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REPORT ON MARS, No. 18
Suggestions and General Data.

WILLIAM H. PICKERING.

In planning our work for the coming opposition it will be well to consider first the conditions which determine the date on which the observations may profitably be begun. It is of no use except for some especial investigation to attempt to observe the planet when it is within 3^h of the Sun. This is not so much because the planet is then so small, but rather that its altitude is then too low, even at sunrise, to distinguish much detail upon its surface. If we turn to the column headed "Transit Meridian of Greenwich" under Mars in the *American Ephemeris* p. 162, we shall find that the hour constantly diminishes, since Mars is an exterior planet. It reaches 20^h, which means that Mars is 4^h west of the Sun, on October 12, 1917. This is about the first date that it could be really profitably observed in the temperate zones. The declination at this time is $+16°.7$. Turning now to the "Ephemeris for Physical Observations" in the same volume, we find that the solar longitude $\odot$ is $17°.7$, corresponding to the Martian Date March 37 (See Report No. 10). Spring will thus have begun, the yellow north polar cloud cap will have dissipated, and the white polar snow cap be visible and very large, but diminishing in size. Vegetation in the southern hemisphere will also have taken on its bright green hue. According to the *Ephemeris* the diameter of the planet on this date is given as $5''.47$. Making the correction described in Report No. 15, this is reduced to $5''.07$. Although this is rather a small disk, yet with good seeing it is ample to enable us to detect considerable detail, and those who are sufficiently enthusiastic to be up before sunrise may obtain observations at any time after this date which will be of use in solving the mysteries of the planet, and especially in recording the dates of the periodic floods occurring upon its surface in the northern portion of the Syrtis Major. These observations are much to be desired, since no more can be obtained to advantage after next January for a number of years (See Report No. 17).

Any person desiring to contribute drawings suitable for publication at the conclusion of the opposition should consult Reports No. 11 and 15 for specifications. In these drawings the axis of the planet should be vertical, and its position indicated by short lines drawn on the disk at the poles, as shown in Report No 17, Figures 2, 6, 10, 14, 18, and 22. In these particular figures, however, the northern lines have been erased by the engraver in whitening the polar cap, leaving only the southern ones. In this connection it may be pointed out that if a special observing book is reserved for the planet, and any considerable part of the suggestions made in these reports adopted, it will be found convenient to copy into the beginning of it the Standard Scale of Seeing from Report No. 9, and also Tables I and II from Report No. 15.

The date of the coming opposition is March 14, 1918, and the six drawings should all be made between February 10 and April 20 inclusive, and the finished results mailed to the writer at Mandeville, Jamaica, B. W. I., not later than May 20. If a complete set of drawings cannot be obtained, it is possible that some of those furnished may still be published if they are really good, and the central meridians are near the adopted longitudes. Sufficient information must be given with each drawlng to make it possible to fill out a table similar to Table I in Report No. 17. Observers are cautioned not to draw anything unless they are sure of it, and particularly not to attempt to see too many lakes and canals. Those seen by only one observer count against his drawings. Especial attention should be paid to the shapes and detail of the more readily seen features. The drawings should always be made by the observer seated at the telescope, in order that they may constantly be corrected by comparison with the planet itself. One observer with whom the writer was acquainted formerly made his drawings at a little table near the telescope, going back and forth between the two, and in this way obtained results differing in some marked respects from those of other astronomers. The danger of this method is that preconceived impressions of what it is thought the detail should be, will take the place of facts. Small changes of detail are also liable to pass unnoted. Observers should on no account take a map of the planet to the telescope in order to hunt for previously recorded canals and lakes. This would not only prejudice their work in favor of those already known, and in favor of locations already recorded, but also in favor of the particular map they selected to use, all of which prejudices are distinctly objectionable.

It would appear to the writer in looking over the drawings in Report No. 17 that the two reflectors did excellent work, and that for a moderate priced instrument intended for use on planetary or lunar detail, the same amount of money spent on a reflector will secure

better results than if spent on a refractor. It is suggested that each observer who made records at the last opposition should compare his drawings with what might be described as a composite of all the drawings published in Report No. 17, criticize them, note the differences and the coming year make a point of deciding for himself which was right. It is unfortunate that half the observers of region B failed to secure drawings when longitude 60° was near the central meridian. This causes these drawings to appear more unlike than is really the case.

In region C, longitude 120°, the divergence is real, and due to the fact that very little contrast was shown by the planet. What little there was had to be greatly exaggerated by the observers in order to show it at all. Figures 12 and 30 are the most divergent, the others apparently all saw about the same thing, although it was imperfectly distinguished by them. After the period at which these drawings were made, however, this region began to show more detail. When ⊙ had reached 73°.7 Tithonius stretched itself far beyond Phoenicis Lacus to longitude 120°, and Gigas confirmed its name, by assuming an enormous width of some 500 miles. It was evident that this region was only awaiting its turn, until the development of the other regions to the east and west of it was completed. At the coming opposition we shall therefore be able to study it to more advantage, and it is possible that instead of being the least interesting region on the planet, it may prove to be the most so. Near its center is found the shifting Nodus Gordii, whose position should be accurately determined whenever possible, and which it is expected may also show changes in density, perhaps from hour to hour. That many canals may develop is also possible, to say nothing of Phoenicis Lacus, which is at times a very marked object, but of late has been seldom recorded.

A careful and beautifully illustrated record of observations made in February 1916 has been received from Mr. McEwen, but too late to appear in any of the former Reports. It is of interest that he describes and illustrates Aurorae, Margaritifer, and Sabaeus as of a full Delft blue, while Acidalium is neutral tint. The writer made a number of color sketches in January and February, Only two, however, one of January 30 and the other of February 26 show these regions. On the former Acidalium is neutral tint, Sabaeus brown, and the region south of Margaritifer green. On the latter, which was considered particularly satisfactory, Acidalium was a gray blue, and Sabaeus, Margaritifer, and Aurorae neutral tint. Nothing like a Delft blue has been seen on any occasion during the last two oppositions in the equatorial regions of the planet. Color observations of these small regions are very difficult to make with a small telescope, but it is probable that the chief cause

of the difference in the results is due to the color of the artificial light employed to illumine the paper. Mr. McEwen uses an oil flame, which gives results for the reds and yellows in close accordance with the writer's. The writer uses, as described in his recent paper on "The Colors of the Stars and Planets," a tungsten lamp shining through a combination of blue glass. More or less blue glass is added until the color of the northern snow cap of the planet exactly matches the white paper on which the color sketch is to be made. It is thought that the various colored regions of the disk should then be correctly represented. In case the snow cap is concealed by clouds, blue glass is added until these appear of a pale straw color.

Attention is again called to the desirability of recording the first appearance of Aryn in the Sinus Sabaeus. At the last opposition although especial attention was drawn to this matter, much divergence of testimony is given, those who were particularly looking for it seeing it in general much later than those who were not. While the latter undoubtedly thought they saw it, and perhaps did, it is suggested that they may have drawn it, merely because they expected it, and thought it ought to be there. Messrs. Lau and McEwen failed to see it as late as February 20. Mr. Phillips, Professor Douglass, and the writer all thought it appeared at about the same time, between February 27 and March 7. The mean solar longitude ⊙ would be 62°. Although carefully looked for in 1914 the writer was pretty sure it was not really visible before March 21, when he suspected it, at ⊙ 51°. He did not feel at all sure of it, however, even then. On the other hand M. Jarry Desloges in a recent letter declares that he saw it both in December and January of the past opposition, thus fully confirming Mr. Wilson, who drew it as clearly visible January 23. On January 23, 24, and 30 the writer felt particularly certain that it was not visible, the seeing being 6, 7 and 9. The question is therefore still undecided, and special drawings of this region should be made whenever possible this coming winter. The planet will reach ⊙ 62° on January 19. The development of this point is of particular interest since it is the assumed origin of longitudes upon Mars.

The maximum diameter of the planet at this opposition will be 15″.27 according to the ephemeris. Correcting this by dividing it by 13.6 and subtracting the result, gives us 14″.15 for its true diameter, or a trifle larger than at the previous opposition. This correction applies to all the European almanacs as well as to the *American Ephemeris*. The writer has been informed from Washington that the required change to avoid this correction will be made in the ephemeris for 1920, but that it was impossible to make the necessary corrections before that date. All the almanacs will then be changed. Those American

observers who are interested in Mars will also be glad to hear that, beginning with 1920, the ephemeris will be calculated for Greenwich midnight instead of noon, thus making interpolations more accurate and convenient, and that the central meridian will be given for every day instead of only for alternate days as heretofore.

For those wishing to study the planet seriously, and who are willing to get up early to observe it, the following plan is recommended. The hours at which it is practicable to observe the meridians 0°, 60°, 120°, 180°, 240°, and 300°, when transiting the center of the disk, should be computed for every day from the date when "Transit Meridian of Greenwich" reaches 20^h until it drops to 4^h, or from October 12, 1917, to August 24, 1918. This is readily done by following the instructions given in Report No. 15. At least one drawing should be secured in each of these six positions of the planet for every presentation between these dates. This means in general that one drawing must be made every six days. Unfortunately in 1918 the Physical Ephemeris of Mars is not published after July 2, but this will be remedied for future oppositions. Between the dates when the planet occupies the same position in its orbit that it did at the last and at the following oppositions, namely those of 1916 and 1920, additional drawings should be secured. These are obtained when the meridians 30°, 90°, 150°, 210°, 270°, and 330° are central. In 1916 opposition occurred on February 9. Adding 687 days, the sidereal period of Mars, brings us to December 27, 1917, when Mars will attain the same position in its orbit, and the series of additional drawings should be begun. The ephemeris for 1920 is not yet out, but opposition will occur about April 21. Subtracting 687 days from this, would give us June 4, 1918, for our later date. Between these two dates then at least one drawing should be secured every three days.

If this plan of work is carried out at every opposition, we shall at the end of fifteen years have two independent sets of drawings, made in different years, in every 30° of longitude upon the planet, throughout the whole of the Martian year. Besides this we shall have numerous other drawings made in every 60° of longitude when the planet was more remote from the earth. Such a series was begun two years ago at this observatory, and it is hoped that some other observer may feel inclined to follow out the same or a similar plan elsewhere. It is much better to secure a comparatively few carefully executed drawings each year than to make a great number of irregularly distributed careless sketches, many of which are duplicates.

At each successive opposition we see the planet at a somewhat later season of its year than at the previous one. Thus prior to November 17 of this year, when the solar longitude $\odot$ reaches 34°.1, and the Martian

date is April 15, the planet will be in a portion of its orbit which we were able to study to more advantage in 1914 than we can the present year. That is to say we were nearer to the planet then than we shall be now. From November 14, 1917 until February 5, 1918, when ⊙ reaches 69°.4 and the Martian date is May 37, the planet will be gradually getting nearer to us, but will not be as near as it was in 1916. After February 5, 1918, however, the planet will have reached a portion of its orbit, that is to say a season of its year, in which we have not been able to study it to as much advantage for the past fifteen years.

It will reach its summer solstice on March 24, Martian date June 27, only ten days after opposition, and but six days after its nearest approach to the Earth. It will therefore be placed in an unusually favorable position for the study of its more northerly latitudes. Indeed so favorable an opposition for this purpose will not occur again for a great many years. The declination is also favorable to northern observers. After October 31 the inclination of the plane of its equator to the line of sight will not fall below 21° for the remainder of the opposition. Special attention should therefore be paid to the melting of the snow cap, and the sudden formation in it of rifts. These latter will generally occur early in the season. When they appear, the polar marshes immediately increase in size, and clouds form in their western borders. Following them the marshes slowly travel westerly, that is to higher longitudes. This will evidently not be a favorable year for detecting an early snowfall in the southern hemisphere. It may be, however, as the winter season progresses in 1918, that we shall then see something of the southern snows, if they are not entirely concealed by clouds. The southern polar cap, unlike the northern one, is eccentric and extends farthest north in longitude 30°, near Margaritifer.

It was noted in Report No. 13 that the northern snow cap extended 5°, or 185 miles, farther south during the opposition of 1916 than it had in the previous one. Later in the Report it was suggested that it would be a matter of interest to see if a colder winter on Mars was followed by a colder winter on the Earth. While the writer has no general figures available to settle this question, the popular reports were that it was an unusually long, cold winter, both in America and Europe. The mean temperatures for this station will be published elsewhere, but the fluctuations in the tropics are usually so regular, that we are enabled to look at the matter in consequence from a somewhat different standpoint. During the five previous winters we have had in all 22 cold nights, that is nights when the minimum thermometer fell to 60°.0, the lowest temperature recorded being 56°.1. In this past winter alone we had 28 cold nights, or more than in all the other five years put together, five of them falling in April. During the past five years

we have had in all 71 hot days, that is days on which the maximum thermometer registered above 85°.0. The number per year ranged from 8 to 22, the highest temperature recorded being 89°.2. This year on only one day did the thermometer exceed 85°.0, and then it rose to 86°.5. It therefore appears that a cold winter on Mars has been followed by an unusually cold year in Mandeville, and perhaps elsewhere in the tropics.

What will make this opposition an especially interesting one, however, is the fact that this year the canals are expected to reach their maximum number. But it is also believed that they will be finer and more delicate than heretofore. We shall therefore require the best of seeing to draw them to advantage. They will probably also be straighter and more artificial looking than of recent years. The double effect due to refraction, caused by rapidly passing waves in our own atmosphere should be well seen. These conclusions are based largely on what was observed towards the end of the last opposition, and in part on the observations of other years. If the markings on the planet ever present a distinctly artificial appearance, they should do so this year. An especial effort should therefore be made to secure any facts that will throw light on their nature, their method of formation and disappearance. Observers should be particularly on the lookout for any curvature that they may possess, since when poorly seen the tendency is always to draw them as straight lines. At the same time there is strong evidence that many of the longer ones really are straight, as seen with our best optical powers. Written notes on the straightness of particular canals are very desirable.

While as many as 33 lakes were noted at the last opposition, it is unfortunate that only twelve of them were seen by more than one observer, and a certain amount of doubt is therefore thrown not only over the remaining 21, but even over some of those that were recorded by two observers, as possibly being merely accidental coincidences. The existence of the eight lakes seen by three or more observers seems to be fairly assured, and doubtless many of the others were genuine. Perhaps the fault really lay with those observers who saw too few lakes, and that they devoted their attention too exclusively to the canals. It is believed in general that the lakes appear rather later than the canals, and therefore observers should make a point of looking for them at the coming opposition. While their visibility may be best recorded by means of a Scale of Lakes attached to the telescope, such, as is described in Report No. 7, another way of recording them is by comparing them with the lunar lakes as seen in an ordinary opera glass, as is described in Report No. 6. All good opera glasses of the older type magnify two and a half times, so that this magnification may be looked on as a standard.

Hourly Changes in the Canals.

It is fairly certain that a number of the canals are simply marshes. This is shown in part by the clouds following them, but mainly by their changes in breadth and density from hour to hour. The so-called canals bounding the polar cap grow distinctly darker and broader as the Martian day wears on, and as the snow melts under the midday Sun. They usually retreat with the snow cap as that gradually diminishes in size, but later in the season they are sometimes left behind by it, another canal forming between them and the snow. They often recede from the snow in a diagonal direction, forming thus very elongated marshes (See Reports Nos. 4 and 14). Ephemeral canals are not however confined exclusively to the vicinity of the snow cap. Some very striking ones were found in the Protei Regio in 1914 (See Report No. 8).

Still another variety of change has been noted in other canals situated near the equator. Instead of growing darker as the Sun gets higher, they grow lighter. Thus on November 26, 1915, Casius, in latitude + 40°, was strikingly dark 30° before reaching the central meridian. Two hours later, when it transited, it was much fainter, being even less marked than the Syrtis, which was nearer the limb (See Report No. 13). There had clearly been a heavy precipitation during the previous night in this region, and a rapid evaporation the following morning, as the warm spring Sun approached its meridian. It appears therefore that while the canals grow darker towards noon in the polar regions, they grow lighter towards noon nearer the equator. A dark spot which shifts about into different positions, and is seen sometimes in one place and sometimes in another, in the vicinity of the region marked Nodus Gordii is evidently a marking of this character (See Report No. 13).

In a recent letter from one of our associated members, Dr. Lau, he says "My drawings show (or appear to show) a very curious fact regarding the faint halftones between Gehon, Deuteronilus, and the place of Hiddekel, (Hiddekel being invisible in my 4-inch). I have never been able to see those shades after the transit through the central meridian. It is absent on 22 drawings from 1914 and 1916! Boiled away?" An examination of my own drawings entirely confirms Dr. Lau's observation, and I feel there is no question but that, owing to the low pressure of the atmosphere of Mars, his explanation that the moisture has evaporated is correct.

The question immediately presents itself to us, are all the canals merely marshes, or are some of them due at least in part to semi-

permanent strips of vegetation? This is a most important question, and under the unusually favorable conditions occurring this year we should all endeavor to obtain as much light upon it as possible. At the last opposition the straight narrow canals suddenly appeared March 1, prior to that only broad curved ones being visible. The value of ⊙ was 61°.5 and the Martian date May 19; the corresponding date this coming year will be January 18, diameter of planet 9″.5. It is very improbable that the exact date will be confirmed, but we need hardly begin to look for the narrow canals before January. From then on, all possible information should be gathered relating to their first and last appearance, and especially as to their visibility at different hours of the Martian day.

Our associate Mr. Wilson in a very interesting paper on Mars published in the Monthly Register of the Society for Practical Astronomy, 8, 51, speaking of the canals says "During the 1916 opposition they developed first as colorless gray lines, then became pale emerald and finally were seen a richer tone of dark blue-green. The canal Thoth is an example of this development." This observation, which of course applies only to the broad curved canals, would if confirmed certainly indicate vegetation, but the writer has hitherto generally found even these canals too narrow to give very reliable indications of color. Or rather one should say they generally appeared to him gray. This may of course have been their true color. In 1914 however Cerberus and Sabaeus certainly appeared to be chocolate brown (See Report No. 10). In 1882 Schiaparelli described some of the canals as reddish brown (Flammarion. Mars 1, 358). It is hoped that others will look into this matter.

Mr. Wilson mentions another subject of great interest in his paper. Many persons have suggested that if the so-called "seas" of Mars were really water, that under proper conditions we should at times see the image of the Sun reflected in their surfaces as a small brilliant spot of light. The writer has looked for this phenomenon on several occasions when the Syrtis Major was near the center of the disk, and the color indicated that the marsh was more or less flooded. He has never succeeded in assuring himself however that he had detected the phenomenon in question. Mr. Wilson says in referring to this matter "While such a high light is certainly not conspicuous, it has been seen when it falls upon the vast yellow regions of the planet. The smaller dark markings and the canals have been observed to become less distinct while passing through it. When the general surface is of a light tint the high-light effect is less noticeable." Now the question at once suggests itself, is Mr. Wilson's explanation of his observation the true one? A smooth dull sphere would, when in opposition, present a

perfectly uniform surface to us. In order to appear brighter at the center the surface must present a certain amount of specular reflection. If true, that of itself would be an interesting matter. But is it not more likely that we have here another illustration of the drying up of the canals towards noon, noted by Dr. Lau and the writer? This observation should certainly be repeated at the coming opposition, and an especial note made as to whether the canals reappear towards sunset after having passed the center of the disk, also their relative intensity at equal distances on opposite sides of the center.

But here as in so many other cases in our studies of Mars, we find that these observations are not new. Cerulli in 1896 recorded that Titan appeared very fine when on the central meridian, but that it appeared much wider when at a distance of 30° from it. Schiaparelli records a similar observation with regard to Nodus Gordii and Solis Lacus, and explains it by saying that the surrounding bright regions when near the limb were brighter and therefore brought out the dark markings by contrast (Flammarion. Mars **2**, 316 326). There can be little doubt but that a phenomenon discovered independently by so many different observers really exists, and must be taken into account in any explanation that is offered to account for the canals.

Somewhat analogous observations should be made regarding any clouds that are noted. We have all noticed how rapidly clouds, conspicuous at sunrise, disappear as the region approaches the central meridian. Do they reform with similar rapidity when near the limb towards sunset? A series of drawings made a few minutes apart, showing the gradual dissolution or formation of a large cloudy area located as far as possible from the limb would certainly be of interest. Such an area was noted on December 7, 1915, ⊙ 23°.8 (See Report No. 14). It is suggested that at this opposition an especial effort be directed to the study of hourly changes in the canals, and of changes still more rapid occurring in the clouds that are found near the limb of the planet.

Shifting of the Canals over the Surface.

It may be thought by some that sufficient evidence has already been furnished from the work of various observers in Reports Nos. 5, 16, and elsewhere, to show that the boundaries of the dark markings, and with them the canals, are subject to a continuous gradual shift back and forth over the surface of the planet, both in latitude and longitude.

Nevertheless the very last letter that the writer received from the late Dr. Lowell indicated doubt on his part regarding the matter. Whether he changed his mind after it was shown that his own obser-

vations furnished one of the strongest arguments in favor of such a shift, the writer does not know. It will be recalled that in 1894 Lowell found that Aryn passed the central meridian by "the unmistakable amount of twenty minutes behind time," 4°.8 of longitude. In 1914 he found it 2°.9 ahead of its earlier position, and within 1°.0 of the position assigned to it in 1879 by Schiaparelli. He gives the probable error of his observations as 0°.2. Now whatever the astronomical world in general may think of Dr. Lowell's drawings, and of his theories, there is no question whatever but that his measurements were very good indeed. Is is unlikely that either of his longitudes should have been in error by more than one degree. He had a fine instrument. his observations were accurate, and his computations sound. His determination of the position of the axis of the planet has been adopted as a standard by the associated nautical almanacs. His measurements were his strong point, and it is a pity he did not make more of them.

Other observers have found still larger deviations. Thus M. G. Fournier, at the observatory of M. Jarry Desloges, during 1911 found Aryn to shift through 7° of longitude, and 6° of latitude. Margaritifer also exhibited a large shift (Report No. 7). Dr. Lau in A. N. 4706 finds that as compared with his own work, Schiaparelli gives the longitude of Aryn as 4°.4 too high, and that of Margaritifer 2°.4 too low (Report No. 3).

As compared with the mean result, it is found that the average deviation of a good observation in either latitude or longitude is about 1°, or 37 miles on the surface of the planet. But no matter how accurate any observer's results may be, they can never be as satisfactory as the mean result of several different observers working at different stations. It is proposed therefore to the Associated Observers this year, and to as many others as would like to join them, that a united effort be made to secure observations of four points on at least one night, near the date of the coming opposition.

It is probable that the most accurate method of observation does not involve the use of a micrometer, but merely a thread in the field of the eye-piece. This thread should be placed parallel to the line joining the middle of the northern polar cap and the center of the disk. If a position circle is available the thread may be set to better advantage by means of the printed ephemeris. The time is then recorded when the point under observation and the center of the polar cap appear to be equally distant from the thread. which is placed first on one side of them, and then on the other. The observations should begin about ten or fifteen minutes before the point apparently reaches the central meridian of the planet, and an observation should be recorded at intervals of about a minute until

the transit is clearly over. A review of these records will enable the observer to decide when the actual transit occurred. To determine the latitude, two circles two or three inches in diameter are drawn on a sheet of paper, a vertical diameter representing the central meridian. On these the point to be observed is located, just before and just after the observations for longitude are made.

The four points selected can all be observed within two hours of one another. They are the preceding edge of Edom north of Sabaeus, the point of Aryn, the preceding edge of Thymiamata following Margaritifer, and Oxia Palus if visible, if not visible, the northern point of Margaritifer. The latitude observations will naturally refer to the southern side of Edom and Thymiamata. For map see Report No. 15. The adopted times of transit and the drawings should be sent to the writer as soon as the measurements are completed, or the positions may be computed by the observer himself, if preferred. They will then all be published together. If a number of observers are willing to contribute, we should, by avoiding the systematic error of the individual, probably obtain the most accurate determination of the positions of these points yet secured. The organization of the Associated Observers lends itself admirably to work of this character, and the writer will always be glad to receive suggestions from others as to how it may be most efficiently employed.

Observations.

Three observations of the planet have been made the present year. The first was on August 27, in longitude 260°, ⊙ 355°.8, diameter 4″.4. Both polar regions were yellow, but no brighter than the rest of the limb. The clouds therefore had not as yet cleared from over the northern snow fields. The dark band surrounding the polar cap had already formed, indicating that melting had begun. The Syrtis was broad and extended towards Thoth, which later was not yet visible. The next observation was made September 4, longitude 166°, ⊙ 359°.5, diameter 4″.5. The northern snow cap was now clearly seen, and extended to latitude 63°.6. The maria were visible though small, and the color of the deserts number 12.0 on the Color Scale. The last observation was made on September 29, longitude 268°, ⊙ 11°.0, diameter 4″.8. The snow cap was readily visible, and reached the latitude 61°.2. The average of the two observations would make it of about the same size as in 1914, and distinctly smaller than at the last opposition. The snow was melting rapidly, as indicated by the breadth of the surrounding dark band, which had reached a width of 600 miles. But what was most striking in the two drawings

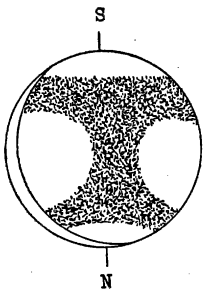

FIGURE 1.

secured on this night was the broad meridional band, which had again appeared, as is shown in Figure 1, and had attained a breadth in its narrowest portion of 900 miles. It therefore reached to the east to Triton, Thoth, and Alcyonius, completely across Casius, to the west to Nilosyrtis, and was distinctly wider than in our first observation.

This is the third opposition in succession in which this band has been recorded. At the two earlier ones a broad band appeared north of Sabaeus and near Margaritifer, connecting them with the polar regions (See plate in Report No. 11). But in both years a second band was visible, of the same shape as the present one, but only of about half its breadth, in this same place. It is surprising that at earlier oppositions so striking a phenomenon should have attracted so little attention or comment. A remarkable feature of the present phenomenon is that it should occur so late in the season. In 1913 and 1915 the band reached its maximum breadth and visibility, as far as the Jamaica observations show, at about $\odot = 330°$, corresponding to the Martian Date of February 1. This band, which doubtless has been visible for some time, is still very conspicuous at $\odot = 11°$, M. D. March 23. At the two previous oppositions but the merest traces of it were left after March 1. Since either as a storm track or marsh, it indicates the passage of huge volumes of water from the polar regions to the southern maria, we should naturally expect the season to be later on Mars at this opposition than usual. Now this is exactly what we find to be the case, for although carefully looked for, no green has as yet been detected in the maria, which are still of identically the same color as the northern marshes. At the two previous oppositions green was first noticed about February 39 and 43 (Report No. 12).

A slight darkening was detected near the place of the Syrtis marsh, but it was indistinct, and clouds interfered before it could be accurately located. The customary table of data follows. Since the published ephemeris does not begin until October 1, they have been in part obtained by extrapolation.

TABLE I.

DATA OF THE OBSERVATIONS.

No.	1915	⊙	M. D.	Long.	Lat.	Sun	Diam.	Seeing
1	Aug. 27	355°.8	Feb. 48	260°	—	−1°	4″.4	10
2	Sept. 4	359.8	" 56	166	—	0	4.5	10, 6
3	" 29	11.0	Mar. 23	268	+16°	+4	4.8	8, 10

No lakes or canals were visible.

Mandeville, Jamaica, B. W. I.
Oct. 3, 1917.