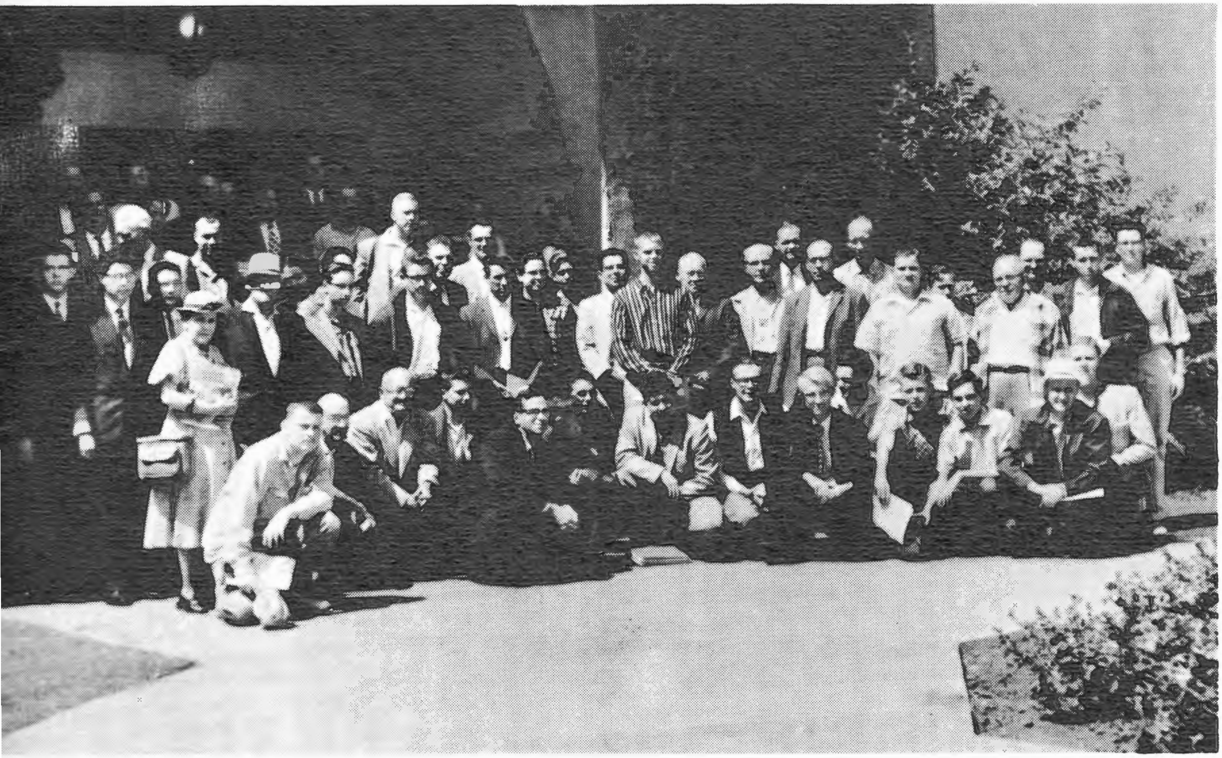
ASSOCIATION OF LUNAR AND PLANETARY OBSERVERS

The Strolling Astronomer

Volume 14, Numbers 9-10 **September-October, 1960**
Published October, 1960



Sixth Convention of the Association of Lunar and Planetary Observers at San Jose, California, August 24, 1960. Noon break for attendees at entrance to San Jose Civic Auditorium. Photograph by Leif J. Robinson.

THE STROLLING ASTRONOMER
Pan American College Observatory
Edinburg, Texas

IN THIS ISSUE

SOME OBSERVATIONS OF SATURN

IN 1958 AND 1959

By: Dale P. Cruikshank, Yerkes Observatory

Saturn was observed at the apparitions of 1958 and 1959 by the writer with the 40-inch refractor and the 24-inch reflector at the Yerkes Observatory. The 40-inch refractor at an optimum magnification of 550X produced generally the most favorable results. Seeing conditions were sometimes quite good in spite of Saturn's low altitude at a large southern declination during the periods covered. The ball was often the only part of the system sketched except in good or exceptional seeing when the full-disc drawings reproduced here were made. The rings were always examined for the appearance of bright spots, divisions or intensity-rifts, and the outer dusky ring.

The Apparition of 1958

In 1958, twenty-three drawings were made, two with the 24-inch Ritchey reflector and twenty-one with the 40-inch Clark refractor. Figure 1 made on August 27, 1958, in "good plus" seeing (8 on a scale of 0 to 10 with 10 best) represents a good summary of the views obtained. This drawing shows the E.B. as a rather thin band of moderate intensity. It was always featureless during the observing period from July 6 to August 29, 1958. The E.Z. was rather bright and slightly off-white. As the apparition progressed the E.B. seemed to become more distinct and intense. This may not have been a real effect, however, because seeing conditions generally improved and the observer gained more experience. By the termination of the observation series in late August, the E.B. was distinct and continuous, usually appearing very narrow and fine in the best seeing.

The $N.E.B._s$ was easily the most prominent feature on the ball during the period covered. At times both components of the N.E.B. could be seen with an extremely thin, faint separation. The $N.E.B._n$ was observed nine times, never in seeing less than 5. It was quite narrow and faint. The $N.E.B._s$ was always featureless and quite dark. Until mid-August the N.E.B. seemed moderately broad but then became narrow. For reasons mentioned above, this may not have been a real effect.

The N.T.B. was visible throughout the period described and remained a moderately broad, rather diffuse feature with no irregularities. The zone between the N.E.B. and the N.T.B. was observed as slightly pinkish on August 5, August 15, and August 17. Lenham (1959) comments that this region contained more red in 1958 than in 1956 or 1957 when he considered it pink. Doubt is immediately thrown on this matter of color observations with a refractor. Lenham, however, was able to check the color with the 82-inch McDonald reflector and the 24-inch reflector at Yerkes. This writer's few observations with the 24-inch early in July disclosed no color.

The N.N.T.B. was rather narrow and faint but was seen a number of times, particularly in August when seeing generally improved.

The N.P.R. was characteristically difficult to observe, and it was found usually to be quite large and dark. Irregularities in intensity in this region were observed on July 28, July 29, July 30, and August 7. Figure 2 shows portions of the sketches obtained on these dates; but these observations are questionable both because of the dusky, dark character of the N.P.R. and because of mediocre seeing conditions. No attempt has been made to obtain a rotation rate from these observations because of their only medium weight.

The Apparition of 1959

Saturn was observed infrequently in 1959 because of concentration of attention upon Jupiter. Figure 3 is a sketch made on July 12, 1959, seeing 6. The most noteworthy feature on this date was probably the dark broad E.B. It was recorded as "easy." When a series of intensity and color estimates was begun with the 24-inch reflector on July 21, 1959, this feature was not visible, though the 24-inch is not well-suited to detailed planetary observations. Seeing was good. On August 5, 1959, with the same instrument (seeing 5) the E.B. was seen with estimated intensity 4.0, the S.T.Z. [?--Editor] and E.Z. being 5.0. The rough sketch made on that date shows the E.B. as quite narrow. Further observations with the 24-inch on August 18 show it at intensity 4.5 with the note "hardly visible at all." On August 21 with the same instrument it was "uncertain, very faint." The E.Z. was quite bright in August with estimated intensity between 5.0 and 6.0.

The most prominent features on the disc, the $N.E.B._s$, was always featureless. The $N.E.B._n$ was not seen during the brief series of observations, even in good seeing. An attempt to recover the pinkish tone in the zone just north of the $N.E.B._s$ yielded negative results with both the 40-inch refractor and the 24-inch reflector.*

The Disc in 1958 and 1959 -- Summary

With the exception of the intensity irregularities shown in the polar region in 1958 (Figure 2) no appendages to the belts or spots in the zones were observed even in the very best seeing. Although there were two or three evenings when a mottled appearance of the $N.E.B._s$ was suspected this impression is attributed to the fair to poor seeing at the time. There was never a suggestion of a festoon.

The Rings in 1958 and 1959

As mentioned above, the rings were always examined for interesting features. Cassini's Division was always visible all the way around the system and Encke's "division" was usually seen except very near the ball. Other minor darkenings in the rings were suspected from time to time but could not be satisfactorily resolved and positioned on a diagram. On the basis of the writer's observations and in accordance with the results of Kuiper with the 200-inch reflector in 1954, it is assumed that the Cassini Division is the only true division, while Encke's and others reported by observers with small telescopes are only intensity-rifts in the rings.

At no time during the two-year series was the outer dusky ring (Ring D) seen or suspected. At every observing session special note was taken of the appearance of the outer portion of the ring system in an effort to see this feature which is not uncommonly visible in some small telescopes (see "Saturn in 1954," T. A. Cragg, Str. A., Vol. 9, Nos. 3-4, p. 29, and some other A.L.P.O. Saturn Section reports. On the basis of his observations in 1958, 1959, and up to the date of this writing, July 15, 1960, the writer concludes that Ring D was not visible during the period of time covered. On the basis of these same observations and the observations of E. E. Barnard (1909) and G. P. Kuiper (1955 and private communication) he concludes that this feature does not exist.

References

1. Lenham, A. P., "Some Observations of Jupiter, Saturn, and Venus in 1958," J.B.A.A., 69, 4, p. 163, 1959.

2. Kuiper, G. P., Transactions of the International Astronomical Union (Dublin Meeting), 9, 1955, p. 255.

*On July 12, 1960, with the 40-inch refractor in seeing 8-9 the color was observed as pinkish-orange. It was located in the same general region, being more intense toward the central meridian.

FIGURE 1. Saturn. August 27, 1958. 40-inch Yerkes refractor, X550. Seeing "good plus" (8 on a scale of 0 to 10 with 10 best). Transparency 4 (scale of 0 to 5 with 5 best). 01:00 U.T.

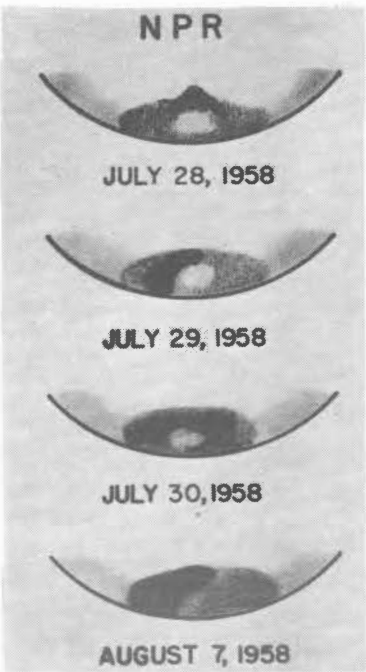


FIGURE 2. Saturn's North Polar Region.

July 28, 1958, 40-inch refractor (stopped to 33 inches), X400, 03:05 U.T.

July 29, 1958, 40-inch refractor (stopped to 18 inches), X400, 02:15 U.T., seeing sometimes good, transparency 4.5.

July 30, 1958, 40-inch refractor (stopped to 18 inches), X400, seeing fair, transparency 4.5, 03:00 U.T.

August 7, 1958, 40-inch refractor (stopped to 30 inches), X350, 01:30 U.T., seeing "fair plus," transparency 4.5, yellow filter (Schott GG-14).

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3. Barnard, E. E., "Recent Observations of the Rings of Saturn," Monthly Notices of the Royal Astronomical Society, LXIX, 8, June, 1909, p. 621.

Note by Editor. Visual, and even systematic, planetary studies with large telescopes have been rather rare in recent years. We hence congratulate Mr. Cruikshank on the advantage which he has taken of the opportunities available to him during his summers at the Yerkes Observatory. Readers may find it instructive to compare Mr. Cruikshank's 1958 studies of Saturn here described with Mr. Thomas Cragg's article "Saturn in 1958" on pp. 122-126 of the July-August, 1960, Str. A.

FIGURE 3. Saturn. July 12, 1959. 40-inch refractor (stopped to 32 inches), X550. 04:40 U.T. Seeing good (7), transparency good, yellow filter (Schott GG-14). Also examined at X1200.

SOME 1958 JAPANESE DRAWINGS OF MARS

The three drawings of Mars here reproduced as Figures 4, 5, and 6 on page 133 were contributed by Mr. Takeshi Sato, Rakurakuen Planetarium, Itsukaichi, Hiroshima, Japan. The observer was Mr. Ichiro Tasaka, Shingu, Wakayama prefecture, Japan. The amount of detail shown is very great for a 13-inch aperture; particularly does this remark apply to Figure 4, made in seeing sometimes as excellent as 9 on the 0-10 scale and also with very good transparency. It will be noted that such canals as Ganges, Jamuna, and Hydraotes were resolved into double chains of small dark spots and that the large maria like Sinus Margaritifer and Sinus Aurorae were similarly resolved into very fine dark detail. Figures 5 and 6 show the more common appearance, in seeing 5 to 7 and hence still fair to good, of wide dark bands within the maria. In the view for Figure 4 Mr. Tasaka saw five dark spots within the Solis Lacus. Curiously, he could not then detect Juventae Fons in spite of a careful search; this region was pale orange in color and was brighter than its surroundings.

Readers might like to compare Figure 4 to Dr. R. S. Richardson's photograph of Mars on August 10, 1956, as published on the front cover of our July-September, 1958, issue. It will be realized, of course, that the Martian season and the tilt of the axis differ in these two views. It should also be borne in mind that some detail on the Richardson original photograph as processed by Mr. Paul Roques with a superimposition-of-images technique has inevitably been lost in reproduction.

A MAP OF MARS FOR 1907-1956 BY SHIRŌ EBISAWA

The map of Mars appearing here in three parts as Figures 7, 8, and 9 has been published in the Contributions from the Institute of Astrophysics and Kwasan Observatory, University of Kyoto (Japan), No. 89, "Planisphere of Mars with the List of the Names of its Surface Markings," by Shirō Ebisawa. The map was constructed from many photographic and visual observations during the period 1907-1956 in Japan, Europe, the United States, and South Africa. It is intended to include new dark

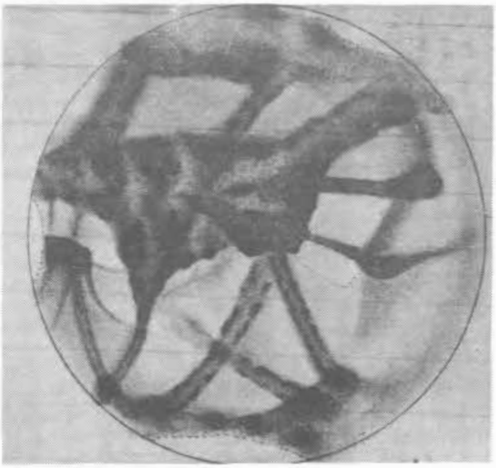

FIGURE 4. Mars.
Ichiro Tasaka.
13-inch reflector. 309X, 540X.
November 11, 1958. $12^{h}\ 35^{m}$, U.T.
Seeing 5-9. Transparency fine.
C.M. = 46°. D = 19".2. D_E = -13°

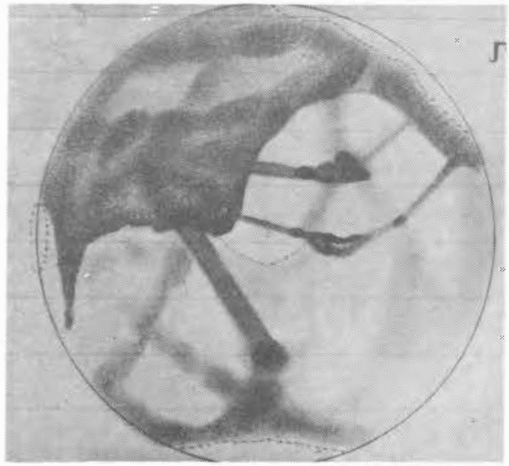

FIGURE 5.
Ichiro Tasaka.
13-inch reflector. 309X, 540X.
November 11, 1958. $14^{h}\ 15^{m}$, U.T.
Seeing 5-7.
C.M. = 70°. D = 19".2. D_E = -13°

FIGURE 6. Mars.
Ichiro Tasaka.
13-inch reflector. 309X, 540X.
November 12, 1958. $11^{h}\ 30^{m}$, U.T.
Seeing 5-7. Partly cloudy.
C.M. = 21°. D = 19".1. D_E = -13°

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markings and secular and temporary changes which have taken place since 1916. The new nomenclature recently adopted by the I.A.U. is not used because Mr. Ebisawa closed his compilation at the end of 1956. Students of Mars will find this Ebisawa map forcibly reminiscent of Antoniadi's general maps.

REPORT OF THE A.L.P.O. MERCURY SECTION AND THE SOLAR TRANSIT OF MERCURY ON NOVEMBER 7, 1960

By: Geoffrey Gaherty, Jr.

The purpose of this report is to describe in some detail the observations listed in a recent issue of The Strolling Astronomer[1]. The nomenclature used is that of Antoniadi[2]. During the period covered by this report (July, 1958 - December, 1959) there were ten apparitions of Mercury; observations were received for eight of them.

July, 1958. Sixteen observations were received from Cruikshank, Mourão, and Wegner for this evening apparition. Cruikshank's two drawings were made with the 40-inch Yerkes refractor and are reproduced in Figures 10 and 11. Mourão's drawing, made on July 30, shows an irregular dark patch on the northern part of the crescent which is quite similar to a patch seen by Wegner on July 28; this is probably S. Aphrodites. On three occasions Wegner resolved S. Aphrodites and S. Criophori as separate

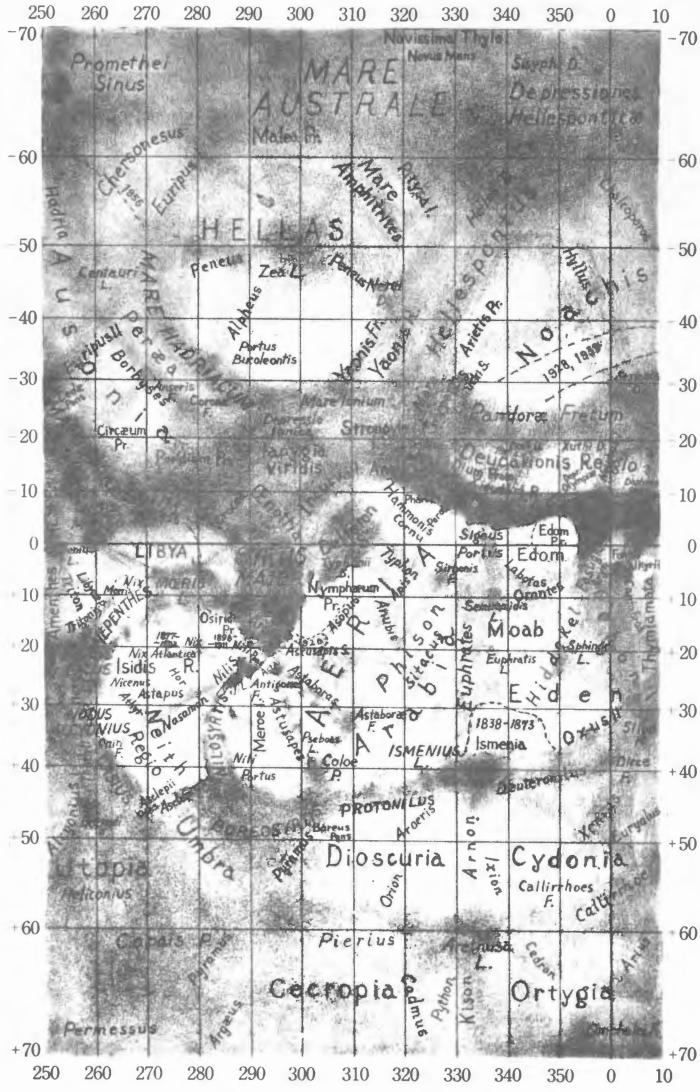

FIGURE 7. Map of Mars for 1907-1956 by Shirō Ebisawa. Longitudes of Syrtis Major and Sinus Sabaeus.

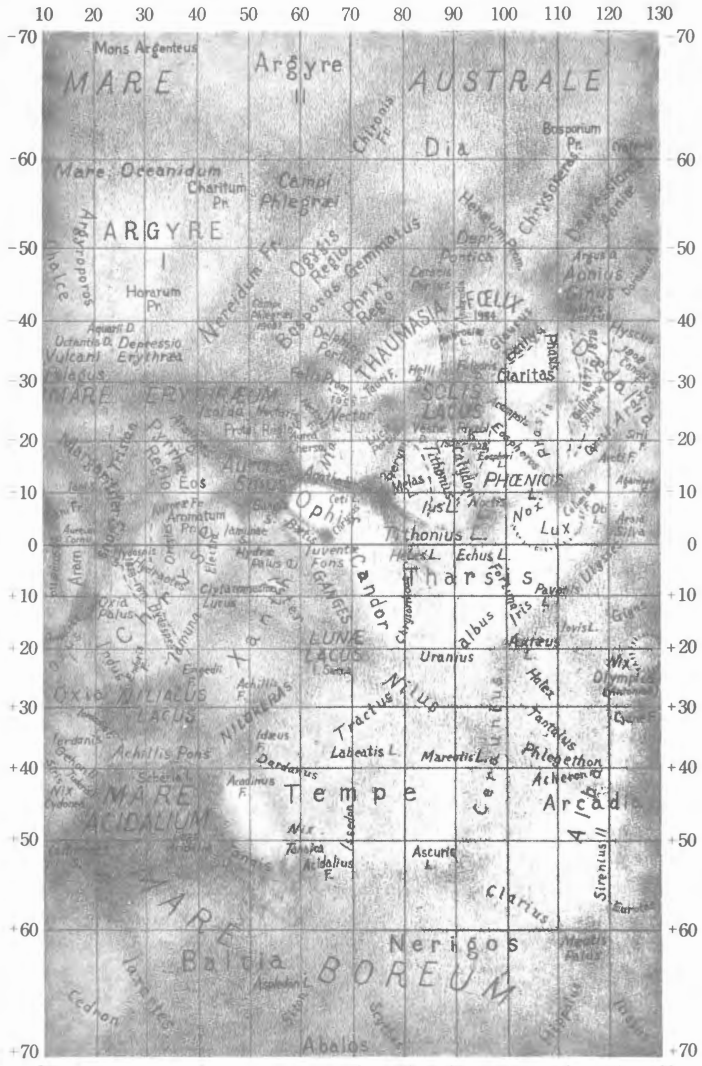

FIGURE 8. Map of Mars for 1907-1956 by Shirō Ebisawa. Longitudes of Mare Acidalium and Solis Lacus.

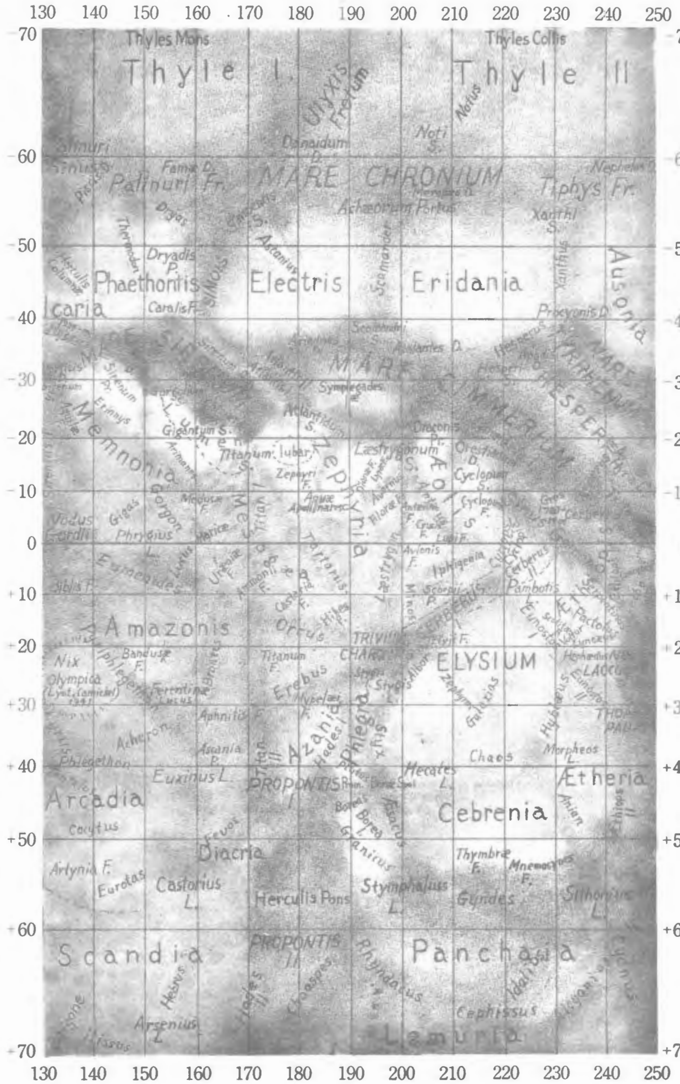

FIGURE 9. Map of Mars for 1907-1956 by Shirō Ebisawa. Longitudes of Mare Sirenum and Mare Cimmerium.

features; on two occasions early in the apparition they were seen as one; twice Aphrodites was seen alone; and once Criophori was recorded alone with a bright streak (Pieria?) south of it. Most of Wegner's observations were made with a 10-inch Dall-Kirchem reflector.

September, 1958. Six observations were received from Johnson, Stoessel, and Wegner for this morning apparition. Johnson was able to detect Horarum Vallis with his 4-inch reflector on Sept. 7, in spite of very poor seeing. Stoessel's three drawings show a large amount of detail and are especially valuable since he has made estimates of the relative intensities of the features seen. Wegner was able to make two drawings, the first of which is shown in Figure 12. He writes: "The south cusp was blunted and seemed to be much brighter than the rest of the planet. Slightly to the north of the bright spot there was a faint, but very dark, marking (I think that it probably was Solitudo Promethei). Farther to the north near the center of the disk there was a dark streak that was distinctly double. Beyond any doubt this was Admeti Vallis and Solitudo Lycaonis. The last marking was just as prominent, running from the north to the south, forming a sort of crude 'X'. The southern tip of this marking was much wider than the rest of the marking, in fact perhaps a marking in itself. I think that these markings were Horarum Vallis and Solitudo Iovis." On Sept. 10 Horarum Vallis was not seen, and a slight "dent" was suspected in the terminator near S. Lycaonis.

December, 1958 - January, 1959. Eight drawings were made by Stuart Emig, Sandner, and Wegner during this morning apparition. Emig's drawing on Dec. 28 shows features probably identifiable as S. Lycaonis, Horarum Vallis, Admeti Vallis, and S. Promethei. Sandner was able to make a drawing on Dec. 31 when he saw S. Lycaonis and an unidentified white area southwest of it. He estimated dichotomy to be on Dec. 28, one day ahead of the predicted time. Wegner tried to observe the planet every morning for almost four weeks but only succeeded on six occasions. On Dec. 22 he saw the dark side of the planet apparently darker than the sky background. This phenomenon is very rare and has yet to be satisfactorily explained. The markings described in the preceding paragraph were again seen. On Jan. 1, one bright and two dark marks on the limb were seen; possibly they were Argyritis, S. Iovis, and S. Phoenicis. This set of observations by Wegner also included a number of graphs continuing his study of the reflection of light of various colors from Mercury's surface. Johnson attempted to observe Mercury on Dec. 27 but was foiled by seeing which he rated as minus 2 on the Tombaugh scale.

March, 1959. Seventeen drawings were received from Haas, Johnson, and Wegner for this favorable evening apparition. Haas contributed a fine set of six drawings as well as written descriptions on two other occasions when Mercury's low altitude made drawing impossible. One of the drawings was reproduced in the last Section Report[3], and is typical of the detail seen. The last of these observations was made on March 24 when the phase angle "i" was 152°. Haas feels that this is about as close to the Sun as Mercury can get and still be observed, at least with the instruments at our disposal. Estimates were made of the intensities of the various features in the drawings. It may be of help to other observers to note that Haas found a red filter (Wratten 25) very useful in emphasizing the contrast of faint markings.

Johnson made five drawings, the first of which is shown in Figure 13. This was made under very good seeing conditions and shows a remarkable amount of detail, considering the small aperture. The remaining drawings show little more than S. Criophori. Wegner made six drawings which show a lot of interesting detail. On March 16 he again saw the dark part of the planet darker than the sky. Both Johnson and Wegner remarked on the blunted appearance of the southern cusp; Haas, using a larger instrument, did not confirm this.

June-July, 1959. Hartmann, Johnson, and Wegner were on duty during this evening apparition, and eight drawings were made. Hartmann's drawing was made with the 13-inch Fitz refractor of Allegheny Observatory and is reproduced as Figure 14. Hartmann also estimated the intensities of the features shown. Johnson was unable to detect any detail on July 1, the seeing being rated at 0. Wegner, unable to use his 10-inch, used 4- and 6-inch reflectors to make seven drawings. S. Criophori, S. Aphrodites, and S. Atlantis were seen at various times.

August-September, 1959. Six drawings were received for this morning apparition from Chapman, Constanten, Stanley and Stuart Emig, and Wegner. Chapman's observation on Aug. 19 with his 10-inch reflector shows much interesting detail; S. Dionysi, Admeti Vallis, S. Lycaonis, Neptuni Vallis, and Horarum Vallis were well seen; S. Lyrae, S. Iovis, and possibly S. Martis were noted with less certainty. Constanten's two drawings were made with a $3\frac{1}{4}$-inch refractor; the only feature positively identified was Horarum Vallis. The Emig brothers made a drawing apiece on Aug. 24 but failed to give the time of observation. Wegner also made a drawing on this date using the Emigs' telescope, an 8-inch reflector. He saw Horarum Vallis and Admeti Vallis apparently crossed; this does not agree with Antoniadi's map but has been seen on quite a number of occasions. I suspect that this may be an effect of libration whereby a white marking to the east of S. Lycaonis is brought into view. See Figure 15.

October-November, 1959. Only three observations were made during this unfavorable apparition. On Oct. 4, Wegner found no markings visible but on Oct. 26 was able to see Aphrodites, Criophori, and Atlantis. On Nov. 3 Johnson could see no detail and did not attempt a drawing.

November-December, 1959. During this morning apparition thirteen drawings were made by Chapman, Johnson, Low, and Wegner. Wegner also contributed a set of photographs. Chapman's three drawings show much detail carefully recorded; one of them is shown in Figure 16. Johnson made three drawings of which the best, made on Dec. 6, shows amazing detail for a 4-inch reflector. Johnson rated the seeing as unusually good, and even went so far as to say that Admeti Vallis and Dionysi "stuck out like a sore thumb"! Low's single observation, also with a 4-inch, shows only Horarum Vallis. Wegner made six drawings; the first three were made under poor conditions and show relatively little detail. On Dec. 19 he again saw the crossed appearance of Horarum Vallis and Admeti Vallis, but on Dec. 26 the "X" shape had become a horizontal "Y." Further study of this region is much needed. Wegner's photographs were made on Dec. 19 and show Mercury in various colors. No definite markings were captured on these photographs due to poor seeing, but they prove useful in studying the color of the planet.

Remarks. The work described above is indicative of the interest that is being paid to the "elusive" planet in recent apparitions. As to the future, I hope that more observers with access to large telescopes will attempt regular observations of Mercury; this practice could add greatly to our meagre knowledge of this planet. I wish to thank all of those whose work is represented in this report for their coöperation.

Solar Transits of Mercury. There is one aspect of Mercury observation in which a small telescope can be used very effectively, namely when Mercury transits across the Sun. As Mercury is an inferior planet, it must pass between the Sun and the Earth once in every synodic period, i.e. about every 116 days. Because its orbit is inclined to the ecliptic at an angle of 7°.0, Mercury is then usually above or below the Sun. Occasionally, when Mercury is near a node of its orbit, it appears silhouetted against the Sun and is said to be in transit. These transits occur about thirteen times in a century, and so are somewhat rare phenomena. Transits of Mercury were first predicted by Kepler; and his predictions enabled Gassendi to be the first person to observe one on November 7, 1631.[2] This November, 329 years later to the day, astronomers in North and South America and western Europe and Africa will be able to observe a similar transit. A chart in the Ephemeris gives exact times of

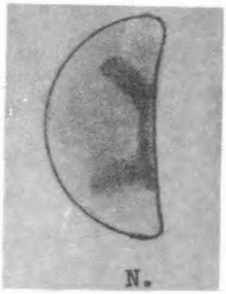

FIGURE 10. Mercury. Dale P. Cruikshank. July 21, 1958. 23^h5^m-23^h35^m, U.T. Yerkes 40-inch refractor at 18-30 ins. of aperture. 350X (with minus-blue filter). Seeing "fair plus." Transparency 3.5.

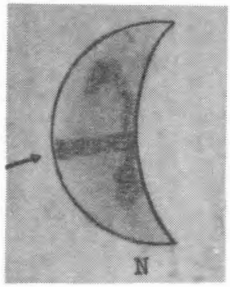

FIGURE 11. Mercury. Dale P. Cruikshank. July 29, 1958. 0^h15^m,U.T. Yerkes 40-inch refractor at 24 inches of aperture. 400X. Seeing fair. Transparency 4.

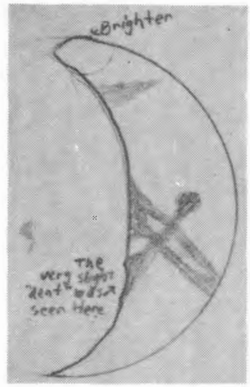

FIGURE 12. Mercury. Gary Wegner. Sept. 6, 1958. 13^h30^m,U.T. 10-inch Dall-Kirchem reflector. 250X. Seeing good. Transparency "perfect."

FIGURE 13. Mercury Craig L. Johnson. March 9, 1959. 0^h45^m,U.T. 4-inch reflector. 167X. Seeing 4-6. Transparency 5. North at top and west at left, according to observer.

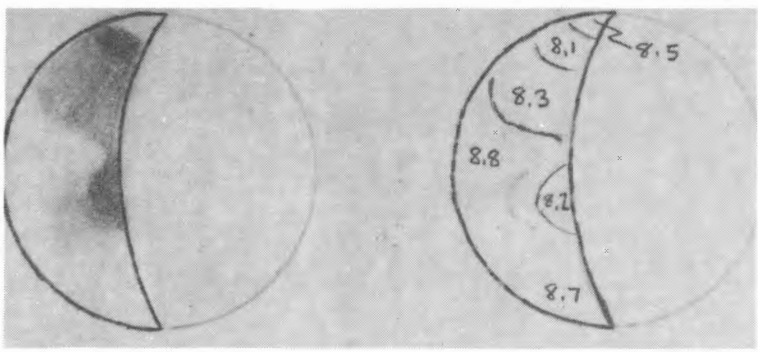

FIGURE 14. Mercury. William K. Hartmann. July 8, 1959. 20^h3^m-20^h10^m, U.T. 13-inch Allegheny Observatory refractor. 245X. Seeing 3. Transparency 4-5.

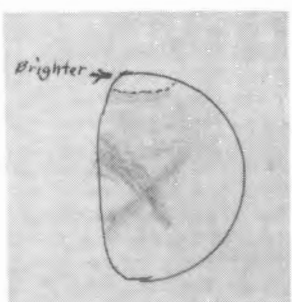

FIGURE 15. Mercury. Gary Wegner. August 24, 1959. 12^h5^m, U.T. 8-inch reflector. 160X. Seeing good. Transparency 5.

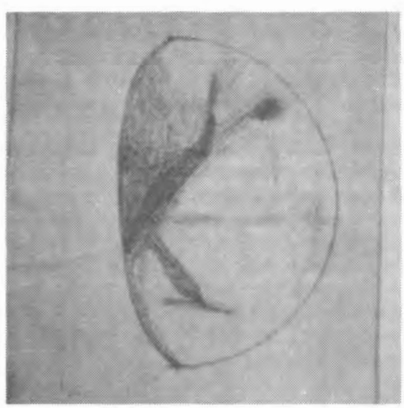

FIGURE 16. Mercury. Clark Chapman. December 14, 1959. 11^h15^m-13^h0^m, U.T. 10-inch Cave reflector. 300X. Seeing 4-8. Transparency 4.

ingress and egress. For this continent the transit will last from $9^h 34^m 45^s$ to $14^h 11^m 50^s$ E.S.T. $\pm 15^s$ ($14^h 34^m 45^s$ to $19^h 11^m 50^s$ on November 7, 1960, by Universal Time.)

Observations of the coming transit fall into three classes, as follows:

Contact Timing. The four contacts should be timed with as great an accuracy as possible. First contact occurs when the disk of Mercury is first detected on the limb of the Sun (at a position angle of 148°). Second contact occurs when Mercury's disk is first seen wholly on the Sun's disk, i.e. when the "black drop" breaks. Third contact is the moment when the "black drop" again forms as the planet reaches the opposite limb of the Sun, and fourth contact occurs when the planet is wholly off the disk.

Photography of Mercury Transits. Unlike most rare astronomical phenomena, a transit is quite easy to photograph. If you can successfully photograph sunspots, you can photograph Mercury in transit. Photography is most important near second and third contacts, but photographs of any phase are of interest. Time-lapse motion pictures would be a good project for those suitably equipped.

Unusual Features During Transits. There have been reports in the past of various unexplained features. Among these are bright spots on the silhouetted disk of Mercury and dark haloes around its disk. These are probably optical effects; but if anything like them is seen, the exact time should be noted.

I have prepared special report forms which I will supply to anyone desiring them. It would be a great help to me if all observations of this transit of Mercury were recorded on these forms and submitted promptly after the event.

References

1. "Observations and Comments," Str. A., May-June, 1960, p. 96.
2. Antoniadi, E. M., La Planète Mercure, Paris: Gauthier-Villars, 1934.
3. Ranck, Owen C., "Report of the A.L.P.O. Mercury Section," Str. A., Jan.-Apr., 1959, p. 21, Fig. 4F.

REPORT ON THE PAN AMERICAN COLLEGE SUMMER INSTITUTE IN THE ASTRO-SCIENCES

By: Tom C. Constanten

During the months of June and July, 1960, thirty-two carefully selected high school students had the good fortune to attend a seminar in the Astro-Sciences, conducted by Pan American College in Edinburg, Texas, and sponsored by the National Science Foundation. The students were given the opportunity to eat, live, and breathe astronomy for six weeks. Professors Paul R. Engle and Walter H. Haas of the college managed the Institute, gave the classroom lectures, and made the arrangements for the field trips. Truly the work which they contributed to the project was tremendous in extent; but in the enjoyment, experience, and knowledge gained by the students it was repaid many times over. The diversity of the students attending the Institute was exceeded only by that of the subject matter taught. There were some who were, in the spring of 1960, Sophomores in high school, and there were some who were Seniors, but the majority consisted of those who were members of the Junior class. Twelve states were represented, scattered all over the country, as far north as Minnesota, as far south as the south tips of Texas and Florida, as far east as New York, and as far west as Nevada. For six weeks "home," to the students, meant the Echo Motor Hotel, a modern, recently built hotel on the south edge of Edinburg. The management of the hotel was most gracious in allowing the use of its facilities since the new dormitories planned for the college have not been completed yet.

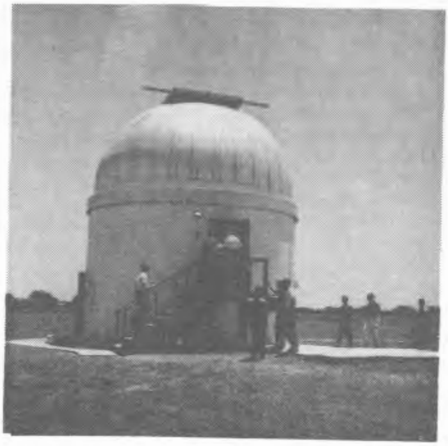

FIGURE 17. Summer Institute students at Pan American College Observatory. Dome houses Paul Engle's 17-inch reflector. Figures 17-26 are photographs taken by Don McKinney.

FIGURE 18. Summer Institute students using 6-inch reflector at Pan American College Observatory. Left to right: Max Schletter, William V. Uhlhorn, Virginia Metzger, and Judy Ann Wainscott.

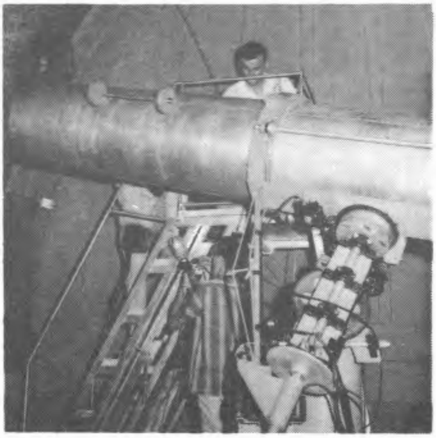

FIGURE 19. Summer Institute students and Mr. Gary Kraus (top of ladder) observing with Pan American College Observatory 17-inch reflector.

FIGURE 20. Mountain scenery on Infiernillo Peak, Northern Mexico. Top of Infiernillo, altitude 10,391 feet, is proposed site of Instituto Tecnológico-Pan American College High Altitude Observatory.

FIGURE 21. Camp near top of Infiernillo, July 2-4, 1960. Note large trees and ground cover, which may help improve atmospheric seeing or steadiness.

The classes were, in spite of the rather early hour (especially to those enthusiastic ones who had been up all night observing!), thoroughly enjoyed by all. There was no sign of any clock-watching or rushing out upon the bell's sounding. In fact, when the last bell rang, there were expressions of regret that it interrupted a high point in Professor Haas' lecture! Happenings like this were exemplary of the tremendous enthusiasm of the class. Professor Engle started off the morning with his class, Astronautics and Space Technology. Well known for his work in the field of Moonwatch, Mr. Engle kept the class up to date with current developments in the field of rockets, missiles, and satellites. The second class found students busily taking notes on Professor Haas' authoritative lectures on pure astronomy--the realm of the stars and the planets. As a textbook, Theodore Mehlin's Astronomy was purchased for the students by the National Science Foundation. A highlight of the Institute was the lecture on meteorites delivered by Mr. Oscar E. Monnig, who has devoted a lifetime of study to that subject. Several examples of meteorites from various places were shown. The group was very stimulated by the lecture, but after hearing some of Mr. Monnig's experiences in the field, realized the high degree of experience, stamina, and patience (with perhaps a stir of luck) needed successfully to locate meteorites. A second guest speaker was an expert in the study of space medicine. With a medical degree, Dr. William P. Blocker made his lecture quite authoritative and interesting. Color transparencies further intensified the interest among the students. The lectures, delivered on a college level, built up the initiative in the students by challenging their outstanding minds. This challenge was readily met with cries for more, a fact that compliments the selection of the group.

In the afternoon, the bus would take the members of the Institute to the college library, where, within seconds, the Astronomy section was nearly empty. This time was truly profitably spent, as the completion of several very good projects attests. Several students managed to order books through the college bookstore, thus securing a tangible memento of their stay at the Institute, along with a useful and informative guide to the heavens.

The enthusiasm of the students did not, however, end at the classroom or library. Almost every night, there was a group at the college observatory (pictures of this observatory are to be found on the cover and on page 91 of The Strolling Astronomer, May-August, 1959, Volume 13, Numbers 5-8), using either the 17-inch reflector of Professor Engle, or the 12½-inch reflector of Professor Haas, or, as usually was the case, both. The desire to observe was so great that lists had to be made out dividing the students into groups, so that no one would be trampled in the rush!

Among the various projects accomplished during the Institute were: Moonwatch (over 50 sightings were made by students), rocketry (two rockets were fired, one landing about a mile away), deep-sky observation, lunar and planetary work, and astrophotography. Although diversification was stressed during the seminar, several students did noteworthy work in various fields. Perhaps a list would be appropriate here: In the field of photography Tom Borlik from South Bend, Indiana, showed his skill with several very good pictures. In rocketry David Howard from McAllen, Texas, Mike English from Irving, Texas, and David Dunlap from La Feria, Texas, were experimenting. In the field of deep-sky Kelly Cook, from Tucson, Arizona, didn't waste a minute getting his observing and cataloguing done. In Moonwatch Bob Shayler, from Randolph Air Force Base, Texas, displayed tremendous enthusiasm and got a phenomenal amount of work done. In the lunar and planetary division, there were Clark Chapman and Bob Havlen from New York State, the former from Buffalo, the latter from Syracuse; Paul Knauth and Ken Short representing the state of Texas, being from Houston and Odessa, respectively; and the writer, from Las Vegas, Nevada, who apologizes for any possible errors in the above list.

The boredom of classes and library, if any such thing could possibly exist in such a group, was relieved by frequent and interesting field trips. Among these were a day spent at Padre Island, and the beach of the Gulf of Mexico there, tours of Harlingen and Moore Air Force Bases, an excursion to the Zapata Radar Station, and a non-scheduled inspection

FIGURE 22. The long, long trail up Infiernillo. Taken near Cieneguillas Farm on Pablillo Ranch, altitude here about 8,500 feet.

FIGURE 23. Summer Institute students observing with 5-inch Moonwatch Apogee 'Scope from near summit of Infiernillo Peak. Left to right: Thomas Stoeckley, Patricia Truax, Bob Shayler (at eyepiece), and Gary Kraus.

FIGURE 24. High Altitude Chamber used in astronautics classes at Pan American College to simulate certain effects of great altitudes. Built by William P. Blocker, M.D., Donna, Texas.

FIGURE 25. Summer Institute students and Walter H. Haas' 12.5-inch reflector at Pan American College Observatory. Note roll-off sheet steel building and canvas wind-screen.

FIGURE 26. Visit to campus of Instituto Tecnológico, Monterrey, Mexico. Front of Library at left center.

of Falcon Dam. A good time was had by all at Padre Island, a long sliver along the Texas coast. On the way there, the group visited Harlingen Air Force Base and saw a planetarium demonstration. Just before crossing the Queen Isabella Causeway, linking the island with the mainland, the bus stopped at the Port Isabel Light House, from which a superb view of the neighboring land can be seen. Soon afterward, a tour was planned of the United States Air Force radar station at Zapata. It was a great experience to see these tools of national defense in operation. On the way back from Zapata, a stop was made at Falcon Dam, and a tour led the group deep inside it. Later, a visit to Moore Air Force Base was scheduled. The flight trainers were shown in detail, followed by a demonstration of static testing of jet engines. An extra note was added when the group went before television cameras in Weslaco, a short drive from Edinburg.

The greatest highlight of the Institute was the trip into Mexico, including a guided tour of the Instituto Tecnológico in Monterrey, which is co-operating with Pan American College in the erection of an observatory at the site of Infiernillo Peak. The peak, which is presently accessible only by mountain trails, was the location of the group over the 4th of July weekend. The schedule was set up in such a manner that the students could sleep in the daytime, and thus be able to observe all night. Several telescopes were brought, including an 8-inch reflector belonging to Gary Kraus, a student member of the Pan American College Observatory staff, and a high quality 2.4-inch refractor brought by Pamela Mumford, one of the students.

This was the first time in Mexico for many of the students, and the trip is worthy of several comments. It was a tight squeeze indeed, with all the luggage and telescopes, in the school bus, but at the border, the change was made to a luxurious, air-conditioned Mexican bus. With the many things that happened on the way, in the bus, the writer feels certain that most of the students have quite an opinion about Mexican bus service, highways, and bus drivers. In a later talk about the trip, presented at a meeting of the Magic Valley Astronomical Society, Lawson Taitte, a student from Harlingen, Texas, gave two reasons for not including in his talk the things that happened: one, they were too many to enumerate in his short allotted time; two, he wouldn't be believed anyway.

Upon reaching Monterrey, the students visited the Instituto Tecnológico, described by Professor Engle as "a miniature M. I. T." After seeing all the technical equipment, one of the students commented that M. I. T. possibly could be called a miniature Instituto Tecnológico! The night was spent in Saltillo, farther west, after a shopping spree that saw everyone getting sombreros, serapés, or something of that nature.

Bright and early the next morning the group awoke and boarded the bus enroute to the mountain, Infiernillo Peak. About noon the trek up to the top was begun; and the late afternoon saw the students at the camp, near the top, 10, 391 feet above sea level, although there were some picturesque (but, unfortunately, unprintable) descriptions of the ascent. Temperatures at the peak ranged from about 48 degrees at night to somewhat more comfortable by day (although no one was awake to enjoy the warmth). The humidity was rather high, sometimes, when a cloud alighted on the peak, around 100%. This was the rainy season for that region; and no one would contest that statement, with the constant showers in the daytime, followed usually by clear skies at night.

The view from the peak was tremendous, even though there were quite a few trees to block it. Potosi, the highest mountain in Northern Mexico, was visible to the north. Immediately adjacent was San Francisco Peak, which the group had to cross before the ascent on Infiernillo itself. On previous expeditions there were reports of seeing the Gulf of Mexico with binoculars. This was expecially noteworthy, as the Gulf of Mexico is approximately 150 miles away from Infiernillo.

The observing the first night was very rewarding; despite the fact that the transparency was not the best recorded in that area, there were

FIGURE 27. Pan American College Summer Institute in the Astro-Sciences, June 7-July 16, 1960. Max Kerr Photography, Edinburg, Texas. Bottom row, left to right: Kelly Cook; Henry Gomez; Rudolfo Perez, Jr.; David Dunlap; Thomas Stoeckley; Thomas Borlik; Lawson Taitte; Lloyd Southwick.

Middle row, left to right: Mrs. Herbert Alston, Counselor; Heddy Halm; Cara Mitchell; Patricia Truax; Prof. Paul Engle, Director of Institute; Prof. Walter H. Haas; Virginia Metzger; Judy Ann Wainscott; Karen Bobkoff; Pamela Mumford.

Top row, left to right: Don McKinney; Paul Knauth; David Howard; Robert Havlen; Herbert Wickel; Max Schletter; William V. Uhlhorn; Richard Rowe III; Robert Shayler; Mike English; Arthur Eberhardt; Kenneth Short; Clark Chapman; Jesse J. Jenkins III; Tom Constanten; James W. Simpson; James Hart.

some who were literally "lost in the stars," the constellations being obscured as such. To the South, Alpha Centauri outshone Antares; and all four stars of the Southern Cross, Crux, were seen. The Milky Way stood out very well, appearing almost as a solid mass of stars. Jupiter, Saturn, and the Moon were seen superbly. After moonset the view could only be described as spectacular, several bright meteors having been seen by members of the group. The second night, however, was not so successful. During the first half of the night a cloud engulfed the peak and obstinately refused to leave until the last half, which was just clear enough to allow planetary observation. However, the clouds left in the morning in time to permit a very good view of the Sun. Professor Engle considered it the best view he had ever seen. The writer recalls unsurpassed detail in one large sunspot group. Immediately after breakfast the walk (or ride, for those who were so fortunate) down the mountain was begun. With the grade with, not against, the adventurers, the bus was under way within two hours. The group also had the curious experience of spending the 4th of July entirely in Mexico--the bus crossed the international bridge linking Hidalgo, Texas, with Reynosa, Mexico, a few minutes after midnight, thus on July 5!

The writer, being one of the students attending the Institute, envies those who may be fortunate enough to be chosen next year, as they will have a great, truly unforgettable experience ahead of them.

A LATE REPORT ON JUPITER IN 1959 AND A SUGGESTION ON THE USE OF THE INTENSITY SCALE

By: Elmer J. Reese

Since the publication of the final report on the 1959 apparition of Jupiter (Str. A., Vol. 14, p. 66), Walter H. Haas has submitted a report on his observations of the Giant Planet in 1959. This report consists of observations made on one date in June with a 12½-inch reflector at Las Cruces, New Mexico, and on five dates from September 7 to November 8 with a 6-inch reflector at Edinburg, Texas. Due largely to the southerly latitude of Edinburg, Haas was able to obtain useful observations of Jupiter considerably later in the apparition than was possible at more northerly stations. His transits are useful in strengthening several drifts and in materially extending the observed life of two others. Thus, the last observed position of object No. 7 of the North Equatorial Current (p. 77 of above reference) now becomes longitude (I) 152° on October 8, 1959. The last observed position of object No. 3 of the North Tropical Current (p. 78) now falls at longitude (II) 14° on September 7, 1959.

This report by Prof. Haas also sheds some light on the problem of when the South Tropical Zone lost the duskiness which characterized it during most of the 1959 apparition, and acquired the remarkable brightness and whiteness which it now possesses (1960). An examination of the following intensities compiled from Haas' estimates reveals that the changeover occurred sometime between September 7 and October 8, 1959:

	Sept. 7 CM_2 16°	Oct. 8 CM_2 300°	Nov. 8 CM_2 236°
STeZ	5.1	5.5	5.0
STrZ	4.6	7.5	6.0
EZ	4.5	5.1	4.6
NTrZ	6.5	6.0	5.0

These intensities are on the usual scale of 0 (shadows) to 10 (very brightest marks).

Visual intensity estimates are at best only relative, not absolute values. One observer may assign a higher number to a certain degree of brightness, while another observer may assign a lower number to the same degree of brightness. Hence the estimates of various observers are not strictly comparable and cannot reliably be combined and averaged. The writer believes that this disparity in the use of the intensity scale could be considerably reduced if all observers would adopt the following guide:

Suggested Intensity Range for Various Jovian Features

Very Bright Zone	8.0 - 8.5
Ordinary Bright Zone	6.0 - 7.5
Dull Zone	5.0 - 5.5
Polar Region (normal)	3.5 - 4.5
Ordinary Dark Belt	2.5 - 3.5
Very Dark Belt	1.5 - 2.5
Shadow	0.0

Postscript by Editor. It has caused considerable personal surprise and much gratification to see how much information Mr. Reese has extracted from a very scanty report. It would be excellent if this circumstance would encourage others to contribute their complete observations to our Section Recorders, for often such records have value when combined with a larger group of data that the observer himself could not foresee or appreciate.

THE GRAVITY "CONSTANT" AS A FUNCTION OF TIME AND THE INTERNAL STRUCTURE OF THE MOON

By: Péter Hédervári, F.I.L.S.

Professor L. Egyed described in 1956[1] how the volume of the Earth-type planets and of the Moon in olden times may have been smaller than at present. These celestial bodies have expanded during the last millions of years. According to Egyed's theory, the Earth is expanding at present. The increase in the radius of the Earth is about 0.5 mms. per year. In the case of the Moon, we know several morphological proofs[2]; we can explain even the origin of the features of the Moon's surface.[3]

The phenomenon of the expansion of the Earth[4] is explained by Egyed according to the change of the gravity "constant" with time[5,6]. According to this theory, the matter of the Earth's inner core is in a metallic-phase. When the gravity "constant," f, decreased, the pressure in the Earth's interior simultaneously decreased. According to Bullen[7] the pressure is, along the Gutenberg-Wiechert surface, which is the boundary of the Earth's core:

$$P_{GW} = 137 \times 10^{10} \text{ dynes/cm.}^2$$

According to Ramsey[8] the matter went into the metallic-phase when the pressure became greater.

In accordance with the investigation of Gilbert[5] the GW-surface was at a smaller depth than at present when gravity was greater. When in a part of the Earth, the pressure went below 137×10^{10} dynes/cm.^{2}, then the matter changed from the metallic-phase into the normal state. This phenomenon produced an increase in the volume of the matter; in other words: this was the cause of the Earth's expansion. Such is the essence of Egyed's theory.

From 1957 till 1960 the author of the present study occupied himself with the problem of the Moon's expansion and elaborated in more detail the expansion theory. The pressure in the Moon's interior is as follows:

$$P = \int_r^R \frac{f\, M_r}{4\pi r^4} \frac{dM_r}{dr}\, dr; \qquad (1)$$

where r is the variable distance from the Moon's center, $R = 1735 \times 10^5$ cms., the radius of the Moon, and M_r is the matter inside a globe the diameter of which is r, $0 \leq r \leq R - T$, where T is the thickness of the Moon's solid crust. According to our calculations[9,10], T is about 45 kms. If the thickness of the Earth's crust is T_E, the thickness of the Moon's crust T, and if the absolute difference between the two chief morphological levels on the Earth is τ_E and on the Moon τ, then:

$$\frac{T_E}{\tau_E} = \frac{T}{\tau} .$$

Now $\tau_E \cong 4800$ meters and $\tau \cong 7100$ meters. The unknown T is equal to:

$$\frac{\tau \, T_E}{\tau_E} \cong 45 \text{ kms.}$$

According to these calculations, the thickness of the Moon's crust is of the same order as the Earth's. Of course, this value of 45 kms. is only an average. Since:

$$M_r = \frac{4 r^3 \pi \sigma}{3}, \qquad (2)$$

where $\sigma = 3.33$ grams per cubic centimeter, the average density of the Moon, and:

$$\frac{dM_r}{dr} = 4 r^2 \pi \sigma ; \qquad (3)$$

therefore the pressure is:

$$P = \frac{4}{3} f \pi \sigma^2 \int_r^R r \, dr = \frac{2}{3} f \pi \sigma^2 (R^2 - r^2). \qquad (4)$$

At the center, where $r = 0$ and $M_r = 0$:

$$P_{center} = \frac{4}{3} f \pi \sigma^2 \int_0^R r \, dr = \frac{2}{3} f \pi \sigma^2 R^2 \geq$$

$$4.65 \times 10^{10} \text{ dynes/cm.}^2 \qquad (5)$$

The expression (5) gives us only a <u>lower limit</u> for the pressure. But we may use another expression:

$$2 P_{center} = R g \sigma , \qquad (6)$$

where g is the acceleration of gravity on the Moon's surface. Now:

$$g = 163.5 \text{ cms./sec.}^2$$

Using the values mentioned earlier, we get:

$$P_{center} \cong 4.72 \times 10^{10} \text{ dynes/cm.}^2 \qquad (7)$$

This value is <u>very small</u> for the metallic-phase. Therefore, <u>the Moon has at present no core</u>[9], and this may be the reason that <u>the Moon has no significant magnetic field</u>.

The distribution of the matter in the internal parts of the Moon is <u>quasi-homogeneous</u>. We may reach this conclusion from the relative moment of inertia of the Moon. The definition of the relative moment of inertia is:

$$\Theta_{rel} = \frac{8 \pi}{3 MR^2} \int_0^R \frac{3 r^4 M}{4 R^3 \pi} dr.$$

Here M is the mass of the Moon. Our ϑ_{rel} in the case of a homogeneous sphere is 0.400, and for the Moon 0.397.

Write, from expression (6), g in the following form:

$$g = f \frac{M}{R^2} \qquad (8)$$

Therefore:

$$2 P_{center} = f \sigma \frac{M}{R} . \qquad (9)$$

We have so far regarded f as a constant. But if, in accordance with Dirac's and Gilbert's result:

$$f = \rho(t), \text{ then, because } P = P(f),\ P = P[\rho(t)],$$

where t is the time. When $t \rightarrow +\infty$, then $P \rightarrow 0$. The Cavendish-"constant" f, as a function of time, may be written in this form:

$$f = \frac{C}{t}, \text{ from which } C = f_{\tau}\,\tau = \text{constant}. \qquad (10)\ \&\ (11)$$

Here f_{τ} is the value of f belonging to the τ epoch. According to Gilbert:

$$\tau = 4.1 \times 10^9 \text{ years}.$$

Using the value of f from expression (10), expression (9) becomes:

$$2 P_{center} = \frac{C \sigma M}{tR}. \qquad (12)$$

Using this formula, we can calculate for any epoch the pressure at the Moon's center. The change of pressure at distance r from the Moon's center with time, with regard to the relation $f = \rho(t)$, may be calculated from expression (4) according to the following formula:

$$3 P = \frac{2C}{t} \pi \sigma^2 (R - r)(R + r). \qquad (13)$$

The definition of the so-called "average pressure" is:

$$P_{av} \gtrsim \frac{f_{\tau}}{4 \pi R^4 M} \int_0^R M^2 \frac{dM_r}{dr} dr = \frac{M^2 f_{\tau}}{12 \pi R^4}. \qquad (14)$$

Numerically:

$$P_{av} \gtrsim 1.83 \times 10^{10} \text{ dynes/cm.}^2 \qquad (15)$$

Taking into consideration the relation $f = \rho(t)$:

$$P_{av} \gtrsim \frac{CM^2}{12 \pi R^4 t}. \qquad (16)$$

We have calculated for several epochs the value of f. The results may be seen in Table I.

Table I.

t in 10^9 years	f in 10^{-9} CGS
4.1, present	66.579
2.0	136.487
1.0	272.974
0.5	545.948
0.4	682.435
0.3	909.913
0.2	1364.870

Table I--continued

t in 10^9 years	f in 10^{-9} CGS
0.1500	1819.826
0.1400	1949.814
0.1350	2022.029
0.1250	2183.791
0.1000	2729.739
0.0500	5459.478
0.0100	27297.390
0	∞

What is the change of pressure at the Moon's center with time? Using several values of f, we can calculate this too. Table II shows the results of these calculations.

Table II.

t in 10^9 years	P_{center} in 10^{10} dynes/cm.^{2}	P_{center} in 10^{10} dynes/cm.^{2}	$P_{\text{"average"}}$ in 10^{10} dynes/cm.^{2}	f in 10^{-9} CGS
4.1, present	4.65	4.72	1.83	66.579
2.0	9.53	9.68		
1.0	19.06	19.35		
0.5	38.13	38.70		
0.4	47.66	48.38		
0.3	63.55	64.51		
0.2	95.32	96.76		
0.1500	127.10	129.01		
0.1413	134.92	136.96		1931.875
0.1412	135.02	137.05	53.14	1933.243
0.1411	135.12		53.17	1934.613
0.1410	135.18		53.21	1935.985
0.13916	137.00		53.92	1961.577
0.05476			137.00	4984.370

According to Table II, if $P_{center} = 4.65 \times 10^{10}$ dynes/cm.^{2}, at the epoch $t = 0.13916 \times 10^9$ years the pressure at the Moon's center was 137.00 $\times 10^{10}$ dynes/cm.^{2}. If $P_{center} = 4.72 \times 10^{10}$ dynes/cm.^{2}, at the epoch $t = 0.1412 \times 10^9$ years the pressure at the center was 137.05×10^{10} dynes/cm.^{2}. In accordance with these results, we may conclude that in olden times the Moon had a central core and this core was in a metallic-phase.

If Gilbert's hypothesis is right, then, according to the results mentioned above, we may see that the Moon had to expand during several millions of years in the past. Therefore, the hypothesis of the Moon's expansion, the idea for which originated from Dr. L. Egyed, is really a physically well established theory.

Next, we must calculate the pressure at several depths in the Moon for the present epoch $t = 4.1 \times 10^9$ years $= \tau$. There is another task, to calculate how large was the radius of the Moon's metallic core at the period of the Moon's birth.

The pressure within the Moon may be obtained from expression (4) and is shown in Table III.

Table III.

Distance from the Moon's surface in kms.	The present value of the pressure in 10^{10} dynes/cm.^{2}
45, the lower boundary of the solid crust	0.24

Table III--continued

Distance from the Moon's surface in kms.	The present value of the pressure in 10^{10} dynes/cm.^{2}
100	0.52
375	1.79
380	1.81
385	1.83, "average" pressure
500	2.30
750	3.15
1000	3.82
1500	4.57
1735, center	4.65

Since expression (4) gives us only the minimal pressure, it is very probable that the real pressure is greater than that shown in Table III. In our calculations, we have considered the density σ as a constant from the Moon's surface to the center. We used the medium density of the Moon, $\sigma = 3.33$. But to use a constant density instead of the real, variable density is only an approximation. The real density of the solid crust is about 2.7 grams per cubic centimeter, like that of granite.

The change of density with increase of distance from the surface is quasi linear. The density at certain depths is given in Table IV.

Table IV.

Distance from the Moon's surface in kms.	Calculated density in grams per cu. centimeter
0, surface	2.70, medium density
45, lower boundary solid crust	3.30
100	3.33, average density of the Moon's matter
385	3.44
500	3.48
750	3.57
1000	3.66
1500	3.84
1735, center	$\leq$3.90

At a depth of 1000 kms., the critical pressure of 137 x 10^{10} dynes/cm.^{2} may have been reached at the epoch t = 0.11402 x 10^9 years.

Now suppose that the Moon's age is 4.0 x 10^9 years. This is a rather probable hypothesis. In this case, the Moon's matter might have been in a metallic state from a depth of 1000 kms. down to the center during the first 14 x 10^6 years of the Moon's life. We ought to know how large was the radius of the Moon's central core immediately after the Moon's birth. Therefore, we have to calculate at first how large was the radius of the Moon at the beginning of its development. In accordance with the Moon's hypsometric curve, constructed by Joksch[11], we may reach the conclusion that the territory of the continental regions of the Moon's visible hemisphere is about 14,220,000 km^2. The whole hemisphere is 18,969,000 km^2. The continents represent the original crust of the Moon[2]. At the beginning of the Moon's development, there were no basins. The lunar basins probably were formed in a later period because of the expansion of the Moon's surface.

We are not yet aquainted with 15% of the lunar surface. We can use, therefore, only those data which pertain to the visible hemisphere.

Let us take F_0 for the whole surface area of the Moon at the beginning of its life and R_0 for the radius of the Moon at this period. Then:

$$0.5\ F_o = 2\ R_o^2\ \pi = 14.22 \times 10^6\ km.^2; \qquad (17)$$

from which:

$$R_o = \sqrt{\frac{0.5\ F_o}{2\ \pi}} \cong 1505 \times 10^5\ cms., \qquad (18)$$

and:

$$R - R_o \cong 230 \times 10^5\ cms., \qquad (19)$$

where R is the present radius of the Moon.

If we use expression (6) for the pressure, instead of expression (4) because expression (4) gives us only a lower limit, then we get the final epoch of the Moon's expansion as between the periods $t = 0.1412 \times 10^9$ years and $t = 0.1413 \times 10^9$ years. The expansion ended when P_{center} decreased below the critical value 137×10^{10} dynes/cm.^{2}. This happened about 3,958,700,000 years ago. If the Moon's age is 4.0×10^9 years and the present value of P_{center} is 4.72×10^{10}dynes/cm.^{2}, then the duration of the Moon's expansion period may have been about 41.3×10^6 years. The increase in the Moon's radius was about:

$$\Delta R = 5.5\ mms./year., \qquad (20)$$

if the speed of expansion was regular. According to professor Egyed's calculations, the increase in the Earth's radius is about 0.5 mms./year, which is one order of magnitude smaller.

Using the data on the speed of expansion mentioned above, we may reach the result that the radius of the Moon's metallic core at the epoch of the Moon's birth may have been 691 kms. At this period, the Moon's radius was only 1505 kms. Then, 14×10^6 years after the Moon's origin, the radius of the celestial body was 1582 kms. and the radius of the metallic core was 582 kms. When in the past gravity was much larger than at present, the Moon may have had an atmosphere, denser and thicker than any present atmosphere.

This theory, explained above, is imposed on the hypothesis that Gilbert's results about the decrease of gravity are correct. Gilbert's calculations originated from the general theory of relativity of Dr. Albert Einstein.

The author of the present dissertation dedicates this study to the memory of one of the greatest explorers of the Moon:

Dr. H. Percy W i l k i n s.

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BOOK REVIEWS

Larousse Encyclopedia of Astronomy, by Lucien Rudaux and G. de Vaucouleurs. Prometheus Press, New York, 1959. 506 pages. 818 illustrations, including 8 full-color plates. Price $15.00.

Reviewed by Ken Steinmetz

The total knowledge of Man, accumulated by dedicated workers down through the ages to the present, is available to us through an awesome variety of recorded media. Between the covers of a book on a specific subject may well be displayed the end result, at time of publication, of untold years of patient labor by equally unknown numbers of devoted scientists. No book can tell of all the hardships, the failures, or of the torture and suffering that befell those who chose to contribute what they could to Man's knowledge against the desires of their contemporaries in power.

Accordingly, it would seem difficult for any amateur astronomer to justify his failure to avail himself of all possible knowledge of the subject. Such knowledge is of far greater importance than his instruments. The professional astronomer with his specialized education most assuredly guides his efforts in accordance with frequent and often prolonged studies of the work done by others. The amateur, if he is to do more than merely ape the work of others, must study, search, work, and contribute meaningful data to Man's bank of knowledge or else be content as a hobbyist of value only to himself.

Astronomical books and charts belong in the library of every amateur astronomer. His library should be as comprehensive as possible, with added emphasis on material that expands upon his chosen category of astronomy. The Larousse Encyclopedia of Astronomy is an excellent start on which to build such a library and is a most worthwhile reference work to be added to any existing collection, no matter how extensive. The encyclopedia is a large volume, as impressive in physical size as it is in subject coverage. The book is entirely readable, being basic and yet thorough. It comprehensively covers the widely dissimilar disciplines of astronomy and pulls them together with unity of meaning.

The book is divided into four sections. The first, "The Splendour of the Heavens," is a pleasant introduction into the wonders of astronomy as we contemplate it from the cool front porch on a clear summer evening. The sub-heading for the first topic is listed simply, "Appearance of the Sky." The authors proceed to answer the fundamental first questions of an inquiring mind asking why the sky appears as it does, and why certain relationships between the Earth, the Sun, the Moon, and the stars constantly change. But, very quickly, basic material is presented on such phases of astronomy as orbits, eclipses, time, and the apparent movement of the stars, to mention only a few. The Earth and its relationship to the great scheme of our celestial environment is dwelt upon in detail and the reader is prepared to explore the vast wealth of information set forth on the Solar System in the second section of the book, "The Empire of the Sun."

The material presented on the Solar System is by far the largest section, taking nearly half the book to cover the Solar System as a unit, the Earth as a planet, and the Moon and its role in eclipses, occultations, and tides. Each of the planets is subjected to detailed analysis, as are comets, meteors, and the Sun. The Moon requires sixty-three pages, and lunar astronomers will find a wealth of information presented in a compact and logical order. Undoubtedly this area of the book will be frequently read and reviewed by everyone interested in lunar work. In this day of lunar missiles few can affored to be disinterested.

"The Realm of the Stars" is a vivid exposition of the universe of light, energy, and of almost incomprehensible distances and dimensions of stars, galaxies, and nebulae. This section comprises the third part of the book. Not only are the stars as such dealt with competently, but the galaxies and nebulae and the current thought concerning expansion of the universe are adequately explained and pictured. As always, there are some seeming omissions or outright neglect of recent theory or finding; but on the whole the topic is well covered with little cause for complaint.

The final section of the encyclopedia is entitled "Astronomical Instruments and Techniques." This section is packed with information on all types of instrumentation, past and present. Methods and applications and means of measurement make interesting reading and furnish abundant food for thought as to future developments and possibilities. No amateur astronomer can read this section and study the many clear photographs without feeling that his thinking must encompass a new concept of instruments and methods that he himself might procure and use. The photos on page 469 of the Jodrell Bank Radio Telescope are dramatic evidence of Man's growth in instrumentation as he searches for knowledge with increasingly complex equipment to furnish the answers to his questions.

The authors are impressive in giving by word and picture the answers to many questions in the many phases of the enormous subject of astronomy and allied sciences. They are equally impressive in stating the many questions that are as yet unanswered. Indeed, it would seem a worthwhile project to pick from this book a compilation of the information that is needed, and amateurs might well devote their efforts to concentrating on just one area where information is lacking and where they are capable of devoting their efforts.

The Larousse Encyclopedia, as with any other such book, is only current at time of publication. It is, however, an easy-to-use reference work that should be near every amateur's desk. The comprehensive index gives adequate coverage of topic location. The very numerous facts, figures, charts, and text combine to give ample coverage of all except the most highly specialized disciplines of astronomy. True, some of the material is controversial, and some information might not contain the latest development; but these details detract only slightly from the overall worth of the book.

Merely to read and to enjoy the book at leisure will surely bring home clearly to the reader that this one book alone contains within its pages the near-total net result of the work of many men of ages long past. It is a chronicle of Man's search for knowledge, of Man's quest to know himself by knowing his world and universe.

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El Hombre ante el Universo, by Dr. Francisco Aniceto Lugo, Caracas, Venezuela. 545 pages. Price 160 Pts. Exclusivas Ferma, Barcelona, 1960.

Reviewed by Carlos E. Rost

In this magnificent, thought-provoking book, Dr. Lugo presents a combination of actual known facts about general astronomy and physics subjects, together with current theories, superstitions, and even the way the layman thinks (and even likes to think) about most common mysteries of Nature, such as the "canals" and the possibility of life on Mars, the "abominable monsters" of the Himalaya Mts., etc.

As a true lover of Nature, Dr. Lugo writes in such an attractive manner as to keep the reader steadily curious about all his extremely interesting inferences to the various astronomical (and other) subjects touched. It should not be considered seriously that the author is accepting falacies for facts, as he cautiously refers to one or another subject of apparent fictitious character with proper scientific sense. It is true that throughout his book, the author seems to be striving to induce the reader to accept the unacceptable, giving as proof many records of published news in the press, and references to the present and former serious scientific observers, leaving always the reader with the most common and simple of questions: "How can we prove or disprove it, since we are only just a minute grain of matter in the midst of our inconceivably enormous Universe?"

Personally, I am of the opinion that this is precisely a very constructive philosophy, as it tends to tempt Man's imagination to continue searching into the depths of Nature's mysteries. Curiosity is the seed that the Creator placed in Man's head, when born as a child, and which Man's duty is to harvest and to make produce for the general welfare of Mankind! At least, this condition should be present, inside the spirit and as a goal, of a true scientist. One thing or two should be remembered: Lowell's insistence upon the nature of the Martian Canals and the habitability of that planet, and the present Project OZMA, which is being undertaken to clarify the current suspicion about the possibility of life on some planet belonging to the stars Tau Ceti and/or Epsilon Eridani, as another planetary system.

It should not be taken as if the reviewer wants to stand by Dr. Lugo's opinions, as for example those concerning the "flying saucers"; but we should be cautious about not being always too sure about ourselves, and rather ask ourselves the question: "Could it be always lawful to believe that we are the only ones to possess the privilege of being the only dwellers of the only inhabited World?" We should also remember the proven fact that Venus, Mars, and our Earth are three worlds lying inside the habitability zone of our Solar System. Other systems far out in space can, and very probably do, have this same condition. At least water, in some of its natural forms, has been found on Venus and Mars; and water is a basic element for the existence of life in some of its various possible forms and adaptable to local, prevailing conditions.

Dr. Lugo's book has a very sound and philosophical tendency; it tends to show by all comparative means the wonders of Nature, from the very bottom of the sea up to the vastness of Space, and the correlated meaning and importance to Man's life. It is nicely illustrated with many photographs, and being in the Spanish language, should have an English version for a more general and better understanding!

****

Moon Maps, by Dr. H. P. Wilkins. 27 charts and Gazetteer. MacMillan Company, New York, 1960. Price $6.00.

Reviewed by Alika K. Herring

This latest edition of the Wilkins 300-inch map has been specially prepared for those observers who desire a detailed lunar map in a form suitable for use at the telescope. Published on a scale of 55.4 miles per inch, or approximately 39 inches for the lunar diameter, the chart sections are therefore somewhat larger than those in the version previously published in book form (The Moon, Wilkins and Moore, The MacMillan Company, 1955), and are consequently more legible and easier to read.

Some new details have been added to this edition; among these is the location of the volcanic degassing reported in Alphonsus in 1958. Also included is the well known chart of interior detail in Ptolemaeus, also reproduced to a larger scale, which chart depicts many details that will tax the resolving power of most amateur instruments. Of special interest is a chart of the averted hemisphere which is based on the photographs secured by the Soviet Lunar Rocket, Lunik III. The complete set of charts therefore depicts all but about 20% of the entire lunar globe.

The Gazetteer consists of a list of 700 named formations, very conveniently arranged in alphabetical order, along with the map section number wherein each may be found. Brief descriptions of each feature are also given; but these are inserted primarily for identification and are not intended to supplant the more voluminous material contained in The Moon, which the student should still retain as a reference.

Moon Maps is presented in a sturdy double ring binding which permits the map containing any feature to be placed opposite its description in the Gazetteer. It is therefore most ideally suited for actual use at the telescope; as a second or working copy of the Wilkins map it is most highly recommended by this reviewer.

THE SIXTH CONVENTION OF THE ASSOCIATION OF LUNAR AND PLANETARY OBSERVERS

By: L. J. Robinson

As has happened several times in the past, the Association of Lunar and Planetary Observers held their convention in conjunction with the Western Amateur Astronomers. This year the Sixth A.L.P.O. Convention was stationed at San Jose, California. At nine o'clock on the morning of August 24, 1960, Room B of the San Jose Civic Auditorium began to fill with delegates, all expecting the twenty papers to provide new insights in astronomy which they might carry back to their telescopes.

The Morning Session was formally called to order by Mr. A.L.P.O., Walter Haas. Mr. Haas gave a résumé of the A.L.P.O.'s efforts in the past together with a taste of things to come; after several announcements he turned the session over to the first eleven speakers. For the sake of brevity I will present the general agenda, adding a brief note at the end of the name of each paper.

(1) Introduction: Walter H. Haas. See above.

(2) Recently Observed Rotation Rates on Saturn: Thomas A. Cragg. Mr. Cragg discussed the incongruent rotation rates (spectroscopic vs. visual) on Saturn at latitude 60° N. Much of the A.L.P.O.'s visual material has come from observations of the Dollfuss spot of May, 1960, and of a spot recently discovered by Robinson in June.

(3) Jupiter in 1958-59 as Observed from Japan: Takeshi Sato. Mr. Sato presented a detailed analysis of the work done by the Oriental Astronomical Association on Jupiter in '58-59. Particular mention was made of colors and of belt descriptions. Several very well-done drawings were projected. Paper read by Walter H. Haas.

(4) Mars and the Telescope: Thomas R. Cave. Mr. Cave showed several drawings as made by himself with an eight-inch telescope. His description of these drawings showed the fine work which can be done with a modest telescope.

(5) Some Problems about the Names of the Martian Markings: Tsuneo Saheki. Mr. Saheki related several instances of erroneous naming of Martian features. He provided the correct nomenclature for the markings. Paper read by Clarion Cochran.

(6) The Future of the Mercury Section: Geoffrey Gaherty, Jr. Mr. Gaherty told of the plans of the Mercury Section for the coming year; special reference was made to the November 7, 1960, solar transit. Report forms are available to those who wish to observe this event. Persons interested should contact Mr. Gaherty, whose address is on the back inside cover.

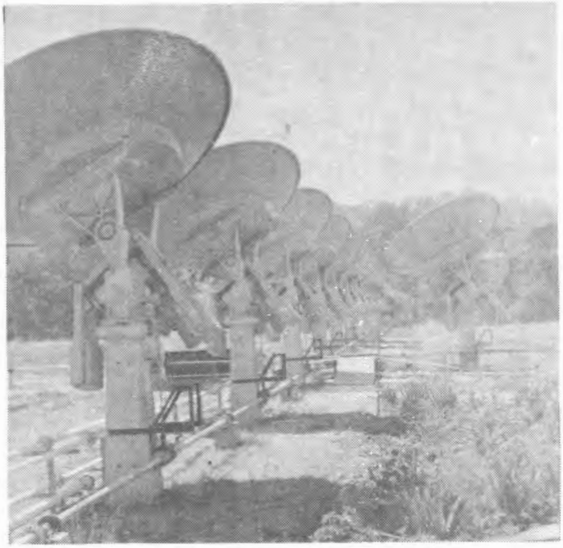

FIGURE 28. Radio Telescopes of Stanford University. Installation visited by Field Trip of Western Amateur Astronomers during their Convention at San Jose, Calif., August 25-27, 1960. Photograph by Jack Eastman, Jr.

FIGURE 29. Dr. Dinsmore Alter (right) and Mr. Alika Herring at Sixth A.L.P.O. Convention at San Jose, Calif., August 24, 1960. Photograph contributed by Alika Herring.

FIGURE 30. Thomas Cragg observing Sun with 6-inch reflector (also called "the plumber's nightmare") during 1960 W.A.A. Convention. Site is San Jose, Calif., Civic Auditorium Parking Lot. Photograph by Jack Eastman, Jr.

FIGURE 31. Presentation of the W.A.A. G. Bruce Blair Award to David P. Barcroft (right) by Walter H. Haas at the 1960 Banquet of the Western Amateur Astronomers. Photograph by Leif J. Robinson.

FIGURE 32. Presentation of an A.L.P.O. Award to Thomas Cave by Thomas Cragg. Left to right: Cragg, Cave, David Barcroft, Mrs. Daly. Photograph by L. J. Robinson.

(7) Venus--Lady with a Past: Dr. James C. Bartlett, Jr. Dr. Bartlett told of the history of Venus and of the observational problems and errors connected with this planet. Read by Natalie Leonard.

(8) The Constituents of the Atmosphere of Venus: Brian Warner. Mr. Warner related the many theories of the surface of Venus to the material within the atmosphere--showing all have merit, but also showing how little is known. Read by Art Leonard.

(9) An Amateur's Lunar and Planetary Photography: Robert R. Cassell. Mr. Cassell showed photographs of his equipment, describing the operation of same as well as the results. His efforts were made with an eight-inch telescope.

(10) A Planetary Camera for a 12.5-Inch Reflector: Jack Eastman. Mr. Eastman did much the same as Mr. Cassell, only specializing in a large projection camera for planetary detail.

(11) The Moon and Ourselves: Carlos E. Rost. Mr. Rost gave an enthusiastic description of amateur lunar studies in our dawning Space Age. Paper read by David P. Barcroft.

(12) Evolution of the Moon: Dr. Dinsmore Alter. The Afternoon Session opened with Dr. Alter as the principal speaker. This most interesting paper concerned itself with the empirical facts relating our moon to the other satellites of the Solar System. This paper will soon be published in the P.A.S.P.

(13) "Saucers" in Ptolemaeus: Alika K. Herring. Mr. Herring presented a fine analysis of his research on the floor of this crater. A composite map was projected showing the 100-plus features observed by Mr. Herring. Read by Raymond Dudley.

(14) The Reported Outbreak in Alphonsus (An Analysis): Patrick Moore. Mr. Moore presented a complete discussion of all observations of the "volcanic" disturbance in 1958 within the crater. He reached the conclusion that the outbreak probably did occur. Dr. Alter interjected several comments supporting Mr. Moore. One will recall that Dr. Alter is noted for his work on Alphonsus. Read by Don Charles.

(15) Lunar Colors: David P. Barcroft. Due to the pressing time limit left for the rest of the papers, Mr. Barcroft elected, under objection from the other delegates, not to present his paper.

(16) Compiling a Precision Plato Map: Patrick McIntosh. Mr. McIntosh described the methods he used in making his accurate map of the floor of Plato. His efforts should be noted by every serious student of the moon. Read by Frank Grow.

(17) Comets in History and Astronomy: Francisco Aniceto Lugo. Dr. Lugo presented an entertaining paper on the "hazards" presented to the earth by comets. Read by Harold Milner.

(18) Methods for Determining the Amounts of Light Reflected from Objects in Different Wave Lengths: Gary Wegner. Mr. Wegner proposed several advanced techniques for refining amateur studies of the lunar and planetary surfaces. Paper read by Stanley Emig.

(19) Some Suggestions for Solar System Observation: Leif J. Robinson. Mr. Robinson gave a short account of the newly formed Methods Committee for the A.L.P.O. He stated that this committee will attempt to solve some of the problems confronting the amateur. Its first project will be to produce an Observing Manual. After the talk Mr. Haas made some additional comments.

(20) A Method for Estimating Positions: William E. Kunkel. Mr. Kunkel gave a delightful talk on a most difficult-to-present subject. He showed how a telescope without a drive can determine the position of an unknown object, e.g. a new comet, with great accuracy.

With these papers the A.L.P.O. session came to a close. All the delegates then made plans for the immediately following three-day W.A.A. Convention. We shall omit the details of the W.A.A. Convention and move to the final banquet, held on the last day of the Convention, August 27, 1960.

Following the principal speaker of the evening, Dr. A. J. Eggers, Jr., Chief, Vehicle Environment Division, Ames Research Center, the banquet M.C., Thomas Cragg, turned the floor over to Mr. Haas, who was to make the presentation of the W.A.A.'s annual G. Bruce Blair Award. The wonderful remarks of Mr. Haas were overshadowed only by the standing ovation given when the A.L.P.O.'s own Mr. David P. Barcroft accepted the Award. The modesty and humility so well attributed by many to David Barcroft was manifest in the heartfelt remarks of his acceptance speech. I am sure that all within the banquet room felt proud in that they recognized one of the greatest amateur astronomers of our era.

But all was not over...no more had the applause died away when Mr. Cragg presented the A.L.P.O.'s Service Award to Mr. Thomas Cave. In Mr. Cragg's own words, "...a man who has given the tools of astronomy to the amateur." The presentation of the Award by Mr. Cragg was most fitting as the "Two Tommies" form a substantial part of the progress of modern amateur astronomy. Those who know Mr. Cave or his works are positive in their belief that the Award was well deserved.

Wordy Postscript by Editor. Our special thanks must go to the Western Amateur Astronomers for making possible the Sixth A.L.P.O. Convention described above by Mr. Robinson. We are especially indebted to the General Chairman, Mr. Walter J. Krumm of Cupertino, California, and to his hard-working committees. We also want to thank Mr. Jack Borde of Concord, California, and his helpers for arranging extremely well an extensive and representative A.L.P.O. Exhibit; and we also thank all those who contributed to this Exhibit.

The following 30 persons registered for the A.L.P.O. meeting at San Jose: Robert R. Cassell, David Barcroft, Stephen W. Bieda, Alika K. Herring, W. P. Overbeck, Thomas R. Cave, Geoffrey Gaherty, Jr., Raymond Dudley, Chalmers B. Myers, Jack A. Borde, Donald K. Charles, David Steinmetz, Leif Robinson, Stuart Emig, Stanley Emig, Grace Fox, Thomas A. Cragg, William E. Kunkel, Natalie R. Leonard, Jim Richmond, Ellis Browne, Clarion A. Cochran, Roy K. Ensign, Ernest O. Lorenz, Edwin B. Edwards, Alan McClure, Jack Eastman, B. Enders, Vic _______ of San Carlos, Calif., and Walter H. Haas. The attendance was more than twice the number of registrants by actual count, and a conservative estimate would be that at least 80 persons were present at one time or another during this A.L.P.O. Convention.

The Western Amateur Astronomers, now headed by Mr. Thomas R. Cave as the new Chairman, have very graciously invited the A.L.P.O. to meet with them next year at Long Beach, California. No final action on this invitation has yet been taken; our plans for 1961 will be announced in a later issue of this periodical.

ANNOUNCEMENTS

Changes in Staff Members. As readers may already have noticed, Mr. Phillip W. Budine, 1435 Upper Front St., Binghamton, N.Y., has been appointed Assistant Saturn Recorder. Mr. Budine will be personally known to many of our members who have attended recent Astronomical League National Conventions and to others through his contributions to this periodical. Even though recently unable to continue in the demanding post of Jupiter Recorder, Mr. Budine has been anxious to serve the A.L.P.O. in some way. He and Mr. Thomas Cragg, the Saturn Recorder, will divide the Section's work, but observations of Saturn and routine inquiries about it should be mailed to Mr. Budine. Beginners planning to observe the Ringed Planet should also correspond with him. Mr. Budine has already created a Saturn Observing Form, distributed to many delegates at the recent Convention at Haverford.

Dr. James C. Bartlett, Jr., has been replaced as Venus Recorder by Mr. William K. Hartmann, 1025 Manor Road, New Kensington, Penna. It is a matter of very deep regret to lose from our staff Dr. Bartlett, who has headed the Venus Section since 1951. His letters--lengthy, witty, often philosophical, and always informative--will be well known to many of our readers. His tremendous personal observational activity on Venus and other objects and his reports about Venus in this periodical deserve great praise. One should mention here his efforts at statistical investigations of certain Venusian phenomena, e.g., the cusp-caps, as a praiseworthy kind of analysis of our often contradictory Venus observations. Dr. Bartlett's decision to leave the post of Venus Recorder has been forced by much increased demands of his employment. The new Venus Recorder, Mr. Hartmann, is already known, at least by his writings, to many of our readers. He brings to the post a very good background in lunar and planetary astronomy and an appreciation of the many perplexing Venus problems, and he is planning a Venus Observing Form. In the future all A.L.P.O. work on Venus should be sent to Mr. Hartmann.

Error in July-August, 1960, Issue. On p. 103, second paragraph, eighth line in paragraph, read comet and not camera. The sentence will then become: "The other is to use an off-axis image of the comet as a guide image."

In Memoriam. We have learned with regret of the death on May 6, 1960, of Mr. W. F. Duncan of Galveston, Texas. He had been an A.L.P.O. member since 1953 and was often very active in Mr. Adams' Lunar Meteor Search project. Mr. Duncan left his books and slides to the Galveston High Schools, where he was teaching a course in astronomy at the time of his death. He regularly attended meetings of the Houston (Texas) Astronomy Club and is much missed by its members.

Binders for Periodicals. Mr. Carlos E. Rost sends the following note: "The two nice-looking and practical Gilmer Binders with a capacity for 24 issues each of this periodical, which were made especially for me by that concern, are keeping my copies in chronological order, extremely handy, and safe. The price for each binder is only $3.50, and a letter to the manufacturer mentioning Carlos Rost as an A.L.P.O. member will suffice. (For your convenience, please mention Order No. 4929.) Gilmer Binder, 8734 West Chester Pike, Upper Darby, Penna."

New Mexico State University Library File of The Strolling Astronomer. Mr. Chester H. Linscheid, Librarian, State University Library, New Mexico State University, University Park, New Mexico, is desirous of building up two complete sets of our periodical, one in the Rare Book Room for preservation and the other for circulation to A.L.P.O. members. Mr. Linscheid has at all times been extremely coöperative and has honored a fair number of requests for the use of back issues and articles. The New Mexico State University Library already has a complete file of The Strolling Astronomer with this exception: they lack Volume 11, Nos. 7-10, July-October, 1957. We shall be grateful to anyone who can supply them with this issue, and the Editor will pay a reasonable sum for one or two copies. We hope at a future date to carry a list of all back issues needed by Mr. Linscheid to complete his double set.

Travel Funds for A.L.P.O. Observing Projects. We have recently received an anonymous gift of modest amount. It has been decided to use the money thus generously made available to help finance travel by qualified A.L.P.O. members doing special research projects at professional observatories. It is our hope that such aid may make possible studies by keen and competent members that would otherwise not be done. The Editor will for the present pass upon applications for such aid, usually with advice from others; of course, applicants must have the advance approval of the Observatory to which they wish to go. The amount of any individual appropriation for this project cannot surpass fifty to one hundred dollars.

Insert on A.L.P.O. Library. Please note the insert in this issue--and don't forget that the A.L.P.O. Library is useful only as it is used.

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

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