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EPHEMERIS FOR COMET BOWELL 1980b, from elements on IAU Circular 3670.

Date ET	R. A. (1950)	Decl.	Delta	r	Elong.	m_1
1982 03 12	$17^h 42^m.68$	$-22° 11'.0$	3.308	3.364	$84°.7$	9.7
1982 03 22	17 53.03	-22 14.1				
1982 04 01	18 01.91	-22 14.8	3.048	3.369	100.1	9.6
1982 04 11	18 09.16	-22 14.3				
1982 04 21	18 14.62	-22 13.4	2.812	3.386	116.7	9.4
1982 05 01	18 18.18	-22 13.1				
1982 05 11	18 19.84	-22 14.0	2.624	3.413	134.9	9.3
1982 05 21	18 19.66	-22 16.4				
1982 05 31	18 17.87	-22 20.2	2.507	3.450	154.6	9.3
1982 06 10	18 14.83	-22 25.1				
1982 06 20	18 11.04	-22 30.7	2.484	3.498	175.3	9.3
1982 06 30	18 07.06	-22 36.5				
1982 07 10	18 03.48	-22 42.4	2.567	3.555	163.8	9.5
1982 07 20	18 00.81	-22 48.0				
1982 07 30	17 59.43	-22 53.5	2.751	3.621	143.8	9.7

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

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FROM THE EDITOR

Well, here it is: our largest issue yet! This 36-page issue "outlengths" the two 32-page issues of last year, and the volume of material seems to have no end in sight.

However, the larger issue-sizes are forcing us to again raise subscription prices (see page 4) to keep us above water with printing and postage costs. We trust that subscribers will continue their support of the ICQ through their contributions, and that any subscription increase will be seen as a reflection of the expansion and the improvement of the content in this journal.

Plans for the year 1982 include publishing photographs on a regular basis and a switch to glossy printing paper. The Editors are still discussing these matters with the printer at Appalachian State University.

We encourage all individuals from the Northeastern United States to attend the ICQ's 1982 American Workshop on Cometary Astronomy, to be held on May 1 in Smithfield, Rhode Island (see page 14 of this issue). Comet enthusiasts from South Africa, Italy, England, and France have already indicated planned-attendance, so the geographical distribution is guaranteed to be quite large among attendants.

--Daniel Green, Cambridge, 19 Feb.

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CORRIGENDUM: In the October 1981 issue, page 103, "The Apparition of P/Schwassmann-Wachmann 2 (1979k)", column 2, lines 3-4, should read: "However, because Δ was increasing, the comet's physical . . ."

OBSERVING COMETS BY RADAR

by
Paul Kamoun
Massachusetts Institute of Technology

ABSTRACT. To date, only one comet, P/Encke, has been detected by radar; it is calculated that only two other known comets (both in 1982: P/Grigg-Skjellerup and P/Churyumov-Gerasimenko) are possible candidates for radar detection in the next five years. Detailed optical, astrometric observations for the improvement of orbital elements are necessary to aid in the radar observations; estimates of the rotations of their nuclei are required in order to properly interpret the radar results.

There are two classes of targets that can be studied by radar: the so-called "hard" objects (i.e., rigid, like planets and satellites), and the "soft" targets (i.e., having shapes that change with time, like plasmas or clouds of particles). Radar astronomical observations of rigid bodies in the solar system can yield information on their sizes, rotation vectors, surface scattering properties, and orbits. Studies of targets in the second group, where possible, permit one to estimate electron densities or, in ideal cases, particle densities.

The study of the moon in 1946 was the first achievement of radar astronomy. Since then, ground-based radar systems have been used, mostly in the United States, to study the sun (a "soft" target), the inner planets, the Galilean satellites of Jupiter, Saturn's rings, and a dozen or so asteroids. It was not until 1980 that the first cometary nucleus, P/Encke, was detected by radar.

The radar detectability of a target depends not only on its size and scattering properties, but also on the inverse fourth power of its distance from the radar. Thus, even for the most sensitive radar facility presently available, the S-band (2380-MHz frequency, 12.6-cm wavelength) radar system at the Arecibo Observatory in Puerto Rico, a cometary nucleus (assumed here to be a rotating solid body about 1 km in radius) could be detected only at a geocentric distance of less than about 0.3 AU, the exact limit depending on the rotation rate and radar albedo. Since comets having earth-crossing orbits are few and small, opportunities for radar observations are rare. In particular, for the next five years, only the appearances of P/Grigg-Skjellerup and P/Churyumov-Gerasimenko should be favorable, both occurring in 1982. The chance of detecting Halley's Comet in 1985-86 is slim.

It can be shown that the detection by radar of the plasma or of the dust component in the coma and tail is virtually impossible (Kamoun et al. 1982a), mostly because of the low critical plasma frequency and the low density and small particle size of the ice and dust grains. However, the transparency of the coma allows radar waves to probe directly the surface of the nucleus. This penetrating capacity gives radar a unique advantage over optical astronomical techniques, as in the latter, it is practically impossible to separate the light reflected by the nucleus from that scattered by the coma.

The radar detection of the nucleus of P/Encke provided the first direct evidence for the existence of a solid nucleus. From the echo power received from the target, it is possible to compute its radar cross-section, and, if the radius is known, to estimate its radar albedo. If the

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Doppler frequency bandwidth of the signal can be measured, the radius of the nucleus in meters, R, is calculated from the radar results as

$$R = \frac{\lambda BT}{8\pi \sin \theta}, \qquad (1)$$

where λ is the wavelength in meters of the transmitted signal, B is the total bandwidth in Hertz of the radar echo caused by the rotation of the nucleus, T is the spin period in seconds of the nucleus, and θ is the angle in radians between the comet's rotation axis and the radar line of sight. Using the bandwidth seen in the 1980 radar observations, combined with the rotation vector estimated by Whipple and Sekanina (1979), P/Encke's radius was found to fall in the range 0.5 - 3.8 km. For a discussion of the errors, see Kamoun et al. (1982b).

As can be seen in equation (1), it is necessary to have an accurate estimate of the nucleus' spin period and pole direction in order to deduce a significant value of the radius from radar observations. The spin vector can be found by the method of Whipple and Sekanina, if several precise optical observations are available. For this purpose, accurate descriptions and photographs of the visual aspects of the head are needed. Here the role of comet observers, professional and amateur, is crucial (Whipple 1981). Numerous accurate astrometric observations are important to establish the ephemerides of the comet, since for a radar observation, one needs to know precisely not only the angular position of the object, but also its velocity, in order to correct the receiver frequency for the Doppler shift introduced by the radial component of the velocity of the target relative to the earth. Such determinations, before, during, and after the actual radar observations, are especially crucial for newly-discovered comets or for comets having few past appearances, although they were also quite important for radar detection of P/Encke, a comet otherwise known for having well-determined orbital elements. In particular, the usefulness of such visual "patrols" during the passage of comets P/Grigg-Skjellerup and P/Churyumov-Gerasimenko should be emphasized.

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NOTICE OF SUBSCRIPTION INCREASE

DUE TO THE INCREASING NUMBER OF PAGES PUBLISHED EACH ISSUE, AND TO THE SUBSEQUENT INCREASE IN PRINTING AND POSTAGE COSTS, THE REGULAR SUBSCRIPTION RATE WILL BE INCREASED TO $14.00 PER YEAR, EFFECTIVE MAY 1, 1982. AT THE SAME TIME, THE SPECIAL RATE WILL BE INCREASED TO $8.00 PER YEAR. Equivalently, this breaks down to $3.50 and $2.00 per issue, respectively, and it will not help to send subscription monies before May 1 at the old rates, because all subscribers in their respective categories will pay the same amount for each issue (compliments of our computer accounting program).

REVIEW OF MAGNITUDE SOURCES FOR VISUAL COMETARY PHOTOMETRY. I.

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and

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ABSTRACT. This first paper in a series begins the discussion of sources of visual and photoelectric-V magnitudes for use in visual cometary photometry. This paper discusses the following references: AAVSO Atlas and charts; Arizona-Tonantzintla Catalogue; U.S.N.O. Photoelectric Catalogue; Yale Catalogue of Bright Stars; Harvard Photometry; Revised Harvard Photometry; S.A.O. Catalog; and the Atlas of the Heavens Catalogue 1950.0.

I. Introduction

As part of the effort to improve the accuracy of cometary brightness estimates (cf. Green and Morris 1981), we have evaluated sources of stellar visual m_v and photoelectric V magnitudes. In this series of papers, we present recommendations for acceptable primary and secondary sources of comparison star magnitudes. The advantages and drawbacks of each reference are cited. Unacceptable sources are also discussed.

Sources of visual or V magnitudes are so numerous that it is not possible to address them all in a single paper. Thus, the most frequently reported and most important comparison star references are discussed in this first paper of the series. Subsequent papers will extend the evaluation to other stellar magnitude sources.

This series of papers deals specifically with stellar magnitudes. Because comets are extended objects, some observers, particularly those who are inexperienced, believe that comets should be compared with nebulae. Unfortunately, this is difficult in practice. Nebulae rarely match comets in size or morphology and often are placed poorly relative to the comet. Most importantly, visual magnitudes of nebulae quoted in the literature are often inaccurate, typically faint. For fainter nebulae, magnitudes can be up to one or two magnitudes faint. Nebulae simply do not make good comparison objects. Comet magnitude estimates based on comparison with nebulae are not acceptable to the ICQ.

As for stellar magnitudes, only those references which quote magnitudes to at least a tenth of a magnitude are considered in this series. Typical accuracy of comet magnitude estimates by experienced observers is ± 0.2 magnitudes. Thus, comparison star magnitudes given to a whole or half magnitude will not be sufficiently accurate. This means that atlases, which indicate star brightness to only half a magnitude, are not acceptable comparison star magnitude sources.

II. Visual Magnitude (m_v) and Photoelectric V

There have been numerous evaluations of systematic differences between m_v and V magnitudes in the literature recently (e.g., Stanton 1981; Feijth 1980; Howarth 1979; Howarth and Bailey 1980; Stanton 1978; and Landis 1977). These studies have shown that the difference between m_v and V is a function of a star's color, represented by the difference B-V, where B is the photoelectric B magnitude in the UBV system. The color index B-V is typically slightly negative for early type and positive for late-type stars.

Stanton (1981) has found the empirical relationship given below for 260 stars listed in the Revised Harvard Photometry:

$$m_v = V + 0.182\ (B - V) - 0.032 \quad (1)$$

This result is valid for stars in the magnitude range $5.5 < m_v < 6.5$. Stanton suggests that for fainter stars ($10 < m_v < 11$), the constant (-0.032) should be closer to -0.15.

Stanton's results are similar to the findings of other investigators. For the typical range of B-V, $-0.2 < B-V < 1.5$, the difference between m_v and V could be as much as ±0.2 magn.

In the past, observers have simply assumed $m_v = V$. Although work by Stanton and others show promise toward providing a more accurate relationship between the two quantities, it is not clear that such refinement is needed for comet work. By only selecting early-type comparison stars, $m_v = V$ to within about 0.1 magnitude without correction. For most situations this is sufficient accuracy for making comet magnitude estimates.

For the purpose of this evaluation of comparison star magnitude references, photoelectric V magnitudes are preferred over the visually or photovisually determined m_v magnitudes because, even without a color correction, V magnitudes are in most cases more accurate.

III. Summary of Findings

Several factors were weighed in our evaluation of the comparison star magnitude sources. These include:

+ method and accuracy of magnitude determination (i.e., photoelectric, photovisual, or visual)
+ range of m_v covered
+ availability of source
+ ease of use.

Based on these criteria, the references were placed in one of the following three groups:

a) Recommended primary source -- comparison star magnitudes from these references should be used whenever possible.
b) Acceptable secondary source -- only to be used if a primary source is not available.
c) Unacceptable source -- should never be used. Comet magnitude estimates obtained using unacceptable sources will be considered approximate and under normal circumstances will not be published in the ICQ.

To further define the best references for comparison star magnitudes, the evaluation was made for these ranges of stellar brightness. These included: 1) $m_v < 6.5$; 2) $6.5 < m_v < 9.5$; and 3) $m_v < 9.5$. The selection of these intervals corresponds to typical break-points in coverage of magnitude references.

Table 1 gives a summary of the ICQ evaluation of comparison star references.

4. Discussion of Individual Sources

To better understand how the recommendations for the various sources were obtained, a short discussion of each reference is given below.

AAVSO Atlas

The American Association of Variable Star Observers (AAVSO) Atlas is an excellent source of comparison star magnitudes. First published in 1980, this atlas is one of the few atlases which can actually be used for comparison stars, as individual stars have visual or V magnitudes written beside the drawn star images. Photoelectric V magnitudes were obtained primarily from the U.S.N.O. Photoelectric Catalogue (described below) for stars equal to or brighter than magnitude 6.5. Magnitudes of fainter stars are from AAVSO sequences (described below), supplemented by magnitudes from the Royal Astronomical Society of New Zealand charts for some southern vari-

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ables. Although some comparison stars fainter than 10th magnitude are given, this atlas is typically useful down to magnitude 9.5. The AAVSO Atlas is available from Sky Publishing Corporation for $50.

AAVSO Charts

The original standard AAVSO charts were based on visual photometry by Pickering of Harvard College Observatory, who used a variable-density wedge to determine comparison star magnitudes. In the early 1930's, the original Pickering charts were revised by the McCormick Observatory of the University of Virginia and, in turn, were approved by the Harvard College Observatory. These revised charts are still in use today.

For new stars added to the AAVSO observing program since the McCormick revisions, comparison star magnitudes are typically obtained from photovisual (yellow) plates. Star diameters are measured on the plate using an iris photometer. The diameters of stars with known magnitudes (e.g., photoelectric), either in the field or nearby, are correlated with their brightness. This establishes a zero-point and slope which allows a comparison-star sequence to be determined from star diameters on the photovisual plate. A chart prepared in this manner is labeled "preliminary," since it is subject to revision. After the preliminary chart is initially checked by several experienced observers, it is provided to other observers. It may take from 5 to 10 or more years before a preliminary chart is finalized into a standard chart. During this period, the preliminary chart has been evaluated by numerous observers to ensure its accuracy.

Comparison star sequences derived from photovisual plates can be in error for a number of reasons. These include an incorrect zero-point determination, error in the magnitude-diameter slope, and a significant color difference in a star. The first two problems relate to the correlation between photovisual star diameters and their magnitudes. If the zero-point of the sequence is incorrect, the comparison star magnitudes might all be off by a constant amount (e.g., 0.5 magnitude too bright or too faint). If the slope is incorrect, errors may show up at the extreme of the magnitude sequence. This is particularly true for faint comparison stars. Finally, if the color of a particular star is substantially different than that of other stars in the field, the correlation between diameter and magnitude may not hold. Thus, when seen with the eye, the star may look significantly brighter or fainter than the given, diameter-derived magnitude. Errors such as these are usually discovered while the variable star chart is considered preliminary.

In addition to the photovisual work, comparison star sequences of new variables in the AAVSO observing program are also being obtained photoelectrically, using the standard V band of the Johnson system and reducing this to the visual. This method is also used in obtaining magnitudes of faint comparison stars even in standard AAVSO charts.

How useful are AAVSO charts for comet work? Fainter than 7th magnitude, the AAVSO variable star charts (and Atlas) are probably the best source of comparison data readily available to the visual observer. For magnitudes fainter than about 9.5, this is particularly true. This does not mean that AAVSO charts are perfect -- they are not. Sometimes the zero-point of two different comparison-star fields will differ, causing a "jump" or discontinuity as an observer switches from one field to the next. Care should be taken to intercompare the two fields, if possible, to minimize errors when switching from one comparison star field to another.

AAVSO charts are available from the AAVSO (187 Concord Ave., Cambridge MA 02138, U.S.A.) for $0.25 per chart or $0.20 per chart if more than 25 are purchased. A chart catalog is avail-

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able for $1.00.

The Arizona-Tonantzintla Catalogue

This catalogue was published in Sky and Telescope in 1965 (Vol. 30, No. 1). It consists of extensive information on 1,325 stars north of declination -50 , most of which are brighter than magnitude 5.0. Visual magnitudes are given, to two decimal places, as photoelectric V (Johnson system). In all, five spectral regions are covered in the multicolor photometry presented in the catalogue.

Stars are designated by both their Yale Bright Star Catalogue (BS) number and Greek-letter names or Flamsteed numbers. Thus, star identification is not a problem in most cases. However, some of the fainter stars with only a BS number might be difficult to identify because the coordinates are given only for epoch 1960.

The Arizona-Tonantzintla Catalogue is not comprehensive; this is its only major drawback. Reprints of this catalogue are available from Sky Publishing Corporation for $1.95.

U.S.N.O. Photoelectric Catalogue

In 1970 the U.S. Naval Observatory published a monumental work entitled "Photoelectric Catalogue: Magnitudes and Colors of Stars in the U,B,V and U ,B,V Systems" (Publ. U.S.N.O., 2nd Series, Vol. XXI), under the direction of V. M. Blanco, S. Demers, G. G. Douglass, and M. P. Fitzgerald. This 772-page single-volume lists 20,705 stars with magnitudes obtained by the authors at Warner and Swasey Observatory and at the U.S.N.O. While this publication is one of the best photoelectric catalogues by virtue of the accuracy of its V magnitudes -- some of the included stars being fainter than 17th magnitude, and many fainter than 12th -- it has major drawbacks for the visual observer. The Catalogue only covers scattered areas of the sky, and a photographic atlas is necessary to identify the fainter stars -- a factor which becomes more of a hindrence because the coordinates of stars are given for equinox 1900.0. Besides a U.S.N.O.-Catalogue numbering system, the brighter stars are also identified by H.D. (Henry Draper Catalogue), B.D. (Bonner Durchmusterung), C.D. (Cordoba Durchmusterung), and C.P. (Cape Photographic Durchmusterung) numbers, a helpful aid in locating a star if one or more of these other identifications are known from other sources.

Despite its drawbacks, the U.S.N.O. Catalogue is an excellent addition to the comet observer's collection of comparison star magnitude sources. However, this reference apparently is not readily available. Those wishing further information should contact the U.S.N.O. in Washington, D.C.

Yale Catalogue of Bright Stars

The Yale University Observatory Bright Star Catalogue updates the Revised Harvard Photometry (RHP, discussed below) presented in the Harvard Annals (H.A.). Extensive information is provided on 9091 stars brighter than magnitude 6.5. The quoted visual magnitude is clearly indicated as either photoelectric V, the original visual photometry (RHP), or the RHP magnitude corrected to V.

Stars are designated by their BS number and Greek letter of Flamsteed number. Coordinates are given for both epochs 1900.0 and 2000.0.

The Yale Bright Star Catalogue is an excellent source of comparison star magnitudes. However, the observer should give preference to the stars with photoelectric V magnitudes. Currently this catalogue is out-of-print, but many libraries have this important reference.

Harvard Photometry

Among the first large-scale projects involving stellar photometry was a study published by Harvard College Observatory Director Pickering in 1884 in Harvard Annals (H.A.) 14. The work was called "Harvard Photometry" (still widely abbreviated as HP), and it involved the determination of magnitudes

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for 4260 stars brighter than magnitude 6 in the declination range +90° to -30°. The coordinates are for equinox 1880.0, and precession is necessary to identify stars properly. Stars are also identified by HP, DM, BAC (Catalogue of British Assn., 1845), and Flamsteed numbers, and by Greek (Bayer) letters. The H.A. generally can be found only in large university or observatory libraries.

In 1890, Harvard College Observatory published magnitudes for 3,146 stars made with the meridian photometer, "an instrument provided with two object-glasses, mounted side-by-side in a fixed position, upon which the light of two stars near the meridian is thrown by means of reflecting prisms or mirrors, while the images thus formed are photometrically compared by polarizing apparatus" (cf. H.A. 24, 200). Stars are given by M.P. (Meridian Photometer) and DM number, with some stars fainter than magnitude 10, and the positions are given for equinox 1900.0.

Also in H.A. 24 is a "Photometric Revision of the Durchmusterung," listing stars down to magnitude 9.0 by DM number (equinox 1855.0).

Original Harvard Photometry is not readily available to the amateur. Because the magnitudes are of questionable accuracy, it is recommended that other sources be given higher priority.

Revised Harvard Photometry

In 1908 the Harvard College Observatory published a revision to the HP Catalogue, known as "Revised Harvard Photometry" (RHP, or occasionally, HR). Some 9,110 stars, mostly brighter than magnitude 6.5, comprised the RHP, all magnitudes being obtained by members of the Observatory observing visually with a prism-device attached to the 4-inch meridian photometer (see discussion above). RHP is located in H.A. 50, and the stars are listed for equinox 1900.0, with the constellation given along with the following star identification numbers: Bayer, Laicaille, and Flamsteed; DM; HP; and AGC (Argentine General Catalogue). While the original RHP Catalogue is not readily available to most observers, this source has been used in more recent publications, such as Becvar's Atlas Coeli II (Atlas of the Heavens Catalogue 1950.0).

A Supplement to RHP, containing 36,682 stars -- mostly fainter than magnitude 6.5 -- was published the same year in H.A. 54. The photometry for these stars was obtained using the 4- and 2-inch meridian photometers, and stars are listed again for equinox 1900.0, although only the DM (and, where appropriate, CD and CP) numbers are given for identification purposes.

S.A.O. Catalog

The Star Catalog of the Smithsonian Astrophysical Observatory is probably the largest and best-known secondary collection of visual stellar magnitudes, and it has the added advantage of being still readily available for purchase by amateurs (the current cost is about $50 for the 4-volume set, and can be obtained from the U.S. Govt. Printing Office or, e.g., book dealers who advertise in Sky and Telescope). The SAO Catalog has many errors throughout, a major result from the copying of magnitude values from some one dozen original sources.

Drawbacks of using the SAO Catalog's visual magnitudes are widely known among experienced comet observers, and some of these problems have been discussed in recent papers (e.g., Herald 1981). Despite these problems, the observer can make good use of this publication by taking proper precautions. The Catalog is fairly detailed in its coverage down to magnitude 9, with many listings given for stars down to 10th magnitude. The positions are given for equinox 1950.0, giving the Catalog an advantage over many other sources because of its parallel to the majority of the star charts used by observers.

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Atlas of the Heavens Catalogue 1950.0

The companion catalogue to the Atlas of the Heavens (Atlas Coeli) by A. Becvar, contains information on stars down to visual magnitude 6.25. The visual magnitude, given to two decimal places, is based on the RHP system. No additional information on the magnitudes is given in the catalogue. It appears that this catalogue is not currently available, having been superceded by more recent catalogues. This catalogue is also known as the Skalnate-Pleso Catalogue.

We thank Mrs. J. A. Mattei, Director of the A.A.V.S.O., for her valuable discussion and comment regarding the AAVSO Atlas and charts for this paper.

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TABLE 1. ICQ RECOMMENDATIONS FOR USE OF COMPARISON STAR REFERENCES.

	Magnitude Range		
REFERENCE	Brighter than 6.5	6.5 - 9.5	Fainter than 9.5
AAVSO Atlas	P	P	U
AAVSO charts	S	P	P
Arizona-Tonantzintla	P	U	U
U.S.N.O. Catalogue	P	P	P
Yale Bright Star Cat.	P	U	U
Harvard Photometry	S	S	U
Revised Harv. Photometry	S	S	U
S.A.O. Catalog	S	S	U
Becvar′s Atlas Coeli II	S	U	U

KEY TO ABOVE TABLE: P = Primary source; S = Secondary; U = Unacceptable.

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OBSERVATIONS OF COMETS AT AGASSIZ STATION DURING 1981

R. E. McCrosky and C.-Y. Shao
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Nearly 100 astrometric observations of 23 comets were made at Harvard Observatory′s Agassiz Station (recently renamed Oak Ridge Observatory) during 1981. The program was supported by a NASA grant to the first author, and the research was carried out in close cooperation with the IAU Central Bureau for Astronomical Telegrams and the Minor Planet Center under the direction of B. G. Marsden.

The observing was done by the authors and G. Schwartz. Exposures were taken with the 1.5-m reflector on Kodak IIIa-F plates hyper-sensitized

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with forming gas of 20% hydrogen. Usually, emphasis is given to faint objects and to those for which critical observations are needed.

The accompanying table lists the comets observed, the dates of observations, and the magnitudes from approximate estimates. Accurately measured and reduced positions have been published in the Minor Planet Circulars and the IAU Circulars. Some results of special interest are briefly mentioned below.

P/Comet Lovas 1980 V = 1980s

Discovered by M. Lovas on Dec. 5, 1980, and independently discovered by C. Kowal 10 days later, the orbit of this comet remained uncertain for a long time because of the lack of adequate information. The Agassiz observations from Jan. to April were vital in the establishment of its orbit. Our last plate was taken on Apr. 3, when the comet appeared as a weak image of $m_2 \sim 19.5$. It was not found on a 40-min exposure one month later.

Comet Bradfield 1980 XV = 1980t

Comet Bradfield was rapidly fading and receding from the sun after passing perihelion on Dec. 29, 1980. It was also reported to have split into multiple condensations after an outburst in mid-January (IAUC 3564 and 3569). Our first attempt was a 20-min exposure on June 28, but we failed to record its image. Subsequent longer exposures showed the comet as a small, condensed object as faint as magn. 18.5. When last observed on Aug. 27 on a 46-min exposure, it was fainter than 20th magn. at a heliocentric distance of over 4 AU. Thus, the Agassiz observations extended the observation arc by 6 months from the last position reported by other observers.

P/Slaughter-Burnham 1981i

Two exposures, one each on July 9 and 10, were attempted to recover this comet, but the suspected images were too weak to be certain. A third plate of 40-min duration, taken on July 28, revealed the comet as a somewhat diffuse object with condensation, at $m_1 \sim$ 19.5 (IAUC 3621). The last exposure led to a positive identification of the candidates found on the two earlier plates when the comet was no brighter than magn. 20 at plate limit. Eight observations were obtained from July to December.

P/Swift-Gehrels 1981j

This comet was recovered on three exposures taken on successive nights, July 31 and Aug. 1 and 2 (IAUC 3622). It was of stellar appearance at magn. 18.5, somewhat fainter than predicted. A weak image of the comet ($m_2 \sim$ 19.5) on a plate exposed under rather bright sky conditions three weeks earlier was identified only after its recovery. This is the first appearance of P/Swift-Gehrels since the second discoverer's accidental rediscovery of comet Swift in 1973. Nine observations were secured from July to Dec.

P/Schwassmann-Wachmann 1

This comet seemed unusually active during the 1980-81 observing season (Shao 1981). A series of photographs in February documented the development of a spiral coma during a spectacular outburst (Sky Tel. 1981).

Other periodic comets we have tried to recover, but for which we were unsuccessful, are Swift-Tuttle, Gale, and Gehrels 3.

REFERENCES

Shao, C.-Y. (1981). ICQ 3, 76.
Sky and Telescope (1981), 61, 390.

TABLE I, on the next page, lists the dates of exposure for plates that were taken at Harvard College Observatory's Agassiz Station in 1981 of comets. Rough magnitude estimates, and occasionally descriptive notes, are often provided.

TABLE I. PHOTOGRAPHIC COMET OBSERVATIONS MADE AT AGASSIZ IN 1981

Name and Designation	Date		m_1	m_2	Notes
P/Schwassmann-Wachmann 1	Jan.	6	17		
	Feb.	1		18-19	
		10	13	15	Outburst
		13			
		28		17.5	
	Mar.	28			
	Apr.	23	11		Outburst
	May	3			Coma
		8	<15	17.5	Coma
P/Smirnova-Chernykh 1975 VII = 1975e	Nov.	2			
		25		18.5	
		26			
		29			
	Dec.	30			
P/Gunn	Jan.	6		18.5	
	Feb.	4			
P/Reinmuth 1 1980 VIII = 1979j	Mar.	2			
	Apr.	8	18		Diffuse
P/Schwassmann-Wachmann 2 1979k	Jan.	11			
	Feb.	28			
Bowell 1980b	Feb.	10			
	Mar.	28	15		
	Apr.	3			
	May	23	15		
	June	6			
P/Brooks 2 1980 IX = 1980f	Jan.	31			
	Mar.	2		>19	Very weak
P/Stephan-Oterma 1980 X = 1980g	Jan.	11			
	Mar.	2		15.5	Sharp condens.
	Apr.	4			
P/Borrelly 1980i	Jan.	30	<14		Strong condens.
P/Kohoutek 1980j	Jan.	31		>19	
P/Reinmuth 2 1980n	Nov.	25	18.5		
	Dec.	30			
Meier 1980 XII = 1980q	Apr.	10			
	June	3			
P/Lovas 1980 V = 1980s	Jan.	9	17.5		
		31	17.5		
	Feb.	6			
		28			
	Apr.	3		19.5	
Bradfield 1980 XV = 1980t	June	29		18.5	
	July	7			
		28		19.5	
	Aug.	27		>20	
P/Longmore 1981a	Feb.	6		18.5	Diffuse/condens.
	June	6		18	Weak tail
P/Bus 1981b	Mar.	4			Near plate edge
		11			
	May	23			
		24		17.5	
	June	6			
		27			

TABLE I. PHOTOGRAPHIC COMET OBSERVATIONS MADE AT AGASSIZ IN 1981

Name and Designation	Date		m_1	m_2	Notes
Bus 1981d	May	3			
		8	16		Well-condensed
		27			Poor sky
	June	24			
P/Gehrels 2 1981f	Aug.	1		19.5	Stellar
		27			
	Sept.	25	17.5		Condensed
	Oct.	31	17		
	Nov.	23			
	Dec.	20			
		31			
P/Kearns-Kwee 1981h	Aug.	1		18	
		29			Stellar
	Sept.	25			
	Oct.	31		16.5	Stellar
	Nov.	25	16	17	Faint tail
	Dec.	30			
P/Slaughter-Burnham 1981i	July	9	>20		
		10			Recovery
		28	19.5		
	Aug.	26			
	Sept.	25			
	Oct.	31	17.5		
	Nov.	23	18		
	Dec.	20			
P/Swift-Gehrels 1981j	July	11		19.5	Pre-recovery
		31			
	Aug.	1		18.5	Recovery
		2			
		26		18	
	Sept.	25			Diffuse/condens.
	Nov.	2			
		23	15		
	Dec.	19			
P/Howell 1981k	Sept.	5			
		7			
		29			
	Nov.	2			
		23			
	Dec.	21			
P/Väisälä 1 1981l	Dec.	31	20		

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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.

ICQ SPONSORS 1982 AMERICAN WORKSHOP ON COMETARY ASTRONOMY

The International Comet Quarterly will sponsor the 1982 American Workshop on Cometary Astronomy, to be held on May 1, 1982, at Bryant College in Smithfield, Rhode Island. This workshop, the first of its kind in the United States, will provide a forum for professional and amateur astronomers to discuss topics of mutual interest in cometary astronomy.

Featured speakers at the workshop will be Dr. Fred L. Whipple, Dr. Brian G. Marsden, Dr. Michael F. A'Hearn, Stephan Edberg, John E. Bortle, and Charles S. Morris. Subjects to be covered include visual comet observing techniques, astrometric observations, comet filters for photoelectric work, and the International Halley Watch. Participants in the workshop will have the opportunity not only to listen to and ask questions of the featured speakers, but to talk informally with them on subjects of specific interest.

The cost of the workshop is $15, which includes lunch. An optional dinner will cost $8. At press time, the tentative schedule of the workshop has a beginning at 10 a.m. (9 a.m. for registration) and lasting until 9:30 p.m.

Further information about the workshop and registration forms can be obtained from:

Richard Lynch
12 Greenbrier Road
Greenville, RI 02828.

There may be a small amount of time available for speakers other than those currently on the workshop schedule. If you have a short paper you would be interested in presenting, please contact Charles S. Morris at the address given on page 2.

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ROMAN NUMERAL DESIGNATIONS OF COMETS.

The following tabulation continues that on MPC 5660. Comet 1979 XI refers to a belated discovery (cf. IAUC 3640, 3647). Comet 1980p does not exist.

Comet	T		Name	Year/letter	Ref.
1979 XI	1979 Aug.	30.9	Howard-Koomen-Michels		IAUC 3647
1980 I	1980 Apr.	11.1	P/Honda-Mrkos-Pajdušáková	1980c	IAUC 3472
1980 II	Apr.	19.9	Torres	1980e	MPC 5836
1980 III	May	19.5	P/Russell 2	1980o	MPC 5639
1980 IV	June	22.4	Černis-Petrauskas	1980k	MPC 5640
1980 V	Sept.	3.4	P/Lovas	1980s	MPC 5975
1980 VI	Sept.	24.7	P/Forbes	1980a	IAUC 3460
1980 VII	Oct.	5.1	P/Wild 3	1980d	MPC 5413
1980 VIII	Oct.	29.8	P/Reinmuth 1	1979j	IAUC 3417
1980 IX	Nov.	25.4	P/Brooks 2	1980f	IAUC 3486
1980 X	Dec.	5.2	P/Stephan-Oterma	1980g	IAUC 3488
1980 XI	Dec.	6.6	P/Encke		IAUC 3526
1980 XII	Dec.	9.7	Meier	1980q	MPC 5975
1980 XIII	Dec.	14.7	P/Tuttle	1980h	IAUC 3493
1980 XIV	Dec.	24.6	P/Harrington	1980m	IAUC 3513
1980 XV	Dec.	29.5	Bradfield	1980t	MPC 5837

LETTER TO THE EDITOR

To the Editor:

With respect to point 5 on page 69 of the July 1981 issue, it would seem sensible to stress that you should compare like with like. My own observations of P/Swift-Gehrels show that there is in excess of one magnitude difference between estimates made with an 11" reflector and a 12" refractor using similar magnification.

Jonathan Shanklin
12 Victoria Street
Cambridge, England CB1 1JP

Mr. Shanklin raises a valid point. When we suggested in our article on the improvement of visual comet photometry that observers should review their observations after the comet's apparition and compare them with other published data, we neglected to mention that significant differences can be obtained by observers using different instruments. As Mr. Shanklin points out, a large difference will occur between large aperture reflectors and refractors (cf. Morris 1973, P.A.S.P. 85, 470). In addition to instrument type, observations made with instruments of significantly different apertures can result in substantially different estimates (i.e., the aperture effect). Thus, one should compare their observations to those made with a similar aperture and type of instrument. --The Editors

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FUNDING FOR PROPOSED PROBE TO HALLEY'S COMET

Scott Mize
Northeastern U.S. Representative, Delta Vee, Inc.

Halley's Comet will make its once-in-a-lifetime voyage through the inner solar system in 1986. Of all the major technological nations, only the United States has given up its plans to visit this most famous of celestial visitors. The Administration's tragic unwillingness to fund the mission is but one more nail in the coffin of American space science.

Delta Vee, home of the Viking Fund, is proposing a solution to this problem. RCA is willing to modify a Dynamics Explorer spacecraft to fly the Halley Mission at 1/3 the cost of the original government mission. Every attempt would be made to ensure that this probe will carry an excellent package of scientific instruments, with special emphasis on high-quality imaging. The millions needed to finance this non-profit mission can be raised from a combination of private donations, corporate support, foundation contributions, and the sale of images and other comet memorabilia. Individuals within the closed-circuit- and cable-television industry believe that exclusive rights to broadcast the encounter with Halley's Comet would be worth millions.

The first goal is to raise $500,000 by October 1982. The Halley Fund is our first chance, and perhaps our last, to change the way the space program does business. The public can play a vital role in making the Halley Mission a success, by donations and by rallying friends to support the mission. Your tax deductible contribution may be mailed to: The Halley Fund; 3033 Moorpark Ave., Suite 27; San Jose, CA 95128. If the Halley Mission cannot be realized, the money collected will be used to support other forms of comet research. For more information, contact Delta Vee at the above address, or Scott Mize at Leverett D-21, Harvard University, Cambridge, MA 02138, phone 617-497-5337.

INDEX TO THE INTERNATIONAL COMET QUARTERLY: VOLUME 3 (1981)

Following is an index to the 4 issues published in 1981 as Volume 3. Indices for each volume are published in the following January issue. References listed below indicate issue number and page; for example, (1:5) indicates [Vol. 3] No. 1, page 5. --D.W.E.G.

LIST OF MAJOR ARTICLES, BY TITLE:

LIST OF MAJOR ARTICLES, BY AUTHOR:

INDEX TO THE INTERNATIONAL COMET QUARTERLY: VOLUME 3 (1981)

INDEX TO THE INTERNATIONAL COMET QUARTERLY: VOLUME 3 (1981)

TABULATED OBSERVATIONS AND NEWS OF INDIVIDUAL COMETS (Cont.):

TABULATION OF COMET OBSERVATIONS

Included in this issue are observations made of comets by members of the Comet Section of the British Astronomical Association (B.A.A.) during the years 1948-1954. Having been prepared for publication by M. J. Hendrie, this is the first time most of these data have been published. Hendrie and C. S. Morris are currently preparing analyses for publication in one or more articles in the Journal of the B.A.A. The 1948-1954 series of B.A.A. observations could not be published in entirety in this issue, and the remainder up to 1954 will be published in the April issue.

Also included in this issue are recent observations which have been sent directly to the ICQ.

The first in a series of articles on magnitude references may be found on page 5 of this issue. No "non-critical" cometary observations made after December 31, 1981, will be published in the ICQ without indication of proper magnitude source for comparison stars, as part of our effort to improve the data available for light curve analyses. We have temporarily retained the "old" code system for references (Reference Key), as used in these tabulations of observations, but hope to instate a new 2-letter key with the April issue.

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NEW ADDITIONS TO THE OBSERVER KEY (cf. ICQ 3, 46):

ACF	07	F. J. ACFIELD, ENGLAND
BAT	07	F. M. BATESON, COOK IS.
BER02	07	D. C. BERRY, NEW ZEALAND
BLA	07	R. A. BLACKETT, ENGLAND
BRI	07	A. BRITO, CEYLON (SRI LANKA)
BRO02	07	P. L. BROWN, ENGLAND
BRO03	07	D. W. BROWN, ENGLAND
BUR01	07	H. T. BURGESS, N. RHODESIA
CLA02	07	W. A. CLARK, ENGLAND
COL01	07	E. H. COLLINSON, ENGLAND
DAV	07	M. DAVIES-SCOURFIELD, ENGLAND
DIN	07	C. DINWOODIE, SCOTLAND
FRI	07	J. FRIENDS, ENGLAND
FUL01	07	D. J. FULCHER, ENGLAND
GAY	07	W. T. GAYFER, ENGLAND
GRA	07	W. A. GRANGER, ENGLAND
HAM	07	A. R. HAMILTON, ENGLAND
JAC	07	C. JACKSON, YALE COLUMBIA STATION
JEF	07	A. JEFFREY, LIBYA
KEL	07	G. F. KELLAWAY, ENGLAND
LIN01	07	W. M. LINDLEY, ENGLAND
MER01	07	A. MERER, ENGLAND
MER02	07	G. MERTON, ENGLAND
NAN	07	G. R. NANKIVELL, NEW ZEALAND
PHI	07	D. A. PHILPOTT, NEW ZEALAND
SMI04	07	J. R. SMITH, ENGLAND
SOP	07	A. T. SOPER, ENGLAND(?)
STE06	07	W. H. STEAVENSON, ENGLAND
STO01	07	G. E. STONE, ENGLAND
WHI	07	J. L. WHITE, ENGLAND

"Eclipse Comet" (1948 XI = 19481)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1948 11 08.65	1	:		0.0	E					1.5		JON
1948 11 08.70				7.5	R		20		8	1.5		JON
1948 11 11.00	2	:		0.0	E			15	7	18		BRI
1948 11 12.00	2	:		0.0	E					8		JEF
1948 11 12.07	2.0			0.0	E					20		JAC
1948 11 13.00	2.0	X		0.0	E							BRI
1948 11 14.06	2.5			0.0	E							JAC
1948 11 14.70	4.0	X			B			4	7	5		JON
1948 11 15.06	2.5			0.0	E							JAC
1948 11 17.70	4.0	X			B			3	5	3		JON
1948 11 18.60	3.7	V			B			3		3	270	JON
1948 11 18.65	3.7	X		0.0	E					6	260	BER02
1948 11 19.00				0.0	E					5		BRI
1948 11 19.66	3.9	X		0.0	E			4				BER02
1948 11 22.00	4.2	X		0.0	E					5		BER02
1948 11 25.58	4.3	X			B			4	5			BER02
1948 11 25.60	4.4	X	S		B			4		4		JON
1948 11 26.50					B					5	275	JON
1948 11 28.50	4.5	X			B			4		6	265	BER02
1948 11 28.60	4.7	V	S		B				2	5	280	JON
1948 12 01.60	4.9	V	S		B			6	3		290	JON
1948 12 02.50	4.7	X		0.0	E					6	280	BER02
1948 12 02.60	5.3	V	S		B			8	3	0.1	270	JON
1948 12 05.50	4.8	X		9.0	R			6	3	0.1	282	BER02
1948 12 06.50	5.3	X		9.0	R			4	3	2	290	BER02
1948 12 07.60	5.7		S		B			5	3	1	290	JON
1948 12 08.40	5.1	C		0.0	E			4	3	3	297	BER02
1948 12 09.48	5.2	X		0.0	E			5		1.5	302	BER02
1948 12 09.60	5.7	D	S		B			5	1	1	295	JON
1948 12 10.40	5.1	X		0.0	E			3	2	2	300	BER02
1948 12 10.60	5.5	V	S		B			7	7	2	305	JON
1948 12 11.60	5.6	V	S		B				4	1		JON
1948 12 15.40	6.2	X		8.0	R	4	6	3	3			BER02
1948 12 15.60	5.8	V	S		B			4	4	0.1	300	JON
1948 12 17.40				8.0	R		6	3	2			BER02
1948 12 17.40	5.9	V	S		B				4			JON
1948 12 18.48				8.5	R			2.1	2	0.7	329	BER02
1948 12 20.50	6.1	V	S		B			5	4			JON
1948 12 20.50				32.0	L	5	104			0.1	330	JON
1948 12 21.50	6.2	V			B							JON
1948 12 24.50	7.0	V	S	7.5	R		23					JON
1948 12 24.50								2		0.7	345	BER02
1948 12 28.50	7.3	V	S	7.5	R		23	4	4	0.1	360	JON
1948 12 29.95	8	:		15.0	R		40	4	1			BRO02
1948 12 30.05	8	:		23.0	L		50	3	2			WHI
1949 01 02.03	7.5	B		13.3	R		33	7	4			FUL01
1949 01 06.50				20.0	L		36	5	4			JON
1949 01 06.50	7.8	V	S	7.5	R		23					JON
1949 01 09.00	8.8	B		13.0	R		33	3	6			FUL01
1949 01 10.60	8.1	V	S	7.5	R		23	4	5	0.1	360	JON
1949 01 14.60	9.0	V	S	20.0	L		36	3.5	4			JON
1949 01 20.50	9.2	V	S	14.0	R		42	4	4			JON
1949 01 21.90	9	:		76.0	L		150	5	3			STE06

"Eclipse Comet" (1948 XI = 19481) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1949 01 24.50	9.8	V	S	32.0	L		62	2.5	3	0.1	10	JON
1949 02 01.50	11.2	V	S	32.0	L		62	1.5	3	0.1	140	JON
1949 02 02.50	10.8	V	S	32.0	L		62	2	3			JON
1949 02 03.99	10.5	B		13.0	R		33	2	3			FUL01
1949 02 04.50	10.8	V	S	20.0	L		36		2			JON
1949 02 05.60	10.9	V	S	20.0	L		36	2.5	2			JON
1949 02 16.90	10.7:			76.0	L		150	6	3			STE06
1949 02 17.80	11.2	B		30.0	R		180	2	2			MER02
1949 02 27.89	11.7	B		30.0	R		180	1.5	4			MER02
1949 03 03.83	11.8			30.0	R		250	1.0				MER02
1949 03 24.90	12.5:			30.0	R		300	0.5				MER02

Minkowski (1951 I = 1950b)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1950 06 22.00	11	:X		23.0	L		150	0.8	7			WHI
1950 07 05.50	10.9	V	S	32.0	L		62		7			JON
1950 07 14.95	11.3	V		23.0	L		150					WHI
1950 07 15.00	10.2	B		32.0	R		65	2	8	0.1	120	MER02
1950 07 15.00	10.7	P						2				MER02
1950 07 16.40	11.8	V	S	32.0	L		62	0.5	4			JON
1950 07 16.97	10	:		15.0	R			1.5	5			GRA
1950 07 18.40	11.3	V	S	32.0	L		104	1				JON
1950 07 19.40	11.5	V	S	32.0	L		104	0.7	5	0.1	90	JON
1950 08 03.30	11.8	V	S	32.0	L		62	1	5			JON
1950 08 06.90	10	:		32.0	R		120	1	7			MER02
1950 08 07.30	11.7	V	S	32.0	L		62	1	6	0.5		JON
1950 08 08.40	12.0	V	S	32.0	L		62		6			JON
1950 08 10.30	12.4	V	S	32.0	L		62	0.6	7			JON
1950 08 11.30	12.4	V	S	32.0	L		62		5			JON
1950 08 13.30	12.2	V	S	32.0	L		62	0.7	5			JON
1950 08 16.90	11	:		64.0	R		210	0.3		0.05	90	STE06
1950 09 02.40	11.5	V	S	20.0	L		36		4			JON
1951 01 05.60	10.8	V	S	20.0	L		35	1	7			JON
1951 01 06.60	11.0	V	S	20.0	L		35		5			JON
1951 01 07.60	10.8	V	S	20.0	L		35	1	5			JON
1951 01 12.60	10.6	V	S	20.0	L		35	1	7			JON
1951 01 13.60	10.8	V	S	20.0	L		35	1	7			JON
1951 01 14.60	11.0	V	S	32.0	L		52	1	4	0.05	35	JON
1951 01 19.60	10.4	V	S	32.0	L		52					JON
1951 01 19.60	10.8	V	S	14.0	R		42					JON
1951 02 03.60	10.6	V	S	32.0	L		52		8			JON
1951 02 13.60	10.4	V	S	14.0	R		42	1.5				JON
1951 02 13.60	10.5	V	S	32.0	L		52		8			JON
1951 02 16.60	10.1	V	S	20.0	L		35	1.2	7			JON
1951 02 17.60	10.4	V	S	20.0	L		35	2	7			JON
1951 03 07.50	9.9	V	S	14.0	R		42	2.1	7			JON
1951 03 12.50	9.9	V	S	14.0	R		42	2	8	0.1	50	JON
1951 03 15.00	9.9	V	S	32.0	L		48					JON
1951 03 15.50	9.8	V	S	14.0	R		42	2	7	0.1	70	JON
1951 03 15.50	9.6	V	S	7.5	R							JON
1951 03 16.40	9.5:			15.0	R		108	1	3			NAN
1951 03 16.60	9.9	V	S	32.0	L		48					JON
1951 03 17.60	10.2	V	S	14.0	R		42	2.1	8			JON

Minkowski (1951 I = 1950b) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1951 03 17.60	10.0	V	S	32.0	L		48		8	0.1	20	JON
1951 03 18.70	10.2	V	S	32.0	L		48		8	0.1	60	JON
1951 03 29.38	9.5:			6.0	A							NAN
1951 04 05.60	10.2	V	S	14.0	R		42	1.5	8			JON
1951 04 06.50	10.2	V	S	20.0	L		35	1.5	8	0.1	70	JON
1951 04 08.40	10.2	V	S	32.0	L		48		8	0.15	90	JON
1951 05 02.40	11.0	V	S	32.0	L		49	0.7				JON
1951 05 03.40	11.2	V	S	14.0	R		42		5	0.05	85	JON
1951 05 05.40	11.4	V	S	32.0	L		48	0.6	6			JON
1951 05 06.30	11.1	V	S	32.0	L		48		4			JON
1951 05 07.40	11.2	V	S	32.0	L		48		5			JON
1951 05 27.30	12.6	V	S	14.0	R		42	0.4	3			JON
1951 05 27.30	12.2	V	S	32.0	L		48	0.4	3			JON
1951 06 04.30	12.6	V	S	32.0	L		48		2			JON
1951 06 09.30	12.7	V	S	32.0	L		48		2			JON
1951 06 30.30	12.6	V	S	32.0	L		48	0.7	2			JON

Pajdušáková (1951 II = 1951a)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1951 02 05.20	8.4	B		5.0	R			0.5	8	0.15	340	MER02
1951 02 06.30	7.8	B		32.0	R		65					MER02
1951 02 07.25	8.5:	B		25.0	L				8			ACF
1951 02 07.25	8.1	B		32.0	R		65	0.7	8	0.05		MER02
1951 02 09.25	7.1	S	S	10.0	R		30	1.5	8	0.15	335	ALC
1951 02 09.25	7.7:			15.0	R		60	1.1		0.1	340	GRA
1951 02 10.23	7.7	S	S	10.0	R		30	2	8	0.15	337	ALC
1951 02 10.24	7.5:			14.0	R		33	1	7	0.1	350	FUL01
1951 02 12.24	7.0:			14.0	R		33	1	7	0.1	340	FUL01
1951 02 17.78	8.6	B	S	10.0	R		30	2	7	0.05	345	ALC
1951 02 18.18	7.4	B		14.0	R		33	1.5	6	0.1	330	FUL01
1951 02 19.79	8.4	B	S	10.0	R		30	2	8	0.05	340	ALC
1951 02 20.80	9.2	B	S	10.0	R		30	2.5	6			ALC
1951 02 27.83	8.5	B		14.0	R		33	3	5			FUL01
1951 03 03.85	9.3:			15.0	R		60	1.5	6	0.05	330	GRA
1951 03 03.90	9.5:			32.0	R		65	0.5	8	0.05	345	MER02
1951 03 04.83	9.2	V		14.0	R		33	1	4	0.05	300	FUL01
1951 03 06.83	9.5:			15.0	R		60					GRA
1951 03 26.97	11 :			14.0	R		33	1	4			FUL01
1951 03 27.84	11 :			14.0	R		33		3			FUL01
1951 03 29.90				23.0	L		55	2	3			GAY

Wilson-Harrington (1952 I = 1951i)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1951 08 09.92	12.7:			76.0	L		150	0.3	3			STE06
1951 08 10.92	13 :			76.0	L		300	0.5	3			STE06
1951 12 24.60	9.6	V	S	20.0	L		35	1	4	0.03	270	JON
1951 12 27.60	9.7	V	S	20.0	L		35	1		0.05	270	JON
1951 12 28.60	9.5	V	S	20.0	L		58	0.75	5	0.04	270	JON
1951 12 30.60	8.9	V	S	7.5	R		23	1	5	0.1		JON
1951 12 31.60	8.5	V	S	20.0	L		58	1.25	7	0.1	250	JON
1952 01 02.60	8.4	V	S	20.0	L		35	1	8	0.2	270	JON
1952 01 05.60	8.4	V	S	7.5	R		23	1.3	8	0.2	270	JON

Wilson-Harrington (1952 I = 1951i) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1952 01 05.60	7.4	V		7.0	R		21		6	0.15	270	PHI
1952 01 06.60	8.4	V	S	20.0	L		35	1.3	8	0.2	265	JON
1952 01 13.60				32.0	L		48		7	0.25	265	JON
1952 01 13.60	7.9	V	S	7.5	R		23					JON
1952 01 18.60	7.1	V	S	7.5	R		23		7	1.0	245	JON
1952 01 21.50	6.6	V		7.0	R		21	1.5		0.1		PHI
1952 01 21.60	7.1	V	S	7.5	R		23		8	0.75	250	JON
1952 01 23.50	6.0	V		7.0	R		21		9	0.15	240	PHI
1952 01 23.65				15.0	L		20		7	0.5		NAN
1952 01 23.70	7.1	V	S	7.5	R		23	2	8	0.7	245	JON
1952 01 26.50	6.0	X		4.5	R		10		9	0.3		PHI
1952 01 26.50	6.4	V	S	7.5	R		23	3	8	0.75	215	JON
1952 01 26.50	6.7	X		15.0	L		20					NAN
1952 01 28.50	5.9	X		4.5	R		10	3	9	0.3	170	PHI
1952 01 28.70	6.3	V	S	7.5	R		23	3	8	1.0	180	JON
1952 01 29.40	5.6	X		4.5	R		10		8	0.5	170	PHI
1952 01 29.46	6.4	V		15.0	L		20					NAN
1952 01 30.40	5.7	V		4.5	R		10		9	0.5	120	PHI
1952 02 04.40	6.3	V		4.5	R		10		9	0.15		PHI
1952 02 05.40	7.3	V	S	5.0	R			3		0.75	90	JON
1952 02 05.40	6.8	V		4.5	R		10	2	8	0.1		PHI
1952 02 08.40	7.7	V		15.0	L		98	0.75	8	0.05	120	PHI
1952 02 12.80	8	:		7.0	R		30			0.15	100	STO01
1952 02 13.40	8.2	V	S	7.5	R		23		6	0.1	90	JON
1952 02 15.40	8.8	V	S	7.5	R		23					JON
1952 02 15.40	8.9	V		7.0	R		21	1.5		0.1		PHI
1952 02 15.80	8	:		15.0	R		60	1.2		0.1	80	GRA
1952 02 19.25	8	:		25.0	L		72	2		0.25		COL01
1952 02 21.81	8.6	B		10.0	R		30	1.75	8	0.4	80	ALC
1952 02 21.81	8.7:			15.0	R		60	1		0.15	85	GRA
1952 02 21.82	8.5:			23.0	L		55			0.2	62	GAY
1952 02 21.88	8.5:			76.0	L		150	1.5	7	0.25	85	STE06
1952 02 22.81	9	:		23.0	L		55			0.15	61	GAY
1952 02 23.40	10.2	V	S	20.0	L		54	1	5	0.3	80	JON
1952 02 23.80	9.9	B	S	32.0	R		62	0.5	7	0.05	75	MER02
1952 02 24.40	10.2	V	S	32.0	L		48		5	0.3		JON
1952 02 25.79	9.5	B		14.0	R		33	1.5		0.1	70	FUL01
1952 02 26.80	8.9	B		14.0	R		33			0.05	80	FUL01
1952 02 27.80	9.0			18.0	R		65	1.1	5	0.1	60	KEL
1952 03 05.80	10.2:		S	32.0	R		240	2				MER02

Mrkos (1952 V = 1952c)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1952 05 17.00	9.7	B	S	32.0	R		62	5	4			MER02
1952 05 22.00	9.6	B	S	32.0	R		62	4	4			MER02
1952 05 22.05	9.7:			10.0	R		30	4.5	4	0.1	100	ALC
1952 05 26.05	10.0			10.0	R		30	4	4			ALC
1952 06 25.80	9.7	V	S	14.0	R		34					JON
1952 06 26.80	9.7	V	S	7.0	R		21		3			JON
1952 06 29.80	9.4	V	S	14.0	R		34	4	3			JON
1952 06 30.00	9.3	B		13.0	R		33	6	4			FUL01
1952 07 03.80	9.0	V	S	7.0	R		21	6				JON
1952 07 15.50	8.9	V	S	7.0	R		21					JON

Mrkos (1952 V = 1952c) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1952 07 16.00	8.1	B		23.0	L		55	7	2			GAY
1952 07 16.50	8.7	V	S	7.0	R		21	8				JON
1952 07 21.50	8.9	V	S	7.0	R		21	5				JON
1952 07 21.50	9.0	V	S	32.0	L		48	3	5			JON
1952 07 23.30	8.6	V	S	7.0	R		21					JON
1952 07 24.50	8.6	V	S	7.0	R		21	6.5				JON
1952 07 24.50	7.7	V	S	5.0	R		7					JON
1952 07 25.50	9.1	V	S	7.0	R		21	4.5				JON
1952 07 27.50	9.1	V	S	7.0	R		21	6				JON
1952 07 27.50	9.3	V	S	32.0	L		48	4	6			JON
1952 07 30.70	9.7	V	S	32.0	L		49	2.5				JON
1952 07 30.70	10.3	V	S	32.0	L		86		2			JON
1952 08 01.70	11.5	V	S	32.0	L		48	1.5	2			JON

Peltier (1952 VI = 1952d)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1952 06 23.00	10.5:		S	32.0	L		62	3.5	3			MER02
1952 07 15.00	9 :			7.0	R		30	5				STO01
1952 07 20.98	9.3	V		10.0	R		48					FRI
1952 07 22.04	9.3	V		10.0	R		48					FRI
1952 07 24.93	9.3	V		13.0	R		33	4	5	0.1	60	FUL01
1952 07 26.90	9.3:			13.0	R		33	4	4			FUL01
1952 07 27.00	9.3			7.0	R		30	6	4			STO01
1952 07 27.00	9.6	V		10.0	R		48					FRI
1952 07 31.00	9.5			7.0	R		30	5				STO01
1952 08 29.94	11.5:			76.0	L		150	2	2			STE06

Harrington (1953 I = 1952e)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1952 08 22.96	13 :			76.0	L		150	1	3			STE06
1952 12 12.44	9.0	V	S	7.0	R		23					JON
1952 12 17.45	9.2	V	S	7.0	R		23					JON
1953 01 07.45	9.4	V	S	20.0	L		54	3	5			JON
1953 01 08.45	9.4	V	S	20.0	L		54	3	5			JON
1953 01 08.45	9.0	V	S	7.0	R		23					JON
1953 01 10.46	9.4	V	S	7.0	R		23					JON
1953 01 10.46	9.7	V	S	20.0	L		54	3	5			JON
1953 01 18.46	9.8	V	S	7.0	R		23					JON
1953 01 20.45	9.8	V	S	7.0	R		23					JON
1953 01 20.45	9.7	V	S	14.0	R		42	3.5	4			JON
1953 02 08.42	8.4	V	S	7.0	R		21					JON
1953 02 09.43	8.3	V	S	7.0	R		21					JON
1953 02 21.40	8.8	V	S	7.0	R		23					JON
1953 02 22.40	8.6	V	S	3.0	R		21					JON
1953 03 07.41	10.1	V	S	7.0	R		23					JON
1953 03 10.39	9.8	V	S	7.0	R		21					JON
1953 03 12.40	10.0	V	S	7.0	R		21					JON
1953 03 18.39	10.2	V	S	7.0	R		21					JON
1953 03 20.39	9.9	V	S	7.0	R		23					JON
1953 03 21.42	10.1	V	S	7.0	R		23					JON
1953 04 05.37	9.9	V	S	7.0	R		23					JON
1953 04 10.35	9.8	V	S	3.0	R		21					JON

Harrington (1953 I = 1952e) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1953 04 14.35	10.5	V	S	14.0	R		65					JON
1953 04 16.36	10.8	V	S	14.0	R		34		2			JON
1953 04 18.40	10.8	V	S	20.0	L		34	2.5	2			JON
1953 05 07.31	11.5	V	S	16.0	R		34		2			JON
1953 05 08.32	11.7	V	S	32.0	L		48					JON

Mrkos (1953 II = 1952f)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1952 12 15.60	10.2	V	S	14.0	R		42	& 2	2			JON
1952 12 16.60	9.9	V	S	14.0	R		42	2.5	4			JON
1952 12 17.60	9.7	V	S	14.0	R		42	3	5			JON
1952 12 23.58	8.6	V	S	7.0	R		23					JON
1952 12 24.59	8.4	V	S	7.0	R		23					JON
1952 12 25.60	8.3	V	S	7.0	R		23					JON
1952 12 26.61	8.3	V	S	7.0	R		23					JON
1952 12 28.64	8.4	V	S	7.0	R		23					JON
1952 12 29.63	8.2	V	S	7.0	R		23					JON
1953 01 06.48	8.2	V	S	7.0	R		23					JON
1953 01 07.46	8.3	V	S	7.0	R		23					JON
1953 01 08.48	8.3	V	S	7.0	R		23					JON
1953 01 10.52	7.4	V		7.0	R		21	2	8			PHI
1953 01 10.53	8.1	V	S	7.0	R		23					JON
1953 01 11.43	7.5	V		7.0	R		21	2	8			PHI
1953 01 13.64	7.9	V	S	7.0	R		23					JON
1953 01 15.51	7.4	V		7.0	R		21	3	8			PHI
1953 01 18.43	7.3	V		7.0	R		21	3	9			PHI
1953 01 19.4/	7.2	V		7.0	R		21	3	8			PHI
1953 01 20.42	7.2	V		7.0	R		21	3	8			PHI
1953 01 20.51	8.1	V	S	7.0	R		23					JON
1953 01 20.51	9.1	V	S	14.0	R		42	4	7			JON
1953 01 21.42	7.3	V		7.0	R		21	3	8			JON
1953 01 27.47	7.5	V		7.0	R		21	2				PHI
1953 01 27.63	8.2	V	S	7.0	R		23					JON
1953 02 05.39	7.7	V		7.0	R		21	2	7			PHI
1953 02 06.41	7.9	V	S	7.0	R		23					JON
1953 02 08.40	8.0	V		7.0	R		21	2	8			PHI
1953 02 08.43	8.2	V	S	7.0	R		21					JON
1953 02 09.42	8.2	V	S	7.0	R		23		6			JON
1953 02 13.39	8.4	V		7.0	R		21	2	7			PHI

Mrkos-Honda (1953 III = 1953a)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1953 04 24.14	8.7	B		15.0	R		60	4	4			GRA
1953 05 02.93	8.8	B	S	10.0	R		30	3	4			ALC
1953 05 02.98	8.5			7.0	R		30	3	4			ST001
1953 05 03.94	8.6	B	S	10.0	R		30	3	4			ALC
1953 05 03.95	8.3	B	S	7.0	R		25					STE06
1953 05 04.93	8.5	F	S	10.0	R		30	3	5			ALC
1953 05 04.98	8.8			23.0	L		55	3	4			GAY
1953 05 05.94	8.7	B		15.0	R		60	5.5	4			GRA
1953 05 06.91	9.2	B	S	10.0	R		30	3	3			ALC
1953 05 06.96	8.8			23.0	L		55					GAY

Mrkoš-Honda (1953 III = 1953a) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1953 05 07.06	8.6	V	S	7.0	R		30	3				STO01
1953 05 08.95	8.5	B		10.0	R		30	3	4			ALC
1953 05 10.92	8.4	D	S	7.0	R		25					STE06
1953 05 10.94	8.6	V	S	7.0	R		30	3				STO01
1953 05 10.95	8.7			23.0	L		55	3	5			GAY
1953 05 10.96	8.5	B		10.0	R		30	3	6			ALC
1953 05 10.99	8.7			15.0	R		60	5				GRA
1953 05 12.91	8.5			23.0	L		55	4.5	6			GAY
1953 05 13.01	8.7	B	S	10.0	R		30	2.5	7			ALC
1953 05 13.94	8.5			23.0	L		55	4	6			GAY
1953 05 15.99	8.5:			25.0	L		100 &	4				ACF
1953 05 16.92	8.2	B	S	10.0	R		30	3	6			ALC
1953 05 18.00	8.3		S	5.0	R			3.5				MER02
1953 05 18.00	8.4	B	S	10.0	R		30	2	6			ALC
1953 05 20.00	8.5:		S	32.0	R		65	4	7			MER02
1953 05 24.94	8.9	B	S	10.0	R		30	2.5	5			ALC
1953 05 30.00	8.3	V	S	7.0	R		30	3	4			STO01
1953 06 01.95	8.3	V	S	7.0	R		30	3	6			STO01
1953 06 08.00	8.6	V	S	7.0	R		30	4.5	5			STO01
1953 06 11.00	9.0	V	S	7.0	R		30	3				STO01

Pajdušáková (1954 II = 1953h)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1953 12 27.45	10.6	V		20.0	L		54	2.5	4	0.2	85	JON

Vozarova (1954 VIII = 1954f)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1954 08 06.90	8.5:			76.0	L		140	3.5	8			STE06
1954 08 06.90				15.0	A	4		3		0.15	167	WAT
1954 08 06.90	9.5:			15.0	R	12	80	2	7			WAT
1954 08 07.90	9.5:			5.0	R		12					WAT
1954 08 11.90	10.0:			76.0	L		140	2				STE06
1954 08 25.93	11 :			15.0	L		30	3	3			PAN
1954 08 25.98	10.0:			76.0	L		140	2.5	3			STE06
1954 08 26.90	11.5:			76.0	L		140		3			STE06
1954 08 26.90	11.7	P		15.0	A	4		2	4	0.02	50	WAT
1954 08 26.96	11.3	N		15.0	L		30	3	2			PAN
1954 08 31.98	11.9	N		15.0	L		30					PAN
1954 09 01.89	12.2	N		15.0	L		30		2			PAN
1954 09 04.90	12 :			10.0	R		40					STE06
1954 09 05.90	12 :			15.0	R							WAT
1954 09 20.84	12 :			76.0	L		140	2	3			STE06

Abell (1954 X = 1953g)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1954 02 23.83	10.0:			76.0	L		140	3	4			STE06
1954 02 25.94	10.5:		S	7.0	R		25	2	3			STE06
1954 02 26.85	10.3:			76.0	L		140					STE06
1954 03 07.97	11 :			22.0	L	8	68					CLA02
1954 03 23.80	9.3			10.0	R		30	2.5	8			ALC
1954 03 28.80	9.3	B	S	10.0	R		30	5.5	5			ALC

Abell (1954 X = 1953g) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1954 03 28.87	9.3			76.0	L		140	2.5	7	0.1	50	STE06
1954 03 28.87	9.3			13.0	L		80					PAN
1954 03 31.80	9.5	B	S	10.0	R		30	6	4	0.05	50	ALC
1954 04 01.87	9.6			13.0	R		80	2.5	2			PAN
1954 04 04.90	9.0	X		7.0	R		30					STO01
1954 04 04.94	9.5:			13.0	R		80	3				PAN
1954 04 07.00	8.8		S	5.0	R		16					MER02
1954 04 07.88	9.2		S	15.0	L		38	3				HEN
1954 04 10.91	9.0:			15.0	L		38	4	3			HEN
1954 04 13.15	9.0			13.0	R		80		4	0.17	360	PAN
1954 04 19.88	9.0			13.0	R		80	5	5			PAN
1954 04 20.90	8.7	X		7.0	R		30	4				STO01
1954 04 21.91	9.0	B		13.0	R		80	3	3			PAN
1954 04 25.90	8.2	B	S	5.0	B		7		7			WAT
1954 04 26.87	8.4	B	S	15.0	L		38	6	5	0.13	360	HEN
1954 04 26.90	8.0	B		5.0	B		7		7	0.05	60	WAT
1954 04 26.90	8.2			7.0	R		30	6				STO01
1954 04 26.93	7.5			5.0	R		25	4	3	0.14	45	MER01
1954 04 27.90	8.0	B	S	5.0	B		7			0.1	60	WAT
1954 04 28.90	8.0	B	S	5.0	B		7		7			WAT
1954 05 04.94	7.0:			15.0	L		38	6	5			HEN
1954 05 07.89	7.3	B		5.0	R		25	5	3			MER01
1954 05 18.90	8.4	B	S	10.0	R		30	7	4	0.13	40	ALC
1954 05 30.00	7.3	B	S	5.0	B		7					WAT
1954 06 05.00	7.2	B	S	10.0	R		30					WAT
1954 06 22.30	8.9	D	S	32.0	L		48	2.5	7			JON
1954 06 23.29				32.0	L		48	3	6			JON
1954 06 23.29	7.7	D	S	5.0	R		7					JON
1954 06 26.28	7.6	D	S	5.0	R		7					JON
1954 07 01.29				32.0	L		86	2	6	0.04	120	JON
1954 07 01.29	7.5	B	S	5.0	R		7					JON
1954 07 02.29	6.9	D	S	5.0	R		7					JON
1954 07 03.29	6.7	D	S	5.0	R		7					JON
1954 07 05.30	6.6	D	S	5.0	R		7					JON
1954 07 06.28	6.9	D	S	7.0	R		23		7			JON
1954 07 08.28				32.0	L		86		5	0.1	130	JON
1954 07 08.28	6.9	D	S	5.0	R		7					JON
1954 07 23.31	6.4	D	S	5.0	R		7					JON
1954 07 24.30	6.6	D	S	5.0	R		7					JON
1954 07 27.31				32.0	L		48	3.5	7			JON
1954 07 27.31	6.2	D	S	5.0	R		7					JON
1954 07 29.30	6.2	D	S	5.0	R		7					JON
1954 08 09.33	8.5	D	S	7.0	R		23					JON
1954 08 18.33	7.6	D	S	5.0	R		7					JON
1954 08 21.35	8.9	D	S	7.0	R		23					JON
1954 08 25.35	7.9	D	S	7.0	R		23			0.2	100	JON
1954 08 29.34	7.8	D	S	7.0	R		23					JON
1954 08 30.34				32.0	L		48	3	7	0.07	135	JON
1954 08 30.34	7.8	D	S	5.0	R		7					JON
1954 09 01.36	7.6	H	S	5.0	R		7					JON
1954 09 07.70	9.9	D	S	7.0	R		23					JON
1954 09 19.37	10.2	H	S	32.0	L		48	2	3			JON
1954 09 23.39	10.9	H	S	32.0	L		48	1.5	4			JON

Abell (1954 X = 1953g) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1954 09 24.38	10.5	H	S	7.0	R		23	3				JON
1954 10 01.39	10.6	H	S	32.0	L		48	2	3			JON
1954 10 15.44	11.6	H	S	20.0	L		54	2	2			JON
1954 10 24.48	11.8	H	S	20.0	L		54	1	3			JON

Kresák-Peltier (1954 XII = 1954d)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1954 07 03.90	9	:		5.0	R		15					WAT
1954 07 04.90				15.0	R	12	60	15	2			WAT
1954 07 22.32				32.0	L		86	3	4			JON
1954 07 22.32	8.0	V	S	5.0	R							JON
1954 07 23.34	8.0	V	S	5.0	R							JON
1954 07 23.34				32.0	L		86	3	4			JON
1954 07 24.35	7.8	V	S	5.0	R							JON
1954 07 26.34	7.8	V	S	5.0	R				5			JON
1954 07 29.35	7.6	V	S	5.0	R							JON
1954 07 29.35				32.0	L		48	3	4			JON
1954 08 09.32	9.1	D	S	7.5	R		23	2	4			JON
1954 08 21.31	8.3	D	S	7.5	R		23	2	5			JON
1954 08 28.74	8.3	D	S	7.5	R		23					JON
1954 08 28.74				32.0	L		48	2	7			JON
1954 09 07.73	8.7	D	S	5.0	R							JON
1954 09 07.73				32.0	L		86		5			JON
1954 09 24.70	8.4	V	S	7.5	R		23					JON
1954 09 25.70	8.1	V	S	7.5	R		23	3	5			JON
1954 10 07.69				32.0	L		48	2	4			JON
1954 10 07.69	9.0	V	S	7.5	R		23					JON

Kohler (1977 XIV = 1977m)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1977 11 02.77	7.0	J	S	5.0	B	4	7					MIL02
1977 11 03.77	7.0	J	S	5.0	B	4	7					MIL02

Bradfield (1979 X = 1979l)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 02 12.77	8.7	T	S	15.0	L	6	22	7	2		0	MIL02
1980 03 04.88	10.5	V		26.0	L		80	3.5	1			HUR
1980 03 09.83	11.3	V		26.0	L		80	3	3			HUR
1980 03 13.88	12.4	V		26.0	L		80	1.4	2			HUR

Bradfield (1980 XV = 1980t)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 01 13.09	4.5	A	S	8.0	B		11	2.0	6	2.0	35	SPR
1981 01 14.09	5.0	A	S	8.0	B		11	2.5	6	1.0	30	SPR
1981 01 15.10	5.1	A	S	8.0	B		11	2.0	6	0.75	30	SPR
1981 01 17.11	5.8	A	S	8.0	B		11	2.0	6	0.50	30	SPR

P/Encke (1954 IX = 1953f = 1980 XX)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1954 07 22.29				32.0	L		48	1.5	5			JON
1954 07 22.29	9.6	V	S	7.5	R		23					JON
1954 07 23.29	9.6	V	S	7.5	R		23					JON
1954 07 23.29				32.0	L		86	2	3			JON
1954 07 27.30	9.8	V	S	7.5	R		23					JON
1954 07 27.30				32.0	L		86	2	3			JON
1980 10 07.97	12 :	P		10.0		4		3	0			HEN
1980 10 12.91	10.5:			26.0	L		80	2.5				HUR
1980 10 19.15	10.6			20.0	R		40	7	1			SHA02
1980 10 20.03	10.1			20.0	R		40	9	1			SHA02
1980 10 28.97	9.0:			20.0	R		40	12	1	0.17	200	SHA02
1980 10 29.76	9.2			20.0	R		40	9	2			SHA02
1980 10 29.76	7.8			8.0	B		10	18	1			SHA02
1980 10 30.22	8.9:			31.0	L	5	60	2	4			PAN
1980 10 30.76	7.2			8.0	B		10	10	2			SHA02
1980 11 01.11	7.6			8.0	B		10	10	1			SHA02
1980 11 01.11	8.5			15.0	L		33	5	2			SHA02
1980 11 02.14	8.1			8.0	B		10					SHA02
1980 11 02.14	9.1			15.0	L		33	6	3			SHA02
1980 11 03.15	8.0			8.0	B		10	8	2			SHA02
1980 11 10.22	7.6			8.0	B		10	5	3/			SHA02
1980 11 12.23	8.1			8.0	B		10	5	5			SHA02
1980 11 12.23	7.3			8.0	B		15	6				PAN
1980 11 14.20	6.5	K	S	5.0	B		7	10				MIL02

P/Tuttle-Giacobini-Kresák (1951 IV = 1951f)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1951 04 25.89	10	P		15.0	A	4		7	3			WAT
1951 04 25.92	10.5:			15.0	R		60	1				GRA
1951 04 27.90	9.8			14.0	R		33	3				LIN01
1951 04 28.90	9.8			14.0	R		33	3				WAT
1951 04 28.90	10 :	B		76.0	L		150	4	3			STE06
1951 04 29.90	10 :		S	10.0	R		30	7	2			ALC
1951 04 29.94	10 :	B		25.0	L		40	8	2			ACF
1951 05 02.92	10.3	B		32.0	R		65	5	2			MER02
1951 05 02.92	10.3:		S	10.0	R		30	7.5	2			ALC
1951 05 10.90	11 :			32.0	R		120	3	3			MER02
1951 05 11.94	10.0	B	S	10.0	R		30	8	3			ALC
1951 05 22.94	11.0			10.0	R		30	7	2			ALC
1951 06 03.95	11.3:			10.0	R		30	7	2			ALC
1951 06 04.00	11.2			32.0	R		230	4.5	2			MER02
1951 06 06.00	11.4			10.0	R		30	8.5	2			ALC
1951 06 08.00	11.5:			32.0	R		230	3.5	2			MER02
1951 06 09.00	11.7:			10.0	R		30	7	2			ALC

P/Tempel 1 (1972 V = 1972a)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1972 04 09.54	12.5	K	B	20.3	L		38	3	2			BOE
1972 04 10.54	12.5	K	B	20.3	L		38	3	2			BOE
1972 04 11.52	12.4	K	B	20.3	L		38	3	2			BOE
1972 04 12.51	12.3	K	B	20.3	L		38	3	3			BOE
1972 04 13.52	12.3	K	B	20.3	L		38	3	3			BOE

P/Tempel 1 (1972 V = 1972a) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1972 04 15.51	12.2	K	B	20.3	L		38	3	3			BOE
1972 04 16.54	12.1	K	B	20.3	L		38	3	3			BOE
1972 04 17.57	12.1	K	B	20.3	L		38	3	3			BOE
1972 04 19.58	12.0	K	B	20.3	L		38	3	3			BOE
1972 05 02.62	11.7	K	B	20.3	L		38	3	4			BOE
1972 05 04.49	11.6	K	B	20.3	L		38	4	5			BOE
1972 06 14.61	12.0	K	B	20.3	L		38	4	5			BOE

P/Perrine-Mrkos (1955 VII = 1955i)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1955 10 28.20	10.0		S	10.0	R		30	5	3			ALC
1955 10 29.20	10.1	P		15.0	A	4		2	4			WAT

P/Borrelly (1980i)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 01 25.80	9.8	S	B	32.0	L	9	70	2.3	4			MOR02
1981 01 30.77	9.9	S	B	32.0	L	9	60	2.5	5			MOR02
1981 02 05.77	9.6	B	B	32.0	L	9	60	2.4	4			MOR02
1981 02 10.76	9.6	B	B	32.0	L	9	45	2.3	4			MOR02
1981 02 28.76	10.0	B	B	32.0	L	9	45	1.5	4	1.0	50	MOR02
1981 03 13.79	10.3	B	B	32.0	L	9	45	1.6	5	1.0	55	MOR02
1981 03 20.80	10.5	B	B	32.0	L	9	45	1.2	5	0.4	57	MOR02
1981 04 01.80	10.7	B	B	32.0	L	9	45	1.0	3			MOR02

P/Kopff (1951 VII = 1951e)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1951 08 19.30	12.2	V	S	14.0	R		42	2	3			JON
1951 09 21.30	11.3	V	S	14.0	R		42	1.5	4			JON
1951 09 22.30	11.4	V	S	32.0	L		86	3.5	3			JON
1951 10 26.40	10.6	V	S	14.0	R		42		3			JON
1951 10 28.40	10.8	V	S	14.0	R		42		2			JON
1951 10 30.40	10.8	V	S	14.0	R		34	3.5	5			JON

P/Giacobini-Zinner (1972 VI = 1972d)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1972 06 16.83	10.5	K	B	20.3	L		38	4	5			BOE
1972 06 17.89	10.5	K	B	20.3	L		38	4	6			BOE
1972 06 18.88	10.4	K	B	20.3	L		38	5	6			BOE
1972 06 19.88	10.4	K	B	20.3	L		38	5	6	0.15		BOE
1972 06 20.80	10.3	K	B	20.3	L		38	5	6	0.15		BOE
1972 06 21.82	10.3	K	B	20.3	L		38	5	6	0.15		BOE
1972 06 22.80	10.2	K	B	20.3	L		38	5	7	0.15		BOE
1972 06 23.79	10.2	K	B	20.3	L		38	5	7			BOE
1972 06 24.83	10.2	K	B	20.3	L		38	5	7	0.13		BOE
1972 07 01.83	10.0	K	B	20.3	L		38	5	7 ?			BOE
1972 07 02.83	10.0	K	B	20.3	L		38	4	6			BOE
1972 07 03.83	10.0	K	B	20.3	L		38	4	6			BOE
1972 07 04.85	10.0	K	B	20.3	L		38	4	6			BOE
1972 09 08.84	11.0	K	B	20.3	L		38	4	5 ?			BOE

P/Giacobini-Zinner (1972 VI = 1972d) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1972 09 14.83	11.5	K	B	20.3	L		38	4	5	?		BOE
1972 09 17.82	12.0	K	B	20.3	L		38	4	5	?		BOE
1972 09 18.85	12.0	K	B	20.3	L		38	4	4	?		BOE
1972 09 19.82	12.1	K	B	20.3	L		38	4	4	?		BOE
1972 09 20.83	12.2	K	B	20.3	L		38	4	4			BOE
1972 09 21.86	12.3	K	B	20.3	L		38	4	4			BOE

P/Wolf-Harrington (1952 II = 1951k)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1951 11 21.80	12.5	P										MER02
1951 12 02.80	12 :			18.0	R		80	0.9	2			KEL
1951 12 02.90	11.3			76.0	L		150	1	4			STE06
1951 12 21.78	12.3:			18.0	R		80	2	3			KEL
1951 12 29.83	12 :			76.0	L		150	1	4	0.05	60	STE06
1952 01 16.85	12.5:			76.0	L		150	1		0.05	55	STE06
1952 01 17.85	12.5:			76.0	L		150	1		0.05	55	STE06
1952 01 18.85	12.5:			76.0	L		150	1		0.05	55	STE06
1952 01 19.34	13 :	P		14.0	A	5			2			KEL

P/Swift-Gehrels (1981j)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 10 04.23	12.5:	A	S	20.0	C	10	125	1.0	2			SPR
1981 10 17.22	12.1	A	S	32.0	L	7	143	1.5	2			SPR
1981 10 21.23	12.5	A	S	32.0	L	7	143	1.0	2			SPR
1981 10 25.24	12.3	A	S	20.0	C	10	125	1.5	2			SPR
1981 10 30.24	11.7	A	S	32.0	L	7	71	2.0	3			SPR
1981 11 04.25	11.7	A	S	25.0	L	5	75	2.0	2			SPR
1981 11 05.12	11.7	A	S	20.0	C	10	125	1.5	2			SPR
1981 11 06.18	11.7	A	S	25.0	L	5	75	1.5	2			SPR
1981 11 21.81	11.0	A	S	25.4	L	4	79	2	2			CAV
1981 11 23.02	11.1	A	S	32.0	L	6	68	2.0	2			BOR
1981 11 24.01	10.9	A	S	32.0	L	6	68	2.1	2			BOR
1981 11 24.05	10.9	A	S	25.0	L	7	68	2.8	2	? 0.03	170	MOR
1981 11 24.20	11.3	A	S	25.0	L	5	75	2.25	3			SPR
1981 11 25.05	10.6	A	S	25.0	L	7	68	2.8	2			MOR
1981 11 26.15	10.9	A	S	32.0	L	6	68	2.1	2			BOR
1981 11 26.18	11.5	A	S	20.0	C	10	125	& 1.75	3			SPR
1981 11 27.16	11.0	A	S	32.0	L	7	71	2.5	3			SPR
1981 11 28.17	10.9	A	S	20.0	C	10	65	2.0	3			SPR
1981 11 29.27	10.8	J	S	15.5	L	6	64	& 2	1			FUL
1981 11 30.17	10.8	A	S	20.0	C	10	65	2.5	3			SPR
1981 12 01.00	10.8	A	S	32.0	L	6	68	2.1	2/			BOR
1981 12 01.02	10.8	A	S	25.0	L	7	68	3.1	2	?		MOR
1981 12 01.87	11.2	J	S	15.5	L	6	64	& 2	1			FUL
1981 12 03.00	10.8	A	S	25.0	L	7	68	3.0	2			MOR
1981 12 03.15	11.1	A	S	25.0	L	5	75	2.0	2			SPR
1981 12 06.16	11.7	A	S	20.0	C	10	125	1.5	2			SPR
1981 12 13.12	11.3	A	S	20.0	C	10	125	1.25	3			SPR
1981 12 13.97	10.7	A	S	32.0	L	6	68	2.4	3	?	225	BOR
1981 12 13.97	10.7	A	S	25.0	L	7	68	2.5	3	? 0.03	100	MOR
1981 12 17.04	10.4	A	S	25.0	L	7	68	3.0	3/			MOR
1981 12 17.13	11.9	A	S	20.0	C	10	113	1.0	2			SPR

P/Swift-Gehrels (1981j) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 12 19.97	10.6	A	S	25.0	L	7	68	2.9	2/			MOR
1981 12 19.98	10.1	A	S	32.0	L	6	68	2.3	2/			BOR
1981 12 20.13	12.2	A	S	20.0	C	10	113	1.25	2			SPR
1981 12 20.98	10.1	A	S	32.0	L	6	68	2.7	2	?	225	BOR
1981 12 20.98	10.4	A	S	25.0	L	7	68	3.2	2			MOR
1981 12 20.98			S	8.0	B		20 & 5					BOR
1981 12 22.14	12.0	A	S	25.0	L	5	38	1.25	2			SPR
1981 12 24.16	9.8	A	S	8.0	B		20	4	2			MOR
1981 12 24.95	10.0	A	S	25.0	L	7	68	3.0	2			MOR
1981 12 25.21	11.9	A	S	25.0	L	5	38	1.25	3			SPR
1981 12 26.00	9.9	A	S	32.0	L	6	68	2.7	2/			BOR
1981 12 26.05	10.0	A	S	25.0	L	7	68	3.4	1/			MOR
1981 12 26.06	9.8	A	S	8.0	B		20	4	1			MOR
1981 12 27.21	12.5	A	S	20.0	C	10	65	1.0	2			SPR
1981 12 30.00	10.1	A	S	32.0	L	6	68	2.4	2/			BOR
1981 12 30.04	10.3	A	S	25.0	L	7	68	2.8	2			MOR
1981 12 30.99	10.0	A	S	25.0	L	7	68	2.9	2			MOR
1981 12 31.00	9.9	A	S	32.0	L	6	68	2.6	2			BOR
1981 12 31.20	12.1	A		20.0	C	10	65	1.0	2			SPR
1982 01 01.20	12.2	A		20.0	C	10	65	1.0	2			SPR
1982 01 12.98	10.4	A	S	25.0	L	7	68	3.4	1/			MOR
1982 01 16.00	10.6	A	S	25.0	L	7	103	2.4	1			MOR
1982 01 17.98	10.7	A	S	25.0	L	7	103	3.0	1			MOR
1982 01 18.99	10.8	A	S	25.0	L	7	103	2.6	0/			MOR
1982 01 21.99	10.9	A	S	25.0	L	7	103	2.6	0/			MOR
1982 01 25.02	11.4	A	S	25.0	L	7	103	2.0	0/			MOR
1982 01 27.01	11.2	A	S	25.0	L	7	103	3	0			MOR
1982 01 27.01	11.2	A	S	25.0	L	7	168	3	0			MOR
1982 01 28.01	11.5	A	S	25.0	L	7	103	3	0			MOR

P/Schaumasse (1952 III = 1951l)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1951 12 21.90	10.3:			76.0	L		150	2	7			STE06
1951 12 21.92	10.6	X		30.0	R		240	1.5	5			MER02
1951 12 29.90	9.9			10.0	R		30	6	6	0.25	80	ALC
1951 12 29.90	9.8		S	30.0	R		230	4	7	0.1	160	MER02
1951 12 29.90	9.4		S	5.0	R		16	7				MER02
1952 01 07.87	9.6			10.0	R		30	5	5			ALC
1952 01 15.80	8.5			15.0	R		60	7	6			GAY
1952 01 15.80	7.8	B		23.0	L		55	7	5			GAY
1952 01 15.82	7.9	B	S	10.0	R		30	9	7	0.2	75	ALC
1952 01 17.79	8.3	B		10.0	R		30	11	5	0.25	55	ALC
1952 01 17.80	8.4	B		23.0	L		55	5.5				GAY
1952 01 17.80	8.2	B		32.0	R		62	8	3			MER02
1952 01 17.94	8.0	B		4.0	R		17					TAY02
1952 01 19.79	7.8	B	S	10.0	R		30	10	7	0.33	75	ALC
1952 01 19.80	7.8	B		5.0	R		6					GAY
1952 01 26.80	8.0	B		23.0	L		55	10	5			GAY
1952 01 27.80	8.0	B		5.0	R		6					GAY
1952 01 28.90	6.5	D	S	5.0	R		7					STE06
1952 01 29.90	6.4	D	S	5.0	R		7					STE06
1952 01 31.80	6.5			5.0	R		6	6	4			DAV
1952 01 31.90	6.3		S	5.0	B		7	17				MER02

P/Schaumasse (1952 III = 19511) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1952 01 31.90	6.4		S	5.0	R		7					STE06
1952 02 01.84	5.1			2.0	B		4					TAY02
1952 02 01.98	4.8	M		22.0	L		67					CLA02
1952 02 02.80	7.5	B		5.0	R		6					GAY
1952 02 03.80	6.6	D		7.0	R		6	7				GAY
1952 02 12.29	6.3	X		5.0	R		6	15				DAV
1952 02 12.95	7.0	B		5.0	R		6					GAY
1952 02 15.85	6.5	V	S	25.0	L		72		4			COL01
1952 02 15.90	6.5			5.0	R		16	19				MER02
1952 02 20.77	6.0	V		6.0	R		80	16	5			DAV
1952 02 20.80	6.7	B		5.0	R		6		5			GAY
1952 02 20.90	6.6	B	S	5.0	R		7					STE06
1952 02 21.78	6.7	B		5.0	R		6	13				GAY
1952 02 22.88	6.7	B		5.0	R		6	12				GAY
1952 02 22.92	6.7	B	S	5.0	R		7					STE06
1952 02 25.85	5.8	X		13.0	R		33	6.5	4			FUL01
1952 02 25.90	6.8	B	S	5.0	R		7					STE06
1952 02 27.82	6.4	V		5.0	R		6	16	5			DAV
1952 03 02.88	6.7	B		5.0	R		6	12				GAY
1952 03 04.90	8.1	B		23.0	L		55	6				GAY
1952 03 14.80	7.7			9.0	R		25	7.5	7			SOP
1952 03 14.82	7.5	B		5.0	R		6	12				GAY
1952 03 14.86	6.6	V		5.0	R		6	18	6			DAV
1952 03 15.83	7.5	B		5.0	R		6	12				GAY
1952 03 15.90	7.0	B	S	5.0	R		7	15				STE06
1952 03 17.86	8.0	B		5.0	R		6					GAY
1952 03 17.99	7.2	B	S	5.0	R		7					STE06
1952 03 18.00	7.7	B	S	5.0	R		16	10	3			MER02
1952 03 20.86	7.1	V		5.0	R		6	17	5			DAV
1952 03 22.80	8.2			9.0	R		25	6	5			SOP
1952 03 22.82	8.0	B		5.0	R		6					GAY
1952 03 22.84	7.1	V		5.0	R		6	18	4			DAV
1952 03 22.88	7.5	B	S	5.0	R		7					STE06
1952 03 22.90	7.0	D	S	4.0	R		6	20	3			MER02
1952 03 24.90	7.5			5.0	R		6	20	2			MER02
1952 03 25.88	7.5	B		23.0	L		55	7				GAY
1952 03 25.90	8.2	D		5.0	R		6	10	6			FUL01
1952 03 26.87	8.7	B		5.0	R		6					GAY
1952 03 26.88	7.3	X		4.0	R		6	15	7			DAV
1952 03 27.86	6.8	B		5.0	R		6	8.5				GAY
1952 03 27.90	7.8	B	S	5.0	R		16	15	6			MER02
1952 04 13.88	8.7	B		5.0	R		6					GAY
1952 04 13.90	9.0	D	S	32.0	R		62	5				MER02
1952 04 16.89	8.8	B		23.0	L		55	6				GAY
1952 04 17.88	8.7	B		23.0	L		55	3				GAY
1952 04 24.00	9.5:	B	S	5.0	R		16					MER02
1952 04 24.95	8.8:	B		23.0	L		55					GAY
1952 05 17.00	10 :			23.0	L		55		3			GAY

P/Kearns-Kwee (1981h)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 12 07.97	14.2	A	B	32.0	L	9	70	0.3	2			MOR02
1981 12 08.95	14.1	A	B	32.0	L	9	96	0.25	2			MOR02

P/Kearns-Kwee (1981h) Cont.

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1981 12 09.95	14.0	A	B	32.0	L	9	96	0.25	1			MOR02
1981 12 17.95	14.0	A	B	32.0	L	9	96		1			MOR02
1981 12 18.96	13.9	A	B	32.0	L	9	96	0.20	2			MOR02
1981 12 24.00	13.9	A	B	32.0	L	9	70		2			MOR02
1981 12 28.99	14.0	A	B	32.0	L	9	70		2			MOR02
1981 12 29.96	14.0	A	S	32.0	L	9	70	0.20	2			MOR02

P/Pons-Brooks (1954 VII = 1953c)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1953 07 05.00	14.5:	P		20.0		2		0.5				MER02
1953 08 11.00	15.3:	P		20.0		2						MER02
1953 09 12.91	13.5:			76.0	L		140	1.5	2			STE06
1953 09 16.90	13 :			76.0	L		150	1.5				STE06
1953 09 18.00	12.8	P		20.0		2		1	3			MER02

P/Tuttle (1980 XIII = 1980h)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 10 09.97	12 :	P		10.0		4		3.5	2			HEN
1980 10 18.18	10.5	A		31.0	L	5	60	5	3			PAN
1980 10 19.16	10.5			20.0	R		40	5	0			SHA02
1980 10 28.98	9.3			20.0	R		40	6	1			SHA02
1980 10 30.00	9.6			20.0	R		40	4	1			SHA02
1980 10 31.16	9.5			20.0	R		40	8	1			SHA02
1980 11 01.14	9.3			20.0	R		40	5	1/			SHA02
1980 11 02.13	9.8			20.0	R		40	4	2/			SHA02
1980 11 03.13	10.2			20.0	R		40	5	3			SHA02
1980 11 10.19	8.2			8.0	B		10	7	3			SHA02
1980 11 10.19	9.7			20.0	R		40	6	3/			SHA02
1980 11 12.07	9.0			20.0	R		40	5	3			SHA02
1980 11 12.07	8.6			8.0	B		10					SHA02
1980 11 12.19	8.5	V		31.0	L	5	60	5	4			PAN
1980 11 12.20	8.7	S		8.0	R		40	4	5			RID
1980 11 18.13	7.8			8.0	B		10	5	4			SHA02
1980 11 18.13	9.0			20.0	R		40		5			SHA02
1980 11 25.21	8.8			8.0	B		10	5	4			SHA02
1980 11 28.16	8.9			20.0	R		40	6	5			SHA02
1980 11 28.16	7.5			8.0	B		10	5	4			SHA02
1980 12 01.25	7.3			8.0	B		15	8	3			PAN
1980 12 01.26	8.4			8.0	B		10	5	6/			SHA02
1980 12 01.26	8.8			20.0	R		40	5	5			SHA02
1980 12 02.65	7.9	V		4.5	R							JON
1980 12 03.23	7.7			8.0	B		10	5	5			SHA02
1980 12 03.23	8.4			20.0	R		40	6	5	0.25	210	SHA02
1980 12 03.24	7.2			8.0	B		15	7	2			PAN
1980 12 03.65	7.8			4.5	R		15					JON
1980 12 07.22	8.4			32.0	R		95	3	4			SHA02
1980 12 07.22	8.5			8.0	B		10	2	6/			SHA02
1980 12 07.26	7.3			8.0	B		15	8	3			PAN
1980 12 07.65	7.2	V		4.5	R							JON

P/Schwassmann-Wachmann 1

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1982 01 27.40	12.3	A	S	25.0	L	7	103	1.4	6			MOR
1982 01 29.37	12.5	A	S	25.0	L	7	103	0.9	6			MOR
1982 01 29.37	12.5	A	S	25.0	L	7	168	1.0	4			MOR
1982 02 02.37	12.8	A	S	25.0	L	7	103	1.5	4			MOR

P/Stephan-Oterma (1980 X = 1980g)

DATE (UT)	MAG.	R	MM	AP.	T	F/	PWR	COMA	DC	TAIL	PA	OBS.
1980 10 18.20	11.1	A		31.0	L	5	60	1.7	4			PAN
1980 10 29.01	10.2			20.0	R		40	3	2			SHA02
1980 11 01.15	10.5			20.0	R		40	2	4/			SHA02
1980 11 01.20	10.9	A		31.0	L	5	60	2	2			PAN
1980 11 02.11	10.5			20.0	R		40	2	5			SHA02
1980 11 03.11	10.5			20.0	R		40	2	5			SHA02
1980 11 03.22	10.6	A		31.0	L	5	60	2	4			PAN
1980 11 10.17	10.6			20.0	R		40	2.5	4			SHA02
1980 11 11.99	10.0			20.0	R		40	3	3			SHA02
1980 11 12.21	10.0	A		31.0	L	5	60	4				PAN
1981 01 10.17	9.7	A		20.0	L	10	65	3.5				SPR
1981 01 11.18	9.9	A		20.0	L	10	65	4.0				SPR
1981 01 12.17	9.6	A		20.0	L	10	65	3.5				SPR
1981 01 13.15	9.7	A		25.0	L	5	38	4.0				SPR
1981 01 14.16	9.7	A		25.0	L	5	38	4.5				SPR
1981 01 15.18	9.8	A		25.0	L	5	38	4.5				SPR
1981 01 16.14	9.9	A		25.0	L	5	38	4.5				SPR
1981 01 17.15	10.0	A		25.0	L	5	38	4.0				SPR
1981 01 24.13	10.3	A		25.0	L	5	38	4.5				SPR
1981 01 25.13	10.5	A		25.0	L	5	38	4.0				SPR
1981 01 27.16	10.6	A		20.0	L	10	65	4.0	3			SPR
1981 02 01.16	10.7	A		20.0	L	10	65	3.5	2			SPR
1981 02 02.15	10.8	A		25.0	L	5	38	3.5	2			SPR
1981 02 03.17	11.0	A		25.0	L	5	38	2.5	2			SPR

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RECENT NEWS CONCERNING COMETS

On February 7, Kenneth S. Russell sent a telegram to the Central Bureau for Astronomical Telegrams from his Australian post with the U.K. Schmidt Telescope Unit, describing two cometary images which had been found by Marc Hartley. The interesting point was that both objects were on the same plate taken Feb. 5 with the 1.2-m Schmidt telescope, and a confirmation plate for both object was obtained on the following night. Designated comets Hartley 1982b ($m_1 \sim 14$) and 1982c ($m_1 \sim 17$), their seemingly-parallel-like motion indicated a likely relationship between the two objects.

Subsequent observations confirmed that one of the two objects had apparently split from the other, and S. Nakano of Sumoto, Japan, suggested the identification of this "double-comet" with the long-lost P/du Toit 2, not seen since its discovery apparition some 37 years ago. A close approach to Jupiter (0.34 AU) in late 1963 and strong non-gravitational forces helped to make this comet now appear almost two months away from its predicted perihelion date (cf. IAUC 3668).

"Object" 1982b has apparently faded to magnitude 17.5 by Feb. 17, while 1982c had remained fairly constant until this date, supporting a suggestion by Zdenek Sekanina, Jet Propulsion Laboratory, that the comet split probably at its last perihelion

RECENT NEWS CONCERNING COMETS (Cont.)

return in 1976 or 1977. The geometry of this return is such that a fairly close approach to the earth (0.3 AU during March-April) will make the two objects appear to draw closer together, while in fact they will be moving further apart; neither component should get brighter than magnitude 16, however.

Periodic comet Schwassmann-Wachmann 1 underwent another outburst (perhaps more than one) in January. In Japan, Dr. M. Huruhata found the comet at photovisual magnitude 12.3 on Jan. 16.87 UT, after having not been able to detect the object on Jan. 13. Yamamoto Circular No. 1968 (1982 Jan. 22) lists A. Nakamura and K. Ichikawa as having found the comet at total visual magnitude 12.1 to 12.3 on Jan. 19.8 (coma diameter 1.2′ to 1.5′). Independent reports of discovery of this outburst were received at the Central Bureau for Astronomical Telegrams from Ed Barker of McDonald Observatory (Jan. 22, 23; magn. about 12); Alan Hale, Mt. Laguna, CA (magn. 12 on Jan. 23 and 25, diameter 1′); and from I. Ferrin, Universidad de Los Andes in Merida, Venezuela, who stated that A. Parravano, E. Guzman, and he found a fan-like coma of magn. 13.5 at 23:00 UT on Jan. 27. Charles Morris, Prospect Hill Observatory, suspected some spiral structure in P/Schwassmann-Wachmann 1 on Jan. 27.40, when he estimated total magn. 12.3 and coma diameter 1.4′ with his 25-cm reflector at 103x; he found mag. 12.5 on Jan. 29.37 and 12.8 on Feb. 2.37.

P/Swift-Gehrels 1981j is now fading after having gotten brighter than magn. 10 in December. The last observation received by press time was that by Morris on Jan. 28.01, when the object was extremely diffuse and difficult to see in his 25-cm reflector at magn. 11.5, coma dia. 3′ and degree of condensation 0.

James Morgan, in Wisconsin, and Graham Keitch, in England, have reported detecting P/Kearns-Kwee 1981h in December with magnitude estimates of 13.5-14.0.

Jim Gibson recovered P/Väisälä 1 on plates taken Dec. 7 and 18 at Palomar with the 1.2-m Schmidt telescope. Designated comet 1981l (IAUC 3654), the object was stellar in appearance and of magn. 20.5.

Gibson also made the first comet recovery of 1982, as P/Grigg-Skjellerup was designated comet 1982a after having been located as a stellar object of magn. 19 on plates taken Jan. 15 and 16. This comet should be visible in amateur telescopes in the coming months, and an ephemeris is provided below.

Comet Bowell 1980b should be visible (low in the south for northern hemisphere observers) during the next few months, brightening to total visual magnitude 9 or 10. An extended ephemeris is on page 1.

--D.W.E.G. (2/19/82)

EPHEMERIS FOR P/COMET GRIGG-SKJELLERUP (1982a) - ELEMENTS FROM MPC 6193

Date ET	R. A. (1950)	Decl.	Delta	r	Elong.	m_1
1982 04 01	$06^h 31^m.40$	$-09° 19'.9$	0.610	1.161	88°.9	12.1
1982 04 06	06 39.22	-07 21.0				
1982 04 11	06 48.59	-05 12.0	0.558	1.097	84.2	11.6
1982 04 16	06 59.57	-02 50.8				
1982 04 21	07 12.32	-00 14.5	0.502	1.045	80.3	11.2
1982 04 26	07 27.03	+02 40.0				
1982 05 01	07 43.97	+05 55.9	0.443	1.009	77.4	10.8
1982 05 06	08 03.51	+09 36.2				
1982 05 11	08 26.10	+13 42.2	0.390	0.991	76.0	10.4
1982 05 16	08 52.33	+18 11.7				
1982 05 21	09 22.83	+22 56.4	0.350	0.993	76.8	10.2
1982 05 26	09 58.06	+27 40.0				
1982 05 31	10 37.99	+31 58.9	0.335	1.015	80.6	10.2
1982 06 05	11 21.69	+35 27.7				