THE INTERNATIONAL COMET QUARTERLY

WHOLE NUMBER 51 JULY 1984 Vol. 6, No. 3

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FM TOKYO ASTRO OBSER
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ATTN DR MARSDEN

TAKAMIZAWA POSSIBLE COMET TAKAMIZAWA
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KOZAI

Initial discovery telegrams sent to the IAU's Central Bureau for Astronomical Telegrams for comets Takamizawa 1984j (above) and Austin 1984i (below). Both discoverers reported their news to professional observatories in their respective countries (see also page 54 of this issue).

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LAKE TEKAPO NEWZEALAND

ASTROGRAM CAN
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CAMBRIDGE

AUSTIN COMET AUSTIN 19501 40708 72917 04515 13850 01087 52578
19452 CLARK CONFIRMS ON DAMON PLATE REGARDS
GILMORE

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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 in Boone, North Carolina, U.S.A.

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Cometary observations also should be sent to the Editor at the above address. Back issues are available from Dr. T. Rokoske; Dept. of Physics and Astronomy; A.S.U.; Boone, NC 28608, USA.

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FROM THE EDITOR

To speed up the publication process -- towards our goal of issuing the ICQ during the month of publication (we've been behind schedule by 1-2 months for several years) -- we are publishing this issue in Cambridge and mailing it directly from the same location.

Observers are strongly urged to put emphasis on observing the new periodic comet Takamizawa (1984j), as it has been exhibiting rather enigmatic brightness outbursts. Emphasis should also be put into observing P/Neujmin 1 and P/Arend-Rigaux, for which ephemerides are provided elsewhere in this issue.

Readers are again reminded that urgent information regarding discoveries of new comets can be obtained by telegram from the International Astronomical Union (IAU) through its Central Bureau for Astronomical Telegrams. On the cover of this issue are the discovery announcement telegrams sent to the Central Bureau for two recent comets, 1984i and 1984j. Following verification of such discoveries, the Central Bureau sends telegrams to subscribers; such telegrams are sent using a special numerical code. The Central Bureau also has two other announcement services, both which deal with more information in what are known as the <u>IAU Circulars</u>; one service is a post-card-size <u>Circular</u> send via airmail, and the other service is a computer dial-in service. These services are explained in literature that can be obtained by writing the Central Bureau at the Smithsonian Astrophysical Obs.; 60 Garden St.; Cambridge, MA 02138.

-- Daniel Green

THE 1983-84 APPARITION OF PERIODIC COMET CROMMELIN

Daniel W. E. Green and Charles S. Morris
International Comet Quarterly

I. Introduction

Periodic comet Crommelin passed perihelion on Feb. 20 during its fifth recorded apparition. Comet 1983n probably was observed more frequently and by more observers because it had been designated the "Trial Run Comet" for the International Halley Watch (IHW).

Comet 1983n, which has a 28-year period and a perihelion distance of 0.73 AU, was recovered last August (somewhat more than 6 months before perihelion) as a nearly-stellar object near magnitude V = 19.7 (cf. ICQ 5, 88), while it was just inside a distance of 3 AU from the sun. Good accounts of P/Crommelin's previous apparitions have been provided by Marsden (1984), Festou (1983), and Morris (1983), in IHW Newsletters Nos. 3 and 4. These Newsletters also included plans by the various IHW discipline groups to coordinate observations of the comet during the week of March 25-31.

II. The 1983-84 Apparition

Comet 1983n was first detected visually as a small, difficult object in late December by J.-C. Merlin and M. Verdenet of France (cf. ICQ 6, 45). During the month of January, P/Crommelin brightened some two magnitudes, to mag 10, as it gradually grew more condensed, with apparent coma diameters ranging from 2′ to 3′. In February, the comet slowly brightened to apparent total magnitude 8, and some observers observed a faint tail structure as long as half a degree by month's end; visual coma diameters of 5′ to 7′ were typical in February. Despite predictions for P/Crommelin to peak near total magnitude 6.0 to 7.0, its apparent brightness stayed close to magnitude 8 for about a month, until the third week of March; the comet remained moderately condensed during that period.

Comet 1983n gradually faded to near magnitude 9, where it essentially stayed for most of the IHW's "trial run" week at the end of March, also it became much more diffuse. Then, between March 31 and April 3, the comet's brightness dropped about 0.8 magnitude; in fact, visual observers could not locate the comet after April 4, because of the waxing moon, when the second author found it as a diffuse object, at total visual magnitude 9.8, with a 26-cm reflector. P/Crommelin's apparent size was reported during March as generally being in the range 5′ to 10′; the April 4 observation placed the coma diameter at 5.5′.

Don Yeomans (1984) finds from orbital computations that P/Crommelin has a very slight secular acceleration from its non-gravitational forces. Several observers obtained spectroscopic data of comet 1983n. Spinrad et al. (1984a, b) used Kitt Peak's 4-m reflector with a CCD detector to record emission lines of molecules usually found in comets, including diatomic carbon, ionized water, and CN. Festou (1984) and Larson (1984) reported emissions of C, O, S, OH, NH, and CH, as well. Danks (1984), using the 3.6-m ESO reflector, noted that the strongest spectral features at visible wavelengths were those of CN, triatomic and diatomic carbon, and NH_2.

Comet 1983n was well observed during February and March, but since April 4, only 17 observations are known to have been made of comet 1983n -- and all 17 were astrometric observations provided by Jim Gibson at Palomar, A. Gilmore and P. Kilmartin at Mt. John University Observatory in New Zealand, and observers at Perth Observatory in Australia. The last successful observations of comet 1983n were photographs by Gilmore on May 26 and 27. The comet has been moderately well-placed, with respect to the sun, in the evening sky during the first half of 1984, and it remained so into August.

III. The 1983-84 Light Curve

The forecasts published by Festou (1983) and Morris (1983) of P/Crommelin's light curve clearly missed the mark, with the predicted curves peaking too bright and fading too rapidly. Morris (1984) discusses the problems with those predictions elsewhere in this issue.

Analysis of the recent apparition indicates that P/Crommelin's light curve can be fairly well represented over a limited arc of orbit by a general power-law formula of the usual form

$$m_1 = H_o + 5 \log \Delta + 2.5\, n \log r,$$

where m_1 is the total visual magnitude, H_o is the comet's absolute magnitude, n is the power-law exponent, and Δ and r are the comet's geocentric and heliocentric distances, respectively.

A total of 121 observations, 42 pre-perihelion and 79 post-perihelion, published in the ICQ, were selected for a least-sqaures reduction. These were reduced to a standard aperture after Morris (1973) and corrected for the changing earth-comet distance. The observers whose data were used in the reduction are listed below (listed in alphabetic order by Observer Code).

BOR	JOHN E. BORTLE, NY, U.S.A.
BUS01	E. P. BUS, THE NETHERLANDS
DEA	V. F. DE ASSIS NETO, BRAZIL
GRE	DANIEL W. E. GREEN, MA, U.S.A.
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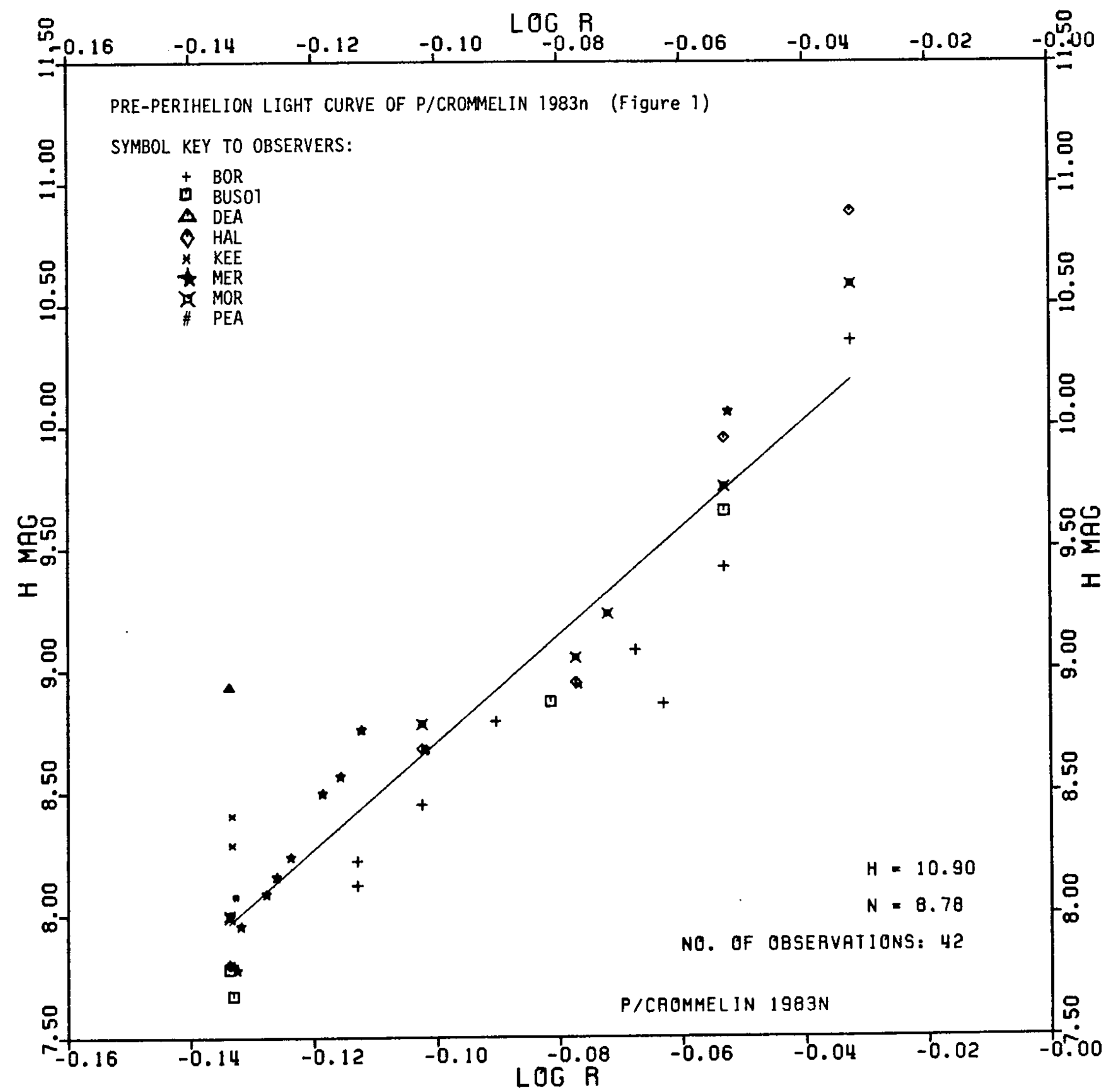
MOR03	WARREN C. MORRISON, CANADA
PEA	ANDREW R. PEARCE, AUSTRALIA
SEA	DAVID SEARGENT, AUSTRALIA



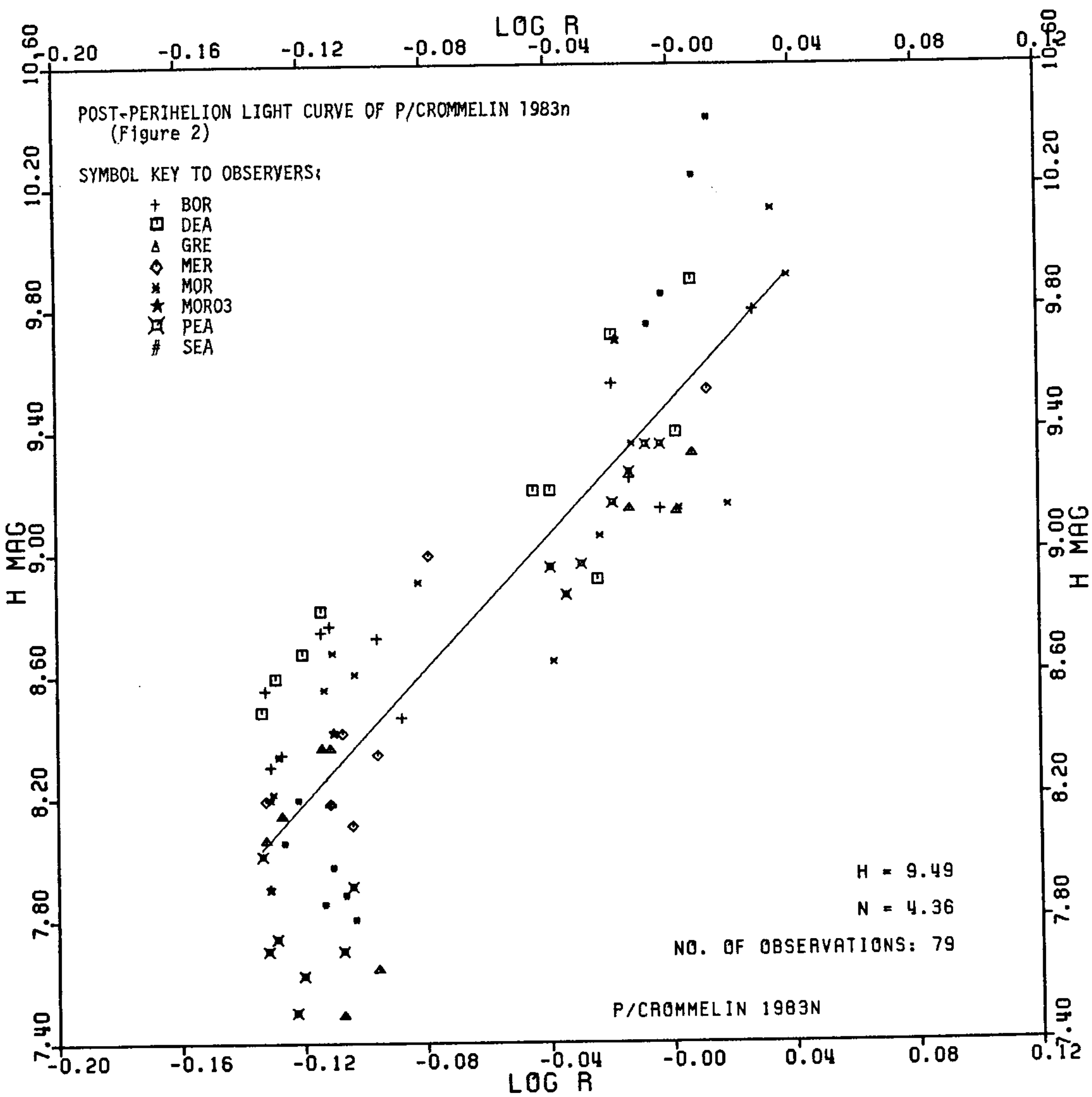
The resulting light curve is depicted in Figures 1 and 2. The derived photometric parameters, with probable errors, are given below.

Pre-perihelion
(range in r: 0.93 to 0.74 AU)
H_o = 10.90 ± 0.10 n = 8.78 ± 0.37

Post-perihelion
(range in r: 0.74 to 1.09 AU)
H_o = 9.49 ± 0.04 n = 4.36 ± 0.19

The arc of observation of P/Crommelin was longer at this return than at previous apparitions. The data show that P/Crommelin behaved differently before perihelion than after -- with a much steeper increase in heliocentric brightness leading to perihelion. Photometric parameters for the power-law formula should be useful only while the comet is less than about 1.1 AU (log r = 0.04) from the sun. It is highly possible that the post-perihelion value for n may be quite different at future apparitions, however, based on previous apparitions and on the many fluctuations (minor brightness flares) at this recent passage of P/Crommelin through the inner solar system. Further discussion on these points is given by Morris (1984).

Figure 2 (post-perihelion) vividly shows that there was much discrepancy between observers in Australia and those in the northern hemisphere, with the southern-hemisphere observers generally finding P/Crommelin quite a bit brighter than the northern observers, even though observations were essentially made on



the same dates and with the comet in similar positions in the sky (with respect to local horizon) for both northern- and southern-hemisphere observers. As discussed by Morris (1984), considerable fluctuations in heliocentric magnitude are highly visible above and below the least-squares line in Fig. 2. Note also that the French observations from late December 1983 cannot be represented properly by the least-squares fit; they were made when the comet was beyond 1.1 AU.

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SOME THOUGHTS ON THE LIGHT CURVE OF PERIODIC COMET CROMMELIN

Charles S. Morris
International Comet Quarterly

In his recent article entitled "'Ain't Misbehavin'?' The Light Curve of P/Comet Crommelin 1983n", J. Marcus (1984), the editor of Comet News Service, chastises this author and M. Festou for their independently-determined brightness predictions of periodic comet Crommelin (Morris 1983; Festou 1983). While there is no doubt that the comet failed to follow the forecasted light curves, I find the Marcus criticism unacceptable and his conclusion that P/Crommelin did not "misbehave" incorrect.

Predicting the brightness of a periodic comet is, at best, risky. One must assume that two fundamental assumptions will hold true. The first is that the comet will perform in the same manner as at previous apparitions. There are documented cases where this assumption has not held true. Second, it must be assumed that observations made at previous apparitions reflect the comet's true brightness. Clearly, the accuracy of any magnitude prediction will depend upon the validity of these assumptions.

THE RATIONALE OF THE MORRIS FORECAST

The data available for evaluating P/Crommelin's past performance was far from encouraging. The comet, observed at four previous returns, had quoted magnitude estimates for only the 1928 and 1956 apparitions, and much of these data were photographic. A plot of the available data (Fig. 1 and Morris 1983) revealed a fairly well defined pre-perihelion light curve. Both visual and photographic data, primarily from 1956, showed little scatter. Unfortunately, no data were available near perihelion. The post-perihelion data, of particular interest because of the IHW trial run, were a disaster. Both the photographic and the visual data, mostly from 1928, showed a scatter of four magnitudes.

Despite the post-perihelion scatter, there were several interesting clues as to the nature of the light curve. First, it was clear that the comet was quite bright (heliocentric magnitude about 6) two weeks after perihelion in 1928. Second, magnitude estimates by individual observers reporting more than one observation in 1928 clearly suggested a rapid decline in brightness. Only a couple of post-perihelion observations, both visual, were available from 1956 and they added no apparent information. A single derived data point from the 1818 apparition fell in the middle of the 1928 data.

Taken together, the data could be explained by assuming that the comet's heliocentric brightness peaked two weeks after perihelion, followed by a rapid decline. Certainly time lags in peak brightness have been previously documented for periodic comets, but the rapid decline in brightness would be unusual. Would this be realistic? Normally the answer would be "no". However, P/Crommelin shows almost no non-gravitational forces (Marsden 1984), which is unusual for a comet with a 28-year period, and suggests that the comet is active for only a short time near perihelion. In addition, there are some examples of comets which fade rapidly after perihelion (e.g., P/Encke). Thus, assuming a rapid fading, with no evidence to the contrary, was the only possible solution.

THE MARCUS CRITIQUE

In his critique of the P/Crommelin forecasts, Marcus (1984) concludes that "the better historic Crommelin visual magnitudes appear essentially reconcilable to the 1983-84 curve." Thus, he implies that by only using visual observations it should have been possible to properly forecast P/Crommelin's light curve. I disagree. My arguments are presented below.

To back his point, Marcus presents a figure depicting his version of the 1983-84 light curve, the two forecasts, and some of the 1928 and 1956 visual data. It is obvious from his figure that the 1984 pre-perihelion data are about

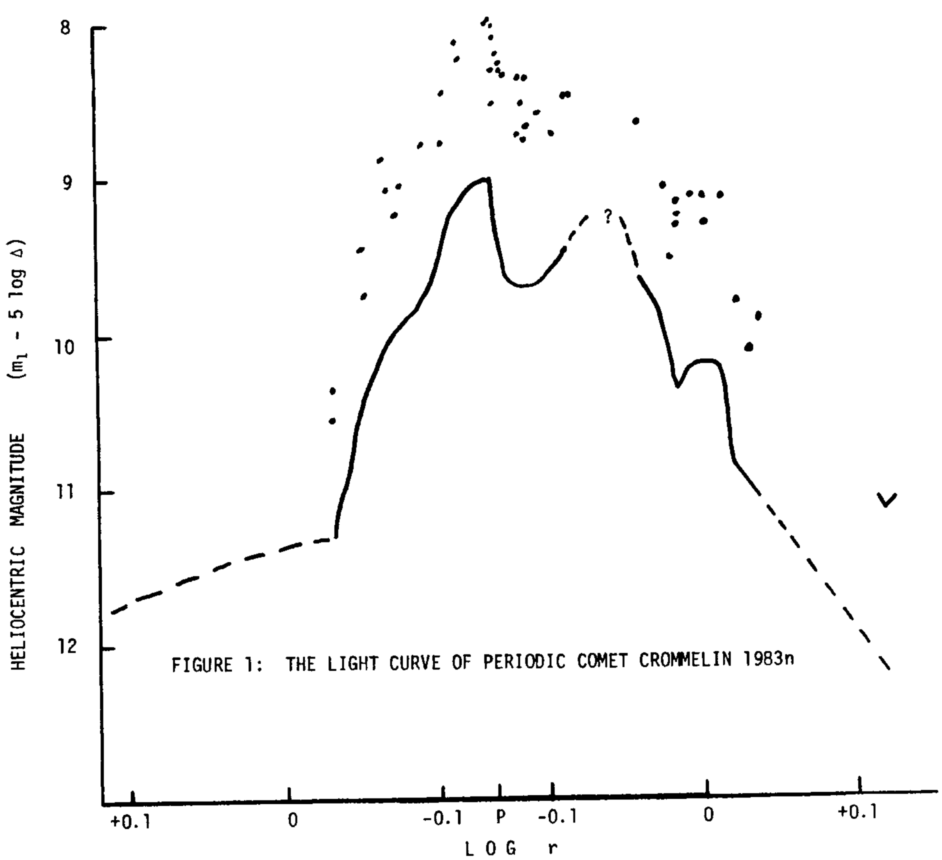

FIGURE 1: THE LIGHT CURVE OF PERIODIC COMET CROMMELIN 1983n

a magnitude brighter than 1956 observations. This difference, which Marcus inexplicably says is only half a magnitude, is explained, he claims, by the so-called (and yet to be proven) visual delta effect. Without getting into the merits of the delta effect concept, it is clear that the 0.3-magnitude value that Marcus calculates for the delta effect is not sufficient to explain the observed one-magnitude difference. His argument is simply wrong.

The pre-1984 post-perihelion visual data he presents consist of four points that have a scatter of FOUR magnitudes! How does this define the post-perihelion light curve? One must admit that the 1984 post-perihelion data do fall in the middle of this four-magnitude scatter, but the Morris and Festou brightness forecasts are also within the range of these data. It is interesting that Marcus would suggest that the light curve should fall in the middle of the four-magnitude scatter. In much of his previous work, he has chosen to ignore all but the brightest estimates.

Taken in total, the 1928 and 1956 visual data that Marcus presents could be used to support almost any light curve, including the 1983-84 light curve or the two brightness forecasts. To suggest that these visual data, by themselves, would have produced a better forecast of the comet's actual brightness is unrealistic.

Marcus is particularly critical of the author's "use" of photographic data when analyzing P/Crommelin's light curve. In fact, all data available at the time were plotted to illustrate how poor the data were and to allow the readers the opportunity to evaluate the light curve themselves. An overall comparison of the data showed that the photographic data had about the same scatter as the visual data and, for the post-perihelion period, were the only data available that covered a significant arc of orbit. There was no other choice. The photographic data had to be considered when evaluating the light curve. Even if incorrect, these data did provide some information. The potential for error and concern over the data scatter were specifically pointed out in the Morris paper.

THE 1983-84 APPARITION

The final question that needs to be evaluated is whether or not the comet truly followed a predictable formula during the recent apparition. In other words, did the comet misbehave? Marcus claims that it did not and presents power-law equations which he believes represent the 1983-84 data. A close examination, however, reveals that the comet's light curve was much more complex than is suggested by Marcus' (1984) analysis. To illustrate this, I have prepared a preliminary light curve based on the observations of the author (MOR), Daniel Green (GRE), and John Bortle (BOR), which is shown in Figure 2. The observed fluctuations, most recorded by more than one observer, have been summarized by the solid-line curve (displaced by one magnitude).

The Marcus pre-perihelion formula appears to represent his brightness data, on average (see Marcus 1984, Figure 2). However, Figure 1 reveals that inside of 1 AU the light curve is highly curved on a log-r plot (similar to P/Encke), and therefore the power-law formula provides only an approximate representation of the comet's brightness variation with respect to heliocentric distance. Indeed, if one includes the early French observations (not plotted), the comet appears (on a log-r plot) to have brightened slowly at first. This was followed by a surge in brightness, peaking at perihelion, which produced a 3.5-magnitude increase within 30 days -- a rate of brightening equivalent to that predicted by Morris (1983).

Contrary to Marcus' Figure 2 (Marcus 1984, p. 2), which suggests a smooth decline after perihelion, the data presented in Figure 1 paint a much different picture. After peaking at perihelion, the heliocentric brightness dropped about 0.7 magnitudes in a two-week period. This was followed by a slight brightness increase just prior to the full moon. The observation by Morris on March 20, 1984, just after full moon, strongly suggests that the comet had undergone a flare in brightness. The coma was larger (10′) and the comet was brighter than had been expected. This observation was followed by a rapid decline in brightness. By the IHW P/Crommelin trial-run week, the comet′s heliocentric magnitude had stabilized. During much of the trial run period, P/Crommelin had a total magnitude of about 8.7 to 9.0. However, between March 31 and April 2, 1984, P/Crommelin lost another 0.8 magnitude. With the moon interfering again, the comet was last seen by Morris as a faint but obvious 10th-magnitude object in a 25-cm reflector. Attempts to observe P/Crommelin visually after the moon left the sky were unsuccessful; the comet must have been fainter than mag 11.0-11.5.

The photometric formula proposed by Marcus does not account for the strongly curved shape of the average post-perihelion light curve. Indeed, using the Marcus formula, the comet should have been observable in mid-April under the excellent conditions which this author had.

In evaluating the whole light curve, it appears that a power-law formula can be used to approximate the average heliocentric variation in brightness over a very limited range of heliocentric distance. The light curve itself is made up of a series of flares in brightness and rapid fadings. Thus, it is not possible to represent the details of the light curve with a simple photometric formula.

THE 1928 AND 1956 APPARITIONS REVISITED

The dissimilarity in the light curves in 1928, 1956, and 1984 can be understood if the random nature of the flaring activity is accepted. One could not predict the 1984 light curve because the comet does not perform in a consistent manner (the first assumption of predicting comet brightness).

In 1928, P/Crommelin no doubt had a major flare two weeks after perihelion as has been suggested by Marcus (1984). The rapid fading that followed was probably real, although perhaps not as great as the photographic observations indicated. In 1956, the comet may not have had any significant post-perihelion flares. This would explain the unexpectedly "faint" post-perihelion observation by A. Jones (Morris 1983; Marcus 1984). The comet may have started its rapid decline earlier in 1956 than in either 1928 or 1984.

"AIN′T MISBEHAVIN′?"

Instead of trying to understand the intricate nature of P/Crommelin′s light curve, Marcus (1984) has chosen to find fault with the methods of his fellow researchers. Such a tactic is constructive criticism only when the 20-20 hindsight is accurate. For P/Crommelin, the arguments Marcus presents do not withstand close examination. Clearly, the comet has a very volatile light curve and it misbehaves quite often. In fact, it is likely that P/Crommelin′s brightness will be almost as difficult to forecast in future apparitions as it was for this apparition.

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Morris, Charles S. (1983). IHW Newsletter No. 3, p. 13.

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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.

A REVIEW OF THE LUMICON SWAN BAND COMET FILTER

Charles S. Morris
International Comet Quarterly

The ICQ is always interested in new technology which improves or expands the visual or photographic observer's ability to make useful contributions to cometary studies. An example of such technology is the new series of comet filters produced by Lumicon, a California-based company. This series includes:

Deep-Sky Filter
Swan Band Comet Filter
Comet Hunter Filters
Comet Photometry Filters.

Unfortunately, Lumicon's scheme for naming their filters is rather confusing. Thus, the following descriptions may prove helpful. The Deep-Sky Filter has a wide bandpass which includes 440- to 520-nm wavelengths. It allows the C_2 Swan Band to pass while screening light pollution. The Swan Band Comet Filter has a more narrow bandpass (495-520 nm). The Comet Hunter Filters are advertised as "high performance" Swan Band Comet Filters with only an 18-nm bandpass (500-518 nm) with 18% transmission. Finally, Lumicon has announced that it will sell Comet Photometry Filters. These filters, one for dust and another for gas, are designed for photoelectric photometry use. I am told that these filters meet the specifications for professional PEP comet work.

Of the above filters, the author had a Deep-Sky Filter and a Swan Band Comet Filter to test. The majority of the testing was done visually with the Swan Band Comet Filter, and, except where indicated, all comments here refer to that filter. In all, 7 comets were tested, with their magnitudes ranging from 7.5 to 11. Unfortunately, no bright comets were available during the test period. As one might expect, the results with the filter varied, depending on the gas production of the comet. For dusty comets, such as Cernis 1983l, the filter did little to enhance the comet's visibility and, in some cases, even made the comet more difficult to see. However, for comets such as P/Tempel 2 1983d, P/Encke (1984), and P/Crommelin 1983n, the filter significantly improved the contrast, literally bringing the comet out of the sky background in some cases.

There have been claims that the Swan Band Filter allows observers to see a much larger comet. My testing did not confirm this. Although the comet's coma at times has appeared initially larger with the filter, further observing without the filter always revealed the larger coma. Thus, I suspect that, in the majority of cases, little or no increase in coma size should be expected. However, the outer coma may become more pronounced.

What really makes the filter of interest to the serious observer is the opportunity to distinguish between gas and dust comets, and between gas and dust features within comets. When P/Kopff 1982k underwent nuclear outbursts, a stellar condensation would be observed to expand and become more diffuse over a period of a few days. When observed with the filter, the stellar condensation was absent. This strongly suggests that dust was being emitted into the coma. It will be interesting to use the filter on a bright comet having significant detail in the coma.

Perhaps the most useful application of the filter will be for ranking comets as either gas or dust comets. I would propose a scale of 0 to 4 for this purpose, as follows:

0 = comet invisible, or nearly so, using filter
1 = comet more difficult to see
2 = no change
3 = comet easier to see
4 = comet much brighter using filter.

If observers indicate significant interest in using the Swan Band filter for this purpose, these data might be included in the ICQ data tabulation in the future. It should be noted that, for faint comets, the filter will be difficult to use for this purpose. The narrow-band nature of the filter simply blocks out too much light to be useful. The Deep-Sky Filter is easier to use on faint comets, but for consistency, only one filter should be the standard.

For the general observer, these filters are supposed to make comets easier to see from light-polluted skies. This aspect has not been tested. It is the author's belief that observers should observe from dark skies whenever possible if one wants to obtain useful photometric data of comets. Dr. Jack Marling, President of Lumicon, has taken photographs of periodic comet Crommelin which clearly show that the Deep-Sky filter improves the photographic results for a strongly-gaseous comet in a bright sky. Undoubtedly, visual observers also will experience some improvement when observing such "gas" comets in light-polluted conditions. However, for bright, dusty comets such as P/ Halley, the filter may be a disappointment for the general observer.

The Swan Band filter is also being promoted as a comet-hunting aid. One of the interesting aspects of the filter is that it significantly darkens twilight. Comet hunting with one of the filters in twilight would probably improve one's chances of discovery. However, I am skeptical that using a filter in a dark sky would improve the odds of discovery.

In summary, the Swan Band Comet filter will be of interest to serious observers, as it has the potential for expanding the usefulness of their observations. However, the benefit of the filter to the casual observer is much more difficult to evaluate. Certainly not all comets are helped by the filter. In addition, it has been my experience that nothing can substitute for experience when it comes to comet observing! A potential filter-buyer will have to weigh the usefulness of the filter against the filter's cost ($79.50 for a 1.25-inch Swan Band filter).

A final note: please do not make magnitude estimates using any of these filters; such estimates are essentially worthless.

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TABULATION OF COMET OBSERVATIONS

MOON: It is pertinent to note the possible effect of moonlight on any observations of comets. Recent phases of the moon (all in ET):

	New Moon	First Quarter	Full Moon	Last Quarter
1984	Jan. 3.22	Jan. 11.41	Jan. 18.59	Jan. 25.20
	Feb. 1.99	Feb. 10.17	Feb. 17.03	Feb. 23.72
	Mar. 2.77	Mar. 10.77	Mar. 17.42	Mar. 24.33
	Apr. 1.51	Apr. 9.20	Apr. 15.80	Apr. 23.02
	May 1.16	May 8.49	May 15.19	May 22.74
	May 30.70	June 6.70	June 13.61	June 21.47
	June 29.14	July 5.88	July 13.10	July 21.17
	July 28.49	Aug. 4.11	Aug. 11.65	Aug. 19.82
	Aug. 26.81	Sept. 2.44	Sep. 10.29	Sep. 18.40
	Sep. 25.13	Oct. 1.91	Oct. 10.00	Oct. 17.88
	Oct. 24.51	Oct. 31.55	Nov. 8.74	Nov. 16.29
	Nov. 22.96	Nov. 30.33	Dec. 8.45	Dec. 15.64

DESCRIPTIVE INFORMATION CONCERNING COMETS (to complement the tabulated data, ICQ 51)

Austin (1984i): Robert McNaught (MCN) noted a circular coma and no tail on July 21 and 28 (15x80 binoculars; good sky on July 28); on July 30, he observed a straight tail 1.8 degrees long. Alan Gilmore saw a narrow tail in p.a. 140° on July 25 (GIL). David A. J. Seargent (SEA) apparently glimpsed the comet via naked eye on July 10.81, after the moon had set. Andrew Pearce (PEA) reports that the tail was "quite easy" in a 15.2-cm reflector on July 27.46, and noted that the central condensation was offset to the northwest; he also found the coma to have an "intense green colour", and the tail was broader, on July 31.46. V. F. de Assis Neto (DEA) noted a "compact condensation" inside a 5′ coma that was fan-shaped in p.a. 320 degrees (31-cm reflector, 61x) on July 20.92.

P/Clark (1983w): Andrew R. Pearce (PEA) no "slightly condensed centre surrounded by vague outer halo" on May 30.

P/Wild 2 (1983s): John E. Bortle (BOR) considers his March 25.03, 1984, observation of this comet to be doubtful: Total visual magnitude 12.4 (Sidgwick method, AAVSO, 31.7-cm f/6 reflector, 88x), coma diameter 1.6′, DC = 0.

P/Crommelin (1983n): Robert T. Price (PRI) reports that the comet was difficult to see, and indeed was only seen with averted vision, on March 28.46 and 29.39, using 15x80 binoculars; he could not find the comet on March 30.42 or April 1.45, despite very good observing conditions. Pearce (PEA) found the coma size smaller on Feb. 20.53 due to proximity of a 9th-magnitude star; the comet was elongated with a broad fan in a northerly direction. Pearce found the comet surrounded by a diffuse outer halo on Feb. 24.52, and noted a "quite faint and vague" tail. On Feb. 29.52, Pearce found that the coma "appeared slightly irregular towards p.a. 315 degrees" at higher power. Pearce also found the comet "quite diffuse and getting difficult" to see on March 26.50; by April 4.50, he noted P/Crommelin "too difficult to get a magnitude estimate". M. Clark (CLA) found the comet "much fainter" on April 1.54 than it had been on March 27.53. James A. DeYoung (DEY) also observed the object "at [the] limit of visibility" on April 1.04 in his 15-cm reflector.

P/Encke: Pearce (PEA) found a "sunward extension appearing as a broad and diffuse fan extending at an angle of about 10-15 degrees" and "a faint, thin tail in [the opposite] direction at about half the length of [the] fan" on April 14.87; also, "before the sky brightened, the condensation was surrounded by a diffuse outer coma." Pearce also noted a possible elongation to the northeast on April 25.87. Seargent remarked that the moon was quite close to the comet on April 26.77.

P/Takamizawa (1984j): John Bortle (BOR) reports a not-quite-stellar condensation of mag 13.0 with a 31.7-cm reflector on Aug. 19.11.

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NEW ADDITIONS TO THE OBSERVER KEY (cf. ICQ 6,38):

DIX01 IAN DIXON, AUSTRALIA

GUB HERBERT GUBO, WEST GERMANY

WOO J. WOOD, AUSTRALIA

NEW ADDITION TO THE INSTRUMENT KEY:

T = Schmidt-Cassegrain

NEW ADDITION TO THE REFERENCE KEY:

AH = G. D. Roth's *Astronomy: A Handbook*, p. 534 (chart of the Pleiades)

Comet IRAS-Araki-Alcock (1983d)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1983 05 11.51	S	2.1	AA	3.0	B		8	30	1			PEA
1983 05 11.51	S	2.2	AA	6.5	B		20	22	1		310	PEA
1983 05 11.51	S	2.1	AA	0.0	E		1	50	2			PEA
1983 05 12.47	S	1.9	AA	0.0	E		1	72	2			PEA
1983 05 12.60	S	2.0	AA	3.0	B		8	48	1			PEA

Comet IRAS-Araki-Alcock (1983d) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1983 05 13.55	S	3.1	AA	3.0	B		8		1			PEA
1983 05 13.55	S	3.1	AA	6.5	B		20		4			PEA
1983 05 13.55	S	3.0	AA	0.0	E		1		1			PEA
1983 05 13.55	M	3.2	AA	6.5	B		20					PEA
1983 05 14.66	S	4.4:	AA	0.0	E		1		2			PEA
1983 05 15.51	S	4.7	AA	0.0	E		1	35	2			PEA
1983 05 15.52	S	5.4	AA	41	L	4	86	25	5/			PEA
1983 05 15.52	S	4.8	AA	3.0	R		6	35	3			PEA
1983 05 15.52	S	5.1	AA	15.2	L	5	30	25	5			PEA
1983 05 15.53	S	4.8	AA	6.5	B		20	28	4			PEA
1983 05 16.51	S	5.0	AA	0.0	E		1	30	3			PEA
1983 05 17.55	S	5.2	AA	0.0	E		1	23	3			PEA
1983 05 17.56	S	6.0	AA	41	L	4	86	10	5/	0.11	194	PEA
1983 05 17.56	S	5.6	AA	15.2	L	5	30	12	5	0.11	194	PEA
1983 05 17.56	S	5.4	AA	3	R		6	22	4			PEA
1983 05 18.50	S	5.9	AA	6.5	B		20	13	4			PEA
1983 05 18.50	S	6.0	AA	15.2	L	5	30	7	5	0.1	323	PEA
1983 05 29.46	S	7.2	VN	41	L	4	86	8	7			CLA
1983 05 29.48	S	7.1	AA	15.2	L	5	30	5	5			PEA
1983 05 29.48	S	7.0	AA	6.5	B		20		4/			PEA
1983 05 30.48	S	7.2	AA	6.5	B		20		5			PEA
1983 05 30.48	S	7.2	AA	15.2	L	5	30	5	6			PEA
1983 05 30.53	S	7.4	VN	41	L	4	86	8	7			CLA
1983 05 31.47	S	7.5	VN	41	L	4	86	12	7			CLA
1983 06 03.50	S	7.3	AA	6.5	B		20	5.5	4			PEA
1983 06 03.50	S	7.4	AA	15.2	L	5	30	4.5	4/			PEA
1983 06 06.47	S	7.4	AA	6.5	B		20	4.5	4			PEA
1983 06 06.47	S	7.5	AA	15.2	L	5	30	4	5			PEA
1983 06 07.47	S	7.6	AA	15.2	L	5	30	4	4			PEA
1983 06 07.47	S	7.5	AA	6.5	B		20	4.5	4			PEA
1983 06 08.48	S	7.4	AA	6.5	B		20		5			PEA
1983 06 08.48	S	7.4	AA	15.2	L	5	30	5	6			PEA
1983 06 09.49	S	7.9	VN	41	L	4	86	10	6			CLA
1983 06 10.47	S	7.4	AA	6.5	B		20	5	5			PEA
1983 06 10.47	S	7.4	AA	15.2	L	5	30	4	6			PEA
1983 06 12.48	S	7.6	AA	6.5	B		20	3.5	5			PEA
1983 06 12.48	S	7.7	AA	15.2	L	5	30	3	5			PEA
1983 07 01.48	S	9.6	AA	15.2	L	5	30	3.5	2			PEA
1983 07 02.47	S	9.8	AA	15.2	L	5	30	3	1/			PEA
1983 07 03.47	S	9.8	AA	15.2	L	5	30	3	1			PEA
1983 07 04.46	S	10.9	VN	41	L	4	86	2.8	1			CLA
1983 07 04.48	S	9.9	AA	15.2	L	5	30	2.5	1			PEA
1983 07 05.48	S	10.2	AA	15.2	L	5	30	2.5	1			PEA
1983 07 10.47	S	10.5	AA	15.2	L	5	30		0/			PEA

Comet Černis (1983l)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1983 09 03.96	B	10.0	AA	10.0	B		14	4	6			HAS02
1983 09 19.13	B	9.0	S	20.3	C	10	80	2.5				GUB
1983 10 12.91	B	10.0	S	12.7	C	10	51	2	2			HAS02

Comet IRAS (1983o)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 03 11.50	S	13.4:	UM	20	L	6	122					HAL

Comet Austin (1984i) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 07 09.7		6.5		15	R			12				GIL
1984 07 10.81	S	5.7	AA	2.5	B		2					SEA
1984 07 10.81	S	6.3:	AA	8.0	B		15	9.7	4			SEA
1984 07 11.81				8.0	B		15		5			SEA
1984 07 11.81	S	5.4	AA	5.0	B		10					SEA
1984 07 18.30		6.4		5.0	B		7	&10				GIL
1984 07 19.92	B	6.3	S	7.0	B		10	5.0				DEA
1984 07 20.45	S	6.1	AA	15.2	L	5	30	5.5	6/			PEA
1984 07 20.45	B	6.2	AA	15.2	L	5	30					PEA
1984 07 20.92				31	L		61	5		0.20	140	DEA
1984 07 21.35		6.0	UX	6.3	B		9	5	7			MCN
1984 07 21.45	S	6.0	AA	20.3	L	6	38	6	7			PEA
1984 07 21.92	B	6.2	S	7.0	B		10	4.0				DEA
1984 07 22.46	S	6.0	AA	15.2	L	5	30	5	6/	?0.22	135	PEA
1984 07 22.91	B	6.1	S	7.0	B		10	3.4				DEA
1984 07 23.46	B	6.1	AA	15.2	L	5	30					PEA
1984 07 23.46	S	6.0	AA	15.2	L	5	30	4.5	6	0.25	135	PEA
1984 07 24.46	S	6.1	AA	20.3	L	6	38	4	6	0.5	136	PEA
1984 07 24.46	S	6.0	AA	15.2	L	5	30					PEA
1984 07 25.3		6.3		5.0	R		7	5			140	GIL
1984 07 27.46	S	5.8	AA	15.2	L	5	30	4	6/	0.75	143	PEA
1984 07 27.46	S	5.7	AA	3.0	B		8					PEA
1984 07 28.36		6.8		6.3	B		9	3				MCN
1984 07 30.37		6.5		6.3	B		9	2		1.8	133	MCN
1984 07 31.37		6.3	S	6.3	B		9	1		2.1	129	MCN
1984 07 31.37		6.3	S	6.3	B		9	1		2.1	129	MCN
1984 07 31.46	S	5.7	AA	20.3	L	6	38	3	6/	1.6	125	PEA
1984 07 31.46	S	5.5	AA	3.0	R		6		7		130	PEA
1984 08 01.37		5.6	S	6.3	B		9	1		2.4	129	MCN
1984 08 01.91	B	5.7	S	7.0	B		10	1.0				DEA
1984 08 02.91	B	5.6	S	7.0	B		10	1.0				DEA
1984 08 03.36				12.0	B		20	0.42				MCN
1984 08 03.36		5.1	S	6.3	B		9			3.1	129	MCN
1984 08 05.90	S	5.4:	S	7.0	B		10	& 0.9				DEA
1984 08 07.36		5.2	S	8.0	B		10	1		0.2		MCN

Periodic Comet Encke

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 01 31.77	S	11.5:	A	25.4	J	6	59	& 1.5	0/			BOU
1984 01 31.77	S	11.6:	A	15.6	L	5	36	1.5	0/			BUS01
1984 01 31.77	S	11.5:	A	25.4	J	6	59	1.5	0/			BUS01
1984 02 05.13	S	11.7	AA	20	L	6	61		1			HAL
1984 02 18.78	S	10.0:	A	15.6	L	5	36					BOU
1984 02 19.79	S	10.0	A	15.6	L	5	36	& 1.75	1			BOU
1984 02 23.02	S	10.8	AC	15	R	5	31	2.5	1			MOR03
1984 03 04.04	S	9.3	AC	15	R	5	31	2.5	5			MOR03
1984 03 08.79	S	8.5	A	15.6	L	5	36					BOU
1984 03 10.01	S	7.9	MP	31.7	L	6	55	1.9	6/			BOR
1984 03 11.14	S	7.9	AA	20	L	6	61					HAL
1984 03 12.01	S	7.7	MP	31.7	L	6	55	1.5	6/			BOR
1984 03 15.01	S	7.5	MP	31.7	L	6	55	1.5	6			BOR
1984 03 16.01	S	7.4	MP	31.7	L	6	55	1.5	7			BOR
1984 03 20.15	S	7.3	AA	20	L	6	61					HAL

Periodic Comet Encke (Cont.)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 04 11.79	S	7.4	AA	8.0	B		15	& 1.25	7			SEA
1984 04 13.80	S	8.0:	AA	8.0	B		15	2.5	5			LOV
1984 04 14.75	S	8.1	AA	8.0	B		15					SEA
1984 04 14.87	S	7.5	AA	15.2	L	5	30	2.5	6/	0.07	65	PEA
1984 04 15.80	S	8.6	AA	8.0	B		15		4			LOV
1984 04 17.79	S	8.5	AA	8.0	B		15					SEA
1984 04 25.87	S	9.0	AA	15.2	L	5	30	3	5			PEA
1984 04 26.77	S	9.2:	AA	8.0	B		15					SEA
1984 04 26.87	S	9.0	AA	15.2	L	5	30	2.8	5			PEA
1984 04 27.77	S	9.1	AA	8.0	B		15	3.3	2			SEA
1984 04 29.77	S	9.5	AA	8.0	B		15					SEA
1984 05 01.87	S	9.3	AA	15.2	L	5	30	2.3	2			PEA
1984 05 02.87	S	9.3	AA	15.2	L	5	30	2.5	2/			PEA
1984 05 04.87	S	9.4	AA	15.2	L	5	30	2.5	2			PEA

Periodic Comet Clark (1983w)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 05 06.47	S	11.1	AA	20	L	6	61	2	2			HAL
1984 05 07.44	S	11.0	AC	25.6	L	4	67	2.0	2			MOR
1984 05 10.48	S	11.1	AA	20	L	6	61					HAL
1984 05 26.46	M	11.0	AC	25.6	L	4	67	2.1	3/			MOR
1984 05 30.80	S	10.8	VN	15.2	L	5	30	1.8	3			PEA
1984 05 31.82	S	10.7	VN	15.2	L	5	30	2	3/			PEA
1984 06 03.45	S	10.9	AA	20	L	6	61		3			HAL
1984 06 03.82	S	10.7	VN	15.2	L	5	30	2.2	3			PEA
1984 06 05.81	S	10.8	VN	15.2	L	5	72		3			PEA
1984 06 05.81	S	10.6	VN	15.2	L	5	30	2	3/			PEA
1984 06 23.40	M	10.4	AC	25.6	L	4	67	2.0	5	0.13	260	MOR
1984 07 07.42	S	10.6	AA	20	L	6	61		4			HAL

Periodic Comet Tempel 2 (1982d)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1983 09 03.97	B	9.8	AA	10.0	B		14	7	2			HAS02

Periodic Comet d'Arrest (1982 VII = 1982e)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1982 09 09.05	S	10.5	AC	15	R	5	31	2.5				MOR03
1982 10 11.01	S	9.5	AC	15	R	5	31	3				MOR03
1982 10 18.99	S	9.5	AC	15	R	5	31	4.5				MOR03
1982 11 16.00	S	10.5	AC	15	R	5	31	3.5				MOR03

Periodic Comet Kopff (1982k)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1983 06 03.92	B	8.8	AA	12.7	C	10	51	3				HAS02
1983 06 04.90	B	9.0	AA	12.7	C	10	51	3				HAS02
1983 07 30.88	B	8.2	AA	10.0	B		14	7	1			HAS02

Periodic Comet Churyumov-Gerasimenko (1982 VIII = 1982f)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1982 12 22.21	S	9.9	AC	15	R	5	62	1.7				MOR03
1983 01 04.08	S	9.6	AC	15	R	5	62	2.3				MOR03
1983 01 09.12	S	10.3	AC	15	R	5	62	1.5				MOR03
1983 01 18.06	S	10.5	AC	15	R	5	62	1.4				MOR03
1983 01 21.09	S	10.7	AC	15	R	5	62	1.1				MOR03
1983 02 13.02	S	12.0	AC	15	R	5	62	1.1				MOR03

Periodic Comet Wild 2 (1983s)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 04 21.22	S	13.0	AC	25.6	L	4	111	& 1	3			MOR
1984 04 22.20	S	13.3	AA	20	L	6	122					HAL
1984 04 23.21	S	13.1	AC	25.6	L	4	111	0.6	3			MOR

Periodic Comet Takamizawa (1984j)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 08 01.41	M	9.5	AA	25.6	L	4	45	1.5	8	0.07	250	MOR
1984 08 03.53		9.5	S	12.0	B		20	& 1		0.07	279	MCN
1984 08 04.55		9.1	S	12.0	B		20	& 2		?		MCN
1984 08 06.78		9.4		12.0	B		20	1				MCN
1984 08 07.52		10.4:		30.5			52	0.50				MCN
1984 08 08.83		9.5:		12.0	B		20	0.75				MCN
1984 08 18.19	S	10.0	AC	31.7	L	6	68	1.5	4			BOR
1984 08 19.11	S	10.1	AC	31.7	L	6	68	2	5			BOR
1984 08 21.10	S	10.1	AC	31.7	L	6	68	& 1.6	4			BOR

Periodic Comet Faye (1984h)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 06 23.46		12.5:		25.6	L	4	156	& 1	2			MOR
1984 06 27.46		12.5:		25.6	L	4	156	& 1	3			MOR
1984 06 28.47	S	12.6:	AC	25.6	L	4	156	1.0	3			MOR

Periodic Comet Schwassmann-Wachmann 1

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 04 23.00	P	[13.5	UP	26.0	L	6						MER

Periodic Comet Crommelin (1983n)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 01 21.15	S	11.7	AA	20	L	6	61	2.8	2			HAL
1984 01 25.15	S	10.7	AA	20	L	6	61					HAL
1984 01 25.77	S	10.5	A	25.4	J	6	59	3	0/			BUS01
1984 01 28.02	S	11.2	AC	15.0	R	5	62	2	1			MOR03
1984 01 30.15	S	9.6	AA	20	L	6	61					HAL
1984 01 31.76	S	9.6	A	25.4	J	6	59	4	2/			BUS01
1984 02 05.14	S	9.2	AA	20	L	6	61		5			HAL
1984 02 18.52	S	8.2	AA	15.2	L	5	30	3.2	6			PEA
1984 02 18.79	S	8.0:	A	25.4	J	6	59	4.5	5			BUS01
1984 02 19.16	S	8.0	AA	20	L	6	61					HAL
1984 02 19.52	S	8.1	AA	15.2	L	5	30	2.5	5/			PEA
1984 02 19.52	S	8.6	A	41.0	L	4	86	2.25	6			CLA

Periodic Comet Crommelin (1983n) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 02 19.79	S	7.9	A	15.6	L	5	36	5	5			BUS01
1984 02 20.52	S	8.4	A	41.0	L	4	86	2.5	6			CLA
1984 02 20.53	S	8.1	AA	15.2	L	5	30	3	5			PEA
1984 02 21.02	S	8.7	AA	15.0	L	8	51	1.9	3			DEY
1984 02 22.01	S	8.5	AA	15.0	L	8	51	2.3	4			DEY
1984 02 23.01	S	8.5:	AA	15.0	L	8	51	2.3	3			DEY
1984 02 23.01	S	8.3	AC	15.0	R	5	31	2.5	5			MOR03
1984 02 23.44	S	7.8	AA	8.0	B		15	3	2			PRI
1984 02 24.43	S	7.7	AA	8.0	B		15	4	2			PRI
1984 02 24.50	S	7.3	AH	20.3	T	10	50	3	5	0.07	30	WOO
1984 02 24.52	S	7.7	AA	15.2	L	5	30	3.5	6	0.33	311	PEA
1984 02 24.52	M	7.8	AA	15.2	L	5	30					PEA
1984 02 25.42	S	7.6	AA	8.0	B		15	4	2			PRI
1984 02 26.43	S	7.5	AA	8.0	B		15	5	2			PRI
1984 02 26.43	S	8.3	AA	20	T	10	50	3.8	4			DIX01
1984 02 26.52	S	7.7	AA	15.2	L	5	30	3.5	6	0.33	312	PEA
1984 02 27.02	S	8.5	AA	15.0	L	8	51	2.2	3			DEY
1984 02 27.43	S	7.9	AA	8.0	B		15	3.4	6			SEA
1984 02 28.44	S	7.5	AA	8.0	B		15	5	1			PRI
1984 02 29.43	S	8.0	AA	8.0	B		15	3	5			SEA
1984 02 29.52	S	7.4	AA	15.2	L	5	30	4	6	0.5	312	PEA
1984 03 01.43	S	7.4	AA	8.0	B		15	5	2			PRI
1984 03 01.53	S	7.5	AA	15.2	L	5	30	4	6	0.5	317	PEA
1984 03 01.53	S	7.9	A	20.0	L	6	60	2.5	6			CLA
1984 03 02.02	S	8.5	AA	15.0	L	8	51	2.9	2			DEY
1984 03 02.43	S	7.6	AA	8.0	B		15	5	2			PRI
1984 03 03.43	S	7.4	AA	8.0	B		15	4	2			PRI
1984 03 03.43	S	7.9	AA	20	T	10	50	3.9	4			DIX01
1984 03 03.43	S	7.6	AA	8.0	B		15	4	5			SEA
1984 03 04.02	S	8.6	AA	15.0	L	8	51	3.7	2			DEY
1984 03 04.03	S	8.6	AC	15.0	R	5	31	4	4			MOR03
1984 03 04.43	S	7.7	AA	8.0	B		15					SEA
1984 03 04.43	S	7.8	AA	20	T	10	50	3.6	4			DIX01
1984 03 04.44	S	7.5	AA	8.0	B		15	4	3			PRI
1984 03 05.43	S	7.6	AA	20	T	10	50	3.8	4			DIX01
1984 03 05.43	S	7.6	AA	8.0	B		15	3.5	4			SEA
1984 03 05.43	S	7.5	AA	8.0	B		15	3	3			PRI
1984 03 05.53				15.2	L	5	30			0.33	300	PEA
1984 03 05.53	S	7.5	AA	15.2	L	5	30	4	5		65	PEA
1984 03 06.43	S	7.5	AA	8.0	B		15		4			SEA
1984 03 06.51	S	7.7	AA	15.2	L	5	30	3.5	5	0.2	298	PEA
1984 03 07.43	S	7.4:	AA	8.0	B		15					SEA
1984 03 08.80	S	8.2	A	15.6	L	5	29	3	5			BUS01
1984 03 09.50	S	7.6	AH	20.3	T	10	50	3	5			WOO
1984 03 10.02	S	8.5	A	31.7	L	6	68	2.3	3			BOR
1984 03 10.52	S	7.4	A	20.0	L	6	60	2.5	6			CLA
1984 03 11.18	S	8.6	AA	20	L	6	61		3			HAL
1984 03 12.78	S	8.9	S	26.0	L	6	63	& 3.0	3			MER
1984 03 20.42	S	8.2	AA	8.0	B		15	5	3			PRI
1984 03 20.50	S	8.6	AA	15.2	L	5	30	4	2/			PEA
1984 03 21.49	S	8.5	AA	15.2	L	5	30	3.7	3			PEA
1984 03 21.55	S	8.5	AA	15.2	L	5	30	3.5	3			PEA
1984 03 22.51	S	8.6	AA	15.2	L	5	30	4	2/			PEA
1984 03 24.03	S	9.5	A	31.7	L	6	68	3.5	1			BOR
1984 03 24.03				12.0	B		20	6				BOR

Periodic Comet Crommelin (1983n) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 03 24.04	S	9.7	AC	15.0	R	5	31	2.5				MOR03
1984 03 24.50	S	8.8	AA	15.2	L	5	30	3.5	2/			PEA
1984 03 25.04	S	9.2	A	31.7	L	6	68	4.5	1			BOR
1984 03 25.49	S	8.9	AA	15.2	L	5	30	3.5	2			PEA
1984 03 26.43	S	9.3	AA	8.0	B		15	& 4	2			SEA
1984 03 26.50	S	9.0	AA	15.2	L	5	30	3.5	2			PEA
1984 03 27.03	S	9.1	A	31.7	L	6	68	3.5	1			BOR
1984 03 27.41	S	8.6	AA	8.0	B		15	4	2			PRI
1984 03 27.43	S	9.4	AA	8.0	B		15		2			SEA
1984 03 27.50	S	9.0	AA	15.2	L	5	30	3.2	2			PEA
1984 03 27.53	S	7.6	A	41.0	L	4	86	2.75	4			CLA
1984 03 28.44	S	9.8	AA	25	L	5	40					NEW
1984 03 28.46	S	8.8	AA	8.0	B		15	3				PRI
1984 03 29.17	S	9.0	AA	20	L	6	61	9	2			HAL
1984 03 29.18	S	8.9	AA	10.8	L	4	22					HAL
1984 03 29.43	S	9.8	AA	8.0	B		15					SEA
1984 03 30.43	S	10.0	AA	8.0	B		15					SEA
1984 03 30.82	S	9.4	A	26.0	L	6	63	& 4.0	3			MER
1984 03 31.19	S	9.3	AA	20	L	6	61		3			HAL
1984 04 01.04	S	10.4	AA	15.0	L	8	67	0.5	0			DEY
1984 04 01.54	S	8.5	A	41.0	L	4	86	3	4			CLA
1984 04 02.04	S	9.8	A	31.7	L	6	68	3.2	1			BOR
1984 04 04.50				15.2	L	5	30	3	1			PEA
1984 04 21.19	S	[11.5	AC	25.6	L	4	67					MOR

Periodic Comet Hartley-IRAS (1983v)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1983 12 28.72	S	10.8	AC	12.7	C	10	51	3	1			HAS02
1983 12 30.76	S	10.5	A	15.6	L	5	36	2.5	1/			BOU
1983 12 30.76	S	10.3	A	25.4	J	6	73		2			BUS01
1984 01 01.74	S	10.8	AC	12.7	C	10	51	2	3			HAS02
1984 01 01.75	S	11.0	AC	11.0	L	10	63	6	3			KOC01
1984 01 02.73	S	11.2	AC	11.0	L	10	63	4	4			KOC01
1984 01 02.75	S	10.8	AC	12.7	C	10	60	2.8	1			HAS02
1984 01 21.99	S	11.0	AC	15.0	R	5	62	1.7	2			MOR03
1984 01 25.76	S	10.0:	A	15.6	L	5	45					BUS01
1984 01 25.76	S	10.0	A	15.6	L	5	45	2.5	1			BOU
1984 01 29.11	S	11.4	AA	20	L	6	61		4			HAL
1984 02 11.56	S	9.9	AA	20	L	6	61			0.17		HAL
1984 02 24.55	S	7.5	AA	5.0	B		10			0.25		HAL
1984 02 28.55	S	8.3:	AA	5.0	B		10					HAL
1984 03 04.78	S	9.0	S	15.0	L	5	25	7.6	3			MER
1984 03 09.15	S	9.0	A	25.4	J	6	59	3	4			BOU
1984 03 11.55	S	9.3	AA	20	L	6	61					HAL
1984 03 25.33	S	10.0	AC	15.0	R	5	31	3	0			MOR03
1984 03 25.90	S	10.8	AC	12.7	C	10	60	3	1			HAS02
1984 03 27.37	S	9.5	A	8.0	B		20	4.5				BOR
1984 03 27.37	S	10.1	A	31.7	L	6	68	2.9	2/			BOR
1984 03 30.84	S	10.4	A	25.4	J	6	59	2.5	1			BOU
1984 04 01.23	S	10.6	A	20.0	C	10	64	3.5	1			SPR
1984 04 02.36	S	10.3	A	31.7	L	6	68	2.5	3			BOR
1984 04 02.36	S	9.9	A	8.0	B		20	3.5	1			BOR
1984 04 09.35	S	10.4	A	31.7	L	6	68	2.9	2			BOR

Periodic Comet Hartley-IRAS (1983v) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 04 21.30	S	10.2	NP	25.6	L	4	45	3.1	2	0.08	180	MOR
1984 04 22.14	S	10.4	A	31.7	L	6	68	3.5	2			BOR
1984 04 22.21	S	10.2	A	20.0	C	10	64	3.0	2			SPR
1984 04 24.20	S	10.5	NP	25.6	L	4	67	3.1	1			MOR
1984 04 26.21	S	10.4	A	32.0	L	7	71	3.5	2			SPR
1984 04 27.15	S	10.5	A	31.7	L	6	68	2.5				BOR
1984 04 27.22	S	10.7	A	20.0	C	10	125	3.0	1			SPR
1984 05 02.06	S	10.7	A	31.7	L	6	68	3.0	1			BOR
1984 05 03.20	S	10.7	NP	25.6	L	4	67	2.8	2			MOR
1984 05 03.38	S	10.9	A	31.7	L	6	68	2.7	1			BOR
1984 05 06.33	S	10.9	NP	25.6	L	4	67	2.6	1			MOR
1984 05 07.46	S	11.0	NP	25.6	L	4	67	3.3	1			MOR
1984 05 19.25	S	11.4	NP	25.6	L	4	67	2.3	0			MOR
1984 05 26.24	S	12.0	NP	25.6	L	4	67	1.6	0			MOR
1984 05 27.24	S	12.2	NP	25.6	L	4	67	2.0	0			MOR

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RECENT NEWS AND RESEARCH CONCERNING COMETS

Daniel W. E. Green
Harvard-Smithsonian Center for Astrophysics

Since late April, 3 new comets have been discovered and 4 previously-known short-period comets recovered. Eugene and Carolyn Shoemaker discovered comet 1984f on circular sheet-film exposed at the 18-inch Schmidt telescope at Palomar on May 27 and 29. Comet Shoemaker was then moderately condensed, at total magnitude about 14, with a fan-shaped coma structure to the north. The object was near opposition, moving slowly southwestward in the southwestern corner of Hercules. Indeed, the comet was more than 5 AU from the sun at discovery, and perihelion will not occur until 1985 Sept. 4 (q = 2.7 AU). Comet 1984f should gradually brighten during the next year, but will probably not get brighter than magnitude 11. Elements (from Brian Marsden, MPC 9026) and an ephemeris are provided below. Peak brightness for comet 1984f should occur near opposition in May 1985, but its declination will be near -38°; while it may remain brighter than 12th magnitude for a year or so, it will remain fairly far south, moving from declination -40° in mid-Oct. 1985 to -62° in Jan. 1986. Photographic observers have been reporting total magnitudes in the range 14 to 15.4 between May 27 and June 3, and it does appear that this is an intrinsically bright comet (absolute mag near 4.0).

The late-May observing run was very productive for the Shoemakers, who are involved in a search for close-approaching asteroids (chiefly Apollo-type objects -- those whose orbits intersect the Earth's orbit); the Shoemakers found two Apollo-type minor planets, 1984 KB and 1984 KD, both being first photographed on May 27. The second asteroid passed about 0.031 AU from the Earth on June 19 (about the same distance as the closest approach of comet IRAS-Araki-Alcock last year), and was near visual magnitude 11 at that time, with changes of up to half a magnitude noted by several observers in times as little as 20 to 30 minutes.

Jim Gibson reported his recovery of P/Wolf-Harrington (1984g) from a plate exposed at Palomar using the 48-inch Schmidt telescope; the comet was found close to the predicted position, with the correction to the time of perihelion being only +0.03 day. CCD images of the comet obtained several nights later with the 60-inch reflector at Palomar (also by Gibson) showed a short tail (about 50 arcsec long in p.a. 270 degrees on a 60-sec exposure on June 8.46 UT). This is the 7th recorded apparition of the object, first discovered in 1924; it has an orbital period of about 6.5 years. Ed Everhart, observing with a 40-cm reflector (f/5.5) in Colorado, found a short tail on a July 3 photograph of comet 1984g. Gibson's June 4.46 photograph showed the comet at total mag 17.

Several large telescopes were aimed toward periodic comet Faye last year, but its apparent location in crowded Milky-Way star fields (it was near magnitude 20 to 21 in 1983 August) made it too difficult for astronomers to definitively identify on photographs. Finally this past June, Gibson reported definite CCD images on several nights with the 60-inch reflector at Palomar, and C. S. Morris independently recovered the comet visually with his 10-inch reflector near Frazer Park, California. It has been many years since a visual recovery of a comet has been accredited to any observer (new discoveries of "lost" short-period comets not counted)! Morris located the comet in morning twilight, low in the southeast sky, as a diffuse object with slight condensation and near total magnitude 12.5 on June 23.44 UT. Designated comet 1984h, this is the 18th recorded appearance of P/Faye (orbital period about 7.4 years; q = 1.6 AU).

The recovery has permitted definite identification of P/Faye's image on exposures taken by Gibson last August 31. Gibson has been the only astrometric observer of comet 1984h at this apparition -- his twilight plates taken on August 19 and 21 show a stellar nucleus with a small amount of surrounding coma.

An ephemeris for P/Faye is provided below, as well as ones for the two other new comets recently discovered, comets Austin (1984i) and Takamizawa (1984j). Comet 1984i is Rodney R. D. Austin's second comet discovery in 2 years. The discoverer found the comet on July 8.73 UT as an 8th-magnitude diffuse object (with some condensation) moving northeastward in the constellation Caelum. A better estimate by the discoverer made the total visual magnitude as 6.5 on July 9.7, with a coma diameter of 12′. The comet was about 0.26 AU from the earth then, but perihelion was not to occur until Aug. 12.1, at a distance of 0.29 AU from the sun.

Austin's comet remained poorly placed for northern-hemisphere observers for 2 months after his discovery from New Zealand. Not until early September will comet 1984i become observable from northern latitudes, as it moves away from the solar glare, and it will then be only about 9th magnitude. The comet did remain between apparent total visual magnitudes 6 and 7, however, during the weeks following discovery, and observers reported a gradual increase to 5th magnitude by early August. At the same time, observed tail lengths grew to over 3 degrees, and, as expected for comets going within 0.3 AU of the sun, the coma diameter gradually decreased to < 1′.

On July 30.528 UT, Kesao Takamizawa of Saku-machi, Nagano Prefecture, Japan, discovered a small, tenth-magnitude comet moving slowly southward in the constellation Capricornus. Takamizawa located the comet visually with 20x120 binoculars. Early total visual magnitude estimates by Charles Morris and Alan Hale, both observing from Whitaker Peak, CA, gave 9.5 (20-cm reflector) and 9.3 (20-cm refl.), respectively, on Aug. 1.4 UT. Morris found the comet extremely condensed, with coma diameter near 1.5′.

Astrometric observations soon indicated that comet Takamizawa 1984j was actually a short-period one, with an orbital period around 7 years. With an inclination quite low (i = 9°.5), why had this comet not been discovered years ago? Answers to this question come from prediscovery images found by T. Seki of Geisei, Japan, on July 26.7 and by Paul Wild, observing at Zimmerwald in Switzerland on July 6.03 and 8.04 UT. Wild notes that he had marked the July 8th image, which shows a bright, asymmetric coma of magnitude 13, but he dismissed the image as a film defect since he could not find anything similar on the film taken of the same area two nights earlier. Armed with orbital elements and ephemeris supplied by Brian Marsden (via IAU Telegram and Circular), Wild proceeded to find a very faint image on his July 6th film, which showed a very tenuous, round coma near 16th magnitude with a distinct 17th-magnitude nucleus. The July 8 image also has a fan-shaped tail about 1′ long to the west.

Seki′s July 26 image showed the comet to be of total magnitude 6.5 (!); the object was extremely condensed and had a short tail in p.a. 270 degrees. P/Takamizawa, then, appears normally to be quite faint, and it experienced a large outburst in early July, resembling perhaps the famous outbursts more than 10 years ago of P/Tuttle-Giacobini-Kresák. Many questions remain concerning its July activity: Did comet 1984j gradually rise from mag 13 on July 8 to mag 6.5 on July 26? Or did the comet have several more dramatic outbursts, with rapid up-and-down fluctuations, during that 3-week period? Observations since discovery show that the comet has not substantially declined by mid-August -- it has remained near total mag 10.

Gibson obtained two 1-minute exposures with the 48-inch Palomar Schmidt telescope of comet 1984j on August 21; these plates showed a nucleus with a jet about 9 arc-seconds long in p.a. 85°. The coma only exhibited "some diffuse light, primarily on the north side". C. Morris and Alan Hale also observed the comet visually on the same night, with Morris commenting on how condensed the object still was. Morris found the stellar condensation slightly off-center (in a direction opposite the tail) and noted a short tail of length 3.5′ in p.a. about 240°; he tried using Lumicon′s Comet Filter, which made the comet less visible, suggesting that the comet is mostly composed of dust.

P/Arend-Rigaux has been recovered as comet 1984k independently by Gibson and by Seki as a stellar object of magnitude 18.5 on Aug. 7 and 8. A 24-min exposure with the 1.2-m Schmidt telescope at Palomar by Gibson on Aug. 6 shows a hint of a very faint tail 1′ to 2′ long in p.a. 255°. This object is similar to P/Neujmin 1 in being almost asteroidal in appearance, indicating it is in a transition stage between comet and minor planet. It may brighten to near 11th total magnitude later this year, and an ephemeris is given below.

P/Gehrels 3 (1983l) has also been recovered by Gibson using plates taken Aug. 7 and 8 with the 48-inch Schmidt at Palomar. The essentially stellar images were near mag 20 to 20.5. This object eluded such observers as Kohoutek in W. Germany and Gibson last year, when it was predicted to be around 19th magnitude but must have been much fainter; P/Gehrels 3 is perhaps "fading out". This comet has an orbital period slightly over 8 years, and has perihelion next June 3 (q = 3.44 AU).

Further observations of comet 1984a show that this comet is indeed a short-period one of around 151 years. Thirty-two observations spanning Jan. 9 to May 30 reveal a semi-major axis of 28.4 AU and an inclination of 51°.8 (orbit on MPC 9025). As noted in this column for the April issue, P/Bradfield 1984a is William Bradfield′s first periodic comet in 12 discoveries. Its next perihelion will not occur, though, until 2135! When last photographed in late May (by A. Gilmore and P. Kilmartin of Mount John University Observatory in New Zealand), P/Bradfield had a nuclear magnitude near 18 (May 26.70 UT).

P/Neujmin 1 (1984c) had a stellar appearance on a May 26 photograph by Gilmore. The same observer also obtained a photographic image of comet Černis (1983l) on May 31. His 1983 Aug. 1.35 photograph of comet IRAS 1983k showed a nuclear mag of 16.4. On 1984 Mar. 6.64, K. Russell and M. Hawkins found the comet at total mag 16 with the U.K. Schmidt telescope in Australia; Oak Ridge Observatory (in Harvard, MA) got poor images on April 9 and May 6 plates of the same comet.

Observers at Perth Observatory in western Australia have been reporting many astrometric comet observations recently, including a series of P/Encke and P/Clark (1983w), both up through May 3. They also obtained a photograph of P/Harrington-Abell (1983r) on March 26; Oak Ridge obtained a weak image of comet 1983r on an April 2 plate.

Oak Ridge also obtained plates of P/Wild 2 (1983s) on Apr. 29, P/Taylor (1983u) on May 3 (very weak image), P/IRAS (1983j) on Feb. 22, P/Hartley-

IRAS (1983v) on June 4 (this author obtained a 16-inch-astrograph plate of the comet at Oak Ridge on April 28.22 which showed a total magnitude of 11.6), and P/Russell 4 (1984d) on May 7. Observers at Kleť Observatory found comet 1984d at total mag 13.2 on March 22.99 and at 14.8 on Apr. 19.88.

Kleť observers also photographed P/Smirnova-Chernykh at total mag 14.5 on March 20.86; B. Skiff at Lowell Observatory found this same comet at total mag 15.0 on Apr. 2.23 and at 15.5 on Apr. 8.33.

Comet IRAS 1983o has been followed by several observatories in recent months, including Kleť (total mag 14.5 on March 21.95), Victoria (tail 1.2′ long in p.a. 163° on Apr. 2.35), Oak Ridge (weak, diffuse, uncertain images obtained May 28 and June 5), and Tokyo Observatory's Kiso Station (total mag 17 on a June 1.56 plate with the 1.05-m Schmidt telescope). J. M. Baur of the Osservatorio Chaonis in Italy found this comet as a diffuse object of total mag 15.5 on a March 22.95 photograph.

An interesting calculation has been made by L. Kresák, A. Carusi, E. Perozzi and G. B. Valsecchi, who find that two short-period comets, P/Neujmin 3 and P/Van Biesbroeck, may actually be fragments of a larger single comet which split around 135 or 140 years ago. In January 1850, both comets had close encounters with Jupiter, and the astronomers find (IAUC 3940) that the two comets had very similar orbital elements prior to this encounter. Other short-period comets have been seen to split (for example, P/du Toit-Hartley), but no such splittings have produced such large and such long-lasting fragments.

West Germany launched a satellite on August 9 known as the "Active Magnetospheric Particle Tracer Explorer", or AMPTE, which has an experiment that will generate an "artificial comet" of barium "to study the effects on a comet of the solar wind and magnetosphere", according to J. Eberhart in Science News 126, 52. Sometime in late December of this year, an exploding cannister will send powdered barium into "a glowing cloud that will be visible from earth, where it will appear about one-third the size of the full moon."

CORRIGENDUM: In this column for the April issue, p. 51 (column 2, line 14 from the bottom), Feb. 23 should be March 23.

Cambridge, MA, 1984 Aug. 24

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ORBITAL ELEMENTS (from MPC 9026) and EPHEMERIS FOR COMET AUSTIN (1984i)
Magnitudes are based on n = 4 and absolute mag = 10.0.

T = 1984 Aug. 12.1346 ET e = 1.0 (assumed)
Arg. of Peri. = 353°.1070
Node = 170.8769 (equinox 1950.0)
i = 164.1578 q = 0.291380 AU

Date	ET	R. A. (1950)	Decl.	Delta	r	Elong.	Mag.
1984 08	18	09h39m.75	+16°40'.3	1.347	0.345	4°.0	6.0
1984 08	23	09 25.15	+19 58.9				
1984 08	28	09 12.41	+22 46.3	1.346	0.552	21.6	8.1
1984 09	02	09 00.80	+25 17.1				
1984 09	07	08 49.50	+27 42.0	1.261	0.775	37.9	9.4
1984 09	12	08 37.70	+30 08.6				
1984 09	17	08 24.53	+32 42.5	1.141	0.987	54.3	10.2
1984 09	22	08 08.96	+35 27.9				
1984 09	27	07 49.67	+38 26.6	1.009	1.186	72.3	10.8
1984 10	02	07 24.90	+41 36.4				
1984 10	07	06 52.53	+44 46.2	0.891	1.375	93.2	11.1
1984 10	12	06 10.58	+47 32.2				
1984 10	17	05 18.79	+49 15.6	0.821	1.555	117.4	11.5
1984 10	22	04 21.01	+49 16.1				
1984 10	27	03 24.92	+47 20.3	0.836	1.727	141.4	12.0

EPHEMERIS FOR COMET AUSTIN (1984i) Cont. from previous page

Date	ET	R. A. (1950)	Decl.	Delta	r	Elong.	Mag.
1984 11	01	02 37.28	+43 55.9				
1984 11	06	02 00.31	+39 50.5	0.951	1.893	154.2	12.7
1984 11	11	01 32.92	+35 44.2				
1984 11	16	01 12.96	+31 59.2	1.148	2.053	147.7	13.4
1984 11	21	00 58.51	+28 43.9				
1984 11	26	00 48.11	+25 59.3	1.400	2.208	134.7	14.2

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ORBITAL ELEMENTS (from IAUC 3974) AND EPHEMERIS FOR P/TAKAMIZAWA (1984j)

Magnitudes are given based on absolute mag of 9.0 and inverse fourth-power formula, a magnitude or so fainter than recent observations show. Observers should monitor this comet for further outbursts, as this is a particularly interesting comet (see text); priority should be given to high-quality total visual magnitude estimates of this object as long as possible. Some pre-discovery ephemeris positions are also provided below.

T = 1984 May 24.9464 ET (Equinox 1950.0)
Arg. of Peri. = 147°.5732 P = 7.26 years
Ascend. Node = 124.2395 e = 0.574508
Inclination = 9.4920 q = 1.596101 AU

Date	ET	R. A. (1950)	Decl.	Delta	r	Elong.	Mag.
1984 06	29	21 10.01	-11 55.7	0.719	1.636	140.4	
1984 07	04	21 12.47	-12 47.8				
1984 07	09	21 14.04	-13 46.7	0.703	1.662	149.7	
1984 07	14	21 14.77	-14 51.1				
1984 07	19	21 14.76	-15 59.5	0.702	1.693	159.8	
1984 07	24	21 14.11	-17 09.9				
1984 07	29	21 12.98	-18 20.3	0.719	1.728	170.2	
1984 08	03	21 11.56	-19 28.5				
1984 08	08	21 10.04	-20 32.5	0.756	1.769	175.8	10.9
1984 08	13	21 08.60	-21 30.6				
1984 08	18	21 07.40	-22 21.8	0.813	1.813	166.7	11.1
1984 08	23	21 06.58	-23 05.3				
1984 08	28	21 06.24	-23 40.7	0.890	1.861	156.7	11.4
1984 09	02	21 06.48	-24 08.0				
1984 09	07	21 07.35	-24 27.5	0.985	1.912	147.2	11.8
1984 09	12	21 08.85	-24 39.6				
1984 09	17	21 10.97	-24 44.8	1.097	1.965	138.3	12.1
1984 09	22	21 13.68	-24 43.9				
1984 09	27	21 16.97	-24 37.2	1.225	2.021	130.0	12.5
1984 10	02	21 20.79	-24 25.4				
1984 10	07	21 25.09	-24 08.9	1.365	2.078	122.2	12.9
1984 10	12	21 29.82	-23 48.3				
1984 10	17	21 34.92	-23 24.0	1.517	2.137	114.8	13.2
1984 10	22	21 40.37	-22 56.4				
1984 10	27	21 46.11	-22 25.8	1.679	2.196	107.7	13.5
1984 11	01	21 52.12	-21 52.5				
1984 11	06	21 58.35	-21 16.8	1.849	2.257	100.9	13.9
1984 11	11	22 04.76	-20 38.9				
1984 11	16	22 11.34	-19 59.2	2.025	2.319	94.3	14.2
1984 11	21	22 18.05	-19 17.8				
1984 11	26	22 24.88	-18 34.9	2.205	2.380	87.8	14.5
1984 12	01	22 31.81	-17 50.6				
1984 12	06	22 38.81	-17 05.2	2.388	2.443	81.4	14.8

ORBITAL ELEMENTS (from MPC 9026) AND EPHEMERIS FOR COMET SHOEMAKER (1984f)

Total visual magnitudes below are based on recent photographic estimates (with assumed slight correction to visual), with n = 4 and H = 4.0.

T	= 1985 Sept. 4.68938 ET		
Arg. of Peri.	= 235°.46296		e = 1.0 (assumed)
Node	= 48.97929	(equinox 1950.0)	
i	= 116.66900		q = 2.6967124 AU

Date ET	R. A. (1950)	Decl.	Delta	r	Elong.	Mag.
1984 08 28	15 21.65	+02 46.5	4.738	4.563	73.9	14.0
1984 09 02	15 20.97	+01 58.0				
1984 09 07	15 20.62	+01 09.7	4.825	4.490	64.9	13.9
1984 09 12	15 20.58	+00 21.8				
1984 09 17	15 20.83	-00 25.8	4.901	4.418	56.0	13.9
1984 09 22	15 21.36	-01 12.9				
1984 09 27	15 22.14	-01 59.6	4.964	4.346	47.2	13.9
1984 10 02	15 23.16	-02 45.7				
1984 10 07	15 24.41	-03 31.3	5.008	4.274	38.7	13.8
1984 10 12	15 25.85	-04 16.3				
1984 10 17	15 27.47	-05 00.9	5.033	4.203	30.3	13.7
1984 10 22	15 29.27	-05 44.8				
1984 10 27	15 31.21	-06 28.3	5.034	4.132	22.3	13.7
1984 12 16	15 55.03	-13 20.5	4.655	3.787	25.2	13.1
1984 12 21	15 57.44	-14 00.8				
1984 12 26	15 59.77	-14 41.3	4.501	3.721	33.5	13.0
1984 12 31	16 01.99	-15 22.1				
1985 01 05	16 04.08	-16 03.4	4.324	3.655	42.2	12.8
1985 01 10	16 06.00	-16 45.3				
1985 01 15	16 07.72	-17 28.0	4.125	3.590	51.1	12.6
1985 01 20	16 09.21	-18 11.7				
1985 01 25	16 10.42	-18 56.5	3.909	3.527	60.3	12.4
1985 01 30	16 11.30	-19 42.8				
1985 02 04	16 11.80	-20 30.8	3.678	3.465	69.8	12.2
1985 02 09	16 11.88	-21 20.7				
1985 02 14	16 11.45	-22 12.8	3.438	3.404	79.7	12.0
1985 02 19	16 10.45	-23 07.4				
1985 02 24	16 08.78	-24 04.7	3.193	3.344	90.1	11.8
1985 03 01	16 06.36	-25 05.0				
1985 03 06	16 03.08	-26 08.2	2.951	3.287	101.0	11.5
1985 03 11	15 58.82	-27 14.6				
1985 03 16	15 53.45	-28 24.0	2.718	3.231	112.4	11.3
1985 03 21	15 46.83	-29 35.9				
1985 03 26	15 38.83	-30 49.7	2.504	3.177	124.4	11.0
1985 03 31	15 29.30	-32 04.3				
1985 04 05	15 18.17	-33 18.0	2.320	3.125	136.7	10.8
1985 04 10	15 05.36	-34 28.8				
1985 04 15	14 50.89	-35 34.2	2.177	3.075	148.2	10.6
1985 04 20	14 34.89	-36 31.1				
1985 04 25	14 17.60	-37 16.9	2.083	3.027	155.6	10.4
1985 04 30	13 59.40	-37 49.2				
1985 05 05	13 40.77	-38 06.7	2.045	2.982	153.7	10.3
1985 05 10	13 22.24	-38 09.1				
1985 05 15	13 04.32	-37 57.5	2.063	2.940	143.9	10.3
1985 05 20	12 47.43	-37 34.1				
1985 05 25	12 31.90	-37 01.6	2.130	2.901	131.3	10.3

EPHEMERIS FOR P/AREND-RIGAUX (1984k) [from elements on MPC 7659]
Magnitudes based on n = 4 and absolute magnitude = 11.0.

Date	ET		R. A. (1950)	Decl.	Delta	r	Elong.	Mag.
1984	08	28	04 37.57	+00 51.0	1.513	1.771	86.8	14.4
1984	09	02	04 49.91	+00 44.3				
1984	09	07	05 02.36	+00 34.8	1.393	1.714	89.7	14.1
1984	09	12	05 14.90	+00 22.8				
1984	09	17	05 27.52	+00 08.5	1.281	1.661	92.4	13.7
1984	09	22	05 40.18	-00 07.8				
1984	09	27	05 52.86	-00 25.7	1.177	1.612	95.1	13.4
1984	10	02	06 05.51	-00 44.7				
1984	10	07	06 18.11	-01 04.1	1.082	1.568	97.7	13.1
1984	10	12	06 30.64	-01 23.2				
1984	10	17	06 43.05	-01 41.3	0.995	1.530	100.4	12.8
1984	10	22	06 55.30	-01 57.7				
1984	10	27	07 07.33	-02 11.2	0.914	1.498	103.4	12.6
1984	11	01	07 19.10	-02 20.7				
1984	11	06	07 30.57	-02 25.1	0.841	1.473	106.8	12.3
1984	11	11	07 41.68	-02 23.2				
1984	11	16	07 52.37	-02 13.7	0.774	1.456	110.8	12.1
1984	11	21	08 02.57	-01 55.1				
1984	11	26	08 12.21	-01 25.8	0.713	1.447	115.8	11.9
1984	12	01	08 21.21	-00 44.4				
1984	12	06	08 29.51	+00 10.7	0.660	1.447	121.9	11.7
1984	12	11	08 37.05	+01 20.6				
1984	12	16	08 43.73	+02 46.5	0.615	1.455	129.5	11.6
1984	12	21	08 49.48	+04 29.0				
1984	12	26	08 54.25	+06 28.1	0.582	1.471	138.6	11.5
1984	12	31	08 58.02	+08 42.9				
1985	01	05	09 00.80	+11 11.0	0.563	1.496	149.3	11.5
1985	01	10	09 02.63	+13 49.1				
1985	01	15	09 03.58	+16 32.7	0.563	1.527	160.8	11.6
1985	01	20	09 03.79	+19 16.7				
1985	01	25	09 03.42	+21 55.7	0.585	1.565	171.1	11.8
1985	01	30	09 02.72	+24 24.5				
1985	02	04	09 01.91	+26 39.3	0.629	1.608	169.7	12.1
1985	02	09	09 01.21	+28 37.3				
1985	02	14	09 00.80	+30 17.4	0.695	1.657	159.8	12.4
1985	02	19	09 00.85	+31 39.2				
1985	02	24	09 01.49	+32 43.4	0.780	1.710	149.8	12.8
1985	03	01	09 02.80	+33 31.3				
1985	03	06	09 04.81	+34 04.4	0.884	1.766	140.6	13.2
1985	03	11	09 07.50	+34 24.6				
1985	03	16	09 10.83	+34 33.4	1.001	1.826	132.3	13.6

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EPHEMERIS FOR P/CLARK 1983w (from elements on MPC 7658)

Date	ET		R. A. (1950)	Decl.	Delta	r	Elong.	Mag.
1984	08	18	20 35.93	-40 00.6	0.787	1.735	148.9	11.9
1984	08	23	20 35.88	-39 26.9				
1984	08	28	20 36.58	-38 46.6	0.868	1.778	142.3	12.2
1984	09	02	20 38.06	-38 00.8				
1984	09	07	20 40.29	-37 10.6	0.963	1.823	135.5	12.5
1984	09	12	20 43.23	-36 17.1				
1984	09	17	20 46.80	-35 20.9	1.071	1.872	128.7	12.9
1984	09	22	20 50.96	-34 22.7				

EPHEMERIS FOR P/NEUJMIN 1 1984c (from elements on MPC 7455)
Magnitude based on n = 4 and absolute mag = 10.0.

Date	ET	R. A. (1950)	Decl.	Delta	r	Elong.	Mag.
1984 08	28	18 19.64	-40 13.6	0.890	1.631	118.1	11.9
1984 09	02	18 27.56	-38 41.0				
1984 09	07	18 36.50	-37 04.9	0.912	1.599	112.7	11.8
1984 09	12	18 46.34	-35 25.7				
1984 09	17	18 56.93	-33 43.4	0.942	1.574	107.9	11.8
1984 09	22	19 08.16	-31 58.4				
1984 09	27	19 19.93	-30 10.7	0.981	1.559	103.6	11.9
1984 10	02	19 32.13	-28 20.6				
1984 10	07	19 44.65	-26 28.4	1.030	1.553	99.9	12.0
1984 10	12	19 57.41	-24 34.6				
1984 10	17	20 10.31	-22 39.4	1.089	1.557	96.5	12.1
1984 10	22	20 23.30	-20 43.4				
1984 10	27	20 36.33	-18 46.9	1.158	1.570	93.4	12.3
1984 11	01	20 49.36	-16 50.3				
1984 11	06	21 02.33	-14 54.3	1.239	1.592	90.4	12.5
1984 11	11	21 15.21	-12 59.0				
1984 11	16	21 27.98	-11 05.0	1.331	1.622	87.5	12.7
1984 11	21	21 40.62	-09 12.6				
1984 11	26	21 53.14	-07 21.9	1.434	1.661	84.5	13.0
1984 12	01	22 05.51	-05 33.3				
1984 12	06	22 17.73	-03 46.9	1.548	1.706	81.4	13.3
1984 12	11	22 29.81	-02 02.9				
1984 12	16	22 41.72	-00 21.4	1.673	1.758	78.2	13.6
1984 12	21	22 53.50	+01 17.5				
1984 12	26	23 05.13	+02 53.8	1.806	1.815	74.7	13.9
1984 12	31	23 16.64	+04 27.4				
1985 01	05	23 28.00	+05 58.4	1.948	1.877	71.1	14.2

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EPHEMERIS FOR P/FAYE 1984h (from orbital elements on MPC 8287)
Magnitudes based on n = 4 and absolute mag = 10.0.

Date	ET	R. A. (1950)	Decl.	Delta	r	Elong.	Mag.
1984 08	28	06 45.81	+17 07.4	2.060	1.672	53.6	13.8
1984 09	02	06 58.70	+16 31.6				
1984 09	07	07 11.15	+15 52.6	2.027	1.705	57.1	13.9
1984 09	12	07 23.16	+15 10.8				
1984 09	17	07 34.70	+14 26.6	1.993	1.743	61.0	13.9
1984 09	22	07 45.76	+13 40.3				
1984 09	27	07 56.31	+12 52.4	1.955	1.785	65.3	14.0
1984 10	02	08 06.35	+12 03.3				
1984 10	07	08 15.85	+11 13.5	1.914	1.832	70.0	14.0
1984 10	12	08 24.81	+10 23.3				
1984 10	17	08 33.22	+09 33.0	1.869	1.881	75.3	14.1
1984 10	22	08 41.04	+08 43.2				
1984 10	27	08 48.26	+07 54.0	1.819	1.933	81.1	14.2
1984 11	01	08 54.86	+07 06.1				
1984 11	06	09 00.81	+06 19.8	1.766	1.988	87.5	14.2