 25.82		M	5.7	AA	25.4	T	6	40	6	5	0.3		ISH02
1995 10 26.81		S	5.8	AA	10.0	B		20	7	5			ISH02
1995 10 26.82		M	5.8	AA	25.4	T	6	40	7	5			ISH02
1995 10 28.74		S	6.3	S	5.0	B		20	4	5	0.3	350	LUE
1995 10 30.73		S	6.5	S	5.0	B		10	4	3			LUE
1995 11 01.82		S	6.9	AA	10.0	B		20	5	4			ISH02
1995 11 01.84		M	6.8	AA	25.4	T	6	50	6	4			ISH02
1995 11 02.19		S	6.7	S	6.0	B		20	4	3			LUE
1995 11 04.19		S	7.3	AA	6.0	B		20	3	3			LUE
1995 11 04.84		M	7.2	AA	10.0	B		20	5	4			ISH02
1995 11 06.39		M	7.8	AA	25.4	T	6	114	3	4			ISH02
1995 11 08.39		M	8.0	AA	25.4	T	6	56	4	4			ISH02
1995 11 09.39		M	8.0	AA	25.4	T	6	76	3	4			ISH02
1995 11 17.43		M	9.4	AA	25.4	T	6	76	3	3			ISH02
1996 06 25.26		k	22.0	EB	121.9	L	8						HER02
1996 06 25.27		k	22.1	EB	121.9	L	8						HER02
1996 06 25.28		k	22.4	EB	121.9	L	8						HER02

Comet 126P/IRAS

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 24.80		S	[12.5	VN	20.0	L	4	100					PEA
1996 09 21.77		S	12.1	VN	20.0	L	4	45	2.1	2			PEA
1996 10 04.53	a	C	12.4	GA	60.0	Y	6		2.1			65	NAK01
1996 10 11.47	a	C	12.3	GA	60.0	Y	6		2.4		3.6m	75	NAK01
1996 10 31.81		S	11.8:	TI	35	L	5	158	2	2			HOR02
1996 11 01.89	w	S	11.8	NP	44.5	L	5	167	1.5	3/			MAR02
1996 11 01.90	w	S	12.1	NP	44.5	L	5	167	1.5	3			SAN04
1996 11 02.79		S	11.7	TI	35	L	5	104	1.8	1/			HOR02
1996 11 02.79	!	V	13.4	GA	36.0	T	7		& 1	7/	& 5 m	90	MIK
1996 11 02.80		S	11.7	TI	35	L	5	104	1.5	1/			PLS
1996 11 02.87	w	S	12.0	NP	44.5	L	5	100	1.5	3			MAR02
1996 11 02.88	w	S	12.6	NP	44.5	L	5	100	0.75	3			SAN04
1996 11 03.80		S	11.9	TI	35	L	5	104	1.7	1/			HOR02
1996 11 04.73		S	12.5	HS	44.0	L	5	100	0.8	3			HAS02
1996 11 04.77		S	12.1	TI	35	L	5	158	1.3	1/			HOR02
1996 11 04.77		S	12.4	HS	35	L	5	158	1	1/			PLS
1996 11 08.75		S	12.5	AC	25.4	L	5	104	0.9	3			MEY
1996 11 08.77		S	12.6	HS	44.5	L	5	230	1.2	5			SAR02
1996 11 08.78		S	11.9	GA	25.4	J	6	88	1.3	3			BOU

Comet 126P/IRAS [cont.]

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 11 09.75			S 13.1	HS	44.5	L	5	230	1.6	5/			SAR02
1996 11 09.81		!	V 13.5	GA	36.0	T	7		& 1	6	& 3 m	90	MIK
1996 11 15.42			C 13.2	GA	60.0	Y	6		2.1				NAK01
1996 11 29.45			S[13 :	GA	25.4	L		71					SEA
1996 11 29.79			S 12.8	NP	44.5	L	5	100	1	3			ROD01
1996 11 29.79			S 13.0	NP	44.5	L	5	100	1	1/			MAR02
1996 12 01.75			S 12.9	HS	35	L	5	104	1.4	1/			HOR02
1996 12 01.75		!	V 14.0	YF	20.0	T	2		& 0.5	8	& 1 m	80	MIK
1996 12 03.47			C 13.7	GA	60.0	Y	6		1.5		3.0m	80	NAK01
1996 12 03.74			S 12.8	TI	35	L	5	104	1.4	1/			HOR02

Comet 127P/Holt-Olmstead

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 19.19			k 20.1	EB	121.9	L	8						HER02

Comet 129P/Shoemaker-Levy 3

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 10 22.72			C 18.7	GA	60.0	Y	6		0.3				NAK01
1996 11 13.67			C 18.7	GA	60.0	Y	6		0.3				NAK01
1996 12 03.56			C 18.9	GA	60.0	Y	6		0.25				NAK01
1996 12 06.50			C 18.7	GA	60.0	Y	6		0.3				NAK01
1996 12 28.48			C 19.3	GA	60.0	Y	6		0.3				NAK01

Comet P/1996 A1 (Jedicke)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 01 16.99			C 16.5	HS	50	Y	4			9	0.05	250	CAV

Comet P/1996 N2 (Elst-Pizarro)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 08 23.00			C 18.0	HS	50	Y	4			9			CAV
1996 09 06.93			C 18.5	HS	50	Y	4						CAV
1996 09 21.23			k 18.0	EB	121.9	L	8						HER02
1996 09 21.24			k 17.9	EB	121.9	L	8						HER02

Comet P/1996 R2 (Lagerkvist)

DATE (UT)	N	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1996 09 20.35			k 16.7	EB	121.9	L	8						HER02
1996 09 20.36			k 16.6	EB	121.9	L	8						HER02
1996 09 21.25			k 17.0	EB	121.9	L	8						HER02
1996 10 02.87			C 17.5	HS	50	Y	4						CAV
1996 10 04.58			C 16.9	GA	60.0	Y	6		0.6				NAK01
1996 10 09.55			C 16.6	GA	60.0	Y	6		0.6				NAK01
1996 10 16.53			C 16.7	GA	60.0	Y	6		0.55				NAK01
1996 11 09.77			S 15.6	HS	44.5	L	5	230	0.5	4			SAR02
1996 12 03.49	a	C	16.7	GA	60.0	Y	6		0.8				NAK01

DESIGNATIONS OF RECENT COMETS

Listed below, for handy reference, are the last 35 comets to have been given designations in the new system. The name, preceded by a star ($\star$) 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 October 1996 issue, p. 208.]

	New-Style Designation	*P*	*T*	*q*	*IAUC*
$\star$	P/1995 A1 (Jedicke)	14.3	8/15/93	4.1	6124
	117P (Helin-Roman-Alu 1)	9.6	3/27/97	3.7	24597
	118P/1995 M1 (Shoemaker-Levy 4)	6.5	1/11/97	2.0	6180
	119P/1995 M2 (Parker-Hartley)	8.9	6/25/96	3.0	6180
$\star$	C/1995 O1 (Hale-Bopp)		4/1/97	0.91	6187
	120P/1995 O2 (Mueller 1)	8.4	4/24/96	2.7	6199
$\star$	C/1995 Q1 (Bradfield)		8/31/95	0.44	6206
$\star$	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
$\star$	C/1995 Y1 (Hyakutake)		2/24/96	1.05	6279
$\star$	P/1996 A1 (Jedicke)	19.3	8/15/95	4.1	6287
$\star$	C/1996 B1 (Szczepanski)		2/6/96	1.45	6296
$\star$	C/1996 B2 (Hyakutake)		5/1/96	0.23	6299
$\star$	C/1996 E1 (NEAT)		7/27/96	1.36	6341
	125P/1996 F1 (Spacewatch)	5.6	7/14/96	1.54	6349
$\star$	C/1996 J1 (Evans-Drinkwater)		12/30/96	1.30	6397
$\star$	C/1996 N1 (Brewington)		8/3/96	0.93	6428
$\star$	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
$\star$	C/1996 P2 (Russell-Watson)		3/1/96	2.01	6448
$\star$	C/1996 Q1 (Tabur)		11/3/96	0.84	6455
$\star$	C/1996 R1 (Hergenrother-Spahr)		8/29/96	1.90	6470
$\star$	P/1996 R2 (Lagerkvist)	7.3	1/18/97	2.62	6473
$\star$	C/1996 R3		5/30/96	1.8	6564
	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
$\star$	C/1997 A1 (NEAT)		6/19/97	3.16	6532
$\star$	P/1997 B1 (Kobayashi)	24.5	3/1/97	2.05	6553
$\star$	C/1997 BA_6 (Spacewatch)		12/4/99	3.45	6561
$\star$	P/1997 C1 (Gehrels)	17.0	12/17/95	3.5	6549
$\star$	C/1997 D1 (Mueller)		10/11/97	2.25	6562