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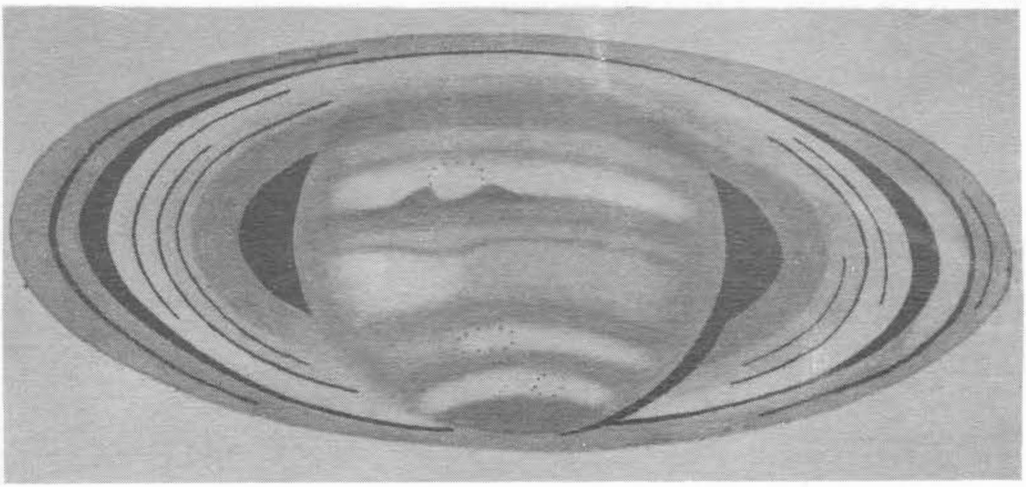
South



Following

Drawing of Saturn by Leif J. Robinson on July 25, 1960, at 6 hrs., 25 mins., Universal Time. 16-inch, F:20 reflector of Biela Observatory at 225X and 550X. Seeing 7 (good), transparency 4 (clear). Note on the ball the two projections from the south edge of the North Equatorial Belt and the associated Equatorial Zone oval and also the activity in high northern latitudes. Note in the rings the delicate division A8 exterior to Encke's Division. This drawing may be compared with the text of Mr. Cragg's article "Saturn in 1960" in this issue.

THE STROLLING ASTRONOMER

Pan American College Observatory
Edinburg, Texas

IN THIS ISSUE

THE LUNAR TRAINING PROGRAM OF THE MONTREAL CENTRE

By: George E. Wedge

(Paper read at the Seventh A.L.P.O. Convention at Haverford, Pennsylvania, on September 5, 1960.)

In every amateur astronomical organization there is always the newcomer who has had no previous observing experience, particularly in lunar and planetary work, which is usually the field in which he first becomes interested. Without the help of experienced observers, the beginner must acquire this experience through trial and error. As a result, a large number of novice observers have little knowledge of what they are doing. Here the need arises for a program of training.

The training program I am about to describe has been used most successfully by the lunar group of the Montreal Centre for over three years. This group consists of twenty-four members, eight of whom have completed the program of training, while the remaining sixteen are currently participating in this course.

This training course is in two parts. The first part teaches the beginner to become familiar with the general topography of the Moon; the importance of this acquaintance is manifest. To accomplish this, the observer is required to locate, identify, and plot the 300 features shown on the lunar map published by Sky and Telescope a few years ago. First the observer is supplied with a form showing a blank disk eleven inches in diameter, on which is drawn a grid of coördinates identical to the grid shown on the map. Using a low power, he first locates and identifies the more prominent features; then, using these as guideposts, he identifies the less prominent. Once he has spotted a dozen or so features, the observer plots them upon the blank using the grid of coördinates as a guide. At this point no attempt is made actually to draw the crater, but merely to plot its position as accurately as possible. The plotting is not done at the telescope, but is copied later from the map. While this process is very elementary, it does give the beginner a feeling that he is accomplishing something, which makes the course interesting.

Once the novice is familiar with the general lunar topography, the second phase of the course is begun. This stage deals with the making of pencil sketches of individual features. The observer makes three drawings under different angles of solar illumination of six different features. Any craters may be selected, of course; but for our program the following six were chosen: Petavius, Posidonius, Aristoteles, Plato, Bullialdus, and Gassendi.

These features, it will be noted, are easily located; and, because of their different locations, at least one will be visible at any time during the lunation. We have purposely avoided the more rugged areas so as not to confuse the beginner. At first all drawings are completed within a set time, usually fifteen minutes, using a power of between 150 and 200X. The size of the sketch is limited to approximately 2½ inches. By keeping these things as uniform as possible, the beginner finds it easier to compare his work with that of others in the group. In this way it has been possible to judge the ability and honesty of each observer. After making eighteen drawings, the observer should be ready for independent work, if he has followed the course faithfully.

One of the main problems often encountered with beginners is that they are inclined to omit certain pertinent information relating to an observation. To avoid these errors, all drawings made in this course are on a standard form which has space for all the necessary information; and the beginner is instructed in how it should be filled in after each observation. Any observations made on scraps of paper are not accepted.

The success of this training program is indicated by the quality of work now being done by members who have completed this course. We have found that in a relatively short time a person with very little sketching ability soon becomes a fairly good draughtsman, whose work can be relied upon to be a true representation of what he observed.

SOME SUGGESTIONS FOR SOLAR SYSTEM OBSERVATION

By: L. J. Robinson

(Paper read at the Sixth A.L.P.O. Convention at San Jose, California, on August 24, 1960.)

In this time of consistent and rapid change one may find, at least for the present, a refuge within Solar System amateur astronomy. Here is a field where old problems are dealt with in a long-established way; indeed, new problems often find the same venerable treatment. One should not be misled into believing that these methods were not effective--they were, and will probably remain so in the future. The only objection one may have, strangely enough, is that these methods were so effective as to make persons hesitant to change and/or experiment in new fields. It is interesting to note that many of these "new" fields are as old as the established ones. The reasons why they are not, at the present time, as popular as the established ones are varied--running the gamut from "more laborious" to "need for accessory equipment."

In the following paragraphs it is my intention to show that there is nothing wrong with these venerable methods--only that they should be used in conjunction with new and more refined techniques. For the sake of uniformity and clarity, the methods of the present time will be reviewed; these will be followed with suggestions concerning certain aspects of the "new" Solar System amateur astronomy.

Planetary

By far, yet unfortunately, the largest effort of the planetary observer is expelled in the least useful form, the purely subjective and reflective planetary drawing. It is common practice to go to the telescope and construct an image of the impressions which one thinks he sees. Such impressions, of course, depend upon the size and quality of the instrument, one's visual acuity, the observing conditions, and, in the last stage, one's ability as a draftsman. When the drawing is completed, assuming one had all of the above positive requirements and conditions, one has the aspect of the planet at one particular instant. To this drawing one might add such things as intensities or color-estimates, both of which add little to the value of the drawing as these two dimensions are physiologically and psychologically more subjective than position placement or shape. At times, certain observers make transit observations, usually without the aid of a micrometer. Such observations, while far from being of professional quality, form the best single visual effort by amateurs with respect to positional accuracy. This form of observation, if made with great care, is most useful and should be encouraged. A moment's reflection will show that the primary purpose of amateur astronomy is to supplement professional endeavors--little is to be gained if the foundation of this purpose, the observation, is of unacceptable quality.

Having tersely reviewed the present day amateur planetary astronomy, we are now in a position to view what instruments and/or methodology will improve the aspects of attaining the ideal as stated in the last sentence of the above paragraph. We will find that the bringing into play of accessory equipment will be the largest single advance.

Of all the many pieces of accessory equipment useful in the field of astronomy, the camera is unquestionably the simplest to use. In planetary studies the photographic plate will allow one, on subsequent drawings, to place with considerable accuracy the location of the major features. The lesser markings, which would have been sketched at the time of the photograph, may now be placed with respect to the larger or photographed ones. Through this method a most accurate drawing may be produced. In practice, it would be best to procure an exposure immediately preceding and following the drawing; in this way the positions of the objects with respect to the changing central meridian would be known. The photograph may then be measured with a micrometer, giving the positions of the major features. Of course, such measurements may also be made at the eyepiece of the telescope. From the above discussion it is seen that the camera and the micrometer form a very close bond--each one being much less useful if separated from the other.

Another and rather new field in amateur astronomy is the photometric study of the planets. It would be wise for all but the most advanced amateur to stay clear of this field, for the use of a photometer on a planetary surface is most difficult but not beyond the scope of the advanced amateur. Such projects as the brightness of the zones and belts of Jupiter, the subtle variations in the brightness of Venus, or the detection of the "blue-clearing" of Mars could be very interesting and important projects.

Lunar

Like planetary observations, lunar studies are carried out, for the most part, in the mode of drawings. Here, more than in the field of planetary observing, the emphasis is placed upon observing the finest detail permitted by the telescope and the conditions. While the planets, for the most part, have changing surface features to hamper observations, the moon presents varying solar illumination together with libratory shifting to confuse the accuracy of a single observation. For these reasons, a single drawing, or even a limited series of drawings, is slightly better than useless. One may, through such a short series of observations, locate the principal features; but the important data--accurate height determinations, exact positions, and exact sizes will go unknown.

Because of the above conditions and due to the prevailing attitude of amateur astronomers, the surface of the moon is in great need of intensive study. Realistically speaking, little useful work has been accomplished, other than roughly defining the general features. An ambitious program of accurately measuring the lunar features would find great welcome in the field of selenography. Mountain altitudes, crater depths, cleft lengths, positions of craters, sizes of craters--all are in need of study. One may say that even the general surface is poorly known. The libratory regions are a good example of this fact. While all these areas are under investigation at the present, greater numbers of competent workers are needed and are in demand. How can the projects as listed above be accomplished?

The most accurate but probably the most tedious way would be to make micrometric measurements at the telescope. A less accurate and still quantitative way would be to measure a photograph. By using the second approach, the student must measure several photographs in order to achieve an adequate degree of accuracy. The photometer may be applied to determine the brightness-changes of craters, spots, or the general surface. Multi-color photometry of an eclipsed moon might also prove interesting.

Cometary

Until recently, few useful observations, other than discovery, were made by amateurs in this field. Progress is being made, due primarily to the fine efforts of the Comets Section of the A.L.P.O.; and with continued proper guidance this section will produce very worthy material. The observational procedures with respect to comets fall roughly into two classes: (1) detection, (2) subsequent observation. While detection is often accomplished with the eye at a telescope, the most rewarding instrument is the large-wide-angle camera. Once a comet is discovered the process of determining its orbit and other physical particulars are next in order. For this goal the camera is again a most powerful tool; the photographic plate may be measured for position, brightness, size, etc.

In a photographic search for comets one might incorporate such long term programs as a nova patrol, thereby making each plate do double duty. It is also possible that one may find a heretofore undiscovered asteroid on such a patrol plate. It is this field of discovery in which the amateur may do the professional a great service. The professional does not have sufficient telescope time to observe for such sporadic events.

Conclusions

It is hoped that the many competent amateurs who read this paper will be stimulated into proceeding beyond the visual methods of astronomy. In working with these new techniques the advanced amateur will find that he may be of greater service to both the professional and his fellow amateur; for his findings will be, within themselves, accurate, complete, and truly representative of the object under study. He will no longer require the necessary confirmation of routine observations. The end result will be: **More topics will be better covered by fewer observers.**

The person undertaking such advanced projects need not fear that the visual observations *en masse* will go neglected. The many less advanced amateurs or persons who simply prefer to do visual work will supply adequate coverage. In fact, the person working along advanced lines might find it best to undertake a single advanced project at a time. He could then give the remainder of his observing hours to visual routine work. It should also be remembered that a night which would permit visual observations may be useless for work with sensitive equipment. Once the amateur raises his methods and his goals--*he will then make valuable and significant contributions to astronomy in the field of fundamental research.*

Postscript by Editor. We hope very much that Mr. Robinson's article will stimulate A.L.P.O. members to some creative thought and constructive action in regard to our methods of studying the lunar and planetary surfaces. Section Recorders and advanced observers in particular can profitably give these matters some thought. Such thinking, of course, need not be a blind, literal acceptance of all that Mr. Robinson asserts. For example, B. M. Peek and others contend that the simple visual central meridian transits are actually preferable to micrometric measures of longitudes of planetary features; and certainly the visual transits have given us almost all of our present knowledge of atmospheric currents at the visible surfaces of Jupiter and Saturn.

It might also be mentioned here that Dr. Hugh M. Johnson of the University of Arizona in conversations with the Editor and others in April, 1961, suggested that an amateur's chief present contribution to planetary astronomy might well be in the direction of correlating optical surface features and radio noise emissions.

SOME PROBLEMS ABOUT THE NAMES OF THE MARTIAN MARKINGS

By: Tsuneo Saheki

(Paper read at the Sixth A.L.P.O. Convention at San Jose, California, on August 24, 1960).

As is already known very well, the present names of the Martian markings were given by G. Schiaparelli in 1877 when he selected names from the famous gods, goddesses, and others in the Bible, the mythologies of Greece and Rome, and elsewhere. For these reasons we are able to find the beautiful, fantastical stages of drama of old mythologies on the surface of Mars when we observe this red star through the modest telescopes. Unfortunately, I think, there have occurred some errors or troubles in the nomenclature of this planet's markings, during the years from 1877 to now. Some of them which I have found during my study of the markings' names will be described here with my private opinions.

1. Achillis Fons or Idaeus Fons?

Achillis Fons is the name used by Antoniadi since 1901, Achilles being a famous Greek general at the Battle of Troy. The name of a dark spot discovered on the S.W. portion of Mare Acidalium is Idaeus Fons, which was named by Schiaparelli on his Map of Mars in 1888; but there are now some observers who believe that its true name is Achillis Fons. As already stated, I believe that the name Achillis Fons was perhaps selected by the great Areographer E. M. Antoniadi in 1901, because he used this name in his Mars Reports in the Memoirs of the B.A.A. from 1901 to 1914, also in his articles published in the Jour. of the B.A.A. until 1924. In spite of these facts, suddenly Antoniadi gave up the use of this name Achillis Fons and returned to Schiaparelli's old name Idaeus Fons in his excellent book La Planète Mars without any statement about this exchange.

I can't understand why Antoniadi made this change, but I like to think that he had found the true, old name for this marking to be Idaeus Fons during his studies of the literature of Mars. Anyhow, observers are now troubled with the question of which is the true name for a dark spot appearing in the middle of the canal Nilokeras. I say that the name Idaeus Fons is the true one; but since Achillis Fons, used by observers of the B.A.A. and France, is the temporary name for the same marking, there is now no need to use this name because there is no marking to call Achillis Fons except the marking already named Idaeus Fons. In 1950, observers of the A.L.P.O. and Messrs. Murayama, Ebisawa, and the author in Japan found a new spot on the S. part of Idaeus Fons; and since that year the Maps of Mars drawn by the Mars Section of the A.L.P.O. show the new spot as Achillis Fons and the old spot as Idaeus Fons.

The table of positions of these two spots which have been recorded by many observers is shown below:

Table I. Positions of the spots on Nilokeras

Year	Position λ	Position ϕ	Observer	
1888	48°	+32°	Schiaparelli	B
1896	50	+23	Lowell	A*
1903	46	+37	Molesworth	B
1918	50	+30	Phillips	A
1920	52	+33	Maggini	B
1909-1937	49	+32	Antoniadi	B
1937	45	+34	Saheki	B
1946	65+	+26	"	A
1950	55+	+35	"	B
"	60+	+25	"	A
1952	55	+27	"	A
1954	55+	+35	"	B
1958	55+	+30	"	B

*Lowell named it Cranium Lucus.
+These data were taken from drawings; and so these are some errors in their positions, especially in longitude.

From this table, one may easily see that these are two groups about the areocentric latitude of the marking:

A group: shows its position $\lambda = 50^\circ \sim 55^\circ$, $\phi = 23^\circ \sim 30^\circ$N.

B group: shows its position $\lambda = 45^\circ \sim 50^\circ$, $\phi = 30^\circ \sim 37^\circ$N.

The B group is the old spot discovered and named Idaeus Fons by G. Schiaparelli, but the A group is the new one found and named as Cranium Lucus by P. Lowell in 1896. The latter one is now called Achillis Fons by the observers of the A.L.P.O.

As to the conclusion, even though there are many reasons or very difficult questions about the name of Achillis Fons as already described, I hope to suggest that, as the Mars Section of the A.L.P.O. did:

1. A spot located on the N. side of the canal Nilokeras (B group in Table I) should be called Idaeus Fons.

2. A more southern spot discovered on the S. side of Nilokeras (A group in Table I) may well be called Achillis Fons, but the reason for this naming must be recorded exactly.

2. What is the true marking called Nodus Alcyonius?

Nodus Alcyonius was an unfamiliar name for observers before Antoniadi's book had been published; until that time most observers believed that the name of Nuba Lacus or Nubis Lacus was the true one for the dark spot located at the connection of the canals Alcyonius, Casius, and Thoth. This dark knot was discovered by Schiaparelli in 1877, and he named it Nodus Alcyonius in 1890 but did not use this name in his Maps of Mars (as far as I have studied them with the large books about Mars written by C. Flammarion). Schiaparelli showed its name as "Golf of Alcyo." in his report about positions of markings based on his micrometric determinations. Next, in 1897 Lowell discovered two spots on the S. top of the triangular shading, Utopia. He named the north one ($\lambda = 253^\circ$, $\phi = +40^\circ$) Aquae Calidae and the southern spot ($\lambda = 255^\circ$, $\phi = +29^\circ$) Lethes Lucus, the position of the former one being exactly equal to Schiaparelli's feature. Third, also in 1897, Cerulli likewise found Lowell's southern spot (Lethes L.) independently, and at the next opposition of Mars in 1899 he identified Schiaparelli's spot; but he believed that it was a new lake, and so he selected the name for this spot of Nuba Lacus.

Since Cerulli's discovery and naming, I think, observers in France have believed that Nubis Lacus (Nuba is wrong but must instead be used as Nubis for meaning the Lake of Nubian) might be the true name, and also thought that there was only one spot on the S. end of Utopia. Antoniadi used this name for long years in his Mars Reports as the Director of the Mars Section of the B.A.A. However, a sudden correction was made by Antoniadi in his book <u>La Planète Mars</u>, in which one cannot find the name of Nubis Lacus but instead Nodus Alcyonius, also without any reference concerning this change from Nubis L. to N. Alcyonius. Since this time all observers are troubled with deciding which of two names is the true one for the knot they observe.

In recent years a new Map of Mars has been published by G. de Vaucouleurs, and it shows that there are two spots at the top of Utopia. Their names are given as Nubis Lacus for the southern one and Nodus Alcyonius for the northern one. Of course, as you will understand soon, this naming is wrong because these two names have been given for only one marking christened differently with two names independently by two observers, Schiaparelli and Cerulli.

Table II shows the positions of the markings recorded near the S. end of Utopia by different observers from 1877 to 1958.

Table II. Positions of the Dark Knot Observed at the S. End of Utopia

Year	Position λ	ϕ	Name of Marking	Observer	Remarks
1877	260°	+37°	No name	Schiaparelli	Junction of canals
1879	258	+34	" "	"	
1881	262	+40	" "	"	
1884	260	+38	" "	"	
1884	260	+25	" "	"	
1888	263	+42	" "	"	
1897	255	+29	Lethes L.	Lowell	
1897	253	+40	Aquae Calidae	Lowell	
1897	261	+29	No name	Cerulli	Junction of canals

Year	Position λ	ϕ	Name of Marking	Observer	Remarks
1899	253°	+41°	Aquae Calidae	Lowell	
1899	259	+37	Nuba L.	Cerulli	
1899	259	+23	No name	Cerulli	
1899	259	+15	No name	Cerulli	
1901	258	+39	Nuba L.	Flammarion	
1901	254	+35	Aquae Calidae	Lowell	
1903	254	+34	" "	"	
1903	254	+28	Nubis L.	B.A.A.	Directed by Antoniadi
1905	260	+28	No name	"	" " "
1905	265	+35	Nubis L.	"	" " "
1907	260	+29	" "	"	" " "
1911	258	+39	" "	"	" " "
1918	254	+32	" "	"	" " "
1924	258	+37	?	Antoniadi	
1926	255	+35	?	"	
1929	260	+25	?	"	
1929	259	+37	?	"	
1937	265	+28	N. Alcyonius	Saheki	
1941	260	+37	" "	Murayama	Position is erroneous
1943	260	+16	?	Saheki	
1943	255	+23	?	"	
1943	250	+29	?	"	
1943	250	+36	?	"	
1946	260	+20	N. Alcyonius	Murayama, Saheki	N. Laocoöntis developed
1948	260	+26	" "	Ebisawa, Saheki	
1950	258	+23	?	Saheki	
1950	261	+39	N. Alcyonius	Saheki	
1952	261	+23	Nubis L.	"	
1952	264	+32	N. Alcyonius	"	
1954	260	+26	?	"	
1956	260	+31	?	"	Positions are uncertain
1958	260	+21	?	Murayama, Saheki, and Photographs by Murayama	

From Table II we note some interesting facts as follows:

a) The Nodus Alcyonius of Schiaparelli is the same marking named Aquae Calidae by Lowell and Nuba Lacus by Cerulli, its position being about $\lambda = 260°$, $\phi = +37°$.

b) An unnamed spot in areocentric latitude +25° was discovered by Schiaparelli in 1884 and was also found by Lowell in 1897. Lowell named it Lethes L. It was discovered independently by Cerulli in the same year, but he did not give it a name. This spot's position is about $\lambda = 260°$, $\phi = +28°$.

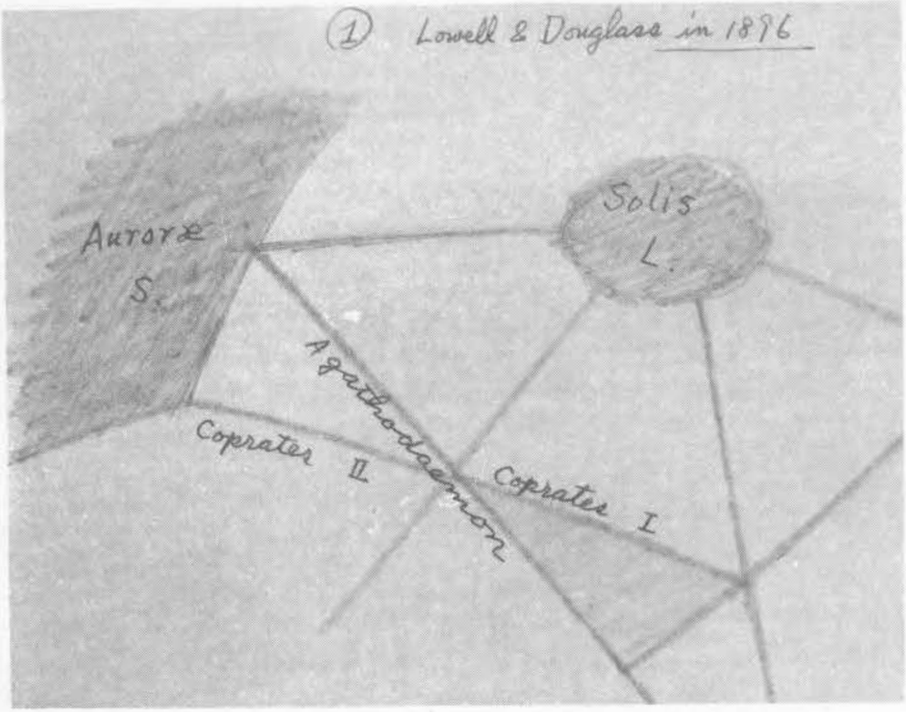
c) In recent years, especially by de Vaucouleurs, the southern of these spots has been called Nubis Lacus and the northern spot Nodus Alcyonius.

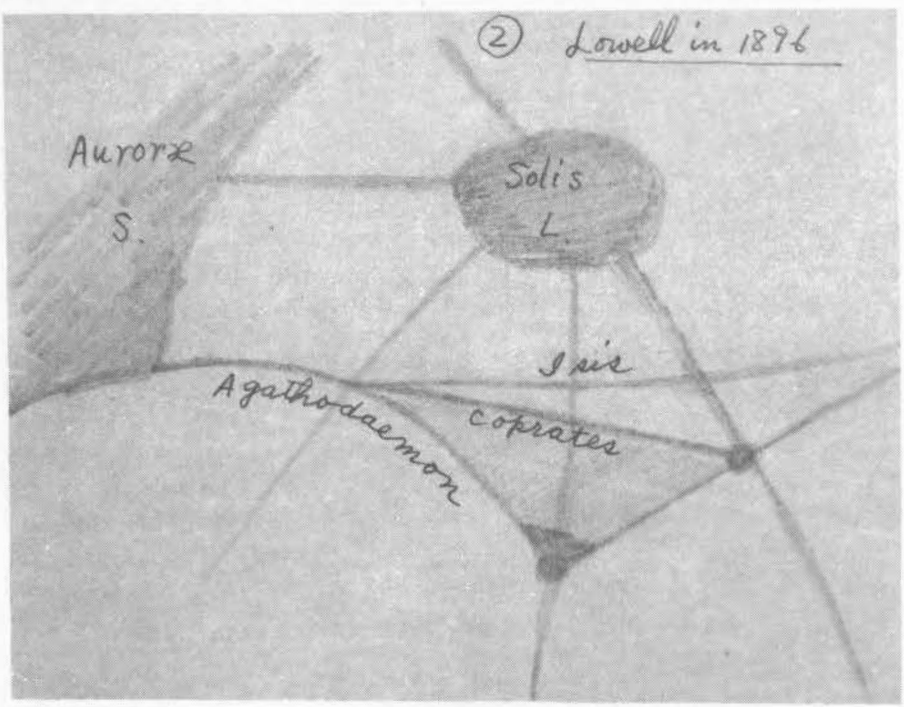
To end these troubles, I suggest the following:

The names of these spots we shall call, as de Vaucouleurs does, the S. one Nubis L., and the N. one Nodus Alcyonius; but if we do so, we should record our remarks about this decision.

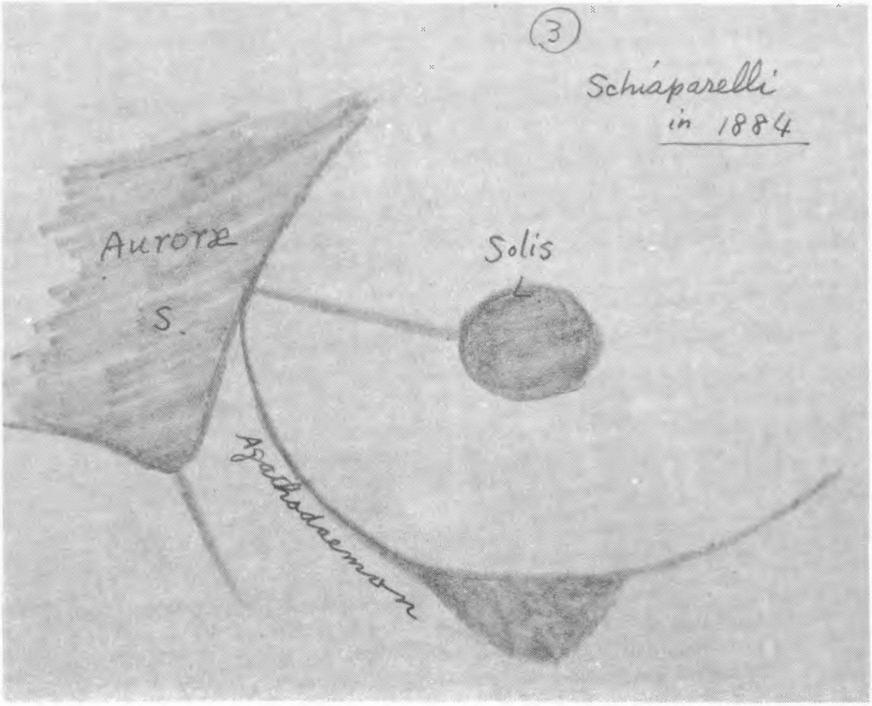
3. Agathodaemon or Coprates?

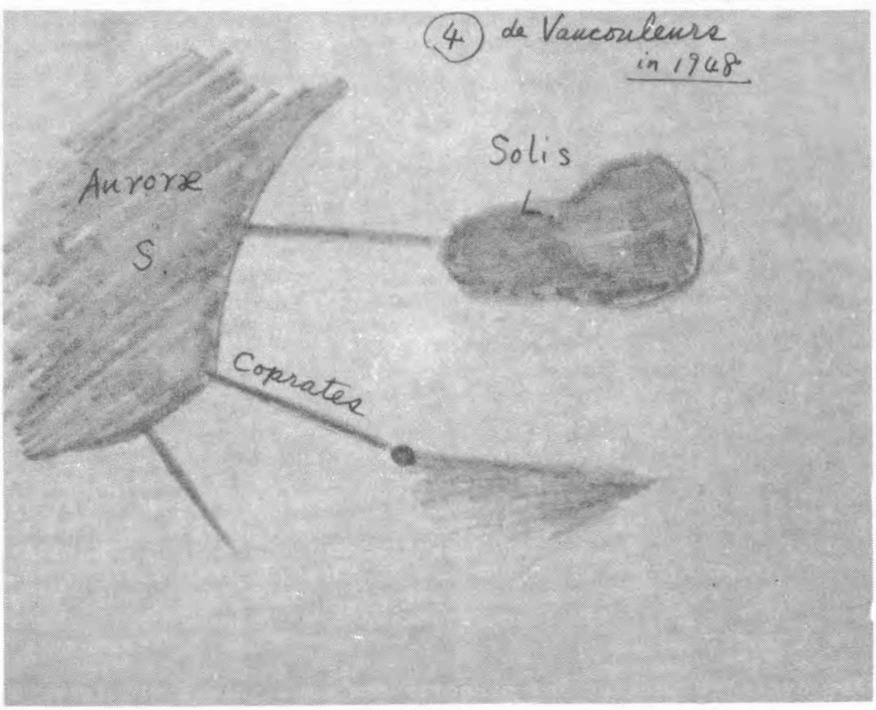
One of the beautiful curved canals surrounding the north part of Solis Lacus is called Agathodaemon, the good spirit god of Greek mythology; but the recent Maps of Mars which were drawn by observers of the Pic du Midi Observatory do not show this name but instead only Coprates (Figure 4).





FIGURES 1 and 2. Charts of detail on Mars north of Solis Lacus. Note use of names Coprates and Agathodaemon. See also text of article "Some Problems about the Names of the Martian Markings" in this issue.





FIGURES 3 and 4. Charts of detail on Mars north of Solis Lacus. Note use of names Coprates and Agathodaemon. See also text of article "Some Problems about the Names of the Martian Markings" in this issue.

Which name should we use for this canal? Agathodaemon is the name selected by Schiaparelli for the curved canal which runs off from the N.W. top of Aurorae Sinus westward through the dark circular spots Ceti Lacus and Melas Lacus to the large lake, Tithonius Lacus, where this canal runs along the lake's E. coast and ends on the N.E. side of this Lacus (Figure 3).

On the other hand, the name Coprates was used by Lowell for the straight canal starting off from Melas L. and running westward, making the S. coast-line of Tithonius Lacus and ending at the S.W. end of this large lake. There are two Maps of Mars which were drawn by Lowell based upon his observations of Mars in 1896. One of them, perhaps the first map, showed the canal Coprates as Coprates I, and the one which started from the N.W. top of Aurorae S. running to Melas L. was named Coprates II (Figure 1). The other map, perhaps the later one, does not use the name Coprates II but rather Agathodaemon (Figure 2).

Considering these facts, I like to say that it is a wrong decision that in recent years the I.A.U. has decided to use the name of Coprates and has rejected the name Agathodaemon.

Why did such trouble occur about the name of this canal? The cause may be the unusual appearance that occurred in 1941, when this curved canal showed a straight-line-like form; and so the French observers thought that it was Coprates but not Agathodaemon, actually a big mistake.

Finally, I hope to say that there is the beautiful curved canal Agathodaemon on the surface of Mars now, and also sometimes we can see Coprates; but I have not yet detected Coprates without Agathodaemon, and so we must not be perplexed in identification of the canal's name due to poor knowledge of the nomenclature of the Martian markings.

POSITIONS OF MARTIAN SURFACE FEATURES--1960-1961

By: Clark R. Chapman

The following list gives the aerographic positions of some of the more prominent surface features on Mars as measured from thirty-three of my drawings made between November 7, 1960, and March 8, 1961, using my ten-inch reflecting telescope. During this period, Mars generally subtended an angular diameter greater than ten seconds of arc.

The positions were measured from the drawings by means of transparent orthographic grids placed over the drawings. These measurements were then weighted; features near the limb or features on drawings made under poor conditions were given only half the weight of the majority of the measurements. My several central-meridian transit timings for longitudes were added to my measurements and were given the same weights as single good drawing measurements. Averages were then computed for each feature. The positions are recorded to the nearest tenth of a degree for the sake of uniformity; although many are accurate to a degree, some are probably accurate to a small fraction of a degree.

In the table, the I.A.U. nomenclature is used. Where finer designations are needed, names from maps by Antoniadi, Avigliano, and de Vaucouleurs are added in parentheses. "West," "south," etc., indicate western or southern boundaries or ends of features. The approximate number of drawings measured for each feature is given in the last column.

Name of Feature	Longitude	Latitude	Number
Amazonis (Orcus dark spot)	167°.5	+17°.6	7
Aurorae Sinus (center)	51.1	-13.2	13
Boreum Mare (Ascuris Sinus)	90.9	+37.5	8
Casius (center)	275.7	+45.0	5
Cebrenia (Stymphalius Sinus)	204.2	+48.2	3
Cerberus I (east)	217.0	+ 3.6	8

Name of Feature	Longitude	Latitude	Number
Cimmerium Mare - Cyclopia (Cyclopum Sinus)	219°8	-13°5	7
Cimmerium Mare - Cyclopia (Gomer Sinus)	239.5	- 8.8	7
Cimmerium Mare (Tritonis Sinus)	246.2	-11.4	5
Cimmerium Mare (south-west projection)	212.0	-46.1	9
Deltoton Sinus	308.0	- 5.5	9
Euphrates (egress)	334.1 (±.7)	- 5.3 (±.6)	7
Ismenius Lacus	336.8	+39.2	7
Laestrygon Sinus (west tip)	190.5	-21.3	9
Lunae Lacus (center)	66.8	+20.3	14
Margaritifer Sinus	18.3 (±1.1)	- 1.0 (±.9)	15
Moeris Lacus	273.9	+ 5.3	6
Nilosyrtis (east lobe)	308.3	+44.7	3
Nilosyrtis (west lobe)	290.2	+44.4	5
Olympica (dark spot)	125.9	+ 0.3	9
Oxia Palus	13.0	+ 6.3	5
Phison (western edge, egress)	329.2	- 5.7	4
Phoenicis Lacus	108.0	-18.0	4
Serpentis Mare (east tip)	326.6	-30.3	8
Sirenum Mare (Gorgonum Sinus)	150.2	-25.1	7
Sirenum Mare (Sirenum Sinus)	124.2	-28.2	6
Sirenum Mare (south-east projection)	170.7	-44.0	4
Sirenum Mare (Titanum Sinus)	167.4 (±1.3)	-18.7	11
Sithonius - Morpheos Sinus	228.1	+38.9	5
Solis Lacus	88.7 (±1.0)	-30.2	12
Syrtis Major (northern tip)	288.6 (±1.0)	+26.5 (±1.0)	9
Syrtis Major (western projection)	280.4	+ 7.2	9
Thoth (Nodus Laocoöntis)	246.5	+10.0	7
Tithonius Lacus - Coprates	77.2	-11.9	9
Trivium Charontis	198.9 (±1.3)	+11.7 (±.4)	12
Tyrrhenum Mare (Syrtis Minor)	257.6	- 9.2	9
Tyrrhenum Mare (south--Xanthus Sinus)	239.2	-43.1	5
Tyrrhenum Mare (east, projection south Libya)	274.8	- 7.8	7

The positions in the following list were obtained in the same manner as in the first list. It contains longitudes and latitudes of boundaries and other features for which the measurements are in one coördinate only.

Name of Feature	Longitude	Latitude	Number
Acidalium Mare - Niliacus Lacus (east)	40°7	-----	11
Acidalium Mare - Niliacus Lacus (west)	21.0	-----	14
Acidalium Mare - Niliacus Lacus (south)	----	+24°4	15
Ausonia (north)	----	-32.3	8
Elysium (east)	232.5	-----	6
Elysium (west)	200.3	-----	9
Erythraeum Mare (south)	-----	-42.0	13
Hadricum Mare (east) Hellas (west)	277.9	-----	7
Hellas (east)	310.4	-----	7
Hellas (north)	-----	-24.2	10
Meridiani Sinus (west prong)	351.7	-----	14
Meridiani Sinus (east prong)	1.0	-----	14
Meridiani Sinus (latitude of center)	-----	-11.8	12
Nilosyrtis (canal)	286.7	-----	4
Pandorae Fretum	-----	-31.9	15
Propontis - Castorius - Euxinus (west)	148.0	-----	6

Name of Feature	Longitude	Latitude	Number
Sirenum Mare - Phaethontis boundary	-----	$-42\overset{\circ}{.}0$	8
Syrtis Major (east)	$300\overset{\circ}{.}6$	-----	9
Thoth (east)	261.9	-----	9
Thoth (west)	242.7	-----	7
Thoth (south)	-----	+ 4.5	7
North Cap (south)	-----	+60.0	32

AMATEUR RESEARCH

By: William E. Shawcross

(Paper read at the Seventh A.L.P.O. Convention at Haverford, Penna. on Sept. 5, 1960.)

Each year as we meet for the annual Astronomical League Convention, we see many familiar faces--and many new ones. Every year amateur astronomy gains new devotees, but why the losses?

Any good hobby must hold the interest of the hobbyist. Just looking around the sky with a telescope is not enough; you must be looking for something. Many simply take the opportunity to marvel at the wonders of the heavens--their love is really philosophy. I am not concerned with these staunch lovers of the heavens; we are in no danger of losing their interest. Rather, it is usually the younger, searching mind that needs a goal to keep up its interest. Here astronomy has much to offer--it is one of the very few fields in which an amateur, with practically no equipment, can make lasting contributions. To name just a few branches of astronomy in which this is the case, we can cite variable star observation, meteor counts, aurora observation, and planetary and lunar observation.

Nothing can surpass a planned program of observation as a practical education, as a sustainer of interest, and as a way of gaining results of lasting importance. Let us anaylze in some detail a few of the avenues open to the amateur.

(1.) Taking the sun as a natural starting point, two specific programs come to mind: sunspot observing and recording of Sudden Enhancements of Atmospherics (SEA). Many amateurs do this work through the Solar Division of the American Association of Variable Star Observers, which works with the National Bureau of Standards. The American sunspot numbers are derived in this manner, and the AAVSO contributes a significant number of the SEA's published by the NBS. Sunspot observing can be done with practically any telescope. The counts depend primarily on two factors--the instrument and the observer. Obviously, the larger the telescope, the more spots that are visible. Experience, though, plays the largest role; and it is interesting to watch the observer's correction coefficient change with his increasing practice. SEA's are recorded electronically, and the equipment is moderately expensive. It is a field particularly suited to the amateur who is also a "ham" radio operator.

(2.) Going outward through the Solar System, we encounter an interesting problem in the phase anomalies of Venus, the most obvious of which is that the time of dichotomy or quarter phase observed usually does not agree with Ephemeris predictions. Amateurs can easily add to our knowledge of this remarkable phenomenon by visual estimates of phase, using a small telescope.

(3.) Numerous things happen in the earth's atmosphere. We are all familiar with amateur contributions to the International Geophysical Year aurora and meteor count programs. The amateur has one advantage over the professional--he outnumbers the professional (of which there are perhaps 500 in the United States). Amateur coverage of the sky is really much more complete for many types of observations. Statistical analysis of vast quantities of data gathered in the aurora and meteor programs has led to several important findings in this field, and the programs are continuing under the International Geophysical Coöperation. Moonwatch and other amateur contributions in the field of artificial satellite observing are too well known to need specific mention here.

(4.) Moving out to the moon, we have a field of study which has always been peculiarly the amateur's, though recently professional interest has centered more and more on our companion. In addition to the traditional charting of the lunar surface, two programs of research come to mind. The first is one that can be carried out with modest instrumental means, and that is measuring the heights and slopes of lunar features by means of shadow lengths, some details of which have appeared in The Strolling Astronomer. The other, which requires practically no optical aid at all, is observing times of umbral contacts during lunar eclipses and also times of crater immersions and emersions in the earth's shadow. From such timings, the earth's shadow turns out to be about two per cent larger than geometrical predictions would indicate, but differs from eclipse to eclipse. This variation may eventually be correlated with some specific phenomenon of the earth's atmosphere.

(5.) We shall briefly mention comets. Here amateurs have a chance to discover new comets and watch old ones--professionals usually do not have the time for this work.

(6.) Planetary work has also been a favorite of the amateur, as we all know. To take a few examples of good programs, let us mention first the determination of the dates of the blue clearing on Mars--occasions usually near opposition when surface detail may be seen in blue light. Times of this clearing are important in framing theories to explain it.

Jupiter is one of the easiest objects in the heavens to observe. Neglecting satellite phenomena, a very useful kind of observation is the timing of central meridian transits of long-lived features in the Jovian atmosphere. On these are based our knowledge of the differing rotation-periods at different latitudes on this giant planet. A recent striking example of the value of amateur drawings of the planet can be found in the article by Otto Struve on planets with rings. Here evidence, mostly from amateur drawings, was presented which strongly suggested that Jupiter has a faint ring similar to Saturn's. If verified, this will indeed be a momentous discovery.

To take one final problem from the field of planetary observing, the rotation period of Saturn is still not known with the highest precision. Here amateur observations of long-lived spots on Saturn's surface, which serve to measure the rotation, are of value, though not too easy to make.

(7.) Taking one example from stellar astronomy leads us to the many opportunities presented by variable stars. Long-period variables are the special province of the AAVSO, which makes very substantial contributions to the knowledge of these objects. Less well studied by amateurs, but worthy of consideration, are the short-period variables. Many of these have periods that change slightly over the course of years, and new timings of minima and maxima are vital. For instance, the bright Cepheids Delta Cephei, Eta Aquilae, and Zeta Geminorum all have changing periods, and are easy objects to study. Another interesting class of variables is typified by RZ Cassiopeiae, an eclipsing variable with a variable period. Times of minima are easy to obtain; yet here is a major field virtually untapped by American amateurs, though German and Russian amateurs have done much good work. It is suspected that these changes in period may be due to stellar evolution, and this would be the only change in a star that would be visible in the course of a lifetime. Here photoelectric photometry, of increasing interest to serious amateurs, offers exciting avenues of exploration.

This completes our brief and far from complete catalogue of opportunities. It merely points the way to the riches that will hold and lead forward the patient watcher of the skies.

AN APPEAL FOR TOLERANCE FOR UNORTHODOX THINKING

By: M. Eugene Spiess

(Paper read at the Seventh A.L.P.O. Convention at Haverford, Penna., on Sept. 5, 1960.)

We as amateur and professional astronomers are of necessity deeper thinkers than the average layman. There has been and still is a tendency for some learned people to take the attitude "if it is not in the textbooks, it can't be correct and worthy of any consideration." This type of reasoning cannot be conducive to progress. After all, what invention or scientific break-through do you know of that was not originally conceived by unorthodox thinking? Even if a man tells you he saw a "flying saucer," you don't have to believe him, but do not ridicule him. Perhaps he did see something more than refracted light rays in a dish pan in the kitchen sink.

We rely heavily on theories in our work, but existing theories are good tools only until they are replaced by new and more nearly correct theories conceived by unorthodox thinkers. This non-acceptance by the "experts" of the thoughts of the "non-expert" has existed since history began and continues to the present time. It is time for it to cease in this present age if we wish to give science a chance to advance as far and as fast as possible with the least amount of retardation.

The following quotes are examples of the "expert's" ridicule for anyone who has strayed off the beaten orthodox path:

When Thomas Edison was asked his opinion on aircraft, he said, "I prefer to devote my time to objects of commercial value. At best, airships will only be toys."

Two members of the French Academy of Science were unseated because they said "stones fall from the sky." The experts of the Academy examined the stones and said, "It can't be; stones do not fall from the sky. These are common rocks that have been struck by lightning."

Dr. Simon Newcomb, a world famous astronomer and the first American since Benjamin Franklin to be made an Associate of the Institute of France, said "It can't be." Then he went on to explain that flight without a gas-bag would require the discovery of some new force of nature.

Rear Admiral George W. Melville, one-time Chief Engineer for the United States Navy, said that attempts to fly heavier-than-air vehicles were absurd.

Admiral William D. Leahy, once Chief of Staff to the President, said, "The atomic bomb is the biggest fool thing we have ever done. The bomb will never go off, and I speak as an expert on explosives."

I feel sure that no one would want his signature to follow any of these quotes; yet it happens day after day. Let us listen carefully to the man who is talking and evaluate his ideas as we choose, but remember that we may be listening to a fool-hardy "Columbus", whose ships are sure to fall off the edge of the world, yet who will return and place a new continent at our feet.

MUTUAL PHENOMENA OF JUPITER'S SATELLITES, SEPTEMBER 18-NOVEMBER 16, 1961

With the earth and the sun both now near the plane of the orbits of the four Galilean satellites of Jupiter, there will begin on August 7, 1961, a series of mutual phenomena--occultations of one satellite by another and eclipses of one satellite by the shadow of another. These events are interesting to observe from several points of view:

1. Times of the first and last contacts and of mid-eclipses and mid-occultations may be recorded and compared with geometrical computations.

2. Very interesting comparisons of the colors and surface brightnesses of two satellites may be made when they are briefly very near each other. Curious contrast-caused dusky bands may border the limb of one satellite when it is occulting, or being occulted by, a second satellite of notably different surface brightness.

3. Most important of all, these mutual phenomena give us an opportunity to observe the appearance of small features on extended surfaces whose true appearances can be determined. We all know well enough how badly planetary observers often disagree about the aspects of finer markings near the limit of visibility. "Lowellian" and "Antoniadian" schools of planetary observers have each claimed to be correct, and a few immodest observers have simply asserted their observations of small details to be superior to those of everyone else. Usually such claims cannot be tested because the true aspect is unknown to us. Here, however, we have the possibility of a control in our studies. Unless we can see correctly a black shadow, we cannot hope to see properly much lower-contrast, and often smaller, features on discs like those of the four large Jovian satellites. Neither can we then suppose that similarly small features are seen properly or correctly on larger discs. Hence careful observations of all these phenomena, but perhaps especially of the mutual eclipses, with detailed notes on what aspects are remarked are very much desired.

The following personal observation by the Editor on May 3, 1956, with a 6-inch reflector at 298X, seeing 4-5 (fair) and transparency 4 (clear), may help readers as a sample description of a mutual phenomenon: "Partial occultation of Jupiter III by Jupiter II. External contact was observed at $5^h\ 29^m.6 \pm 1^m.3$, Universal Time. By $5^h\ 37^m$ the two satellites looked like one. Last contact was observed at $5^h\ 55^m.0 \pm 1^m.5$. J.II had a much brighter surface than J.III, but there was very little difference in color (both yellow). I should estimate that at mid-occultation the center of II lay to the south of the center of III by perhaps 30% of the diameter of III. No unusual or unexpected appearances were seen at any time." One needs high powers for such observations, and good seeing is a considerable help.

Observations secured of these phenomena in 1961 should be mailed <u>promptly</u> to our Jupiter Recorder. He is Mr. Philip Glaser, 400 E. Park Ave., Menomonee Falls, Wisconsin.

The list below is a continuation of the one on p. 104 of the May-June, 1961, <u>Str. A.</u> and will itself be continued in the next issue. We are trying to publish predictions far enough ahead that all our members will have the information soon enough to use it, including those members in other countries. The data here are taken from pp. 38-40 of the 1961 <u>Handbook of the British Astronomical Association</u>. Dates and times are all by Universal Time. In the second column <u>E</u> is for eclipse and <u>O</u> for occultation. The third column tells which satellite is being eclipsed or occulted by which other satellite. An eclipse may be penumbral only. The last column gives the fraction of the diameter of the eclipsed satellite which is covered by umbral shadow.

<u>Phenomena of Jupiter's Satellites</u>

Date 1961	E or O	Sats.	Occultation Begins	Occultation Ends	Eclipse Penumbra Begins	Eclipse Penumbra Ends	Eclipse Shadow Begins	Eclipse Shadow Ends	Mag.
Sept. 18*	E	II by I	---	---	22^h06^m	22^h35^m	22^h08^m	22^h33^m	0.73
19	E	II by I	---	---	06 38	06 56	06 40	06 54	0.64
19	O	II by III	17^h21^m	17^h36^m	---	---	---	---	---
19	E	II by III	---	---	22 39	23 10	22 43	23 06	0.93
22*	E	II by I	---	---	09 43	10 14	09 45	10 11	0.87
22	E	II by I	---	---	20 12	20 27	20 13	20 25	0.66
24	E	III by I	---	---	03 02	03 20	---	---	Graze
25	E	II by I	---	---	15 58	16 13	---	---	---

Date 1961		E or O	Sats.	Occultation Begins	Occultation Ends	Eclipse Penumbra Begins	Eclipse Penumbra Ends	Eclipse Shadow Begins	Eclipse Shadow Ends	Mag.
Sept.	25	E	II by I	---	---	21^h14^m	21^h51^m	21^h16^m	21^h48^m	0.94
	26	O	II by I	00^h55^m	01^h31^m	---	---	---	---	---
	26	O	II by I	06 03	06 31	---	---	---	---	---
	26	E	II by I	---	---	09 38	09 51	09 39	09 50	0.67
	26	O	II by III	21 16	21 35	---	---	---	---	---
	27	E	II by III	---	---	04 28	05 38	04 36	05 30	0.98
	27	E	II by III	---	---	11 53	13 09	12 01	13 01	0.64
	29	O	II by I	12 32	13 01	---	---	---	---	---
	29	O	II by I	19 52	20 11	---	---	---	---	---
	29	E	II by I	---	---	23 01	23 14	23 03	23 12	0.67
Oct.	3*	O	II by I	00 18	00 45	---	---	---	---	---
	3	O	II by I	09 25	09 40	---	---	---	---	---
	3	E	II by I	---	---	12 21	12 33	12 23	12 31	0.67
	4	O	II by III	01 41	02 09	---	---	---	---	---
	6	O	II by I	11 59	12 25	---	---	---	---	---
	6	O	II by I	22 53	23 05	---	---	---	---	---
	7	E	II by I	---	---	01 41	01 51	01 42	01 50	0.66
	9	O	II by I	23 32	23 59	---	---	---	---	---
	10	O	II by I	12 17	12 27	---	---	---	---	---
	10	E	II by I	---	---	14 57	15 07	14 59	15 06	0.65
	11	O	II by III	07 34	08 48	---	---	---	---	---
	11	O	II by III	13 46	15 01	---	---	---	---	---
	14	O	II by I	01 38	01 47	---	---	---	---	---
	14	E	II by I	---	---	04 14	04 23	04 15	04 21	0.63
	17	O	II by I	14 48	15 05	---	---	---	---	---
	17	E	II by I	---	---	17 28	17 37	17 30	17 36	0.59
	21	O	II by I	04 16	04 22	---	---	---	---	---
	21	E	II by I	---	---	06 43	06 51	06 44	06 50	0.58
	24	O	II by I	17 33	17 39	---	---	---	---	---
	24	E	II by I	---	---	19 56	20 04	19 57	20 02	0.54
	28	O	II by I	06 50	06 55	---	---	---	---	---
	28	E	II by I	---	---	09 09	09 16	09 10	09 15	0.51
	29	E	III by II	---	---	22 14	22 20	---	---	---
	31	O	II by I	20 06	20 10	---	---	---	---	---
	31	E	II by I	---	---	22 21	22 28	22 22	22 27	0.47
Nov.	2	E	I by II	---	---	05 45	05 48	---	---	---
	4	O	II by I	09 21	09 25	---	---	---	---	---
	4	E	II by I	---	---	11 33	11 40	11 34	11 38	0.43
	5	E	I by II	---	---	18 51	18 55	---	---	---
	6	E	III by II	---	---	01 27	01 35	---	---	s.t.a.
	7	O	II by I	22 36	22 39	---	---	---	---	---
	8	E	II by I	---	---	00 44	00 50	00 45	00 49	0.38
	9	E	I by II	---	---	07 58	08 02	---	---	---
	9	E	I by III	---	---	12 02	12 09	---	---	---
	11	O	II by I	11 51	11 54	---	---	---	---	---
	11	E	II by I	---	---	13 55	14 01	13 56	14 00	0.32
	12	E	I by II	---	---	21 05	21 09	21 06	21 07	0.06
	13	E	III by II	---	---	04 41	04 49	---	---	s.t.a.
	15	O	II by I	01 05	01 08	---	---	---	---	---
	15	E	II by I	---	---	03 05	03 12	03 07	03 10	0.27
	16	E	I by II	---	---	10 12	10 16	10 13	10 15	0.15
	16	E	I by III	---	---	15 02	15 11	15 05	15 09	0.24

*=Jupiter possibly renders phenomena invisible.
s.t.a.=Shadow tapered away.

SATURN IN 1960

By: Thomas A. Cragg

The 1960 apparition of Saturn was perhaps the most ardently observed thus far in the history of the A.L.P.O. The great activity in the newly formed North Polar Zone (NPZ), where a number of long-enduring white spots were observed, was probably largely responsible for the increased interest in Saturn. Following is a list of the observers contributing to this report:

Mr. Phillip W. Budine, 1435 Upper Front Street, Binghamton, New York, 4" refractor.

Mr. Clark Chapman, 2343 Kensington Avenue, Buffalo 26, New York, 10" reflector.

Mr. Tom C. Constanten, 1650 Michael Way, Las Vegas, Nevada, 3¼" refractor.

Mr. Thomas A. Cragg, 246 West Beach Avenue, Inglewood 3, California, 12" refractor, 12" reflector, 6" refractor.

Mr. Dale P. Cruikshank, Yerkes Observatory, Williams Bay, Wisconsin, 40" refractor.

Mr. Charles M. Cyrus, 1216 Leeds Terrace, Baltimore 27, Maryland, 10" reflector.

Mr. Jack Eastman, 2611 Maple Avenue, Manhattan Beach, California, 12½" reflector, 12" refractor.

Messrs. Stuart and Stanley Emig, Route 1, Leavenworth, Washington, 8" reflector.

Mr. Gary George 1436 Front Street, Binghamton, New York, 2.4" refractor, 10" reflector.

Mr. Walter H. Haas, Pan American College Observatory, Edinburg, Texas, 17" reflector, 12½" reflector, 6" reflector.

Mr. William K. Hartmann, 1025 Manor Road, New Kensington, Pennsylvania, 13" refractor, 8" reflector.

Mr. Alika Herring, 1312 Arlington Avenue, Anaheim, California, 12½" reflector.

Mr. Craig L. Johnson, 765 South 46th, Boulder, Colorado, 10" refractor, 4" reflector.

Mr. Lyle T. Johnson, Welcome, Maryland, 16" reflector.

Mr. José Olivarez, 804 St. Marie, Mission, Texas, 2.4 refractor.

Mr. Morris Rippel, 1427 Richmond Drive, N.E., Albuquerque, New Mexico, 6" reflector.

Mr. Leif J. Robinson, 1411 Amapola Street, Torrance, California, 16" reflector, 10" reflector.

Mr. Carlos E. Rost, Pan American College Observatory, Edinburg, Texas, 10" reflector, 6" catadioptric reflector.

Mr. Kenneth Schneller, 17826 Hillgrove Road, Cleveland 19, Ohio, 8" reflector.

Mr. Ronald Story, 33 Amicita Avenue, Mill Valley, California, 12" refractor, (Lick Observatory).

Mr. Joseph Sullivan, Jr., 11 Brookfield Road, Binghamton, New York, 3" refractor.

Mr. William J. Westbrooke, 4525 Lincoln Way, San Francisco 22, California, 4" refractor.

This report was actually prepared by three people, Mr. Phillip Budine (preliminary outline), Mr. Leif J. Robinson (general apparitional outline), and Mr. Thomas A. Cragg (general apparitional outline and final preparation of report).

Figure 5 is a general diagram illustrating the nomenclature used in this report. The NPZ is the chief addition to names on the ball since the last general nomenclature drawing. Also, the Terby White Spot is included since considerable attention was given it this time. It is depicted in the figure as it should appear after opposition.

Readers should examine the front cover drawing of Saturn, a very detailed drawing by Leif J. Robinson with a 16-inch reflector and favorable conditions. This drawing can be carefully studied in connection with many matters described in this article.

Details of the Ball

E.Z. This zone was nearly alway the brightest region on the ball. The outer part of Ring B rivaled the EZ in brightness during the early part of the apparition. Budine, however, consistently saw the EZ slightly fainter than the outer part of Ring B. Towards the end of the apparition Budine's findings were confirmed by Chapman and George. Westbrooke submitted a fine series of intensity measures throughout the last half of the apparition, and his work shows the EZ averaging about 3 (0 = white, 10 = black) near opposition and 2 by mid-September. Its color, for the most part, was a pale yellow-white.

A small number of bright clouds was observed in this zone, as has frequently been the case in the past; but one large, obvious long-enduring cloud was followed chiefly by Robinson but also by others for at least a one-month period, yielding a rotation-rate of $10^h13^m.6 \pm 0^m.1$, which is a little shorter than the generally accepted $10^h14^m.0$ for this zone.[3] No obvious acceleration was noted in its motion.

E.B. This belt was observed by nearly all of the contributors and especially after opposition was declared by most of them to be "quite prominent." Cragg noted a general increase in the ease of perceiving this belt during May and June, but we were also approaching Saturn at the same time. No. C.M. transits were obtained, but a few very transitory dark spots were observed in the belt.

N.E.B. The NEB was the most obvious belt on the planet and was depicted by all observers. When color estimates were attempted, the most commonly observed hue was reddish-brown, the standard color for both the SEB and the NEB on both Jupiter and Saturn. The intensity of the belt perhaps lightened a little towards the end of the apparition but really remained remarkably constant throughout the observed period. This result was largely the work of Budine and Westbrooke.

The NEB_s was seen a little better than 50% of the time when conditions were good, but some observers didn't see it at all!

A wealth of dark spots was recorded by several observers; but as before, they were too transitory for suitable rotation-rate determinations. It was very good to note a rather long list of C.M. transits of these spots, which is the exact procedure to follow. It was indeed unfortunate that there were no long-enduring spots. Unless it is possible to follow a spot for nearly a month, little can be gained on the rotation-rate already established for this latitude. The primary exceptions to this rule are:

1) A period remarkably different from the accepted one.
2) Any fairly strong accelerations.

Still, securing C.M. transits of any and all spots is very important, since others may be getting them at other times, and yours may then fill in the gaps.

NTrB. The NTrB was the "on again, off again" feature of Saturn in 1960. Cragg and Robinson recorded it rather strong in May but fading and difficult by early June. During the first part of August it became rather obvious since Eastman recorded it on every occasion in late July and early August. Westbrooke called its intensity 7 on August 16, being confirmed

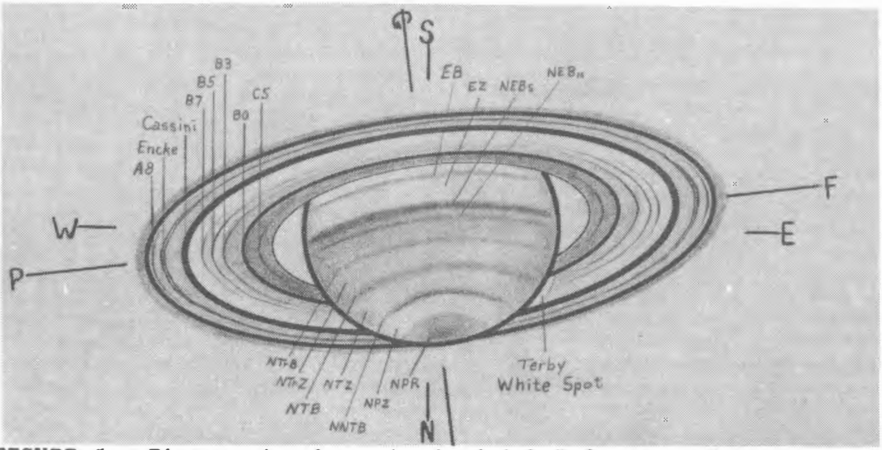


FIGURE 5. Diagram to show standard A.L.P.O. nomenclature of Saturn in 1960. This terminology used in Mr. Thomas Cragg's article "Saturn in 1960" in this issue.

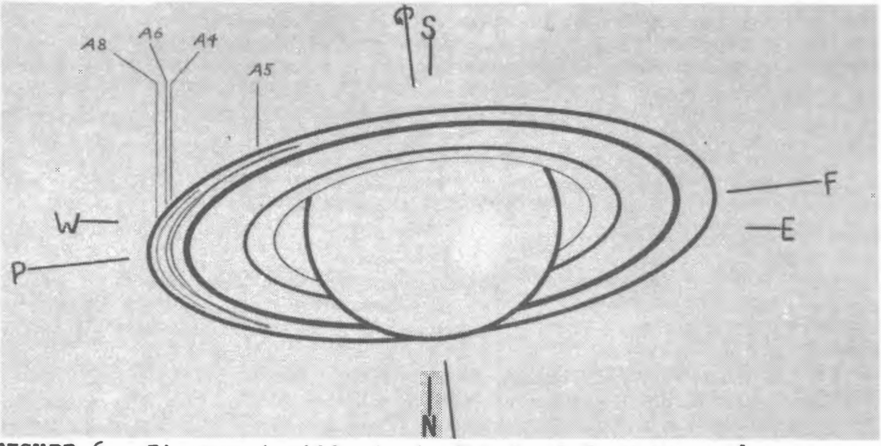


FIGURE 6. Diagram to illustrate Mr. Leif J. Robinson's interpretation of minor divisions in Ring A of Saturn. See Mr. Robinson's remarks under "Ring A Divisions" in Mr. Thomas Cragg's article "Saturn in 1960" in this issue.

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by Sullivan on August 17. Then by September Westbrooke's estimates were running 4½-5 (background probably about 4). It was again "prominent" to Olivarez on September 23 and was seen only faintly by Chapman in October and November. Intensity measures of this feature are clearly desirable every time that Saturn is observed. One must be careful about this feature's being strong in one longitude and weak in others.

NTrZ. This zone, between the NTrB and the NTB, was consistently the least obvious zone throughout most of the apparition. It brightened considerably in November, according to Chapman. This brightening may have begun as early as October 11 since Budine remarked about it at that time, but observations were rather sparse since the end of the apparition was so near.

N.T.B. Most of the time this belt was the second most obvious belt on the planet. During May it was normal to perhaps a little darker than normal, but it showed some evidence of fading in early June to Cragg. A strong darkening trend began in mid-July, and during most of August nearly everyone saw the NTB. Westbrooke's intensity estimates showed this belt fading slightly during September, but it was quite obvious to Olivarez on September 23. By the first part of November it was again strong, fading toward the end of November, and recovering again in December.

NTeZ. This zone became quite active during the 1960 apparition and produced a number of bright spots. Budine, Chapman, Cruikshank, George, Robinson, and Schneller recorded a number of these bright spots; only two transits, however, seem to be of the same spot. This feature is a spot found by Budine on August 27 and recovered as a "large bright section in the zone some 25° to 30° in length" by Chapman on September 8. Since C.M. transits were obtained for both objects, a period can be determined, 10^h40^m best fitting the observations. A pair of drawings by Cruikshank on July 12 and 16 shows a similar pattern, indicating a base period of 10^h40^m also. Other spots observed in this zone cannot be connected by a feasible period. The 10^h40^m period may seem a little long at a latitude of about 45° since Saturn has the highest equatorial acceleration of any of the planets, and a rather good period of $10^h39^m52^s$ seems to fit quite well for the 60° N. zone.[1]

Intensity measures in the NTeZ by Westbrooke made it essentially a constant brightness from June through early September with three conspicuous short-lived fadings around July 3, August 22, and September 4. Budine and Rost continued the intensity measures which indicated, if anything, that the zone got a little brighter in late September and early October.

N.N.T.B. Apparently the first obervation of this normally very elusive belt was by Cragg on June 21, when it was observed as merely a darkened border on the south edge of the obvious NPZ. Within 20 days Robinson recorded the NNTB as the third most obvious belt on the disc. By the middle of September this belt was quite prominent, and was so described by Budine and Schneller on September 4 and August 29 respectively. Cragg saw it doubled on August 9.

N.P.Z. This is the zone which was created by the now famous "Dollfus White Spot." Bordering the NPR on its south edge, this zone dominated everything but the EZ in May and June. When more bright spots appeared here in July and August, it was again rejuvenated into new vigor. In fact, on December 7 Haas called it brighter than the EZ. Quite a number of large bright clouds appeared in this zone; and fortunately many C.M. transits were obtained by A.L.P.O. members, yielding enough material for a good determination of the rotation-rate at this latitude (+60°). This was a fundamental determination since never before had spots been recorded at so high a latitude. A more thorough discussion of the activity in this zone is given elsewhere[1] and so need not be repeated here. However, since that report was prepared, more transit observations have come to hand from J. H. Botham of South Africa, using the 6" and 9" refractors of the Union Observatory, Johannesburg. He observed two different spots, one of which rather closely matches the one observed by Dollfus, but precedes Dollfus's observations by nearly a month! The scatter in the C.M. transits, however, appears to make it impossible to increase the accuracy of the reductions of the Dollfus spot already published ($10^h39^m.9$). Botham's other spot was observed on three occasions over a one-month interval, where a period of 10^h40^m fits best.

N.P.R. Strong evidence has it that this feature started out in February to be very dark and steadily faded throughout the whole apparition. As an example, Westbrooke's intensity measures average 8 in June and July and gradually approach a mean of 4-5 by September. Chapman's observations during October, November, and December indicate the NPR as "small and faint." Several observations indicate some very short-term changes, nearly from night to night. This result suggests that possibly the NPR was not centered on the pole or was not equally conspicuous in all longitudes. A dark spot was seen on the south edge of the NPR by George on September 4; and Schneller saw the area "very disturbed, festoon-like activity present" on August 29. Since activity of this sort is practically never found in the NPR, one is certainly led to believe that it was influenced by the great activity in the nearby NPZ.

Detail of the Rings

Ring A. Westbrooke's estimates of the mean intensity of Ring A showed a general darkening trend from June 20 to August 23, then a lesser brightening trend up to mid-September. Whenever specifically mentioned, the outer part was always darker than the inner part. Chapman on August 18 called the intensity of the outer part of Ring A 5.3 while the inner part was 3.8 (0 = white, 10 = black). Westbrooke noted also that the two ansae of Ring A were not always of equal intensity; and when they were dissimilar, the prec. ansa was always brighter than the fol. ansa. He was also the only observer reporting the "bicolored aspect" so often referred to in past reports. He felt that it was particularly evident during the first week of September, but he had seen it several times before that.

A bright narrow annulus near the middle of Ring A was observed in late July by Robinson, on August 4 by Haas, and on August 7 by Schneller, confirming a similar short-term appearance observed in 1959 by Chapman.

Ring B. Ring B always rivaled the EZ as the brightest part of the Saturnian system in 1960, and was observed by some to be brighter than the EZ, especially near the end of the apparition. Westbrooke's estimates of intensity showed that Ring B kept rather close to the same brightness from June through the middle of September. Of course, this statement refers only to the outer third of Ring B since the rest of this ring was much darker.

Ring C. This supposedly difficult ring was seen by nearly all the observers. Westbrooke's estimates indicate that it remained at a nearly constant intensity when seen. Those who depicted it on drawings showed it extending in very nearly half of the distance from the inner edge of Ring B to the ball. Color estimates made it brownish.

Ring D. Ring D was reported by two observers in 1960, Craig Johnson and Kenneth Schneller. On July 19 Johnson called it $\frac{1}{4}$ as bright as Ring C.

Ring A Divisions

Encke's Division was observed by most of the contributors throughout the apparition. Its placement varied from A5 to A6. When Schneller and Robinson saw the bright annulus in Ring A, both saw Encke's double (a fine division on either side of the bright annulus, at A4 and A5). Robinson and Schneller also report having seen A8, bringing to four the number of observers to perceive this elusive division. There is little doubt of the existence of this division since in three occultations of stars by the ring there has each time been a conspicuous brightening at A8's position.

Leif J. Robinson offers these comments about the nature of Ring A and its divisions: "Taking account of past visual observations, the photometric work of Dollfus, the recent occultations of stars by the rings of Saturn, and my personal observations with 10- and 16-inch telescopes under superlative conditions, I find the following to be most plausible.

"The 'normal' appearance of the divisions in Ring A is that of a single division (Encke's) located 0.5 of the way out on Ring A. At other times, observers have noted another division at 0.8 distance. Lastly, divisions have been seen at 0.4 and at 0.6. It should be mentioned that some slight variations in the position of these divisions have been occasionally noted; but such observations appear sporadic, and hence the above positions may be regarded as factual. The question is: are there divisions at 0.4, 0.5, 0.6, and 0.8? Let us initially study 0.8.

"A8 has been observed several times by visual observers, Dollfus has shown its existence through the photometry of photographic images, and all stars occulted by Saturn, in recent times, have shown a marked brightening at this position. I believe the evidence to be clear, leaving little doubt as to its existence.

"Under average conditions, I have always found Encke's Division to appear as a single demarcation in brightness, 0.5 exterior to the inner edge of Ring A. Under superior conditions, with a large telescope, this division becomes binary, the components being located at 0.4 and 0.6. These visual observations have been vindicated in much the same manner as with A8.

"I attribute the 'strange' appearance of Encke's Division, which is occasionally observed, i.e., A5 is seen either at A4 or A6, to be the result of a slightly imperfect observation. When the seeing is fair (in telescopes of 10 inches or larger) A4 and A6 are imperfectly seen as A5. As the seeing improves, either A4 or A6 may be indistinctly seen. When conditions are excellent, both components take on their true appearance. Figure 6 depicts this perfect view.

"Occasionally, a bright annulus is observed between A4 and A6. I believe it sufficient to attribute this to a contrast effect, caused by the bright ring's being bounded by two very thin dark lines. The same effect has been seen by this observer under similiar conditions in different parts of the ring system."

Ring B Divisions

<u>Cassini's Division</u>. This obvious demarcation in the ring system was reported by all observers, as would be expected at the present ring inclination. Westbrooke's intensity estimates consistently showed it other than black, but this aspect was not particularly confirmed by other observers. In the past some observations have indicated that Cassini's Division is not completely devoid of material.

<u>B7</u>. Observed once by Cragg, Haas, and Robinson in 1960.

<u>B5</u>. Observed by Budine, Chapman, Cragg, Eastman, Johnson, Robinson, and Schneller. Johnson's observation was really of a B6 since he said that it lay definitely outside the middle of B but not so far out as B7. Cragg saw B5 nearly 2/3 of the times when he looked, and on several occasions claimed it to be more obvious than Encke's.

<u>B3</u>. Observed by Budine, Chapman, Cragg, Haas, Hartmann, Johnson, Robinson, and Schneller. Apparently all saw it single, but it has been observed double by Avigliano, Cave, and Cragg on several occasions.

<u>B0</u>. Observed by Budine, Cragg, George, Haas, Johnson, Robinson, Schneller, and Westbrooke. This division is really quite obvious when Ring C is easily seen. It is really the second widest division, its breadth being clearly seen when Ring C is easily visible.

Ring C Divisions

<u>C5</u>. Observed only by Schneller and unconfirmed by any other observers.

In summary, the divisions seen by two or more observers in 1960 were B0, B3, B5, B7, Cassini, double Encke, and A8, which is quite an impressive list.

Terby White Spot

This very common feature hasn't been mentioned in these reports for some time. It was very gratifying to see it described at such length and with such vigor by some of our newer contributors to the Saturn Section. This feature is a bright contrast spot beside the black shadow of the ball on the ring. Some differences were noted this time, however. Once the bright spot was seen as a bright notch in the shadow. Most of the time it was seen only along the boundary where the shadow crosses Ring B since the ring is there the brightest and thus the most capable of producing the contrast effect.

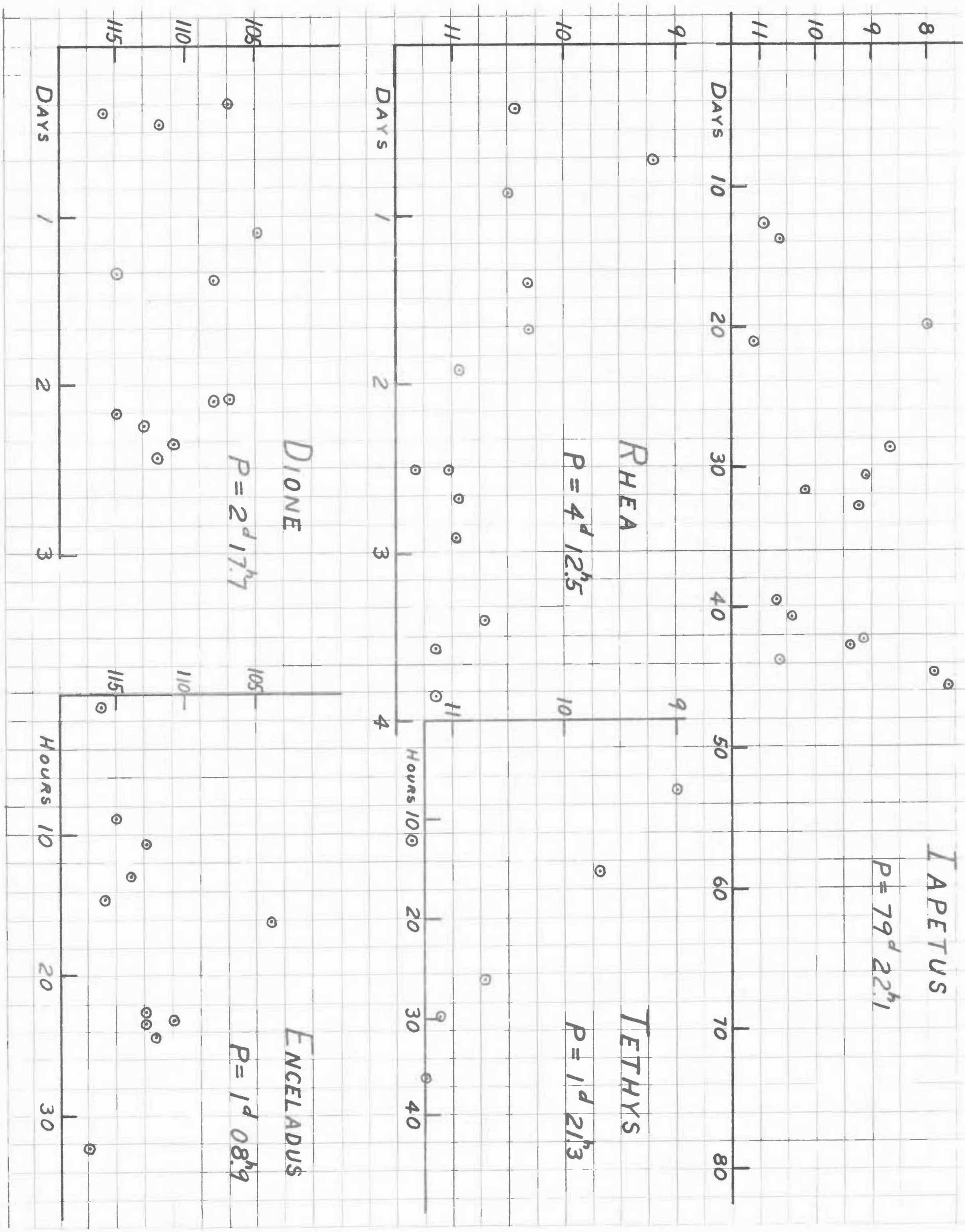

FIGURE 7. Plots of step estimates of stellar magnitudes of Saturnian satellites by William J. Westbrooke with a 4-inch refractor. Zero on time scale is time of eastern elongation of satellite. Graphs constructed by Thomas A. Cragg. See article "Saturn in 1960" in this issue.

Satellites

Westbrooke made a fine series of estimates of the brightnesses of Enceladus, Tethys, Dione, Rhea, Titan, and Iapetus between May 21 and September 7. He made a series of step-estimates, assuming Titan to be constant at 8.3. He also submitted estimates of Titan. Plots were made of his magnitudes against the revolution period of each satellite around Saturn, using eastern elongation as the zero date, especially to see if the observations showed evidence that any of the satellites keep the same face toward Saturn. If one side of the satellite has a different albedo than another and if the satellite keeps the same face towards its primary, then the resulting light-curve must show a periodicity equal to its period of revolution around Saturn. Figure 7 shows the plots of each satellite. A few comments follow:

<u>Iapetus</u>. A large portion of the orbit was not covered, but it appears that a minimum occurs some forty days after E. elongation. Iapetus has the largest range in brightness of any of Saturn's satellites. (P = $79^{d}\ 22^{h}.1$.)

<u>Rhea</u>. Shows definite signs of being brighter for the half cycle after E. elongation than for the half cycle before E. elongation, rather good evidence that it keeps one face toward Saturn. (P = $4^{d}\ 12^{h}.5$.)

<u>Dione</u>. Observations show too much random scatter for any conclusion, or else Dione doesn't keep the same face towards Saturn. It could also keep the same face towards Saturn and have no obvious asymmetry in albedo with longitude. (P = $2^{d}\ 17^{h}.7$.)

<u>Tethys</u>. Despite the curve's showing an obvious relation with the period of revolution, one must be careful since there are only six estimates (one of which falls very far away from the rest). Using these as a criterion, however, it looks very much as if Tethys keeps the same face towards Saturn. (P = $1^{d}\ 21^{h}.3$.)

<u>Enceladus</u>. Although not very obvious, it appears that a minimum occurs near E. elongation with a maximum centered about on W. elongation. As weak as it is, the evidence does indicate that Enceladus appears to keep the same face towards Saturn. (P = $1^{d}\ 08^{h}.9$.)

One is reminded here of Guthnick's epic work[2] on light variations of the Saturnian satellites. The only curve which is really unquestionably related to the period of revolution is that for Iapetus. Rhea is probably next best, but its cycle appears closer to one-half of its revolution period. Mr. Westbrooke is to be congratulated on such a fine piece of work on such a difficult task, because the glare Saturn creates near it makes reliable magnitude estimates of the satellites nearly impossible.

Latitudes of Belts

Professor R. R. de Freitas Mourão of the National Observatory at Rio de Janeiro, Brazil, has carried out measures with a filar micrometer attached to their Cooke and Sons 18-inch refractor of latitudes of belts on Saturn, beginning in 1959. The measures were reduced by Crommelin's formulae. The average latitudes secured were as follows:

S. edge N.P.R.	$63^{\circ}.6$ N.
S. edge N.T.B.	37.3 N.
S. edge N.E.B.	8.1 N.

References

1. <u>The Strolling Astronomer</u>, Vol. 15, pp. 96-98, 1961.
2. <u>A. N.</u>, Vol. 198, p. 233, 1914.
3. L. J. Robinson, "The Rotation of Saturn--1960," <u>P.A.S.P.</u>, soon to be in print.

THE LIMB BAND OF VENUS: A PIECE FOR THE PUZZLE

By: James C. Bartlett, Jr.

By the time this offering sees the light it may well be that the Russian Venus probe will have added many corrections to the views expressed herein--and maybe not. We shall see. [Dr. Bartlett wrote this paper near February 20, 1961.--Editor.]

For the nonce, at least, Venus remains the celestial jigsaw puzzle it has so long been to observers. We must still fit each piece of evidence into place, slowly and with infinite patience, in the hope that eventually the pattern of the whole will become clear. This is the story of one such piece, hitherto neglected, and of the other pieces into which it dovetails. If the first piece fits--a matter I leave to the judgment of my peers--the other pieces will be seen to fall naturally into place, to provide a portrait of the planet somewhat at variance with the fashionable views entertained by many astrophysicists.

Careful observers of Venus have all noticed the appearance of a very bright limb band on the sunlit hemisphere, extending somewhat inward into the less brilliant interior of the disc, and which has been vaguely ascribed to the Venusian atmosphere and/or to clouds. Actually we should expect to find some kind of a limb band even on an airless planet (one exists, for instance, on the moon), and while clouds and atmosphere play a part in its production on Venus it is determined by neither such agent but by the phase. Observers of the planet must also have noticed that the bright limb band is a phenomenon which develops with approach to an elongation. Taking an evening apparition as our starting point, we note that it begins to become evident several weeks after Superior Conjunction, and the earliest date for its presence in my personal records is one with a k value of 0.922. As dichotomy is approached it becomes more and more conspicuous; but after dichotomy, it gradually dwindles in width until just before Inferior Conjunction it is reduced to a very narrow band on the sunlit limb. The latest date on which I have seen it has a k value of 0.206. The bright limb band, therefore, is a geometric production; and while the atmosphere of Venus diffuses and broadens it beyond the extent it would have on an airless planet, it is the angle of incidence of sunlight which determines it. Certain related phenomena may now be considered.

When the planet is observed close to Superior Conjunction the full disc will appear universally brilliant with no sensible brightening of the limbs. I so saw it in '54 when the value of k was 0.994, and when the planet presented the beautiful spectacle of a miniature full moon--but a moon unstained by any shadow of markings and shining with the undimmed lustre of burnished silver. With the development of the bright band on the sunlit limb, the former becomes sensibly brighter than the interior of the disc; though the interior remains very bright through most of the gibbous phase. With approach to dichotomy, however, the brightness of the interior begins to fall off; and this interior may even appear to be lightly shaded in relation to the limb band which grows ever brighter. At this time too faint colors may sometimes be seen in the interior shading, occasionally bluish but more often brownish. The significance of such tints we shall consider later. Sufficient now to observe that the gradual shading of the disc, and the gradual increase in the brightness of the limb band, are the reverse sides of the same coin. In short, as dichotomy is approached, the sun's rays are becoming normal to the limb and tangential to the interior of the disc. After dichotomy the sun's rays become increasingly oblique with respect to the limb, and the width of the limb band will progressively decline.

So much for the <u>raison d' etre</u> of the bright limb band of Venus. We are now ready to consider what bearing this has on the less well known <u>dusky</u> limb band, and what this feature can tell us of the state of Venusian meteorology. From time to time various observers have reported a crescentic dark band parallel to the bright limb and some distance inward. This band forms a dusky border to the bright limb band, and because so it has generally been considered a mere contrast effect. W. H. Haas shows it occasionally, and it appears in the drawings of Brian Warner and others. When well developed it gives the effect of shadow, causing the disc or crescent to appear hollow as if the interior were depressed beneath a shadowed bright rim. On February 14, 1961, at 23^h06^m U.T., I found the dusky border to the bright limb band so conspicuous as to compel me to the conclusion that it was shadow (Figure 8). The interior of the crescent was featureless, save for a small 8^o bright spot* near the south cusp, and was lightly shaded. This shading was faintly but distinctly tinged with brown.

Now if this dusky band is ever a true shadow then we are dealing with something objective and physical. The contrast theory has its points, to be sure, though it is considerably weakened by the fact that very often a bright limb band is seen without any dusky border whereas we should expect to see it much more consistently if entirely a matter of optics. On the other hand the dusky band is only an occasional feature and appears sparingly in the reports of various observers. I have myself seen it only 3 times in 270 observations of Venus. The fact that the dusky band is of random and infrequent occurrence strongly suggests that it is a real phenomenon, the nature of which can scarcely be in doubt. Given an extensive cloud system passing over the limb, the dusky band simply represents the shadow cast from its edges. In this view we would interpret a bright limb band sans dark border to be the effect of direct sunlight on unbroken cloud or upon homogeneous atmospheric haze. A bright limb band with dusky border we would interpret as a broken mass of cloud with definite borders. If this interpretation be tenable, certain interesting corollaries follow automatically. For instance, we notice in Figure 8 that the dusky band, though thicker and darker in the south, nevertheless follows the entire curve of the limb. Therefore a cloud system is postulated so extensive as to cover both hemispheres of the planet, north and south. This would imply a much greater degree of cloudiness than is usual for the earth; but by the same token it disproves a universal cloudiness on Venus, for we are here dealing with a limited cloud system with a trailing edge marked by its shadow.

We have spoken of the shading of the interior of the crescent, which begins to become noticeable after Greatest Elongation East. This shading is, of course, not shadow but a mere difference in intensity as between the interior and the bright limb band; but mention has also been made of the faint flush of color which now may occasionally appear in the interior shading. What is the meaning of this color, and how does it bear upon the interpretation placed upon the limb band's dusky border?

The relation is rather direct. If a dusky-bordered limb band implies the retreating edge of a cloud system, then manifestly clearer skies will follow; but we must also remember that we are dealing with Venus, not earth, so that the clearing of the Venusian sky will be a matter of degree. We may expect a clearing to the extent that unbroken cloud cover has been removed, but the general haziness of the Venusian air will remain.

It seems to this writer that the meaning of the faint tint sometimes observed in the interior shading is to be related to this factor, particularly so in that the tint is almost always brownish. Thus over the years I have recorded color on Venus on 44 occasions, of which a brownish tint has been observed for no less than 35 of them. In only 9 observations was a bluish tint determined. I have observed no other colors on the sunlit hemisphere.

Therefore it seems reasonable to relate this brownish tint to a reddening effect of the Venusian haze; and while this dense haze forbids more than a translucency to the planet's atmosphere, by the same token it does permit a diffusion of sunlight, so that we need not take too seriously pictures of the planet as shrouded in perpetual darkness, or at best semi-gloom.

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*On an intensity scale of 0 to 10, with the most brilliant features 10.

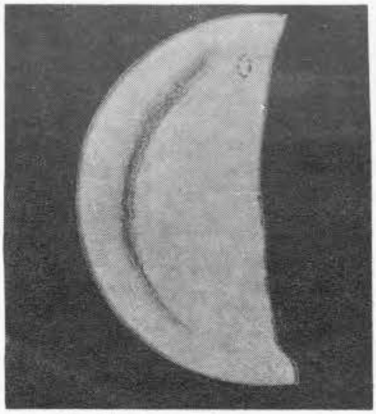

FIGURE 8. Venus.
James C. Bartlett, Jr.
Feb. 14, 1961. $23^h\ 06^m$
U.T. $4\frac{1}{4}$-in. refl. at
120-240X. S=6. T=5.

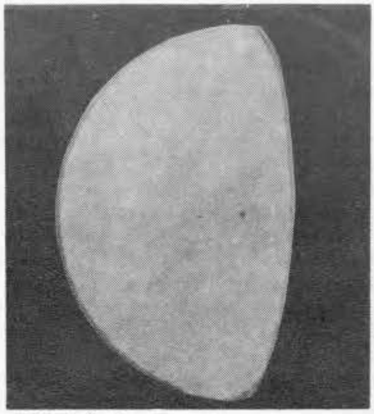

FIGURE 9. Venus.
James C. Bartlett, Jr.
Jan. 5, 1961. $23^h\ 05^m$
U.T. $4\frac{1}{4}$-in. refl. at
120-240X. S=1-2. T=4.

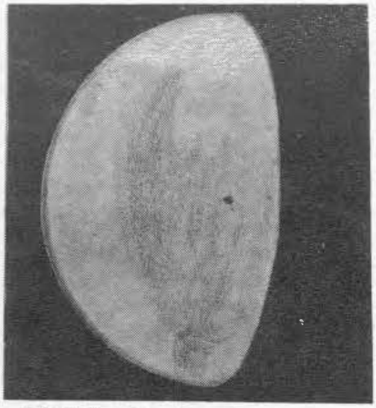

FIGURE 10. Venus.
James C. Bartlett, Jr.
Jan. 6, 1961. $23^h\ 10^m$
U.T. $4\frac{1}{4}$-in. refl. at
120-240X. S=5. T=3.

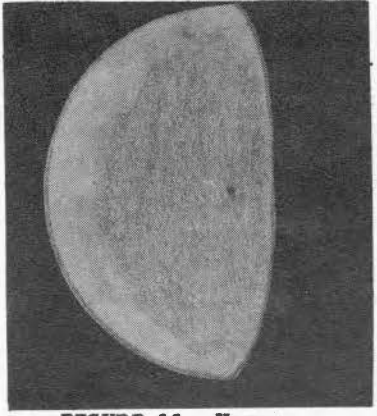

FIGURE 11. Venus.
James C. Bartlett, Jr.
Jan. 7, 1961. $22^h\ 33^m$
U.T. $4\frac{1}{4}$-in. refl. at
120-240X. S=5. T=5.

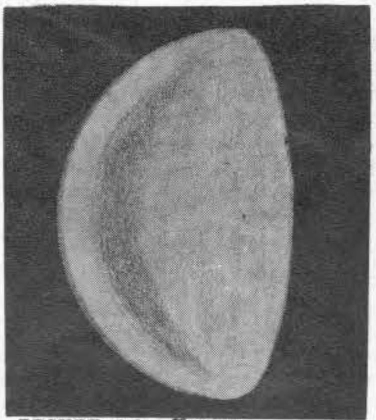

FIGURE 12. Venus.
James C. Bartlett, Jr.
Jan. 9, 1961. $22^h\ 54^m$
U.T. $4\frac{1}{4}$-in. refl. at
120-240X. S=5. T=5.

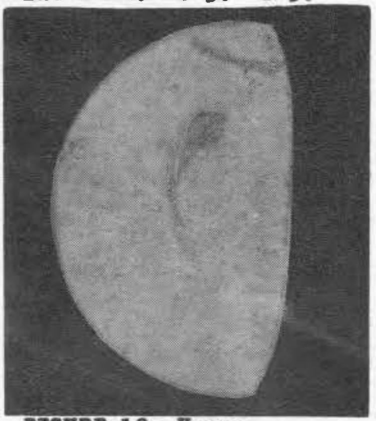

FIGURE 13. Venus.
James C. Bartlett, Jr.
March 20, 1956. $23^h\ 40^m$
U.T. 3.5-in. refl. at
100X. S=1-3. T=5.

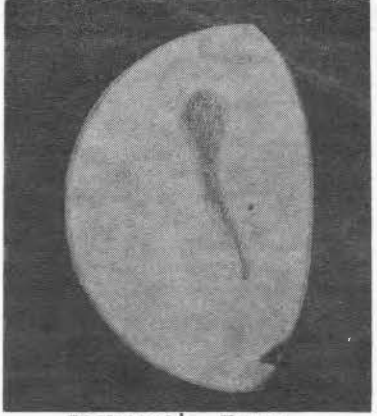

FIGURE 14. Venus.
James C. Bartlett, Jr.
March 21, 1956. $23^h\ 43^m$
U.T. 3.5-in. refl. at
100X. S=?. T=5.

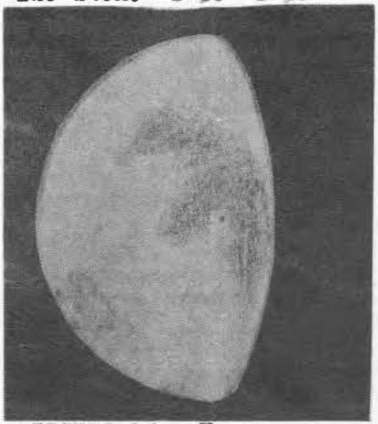

FIGURE 15. Venus.
James C. Bartlett, Jr.
March 23, 1956. $23^h\ 53^m$
U.T. 3.5-in. refl. at
100X. S=1. T=5.

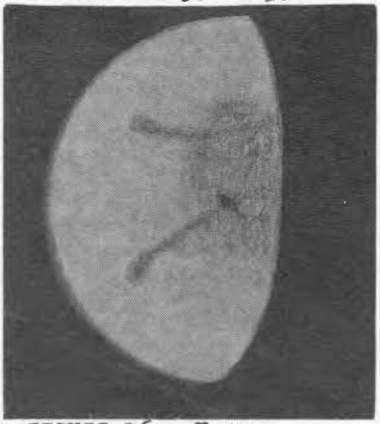

FIGURE 16. Venus.
James C. Bartlett, Jr.
March 26, 1956. $23^h\ 51^m$
U.T. 3.5-in. refl. at
100X. S=5. T=5.

Beginning our studies with the bright limb band and continuing with its dusky analogue, we have now arrived at a tentative portrait of the planet which bears a much closer resemblance to terrestrial conditions than to the usual text book pictures. Can such a revised picture be supported by observational evidence? And if so, what is the nature of the evidence to be sought?

I think that it can; and the evidence is provided by short-term variations in the area relation of limb band to interior shading, and by changes in the pattern of the shading. Two sequences from my own records illustrate both.

On January 5, 1961, at $23^h\ 05^m$ U.T., I found the gibbous disc not only featureless but universally bright (Fig. 9). On January 6, at $23^h\ 10^m$ U.T., this blank whiteness had been succeeded by an emerging pattern of light shading (Fig. 10), which by January 7, at $22^h\ 33^m$ U.T., had developed into a homogeneous shading bordered by a bright limb band (Fig. 11). The width of this limb band should be carefully noticed. On January 8 the limb band was definitely narrower, and on January 9, at $22^h\ 54^m$, a broad dusky border had appeared (Fig. 12). By January 10, at 23^h U.T., the dusky band had vanished and the bright limb band had become reduced to a very narrow ribbon (compare to Fig. 11). The disc meanwhile remained featureless and lightly shaded.

We may now consider a similar though somewhat different sequence from the 1956 apparition. On March 20, 1956, at $23^h\ 40^m$ U.T., a vague, shadowy marking was seen mostly south of the center of the gibbous disc (Fig. 13). On March 21, at $23^h\ 43^m$ U.T., this same marking was again observed but was now somewhat darker and prolonged to the north (Fig. 14). On March 23, at $23^h\ 53^m$ U.T., this marking had been succeeded by or--more probably--had broadened into a massive, irregular shading (Fig. 15). On March 26, at $23^h\ 51^m$, this shading had consolidated to a single mass crossed by two distinct radial streaks (Fig. 16). Thereafter a weather break interrupted these observations.

Other sequences from the writer's records show the reverse of the phenomenon, i.e., the gradual break-up of a universal shading by the intrusion of bright white masses, culminating in a universally bright, unshaded disc. This blank whiteness may continue for several days but always and eventually is succeeded by the reëmergence of shading patterns and/or definite markings.

The meaning of the phenomena encountered in the two sequences given above is rather obvious. In the first series we start with a universally bright and unshaded disc, to be followed by the gradual emergence of a shading coincident with the gradual narrowing of the bright limb band, and the subsequent appearance of a dusky border to the latter just before its final reduction to a thin ribbon. All of these appearances in turn can be nicely explained by the movement of a huge cloud system toward and around the bright limb.

The meaning of events in the second series is perhaps somewhat different. Here we begin with a vague, rather ill-defined, dusky marking, which subsequently intensifies and eventually expands into a solid mass associated with two radial streak markings. This sequence looks like a combination of events: the break-up of a cloud cover, the movement of the residuals toward the bright limb (note that the shaded pattern develops outwardly from the terminator), and the consequent "clearing" of an irregular area of atmosphere.

Thus by simply paying some attention to the varying relation between the bright limb band and the interior shading and by observing daily changes in the pattern of the disc shading, we may learn quite a bit about Venusian weather from an otherwise featureless disc. The following points are supported by observational evidence:

1) The cloud cover on Venus is not universal.
2) Clouds on Venus, as on the earth, are distributed in limited systems.

3) Extension in latitude of the Venusian systems would appear to be greater than the similar extension of terrestrial systems.
4) At least 3 major species of Venusian cloud may be distinguished:
   (a) very high level, thin clouds, which reflect brilliantly but cast no shadow near the bright limb and are probably analogous to our cirrus and cirro-stratus;
   (b) heavy masses of cloud with shadowed borders, probably similar to our cumulus, strato-cumulus, and cumulonimbus;
   (c) small systems represented by isolated bright spots (other than star points), perhaps identical with our ordinary, limited cumulus, cirro-cumulus, and alto-cumulus fields.
5) The movement of the Venusian weather fronts is from west to east and therefore in the normal direction of planetary rotation. [In this paper Dr. Bartlett defines west and east to agree with the sense of the earth's rotation.--Editor.]
6) Insofar as the eastward movement of the cloud systems is a consequence of the rotation, a short period of rotation is indicated.

I have long been of the opinion that the historic controversy in regard to the existence or non-existence of markings on Venus can be resolved by recognition of an elementary fact; namely, that there are cycles in the planet's meteorology in which the cloud systems are neither as extensive, nor the atmosphere as opaque, as at other times; and I would venture to predict that if any one cared to make a really thorough investigation of all the materials, going as far back as possible, such cycles would certainly be revealed. My own records, dating back to 1944, are hardly adequate; and yet even within the brief span of 17 years one finds short-term variations which are highly suggestive. Thus in 1956 I find definite markings recorded for 22 observations out of 26; but out of 34 observations in 1951, markings were recorded only 7 times; and in the current 1961 apparition to date I have recorded markings only 5 times in 24 observations to the date of this writing (February 14, 1961).

But while such evidence would seem to indicate cycles in the planet's meteorology, we may also conclude that evidence is lacking for any seasonal variation in cloud pattern or weather movement; the meteorological pattern on Venus appears to be much more regular than ours. Inference: That seasonal change on Venus is by latitude, not by orbital position in relation to latitude, i.e., that there is no marked movement by the sun north and south of the planet's equator. Corollary: That the axis of rotation is sensibly perpendicular to the plane of the orbit, supported observationally by the position of the cusp-caps.

The picture thus presented is that of a world, differing significantly in its solar relations, and yet withal a world much more nearly like the earth than it is like its theoretical portraits. Cloudy is is; but yet not shrouded in the universal gloom so often depicted. The atmosphere is certainly not transparent, in the sense that the Martian air is transparent; but it is certainly translucent, and therefore the surface is probably sunlit to a much brighter degree than we have supposed. Weather systems move there much as they do here, alternating between sun and shade, calm and storm, moving ever to the east with the rotation of the globe beneath them. The existence of water vapor is now admitted. The crackle of Venusian thunderstorms has come to us as radio static from the planet. Thunderstorms mean lightning; and lightning means the violent disruption of water droplets by the surging currents in the thunderhead; and thunderstorms imply rain, and water that falls from the sky--any sky--must first have reached it by evaporation from surface waters.

How naturally all this fits into the frame of observational evidence we have been considering. How strange it seems when viewed from the reference frame of dry, sun-baked deserts, oceans of plastics, an igneous surface covered by luminescent sulphides, and many of the other strange fancies which have bemused us. But what matter? Perhaps by the time these scribblings appear, the Russians will have told us all about it.

Postscript by Editor. Perhaps Dr. Bartlett's article will have best served his purposes if it stimulates some creative thought about Venusian problems. Observational evidence must here be evaluated most carefully. One should also note that the dusky limb-band cannot be a shadow of the bright limb-band (Fig. 12 on p. 135 shows both) because it lies between the bright band and the sun.

A WARGENTIN-TYPE FEATURE ON THE MARE SERENITATIS

By: Alika K. Herring

Concerning the suspected dome on the Mare Serenitatis which was described by Dr. Joseph Ashbrook (Strolling Astronomer, Nov.-Dec., 1960), while observing on Christmas Eve last I also happened to note this formation, which was well placed near the terminator at the time. This was the first time I had seen it, and I found it so intriguing that I felt a sketch should be attempted in spite of the rather mediocre seeing conditions. The descriptive notes which were subsequently entered in my observing book are reproduced in part as follows: "It appears to be a nearly circular plateau of low elevation, with edges that rise rather abruptly from the surrounding plain. The surface is nearly flat, although perhaps possessing a very slight convexity, and, except for a few small scattered hills, contains no other apparent detail.

"The exact nature of this feature may be somewhat obscure. While it is shown on charts C3-b and C3-d of the Kuiper Photographic Lunar Atlas, the photographs leave much to be desired. The Wilkins map apparently depicts it as a ruined crater, but I cannot agree with this interpretation. I also do not believe that it should be considered a dome since the general contour is quite untypical of this class of feature. Pending a further study, I would say that it is more nearly similar to Wargentin, except in the matter of size, than to any other type of feature on the lunar surface. It is indeed a most extraordinary object."

My copy of The Strolling Astronomer containing Dr. Ashbrook's remarks on this formation did not reach me until December 27, 1960; and I therefore had no prior knowledge of his interest in it. I also subsequently learned that a drawing of this same feature was made by D. W. G. Arthur with the 40-inch Yerkes refractor and published in The Journal of the British Astronomical Association for September, 1960. With the exception of a small cleft which I did not see, I believe the drawings are mutually confirmatory. Arthur also describes the feature as a "plateau."

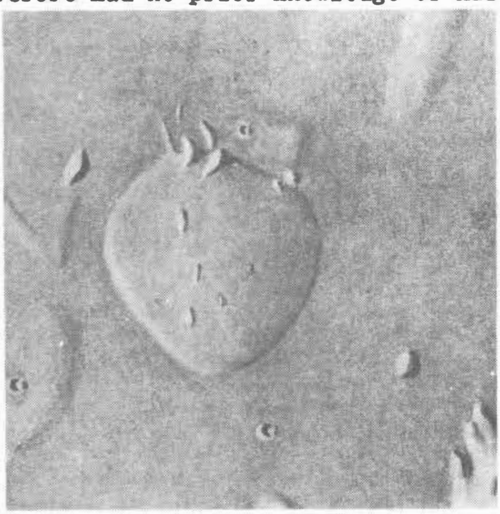

FIGURE 17. Plateau near Linné. Rectangular coördinates xi=+160, eta=+495. Alika K. Herring. December 25, 1960. 2^h 30^m, U.T. 12.5-inch refl. 278X. S=3-5. T=5. Colongitude 353°.1.

The basic difficulty in questions of this sort stems from the fact that as yet there has been no general agreement among students of the moon as to the exact nature of lunar domes. As a result, each individual observer has more or less devised his own criteria or standards for defining them. Unless such an agreement can be reached the probability of bringing order to the chaotic situation is small. I am therefore fully aware that the opinion expressed above concerning the nature of the Serenitatis feature is a controversial one and may not be completely accepted by other observers.

Postscript by Editor. When is a dome a dome? As Mr. Herring says, we need a standardized lunar nomenclature. What are the criteria for defining a dome, a saucer, a cleft, etc.? Perhaps some of our advanced lunar students would like to think in this direction and to discuss the problems present in a future issue.

BOOK REVIEW

A.L.P.O. Jupiter Handbook. Written by Elmer J. Reese. Published privately by Philip R. Glaser. 1961. 12 pages. 3 figures. 3 tables. Price $0.25.

Reviewed by Walter H. Haas

For some years the A.L.P.O. has been striving vainly to develop an Observing Manual for the guidance of observers. Though several different persons have made sincere efforts on this project, the most certain thing about this manual at the moment is that it is far from ready. Neither did the Astronomical League succeed in completing a more general amateur observing manual first planned about 1950.

Perhaps a better goal would be for each Section of the A.L.P.O. to prepare its own manual for the needs of its own observers. Mr. Elmer J. Reese has shown us the way with a truly splendid Jupiter Handbook. It is written extremely well on an elementary level, and at the same time it furnishes a tremendous amount of information about the Giant Planet and about profitable amateur observing programs on it. The physical format selected by Mr. Glaser is also very praiseworthy. The white pages and covers are six by nine inches; and a spiral-type, looseleaf binding permits any of the pages to lie flat--a great convenience at the telescope, where the booklet deserves to spend many hours. Reproduction is by offset and is extremely clear.

The handbook begins with general information about Jupiter, the nomenclature of the belts and zones, the two Systems of longitude, and prevalent kinds of markings. A number of different observing programs are then clearly described--drawings both full-disc and sectional, visual intensity and color estimates, central meridian transits, photography, measurement of Jovian latitudes, estimates of color and brightness of the four large satellites, phenomena of these satellites both ordinary and mutual, and studies of the difficult markings on the satellites. A short concluding section offers several helpful hints about telescopically observing Jupiter. The three figures give the standard Jovian nomenclature, the usual relation of the belts and zones to Jovian latitude, and two full-disc drawings showing the Red Spot region alternately as dusky Spot and bright Hollow. The tables display the increase of central meridian longitude with time in both System I and System II, mean rotation-periods of some well-established currents, and the A.L.P.O. Jupiter intensity scale. Other useful information furnished includes formulas for computing zenographic latitude and formulas for converting drift relative to System I or II to period of rotation. A list of references supplies 26 titles, many very valuable.

One can, of course, find some faults, which perhaps can be corrected in a later edition. "Forward" is presumably "Foreword." On page 2, line 12 System II longitude does not apply to the south edge of the North Temperate Belt, even though it lies outside the domain given in the text for System I. The inclusion of diagrams showing the nomenclature of common types of bright and dark markings and of a sample set of C.M. transits with a corresponding sketch would add much to the Jupiter Handbook, particularly for beginners. Some of the references given should be updated; for example, good visual photometers have surely been described in the literature more recently than 1941.

Every serious student of Jupiter will find this little guide invaluable, be he amateur or professional.

ANNOUNCEMENTS

The A.L.P.O. Library Available to Canadian Members. Books in the A.L.P.O. Library can now be borrowed not only by members in the United States but by those in Canada as well. The Librarian is Mr. E. Downey Funck, 7698 Country Club Blvd., Delray Beach, Florida. Books borrowed can be retained for 30 days, longer if renewed; and there is a charge of 25 cents on each book to defray expenses. In addition, the borrower pays return mailing costs.

The books listed below have been added to the A.L.P.O. Library since October, 1960, and are available for loan. We express our thanks to the various donors for their help and generosity.

Title	Author	Publisher	Date
Practical Astronomy* (second edition)	J. J. Nassau	McGraw-Hill	1948
Planet Earth*		National Academy of Sciences	1958
Amateur Astronomy Handbook*	Lloyd Mallan	Fawcett Publications, Inc.	1960
Observational Astronomy for Amateurs****	J. B. Sidgwick	Macmillan	1955
New Handbook of the Heavens**	Bernhard, Bennett, and Rice	New American Library	1956
Men, Planets, and Stars**	Clyde B. Clason	G. P. Putnam's Sons	1959
Discover the Stars**	Gaylord Johnson	Sentinel Books Publishers, Inc.	1954
Frank's Book of the Telescope**	Charles Frank	Charles Frank	1958
Saturn and Its System***	Richard A. Proctor	Longman, Green, Longman, Roberts, and Green	1865
Climate Makes the Man* (third edition)	Clarence A. Mills	Harper Brothers	1945
El Primer Viaje a la Luna* (second edition)	F. Aniceto Lugo	Exclusivas Ferma	1960
Meteoritics, Vol. 1, Nos. 1, 2, 3, & 4 ++		University of New Mexico Press	1953-56
The Effect of Meteorites upon the Earth ++ (reprint from <u>Advances in Geophysics</u>)	Lincoln La Paz	Academic Press, Inc.	1953
Meteoroids, Meteorites, and Hyperbolic Meteoritic Velocities ++ (Chapter XIX of <u>Physics and Medicine of the Upper Atmosphere</u>)	Lincoln La Paz		1952
Advances of the Perigees of Earth-Satellites Predicted by General Relativity ++ (reprint from <u>P.A.S.P.</u>, Vol. 66, No. 388, Feb., 1954)	Lincoln La Paz		1954

Title	Author	Publisher	Date
Review of book Comets and Meteor Streams, by J. G. Porter ++ (reprint from Journal of the Optical Society of America, Vol. 45, No. 3, March, 1955)	Lincoln La Paz		1955
On the Magnetic Damping of Rotation of Artificial Satellites of the Earth ++ (reprint from Journal of Geophysical Research, Vol. 65, No. 7, July, 1960)	Lincoln La Paz		1960
Magnetic Damping of Rotation of the Vanguard I Satellite ++ (reprint from Science, Vol. 131, No. 3397, Feb. 5, 1960)	Lincoln La Paz		1960
Book reviews of Partial Differential Equations in Physics, by A. Sommerfeld and Mathematical Surveys No. III, by M. Marden ++ (reprint from Mathematics Magazine, Vol. 24, 1950)	Lincoln La Paz		1950
Texas Observers Bulletin, Jan.-June, 1941 and July-Dec., 1941 +++		Edited by Oscar E. Monnig	1941

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Purely Personal. The Editor expects to be absent from Edinburg from about July 18 to about August 26, 1961. While arrangements will be made to forward mail, there are sure to be delays; and he must beg the indulgence of members and other correspondents.

It is always a pleasure to meet astronomical colleagues who happen to be in or near Edinburg for any reason. It is the more a pleasure because geographic location means that one scarcely ever passes through Edinburg in travels between points within the United States. We shall be glad to show interested persons the facilities of the Pan American College Observatory. Among A.L.P.O. visitors during the last two years have been Carlos E. Rost, John Farrell, T. L. Gibson, A. W. Mount, Oscar E. Monnig, David Meisel, Robert Shayler, Tom Osypowski, and Richard Wend.

Ninth Convention of the A.L.P.O. As announced in a previous issue, this meeting will be with the Western Amateur Astronomers in Long Beach, California, on August 24-26, 1961. All paper sessions, all exhibits, the banquet, etc. will be very conveniently held in the Lafayette Hotel in downtown Long Beach. The General Convention Chairman is Thomas R. Cave, 4137 E. Anaheim St., Long Beach 4, Calif. While the Editor does not at present expect to be able to attend, to his deep regret, the A.L.P.O. part of the program will be handled by Dr. Joel W. Goodman, 329 Edgewood Ave., Mill Valley, Calif. Certainly all our West Coast members should make every reasonable effort to attend, for they will gain much from this meeting. The W.A.A. G. Bruce Blair Award will be presented to Mr. Carl Wells, and there may be an A.L.P.O. Award given also. Alika Herring will prepare the A.L.P.O. Exhibit. An extensive and informative display is assured, for it will include most of the A.L.P.O. Exhibit on view at Detroit during the Astronomical League Convention on July 1-3, 1961. A very worthwhile program of contributed papers is being assembled for two scheduled A.L.P.O. sessions. Through the kindness of the Astronomical Society of the Pacific we also have a Morrison Lecture by Dr. Dinsmore Alter, Director Emeritus of the Griffith Observatory in Los Angeles. His subject will be "The Nature of the Lunar Rays." Dr. Alter's lectures added much to former A.L.P.O. meetings in Pasadena and San Jose, and it is very good to have a Morrison Lecture by him on the program. There may be a Star Party on August 25, 1961, (P.S.T. date) to view the lunar eclipse and perhaps a second Star Party on the sea shore at Long Beach.

The A.L.P.O. as a Training Facility. We have recently learned that William K. Hartmann and Alika K. Herring, both on our staff, have joined Dr. G. P. Kuiper's Lunar and Planetary Laboratory at the University of Arizona in Tucson. Also, David Meisel has been accepted for graduate study in physics or astrophysics at the Ohio State University. We are very glad, of course, to have our members select astronomy as a profession, and it is certainly a legitimate function of the A.L.P.O. to provide training for such later professional work.

Major in the Astro-Sciences. Beginning in the autumn of 1961, Pan American College will offer an undergraduate major in the astro-sciences, with emphasis on astronomy. The courses will be taught by Professor Paul R. Engle, Director of the Observatory, and Walter H. Haas. Interested persons can secure the 1961-2 college catalog by writing to the Registrar, Pan American College, Edinburg, Texas.

A.L.P.O. Jupiter Handbook. We are extremely glad to offer to our readers a small, informative, handy Jupiter Handbook. It is a manual to guide observers and has already aroused much interest at the Eighth Convention of the A.L.P.O. in Detroit and among the Pan American College Summer Institute students. It will also be available at our Long Beach Convention. The Handbook is reviewed on p. 139 of this issue. It may be ordered from Philip R. Glaser, 400 E. Park Ave., Menomonee Falls, Wisconsin; the price is 25 cents.

OBSERVATIONS AND COMMENTS

On Jovian Satellite and Shadow Transits. The following discussion by Mr. Elmer Reese is directed to the attention of our readers. It is especially timely with the Giant Planet in the evening sky and with phenomena of J. IV now taking place:

"About twenty years ago Hugh M. Johnson realized the possibility of determining accidental and systematic errors in visual transit observations by timing the transits of satellites and their shadows in exactly the same way as one would time the transit of a surface feature. He investigated this possibility in 1944, utilizing 91 transit observations by 8 observers (JRASC, Jan., 1945). He found that the observed time of transit was usually several minutes earlier than the predicted time. The value of this method has been questioned because of the apparent unreliability of the predicted times of Jovian satellite phenomena.

"In 1949 I examined 20 of my own transit observations of satellites and their shadows. It was found that nearly all transits were observed several minutes earlier than the predicted times--the difference being greatest at morning quadrature and least at evening quadrature--an effect of phase exaggeration caused by the terminator being less brilliant than the limb. When the time difference was converted to longitudinal difference,* the following results were obtained:

---

*Sine of longitudinal angle= $\dfrac{2(O-C)}{T_2 - T_1}$, where O is the observed time of shadow transit. See p. 143 for other symbols.

6 transits near morning quadrature	:	$-6\overset{\circ}{.}0$ (long. error)
2 transits near opposition	:	-4.5
12 transits near evening quadrature	:	-2.9

"Now Mr. Rost's observations of the transits of the shadows of JI and JIV on May 8, 1961, were made near morning quadrature. His transits yield discrepancies in keeping with past tendencies, though a little more extreme:

Date (1961)	Object	O	C	O-C	Longitudinal Error
May 8	Shadow I	6:58	7:07.4	$-9\overset{m}{.}4$	$-8\overset{\circ}{.}0$
May 8	Shadow IV	7:32	7:47.5	-15.5	-7.5

"A quicker method of finding the predicted time of a shadow transit than that given in Appendix II of Peek's book follows:

Computed Time of Apparent C.M. Transit of a Satellite Shadow

$$C = T_1 + \frac{(T_2 - T_1)\ (1 \pm x)}{2}$$

where,

C is the computed time of shadow transit.
T_1 is the predicted time of shadow ingress.
T_2 is the predicted time of shadow egress.
x is a variable depending on the value of i, the Sun-Jupiter-Earth angle. x is positive before opposition, negative after.

"The value of x for any attained value of i is given in the table below:

i	x	i	x	i	x
$0\overset{\circ}{.}0$	.0000	$4\overset{\circ}{.}0$	.0674	$8\overset{\circ}{.}0$	.1301
0.5	.0087	4.5	.0755	8.5	.1376
1.0	.0174	5.0	.0836	9.0	.1451
1.5	.0259	5.5	.0914	9.5	.1525
2.0	.0343	6.0	.0993	10.0	.1598
2.5	.0427	6.5	.1071	10.5	.1670
3.0	.0510	7.0	.1149	11.0	.1742
3.5	.0592	7.5	.1225	11.5	.1811

The Lunar Eclipse of August 26, 1961. The circumstances of this eclipse are as follows:

Event	Universal Time	Eastern Standard Time
Moon enters penumbra	Aug. 26, $0^h\ 36\overset{m}{.}1$	Aug. 25, 7:36.1 P.M.
Moon enters umbra	1 34.9	8:34.9
Middle of eclipse	3 08.2	10:08.2
Moon leaves umbra	4 41.5	11:41.5
Moon leaves penumbra	5 40.4	Aug. 26, 12:40.4 A.M.

The magnitude of the eclipse is 0.992. It will thus be almost, but not quite, total; the north rim of the moon will escape eclipse.

There are a number of suitable lunar eclipse observational programs for amateurs. One of the easiest and most important of them is timing umbral contacts for selected points on the lunar surface. The object is to determine how much the geometrical umbral shadow is enlarged by the earth's atmosphere. The four contacts with the moon itself may also be included in this program, though only first and fourth contacts will occur on August 26. Very modest instrumentation is suitable and even preferable.

Joseph Ashbrook recommends apertures of 2 to 6 inches and powers of 30X to 50X. Objects timed will usually be craters, the centers for small craters like Bessel and the moments of first umbral contact and of final complete coverage for large craters like Tycho. It has been found practical to record times to one-tenth of a minute. Results secured in this program from recent eclipses have been published by Joseph Ashbrook in The Strolling Astronomer, Vol. 14, pp. 163-167, 1960, and Vol. 15, pp. 94-96, 1961, and in Sky and Telescope for June, 1960, pp. 474-475. Variations in how much the geometrical shadow is enlarged from one eclipse to another are strongly suspected, but it is necessary to learn more about the effects of a bright twilight sky and a low lunar altitude on the observed umbral contact times. The August 26, 1961, lunar eclipse is capable of supplying very helpful information in this respect because at many stations in the United States timings can be carried out both with a low moon on a bright sky and with a higher moon on a dark sky. Please note for this purpose the eclipse circumstances times given above, and apply them to your own location.

Another possible program consists of estimates of the color and brightness of the eclipsed moon. The stellar magnitude of the moon may be recorded at different times. Color photography is recommended to equipped amateurs. Others may want to use Danjon's scale of 0 (very dark eclipse) to 4 (very bright eclipse), p. 161 of the Larousse Encyclopedia of Astronomy.

It is interesting that lunar eclipses have been recorded briefly to affect certain lunar areas in a fashion apparently different from the normal cycle of changes due to changing solar lighting. Among such reported eclipse-caused changes have been an enlarging of the white area around Linné and a lightening of the south tip of the dark area in Riccioli. Great care must be exercised in a program of this kind if the results are to have any meaning. The feature under study must be carefully examined just before entering the umbra and just after reëntering sunlight, efforts must be made not to be misled by changes in seeing and transparency or by dim penumbral lighting, and comparisons are needed to the normal full-moon appearance of the area.

Other possible observational programs for the Aug. 26 lunar eclipse are searches for possible lunar meteoritic impact-flares and/or lunar meteors, searches for possible sub-satellites of the moon, and, of course, eclipse photography. Some programs are described more fully on pp. 28-32 of our Jan.-Feb., 1960, issue. We wish all our readers clear skies on Aug. 26 and urge them to submit reports of their work very soon thereafter to the Editor.

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