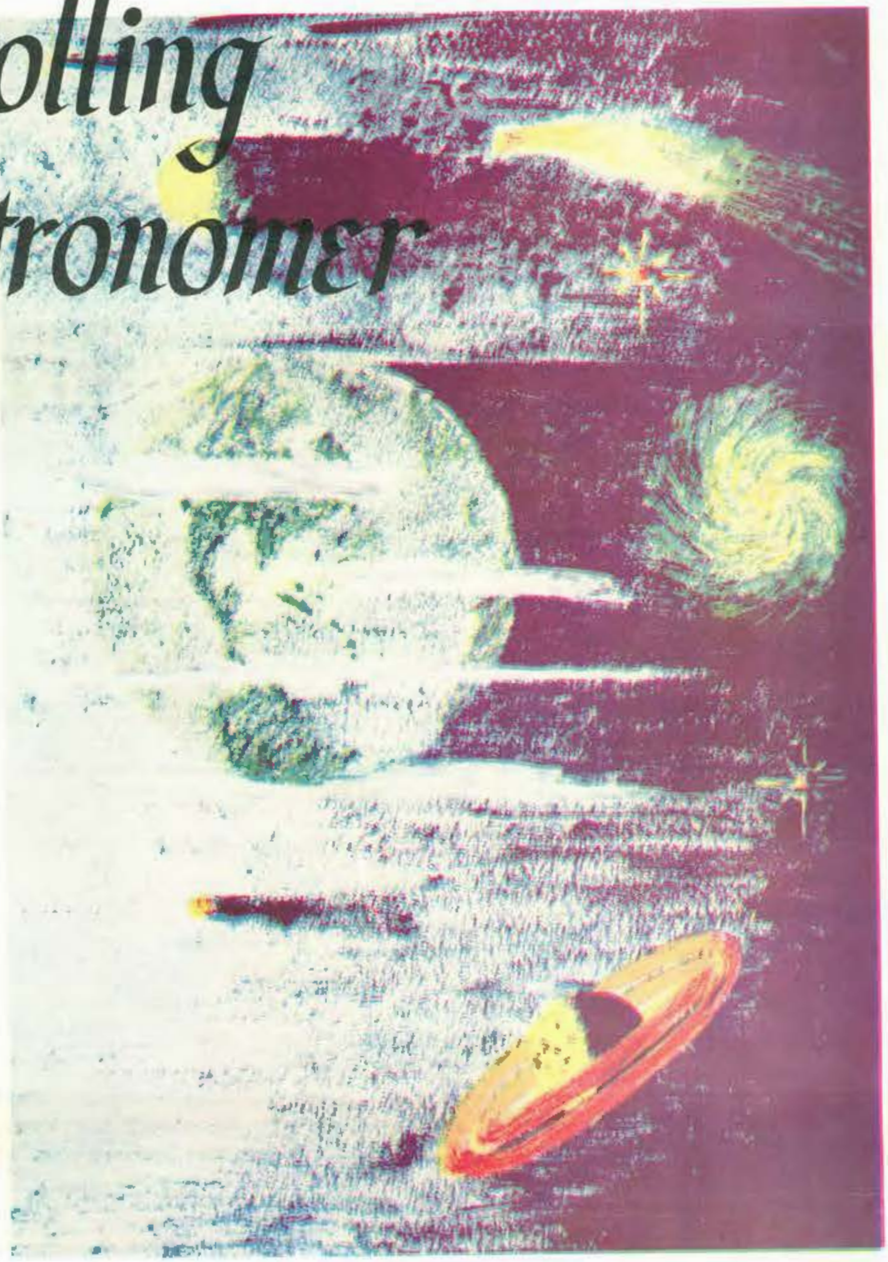
# The Strolling Astronomer

Volume 5, Number 10 October 1, 1951

ASSOCIATION OF LUNAR AND PLANETARY OBSERVERS



The Strolling Astronomer
1203 N. Alameda Street
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Photovisually corrected, completely achromatic Barlow Lenses for reflecting telescopes, according to Dr. Gramatzki.

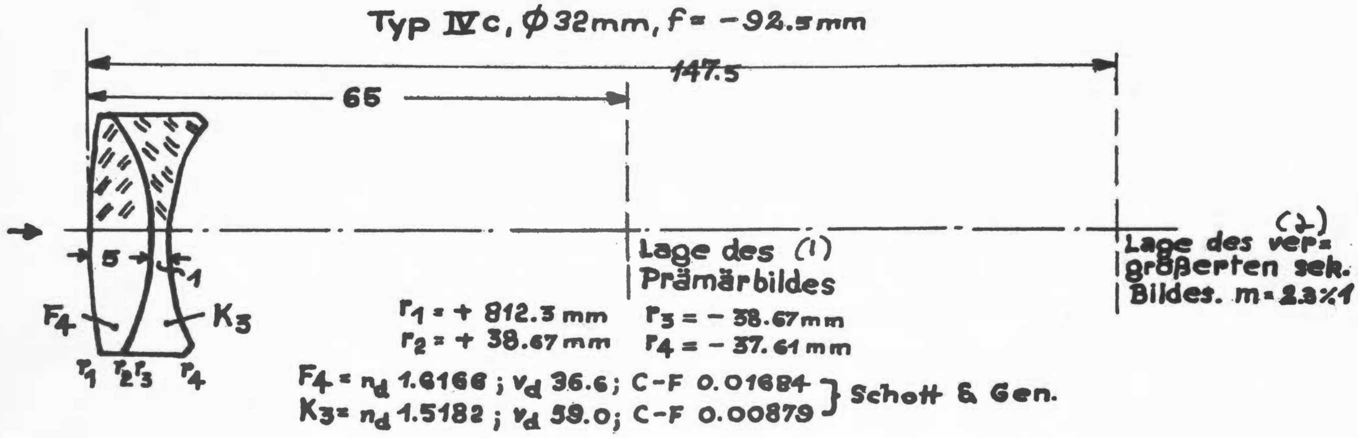



Figure 1

(1) Translation: Position of the primary image.

(2) Translation: Position of the enlarged secondary image. m = 2.3 ÷ 1.

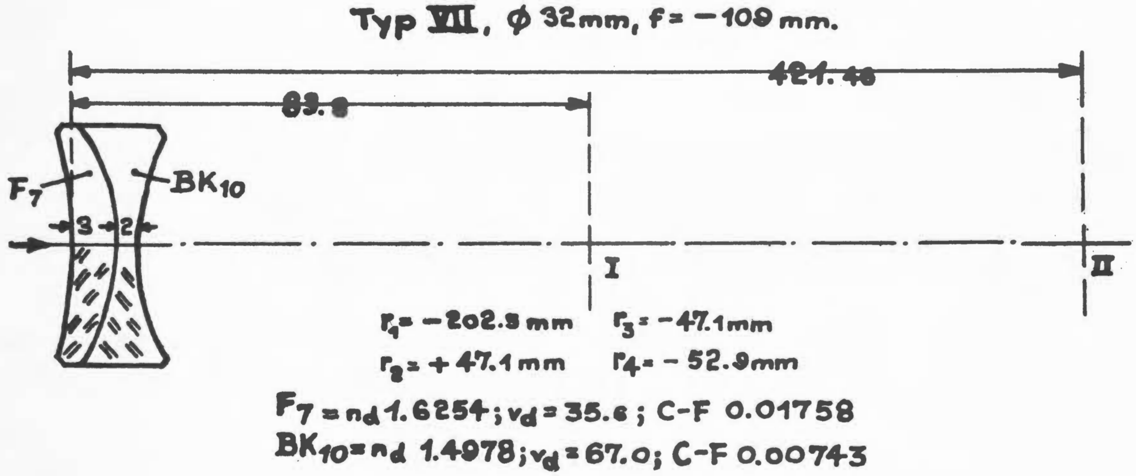



Figure 2.

Photographs of Jupiter in 1950 by E. E. Hare with a 12-inch reflector.

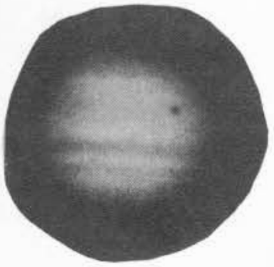


Fig. 3. August 6.
$8^h 5^m$, U.T.
C.M.$_1$ = 201°, C.M.$_2$ = 342°

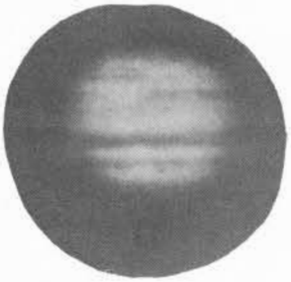


Fig. 4. Sept. 14.
$3^h 12^m$, U.T.
C.M.$_1$ = 64°, C.M.$_2$ = 269°.

Fig. 5. Sept. 13.
$5^h 11^m$, U.T.
C.M.$_1$ = 338°, C.M.$_2$ = 190°

Lunar Formation Bartlett. Mr. H. Percy Wilkins, the Lunar Director of the British Astronomical Association, writes that he is acting upon Mr. P.A. Moore's suggestion on pg. 7 of our July issue and is giving the name Bartlett to the curious formation on the moon between Fontenelle and Birmingham. We congratulate Dr. Bartlett upon a deserved honor! It was Dr. Bartlett who directed attention to Maedler's Square, now Bartlett, in an article in our December, 1950, issue. He thus raised a fascinating lunar mystery, whatever may be the final decision upon the curiously mystifying evidence for a major topographical change here during the last century.

Other A.L.P.O. members whose names appear upon the moon are Dr. Lincoln La Paz, Mr. David P. Barcroft, Mr. P. A. Moore, Mr. H. P. Wilkins, Señor Antonio Paluzíe, and Walter H. Haas.

Corrections to Article "The Meteorite of the Campo Del Cielo, Argentina" by Mr. Lorenzo Orestes Giacomelli in The Strolling Astronomer for February, 1951. In a letter dated April 11, 1951, Mr. Giacomelli pointed out several errors in our published translation. We thank him for his kind and helpful interest.

Page 10, line 28. "I am a modest amateur....", not subscriber.

Page 11, line 6. Piguem Nonraltá, not Pilguen Nonraltá.

Page 12, line 1. 1794, not 1795.

Page 12, line 40. Lagoon of the Paila, not Lake of the Paila. There are no lakes in the Campo del Cielo.

Page 12, lines 46-47. Read "The chemist Auguste Helman Gauna (Argentina) made the first, incomplete chemical study of this stone and observed..."

Page 13, line 15. Holes, not craters. Mr. Giacomelli wishes to stress that it is Dr. Nágera's opinion that we are dealing with holes of human construction. He hence considers the word craters inappropriate.

Page 14, line 2. Insert the phrase "more important no doubt" between the words second and because.

Page 14, line 25. Holes, not craters.

Page 14, line 27. Black Lagoon, not Black Lake.

Errors in September, 1951, issue. On pages 6 and 7 the 7.2-inch reflector employed by Venus observers Campbell, Merritt, and Royer belong to Royer, not to Courtright. Courtright employed his own 6.8-inch reflector. On pg. 4, line 15 the year of the reference is 1949, not 1941.

French Book upon Mercury. Mr. R. M. Baum writes that E. M. Antoniadi's classic book upon Mercury, La Planète Mercure et la Rotation des Satellites, can still be obtained from the publishers, Gauthiers-Villars, Paris, France. The book is excellently illustrated with drawings of Mercury made with the Meudon 33-inch refractor.

Notes about Mercury by Editor. On pg. 5 there appears a map of Mercury, which was drawn by Mr. Donald O'Toole on the basis of observations by A.L.P.O. members in April, 1950. It is discussed by Mr. O'Toole, who is our Mercury

Recorder, in the short article which follows. A.L.P.O. studies of the April, 1950, evening apparition were described by Mr. C. B. Stephenson on pp.2-5 of our November, 1950, issue; and three sample drawings were reproduced on pg. 1 of that issue. The map on pg. 5 may be compared to those by Schiaparelli and Antoniadi on pages 192 and 193 respectively of F. L. Whipple's Earth, Moon, and Planets. The nomenclature on Antoniadi's map has become an international standard for Mercury.

We hope that Mr. O'Toole's work will inspire others to observe Mercury carefully at the coming favorable evening apparition in March, 1952. An intensive, international, cooperative program with many participating observers might well prove very profitable.

## A MAP OF MERCURY BASED ON OBSERVATIONS IN APRIL, 1950

by Donald O'Toole

### The Map

This map is intended to be purely diagrammatic and indicates, therefore, merely the approximate sizes, shapes, and positions of the various markings. The markings were drawn only in the cases where at least 50% of the six participating observers recorded the individual feature under consideration. Thus, the first number enclosed inside each feature represents the number of observers who saw the marking. The second number indicates the intensity of the marking and is entirely relative to all other markings. It is estimated on a scale of 5-0-5, where 0 is the unit surface void of detail and 5 is the intensity on either side, depending on whether the marking is dark or bright. The dark markings are indicated by solid areas; the bright markings, by dashed ones. The phase is represented as gibbous, inasmuch as there were insufficient observations of the planet when nearly circular on which to base the identification of features. Orientation is as in an astronomical inverting telescope, with south at the top.

### Comparison With Antoniadi's Map

A copy of the map of Mercury by Antoniadi is on page 193 of Earth, Moon, and Planets by Whipple. Unlike Antoniadi's map, the April, 1950 map represents the planet in its average gibbous phase during the apparition; and the terminator at E corresponds to O on Antoniadi's map, and the limb at W is identical with a point near "Z" on Antoniadi's map.

The following is the probable identification of the lettered features, using Antoniadi's nomenclature:

A is S. Criophori
B is S. Aphrodites
C is S. Atlantis
D is S. Maiae - S. Panos
E is S. Persephones
F is S. Phoenicis
G is (?)
H is (?)
I is Neptuni vallis
J is S. Lyrae
K is Argyritis
L is Helii Prom.
M is Cyllene

Foreword. Mr. Ernest L. Pfannenschmidt, the Director of the Planet Section of the Bund der Sternfreunde in Germany, is already well known to many of our readers. The following article was first published in the February-March, 1951, issue of Mitteilungen Fuer Planetenbeobachter; and the two illustrations (Figures 1 and 2 on pg. 1) have been reproduced from that periodical with Mr. Pfannenschmidt's kind permission. We heartily recommend Mitteilungen to all lunar and planetary students having some knowledge of the German language. Our contributor's subject, the Barlow Lens, is certainly a timely one in view of recent widespread interest in this country in this valuable telescopic auxiliary. Planetarians will find a Barlow especially helpful with reflecting telescopes of short or ordinary focal ratios. Mr. Pfannenschmidt's address is (20b) Einbeck-Hannover, Grimsehl Strasse 18, British Zone, Germany.

## BARLOW MAGIC

by Ernest L. Pfannenschmidt

The author has frequently been asked to publish optical data for a good Barlow Lens. On page 1, Figs. 1-2 the reader will find two designs which have kindly been submitted to us by Dr. H. I. Gramatzki, optical division of the Kleinmachnow Observatory, Berlin, Germany. Mr. Gramatzki has been experimenting with elongating systems for over 30 years, and we are sincerely indebted to him for generously supplying us with these specifications. Before commenting on his designs, let us consider some general facts about B.L.'s.

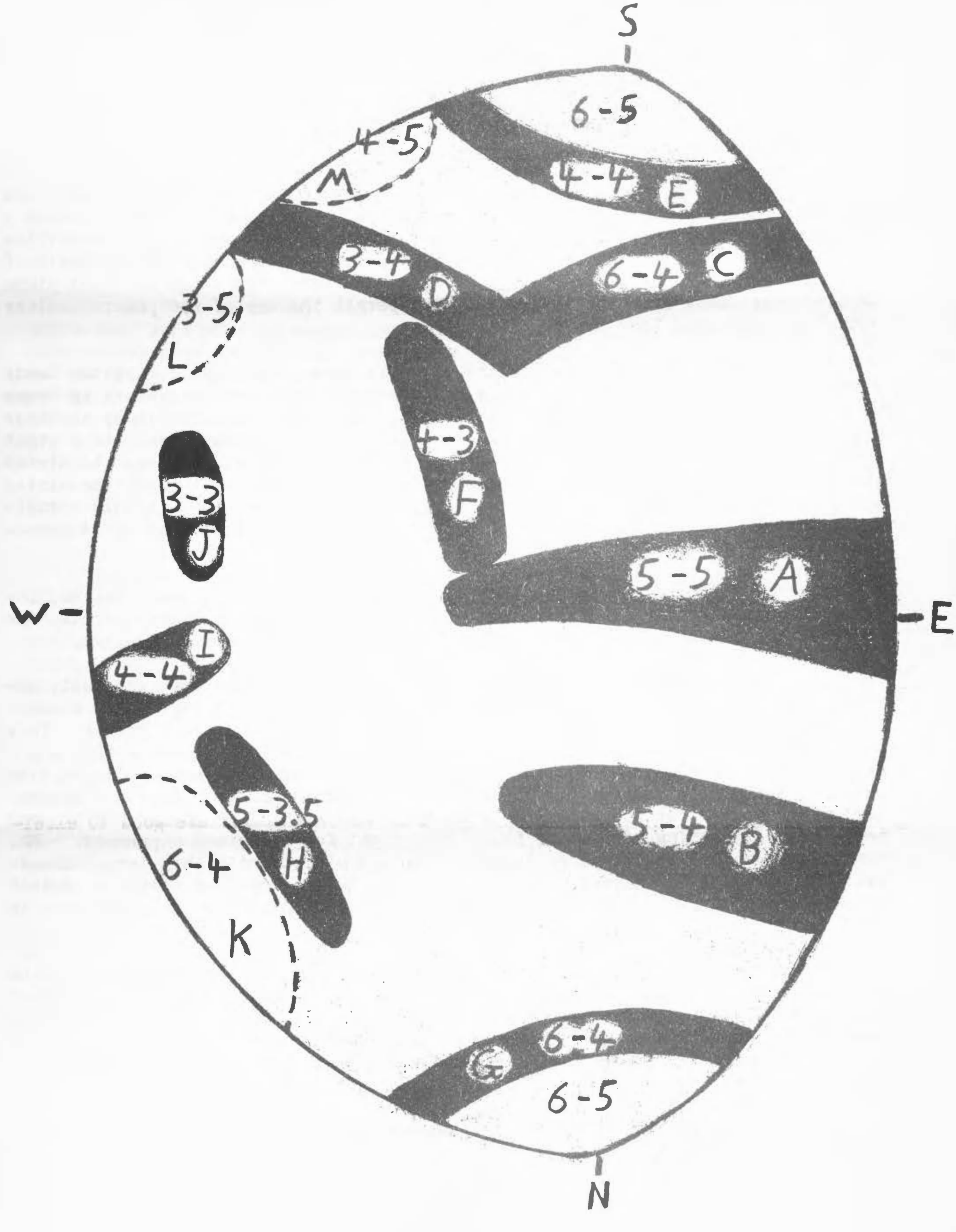
The principal supposition for employing a B.L. is, of course, an optically excellent objective. A B.L. can not and will not improve the performance of a defective primary system; on the contrary, together with the eyepiece it will rather tend to magnify such a system's faults. Really first class performance can only be had if the B.L. has been especially calculated for the objective - either mirror or O.G. - with which it is to be used. There is no such thing as "an all around good Barlow". Naturally a simple plano-concave or bi-concave lens, even if achromatic, is not a Barlow.

To begin with, we must distinguish between the combinations: speculum-Barlow, and object glass-Barlow. Theoretically even a good B.L. used in a reflector will not give the same performance as a long focus mirror of the same equivalent focal length. However, if the B.L. and the mirror are good to excellent, then there will be no noticeable difference in actual performance. The combination will be as good as the long focus objective referred to. Moreover, the field curvature of the combination will be less than that of said primary.

Used in a refracting telescope, our B.L. will magnify the O.G.'s secondary spectrum. This color aberration will be greater than the B.L.'s own injected secondary spectrum. However, it is possible to select glasses and radii that will give a B.L. capable of compensating secondary spectrum to a tolerable amount in a refractor and giving a general performance equal to that of an O.G. of equivalent focal length. Due to the color aberrations of the primary system our O.G.-B.L. combination will still be poorer in performance than a mirror-B.L. combination.

It is easy to see from the above that one can't very well calculate a B.L. that will perform well in both refracting and reflecting telescopes - not to mention instruments of various focal ratios.

MAP OF MERCURY IN APRIL, 1950. DRAWN BY D. O'TOOLE ON THE BASIS OF A.L.P.O. OBSERVATIONS.



Combined with a good speculum of moderate focal ratio a fine B.L., preferably coated, will give you the following astonishing advantages:

1. complete utilization of the objective's full aperture.
2. a wider field
3. less field curvature
4. better definition and resolution
5. reduced chromatic difference of magnification
6. increased eye relief.

To item No. 1: In general, the field lenses in higher power eyepieces are too small to grasp the objective's full aperture. Therefore, such eyepieces - to which planetary observers frequently have to take recourse - can not utilize the objective's full light feed. Properly inserted within the optical train of a telescope, a B.L. will grasp its full aperture, throw the original focal plane farther back (away from the objective), and permit the use of low power oculars with big lenses and long radii.

To items Nos. 2 - 5: The quality of definition in an optical system tends to increase with the decreasing angle of convergence of the image-forming beams of light, e.g., with increasing focal length. This pertains especially to image points farther off the axis. Now a B.L. elongates and spreads the steep light cones of high power objectives and therefore brings the light beams to strike the field lens of the eyepiece at an almost vertical angle. Anyone acquainted with the general principles of geometrical optics will realize that this results in an increase of field, quality of definition, and a reduction of field curvature.

To item No. 6: Due to the Barlow-induced increase in focal length, low power oculars with big eye lenses may be employed. Such eyepieces permit the observer to view the whole field without "glueing" the eye to the eyelens.

Let us now consider the Gramatski B.L.'s. Type IVc has been generally employed in lunar photography (Hilfsbuch der astronomischen Photographie; Himmelswelt Vol. VII/VIII, 1942) and was computed for coma free primary images. This condition is most nearly given by spherical mirrors of long focal ratio, e.g., F/10 and more. Higher elongating factors up to 3:1 are tolerable. Just slide the lens farther in towards the primary by the right amount. Type VII was especially computed for use with the "standard" F/8 parabolic primary mirror and has a high elongating factor of 5:1, just right for planetary observers. Mr. Gramatzki made his beautiful photographs of the planets with this lens (Himmelswelt 1928, pp. 1-5; Himmelswelt 1943, July-Sept.). Together with an 8-inch primary and good seeing this Barlow will photograph planetary detail down to 0".7.

The chromatic aberrations of these B.L.'s are far too insignificant to be noticeable. Their maximal magnitude is of the order of 20/100,000 of the focal length. Chromatic difference of magnification on the focal plane has carefully been avoided. The achromatization is photovisual, which means that blue and yellow rays of light converge. It is thus possible to focus visually when photographing.

There is no practical difference between visual images in these B.L.'s and those of a reflector.

A.T.M.'s interested in procuring Schott & Genossen glass blanks for these Barlows may write to the author. Present cost: per set Type IVc US dollars 1.00, Type VII US-dollars 1.70, plus tax. Prices subject to change. Please note that Mr. Gramatzki will not give permission to make or sell these patented lenses except for one's own private use in amateur astronomy.

## THE SPOTS OF JUPITER

by James C. Bartlett, Jr.

In the course of the evolution of theory we have seen Jupiter, the faintly self-luminous semi-sun, converted to Jupiter, the frigid and frozen Antarctica of the solar system. The white hot eruptions of yesteryear are today's icebergs of ammonia crystals.

Be all that as it may, the temptation to regard the Giant Planet as a miniature sun, sans visible radiation, is one hard to resist; and indeed some notable astronomers have freely subscribed to this concept. The analogies are many and striking; In both the sun and the planet the volume far exceeds the mass in value; the densities of the two, measured, measured on the water standard, are almost identical: 1.4 for the sun, 1.3 for Jupiter; in both bodies the limbs are appreciably darker than the centers; in the sun, as in Jupiter, there is a marked equatorial acceleration (though the relation between the periods of equator and higher regions is not as direct in Jupiter as in the sun); and in both bodies the surface markings are ephemeral, though displaying a little more permanency on Jupiter than on the sun.

Again, on Jupiter, as on the sun, activity is manifested in well-marked belts or zones; but perhaps the most striking analogy is to be found in the dark spots of Jupiter. We are impressed to find that the planet, like the star, is spotted. Indeed the writer was so impressed that he proposed to Mr. Elmer J. Reese, Jupiter authority of the A.L.P.O., the specific designation of these objects as "Jove spots" - a proposal happily resisted in the interest of euphony, for the term <u>is</u> rather barbaric and sadly lacks the smoothness of "sunspots".

Nevertheless, these Jovian spots not only resembly sunspots, as the latter would probably appear at the distance of Jupiter, but their behavior is also similar. According to Webb[1], Schwabe (the discoverer of the periodicity of sunspots) found that the larger Jovian spots were composed of separate entities; i.e., they formed <u>groups</u> as sunspots commonly do. Once, Schwabe observed a multiple spots surrounded by a common penumbra - a normal appearance of multiple-umbra sunspots. The same observer also saw the "resolution"of a spot (disintegration?) into small points. Large solar umbrae frequently break down into smaller fragments. Moreover, the Jovian spots, like their solar analogues, would also seem to be accompanied by bright elevations corresponding to solar faculae. Such Jovian faculae were observed in 1919. Antoniadi, using the 32.7-inch Meudon refractor, observed these objects near the Jovian limbs and thought that they both looked and behaved like solar faculae.[2]

Such parallelisms are certainly convincing, and yet a closer look reveals almost as many divergencies. To press the analogy further it must be shown that the Jovian spots, like sunspots, are subject to a law of periodicity. Moreover, this law must be such that a new cycle of spots will appear in high latitudes and gradually drift toward the equator, where they will disappear after awhile, giving rise to another high-latitude cycle, and so on. To date, such a periodicity has not been established for the Jovian spots - though it is not impossible that it might be. Other striking differences appear. Sunspots are commonly of very dissimilar areas. Jovian spots, on the other hand, are much more nearly of equal areas (we here, of course, and later refer to the dark spots of Jupiter). Sunspots, as a consequence of their periodicity, are conspicuously more numerous at some times than at others. Jovian spots are much more equally distributed in time. Again, sunspots almost never occur at latitudes higher than 45° north or south. Jovian spots may appear along the S.S.T.B. and have occasionally been seen in the polar regions, where (on the sun) sunspots never occur. The majority of Jovian spots seem to be permanently located on the south edge of the NEB and the north edge of the SEB. On the other hand, the position of a sunspot relative to the solar equator will depend upon the phase of the cycle. Perhaps the most notable difference between the Jovian and solar spots is in the relatively long life of the former. This was one of the points urged upon the writer by Mr. Reese, in the course of a Jovian correspondence, as opposed to a close analogy between sunspots and "Jove spots". It has to be admitted that the difference here is very marked;for Jovian spots may persist for many months, whereas sunspots are very ephemeral,[3] and a sunspot which persists through more than two rotations of the sun is regarded almost as phenomenal.

It is clear, therefore, that Jovian spots both are and are not like sunspots; and the balance between similarity and dissimilarity is pretty even. Perhaps it is probable that Jovian spots are similar in structure to sunspots, as Schwabe's observations would seem to show, and that they may have a similar origin. The differences may be related to the very much more rapid rotation of the planet and to the very dissimilar composition of its layers. The fact that Jupiter is intensely cold...maybe..and the sun intensely hot would not, as might be supposed, affect the argument for a similar origin; for it has been pretty well established that sunspots are merely low pressure systems in the sun's atmosphere, and in a planetary atmosphere, no matter how cold, there would certainly exist relative differences in temperature which would give rise to systems of atmospheric "highs" and "lows".

Mention has been made of Antoniadi's observations of faculae on Jupiter, or of objects which closely resembled solar faculae both in appearance and behavior. In this connection the writer would like to call attention to another class of Jovian objects, the festoons, which appear to bear some analogy to the so-called dark filaments on the sun. A festoon may be defined as a dark, wisp-like marking which commonly unites two dark belts across an intervening bright zone. Such festoons were seen in great profusion during the 1949 apparition of Jupiter, and the writer made a special study of them.[4] It was found that in almost every case the festoon began at a small "hump", or dark spot, on the south edge of the NEB and ended in a similar spot either on the E.B. or on the north edge of the SEB. In the latter case the festoon crossed the whole equatorial zone. Festoons connecting the S.E.B.s to the STB were also observed.

The nature of these objects is very difficult to deduce. That they are in some manner related to the spots which form their termini is obvious, and in appearance and behavior they suggest a path of attraction between the spots over which some force is operating as manifested by the festoon. But what is the nature of the force? And why does it manifest its hypothetical presence by a dark line?

The first difficulty might be overcome if we could establish magnetic fields in Jovian spots, similar to those in sunspots, and if we could further demonstrate that the spots of opposite belts had opposite polarities. In such a circumstance we might visualize magnetic lines of force between the opposite poles, over which paramagnetic matter would be distributed and give rise to the visible festoon.

The direct demonstration of such hypothetical magnetic fields centered on the Jovian spots is not very likely; for the observation of a Zeeman effect in a local area of the Jovian spectrum is, at best, a remote possibility. The oretical objection may also be raised on the ground that the magnetic fields of sunspots appear to be due to the rotation of ions in the vortex, the ions resulting from the very high solar temperature. What then would be the source of the ions in a Jovian vortex? Even assuming that the planet is hot. This objection, however, is not as formidable as it first appears. The source would be the ultra-violet, or ionizing, radiation of the sun. That it would not be as effective at the distance of Jupiter as it is at the distance of the earth is true, and yet there must be some degree of ionization of the upper Jovian atmosphere. Of course, if the Jovian temperature is actually as low as presently believed the degree and persistence of ionization would be markedly modified. However, free ions are not the only sources of magnetic fields. As Rowland showed in 1876,[5] if a charged body be rotated a magnetic field will be established. If therefore a rotating Jovian spot carries a charge it will generate a magnetic field. If the charges on two adjacent spots be dissimilar, an attraction will exist between them.

In passing it may be noted that the source of the charge does not present the same difficulties as the source of Jovian ions; for a charge is induced whenever a dielectric body is placed in motion and in contact with another dielectric body. Thus the Jovian atmosphere, in contact with the hypothetically rotating substance of the Jovian spot, might actually act as an electrostatic generator to charge the latter. It might be thought, in view of the distances involved between the terminal spots of a Jovian festoon system, that the respective magnetic fields of the former would have to be improbably intense in order for a flux to be established between them. But this does not necessarily follow. The field could actually be very weak (as in the magnetic field of the earth); but if the paramagnetic material between them was sufficiently attenuated, or very finely divided, the flux would be sufficient to determine its direction and thus give rise to a visible festoon. Thus the weak magnetic field of the earth is nevertheless strong enough to distort the path of ions and electrified particles in the earth's upper atmosphere, giving rise to the complicated structures observed in aurorae.

At any rate, the behavior of the festoon systems very strongly suggests an electromagnetic phenomenon. What would be the tensile strength of a column of ordinary gas extended across the whole E.Z. of Jupiter? Certainly very small. Yet the writer has repeatedly observed differential drifts in the two terminal spots of a system, whereby the festoon was, as it were, <u>drawn out</u> as if perfectly and infinitely elastic. This does not suggest an actual column of gas (improbable as such a structure would be anyway), but it can be accommodated to a flux existing between the spots.

The second difficulty in the electromagnetic theory of festoons, namely the nature of the supposed paramagnetic material and why it manifests itself as a dark line, cannot at present be removed so easily. Yet there is here comfort for those who believe in the ultra-frigidity of Jupiter; for it is a singular fact that many substances, e.g. oxygen, which are not magnetic at ordinary temperatures become strongly magnetic at very low temperatures. It is conceivable, therefore, that the paramagnetic material of the festoon may be derived from some constituent of the terminal spots themselves. But for the present we can only note the fact and guess at the inference.

Unfortunately, to the best of the writer's knowledge, the genesis of a festoon has not been observed. We do not know whether it begins in a single spot and moves upward (or downward) till it meets the center of opposite attraction or whether two spots simultaneously give rise to festoon-like processes which move toward one another and finally meet and coalesce to form the completed festoon. Until such an observation is made there will be an important gap in our theoretical speculations. Any why should not an enterprising A.L.P.O. member be the first to make it?

A recent observation of the writer resulted in a suggestive discovery (though suggestive of just <u>what</u> you had better not ask me). On August 4th, 1951, at $6^h\ 15^m$, U.T., T 5, S 6, C.M. (I) 170°.5, 100x on a 3.5-inch reflector, a remarkably long festoon was observed crossing the E.Z. N.W. to S.E. at a marked angle. The NEB terminal spot lay in longitude (I) 170°.5 (i.e., on the central meridian), while the SEB terminus was at longitude (I) 218°.2. Thus the difference between the termini was no less than 47°.7 of longitude. Memory thereupon recalled that an almost identical festoon had been observed in 1949; and on looking up the records for that year it was found that the writer had observed such a festoon August 24th, 1949, at $3^h\ 23^m$, C.M. 357°.2 (I). Like its analogue of August 4th, 1951, this festoon possessed a marked inclination; and the record showed that the difference in longitude between the termini was also 47°.7! On August 31st, 1949, $2^h\ 43^m$, C.M. 358°.3 (I), the earlier festoon had disappeared, but another, exactly similar, was seen much farther west. The difference in longitude between the termini was 45°. Is this merely coincidence? Or does it point to some fundamental law governing the genesis of this type of festoon? I leave the answer to my peers.

We may close this discussion by coming back to the apparent analogy between Jovian festoons and solar dark filaments. Here again the analogy, while striking, is not complete, if only because we know the nature of the solar filaments, namely hydrogen gas. Still, these vast hydrogen ribbons on the sun appear to be intimately related in some not understood manner to the sunspots, for they often occur between sunspots as termini. Like the Jovian festoons, the spots appear to exercise some attracting and determining influence;[6] and again like the Jovian festoons, the solar filaments are frequently highly inclined and have been observed to stretch across the solar equatorial zone,[7] and in general to cover incredible linear distances. In passing it may be remarked that the solar filaments are "dark" because of absorption.[8] But this would not appear to be a plausible explanation for the darkness of the Jovian festoons.

Such is Jupiter. A world presenting problems to last a dozen lifetimes. And if the famous Red Spot has presented us with a classical and yet not understood mystery, the much more modest dark spots will bear watching too. They are full of surprises.

References


1. Webb, T.W.; <u>Celestial Objects for Common Telescopes</u>; 1917; Longmans, Green and Co.; Longdon; p. 187.

2. Phillips, T.E.R.; Jupiter article in 14th Edition <u>Encylopaedia Britannica</u>.

3. Bartlett, J.C.: <u>Solar Bookkeeping</u>; Popular Astronomy; November, 1948.

4. Reese, Elmer J.; <u>Jupiter in September</u>; The Strolling Astronomer; November, 1949; p.5.

5. Dees, Bowen C.; <u>Fundamentals of Physics and their Applications in Modern Life</u>; 1945; The Blakiston Company, Philadelphia; p. 304.

6. Abetti, Giorgio; The Sun; 1938, D. Van Nostrand Co., Inc., New York; pp. 119 and 146.

7. Abetti, Giorgio; The Sun; 1938; D. Van Nostrand Co., Inc., New York; Fig. 54, p. 114 and fig. 62, p. 126.

8. Abetti, Giorgio; The Sun; 1938; D. Van Nostrand Co., Inc. New York; p.121.

## OBSERVATIONS AND COMMENTS

Figures 3 to 5 on pg. 1 are samples of E. E. Hare's highly creditable work in photographing the planet Jupiter in 1950. His procedure was to project the image through the eyepiece so that the diameter of Jupiter on the film was about one-fourth of an inch. He then employed exposures of five to eight seconds. Mr. E. K. White agrees with Mr. Hare that the best way to photograph the moon and the planets is by such projection, even at the cost of longer exposure times. White's telescope is a 9-inch reflector. Hare frequently enlarged the image of Jupiter several times more in making positive prints from his negatives. Figure 4 on pg. 1 shows the white, oval Red Spot Hollow well, with its following (right) end near the central meridian. On Figure 3 the shadow of satellite III is conspicuous near the east limb of Jupiter, while III itself is faintly present about one-half of a diameter of the planet to the east of the east limb. The editor would venture to say that Mr. Hare has photographed detail (not all of which may show clearly on our published reproductions) which it would be rather difficult to see with a five- or six-inch telescope. We hope soon to persuade some qualified A.L.P.O. member to write an article on lunar and planetary photography, an aspect of our studies that deserves more attention. Possessors of telescopes with apertures of nine inches and more may well seek to imitate Hare's successes.

We acknowledge with thanks the arrival of observations of the brightness of Neptune from R. W. Hamilton, D. W. Rosebrugh, and C. Tarwater. This observational project was described on pp.2-4 of our May, 1951, issue. Mr. Hamilton employed a 3-inch refractor; Mr. Rosebrugh, binoculars and 3-inch and 4-inch refractors, his preference being for the small telescopes; and Mr. Tarwater, 8 x 50 monoculars. Tarwater thinks that the fact that the same comparison stars must be used over and over again results in a loss of accuracy through a lack of independence of the estimates. The editor lacks experience in variable star work but would answer that, first, the observer has no *a priori* reason to expect the light of Neptune either to vary or to fail to vary and, second, a step-estimate should be easy to forget in observations a number of days apart. *We would like to request that any unreported 1951 Neptune observations be submitted at once.* We tentatively plan to continue this observational program in 1952.

What are very likely the first A.L.P.O. drawings of Mars for its 1951-52 apparition, now barely beginning, were secured by Mr. Tsuneo Saheki on August 24 and 30 with an 8-inch reflector at 400X. The angular diameter was only 3".8 so that Mars presented a disc as small as that of Uranus! It is *very creditable* to the observer and his instrument that in spite of such a handicap Syrtis Major and some large northern and southern *maria* are shown rather well. Neither polar cap was even suspected of being visible, but a yellowish white tone of the northern polar regions might be due to clouds. It should be mentioned that the Martian season was early spring in the northern hemisphere, the vernal equinox having fallen on July 15, and that the north pole was tipped toward the earth by 15 degrees. Shakei's August 30 view indicates that the Casius-Utopia shading is as large and as prominent as in 1950. Mr. Saheki has very kindly submitted to us an "Ephemeris for Physical Observations of Mars" for the months of August and September, 1951. The time required to compute this "Ephemeris" was obviously great. We are thus enabled to supply to anyone desiring such data for August and September the physical quantities employed by students of Mars. From October 1 to the end of the year these items are given on pp. 440-441 of the 1951 A.E.N.A.

In letters on August 12 and September 16 C. M. Cyrus expressed considerable interest in the article "The Capabilities and Limitations of Small Telescopes" in our August issue. He has perceived with averted vision a star of magnitude 13.9 with his 10-inch mirror was freshly aluminized and could not see dimmer ones. He expresses much surprise that English observers should see a twelfth magnitude star with two inches of aperture and a fourteenth magnitude star with five inches. The editor wonders whether there may be a differing criterion here as regards the "faintest star seen" between Cyrus and the B.A.A. observers. D.W. Rosebrugh, the well-known variable-star observer, considers that he can catch glimpses of a star as much as a magnitude and a half fainter than the dimmest one that he can see steadily. As regards resolving power, Mr. Cyrus tells of dividing the double star Eta Orionis "reasonably well" with a 6-inch aperture and mediocre seeing. He considers that he could have resolved it with only 4.5 inches under perfect conditions. Norton's Star Atlas, Tenth Edition, gives the separation of Eta Orionis as 1".4 and describes it as "test for 4-inch". Perhaps other readers would like to communicate their personal experiences with the limitations of small telescopes as regards both light-grasp and resolving-power. The subject is one of basic importance in amateur observational work.

D. O'Toole has had some correspondence with R. M. Baum about Lowell's controversial observations of Mercury. On this planet Lowell saw a network of narrow dark streaks, being thus in complete discord with most observers of Mercury. Mr. Baum proposes, however, that a close study really reveals much agreement between Lowell and others and concludes: "Thus the curious network of streaks of Lowell and the partial streak-like features of Schiaparelli become similar to the extensive dusky grey regions drawn by Denning and Antoniadi." For example, Lowell drew a mass of dusky streaks in the position of Antoniadi's S. Lycaonis; and it is interesting that O'Toole saw three streaks here in a good view on October 9, 1950. O'Toole's drawing of that date is reproduced as Figure 2 on pg. 3 of our April, 1951, issue. An excellent article on the role of "personal equation" in drawing difficult lunar and planetary features in H. McEwen's "The Markings of Mercury", Journal of the British Astronomical Association, Vol. 46, pg. 382, 1936. It shows in an instructive manner how different observers may differ greatly in drawing the same feature.

Observations of Saturn have been contributed by J. C. Bartlett, Jr. (3.5-inch refl.), W. H. Haas (6-inch refl.), T. Osawa (6-inch refl.), and C. C. Post (6-inch refl.). In addition, Mr. G. D. Roth, the Director of the Saturn Section of the Bund der Sternfreunde in Germany, has sent us a summary of observational work there upon the 1950-51 apparition of Saturn, along with four sample drawings.

Bartlett and Haas observed in early August when the apparition was ending. Bartlett considered the South Equatorial Belt to be the most conspicuous belt on August 2, but Haas called the North Temperate Belt much the plainest one on August 7. Bartlett could see no difference in brightness or color between the east and west arms of the rings (pp. 12-13 of September issue). Haas found that the Equatorial Zone (between S.E.B. and projected rings) was very dull and that the ball was much more dusky north of the N.T.B. than south of the S.E.B. On

August 5 Bartlett noted a darker and wider section of the S.E.B. near the east limb, perhaps one of the sections which he observed in late June and early July. The South Tropical Zone still looked bright to this observer on August 2, but the brightest zone was the Equatorial Zone - North Tropical Zone.

Post made his only drawing on June 7. He recorded both the S.E.B. and the N.T.B., the latter being much the broader. Cassini's Division revealed itself as two black dots at the ansae, indicating excellent definition. Mr. Post saw imperfectly the shadow of the ball on the rings, a brighter portion of Ring B, and the dark wedge of sky between the rings and the ball.

Osawa has contributed five observations from April 4 to May 23. He found that the N.T.B. and the S.E.B. were the most prominent belts in the north and south hemispheres respectively, and the N.T.B. was the wider and darker of the two. On May 2 the N.T.B. was doubled, the north component being much fainter than the south one. The space between the components was white. Osawa recorded a North North Temperate Belt and a North North North Temperate Belt, which were both very dark on April 4. A South Temperate Belt and a South South Temperate Belt were noted at comparable southern latitudes. Osawa sometimes saw clearly white areas on the limbs of Saturn; these are shown well to the north of the N.T.B. on Figure 4 on pg. 1 of our July, 1951, issue and have also been observed in recent years by Reese and Haas. The Equatorial Zone - North Tropical Zone was brilliant and was white or yellowish in color. The South Polar Region was consistently darker than the North Polar Region; and Osawa's May 2 drawing shows a small, notably dark south cap, very reminiscent of some of the observations of this feature last spring and summer by Ranck and Bartlett. One or two bright zones in high southern latitudes were drawn. Cassini's Division and Ring C were seen well, and Ring A was notably dusky compared to Ring B. Osawa saw a truly remarkable amount of fine detail on the ball; there were many humps along the edges of the S.E.B. and the N.T.B., and often wisy dark streaks joined two belts across an intervening bright zone. It is very curious that dark projections appeared to connect the shadow of the rings and the S.E.B. on May 22 and 23; Osawa writes that T. Saheki saw a similar appearance on May 24. The general appearance of fine detail on the belt-edges and in the zones reminded Osawa of his observations of Jupiter in 1950.

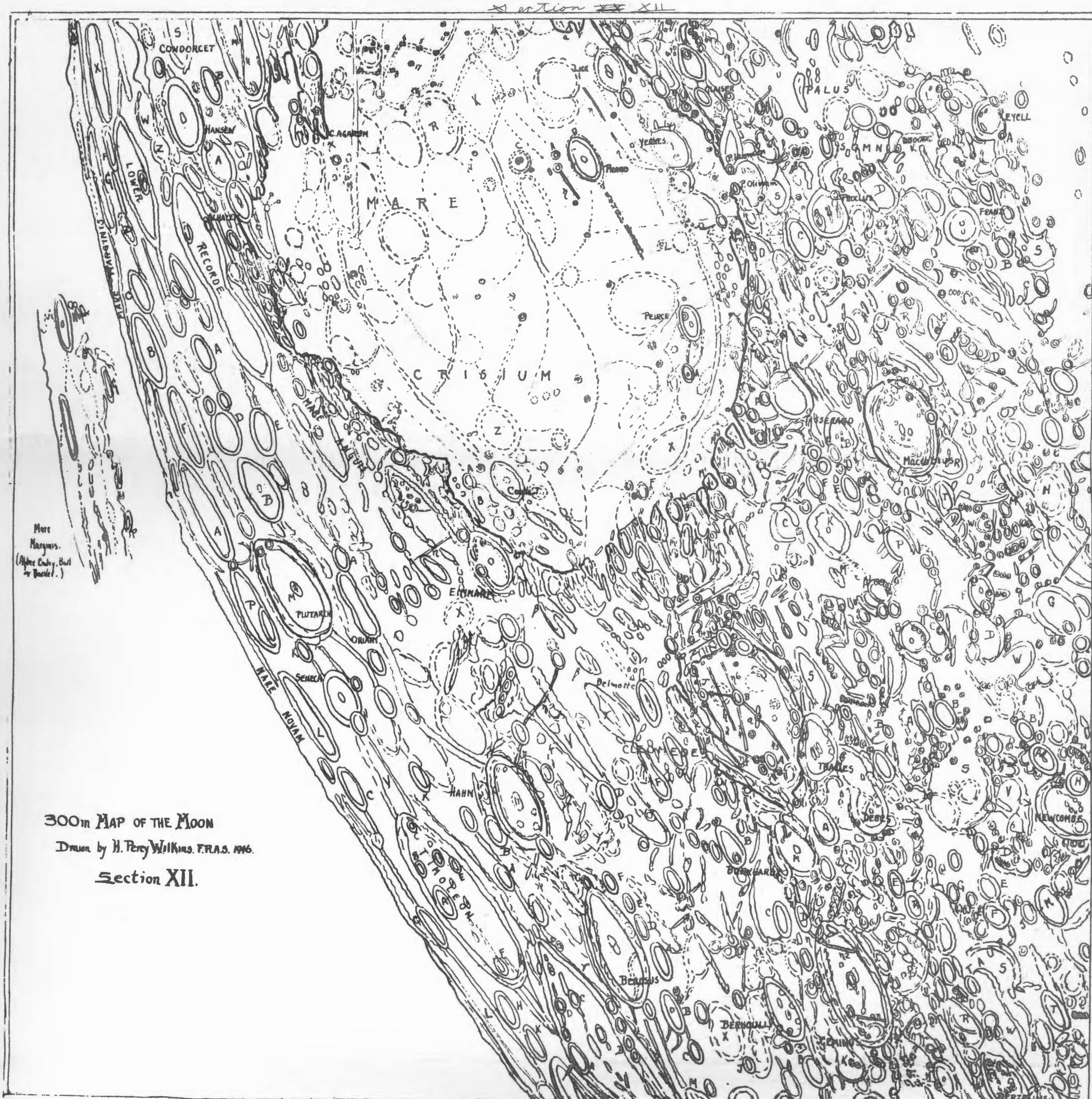
Mr. Osawa drew a very curious object on April 4 at $13^h 30^m$, U.T. On the east limb (right in simply inverted view with south at the top) slightly south of the latitude of the south edge of the South Equatorial Belt there was a bright bulge, and just south of the bulge there was a small hollow on the limb. Is it possible that we are dealing with Saturnian clouds temporarily (and very infrequently?) lying at different levels than the reflecting surface? The required differences of elevation are, however, great; for on April 4 the polar diameter of Saturn was 17".5 so that a second of arc equalled almost four thousand miles. Hence, a true cloud-projection (or cloud-depression) of only 0".2 at the limb - and one could scarcely hope to detect a much smaller one with a 6-inch telescope -would require a difference in level of 800 miles. Therefore, it may be most plausible to attribute the bulge and the hollow to irradiation at the limb upon a bright and a dark feature respectively. The infrequency of such observations would appear to demand features of very unusual brightness or darkness. Irradiation or not, the observation is somewhat reminiscent of W. Herschel's "square-shouldered" aspect of Saturn. R. A. Proctor on pp. 149-155 of his Other Worlds than Ours presents an imposing list of famous observers who have sometimes seen distortions of the figure of Saturn, but such observations apparently have been seldom repeated since 1860.

Mr. G. D. Roth reports that 8 members of the Bund der Sternfreunde, using apertures ranging from two to ten inches, secured about 65 observations of Saturn in February-June, 1951. They found our North Temperate Belt and South Equatorial Belt to be the most prominent belts. These were often double, especially the N.T.B. The south edge of the N.T.B. was frequently sharp and dark; the north component was sometimes very faint and was visible only in disconnected sections. Most of the German observers often drew darker spots and darker sections within both the S.E.B. and the N.T.B., and H. Schumacher and others sought to determine the longitudes of these features. Unfortunately, the observations are not abundant enough to establish reliable rotation-periods. Mr. Roth proposes, and we agree, that observational cooperation on an international scale may well be needed to produce worthwhile information about the rotation of Saturn. Certainly this approach would be an ideal one since suitable features are scarce. The Equatorial Zone-North Tropical Zone was very bright in February-March but was narrower and slightly dimmer in April-June. Its color was white. (J. C. Bartlett may confirm the German observers about this dimming.) Mr. Roth's observers sometimes suspected a South Tropical Zone south of the S.E.B. and a North Temperate Zone north of the N.T.B. and drew a few bright clouds in them. On the Poleward side of these zones were a South Temperate Belt and a North North Temperate Belt. The former varied in darkness, and the latter was visible in broken sections only. The two polar regions were shaded about equally. Dr. W. Sandner and Mr. Roth used color filters but disagree somewhat about their effects on detail. More experimenting appears necessary. Five of the eight observers recorded "light knots" on the ring-arms, and three of them agreed that the knots lay near Cassini's Division. The bright spots were not reported by American observers in 1951. They are well shown, for example, in a 1920 drawing by W.H. Steavenson with a 28-inch refractor, this drawing being reproduced on pg. 370 of Volume I of Hutchinson's Splendour of the Heavens. The explanation usually given is that when the unilluminated side of the rings is turned toward the earth, sunlight penetrates through the thinnest portions of the rings, particularly Cassini's Division and the Crape Ring. In 1951, however, the sun and the earth were always on the same side of the ring-plane.

Near $7^h$, U.T., on August 18, 1951, C. Tarwater, T. A. Cragg, T. R. Cave, Jr., W. H. Haas, and perhaps one or two others had an excellent view of the lunar walled plain Plato in Mr. Tarwater's 8-inch reflector at 180X and 360X. (Others in the party were D. P. Barcroft, D. L. Bellot, C. Landquist, and C. C. Post; but it is not certain from memory that all of these observed Plato.) The colongitude was 100°4; it was lunar noon on Plato. The craterlets on the floor, naturally seen as white spots under such high lighting, were very small and very sharp. All observers who examined the "twin craterlets" in the north central part of the floor (numbers 3 and 4 on Figure 5 on pg. 1 of our March, 1951, issue) agree that the northeast craterlet was very definitely larger, brighter, and more conspicuous than the southwest one. This observation should be completely reliable; the appearance was unmistakable to all the observers, and the twins were separated very well. It is not certain, of course, that the spots seen at noon have exactly the same outlines as the craters they represent. The relative sizes of the twin craterlets in Plato was discussed in our January, 1951, issue and has been mentioned from time to time since then, usually in connection with current observations.

On pg. 14 of our June issue we mentioned E. J. Reese's intensive study of the appearance of the lunar crater Conon on photographs at large observatories. Writing on August 3, Reese tells us that E. E. Hare is engaging in a similar study and says: "Our independent drawings clearly establish that there are apparent differences between photographs taken under similar lighting". Mr. Hare has pointed out that duplicate negatives are needed to establish the reality of very delicate markings. It is certain that the photographs do show a number of features on the floor of Conon.

~~Section IV~~ XII




Section XII

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OF

H.P. WILKINS 300-INCH MAP OF THE MOON

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