THE INTERNATIONAL COMET QUARTERLY

APRIL 1981 VOL. 3, NO. 2

EPHEMERIS FOR COMET BOWELL 1980b
from elements by B. G. Marsden (M.P.C. 5419)
(see page 40)

Date	ET	R. A. (1950)	Decl.	Delta	r	Elong.	Mag.
1981 04	26	$12^h11^m.61$	$+00°55'.4$	3.636	4.513	147°.0	12.8
1981 05	06	12 09.03	+01 10.1				
1981 05	16	12 07.61	+01 16.5	3.716	4.395	126.6	12.8
1981 05	26	12 07.49	+01 14.1				
1981 06	05	12 08.74	+01 02.4	3.860	4.280	107.8	12.7
1981 06	15	12 11.37	+00 41.7				
1981 06	25	12 15.33	+00 12.3	4.035	4.170	90.5	12.7
1981 07	05	12 20.56	-00 25.2				
1981 07	15	12 26.97	-01 10.0	4.213	4.064	74.7	12.7
1981 07	25	12 34.45	-02 01.3				
1981 08	04	12 42.94	-02 58.5	4.372	3.963	59.9	12.7
1981 08	14	12 52.33	-04 00.7				
1981 08	24	12 02.55	-05 07.0	4.500	3.868	46.1	12.6
1981 09	03	13 13.53	-06 16.7				

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INSIDE THIS ISSUE

THE INTERNATIONAL COMET QUARTERLY is a non-profit journal devoted to news and observation of comets. Issues are published four times per year (January, April, July, and October). The ICQ is published by the Physics Department of Appalachian State University and is mailed from Boone, North Carolina.

The subscription rate is $10.00 per year. Subscribers who do not wish to be billed (and who will therefore keep record of their expiration date; the last issue which a special subscriber is entitled to receive is given in the last group of digits in the upper-left-hand corner of the address label) may subscribe at the rate of $5.00/year. Make checks or money orders payable in U.S. funds to THE INTERNATIONAL COMET QUARTERLY and send to D. Green at P-329, S.A.O.; 60 Garden St.; Cambridge, MA 02138, U.S.A. Group subscription rates and advertising rates are available upon request.

Manuscripts will be reviewed for publication; they should be typewritten and double-spaced, and should be sent to the Editor at the above address. All cometary observations should be sent to C. S. Morris; Prospect Hill Rd.; Harvard, MA 01451, U.S.A. Back issues are available from T. Rokoske, Physics Dept.; A.S.U.; Boone, NC 28608.

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This issue is No. 38 of the publication originally called THE COMET, founded in March 1973, and is Vol. 3, No. 2, of the ICQ.

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FROM THE EDITORS

The Editors wish to take this opportunity to welcome Dr. David D. Meisel to the Staff of the ICQ as an Editorial Advisor. Dr. Meisel is an Associate Professor in the Physics and Astronomy Department at State University College in Geneseo, New York. He has done considerable study of comets, particularly in the area of comet photometry. Meisel worked under Dr. N. T. Bobrovnikoff at Ohio State University while studying for his Master's Degree. In addition, he founded the A.L.P.O. Comet Section in 1958 and served as that section's Recorder until 1964. Since 1973 Meisel has been Director of the American Meteor Society.

Due to rising costs in postage, we are raising the regular subscription rate to $10.00 per year, effective June 1, 1981. The special subscription rate of $5.00 will remain unchanged. The 1981 June 1 invoices will reflect this new increase.

All subscribers are requested to write their account number in the upper-left-hand corner of any checks or money orders which are sent to the ICQ. The account number is the first group of digits (those to the left of the first hyphen) in the upper-left-hand corner of the address label. This will greatly expedite accounting procedures. Also, the third, or last, group of digits in the same set of figures (i.e., those after the second hyphen) tell special subscribers which issue number is the last they will receive under their current subscription; number given is THE COMET publication number, printed in the editorial description block on the second page of each issue of the ICQ.

We are publishing in this issue a revised observation report form which we ask observers to begin using. We have added columns to accomodate the reference used for the magnitude estimate (use the code on page 47 of this issue) and the f-ratio of the instrument used.

D. Green, C. Morris, T. Rokoske
1981 April 4

COMET EXPERTS GATHER IN TUCSON
by Charles S. Morris

Approximately 175 astronomers converged on Tucson, Arizona, to attend Colloquium No. 61 of the International Astronomical Union (IAU), entitled, "Comets: Gases, Ices, Grains, and Plasma," held 1981 March 11-14. The conference covered every aspect of cometary physics, as well as many related fields. Particular attention was focused on the upcoming apparition of comet Halley.

The colloquium, which was hosted by the University of Arizona, included the presentation of about 100 technical papers. A number of these were invited review papers which summarized a particular aspect of comet research. These review papers will be published in a book under the title Comets by the University of Arizona Press. Contributed papers were also presented at the colloquium; these will appear in a special issue of Icarus in the near future. Some papers were also presented as poster exhibits or poster talks. A summary of the colloquium is presented here for ICQ readers.

THE NUCLEUS.

The primary component of any comet is its nucleus. Rightfully, discussion of the properties and composition of the nucleus occupied the first day of the conference. Review papers by B. Donn and A. Delsemme covered current models of the nuclei and the abundance of elements in comets, respectively. Dr. F. L. Whipple presented rotation periods of 45 comets determined from measured halo diameters. Whipple found that the median rotation period for comets is about twice as long as that found for asteroids, and it appears that rotation period increases with absolute brightness.

The subject of comet splitting was addressed by Dr. Z. Sekanina, who has developed a model to simulate the motion of companion nuclei. As pointed out by Sekanina, comets can split at almost any distance from the sun. Splitting apparently has occurred as far out as 9 AU! When a comet splits, there is often an associated visual and/or infrared brightness flare, or activity in the tail. Sekanina feels that companion nuclei are very irregular -- perhaps pancake-shaped. He draws this conclusion from the strong fluctuations in brightness observed in them.

Other review papers on the nucleus considered infrared spectra of condensed volatiles and the relationship between comets, large meteors, and meteorites.

Several contributed papers presented photometric results for comet nuclei. For instance, J. Stauffer and H. Spinrad made observations of the red continuum from nuclei of P/Encke, P/Stephan-Oterma, and P/Tuttle during their recent apparitions. They found that P/Stephan-Oterma's continuum was strongly dependent upon heliocentric distance. In contrast, P/Encke showed no variation in continuum brightness with varying heliocentric distance. Their results suggest, when inserted into the context of an icy-grain nuclear model, that P/Encke's nucleus is less than 0.5 km in diameter. However, P. Kamoun and his M.I.T. colleagues presented results from radar observations which indicate a nuclear radius of $\sim$ 2 km for this comet. Other papers reported photometric results for P/Schwassmann-Wachmann 1, P/Schwassmann-Wachmann 2, P/Tempel 2, Meier 1980q, and Bowell 1980b.

Laboratory experiment and numerical modeling results were also given in the session on the nucleus. P. Weissman and H. Kieffer summarized a numerical modeling study of the thermal properties of the nucleus of Halley's comet as it approaches the sun. They find that the development of the coma causes back radiation which makes the nucleus temperature more uniform. M. Moore

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and B. Donn studied proton irradiation of cometary-type ice mixtures in the laboratory. They were able to obtain results concerning the expected nature of cometary ices after 10^9 years of radiation synthesis, and they found that new molecular species are synthesized. The experiments suggested that the albedo and volatility of the nuclear ice are affected by the presence of the synthesized products.

COMET DUST.

The second session of the colloquium dealt with comet dust. Several papers in this portion of the conference pertained to laboratory studies of interplanetary dust. For example, Fraundorf, Brownlee, and Walker showed photographs of interplanetary dust which were both collected from altitudes above 65,000 feet and recovered from the sea floor. In a similar type of study, J. Wagstaff and E. King presented what they believe might be comet dust obtained from the Antarctic ice core. In both papers the particles discussed had a wide range of shapes and compositions.

Observations from the Helios spacecraft were used by H. Fechtig and several other investigators from the Max-Planck-Institut für Kernphysik, Heidelberg, to study the orbital characteristics and bulk densities of micrometeoroids. They conclude that at least 10 to 30 percent of the dust particles detected by Helios were of recent cometary origin.

Ground-based infrared observations were reviewed by E. Ney. Many of the bright comets observed (e.g., West 1976 VI and Bradfield 1980t) showed silicate signatures at 10 and 18 microns, which indicated the presence of small grains (radius < 5 microns) in the comae and tails of these comets. Comet Kohoutek 1973 XII also had a silicate signature in its coma and tail, but not in its anti-tail. This leads Ney to the conclusion that these particles were of a larger size. Ney also finds that the nature of the particle size distribution can change abruptly in an individual comet.

An example of the use of accurate visual observations of the coma was presented by Sekanina. He used visual observations of P/Swift-Tuttle to map active areas on the comet's nucleus. Sekanina was able to identify eight separate emission areas. Only one of these emission areas was active throughout the nearly-two months of observation. All of the others were short-lived. However, most of the jets lasted several rotations; the rotation period for P/Swift-Tuttle was found to be 66.5 hours.

Another interesting paper was presented by D. Yeomans, who analyzed Leonid meteor shower data to obtain the distribution of dust surrounding P/Tempel-Tuttle. He finds that radiation pressure and planetary perturbations, rather than ejection processes, control the dynamic evolution of the Leonid particles. Yeomans also concluded that conditions in 1998-99 are optimum for a significant meteor shower, although such an event is far from a certainty.

The spectacular tail structure in comet West 1976 VI was investigated by Farrell and Sekanina. They developed a simple model that explained the synchrones and striae in West's dust tail. They showed an impressive computer-generated motion picture which depicted the development of these structures.

THE COMA.

The majority of the papers concerning the coma dealt with photometry and spectroscopy. In a review paper, D. Meisel and this author gave an overview of comet photometry including the "classical" visual observations and the newer photoelectric techniques. It was concluded that, although some systematic effects still remain, it is now becoming possible to relate the photo-

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electric work to both the "classical" methodologies and to realistic models of comet comae. In this paper the authors also presented visual photometric parameters for 41 comets observed between 1974-1981. Many of these parameters were derived from observations published in the ICQ. A preliminary analysis of 11 periodic comets observed visually over the last seven years suggests that most of them have not shown any significant secular decrease in brightness since discovery.

In another review paper, M. A'Hearn summarized spectroscopy and spectrophotometry of comets at visible wavelengths. Such observations can be used to derive isotope ratios, column densities, production rates, evaporation rates, and population distributions. These, in turn, can be related to production and excitation mechanics of the relevant species, as well as other physical information. During his talk, A'Hearn charted what is currently known from these observations and what needs to be determined in future work.

Narrowband photometry of P/comet Stephan-Oterma was the subject of a paper presented by Millis, Thompson and A'Hearn. This comet passed through a wide range of solar phase angles, reaching a minimum of < 3 degrees in 1980 December. The authors found a pronounced brightening of the continuum observed at small phase angles, which they attribute to back-scattering from the dust in the comet's coma.

Spectrometric observations of P/Stephan-Oterma and P/Encke during their 1980 apparitions were discussed by A. Cochran and E. Barker. Their work on P/Encke indicates that the maximum emissions (e.g., for C_2) were shifted from the visual center of the comet by about 1200 km in the direction of motion. This is apparently the first time that such a difference has been observed.

In addition to optical photometry and spectroscopy, radio observations of comets were also discussed. However, as noted by Snyder in his review paper on outstanding problems in radio observations of comets, the radio results have been negative more often than positive. Bockelee-Morvan and his colleagues have had success observing the OH radical in several comets at 18 cm. They report a close correlation between OH production rate and visual comet brightness. (Note that A'Hearn and his colleagues have also found a similar correlation for CN and C_2).

ION TAILS.

The various rays, streamers, knots, kinks, and other features observed in ion tails are due to the interaction of the plasma tail and the solar wind. Events such as disconnected tails, which were once viewed as unusual events, are now seen as part of a systematic evolution of the plasma tail, according to J. Brandt. In his review paper, Brandt illustrated the morphology of plasma tail evolution. The current explanation of the disconnection event of the tail is the result of the comet's interaction with sector boundaries of the solar wind (resulting in magnetic reconnection). Other papers in this session covered various aspects of the plasma-solar wind interaction.

COMET MISSION POSTER TALKS.

A Friday-night session of the conference centered on poster talks dealing with spacecraft missions to comets, particularly comet Halley. These talks mainly concerned the instrumentation and mission planning for various proposed comet missions.

ORIGINS OF COMETS.

Several of the papers in this session were directed at investigating the orbital dynamics of comets. In his review paper, P. Weissman stated that the use of Monte Carlo techniques has enabled us to obtain a better understanding of the dynamics of Oort's cloud. Estimates of the current cloud population range between 1.1 and 2.0 x 10^{12} comets. There are several loss mechanisms from the cloud. They include diffusion of cometary perihelia into the planetary regions where planetary perturbations may eject the comets from the solar system, diffusion of cometary aphelia to distances beyond the sun's sphere of influence, and direct ejection due to close encounters with passing stars.

Orbital evolution of short- and long-period comets was reviewed by E. Everhart. Using numerical integrations, he has traced the evolution of both "chaotic" orbits of short-period comets and the more stable orbits of longer period comets after they are perturbed from Oort's cloud.

Other papers in the session dealt with the evolution of comets into asteroids. Arguments both pro and con were presented.

WORKING GROUP ON STANDARDIZED FILTERS.

This group, appointed by IAU Commission 15, has established a set of five standardized filters for use in cometary photometry. A total of 50 matched sets of the filters have been ordered through funding by the U.S. National Science Foundation. These filters will be available on either a sale or loan basis, depending on the needs of the user. The working group, headed by M. A'Hearn, met during the colloquium to discuss the best means of distributing the filter sets. The ICQ was offered as one means of publicizing the existence of the filters. Although the vast majority of these filter sets will be used by professional astronomers, A'Hearn has indicated that qualified amateurs with photoelectric equipment (they are not for visual use) will be considered. Details of how to apply for a set of filters will be given in the ICQ when the procedure becomes known.

THE LIGHTER SIDE.

The proceedings of IAU Colloquium No. 61 were not totally confined to serious business. After the western barbeque, B. G. Marsden and D. Yeomans gave memorable banquet talks. Marsden's talk entitled "Serendipity in Cometography" dealt in part with the meaning of serendipity and cometography. Serendipity means the faculty for making desirable discoveries by accident. The meaning of cometography is less clear, although it is used in the title of Pingre's comet catalog (1883, 1884). Marsden's discourse included a recounting of the tale of the Three Princes of Serendip, a poem (to use that word in a very liberal sense), and his own scale for discoveries ranging from -10 to +10. A serendipitous discovery rates a "10", and other types of discoveries are rated lower. On a serious note, Marsden noted that ephemerides of serendipitously-discovered objects (or any other object, for that matter) may be difficult to provide if more astrometric observations are not forthcoming.

Yeomans' talk concerned comet Halley and some dubious achievement awards. As Yeomans noted, we usually only hear of the advances of science and not the real blunders. So, imitating a television awards show, Yeomans bestowed (posthumously) several dubious achievement awards to such noteworthy people as Kepler, who thought that comets travel in straight lines, and the group that wanted to capture the gas of comet Halley in champagne bottles (after drinking the champagne, of course!), to name a couple. The next day it seemed that everybody was giving out their own dubious achievement awards.

Another humorous event involved Whipple; from the start of the conference, when a speaker needed a pointer, Whipple would loan him or her his telescoping metal pointer. This pointer became known as the "Whipple Stick." Someone appar-

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ently came up with the idea that Whipple should present his Whipple Stick to the person who recovers Halley's comet. Whipple apparently overheard this, and an announcement was made at the conference that Whipple would present the official recoverer (i.e., that accepted by the IAU Central Bureau for Astronomical Telegrams) with the now-famous Whipple Stick.

This review of IAU Colloquium No. 61 only touched on a small number of the many papers presented. The importance of this conference is underscored by the fact that it is the first major comet conference in almost five years. In addition, approximately one third of the partipants were from overseas, representing countries including England, France, Germany, Italy, and Japan. Thus the conference was truly international.

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REQUEST FROM THE EDITORS

In the last issue we began making systematic requests for observations of specific comets to facilitate the publishing of past observations in a more orderly fashion. Our first request was for observations of comet West 1976 VI (1975n), to be submitted prior to August 1981. To date the response has been nonexistent. Your help is needed in this effort.

For our second request, we would like ALL observations of comets made from 1977 to the present which have not been previously published in the ICQ; these should be submitted by the end of 1981.

--- C.S.M., D.W.E.G. (1981 April 17)

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CORRIGENDUM

In the January 1981 issue, p. 4, the formula for tail length should read:

$$\cos d = \sin D \sin \delta + \cos D \cos \delta \; (\alpha - A).$$

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RECENT NEWS CONCERNING COMETS

Schelte ("Bobby") Bus of Caltech discovered a new periodic comet while observing with the U.K. Schmidt Telescope at Siding Spring in Australia in March. He located the 17th-magnitude object on plates taken by Kenneth S. Russell on March 2 and 3, as the somewhat-condensed comet was moving 9′ per day northwestward in Virgo. Comet 1981b then had a faint, 20"-long tail in the direction of motion (cf. IAUC 3578, 3579).

Jonathan H. Elias discovered a 15th-magnitude comet on plates taken April 3 and 4 at Cerro Tololo Interamerican Observatory in Chile. This object has been designated "comet 1981c". (cf. IAUC 3592)

Comet Panther 1980u is still observable in amateur instruments, having passed very near the North Celestial Pole in mid-March as a fairly-bright object near 8th magnitude. Many observations have been received of this comet (see the Tabulation of Observations in this issue), and a report on its apparition will appear in the July issue. All observers of this comet are urged to send their complete reports of observations as soon as possible.

A report on comet Bradfield 1980t will also appear in the July issue, and observations of this comet which have not been published should be sent to Charles Morris of the ICQ promptly. -D.W.E.G. (1981 April 17)

NEW COMET OBSERVATION REPORT FORM

On the following page is a new report form which we ask all observers to begin using at this time. We have added some columns to the old form which should make the reporting of observations and the reduction of the data much easier. The columns on this new form are in the same order in which the data are entered into machine-readable form with the Digital VAX computer at the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts.

The columns are as follows:

1) Date (U.T.). Here the year, month, and date should be given. The date should be given to hundredths of a day, and the time should be given in Universal Time (U.T.). For example, an observation made at 9:20 p.m. Eastern Standard Time from New York City on April 2 would be equivalent to 2:20 UT on April 3, and should be given on this form as April 3.10.

2) Total Magn. The total visual magnitude should be estimated to a tenth of a magnitude using appropriate comparison stars from catalogues (NOT atlases!). If there is some doubt as to the accuracy (more than $\pm$ 0.2), then a colon (:) should be given after the magnitude value. We are not interested in nuclear magnitudes.

3) Ref. This is the reference used for making the magnitude estimate; in other words, where did the comparison star magnitudes come from? The Key to References is published regularly in the ICQ, and is available from the Staff by writing. Atlases are NOT acceptable, and neither is the use of galaxies and nebulae for estimates!

4) Instr. Aperture. The aperture of the instrument used for the observations (in centimeters, please). If a magnitude estimate was made, the instrument FOR THE ESTIMATE should be given here. If two instruments were used, one for a magnitude estimate only, and one for a tail length estimate only, TWO separate lines should be filled in. In other words, EVERY observation given on the same line as a designated instrument will be assumed to have been made with that instrument.

5) Instr. Type. The type of the instrument in column 4. (L = reflector, R = refractor, B = binoculars, C = Cassegrain)

6) f/. The f-ratio of the instrument used for the observation.

7) Power. The magnification used with the instrument in col. 4.

8) Coma dia. The estimated diameter of the coma in arc minutes; estimates to a tenth of an arc minute are acceptable, if accurate. Very rough estimates should be so-indicated, again with a colon (:).

9) D.C. The degree of condensation (9 = stellar, 0 = diffuse).

10) Tail length. Give in DEGREES; convert to hundredths of a degree if known in arc minutes. Again use colon (:) if estimate is very rough.

11) P.A. Position angle of tail from nucleus, measured on an atlas (0 = north, 90 = east, etc.).

12) M. M. The magnitude method used for the magnitude estimate (B = Bobrovnikoff, E = Beyer, M = Morris, S = Sidgwick or In-out).

13) Remarks. Any additional information of importance should be given here, especially that concerning seeing conditions and the placing of the moon at time of observation. Drawings are encouraged on an extra sheet of paper.

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NOTES ON OBSERVATIONS AND EPHEMERIS OF COMET BOWELL 1980b

On the cover-page of this issue is an ephemeris of Comet Bowell 1980b, extracted from MPC 5419. This comet is already observable in amateur instruments (see the Tabulation of Observations in this issue), and should brighten a few magnitudes by perihelion in 1982.

COMET OBSERVING REPORT FORM. Send completed sheets to INTERNATIONAL COMET QUARTERLY, c/o C. S. Morris, Prospect Hill Road, Harvard, MA 01451, U.S.A. Please convert observing times to decimals of a day (e.g., Aug. 3, 12:00 UT = Aug. 3.50 UT). *Xerox this sheet for more copies.*

PLEASE PRINT OR TYPE ONLY. See the ICQ for explanation of individual columns.

Name and designation of comet: COMET ______________________ 19____.

Observer ______________________ Address ______________________

Date (U.T.)	Total Magn.	Ref.	Instr. Aperture	Instr. Type	f/	Power	Coma Dia.	D.C.	Tail length	P.A.	M. M.	Remarks

NOTE: *Drawings and additional remarks or comments should be put on a separate sheet of paper.*

A REPORT ON THE 1980-81 APPARITION OF PERIODIC COMET STEPHAN-OTERMA 1980g

by Daniel W. E. Green and Charles S. Morris

ABSTRACT. The 1980-81 apparition of P/comet Stephan-Oterma 1980g is briefly discussed from the more than 300 observations which have been published in the ICQ. A preliminary magnitude analysis reveals significantly different values of the absolute magnitude and heliocentric brightness parameter values for pre- and post-perihelion data.

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Periodic comet Stephan-Oterma 1980g was followed visually by observers from early 1980 September until early 1981 March, and scores of observations covered the expanse of six months, as this short-period was placed very favorably for northern hemisphere observers (cf. Morris and Green 1980). More than 300 observations have been published in 3 issues of the ICQ (Vol. 2, p. 85; 3, 26; and elsewhere in this issue), documenting the recent apparition quite well.

Comet 1980g was generally observed as a strongly condensed object, only becoming diffuse toward the end of its apparition. Prior to P/Stephan-Oterma's perihelion passage in early December, the comet's appearance at times looked like a superposition of two distinct objects: a very diffuse, circular coma and a star-like central condensation. The two authors were apparently the only observers to have observed the significant "binocular" flare of a magnitude or more on Nov. 13 (cf. Morris 1981a). The coma was then observed as being much larger than at any other time during the apparition, at a diameter nearly 500,000 km; the size on this date was twice that observed on days immediately before and after the outburst.

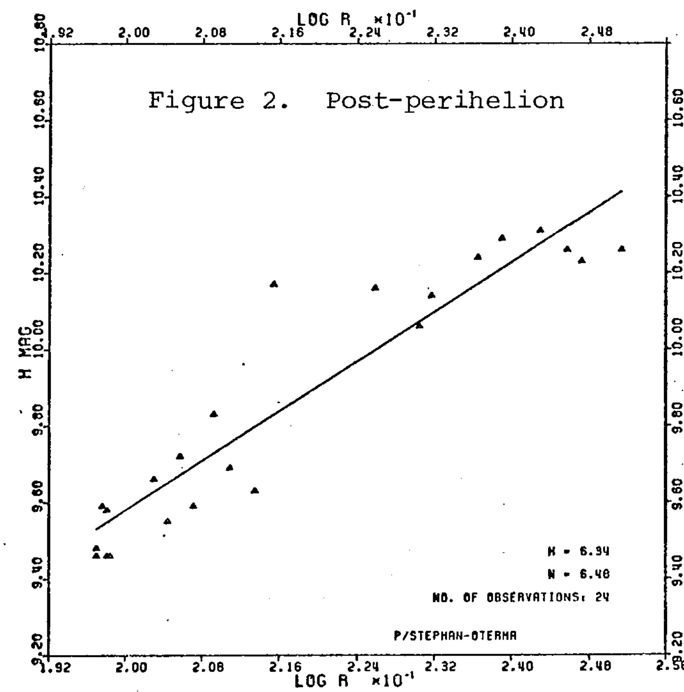

Figure 2. Post-perihelion

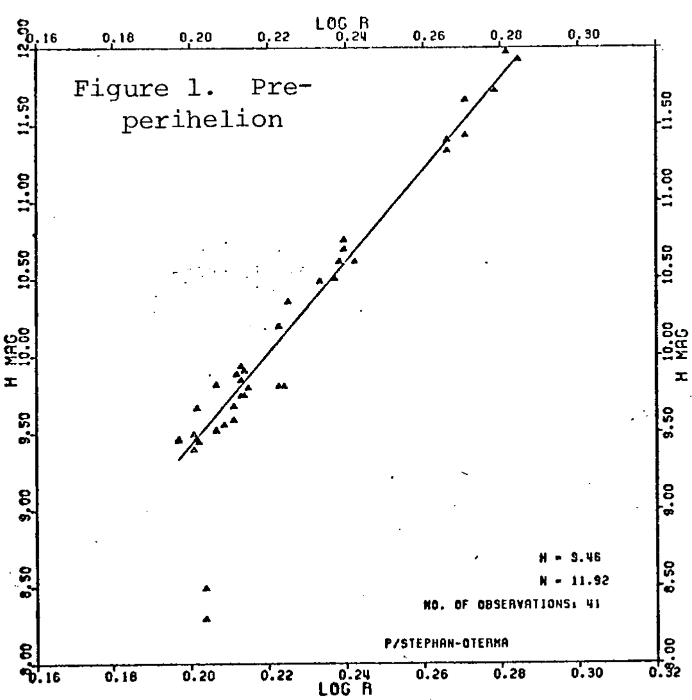

Figure 1. Pre-perihelion

The comet passed within 0.593 AU of the earth near the time of perihelion, but real tail lengths were observed to be generally longer before perihelion than after. The second author noted a tail length of nearly 1.5 million km on November 1.

MAGNITUDE ANALYSIS. The scatter of magnitude estimates for this comet near perihelion was on the order of four magnitudes, creating interpretation problems; these problems will be discussed in a special article in the July 1981 issue of this journal.

To avoid interpretation problems, observations of only three observers [Bortle (BOR), Green (GRE) and Morris (MOR)] were selected and reduced to a standard aperture of 6.78 cm after Morris (1973). Following this preliminary analysis with these selected observations using the method of least squares, it is noticeable that the pre-perihelion observations produce significantly different power-law parameters from those of the post-perihelion data. From 39 pre-perihelion observations (r = 1.926 - 1.574 AU), we find for the absolute magnitude, H_o, and the brightness parameter, n:

$$H_o = 3.46 \pm 0.12 \text{ (p.e.)}$$
$$n = 11.92 \pm 0.21 \text{ (p.e.)}$$

From 24 post-perihelion observations (r = 1.574 - 1.784 AU), we find:

$$H_o = 6.34 \pm 0.19 \text{ (p.e.)}$$
$$n = 6.48 \pm 0.34 \text{ (p.e.)}$$

Due to the transient nature of the November 13 outburst, it was not included in the magnitude analysis, but the two flare observations are plotted in Figure 1 with that data which is used in the above pre-perihelion analysis. The observations and least squares fit for the post-perihelion observations are presented in Figure 2.

P/Stephan-Oterma was the object of some recent photometric and spectroscopic studies, as reported at IAU Colloquium No. 61 recently (cf. Morris 1981b). These observations showed that the comet is relatively dust-rich. This clearly shows that dusty comets do not necessarily have small values of n.

REFERENCES

Morris, C. S. (1973). Publ. Astron. Soc. Pac. 85, 506.
________ (1981a). I.C.Q. 3, 6.
________ (1981b). I.C.Q. 3, 35ff.
Morris, C. S.; and D. W. E. Green (1980). I.C.Q. 2, 43.

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VISUAL MAGNITUDES AND THE S. A. O. CATALOG

by David Herald, Woden, A.C.T., Australia

Henk Feijth, in his article, "Of Sequences and Comparison Star Magnitudes" (ICQ 2, 73), raises the point of the reliability of the star magnitudes listed in the S.A.O. Catalog, and suggests that the visual magnitude should not be used unless it is accompanied by the code letters "H" or "T". Although this may be true for much of the Catalog, it is not true overall, and to see why, one must look somewhat into the background of the Catalog itself.

The S.A.O. Catalog is not an "original" catalogue, but rather a compilation of other catalogues. Neglecting the FK4 and GC catalogue stars (which are generally the brighter stars, and carry the codes "H" and "T"), the S.A.O. Catalog is primarily a compilation of the AGK2, Yale, and Cape catalogues, the AGK2 and Yale sources being used for all declinations north of -30°. In the introduction to the S.A.O. Catalog (Vol. 1, p. xvi), it is stated: "No AGK2 volume provides proper motions, spectral types, or visual magnitudes. . . . No visual magnitudes were taken from the early epoch catalogues used in the derivation of the proper motions, and spectral types were added to as many stars as possible from the Henry Draper Catalogue." The purpose of the Yale catalogues was primarily astrometric, and if one reads the introductions to the various vol-

VISUAL MAGNITUDES AND THE S. A. O. CATALOG

umes of Yale, one finds that, without exception, the magnitudes given therein are also taken from the catalogues which were used for the determination of the proper motions. Thus, for all stars in the S.A.O. Catalog which have a source catalog code identifying it with the AGK or Yale catalogues, the visual magnitude determination was made in the mid- to late-1800's, without the aid of photometers or densitometers; measurements of magnitudes from photographs was by the imprecise method of measuring image diameters.

For stars in the S.A.O. Catalog covered by the Cape catalogues, such is not the case. The Cape Zone catalogues obtained a photovisual magnitude using a photodensitometer, which except in the case of HIGHLY colored stars, is within about 0.07 magnitude of the V-magnitude scale. These photovisual magnitude estimates were all made for the purpose mates were all made explicitly for the catalogue, and all are post-1930 determinations.

South of -64°, the S.A.O. coverage is next to useless, as at the time of compilation, there were no suitable catalogues for this region, apart from some very old, small catalogues. Any astrometric work with comets in this region is generally done using the recent volumes of the Cape catalog covering this region, or for -70° to -90° , the Yale catalogue, which, as usual, takes magnitudes from another source -- in this case the Cape catalogue, except for the extra, faint stars which are specially included. As before, the magnitudes were specially determined in the Cape catalogue.

In summary, I would say that Feijth's conclusion on the reliability of S.A.O. magnitudes is probably correct for stars north of -30° (which is probably all that can be observed from Holland). However, between -30° and -64°, there is no apparent reason for excluding the use of the S.A.O. for comparison magnitudes, and the same can also be said about the Cape and Yale catalogues for regions south of -64°.

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THE 1980-81 APPARITION OF PERIODIC COMET TUTTLE

by Charles S. Morris and Daniel W. E. Green

ABSTRACT. The 1980-81 apparition of P/Tuttle 1980h is discussed. An analysis of 107 visual magnitude estimates gives an absolute magnitude of 8.0. P/Tuttle's light curve was asymmetric, with the pre-perihelion brightness being more sensitive to heliocentric distance.

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The 1980-81 apparition of P/comet Tuttle 1980h was very favorable for both northern and southern hemisphere observers. Beginning as a circumpolar object in the north during 1980 September and October, the comet moved steadily southward. and rapidly brightened. By the end of November, comet 1980h was at its brightest and had moved into southern skies. Shortly thereafter, the comet was lost by northern hemisphere observers. P/Tuttle continued to move rapidly southward, becoming a southern circumpolar object by the end of 1980. At no time during its visual apparition was P/Tuttle's elongation from the sun less than 70 degrees. Thus, the comet was well placed in the sky throughout the period of observation. A preliminary report on this comet was given by Green (1980).

Initial observations in early October showed comet 1980h to be a diffuse object of magnitude 11-12 with a coma diameter of about 2'. Within a month, P/Tuttle's apparent

THE 1980-81 APPARITION OF PERIODIC COMET TUTTLE

size had grown by a factor of three. The comet had become moderately condensed and was an 8th-magnitude bi-

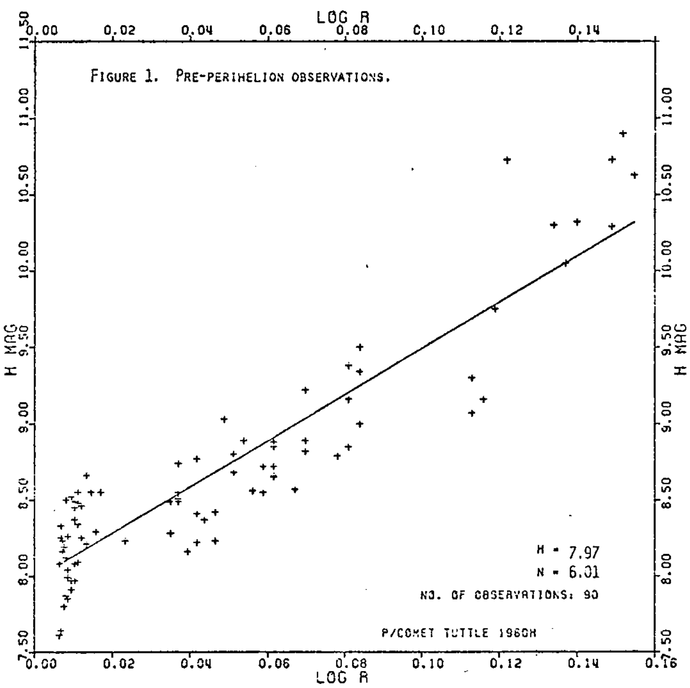

FIGURE 1. PRE-PERIHELION OBSERVATIONS.

TABLE I. OBSERVERS OF COMET 1980h

BOE	05	LEO BOETHIN, THE PHILIPPINES (16)
BOR		JOHN E. BORTLE, NY, U.S.A. (18)
BOU	11	REINDER J. BOUMA, THE NETHERLANDS (6)
BUS01	11	E. P. BUS, THE NETHERLANDS (1)
CAM		J. DA S. CAMPOS, SOUTH AFRICA (6)
COM	05	GEORG COMELLO, THE NETHERLANDS (2)
FUL		MARCO FULLE, ITALY (11)
GRE		DANIEL W. E. GREEN, NC, U.S.A. (3)
MAC		DON E. MACHHOLZ, CA, U.S.A. (7)
MOR		CHARLES S. MORRIS, MA, U.S.A. (15)
MOR02		JAMES A. MORGAN, WI, U.S.A. (1)
MOR03		WARREN C. MORRISON, CANADA (2)
SEA		DAVID A. J. SEARGENT, AUSTRALIA (19)

nocular object. The comet continued to grow in size and increase in brightness as it approached both the earth and sun in November. The apparent size reached about 10′ toward the end of November and the beginning of December; this corresponds to a true coma size of about 240,000 kilometers.

Only two observers, John Bortle (BOR) and Marco Fulle (FUL) noted a tail during P/Tuttle′s apparition. This short tail, which pointed westward, was observed only between 1980 December 1-5. The lack of a significant tail is consistent with previous apparitions of P/Tuttle.

During this apparition, comet 1980h displayed a distinct condensation. Both Bortle and the first author (MOR) noted that this condensation was not always centrally located in the coma, but was offset toward the north (opposite the direction of motion). In general, the comet′s appearance was very similar to that shown in a drawing of this object made during its 1858 apparition (A Popular Treatise on Comets, by James C. Watson, 1861). This suggests that the comet′s morphology has not changed significantly over the last nine perihelion passages.

MAGNITUDE REDUCTION

A total of 107 visual magnitude estimates made by 13 observers have been used to construct a preliminary light curve for P/Tuttle 1980h. The observers and the number of observations of each observer that were used in this analysis are given Table I.

The results of the magnitude

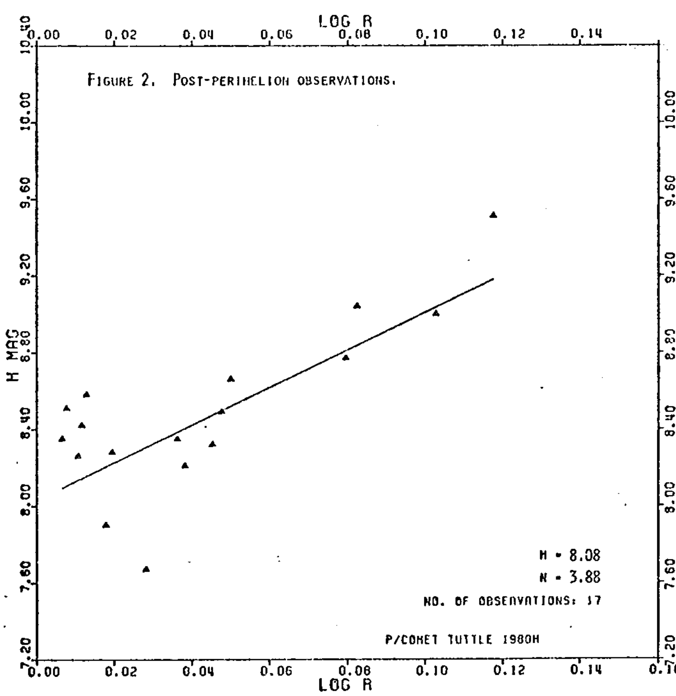

FIGURE 2. POST-PERIHELION OBSERVATIONS.

THE 1980-81 APPARITION OF PERIODIC COMET TUTTLE

analysis for the pre-perihelion and post-perihelion periods are shown in Figures 1 and 2, respectively. The pre-perihelion light curve covers the period 1980 October 8 to December 14 (r = 1.428 to 1.015 AU) and can be represented by a standard power-law formula of the form

$$H_{\Delta} = H_{o} + 2.5n \log r,$$

where H_{Δ} is the heliocentric magnitude, H_o is the comet's absolute magnitude, and n is the index of variation of the comet's brightness with heliocentric distance. When the 90 pre-perihelion observations are reduced, the following results are obtained (all data were reduced to a standard aperture of 6.78 centimeters):

$H_o = 7.97 \pm 0.03$ (p.e.)
$n = 6.01 \pm 0.20$ (p.e.)

Although this solution fits the data quite well, it should be noted that P/Tuttle's pre-perihelion light curve does appear to depart from the power-law formula. In other words, the value of n, instead of being constant, decreased as the comet approached perihelion. This effect can be seen in Fig. 1, and is similar to what was found for P/Encke's 1980 apparition (Green and Morris 1981).

A similar analysis (cf. Fig. 2) for the post-perihelion data covering the period 1980 December 15 to 1981 February 8 (r = 1.015 - 1.311) gives (from 17 observations):

$H_o = 8.08 \pm 0.07$ (p.e.)
$n = 3.88 \pm 0.56$ (p.e.)

The major difference in the the pre- and post-perihelion results is the marked decrease in the value of n. This may be the result of the departure from the power-law of the pre-perihelion observations. This effect is not seen in the post-peri helion light curve, possibly because of the smaller r-interval covered.

REFERENCES

Green, D. W. E. (1980). ICQ 2, 62.
Green, D. W. E.; and C. S. Morris (1981). ICQ 3, 10.

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KEY TO SOURCES

01 THE ASTRONOMER
04 TONIGHT'S ASTEROIDS
05 COMETS SECTION, ASSN. OF LUNAR AND PLANETARY OBSERVERS
06 HOSHINO HIROBA, JAPAN
07 COMET SECTION, BRITISH ASTRONOMICAL ASSOCIATION
08 MPC'S (MINOR PLANETS AND COMETS), I.A.U.
09 COMET SECTION, ROYAL ASTRONOMICAL SOC. OF NEW ZEALAND
10 BEOBACHTUNGEN, EDITED BY M. GROSSMANN, GRONAU, W. GERMANY
11 DUTCH COMET SECTION (WERKGROEP KOMETEN)
12 HUNGARIAN COMET SECTION (c/o Vince Tuboly)

NEW ADDITIONS TO THE OBSERVER KEY

The following observers are added to the lists published in Vol. 1, pp. 32ff. and 57; Vol. 2, pp. 5, 39, 47, and 74; and Vol. 3, p. 15. The Observer Key now contains 379 comet observers from 25 countries. The complete Observer Key, which is the collection of those observers listed below and in the sources just mentioned (above), is available in one list, together with the Key to Sources and the Reference Key, for $2.00 postpaid (airmail) from the Editor at the

NEW ADDITIONS TO THE OBSERVER KEY (Cont.)

Cambridge address on page 34 of this issue.
The second column below, "GA", indicates the "Group Affiliation," or publication source, for certain observers' data.

Code	GA	Observer
AND01		K. G. ANDERSSON, SWEDEN
ANT		MILAN ANTAL, CZECHOSLOVAKIA
BAR		SANDRO BARONI, ITALY
BEL01		EMILIA P. BELSERENE, MA, U.S.A.
BER		A. BERNASCONI, ITALY
BRL	12	PA'L BRLA'S, HUNGARY
CLY	05	ROBERT CLYDE, OH, U.S.A.
DAL	12	ENDRE DALOS, HUNGARY
HAD		K. A. HADDOW, ENGLAND
HOR	12	TIBOR HORVA'TH, HUNGARY
JEK		P. JEKABSONS, AUSTRALIA
JEN	10	GUENTER JENNER, AUSTRIA
KAR	12	L. KA'ROLY, HUNGARY
KRA01		RAINER KRACHT, WEST GERMANY
KRA02		BERND KRAUSE, WEST GERMANY
KRO02	05	GARY W. KRONK, IL, U.S.A.
KUI	11	G. KUIPERS, THE NETHERLANDS
LYN		RICHARD F. LYNCH, RI, U.S.A.
MIZ01	12	ATTILA MIZSER, HUNGARY
MOO		E. MOORE, NM, U.S.A.
PAN01		L. PANSECCHI, ITALY
PED	05	JOSEPH W. PEDRONCELLI, NM, U.S.A.
POI	11	P. POITEVIN, BELGIUM
RAI	05	RODNEY J. RAISANEN, OH, U.S.A.
REI	10	PETER REINHARD, AUSTRIA
SCH03	10	MICHAEL SCHMID, AUSTRIA
SHE01	12	YARON SHEFFER, ISRAEL
SIM01	05	WANDA SIMMONS, FL, U.S.A.
TUB	12	VINCE TUBOLY, HUNGARY
VER02		M. VERDENET, FRANCE
WEG	11	R. L. W. VAN DER WEG, THE NETHERLANDS
WIL		PAUL WILD, SWITZERLAND

FOLLOWING ARE DESIGNATIONS FOR MAGNITUDE REFERENCES USED IN I.C.Q. OBSERVATION TABULATIONS. NEW DESIGNATIONS WILL BE ANNOUNCED AS NEEDED.

NOTE: In the past, we have published unacceptable references which observers have used to make magnitude estimates; this was done to aid the analyists who study the observations in throwing out these inferior observations. Since the references have been used throughout the past 2 years in the ICQ, we will retain the same code, which is now published below in its entirety. Those "references" which the ICQ Staff judges to be unacceptable to the making of good estimates are those below indicated by the following letters: I, M, R, T, X.

A = Charts/Atlas of the American Assn. of Variable Star Observers
B = Bonn Durchmusterung (Argelander)
C = Cape Photographic Catalogs
D = Henry Draper Catalogue, Harvard College Observatory Annals
E = PHOTOELECTRIC OBSERVATIONS (MAGN. GIVEN TO HUNDREDTHS)

(continued on next page)

KEY TO REFERENCES (continued from previous page)

F = Astronomisches Gesellschaft Katalog
G = Groombridge
H = Harvard Revised Photometrical Sequence
I = Atlas Stellarium (by H. Vehrenberg)
J = Revue des Constellations
K = Skalnate-Pleso Atlas Catalog (companion to Atlas Coeli)
L = Lampkin's Naked-Eye Stars
M = Specific Messier objects, globular clusters, galaxies, etc.
N = North Polar Sequence, published by the A.A.V.S.O.
O = U.S. Naval Observatory Photoelectric Photometry Catalog
P = PHOTOGRAPHIC OBSERVATIONS (normally expected to be blue magnitudes)
Q = Falkauer Atlas
R = Norton's Atlas
S = Smithsonian Astrophysical Observatory Star Catalog
T = Atlases Borealis, Eclipticalis, Australis
U = McCormick Photovisual Sequence
V = Variable star charts from recognized groups other than AAVSO (e.g., RASNZ)
X = Specific stars quoted, but no catalogue given.
Y = Yale University Observatory Catalogue of Bright Stars
Z = Arizona-Tonantzintla Catalog

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TABULATION OF PHOTOMETRIC COMET OBSERVATIONS

Following are the remaining A.L.P.O. observations of comets 1975 X and 1979 X. All other observations here were contributed directly to the ICQ or to the IAU Central Bureau for Astronomical Telegrams.

Comet Suzuki-Saigusa-Mori (1975 X = 1975k)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1975 10 08.35	8.1			12.0	R		20					COL
1975 10 08.46	8.1			13.0	R	5						MAL
1975 10 09.46	8.2			13.0	R	5		5				MAL
1975 10 10.42		P		37.0	S	2				1	330	MOO
1975 10 12.05	8.0	P						0.33				HAD
1975 10 12.47	8.1			13.0	R	5						MAL
1975 10 17.46	8.3			13.0	R	5						MAL
1975 10 18.46	8.0			25.0	L							HUD
1975 10 18.48	8.0			13.0	R	5						MAL
1975 10 19.47	8.0			13.0	R	5				?0.7	260	MAL
1975 10 20.48	7.9			13.0	R	5						MAL
1975 10 21.07	7.5			8.0	B		20					AND01
1975 10 21.48	7.9			13.0	R	5						MAL
1975 10 24.48	7.8			13.0	R	5						MAL
1975 10 27.19	6.1			6.0	B		15					BER
1975 10 27.50	5.5			3.5	B		7					KEE
1975 10 28.54	6.0			5.0	B		10					MAY
1975 10 29.19	5.8			6.0	B		15					BER
1975 11 04.39	5.2			5.0	B		7					STE
1975 11 04.47	5.0			0.0	E							HER
1975 11 06.42	4.8			0.0	E							SEA
1975 11 11.40	7.5			4.5	R							JON
1975 11 11.43	7.1			5.0	B		7					SUM
1975 11 12.42	7.8			4.5	R							JON
1975 11 12.53	7.2			15.0	L	4	27					SUM

Comet Bradfield (1979 X = 19791)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1979 12 29.05 *	4.8	L		12.0	R		21	1.0		2.00	300	CAM
1980 01 01.04	4.7	L		12.0	R		21	2.0				CAM
1980 01 04.05	5.5	L		12.0	R		21	1.5				CAM
1980 01 13.05	5.7	L		12.0	R		21	1.5			280	CAM
1980 01 20.92	4.8	L		12.0	R		21	12.0	3			CAM
1980 01 27.82	4.8	L		12.0	R		21	13.0	5			CAM
1980 01 27.88	4.8	L		12.0	R		21	13.0	5			CAM
1980 01 30.01	5.6	X		5.0	B		7	25	2			SIM
1980 01 30.2				8.0	B		11	&13.5	2			CAP
1980 01 31.01				23.0	R	12	250	&15	0	0.17	45	OME
1980 01 31.01				23.0	R	12	250			0.08	225	OME
1980 01 31.01				23.0	R	12	250			0.17	320	OME
1980 01 31.02	7.3:	X		10.0	B		14	4.5	2			SIM
1980 01 31.03	5.2	X		5.0	B		20	30	3	&1.5	110	MAT02
1980 02 01.80	5.8	J		7.0	R	5	16	5	1			FUL
1980 02 01.81	5.5:			8.1	R		24					RAI
1980 02 02.01	7.4	X		10.0	B		14	12	3			SIM
1980 02 02.01	7.4	X		10.0	B		14	16	4			SIM01
1980 02 02.13				15.0	L	8	48		3			PED
1980 02 02.78				3.0	B		8	15				SCH03
1980 02 03.79	6.2	J		7.0	R	5	16	7	1			FUL
1980 02 04.00				23.0	R	12	300	15	2	&0.02	0	OME
1980 02 04.01	7.5	X		5.0	B		20	&30	0			MAT02
1980 02 04.1	7.7	S		15.0	L		32	& 7	5			KRO02
1980 02 04.74	6.6	J		7.0	R	5	16	8	1		350	FUL
1980 02 05.01	6.4	S		5.0	B		10					OME
1980 02 05.01	6.1	S		3.5	B		7	&10	1		100	STE01
1980 02 05.01				23.0	R	12	300	&15	0	0.17	90	OME
1980 02 05.01				23.0	R	12	300			0.13	45	OME
1980 02 05.01				23.0	R	12	300			0.17	0	OME
1980 02 05.80				6.5	B		9	20				REI
1980 02 05.80	6.8	J		7.0	R	5	16	7	1			FUL
1980 02 06.0				23.0	R	12	300	10		0.17	80	OME
1980 02 06.0	7.2:	S		5.0	B		10					OME
1980 02 07.76	6.9	J		7.0	R	5	16	7	1			FUL
1980 02 08.75				15.0	L	8		6				JEN
1980 02 08.83	7.0	J		7.0	R	5	16	7	1			FUL
1980 02 10.76	7.7	K		12.0	R		21	6.0	3			CAM
1980 02 11.76	7.5	J		7.0	R	5	16	6	1			FUL
1980 02 12.80	7.7	J		7.0	R	5	16	6	1			FUL
1980 02 13.1	8.8	S		15.0	L		32	10	5			KRO02
1980 02 14.01	7.5:			15.0	L			5	0			CLY
1980 02 14.1	8.8	S		15.0	L		32	& 6.5	4			KRO02
1980 02 14.80	8.0	J		7.0	R	5	16	6	1			FUL
1980 02 18.1	9.2	S		15.0	L		32	& 9	3	?	90	KRO02

Comet Russell (19801)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 09 06.71	17	P										RUS
1980 09 07.58	17	P										RUS
1980 09 08.79	17	P										RUS

Comet Černis-Petrauskis (1980k)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 08 02.89	11	P										WIL

Comet Meier (1980q)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 11 30.0	10.3	A		21.0	R	11	95	2	3			LYN
1980 12 04.71	9.7	A		25.0	L		79	2.8	3			BAR
1980 12 12.0	9.8	A		21.0	R	11	95	3	3			LYN
1981 01 02.57	9.2	S	S	25.4	L	4	36	4	1			MAC
1981 01 06.57	9.1	S	S	25.4	L	4	36	5	2			MAC
1981 01 13.57	9.1	S	S	25.4	L	4	36	5	3			MAC
1981 01 25.44	8.8	A	S	8.0	B		20	3.2				BOR
1981 01 31.43				32.0	L	6	55	3.3	3			BOR
1981 01 31.43	8.7	A	S	8.0	B		20	3.7				BOR
1981 02 03.53	8.7	S	S	25.4	L	4	36	6	3			MAC
1981 02 13.43	9.0	A	S	8.0	B		20	5				BOR
1981 02 13.43				32.0	L	6	55	3.1	2			BOR
1981 04 01.18	10.5	A	S	32.0	L			3.5	0			BOR
1981 04 03.15	10.6	A	S	32.0	L			3.0	0			BOR
1981 04 07.18	10.5	A	S	32.0	L			3.7	1			BOR
1981 04 07.22	10.0	A	S	25.0	L	7	70	3.0	1			MOR
1981 04 08.16	10.2	A	S	25.0	L	7	70	3.2	1			MOR
1981 04 11.23	9.9	A	S	25.0	L	7	70	4	2			MOR

Comet Bradfield (1980t)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 01 05.71	4.0	O		8.0	B		20	3	6	0.3	45	CAV
1981 01 05.73	4.0	K		8.0	B		15	2		1	30	BAR
1981 01 06.08	4 :		S	8.0	B		20			0.5		MAC
1981 01 06.70	4.9	K		10.0	L	4	24	2	6/	&0.25		KRA01
1981 01 07.70	5.0	K		4.8	R	8				1.3		KRA01
1981 01 07.72	3.3			6.0	B		12		8	3		WEG
1981 01 07.73	4.2	O		8.0	B		20	2	8	0.7	45	CAV
1981 01 07.73	4.2	K		8.0	B		15	2.5	9	3	35	BAR
1981 01 08.72	4.3	O		8.0	B		20	2	8			CAV
1981 01 08.74	4.4	K		8.0	B		15	2.5	8/	1	40	BAR
1981 01 10.72	5.8	K		5.0	B	14	10					KRA01
1981 01 10.72	5.9	K		4.8	R	8				1.1		KRA01
1981 01 10.73	5.5			8.0	B		20		7	8	33	BOU
1981 01 10.73	5.4			8.0	B		20		7	8.5		BUS01
1981 01 10.73	5.0			6.0	B		12			8		WEG
1981 01 10.74	5.5			4.0	R		20					KUI
1981 01 11.09	5.8	S	S	15.0	L	8	45	5				MAC
1981 01 11.71	5.0:			8.0	B		15		7	&0.4		KRA02
1981 01 11.72	5.7			5.0	B		7			&3		BOU
1981 01 11.72	5.6			4.0	B		12					FEI
1981 01 11.72	5.7			4.0	B		12		6	&6		BUS01
1981 01 11.74	5.6			5.0	B		7			&1		KUI
1981 01 11.96	5.4	U	B	5.0	B		10	2.9	7	1.6	35	BOR
1981 01 13.09	6.0	S	S	15.0	L	8	45	5	8			MAC
1981 01 13.70				4.8	R	8				&0.06	210	KRA01
1981 01 13.74	4.7			4.0	B		12		9			FEI
1981 01 13.75	4.7			4.0	R		12					KUI

Comet Bradfield (1980t) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 01 14.73	4.5	O		8.0	B		20	2	8	1	45	CAV
1981 01 15.72	4.7	K		8.0	B		15	2	9	0.92	45	BAR
1981 01 15.73	5.6	K		4.8	R	8						KRA01
1981 01 15.74	4.9			8.0	B		20		6	&4		BOU
1981 01 15.74	5.0			5.0	B		7		7	&6.5		BUS01
1981 01 15.74	5.3			5.0	B		7			&6.5		COM
1981 01 15.74	5.1			5.0	B		7			&3		KUI
1981 01 15.74	4.9			4.0	B		12		8			FEI
1981 01 16.72	4.9	K		8.0	B		15	2	8	1	45	BAR
1981 01 16.74	4.7	O		8.0	B		20	2	7	0.5	45	CAV
1981 01 17.72				8.0	B		20				55	BAR
1981 01 17.72	4.9	K		8.0	B		20	2	8	0.50	45	BAR
1981 01 17.74	5.0	O		8.0	B		20	2		0.6	40	CAV
1981 01 18.73	5.1	K		8.0	B		20	& 2.5	7	0.33	45	BAR
1981 01 18.73	6.5	S		8.0	B		20			&1		BOU
1981 01 18.73	6.2	S		5.0	B		7			&1.5		BUS01
1981 01 18.73				8.0	B		20				60	BAR
1981 01 18.73	5.1	O		8.0	B		20	2				CAV
1981 01 18.97				32.0	L	6	55	1.6	7	0.3	40	BOR
1981 01 18.97	6.5	U	S	5.0	B		10					BOR
1981 01 19.73	6.5	S		4.0	B		12					FEI
1981 01 19.96	6.2	A	S	8.0	B		20	& 3.5	7	0.5	35	MOR
1981 01 20.73	6.6	S		8.0	B		20			&0.25		BOU
1981 01 20.74				8.0	B		20				70	BAR
1981 01 20.74	5.5	O		8.0	B		20	3	6	0.3	40	CAV
1981 01 20.74	5.4	K		8.0	B		20	3	7	0.50	45	BAR
1981 01 20.96	6.4	A	B	8.0	B		20		7/	2.5	30	MOR
1981 01 20.98	6.8	S	S	5.0	B		10	2.0				BOR
1981 01 21.73				8.0	B		20				70	BAR
1981 01 21.73	5.7	K		8.0	B		20	4	5	0.50	45	BAR
1981 01 21.74	5.6	O		8.0	B		20	3	6	0.4	45	CAV
1981 01 21.96	6.6	A	B	8.0	B		20		7/	2.5	40	MOR
1981 01 21.97	6.8	S	S	5.0	B		10	2.4		1.0	35	BOR
1981 01 21.97	6.9	S	B	5.0	B		10					BOR
1981 01 23.97	7.0:	S	B	8.0	B		20		7	2.5	30	MOR
1981 01 24.74	6.6	S		8.0	B		20	2.5	5	0.3	35	CAV
1981 01 24.74	6.6	K		8.0	B		20	2.5	5	0.33	35	BAR
1981 01 24.98	7.2	S	S	5.0	B		10	2.3	6/	0.8	30	BOR
1981 01 25.73	8.5			25.4	L	7	45	2.0	7	0.20		KRA02
1981 01 25.74	7.3	S		8.0	B		10			&1.75		COM
1981 01 25.74	6.9	S		4.0	B		12			&1.75		FEI
1981 01 25.75	7.2	S		8.0	B		10		6	>2		BUS01
1981 01 25.75	6.9	S		5.0	B		7			&0.5		KUI
1981 01 25.75	6.9	S		6.0	B		12			1.6		WEG
1981 01 25.75	7.2	S		8.0	B		20		6			BOU
1981 01 25.97	7.3	S	B	8.0	B		20	2.0	7	1.5	30	MOR
1981 01 25.98	7.3	S	S	5.0	B		10	2.3				BOR
1981 01 25.98				32.0	L	6	55		6	0.5	40	BOR
1981 01 25.98	7.4	S	B	5.0	B		10					BOR
1981 01 26.12	7.4	S	S	25.4	L	4	36	5	7	0.22	25	MAC
1981 01 26.72	8.5			25.4	L	7	45	2.2	7	0.20		KRA02
1981 01 28.97	7.6	S	S	8.0	B		20	2	6	?	30	MOR
1981 01 30.97	7.4	S	S	8.0	B		20	4	6			MOR

Comet Bradfield (1980t) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 01 30.98	7.6	S	S	8.0	B		20	2.3				BOR
1981 01 30.98				32.0	L	6	55	1.3	5	0.1	30	BOR
1981 01 31.97	7.5	S	S	8.0	B		20	3	6			MOR
1981 02 04.76	8.6	A		15.6	L		30	6	4	0.25		BUS01

Comet Panther (1980u)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 01 01.56	9.1	S	S	25.4	L	4	36	4	6			MAC
1981 01 02.57	9.0	S	S	25.4	L	4	36	4	6			MAC
1981 01 03.01	9.5	B	S	32.0	L		56	2.5	4			MOR02
1981 01 06.56	9.2	S	S	25.4	L	4	36	4	6			MAC
1981 01 08.01	9.3	B	S	32.0	L		56	2.5	4			MOR02
1981 01 11.01	9.3	B	M	32.0	L		56	3.0	5			MOR02
1981 01 13.57	8.9	S	S	25.4	L	4	36	4	6	0.12	20	MAC
1981 01 16.21	8.1	A		8.0	B		20	4	6			CAV
1981 01 17.02	9.1	B	M	32.0	L		31	3.0	5			MOR02
1981 01 21.22	7.7	A		8.0	B		20	3		0.07	0	CAV
1981 01 24.03	9.0	B	M	7.5	R		56		5			MOR02
1981 01 24.76	8.3	A		8.0	B		20	4	4			BAR
1981 01 24.76	8.2	A		8.0	B		20	4	4			CAV
1981 01 25.02	8.7	A	S	32.0	L	6	68	2.0	4/			BOR
1981 01 25.99	8.8	A	S	32.0	L	6	55	2.3	4			BOR
1981 01 25.99	8.4	A	S	8.0	B		20	3.0				BOR
1981 01 29.11	9.0	S		6.1	R	9	20	3				SHE01
1981 01 30.10	9.0	S		6.1	R	9	20	3				SHE01
1981 01 31.44	8.4	A	S	8.0	B		20	4.5				BOR
1981 01 31.44				32.0	L	6	55	3.0	5/	0.25	340	BOR
1981 02 02.03	8.9	B	M	7.5	R		56	4.0	5			MOR02
1981 02 07.41	8.5	N	M	8.0	B		20	3	6	0.33	15	MOR
1981 02 09.94	8.9			10.0	B		25					ANT
1981 02 10.11	9.0	S		6.1	R	9	20	3.5				SHE01
1981 02 10.18	8.5			30.0	L		40	5	2/	0.12	135	KAR
1981 02 10.22	8.5			30.0	L		40	5	1/	0.12	135	HOR
1981 02 10.42	8.4	N	M	8.0	B		20	4	6			MOR
1981 02 11.04	8.8	B	B	7.5	R		56	5.0	4			MOR02
1981 02 13.42	8.4	A	S	8.0	B		20	3				BOR
1981 02 13.42				32.0	L	6	55	3.2	6	0.30	325	BOR
1981 02 13.43				8.0	B		20			0.50	30	MOR
1981 02 13.43	8.3:	N	S	8.0	B		20		6/	1.25	18	MOR
1981 02 13.44	8.7	A	M	25.0	L	7	70	2.6	6/			MOR
1981 02 14.13	8.8			10.0	B		25					ANT
1981 02 14.41	8.3	N	M	8.0	B		20	4	6	0.75	12	MOR
1981 02 17.15	8.9			10.0	B		25					ANT
1981 02 18.03	8.7	B	B	7.5	R		56	7.5	4			MOR02
1981 02 20.15	8.6			25.0	L			4.0				SPR
1981 02 24.03	8.5	B	B	7.5	R		56	8.0	4			MOR02
1981 02 25.84	9.2	V		10.0	L		25	10	2			TUB
1981 02 25.93	8.7			10.0	B		25					ANT
1981 02 26.02	8.7			10.0	B		25					ANT
1981 02 26.82	9.2	V		10.0	L		25	10	2			TUB
1981 02 26.83	9.5			30.0	L		40	5	3	0.10	150	HOR

Comet Panther (1980u) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 02 26.94	8.8			10.0	B		25					ANT
1981 02 27.04	8.8			10.0	B		25					ANT
1981 02 27.25	8.7			25.0	L			3.5				SPR
1981 02 28.01	9	:	V	30.0	R		180	2	3	0.05	270	MIZ01
1981 02 28.01				32.0	L	6	55	3.2	5	0.10	330	BOR
1981 02 28.01	8.4	N	S	8.0	B		20	5				BOR
1981 03 01.10	9.0	S		6.1	R	9	20	5				SHE01
1981 03 01.22	8.6			25.0	L			3.5				SPR
1981 03 02.12	8.3	N	S	8.0	B		20	5				BOR
1981 03 02.12				32.0	L	6	55	2.9	6/	0.10	310	BOR
1981 03 02.13	8.7	A	S	20.0	L	10	65	3.5				SPR
1981 03 02.19	8.5	N	M	8.0	B		20	& 6	5			MOR
1981 03 02.19	8.5	N	S	8.0	B		20					MOR
1981 03 03.18	8.6	N	M	8.0	B		20	4	6	0.50	38	MOR
1981 03 04.12	8.4	N	S	8.0	B		20	5				BOR
1981 03 04.12				32.0	L	6	55	2.4	6	0.10	310	BOR
1981 03 04.19				8.0	B		20			0.17	346	MOR
1981 03 04.19	8.5	N	M	8.0	B		20	4	6	0.33	32	MOR
1981 03 04.83	9	:		10.0	L		25	7	3			TUB
1981 03 05.10	8.8	S		6.1	R	9	20	4				SHE01
1981 03 05.15	8.8	A	S	20.0	L	10	65	3.5				SPR
1981 03 05.19	8.4	N	M	8.0	B		20	4	6			MOR
1981 03 05.81	9	:		10.0	L		25	6	3			TUB
1981 03 05.89	8.5			20.0	C						0	VER02
1981 03 06.17	8.1	A	S	25.0	L	5	38	4.0				SPR
1981 03 08.17	8.0	A	S	25.0	L	5	38	4.0				SPR
1981 03 09.15	8.1	A	S	20.0	L	10	65	4.0		0.25	30	SPR
1981 03 10.25	8.1	A	S	25.0	L	5	38	4.0		0.33	30	SPR
1981 03 11.30	8.7	N	S	22.9	R	12			6/			GRE
1981 03 12.10	9.1	S		6.1	R	9	20	4				SHE01
1981 03 12.14	8.2	A	S	20.0	L	10	65	3.5				SPR
1981 03 12.18	8.4	N	S	8.0	B		20	5				BOR
1981 03 12.18	8.9	N	B	32.0	L	6	55	2.5	5	0.12	85	BOR
1981 03 12.18	8.5	N	B	8.0	B		20					BOR
1981 03 12.19	8.6	N	S	8.0	B		20					GRE
1981 03 12.20	9.0	N	M	22.9	R	12						GRE
1981 03 12.20	8.7	N	S	22.9	R	12						GRE
1981 03 13.15	8.2	A	S	25.0	L	5	38	3.5				SPR
1981 03 14.14	8.3	A	S	20.0	L	10	65	3.0				SPR
1981 03 18.08	9	:		154.9	L			& 1.5	1/	0.01	0	GRE
1981 03 18.14	8.9	A	S	25.0	L	5	38	3.5				SPR
1981 03 20.21	9.5	A	S	32.0	L	7	76	3.0				SPR
1981 03 24.07				32.0	L	6		3.2	5	0.08	115	BOR
1981 03 24.07	8.4	O	S	8.0	B		20	6				BOR
1981 03 24.09	8.4	N	M	8.0	B		20	5	5/			MOR
1981 03 24.09	8.4	N	S	8.0	B		20					MOR
1981 03 24.18	9.0	A	S	32.0	L	7	76	3.5				SPR
1981 03 26.10				32.0	L	6		2.9	5/	&0.13	102	BOR
1981 03 26.10	8.4	O	S	8.0	B		20	5.5				BOR
1981 03 26.14	8.6	S	M	8.0	B		20	5	5	?0.17	345	MOR
1981 03 27.03	8.8	S	S	8.0	B		20	& 5	5			MOR
1981 03 27.19	8.9	A	S	32.0	L	7	76	4.0	7	0.08	300	SPR
1981 03 28.20	9.0	S	B	25.0	L	7	70					MOR

Comet Panther (1980u) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 03 28.20	9.0	S	M	25.0	L	7	70	2.3	6	0.17	125	MOR
1981 04 01.14				32.0	L					0.17	105	BOR
1981 04 01.14	8.4	A	S	8.0	B		20	4				BOR
1981 04 01.16	9.1	S	M	25.0	L	7	70	2.4	6			MOR
1981 04 02.19	9.1	A	S	32.0	L	7	76	3.5	6			SPR
1981 04 03.10				32.0	L					0.08	100	BOR
1981 04 03.10	8.5	A	S	8.0	B		20	5				BOR
1981 04 03.11	9.2	A	B	25.0	L	7	70					MOR
1981 04 03.11	9.0	A	M	25.0	L	7	70	2.0	6	?	110	MOR
1981 04 04.05	9.2:	A	M	25.0	L	7	70					MOR
1981 04 04.20	9.4	A	S	20.0	L	10	125	3.0	6			SPR
1981 04 07.12				32.0	L					0.20	80	BOR
1981 04 07.12	8.6	A	S	8.0	B		20	& 6				BOR
1981 04 07.18	9.2	A	M	25.0	L	7	70	2.7	5/			MOR
1981 04 07.19	9.0	A	S	8.0	B		20	5	4			MOR
1981 04 08.11	9.2	A	M	25.0	L	7	70	2.9	5			MOR
1981 04 08.12	9.0	A	S	8.0	B		20	4	5			MOR
1981 04 11.14	9.4	A	M	25.0	L	7	70	1.5	5			MOR

Periodic Comet Bus (1981b)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 02 09.65	19.8:	P		120.0	S						310	BUS
1981 02 13.64	20.0	P		120.0	S							BUS
1981 03 07.63	16.5	P		120.0	S							BUS

Comet Bowell (1980b)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 01 31.42	12.7	A	S	32.0	L	6	110	1.6	3			BOR
1981 04 07.07	11.6	A	S	32.0	L			1.0	3/			BOR
1981 04 08.10	11.6	A	S	32.0	L			1.0	3			BOR
1981 04 11.20	11.8	A	S	25.0	L	7	70	1.1	3			MOR

Periodic Comet Encke

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 09 28.66	12 :			12.0	L		50	2	1			SAK
1980 10 04.60	11 :			12.0	L		50	2	2			SAK
1980 10 12.94	9.5	A		8.0	B		20					BOU
1980 10 12.96	9.5	A		8.0	B		12	&15	1			BUS01
1980 10 13.02	9.1	A		8.0	B		12	&12.5	1			COM
1980 10 13.27	9.6	A		15.0	R		31	7				MOR03
1980 10 14.31	9.4:	A		15.0	R		31	8				MOR03
1980 10 15.00	10.7	A		11.0	L		37					FEI
1980 10 15.34	9.3	A		15.0	R		31	7				MOR03
1980 10 15.94	9.1	A		8.0	B		20					BOU
1980 10 15.95	9.7	A		8.0	B		12	15	2			COM
1980 10 15.98	10.7	A		11.0	L		37					FEI
1980 10 18.99	8.7	A		8.0	B		12	&20	2			BUS01
1980 10 19.01	8.2	A		8.0	B		20					BOU
1980 10 19.02	8.9	A		8.0	B		10	&15				COM
1980 10 20.10	8.0	A		8.0	B		20	&20				BOU

Periodic Comet Encke (Cont.)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 10 20.10	8.2	S		10.0	B		14					DRU
1980 10 20.11	7.8	A		5.0	B		7					BOU
1980 10 20.12	8.0	A		8.0	B		11	11	4			FEI
1980 10 22.59	9 :			12.0	L		33	4	3			SAK
1980 10 26.62	8 :			12.0	L		33	5				SAK
1980 10 27.77	7.4	S	S	12.0	L		33	8	3			SAK
1980 10 29.64	7.2	S	S	12.0	L		33	7	4			SAK
1980 10 31.40	7.6:	A		15.0	R		31	8				MOR03
1980 10 31.72	9.5:			7.0	R		30	15	2			DAL
1980 10 31.75	7.6	S		5.0	B		7					BUS01
1980 10 31.75	7.2	S		8.0	B		20	10				BOU
1980 10 31.80	7.0	S	S	12.0	L		33	9	4			SAK
1980 11 01.15	7.4	S		8.0	B		11					FEI
1980 11 01.23	6.9	S		6.0	B		12	11	5			WEG
1980 11 01.75	7.1	S		8.0	B		20	11	4			BOU
1980 11 01.76	6.5	S		5.0	B		7	20				BUS
1980 11 01.82	7.2	S	S	12.0	L		33	9	4	?0.17		SAK
1980 11 02.19	6.6	S		6.0	B		12	&25	6			WEG
1980 11 02.40	7.7:	A		3.5	B		7					MOR03
1980 11 02.41				15.0	R		31	8				MOR03
1980 11 02.74	6.9	S		8.0	B		20	10				BOU
1980 11 02.81	6.8	S	S	12.0	L		50	10	3			SAK
1980 11 03.80	6.7	S	S	12.0	L		33	8	4	0.25	320	SAK
1980 11 05.84	6.6	S	S	12.0	L		33	7	4			SAK
1980 11 06.09	7.0			6.0	R		20	12	6			SHE01
1980 11 06.83	6.8	S	S	12.0	L		33	8	4	0.33	320	SAK
1980 11 07.83	6.5	S	S	12.0	L		33	7	3	0.25	330	SAK
1980 11 08.10	7.0			6.0	R		20	12	6			SHE01
1980 11 09.83	6.4	S	S	12.0	L		33	8	3			SAK
1980 11 10.83	6.4	S	S	12.0	L		33	7	4			SAK
1980 11 11.84	6.5	S	S	12.0	L		33	7	4			SAK
1980 11 12.83	6.7	S	S	12.0	L		33	7	4			SAK
1980 11 13.18	6.7	S		8.0	B		20					BOU
1980 11 14.85	6.6	S	S	12.0	L		33	6	4			SAK
1980 11 16.44				15.0	R		31	4				MOR03
1980 11 17.83	7 :			5.0	B		6	& 5	4			SAK
1980 11 18.84	7.0	S	S	12.0	L		33	6	5			SAK
1980 11 20.20	6.8	S		8.0	B		15	3.5				BAR
1980 11 26.84	6.5:			5.0	B		6	5				SAK
1980 11 29.85	7 :			5.0	B		6	4				SAK
1980 12 05.85	7 :			5.0	B		6	3				SAK

Periodic Comet Borrelly (1980i)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 01 25.00	9.9	A	S	8.0	B		20	4.5				BOR
1981 01 25.00	10.4	A	S	32.0	L	6	68	2.2	5/			BOR
1981 01 26.00	9.9	A	S	8.0	B		20	3				BOR
1981 01 26.00	10.2	A	S	32.0	L	6	55	2.5	6			BOR
1981 01 26.13	9.7	S	S	25.4	L	4	36	5	5			MAC
1981 01 30.01	9.7	A	S	8.0	B		20	3				BOR
1981 01 30.01	9.9	A	S	32.0	L	6	55	2.4	5			BOR
1981 01 31.01	9.8	A	S	8.0	B		20	3.7				BOR
1981 01 31.01	10.0	A	S	32.0	L	6	55	2.8	5			BOR

Periodic Comet Borrelly (1980i) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 02 03.05	9.3:	A	S	8.0	B		20	& 3	5			MOR
1981 02 04.00	9.2	A	M	25.0	L	7	70	3.2	6/			MOR
1981 02 04.00	9.2:	A	S	8.0	B		20	& 4	6			MOR
1981 02 05.03	9.5:	A	S	8.0	B		20	&				MOR
1981 02 06.00	9.5	A	S	8.0	B		20	3.0				BOR
1981 02 06.00	9.5	A	M	25.0	L	7	70	3	6/			MOR
1981 02 06.00	9.7	A	S	32.0	L	6	55	2.3	6			BOR
1981 02 07.01	9.5	A	M	25.0	L	7	70	& 3	6			MOR
1981 02 12.99	9.6	S	M	25.0	L	7	70	3	6			MOR
1981 02 13.98	9.6	A	M	25.0	L	7	70	& 2.5	5/			MOR
1981 02 14.97	9.4	A	S	25.0	L	7	70	3	3			MOR
1981 02 25.00	9.7	A	S	32.0	L	6	55	2.2	6			BOR
1981 03 02.03	9.4	A	S	8.0	B		20	& 5				MOR
1981 03 02.07	9.6	A	S	32.0	L	6	55	2.3	5			BOR
1981 03 04.01	9.7	A	S	32.0	L	6	55	2.3	5/			BOR
1981 03 06.15	9.8			25.0	L			2.0				SPR
1981 03 06.15	9.8	A	S	25.0	L	5	75	2.0				SPR
1981 03 08.16	10.0	A	S	25.0	L	5	75	1.5				SPR
1981 03 08.16	10.0			25.0	L			1.5				SPR
1981 03 09.14	10.2	A	S	20.0	L	10	65	1.5				SPR
1981 03 10.15	10.4	A	S	25.0	L	5	75	1.5				SPR
1981 03 18.15	10.9	A	S	25.0	L	5	121	1.0				SPR
1981 03 23.03	9.9	O	S	32.0	L	6	55	1.5				BOR
1981 03 24.03	9.9	O	S	32.0	L	6	55	1.7	4			BOR
1981 03 24.16	10.8	A	S	32.0	L	7	76	1.0				SPR
1981 03 26.06	10.4	O	S	32.0	L	6	68	2.2	3/			BOR
1981 03 27.16	11.0	A	S	32.0	L	7	76	1.5	4			SPR
1981 03 28.04	10.4	A	M	25.0	L	7	70	2.6	4			MOR
1981 04 01.04	10.3	O	S	32.0	L			1.9	4			BOR
1981 04 02.16	11.0	A	S	32.0	L	7	76	1.5	4			SPR
1981 04 03.05	10.3	A	M	25.0	L	7	70	2.3	5			MOR
1981 04 03.05	10.3	A	S	25.0	L	7	70	2.3	5			MOR
1981 04 03.05	10.2	O	S	32.0	L			1.5	4			BOR
1981 04 04.03	10.5:	A		25.0	L	7	70					MOR
1981 04 04.17	11.0	A	S	20.0	L	10	125	1.0	3			SPR
1981 04 07.05	10.2	O	S	32.0	L			1.2	3/			BOR
1981 04 08.04	10.4	A	M	25.0	L	7	70					MOR
1981 04 08.04	10.4	A	S	25.0	L	7	70	1.9	3			MOR
1981 04 08.05	10.2	O	S	32.0	L			1.9	3			BOR
1981 04 11.04	10.4	A	S	25.0	L	7	70	2.7	3			MOR

Periodic Comet Schwassmann-Wachmann 2 (1979k)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 01 25.05	11.9	A	S	32.0	L	6	68	1.2	1/			BOR
1981 01 26.03	12.1	A	S	32.0	L	6	68	1.0	3			BOR
1981 01 28.20	11.8	A	S	25.0	L	7	70	1.1	5			MOR
1981 01 28.99	11.8	A	S	25.0	L	7	70	1	5			MOR
1981 01 30.15	12.0	A	S	25.0	L	7	70	& 1	4			MOR
1981 01 31.03	12.2	A	S	32.0	L	6	88	1.1	3			BOR
1981 01 31.14	11.9	A	S	25.0	L	7	70	0.9	6			MOR
1981 02 01.01	12.0	A	S	25.0	L	7	70	1.0	6			MOR
1981 02 01.09	11.8	A	S	32.0	L	6	68	1.2	3			BOR
1981 02 06.10	12.0	A	S	25.0	L	7	70	0.8	4			MOR

Periodic Comet Schwassmann-Wachmann 2 (1979k) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 02 07.04	11.9	A	S	25.0	L	7	70	1.0	4			MOR
1981 02 10.18	12.0	A	S	25.0	L	7	70	1.0	5			MOR
1981 02 28.02	12.9	A	S	32.0	L	6	110	1.0	2			BOR
1981 03 02.07	13.0:	A	S	25.0	L	7	70	& 1				MOR
1981 03 02.08	12.3	A	S	32.0	L	6	88	0.9	3			BOR
1981 03 04.08	12.0	A	S	32.0	L	6	88	1.7	1			BOR
1981 03 24.04	12.7	A	S	32.0	L	6	88	1.1	0			BOR
1981 03 28.20	12.5	A	S	25.0	L	7	70	& 1				MOR

Periodic Comet Tuttle (1980h)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 10 04.61	11 :			12.0	L		33	2	1			SAK
1980 10 13.42	11.0	A		15.0	R		31	4				MOR03
1980 10 15.99	10.9	A		14.7	R		65		3			COM
1980 10 19.03	11.7	A		14.7	R		65					COM
1980 10 19.03	11.7	A		14.7	R		65		4			BUS01
1980 10 19.07	11.2	A		14.7	R		65					BOU
1980 10 19.07	11.6	A		14.0	L		38					FEI
1980 10 20.07	11.0	A		14.0	L		38		3			FEI
1980 10 20.82	10.0	S		20.3	L		38	5	4			BOE
1980 10 22.59	10.5:			12.0	L		50	2	2			SAK
1980 10 24.58	10 :			12.0	L		50	2	2			SAK
1980 10 25.62	10.5:			12.0	L		50	2	3			SAK
1980 10 26.61	9.8	S	B	12.0	L		33	3	2			SAK
1980 10 27.62	9.8	S	B	12.0	L		50	3	2			SAK
1980 10 28.62	9.7	S	B	12.0	L		50	3	2			SAK
1980 10 29.63	9.5	S	B	12.0	L		50	3	3			SAK
1980 10 31.42	9.2:	A		15.0	R		31	4				MOR03
1980 10 31.64	9.6	S	B	12.0	L		50	3	2			SAK
1980 11 01.00	9.9	A		11.0	L		48					FEI
1980 11 01.60	9.6	S	B	12.0	L		33	4	3			SAK
1980 11 01.98	9.1	A		8.0	B		20	8				BOU
1980 11 01.99	9.3	A		14.7	R		65	10				BUS01
1980 11 02.00	9.3	A		14.7	R		65					COM
1980 11 02.02	9.4	A		11.0	L		30	4				FEI
1980 11 02.31	9.1	A		15.0	R		31	6				MOR03
1980 11 06.00	8.6	A		8.0	B		20					BOU
1980 11 06.01	9.6	A		11.0	L		30	4				FEI
1980 11 06.08	8.5	A		6.0	R		20	9	3			SHE01
1980 11 07.78	8.1	S		20.3	L		38	6	5			BOE
1980 11 08.08	8.5	A		6.0	R		20	9	3			SHE01
1980 11 09.76	8.1	S		20.3	L		38	7	6			BOE
1980 11 10.03	8.6	A		11.0	L		30	5				FEI
1980 11 10.80	8.6	S	B	12.0	L		33	5	4			SAK
1980 11 11.01	8.2	A		8.0	B		11	8				FEI
1980 11 11.81	7.9	S		20.3	L		38	7	6			BOE
1980 11 12.03	8.5	A		8.0	B		11	6				FEI
1980 11 12.17	8.0	A		8.0	B		20					BOU
1980 11 12.83	8.4	S	B	12.0	L		33	5	4			SAK
1980 11 13.08	8.5	A		11.0	L		30					FEI
1980 11 13.18	7.7	A		8.0	L		20					BOU
1980 11 14.84	8.3	S	B	12.0	L		33	6	4			SAK
1980 11 15.42	8.4	A		3.5	B		7					MOR03

Periodic Comet Tuttle (1980h) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 11 15.43				15.0	R		31	6				MOR03
1980 11 15.85	7.4	S		20.3	L		38	8	6			BOE
1980 11 16.15	8.5	A		11.0	L		48					FEI
1980 11 16.37				15.0	R		31	8				MOR03
1980 11 16.39	8.2	A		3.5	B		7	&11				MOR03
1980 11 17.05	8.9	A		11.0	L		30					FEI
1980 11 17.43	8.5	A		6.0	R		36	6				MOR03
1980 11 17.78	7.3	S		20.3	L		38	10	6			BOE
1980 11 17.83	8.2	S	B	12.0	L		33	6	4			SAK
1980 11 18.13	8.6	S		15.0	L		30					POI
1980 11 18.82	7.2	S		20.3	L		38	10	7			BOE
1980 11 18.84	8	:		5.0	B		6	5				SAK
1980 11 19.12	8.3	S		15.0	L		30					POI
1980 11 19.85	7.8	S	B	12.0	L		33	6				SAK
1980 11 20.09	7.5	A		6.0	R		20	& 7	4			SHE01
1980 11 20.18	7.9	S		8.0	B		15	8	2			BAR
1980 11 23.45	7.7:	A		15.0	R		31	6				MOR03
1980 11 25.84	7.6	S	B	5.0	B		6	6	4			SAK
1980 11 26.82	7.0	S		20.3	L		38	8	8			BOE
1980 11 26.84	7.7	S	B	12.0	L		33	7	5			SAK
1980 11 29.85	7.6	S	B	12.0	L		33	6	4			SAK
1980 11 30.46	7.7	A		6.0	R		36	5				MOR03
1980 12 01.23	6.8	S		8.0	B		20	&10	5			BOU
1980 12 02.82	7.5	S	B	5.0	B		6	6				SAK
1980 12 03.10	7.2	A		6.0	R		20	7.5	3			SHE01
1980 12 03.79	6.9	S		20.3	L		38	8	8			BOE
1980 12 03.83	7.4	S	S	12.0	L		33	7				SAK
1980 12 04.83	7.2	S	S	12.0	L		33	7	5			SAK
1980 12 05.81	6.8	S		20.3	L		38	8	8			BOE
1980 12 05.84	7.3	S	S	12.0	L		33	8	5			SAK
1980 12 06.43	7.5	A		3.5	B		7	8				MOR03
1980 12 06.85	7.1	S	S	12.0	L		50	8	5	?0.17		SAK
1980 12 06.85	6.8	S		20.3	L		38	8	8			BOE
1980 12 06.99	7.2	K		12.0	R		21	6.5	6			CAM
1980 12 07.86	7.0	S	S	12.0	L		50	8	4			SAK
1980 12 07.86	6.7	S		20.3	L		38	8	8			BOE
1980 12 08.09	7.5	A		6.0	R		20	7	5			SHE01
1980 12 08.83	6.6	S		20.3	L		38	7	8			BOE
1980 12 09.06	7.3	K		12.0	R		21	6.0	6			CAM
1980 12 09.84	7.3	S	S	12.0	L		33	7	4			SAK
1980 12 10.84	6.6	S		20.3	L		38	6	8			BOE
1980 12 10.85	7.5	S	B	5.0	B		6	& 5				SAK
1980 12 12.83	7.3	S	S	12.0	L		33	8	5			SAK
1980 12 12.84	6.5	S		20.3	L		38	5	8			BOE
1980 12 13.06	7.0	K		12.0	R		21	8.0	5			CAM
1980 12 13.83	7.3	S	S	12.0	L		33	8	4			SAK
1980 12 13.86	6.5	S		20.3	L		38	5	8			BOE
1980 12 14.85	8	:		5.0	B		6	& 5				SAK
1980 12 15.10	8	:		6.0	R		20	5	4			SHE01
1980 12 15.84	7.5	S	S	12.0	L		33	7	4			SAK
1980 12 17.09	9	:		6.0	R		20	3.5	4			SHE01
1980 12 20.03	7.7	K		12.0	R		21	7.0	3			CAM
1980 12 26.06	7.9:	V		12.0	R		21	6.0	3			CAM
1980 12 27.01	8.0:	V		12.0	R		21	6.0	3			CAM

Periodic Comet Tuttle (1980h) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 12 30.84	7.5	V		12.0	R		21	5.0	4			CAM
1980 12 30.95	7.4	V		12.0	R		21	4.5	4			CAM
1981 01 05.96	7.5	K		12.0	R		21	4.5	5			CAM
1981 01 09.46	8.1	S		8.0	B		15					SEA
1981 01 10.46	8.0	S		8.0	B		15					SEA
1981 01 13.52	8.2	S		8.0	B		15					SEA
1981 01 14.48	8.4	S		8.0	B		15					SEA
1981 01 15.44	8.6	S		8.0	B		15					SEA
1981 01 26.46	9.0	S		8.0	B		15					SEA
1981 01 27.44	9.3	S		8.0	B		15					SEA
1981 02 03.45	9.4	S		8.0	B		15					SEA
1981 02 08.44	10.0	S		8.0	B		15					SEA

Periodic Comet Stephan-Oterma (1980g)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 10 09.73	11.0	I		20.3	L		38	4	5			BOE
1980 10 13.00	11.6	A		14.7	R		65		7			BUS01
1980 10 13.01	11.8	A		14.7	R		90		7			COM
1980 10 13.01	11.8	A		14.7	R		90	& 1	7			BOU
1980 10 15.95	12.0	A		14.7	R		65					COM
1980 10 17.75	10.5	I		20.3	L		38	4	4			BOE
1980 10 19.04	11.6	A		14.7	R		90					COM
1980 10 19.07	11.5	A		14.7	R		90	& 1				BUS01
1980 10 19.08	11.3	A		14.0	L		38					FEI
1980 10 20.07	11.2	A		14.0	L		38	2.3				FEI
1980 10 31.97	10.5	A		14.7	R		90	2				BUS01
1980 10 31.99	10.5	A		11.0	L		30					FEI
1980 11 01.51	9.9	S	B	32.0	L		70	4.0	5			MORO2
1980 11 01.94	10.2	A		14.7	R		65					COM
1980 11 01.97	10.2	A		14.7	R		65	4				BUS01
1980 11 01.99	9.7	A		8.0	B		20	5				BOU
1980 11 02.03	9.8	A		11.0	L		30	4				FEI
1980 11 03.00	10.2	A		11.0	L		30					FEI
1980 11 04.01	10.3	A		11.0	L		30					FEI
1980 11 05.94	10.4	A		14.7	R		65					COM
1980 11 05.94	10.1	A		14.7	R		65	4				BUS01
1980 11 05.99	10.5	A		11.0	L		30	2.5				FEI
1980 11 07.67	9.0	I		20.3	L		38	4	5			BOE
1980 11 09.04	10.2	A		11.0	L		30					FEI
1980 11 09.05	10.2	A		11.0	L		30	1				BUS01
1980 11 09.40	9.3	S	B	32.0	L		70	4.0	6			MORO2
1980 11 09.60	9.0	S		20.3	L		38	6	5			BOE
1980 11 09.99	10.2	A		14.7	R		65					COM
1980 11 10.04	9.8	A		11.0	L		30					FEI
1980 11 10.04	10.6	A		11.0	L		120					FEI
1980 11 11.65	8.9	S		20.3	L		38	6	6			BOE
1980 11 11.95	10.2	A		14.7	R		65					COM
1980 11 12.03	9.4	A		11.0	L		30	3				FEI
1980 11 12.16	9.4	A		8.0	B		20					BOU
1980 11 12.92	10.2	A		14.7	R		65	3				BUS01
1980 11 12.94	10.3	A		14.7	R		65					COM
1980 11 13.06	9.5	A		11.0	L		50					FEI
1980 11 13.06	9.4	A		11.0	L		25					FEI

Periodic Comet Stephan-Oterma (1980g) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 11 13.17	9.1	A		8.0	B		20					BOU
1980 11 14.16	9.0	Q		7.0	R		22	1	6			FUL
1980 11 14.60	8.8	S		20.3	L		38	6	6			BOE
1980 11 15.10	8.8	Q		7.0	R		22	1	3			FUL
1980 11 15.86	8.8	S		20.3	L		38	5	5			BOE
1980 11 16.15	9.3	A		11.0	L		30					FEI
1980 11 16.15	9.4	A		11.0	L		45					FEI
1980 11 17.05	9.5	A		11.0	L		30					FEI
1980 11 17.85	8.7	S		20.3	L		38	5	5			BOE
1980 11 18.11				15.0	L		30	2.5				POI
1980 11 18.84	8.6	S		20.3	L		38	5	5			BOE
1980 11 19.15	8.8	Q		7.0	R		22	2	3			FUL
1980 11 19.86	8.5	S		20.3	L		38	6	5			BOE
1980 11 20.15	8.8	A		8.0	B		15	4	5			BAR
1980 11 20.40	9.0	A	B	32.0	L		56	3.4	5			MOR02
1980 11 26.53	8.2	S		20.3	L		38	6	6			BOE
1980 11 26.83	9.0	A		8.0	B		20					BOU
1980 11 27.53	8.2	S		20.3	L		38	6	6			BOE
1980 11 27.58	8.8	S	B	32.0	L		56	3.0	5	0.00	265	MOR02
1980 11 27.88	9.5	A		15.6	L		30					BOU
1980 11 27.92	9.4	A		25.0	L		70					KUI
1980 11 28.53	8.1	S		20.3	L		38	5	7			BOE
1980 11 29.54	8.1	S		20.3	L		38	5	7			BOE
1980 11 30.57	8.0	S		20.3	L		38	5	7			BOE
1980 11 30.90	8.9	A		11.0	L		30	4				BUS01
1980 11 30.90	8.9	A		11.0	L		30	4				FEI
1980 11 30.91	9.2	A		15.6	L		30					BOU
1980 11 30.94	9.0	A		8.0	B		20					BOU
1980 12 01.07	10.0	A		15.5	R		60					COM
1980 12 01.25	8.8	S	B	32.0	L		31	5.5	5	0.00	260	MOR02
1980 12 02.22	9.0	Q		7.0	R		22	2	1			FUL
1980 12 02.94	8.9	A		8.0	B		20					BOU
1980 12 03.11	9.4	A		6.0	R		20	2	5			SHE01
1980 12 03.84	7.9	S		20.3	L		38	4	7			BOE
1980 12 04.20	8.8	Q		7.0	R		22	3	3			FUL
1980 12 04.48	8.0			30.0	L		40	2	5		130	HOR
1980 12 04.54	7.8	S		20.3	L		38	4	7	0.05		BOE
1980 12 04.98	9.0	A		25.0	L		70					KUI
1980 12 05.19	8.6	Q		7.0	R		22	4	1			FUL
1980 12 05.20	8.6	S	S	5.0	B		10	4.5	4			MOR02
1980 12 05.85	7.7	S		20.3	L		38	4	7	0.08		BOE
1980 12 05.96	8.6	A		11.0	L		30	3				FEI
1980 12 06.06	8.7	A		6.7	R		12					BUS01
1980 12 06.57	7.6	S		20.3	L		38	4	7	0.08		BOE
1980 12 06.83	8.8	Q		7.0	R		22	5	5			FUL
1980 12 06.97	11.0	V		12.0	R		21	2.5	6			CAM
1980 12 07.19	8.7	Q		7.0	R		22	4	5			FUL
1980 12 07.57	7.5	S		20.3	L		38	4	6	0.08		BOE
1980 12 07.85	8.7	A		20.0	C		100	3	8			BAR
1980 12 07.85	8.8	A		8.0	B		20					BOU
1980 12 07.97	8.7	A		11.0	L		30	4				FEI
1980 12 08.18	8.8	Q		7.0	R		22	5	3			FUL
1980 12 08.91	10.0	A		15.0	L		30	2				POI
1980 12 08.92	8.8	A		8.0	B		20	5				BUS01

Periodic Comet Stephan-Oterma (1980g) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 12 08.92	8.8	A		8.0	B		20					BOU
1980 12 09.00	9.1	A		11.5	L		36	2				KUI
1980 12 09.04	9.0	A		11.0	L		30					FEI
1980 12 09.20	9.0	Q		7.0	R		22	4	3			FUL
1980 12 09.56	7.4	S		20.3	L		38	3	6	0.08		BOE
1980 12 09.92	8.6	A		14.7	R		65					COM
1980 12 10.20	9.0	Q		7.0	R		36	3	1			FUL
1980 12 10.60	7.3	S		20.3	L		38	3	6	0.08		BOE
1980 12 11.15	8.7	S	S	8.0	B		10	4.5	4			MOR02
1980 12 11.59	7.3	S		20.3	L		38	4	6	0.12		BOE
1980 12 11.90	8.7	A		8.0	B		20					BOU
1980 12 11.91	9.1	A		11.0	R		25					COM
1980 12 11.92	8.9	A		11.0	L		30	4				BUS
1980 12 11.93	9.0	A		11.0	L		30					FEI
1980 12 11.97	9.2	A		25.0	L		70					KUI
1980 12 12.59	7.3	S		20.3	L		38	4	6	0.12		BOE
1980 12 13.92	8.8	A		8.0	B		20					BUS01
1980 12 13.92	8.9	A		8.0	B		20					BOU
1980 12 14.00	9.1	A		25.0	L		70	& 2				KUI
1980 12 14.00	8.7	A		14.7	R		65					COM
1980 12 14.05	9.0	A		6.7	R		12					BUS01
1980 12 14.96	9.2	A		11.0	L		30	3				FEI
1980 12 14.96	9.2	A		11.0	L		40					FEI
1980 12 14.96	9.2	A		11.0	L		25					FEI
1980 12 14.96	9.3	A		11.0	L		48					FEI
1980 12 14.96	9.7	A		11.0	L		100					FEI
1980 12 14.96	9.4	A		11.0	L		67					FEI
1980 12 14.98	9.1	A		25.0	L		70					KUI
1980 12 15.54	7.5	S		20.3	L		38	2	7			BOE
1980 12 16.89	9.3	A		14.7	R		65					COM
1980 12 16.92	9.3	A		14.7	R		65	2.5				BUS01
1980 12 17.11	8.8	S	B	7.5	R		56	3.0	6			MOR02
1980 12 25.11	8.7	S	B	32.0	L		56	3.0	7			MOR02
1980 12 25.29	9.5	V		30.0	L		50	3	1/	0.07	10	TUB
1980 12 25.30	9.5	V		30.0	L		50	3	1/	0.07	10	HOR
1980 12 25.76	9.2	A		15.6	L		30					BOU
1980 12 25.76	9.1	A		8.0	B		20					BOU
1980 12 25.78	9.6	A		14.0	L		38					FEI
1980 12 25.79	9.5	A		25.0	L		70					KUI
1980 12 26.76	9.2	A		15.6	L		30	4				BOU
1980 12 27.10	8.9	S	B	32.0	L		56	2.7	6	0.00	162	MOR02
1980 12 27.86	9.5	A		14.0	L		38					FEI
1980 12 27.86	9.2	A		15.6	L		30					BOU
1980 12 27.90	9.2	A		14.7	R		65	3.5	7			BUS01
1980 12 27.90	9.6	A		24.0	L		70					KUI
1980 12 31.31	9.2	V		15.0	L		50	2	5		295	BRL
1981 01 01.09	9.1	S	B	32.0	L		56	2.5	6			MOR02
1981 01 01.39	8.9	S	S	25.4	L	4	36					MAC
1981 01 01.39	9.1	S	M	25.4	L	4	36					MAC
1981 01 01.39	9.2	S	B	25.4	L	4	36	4	6			MAC
1981 01 02.33	9.6	V		15.0	L		50	2				BRL
1981 01 02.37	9.1	S	S	25.4	L	4	36					MAC
1981 01 02.37	9.3	S	B	25.4	L	4	36	4	6			MAC
1981 01 02.37	9.1	S	M	25.4	L	4	36					MAC

Periodic Comet Stephan-Oterma (1980g) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 01 02.37	9.3	S	B	25.4	L	4	36	4	6			MAC
1981 01 02.37	9.1	S	M	25.4	L	4	36					MAC
1981 01 03.84	9.4	A		11.0	L		30					BOU
1981 01 03.84	9.5	A		11.0	L		30	3				FEI
1981 01 03.84	9.3	A		11.0	L		30	3				BUS01
1981 01 04.84	10.1	A		14.7	R		65					COM
1981 01 05.77	10.3	Q		7.0	R		60	0.3	4			FUL
1981 01 07.03	10.4	A		11.0	L		40	1.75				FEI
1981 01 07.77	9.8	Q		7.0	R		36	0.7	1			FUL
1981 01 09.77	10.0	Q		7.0	R		60	0.7	1			FUL
1981 01 10.33	10.0	V		30.0	L		50	3	1	0.07		HOR
1981 01 10.33	10.0	V		30.0	L		50	3	1	0.07		TUB
1981 01 10.87	9.7	A		25.0	L		70					KUI
1981 01 10.94	9.7	A		15.6	L		30 &	4				BOU
1981 01 10.95	10.0	A		15.6	L		30 &	2.5				BUS01
1981 01 10.97	9.6	A		11.0	L		30	4.0				FEI
1981 01 11.00	9.8	A		11.0	R		65					COM
1981 01 11.09	9.4	S	M	32.0	L		70	2.5	6			MOR02
1981 01 11.33	10.5:			30.0	L		50	3	1			TUB
1981 01 13.40	9.7	S	B	25.4	L	4	36	3	6			MAC
1981 01 13.40	9.4	S	S	25.4	L	4	36					MAC
1981 01 13.40	9.5	S	M	25.4	L	4	36					MAC
1981 01 21.98	10.0	A	S	25.0	L	7	70	3	4/			MOR
1981 01 24.78	10.6	A		25.0	L		79	2.3	4	0.07	145	BAR
1981 01 24.78	10.8	A		11.0	L		30					FEI
1981 01 24.78	10.6	A		25.4	L		79	2.3	4	0.07	145	CAV
1981 01 24.87	10.3	A		15.6	L		30					BOU
1981 01 24.88	11.0	A		25.0	L		70	3				KUI
1981 01 25.03	10.2	A		32.0	L	6	55	2.3	3	?	180	BOR
1981 01 25.05	10.7	S	M	32.0	L		70	2.0	4			MOR02
1981 01 25.12	10.0	A	M	25.0	L	7	70	1.8	4	?	120	MOR
1981 01 25.78	11.1	A		14.7	R		65					COM
1981 01 25.78	11.0	A		14.7	R		65	2				BUS
1981 01 25.80	10.4	A		15.6	L		30		3			BOU
1981 01 25.81	10.8	A		11.0	L		30					FEI
1981 01 25.87	11.2	A		25.0	L		70					KUI
1981 01 26.00	10.1	A	M	25.0	L	7	70	1.8	3			MOR
1981 01 26.02	10.1	A	S	32.0	L	6	55	2.8	3	?	180	BOR
1981 01 26.22	9.9	S	S	25.4	L	4	36	3	3			MAC
1981 01 28.76	10.2			15.0	L		50	1.5				BRL
1981 01 30.18	10.3	A	S	25.0	L	7	70	2.4	2/			MOR
1981 01 31.02	10.3	A	S	32.0	L	6	55	3.5	2	?	180	BOR
1981 02 01.18	10.4	A	S	25.0	L	7	70	2.2	3			MOR
1981 02 02.06	11.0	S	B	32.0	L		45	1.0	7			MOR02
1981 02 04.18	10.5	A	S	25.0	L	7	70	2.1	2/			MOR
1981 02 04.87	11.7	A		25.0	L		57					KUI
1981 02 06.01	10.5	A	S	32.0	L	6	55	2.5	2/	?	180	BOR
1981 02 06.17	10.5	A	S	25.0	L	7	70	2.3	2			MOR
1981 02 07.18	10.5	A	S	25.0	L	7	70	2.4	2			MOR
1981 02 10.07	10.6	A	S	32.0	L	6	55	2.4	2			BOR
1981 02 10.19	10.6	A	S	25.0	L	7	70	3	3			MOR
1981 02 11.01	12.1	A		25.0	L		57					KUI
1981 02 28.02	12.7	S	B	32.0	L		45	0.5	2			MOR02

THE DISCOVERY OF PERIODIC COMET BOETHIN 1975 I (1975a)

by The Reverend Leo Boethin, Abra, The Philippines

A native of Germany, I was assigned in 1950 to the northern province of Abra in the Philippines, northeast of Bangued in the village of Mudeng (17°37′ N, 120°36′ E). Besides daily weather observations, I have had much interest in meteor observing. From December through April, Abra skies are usually brilliantly clear. In contrast, from May to November we have our rainy season, and observing conditions are very unfavorable.

In January 1973, I found what may have been a comet, of magnitude 9.5 in the constellation Crater. I observed its motion for 3 consecutive days, when it suddenly faded to magnitude 13.0 and was lost.

Better luck came almost two years later, on 1975 January 4, when I was sweeping in vertical strips the western sky with an 8-inch Newtonian reflector. After 20 minutes, a diffuse, roundish, nebulous object came into view in the constellation Pisces. A check with Vehrenberg′s "Photographic Staratlas" at the same position showed nothing. The next late evening of January 5--the intervening hours were to me an eternity of suspension--I found that the nebulous object had moved further east-northeastward with respect to the surrounding star-field. Not satisfied with two detailed observations, I continued to observe and measure the new object in right ascension and declination. Being aware of the risk that this object might be discovered also by other observers, I sent an airmail letter to Dr. Brian Marsden at the Central Bureau for Astronomical Telegrams. When my letter arrived after 10 days, the moon was already a problem for the 12.0-magnitude object. I myself was able to secure eight approximate positions until January 16, when the moon was 15 percent illuminated. I was confident in finding the comet after full moon on account of my 8 observations.

Thus on January 29, two days after full moon, I excitedly located the comet almost at the very spot where I expected it to be. Finally, after 2 days delay, I sent a cablegram to Dr. Marsden with the last position from February 1; Marsden had received no word on the comet since my letters of mid-January, unfortunately. Charles Scovil may have observed the comet visually from Connecticut on February 4, but the first definite observation other than mine was not made until February 9 by John Bortle in Stormville, New York (cf. IAUC 2745).

In his confirmatory letter on February 10, Dr. Marsden said: "The circumstances of the discovery and confirmation of this comet are quite incredible, and there has not been a comparable delay over announcing a definite visual cometary discovery since the breakdown of international communications during World War II."

Incidentally, Mr. John Bortle, according to his letter on February 12, apparently swept over my comet one month earlier during his regular sweeping sessions. But the comet was a little too faint for detection in his instrument when it was located in the southwest.

It is curious as to why this comet has not been found at previous perihelion passages, as it became clear by the first half of March that this was a short-period comet with a period of about 11 years (cf. Marsden 1979, Catalogue of Cometary Orbits, Third Edition, p. 31); this means that my comet will return with P/Halley in 1986!

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NOTE: Part III of Charles Morris′ three-part series on "A Review of Visual Comet Observing Techniques" will be published in the next issue.

EXTENDED EPHEMERIS FOR COMET PANTHER (1980u)

The following ephemeris revises and extends that published on page 14 of the last issue. The elements are from M.P.C. 5837.

Date	ET	R. A. (1950)	Decl.	Delta	r	Elong.	Mag.
1981 05	01	$08^h21^m.19$	$+42°19'.7$	2.014	2.061	78°.3	10.2
1981 05	06	08 26.02	+39 14.7				
1981 05	11	08 30.83	+36 24.8	2.222	2.138	72.0	10.5
1981 05	16	08 35.62	+33 48.4				
1981 05	21	08 40.40	+31 23.8	2.438	2.219	65.5	10.9
1981 05	26	08 45.16	+29 09.6				
1981 05	31	08 49.90	+27 04.6	2.656	2.303	58.9	11.2
1981 06	05	08 54.63	+25 07.5				
1981 06	10	08 59.33	+23 17.4	2.871	2.389	52.3	11.6
1981 06	15	09 04.01	+21 33.5				
1981 06	20	09 08.65	+19 54.8	3.078	2.477	45.6	11.9
1981 06	25	09 13.27	+18 20.7				
1981 06	30	09 17.85	+16 50.7	3.275	2.566	39.0	12.2
1981 07	05	09 22.39	+15 24.2				
1981 07	10	09 26.88	+14 00.8	3.459	2.657	32.4	12.4
1981 07	15	09 31.33	+12 40.0				
1981 07	20	09 35.72	+11 21.6	3.627	2.749	25.9	12.7
1981 07	25	09 40.06	+10 05.2				

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UNIVERSAL TIME (UT): This time based on the Greenwich meridian is used throughout the ICQ; it is 24-hour time, from midnight to midnight. In North America, add the following numbers to standard times to convert to UT: EST, 5; CST, 6; MST, 7; PST, 8. For daylight savings time, add 4, 5, 6, and 7 hours, respectively.