THE INTERNATIONAL COMET QUARTERLY

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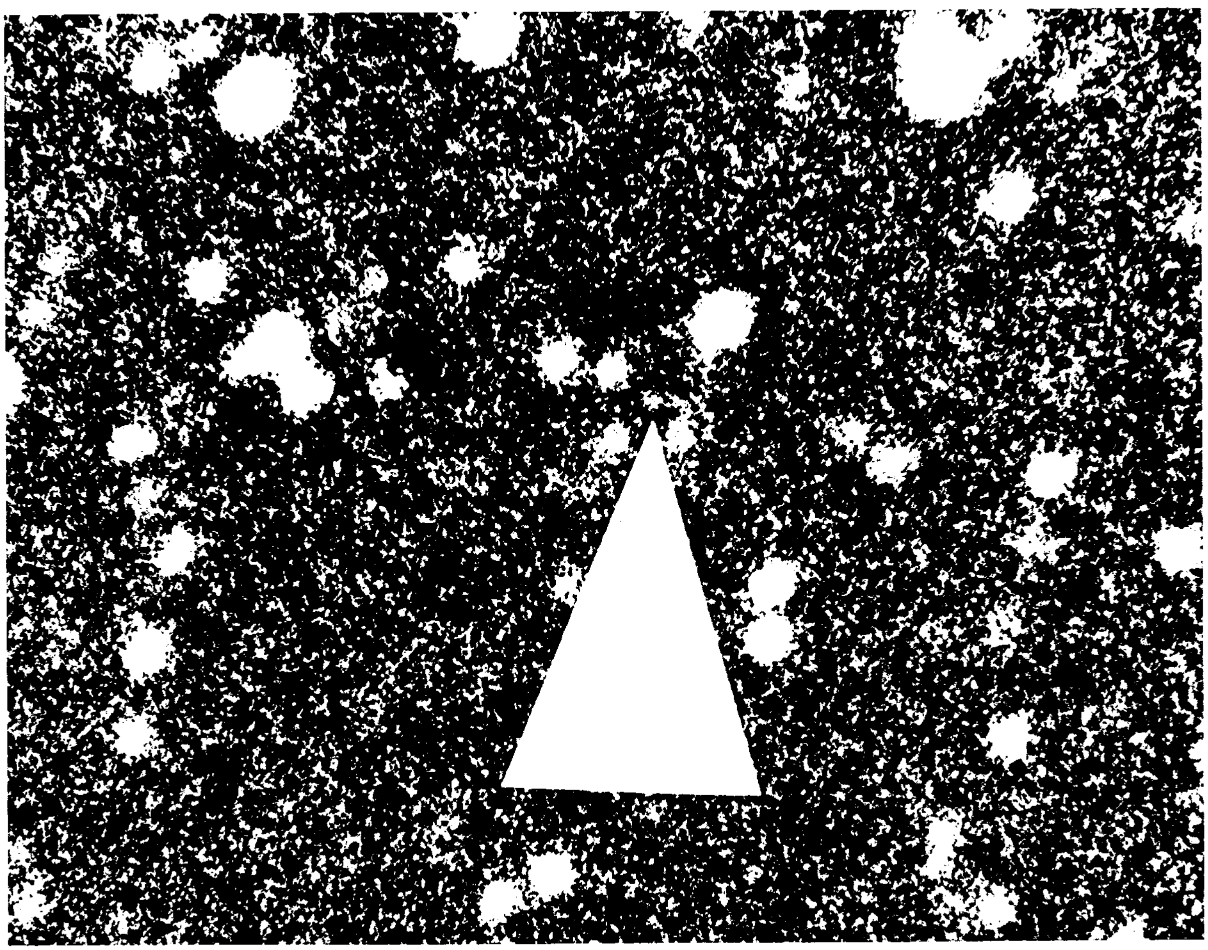

Photograph of Halley's Comet taken 1984 Sept. 22.80382 UT (37-min exposure, scale ~ 13.5"/cm) by T. Seki of Geisei, Japan, with a 60-cm reflector. This appears to be the first photographic image of P/Halley obtained by an amateur astronomer at the current apparition. The comet was at $m_1 \sim 20.5$, with the comet at about 6.2 AU from both the sun and the earth. (*cf. ICQ 6*, 98).

INSIDE THIS ISSUE

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FROM THE EDITOR

The new publication deadline schedule in use by the ICQ should allow authors and observers time to prepare material accordingly so that we receive such information in time for necessary editing. We are setting the deadline for articles, book reviews, and letters to the editor at a date approximately one month prior to going to press. This indicates that such material received by that deadline can potentially get into the next issue of the ICQ, while material received after the deadline will be put off until a later issue. All text published in the ICQ goes to at least 2 referees for critique, and we must allow at least 3 weeks for the referee process to perform properly. In this issue, we publish the deadline schedule for each issue of the year for the convenience of contributing readers.

-- Daniel W. E. Green, Cambridge, MA

I C Q PUBLICATION DEADLINE DATES

Issue:	January	April	July	October
Articles, letters	Nov. 18	Feb. 18	May 20	Aug. 19
Photos, drawings	Nov. 25	Feb. 25	May 27	Aug. 26
Observational data	Dec. 9	Mar. 11	June 10	Sept. 9
Last-minute urgent info/observations	Dec. 13	Mar. 15	June 14	Sept. 13

RECENT DISCOVERIES OF COMETS WITH THE PALOMAR 46-CM SCHMIDT CAMERA

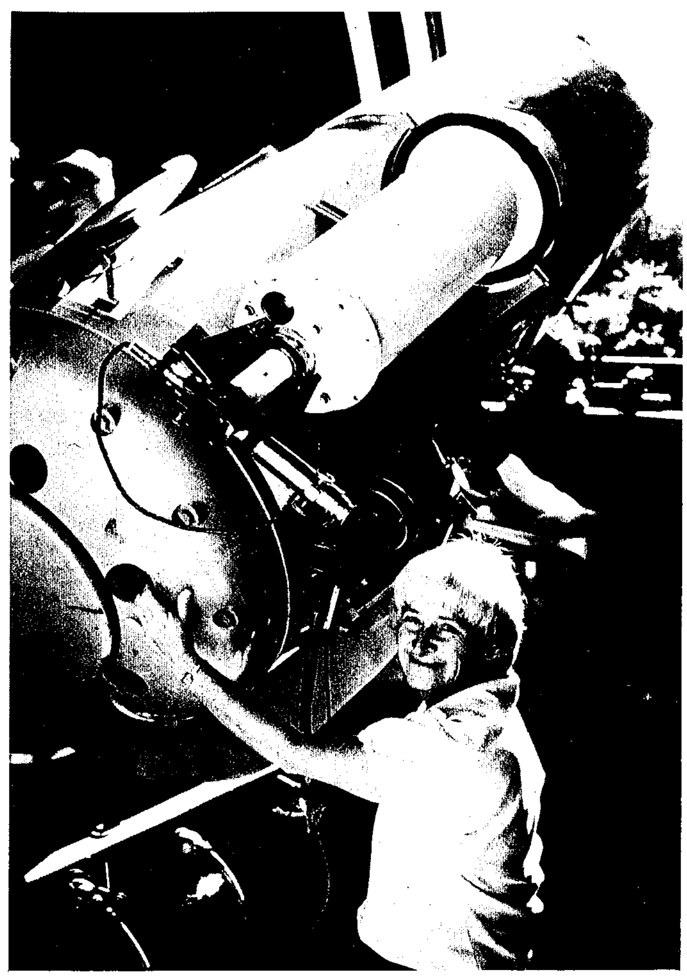
Carolyn S. Shoemaker and Eugene M. Shoemaker
Geologic Division, Branch of Astrogeology
U. S. Geological Survey
Flagstaff, Arizona

Among telescopes currently in use at observatories around the world, the 46-cm (18-inch) Schmidt camera at Palomar Mountain Observatory, California, is especially well suited for a survey or patrol of large areas of the sky. It was built and placed into operation in the 1930s and has enabled a long-term search for supernovae (Sargent et al. 1974). More recently it has been used to conduct a survey for planet-crossing asteroids (Helin and Shoemaker 1979). Two years ago, we began a new survey with this instrument, with the goal of discovering a sufficient number of the various planet-crossing asteroids and comets to (1) estimate the population of each class and (2) refine estimates of cratering rates on the terrestrial planets, the Moon, and the satellites of the giant planets.

Comets are important targets of our new survey, as collision of comets with the solid bodies in the Solar System has produced a large fraction of recent impact craters formed on those bodies. Planet-crossing asteroids are thought to have produced most of the recent impact craters on Mars, Earth, and Venus (Shoemaker et al. 1979; Shoemaker 1981), whereas comets evidently have produced most of the recent impact craters on the Jovian and Saturnian satellites (Shoemaker and Wolfe 1981, 1982) and perhaps about half the recent craters on Mercury and the Moon (Shoemaker 1981). Moreover, many asteroids that cross the orbits of Earth, Venus, and Mercury, as well as recently discovered asteroids that cross the orbit of Jupiter, very probably are extinct comets [cf. ICQ 6, 88. -- Ed.]

Coverage of a large area of sky is feasible with the 6-inch-diameter circular films for which the 46-cm Schmidt is designed. At a scale of 225 arcsec per mm, the effective field covered by each film is about 60 square degrees. We use Eastman Kodak's spectrographic emulsion IIa-D, and our standard exposure with this emulsion on the f/2 Schmidt is 4 minutes. On average, 3 minutes are needed to change film holders, set on a guide star, and begin a new exposure. Hence, about 80 films can be exposed during continuous, acceptable observing conditions on a night of average length.

In order to detect and confirm planet-crossing objects, we take two exposures separated by about 30 minutes



Carolyn Shoemaker with the Palomar 46-cm Schmidt telescope.

for each field. Each pair of films is examined with a stereomicroscope built specifically for use with the 46-cm Schmidt films. Stereoscopy was employed before the turn of the century by Max Wolf to detect asteroids on wide-field plates; since then, however, most observers have preferred to use blink machines. We have found the stereomicroscope method to be fast and reliable, but effective use of the stereomicroscope requires training of the eyes and considerable experience. About 20 minutes are required to scan a pair of films for moving objects. Our stereomicroscope was designed to be portable, so that it can be taken to Palomar Mountain for use during each observing run.

Survey fields photographed during a given observing run generally span a range of about 5 hours in right ascension, centered on opposition, and a range of about 40 to 50 degrees in declination. A standard set of guide stars has been chosen that minimizes overlap between fields without leaving significant gores or gaps in sky coverage. Average overlap is somewhat greater than the geometrical minimum of 34.6% required to avoid gores.

Our strategy has been to start an observing run with fields along the ecliptic and alternate (even-numbered) rows of fields above and sometimes below the ecliptic. Over the next several days, the films covering these fields are scanned with the stereomicroscope

Eugene Shoemaker at the stereomicroscope built for scanning the 46-cm Schmidt films.

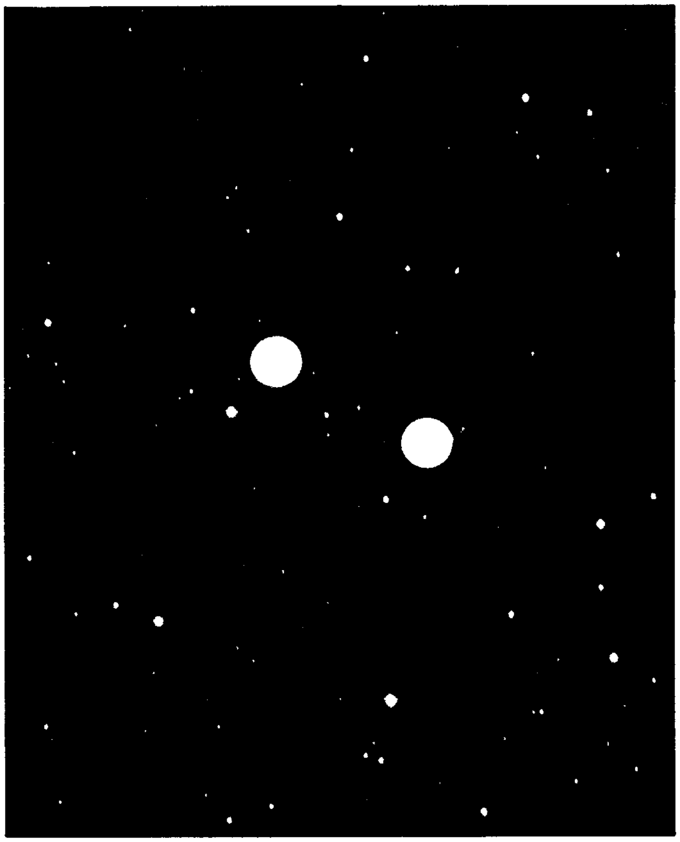
for comets and for asteroids with unusual motion or position. Odd-numbered rows of fields are photographed on the second night. During the remainder of our 5-night run, we try to obtain a second pair of films for fields that cannot be scanned during the time we are at Palomar and to extend the sky coverage as time and weather permit. By taking alternate rows of fields on successive nights, we obtain positions in the overlap areas on additional nights for about 30% of the objects discovered. All objects discovered during an observing run are followed for as many nights as remain in the run. Some exposures are allocated to provide follow-up astrometry of objects discovered in previous runs and to follow or recover other objects of interest. With good weather, as many as 94 fields have been photographed during a single run, but our average number of fields per run during the past year has been about 70. We observed during seven lunations in 1983 and six lunations in 1984. Our average annual coverage of the sky has been about 17,500 square degrees.

Under optimum conditions, the threshold for detection of a comet with the 46-cm Schmidt camera and the techniques we use is close to an apparent total B magnitude of about 16. With the small scale of the 46-cm Schmidt films, and the camera driven at sidereal rate, the images of most comets are not noticeably trailed in the 4-minute exposures. Hence, it is generally not necessary to track a comet in order to reach the magnitude-16 detection threshold or to obtain images suitable for reliable astrometry. For images of nearly stellar appearance, we can follow a comet to a limiting magnitude of about 17.5. A disadvantage of the small film scale is that fine details in the coma and tail are not resolved. Longer focal-length optics must be used to monitor many aspects of the activity of the relatively-faint and commonly-distant comets that we are likely to discover.

Shoemaker and Wolfe (1982) estimated that the number of long-period comets with absolute nuclear B magnitudes less than 18 that pass perihelion each year

RECENT DISCOVERIES OF COMETS WITH THE PALOMAR 46-CM SCHMIDT CAMERA

inside the orbit of Jupiter is somewhat less than 2000. At a total magnitude-detection threshold of 16, very roughly 100 of these comets should become bright enough to be discovered at heliocentric distances greater than 1 AU. The steady number of observable comets at elongations > 90 degrees should be on the order of one per 1000 square degrees. Not all observable comets represent potential new discoveries, of course, as many will already have been discovered, either by other observers or on prior observing runs.



Photograph of P/Shoemaker 1 1984q taken with the 46-cm Schmidt telescope on 1984 Sept. 28.27431 UT. This was the first exposure for the second pair of films taken at the observing run on which the comet was discovered. (The comet is the diffuse image at center, between two large artificial marking dots.) The coma is ~ 1.2' across, total magnitude about 13. North is to the left.

It is of interest to compare these rough expectations with our actual observations of comets over the 2 years that our survey has been in progress. About two to three comets should be observed per observing run, under optimum conditions. In 1983, we observed an average of 1.3 comets per observing run; one of these, 1983p, was a new discovery. In 1984, we observed 2.3 comets per run; among these, 5 (1984f, 1984q, 1984r, 1984s, and 1984u) were new discoveries. Two of the six new comets are periodic, which is about twice the proportion of periodic comets among all discovered comets. The increased frequency of our detection of comets in 1984 is due, at least in part, to better average observing conditions. In addition, a substantial random fluctuation in the number of observed comets should be expected, because of their small total number.

The distribution of perihelion distances of the long-period comets we have discovered so far (Table 1) suggests that we will find a substantially greater proportion of comets with large perihelion distance than has been found among all comets discovered to date (see

Table 1. Selected orbital elements for comets discovered in 1983 and 1984 with the Palomar 46-cm Schmidt

Comet	q	e	Peri.	Node	i	Reference
1983p	3.345	1.0004	176.0	164.0	137.6	MPC 8387
1984f	2.697	1.0006	235.5	49.0	116.7	MPC 9154
1984q	1.977	0.4719	18.6	339.3	26.3	MPC 9293
1984r	5.492	1.0	183.4	238.0	179.2	MPC 9292
1984s	1.214	0.9695	229.2	222.8	13.9	MPC 9305
1984u	1.321	0.6771	317.3	54.8	21.8	MPC 9304

NOTE: Following the comet's name are the heliocentric distance at perihelion (AU), the orbit's eccentricity (e), argument of perihelion, ascending node, and inclination (i), 1950.0, and the Minor Planet Circular where the orbit was published.

Fig. 1). With a sufficient number of discoveries and appropriate analysis of the observational selection effects, we hope to test whether the cumulative frequency of comets is a linear function of perihelion distance (beyond 0.5 AU), as predicted theoretically by Oort (1950), Weissman (1977), and Hills (1981), or whether the distribution follows some other function of perihelion distance, such as that proposed by Kresák and Pittich (1978). From an earlier analysis of observational selection effects, Everhart (1967) found that the intrinsic frequency distribution of perihelion distances may be linear beyond 1.3 AU (Fig. 2). The perihelion distances of all long-period comets discovered to date are so strongly weighted toward

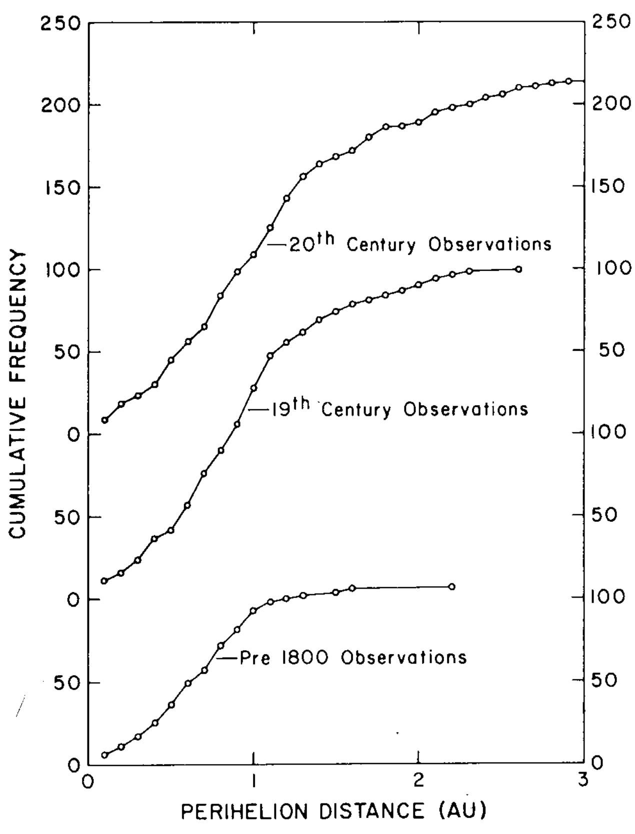


Figure 1. Cumulative frequency distributions of perihelion distance, q, for long- period comets classified by date of discovery. Cumulative frequency is obtained by starting with comets having the lowest observed q and adding the number of observed comets as q is increased. (From Shoemaker and Wolfe 1982, p. 303; reproduced courtesy University of Arizona Press.)

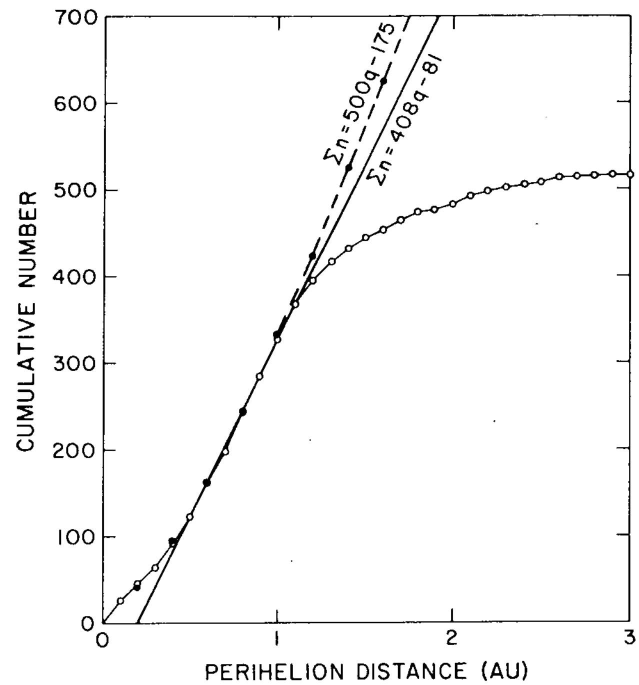


Figure 2. Cumulative frequency distribution of perihelion distance for long-period comets discovered through 1978 (open circles). The distribution of q is essentially linear between 0.5 AU and 1.1 AU; in this interval, it follows the line represented by the equation $\sum n = 408q - 81$. The intrinsic distribution of q obtained by Everhart (1967), fitted to the observed frequencies of long-period comets, is shown by solid dots. Everhart's distribution takes account of observational selection effects; this distribution is linear above $q = 1.3$ AU and follows the line represented by the equation $\sum n = 500q - 175$. (From Shoemaker and Wolfe 1982, p. 304).

distances < 1.3 AU, however, that the true underlying distribution beyond about 1.3 AU is uncertain. Our systematic survey is much less biased toward comets with small perihelion distance than were past circumstances of comet discovery, and a more certain result can be obtained from a much smaller set of discovered comets. Determination of the true underlying distribution is fundamental to the calculation of the impact-cratering rates on the satellites of the giant planets, to the estimation of the population of the Oort comet cloud, and to a full understanding of the capture of short-period comets from the long-period comet swarm.

[References are on the following page.]

REFERENCES

Everhart, E. (1967). Intrinsic distributions of cometary perihelia and magnitudes. Astron. J. 72, 1001-1011.
Helin, E. F.; and E. M. Shoemaker (1979). Palomar planet-crossing asteroid survey, 1973-1978. Icarus 40, 321-328.
Hills, J. G. (1981). Comet showers and the steady-state infall of comets from the Oort cloud. Astron. J. 86, 1730-1740.
Kresák, L.; and E. M. Pittich (1978). The intrinsic number density of active long-period comets in the inner solar system. Bull. Astron. Inst. Czechosl. 29, 299-309.
Oort, J. H. (1950). The structure of the cloud of comets surrounding the solar system, and a hypothesis concerning its origin. Bull. Astron. Inst. Neth. 11, 91-100.
Sargent, W. L. W.; L. Searle; and C. T. Kowal (1974). The Palomar supernova search. In Supernovae and Supernova Remnants (C. B. Cosmovici, Ed.), D. Riedel Publ. Co., pp. 33-49.
Shoemaker, E. M. (1981). The collision of solid bodies. In The New Solar System (J. K. Beatty, B. O'Leary, and A. Chaikin, Eds.), Sky Publishing Corp., pp. 33-44.
Shoemaker, E. M.; J. G. Williams; E. F. Helin; and R. F. Wolfe (1979). Earth-crossing asteroids: Orbital classes, collision rates with Earth, and origin. In Asteroids (T. Gehrels, Ed.), Univ. of Arizona Press, pp. 253-282.
Shoemaker, E. M.; and R. F. Wolfe (1981). Evolution of the Saturnian satellites: The role of impact (ext. abs.). Satellites of Saturn, Lunar and Planetary Science XII, Supplement A, pp. 1-3.
Shoemaker, E. M.; and R. F. Wolfe (1982). Cratering time scales for the Galilean Satellites of Jupiter. In The Satellites of Jupiter (D. Morrison, Ed.), Univ. of Arizona Press, pp. 277-339.
Weissman, P. R. (1977). Initial energy and perihelion distributions of Oort-cloud comets. In Comets, Asteroids, Meteorites (A. H. Delsemme, Ed.), Univ. of Toledo Press, pp. 87-91.

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THE OBSERVATION OF BODIES IN CLOSE PROXIMITY TO THE SUN

John E. Bortle
W. R. Brooks Observatory, Stormville, New York

[Author's note: The following article is intended for highly-experienced individuals familiar with the hazards of observing objects at very small elongations from the sun. Readers are cautioned that viewing the sun through any instrument not specifically designed for that purpose can lead to severe and irreparable eye damage.]

"The comet was observed here at Noon-day on March 30. It was first perceived at 11 a.m. with a power of 40 on our large refractor, the eye being protected from the intense glare (of the sun) by a light-green glass. The nucleus of the comet was round or nearly so, beautifully defined and planetary. Two short rays of light formed a divided tail, not more than 40" in length. At times I felt certain that the nucleus twinkled like a fixed star." So wrote English astronomer John Russell Hind, then director of Bishop's Observatory, of comet 1847 I.

Hind was perhaps the first astronomer to ever intentionally plan telescopic observations of a comet during the daytime, having himself posed the possibility of such observations in a letter to Astronomische Nachrichten (A.N.) dated around the middle of March. In A.N. 25, 292, he states, ". . . it will be almost unnecessary for me to point out the rapid increase in brilliancy which is now taking place or the possibility, that with telescopes, the Comet may be detected in daylight on March 30."

The daytime observations of comet 1847 I, a comet which had been actually discovered by Hind in early February, seemed to have left a very strong impression upon him. For decades following this event, his urgings to attempt daylight observations of other bright comets can be found in the literature.

Although I was prevented by poor weather from seeing comet 1965 VIII during the daytime, it was my good fortune to have observed comet 1976 VI both telescopically and with the naked eye on several days with the sun well above the horizon. Like Hind, I was left greatly impressed by the beauty and almost unreal appearance of the brilliant white comet standing out against the deep blue of the late afternoon sky. Like a total eclipse of the sun, seeing one such event only whets the appetite for another view, and I have been (for the past 8 years) experimenting, and ferreting out what information I can, on the subject of observing objects in extreme proximity to the sun -- to be prepared for the next such opportunity.

The sun-grazing comet Ikeya-Seki 1965 VIII: 12-sec exposure taken 1965 Oct. 31 at 12:52 UT by Alan McClure at Mount Piños, California, using panchromatic film and a Contax camera with a 50mm-f.l. high-speed lens. This comet was observable in broad daylight as it rounded the sun on Oct. 21 at a distance of $q = 0.0078$ AU.

From the literature, it is clear that the daylight observation of comets over the last seventy years or so has been an extreme rarity. The only definite examples appear to be comets 1927 IX, 1965 VIII, and 1976 VI. However, during the previous 100 years, no less than 10 examples can be cited (1843 I, 1847 I, 1853 III, 1858 VI, 1861 II, 1882 I, 1882 II, 1901 I, 1910 I, 1910 II), and there may be others. Since it has been pointed out by David Seargent, by this writer, and by others that the present century is no less rich in bright comets than was the previous one, why the difference?

The answer to this question appears to be rather straight-forward. With the great advances in photographic astronomy early in this century, the techniques employed by the great visual observers of the 19th century were largely forgotten. Today's visual observer generally considers the planets Mercury and Venus to be unobservable when within about 10 of the sun, and the observation of a cometary body at a smaller elongation is regarded as quite impossible unless its magnitude is on the order of that of the quarter moon. Yet astronomers a century (or more) ago routinely followed these bodies to within a degree of the solar limb. In fact, William R. Dawes (of double-star fame) considered that Venus could be observed when no more than one arc minute from the solar limb.

Unfortunately, as is often the

THE OBSERVATIONS OF BODIES IN CLOSE PROXIMITY TO THE SUN

case, precious-little exists in the literature as to how the 19th-century astronomers went about making their near-Sun observations. It does appear, though, that those who succeeded in detecting objects exceedingly near the solar disk often used some type of occulting device to shade the instrument's objective from direct sunlight. Not uncommonly, some sort of weak filter was also employed to reduce the brightness of the sky. Armed with this meager information, I began experimenting in 1976 to redetermine the absolute limites for observations of this nature. It would appear that the limits achievable are extreme, indeed. Based on my work, I believe that I have observed the planet Mercury, employing only simple equipment, closer to the solar limb (62′ on 1978 September 30) than any individual currently living. My figure of 39′ from the limb for Venus (1982 November 2) does not, in my opinion, begin to indicate what can be achieved safely with this much-brighter object.

During the period that I conducted my experiments and tests for visibility, there were no comets sufficiently bright to present the possibility of being viewed in daylight. However, the planets Mercury and Venus proved reasonable substitutes. The highly condensed comae of comets having very small perihelia (< 0.2 AU) typically subtend about 0.2′ (or about 9000 km) when nearest the sun. When very slightly defocused, Mercury and Venus rather closely mimic the appearance of a daylight comet. Since the former planet has a wide range in magnitude, it proved ideal for setting visibility limits. The majority of my tests were conducted using instrumentation of very modest aperture. In general, the results and recommendations are applicable to 20x80 binoculars but should be similar for instruments up to 2 or 3 times larger. While one would normally expect that larger telescopes would reveal correspondingly fainter objects, it may not be the case in this special situation, due to the brightness of the sky background.

SKY CONDITIONS AND ELONGATION

Obviously, near-Sun observations can only be carried out successfully under very clear skies. My observing location was near sea level, in an area not generally considered very favorable for such observations. However, conditions suitable for near-Sun observations did prevail on perhaps 25% of the clear days. On the average, conditions were more favorable prior to 2 p.m. local time than thereafter. The best results were obtained, as might be expected, on days when the solar aureole (the halo of scattered light immediately surrounding the solar disk) was almost absent.

An interesting relationship was noted between brightness and elongation. Objects with elongation > 10°, and whose magnitude made their daylight visibility borderline, benefited greatly by the darker sky background prevalent near the times of sunrise or sunset. However, the longer light path, and resulting scattering at that time of day, produced a more intense aureole that normally hid somewhat brighter objects closer to the sun. Observations made within a couple of hours of local noon showed this aureole drastically reduced in its extent, rendering visible those objects of small elongation that were impossible to see when near the horizon. As a rule, any object whose elongation was < 8°, and with a magnitude of at least -1, was always more readily seen around local noon rather than when low in the sky.

A special effort was made to determine the limiting magnitude of an object detectable with 8-cm aperture at different solar elongations under the most favorable conditions. Observations were made with the sun no more than a couple of hours either side of the meridian on better than a score of different occasions. The tests assumed essentially an evenly-illuminated body 0.2′ in diameter. Based on eleven positive and a number of negative observations, the following formula was derived to predict the faintest cometary object detectable at a given elongation from the sun. It is worth noting that correlation between the formula and the data was very high.

$$m = -2.5 + 2 \log E$$

Here, m is the observed magnitude and E

is the object's elongation from the sun in degrees. The formula is only meant to be valid within about 20° of the sun.

OCCULTING THE SUN

As pointed out by Young and Young (1972), every precaution should be taken to avoid sunlight from striking the instrument's optical surfaces. Sunlight hitting any element of the optical system will cause a great reduction in contrast and can render an otherwise-easy object invisible.

Various methods of occulting the sun are possible. The simplest is to use a very long dew-cap or sun shade on the instrument. In the literature, mention is made of past observers utilizing the edge of an observatory dome to hide the sun or viewing with a guide or finder telescope situated in the shadow of the main instrument's tube. Today, closed-tube Newtonian reflectors (particularly those of long focal ratio) are highly suited to this type of work. As an example, a closed-tube f/6 Newtonian can work within 10° of the sun without any external occulting device. Similarly, an f/15 Newtonian would allow elongations as small as 4° to be reached without sunlight striking the main mirror.

Permanently mounted refractors or Schmidt-cassegrain instruments are, in general, more difficult to use, lacking any simple means for hiding the sun. Binoculars and small, portable telescopes, on the other hand, can do a fine job.

If the object of interest is situated a little north or south of the sun's diurnal path, a suitable T-shaped occulting device can be constructed of scrap lumber and erected some meters in front of the instrument. With the sun near the meridian, hiding the solar disk behind a long, horizontally-mounted board would allow one to follow an object of slightly greater or lesser declination for some time. With such a contraption placed 10 meters ahead of my 20x80 binoculars, I found it possible to see within 0°.5 of the solar limb. Observations virtually at the solar limb itself are possible using the roofline of a distant building, and some 19th-century sightings of Venus were made in just this way.

FILTERS

While the continuum is typically very bright in a daylight comet, it would still be expected that colored filters could assist in daytime work. Hind employed a light-green filter (as noted above) for his 1847 observations, and this may have been useful in passing the green C_2 band in the comet's spectrum. It may also have served to reduce the glare of the sky background. Elsewhere in his report, Hind mentions using a yellowish filter with success, also. Perhaps it proved helpful in isolating the D lines of sodium, often prominent in a comet with a small perihelion distance. The special comet filters offered by Lumicon [cf. ICQ _6_, 90. --Ed.] may also prove to have an application here. This might be particularly true for marginal objects situated deep in twilight, as I find that the Lumicon Swan-band comet filter drastically reduces the twilight glow.

Neutral-density filters are indeed an asset in reducing the brightness of the sky very near the solar disk. I have used several differing, low-density filters successfully when conducting my tests.

PHYSIOLOGICAL PROBLEMS

The functioning of the individual's eyes during observations of this nature is also a problem. The eye at rest is said to be focused at infinity, but this is probably never quite the case during telescopic observation. At night, with the view filled with stars for the eye to "lock on to", focus seems quickly and easily attained. Although the instrument is likely not to be perfectly in-focus, the eye will make up for this without difficulty and there is no problem. Working in the daytime with an essentially blank field is quite another matter.

The greatest care must be exercised in focusing the instrument during the daytime. There are several reasons for not using a distant terrestrial object for focusing. The observer will always find it advisable to select the moon or a bright planet to make the final adjustments. The instrument should be focused in and out a number of times, until the point of true focus can be clearly obtained.

A peculiar idiosyncrasy associated with proper focusing, pointed out to me by Stephen O'Meara (1976), is well worth noting. Unless the lenses of the eyepiece employed are totally free of dust, the eye has a tendency to re-focus on the dust particles, thereby rendering any celestial object in the field out-of-focus.

Finally, in my experience there appear to be some other troublesome factors that contribute to an observer's failure to locate a telescopic object in daylight. On many occasions when searching for Mercury or a star in the daytime, and having examined the field for up to several minutes, the object would suddenly be perceived in the middle of the field! The object had been there all the time, but had been passed over repeatedly. I suspect that the eye is continually altering its focus slightly when staring at a blank field, and the object in question is generally too de-focused to detect. Perhaps also the eye does not perceive a small point of light against a bright background unless its center of attention passes directly over it. One or the other of these explanations must be true, as the problem was encountered many times over.

In summation, I would contend, after examining the literature for potential candidates, that daylight comets probably appear on the average of one per decade, even today. They have not generally been observed as such in this century, however (unless exceedingly brilliant), because of observer ignorance of the methodology required to view them in the daytime. I thus strongly urge some of my highly experienced colleagues to attempt observations similar to those addressed above, as practice for the next brilliant, would-be daylight comet. With the exception of some infrared observations, relatively little seems to be known about cometary behavior at very small heliocentric distances, mainly because of the observational difficulties involved. Unique and beautiful as an observation of a daylight comet may be, such observations certainly have more than just simple aesthetic value. Comet West 1976 VI was only one of many comets which underwent striking changes while it could be observed only in daylight. Other examples are easily cited: 1959 VI, 1962 III, 1970 I, and 1973 XII. We should make every effort to reduce the "perihelion gap" in our data to the minimum possible in the case of major comets, and, in doing so, perhaps gain new insight to their behavior when in "close proximity to the sun".

PARTIAL LIST OF REFERENCES

Dawes, W. R. (1862). Mem. R.A.S. 30, 60.
Elkin, W. L. (1882). Mon. Not. R.A.S. 43, 22.
Hind, J. R. (1847). A.N. 25, 331. [see also Mr. Bortle's text]
Marsden, B. G. (1965). Sky Telesc. 30, 332.
O'Meara, S. J. (1976). Private communication.
Orchiston, W. (1984). 11th NACAA Proceedings, p. 81.
Webb, T. W. (1899). Celestial Objects for Common Telescopes (London: Longmans, Green & Co.), p. 53.
Young, A.; and L. Young (1972). Sky Telesc. 43, 140.
Young, C. A. (1882). The Sidereal Messenger 1, 190.

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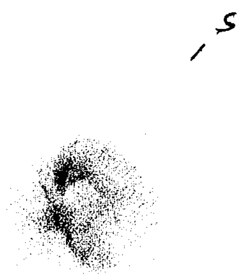
DRAWINGS OF COMET LEVY-RUDENKO 1984t

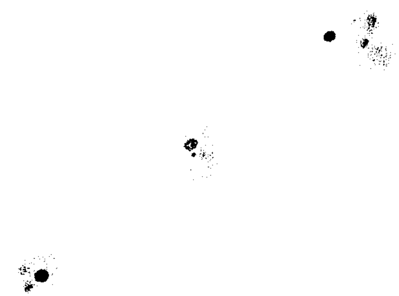
by Stephen James O'Meara

On the following page are drawings of comet Levy-Rudenko 1984t made from my visual observations using the 9-inch Clark refractor atop Harvard College

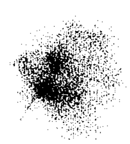
(text continued on page 13)



11/17/84
23:55 U.T.

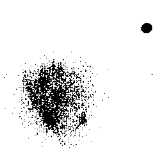


11/19/84
23:25 - 23:45
Near occultation of star. Note how star fades and comet's nucleus becomes more stellar.

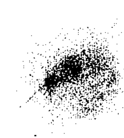


11/22/84
23:00 U.T.

Comet Levy-Rudenko 1984t
by Stephen James O'Meara
Harvard College Observatory's
23-cm Clark
600x – 120x



12/1/84
23:15 U.T.



12/4/84
23:00 U.T.

DRAWINGS OF COMET LEVY-RUDENKO 1984t

(text continued from page 11)
Observatory in Cambridge, Massachusetts. I employ various magnifications (120x to 600x) to illustrate the comet as shown. The comet's immediate inner coma pulsated nightly, affecting that region's diffuseness. Also, the comet nearly occulted a fair number of stars, which allowed me to study the strongest emissions from the comet's nuclear region. As the drawing shows, this one occultation was so close that the comet's inner coma seemed to dim the star's light, as the comet's nucleus became less diffuse and more stellar.

A dusty, broad tail traversed the field just north of east, while a thin, transient whisp of tail-like structure eminated just east of north. At times when the comet's inner coma was diffuse, a plume-like structure with a delicate spiral eminated from the south, eastward, while I regularly observed a few vague patches of diffuse condensations near the very faint nucleus.

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An Editorial:

THE CRAZY YEARS

Charles S. Morris
International Comet Quarterly

The crazy years of comet astronomy have begun. Actually, these years officially started back in October of 1982 when periodic comet Halley (1982i) was recovered. Since then, the comet's brightness has increased by a factor of nearly 100. Even so, the comet remains a difficult object of about 21st magnitude. Despite this discouraging fact, amateur observers are already aiming their large telescopes at P/Halley's field in the hopes of being the first to observe the comet. The photographic "prize" has already gone to T. Seki. However, the visual "prize" is still up for grabs. While it is encouraging to see amateur observers so excited about trying to be the first to see P/Halley, it is disturbing that all this excitement might lead to trouble.

Unlike photographic observations, there is no way to verify a visual observation of a comet. One must depend upon the observer's word that he or she saw the object. Even for experienced observers, it is often difficult to locate a faint comet. Faint stars or double stars often masquerade as comets. Unfortunately, the comet's daily motion will be very small prior to conjunction in 1985. Thus, observed motion will not be a good method of confirming a visual sighting of comet Halley. Only with a photographic star chart (that has a limiting magnitude fainter than the comet's magnitude) can one be assured of properly locating the comet's position. Most amateurs do not have access to such atlases.

Another question which needs to be answered is "What is a visual observation?" This question may seem "dumb", but some amateurs are using image intensifiers in their search for P/Halley. Does this represent a visual observation? In my opinion, no. If it does, then professional observers looking at their TV monitors are making visual observations. A true visual observation does not rely on any electronic enhancement of the image produced by the optical system.

It is my hope that visual observers will use caution. Be certain of your observation prior to claiming to have seen Halley's Comet. An incorrect identification is likely only to lead to embarrassment. As for researchers, be skeptical of early visual observations. Try to assess whether or not the observation is reasonable, based on the instrument used, the experience of the observer, the comet's apparent magnitude, and other criteria.

I would like to wrap up this editorial by pointing out some sobering facts. To my knowledge, visual observations over the last 20 years, even with the large amateur instruments available, have been limited to comets brighter than 14th magnitude. No one has demonstrated that it is possible to visually observe comets at 17 or even 15th magnitude. Prior to conjunction with the sun, the P/Halley will be low in the sky, and -- even by the most optimistic predictions -- it will not be brighter (on average) t'an 15th magnitude and more likely will be 17th magnitude or fainter. These facts are not meant to discourage potential observers. Rather, it is hoped that these observers will keep a realistic perspective on their attempts to observed comet Halley.

Postscript: One of the crazy aspects of P/Halley's current apparition has been the desire of a number of researchers to predict the brightness of comet Halley. The competition has been keen. As many of our readers know, the differences in the predictions are significant. I believe that it is now time to sit back and see what the comet tells us. It really does not matter who is "correct". What matters is that we have a better understanding of comet Halley's photometric behavior after the apparition.

[Editor's note: Observers wishing to try observing P/Halley when it is 13th magnitude or fainter should be practicing now with the many comets available in the total visual magnitude range 13 to 16. It should be possible for observers with large telescopes to observe and make reliable total magnitude estimates of comets fainter than magnitude 14, but no such reports have ever reached the ICQ!]

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BOOK REVIEW: ANNUAL REVIEW OF ASTRONOMY AND ASTROPHYSICS

Annual Review of Astronomy and Astrophysics, Vol. 21 (1983). G. Burbidge, D. Layzer, and J. G. Phillips, Eds. Annual Reviews, Inc., 4139 El Camino Way, Palo Alto, CA 94306, U.S.A., 482 pp., hardbound, $44.00 (USA), $47.00 (outside USA).

This 21st book in the Annual Review of Astronomy and Astrophysics series has articles about many diverse astronomical and astrophysical subjects in by 22 contributing authors. There are few astronomers today who have not used the Annual Review books for reference, as virtually every major topic in astronomy and astrophysics has been covered in the series at one time or another.

The 1983 edition begins as most of the annual volumes do: with an article by a respected, senior astronomer who usually reflects back on certain aspects of his/her long astronomical career. Thus, Bengt Strömgren of Copenhagen begins Volume 21 with his article, "Scientists I Have Known and Some Astronomical Problems I Have Met". While Strömgren is well-known for his work in photoelectric photometry and stellar structure, one finds here that he actually did his doctoral dissertation on the determination of parabolic orbits of comets. One also learns, among his many other interests, of his involvement in the development of the Schmidt telescope.

Among the remaining articles, ICQ readers would perhaps find Gordon Newkirk's "Variations in Solar Luminosity" and William van Altena's "Astrometry" as useful references. One studying comets and their connection to the interstellar medium will find "Dust in Galaxies", by W. Stein and B. T. Soifer of interest. Other review papers discuss x-ray and gamma-ray sources, cosmology, stellar evolution, and "Superclusters".

No professional or student in this field should be without access to the Annual Review of Astronomy and Astrophysics. While generally too technical for the layman, it will hold some value for the advanced amateur, as well.

-- Daniel W. E. Green

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BOOK REVIEW: SOLAR SYSTEM PHOTOMETRY HANDBOOK

Solar System Photometry Handbook (R. M. Genet, Ed.), 1983. Willmann-Bell, Inc., P.O. Box 3125, Richmond, VA 23235. 220 pp., $17.95 paperback.

Willmann-Bell, Inc., is publishing a useful series of books which discuss applications in astronomy, and Solar System Photometry Handbook comes as a practical and timely guide. This recent addition is one that small college observatories and amateur astronomers with suitable equipment and interest will want to purchase. The book is divided into two sections: "Low-Speed Photometry" and "High-Speed Photometry", the latter containing four chapters entitled "Occultations by Planets and Satellites", "Asteroid Occultations", "Lunar Occultations", and "Portable High-Speed Photometer Project". The first section contains chapters on the photometry of asteroids, planets and satellites, and the moon and the sun, as well as a chapter on "Low-Speed Equipment".

And there is, for sure, a chapter in that first section entitled "Photometry of Comets", by Michael F. A'Hearn; this review will concentrate on this 3rd chapter and leave detailed reviewing of the remainder of the book to other reviews published elsewhere. Interestingly enough, the comets chapter is by far the longest chapter in the entire book!

Let it be said here that most useful photometry done by amateur observers is done visually -- whether it be photometry of comets, variable stars, occultations of stars and planets by the moon or by asteroids, or whatever. In all due fairness, then, the book should have been titled Solar System Photoelectric Photometry Handbook, because it really does not talk about visual photometry at all, and will probably not have overwhelming interest to observers without photoelectric equipment. The book would sincerely have benefited from some discussion of visual photometry of comets and of occultations, as this would have made it much more well-rounded; visual photometry in both of these cases is still highly valuable and indispensable. So much for completeness. . . .

Be wary that, in order to perform photoelectic photometry of any solar system objects well, one must first become proficient at doing photoelectic photometry of stars alone. For this, one must look to other sources -- and there are frightfully few good ones.

A'Hearn's chapter is, by far, the most technical and involved one in the book. So A'Hearn will give you nontrivial equations which must be numerically integrated -- but the author leaves to the reader how to figure out such tasks. And A'Hearn provides many graphs from his research to illustrate ideas -- but the reader may find it quite difficult to understand what the axes represent and what the plots actually show.

A'Hearn begins his chapter with a very brief introduction to comets, followed by a section discussing the goals of broadband and narrowband photometry. His third section is devoted to diaphragms and (mostly) to filters. "Observing Techniques" and "Data Reduction" round out the comet photometry chapter.

The entire book has the appearance of typewriter-type, as do most (all?) of the Willmann-Bell books. A problem noticed by this reviewer is the high number of typographical errors in the comet chapter alone -- errors which should have been picked out by the author upon reading proofs by the publisher. The misspelling of comet Mrkos on p. 3-33 and of comet IRAS-Araki-Alcock on p. 3-19 are amusing, but not so much as the misspelling of the name of the author himself on p. 3-33. With the technical nature of chapters such as A'Hearn's, one wonders where other typos might have creeped in.

Regardless of the above criticisms, Solar System Photometry Handbook is to be highly recommended as a useful book for photoelectric photometrists who, having experience at stellar photometry, wish to photoelectrically observe solar system objects.

-- Daniel W. E. Green

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BOOK REVIEW:
IHW AMATEUR OBSERVERS' MANUAL

International Halley Watch Amateur Observers' Manual for Scientific Comet Studies, by Stephen J. Edberg, 1983, Sky Publishing Corp. (ISBN 0-933346-40-9) and Enslow Publishers (ISBN 0-89490-102-8), 192 pp., $9.95 paperback.

As the publishers' press release states, "The most anticipated astronomical even of the century is the arrival of Halley's Comet in 1984-86. [We] have just published the official NASA-JPL guide showing amateur astronomers how to contribute to the scientific study of the comet. The manual. . . contains enrollment and reporting forms for the International Halley Watch (IHW) program, scientific information about the comet, a daily ephemeris and charts of its position, and detailed descriptions of how to make useful observations. Much information will be valuable for observers of all comets. [The IHW] is the organization guiding the worldwide scientific effort to study [this return of Halley's Comet]. Careful observations by users of small telescopes are needed to supplement the planned professional and spacecraft studies."

Thus we have a brief, but accurate, synopsis of the book. Its editor and author, Steve Edberg (IHW Coordinator for Amateur Observations), has done a commendable job in putting the information together in this handbook. The book consists of two parts, "Methods" and "Ephemeris and Star Charts". The second part is really only applicable to observation of P/Halley, but the first part can indeed be helpful to visual observers of all comets.

Part I discusses visual observing, photography, astrometry, spectroscopy, photoelectric photometry, and meteor observing in 6 separate chapters (which follow 4 introductory chapters).

A listing of "Addresses of Organizations and Publications" and a 5-page bibliography has a weird tendency to list a few articles by their titles rather than by author (including one such ICQ article), and to list the publisher for some periodicals (including the ICQ) -- a real oddity. [While the ICQ is printed on the campus of Appalachian State University, subscription materials should be sent only to the Editor, c/o SAO in Cambridge, Massachusetts. Confusion has arisen often because some things have been addressed to A.S.U. in Boone, NC, and even to A.S.U. c/o Cambridge, MA!] (The publisher is not listed for the Astronomical Journal or Sky and Telescope, for example, and the ICQ address is already given earlier in the list of addresses.)

Part II includes a visual observation report form which was designed, in collaboration with this reviewer and an ICQ Associate Editor (C. S. Morris), such that it follows the same basic format of the ICQ report form; this was to assure efficient transfer of data between the IHW and the ICQ. Part II also includes report forms, a glossary of observing terms, and a daily ephemeris by Don Yeomans for P/Halley from 1985 June 4 to 1987 May 4. It is annoying, however, to continually see Yeomans' ephemerides listing phase angle (usually not important in observing comets) while ignoring lunar phase.

The book ends with perhaps ~~its~~ most convenient aspect: the publication of 12 AAVSO Atlas charts and 7 BAA wide-field charts showing P/Halley's path and surrounding comparison stars (with visual magnitudes) for estimating the total visual magnitude of the comet from Nov. 1985 through May 1986 (as with most variable star charts, the magnitudes are given to tenths, with decimal points eliminated to avoid confusion with any stars). Curiously missing from the whole book, however, is a general textual description of this coming apparition of P/Halley.

This book is an absolute "must" for amateur observers of comets; even experienced amateurs can gain new knowledge from the broad spectrum of material included in the manual. The IHW Amateur Obervers' Manual for Scientific Comet Studies is also available as two publications (Parts I and II) from the U.S. Government Printing Office.

-- Daniel W. E. Green

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ANNOUNCEMENT: The Third American Workshop on Cometary Astronomy (AWCA)

This workshop, the third in a series that started in 1982 in Cambridge, Massachusetts, moves to Tucson, Arizona, on Monday, June 17, 1985. The AWCA series is co-sponsored by the International Comet Quarterly and the International Halley Watch (IHW). Held immediately prior to the joint convention of the Western Amateur Astronomers and the Astronomical League, this meeting will feature well-known professional and amateur comet observers discussing various aspects of comets and cometary research techniques. With the first two comets to be visited by spacecraft

(P/Giacobini-Zinner and P/Halley) fast approaching the inner solar system, this is an especially opportune time to review the various methods of cometary study possible from the ground in preparation for support of the spacecraft research and IHW efforts.

At the present time, the list of speakers is just being compiled. There is sufficient schedule flexibility to allow spill-over into June 18 if necessary. Prospective speakers are invited to submit an abstract and a note on the amount of time needed to the Workshop Chairman, Stephen Edberg, at the address below. For further information, send a self-addressed, stamped envelope to: Comet Workshop, c/o Stephen Edberg, MS T-1166 Q, Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, CA 91109, U.S.A. Additional information will be distributed as it becomes available.

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TABULATION OF COMET OBSERVATIONS

NOTE: Complete copies of the Observer Key, Reference Key, Instrument Key, etc., are available from the Editor for $2.00 postpaid. These include explanations to the individual columns of data published below.

NEW ADDITIONS TO THE OBSERVER KEY (cf. ICQ 6, 91):

JOH01 C. JOHANNINK, THE NETHERLANDS
ZAN01 W. T. ZANSTRA, THE NETHERLANDS

DESCRIPTIVE INFORMATION CONCERNING COMETS (to complement the tabulated data):

Levy-Rudenko (1984t): Several observers noted that they found the comet quite low in the sky on their first nights observation. It does not therefore seem that the range in magnitude estimates during the few days surrounding the discovery dates was due to real fluctuations in the comets brightness, but rather to poor observing conditions. Levy initially reported a discovery magnitude of 8.5 on Nov. 14.12, and Rudenko give his discovery (rough) magnitude estimate as 10.5, but both observers have little experience in making magnitude estimates of comets. Mori's independent discovery on Nov. 13.42 UT included a magnitude estimate of 12; he also gave 12 as the magnitude on Nov. 14.42 (reporting thin clouds then). The comet's has been quite asymmetric, noted especially by R. Keen (KEE) and S. J. O'Meara (OME); see also page 10 of this issue.

P/Clark (1983w). Maurice Clark (CLA) noted an almost star-like condensation embedded in a diffuse coma on July 24.54.

P/Arend-Rigaux (1984k): C. S. Morris (MOR) found the comet involved with a star on Nov. 26.47, making the magnitude estimate difficult.

Shoemaker (1984s): Robert McNaught (MCN) noted the tail as generally diffuse with averted vision; he noted possible structure that was exceedingly difficult to define. His first three observations suggested a fan tail and/or a parabolic hood, with a near-stellar central condensation.

Shoemaker (1984r): McNaught (MCN) could not find the comet on Nov. 15.57, with a stellar limit of 15.5 or so and a 32-cm reflector at 76x.

Austin (1984i): Warren Morrison's (MOR03) first observation was made with the comet at only 4 degrees altitude in early twilight. Morris (MOR) noted a very faint main tail on Oct. 2.46. John Bortle (BOR) noted that the comet was visible on Nov. 23.02 in his 32-cm f/6 reflector at 55x (diameter = 4′, DC = 0), but only with use of a comet filter.

Comet Austin (1984i)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 08 25.38	S	6.2:	AC	15	R	5	31	2	7			MOR03
1984 08 29.47				32	L	4	45			&0.4	80	KEE
1984 08 29.47	S	5.3	SP	15	L	3	17					KEE
1984 08 29.47				32	L	4	45	1.0	9	1.0	290	KEE
1984 08 30.46				32	L	4	45			0.1	90	KEE
1984 08 30.46	S	5.7	SP	3.5	B		7			1.3	310	KEE
1984 08 31.39	S	6.5	AA	6	R	15	36	3	6	?0.2	315	MOR03
1984 09 01.38				15	R	5	31	2.5	6	?0.1	330	MOR03
1984 09 01.38	S	6.7	AA	3.5	B		7					MOR03
1984 09 02.10	S	6.0:	A	8.0	B		20		4			BOU
1984 09 02.10	S	6.0:	A	8.0	B		20	2.5				BUS01
1984 09 02.46	S	6.0	SP	3.5	B		7			1.7	320	KEE
1984 09 02.46				32	L	4	45	1.0	9	0.3	120	KEE
1984 09 03.46	S	6.2	SP	5.0	B		7			1.0	310	KEE
1984 09 05.11	S	6.5	A	4.0	B		7	& 5.5	7	&1	302	BUS01
1984 09 05.11	B	6.7	A	4.0	B		7					BUS01
1984 09 05.11	B	6.8	A	5.0	B		7					JOH01
1984 09 05.12	S	6.6	A	8.0	B		20	4.5	4/	1	300	BOU
1984 09 05.12				15.6	L	5	58			0.17	117	BOU
1984 09 05.13				15.6	L	5	30	2.5	8	0.20	114	BUS01
1984 09 05.14	S	7.3	A	8.0	B		15		7			ZAN01
1984 09 05.39	S	7.0	AA	6	R	15	36	2.5	5			MOR03
1984 09 06.10	B	7.1	A	5.0	B		7					JOH01
1984 09 06.11	S	6.9	A	6.0	B		12	3	6/	0.30	313	WEG
1984 09 06.11	B	7.2	A	6.0	B		12					WEG
1984 09 06.11				10.0	L		22			0.14	114	WEG
1984 09 06.39	S	7.0	AA	6	R	15	36	3	5			MOR03
1984 09 07.39	S	7.0	AA	6	R	15	36	2.5	4			MOR03
1984 09 10.10	S	7.5	A	10.8	L		17	3		0.10	125	BUS01
1984 09 12.13	B	7.4	A	6.0	B		12					WEG
1984 09 12.13	S	7.2	A	6.0	B		12	3	7	0.38		WEG
1984 09 12.38	S	7.6	AC	6	R	15	36	2.5	3			MOR03
1984 09 13.11	S	7.6	A	25.4	J		48			0.30	114	BOU
1984 09 14.39	S	7.9	AC	6	R	15	36	2.5	3			MOR03
1984 09 15.47	S	7.1	S	15	L	3	17					KEE
1984 09 15.47				32	L	4	45			0.2	120	KEE
1984 09 15.47				32	L	4	45			0.1	310	KEE
1984 09 17.39	S	7.9	AC	6	R	15	36	3	2			MOR03
1984 09 18.38				32	L	6	55	4.0	5/	0.3	114	BOR
1984 09 18.38	S	7.6	A	5.0	B		10	6				BOR
1984 09 19.41	S	7.7	AC	15	L	8	51	4.1	6	0.08	91	DEY
1984 09 19.41				15	L	8	51			0.05	320	DEY
1984 09 20.39	S	7.6	AC	15	L	8	51	4.0	6			DEY
1984 09 20.48	S	7.4	AA	25.4	L	4	32	7	4	0.20	112	MAC
1984 09 21.39	S	8.4	AC	6	R	15	36	3.5	2			MOR03
1984 09 21.39	S	7.5	AA	15	L	8	38	4.0	7	0.20	141	DEY
1984 09 21.48	S	7.4	S	25.4	L	4	32	7	4	0.16	117	MAC
1984 09 22.05	B	7.2	A	6.0	B		12					WEG
1984 09 22.05	S	7.1	A	6.0	B		12	5	7	0.25		WEG
1984 09 22.39	S	8.3	AC	6	R	15	36	3.5	2			MOR03
1984 09 25.47	S	7.8	S	25.4	L	4	32	6	5	0.14	121	MAC
1984 09 27.09	B	7.6	A	6.0	B		12					WEG
1984 09 27.09	S	7.4	A	6.0	B		12	9	4/			WEG
1984 09 27.12				10.8	L		18	10	4	0.25	122	BUS01

Comet Austin (1984i) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 09 27.12	S	7.8	A	8.0	B		20	& 5.5	3/			BOU
1984 09 27.12				25.4	J	6	48			0.25	119	BOU
1984 09 27.13	B	7.9	A	10.8	L		17					BUS01
1984 09 27.13	S	7.5	A	10.8	L		17					BUS01
1984 09 27.38				15	L	8	51			0.05	152	DEY
1984 09 27.38	S	7.8	AC	15	L	8	51	4.0	5	0.07	223	DEY
1984 09 27.39	S	8.6	AC	6	R	15	36	4	2			MOR03
1984 09 27.49	S	8.2	S	25.4	L	4	32	4	4	0.20	120	MAC
1984 09 28.38	S	8.6	AC	6	R	15	36	4	4			MOR03
1984 09 29.03	S	8.3	A	8.0	B		15	10	3			FEI
1984 09 29.07	S	7.6	A	11.0	R	10	44		4/			COM
1984 09 29.08	S	7.4	A	6.0	B		12	8	2/			WEG
1984 09 29.08	B	7.8	A	6.0	B		12					WEG
1984 09 29.12	S	7.9	A	8.0	B		20	5.5	3			BOU
1984 09 29.44	S	8.3	S	13.1	R	7	27	5	4	0.14	114	MAC
1984 10 02.46	S	7.9	S	8.0	B		20	9	4	&0.17	270	MOR
1984 10 03.11	S	8.1	A	8.0	B		20	6	2			BOU
1984 10 03.12	B	8.5		6.0	B		12					WEG
1984 10 03.12	S	8.0	A	6.0	B		12	12	2/			WEG
1984 10 03.14	S	8.5	A	11.0	R		44		5			COM
1984 10 03.15				10.0	L		22			0.27	118	WEG
1984 10 03.15	B	8.6	A	10.0	L		22	11	3			WEG
1984 10 03.15	S	8.0	A	10.0	L		22	11	3	0.18	260	WEG
1984 10 03.40	S	8.3	AC	15	L	8	51	5.0	4	0.07	123	DEY
1984 10 03.46	S	8.1	S	25.4	L	4	32	7	5			MAC
1984 10 04.08	S	8.0	A	6.0	B		12	9	2/	0.20		WEG
1984 10 04.08	B	8.5	A	6.0	B		12					WEG
1984 10 04.10	S	7.9	A	5.0	L		8					WEG
1984 10 04.10	S	8.0	A	10.0	L		22	9	3/	0.17	113	WEG
1984 10 04.10	B	8.6	A	10.0	L		22					WEG
1984 10 04.12	S	7.9	A	8.0	B		20	7	2			BOU
1984 10 04.12				25.4	J		48			0.33	117	BOU
1984 10 04.13	S	7.8	A	8.0	B		20	11	2/			BUS01
1984 10 04.14	S	8.5	A	11.0	R	10	44		5			COM
1984 10 04.39	S	8.7	AC	6	R	15	36	5	1			MOR03
1984 10 04.77	S	8.4		12.0	B		20	& 5.5				MCN
1984 10 06.37				32	L	6	55	6.3	4	0.2	105	BOR
1984 10 06.37	S	8.1	MP	5.0	B		10	8	2			BOR
1984 10 06.39	S	9.0	AC	15	R	5	31	4.4	2			MOR03
1984 10 06.46	S	8.7	AC	15	L	8	51	3.7	4			DEY
1984 10 06.49				32	L	4	45	7	4	0.4	120	KEE
1984 10 06.49	S	8.5	S	15	L	3	17					KEE
1984 10 06.49				25.6	L	4	67			0.25	125	MOR
1984 10 06.49	M	8.1	AA	8.0	B		20	10	3			MOR
1984 10 06.76	S	8.3		12.0	B		20	7				MCN
1984 10 07.16	S	8.3	A	25.4	J	6	59	7	3	0.23	114	BUS01
1984 10 16.84	S	8.5	A	10.0	L		22	& 5	1			WEG
1984 10 18.93	S	8.4	A	10.0	L		22	& 6	1			WEG
1984 10 21.86	S	8.6	A	10.0	L		22	7	0/			WEG
1984 10 21.93	S	8.4	A	15.6	L	5	24	8	1/	0.25	90	BUS01
1984 10 23.97	S	10.5	A	11.0	L	10	44		0/			COM
1984 10 27.82	S	10.5	A	22.5	L	10	65		1			COM
1984 10 30.90	S	9.2	A	25.4	J	6	38	8	0/	0.20	75	BUS01
1984 10 30.90	S	10.6	A	22.5	R	10	55		1			COM
1984 10 30.97	S	9.0	A	10.0	L		22	6	0/			WEG

Comet Austin (1984i) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 10 31.00	S	9.9	A	25.4	L		70	5	0			KUI
1984 10 31.15		9.3	A	32	L	6	55	6	2			BOR
1984 10 31.15	S	8.9	A	5.0	B		10	9	0			BOR
1984 10 31.93	S	9.1	A	10.0	L		22	5	0/			WEG
1984 11 01.93	S	10.7	A	22.5	R	10	55		1			COM
1984 11 03.05	S	9.3	A	10.0	L		22	5	1/			WEG
1984 11 03.49	S	9.2	NP	25.6	L	4	45	9	1			MOR
1984 11 03.50	S	9.0	NP	8.0	B		20	12	0			MOR
1984 11 16.09	S	11 :		32	L	4	78	3	1			KEE
1984 11 20.03	S	11.0:	A	32	L	6	55	2.6	0			BOR
1984 11 20.25	S	9.9	NP	25.6	L	4	45	7	0			MOR
1984 11 26.16	S	10.4:	NP	25.6	L	4	45	& 8	0			MOR

Comet Meier (1984o)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 09 22.03	S	12.0	A	32	L	6	88	1.5	1			BOR

Comet Levy-Rudenko (1984t)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 11 15.18	S	10.5:	AC	25.6	L	4	111	2.7	3			MOR
1984 11 15.42	S	9.7:	A	12.0	B		20	& 1.5	0			MCN
1984 11 16.07	S	9.4	S	32	L	4	45	2.5	5			KEE
1984 11 16.43	S	9.2	A	12.0	B		20	2.5	0			MCN
1984 11 17.99	M	9.5	AC	22.9	R	12	152					GRE
1984 11 17.99	M	9.4	AC	22.9	R	12	96					GRE
1984 11 17.99	S	9.3	AC	22.9	R	12	96	& 2.5	3/			GRE
1984 11 19.11	S	9.6	S	15.2	L	8	90	2	2			MAC
1984 11 19.14	M	9.0	AC	25.6	L	4	45		5/			MOR
1984 11 19.96	S	9.3	AC	22.9	R	12	96	& 2.5	4			GRE
1984 11 19.96	M	9.3	AC	22.9	R	12	96					GRE
1984 11 19.99	S	8.7:	AC	8.0	B		20	& 3	0			GRE
1984 11 20.01	S	9.1	A	8.0	B		20	3				BOR
1984 11 20.01	S	9.2	A	32	L	6	68	2.2	4			BOR
1984 11 20.10	S	9.6	S	15.2	L	8	76	2	2			MAC
1984 11 20.15	M	8.9	AC	25.6	L	4	45	3.6	6	0.2	70	MOR
1984 11 20.16	M	8.7	AC	8.0	B		20	3.6	5	0.2	70	MOR
1984 11 21.02	S	9.0	A	32	L	6	68	3.2	4			BOR
1984 11 21.10	M	9.0	AC	25.6	L	4	67	2.9	5			MOR
1984 11 21.99	S	8.7	A	8.0	B		20	& 6				BOR
1984 11 21.99	S	9.0	A	32	L	6	68	3.2	4/			BOR
1984 11 22.14	S	9.8	S	25.4	L	4	64	2	1			MAC
1984 11 22.81	S	8.9	A	25.4	J	6	47	& 2.5	3/			BUS01
1984 11 22.99	S	8.6	A	8.0	B		20	3.5	3			BOR
1984 11 22.99	S	8.8	A	32	L	6	68	2.9	5			BOR
1984 11 24.11	M	8.8	S	25.6	L	4	67	& 3	6			MOR
1984 11 24.73	S	9.0	A	25.4	J	6	100		4			FEI
1984 11 24.80	S	8.5	A	25.4	J	6	47	4	4/			BUS01
1984 11 25.72	S	8.8	A	25.4	J	6	59		5			FEI
1984 11 26.09	S	9.3	S	15.2	L	8	76	2	3			MAC
1984 11 26.13	M	8.5	AA	8.0	B		20	3	8	0.5	63	MOR
1984 11 26.14	M	8.5	AA	25.6	L	4	45	3.1	7	0.5	63	MOR
1984 11 27.99	S	8.6	A	32	L	6	68	2.6	5			BOR

Comet Levy-Rudenko (1984t) Cont.

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 12 01.97	S	9.3	AA	22.9	R	12	96	& 1.7	4			GRE
1984 12 01.97	M	9.3	AA	22.9	R	12	96					GRE
1984 12 04.97	M	8.4	AA	22.9	R	12	96			?		GRE
1984 12 04.97	S	8.4	AA	22.9	R	12	96	& 3.5	3/			GRE

Comet Shoemaker (1984s)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 11 03.46	M	11.5	NP	25.6	L	4	67	2.3	6			MOR
1984 11 13.56	S	12.0	A	32	L		76	0.4	7	0.03	40	MCN
1984 11 14.56	S	12.0	A	32	L		76	0.5	7	0.01	65	MCN
1984 11 15.08	S	11.1	A	32	L	6	68	1.5	7/			BOR
1984 11 15.56	S	12.0	A	32	L		76	1.0	7	0.02	25	MCN
1984 11 16.11	S	11 :	S	32	L	4	78	2	5			KEE
1984 11 17.48	M	11.8	A	32	L		76	1.5	8/	0.03	20	MCN
1984 11 20.04	S	11.4	A	32	L	6	68	1.5	7			BOR
1984 11 20.28	M	10.7	NP	25.6	L	4	67	1.5	7/	0.02	25	MOR
1984 11 21.05	S	11.4	A	32	L	6	68	2.0	6/			BOR
1984 11 23.06	S	11.4	A	32	L	6	68	1.6	7			BOR
1984 11 24.82	S	10.6	A	25.4	J	6	47	2	5/			BUS01
1984 11 26.20	M	10.8	NP	25.6	L	4	67	1.6	7/			MOR

Periodic Comet Clark (1983w)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 07 24.54	S	11.2	VN	41	L	4	86	2	8			CLA
1984 08 15.53	S	12.0	V	41	L	4	86	1				CLA
1984 08 22.50	S	12.3	V	41	L	4	86	0.75	7			CLA
1984 09 19.61	S	12.9	V	41	L	4	86	& 0.5	1			CLA

Periodic Comet Arend-Rigaux (1984k)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 11 22.41	S	11.8	A	32	L	6	88	1.2	2			BOR
1984 11 26.47	S	12.5:	NP	25.6	L	4	111	1.3				MOR
1984 11 27.49	S	12 :		32	L	4	150	1.0	3			KEE
1984 12 02.42	M	12.4	NP	25.6	L	4	156	1.2	7			MOR

Periodic Comet Takamizawa (1984j)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 08 02.54	S	9.9		8.0	B		15	2	6			PRI
1984 08 03.22	S	9.8	S	32	L	4	45	1.2	5			KEE
1984 08 03.58	S	9.8		8.0	B		15	2	6			PRI
1984 08 04.36	S	9.7	S	32	L	4	45	1.5	6			KEE
1984 08 15.52	S	10.1	AA	41	L	4	86	1.5	5			CLA
1984 08 18.10	S	10.2	AC	15	R	5	31	2.5	2			MOR03
1984 08 22.51	S	10.4	AA	41	L	4	86	1.5	5	?0.17	25	CLA
1984 08 23.51	S	9.6		15	R	16	50	& 3.5	8			PRI
1984 08 25.13	S	10.4	AA	15	L	8	38	1.6	6			DEY
1984 08 25.17	S	10.5	AC	15	R	5	31	2	2			MOR03
1984 08 26.26	S	10.3	S	32	L	4	45	2.0	4			KEE
1984 09 17.17	S	11 :	S	32	L	4	45	2.5	2			KEE
1984 09 23.19	S	12.0:	S	36.2	L	6	108	3.0	1			MAC

Periodic Comet Faye (1984h)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 08 29.44	S	12 :		32	L	4	78	1.5	3			KEE
1984 10 06.39	S	12.7	A	32	L	6	110	0.5				BOR
1984 12 02.46		[13.0		25.6	L	4	156					MOR

Periodic Comet Wolf-Harrington (1984g)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 10 02.45	S	13.3	NP	25.6	L	4	156	1.0	2/			MOR
1984 11 27.50	S	12 :		32	L	4	150	1.2	2			KEE
1984 12 02.50	S	13.2	NP	25.6	L	4	156	1.0	3			MOR

Periodic Comet Shoemaker 1 (1984q)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 10 06.47	S	12.0:	AC	25.6	L	4	111	1.4	3/			MOR
1984 10 14.15	S	11.3	AC	20	L	6	61					HAL
1984 10 16.01	S	11.0	A	32	L	6	68	2.6	3			BOR
1984 10 17.03	S	11.1	A	32	L	6	68	2.6	3			BOR
1984 10 20.26	S	11.4	AC	25.6	L	4	67	1.6	3			MOR
1984 10 27.80	S	11.7	A	22.5	R	10	55		2			COM
1984 10 30.89	S	11.2	A	25.4	J	6	59					BUS01
1984 10 30.90	S	11.7	A	22.5	R	10	55		2/			COM
1984 10 31.17	S	11.8	A	32	L	6	68	2.4	2			BOR
1984 11 15.07	S	11.8	A	32	L	6	68	2.9	1/			BOR
1984 11 16.12	S	12 :	S	32	L	4	78	1	2			KEE
1984 11 20.02	S	11.5	A	32	L	6	68	2.2	1			BOR
1984 11 20.23	S	11.5	NP	25.6	L	4	67	3.6	1			MOR
1984 11 21.03	S	11.8	A	32	L	6	68	2.1	0			BOR
1984 11 22.01	S	11.8	A	32	L	6	68	1.8	0			BOR
1984 11 23.01	S	11.7	A	32	L	6	68	2.2	0			BOR
1984 11 26.18	S	11.3	NP	25.6	L	4	67	4.0	1			MOR

Periodic Comet Schaumasse (1984m)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 10 06.38	S	[13.0	A	32	L	6	110					BOR
1984 10 06.52		[12.5		25.6	L	4	156					MOR
1984 11 03.53	S	10.7	NP	25.6	L	4	67	3.0	1			MOR
1984 11 20.42	S	9.7	A	32	L	6	68	3.3	4			BOR
1984 11 22.42	S	9.8	A	32	L	6	68	2.6	3			BOR
1984 11 26.54	M	9.7	NP	25.6	L	4	45	4.2	3			MOR
1984 11 27.52	S	9.7	S	32	L	4	78	4.5	4			KEE
1984 12 02.53	M	9.6	AC	25.6	L	4	45	4.3	3/	0.05	170	MOR
1984 12 04.43	S	9.9	A	32	L	6	68	2.8	4			BOR
1984 12 04.43	S	9.6	A	8.0	B		20	4	2			BOR
1984 12 04.54	S	9.1	AA	25.4	L	4	32	4.6	2			MAC

Periodic Comet Neujmin 1 (1984c)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 08 28.20	S	11.5:	S	32	L	4	150	0.7	3			KEE
1984 09 17.13	S	13 :		32	L	4	78	1.5	3			KEE
1984 11 20.20		[13.5		25.6	L	4	156					MOR

Periodic Comet Crommelin (1983n)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 02 19.79	S	7.8	A	6.0	B	4	12	5	5			WEG

Periodic Comet Hartley-IRAS (1983v)

DATE (UT)	MM	MAG.	RF	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1984 03 31.86	S	10.2	A	25.4	J	6	49	& 3.5	1/	0.05	204	BUS01
1984 04 22.95	S	10.8	A	25.4	J	6	49	& 3	1/	0.03	110	BUS01
1984 04 26.90	S	10.9	A	25.4	J	6	49	& 3	1/	0.03	110	BUS01
1984 04 27.90	S	11.4	A	25.4	J	6	49		3			COM

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RECENT NEWS AND RESEARCH CONCERNING COMETS

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

The year 1984 has seen a record number of new comet discoveries: the officially accepted number of 13 new discoveries, as of this writing, surpasses the old record of 12 new comets to be discovered in a single calendar (January 1-December 31) year, set in 1975 and tied in 1983. Five of the 13 newly-discovered comets this past year have been found by the Shoemakers.

In fact, since this column was written for the last issue (Sept. 29), Carolyn and Eugene Shoemaker have reported their discoveries of four new comets, two of them being of short period! Comets Shoemaker 1984r and 1984s join P/Shoemaker 1 1984q and P/Shoemaker 2 1984u among their recent discoveries, and their discovery of 6 comets in only 15 months appears better than any previous comet discovery effort except that by the Earth-orbiting satellite IRAS in 1983 (the latter had 6 comet discoveries in less than 8 months).

Further information concerning the Shoemakers' comet discoveries is given in their timely article on page 3 of this issue. Two of the new comets Shoemaker have been brighter than 12th magnitude in recent weeks, with comet 1984q remaining between total mag 11 and 12 in October and November, and comet 1984s between 10.5 and 11.5 in November.

The Shoemakers have discovered at least one comet on each of their last 4 observing runs at Palomar, extending from comet 1984f in late May to comet 1984u in late November. They will not be observing for a few months, but hope to continue their bizarre streak in early 1985. P/Shoemaker 1 was discovered on films taken Sept. 27 and 28, having passed perihelion some 11 days earlier at q = 2 AU (orbital period = 7.25 yrs); visual observers note coma diameters in the range 1.5′ to 4′ in the two months following discovery, with agreement that the comet changed from slight/moderate condensation to almost no condensation in the same time period.

Comet Shoemaker 1984r is an unusual comet from the view of its orbital elements. Its departure from great-circle motion is so slight that it took some time to decide whether the orbit could be best fit by an ellipse of some 5 yrs or by a parabola. Brian Marsden noted that this comet passed almost EXACTLY through opposition (180° from the sun in the sky, as seen from Earth) on Nov. 10, something he had never seen before in some 30 years of computing orbits for comets! [The opposition point is defined as that point where a comet or planet passes the 180-degree LONGITUDE line opposite the sun; however, objects at opposition are usually not 180° in elongation from the sun, but actually (sometimes considerably) < 180°.]

Comet Shoemaker 1984s was discovered on films exposed on Oct. 25 and 26; the object was diffuse with condensation, and of magnitude 12, and was close to opposition (just as are all of the

Shoemaker comet discoveries when found). P/Shoemaker 2 1984u was found on films taken Nov. 21, the comet appearing as diffuse and condensed, with a possible short tail to the northeast, at total magnitude 14.5.

At much smaller elongation from the sun, a new comet was reported by amateur comet hunters David Levy (Tucson, AZ) and Michael Rudenko (Amherst, MA) on Nov. 14 and 15 UT, respectively. Apparently near 9th magnitude and quite diffuse, comet Levy-Rudenko 1984t was then travelling almost due north in Aquila on its way to perihelion on Dec. 14. This comet has been a binocular object, and should remain brighter than mag 10 (and well-placed for northern-hemisphere observers) for a couple more months. H. Mori of Mukegawa, Japan, got word to the IAU Central Telegram Bureau a week and a half later that he independently discovered the comet the night before Levy located it.

Levy began comet hunting from his native Canada in 1965, logging 917.5 hours of actual hunting time before his discovery of comet 1984t; he used a 16-inch-aperture f/5 Dobsonian-mounted reflector. Levy independently discovered P/Hartley-IRAS 1983v last year, and spent about 57 hours hunting between then and his recent discovery. Rudenko spent 247 hours of comet hunting during the past 3-4 years before finding comet 1984t with a 6-inch refractor.

Comet 1984v was a new discovery by Malcolm Hartley with the U.K. Schmidt Telescope in Australia. Hartley reported the object as near magnitude 15, but failure to successfully locate the comet on photographs taken with 3 observatory telescopes (including the Palomar 48-in Schmidt) cast some doubt as to the reality of the comet. Hartley's initial photographs on Nov. 17 and 23 were not verified, in fact, until Alan Gilmore successfully photographed the comet on Dec. 1 from Mount John in New Zealand; Gilmore estimated a nuclear magnitude of 17. Comet Hartley apparently will pass perihelion on 1985 Sept. 26 at a distance of 4 AU from the sun; its orbit is highly inclined to the ecliptic (89°).

The minor planet 1983 TB, which is thought to be a likely candidate as the progenitor for the Geminid meteor shower, is passing through an unusually good opposition quite close to the earth. If the object is in its last stages as a comet, it may actually exhibit a slight coma near perihelion (Feb. 1985), and many observers are trying to look for just such a coma. Several observers found 1983 TB visually in December, noting the object as simply stellar with magnitudes ranging from 12.9 on Dec. 12 and 18 (Alan Hale and John Bortle) to 13.5 on Dec. 23 (Charles Morris).

Various individuals have been commenting on how unreasonable are the predictions published by some writers (e.g., D. K. Yeomans in the Comet Halley Handbook and J. E. Bortle in Sky and Telescope's "Comet Digest") of the magnitude of P/Halley during late 1984 and early 1985 -- such predictions are 2 to 3 magnitudes too faint. Since we have never before observed Halley's Comet in this portion of its orbit, one should assume that it will be quite faint until conjunction with the sun in June 1985 -- barring an unpredictable brightness outburst. Indeed, at the comet's last apparition, attempts to recover the comet photographically were not successful until only 7 months before perihelion (at a heliocentric distance of only 3.5 AU), when M. Wolf at Heidelberg found an almost stellar image of P/Halley at magnitude 16. It seems fairly certain that the photographic techniques and quality of intruments in 1909 were good enough to have detected the comet when it became 16th or 17th magnitude, and this places an upper limit; thus, P/Halley likely will not reach 16th magnitude at its current return until July 1985 (when it is also close to the sun), and may not brighten to better than 18th magnitude before it becomes lost in the sun's glare next spring.

Indeed, many large observatories unsuccessfully searched for P/Halley in October; astronomers using one of the world's largest Schmidt telescopes reported the comet must have been fainter than total mag 21.5 this past Oct. 29 and 31. Other observers are finding the comet, but are not finding it to be any brighter than mag 20 (even as of this writing). It still appears to be fluctuating in brightness by 1-2 magnitudes.

Concerning the Gary Emerson photograph of comet Austin 1984i on page 97 of the last issue, the caption should have stated that the anti-tail pointed to the left of the comet's coma, with the main tail extending faintly nearly halfway to the upper right corner.
-- 1984 December 22

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COMETS FOR THE VISUAL OBSERVER IN 1985

Alan Hale
Montrose, California

The visual comet observer can expect to remain busy during 1985, with the chief attractions being the approach of the long-awaited periodic comet Halley and a favorable return of periodic comet Giacobini-Zinner. In addition, a number of fainter short-period comets is expected to be visible, and at least one long-period comet discovered in 1984 may be visible most of the year. Ephemerides are published in the ICQ as the season for each comet's visibility approaches.

P/Halley 1982i

This, the best-known of all short-period comets, was initially recovered by D. Jewitt and G. E. Danielson with the 5-meter reflector at Palomar on 1982 October 16 (cf. ICQ 4, 78), and will pass perihelion on 1986 February 9 UT. Visual observers with very large telescopes may possibly be able to pick up the comet during the late spring of 1985 (late autumn for southern hemisphere), when it will be in the evening sky and perhaps at magnitude 15 or 16. During May and June, P/Halley will be too close to the sun for observation, but it should emerge into the morning sky as a 14th-magnitude object toward the end of July. During the next several months, the comet should brighten rather rapidly, reaching magnitude 12 in September, 10 in October, and about 7 in mid-November when at opposition. After this, the decreasing heliocentric distance of the comet will be somewhat offset by increasing distance from Earth, resulting in a slowing of the brightness rise; nevertheless, the magnitude should cross the naked-eye threshold during December and be between 5 and 6 at the end of the year.

Brightness and behavior predictions for the current return of P/Halley are abundant in the recent literature; the above magnitudes reflect the current consensus for pre-perihelion expectations. Predictions for post-perihelion brightness, especially for the opposition in April 1986, vary from a relatively faint magnitude 4 or 5 to a fairly "spectacular" magnitude 2. [Further information on observing P/Halley will be published in the April issue of the ICQ. -- Ed.] Those observers not already involved with the International Halley Watch are encouraged to contact Steve Edberg, the Coordinator for Amateur Observations, at MS T-1166; Jet Propulsion Laboratory; 4800 Oak Grove Dr.; Pasadena, CA 91109, USA.

P/Giacobini-Zinner 1984e

This 6.5-year-orbital-period comet makes one of its more favorable returns in 1985. Recovered on 1984 April 3 by observers at Kitt Peak (cf. ICQ 6, 50), it will pass perihelion at q = 1.028 AU on 1985 September 5.3. Comet 1984e should become observable visually during late spring or early summer (late autumn or early winter for observers in the southern hemisphere), brightening rapidly to a maximum magnitude of about 8 during September, at which time it will be conveniently placed for observers in the northern hemisphere. The comet will then begin fading as it travels rapidly southward. An interesting appulse occurs on September 14, when P/Giacobini-Zinner (at magnitude 8) passes 2 degrees west of P/Halley (at magnitude 12).

Interest in this return of P/Giacobini-Zinner is especially keen, due to what will be the first cometary encounter by a spacecraft: The International Cometary Explorer (ICE) will intersect the comet's ion tail on September 11. The probe is not equipped for imaging, but will employ several plasma and charged-particle measurement devices.

The current return of this comet also shows some promise for producing a strong Draconid meteor shower on October 9. The displays of this shower were especially strong during the returns of 1933 and 1946 (when maximum rates of one to two meteors per second were recorded) -- but there were no strong displays during the favorable returns in 1959 and 1972. In 1985, the earth will pass some 0.033 AU from the comet's descending node 27 days after the comet's passage through it, and the prospects for a reasonably strong shower are somewhat promising.

P/Arend-Rigaux 1984k

This comet, usually classed as one of the "transition" objects between comets and asteroids, passed perihelion on 1984 December 1. It was recovered in 1984 August (cf. ICQ 6, 73, and 6, 96). The current return is the most favorable one since its discovery in 1951; when first seen on February 5 of that year, the comet was at magnitude 11, and the brightness at this return should be similar. During early 1985, it will be favorably placed, passing opposition in late January. An ephemeris for the first few months of the year was published in ICQ 6, 77. While, as expected, coma development is not very strong for this comet, some coma structure, and even some tail development, was observed at P/Arend-Rigaux's last return in 1978.

P/Schaumasse 1984m

After apparently being missed at the very unfavorable returns in 1968 and 1976, Jim Gibson at Palomar recovered this comet on 1984 September 5.5; with a period of 8.3 years, it passed perihelion on 1984 December 6.5 (q = 1.213 AU). Prior to this recovery, the last definite observed return had occurred in 1960 -- now, however, the Gibson recovery positions confirm that a single image obtained in 1976 by Elizabeth Roemer at Kitt Peak, in poor observing conditions and with the comet at low altitude, was indeed P/Schaumasse.

Brightness predictions for this return are somewhat uncertain. At the very favorable return in 1952, the comet surged dramatically at perihelion, reaching magnitude 5 and displaying a coma up to 20′ in diameter. During the less favorable return in 1960, it may have been intrinsically about one magnitude fainter, although this conclusion is open to question. Data from both of these returns indicate that the comet's brightness rises sharply as P/Schaumasse approaches perihelion and fades more slowly after perihelion; based on what information is available, a maximum magnitude of about 10 or 11 should have been reached during December 1984. The brightness at the beginning of 1985 should be similar, but the comet will begin to fade shortly thereafter. C. S. Morris observed P/Schaumasse at total visual magnitude 10.7 on 1984 Nov. 3. An ephemeris may be found in ICQ 6, 101.

P/Wolf-Harrington 1984g

Recovered by Gibson at Palomar on 1984 June 4.5, this 6.5-year-period comet passed perihelion on 1984 September 22. Opposition occurs during late February 1985; while the brightness behavior of the comet is not too well known, a faint observation made by C. Morris in early Oct. and 3 negative observations (all in Oct.) all suggest that this object will be fainter than magnitude 13 during the early months of 1985. An ephemeris for this comet was published in ICQ 6, 100.

P/Ashbrook-Jackson

This intrinsically-bright comet (orbital period: 7.5 yrs) passes perihelion on 1986 January 24.3 at the relatively large heliocentric distance of 2.307 AU. At that time, it will be on the opposite side of the sun and not observable, but it should be visible in moderate-size telescopes when it passes opposition in the late summer of 1985 (late winter for southern hemisphere). Southern-hemisphere observers will be somewhat more favored. Brightness data obtained during the well-observed return in 1978 indicate a maximum total visual magnitude of about 12.

P/Honda-Mrkos-Pajdusakova

Although it normally reaches about magnitude 8 on most returns, this comet has a very unfavorable 1985 return, with the solar elongation not exceeding 30 degrees throughout the apparition. Perihelion passage occurs on May 23.9 at q = 0.542 AU. The best time for observing attempts should be in late March and early April, when the comet will be near maximum solar elongation (just under 30 degrees) in the morning sky and at about magnitude 12; southern hemisphere observers are favored. An ephemeris was published in ICQ 6, 27, for those observers with large telescopes who might wish to attempt observations, although such obsightings will border on the impossible.

P/Boethin (1975 I)

A flare in 1975 quite likely caused this comet to be discovered. With an 11 year period, P/Boethin is making its first potential return since its discovery, passing perihelion around 1986 January 19. The observing conditions will be quite similar to the discovery apparition, although the comet could well be much fainter. Assuming that the comet is recovered, it may possibly reach magnitude 12 or 13 in November or December, and perhaps mag 11 in late January 1986.

P/Tsuchinshan 1 1984p

The first of the "twin Chinese" short-period comets passes perihelion on 1985 January 2 at q = 1.508 AU. Prior to this apparition, P/Tsuchinshan 1 has never been observed visually, and any brightness predictions are thus necessarily uncertain; however, the observing conditions at this return are quite favorable and the magnitude could conceivably reach 13 (ephemeris in ICQ 6, 102).

P/Schwassmann-Wachmann 1

During 1985, this "annual" comet traverses the Milky Way region in Scorpius, about 5 degrees south of Antares, passing opposition in early June. The southerly declination (-30°) may hamper observers in the northern hemisphere, but southern hemisphere observers should be able to conveniently monitor the object for outbursts. This comet has been seemingly inactive in recent years; while two observers reported some activity in early 1983, the last well-observed outburst occurred in April 1982 (see ICQ 6, 27 and 30, for a discussion of the 1983 activity and an ephemeris for the 1985 observing season).

P/Haneda-Campos (1978 XX)

This intrinsically-faint comet may be making its first observed return since discovery and was to have passed perihelion near 1984 Dec. 27. A close approach to Jupiter during the interim revolution has increased the orbital period (from 6.0 to 6.3 years) and the perihelion distance (from 1.10 to 1.22 AU), significantly affecting the other orbital elements; this results in only moderate observing conditions, at best, for the current return. Again, the orbit is not in the best of shape due to only a 3.5-month observation arc at its first apparition in 1978, and an ephemeris will not be published in the ICQ until the comet is actually recovered.

Brightness forecasts for the 1984-85 return are extremely uncertain, as the magnitude data from the 1978 return is quite discordant. Although it was approximately magnitude 10 when discovered, the comet faded as it approached perihelion (passing 0.15 AU from the earth at perihelion); this fact, together with estimates made from pre-discovery photographs (when it was significantly fainter than the discovery magnitude would suggest) implies that the comet flared shortly before its discovery, and may in fact be extremely faint intrinsically. It is even possible that what was witnessed in 1978 was the comet's death throes, and it might not be seen again.

At present, assuming the comet is still extant, an analysis based on its brightness during the first two weeks after discovery indicates a maximum magnitude of about 14 occurring during 1984 December and 1985 January; the brightness will probably be much fainter than this. On the other hand, if the comet is indeed prone to flaring, it could briefly reach magnitude 12 or 13, and observers with large telescopes may wish to monitor it for this type of activity.

Comet Shoemaker 1984f

This intrinsically bright, long-period comet was discovered photographically as a 14th-magnitude object during the course of a systematic search program by Carolyn and Eugene Shoemaker at Palomar, on 1984 May 27. Perihelion passage occurs on 1985 September 4, at a heliocentric distance of 2.697 AU. In early 1985, it will be visible in the morning sky, and will pass opposition in late April when its magnitude may be about 11. (An ephemeris for this opposition was published in ICQ 6, 76.) While observers in the southern hemisphere are somewhat favored, the comet should be accessible to observers in both hemispheres. Superior conjunction occurs shortly after perihelion passage, after which the comet will move toward another opposition in late 1986 January; however, its southerly declination then will probably limit observations to the southern hemisphere.

During the final drafting stages of this article, the Shoemakers discovered a couple of comets, and Levy and Rudenko discovered a comet, all of which may be bright enough to be seen in a 20-cm reflector in early 1985. Further information is given on p. 23 of this issue.

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EPHEMERIS FOR COMET LEVY-RUDENKO 1984t (orbital elements from MPC 9293):

Date ET	R. A. (1950)	Decl.	Delta	r	Elong.	Mag.
1985 01 25	17 30.64	+58 20.5	0.720	1.174	85.6	8.5
1985 01 30	16 58.85	+64 46.0				
1985 02 04	15 57.44	+71 12.9	0.648	1.285	101.7	8.6
1985 02 09	13 55.51	+75 27.9				
1985 02 14	11 21.97	+73 48.8	0.635	1.402	118.0	9.0
1985 02 19	09 48.86	+67 16.5				
1985 02 24	09 03.97	+59 23.7	0.702	1.525	127.9	9.6
1985 03 01	08 40.85	+51 50.5				
1985 03 06	08 28.07	+45 10.5	0.841	1.650	128.2	10.3
1985 03 11	08 20.86	+39 29.7				
1985 03 16	08 16.97	+34 43.4	1.032	1.777	122.5	11.1
1985 03 21	08 15.23	+30 43.3				
1985 03 26	08 14.98	+27 21.0	1.256	1.904	114.8	11.8
1985 03 31	08 15.81	+24 29.3				
1985 04 05	08 17.43	+22 02.0	1.500	2.030	106.9	12.5
1985 04 10	08 19.66	+19 54.3				
1985 04 15	08 22.37	+18 02.2	1.756	2.156	99.1	13.1
1985 04 20	08 25.46	+16 22.7				
1985 04 25	08 28.86	+14 53.4	2.019	2.281	91.6	13.6
1985 04 30	08 32.52	+13 32.3				
1985 05 05	08 36.39	+12 18.0	2.285	2.405	84.4	14.1

EPHEMERIS FOR COMET SHOEMAKER 1984s (from elements on MPC 9305):

Date ET	R. A. (1950)	Decl.	Delta	r	Elong.	Mag.
1985 01 25	05 13.43	−18 03.4	0.434	1.257	119.6	10.7
1985 01 30	05 33.42	−17 21.2				
1985 02 04	05 52.77	−16 22.1	0.481	1.304	121.7	11.1
1985 02 09	06 11.30	−15 10.4				
1985 02 14	06 28.94	−13 50.1	0.543	1.366	123.7	11.5
1985 02 19	06 45.66	−12 24.8				
1985 02 24	07 01.49	−10 58.0	0.622	1.439	124.9	12.1
1985 03 01	07 16.47	−09 32.5				
1985 03 06	07 30.66	−08 10.6	0.720	1.523	124.9	12.6
1985 03 11	07 44.10	−06 53.9				
1985 03 16	07 56.88	−05 43.3	0.835	1.613	123.5	13.2
1985 03 21	08 09.05	−04 39.4				
1985 03 26	08 20.70	−03 42.7	0.968	1.709	120.8	13.8
1985 03 31	08 31.88	−02 53.3				
1985 04 05	08 42.63	−02 10.9	1.118	1.809	117.2	14.3

THE LAST 20 COMETS TO RECEIVE PROVISIONAL LETTER DESIGNATIONS

Listed below, for handy reference, are the last 20 comets which have been given letter designations (1985a is the first comet to be discovered or recovered in 1985, 1985b is the second comet..., etc.). Room is given after the first "equal sign" for the Roman numeral designation (usually not yet given for the last 20 comets), which gives the year of perihelion. After the second "equal sign" is given the name, preceded by an asterisk (*) if the comet is a new discovery (as opposed to a recovery from predictions of a previously-known short-period comet). Also given parenthetically are such values as the date of perihelion, T (month/date), and the perihelion distance, q (in AU). [Note that in the last issue, p. 99, the list was for the last 25 comets, not 20 comets (as stated).]

1984c = 1984 = P/Neujmin 1 (T = 10/8, q = 1.6)
1984d = 1984 = * P/Russell 4 (T = 1/5, q = 2.1)
1984e = 1985 = P/Giacobini-Zinner (T = 9/5, q = 1.0)
1984f = 1985 = * Shoemaker (T = 9/9, q = 2.8)
1984g = 1984 = P/Wolf-Harrington (T = 9/22, q = 1.6)

1984h = 1984 = P/Faye (T = 7/9, q = 1.6)
1984i = 1984 = * Austin (T = 8/12, q = 0.3)
1984j = 1984 = * P/Takamizawa (T = 5/24, q = 1.6)
1984k = 1984 = P/Arend-Rigaux (T = 12/1, q = 1.4)
1984l = 1985 = P/Gehrels 3 (T = 6/3, q = 3.4)

1984m = 1984 = P/Schaumasse (T = 12/6, q = 1.2)
1984n = 1984 = * P/Kowal-Mrkos (T = 5/16, q = 2.0)
1984o = 1984 = * Meier (T = 10/13, q = 0.9)
1984p = 1985 = P/Tsuchinshan 1 (T = 1/2, q = 1.5)
1984q = 1984 = * P/Shoemaker 1 (T = 9/16, q = 2.0)

1984r = 1984 = * Shoemaker (T = 9/4, q = 5.5)
1984s = 1985 = * Shoemaker (T = 1/3, q = 1.2)
1984t = 1984 = * Levy-Rudenko (T = 12/14, q = 0.92)
1984u = 1984 = * P/Shoemaker 2 (T = 9/26, q = 1.3)
1984v = 1985 = * Bartley (T = 9/29, q = 4.0)

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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.

NOTE also that all photographs and illustrations in the ICQ, unless noted otherwise, are published with north oriented toward the top of the page.