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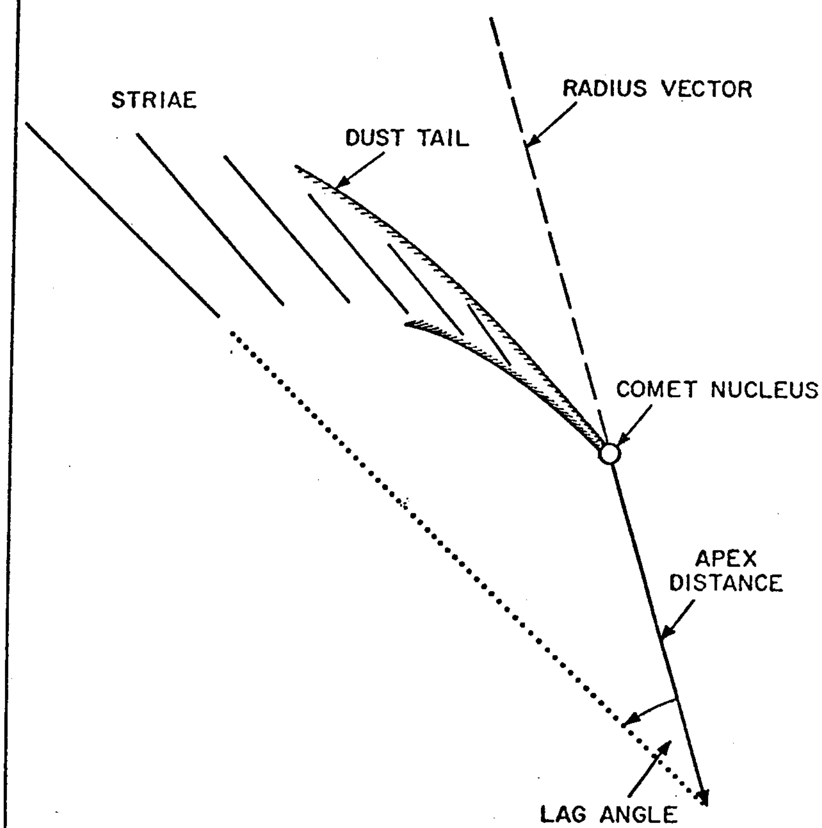

Studying fragmentation phenomena in comets.
This is Fig. 1 of Z. Sekanina's article (see page 95).

INSIDE THIS ISSUE

THE INTERNATIONAL COMET QUARTERLY (ICQ) is a non-profit journal devoted to news and observation of comets. Issues are published 4 times per year (January, April, July, and October). The ICQ is published by the Department of Physics and Astronomy at Appalachian State University and is mailed from Boone, North Carolina, U.S.A.

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All cometary observations should be sent to C. S. Morris; Prospect Hill Rd.; Harvard, MA 01451, U.S.A. Back issues are available from Dr. T. L. Rokoske, Dept. of Physics and Astronomy; A.S.U.; Boone, NC 28608, U.S.A.

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This issue is No. 40 of the publication originally called THE COMET, founded in March 1973, and is Vol. 3, No. 4, of the ICQ.

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FROM THE EDITOR

With this issue we welcome Mr. Graham Keitch to the Staff of the ICQ as the British Coordinator. Mr. Keitch is an active member of the Comet Section of the British Astronomical Association (B.A.A.), and is an avid comet observer. As British Coordinator for the ICQ, Mr. Keitch will be collecting physical observations of comets made by observers in Britain and passing them on to Charles Morris to be included in the ICQ computer files.

Due to unforseen problems with the university printer at Appalachian State University, the July issue of the ICQ sat in limbo, in photographic negative form, for some two months before it could be printed. The Staff is currently working on this situation to determine whether a new printer may be necessary, as the A.S.U. Print Shop is overloaded much of the year with many print jobs. We ask our readers to bear with us; we would like to note that we don't expect any more 2-month delays in publication, however.

By request, the Whole Number of this publication, that is, the number of THE COMET, is now being published on the front cover of each issue, as this number is used to denote the expiration issue for special subscribers. We also remind readers that the special rate is now $6.00/year. Because of inflation and the fact that we cannot predict when we will have to increase subscription rates, we ask that subscribers not send money for more than two years at a time.

--Daniel W. E. Green
Cambridge, Mass., 1981 Oct. 31

ON THE PECULIAR DUST TAILS OF SOME COMETS AND THE HISTORY OF ONE INVESTIGATION*

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Dust tails of comets seldom show any structure. They usually curve gently away from the sun, displaying, as a rule, rather a sharply defined boundary on the side of the prolonged radius vector and a more diffuse boundary on the other side. The intensity decreases smoothly with increasing distance from the nucleus. The celebrated comet West 1976 VI was one of several exceptions, its dust tail showing more than one type of structure; one type had up to two dozen practically straight bands of light stretching across the tail background. The striae -- as they are usually referred to -- were not at all easy to detect visually, not even with the aid of binoculars. However, on photographs taken with small, fast cameras they showed up rather conspicuously, especially when panchromatic emulsion was used.

It has been known for more than a century that particle motions in the dust tail are relatively slow, so it takes the comet some time to build a tail. As a result, the history of dust emission from the comet is preserved in the tail for a limited period of time, and relevant information on the dust can be recovered from observations, if one knows how to "read" the tail. While a general method to do so was developed relatively recently, it has been known since 1861 that particles subjected to a wide range of repulsive accelerations and ejected from the comet in an outburst will line up in the tail to form a nearly straight streamer that points to and practically reaches the nucleus. Early in this century the physical nature of the repulsive force was identified as radiation pressure from the sun and the broad range of repulsive accelerations was explained by the fact that particles of various sizes, densities, and optical properties are affected very differently by radiation pressure. Although there is, technically, a small gap between the tip of a streamer and the nucleus, the heaviest ejecta that populate the tip move so slowly relative to the comet that no gap should be seen on relevant timescales. The streamer's width is a product of the outburst duration and scatter of particle ejection velocities.

A number of comets' tails have exhibited dust streamers, including West. They behave exactly as expected for outburst-originating ejecta, and their orientations in the dust tail can be used to pinpoint the times of outbursts with remarkable precision, often to a fraction of a day.

The striae, on the other hand, pose major problems. They are separated from the nucleus by huge gaps, and, most importantly, they intersect -- when extended beyond visible length -- the radius vector on the sunward side of the nucleus (see Fig. 1, page 93). Although various qualitative hypotheses, mostly involving a presumed interaction of charged dust with the solar wind, have been suggested in the past two decades, until recently the motions of the striae through the tail had not been understood and no quantitative, dynamically sound model developed and tested.

In the following I use the invitation of the Editor of the _International Comet Quarterly_ to describe my work on this intriguing subject, supported by the Planetary Atmospheres

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*This article was written under contract NAS 7-100 to the Jet Propulsion Laboratory, California Institute of Technology, from the National Aeronautics and Space Administration Planetary Atmospheres Program.

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Program of the National Aeronautics and Space Administration, and the invaluable collaboration of Dr. J. A. Farrell. Our contributions that relate to the problem are documented by published papers, research notes, and presentations, a chronological list of which is enclosed for the benefit of the readers who wish to get acquainted with various technical details.

I first got seriously involved with the subject in 1974. Oddly, my interest was aroused by comet Kohoutek 1973 XII, although it showed no striae. However, I was convinced that I detected evidence for vaporizing dust particles in the comet's anti-tail and wondered whether striae could consist of vaporizing dust ejected in an outburst. With disparities outweighing similarities between theory and the observed properties of the striae in comet Mrkos 1957 V, the tentative consideration of particle evaporation led me to a much more definite concept of particle fragmentation far in the tail. Fragmentation appeared to explain in a very natural way both the gaps and orientations of the striae. The mathematical formulation of the model turned out to be straightforward, though rather tedious in cases of multiple fragmentation, i.e., when more than two generations of particles should be involved. For a single fragmentation the model has only three parameters: the time of ejection of parent (first-generation) particles; a constant repulsive acceleration on these particles; and the time of their fragmentation into daughter (second-generation) particles. Since the orientation of a stria at a particular time is described by only two constants (the angle it subtends with the radius vector and the point of intersection), the model testing clearly required more than one observation. The need for investigation of day-to-day motions of striae was thus demonstrated.

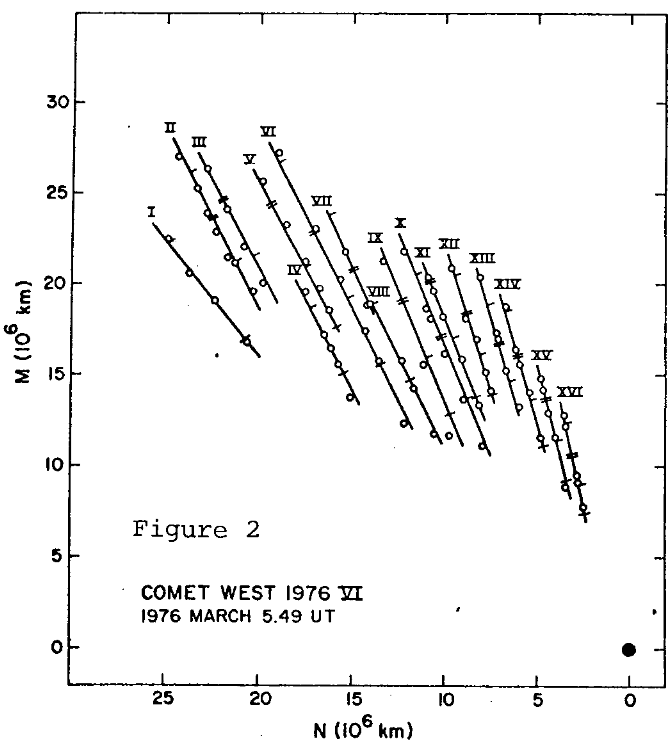
It was now 1975, and still a long way to prove the viability of the model. Comet Mrkos was the best bet for a thorough test, even though only two photographs on two consecutive days were published. I made efforts to locate more systematic series of observations. One of the pursued avenues proved immensely fruitful. Thanks to the late Dr. J. Ashbrook, of the Sky Publishing Corporation, and his contacts with the Dallas Planetarium, I was able to locate Dr. J. A. Farrell, now at the Los Alamos National Laboratory, and to visit him (exactly) 18 years after he had photographed comet Mrkos with his Schmidt telescope. The thor of one of the two published consecutive photographs, he not only turned out to be in possession of a beautiful series of the comet's pictures from several consecutive nights, but he also offered generously his collaboration which involved access to the Laboratory's image processing facility, a technology unavailable to me at the Center for Astrophysics, where I worked at that time. This service proved later indispensable, as the striae on the comet's unprocessed images could not be measured with the measuring engine because of the significant loss of contrast under magnification.

Dr. Farrell's and my plans to collaborate on the analysis of his photographic observations of comet Mrkos were unexpectedly upset by a new celestial visitor. Comet West passed through perihelion in late February 1976, and by mid-March, a flood of photographs of its striated tail, far richer than comet Mrkos could offer, started to arrive. Courtesy of the editors of Sky and Telescope, I had an opportunity to inspect a large number of photographs of the comet taken by observers in several countries. About two dozen of them were selected, most of which were digitally processed at Los Alamos by D. H. Janney and R. O'Connor, and four, on as many consecutive days, were eventually used in the investigation.

The next step was a careful determination of the positions of the striae relative to the nucleus of the comet. The optical distortion of small, wide-field cameras is so severe that, if not eliminated or at least minimized, it would have a devastating effect on the results. Measurements of the striae with the measuring machine was now greatly facilitated, thanks to the image processing. The rectangular coordinates of each measured point were converted to right ascension and declination by the method of dependences, using a densely distributed set of comparison stars as a reference grid. The equatorial coordinates were then transformed to a rectangular system of coordinates in the tangent plane of the sky at the nucleus.

By early 1978 the postional reduction of the four photogtraphs was completed. The progress of the analysis itself was rather slow until February 1979, when at last I was able to apply successfully an efficient method for stria identification. There was no question now that the particle-fragmentation model was indeed consistent with the motions of striae on all photographs (for one example, see Fig. 2). The interpreted evolution of the striae is vividly illustrated by a computer-generated movie that Dr. Farrell made on the basis of these results and presented at a comet conference in Tucson, Ariz., in March 1981. Since the model entailed severe restrictions on particle properties, the proposed physical interpretation had to employ somewhat unconventional concepts. Perhaps the most intriguing result was the inferred structure of the parent particles -- they must have been strongly nonspherical, possibly chain-like aggregates of submicron-sized, absorbing grains. They originated in outbursts -- the same events that were responsible for the streamers -- and they appeared to group into discrete particle types. Rotational bursting caused by a "windmill" effect of radiation pressure was tentatively suggested as a possible fragmentation mechanism.

We feel that much of the mystery that clouded the nature of the striated dust tails of comets for so long has now been removed. We hope to learn still more by studying next our original target of analysis -- comet Mrkos, and then another striated comet -- the Great January Comet 1910 I. All this on the assumption that nature will not soon provide us with a new surprise.



List of Related Technical Papers

1. Sekanina, Z. (1976). Progress in our understanding of cometary dust tails: A review. In The Study of Comets, ed. by B. Donn, M. Mumma, W. Jackson, M. A'Hearn, R. Harrington; NASA SP-393, Washington, D.C., pp. 893-939. [See pp. 919-930.]
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(Continued on next page)

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4. Sekanina, Z., and Farrell, J. A. (1978). Comet West 1976 VI: Discrete bursts of dust, split nucleus, flare-ups, and particle evaporation. Astron. J. 83, 1675-1680.
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*(The asterisk indicates the major paper.)

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RECENT NEWS OF COMETS

The biggest news item to hit the headlines in recent weeks concerning comets was the announcement of the apparent-sungrazing comet of August 30-31, 1979. This object was found this past summer by a group of investigators at the E. O. Hulbert Center for Space Research of the Naval Research Laboratory in Washington, D.C. The object in discussion was found because of the existence of the NRL′s orbiting SOLWIND coronagraph on board the U.S. Air Force Space Test Program′s P78-1 satellite; see IAUC 3640. Due to delays in the release of the tapes by the Air Force, the discovery of the probable comet did not occur until nearly two years after its apparition, when D. J. Michels, N. R. Sheeley, Jr., R. A. Howard, and M. J. Koomen began reducing the data from 1979.

The object found by the NRL investigators looks very much like a comet, exhibiting what appear to be a tightly-condensed nuclear region and a long tail pointing away from the sun. The planet Venus is in the pictures, and the head of the supposed comet is very similar to Venus in brightness, putting at around -3.5 magnitude. The coronagraph normally takes exposures (digital images) every 10 minutes, and a series of photos was assembled which shows the "comet" moving from a distance of 6 solar radii to 2.5 radii in about 2.4 hours; the object reached the edge of the coronagraph′s occulting disk (which extends to 2.5 times the sun′s radius) at August 30.9 UT.

The photographs depicting the apparent sungrazer are really quite convincing. As the head was not seen to emerge on the other side of the occulting disk, it appears that the object itself disintegrated at some stage close to the sun. Dr. Z. Sekanina, Jet Propulsion Laboratory, is currently working with the photographs in an attempt to determine the actual perihelion distance based upon the tail material. Some bright diffuseness on the opposite side of the occulting disk a few hours after perihelion is likely part of the tail or some other fingerprint of the comet itself. Whether the comet actually collided with the sun (perihelion less than 1 solar radius) or disintegrated in the solar atmosphere (> 1 solar radius) is unclear at this writing. Sekanina's previous work in this area (see his article on page 95 of this issue) should help to shed light on the answer to this question.

OTHER COMETS.

Last fall, winter, and spring saw no less than ten comets come into the visual observing range of a 25-cm reflecting telescope. However, these objects have now receded from the vicinities of the earth and sun, and visual observers have again experienced a "lean" period. Observers should remember, however, that P/comet Schwassmann-Wachmann 1 can experience significant outbursts at any time, and an ephemeris was provided on p. 92 of the last issue.

P/Swift-Gehrels (1981j) was recovered by Cheng-Yuan Shao and Gunther Schwartz with the 155-cm reflector at Oak Ridge Observatory (in Harvard, MA, some 30 miles west of Cambridge) on July 31 as a stellar, 18.5-nuclear-magnitude object. Comet 1981j has brightened to nearly 12th magnitude (visual) as of this writing, and an ephemeris for this comet, based on elements on MPC 5638 (cf. IAUC 3622), is given below.

Another comet which may become bright enough to be visually glimpsed in a 25-cm reflector is P/Kearns-Kwee (1981h), an object that was recovered in June/July (cf. IAUC 3618, 3625). This comet may reach total magnitude 13-14 in late December or early January, and the ephemeris below is based upon elements from MPC 5129.

Other comets recently discovered or recovered are all much fainter. The recovery of P/Gehrels 2 (1981f) has now been confirmed by observers at Oak Ridge Observatory (cf. ICQ 3, 75), as noted in MPC 6226; the nuclear magnitude was indicated as 19 in August.

Luis E. Gonzalez discovered a cometary trail on two plates obtained with the Maksutov astrograph at the Cerro El Roble station of the University of Chile on June 29. The 15th-magnitude diffuse object had some condensation, and it was moving southeastward in the constellation Phoenix, then some three months after its closest approach to the sun of 2.3 AU. Comet Gonzalez was designated comet 1981g (cf. IAUC 3617, 3618).

P/Slaughter-Burnham was given the preliminary designation 1981i following its recovery by Schwartz and Shao in July. Shao noted the July 28 photographic image of this comet as slightly diffuse, with condensation, at total magnitude 19.5 (IAUC 3621).

Ellen Howell of Cal Tech discovered a 15th-magnitude comet (1981k) on plates taken with the 18-inch (46-cm) Schmidt telescope at Palomar (cf. IAUC 3631) on August 29 and 30. Dr. Brian Marsden, Smithsonian Astrophysical Observatory, showed this new comet to be of short-period, circling the sun once every 5.9 years in an orbit of eccentricity 0.50 (cf. IAUC 3636).

--D.W.E.G. (1981 November 4)

EPHEMERIS FOR P/COMET SWIFT-GEHRELS (1981j)

Date ET	R. A. (1950)	Decl.	Delta	r	Elong.	Mag.
1981 11 22	22 56.57	+14 12.6	0.652	1.362	110.7	11.6
1981 11 27	23 09.44	+15 18.7				
1981 12 02	23 23.35	+16 25.6	0.683	1.362	108.0	11.7
1981 12 07	23 38.20	+17 32.6				
1981 12 12	23 53.85	+18 38.7	0.723	1.372	106.0	11.9
1981 12 17	00 10.17	+19 43.0				

EPHEMERIS FOR P/COMET SWIFT-GEHRELS (1981j) (Cont.)

Date ET	R. A. (1950)	Decl.	Delta	r	Elong.	Mag.
1981 12 22	00 27.04	+20 44.6	0.773	1.394	104.4	12.1
1981 12 27	00 44.33	+21 42.8				
1982 01 01	01 01.91	+22 37.0	0.835	1.424	102.8	12.3
1982 01 06	01 19.65	+23 26.8				
1982 01 11	01 37.43	+24 11.6	0.911	1.464	101.2	12.7
1982 01 16	01 55.13	+24 51.4				
1982 01 21	02 12.68	+25 25.9	1.002	1.512	99.2	13.0
1982 01 26	02 30.00	+25 55.4				

EPHEMERIS FOR P/COMET KEARNS-KWEE (1981h)

Date ET	R. A. (1950)	Decl.	Delta	r	Elong.	Mag.
1981 11 22	06 54.44	+34 07.3	1.402	2.225	136.5	14.2
1981 11 27	06 54.33	+34 07.2				
1981 12 02	06 53.32	+34 05.4	1.335	2.224	146.4	14.1
1981 12 07	06 51.48	+34 01.2				
1981 12 12	06 48.90	+33 54.4	1.287	2.225	156.6	14.0
1981 12 17	06 45.70	+33 44.3				
1981 12 22	06 42.03	+33 30.8	1.263	2.230	166.1	14.0
1981 12 27	06 38.07	+33 13.5				
1982 01 01	06 34.04	+32 52.4	1.263	2.238	170.0	14.0
1982 01 06	06 30.14	+32 27.9				
1982 01 11	06 26.56	+32 00.4	1.289	2.248	163.3	14.1
1982 01 16	06 23.46	+31 30.5				
1982 01 21	06 20.98	+30 58.8	1.339	2.262	153.3	14.2
1982 01 26	06 19.21	+30 26.1				

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A REVIEW AND RECALCULATION OF BOBROVNIKOFF'S PHOTOMETRIC POWER-LAW SOLUTIONS FOR P/COMET HALLEY 1910 II

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Prospect Hill Observatory, Harvard, Massachusetts

and

Daniel W. E. Green
Smithsonian Astrophysical Observatory

ABSTRACT. The photometric solutions for the 1909-10 observations of P/comet Halley have been recalculated using the individual observations given by Bobrovnikoff (1941, 1942) and using a better ephemeris. The results obtained here are compared with Bobrovnikoff's solutions based upon normal places.

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The upcoming apparition of P/Halley has generated considerable interest in the astronomical community. This has been highlighted by the formation of the International Halley Watch (IHW), which is being sponsored by NASA and coordinated through the Jet Propulsion Laboratory (JPL). In preparing for the 1986 apparition of comet Halley, observations made during previous appearances are being reviewed so that the gross behavior of the comet can be projected (e.g., see Yeomans 1981). These analyses will permit better planning of the various projects to

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be conducted under the IHW. As part of this effort, we have reviewed and reanalyzed N. T. Bobrovnikoff's light curve of P/Halley 1910 II, using his original data.

Bobrovnikoff (1942, 1943) analyzed the P/Halley 1910 II light curve as part of his massive study of comet brightness. In that study, Bobrovnikoff collected 252 observations of P/Halley made by more than 32 observers. These observations were corrected to a standard photometric system and averaged into normal places. Bobrovnikoff then fitted the data, using least square methods, to the standard power-law formula

$$H = H_o + 5 \log \Delta + 2.5n \log r, \quad (1)$$

where H is the observed magnitude, Δ and r are the comet's geocentric and heliocentric distances, respectively, and the least-squares-fitted parameters are H_o , the absolute magnitude, and n, the comet's specific brightness parameter.
If the residuals were not satisfactory and showed systematic variation, he would, by trial and error, include cyclic variations. Many times these periodic trends were attributed to moonlight effects. However, Bobrovnikoff believed that other cyclic trends were intrinsic to the comet.

In the present study, we have reviewed Bobrovnikoff's original analysis. Evaluations of the effects on the photometric results of using normal places versus individual observations, and of using different ephemerides, were conducted. For these analyses, we utilized the individual observations, corrected to a standard photometric system, and the normal places quoted in Bobrovnikoff's paper in Tables 25 and 70, respectively.

For the purpose of this study, we have ignored Bobrovnikoff's periodic solutions to the light curve. We have concentrated instead upon reviewing the standard power-law formula results. Bobrovnikoff gives the following values:

Entire light curve (Normal places I-XXV): $H_o = 5.70 \pm 0.13$ (p.e.)
$n = 3.71 \pm 0.65$ (p.e.)
range in r: 2.75-0.59-1.47 AU.

Normal places I-XI:
$H_o = 5.27 \pm 0.15$ (p.e.)
$n = 5.52 \pm 0.21$ (p.e.)
range in r: 2.75-1.06 AU.
(2)

Normal places XII-XVI:
$H_o = 6.31 \pm 0.10$ (p.e.)
$n = 5.30 \pm 0.24$ (p.e.)
range in r: 0.59-0.89 AU.

Normal places XVII-XXV:
$H_o = 5.22 \pm 0.03$ (p.e.)
$n = 0.40 \pm 0.20$ (p.e.).
range in r: 0.92-1.47 AU.

Using the ephemeris utilized by Bobrovnikoff, all of the above results except those for the entire light curve can be reproduced. Bobrovnikoff's values for the entire light curve are in error, and should read:

$$H_o = 5.44 \pm 0.11 \text{ (p.e.)}$$
$$n = 4.76 \pm 0.23 \text{ (p.e.)}. \quad (3)$$

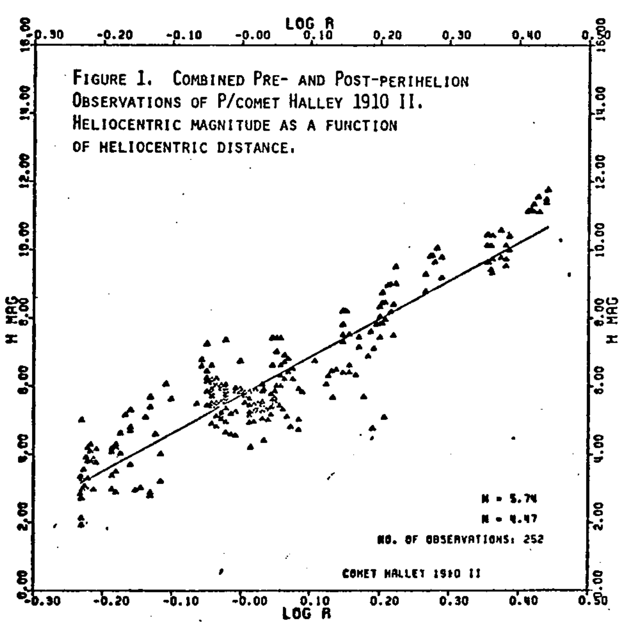

FIGURE 1. COMBINED PRE- AND POST-PERIHELION OBSERVATIONS OF P/COMET HALLEY 1910 II. HELIOCENTRIC MAGNITUDE AS A FUNCTION OF HELIOCENTRIC DISTANCE.

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To evaluate the effects of using a better ephemeris, Yeomans' orbital elements (Marsden 1979) for comet 1910 II were used to generate a new ephemeris. When used in the analysis of Bobrovnikoff's normal places for the entire light curve, the following values were obtained:

$H_0 = 5.54 \pm 0.10$ (p.e.)
$n = 4.68 \pm 0.20$ (p.e.). (4)

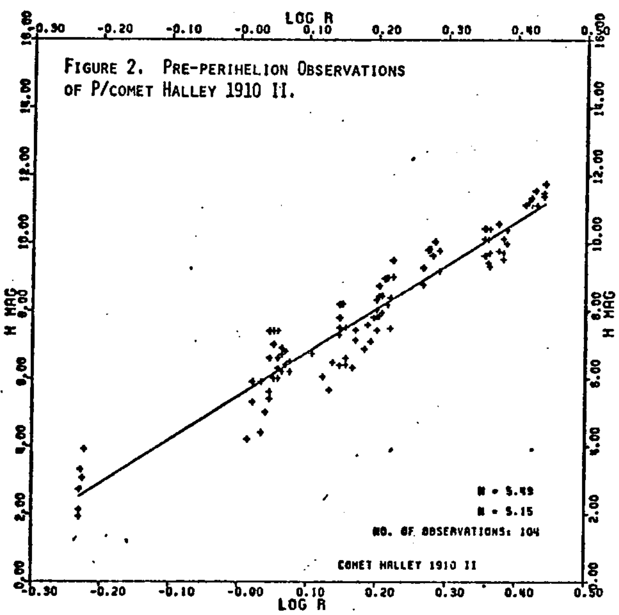

FIGURE 2. PRE-PERIHELION OBSERVATIONS OF P/COMET HALLEY 1910 II.

The solutions given in (3) and (4) are quite similar, suggesting that the different ephemerides have only a small effect on the resulting photometric parameters.

A similar comparison on the effect of using normal places versus individual observations was conducted by analyzing the individual observations for the entire light curve using the new ephemeris (see Figure 1). The least squares results are:

$H = 5.74 \pm 0.04$ (p.e.)
$n = 4.47 \pm 0.08$ (p.e.). (5)
range in r: 2.76-0.59-1.61 AU.

A small but significant difference is visible between the solutions given in (4) and (5). This indicates that the use of normal places does cause a slight bias in the photometric solution.

The pre-perihelion and post-perihelion light curves of P/Halley 1910 II are quite different. Thus, they have been analyzed separately using the individual observations with the following results:

Pre-perihelion
$H_0 = 5.49 \pm 0.07$ (p.e.)
$n = 5.15 \pm 0.10$ (p.e.)
range in r: 2.76-0.59 AU.
(6)

Post-perihelion
$H_0 = 5.44 \pm 0.05$ (p.e.)
$n = 2.70 \pm 0.17$ (p.e.).
range in r: 0.59-1.61 AU.

The preperihelion solution represents the observations well (see Figure 2). There are no obvious discontinuities or suggestions that n varies with heliocentric distance. However, the post-perihelion light curve does show a distinct break near r = 1 A.U. (see Figure 3). When receding from the sun, the comet appeared to fade rapidly (n = 6); after the comet reached about r = 1 A.U., however, its heliocentric brightness remained constant (n=0).

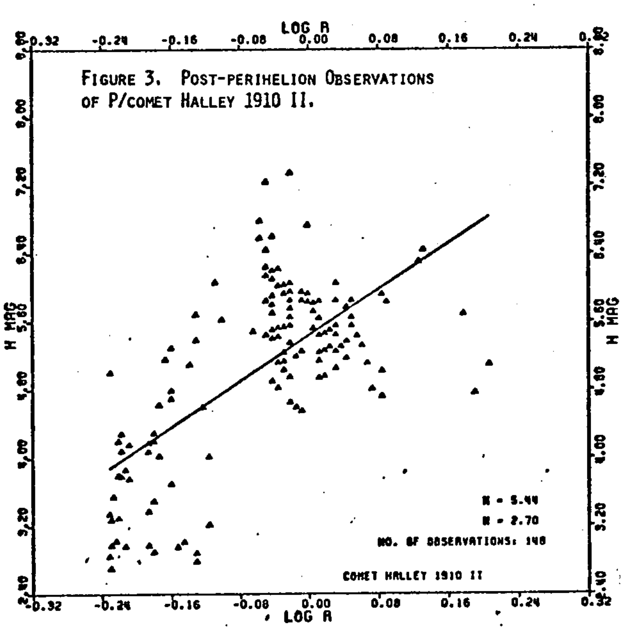

FIGURE 3. POST-PERIHELION OBSERVATIONS OF P/COMET HALLEY 1910 II.

A REVIEW AND RECALCULATION OF BOBROVNIKOFF'S PHOTOMETRIC POWER-LAW SOLUTIONS FOR P/COMET HALLEY 1910 II

This behavior is probably not intrinsic to the comet, but due to observational difficulties resulting from the comet's low altitude. Thus, the post-perihelion solution is not totally satisfactory.

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THE APPARITION OF P/SCHWASSMANN-WACHMANN 2 (1979k)

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Prospect Hill Observatory, Harvard, Massachusetts

Almost lost in the flurry of cometary activity in the last year, periodic comet Schwassmann-Wachmann 2 was recorded for its nineth apparition since its 1929 discovery. This comet, with perihelion distance at 2.1 AU, rarely comes within the reach of amateur-size instruments. However, because the perihelion passage of comet 1979k occurred near opposition, the comet brightened to 12th magnitude and was well-placed for observation.

Despite the favorable conditions, only the following four observers have reported observations of this comet.

OBSERVER	NUMBER OF OBSERVATIONS
John Bortle (BOR)	9
Charles Morris (MOR)	10*
Warren Morrison (MOR03)	2
C. Spratt (SPR)	4

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* One approximate observation was not included in magnitude analysis.

The observations extend over the period 1981 January 11 to March 28, during which time the comet's heliocentric distance ranged from 2.20-2.13-2.14 Astronomical Units.

During the period of observation, the comet's size was typically reported as being between 0.8′ and 1.2′. No trend is seen in the apparent coma diameter estimates. However, because was increasing, the comet's physical diameter also increased from about 55,000 to 80,000 km as it approached perihelion on March 17. The circular coma of P/Schwassmann-Wachmann 2 displayed a small central condensation during much of the apparition.

Because of the small range of r, it was not possible to obtain an accurate estimate of n. Thus, n was assumed to be 4 and the absolute magnitude with that assumption, H_{10}, was calculated. Using 24 aperture-corrected magnitude estimates, $H_{10} = 7.61 \pm 0.19$ (p.e.). This value of H_{10} is in agreement with the one reported in Meisel and Morris (1982) which was based on less data. As pointed out in the Meisel and Morris paper, there has been no significant secular decrease in the brightness of P/Schwassmann-Wachmann 2 since discovery.

REFERENCE

Meisel, D. D., and C. S. Morris (1982). Comet Head Photometry: Past, Present, and Future. In Comets (University of Arizona Press), in press.

TABULATION OF COMET OBSERVATIONS

Included here are only observations made within the past 2 years. We expect to publish observations going back to 1976 in the January issue, and we again ask those readers who have not already done so to send all of their ICQ-unpublished observations of comets made between 1976 and 1981 to Charles Morris (address on page 94).

We are currently working on a lengthy paper concerning sources of V (photoelectric) and visual magnitudes for use in making total visual magnitude estimates of comets (see ICQ 3, 68, Step 3 in col. 2). In fact, this issue is some three weeks late due to the work on this paper, as the article was to be published in this issue. The volume of work involved, however, has forced us to postpone publishing the paper until January, in order to get this issue "on the road." We will be then introducing a new 2-digit, alphanumeric code for the magnitude references as published in the ICQ; this measure has been long overdue.

The "correction" to the Observer Key on p. 78 of the last issue was rather ambiguous to those who did not look at the Key itself. What was meant was that the last name is correctly spelled, "Ujvárosy", but that the original code, "USV" will be retained.

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FOLLOWING ARE NEW ADDITIONS TO THE OBSERVER KEY:

ELT	05	MAURIZIO ELTRI, ITALY
STE05	05	KEITH W. STEWART, SC, U.S.A.
STO	05	ENRICO STOMEO, ITALY

Comet Bradfield (1979 X = 19791)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 02 02.79	6.0	A	S	8.0	B		20	7.8	4	0.41	112	KEI
1980 02 02.79	6.5	A	B	8.0	B		20					KEI
1980 02 02.79	5.8	A	S	5.0	B		10					KEI
1980 02 08.44	6.8	A	B	6.5	B		20					SEA
1980 02 10.80	8.1	S	S	8.0	B		20	6.6			117	KEI
1980 02 10.80				29.8	L	5	62			0.17	117	KEI
1980 02 10.80				29.8	L	5	62			0.07	165	KEI
1980 02 10.80	7.9	S	B	5.0	B		10	8.8				KEI
1980 02 11.46	7.6	A	B	6.5	B		20					SEA
1980 02 11.77	8.2	S	S	8.0	B		20	6.6	1/			KEI
1980 02 12.46	7.7	A	B	6.5	B		20					SEA
1980 02 12.87	8.1	S	B	8.0	B		20		2	0.17	90	KEI
1980 02 13.46	8.0	A	B	6.5	B		20					SEA
1980 02 15.46	8.4	A	B	6.5	B		20					SEA
1980 02 15.88	8.6	S	S	8.0	B		20	4.6	2	0.33	90	KEI
1980 02 16.79	8.8	S	B	5.0	B		10					KEI
1980 02 16.79	8.6	S	S	8.0	B		20	3.7	1	0.17	80	KEI
1980 02 16.79				29.8	L	5				0.17	80	KEI
1980 02 16.79	8.4	S	S	5.0	B		10					KEI
1980 02 17.42	8.6	A	B	6.5	B		20					SEA
1980 02 17.87	8.7	S	S	5.0	B		10					KEI
1980 02 17.87				29.8	L	5	53	4.8				KEI
1980 02 17.87	8.7	S	S	8.0	B		20	5.4	1	0.17	84	KEI
1980 02 19.86	9.0:		S	8.0	B		20	4.0				KEI

Comet Bradfield (1979 X = 19791)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 02 23.85	9.5:		S	29.8	L	5	62	4.0	1			KEI
1980 03 03.80	10.2	V	S	29.8	L	5	62	3.0	0/			KEI
1980 03 04.82	10.5	V	S	29.8	L	5	62	2.7	0			KEI
1980 03 07.84	10.8	V	S	29.8	L	5	62	3.2	1			KEI
1980 03 08.83	10.8:		S	29.8	L	5	62	2.7	0/			KEI
1980 03 09.82	11.0	V	S	29.8	L	5	62	2.2				KEI
1980 03 10.83	11.3	V	S	29.8	L	5	62	2.4	0			KEI
1980 03 12.83	11.4	V	S	29.8	L	5	62	2	0			KEI
1980 03 13.84	11.3	V	S	29.8	L	5	62	2.9	0			KEI
1980 03 17.84	11.7	V	S	29.8	L	5	62	2.0	0			KEI

Comet Meier (1980q)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 11 10.79	9.1	S	S	29.8	L	5	62	2.6	4		50	KEI
1980 11 11.79	9.3	S	S	29.8	L	5	62	2.6	4			KEI
1980 11 11.79	8.8	S	S	5.0	B		10					KEI
1980 11 11.79	8.9		S	8.0	B		20	3.8				KEI
1980 11 12.76	9.4	S	S	12.9	R	5	37		4/			KEI
1980 11 12.76	9.3	S	S	8.0	B		20	3.6				KEI
1980 11 17.82	9.5:			29.8	L	5	62	2.7				KEI
1980 11 25.82	9.1	S	S	8.0	B		20	4.2	4			KEI
1980 11 26.75	9.8	A	B	11.5	L		36					KUI
1980 11 26.75	10.1	A	B	15.6	L		30					BOU
1980 11 26.76	9.1	S	S	8.0	B		20	3.9				KEI
1980 11 26.76	8.9	S	S	5.0	B		10	4.8				KEI
1980 11 26.76				29.8	L	5	62	3.6	4	0.05	31	KEI
1980 11 26.78	10.0	A	B	14.3	L		31					BUS01
1980 11 27.79	9.1	S	S	8.0	B		20	4.2		0.07	97	KEI
1980 11 27.79				29.8	L	5	62	4.5	4/	0.20	110	KEI
1980 11 28.75	9.0	S	S	8.0	B		20	4.4		0.20	86	KEI
1980 11 28.75				8.0	B		20			0.17	58	KEI
1980 11 28.75				29.8	L	5	62	3.9	4/		70	KEI
1980 11 29.75	9.1	S	S	8.0	B		20	3.9		0.08	87	KEI
1980 11 30.73	10.0	A	B	15.6	L		30					BOU
1980 11 30.73	9.9	A	B	11.0	L		30	4				BUS01
1980 11 30.74	10.7	A	B	25.4	L		70					KUI
1980 11 30.77	9.3	S	S	29.8	L	5	62	2.9	4			KEI
1980 12 03.80	9.1	S	S	8.0	B		20	2.9				KEI
1980 12 04.73	10.2	A	B	15.5	L		38		2			FEI
1980 12 04.75	10.3	A	B	15.6	L		30	3				BUS01
1980 12 04.75	10.0	A	B	15.6	L		30					BOU
1980 12 06.77	9.0	S	S	8.0	B		20	4.0				KEI
1980 12 06.77				29.8	L	5	62	4.4	4/			KEI
1980 12 07.75	8.8	S	S	8.0	B		20	5.5				KEI
1980 12 07.75				29.8	L	5	62		4/			KEI
1980 12 08.74	9.9	A	B	15.6	L		30					BOU
1980 12 08.75	10.0	A	B	15.6	L		30					BUS01
1980 12 11.73	10.4	A	B	11.0	L		50		2			FEI
1980 12 11.75	9.9	A	B	15.6	L		30					BOU
1980 12 23.73	10.0	A	B	15.6	L		30					BOU
1980 12 26.74	10.0	A	B	15.6	L		30					BOU
1980 12 27.72	10.2	A	B	15.6	L		30	5	0			BUS01

Comet Meier (1980q) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 12 27.72	10.2	A	B	15.6	L		30	6	1/			BOU
1981 01 04.26	8.2	S	S	5.0	B		10					KEI
1981 01 04.26	8.4	A	S	8.0	B		20	7.2	3/			KEI
1981 01 05.24				29.8	L	5	62	4.6	3			KEI
1981 01 05.24	8.6	S	S	8.0	B		20	5.9				KEI
1981 01 07.21	10.1	A	B	15.6	L		30	3				BOU
1981 01 10.24	10.5	A	B	25.4	L		70					KUI
1981 01 11.21	10.1	A	B	15.6	L		30					BOU
1981 01 11.22	10.3	A	B	15.6	L		30		0			BUS01
1981 01 11.25	8.2	S	S	8.0	B		20	6.1				KEI
1981 01 11.25	8.1	A	S	5.0	B		10	7.7				KEI
1981 01 13.25	8.2	S	S	5.0	B		10	7.7				KEI
1981 01 13.25	8.4	S	S	8.0	B		20	4.4	2			KEI
1981 02 01.22	8.7	S	S	8.0	B		20	5.4	3			KEI
1981 02 10.24	8.7	S	S	8.0	B		20	4.3				KEI
1981 02 11.21	8.7	S	S	8.0	B		20	6.8	2			KEI
1981 02 13.17	10.4	A	B	15.6	L		30					BOU
1981 02 13.18	10.7	A	B	15.6	L		30					POI
1981 02 13.19	10.6	A	B	25.4	L		70	2.8	2			KUI
1981 02 13.23	8.6	S	S	8.0	B		20	5.8	2			KEI
1981 03 09.75	10.4	S	B	8.0	B		15		0			SEA
1981 03 10.75	10.4	S	B	8.0	B		15		0			SEA
1981 03 27.01	10.9	A	B	25.4	L		70	4	1			KUI
1981 03 27.92	11.0	A	B	14.7	R		65					COM
1981 03 27.92	10.3	A	B	14.7	R		65	6	0			BUS01
1981 03 27.98	10.6	A	B	15.6	L		30					BOU
1981 04 05.16	10.5:	Q	S	29.8	L	5	62	2.2	1			KEI
1981 04 06.06	10.9	V	S	29.8	L	5	62	2.0	1/			KEI
1981 04 27.98	13.1	A	B	14.7	R		65					COM
1981 04 27.98	11.6	A	B	25.4	L		70	3	1			KUI
1981 05 02.96	11.6	A	B	25.4	L		70					KUI

Comet Bradfield (1980t)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 01 05.94	4.1	X		3.5	B		7			5		MIL
1981 01 05.95				5.0	B		10		8	3	35	SAB
1981 01 05.96	4.0:	A		5.0	B		20	& 3.5	6/	0.75	80	MAT02
1981 01 07.98				12.7	R	5	17	& 5	8	5	35	SAB
1981 01 08.95	4.7	A		3.5	B		7			3.5		MIL
1981 01 08.96	5.2	A		5.0	B		20	& 3.5	8/	&0.50	90	MAT02
1981 01 08.97				12.7	R	5	17	5	7	6	35	SAB
1981 01 09.77				8.0	B		20	2.4	8	2.00	34	KEI
1981 01 09.77	4.9	A	S	5.0	B		10			4.00	34	KEI
1981 01 10.75	5.2	A	S	5.0	B		10		9	2.00	20	KEI
1981 01 10.95	5.2	A		3.5	B		7			1		MIL
1981 01 10.96	5.8	A		5.0	B		20			&0.75	90	MAT02
1981 01 11.00	5.4	A		8.0	R	15	30	& 3	7	1	35	STE05
1981 01 11.75	5.3	A	S	8.0	B		20	2.0	8/		37	KEI
1981 01 11.75	5.2	A	S	5.0	B		10			2.70	37	KEI
1981 01 11.97	5.3	A	B	5.0	B		10		8	1	35	SAB
1981 01 12.76	5.2	A	S	5.0	B		10			2.40	36	KEI
1981 01 12.76				8.0	B		20	4.0	8/		36	KEI

Comet Bradfield (1980t) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 01 12.96	6.3	A		7.6	R	8	26	& 2.5	7/			MAT02
1981 01 13.96	4.3	A		5.0	B		20	& 3.75	8/	&1.50	100	MAT02
1981 01 14.71	4.7			5.0	B		10	3.7		2		ELT
1981 01 14.73	4.8	X		8.0	B		11	& 2.5		2	26	STO
1981 01 15.72	5.1	X		8.0	B		11			1		STO
1981 01 15.75	5.2	A	S	5.0	B		10		9	1.70	44	KEI
1981 01 16.02	5.8	S		8.0	B		20		7	&0.33	40	KRO02
1981 01 16.72	5.2			8.0	B		11	& 2.5		1	36	STO
1981 01 16.73	5.2			5.0	B		10					ELT
1981 01 16.75				8.0	B		20	4.0	9		35	KEI
1981 01 16.75	5.2	A	S	5.0	B		10			1.50	35	KEI
1981 01 17.02	6.1	S		15.2	L				1			KRO02
1981 01 17.72	5.3	S		8.0	B		11	3				STO
1981 01 17.73	5.2			5.0	B		10					ELT
1981 01 18.02	6.5	S		8.0	B		20	1.5	1/	0.48	25	KRO02
1981 01 23.03	7.2:	S		15.2	L				1/			KRO02
1981 01 25.03	8.0	S		15.2	L			2	1/			KRO02
1981 01 25.78	7.0	S	S	8.0	B		20	2.5	7	1.00	35	KEI
1981 01 31.02	8.8:	S		15.2	L			& 1.5	2			KRO02
1981 02 01.77	8.1	S	S	8.0	B		20	2.3	6/	0.50	33	KEI
1981 02 04.78	8.0:			8.0	B		20	2.7	6			KEI

Comet Panther (1980u)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 12 27.75				12.9	R	5	60		5		360	KEI
1980 12 27.75	8.8	S	S	8.0	B		20	2.7		0.17	3	KEI
1981 01 01.26	8.5	S	S	5.0	B		10					KEI
1981 01 01.26	8.7	S	S	8.0	B		20	4.3	5/	0.17	5	KEI
1981 01 01.74	9.3	A	B	15.6	L		30	6				BUS01
1981 01 01.74	9.5:	A	B	15.6	L		30					BOU
1981 01 01.75	8.7	S	S	8.0	B		20					KEI
1981 01 01.75				29.8	L	5	62	2.8	5			KEI
1981 01 03.85	8.6	S	S	8.0	B		20	& 4.7				KEI
1981 01 04.23	8.5	S	S	8.0	B		20				20	KEI
1981 01 04.23				29.8	L	5	62		5	0.20	44	KEI
1981 01 04.23				29.8	L	5	62			0.20	90	KEI
1981 01 04.23	8.4	S	S	5.0	B		10	5.5				KEI
1981 01 04.23				29.8	L	5	89				20	KEI
1981 01 04.75	8.6	S	S	8.0	B		20	5.5	5			KEI
1981 01 04.77	9.0	A	B	11.0	L		30	5				BUS01
1981 01 04.77	9.1	A	B	8.0	B		20					BOU
1981 01 05.23	9.6	A	B	11.5	L		36	& 2.5	4/			KUI
1981 01 05.26	8.5	S	S	8.0	B		20	6.2		0.20	40	KEI
1981 01 05.26				29.8	L	5	62		4		35	KEI
1981 01 06.75	8.8	A	B	15.6	L		30	6				BOU
1981 01 06.75	9.4	A	B	11.0	L		30					FEI
1981 01 06.75	9.0	A	B	15.6	L		30	6				BUS01
1981 01 07.75	9.6	A	B	11.0	L		30					FEI
1981 01 10.23	9.7	A	B	25.4	L		70	2	6/			KUI
1981 01 10.76	9.6	A	B	11.5	L		36					KUI
1981 01 10.78	8.6:			8.0	B		20	3.5				KEI
1981 01 11.20	9.1	A	B	15.6	L		30					BOU
1981 01 11.20	8.9	A	B	15.6	L		30	5				BUS01

Comet Panther (1980u) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 01 11.25	8.6	S	S	8.0	B		20	2.8	4/	0.12	360	KEI
1981 01 11.25				8.0	B		20			0.12	45	KEI
1981 01 13.25	8.3	S	S	5.0	B		10	5.3				KEI
1981 01 13.25	8.5	S	S	8.0	B		20	3.5	4	0.13	19	KEI
1981 01 16.23	9.7	A	B	11.5	L		36					KUI
1981 01 25.04	9.8:	S		15.2	L				2			KR002
1981 01 25.75	8.9	A	B	8.0	B		20					BOU
1981 01 25.75	9.2	A	B	14.7	R		65					COM
1981 01 25.76	9.3	A	B	14.7	R		65	6				BUS01
1981 01 25.78	9.2	A	B	11.5	L		36					KUI
1981 01 25.79	8.5:			8.0	B		20	4				KEI
1981 02 01.20	8.5	S	S	8.0	B		20	4.7	4/	0.20	15	KEI
1981 02 01.20				8.0	B		20				52	KEI
1981 02 01.20				8.0	B		20				355	KEI
1981 02 05.00	8.9	A	B	11.0	L		30					FEI
1981 02 05.04	9.3	S		15.2	L				2			KR002
1981 02 10.23	8.4	S	S	8.0	B		20	4.2	4/	0.13	355	KEI
1981 02 11.01	9.3	A	B	11.0	L		30					FEI
1981 02 11.12	8.5	A	B	11.5	L		36 &	4				KUI
1981 02 11.21	8.4	S	S	8.0	B		20	3.2		0.33	349	KEI
1981 02 11.21	8.2	S	S	5.0	B		10					KEI
1981 02 11.21				29.8	L	5	53	2.8	4	0.09	323	KEI
1981 02 11.82	8.8	A	B	15.6	L		30	4				BUS01
1981 02 12.03	9.3	A	B	11.0	L		38					FEI
1981 02 13.10	9.3	A	B	11.0	L		30					FEI
1981 02 13.18	8.3	A	B	8.0	B		20					BOU
1981 02 13.19	8.9	A	B	15.6	L		30					POI
1981 02 13.20	8.7	A	B	25.4	L		57	4				KUI
1981 02 13.22				8.0	B		20			0.40	294	KEI
1981 02 13.22				8.0	B		20			0.20	47	KEI
1981 02 13.22	8.5	S	S	8.0	B		20	5.1	4/	0.13	342	KEI
1981 02 15.23	8.3	S	S	8.0	B		20	5.2	4/	0.20	319	KEI
1981 02 24.09	8.9	S		15.2	L				4			KR002
1981 02 25.06	8.9	S		15.2	L				4			KR002
1981 02 26.06	9.1	S		15.2	L			3.0	4			KR002
1981 02 26.84	8.3	A	B	15.6	L		30	3	6			BOU
1981 02 26.93	8.6	A	B	11.5	L		36	3.5				KUI
1981 02 27.02	9.2	A	B	11.0	L		38	5				FEI
1981 02 28.25	8.1	N	S	8.0	B		20	5.6	4		300	KEI
1981 03 01.84	8.2:			8.0	B		20	4				KEI
1981 03 01.87	8.6	A	B	8.0	B		20					BOU
1981 03 02.84	8.3	N	S	8.0	B		20	4.2	4	0.17	338	KEI
1981 03 03.17	9.0	S		15.2	L				2/			KR002
1981 03 05.47	10.0		S	30.0	L	7	40	5	3	?	35	KAR
1981 03 07.17	8.8	S		15.2	L				3			KR002
1981 03 07.29	9.0		S	10.0	L	10	25	5	2			TUB
1981 03 07.34	9.0		S	30.0	L	7	40	6	2	?	100	HOR
1981 03 07.39	8.5		S	7.0	R	7	20	10	7			DAL
1981 03 07.80	9.7			15.0	L	5	50	1.5				BRL
1981 03 09.30	9.0	V	S	10.0	L	10	25	8	2	0.08	125	TUB
1981 03 09.31	8.5		S	7.0	R	7	20	10	7			DAL
1981 03 09.40	9.0		S	30.0	L	7	40	6	2			HOR
1981 03 11.08	8.9	S		15.2	L				4			KR002
1981 03 11.34	9.0		S	10.0	L	10	25	8	3			TUB

Comet Panther (1980u) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 03 12.07	8.8	S		15.2	L			& 3	4			KRO02
1981 03 12.83	8.2	N	S	8.0	B		20	6.9		0.15	107	KEI
1981 03 12.83				12.9	R	5	26		4			KEI
1981 03 13.08	8.8	S		15.2	L			& 3	5			KRO02
1981 03 14.08	9.0	S		15.2	L			3.4	5/			KRO02
1981 03 15.11	9.0	S		15.2	L			2.5	5			KRO02
1981 03 16.86	9.1	N	S	29.8	L	5	62	2.4	5	0.06	138	KEI
1981 03 17.06	9.2	S		15.2	L			& 2	4			KRO02
1981 03 17.84	9.4:	A	B	25.4	L		57					KUI
1981 03 17.88	8.2	N	S	8.0	B		20	3.0	5	0.17	146	KEI
1981 03 23.10	9.4	S		15.2	L			2.1	4/			KRO02
1981 03 23.33	9.5		S	30.0	L	7	40	6	2			HOR
1981 03 23.86	8.2	N	S	8.0	B		20	4.6	5	0.17	83	KEI
1981 03 24.13	9.2	S		15.2	L			3.1	6			KRO02
1981 03 25.08	9.0	S		15.2	L			3.4	5			KRO02
1981 03 25.20	9.4	A	S	15.0	R	5	31	4.5				MOR03
1981 03 25.98				8.0	B		20			0.07	257	KEI
1981 03 25.98				8.0	B		20			0.08	199	KEI
1981 03 25.98	8.3	N	S	8.0	B		20	4.9	4	0.33	103	KEI
1981 03 25.98				8.0	B		20			0.20	151	KEI
1981 03 26.04	9.3	A	S	15.0	R	5	31	4.5				MOR03
1981 03 27.00	9.6	A	B	11.0	L		30	4				FEI
1981 03 27.85	9.5	A	B	14.7	R		65					COM
1981 03 27.86	9.6	A	B	14.7	R		65	4	5			BUS01
1981 03 27.88	8.1	A	B	8.0	B		12					COM
1981 03 27.88	9.6	A	B	11.0	L		38	5	3			FEI
1981 03 27.88	8.1	A	B	8.0	B		12	7				BUS01
1981 03 27.88	8.9	A	B	15.6	L		30					BOU
1981 03 28.20	9.4:	S		15.2	L			3.2	5			KRO02
1981 03 28.36	9.6	A	S	15.0	R	5	31	3				MOR03
1981 03 29.33	9.5	V	S	10.0	L	10	50	8	2	0.05	250	TUB
1981 03 29.33	9.5	V	S	10.0	L	10	50	6	2			HOR
1981 03 31.19	9.4	S		8.0	B		20	& 4	6			KRO02
1981 04 01.10	9.2	S		8.0	B		20	& 4	6			KRO02
1981 04 02.10	9.2	S		8.0	B		20	3.6	6			KRO02
1981 04 02.92				8.0	B		20			0.25	258	KEI
1981 04 02.92	8.5	N	S	8.0	B		20	4.7	4	0.17	126	KEI
1981 04 02.92				8.0	B		20			0.20	170	KEI
1981 04 03.06	9.3	A	S	15.0	R	5	31	4.5				MOR03
1981 04 05.14	8.7	N	S	8.0	B		20	5.4	3/	0.17		KEI
1981 04 05.85	11.5	A	B	14.7	R		65					COM
1981 04 05.86	9.9	A	B	25.4	L		70					KUI
1981 04 05.90	10.4	A	B	14.7	R		65	3	4			BUS01
1981 04 06.02				8.0	B		20				167	KEI
1981 04 06.02	8.6	N	S	8.0	B		20	4.2	3	0.25	95	KEI
1981 04 07.09	9.4	A	S	15.0	R	5	31	4				MOR03
1981 04 07.29	9.5		S	30.0	L	3	50	5	6	0.05	100	TUB
1981 04 08.06	9.4	A	S	15.0	R	5	31	4				MOR03
1981 04 08.10	9.3	S		15.2	L			3.2	4			KRO02
1981 04 10.11	9.3	S		15.2	L				4/			KRO02
1981 04 12.92	9.1	N	S	8.0	B		20	2.7	3/			KEI
1981 04 20.88	9.4	N	S	8.0	B		20	4.2	3/			KEI
1981 04 21.33	9.5		S	30.0	L	3	50	5	4			TUB

Comet Panther (1980u) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 04 23.89	9.3:	N	S	8.0	B		20		3			KEI
1981 04 23.91	10.2	A	B	11.0	L		30	3				FEI
1981 04 23.91	10.1	A	B	15.6	L		30	4				BOU
1981 04 23.95	10.4	A	B	25.4	L		70					KUI
1981 04 24.10	9.5	S		15.2	L				4/			KRO02
1981 04 24.88	10.8	A	B	14.7	R		65					COM
1981 04 25.19	10 :	S		15.2	L				3			KRO02
1981 04 26.11	10 :			15.2	L			& 2	3			KRO02
1981 04 27.14	9.9	S		15.2	L			2.7	4			KRO02
1981 04 27.40	10.0		S	30.0	L	7	40	5	1			HOR
1981 04 27.90	10.3	A	B	11.0	L		30					FEI
1981 04 27.91	10.2	N	S	29.8	L	5	62	2.3	4			KEI
1981 04 27.91	9.5	N	S	8.0	B		20	4.4	2/			KEI
1981 04 27.93	10.6	A	B	25.4	L		70	4				KUI
1981 04 27.94	10.9	A	B	14.7	R		65					COM
1981 04 28.14	10.1	S		15.2	L			& 3	3			KRO02
1981 05 01.14	9.5:	S		15.2	L			2.7	3			KRO02
1981 05 02.19	10.5	A	S	15.0	R	5	31	3.5				MOR03
1981 05 02.90	10.0	A	B	15.0	L		30					POI
1981 05 02.91	10.1	A	B	15.6	L		30	4	3/			BOU
1981 05 02.91	11.3	A	B	11.0	L		30					FEI
1981 05 02.96	10.1	A	B	14.3	L		30	3.5	6			BUS01
1981 05 03.11	10.2	A	S	15.0	R	5	31	4				MOR03
1981 05 04.90	9.5:		S	8.0	B		20	3.2	2			KEI
1981 05 05.40	10.0		S	30.0	L	3	50	2	5			TUB

Comet Bowell (1980b)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 04 23.95	11.8:	A	B	15.6	L		61					BOU
1981 04 23.96	12.5:	A	B	14.7	R		65					COM
1981 05 01.98	12.0	A	B	15.6	L		61					BOU
1981 05 02.93	11.9	A	B	15.6	L		61	& 1.5				BOU

Periodic Comet Encke

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 10 02.98	10.8:		S	29.8	L	5	62	2.1	0/			KEI
1980 10 08.08	10.7	A	S	29.8	L	5	62	2.9	0/			KEI
1980 10 09.06	10.7	A	S	29.8	L	5	62	2.7	2			KEI
1980 10 12.00				8.0	B		20	6.0		0.17	360	KEI
1980 10 12.00	9.7	A	S	29.8	L	5	62	4.2	2			KEI
1980 10 18.02	7.7	S	S	5.0	B		10	13.2	2			KEI
1980 10 18.02	9.2	S	S	29.8	L	5	53	6.0				KEI
1980 10 19.02	8.5	S	S	8.0	B		20	9.8	4	0.50	20	KEI
1980 10 19.02				5.0	B		10	11.2				KEI
1980 10 21.15	8.1	S	S	5.0	B		10	11.4				KEI
1980 10 21.15				29.8	L	5			3/			KEI
1980 10 21.15	8.5	S	S	8.0	B		20	9.5				KEI
1980 10 29.10	7.8	S	S	8.0	B		20	8.0	3/			KEI
1980 10 29.80	7.8	S	S	8.0	B		20				113	KEI
1980 10 29.80	7.4	S	S	5.0	B		10	10.4				KEI
1980 10 30.77	7.5	S	S	8.0	B		20	8.0	4			KEI

Periodic Comet Encke (Cont.)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 10 31.17	7.1	S	S	5.0	B		10					KEI
1980 10 31.17	7.3	S	S	8.0	B		20	10.5	4			KEI
1980 11 02.24	7.5:		S	8.0	B		20	11.6	4/			KEI
1980 11 03.24	6.3:	S	S	5.0	B		10	6.3				KEI
1980 11 04.19	7.5	S	S	8.0	B		20	6.0	5/			KEI
1980 11 12.23				8.0	B		20		5	0.33	82	KEI
1980 11 12.23	6.8	S	S	5.0	B		10					KEI
1980 11 18.23	6.6	S	S	5.0	B		10	5.6	7			KEI
1980 11 18.23	6.8	S	S	8.0	B		20	4.2				KEI
1980 11 25.26	6.6	S	S	8.0	B		20	2.0	7			KEI

Periodic Comet Borrelly (1980i)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 01 25.77	9.5	A	B	14.7	R		65					BUS01
1981 01 25.77	10.3	A	B	14.7	R		65					COM
1981 01 25.79	9.5	A	B	8.0	B		20		4			BOU
1981 01 31.44	9.8	S	B	8.0	B		15					SEA
1981 02 04.76	9.5:	A	B	11.5	L		22					KUI
1981 02 10.81	9.8:	V	S	29.8	L	5	62	2.0	4			KEI
1981 02 26.79	10.1	A	B	25.0	L		70					KUI
1981 02 26.82	9.6	A	B	15.6	L		30	& 2.5				BOU
1981 02 28.80	10.3	V		29.8	L	5	62	1.8	5/		45	KEI
1981 03 16.82	10.4	V		29.8	L	5	62	1.8				KEI
1981 03 23.84	10.5:	V		12.9	R	5	26	1.5				KEI
1981 03 27.84	10.7	A	B	15.6	L		30					BOU
1981 04 23.92	11.8:	A	B	15.6	L		61					BOU

Periodic Comet Swift-Gehrels (1981j)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 10 01.01	13.0:	A	S	32.0	L	5	110	1.1	0			BOR
1981 10 17.01	12.6	A	S	32.0	L	5	88	1.3	0/			BOR
1981 10 17.22	12.1	A	S	32.0	L	7	143	1.5	2			SPR
1981 10 18.04	12.7	A	S	32.0	L	5	88	1.2	1			BOR
1981 10 20.04	12.7	A	S	32.0	L	5	88	1.3	2			BOR
1981 10 21.02	12.6	A	S	32.0	L	5	88	1.2	2			BOR
1981 10 21.23	12.5	A	S	32.0	L	7	143	1.0	2			SPR
1981 10 22.04	12.5:			25.4	L	7	103	2	2			MOR
1981 10 25.24	12.3	A	S	20.0	C	10	125	1.5	2			SPR
1981 10 30.24	11.7	A	S	32.0	L	7	71	2.0	3			SPR
1981 10 31.14	11.7	A	S	32.0	L	5	68	1.8	1/			BOR
1981 11 01.04	12.5:			25.4	L	7	103		2			MOR
1981 11 02.08	12.3	A	S	25.4	L	7	103	1.1	2			MOR
1981 11 03.00	12.3	A	S	25.4	L	7	103	1.2	2			MOR
1981 11 03.03	12.4	A	S	25.4	L	7	103	& 1	2			GRE
1981 11 04.09	11.7	A	S	32.0	L	5	68	2.4	1/			BOR
1981 11 04.09	12.3	A	S	25.4	L	7	103	1.2	2			MOR

Periodic Comet Tuttle (1980h)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 10 08.14	10.6	V	S	29.8	L	5	62	3.3	2			KEI
1980 10 09.08	10.6	V	S	29.8	L	5	53	3.8	2			KEI

Periodic Comet Tuttle (1980h) · Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 10 12.08	10.2	V	S	29.8	L	5	62	2.8				KEI
1980 10 18.04	8.7	S	S	8.0	B		20	8.4				KEI
1980 10 18.04	9.2	V	S	29.8	L	5	53	4.7	3			KEI
1980 10 19.07	8.9	S	S	8.0	B		20	5.2	2/			KEI
1980 10 21.17	8.8	S	S	5.0	B		10					KEI
1980 10 21.17				8.0	B		20	5.4				KEI
1980 10 21.17				29.8	L	5	62	3.6	3			KEI
1980 10 31.20	8.9	S	S	29.8	L	5	62	3.5				KEI
1980 10 31.20	8.6	S	S	8.0	B		20	4.5	4			KEI
1980 11 03.05				8.0	B		20			0.07	360	KEI
1980 11 03.05	8.0	S	S	5.0	B		10	6.9				KEI
1980 11 03.05	8.2	S	S	8.0	B		20	6.9	4	0.33	26	KEI
1980 11 04.21	8.3	S	S	8.0	B		20	7.7	5	0.20	39	KEI
1980 11 10.11	7.8	S	S	5.0	B		10	9.1				KEI
1980 11 10.11	8.0	S	S	8.0	B		20	4.1	4			KEI
1980 11 12.22	8.0	S	S	5.0	B		10	8.4				KEI
1980 11 12.22	8.3	S	S	8.0	B		20	6.0	6			KEI
1980 11 18.21	7.6	S	S	5.0	B		10	9.6				KEI
1980 11 18.21	7.9	S	S	8.0	B		20	9.6	5/			KEI
1980 11 25.23	7.9	S	S	8.0	B		20	5.5	6			KEI
1980 11 28.21	6.8	S	S	5.0	B		10		6	1.50	340	KEI
1980 11 30.11	7	:	S	8.0	B		20	5.0	5			KEI
1980 12 01.16	6.9	S	S	5.0	B		10	8.4				KEI
1980 12 01.16				8.0	B		20	7.8	5			KEI
1980 12 03.16				29.8	L		62		5/		315	KEI
1980 12 03.16	7.3	S	S	5.0	B		10	9.3				KEI
1980 12 04.21	6.9	S	S	5.0	B		10	11.7	5/			KEI
1980 12 07.20	6.8	S	S	5.0	B		10	12.0				KEI
1980 12 07.20	7.0	S	S	8.0	B		20		4			KEI
1981 01 01.46	7.7	S	B	8.0	B		15					SEA
1981 01 09.46 *	8.1	S	B	8.0	B		15					SEA
1981 01 10.46 *	8.0	S	B	8.0	B		15	5				SEA
1981 01 26.46 *	9.0	S	B	8.0	B		15					SEA
1981 02 08.46 *	10.0	S	B	8.0	B		15					SEA
1981 03 01.46	10.8	S	B	8.0	B		15					SEA

Periodic Comet Schwassmann-Wachmann 1

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 04 27.89	12.0	A	B	15.6	L		30	0.5	7/			BUS01
1981 04 27.91	11.9	A	B	15.5	L		50	1				FEI
1981 04 27.91	12.0	A	B	25.4	L		70	0.5				KUI
1981 04 27.91	11.9	A	B	15.6	L		30		8			BOU
1981 05 01.92	11.9	A	B	15.6	L		30	1	5			BUS01
1981 05 01.92	11.9	A	B	15.6	L		30	& 1.5	5			BOU
1981 05 02.90	11.9	A	B	15.6	L		61	& 1.5	2			BOU
1981 05 02.91	12.7	A	B	25.4	L		70					KUI
1981 05 02.91	12.7	A	B	14.7	R		90		1			COM
1981 05 02.92	11.9	A	B	14.3	L		30	& 1.5	0			BUS01
1981 05 02.92	11.9	A	B	15.6	L		50					FEI

Periodic Comet Stephan-Oterma (1980g)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 10 03.04	10.4	V	S	29.8	L	5	89	1.4	1/			KEI

Periodic Comet Stephan-Oterma (1980g) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 10 08.10	10.3	V	S	29.8	L	5	62	1.8	4			KEI
1980 10 09.10	10.2	V	S	29.8	L	5	62	1.4	3			KEI
1980 10 12.09	10.2	V	S	29.8	L	5	62	1.4	4			KEI
1980 10 18.06	10.1	V	S	29.8	L	5	62	0.7	4			KEI
1980 10 21.18	10.0:			29.8	L	5	62	1.1	4/			KEI
1980 10 29.06	10.0	V	S	29.8	L	5	89	0.9	5			KEI
1980 10 31.14	10.0	S	S	29.8	L	5	62	2.0	5/			KEI
1980 11 02.17	9.5:			15.0	L	6	49	1				KEI
1980 11 03.00	9.2	V	S	8.0	B		20	4.0	5/			KEI
1980 11 10.11	9.2	B	S	5.0	B		10	4.0				KEI
1980 11 10.11	9.4	B	S	8.0	B		20	3.5	6/			KEI
1980 11 12.00	9.2	S	S	8.0	B		20	3.5	6			KEI
1980 11 18.21	8.8	S	S	8.0	B		20	2.7	6			KEI
1980 11 18.21	8.5	S	S	5.0	B		10	5.4				KEI
1980 11 26.85	8.6	S	S	5.0	B		10	6.5				KEI
1980 11 26.85				29.8	L	5	62				263	KEI
1980 11 26.85				29.8	L	5	62	2.2	7	0.07	151	KEI
1980 11 26.85	8.9	S	S	8.0	B		20					KEI
1980 11 27.88	7.6	S	S	5.0	B		10	11.9		0.33	168	KEI
1980 11 27.88				29.8	L	5	62			0.17	243	KEI
1980 11 27.88				29.8	L	5	62	1.4	7	0.25	168	KEI
1980 11 28.90				29.8	L	5	62			0.07	273	KEI
1980 11 28.90				29.8	L	5	62	2.0		0.13	187	KEI
1980 11 28.90	8.5:			5.0	B		10					KEI
1980 11 28.90				29.8	L	5	62			0.04	25	KEI
1980 11 29.99	8.6	S	S	8.0	B		20	9.0	7			KEI
1980 11 29.99				29.8	L	5	62	1.0		0.13	236	KEI
1980 11 30.09	8.5	A	S	5.0	B		10	9.0				KEI
1980 11 30.95	8.4	S	S	5.0	B		10	6.8				KEI
1980 11 30.95	8.9	S	S	8.0	B		20	4.8	6			KEI
1980 12 02.99	8.7	A	S	5.0	B		10	6.8				KEI
1980 12 03.17				29.8	L	5	62	4.5		0.13	190	KEI
1980 12 03.85	8.8	A	S	8.0	B		20	3.7	6/			KEI
1980 12 04.15	8.5	A	S	5.0	B		10	5.0				KEI
1980 12 05.97				29.8	L	5	62	4.6			231	KEI
1980 12 05.97	8.4	A	S	5.0	B		10	5.4	6			KEI
1980 12 06.82	8.3	A	S	5.0	B		10	10.4				KEI
1980 12 06.82				29.8	L	5	62	1.1		0.08	226	KEI
1980 12 06.82	8.4	S	S	8.0	B		20					KEI
1980 12 07.99	8.4	A	S	5.0	B		10	7.0	6/			KEI
1980 12 15.00				29.8	L	5	62	3.2		0.13	245	KEI
1980 12 15.00				8.0	B		20		7			KEI
1980 12 15.00				29.8	L	5	62			0.12	218	KEI
1980 12 15.00	8.1	A	S	5.0	B		10	5.0				KEI
1980 12 16.07				8.0	B		20			0.08	45	KEI
1980 12 16.07	8.2	A	S	5.0	B		10	4.7				KEI
1980 12 16.07	8.3	A	S	8.0	B		20		6/	0.33	225	KEI
1980 12 25.82	8.5	S	S	5.0	B		10	6.4				KEI
1980 12 25.82	8.8	V	S	8.0	B		20	4.8	6/			KEI
1980 12 27.77				12.9	R	5	26		6	0.13	218	KEI
1980 12 27.77				12.9	R	5	26				30	KEI
1980 12 27.77	8.5	S	S	5.0	B		10	3.3				KEI
1980 12 27.77	8.8	V	S	8.0	B		20					KEI
1980 12 31.88	8.8	V	S	8.0	B		20	3.3				KEI
1981 01 01.15	8.8	V	S	8.0	B		20	3.5	4/			KEI

Periodic Comet Stephan-Oterma (1980g) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 01 03.86	8.7	V	S	8.0	B		20	5.3		0.13	173	KEI
1981 01 03.86				29.8	L	5	62	2.7	5			KEI
1981 01 04.87	8.8	V	S	8.0	B		20					KEI
1981 01 04.87				12.9	R	5	38	4.5	4/		211	KEI
1981 01 06.90	8.9	S	S	8.0	B		20	4.0				KEI
1981 01 09.85	9.1	A	S	8.0	B		20	2.9			150	KEI
1981 01 09.85	9.6	A	S	29.8	L	5	62	2.2	4	0.07	223	KEI
1981 01 12.85	9.6	A	S	12.9	R	5	26	3.0	3	0.10	134	KEI
1981 01 25.81	9.7	A	S	29.8	L	5	62	2.6	3			KEI
1981 01 29.80	10.1:	A	S	29.8	L	5	62	1.9				KEI
1981 02 02.00	10.9	A	S	29.8	L	5	62	2.0	2/			KEI
1981 02 09.96	11.6	A	S	29.8	L	5	89	1.2	3			KEI

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REPORT OF THE DUTCH COMET SECTION

The Dutch Comet Section has published a report which documents their group's observations from 1968 to 1981. This well-produced 48-page book includes observations and analyses of 15 comets. It is available from Reinder J. Bouma, Bekemaheerd 77, 9737 PR Groningen, The Netherlands, for $4.00.

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CORRIGENDA

1) In the July 1981 issue of the ICQ, p. 75, comet 1981f was at magnitude 19, not 9 (typographical error).
2) In the July 1981 issue, p. 90, col. 2, only 9 of the 10 comets were listed; the tenth was P/Schwassmann-Wachmann 1.
3) In the July 1981 issue, the references in the first paper (pp. 67ff) were somewhat jumbled by accident. The reference on p. 68, col. 2, line 13, should read "Morris 1980a", to which the reference at the end of the article refers. The other "Morris 1980" references on p. 69 should read "Morris 1980b", referring to the article by C. S. Morris in ICQ **2**, 69.
4) In the January 1979 issue, the address for Toshio Haneda should read Haramachi, Fukushima, Japan.
5) In the April 1981 issue, p. 39, our correction was wrong. It should read:

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

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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.

THE TENTH APPARITION OF P/COMET BORRELLY

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and

Daniel W. E. Green
Smithsonian Astrophysical Observatory

Periodic comet Borrelly was recovered by Hans-Emil Schuster on exposures taken 1980 July 9 and 21 at the European Southern Observatory. At that time, the comet was about 2.6 A.U. from the sun, heading toward a perihelion distance of 1.3 A.U. to be reached on 1981 February 20. At the time of recovery, P/Borrelly was of magnitude 18 to 18.5. Originally expected to only reach 12th magnitude (total), P/Borrelly surprised observers by brightening to magnitude 9.5. Moving northward in the evening sky, comet 1980i was observed visually from 1981 January 3 to June 9, being visible in moderate-size binoculars when at its brightest.

Over 80 observations of 1980i by 13 observers have been reported to the ICQ. Throughout most of the apparition, P/Borrelly was reported to be a moderately-condensed object with a diameter typically between 1.5′ and 3′, or roughly 100,000-200,000 kilometers. No visual tail observations were reported during this apparition.

Because of the small range of heliocentric distances, only an H_{10} value (n = 4 assumed) was calculated. Using 59 magnitude estimates (see Fig. 1, below) corrected for the aperture-effect, $H_{10} = 7.36 \pm 0.23$ (p.e.) which is in agreement with the value found by Bortle (1981). As pointed out by Bortle, H_{10} obtained at this apparition compares favorably with the H_{10} value of the discovery apparition (1905). However, during later apparitions, the comet was apparently somewhat fainter.

REFERENCE

Bortle, J. E. (1981). Comet Digest, Sky and Telesc. 62, 222.

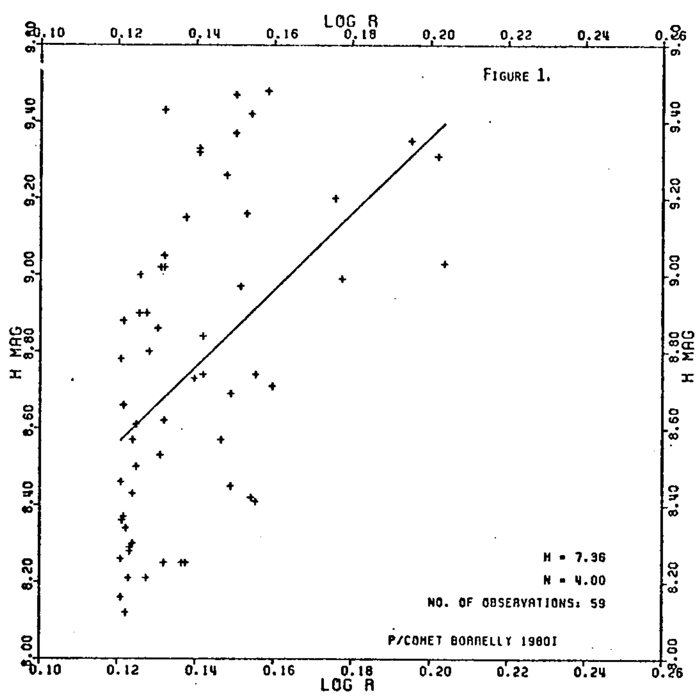

FIGURE 1.

ANNOUNCING

THE 1982 AMERICAN WORKSHOP ON COMETARY ASTRONOMY

Sponsored by The INTERNATIONAL COMET QUARTERLY

Tentative Date: May 1, 1982

Tentative Location: Bryant College, Smithfield, Rhode Island

ANTICIPATED PRIMARY SPEAKERS:

Fred L. Whipple, *Harvard-Smithsonian Center for Astrophysics*

Brian G. Marsden, *Harvard-Smithsonian Center for Astrophysics*

John E. Bortle, *W. R. Brooks Observatory, Stormville, NY*

Charles S. Morris, *Prospect Hill Observatory, Harvard, MA*

This workshop, the first of its kind in the United States, will bring together professional and amateur astronomers to discuss the various topics of mutual interest in cometary astronomy. Included will be such topics as possible observing programs, observational techniques, and professional use of amateur data.

Further information may be obtained from

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