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The Strolling Astronomer

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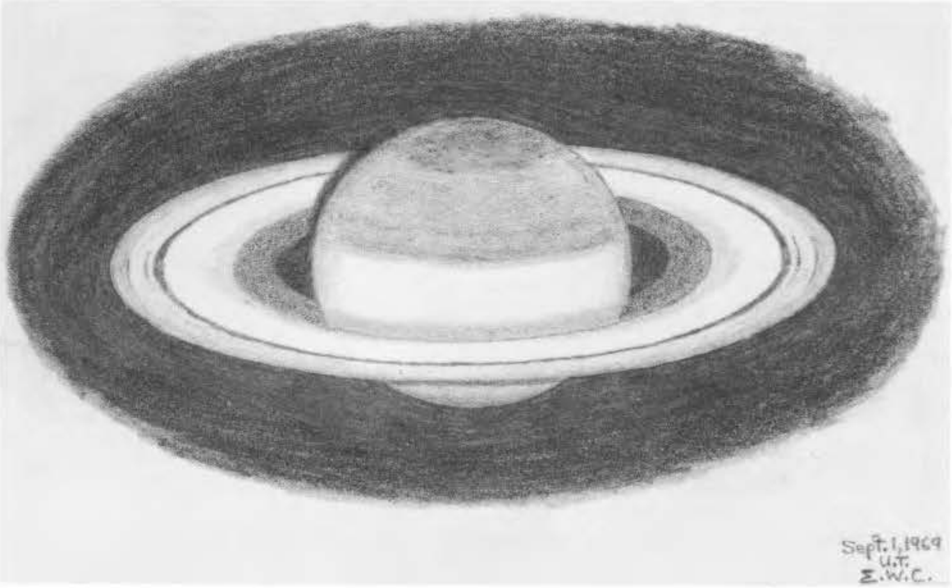

Drawing of Saturn by Eugene W. Cross, Jr. with a 6-inch reflector at 260X on September 1, 1969, 7 hrs., 52 mins., Universal Time. Seeing usually very excellent. Transparency (limiting magnitude)5½. See text on page 35. Drawing completed after leaving the telescope, using partial sketches and notes made at the telescope. South at top, west (in Earth's sky) at left.

THE STROLLING ASTRONOMER
Box 3AZ
University Park, New Mexico
88003
Residence telephone 524-2786 (Area Code 505)
in Las Cruces, New Mexico

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IN THIS ISSUE

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SPECIAL ANNOUNCEMENT

We were greatly embarrassed to discover after mailing our previous issue, Volume 23, Numbers 11-12, that a number of copies of it had missing pages. Specifically, pages 197-200 and 217-220 were omitted. We have no way of knowing how many defective copies were mailed to our subscribers, and even less way of knowing to whom. The blunder apparently resulted from an intermittent problem in the publisher's machine which does the mechanical binding of the issues.

We are anxious to correct this error. If those persons who received defective copies of Vol. 23, Nos. 11-12 will write to us, we shall be very glad to send them corrected copies at once. A reasonable number of valid copies have been prepared with the coöperation of our publisher. Please make this request now; if you wait for many months, or until you are ready to bind your volumes of our Journal, the issue in question may be out of stock.

The Editor and the publisher are very sorry for the inconvenience which our readers have been caused.

VENUS SECTION REPORT: THE EASTERN (EVENING) APPARITION OF 1966-1967

By: Dale P. Cruikshank, A.L.P.O. Venus Recorder

Introduction

The evening apparition of Venus of 1966-1967 includes the period from November 9, 1966 (Superior Conjunction) to August 30, 1967 (Inferior Conjunction). Many observers contributed drawings, photographs, and dichotomy estimates; contributors are listed below. The Recorder expresses his gratitude to those supporting the Venus Section programs and offers his apology that the Report on this apparition is so late in appearing.

Table I. Observers who Contributed to the Report of the Eastern (Evening) Apparition of Venus, 1966-1967.

Visual Observations

Kevin Krisciunas
Cristopher Edsall
Dan Louderback
Fred Lazor
Raymond Reiffer
Kurt Hughes
Michael Kohl
Raymond Rea
L. M. Carlino
Wynn Wacker
Carl F. Dillon, Jr.
Daniel H. Harris
Rodger W. Gordon
Kenneth J. Delano
William R. Winkler
Carl Anderson
Charles L. Ricker
Karl Simmons
Douglas Smith
Alan Heath
Chet Eppert
Dale Cruikshank
A. D. Mallama (reporting for Messrs. Henning and Jackson)
David Fliss
Eric Thiede
Stephen Barnhart

Photographs

Martin Senour
Alan Heath
William R. Winkler

Dichotomy Estimates

Michael Kohl
Alan Heath
Raymond Reiffer
Douglas Smith
Richard Boivin
Raymond Wear
Charles L. Ricker
Carl F. Dillon, Jr.
Raymond Rea
Richard McClowry

Markings on the Disk

Many observers responded to the Recorder's request that certain nights be given special priority for obtaining simultaneous observations from as many individuals as possible. It was also possible to examine ultraviolet photographs of Venus taken on several of those priority nights, and to make comparisons with drawings submitted by A.L.P.O. observers. The ultraviolet photographs were taken with the 61-inch reflector of the Lunar and Planetary Laboratory, mostly by Messrs. John Fountain and Stephen Larson.

Ultraviolet photographs are difficult to obtain and difficult to present in a way suitable for reproduction in a journal. The LPL photographs are normally composited; that is, several negatives taken in succession are printed together to make one high-quality image. As many as twenty individual images are sometimes used for the final composite image, which shows considerably more detail than any one included image would have shown. Composite film negatives of Venus were examined for several nights on which A.L.P.O. observers obtained drawings, and pencil sketches were made by the Recorder at the same scale for direct comparison. In the figures to follow, each ultraviolet view is accompanied by the drawings of A.L.P.O. Venus Section observers for that same date so that direct comparison can be made. Because of increase of contrast in the compositing technique, the position of the terminator in the photographic images sometimes varies in comparison to that actually seen visually through the telescope; but the limb and any dark features seen on the disk will not change their relative positions.

We now consider several sets of visual and photographic observations as reproduced in the following figures. On April 26, 1967, a good ultraviolet photograph was obtained,* as were two drawings by Messrs. Simmons and Ricker. The drawing by Mr. Ricker matches the UV appearance of Venus rather closely, while the southernmost of the dark patches seen by Mr. Simmons may well correspond to the darkest wedge-shaped marking on the UV photograph. The general agreement in this set of observations (Figures 1-3) could be considered good.

On May 4 and 5, the drawings and UV view in Figures 4, 5, and 6 were obtained. The agreement of the drawings with one another and with the UV photograph is poor.

A drawing by Mr. Simmons on May 11, 1967 shows fair agreement with a detailed UV view obtained on the same day one hour later (Figures 7 and 8). The UV photograph shows the characteristic bands extending from the terminator, as discovered by F. E. Ross in 1927.

As seen in the UV photograph of May 14, the southern hemisphere of Venus was quite dark by comparison with the north. This general appearance was well-confirmed by Reverend Delano observing with a deep blue filter (Figures 9 and 10). A nearly simultaneous drawing by Mr. Ricker (Figure 11) shows a central dark band that could be considered as the same dark band shown on the UV photograph, though there is a discrepancy in position. General agreement on this date could be considered good.

The three drawings obtained on May 16 are very diverse in character and agree only vaguely with the UV photograph (Figures 12-15). The single feature on Mr. Rea's drawing may be the largest of the dark markings on the photograph, while the general amorphous terminator shading on Mr. Simmons' drawing may correspond to the general abundance of dark features along the terminator in the UV picture.

At this point it will be of interest to look back at the UV photographic views for May 5, 11, and 16 (Figures 4, 7, and 12) because these dates correspond closely to integral values of the 4-5 day rotation period for the UV markings, as discovered by C. Boyer in France and confirmed by many other workers. One can imagine some correlation of the dark markings near the apparent equator on the May 5 and May 11 photographic views, allowing for some development or change in the size and shape of the markings over the 6-day interval. One rotation later, however, on May 16, the markings near the apparent equator are considerably different. In order to convince one's self of the actual 4-5 day rotation of the markings, one must watch the daily (or hourly) progression of features across the disk. When the same markings reappear in the same position after 4-5 days, there is usually some evidence for change in their shapes, positions, and contrast; but they are often similar enough to be identified with certainty as those features which were in the same general position one rotation period earlier.

On May 17 the most prominent feature on the UV photograph was the dark band near the center of the disk. This band was seen simultaneously by Mr. Wacker (Figures 16 and 17), while Mr. Rea on this date saw no pronounced features (Figure 18). On the next day,

*A very impressive selection of ultraviolet photographs from LPL, including those copied here, has been published in Communications of the Lunar and Planetary Laboratory, No. 102, 1968. This publication is available at moderate cost from the University of Arizona Press, Tucson, Arizona.

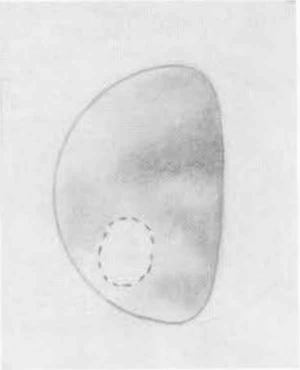


Figure 1 (above). Drawing by Dale P. Cruikshank of ultraviolet photograph of Venus on April 26, 1967 at 2^h11^m, U.T. See also text of Dr. Cruikshank's Venus Report in this issue. All illustrations of Venus in this Report are simply inverted views with south at the top.

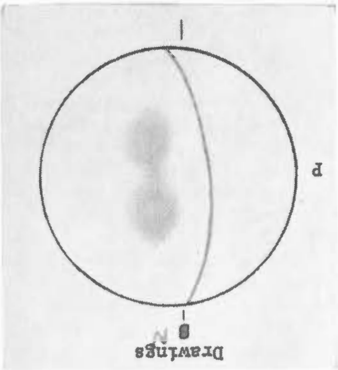


Figure 2 (above). Drawing of Venus by Karl Simmons on April 26, 1967 at 0^h45^m, U.T. 8-inch reflector, 76X. Compare to Figures 1 and 3.

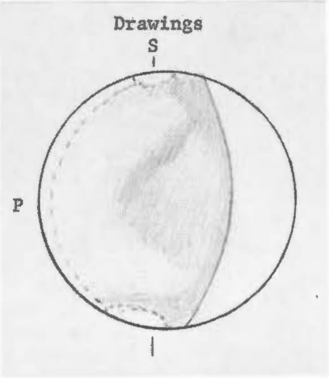


Figure 3 (left). Drawing of Venus by Charles L. Ricker on April 26, 1967 at 1^h58^m, U.T. 10-inch refl., 194X. Compare to Figures 1 and 2.

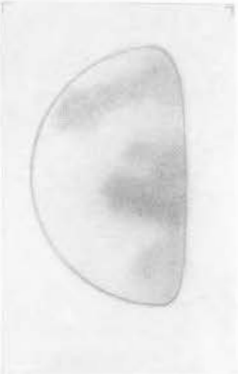


Figure 4 (left). Drawing by Dale P. Cruikshank of ultraviolet photograph of Venus on May 5, 1967 at 1^h42^m, U.T. See also text.

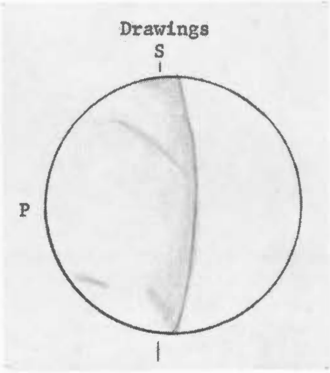


Figure 5 (above). Drawing of Venus by Wynn Wacker on May 4, 1967 at 23^h45^m, U.T. 6-inch refl., 300X.

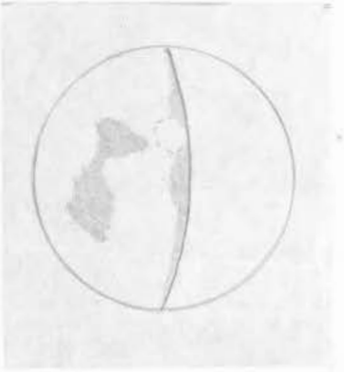


Figure 6 (above). Drawing of Venus by R. Reiffer on May 4, 1967 at 1^h15^m, U.T. 8-inch unsilvered reflector, 85X. Markings uncertain.

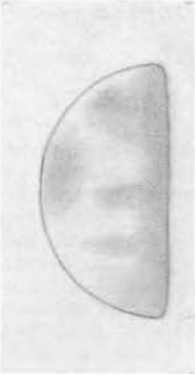


Figure 7 (left). Drawing by Dale P. Cruikshank of ultraviolet photograph of Venus on May 11, 1967 at 1^h53^m, U.T.

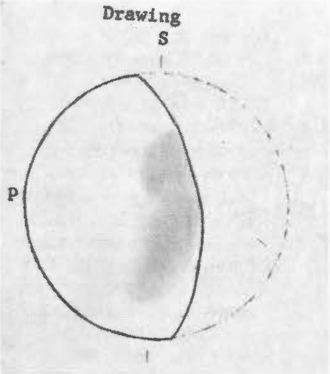


Figure 8 (left). Drawing of Venus by Karl Simmons on May 11, 1967 at 0^h55^m, U.T. 8-inch refl., 76X.

Figure 9 (left). Drawing by Dale P. Cruikshank of ultraviolet photograph of Venus on May 14, 1967 at 23^h57^m, U.T. Note dark southern hemisphere and bright spot in northern hemisphere.

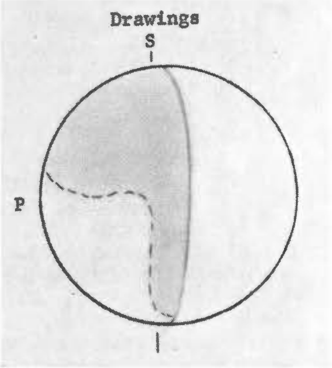


Figure 10 (left). Drawing of Venus by Kenneth J. Delano on May 14, 1967 at 0^h0^m, U. T. 12.5-inch refl., 300X, Wratten #48 blue filter. Note bright region in northern hemisphere shown in Figure 9.

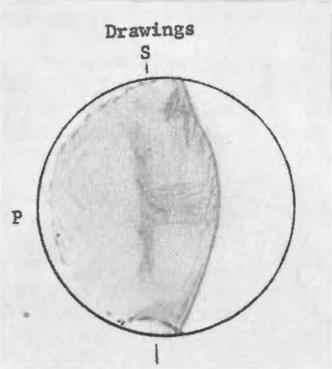


Figure 11 (left). Drawing of Venus by Charles L. Ricker on May 15, 1967 at 1^h25^m, U.T. 10-inch refl., 194X, neutral density filter.

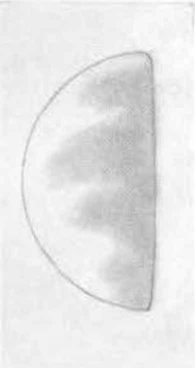


Figure 12 (left). Drawing by Dale P. Cruikshank of ultraviolet photograph of Venus on May 16, 1967 at 1^h47^m, U.T.

however, Mr. Rea recorded three bands remarkably similar to those in the UV photograph of May 17 (Figure 19). Note that Mr. Wacker's representation of Venus' markings is very stylized; it is likely that he saw the same dusky features recorded on the photograph, but he draws them with much sharper boundaries and makes them quite narrow. This general problem of variability in recording the markings makes difficult the job of comparing the results of several observers. There is the point, however, that different people <u>see</u> the markings differently; and drawing style is not the entire source of the problem.

The UV photograph of June 2 shows as its most prominent feature the dark band extending to the upper left in Figure 20. The general impression one gets from Mr. Carlino's simultaneous drawing is that he saw the same features (Figure 21). The two markings shown by Mr. Wacker (Figure 22) near the apparent poles may be the fainter markings similarly

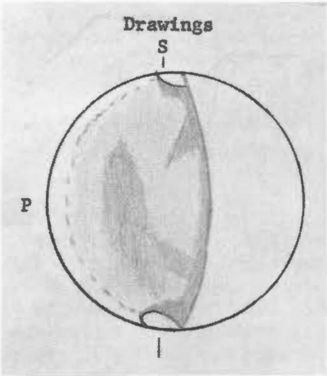


Figure 13 (left). Drawing of Venus by Charles L. Ricker on May 16, 1967 at 1^h42^m, U.T. 10-inch refl., neutral density filter. Compare to Figure 12.

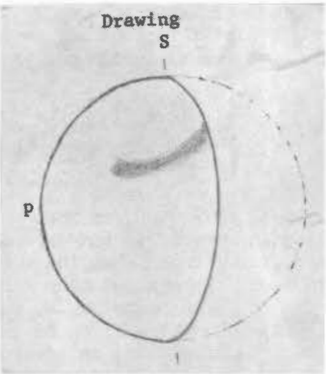


Figure 14 (left). Drawing of Venus by R. Rea on May 16, 1967 at 1^h0^m, U.T. 10-inch reflector, 300X, neutral density filter. Compare to Figure 12.

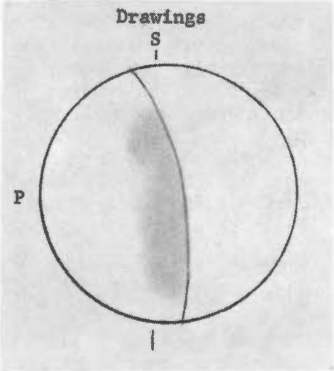


Figure 15 (left). Drawing of Venus by Karl Simmons on May 16, 1967 at 1^h 0^m, U.T. 8-inch refl., 76X. Compare to Figure 12.

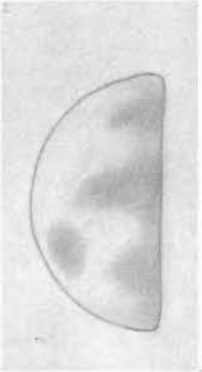
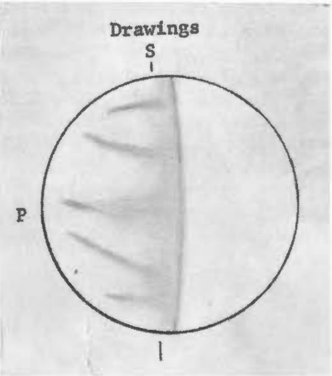


Figure 16 (left). Drawing by Dale P. Cruikshank of ultraviolet photograph of Venus on May 17, 1967 at 0^h 6^m, U.T.



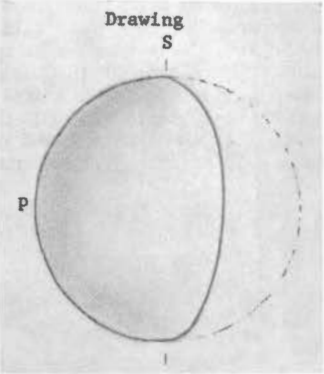


Figure 17 (above). Drawing of Venus by Wynn Wacker on May 17, 1967 at 23^h0^m, U.T. 6-inch refl., 300X.

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Figure 18 (above). Drawing of Venus by R. Rea on May 17, 1967 at 1^h0^m, U.T. 10-inch refl., 300X. Neutral density filter.

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positioned on the UV view; but the absence of the central, darker feature is puzzling. The drawing by Mr. Reiffer (Figure 24) appears to correspond in some ways to the UV view.

The UV photograph of Venus on June 13 is remarkable in that it shows some of the finest details ever reliably recorded on such photographs. The drawing by Mr. Rea generally confirms this appearance, though not in exact position of the features (Figures 25 and 26).

The drawing by Mr. Hughes on June 23 corresponds fairly well to the UV view on the same day (Figures 28 and 29), while the drawing by Mr. Krisciunas shows no obvious similarity.

In summarizing this section, we should note that the ultraviolet appearance of Venus need not necessarily correspond to what would be recorded at visible wave lengths. Perhaps we should be more surprised when there is a significant degree of correlation of visual drawings with the UV photographs than when there is not. An earlier comparison of this type by the former Venus Recorder, W. K. Hartmann, met with less favorable results than the present work. The correlation of visually observed features on Venus during the apparition of 1966-67 is impressive and encouraging in spite of wide variability in observing and drawing styles on the part of various observers.

Since at least some visual observers see the same general features on Venus which are recorded on UV photographs, we ask how most effectively to use visual observations of the planet in order to understand more of its physical nature. In France, C. Boyer is continuing his research on the recurrence of Y- and Ψ- shaped markings seen on the UV photographs and has requested of the Recorder further details on A.L.P.O. observations for his work. However, the best way in which individual observers can contribute to the study of the markings is to make <u>extended</u> <u>series</u> of observations with the closest possible time spacing of drawings (i.e., one every night) so as to follow the progressive development and rotational motion of the features in the clouds of Venus. A uniformity in drawing style and presentation is essential, and observers should keep their drawings simple and devoid of uncertain details. Readers will note the general simplicity of the UV photographic renditions compared to the elaborate and intricate drawings that some observers produce. To be sure, the eye may catch more detail than a photograph; but drawings extending over a long time and recording the principal and most certain features on the planet are likely to be the most useful in tracing the development of features in the atmosphere of Venus.

Dichotomy

Several observers participated in a special program to determine the date of half-phase, or dichotomy, with high precision. The method has been used for several years now since its original application by Alan Binder. Simply explained, the method consists of making a series of estimates of the "probability" that the phase of Venus as seen in the telescope is a crescent (less than half phase), gibbous (more than half phase), or exactly half phase (50 per cent illuminated). A numerical estimate is assigned for the "probability" of each of the three conditions, and the total of the three numbers (from zero to ten) must be ten. Experienced observers will know that when Venus is very near half phase it is often quite difficult, for reasons of bad seeing, low magnification, etc., to determine the exact phase. The series of "probability" estimates was devised for this reason. When such estimates are made for several days before dichotomy and for several days after, we can plot the numerical estimates and get not only a better determination of the exact date of true observed half phase than would result from most other methods, but a helpful numerical estimate of the error of our determination as well.

Figure 31 shows a graph made from the phase probability estimates of Carl Dillon, Jr., who used a 6-inch telescope at 150X, always observing with no filter and in a light sky.

The range in dates of dichotomy determined in this way for the ten participating observers varied widely, as shown in Table II.

Table II. Dichotomy Observations (U.T.)

Dillon 1967,	June 7.0	(+8.1, -3.6 days)
Ricker	June 10.6	(+5.3, -2.6 days)
Heath	June 16.6	(+3.6, -5.4 days)
Reiffer	June 4.0	(+2.9, -1.8 days)
Rea	June 12.3	(+2.4, -6.8 days)
Smith	June 4.0	(+9.9, -17.3 days)
Kohl	June 7.0	(+10.2, -8.2 days)

(Table continues on page 9.)

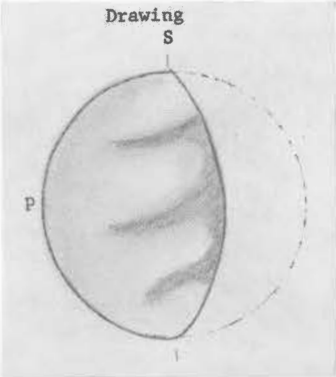


Figure 19 (left). Drawing of Venus by R. Rea on May 18, 1967 at 1^h0^m, U.T. 10-inch refl., 300X. Neutral density filter. Note similarity to Figure 16, an ultraviolet photograph taken 25 hours earlier.

Figure 20 (left). Drawing by Dale P. Cruikshank of ultraviolet photograph of Venus on June 2, 1967 at $2^h 41^m$, U.T.

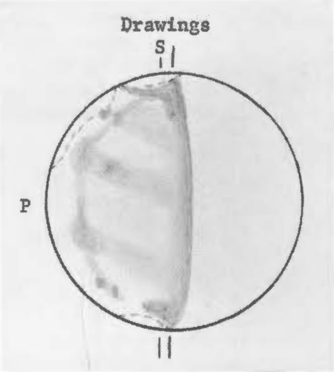


Figure 21 (left). Drawing of Venus by L. M. Carlino on June 2, 1967 at 0^h5^m, U.T. 6-inch refl., 180X.

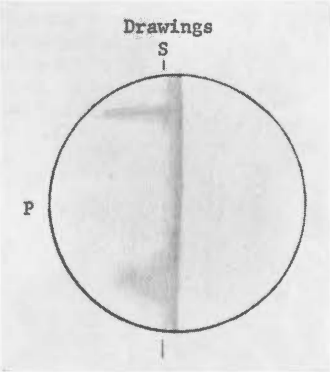
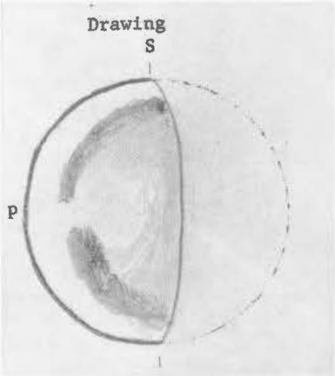


Figure 22 (left). Drawing of Venus by Wynn Wacker on June 1, 1967 at 23^h15^m, U. T. 6-inch refl., 300X.



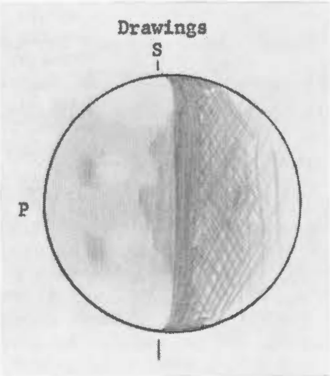


Figure 23 (above). Drawing of Venus by R. Rea on June 2, 1967 at 1^h0^m, U.T. 10-inch refl., 300X. Neutral density filter.

Figure 24 (above). Drawing of Venus by R. Reiffer on June 2, 1967 at 1^h56^m, U.T. 8-inch refl., 85X.

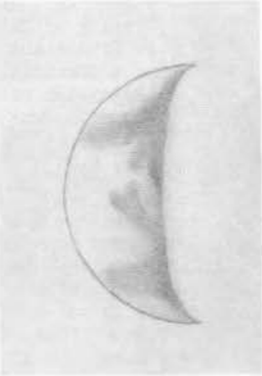


Figure 25 (left). Drawing by Dale P. Cruikshank of ultraviolet photograph of Venus on June 13, 1967 at 2^h 0^m, U.T.

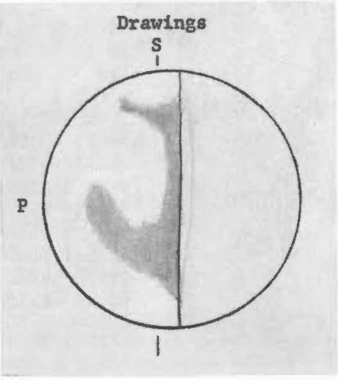


Figure 26 (left). Drawing of Venus by R. Rea on June 13, 1967 at 1^h0^m, U.T. 10-inch refl., neutral density 0.6 filter.

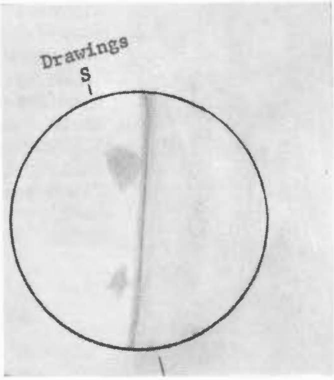


Figure 27 (left). Drawing of Venus by M. Kohl on June 13, 1967 at 1^h50^m, U.T. 6-inch refl., 384X.

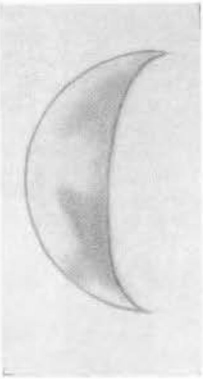


Figure 28 (left). Drawing by Dale P. Cruikshank of ultraviolet photograph of Venus on June 23, 1967 at 2^h 0^m, U.T.

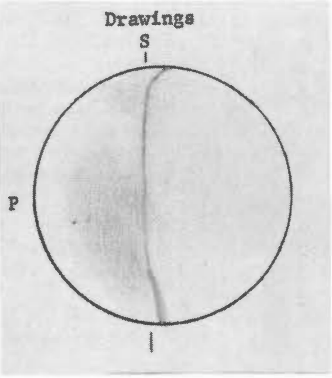


Figure 29 (left). Drawing of Venus by K. Hughes on June 23, 1967 at 4^h0^m, U.T. 4.25-inch refl., 123X. Various color filters.

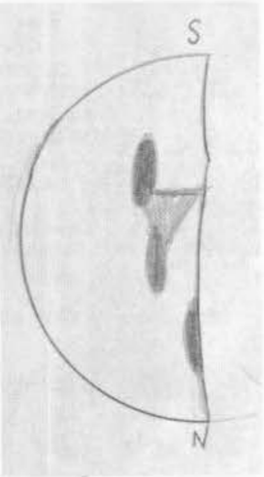


Figure 30 (left). Drawing of Venus by Kevin Krisciunas on June 23, 1967 at 3^h 0^m, U.T. 6-inch refl., 138X.

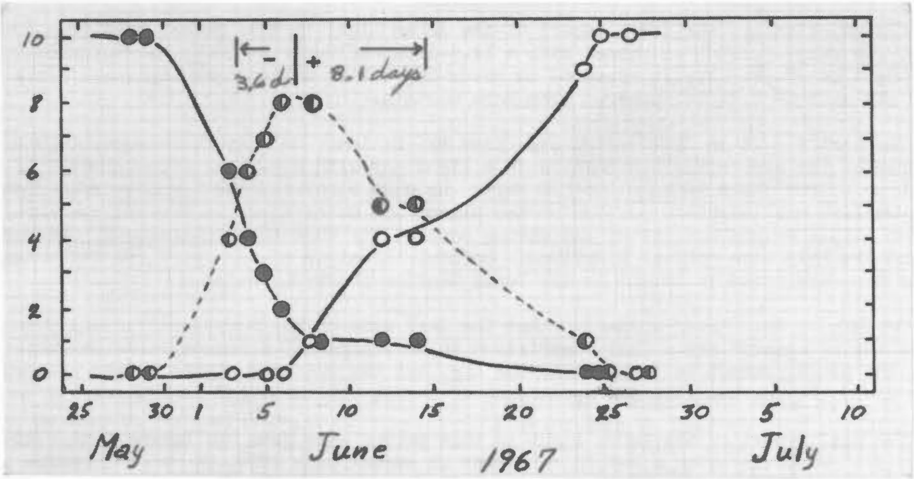


Figure 31. Dichotomy estimates by Carl F. Dillon, Jr. in 1967. The "probability" of the phase is given on the vertical axis and the date on the horizontal. Open circles denote crescent phase, half-filled circles dichotomy, and solid circles gibbous phase. The date of dichotomy is taken as the day on which the dichotomy curve reaches its peak, and the estimated plus and minus errors are reckoned from the points where the dichotomy curve intersects the other two curves.

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Table II. (cont.)

Boivin 1967,	[June 13]
Wear	[June 8]
McClowry	[June 10-11]

The estimates of Messrs. Boivin, Wear, and McClowry were reported in such a way as to make estimates of their errors difficult. The average of the estimates above is June 9.3 (+5.7, -5.5 days) where the plus and minus values indicate the estimated error in the determined date of dichotomy. This large error bracket is somewhat larger than that determined in previous years for some unknown reason. The predicted date of half phase (from The American Ephemeris and Nautical Almanac) is June 20.0, 1967, U.T., making the magnitude of the "Schroeter effect", or discrepancy in the observed date of dichotomy, 10.7 days, which is rather large.

An examination of Figure 31 will clarify how the plus and minus error estimates given in Table II were obtained.

Illumination of the Dark Side and Venus' Appearance at Inferior Conjunction

In addition to the apparent high degree of cloud activity on Venus during this apparition, there were also many reports of the illumination of the planet's dark side (Ashen Light). The Ashen Light has been reported off and on by visual observers for centuries. It is relatively easy to discount these reports when one considers how bright the unilluminated hemisphere of Venus would have to be in order to be visible against the glare of the brilliant crescent and against the daytime sky near the Sun on which it is normally observed. Some years back, however, N. A. Kozyrev in the USSR obtained spectroscopic evidence of emission on the night side of Venus. Gordon Newkirk in the USA also found some evidence of emission, but T. C. Owen has looked with no success. The Recorder is unwilling to discount visual observations of the Ashen Light, even though they are hard to explain, because he has also seen it. When he was observing with W. K. Hartmann in November, 1962, only two hours from Inferior Conjunction, the Ashen Light was clearly visible to both observers, who remarked on it independently. The faint halo caused by reflection in the high atmosphere of Venus could be seen surrounding the entire planet, and the dark side was glowing a faint yellow as seen against the blue background sky. In this section of the present Report we first consider reports of the Ashen Light in the period from July 18, 1967 through Inferior Conjunction (August 29 at $22^{h}0^{m}$ U.T., 1967) and up to September 5, 1967.

Chronologically, the first report of the Ashen Light in this period came from Rev. Delano. On July 18, 1967 at sunset with a 12.5-inch reflector at 300X, he suspected the Ashen Light at 0^h15^m U.T. It appeared to cover the entire darkened hemisphere. In a darker sky at 1^h0^m U.T. it appeared even more certain.

The next report in this period came from Mr. Dillon. On July 22 at about 1^h0^m U.T. he suspected the dark side illumination in a light sky with a 6-inch reflector at 150X using a blue filter (fair seeing, haze in sky). He also suspected the complete halo around the (normally) unilluminated portion of the planet but noted that the observation should be given little weight because of the strong possibility that the appearance of the dark side and the halo were optical illusions. Optical illusions of this kind are not uncommon, as has been noted in detail in the Venus Section observing notes.

On July 24 Mr. Hughes suspected that the dark side of Venus appeared actually darker than the background sky. This observation is an example of a common illusion--physically, the planet cannot be darker than the sky, but the presence of the bright crescent in the field of view can give the appearance of a dark unilluminated hemisphere.

The next report of the Ashen Light in this period came from Mr. Barnhart at 1^h13^m UT on July 30. Observing with a 6-inch reflector at sunset with 180X, he saw both cusps extended and estimated the intensity of the dark side as 3-4 (dark to dusky). See Figure 35. Mr. Barnhart emphasized that the illumination was faint and was not immediately noticeable. It appeared brighter as the sky darkened. One day later, Mr. Lazor, using several filters, did not see the dark side with a 2.4-inch refractor; but on August 2 at about 0 hrs., U.T., Mr. Fliss noted the dark side with a 10-inch reflector in daylight at 150X. He also saw much of the reflection halo on the periphery of the dark side. About 24 hours later Mr. Wacker, observing in daylight with a 6-inch reflector at 300X, did not see the dark side. The next report came on August 10 at 3^h5^m U.T. from Mr. Hughes, who suspected the illumination of the dark side. There were several negative reports by Messrs. Simmons and Hughes between August 15 and 25.

Observing on August 29 and 30, Mr. Anderson noted the illumination of the dark side when using a red filter. It was not seen in blue, green, or yellow filters (except that it was faintly visible on August 30 in the green). Mr. Anderson was especially careful to move Venus around in the field of view to help insure against optical illusions. He found the dark side visible in all positions in the eyepiece. He writes "... unlit portion appears mottled all over with generally darker mottling near sunlit rim and generally lighter on side away. Amorphous mottling was definite since no similar appearance was seen off of the disc and the mottling could be moved around with the planet using the telescope slow motions." This observation was on August 29, 14^h50^m UT, 10-inch reflector, 105-210X, red filter, seeing 4, transparency very good. His remarks for the August 30 appearance at 15^h0^m U.T. are similar. Mr. Anderson's observation closely resembles that of Hartmann and the Recorder noted earlier in that they were both made within some hours of Inferior Conjunction.

A few days later, on September 4 at 14^h15^m UT, Mr. Anderson was unable to detect the dark side illumination in slightly worse seeing, though he looked very carefully for it.

During this same period, Messrs. Wacker and Thiede were making frequent observations with the $15\frac{1}{2}$-inch refractor at Washburn Observatory (University of Wisconsin) in Madison. Their results are reported below, but here it should be noted that they did not report the anomalous illumination of the dark side. They observed with and without a yellow filter.*

In spite of the lack of confirmation by Messrs. Wacker and Thiede, we are forced to conclude that Mr. Anderson's observations are not illusions; there was at least one period at Inferior Conjunction in 1967 when the unilluminated hemisphere was visible. Judging from the fact that the unlit hemisphere was apparent only with a red filter, the predominant color was toward the red end of the spectrum, strongly suggesting that the light was more than just sunlight reflected in the Venusian high atmosphere.

The reports of Messrs. Barnhart and Fliss were made somewhat before Inferior Conjunction when the illuminated crescent was rather bright. Still, we are compelled to accept these observations as reports of actual illumination of the dark side, for whatever

*Yellow filters are frequently useful with large refractors to reduce the blue light which is normally out of focus for objective lenses corrected for visual light.

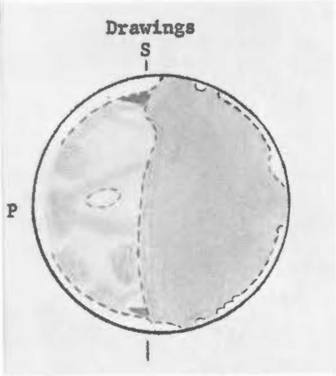

Figure 32. Drawing of Venus by D. M. Fliss on July 7, 1967 at 1^h0^m, U.T. 10-inch refl., 150X. Note cusp extension. Compare to Figures 33 and 34, and see text of Venus Report in this issue.

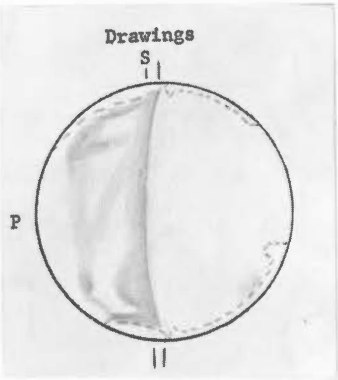

Figure 33. Drawing of Venus by L. M. Carlino on July 7, 1967 at 0^h55^m, U.T. 10-inch refl., 150X. Note cusp extension. Compare to Figures 32 and 34, and see text of Dr. Cruikshank's Venus Report.

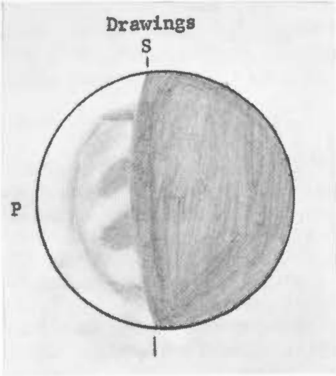

Figure 34. Drawing of Venus by Carl F. Dillon, Jr. on July 7, 1967 at 0^h30^m, U.T. 6-inch refl., 150X. Red filter. Compare to Figures 32 and 33, and see text.

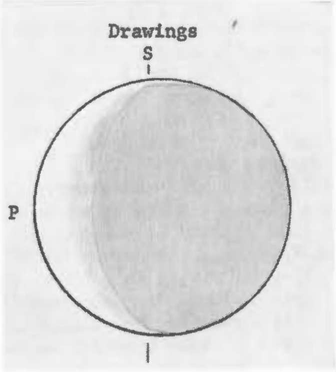

Figure 35. Drawing of Venus by S. Barnhart on July 30, 1967 at 1^h13^m, U.T. 6-inch refl., 180X. Note extended cusps and faint illumination of dark hemisphere. See also text of Venus Report.

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physical reason that this illumination can exist.

So far in this section we have made several references to the halo seen near Inferior Conjunction around the dark side of Venus. This pecurliarity of Venus' appearance results from diffuse reflection of sunlight from particles in the upper atmosphere of the planet, as shown by H. N. Russell at the end of the last century. The halo has been seen and has been photographed, and there is no uncertainty as to its reality. As Venus approaches Inferior Conjunction, the observer sees the two cusps elongate more and more until within a few days of Inferior Conjunction the halo becomes a complete ring around Venus. Russell, and later Edson, showed that the height of the reflecting layer (above the more "solid" cloud deck on the planet) can be calculated from measurements of the angular extension of the cusps at given values of the phase angle $\underline{i}$ (phase angle is the angle between the Earth and the Sun as seen from Venus). Normally, the cusps are noticeably extended only at phase angles between about 155° and 180°*; but there have been re-

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*Phase angle 180° corresponds to Inferior Conjunction in an ideal case—when Venus transits the Sun's disk—but since the orbit of Venus is inclined 3°24' relative to the Earth's orbit plane, Inferior Conjunctions commonly occur at $i = 175°$ or thereabouts.

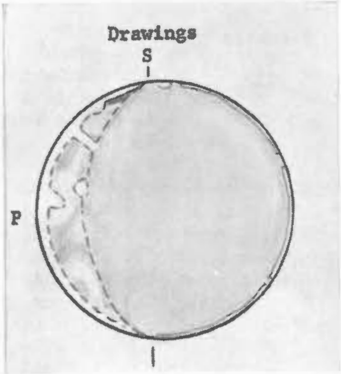

Figure 36. Drawing of Venus by L. M. Carlino on August 2, 1967 at 0^h, U.T. 10-inch refl., 150X. Note cusp extension and complete halo around dark side of planet. Compare to Figure 37, and see text.

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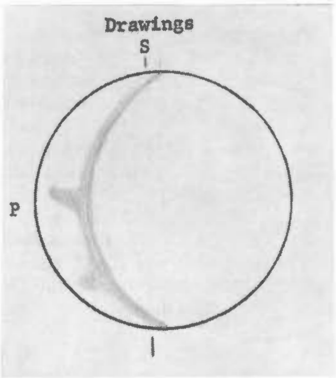

Figure 37. Drawing of Venus by Wynn Wacker on August 2, 1967 at 23^h, U.T. 6-inch refl., 300X. Dark side illumination not detected. Compare to Figure 36, and see text.

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liable reports of the appearance of the complete halo at much smaller phase angles, when the crescent is still large. These observations are very difficult to understand as reflection of sunlight in the Venusian atmosphere and may in fact be related to some other phenomenon, such as fluorescence induced by solar flares.

The first report of the nearly complete halo was from Mr. Fliss on June 20, 1967. He and Mr. Carlino observed with a 10-inch reflector at 150X in good seeing. Mr. Carlino could not detect the halo and remarked that Mr. Fliss was uncertain of its presence. At this time the planet was nearly at half phase. Mr. Kohl suspected an anomalous appearance of the dark side on July 4, but did not provide any details of his observation. On July 7, 1967, Mr. Fliss again observed portions of the halo around the dark side with the 10-inch in fairly good seeing in a light sky. This time, Mr. Carlino (observing simultaneously) also detected the ring and considered it 8 on the conspicuousness scale (0-10, with 10 the most conspicuous). Mr. Fliss' drawing for this date is reproduced in Figure 32. Readers are asked to note the obvious care with which Mr. Fliss made his drawing. The simultaneous drawing by Mr. Carlino is given for comparison (Figure 33). Note, however, that Mr. Dillon, observing from a different location, did not see the halo (Figure 34). The degree of correlation among the three drawings (Dillon, Fliss, and Carlino) is rather good.

On August 2 around 0 hrs., U.T., Mr. Fliss again observed the complete halo with certainty, though seeing was only fair. Observing 23 hours later, Mr. Wacker did not see the halo (Figures 36 and 37). Mr. Hughes noted that the cusps were extended about 45° on August 10. His several observations of this phenomenon are summarized in Table III. Messrs. Wacker and Thiede made a long series of observations throughout the Inferior Conjunction period in order to watch the progression of the halo. Their observations are also summarized in Table III.

Table III was made to help us estimate the height of the reflecting layer in the Venus clouds from ALPO observations in the period of this Report. Figure 38 shows the amount of cusp extension to be expected for three different values of the reflecting layer height above the "solid" surface. The curves were calculated from Russell's equations, and are good only to first order, but are illustrative of one way in which physical interpretations of visual observations can be made.

The height of the "Russell layer" in kilometers is given in the right-hand columns of Table III in accordance with the amount of cusp extension for that date, as estimated from the curves in Figure 38. On those dates when no value of h_R is given the cusp extension was so large as to preclude its origin by reflection in the upper atmospheric layers. It is in these cases, if we can rely on the reality of the observed effect, that the origin of the illumination of the upper atmosphere of Venus probably occurs by fluorescence or some other poorly understood phenomenon. The long series from August 28 to September 2.8 is of considerable interest because of the general uniformity of the estimated h_R. Much of the uniformity is a result of the fact that three observers made all the estimates, thus narrowing the range of differences of estimating techniques and observer errors.

Table III.

Observations of Venus' Cusp Extensions, 1967.

Observer	Date	Cusp Extension		i	h_R (kms.)	
	(1967)	South	North		South	North
Hughes	July 24.1	20°	0°	117°.7	—	—
Barnhart	July 29.1	20	10	123.4	—	—
Fliss	Aug. 2.0	90	90	128.3	—	—
Hughes	Aug. 10.1	40	40	140.0	—	—
Hughes	Aug. 16.0	10	40	149.6	—	—
Hughes	Aug. 16.9	20	80	151.1	>10	—
Hughes	Aug. 18.0	25	90	153.0	>10	—
Hughes	Aug. 19.9	30	90	156.2	>10	—
Simmons	Aug. 20.7	10	10	157.8	4	4
Simmons	Aug. 24.8	20	20	164.0	6	6
Wacker	Aug. 24.8	-few degrees-		164.0	—	—
Thiede	Aug. 24.8	0	0	164.0	—	—
Wacker	Aug. 25.8	5-10	5-10	165.2	1	1
Thiede	Aug. 25.8	0	0	165.2	—	—
Hughes	Aug. 26.0	35	45	165.4	>10	>10
Wacker	Aug. 28.8	25	25	167.7	7	7
Thiede	Aug. 28.8	25	25	167.7	7	7
Anderson*	Aug. 29.6	15	15	167.7	2	2
Anderson	Aug. 30.6	10+	10+	167.6	1	1
Thiede	Aug. 30.7	17	17	167.5	3	3
Wacker	Aug. 30.8	20	20	167.4	4	4
Wacker	Aug. 31.7	14	14	167.1	2	2
Thiede	Aug. 31.7	15	15	167.1	2	2
Wacker	Sept. 1.7	8	8	166.9	1	1
Thiede	Sept. 1.7	11	11	166.9	2	2
Wacker	Sept. 2.8	<5	<5	165.0	<1	<1
Thiede	Sept. 2.8	0	0	165.0	—	—
Anderson	Sept. 4.6	30	30	162.5	10	10

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*red filter used

To summarize this section, we note that sporadic observations of large cusp extensions or of the complete halo around the dark side of Venus suggest some mechanism for the illumination of the upper atmosphere besides the reflection frequently observed at or near Inferior Conjunction. Here is an area of study where individual observers who make long series of observations before, during, and after Inferior Conjunction, can make an important contribution to the study of Venus' atmosphere.

Summary

This 1966-67 apparition of Venus was widely observed and reported upon by A.L.P.O. Venus Section members. The planet appeared unusually active in that the number of persistent dark markings was large, the extended cusps and "halo" presented an interesting show, and the Ashen Light was recorded by several observers. The Recorder again expresses his gratitude to those observers who contributed their work, thus making the preparation of this Report possible.

Postscript by Editor. There is a tremendous scatter in the values of h_R corresponding to the observations in Table III; and thre is even a tendency to obtain smaller values of h_R when i is largest, presumably because less of the extended cusps can be detected on a brighter sky background nearer the Sun. The observable portion of the cusp extensions must vary with such parameters as telescope aperture, magnification, the transparency of

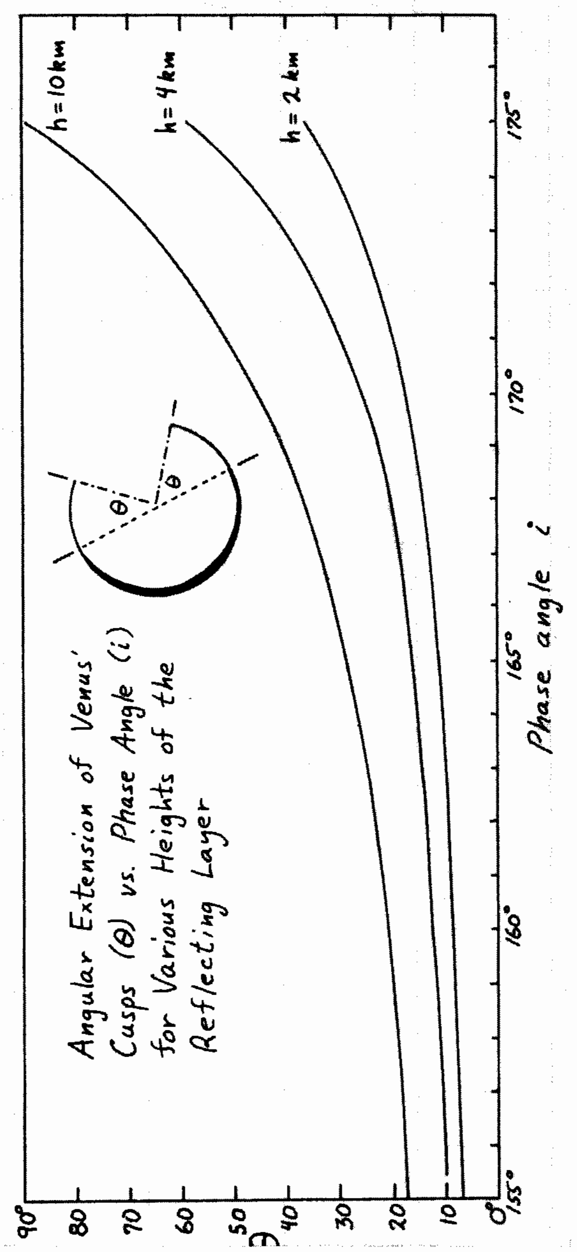

Figure 38. This graph shows the angular cusp extension to be expected for various values of the phase angle i for three different heights of the reflecting layer in the atmosphere of Venus according to Russell's formula. The inset sketch shows how θ is measured. Here Venus is a very thin crescent with cusps extended beyond the geometric "line of cusps" (dashed line), which intersects the apparent center of the disk of the planet. See also text of Venus Report.

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the atmosphere, seeing, and the angular elongation of Venus from the Sun. Perhaps future observers of the Venusian cusp extensions can be more aware of these effects, and data similar to Table III but more extensive can allow better interpretations of the physics of the atmosphere of Venus.

A COMET PHOTOMETER FOR THE AMATEUR

By: R. B. Minton,
A.L.P.O. Comets Section

It is unfortunate that observing the brightness of comets is not so popular among amateurs as observing the brightness of variable stars. No doubt the scarcity of brighter comets dampens one's enthusiasm. A variable star observer soon becomes proficient in his magnitude determinations and also becomes aware of some sources of his errors through comparison of data with other amateurs. The comet observer is handicapped by: (1) less ideal observing conditions, (2) varied form of comets, (3) an apparent instrumental dependency, (4) limitations in equating the magnitude of an extended object to a point source, (5) lack of nearby comparison stars, as in AAVSO charts, and (6) difficulty in comparing results for the above reasons.

A photoelectric photometer increases the accuracy of magnitude measures over those determined visually by a factor of 5 to 10. Magnitude measures to ± 0.02 magnitude (maximum deviation) for a 5th magnitude comet have been obtained with a 6" aperture reflector. Coma diameter measures can be made to a comet/sky intensity ratio of 10 to 1%, depending on the amount of sky fluctuations. One can also measure the surface brightness along the tail, scan sunward in search of an antitail, and perhaps record shells and other features below the contrast threshold of the eye. A comet is usually an extended object, and it is possible to look for short term (10 to 60 secs.) intensity fluctuations that might otherwise be masked by scintillation. It may be possible to determine the rotation period for the nucleus from many accurate observations over one or more nights. With an appropriate set of UBV filters, the photometer is useful for variable star measures as well.

A 6" reflector, photometer box, and tube amplifier were finished by the writer in mid-1969. Recently, the vacuum tube amplifier was replaced with a solid-state version. Adequate literature exists describing the proper design of the optical train and the P-M tube housing, but I reëmphasize some critical factors not obvious at the time of construction: (1) construct a -1000 VDC (HV supply) shield around the tube to reduce stray charges on the tube surface, (2) include at least 2 inches of thermal insulation in the cold box to reduce temperature variations, and (3) cool the tube with dry ice to maintain a constant temperature (thus dark current) and to reduce both the DC and AC components of dark current by a factor of about 100.

Amplifier #1 (A1) is a Zeltex FET linear operational amplifier (op amp) and did cost about $50 in 1965. See Figure 40. A chopper-stablized FET op amp would appear to be an unnecessary and costly luxury since very long term stability is not required. A cheaper and perhaps equal substitute would be a $10 to $15 price class FET op amp such as the very recent (1972) Teledyne Philbrick 1026. The 1026 characteristics are: (1) 10^{12} ohms input impedance, (2) open loop gain of $\frac{1}{2}$ million, (3) 20 pA bias current, (4) 50 microvolts/°C voltage offset drift, and (5) a separate trim lead. A separate input trim lead on A1 is very desirable for obtaining zero output with zero input. It is unwise to balance A1 with a bias battery on the input lead since most of the input signal will go through the battery to ground. The 20K potentiometer (pot) on A1 is for coarse balance, and the 100 ohm pot is for fine balance. The value of R3 should equal the most often used value of R1 to minimize the internal bias drift of A1. A2 is a very inexpensive (less than $1) 741 op amp used to provide additional gain and buffer the A1 from effects of a varying load. The 741 op amp has internal frequency compensation, but a 100 pf condenser and 1.5K resistor on pins 1 and 8 will help prevent it from oscillating. The ± 18 VDC power supply works very well although there is a small amount of 120 Hz ripple, and it lacks regulation (except for the Zener diode). The 1,000 mf condenser on this power supply should be discharged before removing an op amp from circuit or when working in the amplifier section. The 0 to -1150 VDC supply is likewise unregulated and has some ripple, but is perfectly adequate. A condenser discharge switch on the -1150 VDC supply allows the amplifier to be balanced with the 1P21 in circuit under conditions of no voltage or light. Leakage between pins in the P-M tube socket may be measured by applying high voltage with the P-M tube removed. No output current bleed is provided for either power supply since this would increase the output ripple. It is wise to spray the amplifier section and RC switches with oil-free trichloroethylene to reduce minute surface leakage currents. Amplifier warm up time is about 5 seconds, but the 1P21 takes about 30 minutes to reach equilibrium temperature with the dry-ice supply. There is negligible amplifier drift within a 30 minute period once it is cooled, and there is sufficient gain to drive a 0 to 1 ma chart recorder to a steady full scale with the dark current from a dry-ice cold 1P21. Easily measurable deflections are obtained for stars invisible through the eyepiece of a 6" reflector (thus also any other aperture). In regards to preserving observational data, a chart recorder tracing is better than a set of meter readings. With a tracing, a record is obtained for every moment of observation, thus allowing more accurate interpretation; and the observer is freed to attend to other duties. I encourage the builder to spend his time and money in perfecting the electronics rather than in building a larger telescope.

The port is a shutter iris, and the corresponding fields for my 6" vary from 2 to 20 arc minutes in diameter. Correct focus is determined with a viewing eyepiece behind the port, or by the slope of the signal strength change when a star moves across the edge of the port. A rapid change indicates good focus. Use a moderately bright star and a very short time constant on the amplifier. Vignetting is revealed by a progressive loss of signal as a star nears the port edge. Correct this error by centering the suspect optical element or by making it larger. A 1:1 scale ray trace drawing made before assembly is advisable. If vignetting cannot be corrected, use field diameters below the onset of vignetting. Field diameter can be determined by trailing an equatorial star through the center of the port from edge to edge. For bright comets, supplementary smaller ports can be added as long as consistent with sufficient signal. To measure the coma diameter, one trails the comet slowly through the smallest possible port that yields a relatively steady sky signal. A frequency inverter operating at 45 or 75 Hz on the RA drive allows a longer time constant (thus a lower limiting magnitude) on the amplifier—a 1 minute scan duration is fine. If the sky is clear, the sky intensity contribution is usually uniform over a 10 arc minute field, but the sky brightness changes by about 1 magnitude per 5 minutes of time from sunset to the end of twilight. Therefore, measurement during twilight is not advisable; but if attempted, one must measure the sky contribution as often as possible. A formula for calculating the coma diameter is: coma diameter = [(rate of drift X duration of drift) - port diameter] X cosine declination. A N-S scan would give a more accurate value if there was an E-W tail. Once the diameter is known, the port is opened to this value; and the total magnitude is measured (if the comet is spherical). Make a sketch of the areas measured and scanned. In reporting data, include the field diameter used for each observation as well as the filter and P-M tube. For magnitude determinaations, use at least 3 comparison stars. The steps are: (1) comet + sky, (2) sky, (3) star + sky. Measure dark current as often as necessary—frequently if large in value, less often if small. Subtract the sky + dark current value from both the comet and star, and convert the ratio of the comet/star brightness to a magnitude.

My 1P21 is filtered with a Kodak Wratten 64 filter instead of the Corning 3384 (now 3-70), Schott GG-11, or GG-14, which are often used as visual filters. The S-4 response curve crossed with the W64 filter transmission curve gives a response which closely matches the spectral sensitivity of the dark-adapted eye. Hopefully, this fact will allow comparison with simultaneous visual observations—at least for one observer at one aperture. This was the only criterion in choosing the W64; it is not meant to match any existing visual system. However, measures of a few stars of varied color yield magnitudes that are within 0.1 magnitude of the visual magnitude listed in the Arizona-Tonantzintla Catalog. Below 6th magnitude the SAO Star Catalog lists m_v to about 9.5, and is most available to the amateur. I am investigating the possibility of using a few of the large selection of inexpensive interference filters available from Meshna, Lynn, Mass. There appear to be 6 filters suitable for the determination of CN, C_2, Na+, CO+, C_3, and the continuum contribution. The use of interference filters in scanning a comet would provide an intensity profile for that particular ion, molecule, or reflecting particle. Their use would be restricted to that of determining intensity profiles, with magnitude determinations being made with broad-band filters. Absolute intensity measures are only as good as the known magnitudes of comparison stars. Coöperation and standardization among participants is a necessity in order to provide more meaningful measurements and reduce confusion and should be initiated in the near future.

The bibliography at the end is not comprehensive but will get one off to a good start. The publication National Linear Applications Handbook is very informative about op amps. It also contains information about reducing printed-circuit (PC) board leakage currents. A similar manual is published by Teledyne Philbrick, Allied Drive at Route 128, Dedham, Mass. 02026. Astronomical Photoelectric Photometry contains a comprehensive number of references at the end of each chapter. A description of a system in use by some members of the Photoelectric Division of the AAVSO is available for a small charge (about $1) from John J. Ruiz, Photoelectric Division, AAVSO, 187 Concord Ave., Cambridge, Mass. 02138. This source contains updated information originally published by Gerald Kron in Amateur Telescope Making - 3.

This paper is an attempt to bring into the hands of the amateur a powerful tool—the photoelectric photometer. Using near state-of-the-art op amps, such a photometer can be built for $50 to $100, depending greatly on one's ability to scrounge parts. Photoelectric measures of comets are scarce compared to visual estimates. Here is a waiting opportunity for the amateur as well as the professional.

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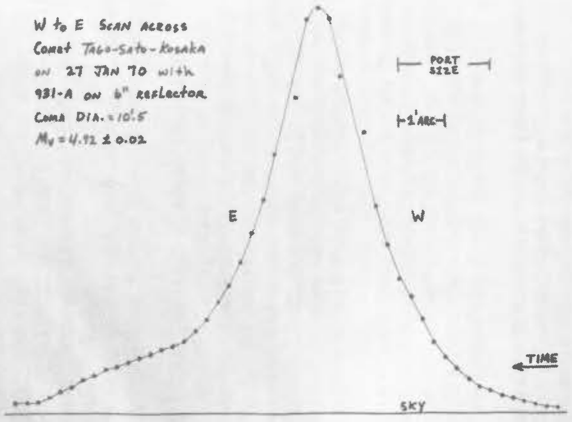

Figure 39. (right) The author used a dry-ice cold 931-A and the vacuum tube amplifier for this observation of Comet Tago-Sato-Kosaka (1969g). With the 1P21 and new solid-state amplifier described in this article, a 10 arc sec. port could probably be used for scanning.

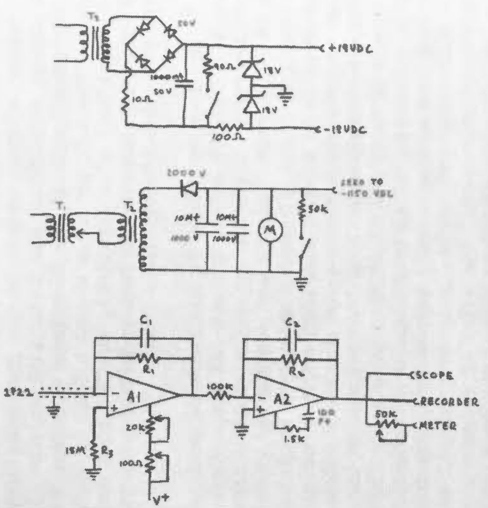

Figure 40. (below-right) The schematics for the ± 18 VDC and 0 to -1150 VDC power supplies and solid-state amplifier are shown. A table of circuit values not drawn is at right.

T1	Autotransformer,0-135VAC
T2	115-350 VAC
T3	115-24 VAC
M	meter,0-200 VDC + multiplier*
A1	Zeltex FET op amp
A2	741 op amp

*value depends on internal resistance of meter

R1	C1	R2	C2
100 K	none	100 K	none
330 K	390 mmf	200 K	0.01 mf
1 M	0.001 mf	500 K	0.1 mf
3.3 M	0.01 mf	1 M	1 mf
10 M		2 M	
33 M		5 M	

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Postscript by Editor. We thank Mr. Minton for his contributed article and invite qualified and interested readers to pursue the project he has described with so many practical details and helpful suggestions. His address is Lunar and Planetary Laboratory, University of Arizona, Tucson, Arizona 85721.

LUNAR NOTES

By: Winifred Sawtell Cameron, Kenneth J. Delano, and John E. Westfall,
A.L.P.O. Lunar Recorders

LTP Program Status

(Winifred Sawtell Cameron, NSSDC GSFC, Greenbelt, Md. 20071 Code 601)

The Lunar Transient Phenomena (LTP) program in the Association of Lunar and Planetary Observers (ALPO) was announced in The Strolling Astronomer, 23 (3-4) in August of last year. The objectives, suggested procedures, and appeals for interested observers appeared in The Strolling Astronomer, 23 (9-10), in June of this year. Thus there has been little time for response to the appeal for observers. Despite the short time since the program was organized, the response has been gratifying.

Some of the aims of the program are: (1) quantification of "seeing" conditions, (2) quantification of some of the parameters of normal aspects of lunar features, e.g. apparent and true albedo, (3) inclusion of "normal" comparison features, (4) submission of negative as well as positive observations, and (5) use of these quantitites in analysis of the data for establishing the possibility of influence by external causes.

Previous analyses of almost 800 reports (Cameron, 1972) did not reveal decisive results for origins from external causes for LTP, e.g., tidal influences. This effect (reported by Burley and Middlehurst, 1966) was found to have diminished as the number of observations used increased; in fact, the observed number very nearly approached the expected number of observations if the phenomena were to have occurred at random. Actually, the strongest correlation was found with sunrise on the feature. Phenomena, however, were reported for all ages of the Moon from zero days (New Moon) to 28 days (1.5 days before New Moon). The data probably showed a bias in observational selection toward the waxing phases (first half of a lunation), but the bias does not completely account for the sunrise correlation. Another objective of the present program is to reduce, and hopefully to eliminate, this observational bias.

It has been my policy to assign features to each observer, honoring any preferences expressed. Four LTP sites, one non-LTP comparison site, and one seismic zone are assigned to each observer. There are approximately 110 sites from which phenomena have been reported at least once. Eighty per cent of all observations are reported from only about a dozen features, while 60% come from only a half dozen features out of the 110 total sites. It is desirable to monitor all 110 features, and preferable that the dozen most active sites be assigned to more than one observer. At the same time, it is preferable that each observer concentrate on only a few features so that he can become very familiar with their normal aspects under all lighting conditions. The two ideal conditions then require a fairly large contingent of participants (about 30). By including the seismic zones (reported from the Apollo seismic experiments) for monitoring, we are establisihing a coöperation with other professionals to determine if any of the zones are sources of observable temporary phenomena. The sites of seismic phenomena have not, so far, been reported as sites of LTP although most of them are near LTP sites.

As of this date (September, 1972), seventeen observers have expressed interest and have been assigned features. A majority of the 110 LTP sites thus have been assigned, but about 40 remain unassigned. Alphabetically the participants are: J. C. Bartlett, I. Beck, J. Benton, R. Borek, B. Frank, D. Harrold, R. Hill, M. Huddleston, P. Jean, Z. Kleinman, T. Lynch, L. Maleske, G. Persson, A. Porter, and H. Stelzer. In addition, a group in Pittsburgh, Pa. directed by R. Clutter and C. Le Roy expressed interest in observing for LTP during the Apollo 17 mission. They were assigned approximately a half dozen features to monitor during that time. My own observations entail the acquiring of spectra of approximately 20 features that have been reported as exhibiting phenomena suggesting the existence of a gaseous medium at the time of the phenomena. Rev. Delano reports his positive and negative results also and should be considered a participant. The distribution of observers includes all sections of the U. S., Europe, and South America. There is coöperation between the Recorders from other groups as well, including the BAA Lunar Section liaison, P. Moore.

As of September, 1972, I have received two positive and 10 negative reports. The two positive ones were for Piton and Aristarchus. The negative reports were for Eudoxus, Aristoteles, Alps, Peirce, Proclus, Gutenberg, Posidonius, Theophilus, Mädler, Tycho, Messier, Dawes, Plinius, Menelaus, Manilius, Hyginus, and Alphonsus, most of which were reported for several times of observing. Analyses or statistics from the program will be reported in a future article.

Since the program is just starting and procedures are not yet routine, more discussion is not justified. I want to express my appreciation to the participants and invite others to join too.

I would like to take this opportunity to call for an Apollo 17 mission watch for all participants. I would like all the LTP observers to observe upon as many nights as possible during the two weeks surrounding the Apollo 17 mission, scheduled to be launched on December 6, 1972. I would like all observers to observe the Moon on every night possible from Dec. 1 to Dec. 15, inclusive, observing each feature assigned and using the suggested procedures. It is assumed that by that time each observer will have set up his gray scale based on Elger's scale (his features observed at Full Moon for the true albedo) from which he can estimate the apparent albedo for each point. The apparent albedo will change throughout a lunation and will be the true albedo only at Full Moon. If each observer will also use the suggested procedures for estimating "seeing", judged by the behavior of the diffraction disk of a star near the Moon, we may be able to get a start on setting up an absolute scale for judging "seeing". More details for the watch will be sent to each participant before the mission.

I would also like to remind the observers to send in every month their lists of negative observations of features, e.g., on the first of each month. Even though observations may be sparse or infrequent, please scatter them throughout all ages of the Moon.

references

Burley, J. M., and Middlehurst, B. M., 1966, "Apparent Lunar Activity: Historical Review", Proc. Natl. Acad. Sci., 55, 1007.

Cameron, W. S., 1972, "Comparative Analyses of Observations of Lunar Transient Phenomena", Icarus, 16, 339-387.

Dark-Haloed Craters

(Rev. Kenneth J. Delano)

In addition to noting the sizes and shapes of dark halos and their craters, participants in the DHC Program should also observe the dark halos closely in order to determine whether there is any ray structure within the halos or extending beyond them. There are numerous bright-rayed craters, large and small; but are there any dark-rayed craters? On October 4, 1971, Kenneth Delano noticed, with a 12.5-inch reflector at 300X, dark rays extending 6 kilometers beyond the western perimeter of the dark halo of the crater Hortensius C (-447+103). Also, the unconfirmed dark-haloed crater Bessel (+286+370) appears to be a dark-rayed crater in some photographs.

Observers are also asked to look for any rilles in the immediate vicinity of dark-haloed craters, i.e., within 15 kilometers of the crater. The DHC Program will try to determine how frequently rilles and DHC's are found together.

In order to aid observers in the location of unconfirmed DHC's, a series of 16 location charts of unconfirmed DHC areas is available. If necessary, this Recorder can supply the full set of charts free of charge; but he would appreciate receiving $2.00 to cover the expense of reproducing and mailing them.

A.L.P.O. Lunar Orbiter Reference Library

(John E. Westfall)

Through the efforts of A.L.P.O. Lunar Recorder Winifred Cameron, N.A.S.A. has generously donated approximately 2,650 photographic enlargements from the Lunar Orbiter Missions to the A.L.P.O. Lunar Section. This gift comprises a 98 per cent-complete collection of the available high-resolution photography by Orbiter II and medium- and high-resolution photography by Orbiters III - V. The enlargements are in the form of third-generation, 20 X 24-inch prints prepared by the U. S. Army Topographic Command.

The large format of these enlargements precludes their being mailed for loan to A.L.P.O. members, as is done with the smaller-format holdings of the Lunar Photograph Library. As an alternative, they have been filed and are available for on-site inspection by A.L.P.O., W.A.A., and A.L. members and other interested lunar researchers. The repository for their storage is the Map Library of the Department of Geography, California State University, San Francisco, located in room 289 of the HLL Building (on campus), which is open and staffed Monday-Friday, 8 A.M. - 12 noon and 1 P.M. - 5 P.M. Inquiries regarding this collection and its use should be addressed to Lunar Recorder John E. Westfall.

A listing of this collection is being prepared, intended for use with such official reference aids as <u>Guide to Orbiter Photographs</u> (NASA SP-242). It is also expected that selected portions of these photographs will ultimately be copied onto 8 X 10-inch format prints, which will then be available for loan to A.L.P.O. members.

Luna Incognita for 1973

(John E. Westfall)

Request for Observations

"Luna Incognita" is that portion of the Moon, the south polar and the southwest (IAU) marginal zones, not adequately photographed by the Orbiter and Apollo Missions and hence not yet adequately mapped (see <u>The Strolling Astronomer</u>, <u>23</u> (1972), 118-122, 134-136). Interested A.L.P.O. members are requested to contact this writer for information on contributing to the Lunar Section's program for mapping this area.

Although observing forms with outline maps will not be available for some time, experienced observers should attempt to sketch this occasionally-visible area on the dates given in the schedule below. Also, photographs of this area are urgently needed in order to determine the positions and outlines of features so that observing forms can be prepared. Enlargements on 8 X 10-inch double-weight paper are suitable for measurement, as are original negatives or positives. Particularly useful for measurement are 35-mm. positives on Kodak Photomicrography Color Film 2483 (previously SO-456), a high resolution, high-contrast, positive color film on highly-stable ESTAR base. Accurate times must be supplied with each sketch or photograph. Photographers with calculating ability can also be supplied with "A.L.P.O. Lunar Photograph Supporting Data" forms, which enable them to perform the necessary reductions from geocentric to topocentric libration.

Luna Incognita Observing Schedule, 1973

The following table gives those dates in 1973 when all or part of "Luna Incognita" is satisfactorily presented, with favorable lighting and libration. The south polar zone (SPZ) is readily visible for a period in every lunation, but the portion of "Luna Incognita" farther north (here called the southwest marginal zone or SWMZ) is more rarely visible. In the table, data are given for 0^h, U.T. A negative "Earth's selenographic latitude" indicates a southerly libration, while a negative longitude indicates a westerly (IAU) libration; all librations are geocentric. Under "Notes":

SPZ--Only south polar zone favorably presented;
SWMZ--South polar zone <u>and</u> southwest marginal zone favorably presented;
SWMZ-N--Northern portion (i.e., about latitude 52° to 70°S) of the SWMZ most favorably presented; SPZ not well presented;
* -- Indicates a low sun angle for the SWMZ.

Also, when the direction of maximum <u>combined</u> latitude and longitude libration falls within "Luna Incognita", the position angle (IAU west = 90°, south = 180°) and magnitude of the maximum libration are given in parentheses. Observers should note the especially favorable conditions occurring during August-November, 1973.

1973			Earth's Selenographic		
Date		Colongitude	Latitude	Longitude	Notes
Jan.	09	326°	- 5°	- 6°	SPZ
	10	338	- 6	- 6	SPZ
	11	351	- 7	- 6	SPZ
	12	003	- 7	- 5	SPZ
	13	015	- 7	- 5	SPZ
	14	027	- 6	- 4	SPZ

(table continued on page 21)

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By: J. Russell Smith

(Published from May, 1971 to September, 1972)

Subject Index (references are to pages)

Author Index (references are to pages)

1973			Earth's Selenographic		
Date		Colongitude	Latitude	Longitude	Notes
Feb.	05	294°	- 5°	- 5°	SPZ
	06	307	- 6	- 5	SPZ
	07	319	- 7	- 5	SPZ
	08	331	- 7	- 4	SPZ
	09	343	- 7	- 4	SPZ
	10	355	- 6	- 3	SPZ
	11	008	- 5	- 2	SPZ
Mar.	02	239°	- 2°	- 5°	SWMZ-N*
	07	300	- 7	- 4	SPZ
	08	312	- 6	- 3	SPZ
	09	324	- 6	- 2	SPZ
	10	336	- 5	- 1	SPZ
	29	207	- 2	- 5	SWMZ-N
	30	220	- 3	- 6	SWMZ-N
	31	232	- 4	- 6	SWMZ-N*
Apr.	01	244°	- 5°	- 6°	SWMZ*
	05	293	- 6	- 2	SPZ
	06	305	- 5	- 1	SPZ
	25	177	- 2	- 5	SWMZ-N
	26	189	- 3	- 6	SWMZ-N
	27	201	- 4	- 7	SWMZ-N
	28	213	- 5	- 7	SWMZ
	29	225	- 6	- 7	SWMZ*
	30	238	- 7	- 7	SWMZ*
May	01	250°	- 7°	- 6°	SWMZ*
	22	146	- 2	- 4	SWMZ-N
	23	158	- 3	- 6	SWMZ-N
	24	171	- 4	- 7	SWMZ-N
	25	183	- 5	- 7	SWMZ
	26	195	- 6	- 8	SWMZ
	27	207	- 7	- 8	SWMZ
	28	220	- 7	- 7	SWMZ
	29	232	- 7	- 6	SWMZ*
	30	244	- 6	- 5	SWMZ* (140°/8°)
June	19	128°	- 3°	- 4°	SWMZ-N*
	20	141	- 4	- 5	SWMZ-N
	21	153	- 5	- 6	SWMZ
	22	165	- 6	- 7	SWMZ
	23	177	- 7	- 7	SWMZ
	24	190	- 7	- 7	SWMZ
	25	202	- 7	- 7	SWMZ
	26	214	- 6	- 6	SWMZ
	27	226	- 5	- 5	SWMZ*
	28	238	- 4	- 4	SWMZ-N*
July	16	099°	- 2°	- 3°	SWMZ-N*
	17	111	- 4	- 4	SWMZ-N*
	18	123	- 5	- 5	SWMZ*
	19	135	- 6	- 6	SWMZ*
	20	147	- 6	- 6	SWMZ
	21	160	- 7	- 7	SWMZ
	22	172	- 7	- 6	SWMZ
	23	184	- 6	- 6	SWMZ
	24	196	- 6	- 5	SWMZ
	25	208	- 4	- 5	SWMZ-N
	26	221	- 3	- 3	SWMZ-N
Aug.	14	093°	- 5°	- 4°	SWMZ*
	15	105	- 6	- 5	SWMZ*
	16	117	- 6	- 5	SWMZ* (141°/8°)
	17	129	- 7	- 5	SWMZ* (141°/8°)
	18	142	- 7	- 5	SWMZ (142°/8°)

1973		Earth's Selenographic		
Date	Colongitude	Latitude	Longitude	Notes
Aug. 19	154°	- 6°	- 5°	SWMZ (142°/8°)
20	166	- 6	- 5	SWMZ (141°/7°)
21	178	- 5	- 4	SWMZ
22	190	- 3	- 3	SWMZ-N
Sep. 11	075°	- 5°	- 4°	SPZ
12	087	- 6	- 5	SPZ
13	099	- 6	- 5	SWMZ* (143°/8°)
14	111	- 7	- 5	SWMZ* (145°/8°)
15	124	- 6	- 4	SWMZ* (147°/8°)
16	136	- 6	- 4	SWMZ (148°/7°)
17	149	- 5	- 3	SWMZ (149°/5°)
18	160	- 3	- 2	SWMZ-N (149°/4°)
Oct. 08	044°	- 5°	- 5°	SPZ
09	056	- 6	- 5	SPZ
10	069	- 6	- 5	SPZ
11	081	- 7	- 5	SPZ
12	093	- 6	- 5	SWMZ* (144°/8°)
13	105	- 6	- 4	SWMZ* (147°/7°)
14	117	- 5	- 3	SWMZ* (151°/5°)
15	129	- 4	- 2	SWMZ-N*(157°/4°)
Nov. 04	013°	- 5°	- 5°	SPZ
05	025	- 6	- 6	SPZ
06	037	- 6	- 6	SPZ
07	050	- 7	- 6	SPZ
08	062	- 7	- 6	SPZ
09	074	- 6	- 5	SPZ
10	086	- 5	- 4	SPZ
11	098	- 4	- 3	SWMZ-N* (145°/5°)
Dec. 02	354°	- 6°	- 6°	SPZ
03	006	- 6	- 7	SPZ
04	018	- 7	- 7	SPZ
05	030	- 7	- 7	SPZ
06	043	- 6	- 7	SPZ
07	055	- 6	- 6	SPZ
29	322	- 5	- 5	SPZ
30	334	- 6	- 6	SPZ
31	346	- 7	- 7	SPZ
1974				
Jan. 01	359°	- 7°	- 7°	SPZ

PERIODIC COMET FAYE, 1843III = 1969a

By: J. E. Bortle, A.L.P.O. Comets Section

Periodic Comet Faye is an outstanding comet for several reasons. First, it has been observed at more perihelion passages than any other comet except P/Halley and P/Encke. Since this comet never becomes brighter than 10th stellar magnitude, it must be observed with apertures of the order of ten or twelve inches. Instruments of this aperture were widely used for comet observing in the second half of the nineteenth century also so that a direct comparison of data obtained then and now can be easily made. Thus, with the considerable body of data available on the comet's physical appearance, its activity, and its absolute magnitude covering fifteen apparitions, P/Faye is a prime candidate for the study of cometary decay.

The 1969 apparition of the comet was one of the best possible in terms of Earth-comet separation, and eight ALPO Comets Section members followed the comet's activities. Because of the comet's large perihelion distance and the fact that opposition occurred fairly soon after perihelion, it was possible to follow P/Faye for nearly five months, from 1969, September 21 to 1970, February 5.

The comet's orbital elements appearing below were employed by Mr. M. McCants to produce an ephemeris used for the reduction of ALPO Comets Section observations.

T = 1969, October 7.5844
$e = 0.57467$
q = 1.61628 A.U.
$\omega = 203^\circ\!.667$
$\Omega = 199^\circ\!.050$
$i = 9^\circ\!.082$

Reports were received from:

J. Bortle, Mount Vernon, N.Y.
L. Farrar, Rialto, Calif.
C. Holmes, Riverside, Calif.
A. Jones, Nelson, New Zealand
G. LeGendre, Phoenix, Ariz.
D. Milon, Cambridge, Mass.
L. Rimes, Omaha, Neb.
B. Smith, Riverside, Calif.

The Comet's Appearance

When first observed on 21 September (about one month before perihelion passage), P/Faye appeared like a large comet in miniature through the 22-inch Maksutov telescope at Stamford Observatory in Connecticut. This large instrument revealed a strongly elongated, well condensed coma with a stellar nucleus of about magnitude 14. A long narrow tail extended 10' to 15' from the comet's head toward the west. This tail was intermittently seen up to 7 November, with its greatest recorded length being over three quarters of a million miles.

The coma's apparent diameter depended somewhat on the aperture being used but was usually between one and two minutes of arc or about 35,000 miles (the extreme reported values were 25,000 and 70,000 miles). The coma's degree of condensation also depended on the instrument in use but usually was considered to be small (2-4 on a scale of 0-9). Even so, on at least two occasions the coma was reported as sharply condensed.

Most observers noted a nucleus which was often slightly displaced to the east or southeast in the coma. During October, November, and early December it was called magnitude 13. Using the 22-inch Maksutov telescope J. Bortle noted that the nucleus was not truly stellar but was rather a very small condensation.

Total or Coma Magnitude

Despite the long period of observation, the total variation in heliocentric distance of Comet Faye amounted to only 0.25 A.U. Such a small variation in r results in a magnitude formula where H_0 (the comet's absolute magnitude) and n (an exponent determining the rate of magnitude change) have a lower than normal level of accuracy. In addition, P/Faye is known for its magnitude fluctuations, and an examination of the data at hand indicates that the comet varied over a range of at least 1.5 magnitudes in a period of only a few nights.

Seventeen estimates of the comet's total magnitude were reduced to heliocentric values. Since, as previously stated, the apertures used to observe the comet in 1969 would be essentially the same as those used in the nineteenth century, no aperture correction needed to be applied to make the bodies of data comparable. The author then proceeded to find the Least Squares Line best fitting the observations. The resulting formula was:

$$m = 8.67 + 11.66 \log r, \quad n = 4.66,$$

where 8.67 is the "absolute magnitude".

Analysis

In 1843, when Faye discovered this comet, it became bright enough to be faintly visible to the unaided eye. Since that time indications have been that the comet has been steadily losing brightness with each return; but the rate at which the fading is occurring is of much debate.

S. K. Vsekhsvyatskii's book Physical Characteristics of Comets lists H_{10} values (assuming $n = 4$) for P/Faye between 1843 and 1955. In addition, the book also gives H_1 values (assuming $n = 2$) as determined by Holeschek. To make the ALPO data comparable, the author reduced the data to H_{10} and H_1, which produced the following values for the comet's absolute magnitude: $H_{10} = 9.05$ and $H_1 = 10.20$.

Below are comparisons of the two lists and the ALPO results:

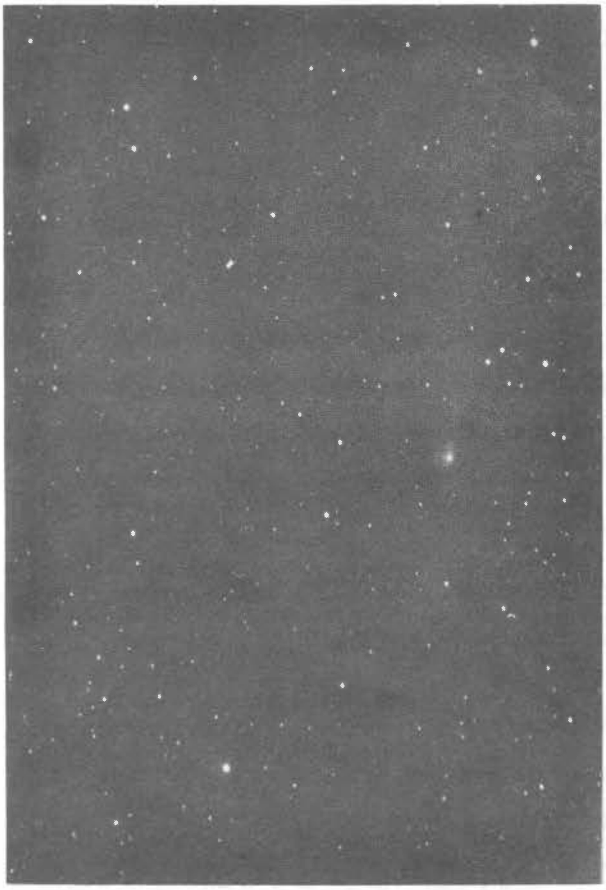

Figure 41. Photograph of Periodic Comet Faye 1969a by Mrs. Ginger Le Gendre on October 17, 1969 at 6^h37^m, U.T. 10-inch reflector, f:7. Cooled emulsion. Exposure 12 minutes. Developed for 4 minutes in D-19.

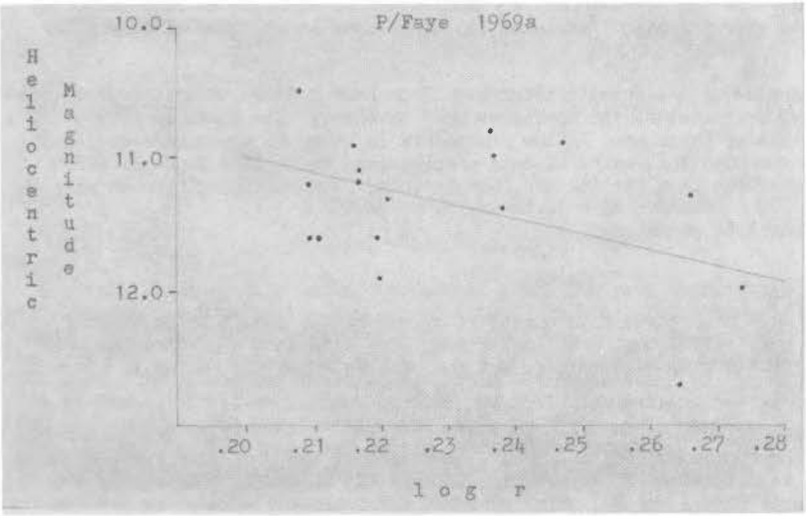

Figure 42. Photometric graph of total stellar magnitude of coma of Periodic Comet Faye 1969a. Based on visual estimates by members of the ALPO Comets Section. See also text of Mr. J. E. Bortle's report on Comet Faye.

Apparition	Vsekhsvyatskii	Holeschek
1843	4.2	5.5
1851	5.5	7.5
1858	7.9	10.0
1866	6.4	7.8
1873	7.4	9.3
1881	7.4	9.6
1888	7.4	10.5
1896	7.8	9.8
1910	9.1	10.3
1925	10.9*	-
1932	9.5	-
1940	10.7*	-
1947	11.2*	-
1955	11.1*	-
1969	ALPO 9.05	ALPO 10.20

*From the text of Vsekhsvyatskii's book it appears that these values are based heavily on photographic magnitudes.

Examination of the figures above clearly shows that although the comet's absolute magnitude declined rather rapidly suring the first few returns, it appears to have leveled off by the beginning of the twentieth century. The absolute magnitude values obtained for the 1969 apparition are fully comparable to those obtained in 1910. Thus, it would appear that the comet's absolute magnitude stabilized at about that time and has remained relatively constant since. A third confirmation of this stabilization is the magnitude formula Dr. M. Beyer derived from his observations of this comet in the 1932 apparition, $m = 8.1 + 13.7 \log r$. While at first glance the ALPO formula and Dr. Beyer's do not appear too similar, the reason lies in the different values of n. As previously noted, P/Faye varies little in heliocentric distances during the period it is usually under observation, making the determination of an accurate value of n very difficult. To verify this statement and to show that the two formulae are almost identical, the author computed the magnitude of the comet for a large number of observed values of r. The results were that the two computed magnitudes always agreed to within ±0.1 of a stellar magnitude.

Table I. P/Faye 1969a Visual Magnitude Estimates.

Date U.T.		Observer	Aperture (inches)	Magnitude	
1969	Sep. 21.28	Bortle	10	11.6	a
	Oct. 5.21	Bortle	10	10.8	a
	18.19	Bortle	10	12.0	a
	18.19	Bortle	6	11.6	a
	Nov. 6.25	Rimes	12½	11.5	a
	7.41	Rimes	12½	11.8	a
	7.64	Jones	12½	11.7	a
	12.51	Jones	12½	12.2	a
	13.29	Holmes/Smith	8	12.5	-
	15.62	Jones	12½	11.9	a
	Dec. 5.60	Jones	12½	11.4	a
	6.25	Bortle	10	11.6	a
	7.23	Milon	6½	12.0	a
	17.31	Bortle	10	11.4	a
1970	Jan. 2.51	Jones	12½	12.9	a
	4.22	Farrar	-	11.5	-
	10.19	Bortle	10	12.0	a

a. AAVSO charts employed in making estimate.

BOOK REVIEWS

Mathematical Astronomy for Amateurs, by E. A. Beet, W. W. Norton and Co., Inc. New York, N. Y. 1972, 143 pages, $7.95 (Hardbound).

Reviewed by Winifred Sawtell Cameron

E. A. Beet, the author, is a well-known English amateur astronomer, a former Secretary and President of the British Astronomical Association, presently the Director of their Historical Section and a member of the Education Committee. He is the author of seven previous books on astronomy, e.g., The Sky and Its Mysteries and A Textbook of Elementary Astronomy.

The previous books were descriptive whereas the book under review is more mathematical. The purpose of the author is to present the elementary mathematical bases underlying some of the astronomical laws and principles. The author declares that the reader needs only a foundation in arithmetic and geometry. Indeed, the mathematics and data presented are complete enough that the examples and problems can be solved by the reader with that limited mathematical background. Algebra and trigonometry, however, are involved in the mathematics, and the expositions will be better understood by readers with such additional background. The author also assumes that the reader is acquainted with basic astronomical facts and concepts.

There are five chapters followed by sections on notes, references and acknowledgements, exercises for each chapter, and an index. Chapter 1, "The Earth, Moon and their Orbits", deals with latitude and longitude, angular measure, motions of the Earth, drawing ellipses, orbits of the Earth and Moon, and eclipses. Chapter 2, "Time", treats sidereal, solar, and mean time, time-angle conversion, longitude and time, sidereal-mean time conversion, and the year. Chapter 3, "The Celestial Sphere", discusses coördinate systems, astronomical triangles, dip, and parallax. Chapter 4, "The Solar System", describes apparent motions, planetary periods, Kepler's laws, planetary orbits, cometary orbits, gravitation, and artificial satellites. Chapter 5, "Stellar Topics", includes discussions of star charts, stellar magnitude, stellar parallax, absolute magnitude, binary star masses, and the Doppler Effect.

The author presents the mathematics in a simple, clear, and interesting manner, using 43 simple diagrams. The first (Earth, Moon) and fourth (Solar System) chapters are well done. The third chapter, on the Celestial Sphere, in my opinion suffers from the omission of the explicit relationships among sidereal time (S.T.), right ascension (R. A.), and hour angle (H.A.). The fundamental equation relating these three quantities, S.T. = R.A. + H.A., is never explicitly stated; nor are the definitions of sidereal time. Two definitions involving the fundamental reference point, the vernal equinox (♈), are: (1) sidereal time is the right ascension of the meridian, and (2) sidereal time is the hour angle of the vernal equinox. A perceptive reader can, however, glean these relations from Beet's Figures 13 and 14.

This short book achieves the author's aims. It is the reviewer's opinion, however, that the book would have been more valuable if it had been expanded to include additional descriptive astronomy so that the inexperienced amateur would not need to be continually referring to other books. The full value of this book will be derived by those readers who prepare themselves with paper, pencil, drawing compass, protractor, ruler, pins or tacks, and string or thread and work out some of the simple exercises provided at the end of the book--perhaps on inclement nights when observing is impossible. There are remarkably few and only minor typographical errors. The price, for value received, is not unreasonable.

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Star Myths and Stories, by Percy M. Proctor. Exposition Press, Inc., Jerico, N. Y. 11753, 1972. 183 pages. $6.00.

Reviewed by J. Russell Smith

The author of this book of celestial stories was a teacher for many years. Through his experiences with students as well as others, he learned the value of star myths in helping to develop interest in astronomy, the oldest of the sciences.

Mr. Proctor covers star myths from Andromeda to Virgo. For most of the constellations about which the stories are told, a clear-cut labeled diagram of the star group is given to aid the reader in his study. The last chapter in the book is an interesting discussion of the Star of Bethlehem which, according to most students of astronomy, could have been a meteor, a comet, the planet Venus, a supernova, or a conjunction of Jupiter and Saturn.

As a teacher of elementary astronomy for many years, I feel that this book should be in every Junior and Senior High School Library.

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Moon and Planets, by William K. Hartmann. Bogden & Quigley, Inc., Publishers, Tarrytown-on-Hudson, New York/Belmont, California, 1972. 404 pages. Price $12.95.

Reviewed by James W. Young

William Hartmann's portrayal of planetary science in Moon and Planets is an excellent introductory study for beginners as well as advanced students. Basically a chronological reflection of man's advances in astronomical knowledge, this book introduces the reader to the many historical influences that make up modern astronomy. Although it is a non-mathematical text, the serious reader will find numerous questions and problems to further his or her knowledge and interests.

The first few chapters present a concise history of theories of the origin of the Solar System, from the Egyptians through the Renaissance Period to Darwin and, finally, to the present. By tying together chemistry, biology, meteorology, and geology, these chapters bring the reader up to date before venturing into the present influences of planetary science.

The middle chapters investigate the formation of the Solar System, and thoroughly examine each type of celestial body amid the Sun's realm. They give the reader an important background in understanding the varied influences of size, shape, and distribution, and their interrelations, on the formation of celestial bodies in the solar nebula. Especially important are the very comprehensive chapters devoted to meteors, comets, and asteroids.

The final chapters introduce the reader to the most current knowledge of planetary interiors, surfaces, and atmospheres. Emphasis is given to modern theories, artificial satellite findings, and current ground-based observations. A study of the Apollo Lunar Mission results is given with important theoretical relations towards understanding the more distant planets and their role in evolutionary beginnings.

We have here a complete book in itself, packed full of references for further reading. I heartily recommend it for space in anyone's library, but more so, next to your favorite easy chair.

Postscript by Editor. Mr. J. Russell Smith adds the opinion that Dr. Hartmann's book would be a very good text. Those concerned with astronomy courses as teachers or students may want to consider the book in this light.

Dr. Hartmann joined the ALPO many years ago as a young amateur, and we are proud of whatever minor role we may have had in his development as a scientist.

THE 1969-70 APPARITION OF SATURN

By: Julius L. Benton, Jr., A.L.P.O. Saturn Recorder

General Introduction

The Report which follows covers the period from June 15, 1969 to April 5, 1970, during which the value of B (the axial tilt of Saturn) varied between -16°5 and -18°7. Opposition occurred on October 29, 1969, when Saturn was a zero magnitude object in southern Aries. At this time, the equatorial diameter of the planet was 20", while the major axis of the ring system extended to 46". As indicated by the data presented here, the southern portions of the planet and its ring system were well presented to observers.

Observations were received from the following 14 individuals:

Observer	Location	Instrument	No. of Observing Dates
Julius L. Benton, Jr.	Savannah, Ga.	4" Refr.	12
Mike Blandford	Dayton, Ohio	6" Refl.	6
Michael Covington	Valdosta, Ga.	6" Refl.	1
William Crawley	N. Vernon, Ind.	7½" Refr.	1
Eugene W. Cross, Jr.	Las Cruces, N.M.	18" Refl. 12" Refl. 24" Refl. & 6" Refr.	18
Richard Dasher	Valdosta, Ga.	4½" Refl.	17
Kenneth J. Delano	Taunton, Mass.	12½" Refl.	38
Walter H. Haas	Las Cruces, N.M.	12½" Refl.	4
Alan W. Heath	Nottingham, England	12" Refl.	19
Ernst Mayer	Barberton, Ohio	6" Refl.	2
Paul Reddick	Valdosta, Ga.	6" Refl.	1
Martin Senour	Cleveland, Ohio	6" Refl.	1
Horace Smith	Willimantic, Conn.	6" Refl.	2
John E. Westfall	San Francisco, Calif.	10" Refl.	15

In all, there was a grand total of 137 observations of Saturn during 1969-70; and Figure 43 will show the distribution of contributed observations throughout the apparition. It will be noted that the period from October, 1969 through February, 1970 was covered adequately, providing a coherent mass of data for analysis surrounding and following the opposition date. It is important for us to receive many more observations of Saturn earlier in the apparition, and observers are strongly urged to pursue such a systematic program in the future.

The Recorder would like to express his sincere gratitude for the contributions submitted to the Section by those individuals mentioned in this Report. In addition, he would like to thank Mr. Elmer Reese for a copy of his paper on Saturn during 1969.

The Globe

Southern Regions of the Disc. Now that a considerable portion of the southern hemisphere of Saturn is available for our inspection, it is natural to assume that more detail is going to be reported in this region than in the earlier apparitions following the 1966-67 edgewise one. The 1969-70 apparition was made especially interesting by the sudden appearance of a small bright spot in Saturn's atmosphere at planetocentric latitude -57°, persisting for more than a year. According to Elmer Reese, then of the New Mexico State University Observatory, the first record of the spot was on a photograph taken on October 25, 1969 by A. S. Murrell. The spot appeared on the planet's CM at 07:43 U.T. on that date, and over a period of several months photographic evidence revealed that the spot was stationary in latitude and was rotating in a period of roughly 10½ hours. Not much change was noted in the observed size, the overall appearance, the brightness, and the period of rotation of the spot. A set of photographs taken in orange, green, and blue wavelengths showed that the spot was of a yellowish color. Reese notes that the last record of the feature at NMSU in 1969-70 was on February 7, 1970, when it was on the CM of Saturn at 02:19 UT. He indicated that, even on this date, the spot was much the same morphologically as recorded more than three months earlier. It was observed that the spot described here made a noticeable interruption in the south edge of the SSSTeB.

Photographically, the spot required only average seeing conditions to be photographed with NMSU's 24" reflector, but it was obviously extremely difficult for the visual observer. Cross reported seeing a white spot in the same general vicinity as the one discussed here on the 21st, 24th, and 25th of February, 1970; but confirmational data is lacking. No other observers reported the spot as being visible with their telescopes, even though it should have been detectable with moderate apertures. Some observers looked without success when the spot was known to be well placed on the disc.

Reese found that the longitude of the bright spot could be determined by the use of a special ephemeris, directly based upon a longitude system known as "System III", which had an arbitrary sidereal rotation rate of precisely $10^{h}38^{m}$. It was resolved that the spot's longitude slowly decreased with time, as indicated by the table accompanying this

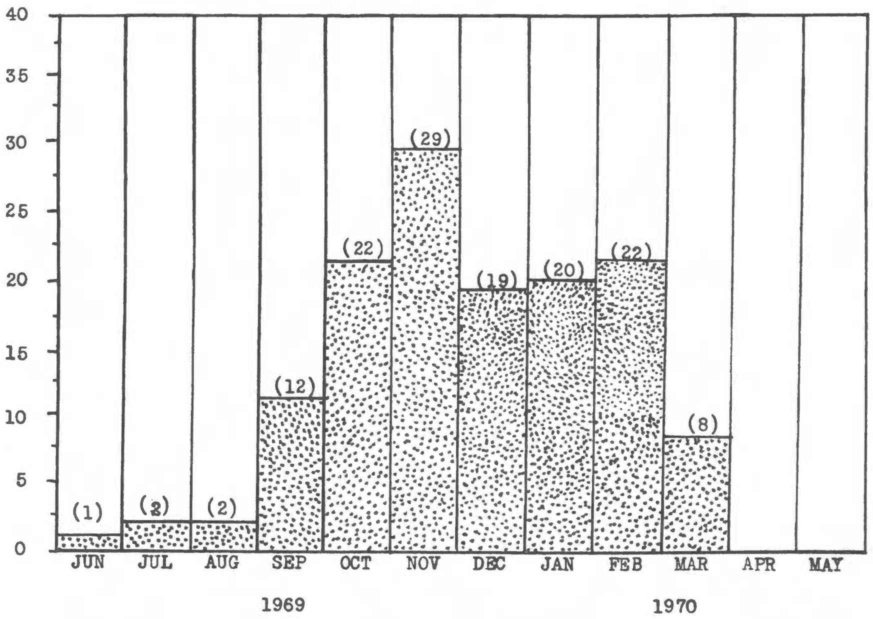

Figure 43. Histogram to show distribution by months of A.L.P.O. observations of Saturn during its 1969-70 apparition. Prepared by Dr. Julius L. Benton. See also his Saturn Report in this issue.

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discussion. A weighted linear least-squares analysis indicated that the spot drifted from longitude 148°9 on October 25, 1969 to 322°8 on February 7, 1970, with a determined rotation period of $10^h36^m36^s.53 \pm 0^s.48$. Reese points out also that a second degree polynomial curve fit showed that the spot drifted from longitude 148°4 on October 25, 1969 to 321°6 on February 7, 1970, having a mean rotation period of $10^h36^m36^s.20 \pm 0^s.47$. The standard deviation of the residuals for the linear and parabolic solutions was not significantly dissimilar. See also Table I and Figure 44.

South Polar Region (SPR). The majority of observers reported the SPR as a diffuse, almost featureless area, frequently darker than the NPR. Everyone tended to agree that the SPR was of a uniform gray color throughout the apparition. Benton and Haas detected the elusive SPB encircling the entire region, and a few individuals were able to see the faint south polar cap with only marginal confidence. Drawings presented to the Section did not show any appreciable differentiation of the SPR.

South Temperate Zone (STeZ). This zone was recorded by nearly every observer, and Heath noted it as an area just a little brighter than the general polar shading. He observed it as having about the same width as the northern and southern limits of the SEB. Most individuals reported that the color of the STeZ was "uncertain" during the apparition. As was pointed out earlier, a small bright spot was seen in the vicinity of the STeZ on photographs taken at NMSU.

South Temperate Belt (STeB). Heath was the only one to suspect the presence of this belt, describing it as a faint gray streak near the SPR border on the 8th of December, 1969. No drawings presented further evidence of its presence.

South Tropical Zone (STrZ). Benton was able to detect this zone on February 7, 1970 as an indefinite brownish-yellow "line". No other reports were received of this area during 1969-70.

South Equatorial Belt (SEB). Observers recorded the SEB as the most prominent belt on the globe of Saturn, quite often finding it differentiated into the SEB_s and the SEB_n with a possible zone in between. As was the case for the two preceding apparitions, the SEB_n was reported to be somewhat darker than the SEB_s. Benton, Heath, and Haas all consistently recorded the color of the whole belt as brown or brownish-grey, while Delano always saw it as a reddish-brown feature. Haas was the only observer who reported fine

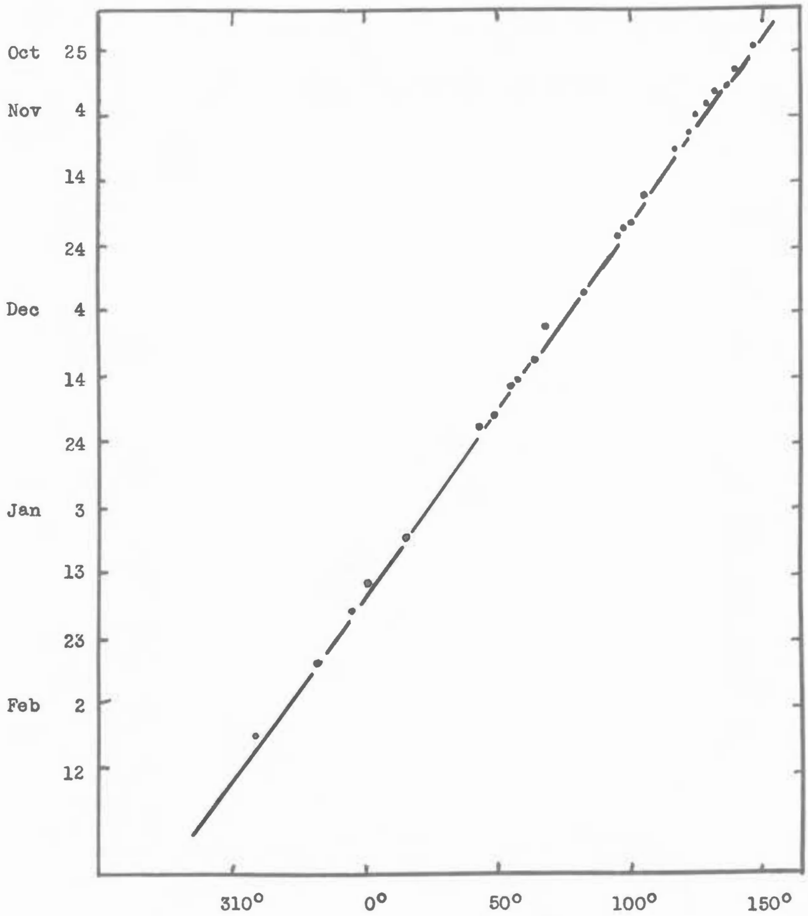

Figure 44. The drift in System III longitude with time of a white spot at planetocentric latitude -57° on Saturn from October, 1969 to February, 1970. See also Dr. Benton's Saturn Report. The dots represent individual measures of longitude on New Mexico State University Observatory photographs. The drift-line corresponds to a sidereal rotation period of $10^h36^m37^s$. System III has an assumed sidereal period of $10^h38^m0^s$.

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internal structure in the SEB; and on September 7, 1969 with good seeing he observed a variety of festoons, condensations, and projections. It would be a little presumptuous for us to state that there has been an increase in activity in this region, chiefly because of our lack of corroborating evidence.

Equatorial Zone (EZ). Virtually every participant in the program indicated that this area was the brightest region on the entire globe of Saturn, but it should be pointed out that there has been a decisive reduction in brightness of this zone since 1966-67 (see Table II). Delano estimated the color of the EZ as being generally dull white; but on October 31, 1969 he reported that it was of a definite light-tan shade. Also, on December 6, 1969 Delano noted the zone as having a yellowish color. Haas always maintained that the EZ was yellow-orange colored, and Heath consistently reported the zone as creamy white or faint yellow. Additionally, Heath reported several vague white patches in the EZ on November 8, 1969, occupying the entire width of the zone. No other observers recorded that they could see any activity in the region. Haas, Cross, and Benton observed the elusive EB on a few evenings near opposition, Benton having the impression that it was of a generally greyish tint.

North Polar Region (NPR). The NPR was reported by observers as being quite featureless, somewhat brighter than the SPR, and having a uniform grey color. Now that the northern regions of the globe are progressively passing out of our view, it is unlikely that

Table I.
Longitude and Latitude Measurements of a Bright Spot in Saturn's Southern Hemisphere.*

Date (U.T.)	Longitude (System III)			Deviation from Least Squares Position		Saturnigraphic Latitude	
				weighted linear	unweighted parabolic		
1969, Oct. 25.29	149°5	±0°4	(9)	+0°5	+1°1	-57°3 ±1°4	(3)
29.29	142.5	±0.9	(7)	+0.7	+1.0		
31.10	140.1	±0.7	(2)	+1.5	+1.8		
Nov. 1.39	134.3	±0.8	(5)	-2.1	-1.8		
3.17	131.5	±1.0	(2)	-1.7	-1.5		
5.37	128.0	±0.3	(14)	-1.3	-1.2	-57.8 ±0.3	(6)
7.14	126.0	±0.9	(3)	-0.2	-0.1		
10.23	119.9	±0.8	(7)	-0.8	-0.9	-56.8 ±0.4	(6)
17.28	107.0	±0.9	(7)	-1.1	-1.4		
21.28	102.1	±0.4	(8)	+1.1	+0.7	-57.9 ±0.4	(4)
22.18	99.1	±1.1	(2)	-0.4	-0.7		
25.26	98.1	±0.8	(4)	+4.1	+3.7		
Dec. 2.29	84.0	±2.7	(3)	+2.5	+2.0		
7.20	70.8	±0.7	(2)	-2.0	-2.5		
12.05	65.7	±0.8	(8)	+1.5	+1.0	-57.1	(1)
15.16	59.5	±1.1	(5)	+0.9	+0.3		
16.07	56.9	±1.0	(6)	-0.1	-0.6		
20.03	50.3	±0.5	(5)	+0.4	-0.1	-56.8 ±0.8	(2)
22.24	44.6	±1.7	(3)	-1.4	-1.9		
1970, Jan. 8.04	16.9	±0.4	(6)	+0.7	+0.6		
15.11	2.5	±1.1	(3)	-1.2	-1.0		
19.09	356.7	±0.8	(5)	+0.1	+0.4		
27.05	344.0	±0.9	(3)	+1.6	+2.2		
Feb. 7.10	320.2	±0.8	(6)	-2.6	-1.4	-56.7 ±0.8	(2)
	standard deviation =			±1°53	±1°50		

*Table I is adapted from a paper by Elmer J. Reese of New Mexico State University Observatory entitled: "Measurements of Saturn in 1969". It includes the standard deviation of each listed mean latitude or longitude and the number of photographic images measured for each value (in parentheses). From 24 measured images the mean Saturnigraphic latitude of the spot was -57°3 ±0°3.

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much will be seen in these areas.

Shadow of the Rings on the Globe. Under conditions of very good seeing, most persons reported this feature as a distinct black shadow; and on those occasions when the shadow was anything other than black, it is likely that the phenomenon was caused by poor seeing rather than by a physical cause on Saturn.

Shadow of the Globe on the Rings. All observers recorded this shadow as a definite black throughout the apparition. The shadow was noted as being prominent on the West side (IAU) of Saturn during September and October, becoming invisible about November 8, 1969, and appearing on the East side by November 15th.

To summarize, aside from the bright spot discovered on October 25, 1969 and with the exception of the vague features noted in the SEB and EZ by Heath and Haas, there appears to have been no substantial increase in activity on the globe in 1969-70.

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Table II. Average Intensity of Equatorial Zone of Saturn.

Apparition	Average Intensity
1966-67	8.03
1967-68	7.94
1968-69	7.41
1969-70	6.91

The zone's intensity is on a scale of 0 (shadows) to 10 (very brightest features). The steady decline in brightness subsequent to the 1966-7 apparition is well shown. (Table II)

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Latitudes of Saturn's Belts and Zones. As in the past, latitudes of the various features on Saturn's disc were determined during 1969-70 by measurement of accurate photographs and by visual estimates of the fraction of the polar radius subtended on the CM by the belt whose latitude is desired. Haas was the only observer to submit observations using the visual method which he developed, and Westfall was the sole contributor of photographic latitude determinations. From a paper prepared by Mr. Elmer J. Reese during 1969, a few additional values were introduced into our sample. He determined latitudes from photographs taken with NMSU's 24" reflector.

For several years now, only planetocentric latitudes have been computed for Saturn, chiefly as a result of the common belief that these values are more relevant to the Earth-based observer. Planetographic latitude is more familiar to the observer of Jupiter, but it is just as easily applied to Saturnian features by using the appropriate formulae. B. M. Peek emphasizes that eccentric (mean) latitudes are really more convenient that the two kinds previously mentioned. It has been shown that the sine of the eccentric (mean) latitude is the fraction of the polar semidiameter of Saturn when the Earth is overhead at the equator of the planet. Furthermore, the product of the cosine of the eccentric latitude and the equatorial radius of the planet is the radius of rotation in that specific latitude.

We next give the formulae required to compute the eccentric latitude, the Saturnicentric latitude, and the Saturnigraphic latitude of a measured feature on the central meridian of longitude (C.M.) of the planet. The reader interested in further details can do no better than to study the text and diagrams in Appendix I, "Reduction of Latitude Measurements", pages 269-271, of B. M. Peek's The Planet Jupiter.

Let X_n denote the distance of the feature from the north end of the C. M. (on the limb) and X_s its distance from the south end (on the opposite limb), in arbitrary units. Then compute:

$$y = \frac{1}{2}(X_s - X_n),$$

where it will be noted that y is positive for features north of the center of the disc and negative for features south of the center.

Next, let r be the measured polar radius of Saturn in the same units as X_s, X_n, and y. Let R be the ratio of the equatorial radius of the planet to its polar radius, which is approximately 1.12 for Saturn. Let B denote the Saturnicentric latitude of the Earth, or the tilt of the axis of Saturn toward the Earth. We find B in The American Ephemeris and Nautical Almanac, or other similar tables. We then compute the eccentric latitude E of the feature by means of:

$\tan B^1 = R \tan B$, where B and B^1 are positive when north,

$$\sin(E - B^1) = y/r.$$

The Saturnicentric latitude C is then found from:

$$\tan C = \tan E/R.$$

The Saturnigraphic latitude G is :

$$\tan G = R \tan E.$$

The eccentric latitude will be near the arithmetic mean of the Saturnicentric and Saturnigraphic latitudes.

Table III gives the results of latitude work done by contributing observers in the three systems mentioned above. Due to the small number of observations of this kind, it would be unwise for us to draw any general conclusions from the data. In any case, the following data should serve to demonstrate that such quantitative work is both useful and important in our studies of Saturnian atmospheric phenomena. More observations of this type are desired for subsequent apparitions, using the visual method proposed by Haas, now the standard procedure of the Section. Upon a preliminary comparative analysis, it appears that his method is both simple and reasonably accurate. Of course, a quantity of measurements made by other methods is important as well. When a good observational sample has been obtained by all methods, then we shall be in a position to prepare a mean-

Table III.
Mean Latitudes of Saturn's Belts and Zones During the 1969-70 Apparition

	Saturnigraphic Latitude			Saturnicentric Latitude			Eccentric Latitude		
Feature	Haas	Westfall	Reese	Haas	Westfall	Reese	Haas	Westfall	Reese
N edge SPC			-75°2			-71°8			-73°5
S edge SPB	-75°7		-69.3	-71°8		-64°8	-74°1		-67.1
N edge SPB	-69.9		-63.0	-64.6		-57.5	-67.0		-60.3
N edge SPR		-61°3			-59°7			-64°4	
S edge STeB			-36.9			-31.0			-33.9
N edge STeB			-31.1			-25.8			-28.3
S edge SEB		-26.5	-26.4		-24.4	-21.7		-28.2	-24.0
N edge SEB		-19.5	-13.3		-17.9	-10.7		-22.3	-11.9
N edge SEB$_n$	-22.4			-18.7			-20.5		
S edge SEB$_n$	-24.5			-20.1			-21.4		
N edge SEB$_s$	-29.5			-24.2			-26.1		
S edge SEB$_s$	-30.1			-25.0			-27.2		
S edge EB			-06.2			-05.0			-05.6
N edge EB			+01.9			+01.5			+01.7

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ingful statistical analysis of the internal accuracy of each method.

The Rings

Ring B. Intensity estimates of various features on the disc of Saturn and of the individual rings are made relative to a standard adopted by Goodman several years ago, whereby the outer third of Ring B was assigned an intensity of 8.0 on a scale of 0 (shadows) to 10 (brightest features). All observers recorded Ring B, taken as a whole, as the brightest part of the ring system; but most individuals tended to regard the inner part of Ring B as being practically equal in intensity to Ring A. The outer part of Ring B was observed to be of a distinct white color without exception, while Heath and Haas agreed that the darker inner part of the ring was light grey or off-white. Haas was the only observer who reported seeing several intensity minima in Ring B during 1969-70. On September 7, Haas recorded that he saw B2 and B6 clearly, noting that they were of equal intensity, estimated on the A.L.P.O. scale as 3.7. Also, on September 27, 1969, Haas noted B3 near the ansae and assigned it a questionable intensity of 3.6. On March 15, 1970 Haas reported B0 and B2, of estimated intensities 1.8 and 3.4 respectively. Both observations were made during periods of average seeing conditions.

Ring A. Throughout the apparition most observers recorded Ring A as being about equal in brightness to the inner part of Ring B. Heath, however, was of the impression that Ring A was much darker than Ring B. Haas noted that the portion of Ring A outside of Encke's Division was brighter than the region inside of that intensity minimum. Most individuals recorded Ring A as having a distinct bluish-white to greyish color during the apparition. Benton detected with some confidence the presence of A8 on September 10, 1969. Almost all observers recorded Encke's Division (A5) and Cassini's Division (A0 or B10) near the ansae. Typical intensity estimates for Encke's and Cassini's Division were 3.5 and 0.2 respectively. Heath indicated that he could not call Cassini's Division completely "black" except on December 8, 1969 and on February 10, 1970.

Ring C. Most observers did not report the Crape Ring during 1969-70. Haas reported it regularly, however; and Benton saw it on two occasions, describing it as having a dark grey color. Heath reported seeing Ring C only near the ansae.

Ring D. This controversial ring, reportedly external to Ring A, was not recorded by A.L.P.O. observers during this apparition.

White Spot on the Rings. During 1969-70, quite a few observers reported seeing a fairly conspicuous white spot on the rings, presumably another Terby White Spot, attributed usually to a contrast effect with the adjacent ball shadow. Heath recorded the spot as a bright, white area, looking much like a satellite; and it was seen by him on the East side of the rings where they join the limb of the planet on October 10, 1969. He indicates that it was brighter than the outer part of Ring B, and much brighter than any feature on the planet. When he first reported the white spot, the shadow of the ball on the rings was on the other side; but when the shadow shifted to the East side, the spot persisted, nearly in "contact" with the shadow. Haas apparently reported the same white spot on several occasions, and both he and Heath agreed that its brightness exceeded all other features on Saturn, as mentioned before. No other observers apparently noticed this anomalous feature, and virtually no drawings or photographs were submitted which even hinted at the presence of such a white spot. It would be interesting to make comparisons between visual and photographic interpretations of similar features in coming apparitions.

Bicolored Aspects of the Rings*. Haas and Heath were the only individuals to notice any difference in brightness between the East and West arms of the rings. Delano indicates that he was unable to detect any effect during the apparition. Haas and Heath quite consistently noted that the E and W arms were of equal brightness during 1969-70 with no filter; but in a blue (W 47) filter, both observers often confirmed each other's impressions that the W arm was somewhat enhanced over the E arm. Haas, however, noted that on September 7, 1969 the E arm was brighter than the W arm in blue light. In a red (W 25) filter, Haas always indicated that the E and W arms were of equal brilliance, but Heath observed that the W arm was enhanced over the E arm in a red filter on December 18, 1969. More observations of this curious, and yet unexplained, phenomenon are wanted in future apparitions. In this discussion West is the left arm in a simply inverted view with south at the top.

The Satellites of Saturn

A number of magnitude estimates of Saturn's satellites were submitted to the Section by Delano, using a 12½" Newtonian reflector for his research. Delano made regular satellite magnitude estimates between the dates of October 16, 1969 and March 4, 1970. In making his estimates, it was usually assumed that Titan's magnitude was stable at 8.4 and Rhea's at 9.8. The three other satellites were estimated relative to Titan and Rhea.

The following table will serve to illustrate the results of the observations during 1969-70:

Satellite	Number of Observations	Magnitude Range	Variation	Average Magnitude
Tethys	27	10.3 - 10.7	0.4	10.51
Dione	32	10.2 - 10.7	0.5	10.51
Rhea	38	9.8 - 10.2	0.4	9.84
Titan	40	8.2 - 8.8	0.6	8.40
Iapetus	39	8.6 - 11.5	2.9	9.81

The satellites Tethys, Dione, Rhea, and Titan all displayed a very small range of variation, roughly only about 0.5 magnitudes. With the exception of Iapetus, no correlation was noted between a satellite's brightness and its orbital position. Iapetus was noted, as expected, to be at its brightest at western elongations and faintest at eastern elongations. Actually, Iapetus showed an average brightness nearly equal to Rhea's. As was true for the two immediately preceeding apparitions, Iapetus did not show an even, gradual increase and decrease in brightness during its revolution period. On the whole, this satellite brightens and fades quite unexpectedly during periods of a few days. (See also "Iapetus and the Glare of Saturn", Str. A., Vol. 23, pp. 126-127.)

Even though Delano is quite experienced in this kind of work, it is not likely that any specific conclusions can be drawn from the work of a single observer, especially since it is quite difficult to evaluate the internal accuracy of the estimates statistically. What is needed, therefore, is a full program undertaken by a larger number of observers, using methods comparable to the above.

Conclusions

When compared with the three immediately preceding apparitions, the 1969-70 period showed a slight increase in activity in Saturn's atmosphere, evidenced by the photographic data. Observer participation during this apparition was somewhat better than in the previous years, but it is still apparent that wider coöperation in all of the Section's programs is necessary for a meaningful analysis of the data to take place. Now that a variety of observing forms and drawing blanks are available to observers, it should be possible for interested individuals to submit a coherent mass of information about the planet in subsequent apparitions. Careful reading of The Saturn Handbook (available from

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*See also the postscript on page 35.

the Recorder) will serve to introduce enthusiasts to the techniques and methods used by the Section, and individuals will find discussed in the booklet all of the programs of the Section as well. It is hoped that individuals will become aware of the need of beginning systematic observations early in the apparition and following them through up to the time when Saturn nears conjunction with the Sun. As always, this Recorder will be happy to provide further details on any aspect of Saturn observing, and interested individuals are encouraged to discuss their observing plans with him.

Postscripts by Editor

Front Cover Drawing. The drawing by Mr. Eugene W. Cross on the front cover will illustrate much of Dr. Benton's discussion in his report. The South Equatorial Belt was the only definitely resolved belt, even though the view was so good as to be diffraction limited for periods of up to two or three seconds. The South Polar Region was very dusky, more so with a red filter. The Equatorial Zone was pale and creamy. Cassini's Division was present all the way around the visible portion of the rings. In the best moments "Encke's Complex" was distinctly visible at the east (right) ansa but was only suspected at the west ansa. The disc of satellite Titan could be distinguished. The Crape Ring (C) was plainly present.

Concerning the Bicolored Aspect of the Rings. Since it is natural to wonder whether these curious observations can be explained by atmospheric dispersion, the differing atmospheric refraction of different colors of light, the Editor on April 11, 1971 intentionally followed Saturn to a very low altitude. He employed a 12.5-inch reflector at 202X and carefully centered Saturn in the field of the eyepiece. He made these observations:

1.2:55, U.T. Seeing 1-3, transparency 5.
The west and southwest borders of the ring-ellipse were reddish; the opposite east and northeast borders, bluish. The dispersion-caused red was much stronger than the similarly spurious blue.

2.3:20 U.T. Seeing 1-2, transparency 5. Perhaps 30 to 35 per cent of the area of the rings and globe was now falsely colored.

3.3:29, U.T. Seeing 0-1, transparency 3. The false hues now pervaded all of Saturn and its rings, with the false reds much stronger than the false blues.

The difference in refraction between red (0.64 microns) and green (0.54 microns) was then computed, as well as the difference between green and blue (0.49 microns). Results were as follows:

Time	Observed Altitude Saturn	Altitude Red -Altitude Green	Altitude Green -Altitude Blue
2:55, U.T.	11°.77	-1".28	0".95
3:20	6.67	-2.16	1.61
3:29	4.86	-2.80	2.08

The position angle of the zenith for the three times was close to 58°. The position angle of the north end of the axis of Saturn (or its rings) was 359°. Dispersion will produce blue colors on the side of an image toward the zenith. The major axis of the rings was 38" on April 11; the minor axis was 15".

Of course, the low altitude of the planet greatly exaggerated the ordinary role of atmospheric dispersion. It is also to be noted that the shorter (blue) wavelengths do not then readily penetrate the atmosphere to reach the observer.

THE 1972 W.A.A. - A.L.P.O. CONVENTION AT RIVERSIDE

By: Christopher Vaucher

The Twentieth Annual Convention of the Association of Lunar and Planetary Observers was held on August 16-19, 1972, in conjunction with the Convention of the Western Amateur Astronomers at Bannockburn, in Riverside, California. The host society for the event was the Riverside Astronomical Society.

At 9:00 A.M. on Wednesday, August 16th, the Convention opened with the usual speeches welcoming the Conventioneers. General Chairman for the Convention was Mr. Clifford Holmes, who made the welcoming speech and introductions. Unfortunately, A.L.P.O. Director Walter Haas was unable to attend this year, due to an illness in the family. After the initial speeches, an Alexander F. Morrison Lecture was given by Dr. William J. Kaufmann, who discussed in detail the topic of "Quasars and Exploding Galaxies". Other papers that

Figure 45. Group at W.A.A.-A.L.P.O. Convention at Riverside, Calif. in August, 1972. Left to right: Dennis Milon, Christopher Vaucher, Harry Jamieson, Kenneth Delano, H. W. Kelsey, J. Russell Smith, Virginia Capen, and Charles F. Capen. All photographs on this page were taken by Christopher Vaucher.

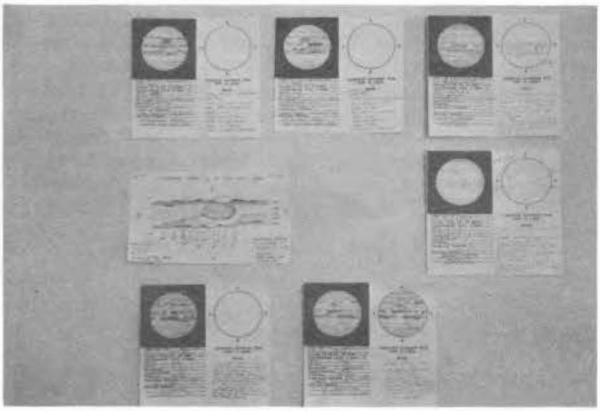

Figure 46. The A.L.P.O. Jupiter Display in the Exhibit Area. Arranged by Mr. Harry Jamieson.

Figure 47. Partial view of the Riverside Convention Banquet. Mr. Clifford Holmes, Chairman of the Western Amateur Astronomers, left of center at the head table.

morning were: "MWP-2, An Evaluation", presented by Raymond G. Coutchie of the Polaris Observatory Association, "Two Films for Astrophotography" by Mary L. Firth, and "The July 10th Solar Eclipse" by Art Johnson.

At noon on Wednesday, the Group Photograph was taken immediately outside of the Bannockburn Student Housing Center (for the University of California), with the afternoon paper session following.

Other papers presented that day included a "Simplification of Guiding for Celestial Photography", by Clarence P. Custer. Jack Eastman discussed some "Inexpensive Techniques for Detecting Solar Prominences", and Warren Estes gave a fascinating talk on "Spectroscopy". One of the highlights of the day was a talk given by A.L.P.O. Mars Recorder Charles F. Capen on "Observing Mars in 1971 - A.L.P.O. Report". In it Mr. Capen mentioned that a huge amount of quality black and white as well as color photographs had been received (more than ever before) and that the Mars Observing Section has recently become an "international affair" with a total of more than 1,575 world-wide observations received by July 12, 1972.

An interesting attraction of this year's convention was an open celestial slide show, held on Wednesday evening. This proved to be a popular part of the program, and all the seats were pretty filled for the session.

On Thursday morning another active paper session got underway. Thomas A. Cragg of Hale Observatories gave a talk on a "Classical Cepheid Project", discussing the results of a project previously proposed whose aims were to determine if any period change occurred in several select Cepheids. Yet another interesting paper was read by Father Kenneth J. Delano, but written by John Westfall, on "SO-456: A New Film for Lunar Photograhy". Mr. Westfall found that the new Kodak film, SO-456, exaggerated lunar tones and color values, but did not produce false hues. It also "could equal, and even surpass the tones and color values visible to the eye". Following this paper, Adrian L. Fitch of Delta Lambda Co. discussed why it was best to use monitored thin films for amateur telescope mirrors. The last paper of the day was by Dr. Harold Ziron on the "Solar Observing Program of the California Institute of Technology". In this article, Mr. Ziron also presented movies of several large flares and sunspot groups taken by the Big Bear Solar Observatory.

Mr. Harry Jamieson collected and set up the A.L.P.O. exhibit. We thank him and all persons who contributed to the display.

At 1:15 Thursday afternoon, field trips to the Big Bear Solar Observatory and the old Mission Inn got underway. Visitors to Big Bear (located on Big Bear Lake, northeast of Riverside in the San Bernardino Mountains) were able to tour the housing facilities and the observatory itself. A highpoint of the trip was the opportunity to see the Sun through the telescope, in filtered light.

In the evening hours after the field trips, the annual A.L.P.O. Business Meeting commenced. After the meeting, the San Francisco Sidewalk Astronomers started an informal star party using their stopped down 24" Newtonian reflector. Other large telescopes, such as the 14" Celestron, also added to the enjoyment of the session.

The paper session started early on Friday morning, with no less than 8 papers presented before lunch. Thomas O'Hara and Victor Wagner gave an excellent lecture "A Comparison of Films for Wide-Field Astrophotography". The results of tests of 6 black and white films and 8 color films revealed that Kodak Plus-X had by far the best overall performance of the b&w films, while in the color film category Kodachrome-X fared best for resolution, and either GAF 200 or 500 did favorably for recording star clouds. John Bally of Chabot Observatory read his article on "A Measurement of the Jovian Atmospheric Temperature". Using the quadrupole rotation-vibration spectrum of molecular hydrogen, Mr. Bally found that Jupiter's temperature ranges between 150 and 180 degrees Kelvin about 10 kilometers above the optical reflecting layer. Yet another excellent paper, "The Intensities of Dark-Haloed Craters", was given by Father Kenneth J. Delano. In his talk Father Delano stated that the purpose of his program was to determine whether dark-haloed craters darken or lighten significantly at certain times in the lunar day. His findings so far indicate that most haloes maintain a constant intensity throughout the lunar day, although the areas surrounding these haloes may vary their intensities, depending on the particular colongitude. Chris Crawford talked about "Visual Methods in Meteor Astronomy", pointing out the most valuable contribution an amateur can make today is determining the rate at which meteors are falling. He then went on to discuss various formulas which could be used to help counteract the undependability of human observations of such events. Ron Doel gave a brief talk <u>in absentia</u> on "Color Recording for the Jovian Observer", stating that he thought the relatively great number of black and white Jupiter drawings indicates a great bias against the true value of color sketches; and he urged more observers to make color sketches.

Friday was topped off by a field trip to Goldstone Tracking Station, leaving Bannockburn at 1:15 P.M. Goldstone is located approximately 45 miles northeast of Barstow, California, on the road to Fort Irwin. Of particular interest on the trip was the 210-foot-diameter dish of the fully steerable radio and radar telescope, called the Mars Station. One of the uses of this large dish is to track extremely distant interplanetary probes, like the Mariner unmanned missions. More recently, it is being used to support the Pioneer 10 mission to Jupiter.

Saturday was the last day of the Riverside Convention, with the paper session starting off by 9:00 A.M. Several articles were presented during the day--some of these were: "A Venus Observing Program" by Brad Dischner, which is a report of the findings of 11 participants observing Venus on over two hundred occasions in April, 1972, "Post Exposure and Planetary Photography" by James P. Little, George H. Sanderson's talk on "The Super Asteroid Theory", and a lecture given by Gerald Wheeler of North American Rockwell, discussing interesting lunar areas revealed by some lunar photos taken by the Apollo manned missions.

In the afternoon paper session, Charles T. Kowal of Hale Observatories talked about a "Supernova Patrol". He argued that valuable contributions in this field can be made by amateurs visually since most of the photographs taken of galaxies are usually "burned out" at the center, meaning that supernovas are detected only when they occur near the edge of galaxies. Another paper by Joan and David Dunham, titled "Observations of the July 10th Solar Eclipse", was an unusual article mentioning the difficulties they had traveling to northern Canada (which was often humorous) and the experiences they went through once there. The last article given at the convention was one by Dr. James A. Cutts of the Jet Propulsion Laboratory, on "Mariner 9". Dr. Cutts discussed some photos taken of Mars, pointing out: large sedimentation deposits at the poles, Nix Olympica--a volcano the size of Missouri, large craters completely filled by sand drifts, and large areas which are apparently fault zones. After this lecture, at 4:30 P.M. the W.A.A. members retired to hold their annual board meeting.

At 7:30 P.M. everyone gathered in the Dining Commons at Bannockburn for the Award Banquet. The Conventioneers enjoyed informal socializing and a magnificent dinner with a good selection of things to eat. Numerous door prizes were presented during the banquet, followed by the presentation of the G. Bruce Blair Award to Clinton B. Ford for his 45 years of variable star work.

After breakfast Sunday, the Convention came to a close. It was decided at the A.L.P.O. Business Meeting that the 1973 Convention would be held at Omaha, Nebraska on August 1-5 in conjunction with the National Convention of the Astronomical League.

The A.L.P.O. members express their sincere appreciation to their host, the Riverside Astronomical Society, and especially to Mr. Clifford Holmes, who helped make this Convention a memorable one.

ANNOUNCEMENTS

Sustaining Members and Sponsors. The persons in these special classes of membership as of November 26, 1972 are listed below. Sponsors pay dues of $25 per year; Sustaining Members, $10 per year. The balance above the normal rate is employed to assist the ALPO in suitable ways. We thank all these colleagues for their generous and meaningful assistance. Many of them have regularly renewed as Sponsors or Sustaining Members for many years.

It is also possible that there are some errors in the lists here given. These are wholly the fault of the Editor's bookkeeping. He will be glad to correct whatever mistakes are called to his attention. In particular, he hopes that no names have been inadvertently omitted.

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Figure 48. Mr. Clifford W. Holmes, the General Chairman of the WAA-ALPO Convention at Riverside, California in August, 1972. Mr. Holmes is also the Chairman of the Board of Representatives of the Western Amateur Astronomers. All photographs on this page were taken and contributed by Mr. Christopher Vaucher.

Figure 49. Group beside 8-inch Cave Reflector in Exhibits Section at WAA-ALPO Convention at Riverside. Left to right: Harry Jamieson, Todd Hansen, and Roy Parish.

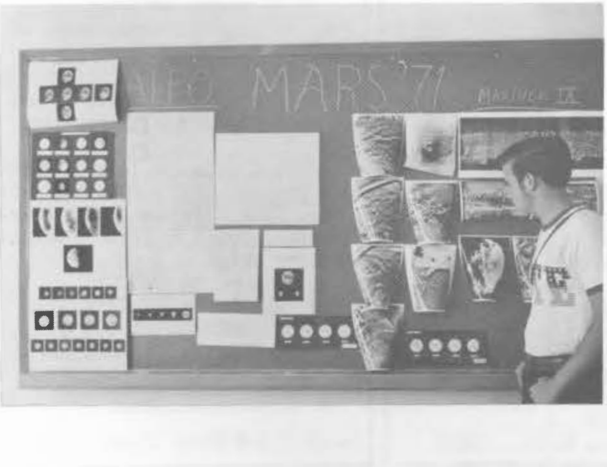

Figure 50. ALPO Mars Display in Exhibit Area at Riverside Convention. Mr. C. F. Capen, the ALPO Mars Recorder, contributed to this display Mariner IX photographs and other Mars items.

Change in Venus Recorder. Dr. Dale P. Cruikshank, our ALPO Venus Recorder for many years, has asked to be replaced. In particular, he feels that an an expected year of research in the Soviet Union would make it impossible for him to answer Section correspondence properly or to deal adequately with Venus observations contributed by members. We express our thanks to Dr. Cruikshank for his many services to the ALPO and to the Venus Section over the years. We are glad that he plans to contribute and to participate in other ways.

The new Venus Recorder is Dr. Julius L. Benton, Jr., Jones Observatory, P. O. Box 5132, Savannah, Georgia 31403. Dr. Benton is already the Saturn Recorder. As a result of a recent change in his employment circumstances, he is very confident that he can find enough time to supervise the ALPO Venus Section as well, and properly. All observers of Venus should begin at once to mail their observations to Dr. Benton, and all correspondence about that planet should be addressed to him. We thank him for accepting the Venus Recordership.

Lunar and Planetary Training Program. The attention of new members is directed to our training program, in charge of Mr. Richard J. Wessling. Indeed, many older members would unquestionably also benefit from this service. Several persons have completed the course of training offered by Mr. Wessling, and we plan to carry their names in a near-future issue. We want at that time to describe the training service in more detail, but we hope that it will meantime be used more by our readers to improve their observing skills and also their knowledge of lunar and planetary astronomy.

Change in a Book Review Policy. It has been our practice for many years that review copies of books furnished by publishers should go to the ALPO Library. It has been decided that in the future such copies will instead be given to the person reviewing the book. This change is due in part to very light recent usage of the ALPO Library, which we regret. Perhaps, however, acquiring a new book will be an added motivation to potential qualified reviewers among our readers; and it is surely a proper reward for such assistance.

Concerning Indexing This Journal. It will be noticed that the index of Volume 23 of *The Strolling Astronomer*, completed with our immediately preceding issue, appears as the four middle pages of this issue. Therefore, those wishing to do so can easily remove the four pages of the index from the rest of the issue. We hope that this capability will make the index more useful and more convenient to use. With considerable help from Mr. J. Russell Smith, we are working upon the problem of providing similar indexing for past volumes. Readers are invited to express their interest.

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STAFF

EDITOR

Walter H. Haas
Box 3AZ
University Park, New Mexico 88003

SECRETARY

Atty. David P. Barcroft.
Box 3AZ
University Park, New Mexico 88003

LIBRARIAN

Mrs. Walter H. Haas
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Dept. of Geography
San Francisco State College
1600 Holloway Avenue
San Francisco, California 94132

Winifred S. Cameron
NASA, Goddard Space Flight Center
Code 641
Greenbelt, Maryland 20771

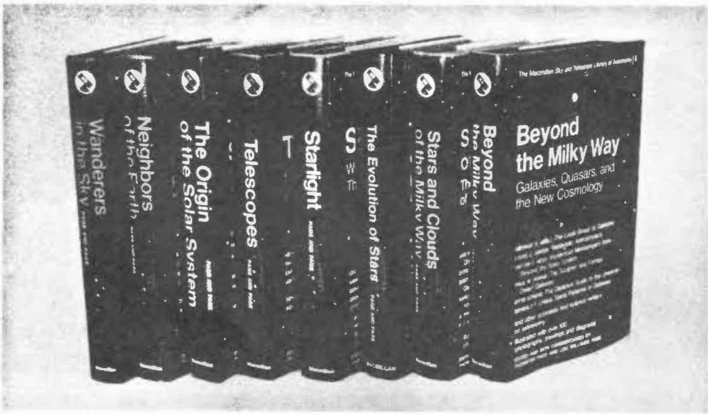
Kenneth J. Delano
22 Ingell Street
Taunton, Massachusetts 02780

Harry D. Jamieson
4030 S.E. Gladstone, Apt. 15
Portland, Oregon 97202

Christopher Vaucher
6130 S.E. Reed College Place
Portland, Oregon 97202

LUNAR AND PLANETARY TRAINING PROGRAM

Richard J. Wessling
946 Deblin Drive
Milford, Ohio 45150



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