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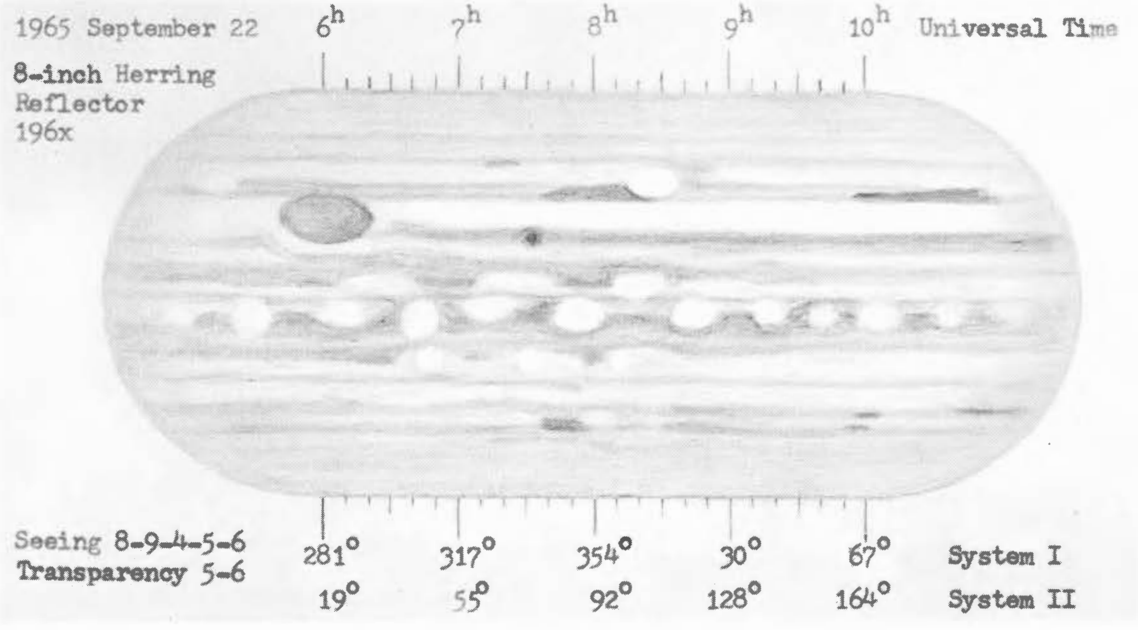

Extended drawing of Jupiter by Charles H. Giffen. Scales show Universal Time at top and corresponding longitudes in System I (low latitudes) and System II (rest of planet) at bottom. Though Jupiter is subject to large and unpredictable changes, this drawing will hopefully show the general pattern of detail in the last months of 1965. Central meridian transits recorded by the observer while making this drawing are listed on pages 33-34. See also Dr. Giffen's article on pages 29-34. The Red Spot is the large dark oval near 20 degrees in System II.

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ASSOCIATION OF LUNAR & PLANETARY OBSERVERS
ALPO

Founded In 1947

IN THIS ISSUE

A.L.P.O. COMETS SECTION REPORT:

COMET EVERHART 1964h

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

Comet Everhart became the third comet to be observed by the Comets Section during the summer of 1964. As may be seen in Figure 1, Dr. Edgar Everhart, who is a Professor of Physics at the University of Connecticut, has a worthy telescope and observing chair for the discovery of comets. Of his comet searching techniques Dr. Everhart writes:

> "Referring to the photo one may see that turning the right handwheel changes the azimuth while the left handwheel controls the elevation. One bends at the hips and the viewing is comfortable for hours at a stretch. The objective is an f/8 5-inch diameter surplus lens fronted by a long dewcap. With this lens and a 1 1/16-inch Erfle eyepiece star images are not particularly good, and I am thinking of trying other objectives. On one of the rare clear nights in Connecticut I am able to find 11th magnitude galaxies.
>
> "For checking suspicious objects found on sweeps with the 5-inch I have a 12-inch f/10 reflector mounted on a 3000 lb. astrographic mount.
>
> "Looking for comets is a lot like fishing when you don't really expect to find anything. My last view of the comet was Nov. 7/8 when it was extremely difficult to see under the conditions. It was about magnitude 12.5 to 13, and the position was measured at $17^h\ 55^m$, + 38° 20' with circles."

Being one of the few amateurs involved in an active search program with such specialized equipment, Dr. Everhart is to be commended for his ingenuity and perseverance. At present his comet seeker is mounted on a 30 foot tower to provide clear horizons. Not since Richard Lines of Phoenix, Arizona, discovered Comet Seki-Lines in February of 1962 had an American amateur claimed a comet.

The following A.L.P.O. members contributed observations of Comet Everhart to the Comets Section:

Rev. Leo Boethin	Abra, Philippines	20X60 binoculars
John Bortle	Mount Vernon, New York	5-inch refractor, 6-inch reflector, 7X50 binoculars
Rev. Kenneth Delano	New Bedford, Mass.	12½-inch reflector
Michael McCants	Houston, Texas	8-inch reflector
Dennis Milon	Tucson, Arizona	7-inch f/7 astrograph

Orbital elements by Dr. Leland Cuningham on IAU card 1873 were used by Michael McCants to give a complete ephemeris for this report. The orientation of Everhart to the earth's orbit may be seen in a model constructed by Steve Larson, shown in Figure 3.

Parabolic orbit. Epoch 1950.

Time of perihelion T August 23.107, 1964
Argument of perihelion ω 20° 37' (Angle between node and perihelion.)
Ascending node Ω 279° 43' (Where the comet crosses the Ecliptic from South to North, measured eastward from 0° at the vernal equinox.)
Inclination i 68° 01' (Tilt of the comet orbit to the ecliptic. If greater than 90°, comet is in retrograde motion.)
Distance from sun at perihelion q 1.2599 Astronomical Units.

Comet Everhart was discovered on the evening of August 7, 1964, local time, as a 9th magnitude diffuse and tail-less object moving north-eastward in Libra. It was then about 62 million miles from the Earth. A.L.P.O. observations gave no indication of a tail, most observers describing a diffuse object of varying size. However, satellite tracking stations using Baker-Nunn cameras* reported a 2° tail (about 3 million miles long) on August 27, 1964, U.T. The same Curacao, Netherlands Antilles, station reported a diameter of about 1/10° on August 28. The Maui, Hawaii station had also reported a 1½° tail on August 26. From August 16 to 23 the Smithsonian stations reported no tail.

*Harvard Announcement Card 1666.

Figure 1. Dr. Edgar Everhart, Wormwood Hill Observatory, Mansfield Center, Conn., with his comet-seeking telescope used for the discovery of Comet Everhart 1964h on Aug. 7, 1964. Photo contributed by Dr. Everhart.

Photos by Milon with a 7-inch f/7 astrograph on August 15 and 16 show only a small 10th magnitude diffuse object on blue plates.

John Bortle's observations of September 2-8 provide evidence of an abrupt fading. He observed it as of magnitude 8.3 on both September 2 and 3, but was unable to find it in a 6-inch reflector on September 6 and 8. On the 8th Mr. Bortle reports that the limiting magnitude was 12.8. The next observation available is on September 22, when B.A.A. observers called Everhart stellar magnitude 10 but give no details about the method used.*

Changes in brightness of up to 6 magnitudes are reported by various Smithsonian stations between August 24 and 31; but since no information is given on the method used, one is led to suspect that photographic magnitudes were being estimated in different ways. Alternately, perhaps visual and photographic magnitudes were reported together.

In October Comet Everhart was further followed by Rev. Boethin in the Philippines and by Rev. Delano in Massachusetts. After Everhart's observation of magnitude 12.5 on November 8, Waterfield in England continued to follow the comet photographically into early January, 1965, when it was fainter than 13.5 at a distance of about 214 million miles from both the earth and the sun.

Bortle and Delano reported the degree of coma condensation on a scale of 0 = diffuse to 9 = sharply condensed. Their estimates averaged around a value of 4 between September 2 and October 13, 1964.

*B.A.A. Circular No. 463, November 9, 1964.

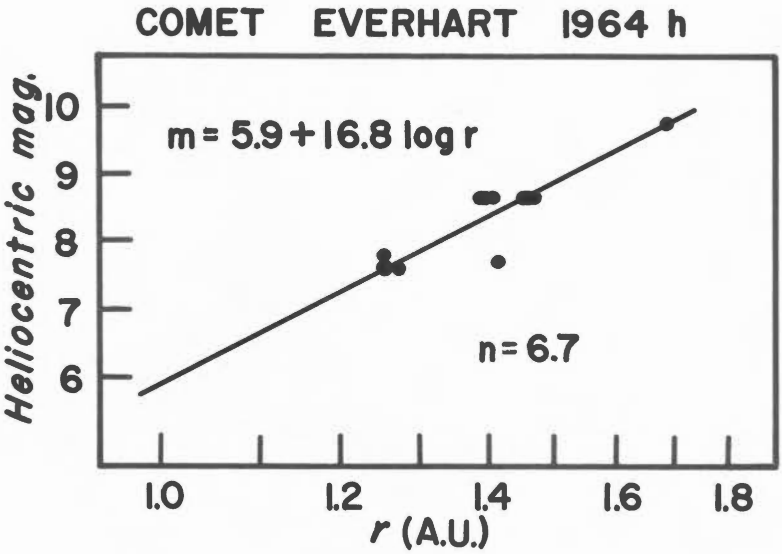

Figure 2. Heliocentric magnitude of Comet Everhart plotted against distance to the sun on a log scale. See the text for a discussion. Compiled by Dennis Milon and drawn by Steve Larson.

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Boethin and Delano both had an estimated observed magnitude (before correction to a standard aperture) of 9.5 on October 3 and 4, respectively; but Boethin was able to see a 25' comet, while Delano saw a coma of 8'. Presumably Rev. Boethin's superior location in the Pacific enabled him to see outlying regions with his 20X60 binoculars.

Details of coma and tail dimensions reported are given below:

1964, Aug. 7	Everhart	5"	No tail.
Aug. 8	Walter Houston	5"	Diameter 30'.
Aug. 15, 16	Milon	Photo 7" f/7	No tail.
Aug. 28	Bortle	6"	Coma 7'. Nucleus mag. 11.5.
Sept. 2	Bortle	6"	Coma 5'. Central condensation 2'.
Oct. 1	Boethin	20X60	Diameter 25'.
Oct. 2	Boethin	20X60	Diameter 25'.
Oct. 4	Delano	12½"	Coma 8'. Central condensation 3'.
Oct. 12	Delano	12½"	Coma 5'. Condensation 1½'.

The observed total magnitudes of Comet Everhart obtained by out-of-focus comparisons with stars and galaxies have been corrected to a standard aperture of 2.67 inches using Bobrovnikoff's formula. Bobrovnikoff found that the stellar magnitudes of comets are estimated progressively fainter as a larger aperture instrument is used. The correction necessary to compare brightness estimates with different telescopes is plus 0.17 magnitude per inch of aperture above 2.67 inches. Strictly speaking, this formula is meant to be used on magnitudes obtained with refractors by comparisons with stars, not with galaxies and nebulae.

Observations used in drawing the photometric graph (Figure 2) are given in the following table:

U.T. 1964		Instrument	Observed Mag.	Corrected Mag.	Heliocentric Mag.	r
Aug. 7.1	Everhart	5" 40X	9	8.6	9.5	1.283A.U.

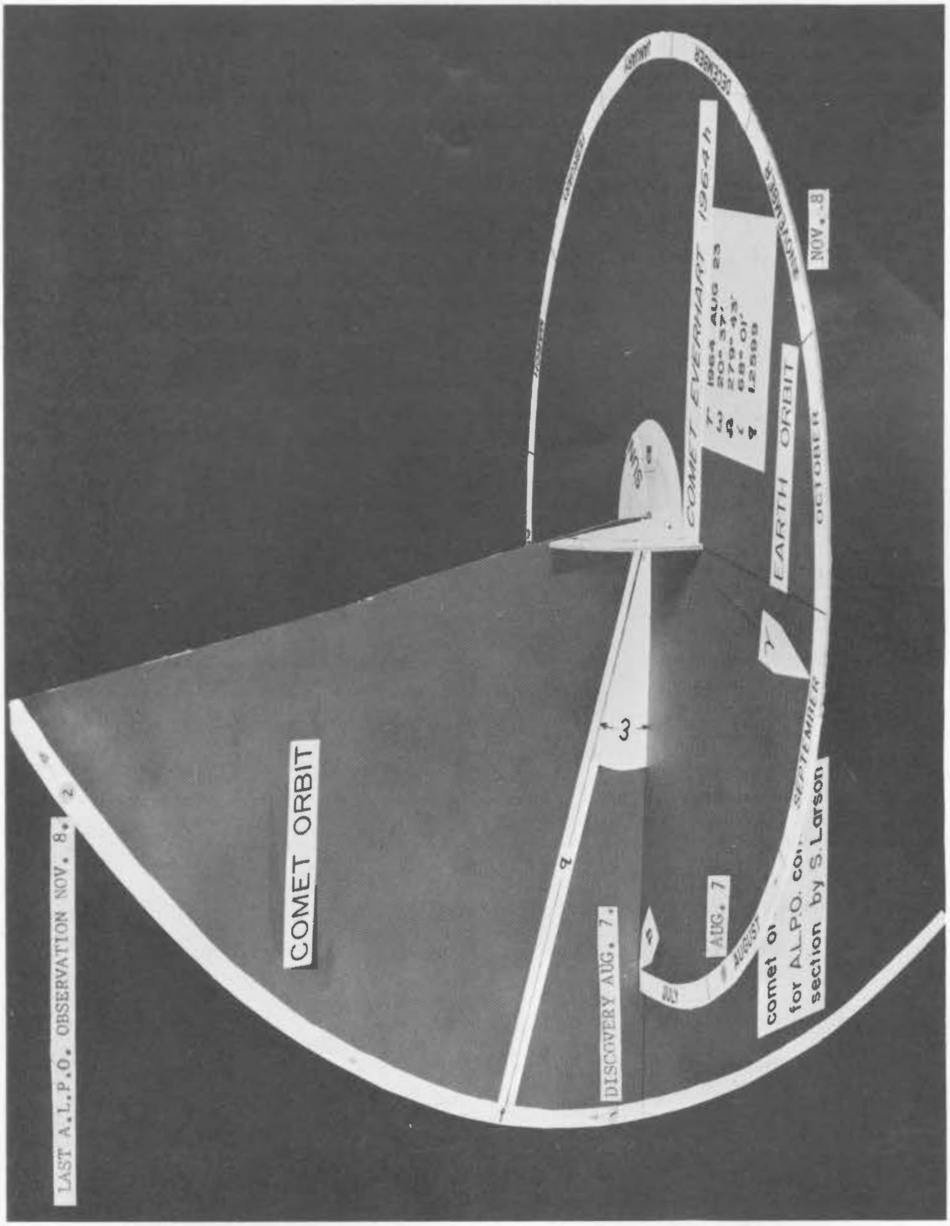

Figure 3. The orbits of Comet Everhart 1964h and the earth illustrated in a model constructed by Steve Larson. Photo by Dennis Milon.

__Note by Editor.__ The model here photographed was intended to be part of the A.L.P.O. Exhibit at the Milwaukee Convention in early July, but it arrived there a little too late. The constructing of such a model might be a worthy Science Fair project for some of our younger members. It will certainly give increased insight into the meaning of the geometric elements which define the orbit of a comet. Such models can also be useful teaching aids in college classes in astronomy. Refinements of Mr. Larson's basic plan here shown will occur to the thoughtful reader. One such addition is to have strings connect the positions of the earth and the comet on selected dates.

U.T. 1964		Instrument	Observed Mag.	Corrected Mag.	Heliocentric Mag.	r
Aug. 8	Walter Houston	5" 20X	7.4	7.0	7.7	1.280A.U.
Aug. 9.10	Bortle	10X50	8.5	8.6	9.3	1.278
Aug.28.04	Bortle	10X50	7.7	7.8	7.8	1.262
Sept.2.03	Bortle	6" 50X	8.3	7.7	7.6	1.268
Sept.3.06	Bortle	6" 50X	8.3	7.7	7.6	1.270
Sept.6.06	Bortle	Unable to find in 6"				
Sept.8.02	Bortle	Unable to find in 6"				
Oct. 1.52	Boethin	20X60	9.5	9.5	8.7	1.391
Oct. 2.48	Boethin	20X60	9.5	9.5	8.7	1.397
Oct. 3.49	Boethin	20X60	9.5	9.5	8.7	1.404
Oct. 4.07	Delano	12½"96X	9.5	8.5	7.7	1.411
Oct.11.04	Delano	12½"96X	10.5	9.5	8.6	1.460
Oct.12.00	Delano	12½"96X	10.5	9.5	8.6	1.468
Oct.13.00	Delano	12½"96X	10.5	9.5	8.6	1.475
Nov. 8.02	Everhart	12"	12.5	10.9	9.7	1.691

Discussion of photometric graph (Figure 2)

The general formula for the magnitude of a comet is

$H = H_0 + 5 \log\Delta + 2.5\, n \log r$, where
H = observed corrected magnitude,
H_0 = a constant termed absolute magnitude representing the magnitude at 1 A.U. from the sun and from the earth,
Δ = distance from the earth,
r = distance from the sun, and
n = a factor that varies among comets, averaging about 4.

Figure 2 shows the heliocentric magnitude (observed corrected magnitude minus $5 \log\Delta$) plotted against r on a log scale. Only the observations after perihelion (on Aug. 23) have been used to obtain a line best fitting the observations. The absolute magnitude H is found graphically by extending the line to r = 1. The factor n is found from the slope of the line by the following method:

$$\text{Slope} = \frac{\text{change in y}}{\text{change in x}} = \frac{\text{observed mags.}}{\log \text{ r values}} = \frac{9.7 - 7.6}{.228 - .103} = 16.8.$$

The line is of the form $y = mx + b$, where m is the slope. In Figure 2:

$H - 5 \log\Delta = H_0 + 2.5\, n \log r$; or
$m = H_0 + 2.5\, n \log r$, where m is the heliocentric magnitude.

Thus $n = \frac{\text{slope}}{2.5} = \frac{16.8}{2.5} = 6.7.$

Hence the equation representing Comet Everhart's heliocentric magnitude is:
$m = 5.9 + 16.8 \log r$, $n = 6.7$.

This value of n supports the idea that the more diffuse comets have larger values of n. As noted previously, the degree of coma condensation for Comet Everhart was small.

It should be emphasized that the accuracy of the photometric graph is quite limited by the small number of observations and by the difficulty of making accurate magnitude estimates on a comet fainter than 8th magnitude.

FROM NEISON'S NOTEBOOKS

By: Patrick Moore, F.R.A.S.,
Director of the Lunar Section of the British Astronomical Association

(Paper read at the Thirteenth A.L.P.O. Convention at Milwaukee, Wisconsin, July 4, 1965.)

Once again I have been honored with an invitation to present a paper to the A.L.P.O.

Convention; once again I am delighted to accept, though I greatly regret that I cannot deliver it in person. I have chosen a somewhat unexpected subject, mainly because a few weeks ago I had the opportunity to examine some unpublished lunar manuscripts. I should make it clear at the outset that my paper is purely historical, but I hope that it will not be entirely devoid of interest to those who are interested in the story of selenography.

The first really great lunar student was, without a doubt, Schroeter, who has been much maligned on the score of being an indifferent draughtsman, but who undertook work of immense value. (In a paper published in the B.A.A. Journal, Vol. 70, pages 363 ff., I defended Schroeter vigorously, so I do not propose to discuss him further here.) There followed Lohrmann; Maedler, with Beer; and Schmidt, in that order, together with energetic observers such as Gruithuisen. But in the English-speaking world, pride of place must go to Edmund Neison, whose great book on the Moon, a book familiar to us all, came out ninety years ago.

Because Neison's book appeared in the 1870's, and I began an active interest in the Moon in the 1930's (as soon as I became old enough), I rather naturally supposed that Neison belonged to the far past. I assumed that he had been dead for many years. In fact, this was not so. While I was beginning my modest lunar observation at East Grinstead, in Sussex, Neison was living in retirement at Eastbourne, also in Sussex - less than thirty miles from me. He died only in 1941, and I shall always regret that I never met him. His book, incidentally, was published when he was a young man in his late twenties.

Then, last spring, I had a letter from Miss Maud Nevill, who lives in London and who had seen one of my television broadcasts in which I had referred to Neison's work. Miss Nevill is Neison's daughter; I must perhaps explain that Neison's real name was Edmund Neville Neison Nevill - he used the "Neison" for scientific purposes, at least for many years, because he thought that the holder of a name so ancient as Nevill should not make a career in science! Subsequently I met Miss Nevill, who was most kind in allowing me full access to all the surviving manuscripts. There was only one faded photograph of Neison (I shall continue to refer to him by the name with which we are all familiar) because he hated being "taken". I borrowed the picture, and we are trying to obtain a satisfactory print from it, though nothing can make it good.

I have written a biographical paper about Neison, and by now this may already have appeared in the B.A.A. Journal so that I will merely give a brief summary. He had an eventful life. For a time he was in the French Army; he served under Marshal Ney during the Franco-Prussian War, and then became a parliamentary reporter for a London daily paper, as well as fashion correspondent (a somewhat odd mixture of duties). But his interest in the Moon began early, and it was not long before he began contributing lunar material to the Royal Astronomical Society, of which he became a Fellow at an early age. He also became Secretary of the energetic but short-lived Selenographical Society; he investigated the Moon's motion, showing himself to be no mean mathematician; he observed the planets, and he was a first-class writer on scientific subjects, even producing one popular-astronomy book which was a model for its period.

In 1882 he went to South Africa to take charge of one station for observing the transit of Venus, and he remained there for almost thirty years; but although he was a Government astronomer, his financial support was poor, and he was unable to publish as much material as he would have liked. Finally the observatory ceased to operate; and Neison returned to live in retirement in Sussex, after which his active scientific career may be said to have closed. As a sidelight, he was a first-class tennis player and introduced the game to South Africa, while his wife, née Mabel Grant, was South Africa's tennis champion for ten years. Neison was also a keen student of Babylonian history; he painted well, and he wrote several novels, but neither his novels nor his non-astronomical researches have been published, and in all probability they will never appear now since they survive only in the form of fragmentary manuscripts. By nature Neison was retiring and modest. He refused the presidency of the Royal Chemical Institute, and twice refused to become a Fellow of the Royal Society, though he was finally persuaded to accept a Fellowship. He enjoyed good health and was ill for only a few hours before his death in 1941. Of his children, one son survives him, as well as his daughter, Miss Maud Nevill; his other son died as a result of wounds sustained during the first World War.

Not many of Neison's lunar notebooks survive; but I have studied those which do, and there is one point that I am anxious to make. It has been said that Neison's map of the Moon was little more than a copy of Maedler's, and that he undertook little work himself so far as direct observations were concerned. I admit that I tended to assume this myself.

Having seen the notebooks, I must stress that such is emphatically not the case, for it is clear that Neison examined the Moon closely at the eye-end of a telescope; in his early days he used a 6-inch refractor and a 9.5-inch reflector, set up in the Hampstead area, and it was these instruments which provided most of the groundwork for his lunar map.

Moreover, his observations were skillful, and his drawings were excellent. Checking his sketches with those of modern selenographers, who are able to draw upon photographic outlines as well as to use much bigger telescopes, shows how good an observer Neison was. He missed very little; he made occasional mistakes (as in the Fontenelle region, where the famous "square" now named after our member Dr. Bartlett is still drawn, though in fact it does not exist and probably never did), but few men could have done so well. It is also an interesting exercise to compare Neison's map with those of today. You will find that Neison is remarkably accurate.

He was never afraid to speak his mind, and some of his views have not been confirmed; for instance, he believed in an appreciable lunar atmosphere, but this was rational enough since he based his opinions on occultation timings made by no less a person than Sir George Airy. And so far as lunar changes were concerned, he believed that small alterations did occur, and in particular that Linné had undergone an upheaval. In an article written in the Quarterly Journal of Science for January, 1877, pp. 1/26, he said that: "The facts about Linné may be summed up very briefly. According to three or more independent selenographers, the most experienced and eminent that Science has seen, the object named Linné was a conspicuous crater of large diameter and depth. Now in its place all that exists is a tract of uneven ground, containing a small, scarcely-visible, insignificant crater-like object. It is impossible that the one could ever be systematically taken for the other. It is inconceivable how our three greatest selenographers* could have systematically and independently made the same blunder, and that blunder only. For in no other case do we find any error of this nature. Their description must therefore be held to truly describe the nature of the formation at their epoch (1820-1845). The object is no longer of the same size and description. A real physical change on the Moon's surface must therefore have occurred at this point." He felt that the walls of the old Linné had collapsed and had fallen into the interior, but referred to Sir John Herschel's view that the old crater of Linné had been filled to the brim with viscous lava.

Neison also thought that there had been a probable change in the Messier pair of craters between 1838, when Beer and Maedler virtually ended their lunar work, and November, 1855, when the Rev. T. W. Webb saw that Messier and its companion were no longer alike. Neison's own explanation was "a slow squeezing of a crater plain out of shape", and a sliding of the north and south walls of Messier into the interior, so pushing down the entire west wall, outwards and westwards, down an incline existing there (west presumably in the older, non-IAU sense). He published a long paper about this and other supposed changes in the Quarterly Journal of Science for 1877, and in Popular Science Review for April, 1879 discussed the enigmatical case of Klein's Hyginus N, though here he considered that "further information must be obtained before a decision can be arrived at whether this crater of Dr. Klein's is or is not a new formation".

It is probably true to say that all material of value in Neison's lunar notebooks has been incorporated in his published work, but to me at least it was most satisfactory to be able to examine the surviving originals, and to see that he was himself an observer of the very first rank. It enhances the value of his book and map since we now know that he was not prepared to take anything on trust. Then, too, Neison provides a link between the past and the near-present; we have progressed far in lunar research since he was busy observing at Hampstead, but we have been able to use his pioneer work to guide us. In the history of selenographical research he will never be forgotten.

ARISTARCHUS: THE EAST WALL BRIGHT SPOT

By: James C. Bartlett, Jr.

The Lowell Observatory observations of the now famous Aristarchus red spots, announced in the fall of '63, doubtless brought a certain bemusement to those circles in which inconvenient lunar reports are customarily referred to inadequacies in the observer and/or his equipment; but it cannot be said that the Lowell observations were surprising to any

* Lohrmann, Maedler (with Beer), and Schmidt.

close student of the crater. The fact is that Aristarchus has long been the site of many curious appearances, for some singular examples of which the reader is referred to the literature. Some years ago it appeared to me that many of the observed phenomena could not be exclusively related to the angle of solar lighting, roughly measured by colongitude, even by the most liberal allowances. Thus convinced, I determined upon an extensive and systematic investigation of the crater before venturing any opinions, a work which now has occupied the better part of fifteen years. The first five years of this period were devoted to getting acquainted with the crater's features, and the last ten to a rather intensive study of them. The instruments employed were a 3.5-in. reflector, a 5-in. reflector, a 4.25-in. reflector, and, lately, a new 3-in. refractor to serve as a check instrument on nights when seeing was poor with the mirrors but much better with an objective. The overwhelming majority of the observations were made with the 5-in. and 4.25-in. reflectors. Naturally it is not to be expected that such modest apertures can reveal the fine details recorded by Mr. Elmer J. Reese and by Mr. Leif J. Robinson, among others; but they have been entirely adequate to the class of phenomena investigated, which therefore are accessible to all observers with small instruments.

The voluminous data which have been accumulated make it necessary to choose representative selections and to confine discussion to one feature at a time, a plan which will be followed in this and possible succeeding papers. Accordingly, we shall begin with one of the most variable of all Aristarchean features, the East Wall Bright Spot (EWBS), using <u>east</u> and <u>west</u> in the newer IAU sense where Mare Crisium is near the moon's east limb.

Shortly after sunrise a small craterlet is to be found on the eastern glacis, just below the crest, together with a ravine which runs the length of the eastern glacis. Wilkins and Moore mention the ravine but not the craterlet which, however, is not a difficult object. There is some reason to suppose that this feature is occasionally obscured, for I have sometimes failed to find it with the same instrument which showed it clearly at other times.

Associated with this craterlet is a surrounding high-sun white area, ordinarily not visible at all at sunrise, when the eastern glacis appears dark gray and coarsely laminated. As the altitude of the sun increases this white area begins to develop, ultimately becoming many times larger than the little craterlet with which it is associated; and when fully formed the area presents the appearance of a brilliant white spot from which a winding streak, the "tail", runs east and north down the glacis. This tail is one of its most characteristic, but not consistent, features. The tail itself presents many anomalies. I have observed it to disappear after initial formation; to be on occasion both shorter and longer than average; to be sometimes very thin, at others very thick; occasionally to be wanting; and once I observed the beginning of formation of the base of the tail before the EWBS itself had appeared. Normally, to the apertures employed, it presents an amorphous aspect; but on two recent occasions, August 22 and August 23, 1964 (U.T. dates), at $4^h\ 54^m$ and $4^h\ 45^m$ U.T. respectively, it was seen to have a distinct filamentary structure, as if made up of interlacing rows of white streaks. The instrument used on both dates was the 5-in. reflector, which had never before shown any fine detail in this feature. I might add that the general aspect of the tail on these two dates was abnormal, being much longer than usual and being apparently somewhat shifted in position. On the succeeding night, August 24, 1964, at $4^h\ 22^m\ 30^s$ U.T., all appearances were normal once more; and the tail was reduced to its usual length and position. The filamentary structure was no longer seen.

The EWBS itself is quite small shortly after its appearance, which is well shown in the fine drawing by Mr. Robinson on the cover of <u>Str.A.</u>, Vol. 16, Nos. 1-2, 1962. Development ordinarily is rapid, though there are many exceptions; and the spot increases slowly in size. Around colongitude 70° it begins an extraordinary expansion, becoming quite brilliant, and making a large hump in the east wall. The outline of the wall is broken, and the spot appears to project westward over the crest, appearing like a huge, more or less oval to rounded blaze of light perched upon the very edge of the wall crest. The appearance of a rounded blaze of light, centered on the crest of the wall and projected westward over it, is, however, an illusion. The westward projection is really caused by a coincidental brightening of a broad band of white material on the inner surface of the east wall, which band continues upon the floor of the crater westward to the central peak. This band becomes almost as brilliant as the central peak itself, and on passing up the east inner wall it merges optically with the expanded white area on the glacis to create the appearance noted above.

The foregoing aspect remains fairly constant until around lunar noon, by which time the EWBS and the bright floor band have both enlarged and have optically merged so that to the eye the EWBS appears to be connected to the central peak by a broad and brilliant band, usually, though not always, of the same intensity as the EWBS itself. Not infrequently the central peak, the floor band, and the EWBS are all of the same intensity, in which case one observes what seems to be a huge, oval bright area extending from the central peak eastward over the crest and onto the eastern glacis. This appearance can be very confusing and a trap for the unwary. For several days after noon on Aristarchus this expanded aspect may continue, after which a slow reduction in size of the EWBS is to be expected. However - and perhaps significantly - the afternoon decline appears to be much more gradual than the morning development, so that the EWBS remains bright, conspicuous, and large almost to sunset. Thus I have seen it large and an estimated 9°5 bright (scale 0° to 10°, with 10° brightest) as late as col. 196°11 (July 24, 1954, at 7^h19^m U.T.) and as large, though only 6° bright, as late as col. 217°01 (July 5, 1964 at 7^h55^m U.T.). The extreme range of its visibility (as I have observed it) lies between col. 47°5 and 221°, but this range is not consistent.

On the face of it, the development of the EWBS would appear to be a perfectly normal case of high-sun brightening; but when we examine the phenomenon in some detail it becomes obvious that something more than solar altitude is involved. Granting that colongitude is not an exact measure of the lighting, it nevertheless remains true that greatly different appearances should not be seen for closely comparable colongitudes; i.e., if the appearance at any given time is solely and always the result of the angle of illumination. In particular it might be expected that the date of first appearance should bear a reasonably fixed relation to colongitude; but this is emphatically not the case with the EWBS, which shows such a wide range between dates of first appearance as quite to preclude the sun's altitude alone as the determining factor.

This fact is brought out in Table 1, which includes the very earliest and the very latest date on which the EWBS has developed, as observed by me up to the present time. Inspection will show that the range so far observed has been fully 27° of colongitude.

TABLE NO. 1

Colongitude of first appearance	Local time date
57°98	Aug. 20, 1964
49°88	July 20, 1964
68°46	June 22, 1964
47°50	June 27, 1958
52°93	May 29, 1958
50°72	March 12, 1958
50°62	Oct. 15, 1958
74°31	Sept. 29, 1955
65°46	Oct. 9, 1954
72°73	July 13, 1954

Unless our understanding of the nature of high-sun bright areas is completely erroneous, we must suppose that the surface comprising the EWBS, like all other such surfaces, is composed of, or overlain by, some material which becomes highly reflective with given altitudes of the sun; the difficulty here is to explain the lag.

The recent Ranger VII photographs of one area of the lunar surface show that particular surface to be literally pitted with minute depressions. Assuming that the EWBS area on the eastern glacis of Aristarchus may be of the same nature, we may further suppose that the bright material represents the walls of these tiny pits. If so, it could well be that the angle of incidence must be highly critical, in which case variations in the earth's selenographic longitude and latitude would appear to be more important than the altitude of the sun. But when these data are compared, no apparent relation can be found. Thus on July 20, 1964, col. 49°88, the earth's selenographic longitude was plus 2°5 and its selenographic latitude was minus 2°94, as of 0^h U.T. Yet on August 20, col. 57°98, when the EWBS made its first appearance, the same quantities were minus 2°19 and plus 2°24 respectively. Again, in September, 1955, when the EWBS did not appear until col. 74°31, the earth's selenographic longitude was minus 5°37 and its selenographic latitude minus 6°51 on September 30 by U.T., corresponding to the local time date, September 29. The physical librations we may ignore, as being always too minute to matter. Thus the date of first appearance of the EWBS would appear to have no more fixed relation to the earth's selenographic longitude and latitude than to the colongitude. The cause of the time lag, therefore, must, for the present, remain speculative.

The presence of bluish, blue-violet, and violet glares in and around Aristarchus has been reported in the literature both of the last century and this one. Because a convenient explanation was not at hand, the tendency has been to dismiss all such reports as being due to secondary spectrum, "contrast", or even delusion. The phenomenon, therefore, remains highly controversial; but for my part it is none-the-less a genuine and objective phenomenon, however it is to be explained.

The EWBS is frequently involved in this glare, which sometimes occurs only around the periphery of the spot while at other times it may overlay the whole spot. Sometimes the tail is involved and sometimes not. Occassionally the glare may also embrace the EWBS, the bright band which optically connects the spot to the central peak, and the central peak itself. Its appearance on or around the EWBS may last from one to four days; and as with the spot itself, its date of first appearance shows no discernible relation to the colongitude. The earliest I have recorded it in association with the EWBS is at col. 74°31, and the latest date of its first appearance has been at col. 166°18- a range of over 91°. Clearly, something more than lighting is also involved here.

Although it is true that very small changes of the angle of incidence of light may have profound apparent effects on minute lunar features, the features we are considering are not in this category. Hence an area the size of the EWBS should show at least reasonably similar appearances for comparable lightings. This is decidedly not the case with the EWBS. A slight, perhaps even fancied change in intensity, or a small change in shape, might be dismissed as non-evidential of anything save miscalculation or bad drawing on the part of the observer. But what are we to say to a large, 8° bright EWBS which at a comparison colongitude is found to be completely absent? Or what explanation is to be offered for a conspicuous, bright white EWBS which on the succeeding evening is found to have vanished without trace? It is certainly clear that such appearances are not to be explained by any recourse to the theory of incident lighting. Nor, I think, would the following:

On July 12, 1954, at col. 59°02, the EWBS had not yet developed; yet on July 13 (July 14 by U.T.) at col. 72°73 it presented the extraordinary spectacle of a huge blaze of light which not only broke the crater's rim but enveloped the entire eastern glacis, from crest to foot and from S.E. to N.E. The intensity was estimated as being from 9° to 10°, and the affected area was tinged with violet light. Two days later the EWBS was back to normal dimensions, though still brilliant. This phenomenon, so far as my records are concerned, is absolutely unique.

Thus, as with the inability to relate first development to a definite colongitude, it is also found that the pattern of development is often inconsistent, and that very gross differences in appearance and in size may frequently occur with closely comparable lighting. In Table No. 2, which is a selection from 137 comparison colongitudes, some of these differences are brought out.

TABLE NO. 2

Appearance at comparison colongitudes

Col.	Local time date	Remarks
49°05	May 22, 1964	Absent.
49°88	July 20, 1964	Small area, S. side of craterlet already beginning to whiten.
49°36	Mar. 24, 1964	Absent.
50°36	June 19, 1956	Absent.
50°62	Oct. 15, 1956	Well formed, complete with tail.
50°72	Mar. 12, 1957	Smaller and tail shorter than above.
65°46	Oct. 9, 1954	Very abnormal aspect; spot itself has not yet appeared, but base of tail has developed at foot of east wall glacis.
65°15	May 30, 1958	Large spot with tail.
72°73	July 13, 1954	Enormously developed, 9° to 10° bright.
72°73	June 30, 1958	Normal size, dull 5° bright including tail.

TABLE NO. 2 (cont.)

Col.	Local time date	Remarks
85:83	July 29, 1950	Very large, 10° bright. Tail missing.
85:04	July 1, 1958	Very large, 9°, 5° bright tail.
89:83	Oct. 11, 1954	Abnormally small, 10° bright with 8° bright tail, abnormally long.
90:46	Oct. 30, 1955	Large, 9° bright with 5° tail.
208:84	Aug. 8, 1950	Very small but brilliant, tail absent.
208:95	July 25, 1954	Abnormal aspect. Spot is enormously developed, merging with brilliant white band on east glacis.

A few words of explanation in regard to the above table may be in order. Many comparison groups have been omitted, as shown by the gap between 90° and 208°. This is because the phenomena recorded are essentially represented by the selection given, and thus more examples would be repetitious. Whereever the word "normal" is used, it is to be understood as referring to the average aspect at that particular colongitude. "Abnormal", of course, implies that the aspect is fundamentally different from the average aspect at that particular colongitude.

The use of the intensity scale does not, of course, imply absolute values. One might wonder, for instance, if a distinction between, say, 9° and 8° is even meaningful. In an absolute sense, No; but it does accurately establish the essential fact that as compared to a mark rated 9° bright, another mark is almost but not quite so bright.

We may close this discussion by attempting to clarify the role played by the brilliant floor band in the EWBS phenomena, to which allusion has previously been made. Its relation was very clearly revealed in the observation of July 25, 1954. The floor was then very bright (8°), while the central peak was rated 1° brighter. Running east from the central peak was a broad, fan-shaped band a little brighter than the floor average, not quite so bright as the central peak. This band passed up the inner east wall, crossed the crest, and fanned out down the eastern glacis to end at its foot. It is this area, which, when fully developed, merges with the EWBS to enhance its size and brightness, the latter then appearing to be of extraordinary dimensions. But why it does not always develop for similar lighting is not understood.

The persistence of this feature is even more remarkable than its failures, for on occasion I have seen it extremely close to sunset. Thus on July 5, 1964, at 8^h 28^m U.T., col. 217:3, T 5, S6, it was easily visible to a 3-in. refractor at 300x. In this view on July 5, 1964 the band was seen to be curiously flattened and spread out on the floor at the foot of the inner east wall, looking almost as if it had retreated across the floor in advance of the evening shadow and was condensing, so to speak, at the foot of the wall. The east glacis ravine for some reason could not be seen north of the bright area. Finally, a projected wall band still visible on the surface outside the crater is the one designated "A" in Mr. Leif J. Robinson's nomenclature and known as Beta in my own.

References

1. Aristarchus from Sunrise to Sunset, E. J. Reese, Str. A., Vol. 10, Nos. 3-4, 1956, p. 35.

2. Contributions to Selenology. Part 1. Aristarchus, 1957-1960, L. J. Robinson, Str. A., Vol. 16, Nos. 1-2, 1962, p. 33.

Postscript by Editor. Dr. Bartlett's article must derive a certain added interest because of the present considerable interest among professional astronomers in lunar transient phenomena. It also derives added interest from the fact that many of the phenomena of this kind reported during the last two years have occurred either in Aristarchus or near this crater. Dr. Bartlett's active interest in lunar changes is long-standing, going back to before 1950; he is not simply imitating, however unconsciously and however sincerely, the recent professional reports from the Lowell Observatory and elsewhere.

It may be worth remembering that searching for lunar changes was long the domain of dedicated amateurs. Many examples have been published in The Strolling Astronomer during the 19 years that it has existed. Among such reports that we have carried one might call attention to a transient light in Plato reported by A. W. Mount (Vol. 1, No. 8, pg. 2 *et seq.*, 1947) and to Dr. Leon H. Stuart's photographic and visual observation of a very brilliant spot near Pallas (Vol. 10, #'s 3-4, pp. 42-43, 1956). The amateurs making such reports were not carrying on research subsidized by government grants. Neither were they likely thus to enhance their scientific reputations; for as Dr. Bartlett indicates in his article, the invariable reaction among professional scientists was skepticism about the observation, the observer, and the equipment employed. And in truth, it usually was possible to find faults with the observation and its interpretation, as perhaps it always will be possible; and the greatly needed independent confirmation by other observers was always lacking. Yet we may now wonder whether these amateurs did not see more than their colleagues were willing to believe.

Since the apparent lunar changes described in the article above were found with apertures of 5 inches and less, it would appear that they should be capable of being studied on excellent photographs of Aristarchus.

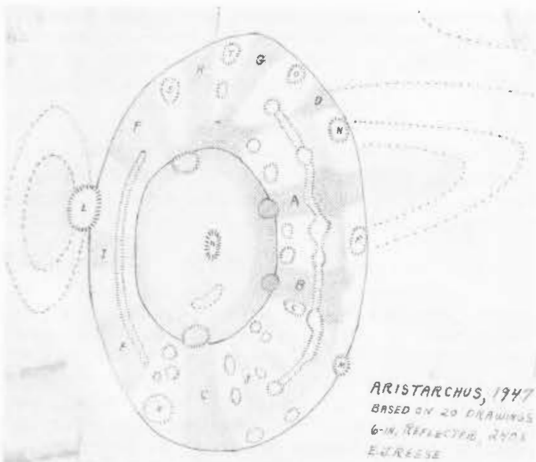

Figure 4. Preliminary chart of Aristarchus by Elmer J. Reese, based on 20 drawings in 1947 with a 6-inch reflector at 240X. The "east wall bright spot" of James Bartlett's article is feature "L" on the crest of the east rim. Lunar south at top, lunar east (IAU sense) at left.

Figure 5. Drawing of Aristarchus by Charles M. Cyrus. March 15, 1941, 5^h40^m- 6^h5^m, U.T. 10-inch reflector at 120X. Seeing 2, transparency 5. Colongitude 114°4. Same orientation as Figure 4. The "east wall bright spot" is the spot of intensity 8 on the east rim.

THEORIES REGARDING THE CANALS OF MARS

By: Rev. Kenneth J. Delano

(Paper read at the Thirteenth A.L.P.O. Convention at Milwaukee, Wisconsin, July 4, 1965.)

Hopefully, within a few days the camera of the Mariner spacecraft will provide at least partial answers to a century-old problem, the question of the canals of Mars -- a question which has been demanding an answer since 1877. It was in the apparition of 1877 that the Italian astronomer Giovanni Schiaparelli, using an 8.75-inch refractor, recorded having seen about 40 channels, or "canals" as they were later called, crisscrossing the reddish deserts of Mars. Schiaparelli was not the very first to see canals, but it was the great number of canals which he reported having seen that awoke curiosity and evoked numerous theories as to their nature and origin.

My purpose is to give a brief account of the various theories that have been proposed over the years in explanation of the canals of Mars. Schiaparelli himself only went so far as to say that the canals were probably some kind of formation as natural to Mars as the English Channel is to the earth, but he also had this to say in behalf of those who claimed that the canals were the work of intelligent beings on Mars: "I should be very careful not to combat this supposition, which involves no impossibility."

What made the canals as drawn by Schiaparelli seem so unnatural was that they never ended abruptly in a vacant space, they were so long and straight, and they invariably chose the shortest route between two points. Percival Lowell continued Schiaparelli's dedicated study of Mars at his observatory in Flagstaff, Arizona, from 1894 until his death in 1916. Lowell became the chief proponent of the belief that the canals are the work of intelligent beings. As he saw the canals, they formed a network designed to bring much-needed water down from the polar caps for the purpose of irrigation. Lowell believed that plant life flourishing for several miles on either side of the waterways is what gives evidence of the canals. Almost anyone would agree that the canal system presented on Lowell's charts of Mars is too regular to be the work of nature, so much so that to accept Lowell's charts necessarily involves acceptance of his whole theory of intelligent beings on Mars.

There soon followed a rash of arguments challenging the validity of Lowell's observations and theories. Most irritating to Lowell was what he contemptuously referred to as "the small-boy theory" of the English astronomer, Maunder. In 1902 Maunder experimented by having schoolboys copy from a distance a drawing of Mars without canals but with indistinct shadings and roughly aligned dusky patches. Many of the boys did, in fact, draw fine linear streaks in making their copies.

Some more recent astronomers have held the illusion theory. In 1930 Antoniadi, who was unable to see the canal network with the 33-inch Meudon telescope, wrote: "No one has ever seen a true canal on Mars. The rectilinear canals of Schiaparelli, single or double, do not exist...though they have a basis of reality, since all are situated either on spotted irregular tracks or rugged grey borders."[1] Furthermore, Dr. Dollfus of the Pic du Midi Observatory has claimed that the canals dissolve into individual spots and patches under perfect seeing conditions; but when seeing becomes poorer, these spots and patches take on the appearance of fine, straight lines. Even if these two distinguished astronomers are proven to be correct, it would still remain a mystery as to what natural forces could arrange fine detail approximately along straight lines.

Lowell credits rivers and cracks as being the two most plausible suppositions made to account for the lines on any theory of natural causation, but he argues that rivers are never straight and never uniform in width and that cracks are irregular and often lead nowhere.

Professor William Pickering has suggested that the canals may be natural cracks radiating from large craters as centers and that the cracks resulted from internal stresses. He further supposed that water and carbon dioxide issue from the interior of these fissures. Because of the very rare atmosphere, the vapors do not ascend very high, but instead sort of roll down the outside of the craters and along the borders of the fissures, thereby irrigating the immediate vicinity and serving to promote the growth of some form of vegetation. Alfred Russel Wallace adopted Pickering's earthquake theory and tried to go on to account for the fact that the canals are so long, so straight, and so different from anything found on the earth or the moon. In his book, Is Mars Habitable, published in 1907, Wallace tried to explain that the cracks were produced by a case unique in planetary formation -- the contraction of a heated outward crust upon a cold, non-contracting interior. Wallace departed from Pickering's belief that the fissures still give out water and carbon dioxide by affirming that Mars has cooled down now and that "-the fissures -- now for the most part broad shallow valleys -- serve merely as channels along which the liquids and heavy gases derived from the melting of the polar snows naturally flow, and, owing to their nearly level surface, overflow to a certain distance on each side of them."[2]

The Swedish physicist and chemist, Svante Arrhenius, also considered the canals of Mars to be earthquake-like cracks, and he tried to explain their seasonal changes in visibility not by the growth of vegetation but by a purely chemical reaction. According to him, the water which evaporates from the moist soil along the cracks finds its way to the poles, leaving behind a salt residue. When spring comes, the polar cap evaporates; and when the salt absorbs some of the moisture in the air, a darkish mud results, thus accounting for the changing tints without necessitating vegetation.

Less scientific and much more imaginative have been some of the other theories regarding Martian canals. Even as late as the first decade of this century there were some who believed that there are on Mars large, open bodies of water -- seas, lakes, and rivers. Percival Lowell put it this way: "The seas of Mars held water in theory centuries after the idea of the lunar seas had vanished into air." Ludwig Kann[3] claimed in 1901 that Mars was a completely water-covered planet and that most of its watery surface is covered by floating masses of yellowish-reddish weeds. According to Kann, the dark areas we see on Mars are areas where the weeds fail to grow so that we see the dark bottom showing through fairly clear water, and the canals are due to ocean currents which periodically part the masses of floating weeds. Adrian Bauman[3] published in 1909 his Explanation of the Surface of the Planet Mars, in which he expressed the belief that the Martian deserts are really frozen oceans and that the dark regions are land areas. The islands, or oases, in the frozen oceans are for the most part volcanoes which occasionally erupt, causing yellow clouds visible even from earth. The dust settling from the yellow clouds colors the frozen oceans a reddish-yellow. The canals which radiate from the islands are huge cracks in the frozen seas -- a logical outcome of vulcanism in a solid ice-sheet.

Another very old theory is one suggested by the Geneva inventor Herman Ganswindt,[3] who believed that the canals may be the routes of animal migration. Professor Elihu Thompson[3] found the theory acceptable and explained that there may be primitive animals on Mars which would migrate from Mars' equatorial zone poleward as the vegetation spreads to higher latitudes with the advance of summer. Since there are no mountains or rivers to obstruct them, the animals can make their yearly treks in straight lines. Thompson claimed that "Repeated fertilization and the long process of wear have gradually established paths of travel which have grown up with thick vegetation, leaving the rest of the planet a desert. At this great distance the pattern of interlacing routes can be mistaken for canals." At the A.L.P.O. Convention in Flagstaff in 1956 Donald Lee Cyr[4] said that the fertility-path idea came to him when he saw the old abandoned wagon trails near Las Cruces, New Mexico. When the summer rains come, brilliant green trails appear across the desert, whereas during the rest of the year the paths are invisible. The appearance of these paths in a rather short time each year is due not only to the rain but also to the fertility still lingering as a result of the passing horses and oxen of many years ago. In regard to the possibility of animals on Mars, Willy Ley and Wernher von Braun wrote, though not in connection with the animal migration theory: "It is very hard to admit the existence of large areas of vegetation and in the same breath to deny the possibility of creatures that eat those plants."[3]

One of the oldest theories regarding the canals is that proposed by Dr. Joly, Professor of Geology at the University of Dublin. Dr. Joly[5] believed that in the past Mars attracted small bodies, which after whirling about the planet, finally came down on the crust and caused the lines we see as canals. He suggested that a satellite about 72 miles in diameter circling only 63 miles above the surface of Mars would rend the surface in a zone 220 miles wide, thus forming two parallel ridges, which might be visible to us as a double canal. Percival Lowell lightly dismissed the meteor theory by saying: "Nor can the lines be furrows ploughed by meteorites -- another ingenious suggestion -- since in order to plough, invariably, a furrow straight from one center to another, without missing the mark or overshooting it, the visitant meteorite would have to be specially trained to the business."[6]

More recently, Dr. Dean McLaughlin has attempted to account for the shapes of the dark markings and the courses of the dark lines by a study of the expected atmospheric circulation on Mars.[7] According to Dr. McLaughlin, prevailing winds would distribute the dark ash from still active volcanoes in the pattern of funnel-shaped bays and along narrow lines.

In the January-February, 1961 issue of The Strolling Astronomer Dr. S. Miyamoto of the Kwasan Observatory in Japan expressed another theory in which the wind figures.[8] Dr. Miyamoto believes that the dark maria and dark lines on Mars are evidence of a deeper lying basaltic layer over which the lighter-weight and lighter-colored granitic mass had largely spread at the time of the formation of Mars' original crust. Contraction cracks which appeared in the reddish highland deserts revealed the underlying dark basalt. Because there is likely to be higher temperatures and greater humidity in the lower maria and in the cracks, erosion of the dark basalt would proceed at a faster pace than in the granitic deserts, with the result that the maria would tend to deepen and the cracks to widen, assuming only that the winds carry away the loose soil in much the same way as wind deflation deepens the Gobi desert and other arid basins of Central Asia. Dr. Miyamoto's point is that the role of wind erosion is not always to bury clefts in the desert and that a dark basaltic layer revealed in the erosion-widened cracks can account for the canal phenomenon.

Ever since Schiaparelli reported long straight lines on Mars, people have been trying to find similar straight lines of quite natural origin on either the earth or the moon.

Alfred Russel Wallace in his book Is Mars Habitable mentions the 120 mile fault between the Highlands and Lowlands of Scotland, the 180 mile depression in the earth through which the Upper Rhine River flows, and the 400 mile geological depression or fracture marked by the Sea of Galilee, the Jordan River, the Dead Sea, the Wadi Arabah, and the Gulf of Akaba. In a theory proposed just last year in the July, 1964 issue of Icarus, Frank A. Gifford of the U.S. Weather Bureau at Oak Ridge, Tennessee called attention to another type of long straight lines on earth -- long sand dune chains.[9] As Mr. Gifford points out, there are about fifty nearly perfectly parallel seif dunes in the desert of Southern Arabia, some of which attain lengths of over 200 miles, and even longer sand dune chains could result on Mars, given a sufficient amount of sand and the wind velocities of 8 to 12 meters/sec. which have been observed on Mars. The conclusion is that Mars is not alone in having long, narrow, straight, and in the case of double canals, parallel lines, and that the wind may be as much a factor in the formation of Mars' straight lines as it is in the earth's long straight sand dunes.

Soon we may know just how "different" the canals of Mars are and what we should think of statements like that made by Edward S. Morse in his book Mars and its Mystery: "The unnatural straightness of these interlacing lines on Mars, many of them following the arcs of great circles, their uniform width throughout, their convergence to common centres, and their varying visibility synchronizing with the Martian seasons find no parallel in natural phenomena."

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4. "THE STROLLING ASTRONOMER", Vol. 10, #9-10, Sept.-Oct.1956, pp. 110-113.

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8. "THE STROLLING ASTRONOMER", Vol. 15, #1-2, Jan.-Feb. 1961, pp. 23-26.

9. "ICARUS", Vol. 3, #2, July, 1964, pp. 130-135.

Postscript by Editor. An important part of the A.L.P.O. Exhibit at the Milwaukee Convention this year was a book of maps of Mars collected and attractively arranged by Reverend Delano, who has since then generously given this book to the A.L.P.O. The book includes almost 40 different maps from the earliest useful ones made down to the present day.

The Mariner IV Mars photographs are now history, but discussion and interpretation will be considerable in the coming months. The Editor feels that it may be rather early to say what the photographs tell us about the canals of Mars. The region covered by the Mariner IV trace is one of almost uniquely difficult detail for earth-based observations. The Editor's preliminary opinion is that the certain correlation of Mariner IV detail and features known in earth-based observations may prove difficult. Without knowing which reported canals are located on which Mariner frames, interpretation of the canals may well remain inconclusive.

On August 19, 1965 Reverend Delano wrote that Mr. Frank Gifford, whose sand dune theory is mentioned above, had written of finding a perfectly straight bright feature on a Mariner IV frame. Mr. Gifford thinks that his sand dunes hypothesis may thus be confirmed, the chain of dunes looking brighter as the illumination for the observer becomes more direct. In the 1902-3 apparition Lowell found Brontes canal, which runs north-and-south, typically less visible close to opposition, when the lighting near the C.M. was most direct, than both before and after opposition, when Brontes looked darker (see Mr. Delano's reference 9).

PLANETOLOGICAL FRAGMENTS-1

By: DPC

The Surface of Mars

In a recent publication Alan B. Binder and Dale P. Cruikshank have reported results of a study of the surface of Mars and comparisons with weathered terrestrial rocks. The observations were made in the near infrared (0.9-2.6 microns) and indicate that the surface of Mars (the desert regions) consists of a weathered surface of limonite ($Fe_2O_3.nH_2O$). This reddish stain appears on a wide variety of igneous rocks and may be either a powdery coating or a surface stain, both of which are formed and preserved in arid desert environments. A powdery surface would be suggested by the previous polarization measurements of Dollfus. No other reddish rocks (sandstones, granites, siltstones, etc.) matched the Mars observations, which had been made in 1961 with the Mc Donald 82-inch reflector. Geological field observations indicate that in terrestrial deserts the stained surface is more common than the powdery surface; and if an analogy can be drawn between Martian and terrestrial deserts, it is tentatively assumed that the surface of Mars is composed partly of stained outcrops, rock fragments, and finer material. A main point of this work was to demonstrate that the exact rock type (rhyolite, granite, sandstone, etc.) constituting the surface of Mars cannot be determined because the limonite stain or powdery coating occurs on a very wide variety of rocks, and it is this coating that gives the optical properties observed from the earth. (Reference: Binder, Alan B., and Cruikshank, Dale P., "Comparison of the Infrared Spectrum of Mars with Spectra of Selected Terrestrial Rocks and Minerals", Comm. Lunar and Planet. Lab., Vol. 2, No. 37, pp. 193-196, 1964.)

Search for Volcanic Material on the Moon

Soviet astronomers commonly use the methods of photometry and spectrophotometry to fullest advantage for studies of the surfaces of the moon and planets. V. V. Sharonov (author of Priroda Planet, in English Nature of the Planets, Moscow, 1958) has recently studied volcanic sands, slags, and lapilli from the Kamchatka and Simushir Island volcanic fields. His photometric measurements of the indicatrix of reflection (direction and intensity of the reflected light) from these various volcanic materials indicate that volcanic ash does not match the lunar surface. Rough, lumpy lava flows covered by a crust of bubbly slag have the same type of reflection indicatrix as the lunar surface. Areas of lapilli (small, glassy, nut-size volcanic eject fragments) also have the lunar-type indicatrix.

In spite of the photometric similarity of these materials to the lunar surface, Sharonov notes that observations in radio, infrared, and radar wavelengths indicate that the surface of the moon is extremely homogeneous. The current theory of the form of the lunar surface held in the USSR is that the moon is covered by "meteoric slag", accumulated debris from meteoritic impacts including portions of the lunar surface as well as the meteorite fragments. Also in this theory it is assumed that a large portion of the evaporated meteorite and lunar surface material condenses and precipitates near the impact site and forms a crust consisting of a vesicular mass with cavities separated by very thin walls. The layer would appear spongy and cellular in structure.

In view of the findings of Ranger IX photographs of the crater Alphonsus, it would be of interest to determine the reflection indicatrix of the dark halo craters on the floor of that crater. They appear to consist of finely divided volcanic ash blown from the central craterlets and cover the surrounding areas with a resonably thick layer of this debris. (Reference: "A Photometric Investigation of the Presence of Outer Layers of Volcanic Origin on the Moon", by V. V. Sharonov, Astronomicheskii Zhurnal, 42, No. 1, pp. 136-144, Jan-Feb., 1965, in Russian.)

*Note by Editor. We should welcome comments from our readers about this article. If there appears to be sufficient interest in this kind of material, we shall request the author to furnish future similar articles as a frequent or regular feature. Comments might include, for example, the desired technical level of presentation here, the amount of space which we are to give to such material, and the sources from which it may be taken. Let us know how we may better meet your wishes.

SOME RECENT A.L.P.O. OBSERVATIONS OF LUNAR DOMES

This article is a selection and editing of material submitted by Mr. Harry Jamieson, the Lunar Recorder in charge of the Lunar Dome Survey. Our intention is simply to give readers a picture of what is going on in this particular lunar project. Readers who would like to participate in such studies are invited to write to the proper Lunar Recorders, Mr. Jamieson and Reverend Delano, whose addresses appear on the back inside cover. Persons with no background at all in observing the moon, however, may first wish to participate in Mr. Chapman's Lunar Training Program.

A Dome and a Dome-Like Plateau South of Archimedes. Figure 6 is a drawing contributed by the Reverend Kenneth J. Delano of New Bedford, Massachusetts. The dome there shown is located at longitude -4°33' and latitude +21°57'. Its corresponding positional designation is -074+374. In other words,in lunar rectangular coördinates it lies at xi = -.074, eta = +.374. Latitude and eta are positive to the lunar north; longitude and xi, to the IAU lunar east, where east is the hemisphere of the Mare Crisium. It might be instructive to verify this relation between latitude and longitude on the one hand and xi and eta on the other with the aid of Mr. W. M. Swinburn's lunar grid conversion scale (Str. A., Vol. 18, Nos. 9-10, pp. 195-199, 1964). The dome under discussion is shown on Figure 6 at the end of the shadow-line of a ridge or cleft which runs in a general north-south direction. The dome was observed to be 12 kms. by 15 kms., having a longer and more gradual slope upward from the southeast (IAU east here and elsewhere in this article). The slope was otherwise moderate. The dome is shown on LAC 41 (First Edition, Sept., 1963), with a craterlet just north of its center; but Mr. Delano recorded no craterlet on the dome in this view.

Leading away from the dome's southwest base, LAC 41 vaguely depicts a low ridge running toward the eastern end of a row of hills which parallel the Apennine Mountains. The observer in this view found the shadow more like a fault line since it was a fine, dark line (at least the half of its length nearest the dome.) Towards the south the shadow broadened, and very small hillocks brightly dotted the eastern edge of the shadow there (Figure 6). Mr. Delano classifies the dome in the Westfall System (Str. A., Vol. 18, Nos. 1-2, pp. 15-20, 1964) as DW/2b/6f'/0.

A little to the northwest of the dome is a dome-like plateau, which is evidently composed of the very same surface material as the dome (Figure 6). Both showed a pebbly-grey appearance and stood out well against the mare. Because of its flatness and its kite-like shape, one may question whether this dome-like plateau should be classified as a dome, even though it otherwise has the identical surface appearance of the neighboring dome and presumably much the same origin. A small craterlet was seen on the plateau near its northeast edge. LAC 41 gives no indication of any dome or plateau here. The darker shadow on the plateau's southwest slope suggests a steeper slope there. This dome-like plateau is located at longitude -5°8', latitude +22°56'; the positional designation is -082+390. Dome -074 +374 had previously been "discovered" by Olivarez, who made the diameter 13.5 kms.

Recently Discovered Dome Near Kies. Figure 7 is a drawing of a "new" dome between Kies and Pitatus, positional designation -297-475(xi = -.297, eta = -.475). The existence of this object has now been confirmed by Reverend Delano. Mr. Olivarez in the view shown in Figure 7 recorded the object as looking nicely domical and rough in excellent seeing moments. It resembled the very rugged Darwin dome. There was noted a peak or two on top, and the dome appeared to be crossed by one of Tycho's bright rays.

Mr. Olivarez proposes as the Westfall designation DW(-297-475)2e/5f/ "rugged all over in good seeing."

Three Domes East (IAU) of Gambart. Figure 9 is a drawing by A.L.P.O. Lunar Recorder John Westfall. The three domes shown are good examples of the rather common type of dome characterized by a round shape and a hemispherical profile. All are of a moderate size and are easily seen when near the terminator. These domes have been well confirmed and are listed in the BAA-ALPO Joint Catalogue as -247+013, -250+021, and -257+030.

Dome Between Lalande and Fra Mauro. Figure 8 is a sketch by Mr. Westfall of a dome originally found on Table Mountain Obsrvatory Photograph #1418, taken by Mr. Charles Capen with a 16-inch Cassegrain reflector of F.L. 315 inches on July 14, 1963, at 11^h3^m, U.T., colongitude 186°.8. Good photographs of the moon with adequate apertures must certainly be a fruitful source of newly known domes; perhaps some A.L.P.O. members with access to files of such photographs could very profitably peruse them for this purpose. It should also en-

Figure 6. Lunar dome and dome-like plateau south of Archimedes. Kenneth J. Delano. 12.5-inch reflector. 300X. May 9, 1965. 2^h0^m-4^h0^m, U.T. (between clouds). Seeing 5. Transparency 2-4. Colongitude 7°.44-8°.46. Lunar south at top, lunar east (IAU sense) at left.

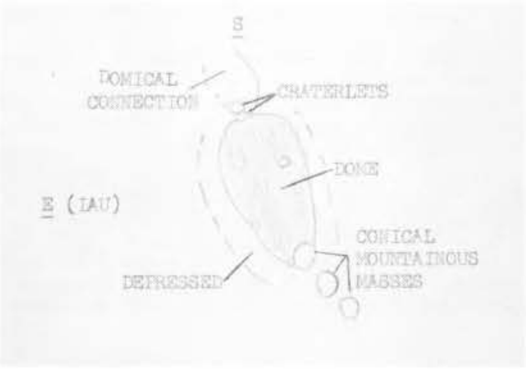

Figure 7. Dome near Kies. José Olivarez. Pan American College 17-inch reflector. 250X (about). March 12, 1965. 1^h30^m, U.T. (about). Seeing good. Transparency fair. Colongitude 19°.9.

Figure 8. Dome between Lalande and Fra Mauro. John E. Westfall. 4-inch refractor. 230X. August 1, 1964. 9^h50^m, U.T. Seeing 6. Transparency 5. Colongitude 188.°0. South at top, east at left. See also text.

Figure 9. Three domes east of Gambart. John E. Westfall. 4-inch refractor. 230X. August 1, 1964. 9^h45^m, U.T. Seeing 6. Transparency 5. Colongitude 187.°9. South at top, east at left.

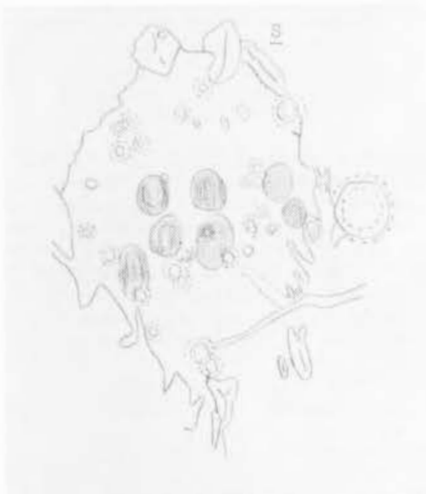

Figure 10. Domes within Flammarion. Harry D. Jamieson. 10-inch reflector. 170X-190X. August 16, 1964. 1^h0^m-1^h10^m, U.T. Seeing 3-4. Transparency 6. Colongitude 7.°1. South at top, IAU east at left.

Figure 11. Dome east of Lubbock. Harry D. Jamieson. 10-inch reflector. 185X. August 12, 1964. 0^h57^m-1^h1^m, U.T. Seeing 3-5. Transparency 5. Colongitude 318.°12. Same orientation as Figure 10.

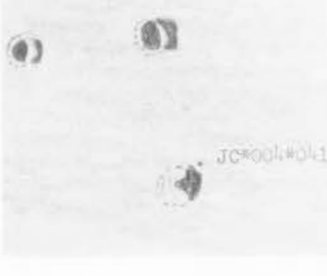

Figure 12. Dome in Sinus Medii. Charles L. Ricker. 10-inch reflector. 291X. June 7, 1965. 2^h10^m, U.T. Seeing 6. Colongitude 1.°8. Transparency 5.5. Same orientation as Figure 10.

courage possessors of small telescopes of good quality that Mr. Westfall was able to effect the visual confirmation of this dome with only a 4-inch refractor. Mr. Westfall directs attention to the very complex summit, the oval-odd shape, and the extensions to the southwest and east. He proposes the Westfall Classification, including positional designation, to be DW(-218-090)3d/6i'/8p9p.

Domes Within Flammarion. The seven domes shown in Figure 10 were found by Mr. W. L. Rae of the B.A.A. and have been confirmed by Mr. Harry Jamieson. To the latter observer they appear to be 10 kms. or less in diameter, round or oval, and with hemispherical profiles. They thus range from DW-2a/5f to DW-2b/5f in the Westfall Classification. All these domes are in the BAA-ALPO Joint Catalogue. A shaded drawing of them by John Westfall appeared in Str.A., Vol. 18, Nos. 9-10, Figure 3, pg. 181, 1964.

Dome east of Lubbock. This dome, ALPO +697-075C was first noted by Leif J. Robinson in 1962 and has since then been confirmed by Jamieson. The dome itself appears to be a large, irregular swelling about 45 kms. in diameter situated between W. H. Pickering and Lubbock. The Westfall Classification is DW(+697-075)4e/5g/7p. Although the sun's altitude above the dome was only 2°22' for Jamieson's drawing given here as Figure 11, the dome cast very little shadow. This dome is indeed a very low object and is therefore best observed when very near the terminator.

Dome in Sinus Medii. Mr. Ricker's drawing here published as Figure 12 shows the Joint Catalogue Dome JC+004+041. The observer sought to determine height, diameter, and slope angle by using Ashbrook's methods (Str.A., Vol. 15, Nos. 1-2, pp. 1-3, 1961). The diameter was found in two ways. First, visual comparisons with the known diameters of the craters Bruce, Blagg, and Chladni gave a diameter of 10.55 kms. Second, actual measurement on Orthographic Lunar Atlas, sheet C4b gave 11.67 kms. as the diameter of this dome. Jamieson has found about 13 kms., in pleasing agreement. Mr. Ricker measured the slope angle to be about 2°2; and if we take this slope angle and a diameter of 11.67 kms., the height of the dome comes out to be 223 meters.

Domes in the Delisle Cluster. Figure 13 is a drawing by Charles L. Ricker of domes near Delisle in the northern part of the Mare Imbrium. The observer remarks: "This observation was suggested to me by the 'Dome Observers Circular #1', in which it was stated that the region needed much more study because of the tendency to mistake ridge-swellings for domes. My observations confirm this tendency; for out of the 11 objects studied on this occasion, evidently only 4 are domes. Of course, much more study will be needed before these objects may be considered as confirmed or otherwise. No attempt was made at this time to chart delicate detail in the Delisle region, but instead merely to record domes and ridges. A detailed description of the domes and previously suspected domes follows [see Figure 13 for numbers of objects]:

"1. -508+439 (positional designation). Obviously a swelling in the ridge.

"2. -496+480. Undoubtably a dome with a rather sharp summit. Very large, taking up almost the entire area between Delisle and Diophantus, as shown.

"3. -520+481. A beautiful dome. Circular, very low slope.

"4. -524+457.

"5. -525+460. Neither of these objects is shown on a recent BAA chart, but they were quite evident. They are quite small, circular, and very low.

"6. -526+440. Evidently a swelling in the ridge.

"7. -535+447.

"8. -542+451. Both objects part of this very prominent ridge. Under this very low light, this ridge appeared much as a low crater rim.

"9. -538+474.

"10. -535+485.

"11. -534+497. These three features also part of a low ridge, as shown."

Lansberg D Dome Complex. Figure 14 is a drawing by Mr. José Olivarez and shows all the domes connected into one system. Other observers except for Alika K. Herring have recorded these domes as separate units. On this occasion Olivarez was impressed by the broad connection of the triangular feature to one of the "pancake" domes. He thought that the neck joining these features is not narrow as suggested by Herring (Sky and Telescope, Vol. XXVII, No. 1, pg. 60, 1964) but is instead notably broad. Do we here have the effect of a difference in aperture between Herring (12.5 inches) and Olivarez (17 inches)? However, Herring had really excellent seeing. Olivarez notes that larger telescopes always give poorly defined domes, such as this one, larger apparent boundaries. Domes A and B on Figure 14 are in the Joint Catalogue as -496-062 and -502-071 respectively.

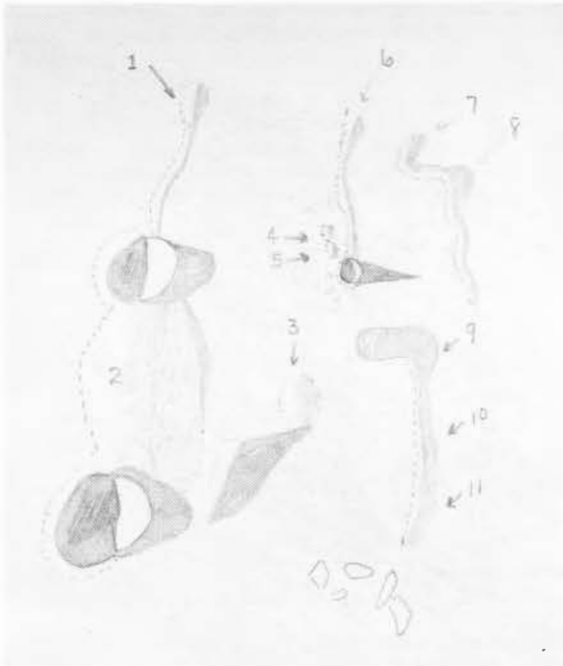

Figure 13. Domes in the Delisle cluster. Charles L. Ricker. 10-inch reflector. 208X. June 10, 1965. $1^h 15^m$-$2^h 40^m$, U.T. Seeing 4-6. Transparency 6. Colongitude 38°3 at mid-time. South at top, IAU east at left.

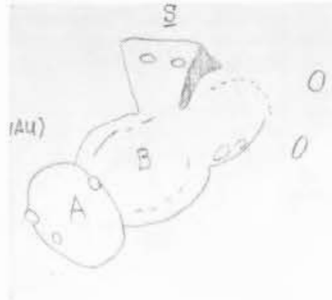

Figure 14. Lansberg D dome complex. José Olivarez. Pan American College 17-inch reflector. 250X. March 13, 1965. $0^h 30^m$-$1^h 25^m$, U.T. Seeing 4. Transparency 4. Colongitude 31°8. South at top, IAU east at left.

THE 1965 ANNUAL CONVENTION OF THE ALPO

By: Richard E. Wend

The Thirteenth Convention of the ALPO was held in Milwaukee, Wisconsin on July 2-5, 1965 in conjunction with the National Convention of the Astronomical League. Host societies were the Milwaukee (Wisc.) Astronomical Society and the Racine (Wisc.) Astronomical Society.

After registering in the lobby, guests proceeded to the Lorraine Room of the downtown Schroeder Hotel, where the ALPO Exhibit was one of the main attractions. Tom Osypowski was in charge of the Exhibit, which included fine comet photographs, lunar and planetary drawings and photographs, and oversized enlargements from 35 mm. negatives showing considerable lunar detail. A relief model of a portion of Mare Cognitum on a scale of 1:80 showed a part of the area photographed by Ranger VII, with contour line intervals of 10 centimeters! (Prepared by the U.S. Geological Survey.) The Exhibit was arranged by Tom Osypowski, Philip Glaser, and Virginia Glaser.

A hearty buffet dinner was followed by speaker Robert E. Cox of McDonnell Aircraft Corp., and editor of "Gleanings for ATM's" in Sky and Telescope. "Optical Fabrication Support of a Company Space Program" explained special optical jobs and testing, such as creating the camera that photographed the Gemini space walk. The special lens was made with a focal length of 0.2 inches! Buses then took the delegates to the observatories of the two host societies the Milwaukee Astronomical Society Observatory and the Modine-Benstead Observatory of the Racine Astronomical Society. Racine featured a 16" Cassegrain, convertible to a Newtonian but used that night at the Cassegrain focus. The Milwaukee Observatory showed two 12½" Newtonians, a 10" Newtonian, and a sky patrol camera of 12" f.l. and clock drive. Skies were partly cloudy, but the moon and a close Venus-Mercury pair were observed between clouds. There was also a great deal of "shop talk" at both observatories, and visitors enjoying discussions with old and new friends were reluctant to board the buses back to Milwaukee.

Saturday's luncheon at the hotel was highlighted by the ALPO's founder and Director, Walter H. Haas, who spoke on "Faces and Phases of Current Amateur Astronomy." In his introductory comments Phil Glaser mentioned that Mr. Haas had observed in Jamaica at the age of 18 with the great astronomer W. H. Pickering. Then, as house lights dimmed, the Maître d' Hôtel carried in a sparkling birthday cake, as Mr. Glaser announced that this was indeed the birthday of Mr. Haas!

In the afternoon general paper session, Commander A. H. Rice of the U. S. Naval Academy demonstrated with red and white flashlights the "Project Moonblink" apparatus described in The Strolling Astronomer, Vol. 18, pg. 183, 1964. He explained that the purpose of the image converter is to avoid the eyestrain and headaches caused by long viewing of alternating red and blue images.

After a dinner at Williams College, adjacent to Yerkes Observatory on Williams Bay, Wisconsin, 230 conventioneers assembled at the doors of the world-famous Observatory, operated by the University of Chicago. Dr. Hiltner, Director of the Observatory, explained about the three telescopes that would be shown. The historic 40" refractor was trained on M13, while in the two smaller domes an old and a new 24" reflector were exhibited. The new one had automated controls, and the tube rotated on its optical axis for studies of polarized starlight. The old 24", Ritchie's first for Yerkes, was used for many years by Dr. Van Biesbroeck for comet work and will soon be retired to a museum, to be replaced by a modern 40" reflector. Time ran out before everyone had a chance to see M13 thru the 40" refractor, but those who were fortunate enough to see it were greatly impressed.

The evening was saddened by the tragic death of Mr. Floyd Shirey from Dallas, Texas in a fall from the roof of the observatory. Mr. Shirey had been an officer of the Southwest Region of the Astronomical League and was for some years a member of the ALPO. A scholarship fund at the University of Chicago is being started in his memory.

On Sunday, the ALPO paper session produced 15 papers. Since many of these will be published or abstracted in future issues of The Strolling Astronomer, only very brief comment will be made here on the content of the papers.

1.) "The Doubling of Jovian Satellite Shadows", Richard E. Wend. Speculation about a series of three color photographs of Jupiter taken by P. R. Glaser, in which the first and third show a normal shadow of Io, and the second shows a doubled shadow without doubling of other detail.
2.) "From Neison's Notebook", Patrick Moore. Read by Leonard Abbey. Of historic interest. Comments were made on unpublished manuscripts and original drawings.
3.) "Some Observations of Mars - 1965", Kenneth Schneller. Seasonal and secular variations of Martian features were scientifically measured, utilizing fine seeing and 856X-1056X on an 8" Newtonian and a replica grating spectroscope.
4.) "Spiral Structure of Lunar Craters", Alan W. Heath. Read by Richard Fink. Craters studied at full moon reveal 21 examples of spiral nature, classified as tight, open, loose, or incomplete.
5.) "High Resolution Lunar and Planetary Photography", Tom Osypowski and Tom Pope. Read by Tom Osypowski. Discussion and illustration of the techniques and requirements of this fine art. The Strolling Astronomer, Vol. 18, pp. 193-194, 1964 contains examples of the authors' work.
6.) "Some Advantages and Results with the Small Refractor", Phillip W. Budine. Read by Jeff Lynn. Skilled observers can see a great amount of detail with the uncomplicated small refractor.
7.) "The Distribution of Known Lunar Domes", Harry Jamieson. Domes tend to form not only clusters, but chains, and even chains of chains. Definitely not a random distribution.
8.) "Latitude Deviations of the NEB_n and NEB_s of Jupiter", Paul K. Mackal. Read by Philip R. Glaser. Studies of data from 1903-1947 on this very conspicuous belt reveal a range of 2°2 in latitude for the NEB_s and 5°5 for the NEB_n.
9.) "Lunar Terminator Deformations", John E. Westfall, ALPO Lunar Recorder. About 5X overexposed photographs of the entire moon are needed to detect the deformations and have so far revealed 10 elevated and one depressed area on the moon.
10.) "Some Highlights of the 1964-1965 Jupiter Apparition." P. R. Glaser, ALPO Jupiter Recorder. Great belt formation in the Northern Hemisphere, including a thin NTB redder than the Red Spot, a yellow EZ, and a conspicuous SEB were illustrated by color photographs taken

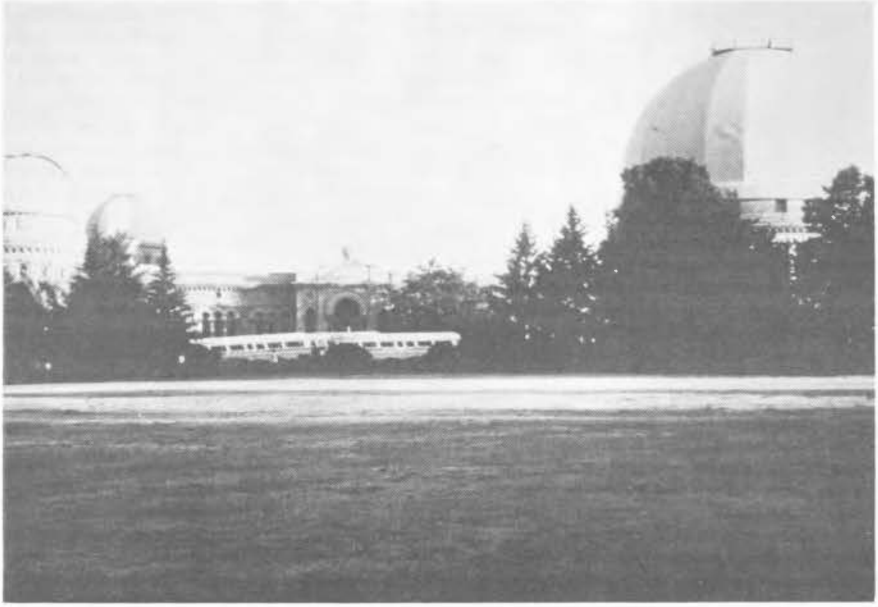

Figure 15. Yerkes Observatory of the University of Chicago and grounds. The 40-inch refractor is in the dome to the right; two 24-inch reflectors are in the smaller domes to the left. Figures 15-20 were taken and contributed by Mr. Frederick W. Jaeger; they were processed from colored slides for reproduction here by the Central Photo Service, East Chicago.

Figure 16. Astronomical League - A.L.P.O. Convention delegates at the Yerkes Observatory, July 3, 1965.

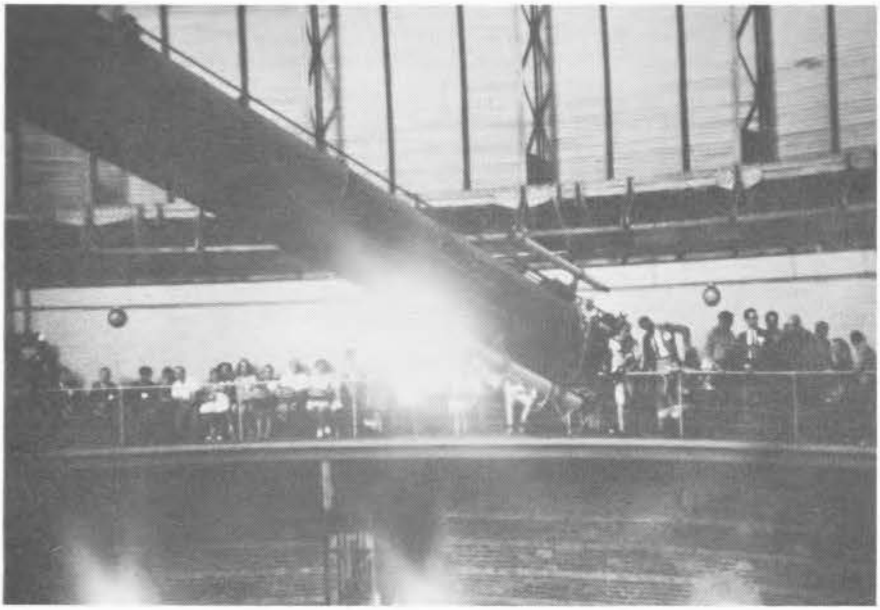

Figure 17. Astronomical League - A.L.P.O. Convention delegates in dome of Yerkes 40-inch refractor. The barrel of this instrument is 63 feet long. This telescope is the world's largest refractor.

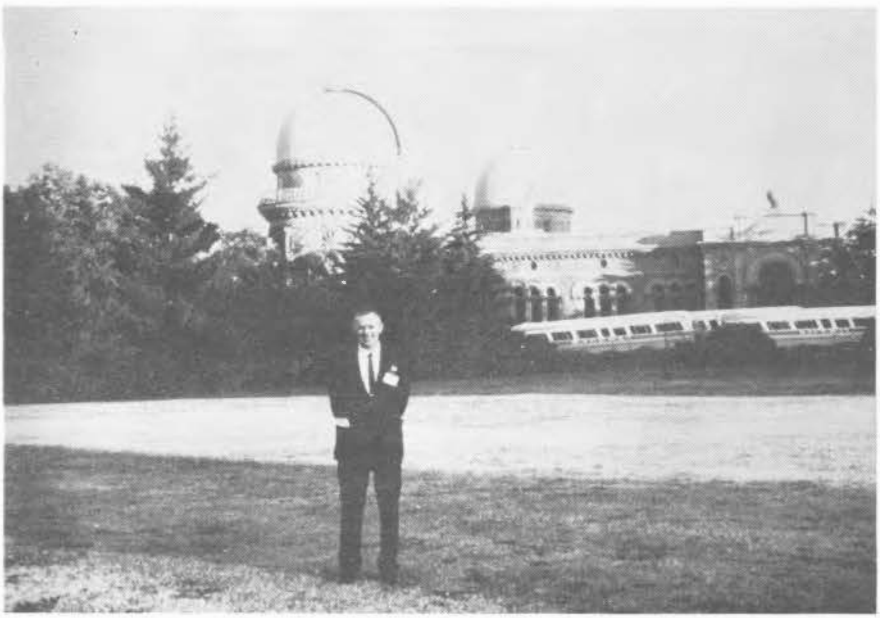

Figure 18. Frederick W. Jaeger at Yerkes Observatory during League - A.L.P.O. Convention.

with Mr. Glaser's 8" reflector.
11.) "The Phase Anomaly of Venus, 1964." Alan W. Heath and J. Hedley Robinson. Read by Richard Fink. Observations with color filters graphically illustrate that the "blue" phase lies below the "red" phase for both morning and evening apparitions of Venus.
12.) "Slitless Photographic Spectrophotometry of the Eclipsed Moon." D. Meisel, J. Jenkins, and J. Monahan. Read by D. Meisel. An Edmund transmission grating with maximum dispersion at right angles to the direction of the moon's motion was used with a very high speed panchromatic film and widest lens opening, allowing the moon's image to trail.
13.) "Theories Regarding the Canals of Mars", Rev. Kenneth Delano. An historic review of the widely divergent views held as the nature of greatly debated features.
14.) "Improving Methods in Astrophotography", Paul Riherd. Hypersensitization, large plate size, and special processing and printing were stressed.
15.) "An Electronic Image Converter for Lunar and Planetary Astronomy", Henry P. Squyres. Read by Harry Pease. Using a power supply costing under $30, the author found the lunar ray system more pronounced in infrared, particularly Proclus. Venus is to be observed in ultraviolet.

After the break for lunch, Robert E. Cox of McDonnell Aircraft Corp. showed color movies of the Russian "Walk in Space" and the official NASA film of astronaut Edward White's "Walk in Space". The Russian film used a telephoto lens, magnifying speed as well as the earth. Color balance was inferior to the NASA film, but a beautiful sequence of specular reflection of sunlight from some large lakes below was truly magnificent. In the NASA film the 0.2-inch lens mentioned previously showed edges of the Gemini spacecraft in the same depth of field as the panoramic view of the earth below and the floating astronaut.

Banquet speaker Kenneth E. Kissell, of Wright-Patterson AFB, spoke on the "1965 NASA-IQSY Solar Eclipse Expedition from an Experimenter's Point of View". A jet aircraft was equipped with special windows to view the eclipse from high altitude and above all clouds.

A special meeting of the A.L.P.O. was held immediately after the banquet speech. The writer was unable to attend because of the need to be at a League Council meeting, but David Meisel has supplied notes of the informal discussion. About 25 persons attended. A letter from Clark Chapman was a status report on the A.L.P.O. Observing Handbook. It was hoped to have an initial draft of all chapters complete by the end of September, 1965. Possible meeting places for 1966 and later years were discussed, but no final decision was reached. The invitation of the League to come with them to Miami in 1966 was considered. The possible role of the A.L.P.O. in the topical survey for possible lunar transient phenomena was discussed at some length. It was the majority opinion that probably our participation should be on specific projects and for limited periods of time. Other matters brought up included Association finances, the very late publication dates, and a possible more formal organization.

Many thanks are due to Mr. Ralph Brichta, General Chairman of the Convention, and to the two host societies for arranging such an enjoyable gathering.

The Milwaukee Convention has also been described in <u>Sky and Telescope</u>, Vol. XXX, pp. 132-136, 1965 and in <u>The Review of Popular Astronomy</u>, Vol. LIX, No. 534, pp. 3-4, 1965.

BOOK REVIEW

<u>Wanderers in the Sky</u>, edited with commentary by Thornton Page and Lou Williams Page, Macmillan, 1965, 338 pp., $7.95.

Reviewed by William O. Roberts

A new series of astronomical books is now in preparation. Each title pursues some particular line of astronomical thought and activity. Texts are made up of extracts from articles which have appeared in the pages of <u>Sky and Telescope</u> and its parent journals over the past thirty years, and continuity of content is maintained by the use of editorial commentary. Our review work is the first of these collections to appear in print.

<u>Wanderers in the Sky</u> is divided into five sections. Part I is entitled <u>The Dawn of Understanding</u> and discusses our comprehension of the motions of the heavenly bodies up to the time of Isaac Newton. Part II, <u>Newton's Mechanical System</u>, commences with Newton's work and carries the discussion through the great period of classical mechanics, showing how the weaknesses of Newtonian mechanics became apparent, and how relativity was developed to take errors into account. Part III, <u>Recent Probing of Space</u>, is concerned mainly with space-ve-

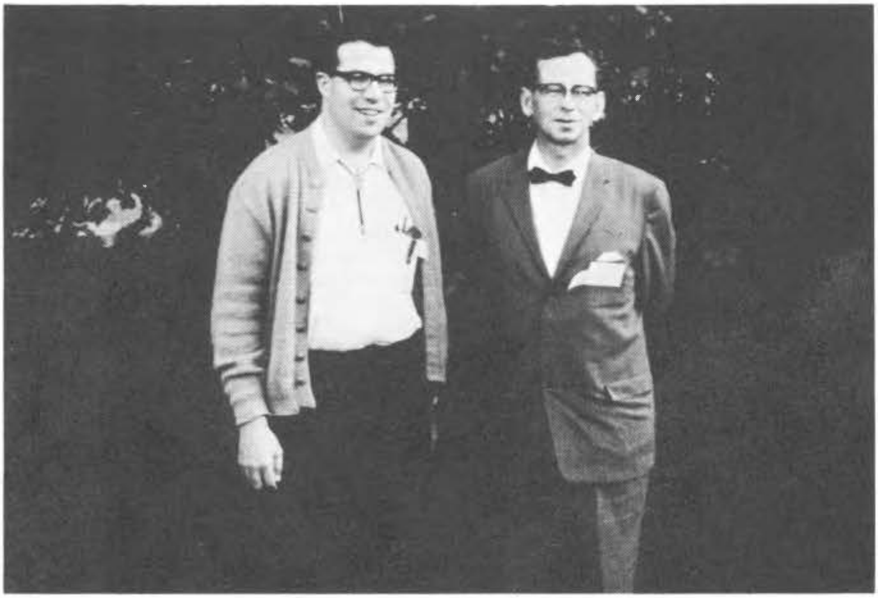

Figure 19. David D. Meisel (left) and Walter H. Haas at Milwaukee Convention. Mr. Meisel was the first A.L.P.O. Comets Recorder and is now with the Department of Astronomy of the University of Virginia.

Figure 20. After-luncheon talk during the Astronomical League - A.L.P.O. Convention in Milwaukee. Place is Lorraine Room of the Hotel Schroeder.

hicle activities, and the value of Newton's mechanics becomes very evident. Part IV, The Hazards of Interplanetary Space, runs the gamut from asteroidal and cometary collision to the intense radiations of the solar wind and the Van Allen Belt. Part V, Our Moon, A Big Satellite, homes in on a target of prime interest to the A.L.P.O. with a series of thirty-one extracts dealing with the behavior, structure, and probable origins of the Moon, and with our efforts to learn more about these things through a wide variety of techniques. Three appendices, a glossary, and a supplementary reading list round things off.

The book gains unity from the binding theme of Newtonian and Einsteinian physics, which runs like a thread through the entire discussion. The editorial selection shows a strong historical sense, along with good scientific grasp; and the essentially non-mathematical treatment, typical of Sky and Telescope, will make it attractive to intelligent laymen, as well as to amateurs seeking an uncomplicated source of information about their avocation. The advanced amateur and the professional will continue to place their principal reliance upon more complete references, such as the professional journals, specialized texts, and the encyclopaedic series commenced by Kuiper and Middlehurst.

Withal, this is an up-to-date work that was able to report the success of Ranger VII's mission, although it was not considered practicable to delay publication long enough to include a discussion of the results. A great many of the contributors are distinguished astronomers whose professional skill is often equalled by their ability to impart their knowledge to others. One small mistake was caught in Pendray's article on page 180. Cyrano de Bergerac's Voyage to the Moon and the Sun is of unknown authorship, according to the Reader's Encyclopaedia, rather than by de Bergerac himself.

This reviewer is a strong foe of books prepared with scissors and paste-pot from a file of old magazines, and it was with many misgivings that he undertook to read and to criticize the present book. It is possible to report that the misgivings, for once, have proven unfounded; and an enjoyable accession has been added to the amateur's library.

A NOTE CONCERNING THE OFFICIAL I.A.U. LUNAR NOMENCLATURE

By: Clark R. Chapman

There has been some confusion recently concerning lunar nomenclature (Ref.5). In the histroy of lunar observation over the last centuries many maps have been made, and each new observer has supplied new names or has made mistakes in applying existing names to the intended objects. Hence, for some craters there are almost as many different names as maps. In order to remedy the confusion, the International Astronomical Union attempted to standardize the nomenclature three decades ago (Ref.4). Unfortunately, the problems were only partially remedied because of numerous mistakes in the I.A.U. map. In some places Blagg and Mueller only added to the confusion themselves by mis-identifying features. Near Sinus Iridum there is a reasonably large area actually missing from their I.A.U. map! Nevertheless, the I.A.U. nomenclature was moderately helpful as a standard, particularly for the larger craters and for regions not near the limb.

The most recent hand-drawn map of importance is the so-called 300-inch map of H. P. Wilkins (Ref.6). Despite the length of time which was spent in construction of the map, the style is poor and difficult to interpret, particularly near the limb. Wilkins liberally chose the names of his friends and associates, particularly in England and Spain, and added them to his map (often in place of I.A.U. designations already existing). He also appended numerous other designations, disregarding entirely both the existing I.A.U. nomenclature and the I.A.U. policies of appending new names. In short, the general confusion became chaotic because of the widespread acceptance of his map as a standard in such countries as England and Russia, despite its many obvious faults.

In order to remedy the problem, a complete overhaul has been carried out by D. W. G. Arthur, presently of the Lunar and Planetary Laboratory in Tucson, in conjunction with the diameter catalogs which the laboratory has been publishing (Ref.2). For the last several years, all the nomenclature for the Air Force independent ACIC (LAC lunar charts) has been coördinated with the L.P.L. work. The procedure of fixing the lunar nomenclature was rather complicated, and it will be explained briefly below; but first it is important to note that Arthur's lunar nomenclature has been officially adopted by the I.A.U. (at the general meeting in Hamburg in 1964). Patrick Moore seems not to have realized this point when he wrote in a recent B.A.A. Journal (Ref.5) that "the present state of lunar nomenclature can only be described as chaotic...a thorough overhaul is essential." The fact is that the

"U.S.A.F. mappers" are not just adding to the confusion but are using Arthur's nomenclature which was officially adopted by the I.A.U. For this reason, it is urged that A.L.P.O. members use the new nomenclature which is being given in its entirety in "The System of Lunar Craters" catalogs and on the L.P.L. lunar quadrant maps (all purchasable from the University of Arizona Press.) It is the same nomenclature which is given on all but the earliest of the Air Force maps.

I do not know of a complete published description of Arthur's procedure of improving the lunar nomenclature, although a partial account is given on pages 74 and 75 of the first quadrant catalog (Ref.2). First, let me list some of the types of problems which Arthur has attempted to remedy. In Blagg and Mueller's original official nomenclature alone there are cases of craters which do not exist, craters with two designations, different craters with the same designation, and illogical cases where craters were given letters associating them with a named crater lying beyond another named crater. Another major problem which had to be overcome was the fact that previous nomenclature schemes paid no attention to the foreshortening effects near the limb so that on conformal projections (such as used by the Air Force) some craters were given designations associating them with named craters much farther away than other named craters.

In the new nomenclature, the 1935 I.A.U. nomenclature was used as a base and was usually changed only in cases where mistakes had been made. The earlier basic maps of Riccioli and Maedler were used in an attempt to provide historical accuracy for existing designations if otherwise appropriate. In addition, many new designations were added, especially in the limb regions, to provide a more or less uniform distribution of named and designated formations. Certain general precepts were followed: (1) In order to lessen confusion, designations of objects were applied to named formations in such a wav that a line drawn from each object to the named crater with which it is associated would not intersect the lines connecting the family of another named crater. (2) In general, it was felt inappropriate to give names to craters lying within other named craters. (3) In accord with historical conventions, the new names added to the nomenclature (mostly in the limb regions) were names of famous scientists, mathematicians, and explorers, <u>not now living</u>, of many different nationalities. (Note that Wilkins departed considerably from this convention.) (4) Names were generally applied to individual features only. For instance, the original designation "Anaximander" was applied to a group of confluent craters; in the new nomenclature, only one of them is given the name "Anaximander". (5) In accord with the I.A.U. recommendations of 1961, the generic terms and names have been latinized. Although in a few cases some of the names will seem strange (e.g. the "Straight Range" is now "Montes Recti"), the nomenclature is now much more uniform.

Once again, I strongly urge A.L.P.O. lunar observers to use the new nomenclature and to avoid using Wilkins' map for nomenclature (or for positions). The new nomenclature is <u>much</u> superior to any earlier scheme, although there still may be occasional problems. In addition, the <u>Orthographic Lunar Atlas</u> (Ref.3), the L.P.L. catalog of standard positions (Ref.1), the quadrant maps accompanying "The System of Lunar Craters" catalogs, and the Air Force maps are much more reliable for positions than any earlier maps. Finally, it should be realized that the Air Force maps are, by far, the best lunar maps ever produced and clearly ought to be used in preference to the mistake-ridden and ambiguous Wilkins map. Perhaps a word should also be mentioned about lunar directions: the I.A.U. definition of lunar <u>west</u> as in the lunar hemisphere of Grimaldi, while opposite to the historical usage, is being employed by many of the principal investigators in lunar astronomy; and it would be better for A.L.P.O. members to get used to the new directions now since eventually they will have to do so anyway.

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THOUGHTS ON LUNAR NOMENCLATURE

By: C. A. Wood

(Foreword by Editor. The following article by Mr. Wood, who has been in extremely close touch with Mr. D. W. G. Arthur and the new system of lunar nomenclature now endorsed by the I.A.U., was written primarily in response to a circular letter from Clark Chapman to C. A. Wood and a few others on June 26, 1965. We appreciate this opportunity to inform our readers of some of the facets of the new system. Constructive comments from readers will be welcomed.)

(1) The "corrections" in spelling of lunar names, which occurred mostly in the Photographic Lunar Atlas, were made partly because the French wanted to spell the names of Frenchmen on the moon in the French fashion, and partly because Ewen Whitaker found that earlier selenographers made small errors in spelling. All but one of the PLA spellings (Tenarium for Ænarium) are close enough to the traditional spellings that little or no confusion should arise. LPL publications, ACIC maps, and any IAU maps will use the new spellings; anyone else is free to spell any of these altered lunar names in the traditional way. Anyone who wishes officially to "correct" a spelling should submit his arguments to D. W. G. Arthur (LPL, University of Arizona, Tucson), the IAU working committeeman in charge of lunar name additions and revisions. The confusion which has enveloped lunar nomenclature ever since the second selenographer wrestled with the designations of his predecessor is now beginning to clear. It can only be hoped that the IAU revisions and additions will be universally accepted.

(2) In heavily cratered areas of the moon's surface the 26 letters of the English alphabet are insufficient to designate the needed landmarks, and double letters (CA, CB, etc.) are then used. Double letters appear near Clavius in the 1935 IAU Map of the Moon and are currently being given where needed. Triple-letter designations are given on the ACIC Ranger charts as the logical extension of normal naming procedure. Incidentally, I worked out the designations for the Ranger charts. (The people at ACIC worked out a system which applied single letters to craters visible only on the later frames; that was unallowable, and so we scrapped their system and started anew.) I personally do not believe that a large number of lettered craters is necessary since any crater can be accurately described by coördinates from the Orthographic Atlas.

(3) Letters are given to craters which are conspicuous landmarks at most lightings (ideally) and to less conspicuous rings which merit designations only because of their size. The letters used in the 1935 IAU map have been retained; and whenever that map is ambiguous, the map of the authority (Maedler, Schmidt, etc.) for that letter is checked. When letters are applied to different craters than they were originally given to in the IAU map, a note appears in "The System of Lunar Craters" to that effect. The numbering of rimae follows the 1935 IAU map whenever possible. The longest and most prominent rima usually receives the lowest Roman numeral.

(4) The latinized names of the mountain ranges, faults, etc. are awkward now, but after 20 years of use they will be more familiar.

(5) A person who makes a thorough study of a certain limb region may feel that additional letters are needed in order to write conveniently about the area. He may assign new letters to worthy craters (being careful to avoid duplication) and submit them to D. W. G. Arthur, who will evaluate the need for them and transmit them to the IAU nomenclature committee, suggesting their inclusion in the official nomenclature if they are thought to be necessary.

VISUAL LONGITUDE DETERMINATIONS ON JUPITER

By: Charles H. Giffen, A.L.P.O. Assistant Jupiter Recorder

Introduction. The visible detail of Jupiter belongs to its extensive, complex, and always-changing atmosphere. Each of the many Jovian atmospheric currents, permanent or temporary, rotates in a sharply bounded, often narrow region of latitude. Visual central meridian (CM) transit observations provide almost all that is known about the rotation of Jupiter.

Because they are so useful and yet so easy to secure, CM transit observations form the most important program of the serious visual observer of Jupiter. The observing procedure is a model of simplicity, the only accessories required being a pencil, a notebook, and a reliable watch. With care, the probable error of a visual CM transit timing is often less than three minutes, or two degrees of longitude. If systematic errors can be corrected in reduction, then the probable errors may be halved on occasion.

This paper outlines the procedures for making worthwhile visual longitude determinations of markings on Jupiter. For completeness, a brief description of the usual notation and nomenclature for recording and reporting observations of CM transits is included. The accompanying sketch on the front cover should give an idea of the current aspect of Jupiter for observers making CM transit observations. It must be realized that this aspect is subject to major variations. Most important in rotational studies of Jupiter is completeness. This goal means that CM transit timings should cover as much of an apparition as possible. At the same time, such observations should not be too widely separated from others; for the identity of the features observed may thus be lost, and the CM transits become worthless. It takes about four or five CM transits of a marking over a period of thirty days to ensure certain identification and a reliable rotation period.

Jovian CM transit observations and any concomitant observations (drawings, photographs, written descriptions, latitude measures, etc.) should be sent directly to the author (address on inside back cover), who now reduces them for publication and analysis in this journal. Observations other than CM transits are then forwarded to the A.L.P.O. Jupiter Recorder for further study. It is important that CM transit observations be reported promptly so that sudden changes may be noted quickly, alerts posted, and further observations secured.

Jovian Nomenclature. Abbreviations of the names of Jovian belts and zones are given in Figure 21, with which the Jupiter observer should be thoroughly familiar. Not all of these features may be seen at any given time. Zones and belts south of the SSTB or north of the NNNTB may be seen on occasions. They would be abbreviated SSTeZ, SSSTB, SSSTeZ, etc. or NNNTeZ, NNNNTB, NNNNTeZ, etc., respectively. Sometimes a belt appears double, in which case the suffixed letter n or s indicates the north or south component respectively. This usage is indicated in Figure 21 for the SEB, which normally appears double; doubling is not uncommon with the STB, NEB, NTB, and NNTB. Note also the term SEBZ given to the region between the two components of the SEB. For a zone, especially the EZ, suffixing n or s indicates the north or south part of the zone; thus EZn indicates the north part of the EZ, especially that part between the EB (when visible) and the NEB. The Red Spot and Red Spot Hollow are abbreviated as RS and RSH respectively. A projection, festoon base, condensation, or some other marking may appear at the edge of a belt. This location may be conveniently abbreviated by prefixing the belt abbreviation with N- or S- to indicate north or south edge respectively. Thus, S-NEB indicates a marking at the south edge of the North Equatorial Belt.

Most Jovian markings worthy of CM transit observations can be classified as either dark or light. The time of transit can refer to the preceding end, center, or following end of a marking. Hence, in describing a feature whose longitude is to be determined, a two letter symbol is employed. The first letter can be either D or W, indicating a dark or light (white) marking respectively; the second letter can be either p, c, or f, indicating the preceding end, center, or following end respectively. Thus, Dp indicates the preceding end of a dark marking; Wc, the center of a light marking, etc.

Further description often assists the Recorder in identifying a marking. The following table gives a list of almost all the vocabulary necessary for describing Jovian markings, together with acceptable abbreviations employed in transcribing them.

D	dark marking	br	bright, brilliant
W	light marking	wh	white
p	preceding, preceding end	lt	light
c	center	dk, D	dark
f	following, following end	proj	projection
N	north	cond	condensation
S	south	sect	section
v	very	col	column

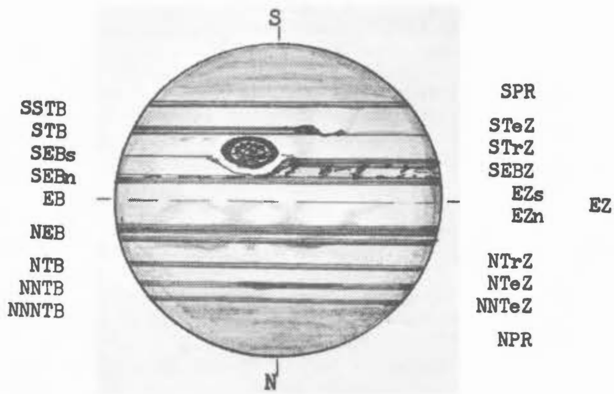

Figure 21. Diagram of Jupiter to show the adopted standard nomenclature of the belts and zones. The appearance of the Giant Planet is subject to large and unpredictable changes. The aspect in September, 1965 is indicated by the front cover drawing by Dr. Charles H. Giffen. See text of Dr. Giffen's accompanying article for further notes on Jovian nomenclature.

B	**Belt, band**	R	**Region**
E	**Equatorial**	T, Te	**Temperate**
N	**North**	Tr	**Tropical**
S	**South**	Z	**Zone**

sl	slight, slightly	fest	festoon
L, lg	large	jct	junction
sm	small	--	spot
rd	round	--	oval
elong	elongated	--	rod
--	wide	--	streak
--	thin	--	base
conspic	conspicuous	--	bay
indef	indefinite	--	hump
		--	loop

Systems of Jovian Longitude. Ordinarily, longitudes on a planet are referred to an arbitrary zero meridian on the surface of the planet. On Jupiter, the "solid surface" has never been seen; and it is impossible to select a standard zero meridian based on the position and rotation of any spot on Jupiter, for all known spots (even the long-lived Red Spot) are subject to changes in rotation period. The best substitute is to refer longitudes to a zero meridian which rotates about the planet's axis in very approximately the rotation period of the various spots seen on Jupiter. It has been found that markings near the equator of Jupiter have rotation periods about five minutes shorter than markings in most other regions. This is a sufficiently large difference to make the use of a single rotation period and corresponding system of longitudes quite unsuitable for analyzing Jovian CM transit observations. Therefore, two visual rotation periods for Jupiter have been adopted, known as System I and System II. The rotation periods are $9^h\ 50^m\ 30^s.003$ and $9^h\ 55^m\ 40^s.632$ respectively. They are not rounded off to the nearest second because they correspond to rotations through exactly $877^\circ.90$ and $870^\circ.27$ of longitude in twenty-four hours for Systems I and II respectively. Features situated between the south edge of the North Equatorial Belt and the north edge of the South Equatorial Belt are usually referred to the zero meridian for System I, and other features to the zero meridian for System II, with rare exceptions.

Longitudes of the Central Meridian. The central meridian (CM) is the imaginary line or meridian extending from pole to pole and bisecting the planetary disc. The American Ephemeris gives the longitude of the CM of the illuminated disc of Jupiter in each system for 0^h Universal Time (UT) of each day of the year. The longitude of the CM at any other time is found by adding to the value for 0^h UT the motion of the CM for the time elapsed after 0^h UT (tables for which are also in The American Ephemeris), and subtracting 360° as often as necessary to make the result fall between 0° and 360°.

Central Meridian Transit Observations. A CM transit observation consists merely of recording the time, to the nearest minute, when an appropriate part of a Jovian marking appears to be on the CM. With a simply inverting telescope and Jupiter near the meridian in the northern hemisphere, spots appear to move from right to left across the disc. Five minutes will disclose an obvious shift in positions of markings, and an object normally will not appear to remain on the CM for more than two or three minutes.

Each CM transit observation must include the date, the time of observed transit, a description of the object being observed, and its location relative to the belts or zones. These are usually recorded using the suggested nomenclature above. E.g., on September 8, 1965, the author observed CM transits which were noted as follows:

08 45 UT	Wc wh spot NTrZs
08 49	Dc proj S-NEB
09 12	Wc lt oval EZn

Before reporting CM transit observations to the A.L.P.O. Jupiter Section, one should calculate the longitudes of the features observed. This is an aid to the Recorder, as well as a device by which the observer becomes familiar with the aspect of Jupiter in various longitudes. To calculate the longitudes of the above spots, for example, one makes the following computations:

$$218^\circ1 + 317^\circ3 = 535^\circ4;\ 535^\circ4 - 360^\circ = 175^\circ4(II)$$
$$11^\circ0 + 322^\circ5 = 333^\circ5(I)$$
$$11^\circ0 + 336^\circ5 + 347^\circ5(I)$$

The first number is the longitude of the CM at 0^h UT on September 8, 1965 for the appropriate longitude system. To this is added the motion of the CM in the appropriate longitude system for the time elapsed after 0^h UT. Note that in the first computation, it is necessary to subtract 360° to bring the result between 0° and 360°. The Roman numeral in parentheses after each result refers to the longitude system used; the first object is referred to System II, and the other two objects are referred to System I.

Of course, an observer wishes to make as accurate an observation as possible. There are ways of trying to achieve this goal in CM transit observing. First of all, the watch or clock used must be accurately set (the author checks his watch before *and* after each observing session with a standard time source). Second, the observations must be accurately recorded as seen; often a sketch (even if very rough) helps in describing the location of a spot or the spot itself (especially when its shape or appearance is extraordinary).

Most important, though, is the care with which the time of apparent CM transit is determined. One way of securing a good timing is to take the mean of the times when the object first and last appears to be on the CM. Another way is to determine the times when the object appears (a) just short of the CM, (b) on the CM, and (c) just past the CM -- then divide this sum by three. The method employed by the author is a combination of these two methods: determine the times when the object appears (i) just short of the CM, (ii) first on the CM, (iii) last on the CM, and (iv) just past the CM -- then divide this sum by four. This appears to give the author the most consistently accurate results. If a CM transit timing appears to be poor, it should be so indicated in the observing notebook.

The centers of spots, ovals, condensations, projections, and such objects are the most frequently timed features. Preceding and following ends are normally timed only when the object has a considerable longitudinal extent -- usually at least ten degrees. It is usually poor practice to time the preceding and following ends of a spot of length less than five or six degrees (especially when the center of such an object is not timed), for most observers will time only the center. At best the preceding and following end times for such a spot can be averaged to give the time for the transit of the center of the object.

With regard to festoons in the Equatorial Zone, one should time the centers of festoon bases, e.g. "Dc N p fest base S-NEB" (center of a north preceding festoon base at the south edge of the North Equatorial Belt), or "Dc S f fest base N-EB" (center of a south following festoon base at the north edge of the Equatorial Band).

One should remember this rule: *the most valuable CM transits are those which others are likely to observe also*. Table 1 gives a list of sample CM transits which one might record.

Systematic Errors. As mentioned in the introduction, there may be systematic errors in one's visual CM transit timings. It is important to try to correct for these in reductions, whenever possible. However, *this should not be done at the telescope*! Only after longitudes have been computed and examined in relation to others can corrections legally be attempted. The author has recently discovered that his left eye judges a CM transit to occur several minutes earlier than his right eye does. Apparently, most right eyes observe CM transits to occur a few minutes earlier than measured positions from photographs indicate. This has also been substantiated by comparing predicted and observed CM transit times of Jovian satellites and shadows.

One should always report observed CM transit times of Jovian satellites and shadows along with regular CM transit observations, for this procedure gives a direct measure of the systematic error of the observer and makes correction a fairly easy matter. It is very unfortunate when an observer fails to observe these phenomena, especially when he is making other CM transit observations on the same date. Otherwise, the corrections for systematic errors must be made on the basis of measured positions from photographs taken on the same date (which are not always available) or by less direct methods (which mean less accurate results).

Note. Forms for reporting Jovian CM transit observations are available from the A.L.P.O. Jupiter Section. They are in tablet form, and one should send postage to cover mailing expense. The forms are by no means essential to reporting CM transit observations, however.

Sample Record of Jovian CM Transits. There follows a list of Jupiter central meridian transit timings actually observed by the author. The features in the list are on the extended drawing of Jupiter on the front cover of this issue. The abbreviations discussed above in the text are employed. Readers will find it instructive to identify on the cover drawing the features on this list of transits. Computed longitudes are usually rounded to the nearest whole degree; one decimal place is meaningful only if the time is correct to within about 10 seconds - but will here allow beginners to check the arithmetic described above. The longitudes in the list correspond, of course, to those marked along the base of the front cover drawing.

Table 1.

1965, September 22. Jupiter, 8-inch reflector. (Colon: indicates poor timing of CM transit.) Charles H. Giffen, Princeton, New Jersey.

UT	Feature	System 1	System 2
05^h30^m	Wc L wh oval EZn	262°4:	
05 44	RSp		9°4
05 50	Dc proj S-NEB	274.6	
06 03	RSc		20.9
06 10	Wc lt spot EZn	286.8	
06 22	RSf		32.4
06 28:	Wc lt oval EZs	297.8:	
06 29	Dc proj S-NEB	298.4	
06 35:	Df wide sect N-NEB		40.3:
06 42	Wc L wh oval EZn	306.3	
06 48:	Wc lt spot NTrZs		48.1:
06 55:	Dc elong proj N-SEBn	314.2:	
06 59	Dc proj S-NEB	316.6	
07 08:	Df elong proj N-SEBn	322.2:	
07 13	Wc lt sect EZn	328.3	
07 20:	Dc elong cond SSTB		67.4:
07 25:	Wc lt bay-oval N-SEBn	332.5:	
07 32	Wc lt spot NTrZs		74.6
07 34:	Dc cond SEBs		75.8:
07 35	Dc proj S-NEB	338.6	
07 35:	Dp sect STB		76.4:
07 45	Dc rod NNNTB(?)		82.5
07 52	Wc v L wh oval EZn	349.0	
07 53	Dc elong proj N-SEBn	349.6	
08 00	Dc D proj N-NEB		91.6
08 04	Wc lt spot NNTeZ		94.0
08 10:	Wp wh oval EZs	0.0:	
08 20	Dc elong proj S-NEB	6.1	
08 22	Wc wh oval EZs	7.3	

Table 1. (cont.)

UT	Feature	System 1	System 2
08 26:	Df sect STBn		107.3:
08 28	Wc wh oval STeZn		108.5
08 33:	Wf wh oval EZs	14.0:	
08 38:	Wf wh oval STeZn		114.6:
08 45	Dc col-fest STeZ		118.8

ANNOUNCEMENTS

Sustaining Members and Sponsors. As of October 4, 1965, we have in these special classes of members:

Sponsors - William O. Roberts, David P. Barcroft, Grace A. Fox, Philip and Virginia Glaser, Charles H. Giffen, John E. Westfall, Joel W. Goodman, the National Amateur Astronomers, Inc., James Q. Gant, Jr., David and Carolyn Meisel, Ken Thomson, Kenneth J. Delano.

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Sponsors pay $25 per year; Sustaining Members, $10 per year. The surplus above the regular rate is used to support the work and activities of the A.L.P.O.

Request for Amateur Lunar and Planetary Photographs. Mr. Dennis Milon, Lunar and Planetary Laboratory, University of Arizona, Tucson, Arizona issues the following appeal: "I am gathering illustrations for the photography chapter of the A.L.P.O. Observing Manual and would like to ask the members who have done lunar and planetary photography to contribute photos. Besides the best telescopic photos, illustrations of equipment would be useful. I am particularly interested in showing different camera systems attached to telescopes. Full details on the lunar and planetary photographs should be included, such as f/number, exposure, camera system, film, developer, and paper grade. Details on individual camera setups will be informative. Of course, I cannot promise that all the photos submitted will be published. The main purpose of the illustrations is to give examples of photographic techniques and telescopic equipment so that other amateurs can select the best methods in lunar and planetary photography." The Editor urges the readers thus addressed to coöperate with Mr. Milon on this worthy project.

Staff Changes. The Lunar Meteor Search program is being terminated for several reasons: Recorder Kenneth Chalk's inability to continue, the consistently negative results with the apertures and procedures employed, the lack of sufficient participation apart from the considerable efforts of Montreal Centre members, and the weakening of a basic reason for the program by the almost universal failure to detect impact-flashes when Ranger vehicles struck the surface of the moon. Lunar Recorder Patrick McIntosh is relinquishing the Selected Areas Mapping Program because of the many duties involved in new employment. The future of this project is at the moment uncertain.

We thank Mr. McIntosh and Mr. Chalk very much for their excellent help as staff members.

Corrections to Volume 18, Numbers 11-12. Figures 2 and 12 in our preceding issue were drawn by Mr. Isamu Hirabayashi, information not available when the Jupiter Report was received. On pg. 233 the next to the last sentence should have been: "To convert the diameter of the cap into areocentric degrees (θ), the equation, sin $\frac{\theta}{2} = \frac{D}{2}$, may be used." On Figure 24 on pg. 235 the latitude-circles are missing. The 75° N. latitude circle would have a radius of 27.5 mms.; the 78° N. latitude circle, one of 22 mms. The editorial comment at the top of pg. 237 is also somewhat misleading. Although the approximate formula applied in computing the size of the north cap ignored variations in the tilt of the axis of Mars, there is actually no effect on the apparent size of the north cap for all positive values of the tilt from geometry alone - hence no difference from this cause between the 1962-3 and 1964-5 apparitions plotted in Figure 23. Ignoring tilt does produce a small error in using the formula on pg. 233 (as here corrected!) to find the number of areocentric degrees covered by the cap.

Jupiter Section Procedures. All C.M. transits and concomitant or relevant observations should be mailed directly to Charles H. Giffen, Institute for Advanced Study, Princeton, New Jersey 08540. The three A.L.P.O. Jupiter Recorders are seeking to share work so as to improve efficiency, and inquiries may not always be answered by the person to whom they were addressed.

LUNAR, PLANETARY, AND COMETARY PROSPECTS, OCTOBER - DECEMBER, 1965

Mercury was at superior conjunction on September 27, will be at greatest elongation east on November 13, will reach inferior conjunction on December 3, and will be at greatest elongation west on December 21. It will accordingly be observable in the telescope in the evening sky during late October and much of November and in the morning sky after the first week of December, but neither apparition will be particularly favorable for observers in middle northern latitudes. Readers will know of the current confusion about the rotation of Mercury; a period of about 59 days is now favored by many radio astronomers in contrast to the 88 days long accepted (synchronous with the period of revolution). A concerted and intensive attack on this problem by A.L.P.O. members might prove rewarding. It will be important in such a project to observe Mercury as often as possible over the available period of several weeks during each apparition, recording carefully the positions of any features detected.

Venus will be a brilliant object in the evening sky during the months considered, reaching greatest elongation east on November 15 and maximum brightness on December 21. Studies of the phase might be carried on between about October 25 and November 25; the method of probability estimates described in Str. A., Vol. 18, Nos. 11-12, pp. 228-230, 1964 is recommended. Venus observers should guide themselves by the contents of recent Venus Reports and by correspondence with Mr. Cruikshank, the Recorder.

Mars will have an angular diameter of less than 5" and cannot be observed to much purpose with ordinary telescopes.

Jupiter reaches opposition on December 18 and will be already excellently placed in the morning sky in October. The Red Spot now lies near longitude 23°(II). The most valuable program for amateur observers of Jupiter is the systematic recording of C.M. transits, discussed in this issue on pp. 29-34. Our Jupiter Handbook, written for beginners, is still in stock and retails for 50¢.

Saturn was at opposition on September 6 and remains well placed in the evening sky. The rings are approaching their 1966 edgewise presentation. Satellites Rhea, Tethys, and Dione offer us the phenomena of transits across Saturn, shadow transits, eclipses, and occultations. More evidence upon the observability or otherwise of these phenomena with ordinary telescopes is desired; detailed predictions are carried on pages 42-45 of the 1965 Handbook B.A.A. Craig L. Johnson directs attention to some double shadow transits. On November 18 the shadow of Dione is on the disc from 6^h10^m to 9^h19^m, U.T.; that of Tethys, from 7^h37^m to 10^h25^m, U.T. On December 9 the shadow of Tethys transits from 2^h6^m to 4^h57^m; that of Rhea, from 2^h41^m to 6^h21^m- all by U.T. Readers observing Saturn will do well to refer to past Saturn Reports to guide their programs and to correspond with the Recorders.

Comet Ikeya-Seki (1965 f). We regret that lack of space requires this article to be shorter in this issue than it will ordinarily be, but we must not fail to speak of what may turn out to be one of the most spectacular comets of the present century. A telegram from the Smithsonian Astrophysical Observatory to the Lunar and Planetary Laboratory on October 1, 1965 said in part: "It is a member of the sun-grazing family but possibly five magnitudes fainter than 1882 II. Comet Ikeya-Seki will pass perihelion on October 21, perhaps attaining magnitude minus seven and a distance within 500,000 kms. of the solar surface. A rapidly moving tail might be seen from North America after sunset October 20. At other times near perihelion any tail would appear in the morning sky."

The following ephemeris was computed by Michael McCants from a parabolic orbit based upon three observed positions. Observations of magnitude, coma size, and tail length are requested by the A.L.P.O. Comets Recorder, Mr. Dennis Milon. The predicted magnitudes given are for a 50-mm. aperture and are based on the expression 6.2 + 5 log (delta)+10 log(r). Quantity L is the length in millions of miles which one degree of tail would represent. The extremely close solar passage may have a tremendous disrupting effect upon the comet.

Date	Right Ascension (1950)	Declination (1950)	R	Delta	L	Stellar Magnitude
1965, Oct. 17	$12^h24^m.16$	$-14° 36'.7$	0.279	0.911	1.4	0.4
Oct. 20	13 15.98	-12 55.2	.118	.931	1.7	-3.2
Oct. 21	13 38.42	-11 20.1	.032	.968	2.7	-8.8
Oct. 22	13 24.91	-10 53.0	.088	1.020	1.7	-4.3
Oct. 27	12 42.92	-14 57.9	.348	1.029	1.7	1.6
Nov. 1	12 17.71	-18 26.7	.531	1.032	1.7	3.4
Nov. 6	11 56.94	-21 40.3	.686	1.032	1.8	4.5
Nov. 16	11 18.47	-27 41.1	.954	1.027	1.9	6.0
Nov. 26	10 36.87	-33 4.1	1.186	1.021	2.0	6.9
Dec. 6	9 46.58	-37 10.7	1.402	1.032	2.3	7.6
Dec. 16	8 50.16	-39 11.7	1.599	1.068	2.8	8.3
Dec. 26	7 53.87	-38 33.1	1.786	1.144	3.6	8.9

Longitudes of Features on Jupiter. Charles Giffen reports the longitudes on September 22 and 23, 1965 of a number of features on Jupiter and requests observers to look for them. The long-enduring white ovals in the STeZ were then located as follows in System II: FA 108°, BC 221°, and DE 350°. Along the north edge of the SEB_n and the south part of the EZ there were these objects in System I: white 7°, dark 170°, and dark 350°. The north part of the EZ and the south edge of the NEB was a very active current; selected features were located as follows in System I: dark 6°, white 104°, white 140°, white 208°, dark 226°, white 263°, white 306°, and white 349°. Selected features in the NTrZ and along the north edge of the NEB were located as follows in System II: white 75°, dark 92°, white 287°, dark 295°, and white 304°. The NTrZ features at 287° and 304° are the "eyes" of the 1964-5 apparition. The STB as of late September from oval BC to oval DE exhibits a very fine north component and a presumed south component distended well into the STeZ, the latter component fading off near 270° (II).

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STAFF