pg. 62 et seq.

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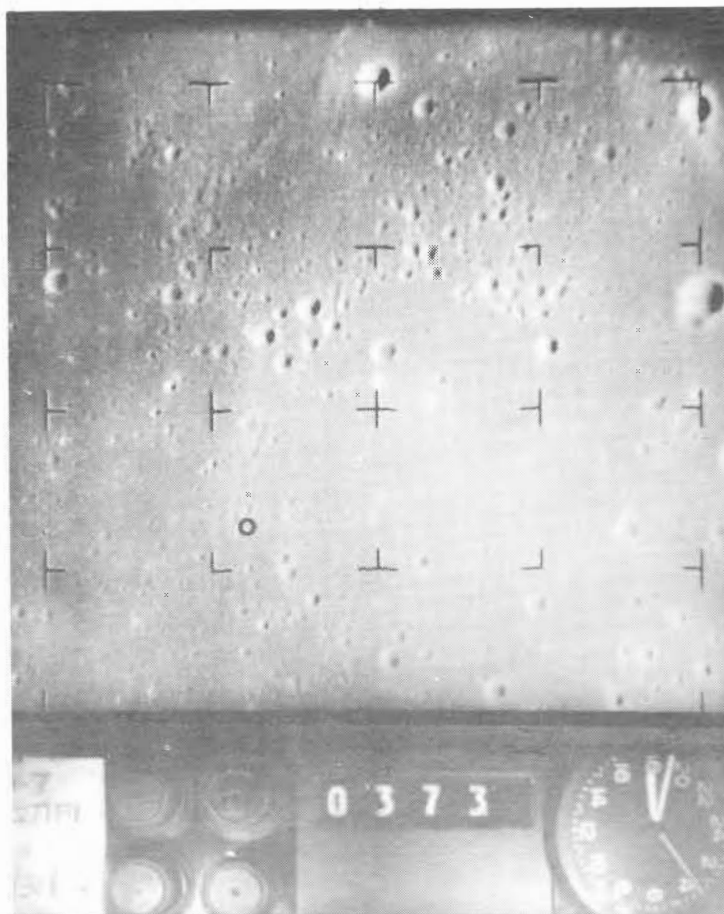

A Ranger VII photograph showing part of Mare Nubium from an altitude of 55 kms. (Photo No. 64 - Ranger B -28.) 13 hrs., 25 mins., U.T., on July 31, 1964, 25 mm. f/1 lens. The area photographed is about 26 kms. on a side and is about 30 kms. east (I.A.U. sense) of Bonpland P. The crater cluster shown appears as a Copernicus ray on earth-based photographs. The small circle below and left of center is the Ranger VII impact-point. Lunar south at top and west (I.A.U.) at right. Photograph released by N.A.S.A. and submitted by John E. Westfall.

THE STROLLING ASTRONOMER

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ASSOCIATION OF LUNAR & PLANETARY OBSERVERS
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IN THIS ISSUE

SOME NOTES ON LUNAR COLOR PHENOMENA

By: Kenneth Schneller

Noting the recent interest in lunar color phenomena and recalling Dr. Bartlett's informative and interesting article on Piton (Str. A., Vol. 17, pp. 3 - 12), the writer would like to comment on his observations of Piton during November and December, 1960 and January, 1961, near colongitude 3°, and would like to suggest construction of a simple, inexpensive spectroscope to be used in a search for possible lunar color phenomena.

Only on three occasions during the past four years (i.e., on the above implied dates) has the writer seen some type of definitely peculiar lunar color phenomenon. On these occasions, observing with an 8" Newtonian, using a 53X Plossl eyepiece when the Moon was near the zenith, the writer saw red "obscurations" that concealed some or all of Piton's peaks. At maximum size the November obscuration covered a 10 sq. mi. area, rapidly changed shape (despite steady seeing), reached a maximum red enhancement in only five minutes, faded slowly during the next fifteen or twenty minutes, and finally completely disappeared, leaving no trace of its previous existence as Piton resumed its normal appearance! The December and January obscurations were correspondingly much less intense, did not reveal so bright a red color, and did not reach such a large size at maximum. Each obscuration was slightly different; but all were observed under good seeing with no signs of chromatic aberration (optical or atmospheric) at the cusps, terminator, limb, or lunar "interior". Moreover, the transparency was constant. Since then, despite visual observations of the same region (three times during the same lighting conditions) using color filters and a visual spectroscope, the writer has never again observed anything on Piton to suggest a similar phenomenon.

The writer has, however, noted a very temporary red enhancement of a bright spot on the wall of Gassendi (xi = - .634, eta = - .299, as plotted in the Orthographic Lunar Atlas) at colongitude 40°.12 lasting for about 45 minutes; but he strongly believes that the color (not noted in integrated light, but observed with color filters and also with a spectroscope) may be no peculiarity but probably merely an aspect at normal morning illumination. On one other occasion, a color phenomenon was suspected (in Burg); but again it was not seen in integrated light and was noted only weakly with color filters and a visual spectroscope. Except for the Piton observations (in which the red color was very strong, even without filters), the writer is very skeptical of his other observations (a larger instrument would help to reduce the uncertainty) but nevertheless feels that, should a real phenomenon occur, the spectroscope would be the best means of observation.

Color filters have proved very unreliable. Because a red filter is a good contrast filter for lunar observation, all bright areas look like emission patches! In the writer's opinion a spectroscope, when properly used, is needed to untangle the observations. When examining the moon for possible color phenomena, the writer carefully compares the spectrum of suspected objects with that of nearby features. If the enhanced region covers too large a region of the visual spectrum, the enhanced color is considered to be due only to the object's own reflective properties. If the enhanced portion covers only a small section of the red, and if during the decrease of the red enhancement, a simultaneous increased enhancement of a narrow region (30 to 40 Å or slightly more - comparable to the effective resolution of the spectroscope) in the blue is noted, then the writer suspects a possible color phenomenon. The spectroscope is used regularly with the telescope for lunar observation. Except for the Piton observations, the other rare suspected cases were dubious, recorded when using only color filters. Lunar colors should be accepted as good possibilities only after very careful spectroscopic scrutiny.

For these reasons it is urged that interested observers use a spectroscope to carry out a similar search. For those who believe that a spectroscope is too expensive an accessory, the writer might describe his inexpensive spectroscope. A Plossl eyepiece (incidentally, the same one used visually for the Piton observations) is employed with a razor-blade slit mounted at its focus and a very inexpensive (Edmund Scientific Co.'s stock number 40, 272, price 25¢) replica grating capped over the eye-lens. For an 8", f/8.5 reflector, the spectroscope works best visually when the slit is adjusted to give an effective resolution of about 40 Å. A clock-drive is almost a necessity, and an amplifier-oscillator to regulate the driving rate is most helpful.

The writer hopes that this paper has stimulated interest in this type of observing and welcomes any criticisms and suggestions concerning this paper. Readers may properly be skeptical of the comments made here; but if they will carry out a similar search, the paper will have well served its purpose. The writer will welcome correspondence at his address, 17826 Hillgrove Road, Cleveland, Ohio 44119.

MEASUREMENTS OF THE VENUS TERMINATOR CUSP-CAPS

By: Klaus R. Brasch

The terminator cusp-caps appear to be the only features visible on Venus which are at least of a semipermanent nature, all other markings being distinctly temporary both in shape and in duration. "Semipermanent" means that, while they are not obvious concrete surface markings (as, for example, the Martian polar caps), they remain nevertheless the only Venusian features to retain a basic identity and to be reported with some degree of regularity. In view of this fact, an attempt has been made to measure the size of these caps from drawings in an effort to find any possible significant trends therein.

Any study of Venusian surface detail is immediately confronted with the major difficulty that neither the planet's period of rotation nor the position of its polar axis is accurately known. Concerning the latter, if it is assumed that the cusp-caps represent the true poles of Venus, the axis near dichotomy would then lie approximately along the position of the terminator; and at the same time the period of rotation would presumably have little effect on the size of the caps over a prolonged period of observation.

With the above assumption in mind, the angle ϕ at the center of the planet's disk, subtended by the extremity of a cusp-cap (or by the region contained by a cusp-band) and the line joining the two cusps was measured (see Figure 1). A total of 61 suitable drawings, made during three successive evening apparitions by observers of the Montreal Centre of the R.A.S.C., was used for this purpose. The advantage here is that a sizeable sample of observations, made over an extended period of time, by more than one observer provides a fairly good control for the results obtained. Only drawings made between k = 0.80 and k = 0.30 were utilized, all others beind deemed unreliable for positional measurements. As usual, k denotes the illuminated portion of Venus. The values of ϕ thus secured are tabulated below:

Evening Apparition:	1960-61	1962	1964
North Cap			
Mean Angle	$34^\circ \pm 6.^\circ0$	$38^\circ \pm 4.^\circ0$	$33^\circ \pm 2.^\circ6$
No. of Observations	13	18	5
South Cap			
Mean Angle	$26^\circ \pm 4.^\circ6$	$26^\circ \pm 3.^\circ8$	-
No. of Observations	20	28	0

After we inspect the data, the following three points may be noted:

(1) There appears to be no significant change in the size of a cap during a given period of observation (at least none is detectable within the limits of accuracy of the above data).
(2) No appreciable change in the size of a given cap from one apparition to the next is evident.
(3) The northern cap appears to be consistently the larger of the two.

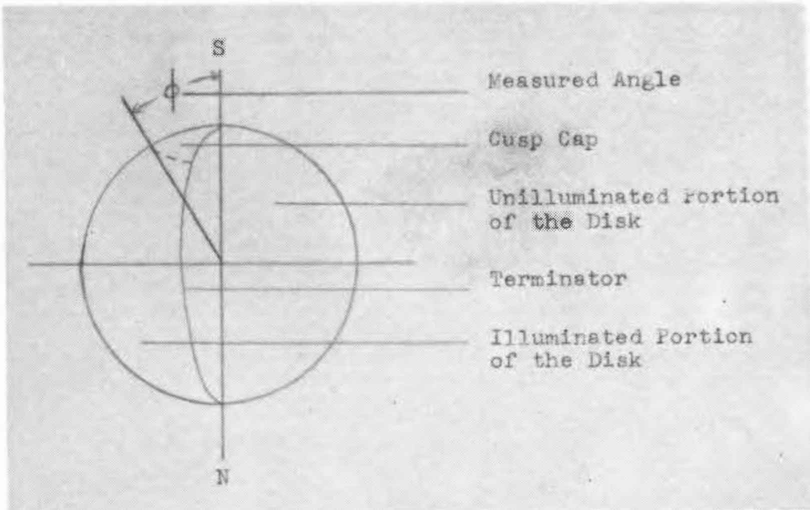

FIGURE 1. Schematic to show angle ϕ measured by Klaus R. Brasch in his study of the size of the Venusian cusp-caps. See also text.

The last statement is in agreement with other A.L.P.O. observations for 1960-61 and 1962[1]. In the light of the above conclusions, histograms were constructed by combining all three sets of observations (Figure 2).

Discussion

Several criticisms can immediately be levelled against the above statistics. In the first place, are the figures at all valid? Keeping in mind that, (1) all detail noted on Venus is near the threshold of visibility, and (2) as mentioned earlier, the measurements are based upon an unproven assumption, can the above generalizations be accepted at face value? No definite answer can be given here, except perhaps to point out that since the values are reasonably consistent, they do carry more weight than if they were merely scattered at random. Is the apparently consistent difference in the size of the two caps significant? A single observer might possibly tend to show the northern cap consistently larger than the southern one; however, this error is much less likely to occur with three observers, as here described.

More curious still, is the seeming stability of the size of a given cap during a single period of observation (averaging about three months), as well as from one apparition to the next, actual? If one were to draw a somewhat dubious analogy between the Venusian cusp-caps and the Martian polar caps, one would reach the conclusion that, unlike the latter, the Venus caps do not exhibit seasonal changes. Of course, in view of our present knowledge of Venusian temperatures and atmospheric conditions, the caps of the two planets are probably not at all similar, in which case a term like seasonal changes would have no meaning whatsoever with reference to Venus. On the other hand, the cusp-caps do undergo long term changes in size which, as indicated by past A.L.P.O. records[2], only become evident over a number of years.

An additional consideration to be made when discussing the possible nature of these caps is in reference to the observations themselves. Does the actual measured extent represent the visible part of a cap whose complement (as one would be led to believe by morning apparition observations) lies obscured in the unilluminated portion of the planet? If this is so, then all the values of ϕ would presumably have to be doubled in order to

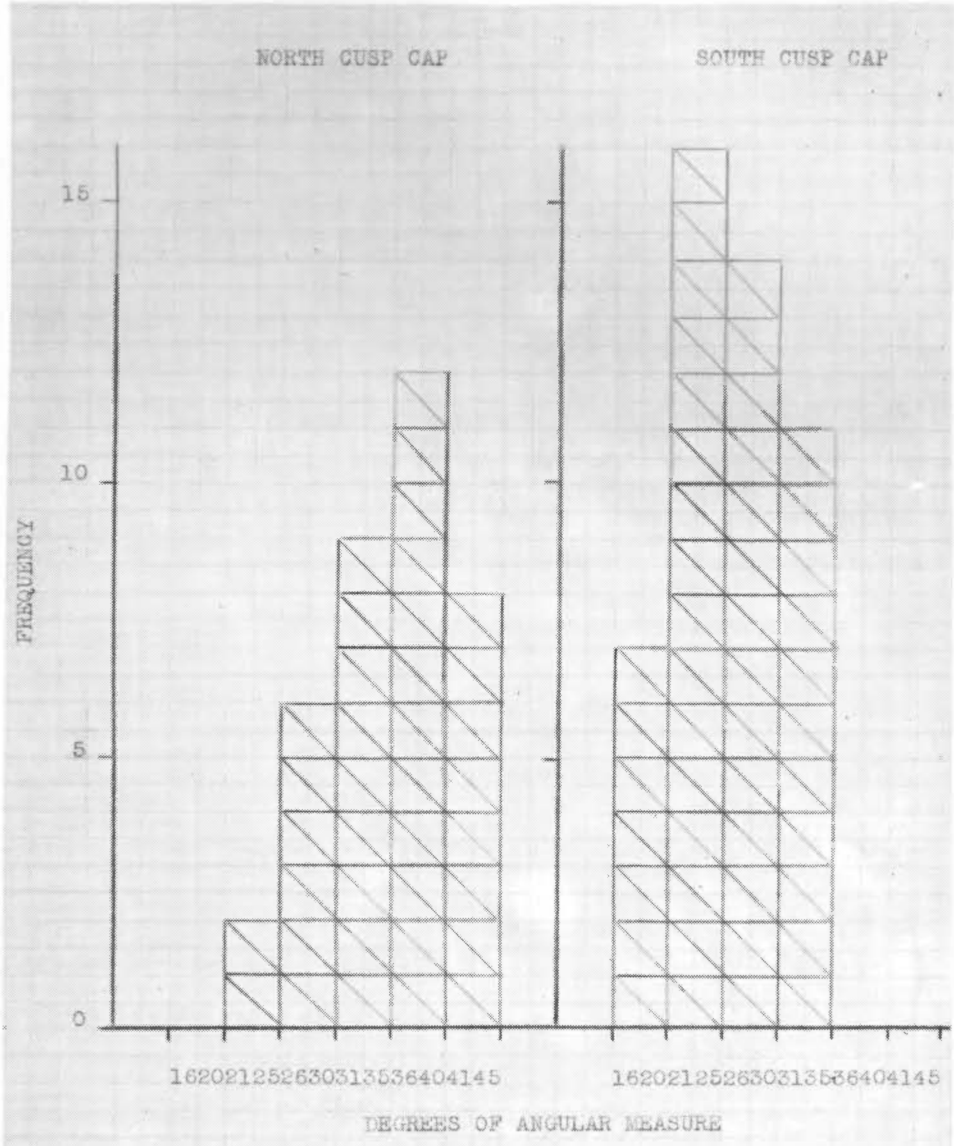

FIGURE 2. Histograms to show frequency of occurrence of various intervals on values of ϕ in Mr. Brasch's study of the size of the two cusp-caps of Venus. By "1620" we mean the interval on ϕ from 16 degrees to 20 degrees, by "2125" the interval from 21 degrees to 25 degrees, etc.

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express the size of an entire cap.

Finally, then, there seems to be very little that can be concluded with any certainty from the above statistics. In fact, one would tend to disregard them altogether, were it not for their internal consistency.

References

1, 2, Hartmann, W., Str. A., Vol. 17, pg. 252, 1963.

SOME OBSERVATIONS OF THE LUNAR FEATURES HERACLITUS AND LICETUS

By: George E. Wedge

(Paper read at the 1962 A.L.P.O. Convention at Montreal.)

Lying just south of Stoefler is a curious group of features known as Heraclitus and Licetus, whose general appearance is that of a large, irregular enclosure, with curved walls to the north and south and straight walls along the eastern and western sides. This region is shown in Figure 3. However, further investigation reveals that it consists of two large circular walled plains, joined by what appear to be two very large faults. The following brief description of these features is based on 21 observations made during 1960-1961 by five members of the Montreal Centre of the R.A.S.C. Lunar east and west are used in the old sense where west is the hemisphere of the Mare Crisium.

Licetus lies to the north of the faults. It is roughly circular in shape and has a diameter of approximately 73 kilometers. Most of its western rim has been ruined by the intrusion of several large craters, and much of the southern rim has disappeared, due presumably to the collapse of the region to the south. The remainder of the wall, except for a few isolated disturbances, appears to be intact.

The southern feature is somewhat smaller than Licetus,being approximately 54 kilometers in diameter. It is circular in shape and has broad walls to the south and east. The western and northwestern sections are very narrow and appear to drop steeply to the crater floor. The north-eastern section of the rim appears to be non-existent; however, a very narrow rim was observed on May 4, 1960, and again on October 29, 1960, at colongitude 5°.61 and 18°.5 respectively.

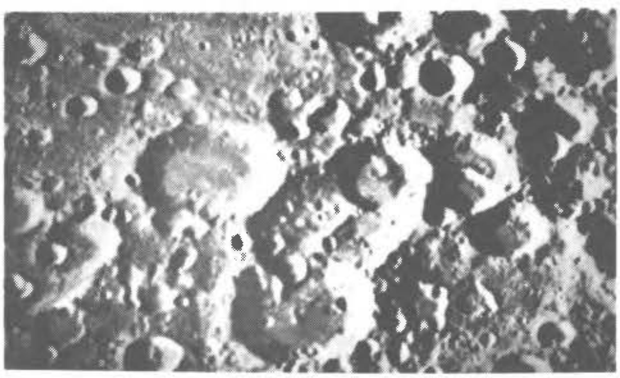

FIGURE 3. The Heraclitus - Licetus area on the moon discussed by Mr. George E. Wedge in his article in this issue. Plate C 7-a in the Kuiper Photographic Lunar Atlas, a Pic du Midi photograph taken on May 30, 1944. Lunar south at top, lunar west (non-IAU sense) at left. The photograph shows many of the features discussed in the text.

The two large faults between these two formations appear to slope downwards from the east and west, each terminating at the foot of a long irregular ridge at the center. This ridge is about 36 kilometers in length and has been ruined along most of its eastern edge by five large craters.

Detail within the western fault consists of several small ridges and numerous craters, many of which are grouped in chains. A very fine chain of seven small craters is located about one-third of the distance from the western edge of the fault to the central ridge.

The eastern fault is similarly abundant in small craters, many of them occurring in pairs. The most notable feature within this region is a long rille; this feature begins as a chain of four small craters, near, and almost at right angles to, the central ridge; it then becomes a broad rille curving northeast, and then east again, becoming narrower as it nears the eastern edge of the fault. This feature was observed on April 24, 1961, at colongitude $14^\circ.2$, and was subsequently seen on three other occasions at colongitudes $14^\circ.3$, $7^\circ.4$ and $357^\circ.9$, the latter value being very near local sunrise.

From the above description, it appears evident that this particular region of the moon suffered some rare catastrophe. Perhaps whatever caused the formation of the two circular plains weakened the region between them, causing the whole area to collapse. Rectified photographs of this region might show this aspect more clearly.

SOME COMMENTS ON COMET OBSERVING - PAST AND FUTURE

By: David D. Meisel, A.L.P.O. Comets Recorder

Some time ago, I received a print of a photograph taken of Halley's Comet by Mr. Clive Chapman of Woollahra, Sydney, Australia. I had fully intended to add this to the material on a number of comets submitted by Mr. Frank Kelly of St. Petersburg, Florida and to write an article on some of the comets that appeared earlier in this century. However, time has gone by, and there is still no inspiration for this article. Mr. Kelly's observations have found their way to a number of A.L.P.O. Conventions for exhibit and perhaps have been seen by many of you. Upon reading lately of some of the trials of amateur astrophotography, I was reminded of Mr. Chapman's comments. I would like to share them with you, now. Perhaps time in the future will permit some reflections on both Mr. Chapman's and Mr. Kelly's interesting comments on previous comets. Mr. Chapman wrote:

> ". . . . but of course my photographic means were of the slightest; an old camera, bellows type; which cost me only 7/6 at that time. Also we had to use dry plates which demanded long exposures; I gave the comet a little over 30 seconds (!); holding the camera (tied to the tube of a small 1½" telescope) on the back of a chair, while I held the telescope as a finder, as I sat astride the chair for those 30 seconds (without even breathing?). I often laugh now when I think of it; as one little shake would have ruined the picture".

I present the photograph not as an example of exquisite photography, but rather as a "think-you-have-had problems" picture of what can be done with the crudest of equipment. Some of us who own some fancy pieces of equipment should be so lucky. Of course, Mr. Chapman had the advantage of a very bright comet to help him out. The question is, will you be ready if a bright comet appears?

Many amateurs are concerned about how to get news of comet discoveries. There are a number of possible solutions. Telegraphic communication with the Harvard College Observatory (the official I.A.U. distribution center for the western hemisphere) or with the I.A.U. center in Copenhagen is very expensive, and very few people can afford this type of service. Somewhat cheap, though somewhat slower, are the mail circulars. Among these are the Harvard Announcement Cards, the B.A.A. Circulars, and the I.A.U. Circulars. The B.A.A. Circulars are available to B.A.A. members on an annual subscription basis. The other two are also available to the amateur observer on a subscription basis. The H.A.C. are available by prepaid subscription. (Write to the Librarian, Harvard College Observatory for a rate schedule.) The I.A.U. Circulars are available to responsible amateurs on a deposit basis. At the beginning of the year a deposit (say 10 dollars) is made. The account is kept for a year. If the deposit is not sufficient to cover the number of cards you received, you are billed for the balance. (Inquire from the Bureau Central des telegrammes astronomiques, Observatory, Östervold 3, Copenhagen K, Denmark.) Observers in the western hemisphere (N. and S. America) would probably receive the Harvard Cards before the I.A.U. Circulars.

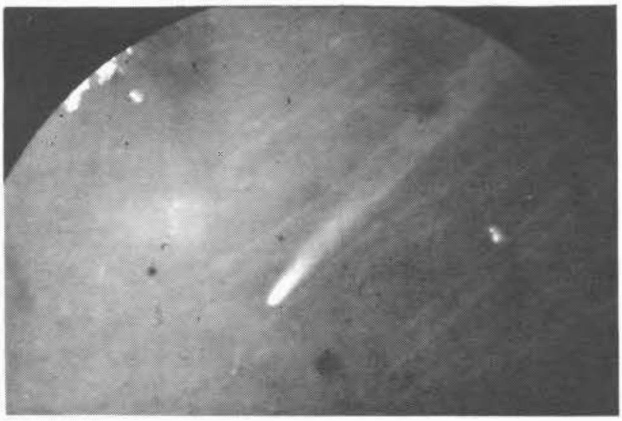

FIGURE 4. Photograph of Halley's Comet at its last return by Mr. Clive Chapman, Sydney, Australia. Equipment and circumstances are described in Mr. David Meisel's first article in this issue.

Observers interested in the return of periodic comets should consult a copy of the current B.A.A. Handbook. This publication is issued annually, with publication usually in November of the preceding year. In all of these publications ephemerides (predicted positions) are given. Many times, however, for various reasons, the given right ascension and declination may differ somewhat from that observed. The reliability of a published table depends in general on the number of positions used to compute the orbit. If only a few observations are available, the positions will tend to be less certain. Users of cards and circulars should always be aware of the possibility of a set of positions with relatively low intrinsic accuracy as compared with observation.

Now we will assume that the observer can locate the object in the sky after he has received notice of its discovery. The question is, what observations to make. Much of the answer depends on the observer and his equipment. However, the author should like to point out briefly some of the programs of interest. In the future, the Comets Section of the A.L.P.O. will be mainly interested in the following items.

Visual Observations:

1) Visual magnitudes estimated with out-of-focus stars
2) Visual coma diameter estimates
3) Visual tail length estimates and position angles

In reporting the above, always include the aperture of the telescope and the magnification used.

Photographic Observations:

1) Photographic magnitudes
2) Photographic coma dimensions
3) Photographic tail position angles and lengths

It is preferred that the observer do his own photographic reductions and send the results to the Comets Recorder. Sketches from the photographs for identification purposes can also be included. If the observer wishes to send prints of the photographs he may do so. However, photographs submitted for possible publication should be sent directly to the Str. A. Editor. If photographs are sent to other magazines, it is recommended that entirely different negatives be used in each case.

Special projects:

1) Comet searching
2) Faint comet survey
3) Orbit computation and astrometry

It is not unusual for a usually faint comet suddenly to flare-up and to become much brighter than normal. A recent example of this was P/Comet Kopff 1963i. During May of 1964 it was sighted by members of the Oriental Astronomical Association in Japan at about 9th magnitude. According to the ephemeris for that date, its brightness should have been about 12 to 14. The mechanism for such outbursts is not known, and it would be useful for amateur observers to check very faint comets for such behavior. Negative reports are also of value in such a program.

Details of these various programs will be included in the Comets Chapter of the forthcoming A.L.P.O. Observing Manual. All material which was originally planned for a Comets Section Monograph Series is now being edited for the Manual.

Finally, although the Comets Section is primarily interested in the types of observations listed above, any and all contributions are welcome. Because of the financial burden, postal acknowledgments cannot be made in every case unless return postage is included. All contributions are acknowledged in the pages of the Section Reports in the Str. A.

A.L.P.O. COMETS SECTION 1962 FINAL REPORT, PART II

By: David D. Meisel, A.L.P.O. Comets Recorder

Comet Humason 1961e

The list of observers of this comet and other particulars were given on pages 232-234 of the Nov.-Dec., 1963 Str. A. Although discovered in 1961, this comet did not reach perihelion until December of 1962. Because of its orbital configuration, it was best seen from the northern hemisphere in the fall of 1962 before perihelion. Comet Humason was quite unusual in that it was discovered and was seen at very great distances from the sun and earth. During August, 1962 it showed remarkable tail and coma activity. Quoting from H.A.C. (Harvard Card 1575):

> "Observations at the prime-focus spectrograph ... show that Comet Humason is in a very unusual physical state. Spectra on Aug. 1 and 2, 1962 at a heliocentric distance of 2.6 (A.U.), show strong comet tail bands over the inner four minutes of arc. A diffuse relatively faint nucleus shows only very weak emission lines and the normal reflection spectrum. Approximately 40 bands of CO once ionized are visible ...... CN is present in the tail but C_2 is very weak or absent ..... The comet form is highly distorted. It is possible that a very active interaction with solar plasma is occurring ......"

Yet this was not the only incident. In an I.A.U. Circular Dr. Ch. Fehrenbach writes:

> "Comet Humason has undergone a strong increase in luminosity. Photographs and visual estimates by Dossin ...... indicate a photographic magnitude of about 10.5. (The observations were made June 8, 9, and 10, 1964.)
>
> "The comet is located some 6 A.U. from the earth and the sun and was about 16th or 17th magnitude last February."

In both the previous observations by Greenstein and the last one by Dossin, the comet was quite unusual.

In view of this great amount of activity, it is disappointing that the A.L.P.O. observations were as few as they were. Of those that were received, nearly all were very useful. Especially notable was the long series of visual magnitude estimates obtained by Darrell Conger, with binoculars, and the structural drawings by Clark Chapman. It is very disappointing that no

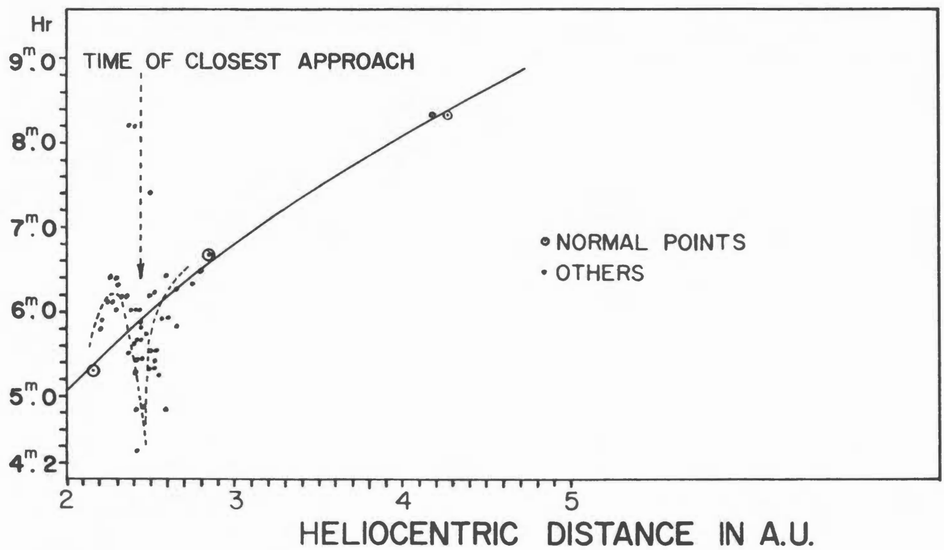

FIGURE 5. Heliocentric visual stellar magnitude of Comet Humason 1961e plotted against heliocentric distance. See also text. Figures 5-8 were contributed by Mr. David Meisel and were prepared for publication by the kindness of Mr. Ray Montes.

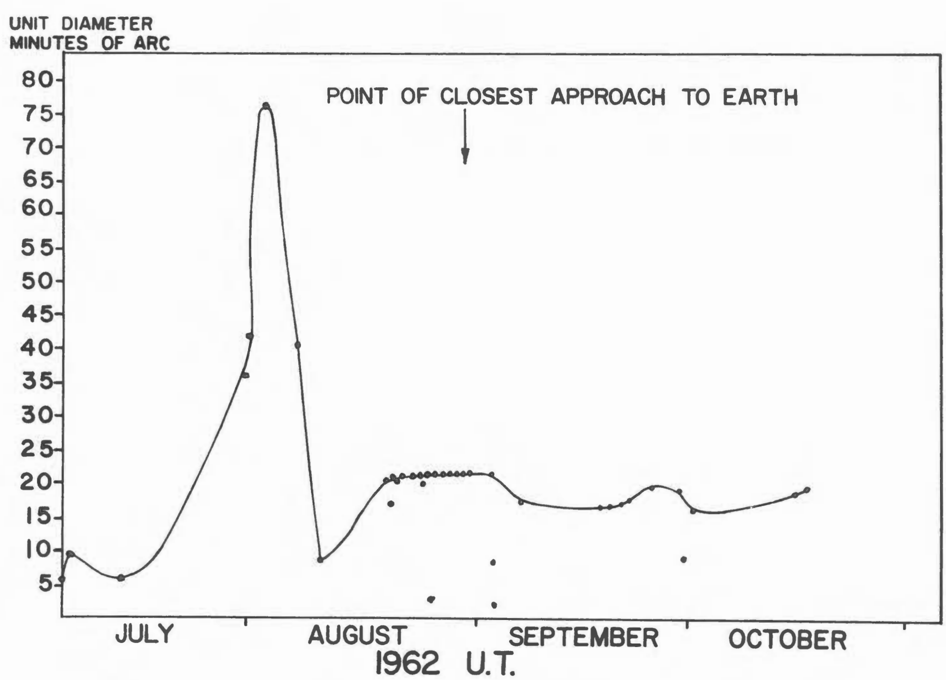

FIGURE 6. Observed coma diameter of Comet Humason 1961e, reduced to unit distance, plotted against date. See also text.

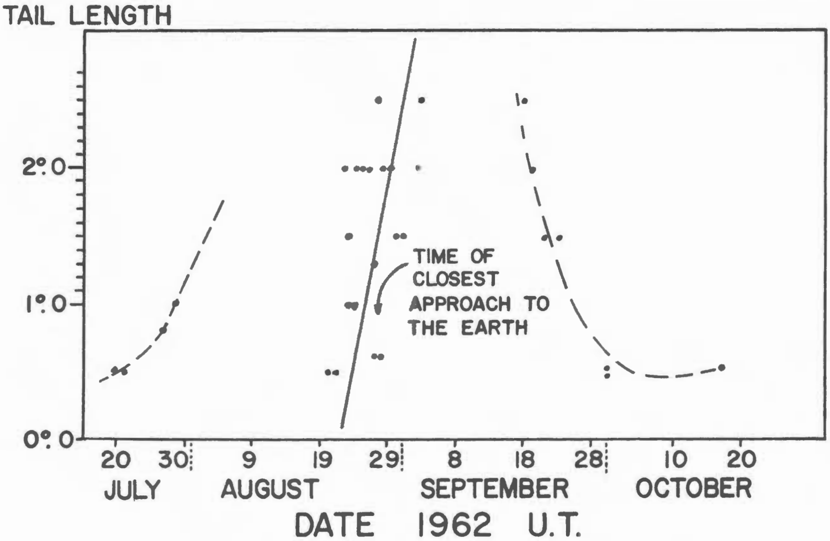

FIGURE 7. Observed tail length of Comet Humason 1961e plotted against date.

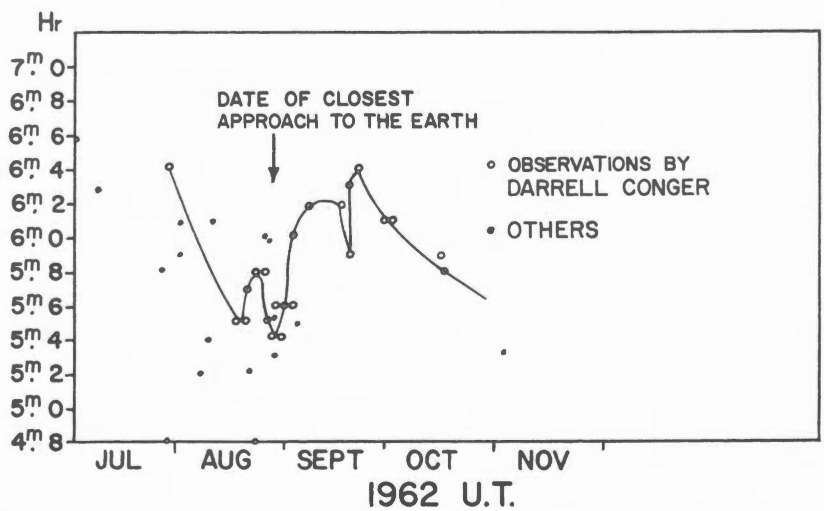

FIGURE 8. Heliocentric magnitude of Comet Humason 1961e plotted against date. See also text.

A.L.P.O. members submitted photographic records.

In Figure 5 the visual magnitude estimates are presented after reduction to a standard aperture according to Bobrovnikoff's system, and then to unit geocentric distance. The plot is then of heliocentric visual magnitude versus heliocentric distance. Since quite a bit of dispersion is present in the data, the normal points taken for the observations were difficult to obtain. The following points were finally chosen:

Date	H_r	r(A.U.)
Dec. 26, 1961	8.3	4.3
July 1, 1962	6.6	2.9
Nov. 2, 1962	5.3	2.2

These were chosen because they represent the longest time base and were obtained by observers who had previously submitted observations. These three points give a solution:

$$m_r = 1.9 + 10.1 \log r,$$

where m_r ($= H_r$) is the heliocentric magnitude (visual) and r is the comet heliocentric distance.

In Figure 6 the estimates of coma diameter are given versus the dates of observation. The diameters have been reduced to unit distance to permit useful comparison. The only notable feature is the sharp increase in coma size during the period of supposed plasma encounter, near August 1 and 2.

In Figure 7 the apparent tail length is given as a function of date. It is unfortunate that no reliable estimates of tail length were obtained during the critical period at the first of August, 1962. It is not known whether this lack was due to the fact that the comet had lost its tail, as proposed by Greenstein, or not. Nothing was found in available A.L.P.O. observations which would support such a view.

Finally in Figure 8 the heliocentric magnitude is given versus the date in an attempt to find some time correlation of the magnitude. The scatter is simply too bad to allow any definite conclusion. Although it is suggested that the comet varied over a wide magnitude range, it is more likely that large systematic differences between individual estimates exist. The simultaneous observations necessary to test this matter were not available. In spite of this, a definite brightening trend can be seen for the weeks following the supposed plasma encounter. The single observation on July 31 indicates that some brightening did occur <u>prior</u> to the enlargement of the coma. If the July 31st observation is correct as well as those made in the following days, it would indicate the encounter to have been a very brief one.

In any event it is unfortunate that more observations were not available. Observations by those in the southern hemisphere would have been particularly valuable.

A.L.P.O. COMETS SECTION 1962 FINAL REPORT, PART III

By: David D. Meisel, A.L.P.O. Comets Recorder

Comet Seki-Lines 1962c

In contrast to the situation with Comet Humason, there was plenty of material available on Comet Seki-Lines. The comet put on a spectular show in the evening sky in spite of its proximity to the horizon. A number of observers contributed and were mentioned in a previous report. (*Str. A.*, Vol. 17, pg. 233, 1963.) The Recorder would like to thank all those who submitted observations. So much material was submitted that it was hard to select topics for discussion in this limited space.

The number of visual estimates was gratifying. The total number was 124 from A.L.P.O. sources. From these a total of 19 normal points was calculated. The mean deviations of the normal points were computed for each date. Errors due to time averaging should not exceed 50% of the quoted deviations.

In the pre-perihelion period a total of 13 magnitude estimates was secured. These are plotted in Figure 9. Four estimates were on two dates, and hence averages were taken and are indicated by error brackets. Figure 9 shows the reduced unit heliocentric distance magnitude versus heliocentric distance. These observations give a photometric solution of

$$m_r = 6.1 + 8.9 \log r, \quad n = 3.55,$$

where m_r is the heliocentric magnitude and r is the heliocentric distance. The post-perihelion observations are given in Figure 10. The pre-perihelion points are also plotted again. Using the normal points listed below, the solution for the pre-perihelion period held for the post-perihelion period. In the post-perihelion period, however, enough normal points were available to give some definite outline of the actual time variations of the brightness. The following normal points were computed. All the photometric observations were reduced to the Bobrovnikoff standard aperture and then to heliocentric magnitudes before averaging and plotting.

Date	Magnitude (Hr)		Heliocentric Distance	Number of Estimates
April 1962				
8	2.0 ±	1.0	0.34 A.U.	4
9	2.4	0.8	0.38	3
10	3.0	0.7	0.42	5
11	3.2	0.2	0.45	7
13	3.6	0.7	0.52	2
14	2.4	0.3	0.56	3
15	3.0	0.6	0.58	10
17	3.6	0.5	0.64	11
18	4.0	0.6	0.68	8
19	4.4	0.8	0.69	5
20	4.6	0.3	0.72	8
21	5.0	0.2	0.75	3
22	4.1	0.8	0.78	8
23	4.8	0.3	0.80	7
24	5.0	0.4	0.83	6
25	4.0	0.7	0.86	5
26	4.6	0.8	0.89	3
29	5.83	0.05	0.96	2 } Extinction
30	5.94	0.05	0.99	2 } Photometer

On April 24, 1962 the color index C.I. was equal to $-0\overset{m}{.}4$.

Two definite maxima were observed, as can be seen from Figure 10. In checking the solar data, the following sequences were found:

Well-developed solar area passed the comet	Apr. 03 - Apr. 15, 1962
Well-developed area visible from earth	Apr. 14 - Apr. 25, 1962
Well-developed area visible from comet	Apr. 22 - May 5, 1962
Well-developed area visible from earth	May 3 - May 15, 1962

There is one interesting note. On the nights of comet brightness maxima, the final sunspot numbers for the whole disk (see J. Geo. Res., 68, 3301, 1963) were maximum. The whole period of comet brightness disturbance lasted from April 12 to May 2, 1962. The brightness maxima were on April 14 and April 24. It is interesting to note that the spot numbers were minimum on April 10 at 10; April 18 at 71; and May 7 at 31. The spot numbers were maximum on Apr. 16 at 90 and on April 22 at 78. A minor maximum was observed on Apr. 28. If one plots the residual of the observed magnitude and the calculated magnitude one obtains the top graph of Figure 11. In the lower graph of Figure 11 the final sunspot numbers are plotted. It can be seen

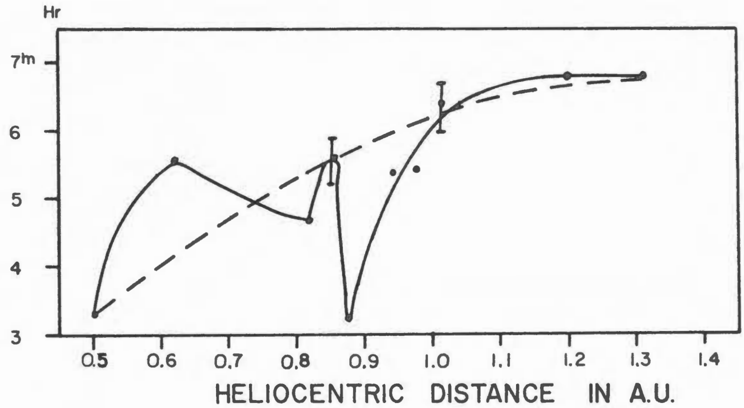

FIGURE 9. Heliocentric visual stellar magnitude of Comet Seki-Lines 1962c plotted against heliocentric distance. Pre-perihelion period. See also text. Figures 9-11 were contributed by Mr. David Meisel and were prepared for publication by the kindness of Mr. Ray Montes.

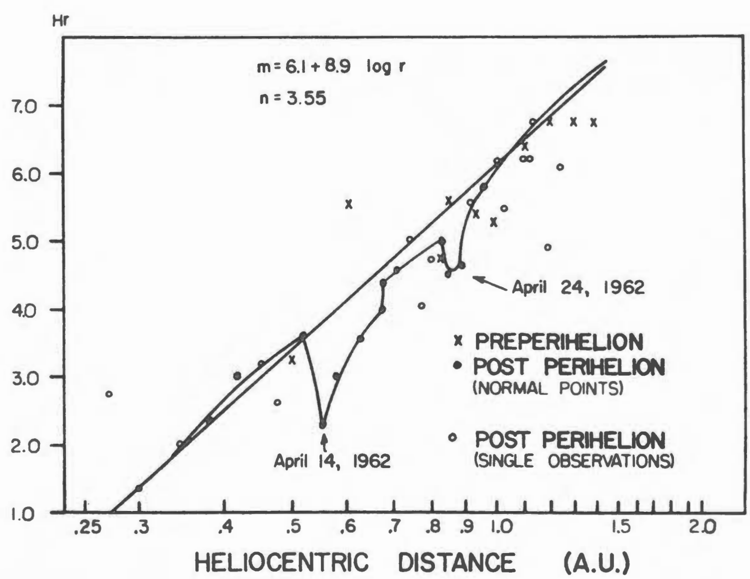

FIGURE 10. Heliocentric visual stellar magnitude of Comet Seki-Lines 1962c plotted against heliocentric distance. See also text.

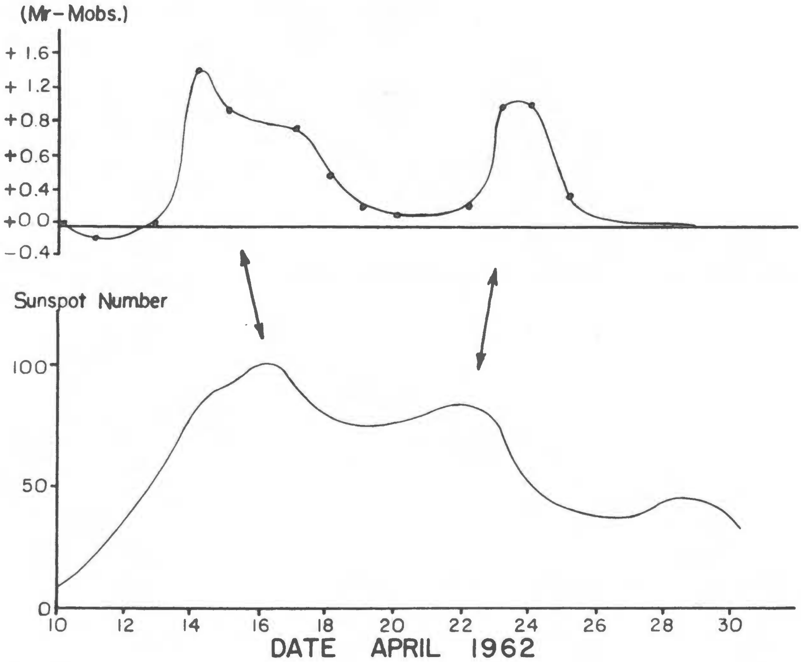

FIGURE 11. Upper curve: magnitude residuals, calculated minus observed, of Comet Seki-Lines 1962c. Lower curve: sunspot number. Note the extremely close agreement in time of two brightness maxima of the comet with two sunspot maxima. See also text.

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that the degree of relative agreement is quite striking. If it is coincidental, then it is quite unlike anything which the author has seen. If it is not coincidental, then one must find an adequate explanation for the behavior. It is not easy to see what correlation would be brought about by something affecting the whole sun. Is this, perhaps, something to do with the corona? We cannot say at this time.

There is some evidence for particle action on the comet. On April 10 a photograph by Alan McClure here shown as Figure 12 (and similar ones by others) revealed the peculiar parallel ray structure that was observed in comet 1957d (Mrkos). Figure 13 shows a set of sketches based on McClure's photograph. It should be noted that the tail assumed an angle intermediate between the anti-solar point and the radius vector of the motion. Before analyzing such a photograph, one must be aware of perspective. The comet was at the time going away from the earth, trailing its huge tail in an arc behind it. The small anti-tails labelled J and K are actually in the plane of the comet's orbit with the long axis pointing toward the plane of the ecliptic. The features in and near the nucleus appear normal. Then at a point several degrees away from the nucleus along the curved main tail, the ray structure is deflected as if encountering drag! The faint amorphous structure of the rest of the curved tail seems not to be even affected. It is not clear at this time just what the situation really was. Careful analysis will show, however, that rays C, D, E, and F (Figure 13) are along great circles which intersect near the sun rather than near the head of the comet. A more rigorous study of the situation is necessary before the relative orientation will become clear. It would be interesting to see how near these rays lie to the lines of magnetic force theorized as being associated with the "solar wind".

FIGURE 12. Photograph of Comet Seki-Lines 1962c by Alan McClure with a 5.5-inch F:5 Zeiss Triplet. U.T. April 10, 1962, $3^h\ 42^m - 3^h\ 52^m$. Panchro emulsion, filter transmitting from 3800 to 6300 angstroms. Some moonlight. Frazier Mountain, California, 7300 feet.

Since we have postulated solar activity as being responsible for the photometric maxima observed on April 14 and April 22, 1962, is there any effect observed in the photographs? In the June, 1962 issue of Sky and Telescope on page 307 there are two photographs taken on the nights in

FIGURE 13. Sketches by David Meisel of tail structure of Comet Seki- Lines 1962c adapted from photograph by Alan McClure on April 10,1962. See text.

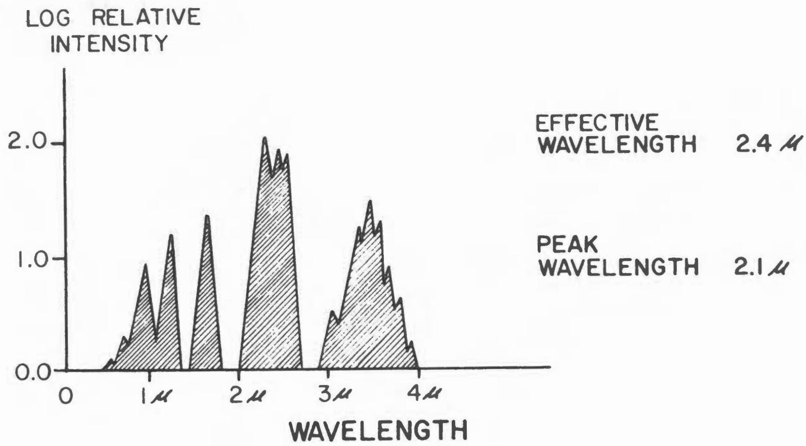

FIGURE 14. Transmission characteristics of E3 infrared detector + atmosphere, no filters. This system used in making the tracings presented in Figure 15. See also text. Prepared for publication by Mr. Ray Montes.

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question, each shows a double tail pattern. One of these tails points in the anti-solar direction. The other, apparently what was left of the long curved tail, is somewhat askew at a 30° angle to the north. Since no photographs appear to be available for the period between April 14 and 22, it cannot be said what affects can be directly attributed to solar activity.

One final set of observations should be mentioned. At the request of the Comets Recorder, Mr. P. Barnhart attempted infrared observations of Comet Seki-Lines. These observations have been made available to the Recorder by Dr. Walter E. Mitchell, Jr. of the Perkins Observatory in Delaware, Ohio. The instrument used was the 32-inch telescope of the Perkins Observatory. The IR photometer was equipped with an "E3" detector with effective transmission properties as given in Figure 14. Four traces were made of the comet, sweeping in declination (Figure 15). The visual aspect of the comet is shown for comparison. Attention is drawn to the presence of the two tail rays in the IR tracing. A rough calibration was made using an F5 star with the result that m (IR) of Comet Seki-Lines = $4^{m}.0$. Comparing with the visual magnitude, $m_v = 3^{m}.7$ on the same date. The comet was apparently about normal in visual magnitude. Just what is the interpretation of the IR magnitude is not known at this time. It is presented here to show a possible direction for future research with large telescopes. The observation may represent an astronomical first even if it does not have any intrinsic accuracy.

In most of the areas studied we have found the situation to be normal, that is, we have posed more questions than we have answered. However, let us not end on a note of despair. One thing was demonstrated by the observations. In certain instances, magnitude estimates made by amateur observers under different conditions and with different instruments can be made to agree. Correction to a common photographic system as advocated by Bobrovnikoff appears to be necessary, however. It is often stated that visual star observations can be made to agree to within 0.1 magnitudes by systematic corrections. Here we have found that the average error of visual observation is about $\pm 0^{m}.4$. Bobrovnikoff found that for very experienced observers accuracies of $\pm 0^{m}.2$ in individual observations might be expected. However, the Recorder would be very happy if all the magnitude estimates could be trusted to be within $\pm 0^{m}.4$. There is still room for improvement, but the results are encouraging.

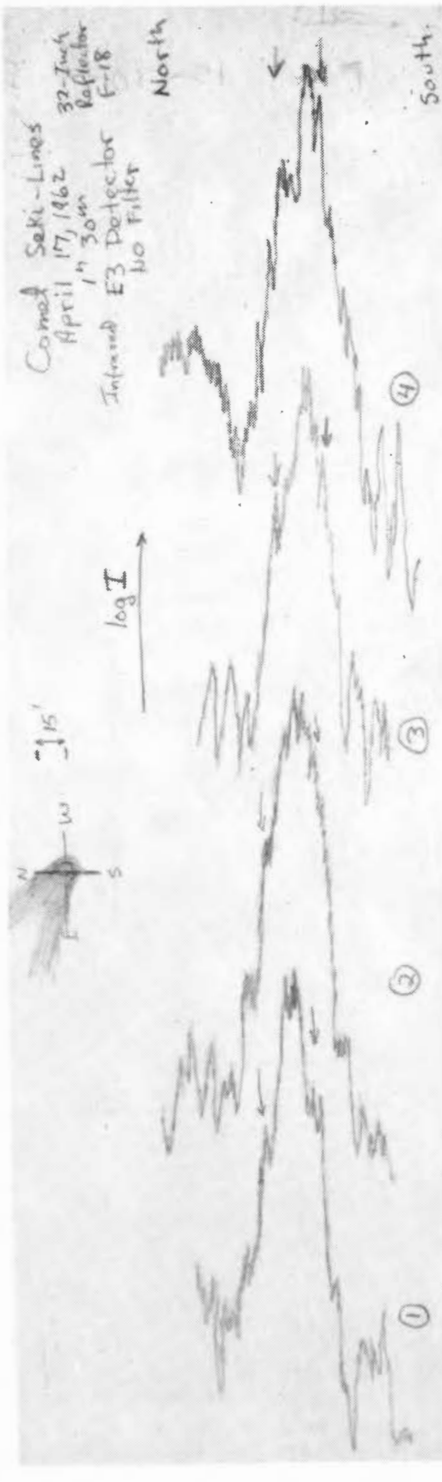

FIGURE 15. Infrared tracings of Comet Seki-Lines 1962c on April 17, 1962 at $1^h 30^m$, U.T. Perkins Observatory 32-inch reflector. E3 detector and no filter. See also text on page 61.

A.L.P.O. LUNAR PHOTOGRAPH LIBRARY

**By: John E. Westfall,
A.L.P.O. Lunar Recorder**

Recently Mr. C. F. Capen, of the Jet Propulsion Laboratory's Table Mountain Observatory, has generously furnished the A.L.P.O. with a number of lunar photographs taken with the Table Mountain's Observatory's 16-inch Cassegrain reflector. These photographs are of excellent quality, and (for earthbound telescopes!) show lunar detail only exceeded by photographs taken with the largest professional instruments. The photographs furnished are in the form of 5 X 7 and 8 X 10-inch enlargements. The Table Mountain lunar photographs are entirely suitable for selenographic and selenologic research.

Two examples of the Table Mountain photographs are published in this issue, in order to show the high quality of the series. These are number 1689, of the Wargentin area, and number 1418, of the Eastern (IAU) Mare Nubium (Figures 16 and 17).

Enlargements of these photographs are available, on loan, to interested A.L.P.O. members for use on specific research programs. In order to distribute the photographs, the following procedure is to be followed (which may be modified in the future, depending on the number of requests received):

1. Requests are to be mailed to:

   John E. Westfall
   A.L.P.O. Lunar Recorder
   3104 Varnum Street
   Mount Rainier, Md. 20822

2. The request letter should include:

   a. Either a list of the photographs wished <u>or</u> a description of the area for which coverage is wished. Also list the colongitude range preferred, if any.

   b. A brief description of the use to which the photographs are to be put.

   c. Fifteen cents in stamps to cover postage.

3. The date the photographs should be mailed back to the author will be the <u>last</u> date on the back of the photograph (normally six weeks from the date the photographs are mailed to the user). All photographs are to be returned on or

before this date. A six-week renewal is allowed, if requested in advance of the return date and if no other requests for the same photographs are outstanding.

4. All photographs are to be returned to the author unfolded and unmarked, in manila envelopes reinforced by cardboard.

5. If 8 X 10 enlargements are available, they will be sent in preference to 5 X 7's.

The following photographs are available at present:

Code Number	Area Covered*	Date & Time (U.T.)	Colong.	Approx. Scale**
1416	North Mare Imbrium - North Limb	14 Jul.1963, 10:54	186°.7	6M
1417	Copernicus - SE Mare Imbrium	14 Jul.1963, 10:58	186.7	6M
1418	Southeast Mare Nubium	14 Jul.1963, 11:03	186.8	6M(3.3M)
1419	Pitatus - South Limb	14 Jul.1963, 11:08	186.8	5.5M
1505a	Mare Nectaris - Altai Mountains	9 Aug.1963, 11:18	144.6	(4M)
1505b	M. Tranquillitatis - M. Serenitatis	9 Aug.1963 11:18	144.6	(4M)
1505c	East Mare Serenitatis	9 Aug.1963 11:18	144.6	(4M)
1505d	Aristoteles Area	9 Aug.1963 11:18	144.6	(4M)
1594a	Regiomontanus - South Limb	10 Sep.1963, 10:28	175.0	6M(4M)
1594b	Sinus Medii - Arzachel	10 Sep.1963, 10:28	175.0	6M(4M)
1594c	Southeast Mare Imbrium	10 Sep.1963, 10:28	175.0	6M(4M)
1594d	NE Mare Imbrium - North Limb	10 Sep.1963 10:28	175.0	6M(4M)
1689a	Phocylides-Wargentin-Schickard	1 Oct.1963, 06:58	069.6	2M(1.2M)

*Directions follow I.A.U. Convention

**Ex.: 6M = 1:6,000,000 scale, 5 X 7 enlargement.
(4M) = 1:4,000,000 scale, 8 X 10 enlargement.

As future lunar photographs are received, additions to the above list will be published in The Strolling Astronomer.

A.L.P.O. members who possess, or have access to, unpublished lunar photographs of good quality are requested to forward enlargements of them to the writer, along with the following information: instrument used, seeing, transparency, and date and time (U.T.) of the photograph. Such enlargements will be included in the A.L.P.O. Lunar Photograph Library so that they will be available to other A.L.P.O. members.

THE RANGER VII PHOTOGRAPHS: A PRELIMINARY REPORT

By: John E. Westfall, A.L.P.O. Lunar Recorder

Preface

On July 31, 1964, at 13:25:49 U.T., the NASA lunar probe, Ranger VII, crashed on the moon. The photographs this missile telemetered back to earth signalled a new era in selenography; the final photographs showed details three orders of magnitude smaller than those observable from the earth. It is too early to assess the full effect of these photographs on lunar study, but it will certainly be profound. In spite of well-justified optimism, however, it is necessary to outline the characteristics and limitations of the Ranger photographs.

Characteristics of Spatial Photographs

Ranger VII furnished the first example of what may be called "spatial photographs" - - close-up photographs of an astronomical body from space. Spatial photographs have many characteristics in common with everyday aerial

FIGURE 16. Photograph of the Wargentin area of the moon by C.F. Capen with the Table Mountain Observatory 16-inch Cassegrain reflector, EFL 1260 in., 1/5 sec. exposure, Panatomic-X film. Taken October 1, 1963, 06:58 U.T. Colong.: 069°.6. South on top.

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photographs. For example, the negative scale of both is equal to the ratio of lens focal length to the altitude above the surface when the photograph was exposed.

Unfortunately, both forms of photograph possess inherent errors. First, if the optical axis of the camera is not exactly vertical to the surface of

FIGURE 17. Photograph of the Eastern (IAU)Mare Nubium by C.F.Capen with the Table Mountain Observatory 16-inch Cassegrain reflector, EFL 315 in., ½ sec. exposure, Plus-X film. Taken July 14, 1963, 11:03 U.T. Colong.: 186°.8. Note Straight Wall in upper left, and the Fra Mauro-Guericke group of ruined craters in lower right. South at top.

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the body photographed, some degree of distortion (i.e., foreshortening or scale variation) will exist. Second, the curvature of the body photographed causes some distortion. In the case of aerial photographs, this effect is slight; an aircraft flying at 20,000 feet is only about 0.001

terrestrial radii from the ground. The first Ranger photographs, on the other hand, were taken at an altitude of about one-half of the lunar radius; in these photographs the effect of curvature is significant. This problem is exactly similar to that faced by cartographers in reproducing a round body on flat paper.

A further difficulty arises when one attempts to measure positions from spatial photographs. Although relative positions can be measured to meters or better on the final Ranger photographs, it is at present impossible to "tie in" such positions to an absolute coordinate system of comparable accuracy. At present, and for some time to come, the lunar coordinate system is based on photographs taken on earth and is accurate, at best, to several hundred meters. In the future, however, sequential photographs from a lunar orbital vehicle should yield a lunar reference system several orders of magnitude better than the present one.

Furthermore, the Ranger photographs were practically instantaneous; they show the lunar surface under only one lighting. Just as it is impossible to produce an accurate lunar topographic map from a single observatory photograph, it is impossible to interpret lunar topography without ambiguity from the Ranger photographs. Once again, sequential lunar orbital photographs will eventually remove this difficulty.

Finally, it is necessary to remember that the Ranger "photographs" were not actual photographs, but televised images. Although both the resolution and the contrast of the cameras employed were superior to commercial television, they were inferior to the resolution and contrast of a good photograph taken under similar conditions. For example, the scan lines of any television system tend to "quantize" the positions of features, producing sharp contrasts and edges where none may exist in reality.

The above limitations do not, of course make the Ranger photographs valueless; on the contrary, their value is unique. Nonetheless, it is necessary not to expect information from the photographs which they cannot contain.

The Trajectory and Impact Point of Ranger VII

Using lunar features whose positions are known, it is possible to triangulate the approximate flight path and impact point of Ranger VII. The writer did this by means of plotting on the USAF LAC 76, which shows the Mare Nubium on a Mercator projection at a scale of 1:1,000,000. The altitudes of the photographs, when compared with the positions of their center points as projected on the lunar surface, indicate that the lunar probe approached the surface at a steep angle - - approximately 85°from the horizontal, moving in a generally northeast direction[1].

The point of impact was determined from the final Ranger photograph, then transferred to photographs of successively smaller scales, until the impact point could be identified in relation to charted craterlets on LAC 76. The charted craterlets used were Bonpland P, Bonpland H, and the unnamed craterlet about 12 kms. west of Bonpland H. Radials drawn from these three points indicated the impact point to an estimated accuracy of one kilometer: 10° 37' S, 20° 27' W; or, in Mare Nubium, about 27 kms. northeast of Bonpland H[2]. This point is approximately 20.1 kms. northeast of the aiming point (11.0° S, 21.0° W)[3] and about 3.8 kms. south-southeast of the calculated impact point (10.°5 S, 20.°5 W)[4].

At the instant of impact, the colongitude was 177.°57, and the solar selenographic latitude was +0.°94. At the point of impact, the solar altitude was 22° 17', and the solar azimuth was 275° 27' (measured north through east).

Figure 18 is a tracing from LAC 76, showing the approximate flight path and impact point.

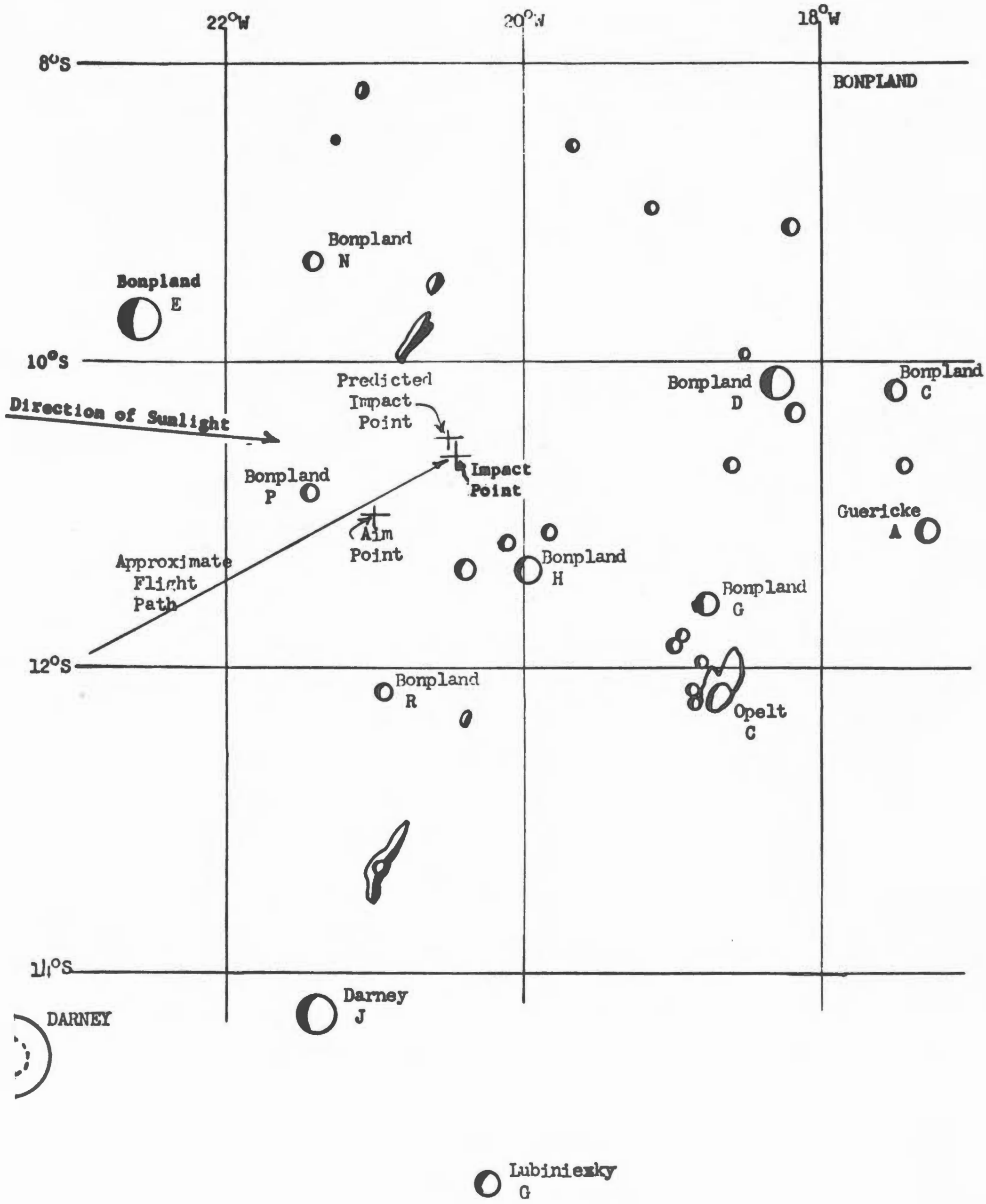

FIGURE 18. Impact point and approximate flight path of Ranger VII. Lunar surface markings traced from LAC 76. Chart prepared and contributed by John E. Westfall. North at top, lunar east (IAU) at right.

List of Photographs

Shortly after the Ranger impact, NASA generously supplied the writer with ten 8 X 10-inch enlargements of the Ranger photographs so far released. These prints show more detail and display better contrast than the now-familiar newspaper and national magazine reproductions of them. In addition, the backs of the photographs give information as to the camera used, the altitude, and the size of the area photographed. These ten Ranger photographs have been added to the A.L.P.O. Lunar Photograph Library (see: "A.L.P.O. Lunar Photograph Library" on pp. 62-63 of this issue) and are available to interested A.L.P.O. members on the same basis as are the other photographs in the library. One of these photographs (64-Ranger B-28) is reproduced as the front cover photograph on this issue. The ten photographs were taken 31 July, 1964, 13:09 - 13:26 U.T., Colong. 177°.4 - 177°.6. Table I gives further information.

Table I: Ranger VII Photographs*

Code Number; 64-Ranger	Area Photographed	Altitude/ Lens F.L.	Approx. Scale of Enlargement
B-22	Mare Nubium, N of Lubiniezky	770km/25mm	1:2,000,000
B-23	Impact Point	300m/25mm***	1:350
B-24	Area of Impact Point	5km/25mm	1:15,000
B-25	Guericke and area to west	760km/75mm	1:650,000**
B-26	Mare Nubium NE of Darney	380km/25mm	1:980,000
B-27	Bonpland H - Bonpland P	140km/25mm	1:400,000
B-28	Crater cluster ca. 30kms. east of Bonland P	55km/25mm	1:140,000
B-29	Area of Impact Point	19km/25mm	1:40,000
B-30	Ca. 15kms. NE of Bonland H	40km/25mm	1:35,000**
B-31	Ca. 2kms. SE of Impact Point	13km/75mm	1:11,000**

*The photographs are not listed in sequence of exposure.
**Photographed with side camera, causing foreshortening. The maximum scale is given.
***And also 900m/75mm.

Determination of Scale

The writer found the scales of photographs B-22,-25,-26, and -27 by measuring the distances between craters on the Ranger VII photographs and comparing them with the same distances on LAC 76 (scale 1:1,000,000) and on plates from the Photographic Lunar Atlas (scale approximately 1:1,370,000). With the scales of the above four photographs determined, it was possible to find the scales of B-28 and B-30, which showed several features also found on the smaller-scale photographs. Likewise, using the scales of B-28 and B-30, the scales of the remaining four photographs (B-23, -24,-29, and -31)were found. A defect of the above method is that the scales of the large-scale photogaphs are dependent on the scales of the smaller-scale photographs and are correspondingly less accurate. All the scales found, of course, are approximate.

NASA furnished information on the altitudes of the photographs, the focal lengths of the lenses used, and the sizes of the areas photographed. From such data it is theoretically possible to compute the scales. The scales so derived, however, are not always equal to the writer's and, worse, are not even internally consistent. It is hoped that more satisfactoty scale data will be available in the near future.

In brief, the scales of B-26 and B-28 appear well determined; B-22, -24, -27, and B-29, fairly well determined; the scales of B-23,-25,-30, and B-31, dubious.

Measurement of Crater Diameters and Depths

Because the depth:diameter ratio for lunar craters is of considerable significance in selenology, and because the Ranger VII photographs allowed the depth vs. diameter curve to be extended to craters about three orders of magnitude smaller than any lunar craters previously measured, the writer measured the depths and diameters of some 42 craters and the altitudes of four other objects, using six photographs (B-23,-24,-26,-27,-28, and B-31). Due to scale uncertainty, and other factors, the values found should be considered as tentative only; but it is hoped that they will be of interest.

A six-power magnifier with a recticle graduated to 0.1mms.was used to measure crater diameters and shadow lengths. Considering the shortness of the shadows measured, the effect of the curvature of the lunar surface is far smaller than the observational error, allowing a simplified formula for relative altitudes to be used:

height = shadow length X tangent of solar altitude.

An overlay for LAC 76 was prepared, showing curves of equal tangent solar altitude for the areas photographed at the time of impact.[5] The tangent of the solar altitude could then be determined (to $\pm 0.^{\circ}01$) at a glance for any feature shown in the photographs. Table 2 gives the diameters and depths measured, expressed in feet in order to conform to the figures used by Baldwin.[6]

Table 2: Crater Diameters and Depths in Feet

Pho. No	Ctr. No.	Diam.	Dpt.	Notes
B-23	1	23	0.9	S
B-23	2	1.8	0.3	H
B-23	3	3.8	0.4	H
B-23	4	6.9	0.6	F
B-23	5	4.0	0.4	H
B-23	6	2.3	0.3	H
B-23	7	1.8	0.2	H.On mound.
B-23	7a	---	0.2	Hgt.of mound contng. Ctr. 7
B-23	8	1.5	0.3	H
B-24	1	190	22	H
B-24	2	810	91	TE
B-24	2a	---	14	Hgt. of E in 2
B-24	3	300	55	CT
B-24	4	60	7	H
B-24	4a	---	14	Hgt. of rock shelf at west edge of irreg. depression
B-24	5	150	18	H
B-24	6	100	18	H
B-24	7	70	8	H
B-24	8	960	32	S
B-26	1	49600	8600	FE. Darney
B-26	2	22800	4200	H.Bonpland E
B-26	3	22600	2800	H.Darney J
B-27	1	6600	1020	H. Bonland P
B-27	2	3500	580	H
B-27	3	8500	1030	HQ. W of Bon.H
B-27	4	3400	480	H
B-27	5	5600	860	H
B-27	6	12200	1730	H.Bonland H
B-27	7	5900	840	H
B-28	1	5200	580	H
B-28	2	2400	290	HQ
B-28	3	3400	580	P
B-28	4	2800	150	F
B-28	5	2800	360	H
B-28	6	1200	210	H
B-28	7	2300	80	F
B-28	8	1900	220	H
B-31	1	90	12	H
B-31	2	600	15	S
B-31	3	270	27	HE
B-31	3a	---	6	Hgt.of E in 3
B-31	4	70	9	H
B-31	5	200	21	CF
B-31	6	110	15	H
B-31	7	140	30	C
B-31	8	830	37	S

Explanation of Notes:
F = Flat-floored crater
S = Shallow crater, shadow ill-defined
C = Conical profile crater
P = Parabolical profile crater
H = Hemispherical profile crater
T = Terraced walls
Q = Square Outline crater
E = Interior elevation

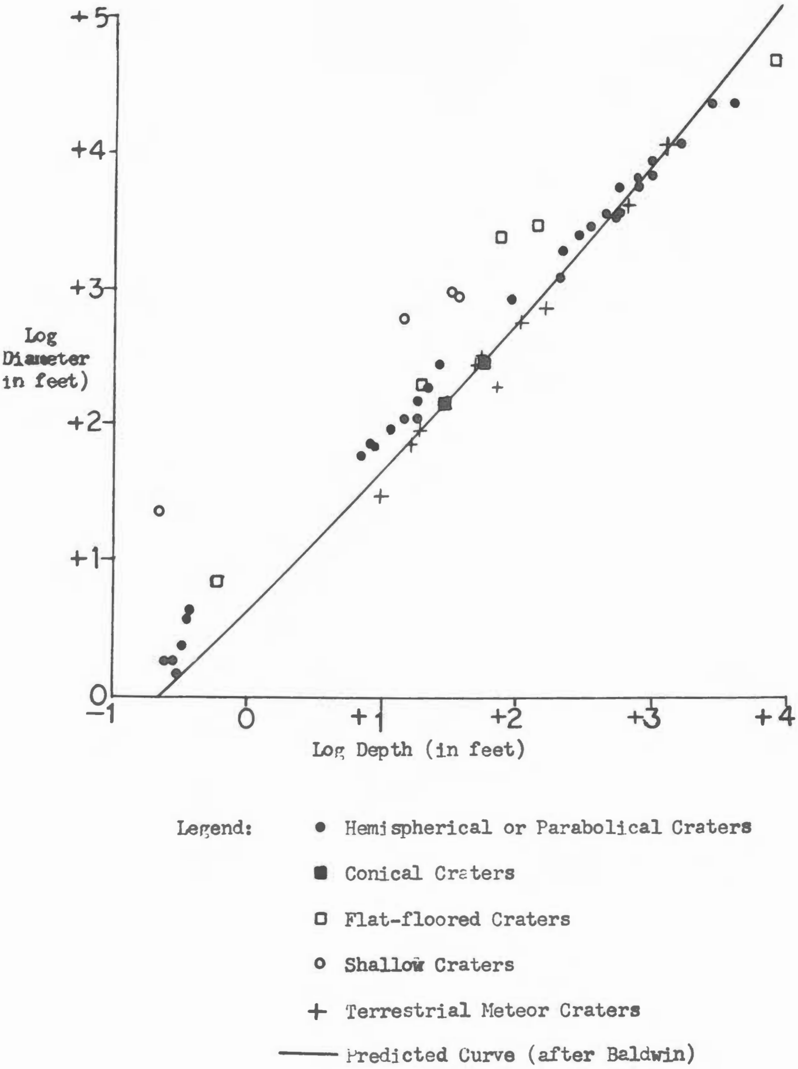

FIGURE 19. Diameter-Depth Relationship for lunar craters studied on Ranger VII photographs by John E. Westfall. See also discussion in text of Mr. Westfall's article in this issue.

It is difficult to compare the results of Table 2 with previous measures. In only three cases do accurate previous diameter measures exist for comparison:[7]

Crater	Previous Meas. $10^{-3}R$	Previous Meas. feet	Ranger Photo. Meas. (feet)	Difference
Darney	8.8	50,200	49,600	1.2%
Bonpland E	3.9	22,200	22,800	2.7%
Darney J	3.7	21,100	22,600	7.1%

LAC gives the depths of Darney and Bonpland E as 900 meters and 500 meters, respectively (2950 ft. and 1640 ft.), both values markedly less than those derived from the Ranger VII photographs. This discrepancy is surprising since the rim shadows of both craters were well-defined and easy to measure. It is conceivable, of course, that the local contrast was distorted in the television picture and an erroneous shadow measured. However, Plate E6f of the Photographic Lunar Atlas (Colong. 172.°3) gives the impression that Darney and Bonpland E are considerably deeper than LAC 76 indicates. It is the writer's opinion that LAC relative altitudes are often underestimated and that the altitudes taken from the Ranger photographs better represent the actual terrain.

It would be premature to attempt much in the way of interpretation of the above rough measures. It is of interest, though, to plot the logarithms of the craters against the logarithms of their depths. Figure 19 shows the resulting distribution. It must be remembered that the craters studied do not constitute a random sample. Only fairly well-defined features were measured; and many vague, shallow, or irregular depressions were ignored. Nonetheless, it is clear that, for the range of crater sizes studied, the crater diameters are nearly proportional to the depths.[8] It is also evident that the observed distribution does not exactly match the predicted curve of Baldwin.[9]

The flat-floored and shallow craters evidently form a separate class of feature; they differ from the norm both on Figure 19 and in appearance. It is surprising to note that flat-floored craters as small as seven feet in diameter were found. It is tempting, but premature, to hypothesize that these craters are due to secondary impacts.

The author was also surprised to find several craters that had a definitely conical cross-section. These craters have few or no large-scale analogies, and their manner of origin is uncertain.

In conclusion, the author wishes to reiterate that this report is a preliminary study only. It is hoped that A.L.P.O. members will use the Lunar Photograph Library to obtain the Ranger photographs and study them in greater detail. [Mr. Westfall submitted this report on August 14, 1964 and naturally had no access to a substantial number of Ranger VII reports published since then. - Editor.]

References

[1]Directions given in this paper conform with the I.A.U. convention (1961).

[2]The preliminary position of the impact point, as determined by NASA, was 10.°7 S, 20.°7 W; this value will probably be refined later.

[3]NASA Photo No. 64-Ranger B-19, released 30 July 1964.

[4]Ibid.

[5]Curves were drawn for tan A = 0.30, 0.35, 0.40, 0.45, 0.50, and 0.55 (i.e., A = 16°42', 19°17', 21°48', 24°14', 26°34', and 28°49'). The longitudes of the curves were determined at latitudes 9°S, 12°S, and 15°S; a smooth curve was then drawn through the points computed.

[6]Baldwin, Ralph B. The Measure of the Moon (Chicago: University of Chicago Press, 1963), pp. 443-446.

[7]Arthur, D.W.G. Consolidated Catalog of Selenographic Positions (Comm. No. 11, Lunar and Planetary Laboratory; Tucson: University of Arizona Press, 1962), p. 107.

[8]A least-squares solution gave (units in feet): Diameter = 9.3 X $(\text{Depth})^{0.97}$.

[9]Baldwin, Ibid, pp. 143, 187.

LUNAR CHANGES AND THE MODERN AMATEUR OBSERVER

By: Walter H. Haas, Director A.L.P.O.

(Paper read at the Twelfth A.L.P.O. Convention at Denver, Colorado, August 28-31, 1964.)

In recent months I have received a substantial number of reports on abnormal aspects of lunar regions. An incomplete, but perhaps typical, listing follows:

1. On December 28, 1963 (U.T. here and later) a group of nine amateur Japanese observers with a 10-inch reflector at the Rakurakuen Planetarium in Hiroshima recorded a large and variable pink or red patch in the Aristarchus-Herodotus region. The patch was under observation for about 30 minutes and was an easy object only because of its distinctive color.[1]

2. On June 6, 1964 four members of the Amateur Astronomers Association in New York remarked a small pale red spot just outside the southeast rim of Herodotus (east by I.A.U. usage, where Mare Crisium is near the east lunar limb). An 8-inch reflector was employed, and the spot was visible for 50 minutes from the time when observation started.

3. A photograph of Mare Imbrium by an Eastern amateur with a 4-inch refractor, the sunrise terminator being just past Sinus Iridum, shows a round and very dark spot not far from Archimedes. This spot is faint or absent on other photographs on the same evening, nor did the observer notice it in concurrent visual observations. The spot is very similar in appearance to a type of blemish familiar to lunar and planetary photographers.

4. James C. Bartlett, Jr. on May 20, 1964 near $1^h 15^m$, U.T. remarked a strong orange-red illumination of part of the west wall of Plato. He was using a 2.4-inch refractor. The area was kept in view for 10 minutes and did not change during this period. No similar color could be found in other formations closely adjacent to the terminator, as Plato then was. Dr. Bartlett has occasionally recorded bright lunar colors for a number of years.

5. On May 17, 1964 Professor Sally H. Dieke and others at Goucher College in Baltimore with a 6-inch refractor at 125X saw "a crescent of crimson color"between the illuminated west rim of Theophilus and the still shadowed floor of that crater. This aspect was remarked between $1^h 5^m$ and $1^h 15^m$, U.T.; it had not been present at $0^h 50^m$, and it did not reappear during the 90 minutes subsequent to $1^h 15^m$. Secondary spectrum?[2]

6. Mr. Eugene W. Cross of La Mirada, California calls attention to a delicate companion crater of Ross D, near the north edge of the Mare Tranquilitatis, and suggests that it may be a new lunar feature. According to Clark Chapman, however, the companion is shown on a few excellent lunar photographs. Mr. Cross and others on April 22, 1964 with the Whittier College Observatory 19-inch reflector recorded "gas clouds" over Ross D and its companion; the seeing was good, and powers of 800X to 1200X were applied. Elsewhere near Ross D very fine detail was simultaneously observed. On May 18, 1964,again with the Whittier College 19-inch reflector, six observers recorded "gas clouds movements along the rim of Ross D."

Now what are we to make of these reports, and others like them? Can we accept all of them at face value as evidence of some kind of largely unexplained activity on the moon? Against these reports we have the awkward fact that such experienced lunar observers as Alika Herring, Clark Chapman, Clyde Tombaugh, and Elmer Reese in years of watching the moon have quite failed to observe anything obviously out of the ordinary. I think that we must suspect a very strong psychological effect on modern amateur observers of the degassing observed in Alphonsus by Kozyrev in 1958[3] and of the red colors recorded in Aristarchus and vicinity by Greenacre and others in 1963.[4,5] Dr. Kozyrev's spectrograms simply leave no doubt that something did happen on the moon - presumably a degassing phenomenon. The Greenacre lunar color observations, unlike many similar records of the last century that have been published and then quickly forgot, have apparently been accepted as genuine by the astronomical community.

It may not be amiss to review a little of the history of observations of reported changes on the moon. The names of lunar "seas" still show the eagerness of the early telescopists to find in the moon a world like the earth. J. H. Schroeter wrote of an extensive lunar atmosphere and of many changes in lunar features;[6] Gruithuisen recorded lunar "cities" and other evidence of the moon's being inhabited. The publication of Der Mond in 1837 by Beer and Maedler buried many of these fancies; in the most careful study of the lunar surface up to that time, no changes were detected.[6] Yet when interest in the moon revived in the late nineteenth century, from time to time minor changes were reported. Linné is the best known example.[7] These reports usually involved rather small lunar markings, small enough that the observational evidence was regularly marginal and inconclusive. Also, of course, the feature suspected of change had never been observed with sufficient care before the time of the supposed change.

W. H. Pickering studied another kind of lunar change, apparent variations repeated regularly (at least in their general outlines) each lunation.[8] A good example is the dark areas on the floor and inner and outer walls of Eratosthenes. Pickering invoked vegetation, snow, clouds, hoarfrost, and eventually even lunar insects to account for these apparent changes. Others who studied them, e.g., G. H. Hamilton, were satisfied that the ever-changing solar lighting of the lunar surface was sufficient explanation.

A little thought will show that recognizing physical changes on the moon, as distinct from effects caused by this changing solar lighting, is a very ticklish matter. The great influence of lighting must be appreciated - it is very instructive to compare the similar aspects of Copernicus and Eratosthenes near the terminator and their extremely different aspects under high lighting. If we measure accurately enough the sun's position as seen from the moon, say to 0.001 degrees in both selenocentric latitude and colongitude, we shall obviously never have two lunar observations made under the same lighting. Are, then, comparisons between two observations never permissible as regards differences in lunar detail observed? This point of view appears extreme, but it is hard to specify a rational quantitative criterion. The librations of the moon must further complicate the study of lunar changes, especially for features far from the center of the disc. The lunar librations will differ when the solar lighting is very similar. Finally, we have all the usual effects upon the precise appearance of the telescopic image-aperture, telescope quality, seeing, magnification, transparency, etc. We should in visual work certainly not forget that embarrassingly subjective and greatly variable parameter, the observer's ability to interpret the telescopic image.

Are there, then, any guiding principles or policies for a modern amateur observer of lunar changes? I suggest that there are and that he may profit from the mistakes of the past.

The visual observer - and presumably many amateurs will still be visual observers for a while - might begin by learning causes of false appearances to lunar regions. Secondary spectrum can be produced by the dispersion of light in the atmosphere or in the eyepiece, even with a reflector. Colors at the boundaries of much brighter or darker lunar features especially should be examined very critically. In fact, it is best to observe colors only with a reflector and with an adequate aperture, perhaps at least 8 inches. Confirmation by others is important in visual work and is most convincing when truly independent. One may wonder whether some of the recent group lunar observations of unusual effects cited above were truly independent; one must fear that the different observers at the same place had too much opportunity to learn what the others were seeing. The moral is simply not to tell your astronomical colleague in detail what you see. Tell him in general terms only; let him then look for himself and confirm or contradict your observation. Of course, the visual observer should always document his report fully as regards time, aperture, seeing conditions, etc. Finally, we would certainly desire that the observer be very familiar with the region in which he reports a change. It is not very convincing when, as has already occurred, the observer with "years of experience" in looking at the moon needs a lunar map to find the name of the lunar crater in which he is reporting something extraordinary.

The photographic observer will similarly do well to study at some length spurious effects in his art. If he is concerned chiefly with detecting lunar changes, he might do well always to take two exposures in quick succession since blemishes would be less likely to affect both photographs in the same way. Probably such an observer should adopt a highly standardized procedure in order to reduce the number of variables needing to be considered. Photographs in different wavelengths are an obvious method of confirming the reality of lunar colors.

New instrumentation and new twchniques should also be carefully considered. They may well supply new and meaningful data about lunar changes, the study of which has been so controversial and so inconclusive in the past. Elsewhere on this program there is described an image converter tube for use by amateurs with a color blink technique as a method of surveying the moon for transient phenomena.[9] We also have a recommendation by a user of a very inexpensive Edmund spectroscope for the more certain identification of temporary red areas.[10] Other techniques may well occur to the alert amateur.

In conclusion, I would recommend to the interested amateur that he select for frequent and detailed study a small number of lunar features . The areas where positive results appear most likely are probably Aristarchus and vicinity and Alphonsus. Other features where changes have been reported in the past may also be good choices (Plato, Eratosthenes, Linné, etc.). The observer should not be discouraged by negative results, for acquiring sound statistical data on suspected lunar changes is a definite need. It will, moreover, take time to become fully familiar with the normal appearance of a lunar area - a necessary prerequisite to the correct recognition of the abnormal.

Lunar activity sensitive to temperature effects, or more generally to major changes in solar radiation, might well be affected by eclipses of the moon. Hence, changing lunar areas should be carefully studied before immersion in the umbra, after exit from it, and even within the umbra if the moon's brightness so allows. For best results, this study is neither casual, quick, nor confined to the night of the eclipse.[11] Considerable care should be given to ascertaining the normal full-moon appearance of the feature being studied; one must also be wary of false changes in aspect when the object is dimly illuminated close to the edge of the umbra. Such studies for physical effects of lunar eclipses are not new.[12] Minor effects have been reported on the Atlas main dark areas, the Linné white spot, the Riccioli dark area, and a few other places. Aristarchus and Alphonsus have sometimes been watched during lunar eclipses, but so far with no hint of the abnormal phenomena noted by Greenacre and Kozyrev respectively.

Perhaps a modern coordinated attack on the old problem of lunar changes will not merely show that something does happen on the moon but what, where, and how often.

References

[1] Sky and Telescope, letter from Takeshi Sato, Vol. XXVII, pg. 351, 1964.

[2] The Strolling Astronomer, Vol. 18, pg. 44, 1964.

[3] Sky and Telescope, N. A. Kozyrev, Vol. XVIII, pg. 184, 1959.

[4] Sky and Telescope, James A. Greenacre, Vol. XXVI, pg. 316, 1963.

References (cont'd)

[5] Sky and Telescope, Vol. XXVII, pg. 3, 1964.

[6] A Survey of the Moon, Patrick Moore, pp. 55-58, 1963.

[7] The Moon, Edmund Neison, pp. 185-192, 1876. Many other references to the Linné controversy could be given.

[8] Journal of the Royal Astronomical Society of Canada, Walter H. Haas, pp. 238-239, et seq., 1942.

[9] "Operation 'Moon-Blink'", by John J. Gilheany, Proceedings of the 1964 N.A.A.C. It will be published in Str. A. in a future issue.

[10] The Strolling Astronomer, Kenneth Schneller, pp. 45-46 of this issue.

[11] Popular Astronomy, Walter H. Haas, Vol. 51, pg. 264 et seq., 1943.

[12] Popular Astronomy, Walter H. Haas, Vol. 47, pg. 373 et seq., 1939.

THE A.L.P.O. OBSERVING MANUAL

By: Clark R. Chapman and Dale P. Cruikshank

(Paper read at the Twelfth A.L.P.O. Convention at Denver, Colorado, August 28-31, 1964.)

There has been a growing need for a publication describing amateur lunar, planetary, and cometary studies. In spite of the large number of popular books and other "guides to observing" which are on the market, there is no single volume giving the amateur detailed information on making, analysing, and understanding visual and photographic studies of the moon and planets. Furthermore, the Recorders in the A.L.P.O. receive many inquiries from beginners, and an observing manual discussing the routine questions would lessen considerably the letter-answering load. Lastly, there is a need for an observing manual to direct and to unify the observing programs of A.L.P.O. members so that the Section Reports can be based on more rigorous and uniform observations.

A number of years ago a project was started in the A.L.P.O. to assemble and to publish an observing manual that would meet the need. The project passed from hand to hand, and eventually interest was lost. The problems of publication of such a volume seemed too large to surmount, and several of the A.L.P.O. Sections began issuing their own small handbooks and mimeographed sheets to help fill the need. In the summer of 1963 the authors of this paper undertook to renew the project by soliciting articles from Section Recorders and other advanced A.L.P.O. members.

It has been our belief that an observing manual should serve two principal functions. First, the manual should provide the rank beginner with a detailed, easy-to-read description of the basics of lunar and planetary drawing, observing, and photography. Not only should the beginner be given simple definitions and descriptions of basic procedures, but we feel that he should be given some perspective on the role of the amateur in astronomy and some appreciation of the use of scientific method in solving problems. Secondly, an observing manual should contain all the detailed information and suggestions for useful projects that can serve as a constructive guide for the advanced amateur who has mastered the basics and is ready to begin studying special problems.

In order to provide the chapter authors with an idea of what was wanted (in terms of style, format, complexity, etc.), we prepared a chapter on Mercury from material originally written for the manual several years ago, and distributed mimeographed copies to the chapter authors. Several months later, first-draft manuscripts for some of the chapters were sent to us for editing. The edited versions of many of the chapters have been mimeographed and distributed to about 25 persons interested in the project and in a position to provide helpful criticisms and suggestions. It has been our hope that a considerable amount of interest will be generated which will eventually lead to an accurate and comprehensive manual, concisely and clearly written.

The chapters which have been edited and distributed are: the original Mercury chapter by Dale Cruikshank, a chapter on planetary colorimetry and the use of color filters by Charles Capen, a chapter on Saturn by Joel Goodman, a Venus chapter by William Hartmann and Cruikshank, and a brief chapter on matters common to Mercury and Venus by Cruikshank. The introductory section of the lunar chapter by John Westfall has been edited but has not yet been distributed. A section on color photography by Capen and a lengthy chapter on comets by David Meisel have also been received. Chapters still in preparation are: Mars (Ernst Both), Jupiter (Philip Glaser), the moon (Joseph Ashbrook, John Westfall, Patrick McIntosh), and photography (Dennis Milon). Charles Giffen is working on a chapter about the theory of observing (seeing, transparency, and intensity scales; physiology and psychology of observing; etc.). Clark Chapman is working on a chapter dealing with observing and drawing techniques, methods of reduction, and the role of the amateur astronomer in general. Walter Haas will contribute an introduction; and brief sections on other A.L.P.O. activities, such as lunar meteor search, book review department, and the Uranus-Neptune Section are being prepared. Throughout the project we have been relying on many other persons who have been offering suggestions and contributing small sections for some of the chapters.

While several modes of publication and distribution are currently under consideration with several attractive prospects, we believe that the matter of first importance is preparation of a suitable manuscript. Once the manual is in final form, we believe that the problems of publication and distribution can be solved. We have tried not to impose deadlines on the chapter authors, but we hope that all the preliminary drafts can be finished as soon as possible so that the manual can be published within a year.

We hope that the observing manual will be of interest and use to a larger audience than just the A.L.P.O. membership. Persons with an active interest in the moon, planets, or comets are invited to contribute suggestions and criticisms in these, the formative, stages of the manual. Please write to us at the following address:

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Tucson, Arizona

A NOTE ON THE COBRA HEAD OF SCHROETER'S VALLEY AND VICINITY

By: Harry D. Jamieson, A.L.P.O. Lunar Recorder

Figure 20 shows a recent good view of one of the Aristarchus - Herodotus "eruption points". A few notes follow.

ALPHA α: (Xi: -.6930, Eta: +.4130)

This is a very minute pit nestled between the (IAU) SW rim of the Cobra Head and the (IAU) NW base of the nearby mountain mass - right in the center of the spot where the "red glow" was reported at Lowell on October 30, 1963. Its diameter (which could be only roughly measured) appears to be about 2.3 kms. Lunar east and west are in this article according to the 1961 I.A.U. resolution.

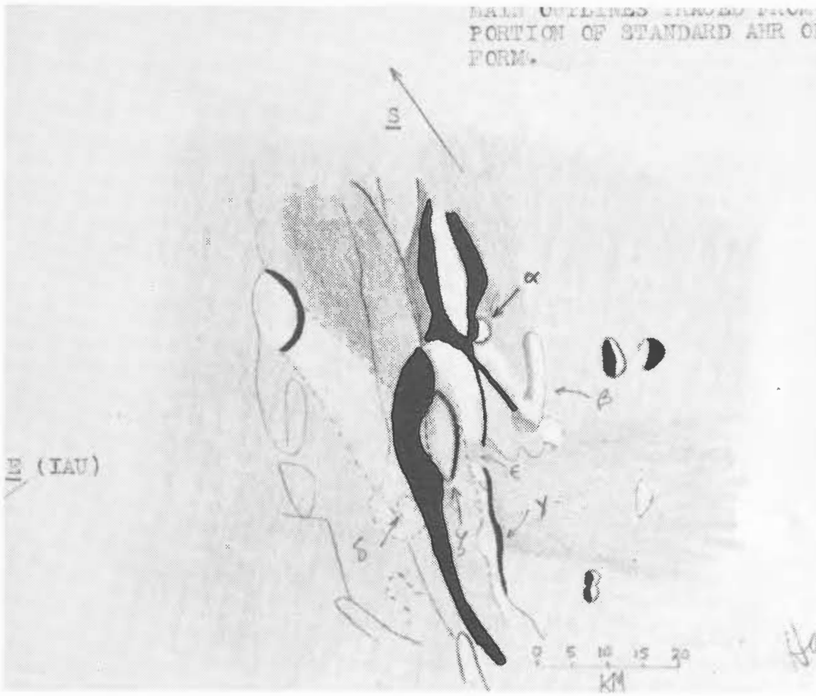

FIGURE 20. The Cobra Head and vicinity in Schroeter's Valley on the moon. Drawing by Harry D. Jamieson on July 22, 1964 at $2^h\ 18^m - 2^h\ 58^m$, U.T. 10-inch reflector. 300X with Zoom and Barlow Lenses. Seeing 5-6 (0 to 10 scale). Transparency 4 (limiting magnitude). Colongitude 62.3 degrees. Sun's altitude 12 degrees.

BETA β : (Xi: -.6985, Eta: +.4160)

A rather shallow "Y" shaped depression having an enlarged segment at its N end, while its SE branch may be connected to the N wall of Alpha. Some dark shadow could be seen along the E rim of the SE branch, though the W branch held only grayish shadow, indicating a lesser depth there.

GAMMA γ : (Xi: -.6895, Eta: +.4225)

This feature seems to be a very small, but brilliant peak situated on the inner W rim of Schroeter's Valley, though the ACIC shows a craterpit here. A very short shadow could be seen to its W, limiting its height to 200 meters at the very most - and probably much less.

DELTA δ : (Xi: -.6855, Eta: +.4195)

A very tiny bright spot which seems to be the location of a small peak on or near the E rim of the Valley. On 1963, October 29 .993055 UT I measured the height of this peak as being 1100 meters above the floor of the Valley, though this value is a tentative one only.

EPSILON ϵ : (Xi: -.6905, Eta: +.4175)

An apparent landslide. This feature is seen as a dull discontinuation of an otherwise brilliant inner W wall of the Valley; while on photographs taken under a setting sun, it can be seen that no shadow is cast here. Observations made under a setting sun could yield a slope angle for this slide.

ZETA ζ : (Xi: -.6885, Eta: +.4185)

This is the low hill located near the center of the Cobra Head's floor. Its height cannot exceed 300 meters.

AIMS OF THE A.L.P.O. COMETS SECTION

By: Dennis Milon, A.L.P.O. Comets Recorder

It is regrettable that David Meisel, the founder of the A.L.P.O. Comets Section, is unable to continue his leadership because of the press of academic work. However, it is this writer's opinion that the Comets Section should continue to disseminate and evaluate comet information with the A.L.P.O. group that has shown its enthusiasm for observation under Dave's direction.

For the past several years Michael McCants and I have forwarded news of comet discoveries to a small group of comet observers. In return, we have asked for observations that would enable Mike to compute a finding ephemeris. These activities have placed us in contact with an interested group of A.L.P.O. observers, and I now welcome the opportunity to correspond with a larger number of A.L.P.O. members.

In order to receive news of comet discoveries announced by Harvard College Observatory telegrams, ALPO members should send a supply of self-addressed air-mail postcards to the new Comets Recorder. For those observers wishing faster notification, I can also telephone or telegraph collect. Observers should state how faint a comet they wish to be called about.

About a week after discovery Michael McCants may have a first orbit, telling observers where to look for a comet, its distance, and how bright it may get. To receive a copy of this ephemeris, ALPO members should send a supply of stamped, self-addressed legal-size envelopes to the Recorder.

After ALPO observers have data on where to locate a comet, it is hoped they will forward a description to the Recorder. The collecting of observations will be the chief activity of the Section.

Total magnitude estimates, using out-of-focus images, and measures of coma, nucleus, and tail dimensions may be made by the visual observer. Total magnitude estimates should be made with the smallest optical aid possible, beginning of course with the naked eye. The method of observation is first to put the image out of focus, then estimate the brightness in terms of tenths between two stars, one slightly fainter than, and one slightly brighter than the comet. If the name, position, or a sketch of the comparison stars is sent to the Recorder, he will then secure the magnitudes from a star catalogue. The angular dimensions of comets are most easily obtained by drawing on a star atlas. The Recorder uses Norton's, Skalnate Pleso, Atlas Eclipticalis, and Atlas Borealis. Photographs should also be plotted to find coma and tail sizes.

Both magnitude and tail length estimates will be more accurate if made away from city lights.

Amateurs with long focal length cameras may obtain fairly accurate positions by placing a comet negative in an enlarger and projecting an image on a large scale star atlas. The comet position is then measured on the atlas.

In order that other observers may be notified quickly of unusual appearances, observations should be sent to the Recorder shortly after they are made. Positions of newly discovered comets may be sent directly to Michael McCants, 5481 Cedar Creek, Houston, Texas.

Observations sent to the Comets Section should include the following:

- Universal Time and date.
- Telescope type and size.
- Location of the observer.
- Transparency.
- Eyepiece power and field diameter.
- Darkness of the sky (twilight, zodiacal light, moonlight, city lights.)
- Altitude above horizon of the comet.

BOOK REVIEWS

Cosmic Dust, by A. Dauvillier. Philosophical Library, 1964. Translated from the French by Alan Crozy. Price $15. 167 pages, with illustrations.

Reviewed by David D. Meisel, A.L.P.O. Comets Recorder

Although entitled "Cosmic Dust", this volume deals with a wide variety of subjects, ranging from the interplanetary gaseous medium to the intergalactic medium now assumed to be mostly gas with some dust. The bulk of the material deals, however, with cometary phenomena. The book starts out with a short résumé of the topics of the following eight chapters. In the foreword the author states that in order to synthesize the present work it was necessary to upset in some measure widespread ideas. He then leaves it to the reader to judge whether he has been lacking in prudence. According to the dust cover front flap (excuse the pun), the author is professor at the College de France and is associated with the Pic du Midi Observatory. The book itself is described as the first English edition of an outstanding book by a distinguished French astronomer, who has studied the origins and significance of cosmic dust for thirty years. It is said to be appropriate at a time when man stands on the threshold of space exploration and is particularly valuable for its confrontation of theories and experimental data drawn from many sources and ranging in time from ancient Greece to the present day. The book is said to be a challenging synthesis of ideas on the evolution and future of the universe.

As much as the reviewer would like to recommend this book to the A.L.P.O. as good reading and a useful reference, he cannot do so with a clear conscience. First of all, the price of the translation version is much too expensive for the quality of workmanship and translation presented in the book. A price of five to seven dollars would be more reasonable. Secondly, the translator does not seem to be familiar with a sufficiently technical vocabulary since a number of translating blunders are evident throughout the book. Thirdly, the documentation, while very good in some places and quite up to date, is very poor in other parts of the book and even the same chapter. While there is such a thing as over-documentation, once an author has started it he should maintain the same level throughout. Lastly, the book is written in a style that is very common among books popularizing science. There is no indication of where fact ends and fancy begins. Such books give the layman a false picture of the universe, where one neat survey apparently gives all of the answers and only the details remain to be worked out. And since the author evidently had misgivings about the prudence of his presentation, one wonders just for whom the volume is intended. While a professional astronomer would have no trouble deciding what was speculation and what has a reasonable credulity, a lay reader might encounter some difficulty. At least one reader, the reviewer, found the exposition to be somewhat lacking in prudence; and others may also come to the same conclusion.

In conclusion, it must be stated that the book does make interesting reading even if the ideas are entirely speculative. Also a number of references to little known papers are valuable in themselves. The discussion of the differences between the various proposed mechanisms for comet tail formation is especially good. In the reviewer's opinion it is a shame that the good features of the book do not seem to overcome the bad ones. It is felt that the format would be greatly improved if the material could be rearranged so that the observational data could be distinctly separated from the theories or speculations. While it is likewise felt that the volume does not quite live up to its price or the claims on its paper cover, if your local library acquires a copy, by all means read it for sheer entertainment. Your time will not be completely wasted by the exposure to some radically different interpretations of current research topics as presented in the book, Cosmic Dust.

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A Handbook of Practical Amateur Astronomy, edited by Patrick Moore. W. W. Norton & Co., Inc., 1964. Price $5.95, 254 pages.

Reviewed by Rodger W. Gordon

Twenty different authors combine their talents into a highly readable, non-technical review of the capabilities of amateur-sized telescopes. Every contributor is a well known specialist in his field. Chapter topics range from the selection of telescopes to earth satellite observations. The major part of the book is devoted to lunar and planetary observations.

This volume contains a wealth of information for amateurs who are ready to decide on their particular field of specialization; and it makes a handy reference volume for those who are more advanced. The book is presented in the same manner as Sidgwick's Observational Astronomy for Amateurs, but less information is covered. This is no detriment, however, as the price is less than half that of Sidgwick's volume; and it make a handy companion to Observational Astronomy for Amateurs.

There is an excellent selection of photographs in the middle of the book, showing amateur telescopes and observatories of noted British amateurs, plus excellent planetary photographs and drawings made with modest equipment. Photos of meteors and aurorae are also included.

There are a few places in the book where some amateurs may disagree with the opinions presented regarding the use of small telescopes and limiting apertures for various planetary studies. This situation may come from the fact that the British Isles are in a high northerly latitude, and some of the planets (Mercury for example) are not too favorably placed for observation with small telescopes. Here in America conditions are less extreme so that good planetary observations may be made with apertures considerably less than those given in parts of this book - on pages 82, 83, and 84, for example.

To sum up: Patrick Moore has done an excellent job of presenting a low-cost book intended primarily for an amateur beginning to specialize. I recommend it enthusiastically.

ANNOUNCEMENTS

Lunar Training Program Forms Available. Mr. Clark Chapman, 94 Harper, Buffalo 26, New York, the Lunar Training Program Recorder, wishes readers to know of the availability of a number of standard crater outline forms. Lunar regions represented are Thebit, Hesiodus-Pitatus, Cassini, Posidonius, the Ranger VII impact area, and the Guericke-Bonpland-Parry-Fra Mauro region. The forms include instructions for their proper use; positions of features are based on photographs tp insure accuracy. Persons interested in this Lunar Training Program and wishing to participate should write to Mr. Chapman at the address above.

Sustaining Members and Sponsors. As of September 28, 1964, there are in these special classes of membership:

Sponsors - W. O. Roberts, Jr.; David P. Barcroft; Philip and Virginia Glaser; Charles H. Giffen; John E. Westfall; Joel W. Goodman; the National Amateur Astronomers, Inc.; James Q. Gant, Jr.; David and Carolyn Meisel; Clark R. Chapman; Ken Thomson.

Sustaining Members - Grace E. Fox; Sky Publishing Corporation; Joseph Ashbrook; Charles F. Capen; Kenneth J. Delano; Craig L. Johnson; Geoffrey Gaherty, Jr.; Dale P. Cruikshank; Charles L. Ricker; James W. Young; Charles M. Cyrus; Alan McClure; Elmer J. Reese; George E. Wedge; Carl A. Anderson; Richard E. Wend; Gordon D. Hall.

Sustaining members pay $10 per year; sponsors, $25. The surplus over the ordinary rate is used to support the work and activities of the A.L.P.O. Several persons have already renewed for a second year as special members.

A.L.P.O. Staff Changes. Our Mercury Recorder has a new address:

Geoffrey Gaherty, Jr.
131 Bloor Street West, Apt. 505
Toronto 5, Ontario, Canada

Mr. Gaherty is beginning graduate studies in anthropology at the University of Toronto.

The Mars Section has been reorganized with the new Mars Recorder:

Klaus R. Brasch
224 Montée Sanche
Rosemere, Quebec, Canada

The new Assistant Mars Recorder is:

Richard E. Wend
2050 N. Lawler Ave.
Chicago 39, Illinois

The new Mars staff will already be known to many of our readers. Some members may want soon to begin their observations of Mars at its 1964-5 apparition. All such observations should be mailed to Mr. Brasch at the address above.

It is appropriate at this time to express our appreciation to Dr. Ernst E. Roth for his contribution in serving as Mars Recorder. He brought to the post unusual familiarity with observing techniques and unusual knowledge of the literature of the Red Planet, and it is a matter of regret that he has for some time been unable to be active in the Recordership.

Mr. Elmer J. Reese is being dropped as Assistant Jupiter Recorder at his own request. Mr. Reese's excellent observations and frequent contributions to the work of the A.L.P.O. are very well known to all our older readers. We shall be fortunate to find a successor who will maintain the high standard set by Mr. Reese for the annual reports on Jovian rotation periods deduced from central meridian transits.

In the Comets Section Mr. David Meisel has been replaced as Recorder by:

Dennis Milon
Lunar and Planetary Laboratory
University of Arizona
Tucson, Arizona

Mr. Meisel was in truth the creator of the Comets Section and has established a very worthy standard in his reports on comets observations contributed to the A.L.P.O. At present, however, he finds the pressure of graduate studies in astronomy too great to allow much else. Mr. Milon has long been an active worker in the Comets Section. His plans and goals for the Section are outlined in his article on pp. 78-79.

Coming Lunar Eclipse. Readers are invited to start making plans for the systematic observation of the total lunar eclipse on December 19, 1964 (U.T. date). Totality will last from $2^h 8^m$ to $3^h 8^m$, U.T. (by E.S.T. from 9:08 P.M. to 10:08 P.M. on December 18); the moon will thus be well placed over most of the United States and Canada. Material now scheduled for our next issue will describe several eclipse projects for observers. will report on the total lunar eclipse of June 24-25, 1964, and will include a comprehensive report-form designed by Lunar Recorder John Westfall. Careful estimates of the brightness of the moon in eclipse are especially desired because of the very extreme darkness of the lunar eclipse on December 30, 1963 and the great, if perhaps lesser, darkness of the eclipse on June 24-25, 1964.

N.A.S.A. Survey for Transient Lunar Phenomena. We had hoped for greater reader response to Dr. Urner Liddel's letter quoted on pp. 259-260 of our November-December, 1963 issue. In fact, only one person wrote specifically about the project outlined, leaving the extent of likely A.L.P.O. participation in such a program in considerable doubt. The Editor and staff always find constructive comments and discussions by readers helpful.

A.L.P.O. members who observe Aristarchus and vicinity for color with either positive or negative results are invited to continue to send reports to Lunar Recorder Clark Chapman. In recent months more sophisticated instrumental approaches to a patrol for unusual lunar phenomena have been proposed. While the Editor would still welcome an adequate A.L.P.O. effort on such a patrol, he would not be able personally to direct it properly in addition to present commitments.

OBSERVATIONS AND COMMENTS

Historical Note on Colors in Aristarchus Region. Mr. R. M. Baum of Chester, England directs attention to the following extract from the Selenographical Journal, December 2, 1880, Vol. III, No. 34, pg. 95:

> "The group of Aristarchus and Herodotus. On several occasions the lofty peak to the north of Herodotus has been seen surrounded by a bluish glare, and this in both refractors and reflectors . . . . Near Wollaston, Neison has suspected two or three distinctly red hillocks in the midst of a number of white ones. These hills are near β [whose map?] It will be remembered that Maedler found a peculiar reddish tinge on a portion of the surface near Lichtenberg, a neighbouring formation, though this red tinge has since disappeared".

Neison does not refer to this reddish area near Wollaston in his classic The Moon, published in 1876. It is known that he was very active observationally between 1876 and 1880. Mr. Baum remarks: "The fact that reddish hues are reported near Aristarchus, Wollaston, and Lichtenberg, all neighboring formations, relatively speaking, may or may not be significant. At any rate one feels the whole area should be closely watched on a large scale just in case it is peculiarly tinged".

Venus at Inferior Conjunction in June, 1964. Figures 21 and 22 are drawings of Venus at this inferior conjunction. Both may be compared to a near-simultaneous photograph taken by the Research Center of New Mexico State University and published in our January-February, 1964 issue. Figure 21 is thus distant only 10 minutes in time from Mr. Smith's photograph appearing as Figure 14 on pg. 43 of the Jan.-Feb. issue; and Figure 22 is only 32 minutes later than the front cover photograph by Mr. Murrell on the issue mentioned. The agreement between photographs and drawings is pleasing.

Mr. Chapman's June 19 drawing is confirmed very well by a concurrent drawing by Mr. Reese with the same telescope and conditions and is also compatible with another concurrent, but rather poorer, drawing by Walter H. Haas, also with the same telescope and conditions.

The ring of light is produced primarily by the diffuse reflection of sunlight in the atmosphere of Venus. At most inferior conjunctions the planet does not come nearly enough exactly between the earth and the sun to give a complete ring, but a considerable extension of the cusps far beyond their geometrical positions is regularly present. It will be noted on the drawings and photographs referred to above that the geometrically dark limb is by no means uniformly lit, a consequence of the non-homogeneous nature of the atmosphere of the planet. The brighter knots on Figure 22 are presumably higher-lying clouds.

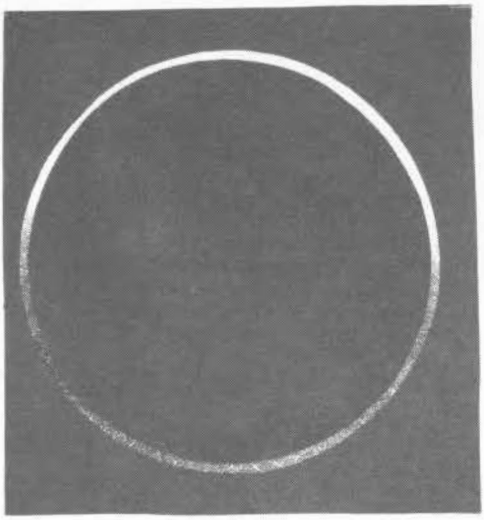

FIGURE 21. Venus. Clark R. Chapman. 8-inch refl. at 4-inch aperture. 60X. June 19, 1964. $17^h\ 10^m$, U.T. Seeing 3-4 (0 to 10, with 10 best). Transparency 6 (limiting magnitude). North at top, west in earth's sky at right.

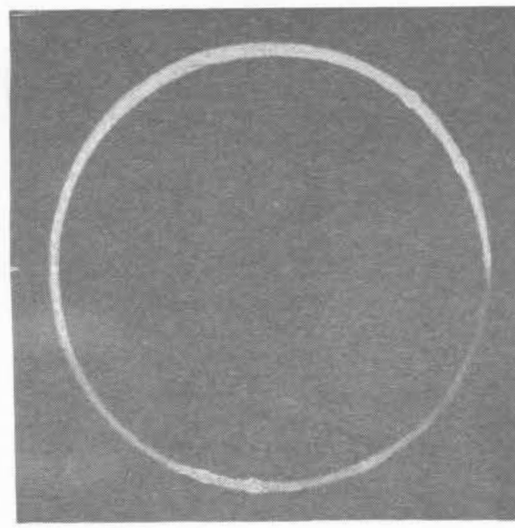

FIGURE 22. Elmer J. Reese. 8-inch refl. at 4-inch aperture. 60X. June 20, 1964. $17^h\ 50^m$, U.T. Seeing 5 (0 to 10 scale, with 10 best). Transparency $6\frac{1}{2}$ (limiting magnitude). Same orientation as Figure 21.

Guerické. Figure 23 presents a not very recent drawing by Mr. Herring. It is shown here chiefly in the thought that readers may enjoy comparing an earth-based drawing by a skilled and experienced observer with the aspect of Guerické on one of the most-published Ranger VII photographs. In seeing as poor as 3 - 4 Mr. Herring was naturally not able to record anywhere near all the fine detail within the reach of his telescope.

Current Phenomena of Saturn's Satellites. When the rings are sufficiently nearly edgewise (when the earth and the sun are close enough to the plane of the equator of Saturn), there occur phenomena of the satellites exactly like the more famous ones of the Galilean satellites of Jupiter. The satellites and their shadows transit in front of the face of their primary; they are also occulted by its disc and eclipsed in its shadow. These Saturnian satellite and shadow transits are rather difficult to observe in small telescopes except for those involving Titan. Phenomena for Tethys and Dione began in May, 1964; the satellites farther out still escape, just as Jupiter IV often avoids transit, eclipse, or occultation. Predictions for Tethys and Dione are given on pp. 41 - 45 of the 1964 Handbook of the British Astronomical Association. For example, Tethys on November 15, 1964 will offer a

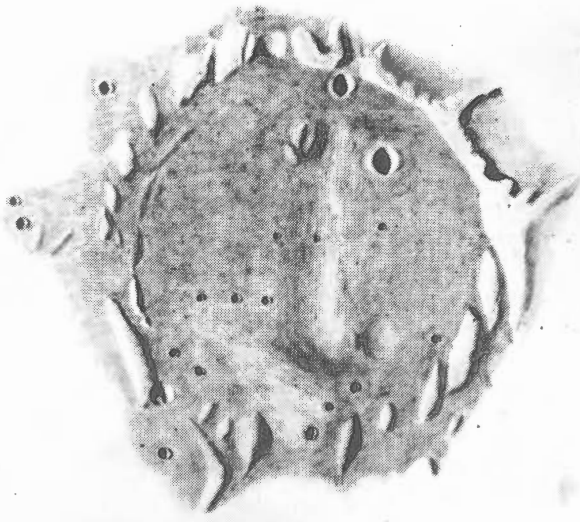

FIGURE 23. Lunar Crater Guericke. Alika K. Herring. 12.5-inch refl. 228X - 310X. May 28, 1958. $4^h\ 15^m$, U.T. Seeing 3 - 4 (0 to 10 scale). Transparency about 5 (limiting magnitude). Colongitude = 28°.9. Lunar south at top, lunar west (IAU) at right.

transit ingress on the disc of Saturn at $3^h\ 35^m$, U.T., followed by its shadow ingress at $3^h\ 41^m$; transit egress is at $4^h\ 40^m$; shadow egress, at $5^h\ 52^m$. On November 16 Tethys disappears in occultation at $2^h\ 14^m$, U.T. and reappears from eclipse at $4^h\ 31^m$, being in the shadow of Saturn at occultation reappearance.

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STAFF