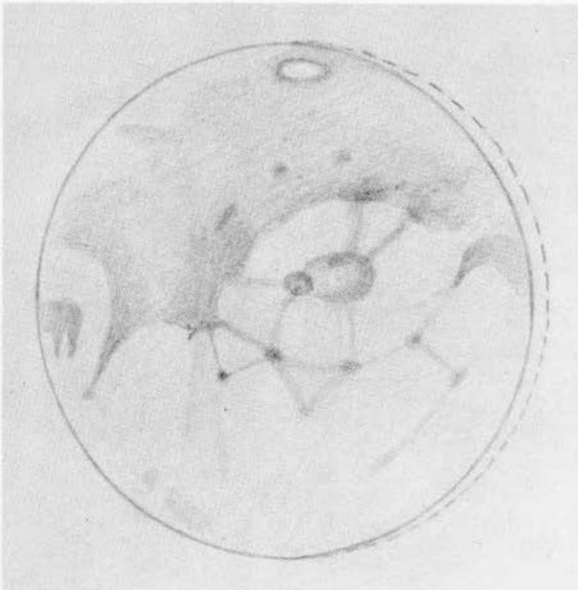
The ASSOCIATION OF LUNAR AND PLANETARY OBSERVERS

The Strolling Astronomer

VOLUME 10, NUMBERS 3 & 4 MARCH-APRIL, 1956



"THE EYE OF MARS"
Drawing of Mars by Clyde W. Tombaugh on November 3, 1941, 4 hrs., 30 mins., U. T. Lowell 24-inch Refractor at 15-18 inches of Aperture. 310 X with Orange Filter. CM.=83°.

THE STROLLING ASTRONOMER
1203 North Alameda Street
Las Cruces, New Mexico

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ANNOUNCEMENTS

W.A.A. Convention and A.L.P.O. Convention. Although the events will probably be history before this issue reaches most of our readers, we want again to mention the Convention of Western Amateur Astronomers at Flagstaff, Arizona on August 29-31, 1956, to be followed immediately by the first Convention of our Association of Lunar and Planetary Observers at the same place on September 1. A special feature of these meetings will be the opportunity to observe Mars near an extremely close opposition with the famous Lowell Observatory 24-inch refractor. Mars will be closest on September 7 when its angular diameter will reach a maximum value of 24".76. The W.A.A. Convention will include the usual splendid papers, exhibits, trips, a telescope party, and a banquet. We are naturally very anxious that our first A.L.P.O. Convention should be a success - and it will be a greater success to the degree that our members attend and contribute to it. We already have a number of papers on several different lunar and planetary subjects and can promise a worthwhile program. However, the main Convention is still the W.A.A. Convention; and it is only through their courtesy and helpfulness that our informal little meeting has become possible. We hence urge everyone who can to attend the three days of the W.A.A. meeting - you will never be sorry that you did.

The W.A.A. Convention Chairman is Mr. Thomas R. Cave,Jr., 4137 E. Anaheim St., Long Beach 4, California.

Concerning Changes of Address. A few of our members have occasionally lost copies of The Strolling Astronomer when such members moved to a new address. We naturally undertake to replace copies lost in this way; but since we cannot make many extra copies of most issues, a given issue is sometimes soon out of stock. We shall hence appreciate it if subscribers will be careful to report changes in address promptly so that they will not risk missing an issue. A convenient card-form for telling publishers of changes of address may be obtained from any post office.

Nineteenth Meeting of Meteoritical Society. This meeting will be held at Indiana University, Bloomington, Indiana on September 4 and 5, 1956. There will be sessions for papers, open to the public, on both days, a Society dinner on the evening of September 4, and a trip to the Indiana University Observatory. The Chairman of the Program Committee is Dr. Carl W. Beck, Department of Geology, Indiana University, Bloomington, Indiana.

The Meteoritical Society has seldom met east of the Mississippi so that this meeting may be geographically convenient for many persons interested in meteoritics.

International Lunar Society. We are glad to announce the founding, in part through the efforts of our colleague Dr. H. P. Wilkins, of a new group called the International Lunar Society. Its goal is to be a medium through which existing societies, such as the B.A.A. Lunar Section and the A.L.P.O., can make known throughout the world the more important items of lunar research. The I.L.S. will not interfere in any way with existing societies; rather it will supplement and increase their present services to their members. Increased international coöperation among lunar and planetary observers has been an important aim of the A.L.P.O. since its founding in 1947, and we are hence glad to give our support to this new group. The officers of the International Lunar Society from now until the end of 1958 are:

President - H. P. Wilkins, England.
Vice President - Walter H. Haas, U.S.A.
General Secretary - G. D. Roth, Germany.
Permanent Secretary and
Editor of Journal - A. Paluzíe, Spain.

The first issue of the Journal is scheduled for March, 1957. All contributions for it, and we do want a few A.L.P.O. contributions, must reach Mr. Paluzíe by the middle of December, 1956. Dues will be kept as small as possible.

Partly to make our participation in the I.L.S. more effective, the Editor plans to appoint one or two Lunar Recorders for the A.L.P.O. Their names will be given in a future issue.

MARS, 1954 - UNUSUAL OBSERVATIONS

by D. P. Avigliano

Through the years that Mars has been under telescopic observation there have been reported many observations of unusual phenomena and the apparition of 1954 has certainly produced its share of unusual reports - these being primarily concerned with dark spots, bright spots and clouds.

Unusual Dark Spots. Notable among the reports received from Dr. James C. Bartlette,Jr. were two showing very small intensely dark spots on the Martian disc. As Bartlett also reported two similar observations at the 1952 apparition of Mars, we will list all four of these observations. The quotes are directly from Bartlett's original reports.

Spot number one. "May 1, 1952 - Tyrrhenum dark spot.
Near to the southern terminus of Mare Tyrrhenum I was surprised to find a very small, intensely dark spot looking much like a satellite shadow, though perhaps not quite as black. I feel certain of the existence of this spot."

The reference Bartlett makes regarding the spot looking like a satellite shadow is that it resembled the shadows thrown on Jupiter by the Jovian satellites. The usual tests of objectivity were employed by Bartlett (moving the image through the field, revolving the eyepiece, etc.) with the result that Bartlett was convinced that the spot was truly on the planet. See Figure 1.

Spot number two. "July 3, 1952 - Hellespontus dark spot.
A minute black spot - like a satellite shadow - was suspected on the N. edge of the Hellespontus at about latitude -35°. This was so minute that I cannot be absolutely sure of its existence, though it recalls the similar anomalous spot observed near Mare Tyrrhenum." See Figure 2.

Spot number three. "July 7, 1954 - Castorius black spot.
At about the position of Castorius Lacus, fixed from its relation to Propontis, and therefore far north on the disc, I distinctly saw a very small,round,intensely black spot, perhaps not more than 2" diameter - a mere dot. This appears to have been of the same nature as the two black spots seen in July and April of 1952 associated with the Hellespontus and Mare Tyrrhenum respectively." See Figure 3.

Spot number four. "September 23, 1954 - Ascuris Lacus black spot.
With 300X a much darker, blackish spot came out near or at the site of Ascuris Lacus." See Figure 4.

Regarding this latter observation Bartlett writes, "It is to be noted that the apparent diameter of the(Martian) disc was then only 12".6 though with 300X an apparent diameter in excess of 53' was obtained. This was the same apparent diameter as on July 3, 1952, when with only 3.5" aperture and 100X, yielding an apparent diameter of 20', the Hellespontus spot was discovered."

Confirmation of Bartlett's dark spot of July 7, 1954 was obtained independently by Avigliano on July 9, 1954 with an 8" Cave reflector (see Figure 5). Concerning this observation Avigliano's notes read in part: "The oasis near the position of Euxinus Lacus appeared abnormally dark, much darker than the other oases seen." The C.M. of Mars at the time of Avigliano's report was almost identical with that of Bartlett's observation; and as the positions of the dark spot as seen by each observer check so closely (compare Figures 3 and 5), the abnormal darkening of the oasis

Figure 1. Mars, showing Tyrrhenum dark spot. May 1, 1952. $4^h\ 41^m$, U.T. C.M. 247°. 3.5" refl. 100X. James C. Bartlett, Jr.

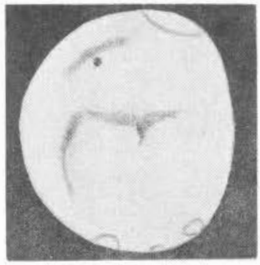


Figure 2. Mars, showing Hellespontus dark spot. July 3, 1952. $1^h\ 52^m$, U.T. C.M. 358°. 3.5" refl. 100X. James C. Bartlett, Jr.

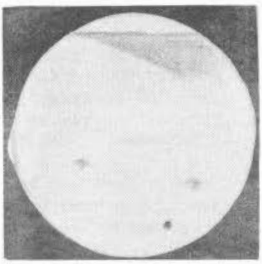


Figure 3. Mars, showing Castorius black spot. July 7, 1954. $4^h\ 34^m$, U.T. C.M. 140°. 5" refl. 150X. James C. Bartlett, Jr.

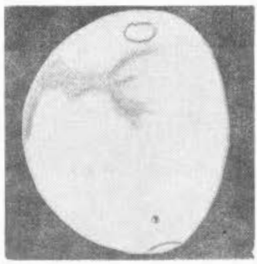


Figure 4. Mars, showing Ascuris black spot. Sept. 23, 1954. $0^h\ 0^m$, U.T. C.M. 70°. 5" refl. 150X and 300X. James C. Bartlett, Jr.

(most probably either Euxinus Lacus or Castorius Lacus) must certainly have taken place over a period lasting for at least the intervening time between the two reports. It is interesting to note that Avigliano drew the dark oasis as a somewhat larger spot than Bartlett shows it. Also noteworthy is the fact that the 1952 darkenings appeared in the S. hemisphere of Mars while the 1954 darkenings were seen in its N. hemisphere. What may account for the darkening of these and other similar areas seen on Mars by past observers we will leave for those with more speculative minds to ponder.

Unusual Bright Spots. What is without a doubt the most unusual observation report we received in 1954 is one made by Tsuneo Saheki. It records a truly unique brightening of a small area on Mars, the Edom Promontorium. We print here the observation as recorded in Saheki's own words:

"On the night of July 1, 1954 at about $13^h\ 15^m$ plus 1^m U.T. when I had been carefully looking at the whole disc of Mars getting ready to begin a drawing of the Martian markings, the lighter yellow patch of Edom Promontorium was seen in its usual form and aspect. Suddenly it began to increase in brightness, changing in color to white. In about 3 seconds it reached its maximum brightness when it showed as very bright (about half the brightness of the south polar cap). At this time it showed as a white, larger round form isolating the Sinus Meridiani from the dark band of the Sinus Sabaeus.

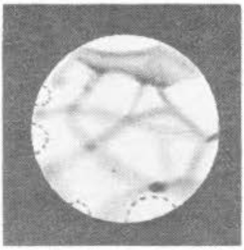


Figure 5. Mars, showing N. hemisphere dark spot. (Compare with Figure 3).
5^h 55^m, U.T. C.M. 142°.
8" refl. at 325X. Neutral density and #25 (red) filters used.
D. P. Avigliano.

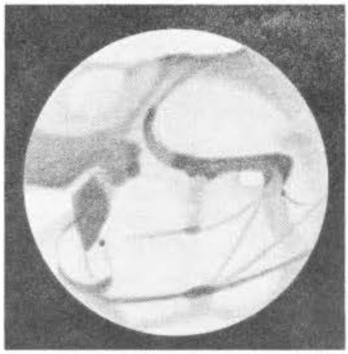


Figure 7. Mars.
July 1, 1954.
13^h 17^m, U.T. C. M. 320°
8" refl. at 330X, 400X and 500X.
Tsuneo Saheki.

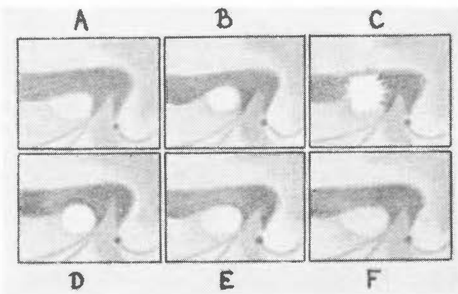


Figure 6. Mars, showing unusual bright spot in the area of Edom Promontorium. July 1, 1954.
A - area normal, yellowish white. Minus 3 secs. from maximum brightness.
B - area white and bright. Minus 2 secs. from maximum brightness.
C - area maximum white and very bright. 13^h 15^m plus 1^m, U.T.
D - area white and bright. Plus 1 sec. from maximum brightness.
E - area yellowish white and rather bright. Plus 3 secs. from maximum brightness.
F - area yellow or yellowish white, not bright. Plus 5 secs. from maximum brightness.
See text for further details.
8" refl. at 330 and 400X.
Tsuneo Saheki.

"Soon the glare spot began quickly to decrease in brightness and in about 5 seconds it returned to its usual yellow appearance. The brightness of the spot seemed to be somewhat fainter than the bright spot that I observed in 1951 and the duration of this brightening was much shorter than that in 1951. I can state that this bright spot was not illusive but true, because the seeing conditions were rather good at the time of the observation; I recorded them at 6-7 on Pickering's Standard Scale." See Figure 6.

In June, 1937, the Japanese observer S. Mayeda saw a tiny bright spot at the location of the dark spot, Sithonius Lacus and in December, 1951 Saheki saw a white glare spot at the approximate center of Tithonius Lacus (to which he refers in the above report). These two previously recorded glare spots were seen near the limb of the Martian disc. The 1954 glare spot, however, was well on the disc at the time of the observation (see Figure 7 by Saheki for a full disc view of Mars near the time that the glare spot was seen - also note on this drawing the two tiny oases, the Antigones Fons following the tip of the Syrtis Major and the Lex Fons at the tip of the following fork of the Meridiani Sinus, plus other delicate details). Saheki notes that his eye was not fatigued from observing at the time of his observation of the glare spot and that what was seen could not have been caused by effects in the Earth's atmosphere or

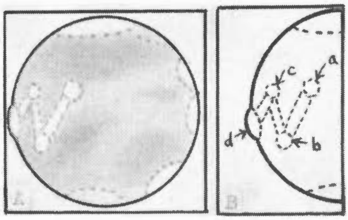


Figure 8.
A - Mars, June 3, 1954.
$8^h\ 28^m$, U.T. C.M. 139°.
Drawing made from a blue photograph taken with the Mt. Wilson 60" refl. showing the "W" shaped afternoon cloud formation.
B - Indentification of the knobs at the intersections of the arms of the "W" on the Mt. Wilson photograph. See text.

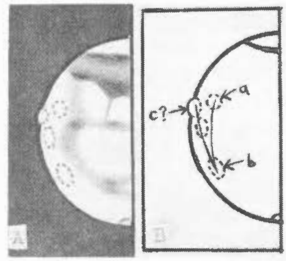


Figure 9.
A - Mars (preceding hemisphere), June 3, 1954.
$10^h\ 10^m$, U.T. C.M. 164°.
Lowell Observatory 24" refr. at 12" aperture.
210X, 310X and 540X.
Showing the knobs of the afternoon "W" shaped cloud as seen visually by D.P. Avigliano later on the same night as Figure 8. Note the foreshorting of the "W" shaped clouds in Figure 9A, due to the planet's rotation.
B - Identification of the knobs on Avigliano's drawing using the same lettering as in Figure 8B. See text.

effects in the eye itself such as Muscae Volantes (flying flies). For more details on these glare spots see the article, "Martian Phenomena Suggesting Volcanic Activity" by Saheki in the February, 1955 issue of Sky and Telescope, pp. 144-146. This observation by Saheki shows excellently what is possible for an experienced observer of Mars to achieve through persistent effort in the study of the planet. The area of Edom Promontorium has been seen as very white on many occasions in the past, but to this Recorder's knowledge such a sudden increase and decrease in brightness in this area as seen by Saheki is indeed unique.

Another somewhat unusual bright area that was seen in 1954 (not of such an inexplicable nature, however, as Saheki's glare spot recorded above) was an area that persisted for several days seen in the latter part of July, 1954. It was observed as a roundish, brighter spot between the two canals, the Nilokeras I and the Nilokeras II. The following observers reported this area on the dates noted (U.T. dates):
July 17, 1954. Seen as a bright spot near C.M. (Bohannon).
July 19, 1954. Seen as a lighter yellow spot, near C.M. (Avigliano).
July 20, 1954. Seen as a brighter yellow spot well on disc.(Avigliano).
See drawing number 3 on the full page of Avigliano's drawings which appeared on page 41 of the March-April, 1955 issue of The Strolling Astronomer.
July 24, 1954. Seen as a lighter yellow spot near limb. (Saheki).
See drawing number 4 on the full page of Saheki's drawings which appeared on page 81 of the July-August, 1955 issue of The Strolling Astronomer.

As most of the observers recorded this spot as yellowish in tint it most probably was either an unusually prominent yellow cloud or a much brighter desert region. This spot was not seen at other presentations of this general area both before and after the dates noted.

Unusual Clouds. Most unusual was the persistence of afternoon clouds over the general area of the Candor-Tharsis regions. Afternoon cloud action over this area was recorded by our observers at the presentations of this side of the Martian disc from early April, 1954 to early October, 1954. How much longer than this five month period cloud action was present cannot be ascertained due to the lack of earlier and later reports. A feature of this cloud area was the unusual configuration of these clouds during the Martian afternoons, the clouds forming roughly the shape of a "W" with brighter knobs at, at least, three of the intersections of the strokes of the "W". For more details on these "W" shaped clouds see the article, "New Findings About Mars", by William M. Sinton in the July, 1955 issue of Sky and Telescope, pp. 360-363. While the entire arms of the "W" were visible in blue light photographs the brighter knobs were easily visible to the eye. Figure 8 shows the location of these knobs and arms of the "W" on a drawing made from a Mt. Wilson blue photograph (taken with the 60" reflector). Figure 9 shows the preceding hemisphere of Mars as seen by Avigliano later on the same night on which the Mt. Wilson photograph (Figure 8) was taken, showing these knobs as they were nearing the terminator of Mars (see also the drawing and report by Avigliano on page 83 of the July-August, 1954 issue of The Strolling Astronomer). Your Recorder wishes to express his thanks to Dr. Robert S. Richardson of the Mt. Wilson Observatory for allowing the photograph (Figure 8A) to be copied and also for his other valuable help concerning the 1954 apparition of Mars.

ON THE OBSERVED APPEARANCE OF A REMARKABLE LIGHT SPOT ON THE NIGHT SIDE OF VENUS

by Richard M. Baum

In his valued reports on the activities of the Venus Section, Dr. James C. Bartlett, Jr. has from time to time had occasion to refer to a most peculiar phenomenon of the planet - the "star-spots", minute stellar-like brilliants flashing white in contrast to their duller surrounds. Though attention has only quite recently been centered on these objects, they are not in any way "new" to astronomy. Some 150 years ago the famous German planetary and lunar worker J. H. Schroeter observed them, in one particular instance of celebrity interpreting what he saw as a 25-mile high mountain! Towards the end of the nineteenth century the eminent French astronomer, E. L. Trouvelot, frequently saw them, especially depicting them in great numbers around and within the north and south polar zones. From his valuable memoir on Venus, published in 1892, we gather that he regarded these curious features as the snow-capped summits of lofty peaks protruding up through the dense cloud layers of the planet's atmosphere. Early in the present century another distinguished observer, E. E. Barnard, not only recorded them, but subscribed to Trouvelot's hypothesis and as a consequence attempted to employ the "star-spots" as a means to determine the planet's controversial period of rotation. Needless to say he did not succeed. More recently Dr. Bartlett, Jr. has given the matter some thought and together with T. A. Cragg, another leading observer of the planet, seems inclined to follow both Trouvelot and Barnard in interpreting the manifestations. Over the period 1947-1954 I myself was able to see them. According to the late H. McEwen, the venerable British authority on Venus, all the so-called classic observers reported, at one time or another, having seen these "star-spots".

However it is not the object of this note to discuss the nature of the "star-spots", but rather to introduce them in order to differentiate their appearance from that of a most remarkable spot which I saw in March 1953, which at first sight seemed very similar to the accepted and known spots, but which upon reflection could not despite this facade be associated in any way with the "star-spots". This fact will emerge from a brief discussion of the general whereabouts of the latter, as we shall presently see.

Though there does seem to be a certain amount of individuality about the behaviour of each observed star-spot - some remaining as hard steely points of light, others which appear to scintillate, and yet others that exhibit strong spectral effects - all have one property in common, all have been seen on the illuminated side of the planet. When, however, they have been noted off the sunlit side they have always been seen a little way inside the terminator, on the night side. They have never been seen off the disk of the planet. From these basic facts it would appear that (a) these spots rely on the sun for their visibility, i.e. they are not artificial as some have been pleased to announce, (b) are the astronomical result of some comparatively rare phenomena of the apparent surface, and as a consequence (c) may be either towering cloud masses, which would seem to be the case with those noted off the terminator, or reflections from some cloud-bank so placed with respect to the sun as to reflect the incident light in the observed manner.

Though this explanation would seem to account for the star-spots as such, it does not do the same for the observation now to be related. Consequently I conclude that the nature of this unique feature is hidden entirely in the general ignorance that characterises our knowledge of Venus.

The observation under review was made in 1953 on March the 17th., at 19^h, and continued until $19^h\ 40^m$, U.T. Seeing conditions at the time were estimated to be 4 (scale of 10). Two instruments were used, a 6.5-inch reflector (f/7.4), 216X, and a fine 3-inch refractor by Cooke (f/12), 120X.

Due to overcast skies it had not been possible to commence observations earlier than 19^h, so that when the cloud thinned and cleared it was to reveal a rapidly darkening sky, a condition not conducive to accurate observations of Venus, through reason of the overpowering glare from the planet. However within the hour haze began to form and with this acting as filter it was possible to make an observation and even to attempt a drawing. Happily seeing conditions which before had been classed as 0.5 rose to 4. Apart from some irregularities along the southern limb the most interesting part of this observation was the visibility of the dark side - a manifestation of that most curious phenomenon, the "ashen light".

On this occasion the dark side was seen to be brighter than the sky, as is the case when the planet is projected against a dark field, and to be veritably glowing with a strong phosphorescent glow of a deep ruddy hue. Upon closer inspection the whole of the dark hemisphere was found to be not uniform in hue but actually mottled over with minute nebulous granules. These were seen better by averted vision.

It was whilst studying this strange structure, that my attention was deflected by what appeared to be a speck of light of about the 8th magnitude situated in the southwest quadrant of the disk, i.e., in the southern part of the dark regions. The position angle of this feature measured round from the north point through west (in this case the right hand limb, taking west as right and the bottom as north, as with the Earth) was 171°. Its estimated distance from the terminator taken in angular measure from the drawing made was about 49°, where the disk is imagined flat. Nothing certain was seen by looking directly at the spot but by averted vision it was seen with certainty - additionally I could not be sure but that it was scintillating, which could have been pure fancy though.

Thinking that/the object was due to an optical fault in the reflector, which was the instrument in use at the time, I switched over to the aforementioned refractor. A much sharper image was obtained and the dark side shone out with greater clarity. The fine mottling was also more distinctly perceived. Above all however out shone the stellar speck. Thus having satisfied myself of its objectivity, I at once returned to the reflector and continued to observe until $19^h\ 40^m$, after which time the planet could no longer be followed, owing to an irregular skyline - trees and distant hills. At any rate it is doubtful whether anything further could have been done, seeing was dropping and there was a good deal of interference from mist along the horizon.

From the time observations commenced and the spot was noted, no observable change took place in it, either in its light or in its position. Owing to the fact of the planet's descent into the horizon mist bank the spot did undergo a fading, but this was not inherent as it was shared by the disk as a whole.

Quite naturally this strange experience enthralled me, and upon the next fine occasion I again looked for the mysterious speck, but to no avail. Later searches and a thorough combing through of my Venus books have revealed that this spot record stands as a unique observation.

Unfortunately the most critical part of this study stands as unconfirmed. As for the visibility of the dark side, its reddish tint, and the fine mottling, complete accord has been found with an observation made at the same time as I was observing by an independent worker two hundred miles or so away. For on this same evening at the same hour as I was so engaged, Mr. M.B.B. Heath, F.R.A.S., using his fine $10\frac{1}{4}$-inch reflector was similarly so. He described exactly the same appearance as confronted me, a notable point in view of the wide difference of instruments used and also the accepted difficulty of the subject, but failed to detect even the slightest trace of the light speck. In later correspondence Heath considered that differences in our respective seeing conditions at the time could have accounted for this, also the fact that he did not continue to observe after 19^h, U.T.

To attempt an explanation of this report is to me fruitless; we know too little about the cytherean problem as a whole to consider an insignificant observation as this essentially is. Hence, apart from making one point I will go no further. The object's great distance from the terminator obviously precludes its having been sunlit, unless of course it was situated away from Venus out of the planet's shadow, and so placed in the line of vision as to appear in the observed position. If not illuminated by the sun and if a surface phenomenon, what then?

BANDED CRATERS

by Brian Warner

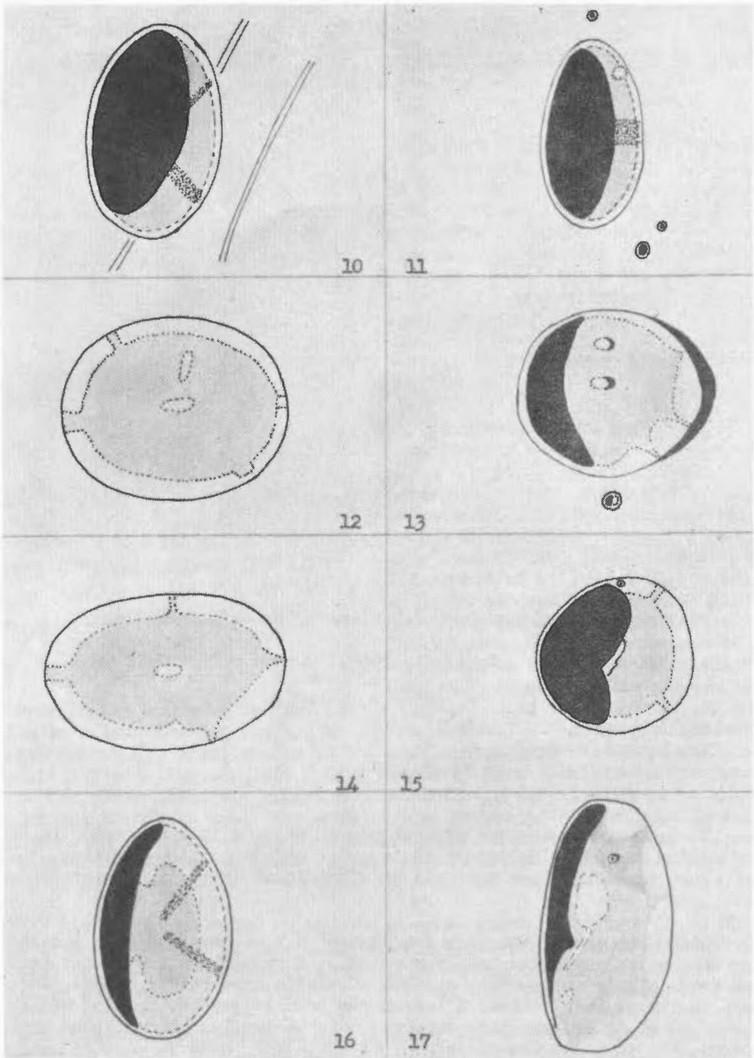
The Aristarchus bands have long been a source of interest to lunar observers, but until fairly recently few other banded craters were known. The Aristarchus bands need no comment for they are obvious in any instrument over 3 inches in aperture and have been adequately dealt with elsewhere. The smaller banded craters, however, are a means by which any observer with a moderate sized telescope can obtain satisfaction. Apart from the delicate appearance of some of the radial bands, there is a very strong chance of discovering more banded craters.

The writer intends to give here the results of some observations of banded craters and to suggest further results that may be obtained with future careful observation. It should be noted here, however, that although several of the banded craters are visible in fair conditions of seeing, many need very good visibility to detect the bands in them, and perfect seeing to arrive at the true shape and position of the bands. To give a list of craters with bands visible in a 3 inch telescope would be a waste of space, for obviously acuity of vision accounts for some bands being seen and others not. The most prominent bands are those in Aristarchus, Birt, Conon, Moore, and Pytheas. The accompanying drawings (Figures 10-23) give some idea of what to look for when observing lunar banded craters. It will at once be noticed that there are several types of bands; those in Moore, Birt, and Darney being similar, and those in Eimmart, Conon, Thaetetus, and Pytheas also being alike. For a comprehensive list of banded craters and their types, reference should be made to Abineri and Lenham's catalogue (1).

In the smaller craters the bands are often merely irregular shapes of the floors, e.g. Guttemberg A. This deformity is only visible under high light, but the true bands, e.g. Moore, are visible under almost any lighting. Some craters even exhibit both types of bands, one of the drawings of Moore shows this, and Giner is also similar in this respect. In several craters, especially of the Moore and Birt type, apparent changes are seen as the angle of illumination increases. This is generally shown by a broadening of the bands, or even a darkening of the bands, the latter probably being due to contrast with the brighter surrounds.

Any good photograph taken under high light will show several banded craters, and from these and visual studies it is found that nearly all the regions of the Moon contain a few banded craters, though one or two places do seem to be rather bare of them.

There is ample opportunity for the possessor of a moderate instrument to contribute information of great value to the selenographical world. In a good evening's work it is possible to find several completely "new" banded craters. Eimmart, Giner, and Damoiseau E are "new" in this respect, and need confirmation. The bands

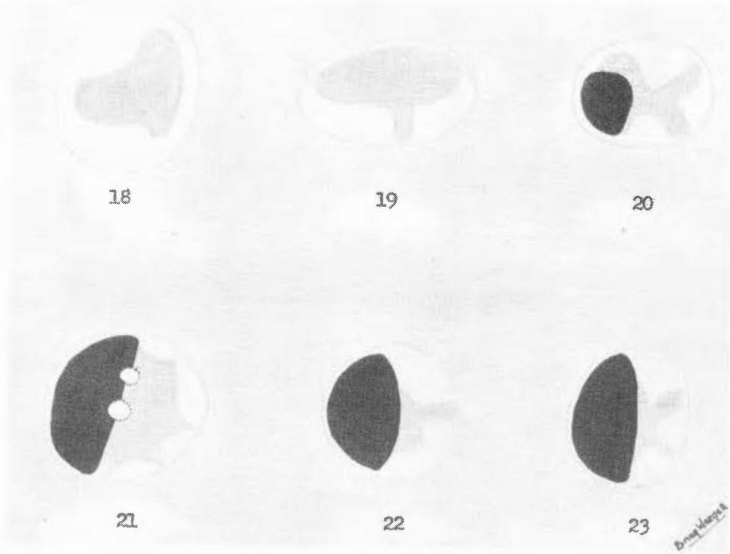


Drawings of Lunar Banded Craters by Brian Warner

Figure 10. Moore. March 22, 1956, $20^h\ 40^m$, U.T. 7" refl. 230X:Col.40°.5.
Figure 11. Damoiseau E. March 24,1956, $21^h\ 45^m$, U.T. 7" refl. 230X:Col.65°.3.
Figure 12. Menelaus. March 22, 1956, $20^h\ 15^m$, U.T. 7" refl. 230X: Col. 40°.2.
Figure 13. Pytheas. March 22, 1956, $20^h\ 30^m$,U.T. 7" refl. 230X: Col. 40°.3.
Figure 14. Thaetetus. March 24, 1956, $21^h\ 55^m$,U.T. 7" refl. 230X: Col. 65°.4.
Figure 15. Conon. February 19, 1956, $20^h\ 30^m$,U.T. 12½" refl. 350X:Col.10°.7.
Figure 16. Moore. March 24, 1956, $21^h\ 35^m$,U.T. 7" refl. 230X: Col. 65°.2.
Figure 17. Eimmart. April 15, 1956, $20^h\ 05^m$,U.T. 12½" refl. 350X: Col. 332°.7.

in Eimmart are very conspicuous on some photographs, even though they are fainter than the average bands.

So far very few observations of banded craters under evening lighting have been



Drawings of Lunar Banded Craters by Brian Warner

Figure 18.	Guttemberg A.	April 21, 1956.	7-inch refl.	230X.
Figure 19.	Giner.	" " "	" " "	"
Figure 20.	Birt.	" " "	" " "	"
Figure 21.	Pytheas.	" " "	" " "	"
Figure 22.	Lenham.	" " "	" " "	"
Figure 23.	Darney.	" " "	" " "	"

obtained. It is required to know whether the appearance in each crater is the same under medium evening lighting as it is under medium morning lighting. The results of these investigations may well be significant in the interpretation of the bands.

Banded craters are one of the very few phenomena that have got even the leading lunar observers utterly and completely puzzled. A vegetation theory has been tendered, but seems highly improbable; systems of clefts have been proposed, but this again seems unlikely; even optical illusion has been suggested, but the writer would be one of the first to condemn this theory. Due to the fact that banded craters are so common, the cause of the bands MUST BE EXPLAINED, even if only to keep up the morale of lunar observers. If sufficient observations are made under suitable differences of lighting, each individual observer should be able to form a theory of his own, from which the complete explanation may be compounded.

The writer only hopes that this paper will cause enough interest at least to begin a mass attack on banded craters, if not entirely to clear up the problem.

The writer would like to point out the large mountain mass to the south of the central peak in Pytheas, which is not shown on a number of drawings that he has inspected, nor is it shown on Wilkins' chart. It is very conspicuous visually and on photographs.

References:

(1) J.B.A.A., Vol. 65, No. 4, pg. 160, 1955.

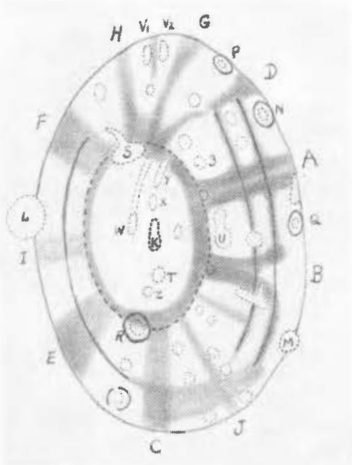


CHART OF ARISTARCHUS BASED ON 75 DRAWINGS BY E. J. REESE WITH 6-IN. REFLECTOR, 1946-1956.

Figure 24.

ARISTARCHUS FROM SUNRISE TO SUNSET

by Elmer J. Reese

The sun begins to rise over Aristarchus near colongitude 47°. By 52° the shadow of the west wall has receded down the inner east wall revealing hill U and the small but brilliant peak 3 which forms a tiny dent in the edge of the shadow. The interior shadow of craterlet N is fairly easy to see from sunrise to about 60°, and again from 185° until 200°. (The reader should refer to Figure 24 to identify the objects in Aristarchus mentioned in this article.)

The shadow of the west wall of Aristarchus reaches the eastern edge of the floor at 54°. At 55° the central peak K glitters like a star in the shadow as it catches the first rays of the rising sun. Detail on the floor is best seen near 59° when most of the floor is free of shadow. The summit of hill S is just coming into sunlight and sending its long pointed shadow along the foot of the southeast wall. The place occupied by this shadow later turns out to be the very dark base of wall band D. (When studying lunar features, it is by no means a rarity to find that a high-sun dark area conforms in shape and position to a long-lasting sunrise or sunset shadow.) The very brilliant central peak with its sharp, black shadow is the most conspicuous object on the floor. Low rounded hill T with its smaller, softer shadow is also a fairly easy object to observe. The other hills and ridges on the floor are very low; however all these hills, except W and the small one east of the central peak, are usually visible as bright spots during most of the lunar day. The relative brightness of some of these high-sun bright spots seems to vary from lunation to lunation (see Table I at end of this article.)

Hill S has a curious ridge or appendage curving southward from it. This ridge is well seen near 66°. At this time the top of a terrace about halfway up the inner west wall of Aristarchus is gleaming in sunlight while the rest of the wall is still in shadow.

As the afternoon progresses in Aristarchus, the east wall loses the brilliancy that characterized it from early morning through early afternoon. By 170° it is noticeably duller. The illumination begins to diminish rapidly near 185°, and by 214° the sunset shadow has spread over all of the east wall except for the top of a terrace a little below the northeast rim. The shadow then spreads westward across the floor leaving only the west inner wall in sunlight by 220°. A fairly large but shallow craterlet R has been repeatedly seen at the north edge of the floor from 190° to 214°. In some lunations craterlet R is clearly seen but not hill T, while in other lunations T is clearly seen but not R. The two have never been clearly seen simultaneously.

The central peak is regarded as the most reflective object on the visible surface of the moon. It is invariably a conspicuous object from sunrise until 150°. After 165°, however, it is occasionally quite difficult. This may be due in part to decreasing contrast with the brightening floor, and in part to the fact that the east slope of the peak is not well presented to the earth. The observed shape of the central peak is usually that of an ellipse elongated north and south by foreshortening. On rare occasions, however, the peak presents an unusual appearance. Thus on October 24, 1948 at 169° the peak appeared dim and diffuse with a circular outline.

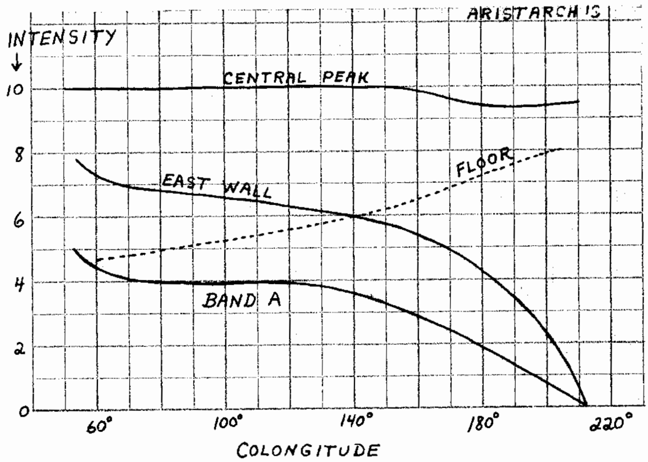


Figure 25.
Intensity-Curves of Features in Lunar Crater Aristarchus as Determined by Elmer J. Reese.
See Text.

On March 14, 1949 at 84° the peak presented a very irregular outline. Again on June 19, 1949 at 189° the peak was very dim being scarcely visible.

Wall bands A and B on the east inner wall are rather faint when the first rays of the rising sun fall upon them; however, they darken rapidly during the first several hours they are in sunlight. After 70° they change very little until a rapid darkening sets in near 130° and continues until sunset. Since the shape of the intensity curve for band A or B differs little from that for the bright sections of the east wall (see Figure 25), it seems probable that the changing intensity of the bands is merely a function of the angle of solar illumination. Generally, band A is the most conspicuous of the wall bands. A thin light streak is occasionally visible extending up the wall along the middle of this band. Band B is usually fully as dark as A; however, B rarely, if ever, reaches the crest of the wall. When best seen, B extends about two-thirds of the way up the wall and is noticeably forked or split at the top. A small but deep craterpit has been seen at the base of band A. A smaller pit has been glimpsed at the base of band B. Band D is remarkable in that it is usually faint or completely broken about halfway up the wall. Bands D and A are very nearly parallel.

As the sun rises higher above Aristarchus, the shadow on the west inner wall gradually shrinks until only two small patches of shadow remain in the upper portions of bands E and F. The unshaded lower portions of these bands are then light gray in tone. After the last traces of the true shadow lift near 78°, bands E and F may remain light gray until sunset. However, in some lunations a very dark triangular pseudo-shadow with its base on the rim of the crater soon develops in the position of each band and may persist until noon at 137°. This is difficult to understand and certainly requires further investigation.

TABLE I

INTENSITY ESTIMATES FOR SOME FEATURES IN ARISTARCHUS
See Figure 24 for identities of these objects.

Date	Colong.	K	T	Y	M	N	P
1949, Mar. 14	83°.8	10.0	6.0	5.7	8.0	8.0	8.0
1948, Nov. 16	86 .9	10.0	7.0	5.5	8.5	8.0	9.0
1947, Sep. 1	100. 5	10.0	6.0	-	8.0	8.0	8.0
1949, Oct. 8	102. 6	10.0	7.0	6.5	10.0	7.5	7.5
1948, Oct. 19	105. 4	10.0	6.0	6.0	8.0	7.5	7.5
1953, Aug. 26	108. 3	10.0	8.0!	8.0!	9.0	8.0	8.0
1949, Jan. 16	109. 1	10.0	6.0	5.8	10.0	7.0	7.5
1948, Nov. 18	111. 5	10.0	7.0	6.0	9.0	8.0	8.0

Date	Colong.	K	T	Y	M	N	P
1948,Sep.20	113.4	10.0	7.0	7.0	8.5	8.0	7.5
1948,Aug.22	119.6	10.0	8.0!	8.0!	9.0	8.0	8.0
1953,Feb. 2	126.7	10.0	8.0	7.0	9.0	8.0	8.0
1947,Dec. 1	129.0	10.0	7.0	6.5	9.0	8.0	8.0
1948,Aug.24	146.2	10.0	8.0	7.0	9.0	7.0	9.0

SATURN IN 1955

by Thomas A. Cragg

The nomenclature in this report is the same as that in previous ones unless the reverse is specifically stated. One may find it useful to refer to the last description and drawing showing the general nomenclature.[1]

The Recorder wishes to thank the following colleagues for their invaluable contributions rendering this report possible:

Mr. Leonard B. Abbey, Jr.
822 South McDonough Street, Decatur, Georgia. 6-inch refl.

Mr. Robert M. Adams,
324 South Valley, Neosho, Missouri. 10-inch refl.

Mr. William F. Barber, Jr.,
2080 Dunwoody Street, Atlanta, Georgia. 6-inch. refl.

Mr. Phillip W. Budine,
102 Trafford Road, Binghamton, New York. 3½-inch refl.

Mr. Thomas A. Cragg,
246 West Beach Avenue, Inglewood 3, California. 6-inch refr., 12-inch refr., and 12-inch refl.

Mr. Charles M. Cyrus,
1216 Leeds Terrace, Baltimore 27, Maryland. 10-inch refl.

Mr. Walter H. Haas,
1203 North Alameda Blvd., Las Cruces, New Mexico. 12½-inch refl., 6-inch refl.

Mr. Bill Hartmann,
1025 Manor Avenue, New Kensington, Pennsylvania. 2.4-inch refr.

Miss Cecelia Little,
1340 Eighteenth Street, Manhattan Beach, California. 6-inch refl.

Mr. David Meisel,
800 Eighth Street, Fairmont, West Virginia. 3-inch refr.

Mr. Patrick A. Moore,
Glencathara, Worsted Lane, East Grinstead, Sussex, England. 12½-inch refl.

Mr. Owen C. Ranck,
Box 161, Milton, Pennsylvania. 4-inch refr.

Mr. C. J. Smith,
9775 Burgos Avenue, Oakland 5, California. 6-inch refr., 20-inch refr.

Mr. J. Russell Smith,
Skyview Observatory, Eagle Pass, Texas. 16-inch refl.

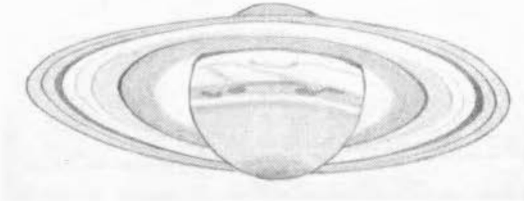


Figure 26. Saturn.
Thomas A. Cragg.
6-inch refractor, 300X.
July 21, 1955. 4^h 20^m, U.T.
Seeing fair, sky clear.

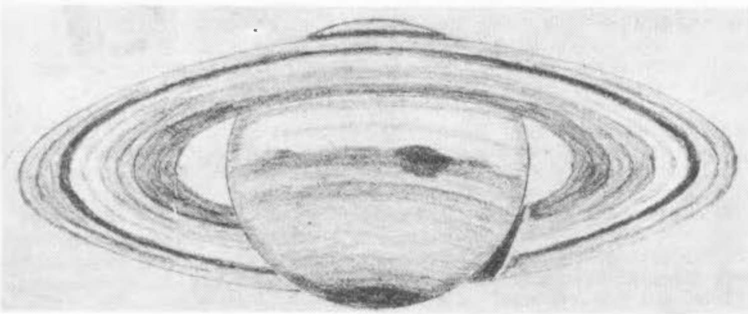


Figure 27. Saturn.
Chester J. Smith.
6-inch refractor.
June 5, 1955. 10^h 15^m, U.T.

Mr. J. Edward Westfall,
2513 Piedmont Ave., Berkeley 4, California. 4-inch refr.

Verbal Reports from:

Dr. James C. Bartlett, Jr.,
300 North Eutaw Street, Baltimore 1, Maryland. 5-inch refl. (?)

Mr. George Carroll,
7114 Summitrose Avenue, Tujunga, California. 6-inch refr.

Mr. Thomas R. Cave, Jr.,
261½ Roswell Avenue, Long Beach, California. 12½-inch refl.

BALL

Southern Portion of the Ball:

Such a small portion of the southern half of the ball was visible, little attention was paid it. Some apparently random variation in tone was shown on several drawings. Generally, it was a darker shade similar to the northern part of the ball near the NPR.

EZ:

In 1954 this region was frequently the brightest part of the whole Saturnian System, but the outer portion of Ring B was the brighter about half the time in 1955.

There seemed little or no general trend in either direction anytime during the apparition. Some bright elliptical clouds were seen, but very few compared to earlier apparitions. Mr. Ranck has continued to see many EZ festoons[2] in some case connecting to something hidden under the ring. The apparent steeper darkening of the limb effect in the EZ was again noted in 1955 by Cragg. There seems little physical evidence for such to be the case, probably an illusion of sorts. A yellowish-white was the color ascribed to this feature most of the time by Bartlett.

EB:

This usually elusive belt was observed on many occasions by at least five observers. The only details reported in the EB were occasional dark spots where a festoon joined or crossed the belt. These were observed chiefly by Ranck. Apparently this feature became a little easier after opposition (May 9) as it was reported rather frequently from May through August.

NEB:

Again this was far and above the most active feature on the ball. Generally, the belt was rather wide and split into two components. The southern component was almost invariably much the stronger; but Ranck frequently made them equal, and Budine made the northern component the stronger once. Ranck frequently saw both components rather narrow. Dark spots and a wavy southern edge were rather common features. Again, these features were so transitory for the most part as to defy identification with much certainty. Those few that were identified yielded periods near $10^h\ 15^m$ which is the accepted rate for that latitude. Westfall, Ranck, and Bartlett were chiefly responsible for these observations. As an example, a pair of observations by Westfall on May 19 and 28 showed humps on the south edge of the NEBs yielding a period of $10^h\ 15^m.0$ after the necessary corrections were applied. This one was cited since the extra decimal place is real.

Fine structure in the NEB was usually available when the proper observing conditions presented themselves. Such an example is Cragg's view of July 21 (Fig. 26). One may wish to compare this detail with the fine structure shown in Avigliano's drawings in the 1954 summary. Also, note the similarity of this with the NEB of Jupiter when far from opposition.

Gray and reddish-brown were the colors most often associated with the NEB. The reddish-brown is frequently very obvious in large telescopes when good conditions exist. The color determinations mentioned here were chiefly the efforts of Dr. Bartlett.

NTB:

Most of the contributors found this somewhat elusive feature, but did not agree very well as to its appearance. Budine and Ranck showed it rather narrow while Cragg, Cyrus, Little, and Smith show it wide and faint. Westfall shows it a medium width. An occasional wavy south edge and duplicity were observed by Ranck a few times. Ranck was also able to perceive some delicate festoons between the NTB and NEB three times! As evidence for the variability of intensity of this feature, Budine showed the western half almost as strong as the NEB and the eastern half barely visible on July 13.

NNTB:

This very delicate feature was reported only by Cragg and Ranck, but both disagreed badly as to how it appeared. Cragg saw it very faint and widish and Ranck saw it definite and narrow. On June 4 Ranck saw the NNTB stronger than the NTB.

NPR:

Most observers reported this dark region, but it is conspicuously absent on many of Ranck's drawings. Without question, this region was generally less dark than in 1954. This contrasts sharply with the SPR when seen under similar conditions.[3]

Bartlett reported a small bright cap at the pole several times. This was confirmed by W. H. Haas chiefly in the late part of the apparition. In fact one of the drawings by Haas shows a bright polar cap of rather large dimensions, even larger than the comparable cap observed in the south when that part of the ball was turned toward the earth.

ZONES (NTrZ and NTeZ):

It seems reasonable that there should be some semblance of a zone between two belts, if for no other reason than a contrast effect. Bartlett has studied the zones which may be described as a tropical and a temperate zone and has found some marked variation during the apparition. How much of this variation in the zones is due to opposite variation in the belts is an open question. This is a topic we have little information on which to base much of a premise.

RINGS

BICOLORED ASPECT:

In the last annual summary the illusionary nature of this effect was discussed. Now we have nearly irrefutable evidence that this effect is illusionary. Dr. Bartlett is to be heartily congratulated for his unrelenting efforts for a true scientific explanation of what is happening here.

The following is a quote from Bartlett:

"It is now almost certain that the bi-colored aspect of A is an illusion which seems to depend upon the angle through which the eye is turned at first observation, and upon which ring arm is first examined. The basic color of A appears to be a reddish-gray. Hence if the first impression received is red for one ring arm a complementary blue appears to follow when the eye is shifted to the other. It is easily seen by this hypothesis why the colors may appear to switch sides during the course of a single but intermittent observation.

"Less easily explained is apparent confirmation of the colors by filters; but this may be only a psychological anticipation rather than a physical reality. On going over my records of this phenomenon dating to 1941, i.e. for 14 years, it is found that the appearance is non-systematic, cannot be related to the rotation of the ring, and often is variable for a single observation; all of which overwhelmingly indicates an illusionary nature."

[Fully granting the great difficulties in finding a plausible physical explanation of the bicolored aspect, we may still do well to remember that this appearance has sometimes been very real to some observers. For example, F.E. Brinckman, Jr. and W. H. Haas independently agreed on its existence, using filters, on several dates in November, 1949. They sometimes looked first at the west ring-arm, sometimes at the east ring-arm. - Editor.]

Brightness Across Rings:

Haas regularly found Ring A to be slightly brighter outside of Encke's Division than inside of it, but Ring A was brightest of all in a narrow annulus at its inner edge. This annulus has been seen well by several different A. L. P. O. members, including Haas with an 18-inch refractor. Avigliano in 1954 found Ring A darker outside of Encke's than inside of this division.[3]

The outer portion of Ring B was always the brightest portion of the ring system, but it faded toward its inner parts in two distinct steps (generally at the positions of divisions 3 and 4). The inner third of B was often as faint as A.

Ring C (the Crape Ring) was seen crossing the ball by nearly all observers, but in the ansae by less. Apparently Ring C is a little more conspicuous at higher inclination angles since more observers are reporting it now than before.

Ring D was indicated by Carroll, Cave, Cragg, Little, Meisel, and possibly Ranck. It cannot be over-emphasized how easy this feature is to confuse with a "fast" seeing pattern. If larger numbers of observers report this feature, we are forced to one of three conclusions: Ring D is easier to see at high inclinations, more observers have acquired the necessary equipment or skill or both, or the "power of suggestion" is taking a tragic toll. We must not overlook the last conclusion since most of these recent articles have emphasized this feature. At present it is difficult to be absolutely sure of any of them!

DIVISIONS:

Refererence should be made to Figure 27, a drawing by C. J. Smith showing seven divisions! It follows that this was made under unusual conditions.

Casininni's was found by all contributors and was seen completely around the visible portion of the ring by most.

Encke's was also seen by nearly all the participants indicating it was certainly easier. Most agreed it was between 0.5 and 0.6 the way out on Ring A.

Nos. 3, 4, and 7 (see last year's summary for position of 7) were positively identified by Smith, Ranck, and Cragg on several occasions. Toward the end of the 1954 apparition Cragg felt 7 was more prominent than 3 or 4. Some confirmation of this existed in 1955 when Meisel saw 7 and not 3 or 4. This is in direct contrast to Haas, however, who saw all divisions except 6 and 7. Division 7 has been mapped by the Pic du Midi observers on several occasions and is also shown on Lowell's 1915 work.[4]

Divisions 5 and 6 were also observed by several persons in 1955. Division 5 (between Rings B and C) is quite evident to Cragg in good seeing; in fact on July 21 he saw it all the way around the visible part of the ring.

Mr. Walter H. Haas has suggested a very nice way of solving the confused numbering system of the ring divisions. It is based entirely on the position in the ring. For example, a division 0.7 the way out on Ring A would be called A7; if one were on the border between Rings A and D it would become A10 or D0. With this system the seven recognized divisions in the A.L.P.O. would be as follows: (old system first, new second).

Casinni's	B10 or A0	No. 5	C10 or B0
Encke's	A5 or A6	No. 6	C5
No. 3	B3	No. 7	B5
No. 4	B7		

Personally, the Recorder feels the new system is better than the old because of the ease of adding new ones without affecting the others. How do our readers feel? Let us hear.

SATELLITES:

Observations of the satellites were contributed by Bartlett, Moore, and Haas. Bartlett and Haas mentioned the satellites which were seen while Moore gave some magnitude estimates.

Bartlett saw Titan every time and Rhea and Iapetus nearly every time. Dione was seen three times; Enceladus, Tethys, and Hyperion were seen once. Indeed Hyperion was as bright as Iapetus on June 1 according to Bartlett!!

In Table I Moore's estimates are compared with those in the appendix of Volume I, "Astronomy", by Russell, Dugan, and Stewart. Since Saturn was only about one month from opposition when Moore made his estimates, the two groups should be reasonably comparable. Our most hearty congratulations are in order for Moore for such splendid agreement with no comparison stars for reference. Anyone not familiar with the difficulties of this kind of estimation has a rude shock awaiting him when he tries it. Comparison of this table and the one published in the 1953 general report[5] will convey the general differences one might expect between mean opposition and mean distance.

TABLE I

Satellite	Moore 1955, April 6	April 7	Russell, Dugan, and Stewart*
Mimas	11	11	12.1
Enceladus	11	12	11.6
Tethys	10.7	10.9	10.5
Dione	10.5	10.7	10.7
Rhea	9.6	9.4	10.0
Titan	8.0**	8.0**	8.3
Hyperion	12	12	13.0
Iapetus	10.5	10.5	10.1 to 11.9
Phoebe	-	-	14.5

*Stellar magnitudes at mean opposition.
** Assumed values.

References

1. "The Strolling Astronomer", Vol. 8, Nos. 3 & 4, p. 29.
2. "The Strolling Astronomer", Vol. 6, No. 11, Nov. 1, 1952, Fig. 3 on p. 158.
3. "The Strolling Astronomer", Vol. 9, Nos. 3 & 4, p. 28.
4. "Memoirs of the Lowell Observatory", I, No. II, 1915.
5. "The Strolling Astronomer", Vol. 7, No. 8, p. 117.

A PHOTO-VISUAL OBSERVATION OF AN IMPACT OF A LARGE METEORITE ON THE MOON

by Leon H. Stuart, F.A.C.R.

Some time ago the writer made a camera to fit over the eyepiece of an eight inch f/8 reflecting telescope for the special purpose of making pictures of small star fields. For the evening of 1953, November 15, four plates had been taken out of refrigeration for some pictures of the moon at First Quarter. These were to be test plates for focus. The first became light fogged by accident; the second showed only fair focus and the third was not much better. On removal of the fourth from the camera-back after approximately one-half second exposure (black cloth over tube end method) the moon image was seen on the ground-glass as after the exposure of the other plates. This time, however, a bright spot was noted near the terminator's mid-point and immediately test was made for integration with the moon image. Movement of the telescope caused the spot to move with the moon image with no change in relative position to near-by moon objects. When this was determined it was thought better to see if the bright spot were on the plate just exposed and, if not, to expose another as soon as possible. When immediate development showed that it was present, it was also realized that there were no more plates available.

The exposure was made at $2^h\ 0^m$ U.T., locus 95° 55' 42" W., 36° 11' N. and in the process of focussing no spot was seen. The total photographic-visual time was at first thought to be, roughly, less than thirty seconds but later re-enactment of the entire process of loading, exposing and unloading the camera and making tests averaged about eight seconds. Neither the beginning nor the end of the flare was seen for, on return to the telescope after development of the fourth plate (in ten minutes), no spot was to be seen.

Since this was the last plate out of refrigeration no further photography was done until the next day at $2^h\ 0^m$ U.T., just 24 hours after the time of exposure of the plate showing the spot. There was not sufficient detail on this plate to determine any change on the surface of the moon. The position of the spot is estimated as three-fourths of the distance from Schroeter to Pallas.

The general impression is that the phenomenon photographed and seen was that of the impact of a meteorite large enough to produce sufficient heat to cause incandes-

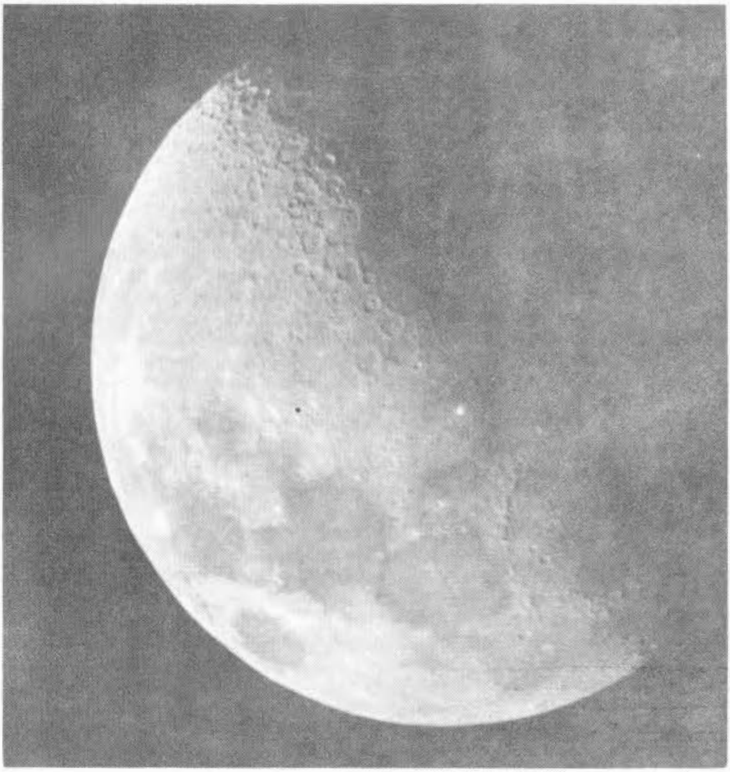


Figure 28. Photograph of Moon by Leon H. Stuart with 8-Inch Reflector on November 15, 1953 at $2^h\ 0^m$, U.T. Colongitude $14^\circ.6$. Note Brilliant Spot near Middle of Terminator. See Text.

-cence of involved meteorite-moon structures and being manifested as a short-lived flare. So far as is known to the writer, this is probably the first photo-visual observation of such an occurrence.

It was noted that the visualized spot did not appear as bright as that seen in the picture and a slight halo was noted in the negative that did not show visually. The plate used was Eastman Kodak Co. Spectroscopic 103aF3 which has a special sensitivity in the red part of the spectrum from 4500Å to 6800Å besides the ordinary sensitivity to shorter wave lengths.

Note by Editor. Dr. Stuart would be glad to hear from A. L. P. O. members about this remarkable visual-and-photographic observation. His address is 411 Medical Arts Bldg., Tulsa 19, Oklahoma.

MR. BRAUN'S PROPOSAL FOR QUANTITATING ESTIMATES OF TELESCOPIC "SEEING"

by Frank Vaughn

It is pleasing to see that some attempt is being made to develop a more exact method of specifying conditions under which an observation is made. Mr. Braun is to be congratulated for making an effort in this direction (The Strolling Astronomer, Nov.-Dec., 1955). Certain objections to the method occur to the writer; but lest these seem too strong, it should be borne in mind that no system is likely to be perfect, and that a start must be made somewhere if any improvement is to be achieved.

1. There are effectively two varieties of atmospheric inhomogeneities; those of long wavelength which cause motion in the larger portions of the image without seriously impairing the sharpness of its smaller parts, and those of short wavelength, which by continuously varying the focal length of many small regions of the objective or mirror, blur the image. Mr. Braun's method does not distinguish between these. It might improve matters to take into account the frequency of motion of the images, for with the shorter wavelength disturbances the oscillations would generally be more rapid. This does complicate the method, however, and it is moot whether or not this variation is practical.

2. The more important thing is not the "average" seeing over a period of time, but rather the best "seeing moments" during the observation, providing these are fairly frequent. Mr. Braun's method singles out the worst moments. Perhaps an estimate of the average dark space between the edges of the images would be more pertinent, though again an element lacking precision creeps in.

3. Reflecting telescopes, more than refracting, are subject to tube currents, of which any long-time user of the former is painfully aware. A very slight breeze, or a gentle forced draft, often improves images dramatically. The reflector generally works best when there is a slight but continuous movement of air through the tube, preventing layering and convection currents in the optical path. The placing of a "lid" on the tube, with two small holes in it, would be expected to disturb this circulation. A reasonable variation might consist in so mounting the mask that it is several inches away from the end of the tube, disturbing its normal functioning as little as possible.

The writer once tried recording seeing by a dual number, the first specifying the sharpness of the image, and the second its motion or degree of vibration. Thus S 6-2 denoted a fairly sharp image with considerable motion of its parts. This seemed an improvement over the usual methods, but obviously still lacks the precision Mr. Braun seeks.

Comment by William C. Braun. As I have had a preview of Mr. Vaughn's comments on my article "A Quantitative Method for Determining and Specifying Astronomical 'Seeing'", I am in position to add comments of my own in this issue. I must confess that I was premature in submitting my article, since further experiments on my part have convinced me of the unreliability of my suggested method, and this for the very reasons so aptly enumerated by Mr. Vaughn. I stand corrected.

MARS IN 1956

by Walter H. Haas

Foreword. This paper was presented, with some very minor differences, during the National Convention of the Astronomical League at Miami, Florida on July 2 - 5, 1956. It is realized that it is similar to Mr. Vaughn's excellent article "Mars - 1956"in our January-February, 1956 issue; but it is hoped that the very considerable current interest in Mars will justify the inclusion of another rather general and elementary article.

Let us inquire about the aspect of Mars during this present apparition of 1956. The angular diameter will increase to a maximum of 24".8 on September 7, when a power of only 75X will make Mars as large as the moon appears to the naked eye. Opposition comes three days later on September 10. The Red Planet will then recede from us, the diameter diminishing to 20" on October 13, 15" on November 8, and 10" on December 18, by which last-named date regular observations will not be profitable with ordinary-sized telescopes. During the latter half of 1956 the south pole will be tipped toward the earth by from 19 to 25 degrees. This tip will favor the visibility of the large southern maria, such as Mare Cimmerium; northern features, like Mare Acidalium, will be far from the center of the disc and will be difficult to observe. The vernal equinox of the southern hemisphere of Mars (and the autumnal equinox of the northern hemisphere) was reached on May 4, 1956. The summer solstice of the southern hemisphere (the winter solstice of the northern hemisphere) is scheduled for September 27. Thus the south polar cap is at present melting rapidly in its spring season and is surrounded by a very dark "melt-band". Several darkish rifts have been noted in the cap. In the coming months the south cap will decrease in size, and the "melt-band" will fade; as the cap shrinks, it may be found to be unequally bright in its different parts, and detached "snow-fields" may be left behind as small, brilliant spots. The north polar cap in its autumn season is small,rather dim, diffuse, and highly variable - in brief, composed of changing clouds and perhaps also of transient frost-areas. By October or November, however, the growing north surface cap may sometimes be brilliant on the north limb. Many observers of Mars have found the dark areas to grow darker and to change color in their spring season. The 1956 apparition is a favorable one at which to look for this effect in the southern hemisphere.

There are a few things which should be pointed out to the beginning student of Mars. Those of us who first learn of Mars through Lowell's detailed drawings and maps are apt to find the actual Mars dismayingly blank of features, especially in a small telescope on an ordinary night. The beginner should not be discouraged, however; for it is to be expected that one's first views of Mars should be undetailed ones. In some fashion the eye needs to be "trained" for planetary detail; with practice, and there is no substitute for practice, the observer will see and draw more and more detail, improving to an extent he would not have thought possible at first. Next, it is an unfortunate fact that our earth's atmosphere severely hampers our studies of the finer planetary detail. This atmosphere is more or less turbulent, and light waves are bent irregularly as they pass through it. Stars twinkle, delighting poets but not astronomers. Mars occasionally twinkles; but more often its disc merely shimmers badly, blurring and hiding the more delicate markings - the enigmatic canals and complex structure in the maria. There is no help for this poor seeing, as it is called; one can merely try to make the most of the more favorable nights or the more favorable moments on a poor night. Finally, we may wonder what size of telescope is required to study Mars. It is apt to be embarrassing to set limits on what minimum size is needed, for some talented and persevering amateurs have done very laudable work with extremely modest instrumental means. Usually, however, a 4-inch telescope would be almost the minimum; a 6-inch will supply good views of the coarser features; and a 12-inch will allow better views of colors,studies of fine detail on the more favorable nights, and useful photography of the planet. With even larger apertures opportunities are increased. I must confess myself completely out of accord with the widespread idea that in many locations small telescopes usually show more than large telescopes on the moon and the planets. There is no substitute for aperture; and until I have seen the terminator-shading of Saturn, the phase-cusps of Jupiter, and Jupiter II near the center of its primary as clearly in small telescopes as I did in an 18-inch refractor, I shall share Antoniadi's taste for large, unmasked apertures and shall ever be wanting a larger telescope. Nevertheless, much really good visual work on Mars has been done with apertures of 6 to 12 inches.

Every observation of Mars should have certain accompanying data if it is to be of value,as follows:

1. The name and address of the observer.
2. The telescope, aperture, whether a refractor or a reflector, maker if a professional instrument, etc.
3. The date, including the year, and the time to the nearest minute. One should also state what kind of time is used in giving the time and date (E.S.T., C.D.S.T., etc.) Beginners will probably be wise to use the local Standard or Daylight Saving Time, though the observations are reduced when analyzed to Universal Time, the local mean solar time at Greenwich.
4. The magnification used. As a rough guide, I would suggest for most work on Mars powers of 150X to 250X on a 6-inch telescope and powers of 250X to 400X on a 12-inch telescope.
5. The seeing or atmospheric steadiness on a scale of zero (hopeless) to ten

Figure 29. Mars.
C. Rex Bohannon.
July 14, 1956. $10^h\ 30^m$, U.T.
8.5-inch refr. 300X, 450X.
Seeing fair. C.M. = 267°.

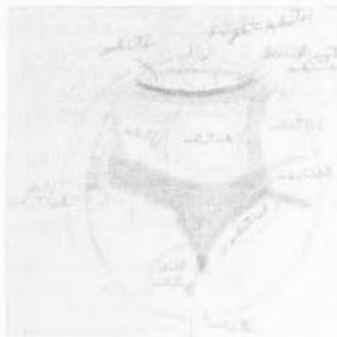


Figure 30. Mars.
Walter H. Haas.
July 15, 1956. $11^h\ 55^m$, U.T.
12.5-inch refl. 367X.
Seeing rather poor. C.M. = 278°.

(perfect).
6. The transparency or atmospheric clearness on a scale of zero (worst) to five (extremely clear).
7. Any additional information helpful in evaluating the observation, such as breaks caused by passing clouds, color filters employed, etc.

Drawings of Mars have long been a classic method of studying the Red Planet. They are still of some value and are suited to the amateur observer. The method is simply to make at the telescope a pencil sketch of the markings in their proper positions on the disc. It is an advantage to prepare outlines for drawing Mars before going to the telescope. Circular outlines may be used for several weeks on each side of opposition; at other times the phase can be drawn in with the help of columns P, Q, and q in the "Physical Observations of Mars" part of the Ephemeris. A good scale for drawing Mars is to set one second of arc equal to 2 mms. on the paper. Others prefer to make drawings of certain fixed diameters, say two inches near opposition and an inch or an inch and a half at other times. Because of the rotation of the planet, drawings must be made rather hurriedly; in 15 minutes Mars rotates through almost four degrees of longitude, and a longer sketching-time will give rather bad positional errors from this cause. The observer can, however, first sketch in the major features during the allotted 15 minutes or less and can then, over a longer time if necessary, locate the finer detail relative to these main markings. Pencils used for sketching should be soft enough to give a fair variety of shading, for there are many subtle tones and differences of intensity on Mars.

Estimates of color form perhaps the most subjective branch of planetary astronomy, but on Mars they possess a special interest because of seasonal changes in color of the dark areas - often interpreted as seasonal variations in some kind of hardy vegetational growth. Color filters may be helpful in establishing the reality of certain colors; e.g., a blue mare will look darker with a red filter, lighter with a blue filter. Of course, only standard commercial filters, such as the Wratten Filters employed by photographers, should be used. Perhaps, however, the objective determination of colors on Mars is too difficult a task; and we should instead concentrate upon detecting changes in color, seasonal or otherwise. Our observations must then be made under highly standardized conditions, with one telescope and one eyepiece and only on a clear and dark sky. It may also be best to make color estimates quickly, avoiding prolonged stares - for when we see red deserts and green maria, we should bear in mind that red and green are complimentary colors.

Some observers have found it profitable to use standard color filters regularly in their studies of Mars. Broadly speaking, a red or orange filter will show the surface markings more clearly, and a blue filter will enhance the visibility of cloud-areas, which are atmospheric. Thus filters may sometimes give a clue to the nature of what is being observed on Mars. When the north cap is a cloud-cap on the north limb during the coming months, for example, it will be much brighter with a blue filter than with other filters; but when it is composed of frost, it will, like the south cap, be about equally prominent with all filters.

Intensity-estimates of the brightness or darkness of the different Martian features are another method of study. These intensities are given on a numerical scale, for example on one where zero is used for the dark sky near Mars and ten is used for the south cap when at maximum brilliance. It may be objected that the south cap is of variable brightness so that our ten is not really fixed. It may also be objected that the eye is easily deceived in such intensity-estimates. Thus we may see Jupiter IV or Callisto shining brightly enough on the sky near its primary and obviously much brighter than the dusky Jovian polar regions - but it will turn as black as shadow when it transits those same polar regions! Even so, such an eminent authority on Mars as Dr. G. de Vaucouleurs thinks that the serious amateur can make a worthwhile contribution to our knowledge of Mars by means of careful intensity estimates, and discusses the whole subject at some length in his Physics of the Planet Mars. On the scale mentioned most of the large maria would be about three in intensity, and an ordinary white cloud would be about six. Such estimates can be made to give information about seasonal changes on Mars and about the diffusing effects of its atmosphere.

Planetary photography has been discussed at length elsewhere and will be passed over here, except that I should like to urge all suitably equipped readers to attempt photography of Mars while it is near opposition. A 10-inch telescope is about the minimum size for useful results.

So far I have dealt in generalities. It appears well now to give some attention to certain special projects. Those which will be mentioned are only a few of those which are possible.

Precise measurements of the size of the melting south polar cap may give us certain desired information about such matters as the thickness of the cap. The size of the cap can even with practice be estimated visually with some accuracy; for example, it might be found on a given date to have a diameter one-fifth of the diameter of Mars. This cap may also be measured on either drawings or photographs. Perhaps the best method of all is to measure the position of its edge with a filar micrometer. Measurements should be made every two or three days to obtain a complete picture of the melting. Past studies of this kind have indicated that the melting of the cap is more rapid in some Martian years than in others. The planet apparently has warmer and colder years, just like our earth.

Little is yet known of the motions of Martian clouds over the surface of the planet. Serious amameurs may be able to contribute something here. What is needed, of course, are accurate determinations of the latitude and longitude of a cloud on two different dates, preferably on two successive dates. Perhaps these latitudes and longitudes are most accurately obtained when a cloud projects slightly on the limb or the terminator - and it is often no easy matter to decide whether such projections are real or optical. He who sees such a cloud-projection should make every effort to reobserve it on the next date, that is, one rotation of Mars or about 24 hrs. and 37 mins. later; and he should also notify immediately other observers of the planet. Through such careful studies of cloud-motions of Mars we may hope to learn more about the atmospheric circulation on the planet. (Interested readers might like to participate in the Lowell Observatory program on the clouds of Mars. See "Postscript").

Central meridian transits of features on Mars may be observed in order to obtain accurate determinations of their longitudes. The method is simply to time to the nearest minute when a marking crosses the central meridian of longitude, the one passing through the center of the disc regarded as circular. For this purpose Mars may be oriented now by means of the south polar cap. The longitude is computed from the time of transit with the help of The American Ephemeris and Nautical Almanac. The method has shown itself surprisingly accurate on Jupiter; the eye is rather good at telling when a spot is equally distant from the two opposite limbs. On Mars the phase usually introduces a serious complication, and transits can only be advantageously observed within a few weeks of opposition. One obvious application of such Martian longitudes over a period of years is to evaluate possible very small correc-

-tions to the adopted period of rotation, a subject in which Dr. Joseph Ashbrook has recently been interested.

One mystery of Mars which will certainly receive close attention this year is the "blue clearing". As is well known, the atmosphere of Mars is usually capable of scattering an amazing amount of short-wave light so that blue and violet photographs show chiefly atmospheric features, the surface markings being indistinct. Yet sometimes there is a remarkable temporary clearing in the atmosphere of Mars for a few days , and then blue photographs show the maria and other surface markings almost as well as red or yellow photographs. Prior to the 1954 apparition this "blue clearing"had been recorded only within a few days of an opposition, and it was conjectured that some of the solar radiation reaching Mars was somehow influenced by the earth when the three bodies were nearly in line. In 1954, however, a partial "blue clearing" was observed over a period of some weeks. This intriguing phenomenon has to date been studied on photographs, but perhaps some enterprising amateur who would thoroughly familiarize himself with the aspect of Mars through blue or violet color filters could watch the effect visually.

We shall certainly want to look for the new dark marking which developed in 1954 near longitude 245°, latitude 20° north. An area previously always found to be desert and almost as large as the state of Texas darkened and looked exactly like one of the permanent dark areas. There is a splendid discussion of this marking by Mr. Tsuneo Saheki in Sky and Telescope for August, 1956, pp. 442-443.

We shall follow with great interest experiments with the image orthicon tube for photographing Mars. This device was employed in 1954 on the 42-inch reflector and 24-inch refractor of the Lowell Observatory. The telescopic image was focussed on the photocathode of the image orthicon, and photographs were made of the intensified image on the kinescope screen. The experimental 1954 photographs made in this way did not surpass conventional ones but were still extremely encouraging. Our conventional photographs are primarily limited in the fine detail which they can record by the "seeing" conditions in the earth's atmosphere. It has been found that in one second of time a point image will wander more than one second of arc, and with a 1-second exposure the integrated image on the photographic plate cannot contain the finest details seen visually. With the help of the lumicon, as it is often called, it is hoped to reduce the necessary exposure-time to much less then one-fifteenth of a second of time with correspondingly improved definition. Perhaps we shall at last have clear photographic evidence on the aspect of the long-disputed canals.

Postscript. We have just received from the International Mars Committee of the Lowell Observatory a special invitation to study cloud-motions on Mars. Under date of August 6, 1956, Dr. Albert G. Wilson has written us in part as follows:

"We would like each of the participating observers to examine the planet carefully each observing night during 1956. When any obscuration of the normal surface features is observed, the position, shape and color of the obscuration should be recorded. We have prepared simplified maps of Mars upon which the record may be kept. Space is provided at the bottom of the map for essential data relating to the observation. It is important that all the data called for should be entered. An observer also may and should keep his customary observing record. Thus it will be possible to gather the maps in one central place for study without depriving anyone of his observing record.

"If you wish to participate in this program, please write to:
Dr. Seymour L. Hess, Lowell Observatory, Flagstaff, Arizona who will act as coordinator for the program. He will send you a supply of maps and will compile and study the results when the observing season is over. In this entire program due credit will be given to all participants, and the results of the study will be sent to all the observers.

"This represents an opportunity for each of us, working together, to contribute far more to the solution of a significant Martian problem than any of us could do working alone. We sincerely hope that you will be able to participate."

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