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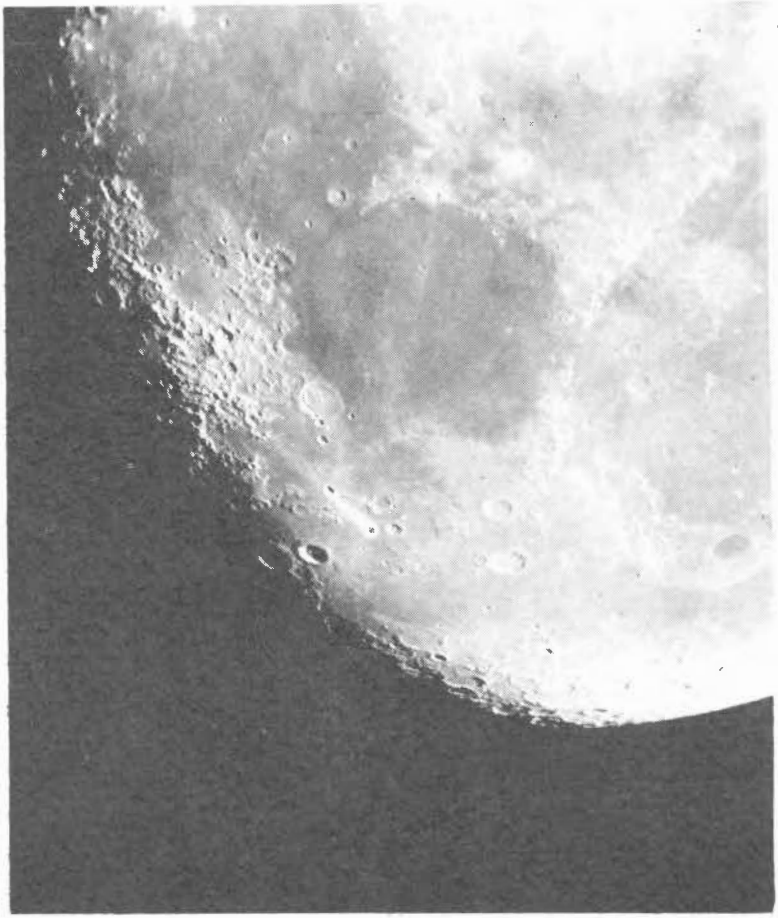

Photograph of Mare Serenitatis, Mare Tranquilitatis, and vicinity under evening lighting on the moon. Taken by F. Jack Eastman, Jr., with a 12.5-inch reflector on July 12, 1960, at 10 hrs., 46 mins., Universal Time. 65 ft. e.f.l. Seeing 6, transparency 4. Ansco Super Hypan. One-half second exposure. Colongitude = 133.3 degrees. Read Mr. Eastman's discussion of lunar photography in this issue.

THE STROLLING ASTRONOMER

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IN THIS ISSUE

LUNAR PHOTOGRAPHY

By: F. Jack Eastman, Jr.

More and more amateurs are hooking their cameras to their visual telescopes, and taking some rather good photographs. The extremely good photograph is, however, usually the exception rather than the rule. More often than not, one's first photograph is as disappointing as one's first look at Mars in seeing 0 - - !

There have been many attempts to control techniques, etc. with the idea that a person can go to the telescope and get a perfect picture every time. While it is true that one can analyze a situation and eliminate many problems, there still exist a host of random variables to plague us. The most notorious of these is transparency, which includes reflectivity of mirrors, transmission of eyepieces, and, of course, atmospheric conditions. These variables make a purely mathematical approach unsuitable. One will have to make test exposures anyway. The other problems, such as focal length, speeds, etc. follow the same laws in lunar work as they do in ordinary photography.

The following is a discussion of the author's methods and equipment, and is intended only as a guide, since differences will exist in the individual equipment and conditions.

Before embarking on the problems of photography, let us see about a suitable telescope. Perhaps the most important thing is the mounting. We all know the frustration of trying to look through a shaky telescope; well, the problem is much more so for a photographic instrument. If we can keep our exposures short, say 1/150th of a second, we won't need a drive; but for anything much longer, a fairly good drive will be necessary. For example, in 1/15th second of time, the moon will move about 1", which corresponds to the resolution of a 4½-inch 'scope. (The actual motion will be approximately 1 sec. arcXcosD, where D is the declination). For projected focal lengths, a drive is a must; and slow motions will be helpful.

Optically, there is no substitute for aperture. The larger the aperture, the brighter the image (for a given focal length), and the sharper it is. As to the type of telescope, the reflector is by far the best. While visual observers have their controversies, photographic observers almost all will agree that the absence of chromatic aberration in the reflector is a great boon. One can shoot in the ultra-violet or infra-red with the reflector without fear of being out of focus, etc.

While on the subject of optics, let us see how the focal length, speed, etc. affect the photograph. If we are photographing a star, which is a point, the brightness of the image depends <u>only</u> on the area of the collector, i.e., lens or mirror. Since the moon is an extended object, the final brightness of its image will also depend on how spread out the light is, thus on the size of the image. The size of the moon's image is determined by the focal length of the objective. In fact, the diameter of the moon's image is 1/115th of the focal length at the moon's average distance, so a mirror of 115 inches focal length will form a 1-inch image of the moon.

Perhaps this idea can be clarified by way of example. Let our standard telescope have an aperture of 8 inches, and a focal length of 57.3 inches. Let us say that the half-inch image of the moon has a surface brightness of 4 units. If we increase the focal length to 114.6 inches, the brightness will go down to one unit, since the image is now twice as large in diameter, and spread over four times as much area. If we now increase the aperture to 16", increasing the light by a factor of four, our image is once again 4 units bright. Further, a 16" aperture at a focal length of 57.3" would form an image with a surface brightness of 16 units, four times that formed by the original 8" (fourfold increase in light grasp, no change in image size). We will come back to this idea when we discuss exposures.

"What image size is the best?" is an often heard question. The answer will, of course, depend on the reader's own requirements; but remembering that the image diameter is about 1/115th of the focal length will help. For a 35mm. negative, a 22mm. image is good for the whole moon, being secured from an 8-feet focus. A 35-feet focus will do about the same for a 4x5 inch negative, forming about a 3½-inch image. For almost all his work, the writer uses a 7½-inch image, corresponding to a focal length of 65 feet.

About the most important accessory which one can have is a guide telescope. The function of the guide telescope is to keep the "camera" aimed, and, still more important, to monitor the seeing. The guide should be as large as possible, so the seeing with it will be as near as possible to that in the main 'scope. As a minimum size, let us say that the guide telescope should be no less than 1/3 the aperture of the main 'scope, and of about the same focal length. It would be much better if the guide were 2/3 of the main aperture.

The author's equipment is the permanently mounted 12½-inch shown in Figure 1. The main mirror has a focal length of 96 inches, f/7.7. The rack and pinion eyepiece holder is removable, allowing the camera (and other accessories) to be bolted directly to the tube. The camera on the 12½" is a 4x5 inch projection camera, more about which will be said later. The finders are 2½-inches aperture; the lower one is f/5, and the upper, near the eyepiece, is an f/9, usually used at 20X, though it will take up to 170X to serve as an emergency guide. The guide telescope is the long-focus 4.2-inch reflector on the right side (Figure 1). This has a focal length of 92 inches (f/22) and is used with 140X to 340X for monitoring the seeing. Mechanically, the mounting is equipped with a hand-operated slow motion in declination, and a dual speed electric drive, providing electric slow motions in right ascension, operating at the sidereal rate. This telescope was built from odds and ends of scrap metal, etc., and cost the writer about $200.00.

For portable use on the moon, the writer also has a 6-inch f/8.3 reflector with a 4.2-inch f/10 guide 'scope. The 2/3 ratio in aperture of guide to main telescope here is better; but this ratio would require an 8-inch guide for the 12½", which would have introduced mechanical difficulties.

Now that we have looked at the telescope, let us examine the camera attachments a little more closely. As we said before, the image size depends only on the focal length of the system, for the moon being about 1/115th of the focal length. If we want to fill a 35mm. negative, a focal length of about 90 inches is very good. This is about the focal length of the average 6-inch refractor or 12-inch reflector. To fill a 4x5 inch negative, a focal length of about 35 feet is necessary. This is about what we would expect from a 24-inch refractor or about a 60-inch (f/7) reflector!! In order to get these long foci on smaller instruments, it is necessary to use some kind of compound system, such as a Barlow Lens or a projection eyepiece. In this discussion, we shall consider the latter. Figure 2 is a diagram of a typical projection camera system. In Figure 2, F is the focal length of the objective, P is the distance from the focus F to the eyepiece, and P' is the distance from the eyepiece to the film (F'). The distances P and P' must be measured with the system in focus since the eyepiece is moved out from its usual position so as to converge the light from F to F'. The problem now is to compute the effective focal length (hereafter to be known as F'), knowing P, P', and F. This is done as follows:

$$F' = \frac{F\,P'}{P} \quad \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

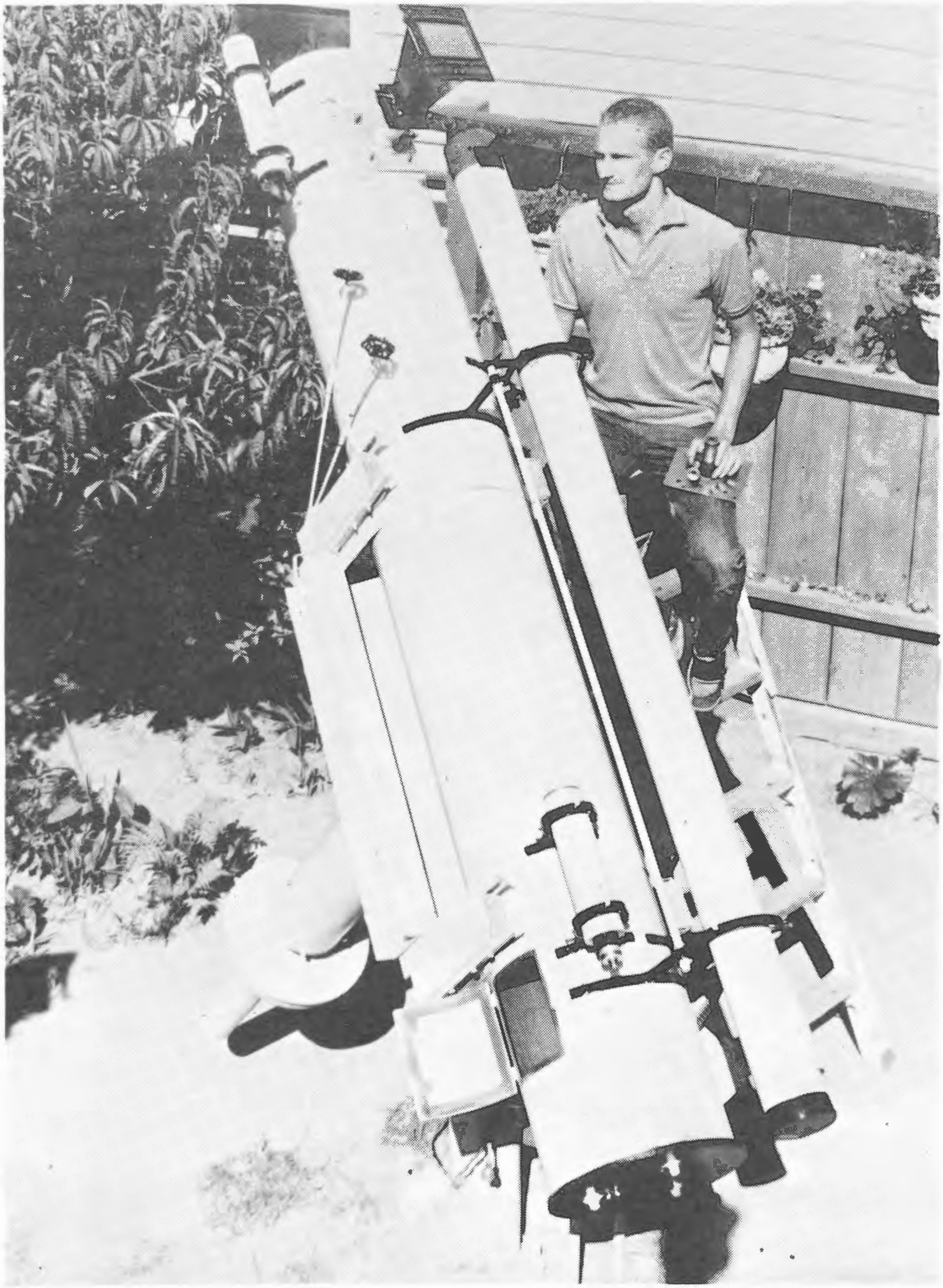

FIGURE 1. F. Jack Eastman, Jr. and his 12.5-inch reflecting telescope used for lunar photography. See also text of Mr. Eastman's article in this issue. All lunar photographs by Mr. Eastman in this issue were taken with this telescope. 4x5-inch camera in place over eyepiece holder. Rack and pinion eyepiece holder in observer's hand.

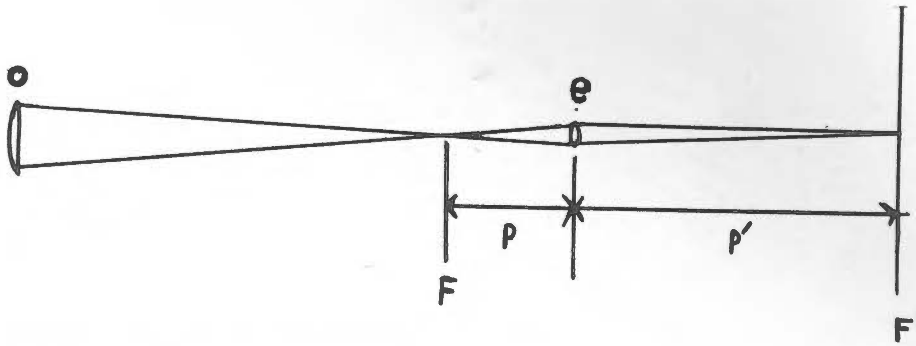

FIGURE 2. Diagram by Jack Eastman of typical projection camera system for lunar photography, with notation. See also text.

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The writer's camera is fully described, with illustrations, in the Sept.-Oct., 1961 Strolling Astronomer, Vol. 15, Nos. 9-10.

With this brief description of instrumentation, let us now look into the specific problems of lunar photography. The proper exposure for an object will depend on the surface brightness of the image, speed, or sensitivity of the detector (in this case the film emulsion), and the time of exposure. First, let us look at the laws which govern the surface brightness of the image. This will depend on the surface brightness of the object, and the speed or f/number of the camera. The surface brightness of the object will be a function of its distance from the source of light (by the inverse square law, i.e., twice as far means one-fourth as bright), and its reflectivity.

In the case of the moon, if we hold the speed of the telescope constant, the film speed constant, and assume the mean reflectivity of the moon to be constant, the only variable will be the changing distance of the moon from the sun. The brightness change then amounts to about 4% from the mean value, which change is negligible.

From the above, we see that we need not worry about the distance of the moon, since the differential in brightness is well within the latitude of the film. There is, however, a radical change in illumination with phase. As the sun gets lower and lower, the total light per unit area becomes less. The illumination may be called 1 at the subsolar point ($h = 90^\circ$), going to 0 when $h = 0^\circ$. The illumination varies as sin h. (h = altitude of sun as seen from lunar point in question.) It follows, then, that the exposure will vary as csc h, the exposure being unit time for vertical solar illumination (as seen from the earth), going to double that time at the point where h is 30°, to four times the unit where h is $14\frac{1}{2}^\circ$, and finally to infinity at the terminator, where h is 0°. It is beyond the scope of this paper to derive the results for all phases of the moon, but it turns out that if the proper exposure for the Full Moon is 1 unit, then the First and Last Quarters will be about 3, and the crescents within $3\frac{1}{2}$ days of New Moon about 12. Before we leave this subject, we should remember that at Full Moon, the earth and sun are almost in a line, so that we can consider all parts of the moon's surface as then being at the sub-solar point as seen from earth. The above relative exposures are empirical, taking this concept into account.

Enough theory! Now let's go to the telescope and take some pictures. The first thing to be determined is the exposure time for a given film. For this purpose there are more formulae, but these formulae contain certain "constants" that depend on transparency of the air, reflectivity of the telescope mirror, and cleanliness of the eyepiece. These "constants" hence have to be guessed at, so let's see if there is a way we

FIGURE 3. Photograph of part of moon near full phase by F. Jack Eastman, Jr. with 12.5-inch reflector. Lunar north at left, lunar east at bottom. Copernicus in upper left center, Aristarchus in lower left, Grimaldi near bottom center, Gassendi in lower right. June 28, 1961, 7 hrs., 45 mins., Universal Time. Focal length 65 feet. Contrast Process Pan, a good film near Full Moon. Exposure 1 second. Development in DK - 60 a. Colongitude = 90.4 degrees. See also text.

can guess at the exposure directly. The moon is a big hunk of rock in bright sunlight, and so is a mountain scene on a clear day. For a film with a speed of 100 we would set our snapshot camera at 1/100 second and f/16. Well, if the moon is the same type of scene, let's shoot it at 1/100 with f/16. Upon developing the film, we find that the negative, in most cases, is fairly good. Don't expect to get a light meter reading from the moon, even though it is as bright <u>per unit area</u> as the mountain scene, since it doesn't subtend a big enough angle in the sky. In other words, there isn't enough apparent angular area to reflect back enough light to affect the meter.

Before giving any specific exposures, let us talk a little about films. For photography directly at the focus of the telescope, we shall want a slow fine-grain film such as Panatomic X, or Kodachrome. For the Full Moon, we shall want a maximum of contrast. Microfile is good in this respect. For the projection camera, a faster film is necessary, due to the slower speeds of the optical system. Kodak Royal Pan and Ansco Super Hipan are good. For Full Moon, Kodak Contrast Process Pan is very good. Below is a table of exposures taken at random from the writer's notebook. As emphasized before, these are only to be used as a guide.

Newtonian Focus . . . . Focal length 8', f/7.6.

Subject	Film type	Time
Moon $6\frac{1}{2}$ days from new	Kodachrome	1/5- 1/25 sec.
" near full	"	1/25- 1/50 "
" " "	H.S. Ektachrome*	1/250 "
" in total eclipse	" " "	9- 20 secs.
Moon, Quarters	" " "	1/50- 1/100 sec.

Projection Camera . . . Focal length 65', f/64.

Subject	Film type	Time
Moon, near term.	Ansco Superhipan	$\frac{1}{2}$ - 1 sec.
" " "	Kodak Royal Pan	$\frac{1}{2}$ - 1 sec.
Moon, Full (h near 90°)	Contrast process	$\frac{1}{2}$ - 1 sec.

* Plus - X may be substituted for H.S. Ektachrome.

In order to get the most out of one's photography, one should do his own processing. The commercial photofinisher works on a production line basis, based on the average snapshot. He cannot afford to take the time carefully to control one or two pictures. If one does his own processing, it is rather easy to control things like contrast, grain, and so forth. Processing of films is rather simple, and all the needed chemicals and instructions can be purchased in a kit for a few dollars. Another advantage to home-processing is that the results are immediately available for inspection; and if a mistake is made, corrective measures may be taken without waiting. A darkened closet is all that is needed to begin. The best results will be realized if the instructions packed with the film and chemicals are followed to the letter.

Almost all of the author's photographs were developed in DK-60a, although some other developers might be used for special needs. Perhaps the following table will be of use.

Developer	Grain	Contrast	
Kodak Micridol	F	L	F-fine
" D-76	F-M	L-M	M-moderate
" DK-60a	M	M	B-bad
" D-11, D-19	M*	H	L-low
" D-8**	M	Very H	M-moderate
Accufine ***	F	M	H-high

*D-11 is a little less grainy than D-19.

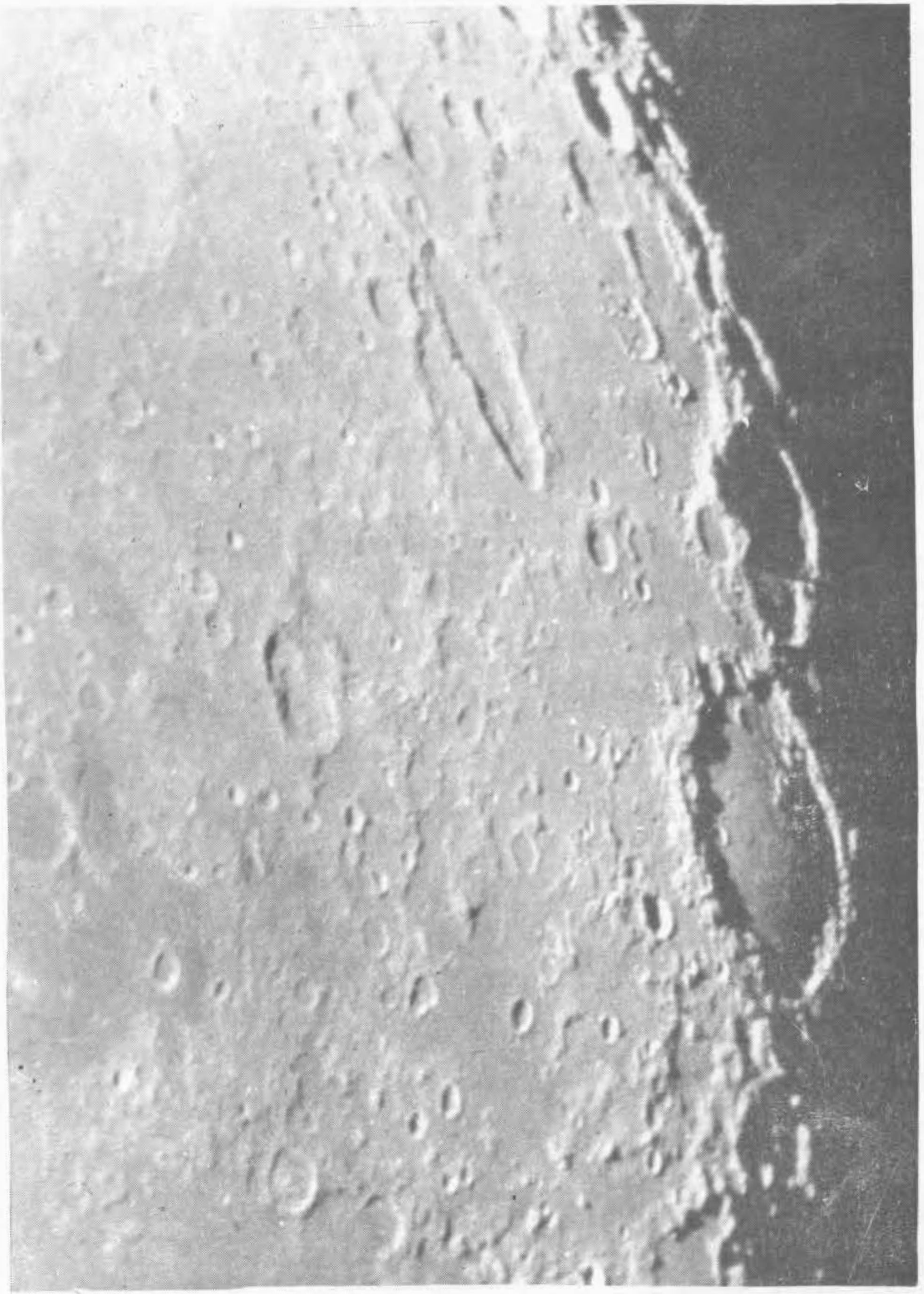

FIGURE 4. Photograph of part of southeast quadrant of moon by F. Jack Eastman, Jr. with 12.5-inch reflector. South at top, east at right. Schickard and Phocylides on sunrise terminator. June 18,1959, 5 hrs., 15 mins., U.T. Focal length 65 feet. Seeing fairly good (6). Colongitude = 55.5 degrees. Readers will realize that these published reproductions necessarily lose some of the smallest markings and some of the finer contrasts of tone present on the prints supplied by Mr. Eastman, which in turn must have been inferior to the originals which he secured at the telescope.

**D-8 has a very short life.
***Acoufine and Ethol UFG are <u>very good</u> developers, but are easily contaminated!

So far the discussion has been concerned with one instrument. If the reader's focal ratio is the same as the author's, there is no problem in using the recommended exposures for the initial tests. If the reader's f value is different, the following relation will be of use:

$$\frac{(f')^2}{(f)^2}, \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where f is the focal ratio of the first instrument and f' is the focal ratio of the second. If the exposure is 1 second on a telescope of f/64, then it will be:

$$\frac{(32)^2}{(64)^2} = \frac{(1)^2}{(2)^2} = \frac{1}{4},$$

or one-fourth second on an f/32 'scope. The exposure varies inversely as the film speed; i.e., a film that is twice as fast will require half the shutter speed.

About the most important thing associated with any type of astronomical work, and especially so with photography, is the keeping of a complete set of records pertaining to date, time, instrument, etc. The following outline contains 10 items which should accompany any and all photographs. It has been the author's experience that the information should be put down as soon as possible, lest one forget some point.

1. Date, Day, Month, and <u>Year</u>, preferably in Universal Time.
2. Time, to nearest minute, also in U.T.
3. Instrument, including:
   - A. Aperture.
   - B. Effective focal length.
   - C. Type of camera attachment (projection, etc.)
   - D. Type of telescope.
   - E. Maker of instrument.
4. Film type.
5. Exposure time.
6. Filter Data, number and maker, or transmission.
7. Developing data, type of developer, time and temperature.
8. Sky conditions, especially:
   - Seeing, Quality (1-10), and type of motion, slow, fast, etc.
   - Transparency (this will affect exposure time).
9. Physical data, like colomgitude, central meridian, etc.
10. Personal comments.

Any photograph with the above information can be and often is a contribution to science. Unfortunately, there are a lot of excellent photos which are really useless because the photographer doesn't remember when he took them, or the exposure, etc.

In conclusion, let us go to the author's 12.5-inch telescope and actually shoot a photograph of the moon. The first thing that is done is to set up the telescope visually, and to see whether the seeing is any good. If the seeing is good, i.e., we can use 800X, but the image is "wandering", we can say it is a good night for visual work but not for taking pictures. Any wandering will kill a photograph, which integrates the movement over the time of exposure. Well, let us assume that the seeing tonight is good enough for taking pictures. The eyepiece holder is then removed from the telescope, and the camera is attached. At the same time the guide telescope is uncapped and fitted with a 270X crosshair eyepiece. The shutter on the camera is opened on "time"; and the image is focussed carefully on the ground glass back of the camera, care being taken that the corners of the plate are in focus as well as the center. Tonight we have set up the camera at an E.F.L. of 65', the effective aperture ratio being f/64. The film is Kodak Royal Pan (ASA 400). The exposure for an average scene in bright light is about 1/250 sec. at f/16. Since we are working at f/64, our exposure will be about 1/10 sec. We have chosen a region about 30 degrees from the terminator, so the average illumination will be about half of the above, requiring about twice as long an exposure. Another look is taken at the ground glass to be sure that everything is properly centered, and the crosshair in the guiding eyepiece is placed over a familiar feature. From the above ideas we finally decide that 1/5 sec. is the proper exposure, and the shutter is so set. The filmholder is then inserted into the camera, and the dark slide is withdrawn. (It is most disconcerting to make an exposure with the dark slide in place!) The moon is then watched in the guide telescope, to make sure that the centering is proper, and that the seeing is still good. We find that the seeing has become a little worse, and hence the moon is watched carefully so that the exposure can be made at the time when the seeing is best. The slide is replaced, and the film is taken into the darkroom and developed. In about 10 minutes, we can look at the negative. If the negative has been too thin (underexposed), we can go to the telescope again and take another picture, doubling the exposure. Fortunately, this negative was good; so all the information is put down in the notebook, and the finished negative is put in the file.

Now, while the moon is still up, let's try a prime-focus shot in color. The projection camera is removed, and replaced with an Exakta body loaded with Kodachrome (ASA 10). Since this is a single-lens reflex, we can focus and monitor the image directly through the camera, using the 12½-inch 'scope as its own guide-telescope. The exposure at the f/7.7 focus is "guesstimated" to be about 1/25 second, reasoning as we did with the projection camera. The exposure is set, and made in a method similar to that with the projection camera. Since we are unable to develop this negative right away (if at all), it is good to take two more pictures, one at half the above exposure, the other at double the original exposure.

The question now is: "What do I do with the pictures?" We all know that the eye is much better in seeing fine detail than the photographic plate, but the eye is also affected by certain psychological and physiological effects which detract from the accuracy of the observation. The photograph is a permanent, accurate record, which may be compared with other photographs. Also, for visual observations, if the coarse details are obtained from a photograph, one can place the finer details with greater accuracy.

If it is clear tonight, go on out to your telescope and take some pictures - - it's easy, and the results may surprise you.

<u>Suggestions for further reading</u>

Books:

Paul, H., <u>Outer Space Photography for Amateurs</u>, Amphoto, 1960. A good general treatment of astrophotography and equipment.

Rackham, Thomas, <u>Astronomical Photography at the Telescope</u>, MacMillan Co., N.Y.,1959. A general treatment.

Selwin, E.W.H., <u>Photography in Astronomy</u>, Eastman Kodak Co., 1950. An excellent technical treatment of the subject.

Magazine articles and pamphlets:

Cassell, Robert R., "An Amateur's Lunar and Planetary Photography", <u>Strolling Astronomer</u>, Vol. 15,, Nos. 9-10.

Eastman, Jack, Jr., "A Planetary Camera for a 12½-Inch Telescope", Strolling Astronomer, Vol. 15, Nos. 9-10.
Description of camera for telescope.

Eastman, Jack, Jr., "Astronomical Photography in your Back Yard", Griffith Observer, Feb., 1961.

Eastman Kodak Co. Data Guides:
Kodak Films
Materials for Spectrum Analysis*
Processing and Chemicals and Formulas*
Kodak Wratten Filters*

* Especially valuable.

COMET BURNHAM 1959k: FINAL REPORT, PART IV. SUPPLEMENTARY NOTES

By: David D. Meisel, Comets Recorder

In Part III in the May-June, 1962 Strolling Astronomer, the most general aspects of the postperihelion period of this comet were outlined. However, certain details were deleted which will be included in future papers. Other miscellaneous data do not fit into the continuity of any of the planned papers, but have definite interest and should be published. It is this material with which Part IV is concerned.

A. Colorimetric Observations

During the period of observation some colorimetric work was done. Alan McClure attempted to obtain nearly simultaneous photographs, one on a red sensitive emulsion, the other on blue. The venture was very successful. From two plates of the series it was possible to confirm the existence of short term variations in the size and shape of the comative appearance in red light. Also, differences in internal structure and tail structure were noted. The blue tail images always had a definite ray structure, while the red images showed little of such structure. On photographs taken on Apr. 22, 1960 this difference is especially evident. (Figures 5 and 6). On the blue plate the ray structure is very strong. On the red plate only the two main tail streamers are at all plain. The measured diameter of the image from the red plates was more variable than could be expected from differences in exposure and sky condition.

Gary Wegner attempted to make colorimetric intensity measurements over the entire visual range. He found that on Apr. 27 and Apr. 29 the comet's surface was brightest in the middle of the green region of the spectrum. The average intensity values on the A.L.P.O. Scale (0 darkest and 10 brightest as compared to the total intensity of the coma) according to Wegner were:

Red	0	
Orange	0 to 2.5	
Yellow	2.5 to 6.0	
Green	6.0 to 8.0 to 7.0	Apr. 27 and
Blue	7.0 to 5.0	Apr. 29, 1960.

This result bears out the strength of the photographic image on these dates. Wegner's observations were made using filters visually with a 10-inch reflector.

B. Spectral Observations

In addition to colorimetric estimates, Wegner obtained a visual

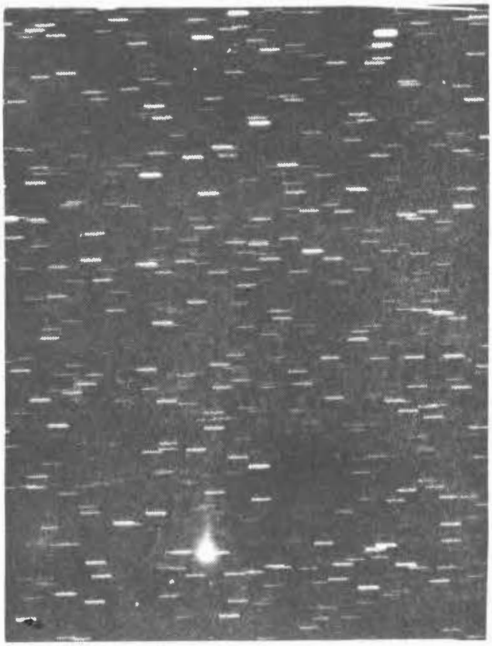

FIGURE 5. Red-sensitive photograph of Comet Burnham, 1959k, by Alan McClure. 4-inch f/5.0 Goto refractor. April 22, 1960. 10 hrs., [illegible] mins. - 10 hrs., 56 mins., U.T. on a 103 a - E plate with a 23 a filter. Note scarcity of stars compared to Figure 6 in blue light.

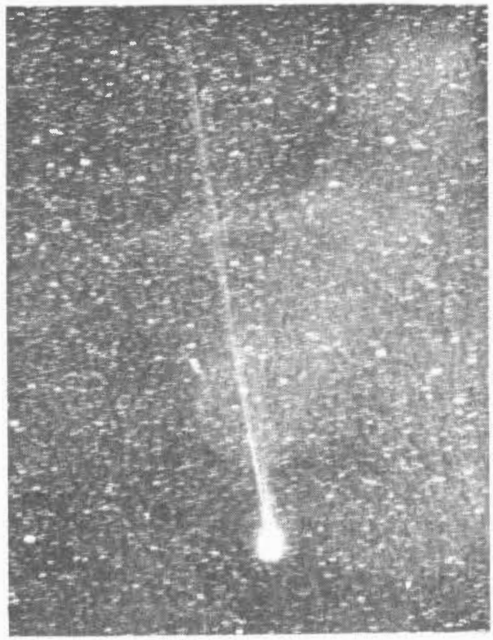

FIGURE 6. Blue photograph of Comet Burnham, 1959k, by Alan McClure. 5.5-inch f/5.0 Zeiss Triplet. April 22, 1960. 11 hrs., 0 mins. - 11 hrs., 25 mins., U.T. No filter (?). 103 a 0 plate (?). Compare to Figure 5 in red light, and see discussion in text of Mr. Meisel's article.

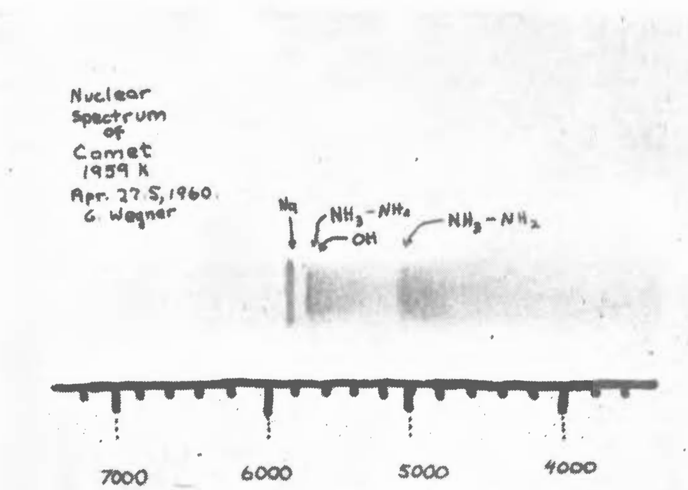

FIGURE 7. Sketch of nuclear spectrum of Comet Burnham, 1959k. Adaptation by David Meisel of original spectrum sketch by Gary Wegner. April 27.5, 1960, 10-inch Cassegrain reflector; transmission grating 13,400 lines per inch, slit width 1/300 inch. See text for details of line and band identification.

spectrum drawing. This drawing shows the spectrum of the nucleus and the surrounding area. (See Figure 7.) Plainly visible were the sodium D doublet in emission and two molecular band systems. The observation was made with a slit spectrometer using a transmission grating. The fact that the sodium $^2P - ^2S$ transition was visible at such a large heliocentric distance of more than 1 A.U., is a bit unusual. However, this emission can be explained fairly easily if one goes back to the photometric data. At the time the spectrum was obtained the comet was at the peak of one of the short term brightness increases. In Part III it was postulated that these fluctuations were caused by particle bombardment. The presence of the Na emission lends more support to the argument. The green tint of the colorimetric data could be accounted for by this emission. The Na lines were by far the brightest visually. However, the two band systems were noticed as fairly plain but faint. Tentative identification of the band systems was possible. System I started at about 5700 Å and was identified to be a mixture of NH_3 - NH_2 bands with OH bands. System II started at 5050 Å and was identified with the second series of NH_3 - NH_2 bands. No red emissions were detected above the general continuum. (See Figure 7.)

Mr. McClure and Mr. Wegner are to be congratulated for their work. Others who possess the proper equipment are encouraged to attempt similar programs. It is only through the cooperation of all interested amateurs that these reports are possible.

C. Unusual Observations

I. Coma and Tail Structural Pecularities

Close examination of McClure's photographs shows the existence of a weakly lighted diffuse area associated with the portion of the coma located some 30 degrees in position angle sunward from the main tail. This feature is present in the red plates as a broad diffuse fan, the width of the coma. It was photographed on Apr. 22 and 29 and on May 1. A similar appendage was observed by Meisel visually on Apr. 20. It is suspected that this feature is the broad curved tail reported by Roemer during the preperihelion period. Since it is more evident in red light, it is probably a tail of meteoric material or dust ejected from the interior of the comet.

Careful measurement of the relative dimensions of the coma show that the coma was consistently elliptical with its major axis perpendicular to the axis of the main tail. At 45 degrees angle to the tail axis, Wegner and Hartmann both recorded faint jets of material being ejected from the nucleus. Wegner's observation on May 1 shows the two jets entirely within the coma. On May 2 Hartmann shows the same features, only now much longer and extending out of the inner coma.

In the I.A.U. Circular No. 1726, J.B. Tatum of the University of London Observatory reported a curious depression in the coma opposite the tail. This feature was recorded photographically on Apr. 27 and May 4. No mention of it was made on Apr. 28 and 29, although the coma appeared more centrally condensed on those dates. One gets the impression that a stream of material or radiation pushed the coma in and shoved the coma material out into the tail. It should be noted that solar activity was at a high peak during this interval, and the intersection with solar material is highly probable.

On Apr. 29 McClure took two blue sensitive plates of the comet, the two being separated by two hours. In the earlier plate, the main tail and a smaller secondary tail were plainly visible. The main tail appeared broader than usual with some ray structure. Two hours later, the small secondary tail could not be detected at all; and the main tail was now much narrower. A dark rift in the main tail in the earlier exposure was on the left of the tail axis. In the later exposure, the dark rift was gone on the left side but a narrow dark rift was plainly visible on the <u>right</u> side of the tail axis. This change seems indicative of either rapid twisting of the entire tail or magnetic interaction of the tail particles causing rapid contractions. More information is needed to determine which. Either explanation has its drawbacks.

Additional peculiarities are discussed by Charles Bertaud, of Meudon Observatory, in the I.A.U. Circular No. 1726 (translation of French):

> ". . . the tail having a length of 4°.6 is threadshaped at the junction of the coma and is widened at the end after 1°.5 . . . the thin and scarcely curved tail expands slightly toward the end, its boundaries are well defined from the junction to the coma, on. To the north, there is a large region of several degrees in area and weakly illuminated by the presence of gas or dust. On April 29 the phenomenon, which appeared remarkable, is still visible . . . April 22nd this luminous region already existed, weaker, bounded by the tail but south of the latter. (Observation confirmed by a photographic plate taken by R. Weber on the same date.) . . ."

It is assumed that this object is the same feature as described earlier (dust tail).

From the I.A.U. Circular No. 1729, Dr. R.L. Waterfield comments:

> " . . . The tail where it emerges from the coma is about 1' of arc wide and forms a narrow cone that subtends an angle of 2½° (at the center of the coma). The narrow root of the tail can be traced through the coma to within about 2½' of its center . . .
>
> "On the second and third plates obtained on the night of Apr. 26-27 a stretch of the northern edge of the tail about 30' in length and about 8° from the nucleus is clearly brighter than the parts of the edge on either side. In the eighty minute interval between these two exposures this linear intensification of the edge of the tail has undoubtedly shifted by 20' to 25' in the direction <u>towards the head</u>. Unfortunately, the first plate taken that night gives no certain confirmation as the suspected linear feature falls on the edge of the plate. This phenomenon if confirmed would suggest that the comet, which was traveling tail foremost, was passing through a stream of particles capable of exciting the gases of the tail."

It is interesting to note that some hours after this, Wegner recorded the definite Na emission; and a short-period brightness outbreak was taking place. One wonders if these events are somehow connected and if so in just what manner.

II. Possible Star Occultation

R. V. Ramsay of the Toronto Centre, RASC, has submitted a copy of the Summer, 1960 <u>Scope</u>, which contains a description of his observation of a possible occultation of a star by Comet 1959k. The observation was made with a 3.25" refractor at 72X. The occultation was observed while the star was passing through the outer edge of the coma. Approximate duration of the minimum phase was 15 minutes. The time of minimum was May 2, 1960 at 4:05 U.T. To date, this is the only report that has been received on this phenomenon. Anyone who possibly has observations on or near this time is urged to submit them to the Recorder. There is yet to be a case of star occultation by a comet substantiated by simultaneous observations. It would be highly desirable to determine if such phenomena actually occur.

The Recorder would like to express his gratitude to all those who submitted observations and material used in this Report. In addition, the Recorder would like to thank Director Haas for his patience and goodwill during the production of this manuscript.

A RE-EXAMINATION OF THE PLATO PROBLEM

By: Alika K. Herring

While the floor of Plato has been one of the most observed areas on the lunar surface, the amount of detail seen thereon has varied enormously. Some observers have reported numerous craterlets and spots (2, 8), others have seen far smaller amounts of detail, with one observer even stating categorically that no more than 5 true craterlets exist on the floor (9). A comparison of the charts of the floor detail that have been compiled by these various observers does little to settle the question. Not only do these charts suffer from errors that are subjective in nature; but for the most part they are rather poorly drawn, with the result that serious discrepancies in the positions of even obvious details may be present. These charts, which have been based principally on visual observations, are therefore inconclusive, and probably have little intrinsic value.

The chart based on the observations of the writer unfortunately suffers from the same defects. Shortly after its publication (8), a comparative study was made between the various published charts; and the review of the situation that subsequently followed indicated that visual observations extending over more than a century had in truth answered few of the questions concerning the detail in Plato, and that there was little possibility that they would do better in the future. When it became obvious that further efforts of this nature would do little more than add to the already existing confusion, the personal observations by the writer of the floor detail were discontinued indefinitely, pending a better approach to the problem.

New information on the matter became available in the form of a photograph that was recently brought to the attention of the writer. This photograph, No. 822 of the Yerkes series, was made with the 40-inch refractor; and an examination of the original negative revealed a remarkable amount of detail upon the floor. The accompanying chart (Figure 8) was drawn from this photograph. Only those details that could be identified with reasonable certainty were inserted, those of a doubtful nature being omitted altogether.

The writer believes that this chart, which is based solely on objective evidence, will have a significant value in throwing new light on the Plato problem.

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2. W. H. Pickering, "Plato, 1895", Annals of The Observatory of Harvard College, Vol. 32, Part 2.

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4. H. P. Wilkins, "Chart of Plato Detail, 1936-39", Journal of The British Astronomical Association, Vol.50, No. 4, Feb. 1940, page 153.

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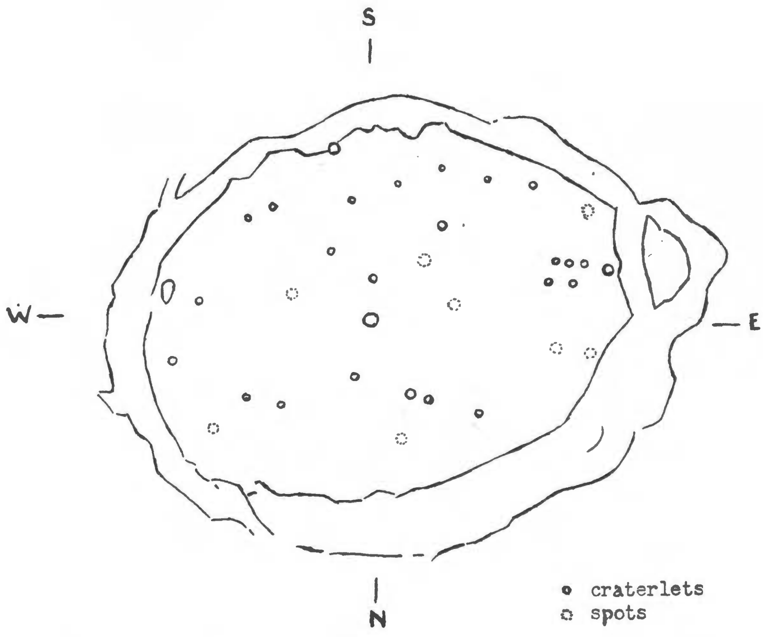

FIGURE 8. Photographic chart of the floor of the lunar crater Plato constructed by Alika K. Herring from Yerkes Photograph No. 822. Made with the 40-inch refractor on March 8, 1960 at 0 hrs., 49 mins., Universal Time. Co-longitude 30.5 degrees (about 1.5 days after sunrise on Plato).

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8. A. K . Herring, "Some Recent Observations of Plato", The Strolling Astronomer, Vol. 11, Nos. 7-10, July-October, 1957, page 96.

9. H. P. Wilkins, "Plato", The Strolling Astronomer, Vol. 12, Nos. 1-3, January-March, 1958, page 10.

10. H. P. Wilkins, "The Spots Within Plato", Journal of The International Lunar Society, Vol. 1, No. 3, July, 1958, page 76.

11. A. K. Herring, "Some Observations of Alphonsus and Plato With A Large Telescope", The Strolling Astronomer, Vol. 13, Nos. 9-10, September-October, 1959, page 100.

12. P. McIntosh, "Chart of Plato Detail", The Strolling Astronomer, Vol. 13, Nos. 11-12, November-December, 1959, page 155.

Postscript by Editor. The quality of Yerkes Photograph No. 822 is indeed very good. Mr. Herring considers it probably the best photograph ever taken of Plato. The detail charted by Mr. Herring on Figure 8 was confirmed almost entirely by Mr. Ewen Whitaker. In Harvard Annals, Vol. 32, Part 2, pg. 180, W. H. Pickering reported from micrometric measurements that the diameter of the conspicuous craterlet in the southeast quadrant of the floor of Plato is 4200 feet. On this basis one might estimate that the diameters of the smallest objects plotted on Figure 8 are 2,000 feet or even less, corresponding to photographic resolution near 0".3.

We certainly share Mr. Herring's desire that this photographic map should provide a sound future basis for further studies of delicate floor detail.

Some may feel our colleague's evaluation of the worth of visual studies of Plato to be rather severe. We must surely recognize, however, that here and elsewhere in lunar and planetary astronomy we serve no useful purpose by studying markings at the extreme limit of visibility. All data then become very uncertain. All scientists, including amateurs, must learn to recognize the limitations of their equipment and themselves. A dozen reliable Jovian C.M. transits timed with a 4-inch telescope may be worth tremendously more than a hundred drawings with such an aperture of very subjective features on Ganymede.

BLOODY BUT UNBOWED

By: James C. Bartlett, Jr.

In the Sept.-Oct., 1961 issue of Str. A., Mr. Joseph Eyer had at me for certain allegedly erroneous ideas concerning the meaning of the dusky limb band of Venus; and I gathered he suspects that a brief course in elementary meteorology would do me no harm. Finally, I am accused of inverting the order of quantitative-qualitative analysis, a sin of no mean proportion. To the last charge I cheerfully plead guilty without more ado, for I do not quite see that the correct approach to a problem should be first to determine if theory will "allow" the observed phenomena. Nature not infrequently produces phenomena "forbidden" by even the most mathematically proper theory. Does not every aerodynamics engineer know that a bee cannot fly?

Mr. Eyer states that even a slow rotation of Venus makes it altogether impossible for "a frontal (cloud) system from pole to pole" to move "in unison with the rotation of the planet". And why? Because by the very fact of rotation certain forces arise (coriolis effect) whereby the circulation in one hemisphere is the opposite of that in the other, with a discontinuity at the equator. The objection is very sound. But to what is it applied? Certainly not to such a claim in my original paper, in the July-August, 1961 Str. A., for no such claim was made. Nowhere was it stated that an unbroken front extended from pole to pole, only that a cloud system extending into both hemispheres existed.

Indeed as to a cloud system coextensive with both hemispheres, including the equatorial discontinuity, I here find myself in company with authorities of the highest tone, who - at least a few years ago - were assuring us that the entire planet is surrounded by a perpetual shell of cloud. Ironically, I do not subscribe to this theory and indeed specifically disavowed it in the very paper which drew Mr. Eyer's attention. The point which Mr. Eyer seems to have missed is that such a system can exist without the necessity of postulating a single, unbroken front. For such a system can consist of several systems united only by propinquity. Hence hemispheric discontinuity in atmospheric circulation is by no means fatal to a cloud cover common to both hemispheres and which, in this sense, might truly extend from pole to pole. It must also be understood that propinquity, when applied to cloud systems viewed at a minimum distance of 25,000,000 miles, can be a very relative term. The actual physical intervals between such systems can be considerable, as measured from the surface of the planet, and yet remain virtually undetectable to an observer on the earth; particularly when the planet is such a one as Venus which shows so little contrast between specific cloud masses and the general background.

As touching upon the general atmospheric circulation of the earth, Mr. Eyer's picture of the thermal exchange between equator and poles is quite correct. As Mr. Eyer implies, the atmospheric circulation of the earth is quite complex. Whether it is necessarily the same on Venus is another matter. But supposing it so, what has this to do with the general proposition that weather fronts move from west to east? Nothing at all. For we must remember that regardless of the local directions of wind systems the whole atmosphere shares in the rotation of a planet.

Hence while a local cloud system may be moving in any direction, relative to the surface of a planet, it is also simultaneously moving steadily eastward with the rotation of the planet (assuming that the rotation is direct); and this is true for both hemispheres since the direction of rotation is the same for both.

Relating these obvious facts to Venus, it is true that a general system of cloud extending into both hemispheres would necessarily move eastward in unison with the planet's rotation (though not necessarily at the same rate). Hence an observed eastward drift of a general cloud cover common to both hemispheres would imply a west-to-east rotation. Whether the twin limb bands of Venus can be correctly ascribed to cloud systems and their shadows I shall leave to the jury.

This last has a conclusive bearing on Mr. Eyer's Point II; for if the eastward drift of either limb band is an objective fact, then it is also at least an index to the rate of rotation which therefore must be short. Unfortunately the delicacy of the phenomenon precludes any hope of establishing even an approximately correct rate thereby.

Mr. Eyer relates the formation of cloud to turbulence, and remarks that "turbulences are by nature local phenomena, certainly not extending from pole to pole". Not in a simple linear distribution, one may agree; but since turbulences by their very nature as local phenomena must exist in one hemisphere as in the other, including the equatorial zone, then however random their distribution, in this sense they do extend "from pole to pole".

Mr. Eyer further objects that his measurements on my drawings of the limb band imply an unlikely height for Venusian clouds, or else a fantastic density for the planet; but I would not suppose that meaningful measurements could be made of any drawing of Venus in relation to such a delicate phenomenon as the limb band. The reason is the notorious lack of contrast, which makes pinpoint precision in delimitation all but impossible and which quite precludes micrometric measurements at the telescope. Hence I do not believe that we need worry about 50-mile high clouds nor impossible planetary density.

In my original paper I had speculated that the faint brownish tinge occasionally - but very rarely - present in the disc shading of Venus was an indication that the atmosphere is translucent rather than opaque; and the suggestion was made that this color might be due to a reddening effect of Venusian haze. Mr. Eyer objects that such an effect would be visible only to an observer on Venus, and even so that it would be the image of the sun alone which would be reddened, the area of red scattering not to exceed much more than twenty degrees and hence virtually undetectable on the earth.

But we are not dealing with red scattering, and Mr. Eyer's objection is valid only if we assume complete opacity of the Venusian atmosphere. Elsewhere I have shown from historical evidence that translucency rather than opacity is the more probable state of the planet's atmosphere. Grant only that on occasion we can visually penetrate through several strata of Venusian air. Eventually we may come to an opaque stratum, but by this very fact it becomes a mirror by which sunlight is reflected back to us through the superincumbent layers of atmosphere. Thus the position is reversed, and now it is we on the earth for whom the haze lies between the observer and the source of light, in this instance a reflecting layer beneath translucent layers of the planet's atmosphere. Here we do not depend upon red scattering, but upon a reddened image, the cross section of which depends upon the cross section of the reflecting area.

Incidentally the <u>modus operandi</u> can be demonstrated experimentally; but,alas, space does not permit its inclusion here. The ingredients, however, are very simple - a Wratten A filter (red), a plane mirror, and a candle. Perhaps it will be amusingto my customers to figure out the relations!

Before I shut down at last, a word of appreciation to Prof. Haas for his generous acknowledgment of an error of interpretation in regard to the drawings which adorned my original paper of this series. Would that I had never made a more serious one!

EFFECTS OF OBSERVATIONAL CONDITIONS

By: Takeshi Sato,
Rakurakuen Planetarium and Observatory, Hiroshima, Japan

As is very well known, the quality of visual observations of the moon and the planets is greatly affected by observational conditions such as the keenness of the observer's eye, differences in telescope aperture, magnification and type of eyepiece, and seeing and transparency in our earth's atmosphere. Indeed, one of the chief tasks of lunar and planetary students is the evaluation of the effects of these observational conditions.

It is quite obvious that very small or very faint markings cannot be seen under poor observational conditions. For this reason it cannot be concluded that a feature has disappeared even though it is invisible under poorer observational conditions than those prevailing when it was previously observed. This fact is obvious, but there are many other effects of observational conditions.

In this article I shall show some examples of these effects and would then like to make a proposal.

The keenness of the observer's eye in lunar and planetary observation is much more seriously dependent upon his experience in observation than upon the natural keenness of his vision. An experienced observer with poorer eyes can see much more detail with much greater accuracy than a novice observer having far better eyes;and indeed if the novice records much detail, many of the observed features are usually illusory.

Even in the case of experienced observers there are many different types of eyes. For example, my own eye is superior in resolving power but is inferior in detecting very faint markings, though some other observers appear to have the reverse experience.[1]

Color is also differently perceived by different observers. Apart from color blindness, color sensitivity is considerably different among different observers; and even with a single observer, one eye is much different from the other eye in color sensitivity. All observers whom I have tested agree that the eye used more often for observation shows warmer color than the other eye. Such disagreement can hence be expected between experienced and novice observers. The disagreement about color between different observers or between a single observer's one eye and his other eye appears to become much greater when very bright markings are observed. Excessively bright markings often show contrary colors to different observers.

As to the telescope, if the seeing is perfect, of course, larger apertures give greater resolving power; but in reality too large an aperture appears to give less resolving power because of the seeing, which more seriously handicaps the larger aperture than the smaller one. On the other hand, small differences in color and brightness, or intensity, between comparatively large regions seem to be almost always more easily distinguished with the larger aperture.

Magnification is less important than aperture; but it also affects resolving power, color, and brightness, or intensity. Observers equipped with giant telescopes, such as Dr. Gerard P. Kuiper, usually employ too low magnifications to take full advantage of the resolving power of the large telescope if the seeing is as excellent as they sometimes claim. Based upon the famous Dawes Limit, it is usually stated that the minimum necessary magnification to allow full resolving power is thirteen times the telescopic aperture in inches; but according to the experience of many observers, including myself, this value is definitely insufficient, and a magnification of at least twenty-five times the aperture in inches is needed. (For example, the minimum necessary magnification on the 200-inch telescope is then 5,000X !)

As to color observations, it is very well known that the color of markings becomes less distinct with smaller apertures and is quite distorted with refractors because of their chromatic aberration.

The seeing and the transparency are also very important. It is quite obvious that under poor seeing conditions very small or very faint markings must become quite invisible; but in addition false color is often observed with poor seeing. For example, the dark maria on Mars often appear much bluer under poorer seeing than under better seeing, probably because of the orange color of the neighboring desert regions.[2] Transparency is less important for resolving power and instead more seriously affects the observations of color and brightness, or intensity, but very poor transparency also reduces the resolving power.

As has been seen, the effects of observational conditions can be classified into two different categories, of which one is the effect on color and brightness, or intensity; and the other is the effect on resolving power. In the following paragraphs I would like to give two concrete examples of the effect of insufficient resolving power.

The first example is the "canals" of Mars. According to such keen-eyed observers as Shirō Ebisawa, Tsuneo Saheki, and Ichiro Tasaka in Japan and Dr. Audouin Dollfus in France, the appearance of the Martian canals varies greatly in different grades of seeing; and if the telescope is sufficiently large [3], the change in aspect of typical canals is as follows:

Under bad or poor seeing, canals are quite invisible; under moderate to fair seeing they appear as diffuse wide bands; under good seeing they appear as narrow lines; and under very excellent seeing, they are resolved into chains of numerous dark spots.[4]

Another good example is the "festoons" of Jupiter. Festoons are most often observed in the Equatorial Zone of Jupiter, though occasionally found also in other zones. With low resolving power most of the festoons in the E.Z. appear to be connecting both to the North Equatorial Belt and to the South Equatorial Belt North; but with higher resolving power most of them are quite detached from the $S.E.B._n$, though connecting with the N.E.B. From this point of view the 1961 apparition of Jupiter was very interesting. In this apparition the north component of the S.E.B. was unusually far north; and even under fair seeing, with a 10-inch reflector most festoons looked as if they were connecting with the $S.E.B._n$ (Figure 9, right); but under very excellent seeing, many of these festoons, though not all, were clearly separated from the $S.E.B._n$, each by a very narrow space (Figure 9, left).

For this reason, when we make a statistical study of the festoons, for example, the results become quite meaningless if we neglect the effect of observational conditions.

Figure 10 illustrates some examples of false appearances of festoons and some other markings in the E.Z. of Jupiter.

As we have just seen, visual lunar and planetary observations

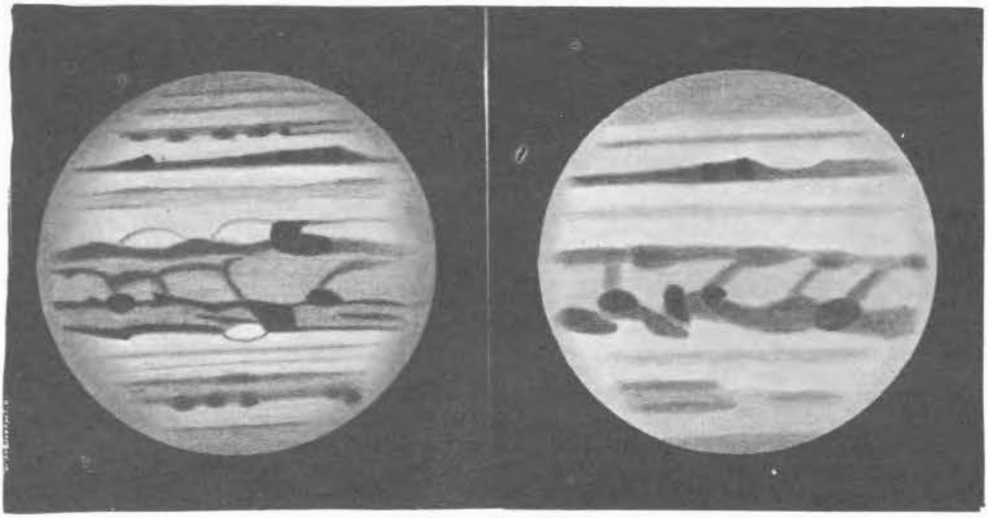

FIGURE 9. Comparative drawings of Jupiter by Takeshi Sato to show effect of different seeing on appearance of surface markings. See also text of Mr. Sato's article. Left drawing: July 15, 1961; 14 hrs., 50 mins., U.T.; $C.M._1 = 7^\circ$, $C.M._2 = 257^\circ$; 10-inch refl. at 278X; seeing 6-8 (excellent); transparency 3-4. Right drawing: August 11, 1961; 12 hrs., 45 mins., U.T.; $C.M._1 = 238^\circ$, $C.M._2 = 282^\circ$; 10-inch refl. at 216X; seeing 2-3 (poor); transparency 4. Compare aspect of Equatorial Zone festoons with excellent seeing (left) and poor seeing (right).

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are strongly affected by observational conditions in various ways. For this reason, the data for observational conditions should always be reported with each observation in order to make correct judgment possible about the true nature of the observed markings. In The Strolling Astronomer, the name of the observer, the size and type of telescope, and the magnification are almost always given for each published drawing; but the data for seeing and transparency are often omitted.[5] It is extremely regrettable because the reader cannot then form his own judgment. Of course, the individual observer is another essential factor; but his observations, by themselves, tell about his ability if seeing, transparency and other observational conditions are given. Published drawings are also very useful for many other purposes; but if the observational conditions are omitted, such drawings greatly lose in value.

In concluding this article, I would like to urge all contributors to The Strolling Astronomer to give the data for seeing and transparency as well as the other observational conditions upon all drawings that may be published.

Footnotes and References

1. A number of very excellent examples of similar effects are shown by Brian Warner in the Journal of the British Astronomical Association, Vol. 71, No. 5, 1961.

2. A similar effect has been observed by Gerard P. Kuiper. Refer to the Publications of the Astronomical Society of the Pacific for October, 1955.

3. This does not mean "Giant Telescope". During the favorable approaches of the Red Planet an 8-inch telescope is capable of revealing fine details in the Martian canals.

4. See Ichiro Tasaka's drawings of Mars in 1958 in The Strolling Astronomer for September-October, 1960.

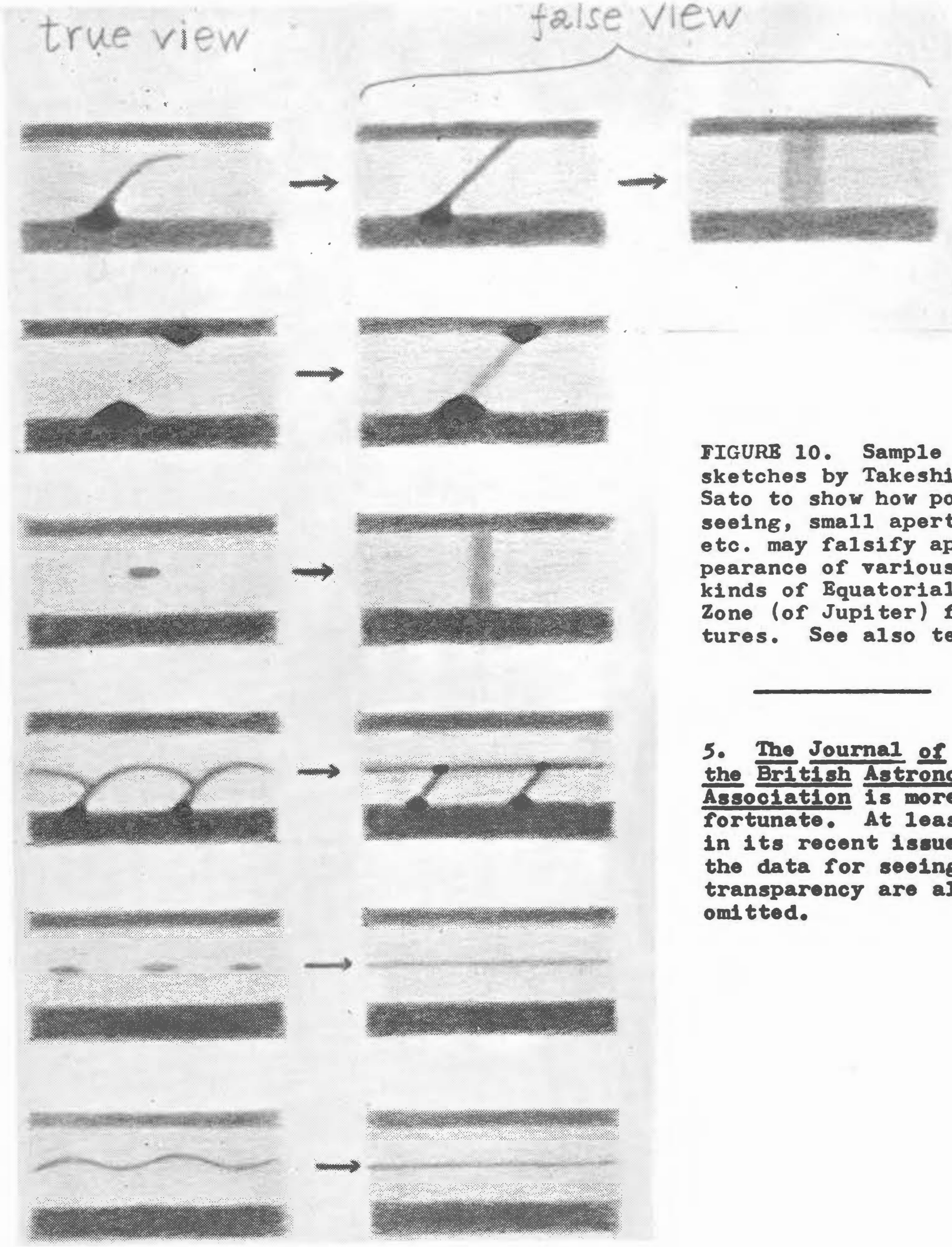

FIGURE 10. Sample sketches by Takeshi Sato to show how poor seeing, small aperture, etc. may falsify appearance of various kinds of Equatorial Zone (of Jupiter) features. See also text.

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5. The Journal of the British Astronomical Association is more unfortunate. At least in its recent issues, the data for seeing and transparency are always omitted.

A.L.P.O. COMETS SECTION: FINAL REPORT FOR 1961. PART I. - GENERAL DESCRIPTION

By: David D. Meisel

Abstract: During 1961, observations of five comets -- 1960 n, 1960 i, 1961 d, 1961 e, and 1961 f -- were received. This report covers all work submitted before December 31, 1961. Part I of this report deals with general descriptions of the objects. Part II is a more detailed analysis of the physical characteristics of the objects with possible phenomenological

characteristics. Part III contains commentary on various unusual aspects of appearance or physical observation. Although each part is intended to be virtually independent of the other parts, the entire sequence should be read if an overall view of the situation is desired. Because of orbital peculiarities, full discussion of Comet Humason 1961 e will be covered in a separate report after it has brightened sufficiently for amateur observation. Comet Humason will reach perihelion in December, 1962.

Comet Candy 1960 n

M. P. Candy, Director of the British Astronomical Association Comet Section, discovered this object five days before the beginning of 1961. Mr. Candy was testing an eyepiece on a 5-inch comet-seeker when he came upon the comet, then a circumpolar object for northern observers. A.L.P.O. observations were made early in the new year. This comet's appearance was generally described as diffuse and spherical with a very faint ribbon tail. Provisional parabolic elements were derived.

$$\begin{aligned} T &= 1961,\ \text{Feb. } 8.58392 \text{ E.T.} \\ \omega &= 136^\circ\!.25737 \\ \Omega &= 176^\circ\!.56728 \quad \Big\} \ 1950.0 \\ i &= 150^\circ\!.92767 \\ q &= 1.0640394 \text{ A.U.} \end{aligned}$$

Computed by M. P. Candy.

The closest approach to the earth occurred near the discovery date. Because the earth and the comet were moving in opposite directions, the observation time was limited to January and early February, 1961.

Photographs, sketches, verbal reports, and magnitude estimates were received from these observers:

Larry Athenien	San Jose, Calif.	6" Refl.
Lewiss Bartha	Budapest, Hungary	8" Refr.
Walter Haas	Edinburg, Texas	17" Refl.
Jim Heineman	Denver, Colo.	10" Refl.
Craig Johnson	Boulder, Colo.	7 x 50 Binoculars, 4" Refl.
Frank J. Kelly	St. Petersburg, Fla.	4" Refl.
Paul Knauth	Houston, Texas	8" Refl.
Gary Kraus	Edinburg, Texas	6" Refl.
Mike McCants	Houston, Texas	8" Refl.
Alan McClure	Los Angeles, Calif.	7" Astrocamera
John McPhaul	Bastrop, Texas	4" Refl.
David Meisel	Fairmont, W. Va.	8" Refl.
Robert Miller	Miami, Fla.	12½" Refl.
Dennis Milon	Houston, Texas	6", 8" Refls.
Allen Montague	Oak Park, Ill.	6" Refl.
Ken Steinmetz	Denver, Colo.	6" Refl.
Gary Thayer	Boulder, Colo.	2.4" Refr.
H. J. Willis	Lone Oak, Texas	----------

The Observing Group of the Amateur Astronomers Association, N.Y.

Published data taken from the I.A.U. cards and the Harvard Cards have been utilized in the later Part II of this report. Of special note are the magnitude estimates of the Polish Society of Amateur Astronomers, Warsaw, Poland, as reported in the I.A.U. Circulars. Others whose work was reported in the Circulars were:

Maffei	Asiago	Spectra
Schubart, Hoffmeister	Sonneberg	Magnitudes
Schröder	Wilhelm-Foerster Observatory, Berlin	Magnitudes
Arend	Uccle	Magnitudes

Relative sunspot numbers are the American numbers derived from AAVSO Solar Division observations by Dr. Sarah J. Hill, as reported in the April and May, 1961, issues of Sky and Telescope. The relative sunspot numbers are utilized in the interpretation of photometric observations in Part II.

Periodic Comet Encke 1960 i.

This object has been observed during more successive returns than any other periodic comet. Its return during 1960-61 was very favorable for northern observers during the preperihelion period. For a while after its recovery by Dr. Elizabeth Roemer at the U.S. Naval Observatory, Flagstaff Station, it appeared as if the comet might become bright enough to be seen in small telescopes. Like most long range predictions of comet brightness, these were not accurate. Although Comet Encke was fainter than Comet Candy, which was visible at the same time, several interesting observations were reported. This comet has quite a history and is described in detail in several works currently available.* Approximate orbital elements for Comet Encke are:

Period = 3.30 yrs.	T = Feb. 5, 1961
ω = 185°2	a = 2.214 A.U.
Ω = 334°7	e = 0.847
i = 12°4	q = 0.338 A.U.

To the casual observer, Comet Encke and Comet Candy were very similar. However, closer inspection of Comet Encke and its coma revealed a crescent-shaped coma condensation. Details of this feature will be given in Part III of this report. Observers submitting reports on Comet Encke were as follows:

Walter Haas	Edinburg, Texas	17" Refl.
Frank J. Kelly	St. Petersburg, Fla.	4" Refr.
Paul Knauth	Houston, Texas	8" Refl.
Mike McCants	Houston, Texas	8" Refl.
Alan McClure	Los Angeles, Calif.	7" Astrocamera
David Meisel	Fairmont, W. Va.	8" Refl.
William Westbrooke	San Francisco, Calif.	4" Refl.
H. J. Willis	Lone Oak, Texas	--------

A series of magnitude estimates, published in the I.A.U. Circulars, made by the Polish Society of Amateur Astronomers and a spectral observation by Maffei at Asiago were utilized in the analysis of the observational data submitted. The American relative spot numbers derived by Hill appearing in the April and May, 1961, issues of Sky and Telescope were again used in the photometric analysis.

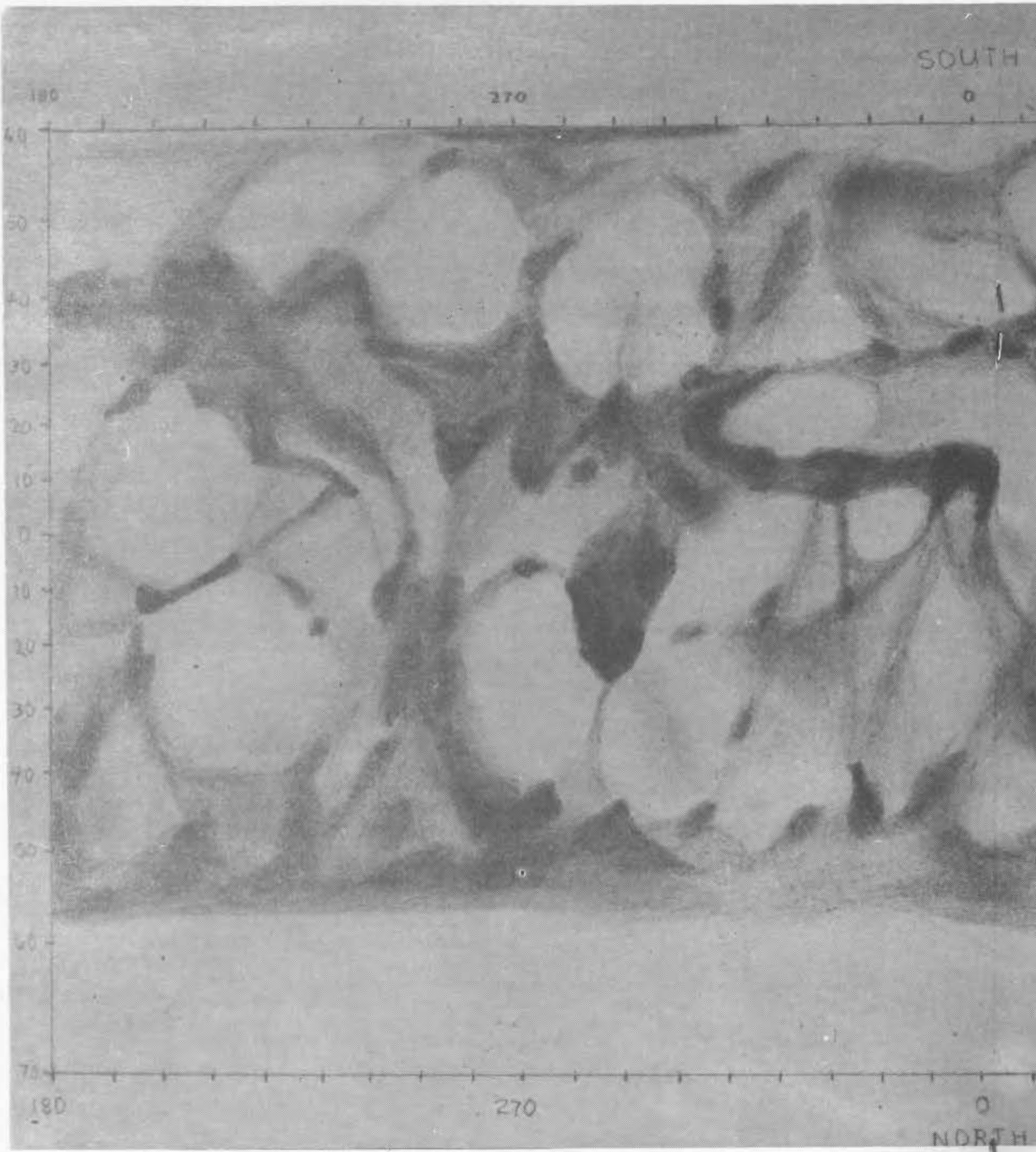
Comet Wilson 1961 d

This brilliant object was discovered at near 2nd magnitude by A. S. Wilson of Seattle, Washington, while he was navigating a Pan American 707 Jet on a flight from Honolulu to Portland, Ore. Its appearance was sudden and striking. For about three days after its discovery it remained between 2nd and 3rd magnitude with a great fan tail at least 30 degrees long! After causing quite a stir among astronomers, the comet a week later had faded by nearly two magnitudes; and by August 5, 1961, it was no longer easily visible. This fading was so rapid that the comet was not located, even using moderate apertures, despite a very careful search on the mornings of August 14 and 15, 1961. Although it was a morning object with the added interference of moonlight, reports were contributed by eight A.L.P.O. observers. Because of the short duration of visibility, the many attempts at orbit calculation failed to produce very satisfactory results. Out of eight sets of elements published, one was even hyperbolic. Since no definitive orbit is available, examples of the parabolic elements are:

T = 1961, July 16.960 E.T.	T = 1961, July 17.50267
ω = 274°902 (1950.0)	ω = 270°6176 (1950.0)
Ω = 300°669 (1950.0)	Ω = 298°3489 (1950.0)
i = 24°780 (1950.0)	i = 24°2318 (1950.0)
q = 0.05905 A.U.	q = 0.04008256 A.U.
Observations: Up to Aug. 2, 1961.	Up to Sept. 6.5, 1961.
Computer: Sekanina	Computer: M. P. Candy

* See list of references at the end of the report, Part I.

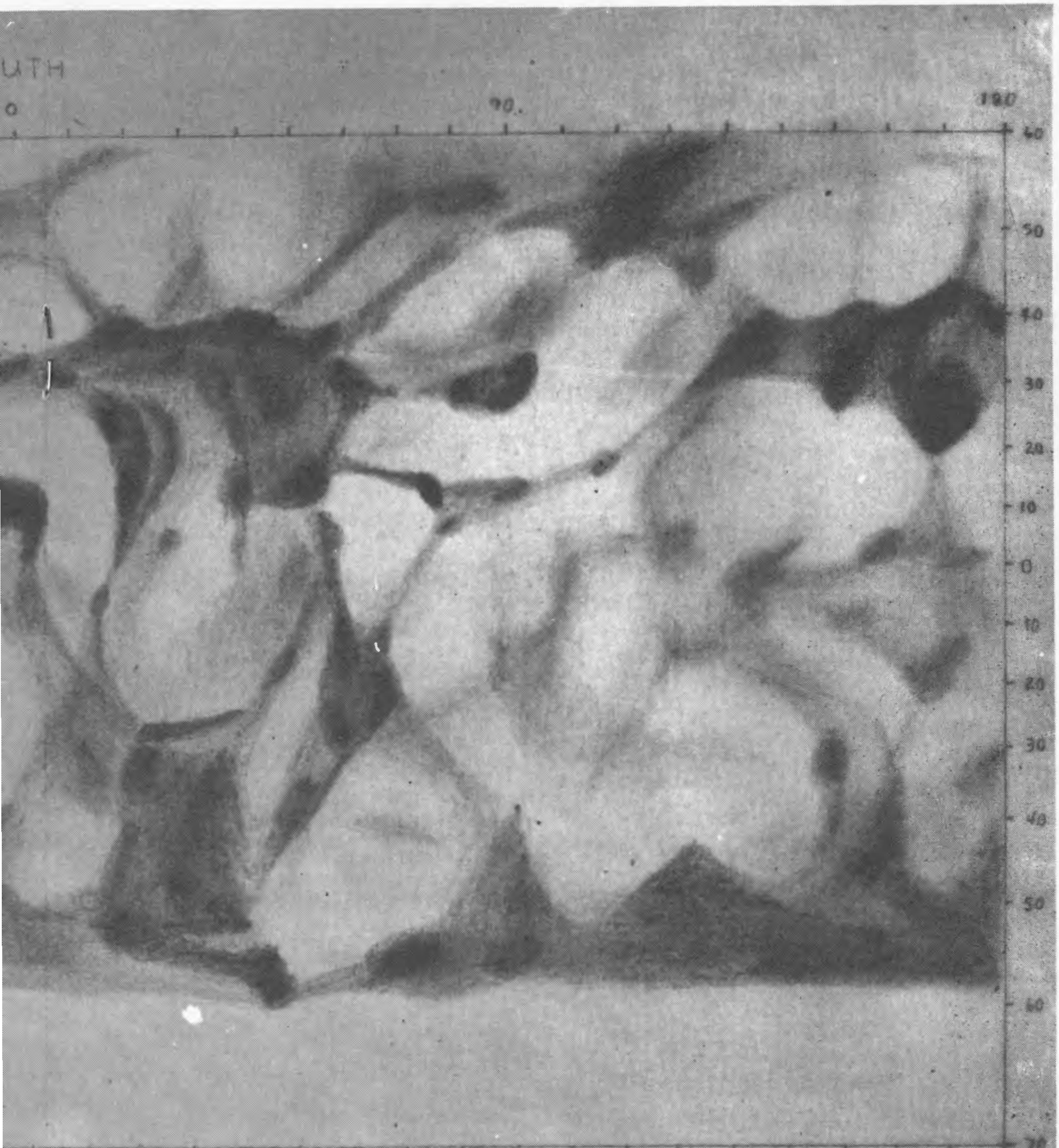
(text continued on page 170)



CLARK R. CHAPMAN'S 1960-61 MAP OF MARS

By: Clark R. Chapman

The map of Mars appearing on these two pages was constructed by Clark R. Chapman and is based on 60 of his drawings during the 1960-61 apparition of Mars. The drawings were made primarily with his 10-inch re-



flector between May 19, 1960, and May 31, 1961. The positions on the map are based on positions measured from 33 of Mr. Chapman's drawings (November 7, 1960, through March 8, 1961). These positions were listed in the July-August, 1961, issue of The Strolling Astronomer.

The map is placed on a Mercator projection. It may be compared with Ernst Both's map based on all A.L.P.O. observations in 1960-61 and appearing on pages 22 and 23 of the January-February, 1962, Strolling Astronomer.

The rapid fading of this object is illustrated by the (observed minus computed) O-C value of nearly 10 magnitudes according to an observation on September 6 by Elizabeth Roemer of the Flagstaff Station, U.S. Naval Observatory. The computed value was based on observations by McClure on July 25, 1960, assuming inverse 4th power variation. Full discussion of the observations of this object's brightness is given later in Part II.

Contributing observers were:

Clark Chapman	Buffalo, N. Y.	Eye, 7 x 50 Binoculars
Robert Farmer	Houston, Texas	Eye, 7 x 50 Binoculars
Russell Maag	California, Mo.	7 x 50 Bin., 4.5" RFT.
Alan McClure	Los Angeles, Calif.	Opera glass, 7 x 50 Bin., 7" Astrocamera
David Meisel	Fairmont, W. Va.	8" Refl.
Dennis Milon	Mt. Locke, Texas	Eye, Camera, 7 x 50 Bin.
Fred Wyburn	Red Bluff, Calif.	Eye
Craig L. Johnson	Boulder, Colo.	7 x 50 Bin., Eye, 50mm. Camera

Again the AAVSO Solar Division observations of spot numbers are used in the photometric analysis of Part II. The story of the discovery of Comet Wilson is very interesting. Readers are referred to the September, 1961, issue of Sky and Telescope for a detailed account.

Comet Seki 1961 f

This comet was discovered by T. Seki on October 11, 1961. Orbit calculations show that this date was one day after perihelion passage. Although seventh magnitude at discovery, the comet during the succeeding weeks brightened enough to become a fairly plain object for most observers. During the latter part of November, the geocentric distance was minimum. Unfortunately for northern observers, the object was then circumpolar in the southern hemisphere.

Orbital Elements computed by Cunningham give a long-period elliptical orbit.

time of perihelion = T = 1961, October 10.64816 U.T.

$$\left.\begin{array}{l}\omega = 126^\circ.61042 \\ \Omega = 246^\circ.67884 \\ i = 155^\circ.71183\end{array}\right\} 1950.0 \qquad \begin{array}{l} q = 0.6812271 \text{ A.U.} \\ e = 0.9919107 \\ p = 770 \text{ yrs.}\end{array}$$

Computer: Cunningham, University of California

During October and November, 1961, the object approached the earth. Geocentric distance was minimum on November 28. Predictions of possible meteor showers associated with Comet Seki were made by Hasegawa assuming (incorrectly) a parabolic orbit. Even though the orbit was found not to be parabolic, except for the velocity the following results by Hasegawa are fairly good.

Epoch = November 28, 1961, 18^h U.T.

Radiant Point $\left\{\begin{array}{l}\alpha = 181^\circ \\ \delta = +15^\circ\end{array}\right\}$

Geocentric Velocity = 69 kms./sec. (parabolic)

$r_{comet} - R_{earth} = -0.136$ A.U.

The comet passed the descending node on Nov. 5, 1961. Betweeen November 13 and 21, 1961, the comet was visible from southerly latitudes. By the time that it was to be visible again from the north, it had faded beyond the range of small instruments.

Early physical observations indicate that the object was diffuse and spherical with a very, very faint fan tail. On November 12, the outer coma was estimated to have been nearly 40' of arc in mean apparent diameter. This diameter is about 1.3 times that of the full moon (40' vs. 30'). The 40' of arc corresponds to a real diameter of nearly 90,000 miles.

Observers submitting reports received previous to Jan. 1, 1962, were:

Larry Athenien	San Jose, Calif.	6" Refl.
Jack A. Borde	Concord, Calif.	2.5" Refr. with Astrocamera
Clark Chapman	Buffalo, N. Y.	10" Refl., 7 x 50 Bin.
Rev. Kenneth Delano	Wareham, Mass.	Eye, 58mm. Camera
David Meisel	Columbus, Ohio	Eye, 1.5" Refr., 6" Refl.
J. Russell Smith	Eagle Pass, Texas	16" Refl.
Dennis Milon	Houston, Texas	8" Refl.
George W. Rippen	Madison, Wisc.	6" Refl.
Jerry Thrasher	Reynoldsburg, Ohio	6" Refl.

Of special interest would be any observations of meteor sightings that might confirm the existence of a meteor stream related to Comet Seki.

Comet Humason 1961 e

This object was discovered by M. Humason at Mt. Palomar on September 1, 1961. At discovery its magnitude was reported as 14th. Orbit calculations show that it was moving in a retrograde elliptical orbit with the following elements, as computed by B. G. Marsden of Yale Observatory:

$$T = 1962, \text{ December } 10.3077, \text{ E.T.}$$
$$\left.\begin{array}{l}\omega = 233^{\circ}.6187 \\ \Omega = 154^{\circ}.7388 \\ i = 153^{\circ}.2822\end{array}\right\} 1950.0$$
$$q = 2.131817 \text{ A.U.}$$
$$e = 0.989519$$
$$P = 2900 \text{ yrs.}$$

This orbit was derived from 73 positions between September 6, 1961 and February 10, 1962. Parabolic orbit residuals were on the order of 1' of arc. An elliptical orbit gave few residuals greater than 3" of arc. J. R. Smith of Skyview Observatory, Eagle Pass, Texas, was the only A.L.P.O. member reporting 1961 observations of this object. However, Dr. Elizabeth Roemer reported considerable physical activity of the comet even at the large heliocentric distance of nearly 5 astronomical units.

The comet itself appears to be very large. Its brightness seems to follow an inverse 4th power heliocentric variation with a unit distance parameter of magnitude 1.5. This comet is very remarkable and should provide an excellent object for study, especially for southern hemisphere observers. Carefully made photometric observations are important. Maximum brightness is expected to be magnitude 6.2, occurring near September 13, 1962. Observers with large instruments are encouraged to attempt continuous photography of this object. An ephemeris of this object has already been published on page 99 of the May-June, 1962, Str. A.

References

1. Watson, Between the Planets, Harvard Press, 1956.
2. Alter and Cleminshaw, Pictorial Astronomy, Crowell, 1952.
3. Lyttleton, The Comets, Cambridge University Press, 1953.
4. Porter, Comets and Meteor Streams, Chapman and Hall, 1952.

VENUS SECTION REPORT: EASTERN APPARITION, 1960-1961. PARTS 6-8.

By: William K. Hartmann

Part 6: The Terminator

Irregularities of one sort or another were rather frequently reported. Figure 43 on page 116 of the May-June, 1962, Str. A. shows one confirmed case. Besides agreeing on the "ashen light", Lovi and Bisjak both commented on terminator irregularities. Lovi wrote: "It could be noticed that the terminator had a somewhat jagged appearance...the image shimmered somewhat, but the terminator irregularities remained constant, thereby making it unlikely that they are caused by the Earth's atmosphere." Bisjak noted: "The terminator seemed somewhat uneven." Other forms of irregularities, from small serrations to large scale sinuosities, were recorded. A very interesting case of apparently confirmed flattening appears in a pair of drawings by Bartlett and Favalora, reproduced here as Figure 11. Both observed two flat segments, and that toward the south is apparently confirmed. Bartlett recorded small serrations in addition. The good agreement in limb brightening and terminator shading also lends credence to this pair of drawings.

The north and south cusp-indentations were observed several times as summarized below in a table compiled from 235 observations with phase parameter k ranging from .900 to almost zero.

Table 4: Observations Indicating the Cusp Indentations, k = .900 to k = .000

	No. Observations	Percentage
South Indentation Alone	4	1½%
Both Indentations	3	1½
North Indentation Alone	6	2½

We see that the south indentation was recorded seven times and the north, nine times. Bartlett's 1958 paper (referred to in earlier parts of this report) shows that the south cusp-indentation is usually seen about twice as often as the northern one. (He found that they are both more often visible than these 1960-61 figures indicate.) Thus, as also for the north cusp-cap and the north cusp-band, the north cusp-indentation appears to have increased its visibility relative to its southern counterpart during the 1960-61 apparition.

Part 7: Observed Dichotomy

The response to the request for observations of the time of dichotomy was very good, making this the best observed dichotomy to date in our records. Forty-six observations and reports of an approximately straight terminator or of dichotomy were available to be included in an analysis. They were weighted and combined to give a mean date of dichotomy and standard deviation in days. This plan follows methods described in more detail in a more extensive study of "Schröter's Effect" recently submitted by the writer for publication in The Strolling Astronomer.

These weighted observations are shown in the histogram of Figure 12. The result of the analysis showed that dichotomy occurred on Jan. 23.3, 1961, with a standard deviation of ±4.2 days. This mean is thus 8.4 ± 4.2 days earlier than the predicted date, again confirming Schröter's Effect. The accuracy of the result may be better than is indicated by the standard deviation, since the use of some observations when the curvature of the terminator was described as uncertain or as approximately straight, and the fact that each observer tended to call the terminator straight for several days in a row increased the spread of the observations in both directions. Thus, for example, Dr. Bartlett began calling the terminator "sensibly straight" on Jan. 13; and apparent straightness persisted for him through Jan. 30. More commonly, the period of apparent straightness for one observer was about 3 or 4 days. Thus the above standard deviation is not only a measure of the error in judgment of the moment of dichotomy, but also a measure of the duration of the period of straightness during which the observers, through no great fault of their own, can't detect whatever slight degree of curvature may exist. That the two sources of scatter are not the same is shown by the fact that two observers may place the date of observed dichotomy ten days apart, even though each one saw the terminator as straight for only a couple of days.

A second method of analyzing the material is to determine a best value from each observer, thus treating the problem as if each observer had

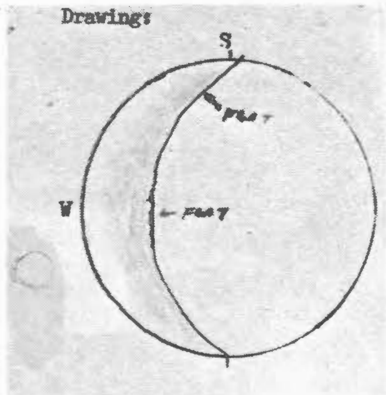


FIGURE 11a. Venus. James C. Bartlett, Jr. March 12, 1961. $23^h\ 34^m$ to $23^h\ 55^m$, U.T. 4½-in. Refl., 50X, 120X, 240X. S=5. T=3.

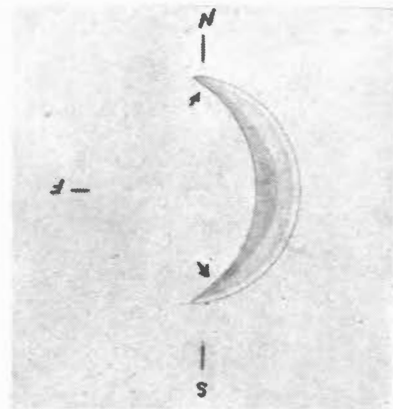


FIGURE 11b. Venus. Vincent H. Favalora. March 13, 1961. $00^h\ 00^m$, U.T. 4-in. Refl., 165X, S=6. T=5. Arrows mark "Linearity of north and south terminator, the southern being greater than the northern."

FIGURE 11. Independent observations of terminator flattening on March 12/13, 1961. Only other observation within 20 hours, by K. Brasch at $22^h\ 30^m$, does not mention flattening.

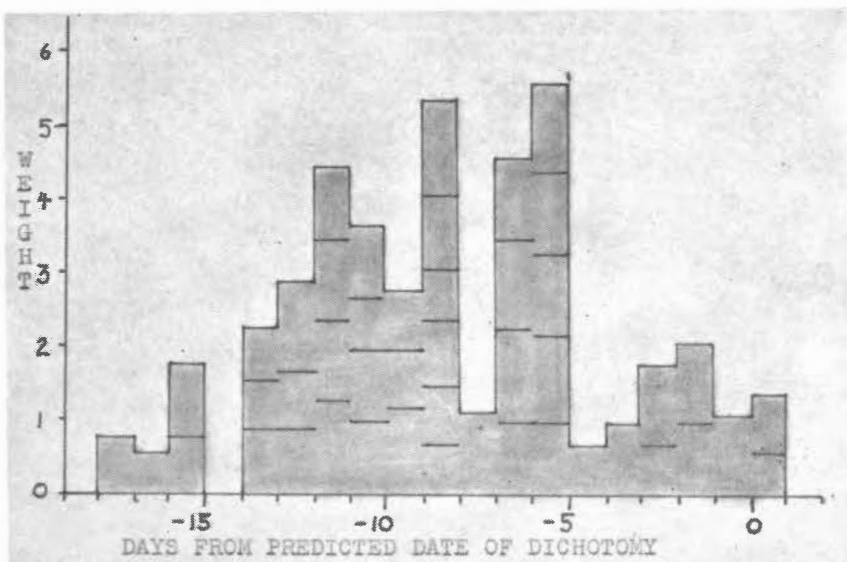


FIGURE 12. Weighted (average weight ≃ 1) observations of straight or nearly straight terminator versus number of days from predicted date of dichotomy. See also text of Mr. Hartmann's article in this issue.

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been able to decide on a single day for the occurrence of dichotomy and thereby reducing that part of the scatter due to the period of apparent straightness. The best estimates of 13 observers, as determined by the Recorder from their observations and remarks, are listed in Table 5. A question mark indicates interpolation over a considerable interval and/or unusual uncertainty in the decimal place. The range from Jan. 16 to Jan. 30 is unhappily large, and it seems that we should be able to do better than that!

Table 5. Observations of Time of Observed Dichotomy in Chronological Order

Observer	Aperture Used for Dichotomy Work	Best Estimate, 1961	Days from (before) Predicted Date
Anthenien	6 inches	Jan. 16.2, U.T.	-15.5 days
Chapman	10	19.7	-12.0
Cochran	8	20.4	-11.3
Rushton	6	22.0?	- 9.7?
Binder	4.1	22.5	- 9.2
Borde	6	23.1?	- 8.6?
Bartlett	4¼	24.5	- 7.2
Hartmann	6	24.9	- 6.8
Eastman	4¼?	25.0?	- 6.7?
Emig Brothers	8	25.5	- 6.2
Hicks	5	25.5	- 6.2
Robinson	10	26.0	- 5.7
Williams	3,4¼	30.0	- 1.7

It is interesting to note that there does not seem to be any tendency for the larger apertures to give the most consistent results. Analysis of these unweighted figures indicates that dichotomy occurred on Jan. 23.5 with a standard deviation of ±3.3 days, or 8.2 ± 3.3 days early. This agrees well with the result described above.

Part 8: Confirmation of Detail on Venus

Some examples of possible confirmation of Venusian detail have been mentioned incidentally in earlier parts of this Report. This part deals specifically with this problem. Prior to the 1961 evening greatest elongation, a program was proposed to obtain simultaneous observations to be compared to a matching set of "imaginary observations" in order to study marking visibility. There was a fair response to this program, but probably not enough to proceed at this time with the proposed method of analysis.

However, due to the recent fine coverage of Venus by A.L.P.O. observers, especially during January, 1961, something can now be said about the problem. On many evenings there were several observations, and comparison of these is of interest. In a number of cases, there appears to be some agreement. The reader should be warned, however, that what a Venus Recorder may call agreement might cause a Mars or Jupiter Recorder to give up in dismay. Remember that while on other planets, visual observational problems center on the positions and shapes of markings, on Venus we have yet to show whether or not the markings exist at all.

The best course of action here is to present several sets of these near-simultaneous observations. Accordingly, in Figures 13 to 19, inclusive, seven sets of drawings are reproduced; and the reader is invited to study them for himself.

The following ideas emerge from a study of these illustrations:

(1). It begins to appear that dusky and bright markings on Venus can occasionally be seen objectively enough visually to be confirmed in broad outline.

(2). While strict agreement among observations is not often found, observers frequently agree as to the general structure or pattern of the markings over periods of several hours, and occasionally over periods ranging up to several days, e.g. Figure 13. This result may indicate that while Venusian markings can change appearance over, say, three or four hours, sometimes markings may retain some large scale patterns for longer periods up to, say, several days. This behavior is consistent with their assumed atmospheric origin. However, differences in the drawings must also be due in great part to differences in drawing style, observing conditions, and perhaps mostly to the closeness of the detail to the threshold of vision.

(3). Kuiper (Ap. J., Vol. 120, No. 3, p. 604, 1954) considers that in the ultraviolet the banded appearance, typically with three bright and three dark bands, represents a normal or quiescent state of the atmospheric circulation, which is occasionally disturbed. If we assume that the visual observations tend to show the same features that can be photographed in the ultraviolet, we may say that the observations given here are compatible with this idea. However, the question remains open as to what proportion of the time the "quiescent" pattern is present.

(4). Thus, keeping these ideas in mind, we might say that for a day or so near Dec. 28, 1960, this normal banded appearance applied (Figure 13). On Jan. 11, 1961, streaky markings were suspected; and a band was possibly confirmed in the northern hemisphere (Figure 14). On Jan. 14-15, more streaky markings and a central darkish area were seen (Figure 15). On Jan. 20, not much of anything was reported (Figure 16). On Jan. 22-23, streaky markings predominate; and if one were to take the drawings literally, he might see a gradual increase in the conspicuousness of a north-south streak near the limb, altering the earlier banded appearance observed at 22^h U.T. (Figure 17). Is such a possible change in a two and a half hour period produced by Venusian rotation or atmospheric disturbance; or are all these markings subjective only, making the partial agreement due to chance? The truth is probably somewhere between these extremes. Two drawings on Jan. 24-25 two and a half hours apart seem to give excellent confirmation of two short bands (Figure 18). Streaks and patches are recorded on Jan. 25-26 (Figure 19).

(5). The well known cusp-bands may be simply the most stable of the typical set of quiescent-state bands, thus accounting for their being observed more frequently than bands closer to the (apparent) equator.

(6). The composite drawings in Figures 14-17 may be a good way of showing the most conspicuous, and therefore confirmed, markings. Here, the confirmed markings are combined into one drawing. Intensity and conspicuousness estimates are a great help in making such composites.

(7). If the conspicuousness scale continues to spread in usage, it will be most interesting to see if the markings considered most conspicuous by individual observers are the ones actually confirmed in the composite drawings.

An interesting sidelight on the composites is the following. From the copies of eight independent Ganymede observations reproduced in Str. A., Vol. 15, Nos. 11-12, p. 219, Alan B. Binder, Dale P. Cruikshank, and the writer made independent composite drawings, which were compared along with Robinson's composite (on the cover of that issue). On the following day, Binder and Cruikshank made, from the observations in Figures 14 through 17 here, independent composite drawings of Venus, which were then compared along with the ones by the writer published with this article. It appeared that our independent interpretations of the Venus observations were more consistent than the independent interpretations of the Ganymede drawings. The possible conclusion is that the independently reported (and probably unusually prominent, if real) Venusian markings, drawn under various conditions, are more probably of planetary origin than the markings on Ganymede determined from independent observations with ten-inch reflectors and good seeing. However, the reality or unreality of neither is actually proven.

It was suggested above that the detail observed visually in white light is closely related to that visible in the ultraviolet. Is this thought justified? Some evidence indicates that it is. In an article on studies of ultraviolet photographs of Venus, (P.A.S.P., Vol. 67, No. 398, p. 306, 1955), Robert S. Richardson describes agreement between drawings of Venus by Henry P. Squyres with a six-inch telescope and ultraviolet photographs for two dates. He writes: "The markings on his drawings were readily identified with those on our photographs...."

Ultraviolet photographs received for this apparition supply further evidence. Ewen A. Whitaker has kindly supplied a set of three photographs taken informally through the eyepiece of the McDonald 82-inch reflector with

(text continued on page 184)

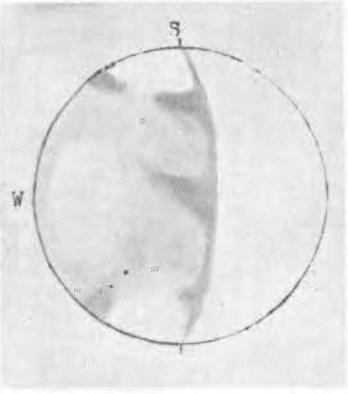

FIGURE 13a. Venus. Constantine Papacosmas. December 27, 1960. $19^h\ 03^m$, U.T. 6-in. Refr., 150X. S=2-3. T=3.

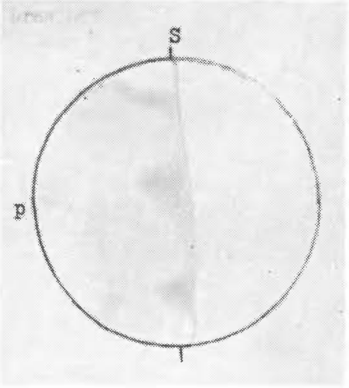

FIGURE 13b. Venus. Klaus R. Brasch. Dec. 27, 1960. $19^h\ 05^m$ to $19^h\ 10^m$, U.T. 6-in. Refr., 150X. S=2-3. T=3.

FIGS. 13a and 13b were made with same telescope.

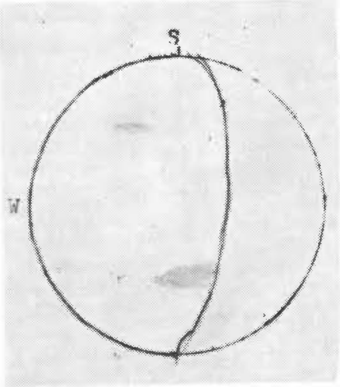

FIGURE 13c. Venus. Stuart & Stanley Emig. Dec. 28, 1960. $00^h\ 45^m$, U.T. 8-in. Refl., 168X. S=5+. T=1.

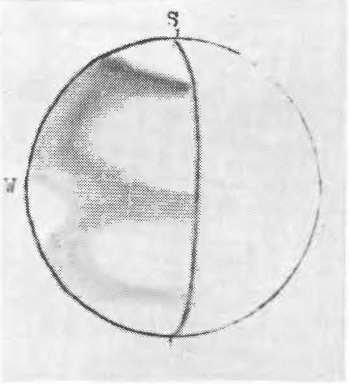

FIGURE 13d. Venus. William K. Hartmann. Dec. 28, 1960. $22^h\ 27^m$, U.T. 8-in. Refl., 184X. S=5. T=2.

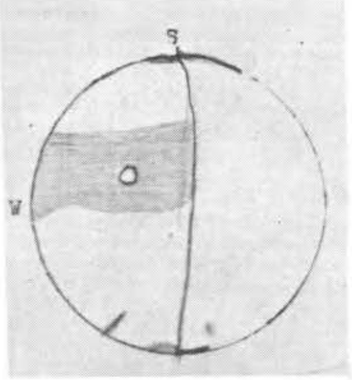

FIGURE 13e (left). Venus. Stuart and Stanley Emig. Dec. 29, 1960. $00^h\ 40^m$, U.T. 10-in. Refl., 241X. S=3-6. T=4.

FIGURE 13. All observations of Venus in 1960 received for the period Dec. 25, 00^h through Dec. 29, 01^h U.T. Conclusion: Banded appearance predominant during interval Dec. 27.8 to Dec. 29.0, U.T. See also text.

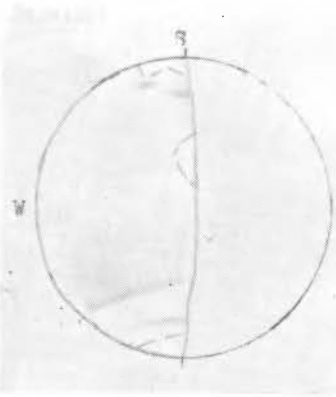

FIGURE 14a. Venus. Craig L. Johnson. Jan. 11, 1961. $00^h\ 25^m$, U.T. 4-in. Refl., 135X. S=5-6. T=5. N. cap the brighter.

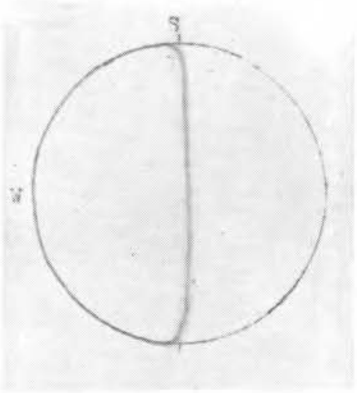

FIGURE 14b. Venus. Minick Rushton. Jan. 11, 1961. $00^h\ 45^m$, U.T. 6-in. Refl., 200X. S=2.5. T=2.5. No detail seen.

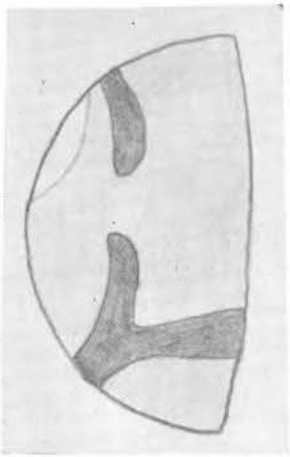

FIGURE 14c. Venus. James V. Marshall. Jan. 11, 1961. $01^h\ 00^m$ to $01^h\ 10^m$, U.T. 2.4-in. Refr., 60X, 90X, 101X. S=6. T=5.

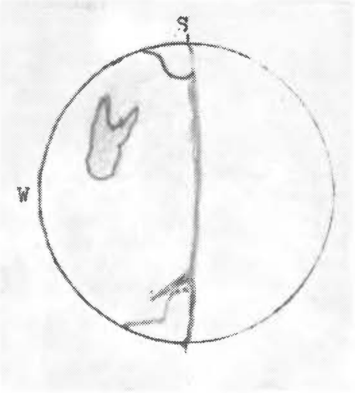

FIGURE 14d. Venus. Larry Anthenien. Jan. 11, 1961. $1^h\ 27^m$, U.T. 6-in. Refl. 160X. S=6. T=2-3.

FIGURE 14. All observations received for the period Jan. 10, 03^h through Jan. 11, 21^h, U.T. and resulting composite. Agreement is rather poor. Three out of five observations indicate an E.-W. band in northern hemisphere. See also text.

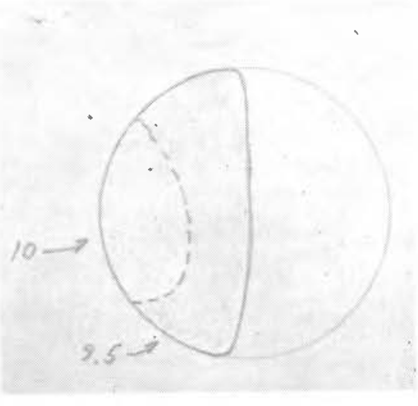

FIGURE 14e. (left) Venus. Minick Rushton. Jan. 11, 1961. $10^h\ 30^m$, U.T. 30-in. Cassegrain Refl., 180X. S=3. T=2. Intensity scale 0 (sky black) to 10 (brightest).

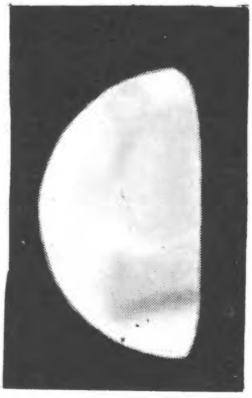

FIGURE 14f. Venus. Jan. 11, 1961, ca. 01^h, U.T. Composite drawing by Venus Recorder based on 5 observations, Jan. 11, 00^h to Jan. 11, 11^h, U.T. Markings difficult.

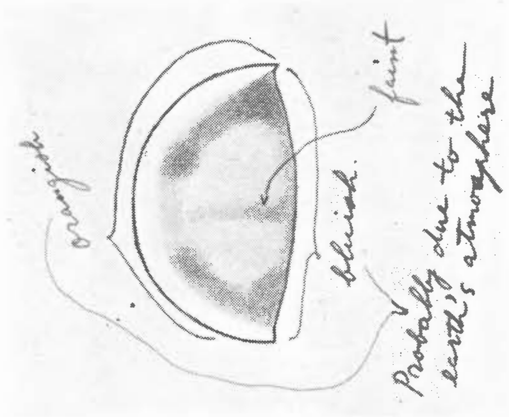

FIGURE 15a. Venus. Takeshi Sato. Jan. 14, 1961. 08^h 20^m, U.T. 10-in. Refl., 278X, 390X. S=3-5. T=4.

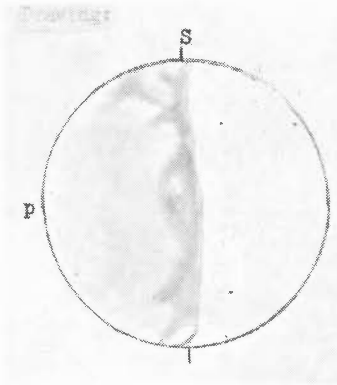

FIGURE 15b. Venus. G. Wedge. Jan. 14, 1961. 19^h 25^m to 19^h 35^m, U.T. 6-in. Refr., 150X. S= 4-3. T=4.

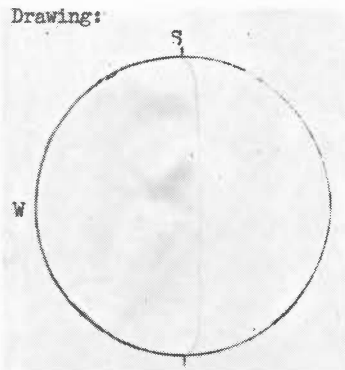

FIGURE 15c. Venus. Klaus R. Brasch. Jan. 14, 1961. 21^h 30^m, U.T. 8-in. Refl., 300X. S=3-4. T=4. "Most definite view of Venusian markings... to...date."

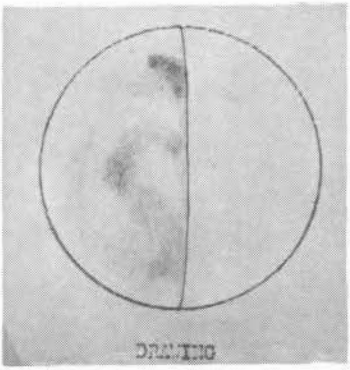

FIGURE 15d. Venus. Clark Chapman. Jan. 14, 1961. 23^h 00^m to 23^h 15^m, U.T. 10-in. Refl., 390X. S=3. T=$3\frac{1}{2}$. "Conspicuousness of the features was about 4."

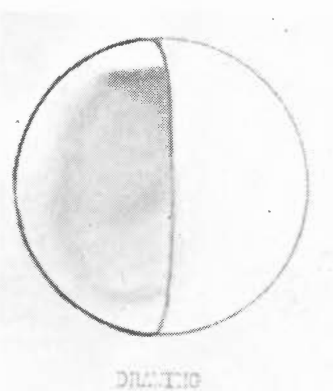

FIGURE 15e (left). Venus. William K. Hartmann. Jan. 14, 1961. 23^h 30^m to 23^h 47^m, U.T. 6-in. Refr., 180X. S=3. T=2. Conspicuousness of dusky markings = 2, 3.

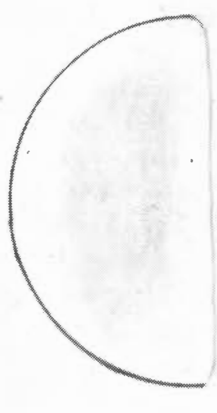

FIGURE 15f (left). Venus. José Olivarez. Jan. 15, 1961. 01^h 00^m, U.T. 2.4-in. Refr., 100X. S=4. T=4.

FIGURE 15. All observations received for the period Jan. 14, 04^h through Jan. 16, 00^h, U.T., and resulting composite. Agreement is fair. Bright limb, dark south cusp-band, and dusky marking near center of disk are indicated on at least 4 out of 6 drawings. See also text.

FIGURE 15g (left). Venus. Jan. 14, 1961, ca. 23^h, U.T. Composite drawing by Venus Recorder based on 6 observations, Jan. 14, 08^h to Jan. 15, 01^h, U.T. Markings relatively conspicuous.

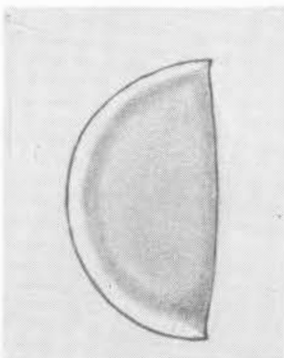

FIGURE 16a. Venus. Takeshi Sato. Jan. 20, 1961. 08^h 05^m, U.T. 10-in. Refl., 390X. S=7. T=4.

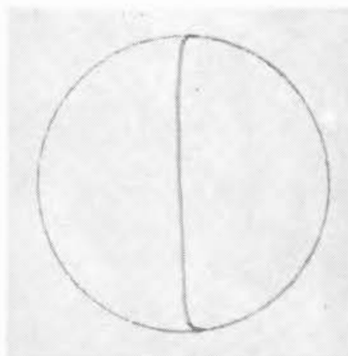

FIGURE 16b. Venus. Minick Rushton. Jan. 20, 1961. 11^h 30^m, U.T. 6-in. Refl., 200X. S=2. T=3.5. No markings or brightness variations were observed.

"Disk lightly shaded but otherwise featureless. Brilliant white limb band and a brilliant white S. Cusp Cap observed. N. Cusp Cap not seen."
(No drawing)

FIGURE 16c. Notes on Venus. James C. Bartlett, Jr., Jan. 20, 1961. 23^h 00^m to 23^h 05^m, U.T. 4½-in. Refl., 120X, S=1. T=5.

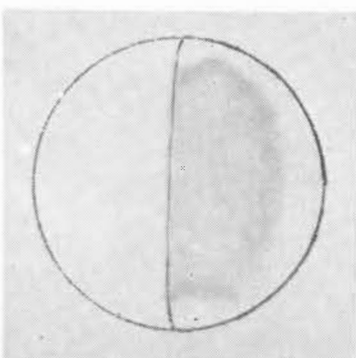

FIGURE 16d. Venus. William K. Hartmann. Jan. 20, 1961. 23^h 29^m to 23^h 41^m, U.T. 6-in. Refr. 180X. S=3-4. T=5. Lack of contrasty markings noted.

FIGURE 16e. Venus. Jan. 20, 1961, 08^h, to Jan. 21, 1961, 00^h U.T. Composite drawing by Venus Recorder based on 4 observations, Jan. 20, 08^h to Jan. 21, 00^h. Limb bright, but disk essentially void of markings.

FIGURE 16. All observations received for the period Jan. 19, 03^h through Jan. 21, 17^h, U.T., and resulting composite. Agreement is good concerning a lack of detail. See also text.

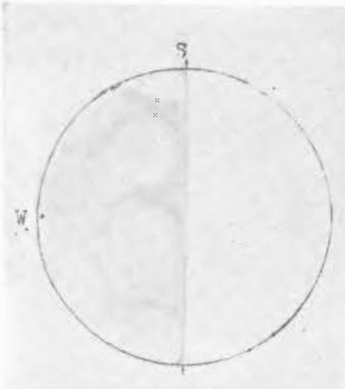

FIGURE 17a. Venus. Klaus R. Brasch. Jan. 22, 1961. 22^h 00^m, U.T. 8-in. Refl., 300X. S=5-7. T=1-3. Similar markings found with violet filter.

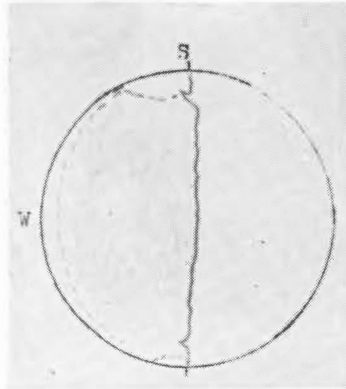

FIGURE 17b. Venus. James C. Bartlett, Jr., Jan. 22, 1961. 22^h 14^m--22^h 23^m, U.T. $4\frac{1}{4}$-in. Refl., 120X, 240X, S=1-5 (variable). T=5. "S cusp and N cusp indentations visible."

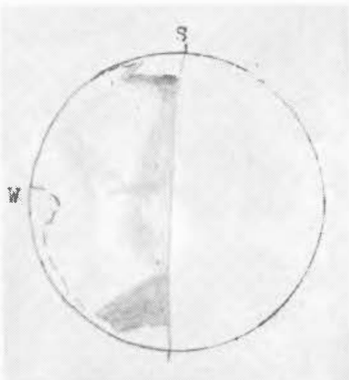

FIGURE 17c. Venus. Craig L. Johnson. Jan. 22, 1961. 23^h 30^m, U.T. 4-in. Refl., 135X. S=3-5. T=5-.

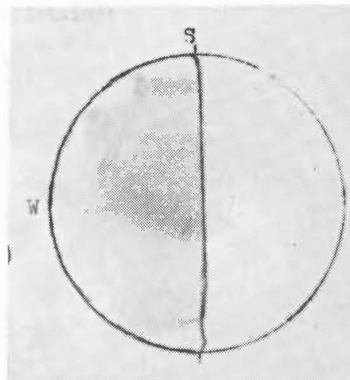

FIGURE 17d. Venus. William K. Hartmann. Jan. 22, 1961. 23^h 35^m to 23^h 49^m, U.T. 6-in. Refr., 180X. S=7. T=3. N. cusp indentation suspected, with conspicuousness 3.

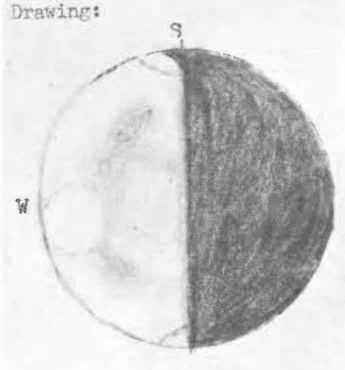

FIGURE 17e(left). Venus. Earl F. Hicks. Jan. 23, 1961. 0^h 30^m, U.T. 5-in. Refr., 127X. S=2. T=4.

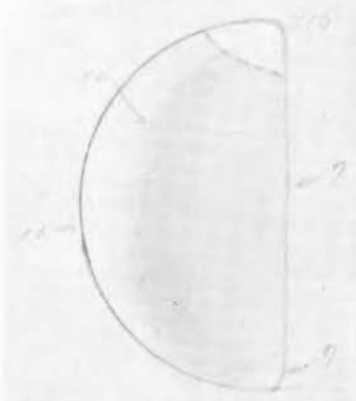

FIGURE 17f(left). Venus. José Olivarez . Jan. 23, 1961. 0^h 30^m, U.T. 2.4-in. Refr., 100X. S=3. T=3. Conspicuousness estimates are indicated.

FIGURE 17. All observations of Venus received for the period Jan. 22, 04^h through Jan. 23, 23^h U.T., and resulting composite. Agreement fairly good. North cusp-indentation reported by 2 observers; bright limb and both cusp-caps reported by all 6 observers. See also text.

FIGURE 17g (left). Venus. Jan. 22, 1961, 22^h to Jan. 23, 1961, 00^h, U.T. Composite drawing by Venus Recorder based on 6 observations from Jan. 22, 22^h to Jan. 23, 01^h, U.T. Markings relatively easy; possible north cusp-indentation.

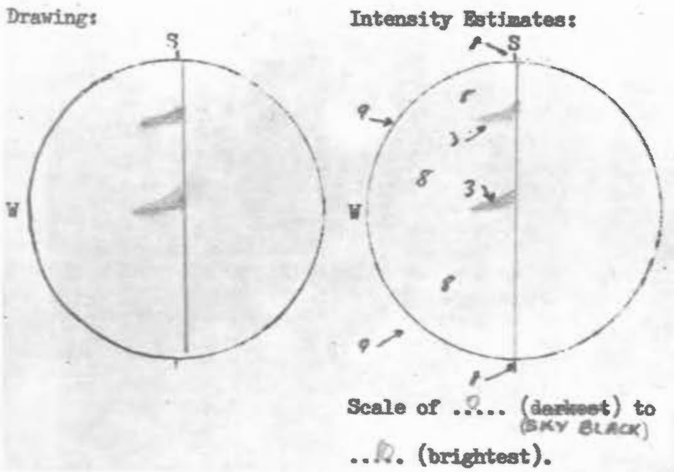

FIGURE 18a. Venus. James C. Bartlett, Jr. Jan. 24, 1961. 22^h 05^m to 22^h 15^m, U.T. $4\frac{1}{2}$-in. Refl., 120X. S=1 to 5 (variable). T=5.

"No definite limb band...though the limb was slightly brighter than the interior...Cusp caps ...not observed."

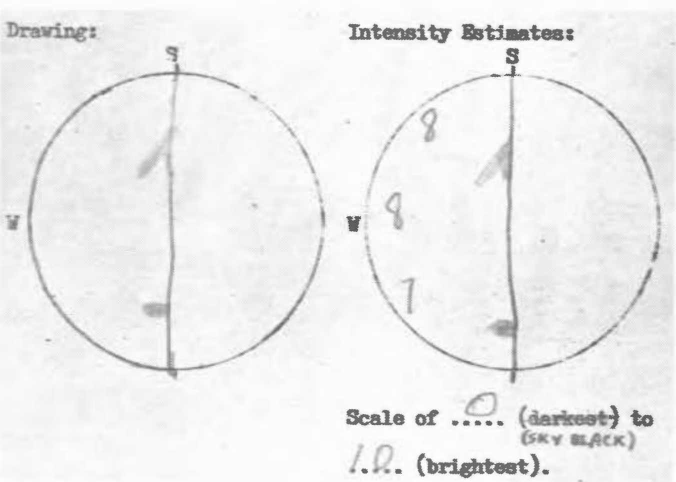

FIGURE 18b. Venus. Stuart and Stanley Emig. Jan. 25, 1961. 00^h 40^m, U.T. 8-in. Refl., 168X. S=3-4. T=$2\frac{1}{2}$. Wratten No. 25 (red) filter used.

FIGURE 18. All observations received for the period Jan. 24, 00^h, through Jan. 25, 12^h, U.T. Note striking agreement on shapes of markings present, but disagreement on position of more northern band.

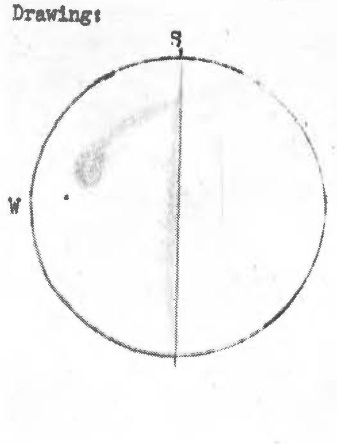

FIGURE 19a (left). Venus. James C. Bartlett,Jr. Jan. 25, 1961. 21^h 55^m to 22^h 05^m, U.T. 4½-in. Refl. 120X, 240X. S=1. T=5.

"...Spot in SW quadrant, connected to curved streak running to terminator; definitely present though exact positioning may have been affected by very bad seeing." Neither cap present; "Cusps no brighter than average for disk."

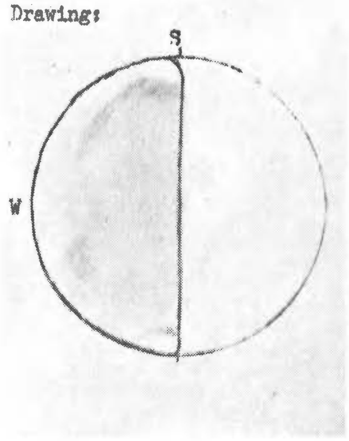

FIGURE 19b. Venus. William K. Hartmann. Jan. 25, 1961. 22^h 41^m to 22^h 49^m, U.T. 6-in. Refr., 180X. S=6. T=5. Both caps suspected; "N cap seemed unusually white....S cusp seemed more rounded."

FIGURE 19. All observations received for the period Jan. 25, 12^h, through Jan. 26, 01^h, U.T. For Jan. 26, 01^h 40^m, Stuart and Stanley Emig write: "Shading in SW quadrant occasionally suspected. If real, it is very very faint, impossible to draw." Thus, agreement is fairly good on the dusky markings, with disk for the most part featureless. There is disagreement on cusp-caps.

FIGURE 20a. Multiple print.

FIGURE 20b. Drawing by William K. Hartmann based on multiple prints.

FIGURE 20. Ultraviolet photograph of Venus by Ewen A. Whitaker. Jan. 30, 1961, ca. 01^h or 02^h, U.T. 82-in. Refl. (McDonald Observatory). Taken with 35mm. camera through eyepiece at 91 feet Cassegrain focus. Plus X film, ultraviolet filter, ca. 1 sec.

FIGURE 21a. Multiple print.

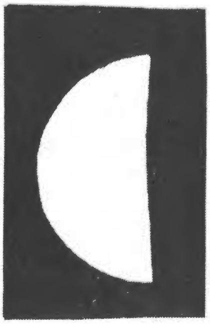

FIGURE 21b. Drawing by William K. Hartmann based on multiple prints.

FIGURE 21. Ultraviolet photograph of Venus by Ewen A. Whitaker. Feb. 1, 1961, ca. 02^h, U.T. 82-in. Refl. (McDonald Observatory). Taken with 35mm. camera through eyepiece at 91 feet Cassegrain focus. Plus X film, ultraviolet filter, ca. 1 sec.

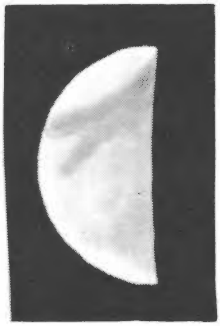

FIGURE 22. Ultraviolet photograph of Venus by Ewen A. Whitaker. Feb. 4, 1961, ca. 01^h, U.T. 82-in. Refl. (McDonald Observatory). Taken with 35mm. camera through eyepiece at 91 feet Cassegrain focus. Plus X film, ultraviolet filter, ca. 1 sec.

FIGURE 22a. Multiple print. FIGURE 22b. Drawing by William K. Hartmann based on multiple prints.

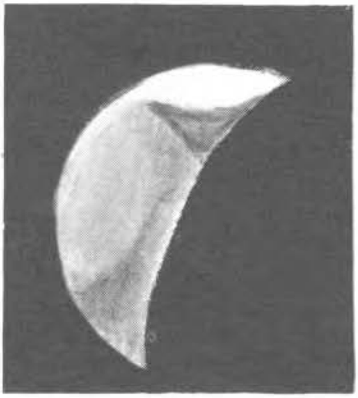

FIGURE 23. Drawing of ultraviolet photograph of Venus by Jack Eastman, Jr. Feb. 11, 1961, 02^h 15^m, U.T. 12½-in. Refl., E.F.L. 175 feet. S=1. Contrast Process Pan, Wratten 18a filter. Drawing by Jack Eastman. Contrasts greatly exaggerated on Figures 23-25 for clarity in reproduction.

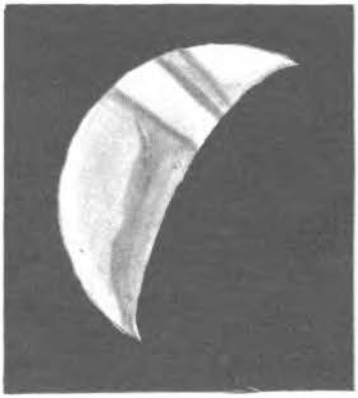

FIGURE 24. Drawing of ultraviolet photograph of Venus by Jack Eastman, Jr. Feb. 14, 1961. 02^h 15^m, U.T. 12½-in. Refl., E.F.L. 175 feet. S=2. Royal Pan, Wratten 18a filter. Drawing by Jack Eastman.

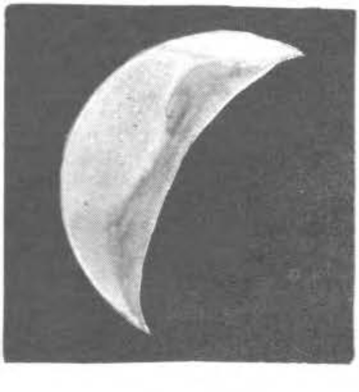

FIGURE 25. Drawing of ultraviolet photograph of Venus by Jack Eastman, Jr. Feb. 16, 1961, 02^h 00^m, U.T. 12½-in. Refl., E.F.L. 175 feet. S=1-2. Royal Pan, Wratten 18a filter. Drawing by Jack Eastman.

an ultraviolet filter in late January and early February, 1961. Through multiple printing of several images, Mr. Whitaker obtained prints which clearly show markings, and these are reproduced in Figures 20-22; since these may not be contrasty enough to reproduce well, drawings of them by the writer are also given. Jack Eastman has sent drawings of three more ultraviolet photographs made by him during mid-February, 1961; and these are presented here as Figures 23-25. We may note that these photos are surprisingly consistent, in view of their half-month time span; five out of six indicate a bright area near the south cusp and dusky markings near the north edge of this bright area.

Let us now compare the photos and visual observations. It should be said at once that we find we can draw no firm conclusions. Attempts to compare photographs with simultaneous drawings are unsuccessful in most cases since few of the visual observations coincide with the photos. However, as examples we may consider an observation by Clark Chapman for Jan. 29, $22^h 25^m$ U.T., (Figure 26), about three hours before Whitaker's Jan. 30 photo, and an observation by Craig L. Johnson for Feb. 1, $00^h 40^m$ and $02^h 00^m$ U.T. (Figure 27), at about the time of Whitaker's Feb. 1 photo. Chapman is compatible with the corresponding ultraviolet photograph in that he shows the south cusp as brightest and the darkest marking just north of this south cusp-cap. Johnson's drawing does not seem to match up so well, for we note that the darkest marking on the photo is a patch at the central west limb, not shown by the drawing. However, we should note that the markings of Feb. 1 were apparently not so prominent as those of Jan. 30 (as judged by comparing the photographs) and that Johnson had poorer seeing. Still, both observers, using similar instruments, felt fairly sure of themselves. Chapman wrote: "...markings were almost certainly seen (8 on the conspicuousness scale)"; and Johnson wrote: "General conspicuousness nearly 10 after using both 'scopes'". Should we conclude that the ultraviolet markings are very near the threshold of visibility, and that slight decline in their actual prominence or in observing conditions greatly decreases the possibility of observing the markings objectively, increasing the chances of subjective effects? Or instead that the ultraviolet markings are unrelated to the visual markings?

Since the ultraviolet photographs for this half-month period indicate a recurrent, bright south-cusp area, we are led to consider the descriptions of the cusps by visual observers in this period. In so doing, we find that we have 36 observations in the period Jan. 29, 12^h U.T. to Feb. 16, 12^h. Of these, 20 show one or both cusp-caps and give sufficient data to judge their relative sizes. We find 8 (40%) show a bigger south cap, 5 (25%) show equal sizes, and 7 (35%) a bigger north cap. When these figures are compared to those for the whole apparition (Part 3 of this paper), we note a substantial decrease in the percent of observations showing a larger north cap. Similarly, 17 observations gave sufficient data to judge relative cap brightnesses. We find 8 (47%) show the south cap brighter, 3 (18%) show them of equal brightness, and 6 (35%) show the north cap brighter. These figures are admittedly of questionable value due to the small sample and possible errors in interpretation. But we should remember that for this apparition as a whole, the north cap appeared to be unusually prominent (Part 3 of this paper). We note that for the period of these ultraviolet photographs, the south cap was both more often larger and more often brighter. Thus we may say that the visual observations for this period at least deviate from the mean in such a direction as to confirm the ultraviolet photographs of the cusp regions.

To sum up, it appears that when there are unusually prominent markings visible in the ultraviolet, they are likely to be confirmed under good conditions in white light. From the long history of visual and ultraviolet photographic reports of bright cusp-caps, it appears to the writer that the above statement may hold especially for markings of this type. However, these ideas certainly cannot be considered to be definitely established, and Patrick Moore seems to lean toward the opposing conclusion in his The Planet Venus (1957). Speaking of bright areas photographed in the ultraviolet vs. visually observed bright areas, he writes: "The two phenomena are probably quite distinct, though the question remains open."

Further ultraviolet photography of Venus is greatly to be encouraged, as photographs showing the markings would take us out of the realm of uncertainty where the Venus Section presently finds itself, and resolve the issue of the possible identity of U.V. detail with visual detail.

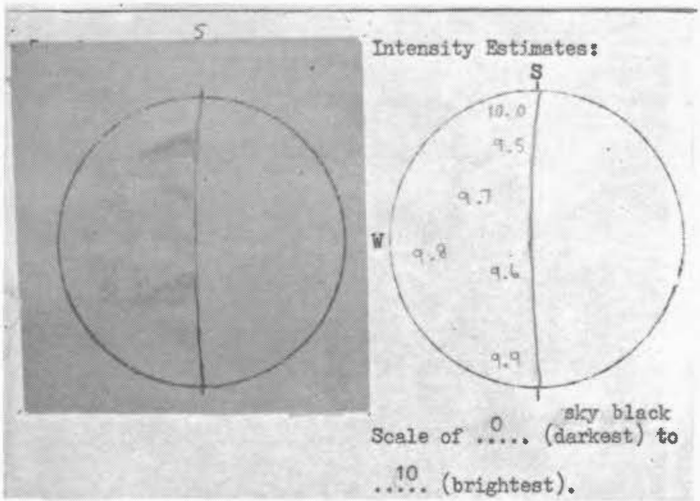

FIGURE 26. Venus. Clark Chapman. Jan. 29, 1961. 22^h 25^m, U.T. 10-in. Refl., 400X; N.D. 1 Filter. S=8-6. T=4½. Markings rated 8 on conspicuousness scale. Compare drawing to ultraviolet photograph in Figure 20.

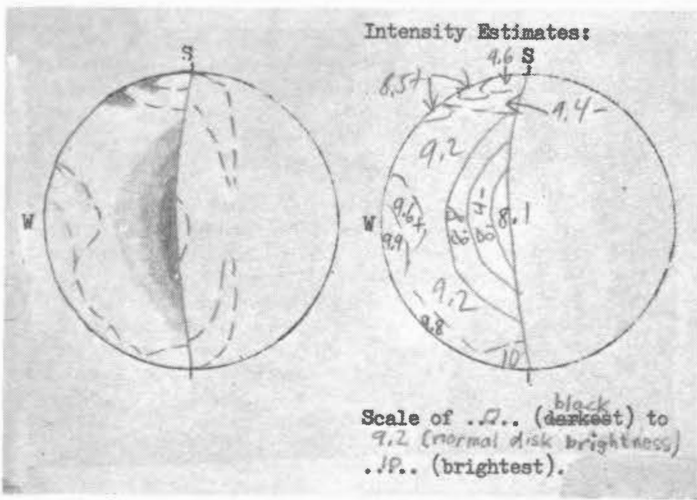

FIGURE 27. Venus. Craig L. Johnson. Feb. 1, 1961. 00^h 40^m and 02^h 00^m, U.T. 4-in. Refl. and 10½-in. Refr. 135X, and 150, 290, and 400X. S=5 (with 10-in.). T=5. Dusky markings rated nearly 10 on conspicuousness scale after using both 'scopes. Compare drawing to ultraviolet photograph in Figure 21.

The writer wishes to thank Alan B. Binder and Dale P. Cruikshank for helpful conversations during the preparation of this Report.

BOOK REVIEWS

A HISTORY OF LUNAR STUDIES, by Ernst E. Both, Buffalo Museum of Science, (available from the Buffalo Museum of Science, Buffalo 11, New York, price $0.75 postpaid). 1961.

Reviewed by F. J. Manasek

Although only 34 pages long, this booklet contains a surprising amount of information. Devoted primarily to the history and evolution of selenography, A History of Lunar Studies briefly discusses each major contributor to lunar science and most major works, both published and unpublished.

The author divides selenography into several phases: early work with visual positional estimates; use of micrometric techniques; introduction of the reflecting telescope; detailed observation of individual structures and application of cartographic methods of lunar charting. Also discussed is the role of photography in lunar charting, the history of nomenclature, and some of the observing groups that were formed in the 19th century. To a lesser extent there are discussed the historical aspects of selenology, selenophysics, and selenodesy. However, we must remember that the book contains only 34 pages!

Beginning with the work of Galileo in the 17th century and carrying through to the present group of English selenographers, the book is of necessity little more than a bibliography with a few lines explaining each contribution and a bare sketch of the personalities involved. However, as a brief outline of the history of lunar research the book is a resounding success, and the reviewer hopes that eventually it will be expanded.

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PLANETS AND SATELLITES, edited by G. P. Kuiper and B. M. Middlehurst, University of Chicago Press, 1961. $12.50.

Reviewed by Rodger W. Gordon

Planets and Satellites fills a long standing gap on the bookshelf of both the amateur and the professional. It shows the ever-expanding and far-reaching effects of modern astrophysics when applied to our planetary neighbors.

Chapter 1 shows the planet earth as photographed from space by the Tiros I weather satellite. The pictures are very interesting, but the lack of sharp detail on many pictures shows that this is a pioneering frontier. The pictures, however, do give very vivid impressions of the great weather systems which affect all of us.

Chapter 2 deals with Clyde Tombaugh's search for, and ultimate discovery of, the trans-Neptunian planet--Pluto. Starting with the early visual work of Todd with the 26-inch U.S. Naval Observatory refractor, Mr. Tombaugh proceeds to the theoretical discussions of Pickering and Lowell and later Lowell's photographic work with a 5-inch short focus telescope. Tombaugh then advances to a detailed account of how he himself used a 13-inch photographic refractor and a blink microscope in the search for the elusive planet. Today most observers have read a little about the methods used to find Pluto; but Chapter 2 of Planets and Satellites shows that it was very laborious, tiresome, and painstaking work.

Chapters 3-14 are very technical and are recommended for only those who can follow advanced mathematical reasoning. The amateur will want to read these chapters, however, because they show the great amount of theoretical and physical methodology necessary in order to study effectively many of the problems confronting the astrophysicist engaged in planetary and lunar studies. Particulary interesting in these respects are the chapters on the photometry and colorimetry of the moon and planets. Other interesting chapters are A. Dollfus' polarization studies of the planets, and the recent radio observations of the planet Jupiter by Burke, Franklin, Shain, and others.

No doubt, Chapters 15-18 will be the most-interesting for A.L.P.O. members. The visual and photographic studies of the planets carried out by Lyot, Dollfus, Camichel, etc. leave little to be desired. Many photographs of the planets are given, some never before published. An entire section (Chapter 16) is devoted to planetary photographs with the 200-inch Palomar reflector.

Chapter 17 deals with the very interesting color photographs of Mars made by Finsen, Director of the Union Observatory in South Africa. It would seem that these photographs, although they are composites, prove that the various colors and color changes in the appearance of surface markings recorded by many amateur observers actually do exist. Chapter 18, by Kuiper, deals with the possibility of finding intra-Mercurial planets, Venusian satellites, other trans-Neptunian planets, undetected satellites of Jupiter and Saturn, etc.

To sum up, the book is well worth $12.50 although the great majority of chapters will interest only professional and very advanced amateur astronomers.

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STARS, MEN, AND ATOMS, Heinz Haber, Golden Press, New York, ©1962. 188 pp. $3.99.

Reviewed by Fred C. Trusell

Haber's book might better be entitled, The Universe, Men, and Atoms; for with the exception of a rather brief chapter on the sun the book contains somewhat less about stars than the average amateur astronomer might like. It is, however, a fascinating account of our planet (with a brief nod to its neighbors), the universe in which it exists, and the men who have contributed to our understanding of it.

The author ranges over a wide field of subjects including a model of the sun, atomic structure, radioactive decay, dating by the carbon-14 method, the possibility of life on other planets in our Solar System, the possibility of life on planets of other stars, the practicality of space travel, the fourth dimension, and the finiteness or infiniteness of space. In each of these, Haber displays an unusual ability to explain lucidly the most complex concepts in terms that the average high school student can understand without watering down the book to the point where it becomes dull for the more experienced reader. Another strength of the book, which more writers would do well to emulate, is the manner in which the author makes the ancient ideas concerning the universe seem quite logical in the light of what men knew at that time, rather than making them look ridiculous in the light of what we know today. May writers in coming centuries be as kind to us.

For evenings when the sky is overcast, this book can provide thought-provoking moments, raising as many questions as it answers, but at the same time providing the reader with some of the tools with which to arrive at his own answers.

(another review on p. 189)

ANNOUNCEMENTS

Concerning the Reviewing of Books. In recent weeks we have twice been a little embarrassed to receive reviews of the same book by two different A.L.P.O. members. We appreciate the keen interest and enthusiasm motivating our members to contribute volunteer book reviews. However, a little more coordination of such efforts does appear necessary. In the future everyone is requested to check with Mr. J. Russell Smith, the Book Review Editor, before submitting a review.

New Address for Thomas Cragg. The mailing address of our Assistant Saturn Recorder is now:

Thomas Cragg
Mount Wilson Observatory
Mount Wilson, California

Mr. Cragg was recently promoted to Resident Solar Observer on Mount Wilson, succeeding Mr. Joe Hickox, who had held that post for 40 years. The many A.L.P.O. members knowing Tom Cragg will join us in congratulating him upon this new distinction. He is now on Mount Wilson all but 9 days each month.

Resignation of Special Lunar Projects Recorder. Mr. Leif J. Robinson has given up this post because of the demands of many other astronomical interests. Efforts to organize an effective Lunar Section continue, but no other person to head Special Lunar Projects has yet been found.

Acknowledgments. It is a pleasure to acknowledge the financial help of Pan American College with the preparation and mailing of The Strolling

Astronomer from October, 1959, to April, 1962. It is also a more personal pleasure to express appreciation to Miss Patricia Hiesermann, who gave the help indicated, chiefly typing and mailing details, as student assistant at the College Observatory over the period mentioned. The present issue has been typed jointly by Mrs. Beryl Haas and Miss Hiesermann. The Director of the Observatory is Professor Paul R. Engle.

Tenth A.L.P.O. Convention. At this date (July 19) it is difficult to say exactly when this issue will reach our readers so that news about our meeting at Montreal on September 1-3, 1962, may be correspondingly dated; however, we invite everyone who can to make plans even now to be with us. Registration will be on the morning of Saturday, September 1, with the first session for papers in the afternoon and a visit to the Montreal Centre's Observatory in the evening. On Sunday, September 2, the afternoon will feature the second session for papers and the Convention group photograph, to be taken by William Shawcross, Assistant Editor of Sky and Telescope. In the evening there will be a buffet supper, the presentation of the 1962 A.L.P.O. Award to Phil Glaser, the hard-working Jupiter Recorder, and a popular-level illustrated lecture by Joel Goodman, who will give us some astronomical highlights of the year he recently spent in England. The final session for papers will be on the forenoon of Labor Day Monday. The General Convention Chairman is Mr. W. A. Warren, 30 - 52nd Ave., Lachine, Quebec, Canada, who will supply needed information about this Convention on request. The chairmen of the three sessions for papers will be Joel Goodman, Geoffrey Gaherty, and Walter Haas. Clark Chapman is assembling a good current lunar and planetary Exhibit. Up to today (July 19), 39 persons have registered to attend, with a fair number of others expected.

A varied and really excellent program of papers is nearing its final form. It is very gratifying that almost all authors will be at Montreal in person to give their papers, contrary to some past A.L.P.O. meetings. Three papers are by professional scientists: Dr. Albéric Boivin of the Dept. of Physics of Laval University, Québec, will speak on "New Vistas in Astronomical Optics"; Dr. S. Miyamoto, Kwasan Observatory, University of Kyoto, Japan, will tell us, with many slides, about "Studies of the Maria in the Libratory Regions of the Moon"; and Joe Ashbrook of Sky and Telescope will speak upon "Measuring Heights on the Moon." Some of the other papers are "Some Recent Changes in Jupiter's Aspect," by Phil Glaser; "The Rings of Saturn," by Joel Goodman; "A Relief Model of Eratosthenes," by John Westfall; "Lunar-Type Terrestrial Vulcanoids," by Patrick Moore; "Current Research in Atmospheric Science," by George W. Rippen; and "Cloud Satellites," by Richard Hodgson.

We do want to see you at Montreal!

New Books in A.L.P.O. Library. The following books have been added since the last listing appeared in our July-August, 1961, issue. All A.L.P.O members in the United States and Canada are eligible to borrow our books. The cost is 25 cents per book, plus return mailing charges.

Title	Author	Publisher	Date
El Telescopio (in Spanish)[1]	Miguel Valdez	----	1960
Frontiers of Astronomy[2]	Fred Hoyle	Harper & Bros.	1955
The Birth and Development of the Geological Sciences[3]	Frank Dawson Adams	Dover Publications, Inc.	1954
The Telescope[1] (2nd copy)	Harry Edward Neal	Julian Messner, Inc.	1960
Looking at the Stars[1]	Michael W. Ovenden	Philosophical Library	1958
A Dipper Full of Stars[1]	Lou Williams Page	Follett Publishing Company	1959
Experiments in Sky Watching[1]	Franklyn M. Branley	Thomas Y. Crowell Company	1959
Catalogue of Cometary Orbits[4]	J. G. Porter	Memoirs B.A.A.	1960

Title	Author	Publisher	Date
An Atlas of the Moon's Far Side	N. N. Barabashov, A. A. Mikhailov, & Yu. N. Lipsky	Interscience Publishers & Sky Publishing Corp.	1961
Astronomical Spectroscopy	A. D. Thackeray	Macmillan	1961
Tools of the Astronomer	G. R. Miczaika & W. M. Sinton	Harvard University Press	1961
A History of Lunar Studies	Ernst E. Both	Buffalo Museum of Science	1961
Orion (various issues)	Edited by R. A. Naef		
The Planet Venus (Third Edition)	Patrick Moore	Macmillan	1961
Stars, Men, and Atoms	Heinz Haber	Golden Press	1962
The Planet Saturn	A.F.O'D. Alexander	Macmillan	1962
The Universe Around Us	Sir James Jeans	Cambridge Univ. Press	1960

[1]Donated by T. F. Cheaney.
[2]Donated by Harry Jamieson.
[3]Donated by Fred Wyburn.
[4]Donated by David Meisel.

Birthday Thank-Yous. We want to express our deep appreciation to the many friends and colleagues who so graciously sent their congratulations and best wishes on the occasion of our recent fifteenth anniversary. We were especially delightfully surprised by the article "ALPO 15th Anniversary" on p. 3 of the July, 1962, Sky and Telescope. To one and all--thank you very much!

Possible Changes Ahead. At this date (July 19) the Editor is giving very serious thought to a possible change of employment and a corresponding change of address. Should such a change be made, there will be the usual period of disorder and confusion. Among other things, the mailing of our September-October issue will be delayed; and it will be for some time even more difficult than usual to answer correspondence. The Editor begs the indulgence of A.L.P.O. members during such a possible period of transition. A new address for our headquarters will be given as soon as possible. The Editor will certainly consider the best interests of the A.L.P.O. and its journal in whatever decision he reaches.

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This review arrived really too late for inclusion in this issue; but in view of the importance of the book, the Editor thought it better to publish the review here out of sequence than to defer its publication for at least two months.

THE PLANET SATURN. A HISTORY OF OBSERVATION, THEORY AND DISCOVERY. Written by A. F. O'D. Alexander. Published in the United States by the Macmillan Company, New York, 1962. $14.75. 474 pages.

Reviewed by Joel W. Goodman

The Planet Saturn, like its predecessor, B. M. Peek's The Planet Jupiter, will find a place in the library of every student of the planets, amateur or professional. Written by Dr. A. F. O'D. Alexander, a former Director of the Saturn Section of the British Astronomical Association, it has within its confines a most comprehensive collection of observations of the Ringed Planet spanning the ancient civilizations of Babylonia, Egypt, and Greece right on up to the outbreak of white spots at 60°N. latitude in 1960 A.D. A fascinating evolution of concepts concerning the planet is unfolded, particularly as a consequence of early telescopic observations and misinterpretations of the rings.

Unlike Peek's format, the presentation is chronological, which perhaps enhances its readability but detracts somewhat from its convenience as a reference volume; information regarding specific features is scattered throughout its pages. Since the primary function of a book of this type is one of reference, this shortcoming is of considerable moment.

Very little space is specifically allocated to methods of observing Saturn, although, as Dr. Alexander points out, such information is scattered throughout the text. Furthermore, many of the methods described by Peek in his book are equally applicable to Saturn. It can probably be assumed that readers of this book will be familiar with Peek's as well.

Professional as well as amateur work is covered in adequate detail, and the observations are thoroughly documented. Understandably, emphasis is given to the activities of the Saturn Section of the B.A.A.; this emphasis is well deserved since the Section dates back to 1891 and has compiled a very impressive log of observations.

Approximately 20 percent of the book is devoted to pre-telescopic observations of Saturn. These involve determinations of position and little else. While interesting, this part of the book, in the Reviewer's opinion, could well have been condensed. The Planet Saturn is more than 50 percent again as long as The Planet Jupiter. Its price is proportionately greater and may perhaps be considered prohibitive by some amateurs. Both size and price could have been advantageously reduced.

Dr. Alexander describes seventeenth century observations and ideas regarding Saturn in admirable detail. This section of the book, chronicling the pioneering work of Galileo, Huyghens, and Cassini, among others, is perhaps its most fascinating part. Of particular interest is the controversy concerning the nature of the rings between Huyghens, who was the first to correctly interpret their telescopic appearance, and his adversaries.

Contemporary observers interested in such unsolved riddles as minor divisions in the rings and the existence of a faint ring exterior to Ring A will find the pros and cons on these matters set forth objectively. A concept of great importance pointed out by Alexander, which is perhaps not given sufficient consideration by many observers, is that the rings may not be constant with regard to intensity minima. Minor divisions reportedly seen at times with relatively small apertures but absent at others in large telescopes may be transient "ripples" in the rings, due perhaps to the orientation of the satellites.

The text seems remarkably free of flaws despite the forebodings expressed by the author in his preface. A couple of minor typographical errors were found: The caption to Plate IV, Figure 2 should read "...6½-inch reflector..." rather than "...6½-inch refractor..."; on page 421, line 8, several words appear to have been omitted, presumably "...the 1955...". Other specific criticisms are as follows: In describing the occultation of BD-20° 4568 by Saturn in 1957 (p. 425), no mention of the star's magnitude is made. A description of observations of Saturn using filters (p. 426) gives the manufacturer's code numbers but not the transmission properties of the filters, leaving the reader very much at sea unless he happens to be familiar with Dufay code numbers.

The Reviewer has perhaps overemphasized what he has found to be the weak links in a very strong chain. To his knowledge, no significant observations of Saturn up to the year 1960 have been ignored by Alexander, making his book very nearly indispensable for serious students of the planet.

OBSERVATIONS AND COMMENTS

Stereoscopic Lunar Photographs? Mr. Robert H. Henderson, 2210 Ogden St., San Bernardino, Calif., invites comments on these ideas: "A combination of the advanced photographic techniques of the present with the simplicity of the old time stereopticon could, it seems to me, be combined in the de-

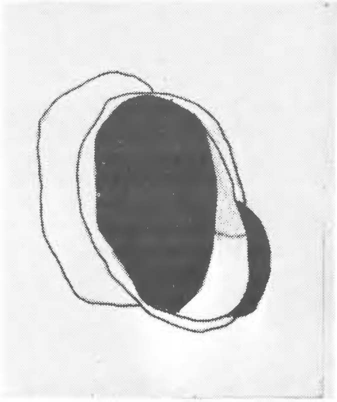

FIGURE 28. Lunar Crater Daniell. Keith Peterson. October 14, 1961. $1^h 1^m$ - $1^h 14^m$, U.T. 7.5-inch reflector. 60X (for drawing), 120X (for checking). S=2-7. T=2-3.5.Colongitude=325°.9.

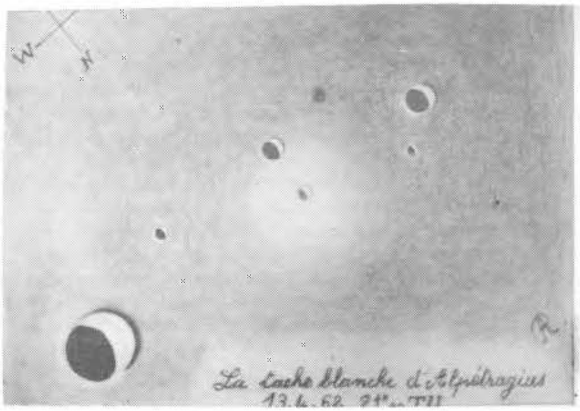

FIGURE 29. White and Dark Spots near Lunar Crater Alpetragius. Robert Abraham. April 13, 1962. $21^h 0^m$, U.T. 8.8-inch reflector. 260X. S=7. T=4. Colongitude=18°.8.

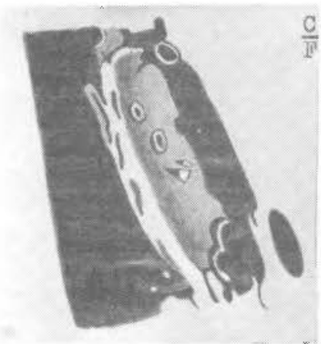

FIGURE 30. Lunar Crater Cleomedes. Carlos E. Rost. February 22, 1962. $3^h 17^m$, U.T. 6-inch Fecker catadioptric reflector. 285X. S=3-4. T=2-3. Colongitude=120°.4.

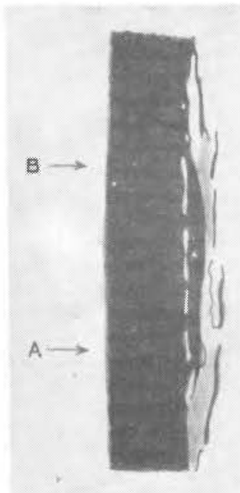

FIGURE 31. Lunar Crater Neper. Carlos E. Rost. February 20, 1962. $1^h 15^m$, U.T. 6-inch Fecker catadioptric reflector. 285X. S=5. T=2. Colongitude=95°.1.

velopment of an interesting project. The realism of three dimensions in the old device and its modern counterparts is so striking, compared to an ordinary photograph, that I wonder if it has ever been applied to astronomical photographs. Precise timing would, of course, be necessary, as well as telescopes of the same aperture using identical magnifications. Similar makes of telescopes and cameras would be preferable.

"The moon could be photographed from approximately the First Quarter into the Last Quarter. An observer on the West Coast, and another on the East Coast (identical equipment, etc.) would, at the same instant, photograph some pre-selected feature, carefully centered in the field of view. The comparatively slight difference in the distances from the two observers to the moon might have to be compensated for at the First and Last Quarters.

"The resulting photos in the viewer would represent, at 240 power, the view produced by a pair of 'eyes' some 12 miles apart and 940 miles from the moon. The three-dimensional effect would be about the same as for an object about eight feet from the unaided eyes. These figures are rather approximate, and I am optimistically assuming ideal conditions all around. Different magnifications and observers at varying distances would have to be tried to produce the best results.

"As to the planets, probably the much greater distances would nullify any visible stereoscopic effect. Such lunar, and possibly planetary, views might be spectacular and useful."

Daniell. Figure 28 is a drawing of this rather small crater by Mr. Keith Peterson, 4615 Grand Prairie Rd., Kalamazoo, Michigan, with the usual accompanying information. It will be noticed that the seeing varied greatly. Daniell lies just north of Posidonius on Section III of the Wilkins map of the moon. The observer says: "About one-fourth of the floor was visible. The rim on the northeast cast a shadow varying little in height. The highest part of this portion of the wall lies almost in the middle of the portion involved. The wall height does not vary much in this region. The northern part of the illuminated floor was bright. The southern area appeared dusky. About two-fifths was dusky. No radial bands could be detected. No detail on the floor or rim was observed. Adjacent to the south and west walls was a whitish area not quite so bright as the bright part of the floor. The central hill wasn't in sight at the time." Mr. Peterson is anxious to improve his lunar techniques and will welcome correspondence.

White and Dark Spots near Alpetragius. Mr. Robert Abraham, Verneuil-en-Halatte, Oise, France, has contributed the drawing of these objects appearing here as Figure 29. The white spot reminds one forcibly of the Linné white spot.

Cleomedes. Mr. Carlos E. Rost of Santurce, Puerto Rico, submits the drawing published here as Figure 30, with the usual data in the caption. The drawing was interrupted many times by clouds and was finally terminated while still incomplete. The libration in longitude was east on February 22, 1962, hence unfavorable for studying formations near the west limb (like Cleomedes). The observer notes: "Notice the curvature of the crater floor and craterlets south of the central peak. The west wall is seen to have several depressions. The long, black oval to the northeast of Cleomedes is Tralles, which partly intrudes on the east wall."

Neper. Figure 31 is a drawing contributed by Carlos E. Rost. He remarks: "The darkening of the west wall was at a rather noticeable speed; bright edges at 'A' and 'B' were the last to vanish into darkness. The central peak appeared dusky. The extreme south end of 'B' disappeared at $2^h 29^m$, U.T. The extreme north end of 'A' disappeared at $2^h 38^m$, U.T., or approximately 9 mins. later."

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