The Strolling Astronomer

ASSOCIATION OF LUNAR AND PLANETARY OBSERVERS

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In This Issue

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THE

STROLLING ASTRONOMER

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NOTICE: In order to facilitate the reproduction of drawings in future issues readers are requested to exaggerate contrasts on drawings submitted. Extremely faint marks cannot be reproduced. Outlines of planetary discs should be made dark and distinct. It is not feasible to reproduce drawings made in colors. Following these precepts will permit better reproductions.

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ACKNOWLEDGMENT. Our deep thanks go to Mr. Albert Ingalls and Scientific American magazine for their kind mention of The Strolling Astronomer and the A.L.P.O. in their May, 1953 issue. In his "The Amateur Scientist" Mr. Ingalls describes Mr. Elmer Reese's study of long-lasting features in the South Temperate Zone of Jupiter, Mr. Reese's very praiseworthy results having been reported in The Strolling Astronomer for March, 1952. We are glad to have a project of such interest and importance brought to the attention of a much larger reading public through the pages of Scientific American and appreciate Mr. Ingalls' kind assistance.

PERSONAL. The Editor will have left Las Cruces near the middle of May and will not return until late in June. It will be completely impractical for him to answer correspondence during this period; matters demanding prompt attention should be addressed to Mr. David P. Barcroft, Secretary A.L.P.O., 1203 North Alameda, Las Cruces, New Mexico. The customary renewal notices for expiring subscriptions will not go out with the May issue but will accompany the later June issue.

SUGGESTED RADIO COMMUNICATION AMONG OBSERVING AMATEURS. On pg. 30 of our March, 1953 issue we spoke of the need for rapid communications among our active observers. This need was underscored again when C. C. Post and C. W. Tombaugh in Las Cruces on April 1, 1953 near 6:45 P.M., M.S.T. made what may be an extremely unusual and valuable observation of the dark hemisphere of Venus. Though like the surrounding twilight sky without a color filter, the dark hemisphere with a red filter was definitely brighter than the sky; and the two observers suggest that a red auroral illumination of the upper Venusian atmosphere is the cause. On the evening of April 2 (M.S.T. date) the effect was no longer visible. Was it, then, of very brief duration, perhaps lasting only some hours? Exactly when did it begin and end? Is there any possibility of relating this phenomenon to unusual solar activity? Assuming that the brightening of the dark hemisphere could be seen best against a twilight sky, as is very likely, then the desired continuous records of this phenomenon could only have been secured by a chain of observers scattered in longitude around the whole world. We might have such records if Post and Tombaugh had been able immediately to notify observers on the West Coast of this country and if the important news had then been relayed to Rarotonga, to New Zealand and Australia, to Japan, and so on around the world ahead of the evening twilight advancing ever westward. As it is, whatever confirmatory and supplementary records may have been secured were secured only by the merest chance. Perhaps some forewarned amateur would even have been able to photograph the dark hemisphere as brighter than the sky-background!

With such ideas in mind we read with very great interest a letter from Dr. W. L. Minear, the Chief Surgeon at the Carrie Tingley Hospital at Hot Springs, New Mex. on April 22, 1953. Dr. Minear says in part: "I suggest that the members of the Association of Lunar and Planetary Observers in each town invite to associate membership an active radio amateur (ham) with a transmitter. In this way, the information regarding observations could be immediately disseminated to all parts of the country. Also, one could have a short-wave astronomical symposium, to the benefit of all. With such a system, your symposium on the Limits of Telescopic Resolution could have been carried on in a single evening instead of taking two years." (The development of the ideas presented would actually have taken more than a single evening; but still the saving in time could have been very considerable.) C.W.O. Robert N. Rader, Box 35, 93rd A. and E. Maintenance Squadron, Castle A.F.B., Calif. has also suggested that we use amateur radio enthusiasts to achieve rapid communication. We should be glad to hear more from our members on this subject. It would appear that each active observer would need to have one associated radio "ham" in his neighborhood and at least one alternate since the first man might be unavailable when an important and unforeseen solar system event occurred. A complete file of observers and their radio contacts would have to be kept somewhere, perhaps at the A.L.P.O. general headquarters in Las Cruces. The complete cooperation of the different Section Recorders would be necessary to the success of the plan. After we have heard from some of our readers, we might write the Amateur Radio Relay League, outlining the problem and requesting their assistance.

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CONCERNING THE PALOMAR LUNAR AND PLANETARY PHOTOGRAPHS

By this time many of our readers must have seen at least some of the set of lunar and planetary photographs taken with the 200-inch Hale Telescope and sold by the California Institute of Technology Bookstore. Information on how to obtain this attractive set was given on pg. 1 of our January, 1953 issue. Since popular interest in the work of the 200-inch is very high, we have also given thought to reproducing this series of photographs in The Strolling Astronomer. Photograph SP-14, showing the Clavius region of the moon under evening solar lighting, appears on the back inside cover of this issue. Whether we shall reproduce all the remaining photographs in the series will depend upon costs and reader interest. If you want to see them in this periodical, we shall do our best to give you this service.

It is most unfortunate from the point of view of the serious lunarian and planetarian that these published photographs lack dates and times. Mr. Lyle T. Johnson wrote for this information, which was kindly furnished by Miss Alice Beach. Mr. Johnson also computed the pertinent colongitudes and central meridians. With the permission of the California Institute of Technology we give dates, times, and physical data below. Those who have a set of the Palomar photographs may wish to copy these items.

SP-14. Moon. Pacific Standard Time 2:05 A.M. on October 3, 1950. Universal Time $10^h 5^m$ on October 3. Colongitude 173.°6.

SP-15. Moon. Pacific Standard Time 7:06 P.M. on October 9, 1951. Universal Time $3^h 6^m$ on October 10. Colongitude 25.°3.

SP-16. Mars. Red photo on April 22, 1952 at 12:01 A.M. by P.S.T. or at $8^h 1^m$ on April 22 by U.T. Central meridian = 15°. Blue photo at 12:40 A.M. on April 22, 1952 by P.S.T. or at $8^h 40^m$ on April 22 by U.T. Central meridian = 25°.

SP-17. Mars. Left photo on May 10, 1952 at 11:46 P.M. by P.S.T. or at $7^h 46^m$ on May 11 by U.T. C.M. 205°. Right photo on May 19, 1952 at 10:01 P.M. by P.S.T. or at $6^h 1^m$ on May 20 by U.T. C.M. 100°.

SP-18. Jupiter. P.S.T. October 4, 1950, 8:36 P.M. U.T. October 5, $4^h 36^m$. Central meridian 193° in System I and 237° in System II.

SP-19. Jupiter. P.S.T. August 24, 1951, 4:18 A.M. U.T. August 24, $12^h 18^m$. C.M. 312° in System I and 49° in System II.

SP-20. Jupiter. P.S.T. September 24, 1951, 1:33 A.M. U.T. September 24, $9^h 33^m$. C.M. 70° by I and 291° by II.

SP-21. Jupiter. P.S.T. October 23, 1952, 11:41 P.M. U.T. October 24, $7^h 41^m$. C.M. 212° by I and 293° by II.

SP-22. Jupiter. P.S.T. October 23, 1952, 11:21 P.M. U.T. October 24, $7^h 21^m$. C.M. 200° in I and 281° in II.

SP-23. Saturn. P.S.T. May 22, 1952, 7:59 P.M. U.T. May 23, $3^h 59^m$.

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FOR THE BEGINNER: WHAT TO RECORD WITH EVERY LUNAR AND PLANETARY OBSERVATION.

In order that a lunar or planetary observation should have as much value as possible, it is necessary that certain accompanying information should be recorded with it. This remark applies both to drawings and to descriptive remarks. The omission of any of the needed information will diminish the value of the observation and may even make it worthless. We shall hence next describe what items ought to be recorded with each observation.

1. The name and address of the observer.
2. The place of observation. Occasionally its latitude and longitude will need to be known.
3. The telescope used, its aperture, whether it is a refractor or a reflector, its focal length and its maker.

These three items can usually be recorded once for all in a given series of observations. The remaining ones must be entered with each individual observation.

4. The date, which always includes the year.
5. The time. As a rule it is sufficient in lunar and planetary work to record the time to the nearest minute only. One should, of course, check the accuracy of one's watch or clock against Radio Station WWV or some other reliable source. We must also decide what kind of time-system to use in recording the date and the time. The system used should always be stated. Probably the beginner will do best to employ the system kept by his watch or clock. It is, however, necessary to convert such a time to Universal Time (sometimes still called Greenwich Civil Time) in order to obtain needed physical data from the Ephemeris. In The Strolling Astronomer dates and times are in Universal Time unless the reverse is clearly stated. Such a system is almost a necessity with our worldwide group of observers. The time-zones in use in this country may be known to American readers, but few of the same readers will be familar with Japanese Standard Time or South Africa Standard Time, for example.

As indicated above, the date and time allow needed physical data to be computed. This computing can be done by a Section Recorder, though the observer will find his interest in the work increased if he does such computing himself. Obviously, observations lacking dates and times are apt to be good for nothing but the wastebasket.

6. The object observed, what planet or what lunar region.
7. The magnification. It may also be well to state here the type and focal length of the eyepiece. The practices of different observers vary so widely that it is difficult to give rules for suitable magnifications in lunar and planetary studies. Although the ratio is dependent upon the diameter of the pupil of the eye, probably most observers will need a power of 25X-35X per inch of aperture (thus 150 X to 210X on a 6-inch telescope) to take advantage of the potentiol resolving power of their telescopes. A Barlow Lens is often the most practical way to obtain the desired high magnifications, especially with a telescope of rather short focal ratio. A power lower than the 25X per inch of aperture mentioned above will give stronger contrasts of tone and a wider field than high powers and hence will be useful for color observations, detecting faint shadings on the floor of Plato, lunar meteor searches, and the like.
8. The seeing, or atmospheric steadiness, often abbreviated by the letter S. Light is refracted irregularly in the atmosphere of the earth as the rays pass through air layers of different densities. As a result, stars twinkle; and though planets do not usually twinkle, each point on a planetary disc does so. The telescopic image of a planet hence shimmers. The same effect can be seen by looking at more distant objects through the heated air above a bonfire. The degree of unsteadiness (in other words, the quality of the seeing) varies greatly from night to night and even from hour to hour on the same night; in addition, favorable nights are much more common at some places than at others.

The seeing is estimated on a scale of zero (worst possible) to ten (best possible, image absolutely steady). With a little practice any attentive observer can learn to use this scale with sufficient accuracy. Only the Standard Seeing Scale of zero to ten should be used by A.L.P.O. members; it is an unnecessary waste of time to have to convert other scales to the Standard Scale.

9. The transparency, or atmospheric clearness, often abbreviated by the letter T. It is estimated on a scale of zero (worst) to five (best, very clear). Only this scale should be employed for transparency-estimates by A.L.P.O. members. There is no logical reason for the numerical difference between the seeing and the transparency scales, but it has now been established by usage. It should be clearly realized that seeing and transparency are not identical or even similar terms but denote two entirely separate properties of the atmosphere. Seeing may be good when transparency is poor, and conversely. Together seeing and transparency tell us much about the conditions of the observation.

10. Any additional information helpful in evaluating the observation. Here one may include such things as any color filters used, the observer's own opinion of the quality of a drawing made, and interruptions of the observing by passing clouds.

We conclude with some miscellaneous hints. The use of a notebook for keeping observations is an absolute must. Perhaps the best plan of all is a separate notebook for each planet and each lunar region. A flashlight, not so bright as to be dazzling, is also necessary. It will speed up drawings and increase positional accuracy to prepare form outlines in the notebook of the planet or lunar region being drawn before going to the telescope. The medium for drawings and notes should be pencil, not ink; and the pencil should be not so soft as to smear and also not so hard as to be difficult to read. In damp climates the pages of the notebook should not be exposed to the nighttime dews any more of the time than is necessary. The observer will find that it pays dividends to make himself physically as comfortable as possible; and a simple stand or table can serve as a useful desk for drawing or writing and as a handy place for eyepieces, charts, color filters, etc. Finally, let us not forget the objective of the whole business. At regular intervals the observer should submit copies of his records to the proper A.L.P.O. Section Recorder, who can integrate them with the work of others and study the results. In this fashion only can the observer's own work be of the greatest usefulness in our lunar and planetary programs.

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THE APPARENT SOUTH POLE OF VENUS WITH SOME NOTES ON THE INCLINATION.

by James C. Bartlett, Jr.

"The declination of the Sun on each side of Venus' equator, must be equal to the inclination of her axis; and if this extends to 75°, her tropics are only 15° from her poles, and her polar circles only 15° from her equator. It follows, also, that the Sun must change his declination more in one day at Venus, than in five days on the Earth; and, consequently, that he never shines vertically on the same places for two days in succession. This may, perhaps, be providentially ordered......"[1] Our author is the celebrated Elijah H. Burritt, A.M., who brought out a small astronomical handbook so popular that it sold 250,000 copies; as we are reminded by Editor Mattison who published an enlarged revision in 1856. Magister Burritt, in thus considering the strange behavior of the Venusian sun, was simply giving recognition to a theory common in his day; namely, that the inclination of the Venusian axis is very great. As late as 1870 we find R. A. Proctor willing to devote some attention to this theory, though he makes it rather clear that he by no means accepts it as established and one gathers that his own preference was for an inclination similar to our own. [2] W. H. Pickering was perhaps the last observer to believe in an extreme inclination, and during the course of the Jamaica observations, in 1921, he announced the axis to be inclined only 5° to the plane of the orbit, [3] which would make the inclination of the equator to the same plane no less than 85°. [In 1935 Pickering did not take such an extreme inclination very seriously. - Editor.]

Such inclinations as these - 75° or 85°-

would produce novel effects indeed. Admiral Smyth, sea dog that he was, found such an arrangement rather favorable for any Venusian navigators; as giving them a ready means of determining longitude from the variations in the apparent distance of the sun from the east and west points of the Venusian horizon at his rising and setting. But, as Proctor remarked, "...the problems involved must be very difficult, and I wish her mathematicians joy of them".[4]

It has become unfashionable in our day to consider the possibility of either navigators or mathematicians existing on Venus or anywhere else; but the question of the position of the Venusian axis of rotation still awaits an answer. Why is this so? Simply because the markings of the planet are too inconstant to permit of fixed points being determined. In the case of a planet like Mars, with conspicuous and permanent surface markings, the position of the equator (and therefore of the poles) can be determined with great accuracy; and the angle which the equator makes with the plane of the planet's orbit, i.e. the planet's inclination, can be determined by measuring the angle which markings on or very near to the equator make with the same plane. This is quite impossible with Venus; for although some pretty definite markings are seen from time to time they are never visible consistently long enough for a number of consecutive observations to be made.

Nevertheless the case is not altogether hopeless. If only we had some means of recognizing the poles of rotation, the position of the equator would follow automatically; and by noting the changes in angular distance of either pole from its respective north or south limb, we could come to a pretty fair estimate of the inclination even if no markings whatever appeared on the disc. For Venus, therefore, the question thus becomes one of recognizing her poles of rotation. Simply stated the problem seems simple of solution but here, alas, certain practical difficulties arise. In the first place, in the absence of certain knowledge of the position of the equator, the poles would have to be marked in some way to enable us to recognize them. We might reasonably hope that the stigmata would be in the nature of polar caps, such as those which adorn Mars. But having found such polar caps we should still not know the exact position of the pole at either cap; for there is no reason whatever to suppose that the pole would occupy the very center of the cap. It does not do so on the earth and it does not do so on Mars. Moreover, the shape and area of the cap would be pretty largely determined by the local topography and meteorology; factors which, in the case of Venus, must remain more or less unknowable.

Hence in seeking to use a polar method of determining inclination we meet with very great difficulties; difficulties which preclude our obtaining any but approximate positions. Still, even this imperfect method, if applicable at all, enables us at least to set probable upper and lower limits between which the poles must lie. The writer considers that we could thus arrive at positions in error probably by no more than 10° or 15° at the most.

Of course it is also necessary that the polar caps be sharply delimited with respect to the contiguous surface, for such a method to yield even approximate results; and many observers will question whether this condition is fulfilled on Venus. The writer believes that in the case of the south pole - if it is the south pole - the required condition is frequently present. But first let us see whether there are indications of polar caps at all upon the planet.

Gruithuisen, for all his unfortunate penchant for blending fantasy with science, was, according to Webb, none the less a good observer; and he was among the first investigators who frequently reported two bright white spots at either cusp of Venus. Webb thought that Gruithuisen may have suffered "a deception"; but Trouvelot, basing himself upon his own extensive observations, together with the work of others, concluded that the bright cusp caps were real.[5] Mascari frequently figured them at Etna, and Young, apparently accepting these results, conceded that they "may possibly be polar caps like those of Mars ..." [6]. They would certainly appear to be present in the 1927 photographs taken at Mt. Wilson, [7] which also show the south cap generally the larger and brighter. Finally, A.L.P.O. observations show a high degree of unanimity in recognizing the existence of these phenomena. It may be accepted therefore, and with some degree of confidence, that at either cusp of Venus there exists a dazzling white cap much brighter than the average for the disc as a whole. W. H. Haas and others occasionally have seen dusky caps; but these would appear to be abnormal and the usual aspect is certainly as we have described it above.

Granting their existence, as the writer thinks we must, there is hardly much question as to their nature. Two more or less permanent bright areas, 180° apart on the disc, and which maintain that relation vis-a-vis each other, must certainly indicate some special relation to position; and while the relation is just what we should expect if they are true polar caps it is difficult to imagine its nature if they are not.

Trouvelot, as we have seen, not only recognized the reality of the cusp caps but did not hesitate to proclaim them as marking the poles of rotation. He concluded also that they indicated the equator to be inclined by no more than 10° or 12° to the plane of the orbit. Young agreed that "the planet's axis must be nearly perpendicular to its orbit". T. Cragg and R. M. Baum are also convinced that the equator must lie sensibly in the plane of the orbit, or not far from it; a belief that is fully shared by the writer. Finally, examination of A.L.P.O. drawings by various observers, taken at various points in the orbit, would certainly indicate the same thing.

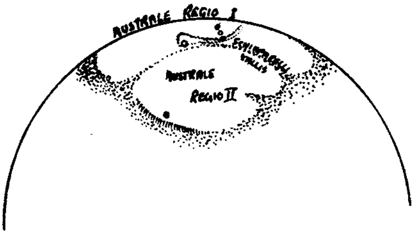
We now come to an interesting fact. Some years ago, W. H. Haas attempted to determine which of the apparent polar caps was the more prominent of the two. Comparison of the drawings of various observers convinced him that it was impossible to determine this, and that to show a trend one would have to take the work of a single observer as material. Nevertheless, recent A.L.P.O work, including observations of the writer, rather indicate that it is the apparent south polar cap which is most consistently the brighter and larger.

R. M. Baum has made a special and exhaustive study of the bright cusp caps, with special attention to the southern one. His work, which is notable for consistency care, and beautiful delineation, gives us an important record of the behavior of these spots between 1947-1952, perhaps among the most complete possessed by any group. Mr. Baum writes as follows:

"From a study of 600 drawings of Venus taken in 1947-1952, I feel that the bright cloud-like spots at the N. and S. points of the disc are the 'polar caps'; being the regions of perhaps snow and ice.

"Study of the southern area shows that the delineations of Gruithuisen and Schiaparelli are essentially correct - a fact borne out by the recent work and also from comparison of these drawings with the Ross photographs of 1927".

Baum finds that the southern cap is divided by a dark streak, possibly a rift, into two unequal parts. He proposes that



Sketch map of the detail at the
Southern point of Venus.

Figure 1. The apparent south pole of Venus, according to R. M. Baum.

this cap be known as "Australe Regio", and that the larger part be called "Australe Regio I" and the smaller, Australe Regio II". He further proposes that the dividing rift be called "Schiaparelli Vallis" Fig. 1 gives his delineation.

Accepting this terminology, we find further from Baum that the southern cap appears to undergo a more or less regular development, apparently seasonal, which somewhat reminds us of the Martian phenomenon. But here we come to an important distinction which should be clearly understood. If the south cap truly marks the Venusian south pole (as this writer agrees that it does), then the equator lies sensibly in the plane of the orbit. This being so, no marked seasonal developments are to be expected from the effects of inclination. Furthermore, since the orbit of Venus is almost a perfect circle (eccentricity only 0.007), the planet is always very nearly at the same distance from the sun in all parts of the orbit; and consequently no marked seasonal effects are to be expected from the slight change in length of the radius vector. It should be further understood, however, that these considerations in no way invalidate the phenomenon; but simply refer it to a cause other than seasonal. Such a cause is readily found in phase effects which, in turn, are caused by variations in the angle of incidence. For instance, when Venus is just past superior conjunction the angle at the planet between the sun and the earth is very nearly 0°. Consequently the illumination is direct and details visible only by their shadows cannot be seen. The position corresponde to the moon at opposition when, for the same reason, lunar formations cannot be seen in relief. Significantly, Baum remarks that "The 'cap(s)' at the poles appear as brilliant shining patches always visible, but only strongly so at dichotomy". [8] This is exactly what we should expect if the apparent changes in either cap are due to phase effects, and it is common knowledge that bluntings of the horns, irregularities, terminator indentations, etc., are seen more easily and frequently in proportion as the planet nears elongation. At elongation the angle between the sun and earth, as seen from Venus, is equal to 90° and the phase corresponds to the lunar phase when the moon is at one of her quarters. We then see the planet's apparent surface by what artists call "raking light", as we see the lunar surface in similar illumination. We are all familiar with the startling relief of the surface thus given, whereby quite small lunar features cast disproportionately large shadows. It is to this effect, in the writer's opinion, that we must look for an explanation of the apparent changes in the Venusian south cusp cap.

Baum finds the south cap consistently bordered on the north, even in the gibbous phase, by a dark band. This has been abundantly confirmed by many A.L.P.O observations. As dichotomy is approached, Baum finds occasional dark knots developing in this band and irregularities at the limb edge of the cap itself (Figs. 2-3-4). The outline of the cap also assumes (or may assume) a flattened aspect (Fig. 5). Schiaparelli Vallis developes as a dark division from the dark cusp band (Fig. 6). Bright "star-spots", i.e. brilliant points brighter than the average brightness of the cap itself, are occasionally seen in Australe Regio which remind one of the similar manifestations in the Martian south polar cap. Baum regards these as real surface features, from their persistence, and considers that they may represent icy mountains. He has

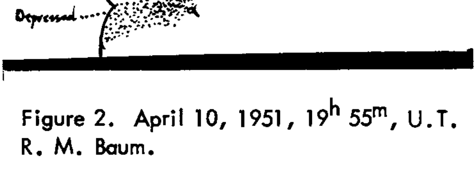


Figure 2. April 10, 1951, $19^h 55^m$, U.T. R. M. Baum.

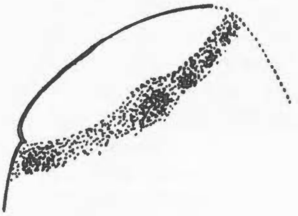


Figure 3. April 21, 1951. 19^h00^m UT. R. M. Baum.

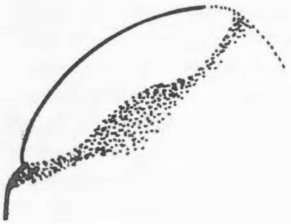


Figure 4. April 21, 1951. 19^h15^m UT. R. M. Baum

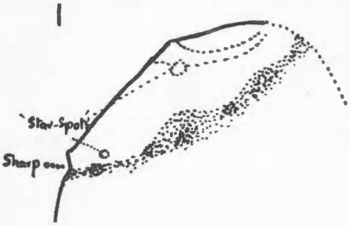


Figure 5. April 24, 1951. 13^h–19^h 15^m U.T. R. M. Baum

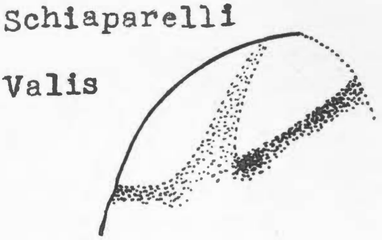


Figure 6. May 10, 1951. 16^h–20^h 20^m U.T. R. M. Baum.

found them in other parts of the disc but remarks that "a tendency to group within the southern cap has been noticed".

The writer has found no representation of Schiaparelli Vallis among his own drawings; though this means very little when one considers the much more numerous observations from which R. M. Baum has compiled his record. A drawing by Phil Cluff, however, shows a dark band intruding into the bright Australe Regio (Fig. 7), which the writer thinks very probably represents Schiaparelli Vallis. We also have a beautiful drawing by Saheki (Fig. 8) in which this feature appears to be shown. In Saheki's original, the feature is so lightly sketched in as to be almost invisible. The Recorder, therefore, has had to darken this line in order to achieve reproduction; and to this extent only the drawing has ben altered from the original.

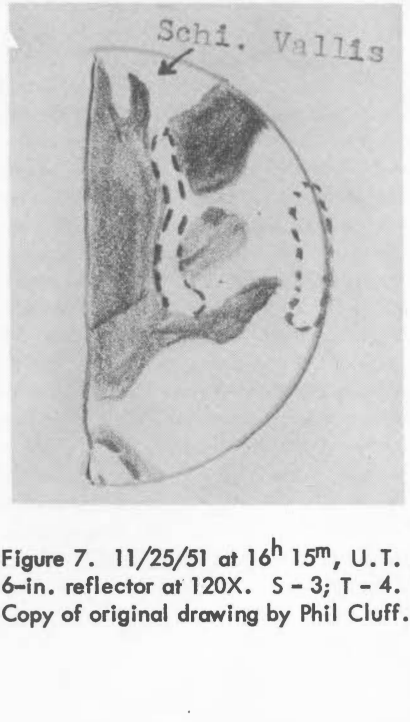


Figure 7. 11/25/51 at 16^h 15^m, U.T. 6-in. reflector at 120X. S – 3; T – 4. Copy of original drawing by Phil Cluff.

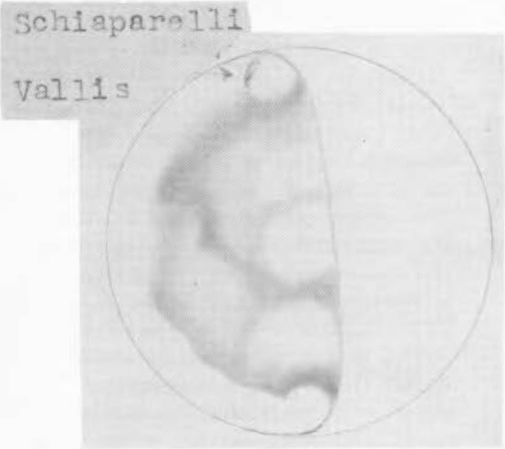


Figure 8. June 10, 1951, at 10^h00^m UT
8-in. refl. at 222X and 160X. T. Saheki

Baum has noted several examples of marked projections and other irregularities in the limb aspect of the south cap, an exquisite example of which is given in Fig. 9. W. H. Haas questions the reality of all such irregularities and reminds us of the formidable heights which such features would have to have in order to be visible at the distance of Venus.

While this reminder cannot be ignored, nevertheless it remains true that irregularities and projections from the limb have been reported by many observers, and the writer has occasionally noted some which could scarcely have been illusionary. Finally, if we consult the Ross photos (taken in ultra-violet), we notice many distortortions along the bright limb and some at the south cap. These, of course, arise from density differences in different parts of the Venusian atmosphere and to qualitative difference in the clouds, both combining to affect locally the penetration by ultraviolet which has small penetration at best. In this sense, therefore, the Ross projections are not true projections at all but mere artifacts of the technique. The writer proposes that for a somewhat similar reason projections may appear upon the limb during visual observation. If selective absorption alters the wavelength of reflected light, thereby changing its color, an eye perhaps less sensitive to the altered color than to a contiguous area might well see the latter as much brighter and therefore projecting beyond that portion of the limb recognized as duller. This explanation, however, cannot well apply to sharp, angular asperities such as those recorded by Baum; and for the moment we must be content to record them without either rejecting or explaining them.

The one feature of the south cap upon which all observers agree with significant unanimity is the presence on its northern border of a dark band. A similar band is often seen on the south border of the north

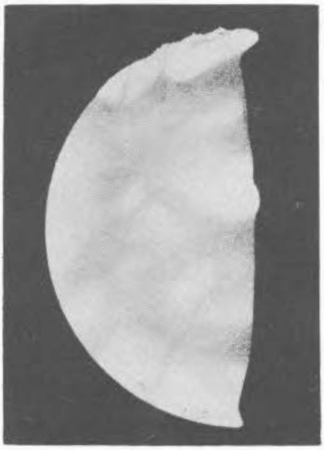


Figure 9. June 6, 1951, 20^h00^m, U.T.
3-in. refr. at 90X and 6.5-in. refl. at 216X. Sky 3/10; seeing, 9. R.M. Baum

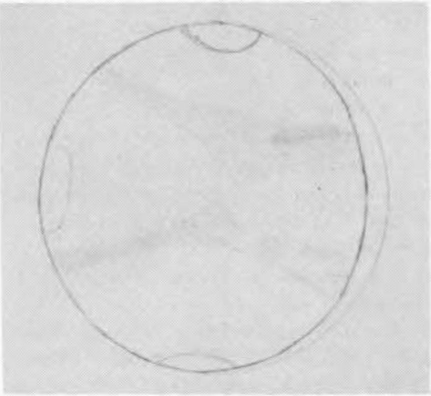


Figure 10. 9/3/52 at 2^h 30^m, U.T.
6-in. reflector at 104X. S-2 to 3; T-4.5
T. Cragg.

Figure 11. 3/11/51 at 23^h25^m, U.T. 3.5-inch reflector at 100X. S-5; T-5. James C. Bartlett, Jr.

cap, but in this paper we shall confine ourselves to Australe Regio.

It seems questionable that the development of this band can be entirely a matter of phase effect, for it has been well seen when the planet was not far past superior conjunction. Cragg, for instance, definitely records it when the phase was only 6% less than full (Fig. 10). O. C. Ranck also saw it at about the same time (September 7), and remarks that the appearance of the south cap was then "similar to Mars." Finally, in 1951 when the phase was still 89% of being full, the writer found a large, brilliant white southern cap bordered by the characteristic dark band (Fig. 11).

It is tempting to regard this as merely a necessary optical contrast effect; but such an explanation is not valid because the band is not invariably visible, though the cap is often at the same time seen to be definitely brighter than the average for the disc as a whole. It may be added that Schiaparelli Vallis shares in this occasional invisibility, and that the cap itself cannot always be distinguished. This, however, is hardly surprising when we remember the cloudiness of the Venusian atmosphere.

To conclude with R. M. Baum's studies of the south cap, he regards it not only as the south polar cap of Venus but remarks that "What seems to be suggested by the 'Australe Regio' is a high plateau, surrounded by some very lofty mountains". The writer had independently arrived at the same conclusion several years ago, and has canvassed the matter thoroughly in correspondence with W. H. Haas and T. R. Cave, Jr.; and long ago Trouvelot arrived at a somewhat similar deduction, depicting both poles as consisting of "elevated mountain masses, ice or snow covered". Espin remarks that "Under favorable conditions the margins of these polar spots appear formed of minute brilliant points, or detached mountain peaks" - probably among the "star-spots" of R. M. Baum.

The many marked similarities between Venus and the earth have often been quoted; but none perhaps is more startling than the agreement between the antarctics of the two planets. Assuming the south cusp cap of Venus to be in fact its south polar cap, then we may notice that on both planets the southern cap is the larger. On both planets the south pole occupies a high plateau; and on both planets, apparently, the polar plateau is marked by lofty mountains. In Antarctica are several notable mountain ranges including peaks up to and perhaps beyond 15,000 feet high.[9]

When the earth is at elongation, as seen from Mars, these ranges and peaks must present to the Martians - if any - many of the phenomena we see at the apparent south pole of Venus.

Finally, it may be noticed that while the apparent south polar cap of Venus, like the south polar cap of the earth, is the larger of the two it must be so for very different reasons. The terrestrial south pole, like its Martian analogue, goes through its winter when the planet is farthest from the sun. The southern winter, therefore, is both longer and colder; the summer, hotter but shorter. But such considerations cannot apply to Venus. If the cusp caps do mark the poles of rotation it is clear that the inclination is very slight.

Moreover the very small eccentricity of the orbit - 0.007 - rules out any marked seasonal effects due to orbital position. Consequently insofar as seasonal effects is concerned, one pole will not differ materially from the other. If it does in fact - as seems to be the case - then it must be because local conditions favor one over the other. The elevation of the apparent Venusian south pole, if much greater than the north, would from this reason alone favor greater accumulation of snow and thus provide a more prominent south polar cap.

At any rate, if we discreetly ignore the formaldehyde clouds of recent theory, it is this writer's opinion that a 25th Century Byrd or Shackleton, exploring the Venusian antarctic, might find himself in surprisingly familiar surroundings.

References

1. BURRITT, ELIJAH H.: The Geography of the Heavens; Mason Brothers, New York; 1856; p. 191.
2. PROCTOR, R.A.; Other Worlds than Ours; D. Appleton & Co., New York; 1883; pp. 87-88.
3. PHILLIPS, T.E.; Venus; Encyclopaedia Britannica, 14th Edition.
4. PROCTOR, R.A.; Other Worlds than Ours; D. Appleton & Co., New York; 1883; footnote, pp. 90-91.
5. WEBB, T.W.: Celestial Objects for Common Telescopes; Longmans, Green and Co., London; 1917; p. 72.
6. YOUNG, C.A.; Mannual of Astronomy; Ginn and Company, Boston; 1904; p. 357.
7. ALTER AND GLEMINSHAW: Pictorial Astronomy; Thomas Y. Crowell Company, New York; 1952; p. 94
8. BAUM, R.M.; letter to the author.
9. NATIONAL GEOGRAPHIC SOCIETY MAP; The Antarctic Regions; Washington, D.C.; 1932.

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LUNAR AND PLANETARY OBSERVATIONS WITH ELECTRONIC IMAGE CONVERTERS

by A. G. Smith

During recent months the writer has made a number of successful observations of the moon and the planet Venus in both infrared and ultraviolet light. These observations were made visually with the assistance of electronic image converter tubes which were attached to the eyepieces of several telescopes ranging from a two-inch refractor to an eight-inch reflector.

Fundamentally, the image converter tube is similar to a photoelectric cell, in that radiation falling on a special sensitive surface drives electrons out of that surface. In the ordinary photocell, these electrons are merely collected by a positive electrode, and the resulting electrical current is measured or used to operate some device. In the image converter tube, however, the emitted electrons are imaged on a small fluorescent screen similar to the screen of a television set, so that any pattern of light present on the sensitive surface (cathode) is reproduced on the screen (anode). The importance of the device lies in the fact that the response of the cathode extends beyond the visible spectrum, into the infrared and ultraviolet, so that such normally invisible radiation falling on the sensitive surface liberates electrons and produces a visible image on the screen. This visible image is, of course, monochromatic, and of a color determined by the choice of phosphor; it is usually made green to correspond to the maximum sensitivity of the eye. The well known "Snooperscope" night rifle sight of World War II was based on image conversion, allowing a rifleman to illuminate his target with an infrared spotlight which gave the enemy no warning of its presence. Similar devices were developed for signalling, reconnaissance, and night driving. [1]

The tubes available to the writer were the American 1P25 and the British E.M.I., both of which have been sold on the surplus market since the war. In use they were mounted on the telescope in such a way that the usual eyepiece could be employed to project an enlarged image on the cathode. Provision was made for inserting infrared or ultraviolet filters in the optical path. The American tube is elaborate and requires a somewhat involved power supply capable of furnishing four different electrode potentials, the largest of which is 4000 volts. It has nominally higher resolving power of about 450 lines per inch, but in the writer's experience the field of good definition was quite limited, due possibly to the optical difficulties introduced by the curved cathode surface. The British tube is very simple, requiring only a single potential of about 5,000 volts (this is not at all critical), and it has a plane cathode. While the rated resolution is only 350 lines per inch, the usuable field was much larger than for the 1P25. In both cases a 4X jeweler's loupe was used to magnify the screen images.

The principal limitation to the use of these tubes for astronomical purposes appears to be their relative insensitivity to low levels of illumination. Good images of the moon, Venus, and the sun have been obtained, but the images of Jupiter and Saturn were too dim to reveal any detail. This situation could doubtless be alleviated by using a larger telescope. The observations of Venus were particularly striking as the crescent narrowed during the latter part of March, 1953. Using the EMI tube with an eight-inch reflector and a 16 mm. orthoscopic ocular, adequately bright images of the planet up to 1° in apparent diameter could be obtained (this was estimated from comparisons with the naked eye image of the moon). Under these conditions, the image of Venus on the screen was about 0.042 inch in diameter. Assuming a screen resolution of 350 lines per inch, the overall resolution of the system would be 1/15 the diameter of Venus, or 3-1/2" of arc, which should be adequate for revealing surface detail. As is well known, detail on Venus is generally quite elusive in ordinary light, but becomes more conspicuous in violet or ultraviolet light. Figure 12 shows the result of observations made on March 27.

Using an ultraviolet filter cutting off at 4100A°, the northern cusp of the planet was seen blunted, ill-defined, and dusky. The southern cusp was slightly dusky. A distinct notch was noted near the center of the terminator. With an infrared filter cutting off at about 6500A°, the northern cusp was still blunted, but well-defined, and the duskiness of both horns was very much less. There was a trace of the notch. When the planet was viewed without the image converter, the only detail noted was

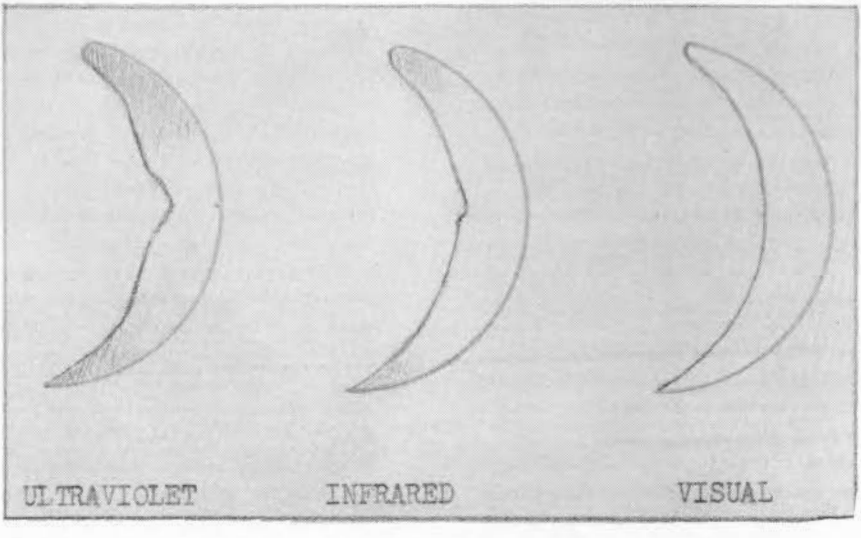

Figure 12. Comparison of Images of Venus on March 27, 1953. North at top, west at right.

a slight bluntness of the northern cusp. It was found that the image converter appears to stabilize the seeing conditions; images which were "boiling" badly when viewed ordinarily appeared quite steady in the converter. This effect is probably a combination of the reduced resolution, together with the persistence (after-glow) of the phosphor of the screen, which would have a tendency to "average out" unsteadiness in the image.

Excellent images of the moon were obtained with both image converters on telescopes of two-inch, six-inch, and eight-inch apertures. The combination most used was the E.M.I. tube on the eight-inch reflector, with a 32 mm. orthoscopic eyepiece. Some comparison has been made of the infrared and ultraviolet images with ordinary "white light" views of the moon, and apparent differences have been noted. Among these differences was an area between Copernicus and the southern end of the Apennines; dusky in infrared and ordinary light, it became light-toned in the ultraviolet. (A spot of inverse behavior with R.W. Wood is said to have discovered photographically near Aristarchus has as yet not been detected by the writer.)[2] Grimaldi appeared less intensely dark in the violet than in the red; Bullialdus, bright near full moon in white light, was much less conspicuous in the infrared. The behavior of many of the rays was peculiar. Under certain conditions of illumination they seemed brighter than normal in the infrared, while at other times they were less conspicuous. The writer's investigation of these differences has been far from exhaustive.

Using exposures of one-fifth second to one second at f:2.8, reasonably good photographs of the lunar image on the screen of the image converter have been obtained. Super XX film was used, and itwas developed in D-76 with added Hydram for maximum speed. [3] Under the same conditions images of Venus were also recorded, although they show no detail.

The writer is greatly indebted to Mr. Hans Schrader for invaluable assistance in preparing power supplies and other accessories for these experiments.

References

1. G. A. Morton & L. E. Flory, RCA Review, Vol. VII, No. 3, p. 385 (1946)
2. Russell, Dugan & Stewart, Astronomy, Vol. I, p. 183, Ginn & Co. (1945).
3. T. E. Howe, Strolling Astronomer Vol. 6, No. 3, p. 36 (1952).

POSTSCRIPT BY EDITOR. Dr. Smith is a member of the Physics Department, University of Florida, Gainesville, Florida. We thank him for his excellent paper, and we urge our readers to follow up on the experiments here described. Although most of our A.L.P.O. studies are by the long-used visual methods, we should realize that there are always great possibilities in a new technique; and little enough is known of the appearance and behavior of the lunar and planetary surfaces in infrared and ultraviolet light. Perhaps an enterprising amateur can reap a rich harvest.

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OBSERVATIONS AND COMMENTS

We first want to finish our description of recent observations of Plato begun on pg. 61 of the April issue. Using a 6-inch reflector at 190X and 500X, Mr. H. P. Squyres on December 26, 1952 near colongitude 25° drew Plato, showing bright spots A, C, B, H, and E (Reese's nomenclature). He also drew a number of bright streaks on the dark floor, and these conform very pleasingly to Reese's preliminary map.

Mr. Epstein made a very curious observation of Plato on December 27, 1952 with his 10-inch reflector at 227X. At $1^h 40^m$, U.T., and thus at colongitude 35.°6 the eastern one-third of Plato was much lighter than the rest of the floor. By $2^h 15^m$, colongitude 35.°9, the lighter part was confined to the northeastern (?) portion of Plato. The southeastern (?) part had apparently darkened considerably in only 35 minutes! The appearance remained the same until 5h 45m on December 27 and was also the same during the next few days; therefore, the aspect at 1h 40m would appear to be the abnormal or unusual one. We hope that someone else will communicate an observation of Plato last December 27 (U.T.). Rapid changes in the appearance of lunar regions are not rare under very low solar lighting, but Plato was fully two days from the sunrise terminator on December 27. If such rapid changes can occur under relatively high lighting, they are of great importance in our studies of apparent lunar changes. Epstein's view on December 27 was good enough to reveal at all times the twin craterlets D and one or two others. The observer is, unfortunately, not entirely certain about his lunar directions; but it would still appear worthwhile for others to study Plato carefully near the solar lighting of the reported change.

In January, 1953 Epstein continued his work on Plato. On January 24 with the Cal Tech Cassegrain 20-inch reflector at perhaps 150X and colongitude 17.°7, thus soon after sunrise, he noted a darker area in the northeast quadrant of the floor. On January 28 at 65.°4 the 20-inch at about 200X showed the same whitish area in the same aspect as from 2h 15m to 5h 45m on December 27. On January 30 at 90.°6 the same telescope and power revealed the white "F" shown in Wilkins' Meudon drawing of Plato (Figure 1 on pg. 96 of The Strolling Astronomer for July, 1952). On January 31st at 104.°4 Epstein found with his own 10-inch reflector that the detail varied in appearance with large changes in the direction of his vision; he employs a rotating I-beam assembly, and the eyepiece is often in awkward positions. (Of course, the direction of his vision changed little between 1h 40m and 2h 15m on December 27.) Epstein suggests as causes of this curious effect the known astigmatism of his eyes and the physical position of his head.

The adjacent Figure 13 shows R. Barker's Quadrangle in Mare Crisium, a trapezium-like arrangement of white spots and streaks near the southwest edge of this mare. This drawing by Mr. Patrick A. Moore, Glencathara, Worsted Lane, East Grinstead, Sussex, England is under low evening illumination. This quadrangle is now visible with the greatest of ease in even a 3-inch refractor; yet it is curiously absent from nineteenth century (and earlier) lunar maps, and Mr. Barker was the first to record it in its entirety. In his view on September 6, 1952 Mr. Moore saw the two main objects as craters, not mere spots. The two white spots in the lower right part of Figure 13 and the ridge (shown as a broken line) joining them to the lower of the two chief objects had not been previously noticed by Mr. Moore, although he made a thorough survey of this region in 1947-9 and recorded details "much more delicate." Moore's survey was reported in The Journal of the British Astronomical Association, Vol. 59, pg. 250, 1949. In this paper he mentions examples found by experienced lunarians of how the tiny craterlets and white spots in the southern half of Mare Crisium have apparently varied in visibility and of how they have occasionally looked hazy and ill-defined when they would have been expected to be sharp and distinct. The region might repay careful study with even a modest-sized telescope.

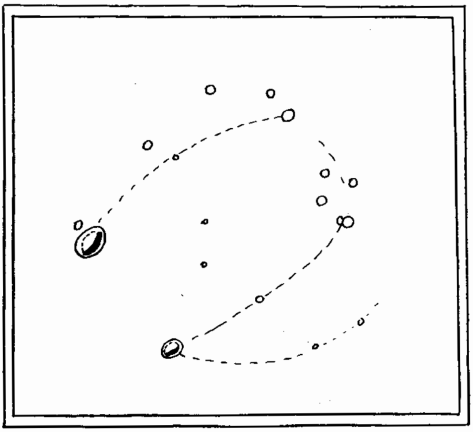

Figure 13. Barker's Quadrangle. Patrick A. Moore. Sept. 6, 1952. 0h 25m, UT. 12.5-inch refl. 350X.
Colongitude = 110.°9

K. W. Abineri has contributed a number

of truly artistic and natural-looking lunar drawings. Like many other British lunarians, he has been especially interested in the limb regions, where until very recently our maps were extremely inaccurate and incomplete. Indeed, there is still much to be done in mapping these limb regions; and it is work which can be done by a patient and persistent amateur having a small telescope of good quality. One must, of course, choose nights when the solar lighting and the libration are favorable; it may be months between opportunities for good views. Among the limb features studied by Mr. Abineri are the walled plains W. Humboldt and Hecataeus, Figure 14 being one of his drawings. These objects may be found on Section X of the Wilkins map; they lie on the west limb of the moon to the west of Petavius. Figure 14 is not in the usual astronomical orientation; instead it has west at the top and north at the ~~bottom~~ left. Humboldt and Hecataeus were also observed by P.A. Moore on April 26, 1952 with a 3-inch refractor at 125X. The colongitude was then 296.°7. The observers agree that the two plains have a common wall, and Figure 14 shows two narrow valleys cutting through this common wall.

On the interior of Humboldt are some complex—central mountains, resolvable into separated peaks, a crater N, and many small details. There are many small craters on the west inner wall of Hecataeus. The southeastern inner wall may be terraced. Hecataeus appears to have been formed by the partial coalescence of two rings, the southern one being much the larger and the deeper. Abineri has resolved the mountain-mass M in the southern portion of Hecataeus into several separate mounds. As Mr. Abineri has pointed out, many of the details recently drawn require confirmation; and we hence urge A.L.P.O members to study W. Humboldt and Hecataeus.

Recent searches for possible lunar meteors and/or possible lunar meteoritic impact-flares have been reported by R. M. Adams and E. J. Reese. Mr. Adams observed on 7 dates from November 21, 1952 to March 20, 1953; he spent a total of 4 hrs., 30 mins. in such searches, using sometimes a 3-1/4 inch refractor and sometimes a 10-inch reflector. The larger instrument with its greater light-grasp would be preferable in such searches for rather faint luminous phenomena. Adams' results were negative except that he suspected two stationary lunar flashes near $1^h 42^m$, U.T. on January 20, 1953. He says of them: "Spaced two seconds apart. The first between Plato and Aristarchus, the

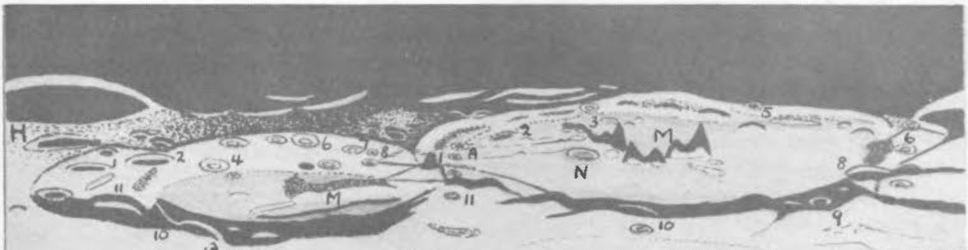

Figure 14. W. Humboldt and Hecataeus. Keith W. Abineri. October 15, 1951. 21^h, U.T. 8-inch refl. 232X. Colongitude = 95.°2.

second slightly south and west of Aristarchus. Both eighth to tenth stellar magnitude. Seemed to have same width, one to two miles. Momentary duration, 1/2 to 1 second." He was using the 3-1/4-inch refractor at 80X. Reese obtained negative results in a 20-minute search on January 19, 1953, employing a 6-inch reflector at 60X. His view of the earthshine was clear enough to show Grimaldi as very plain, Kepler as a nebulous patch, and the central peak of Aristarchus as a blue-white, star-like point.

On February 24, 1953 R.M. Baum wrote to D. P. Barcroft in part as follows: "To deal for the passing moment with lunar affairs, I wonder if you have ever studied the dark spot upon the east floor of Alphonsus. During 1952, November, at colongitude 42.°0 to 42.°5, I found that definite curious changes, especially as regards movement of a certain spot within the main area took place. A study of the drawings taken shows that during colongitudes 18° to 88°, one spot appeared to 'flow' or drift away from the wall towards the center of the floor. I have spoken about this curious effect, or whatever it is, at the January and February Meetings of the Department of Astronomy here [in Chester, England] . So far as I can make out this has not been recorded before, at least nothing appears in print about such, apart from Pickering's work, and this I may say does not agree with my studies". Mr. Baum then extends an invitation to his fellow A.L.P.O. members to investigate the Alphonsus dark spots. Under low lighting Alphonsus is easily found just south of the giant walled plain Ptolemy. Under high lighting the position of Alphonus is marked by several intensely dark spots, and it is difficult for the visual observer to resist the strong impression that these darken as the sun's altitude above Alphonsus increases. Nevertheless, a photometric study with simple equipment carried out by E. J. Reese some years ago indicated that the darkening was only relative, not absolute. Mr. Baum's detection of the motion of an Alphonsus dark marking over the lunar surface is reminiscent of W. H. Pickering's reports that the dark areas on the floor and walls of Eratosthenes move across the lunar surface, as described by him in articles in Popular Astronomy about 30 years ago. If the motion is not merely optical, different lunar areas darkening with the sun's changing position, it is difficult to explain. If it is merely optical, the position of the moving dark areas must be exactly the same at the same solar lighting in different lunations.

A. P. Lenham could see no dark spots in Alphonsus on November 24, 1952 at colongitude 2.°6 or on November 25 at 14.°4, although Plate 8A at colongitude 15° in W. H. Pickering's Photographic Atlas shows the eastern of the three main dark spots clearly. On December 3, 1952 at 112.°9, thus soon after noon on Alphonsus, Mr. Lenham drew the markings visible to his 3-1/4-inch refractor at 166X. There is then a prominent dark spot near the east wall, another near the southwest wall, and another near the northwest wall. Lenham saw the eastern dark spot to have three short projections toward the east. There are then present a number of fainter dark spots and several dusky streaks on the floor; Lenham's drawing of them partially agrees with past work by S. M. Green and C. M. Cyrus.

P. A. Moore has contributed a number of 1952 lunar drawings. On April 8 at colongitude 77.°9 he drew Seleucus with the Meudon 33-inch refractor, but the drawing is incomplete because of clouds. On Section XVIII of the Wilkins map, this crater is near the east shore of the Oceanus Procellarum. Moore depicted a central peak, an apparent ridge or terrace in the east inner wall, and a number of humps on the shadow-edge which would indicate peaks on the northwest rim. Moore drew Inghirami and vicinity on August 4 at 78.°8, 3-inch refractor at 125X, and on September 3 at 85.°8, 12.5-inch reflector at 350X. On Section XXI of the Wilkins map, Inghirami lies between Schickard and the southeast limb. Inghirami has intruded into a formation of similar size, B, to its east. On the east glacis of B are two bright peaks. Still farther east is a long ring about 75 miles in diameter, which perhaps possesses a central ridge.

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PHOTOGRAPH SP-14. Mount Wilson and Palomar Observatories. Clavius and Vicinity with the Hale 200-Inch Reflector at $10^h 5^m$, U.T., on October 3, 1950. Colongitude 173.°6.

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