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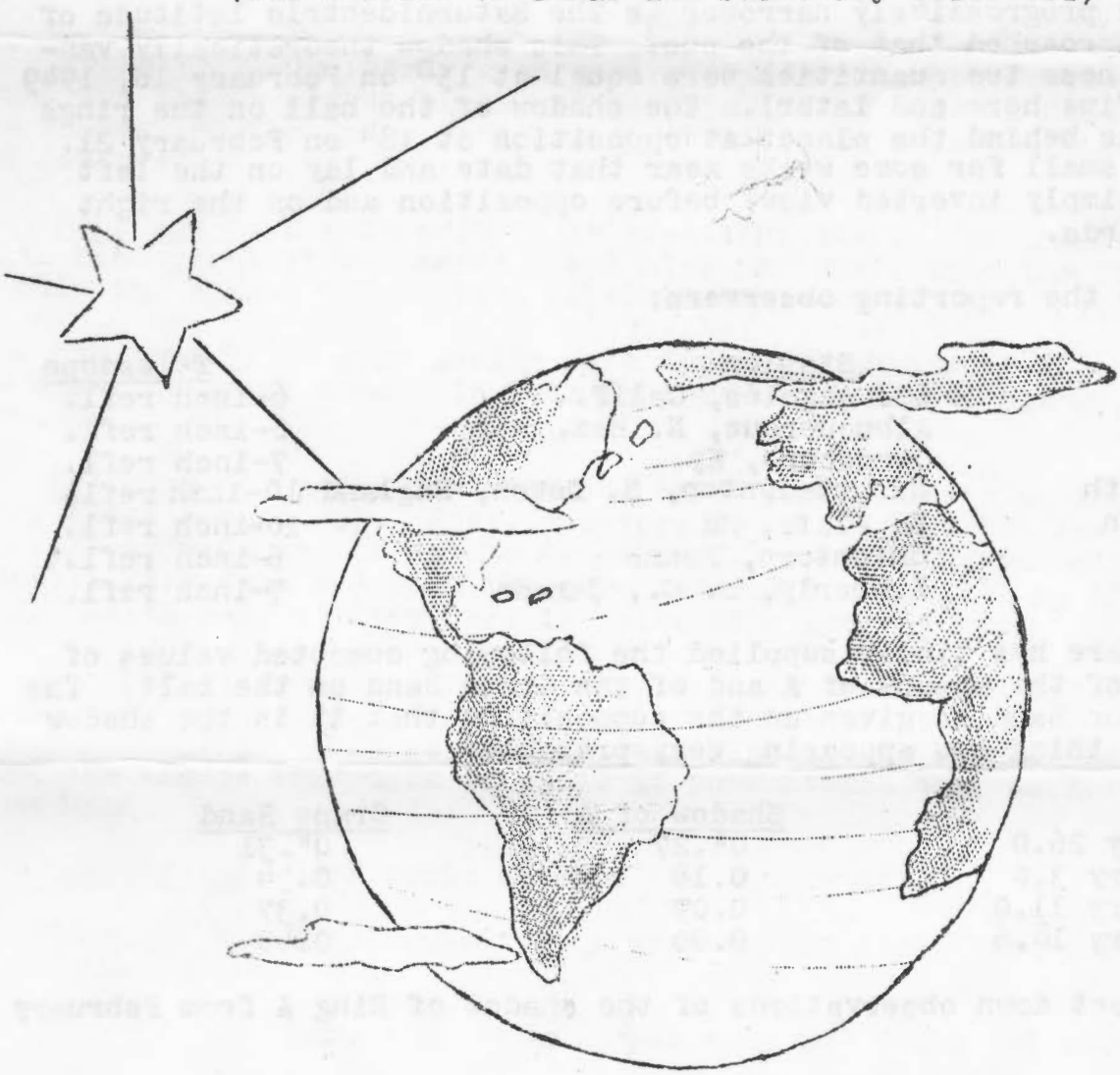

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THE VISIBILITY OF SATURN'S SHADOWS IN FEBRUARY-MARCH, 1949: SOME INTERPRETATIONS

by Walter H. Haas

On pp. 8-9 of our February issue we requested readers to give close attention that month to the shadow of the ball of Saturn on the rings and also to the shadow of the rings on the ball. Both shadows were to disappear during February, and it was desired to note their presence or absence and any changes in their appearance as they became smaller and smaller. The shadow of Ring A on the ball, which had been very conspicuous just north of the rings during the last months of 1948, became progressively narrower as the Saturnicentric latitude of the earth approached that of the sun. This shadow theoretically vanished when these two quantities were equal at 15^h on February 18, 1949 (Universal Time here and later). The shadow of the ball on the rings was invisible behind the planet at opposition at 18^h on February 21. It was very small for some weeks near that date and lay on the left limb (in a simply inverted view) before opposition and on the right limb afterwards.

We list the reporting observers:

Name	Station	Telescope
T. Cragg	Los Angeles, Calif.	6-inch refl.
W. H. Haas	Albuquerque, N. Mex.	6-inch refl.
E. E. Hare	Owensboro, Ky.	7-inch refl.
M. B. B. Heath	Kingsteignton, S. Devon, England	10-inch refl.
L. T. Johnson	La Plata, Md	10-inch refl.
E. J. Reese	Uniontown, Penna	6-inch refl.
E. K. White	Kimberly, B. C., Canada	7-inch refl.

E. E. Hare has kindly supplied the following computed values of the breadth of the shadow of A and of the Crape Band on the ball. The breadth of the Band is given on the supposition that it is the shadow of Ring C, a thing now appearing very probable.

Date	Shadow of A	Crape Band
1949, January 26.0	0".27	0".31
February 3.0	0.18	0.34
February 11.0	0.09	0.37
February 18^d.6	0.00	0.40

We now set down observations of the shadow of Ring A from February 1 onward.

February 1. A drawing by Johnson shows the shadow narrow and black. Haas found it very narrow, apparently no longer black, and somewhat inconspicuous when the seeing was mediocre. Hare observed the shadow to be 3/4 as wide as the Crape Band and darker.

February 2. Haas found the shadow easily visible, almost black, and apparently about as wide as Cassini's at the ansae (or 0".6). Johnson in good seeing saw the shadow "dark and narrow."

February 3. A drawing by Cragg in fairly good seeing shows this shadow thin but apparently quite black. Haas confirmed his impressions of February 2 but revised his estimate of the breadth to 2/3 that of Cassini's (still really much too great). Hare thought the shadow 2/3 to 4/5 as wide as the Crape Band.

February 6. Hare considered the shadow and the Band sensibly identical; the shadow was not less than 4/5 as broad as the Band, and the two were equally dark (shadow thus not black). Haas confirmed his view of February 3. He thought the shadow about 3 times as wide as the Crape Band.

February 7. In fairly good seeing (better than on February 6) Haas found the shadow almost black and perhaps 1/2 as wide as Cassini's. The shadow and the Crape Band now appeared to be much the same width and darkness.

February 8. R eese enjoyed an excellent view. The shadow was not quite black; but it was darker, and also narrower, than the Crape Band. He made the shadow 4/7 as wide as the Band.

February 9. In poor seeing Hare found the shadow of A harder to see than the Crape Band. In fair seeing Haas repeated his results of February 7.

February 10. A drawing by Cragg makes our shadow thin and apparently black (no notes). Hare, however, found it gray and now perhaps only 1/2 as wide as the darker Crape Band. Haas disagreeingly thought it still very dark and much the same intensity and width as the Crape Band. Heath made it very dark in spite of a poor view.

February 11. Hare found the shadow light gray and difficult to see. Haas, however, thought it still similar to the Crape Band in width and darkness and 1/3 to 2/5 as wide as Cassini's at the ansae. Heath again found the shadow very dark in spite of poor conditions, darker than the Crape Band.

February 12. Hare could glimpse the shadow of A.

February 15. Though conditions were rather good, Haas was unable to see the shadow.

February 17. Hare near 4^h and Haas near 10^h could not see the shadow.

February 18. Theoretical disappearance occurred at 15^h. With seeing sometimes really good near 5^h Haas saw nothing. At 6^h Hare recorded: "A gray border to Ring A was suspected, but many good moments showed nothing in the position of the shadow of A." Reese saw Saturn

very well from 3^h to 6^h but found no hint of this shadow. Nevertheless, a drawing by Cragg at 7^h in good seeing shows it and shows it apparently black. In view of the negative results that others obtained, it is unfortunate that Cragg recorded no notes on this feature. Its width would have been about 0".004.

The different observers agree that no dark band was seen north of the rings after shadow was geometrically impossible. In early 1949 the projected Rings A and B differed very little in brightness from the ball to their north, and E. K . White suggests that there was not enough contrast to cause a spurious band. This explanation implies that a band not shadow sometimes seen as a north border of the rings in the past was a contrast-caused illusion. It appears favorable to Mr. White's proposal that several observers saw such a band in 1947, that fewer (perhaps only one) did so in 1948, and that none did so in 1949; for the brightness of the rings has been diminishing from 1947 to 1949 with their gradual closing.

The widths of the shadow of the ball on the rings near the last opposition have not been computed yet, and in addition at a given moment they are not usually constant from the outer edge of Ring A to the inner edge of Ring B. Experience with such calculations would suggest that approximate values can be obtained, however, by taking a width of zero at opposition and a rate of change of 0".02 per day. If so, one would have as a rough guide:

Date	Width of Shadow of Ball
1949, February 21	0".00
February 16 and 26	0.10
February 11 and March 3	0.20
February 6 and March 8	0.30

We now list all observations of the shadow of the ball within 15 days of opposition, hence from February 6 to March 8.

February 6. In rather poor seeing Haas suspected a darkening on the left limb (simply inverted view), where the shadow lay.

February 7. In better seeing Haas found the shadow barely visible as a black line bordering the left limb.

February 8. Reese in splendid seeing found the shadow perfectly black, widest at the outer edge of Ring A and narrowest at the inner edge of Ring B. He drew a gray line, thinner than the true shadow, beside the right limb.

February 9. Haas in mediocre seeing noted identical near-black lines bordering the left and right limbs.

February 10. A drawing by Cragg shows a very thin and quite black shadow on the left limb, nothing on the right limb. Haas repeated his observation of February 9.

February 11. Haas again got the same results as on February 9.

February 15. In good seeing Haas found the shadow of the ball to be visible as a thin black line beside the left limb.

February 17. Hare recorded that the shadow was not certainly seen, being suspected on both sides. Haas in fair to good seeing perceived the shadow as " a very dark line beside the left limb" and saw nothing beside the right limb.

February 18. In fair to good seeing Haas noted: " A very narrow dark line borders each limb where the rings pass behind it; the line beside the left limb may be the wider and easier." Reese with excellent seeing found a near-black shading perhaps 7/10 as wide as Cassini's at the ansae (hence 0".4) adjacent to each limb. At the left limb the inner part of the shading was even darker, though not quite black. This inner part, the presumed shadow of the ball, Reese again found to be widest at the outer edge of Ring A; it tapered to nothingness at the inner edge of Ring B. A drawing by Cragg, without any notes on this subject, appears to show a very thin and very dark line beside each limb.

February 19. In poor to fair seeing Haas observed: "Dark lines border each limb where projected on the rings; the left limb band is the easier [shadow about 0".04 wide lay on the left limb] , and perhaps the wider."

February 20. At 5^h35^m, about 36 hours before opposition, Haas in a heavy haze found the two limb bands apparently equally dark and wide.

February 21. Cragg at 5^h40^m , only 12 hours before opposition, observed that "the shading on the ring from the ball was equal on both sides," as nearly as he could tell.

February 23. Johnson observed from 4^h35^m to 6^h5^m, thus from 35 to 36 hours after opposition; conditions during this interval were poor at first but improved to good. He writes: "At first when the seeing was poor it was thought that there was a narrow shadow on the rings on each side of the ball. But when the seeing became better it seemed to me that this was just the shaded limb of the ball." Haas in fair seeing found: " The dark band beside the left limb is clearly narrower than the one beside the right limb. The latter is easily seen; it is very narrow and almost black." The globe's shadow now lay on the right limb and was about 0".03 wide.

February 24. Haas found "a very narrow, almost black band" beside the right limb and was uncertain of seeing anything beside the left limb.

February 26, 27, and 28 and March 1 and 2. White on February 26 saw "a definite tiny wedge shaped shadow over Rings A and B" on the right limb. The rings on the left side "seemed to be separated from the limb by a very thin contrast line." This line was still visible on March 2, and the right limb shadow was now wide enough to be almost conspicuous.

March 3 and 4. With conditions rather poor to fair Johnson drew the shadow and saw nothing on the left limb. He estimated the shadow on March 3 to be about the same width as Cassini's at the ansae (it was really about 1/3 as wide). It was more conspicuous than Cassini's, less conspicuous than the Crape Band.

March 6. Cragg drew a very thin shadow on the right limb, nothing on the left limb.

(to be continued)

COMING PHENOMENA OF SATURN'S SATELLITES

On pp. 4-6 of our February, 1949, issue, we described the current phenomena of some of the satellites of Saturn; these are the precise analogues of the familiar eclipses, occultations, transits, and shadow-transits of the four large satellites of Jupiter. A number of readers expressed interest in these events; and we accordingly predict coming Saturnian phenomena from May 4, 1949, to June 6, 1949. All times are by Eastern Standard Time. Attention is limited to phenomena occurring between 8 P.M., E.S.T., and 1 A.M., P.S.T.; for only such ones can be observed from at least part of the United States. In May and June we shall have phenomena involving the four innermost satellites, but only those of Tethys and Dione can be observed with ordinary telescopes. The predictions are taken from pp. 39 and 40 of the 1949 Handbook of the British Astronomical Association except that egress times have been computed by the editor from their data. The occultations and transits will occur in May and June near the south and north limbs of Saturn respectively. For Tethys one will have an occultation disappearance followed by an eclipse emersion; for Dione both beginning and end of eclipse can be seen south of the south limb. In a simply inverted view with south at the top occultation disappearances are at the left limb; transit ingresses, at the right limb.

We should like to hear from our readers how successful they are in observing these events. E. K. White saw a transit ingress of Tethys on February 27 (U.T.) with a 7-inch reflector. On March 1 (U.T.) E. E. Hare was unable to see the shadow of Tethys in transit with a 7-inch reflector and good seeing. Negative reports of this sort may be as useful as positive ones.

Date	Time (E.S.T.)	Phenomenon	Remarks
1949, May 4	3:30 A.M.	Tethys transit ingress	
May 4	3:40 A.M.	Tethys shadow ingress	
May 5	2:09 A.M.	Tethys occultation disappearance	
May 6	12:49 A.M.	Tethys transit ingress	Egress near 2:07 A.M.
May 6	12:59 A.M.	Tethys shadow ingress	Egress near 3:17 A.M.

Date	Time (E.S.T.)	Phenomenon	Remarks
1949, May 6	11:28 P.M.	Tethys occultation disappearance	
May 7	12:14 A.M.	Dione shadow ingress	Egress near 1:24 A.M.
May 7	1:57 A.M.	Tethys eclipse emersion	
May 7	10:07 P.M.	Tethys transit ingress	Egress near 11:26 P.M.
May 7	10:18 P.M.	Tethys shadow ingress	Egress near 12:36 A.M. on May 8
May 8	8:46 P.M.	Tethys occultation disappearance	
May 8	11:16 P.M.	Tethys eclipse emersion	
May 9	8:45 P.M.	Tethys transit egress	
May 9	9:56 P.M.	Tethys shadow egress	
May 10	8:36 P.M.	Tethys eclipse emersion	
May 11	2:52 A.M.	Dione eclipse immersion	
May 13	8:33 P.M.	Dione eclipse immersion	
May 13	9:51 P.M.	Dione eclipse emersion	
May 17	11:00 P.M.	Dione shadow ingress	Egress near 12:20 A.M. on May 18
May 21	3:17 A.M.	Tethys transit ingress	
May 21	3:30 A.M.	Tethys shadow ingress	
May 22	1:37 A.M.	Dione eclipse immersion	
May 22	1:56 A.M.	Tethys occultation disappearance	
May 22	3:02 A.M.	Dione eclipse emersion	
May 23	12:36 A.M.	Tethys transit ingress	Egress near 2:01 A.M.
May 23	12:49 A.M.	Tethys shadow ingress	Egress near 3:11 A.M.
May 23	11:15 P.M.	Tethys occultation disappearance	
May 24	1:51 A.M.	Tethys eclipse emersion	
May 24	8:45 P.M.	Dione eclipse emersion	
May 24	9:54 P.M.	Tethys transit ingress	Egress near 11:20 P.M.
May 24	10:08 P.M.	Tethys shadow ingress	Egress near 12:30 A.M. May 25
May 25	8:33 P.M.	Tethys occultation disappearance	
May 25	11:10 P.M.	Tethys eclipse emersion	
May 26	8:40 P.M.	Tethys transit egress	
May 26	9:50 P.M.	Tethys shadow egress	
May 27	8:30 P.M.	Tethys eclipse emersion	
May 28	9:46 P.M.	Dione shadow ingress	Egress near 11:14 P.M.
June 2	12:23 A.M.	Dione eclipse immersion	
June 2	1:56 A.M.	Dione eclipse emersion	
June 6	2:50 A.M.	Dione shadow ingress	

Some of our readers might like to make estimates of the brightness of the satellites of Saturn; for it is still uncertain whether their light is constant or variable(Japetus is widely variable), and brightness-variations can give information about the rotation-periods of these bodies. Interested persons ought to read R. R. La Pelle's

article on pg. 80 of the January, 1949, Sky and Telescope and to study the accompanying chart on pg. 81. The editor would suggest that the best way of estimating the differences in stellar magnitude among the various satellites is by Argelander's step-method; for example, a typical estimate might be Titan 14 Rhea 4 Dione 1 Tethys. Here the "step" or unit (1) is the smallest perceptible difference in brightness and is usually near 0.1 magnitudes for experienced variable-star observers. Four "steps", as above, would then be about 0.4 magnitudes, etc. There is no objection to including stars near Saturn in the sequence; on the contrary, this procedure is a considerable advantage if the stars (whose position should be noted) can later be identified in some catalogue which gives their brightnesses. Neither is it necessary to identify the individual satellites before making an estimate; a rough sketch of positions relative to Saturn will allow later identification. Observers will find that the satellites are much more easily seen at elongation than at other times. On March 29 (U.T.) E. E. Hare was able to see Mimas, Tethys, Dione, and Titan, all near eastern elongation, in his 7-inch reflector. He did not know the position of Mimas at the time of the observation. Readers interested in such magnitude-estimates but desiring further details might write either to Mr. R. R. La Pelle or to the editor; the former's address is 54 Fernleaf Ave., Longmeadow 6, Massachusetts.

AN ASTRONOMER'S MEMORIAL

Our readers will already have heard the sad news of the death of Dr. Russell W. Porter. It is scarcely necessary to describe the achievements of this man, who, among many other things, inspired the telescope-making movement in this country and aided importantly in the design of the Hale 200-inch telescope. A biography by Leo and Margaret Scanlon is in the April, 1949, Sky and Telescope.

After learning of Dr. Porter's death, Mr. David P. Barcroft of Madera, Calif., and Mr. Albert G. Ingalls of Scientific American magazine, who was a lifelong friend of Dr. Porter's, set in motion a project to name a lunar formation for Dr. Porter. Mr. Ingalls said: "I think this is the kind of a memorial Porter would have liked." Mr. Barcroft addressed a letter on this subject to Mr. H. Percy Wilkins, outstanding student of the moon and Lunar Director of the world-wide British Astronomical Association. We are happy to be able to report that Mr. Wilkins was thoroughly agreeable to this project and that crater Porter on the moon now commemorates a great astronomer and a kindly and generous man. We quote part of a letter from Mr. Ingalls to Mr. Barcroft dated March 19, 1949:

"I was glad to receive your letter but very sorry indeed to learn the sad news of the decease of Russell W. Porter, who did so much, in a really great manner, for science in general and astronomy and astronomical instruments in particular.

"I fully agree that Porter is entitled to a place on the moon and am very glad indeed that it lies within my power to further this. Since I received your letter I have given the most careful consideration to the suggestion and have decided that no better formation could be chosen than the one under mention.

"One of the finest of all the lunar formations is Clavius, the great 'crater" south of Tycho. Now on the walls of Clavius we find two prominent craters, one on the south wall and the other on the north. They used to be known as Clavius A and B. The one on the south is now called Rutherford after the famous American lunar photographer but, until the present time, the crater on the north wall has been unnamed. It is about 25 miles in diameter and has a central peak and a curved ridge within it.

"I therefore propose to name the crater Clavius B, on the north wall of Clavius,--Russell W. Porter. To this end I have already inserted it on my copy of the 300 inch map, and on the tracings from which prints are taken and this name will appear on all future copies of the map. I am also inserting at the head of the next Interim Report [in Journal of the British Astronomical Association], now being sent to the Editor, a note to this effect and also a request that all persons who possess a copy of my map will insert the name Porter on their copies.

"I trust that my selection of Clavius B to be named Porter will meet with your approval. I really do not think I could have selected a better object.

"Please therefore inform all persons interested in the matter, throughout the U. S. A. or elsewhere that this has now been done, and that this name appears on the great lunar map."

All amateurs owe thanks to Messrs. Barcroft, Wilkins, and Ingalls for their efforts in securing so fine a lunar monument to Dr. Porter. His crater will be finely displayed near the terminator in the near future on the evenings of May 6, June 4, and July 4, local civil time dates.

OBSERVATIONS AND COMMENTS

Note. Unless the contrary is explicitly stated, all dates and times in this publication are by Universal Time.

Our presentation of observations of the Crape Band last February on pp. 6 and 7 of our April issue requires one correction and one addition. Cragg's last reported observation was not on February 20 but on February 21 by Universal Time. On February 24 Haas observed: "The Crape Band is 1/4 as wide as Cassini's." These alterations do not affect the argument in the rest of the article.

Observations of Mercury are rare enough that it is good to find some made in Germany reported by E. Pfannenschmidt on pp. 41 and 42 of Sternenwelt for February, 1949. The editor here translates:

"In spite of the unfavorable conditions of visibility which prevailed at the beginning of November [1948] , some few visual results on Mercury are present. They have been submitted to us by Dr. W. Sandner, Munich (116-mm. refractor) and by Dr. H. Ruegemer, Neustadt-Waldnaab (135-mm. refractor). Bad seeing and cloud covers hindered the certain perception of surface details. Sandner could observe on five days but perceived even with 'relatively favorable atmospheric conditions' (November 6, 1948) no sort of surface detail. It was only possible for him to recognize the decrease of the apparent diameter and the corresponding phase.

"Dr. Ruegemer reports from his Private Observatory, among other things, the following: 'In consequence of a stubborn, unbroken high layer of clouds I could see Mercury only once, early on November 9. The seeing was also very poor then so that I even had difficulties in determining the phase. Dichotomy was doubtless already past. [It was well past when he observed, the sun-Mercury-earth angle being 63°.--W. H. H.] To my very great surprise I saw very plainly, in spite of this poor seeing, an approximately triangular dark feature in the southern hemisphere, the smallest side parallel to the "equator" and located only a little south of it, a second side beginning at about the "south pole" and running to a point which divided the width of the crescent [?--W. H. H.] in the ratio 2:3 from the terminator toward the limb, and the third side forming the terminator which as a result appeared almost concave. I could not recognize "polar caps" nor any distinct limb-band; on the contrary, I suspected in the southern hemisphere, beginning near the limb at about 80° south latitude and running toward the center of the disc, a very narrow dark mark, but it was not to be made out with certainty with the very strongly undulating image.'

"These results are unfortunately very scanty, and it appears highly questionable whether observation of the planet in our high latitudes has much purpose. Nevertheless, the amateur astronomer will not neglect to watch the ~~sky~~ planet sometimes at favorable opportunities. Reliable observations of the phase, especially at the time of theoretical dichotomy, are indeed valuable."

E. J. Reese reports that at 2^h on March 9, 1949, he was unable to see any detail on the floor of the lunar crater Plato, not even the central craterlet. The view was excellent enough to reveal clearly in the crater Conon a mark called "Cleft V" (Reese's terminology); this feature is difficult and is absent from Wilkins' 300-inch map of the moon and from all other lunar charts known to the editor. Under similar solar illumination on March 31, 1947 and October 12, 1948, Reese had clearly seen craterlets on the floor of Plato; these two views also had shown him "Cleft V" in Conon. We cannot doubt that in the past many different observers saw some Plato craterlets near the same solar illumination as prevailed at 2^h on March 9 and that at least some

of them examined Conon without seeing the cleft in question. Such was the editor's experience in 1941-5 when he was using the Flower Observatory 18-inch refractor, for example. One can hence hardly doubt that Plato floor detail was unusually inconspicuous on March 9, at least relative to "Cleft V". Important confirmation of this conclusion comes from the fact that T. R. Hake, observing the moon under good conditions near 3^h on March 9, also saw no detail on the floor of Plato but did see "Cleft V" for the first time. Reese employed a 6-inch reflector at 240X; Hake, a 5-inch refractor at 300X.

Some notes on Saturnian colors by E. J. Reese in January-March, 1949, will be reported next. Ring A appears pale blue or bluish gray to this observer. Ring B is white at its outer edge and middle, yellow-white at its duller inner edge. Ring C near the ansae is pale blue. The shaded South Polar Region and its bounding South Polar Band are usually gray, though the latter appeared olive-gray on February 18. The very broad South Temperate Zone is yellow-gray; brighter zones in it are yellow-white. The South Equatorial Belt is perhaps usually reddish-brown; but it has also been described as brown-gray and orange-brown. The Equatorial Zone is yellow-white. The Crape Band is brown, though by March it had become so dark as to be almost black. The ball north of the rings is neutral gray.

J. C. Bartlett continues to find Saturnian colors dull and subdued. (Refer to pg. 9 of our February, 1949, issue.) The ball-background is a whitish yellow in his 3.5-inch reflector; the darker markings, close to gray. He has reported a small number of exceptions: The South Polar Region was olive-brown on February 13, faint yellowish brown on March 20, and light gray-green on March 21. The South Temperate Belt was olive-brown on February 13 and brownish on March 9. The North Temperate Belt was distinctly bluish-gray on March 20. Dr. Bartlett notes that he has found the South Polar Region to show brown more often than any other color in 1948 and 1949 and wonders whether there has been a significant change from the green often found there in the past.

We give the usual data on observed widths of the Crape Band at the central meridian of Saturn, where the unit is the width of Cassini's Division at the ansae: E. E. Hare, 7-inch refl., 0.75 on March 16; E. K. White, 7-inch refl., 1.2 to 1.3 as reported in a letter on April 8; T. R. Cave, 12-inch refr., 0.9 on January 15; W. H. Haas, 6-inch reflector, 0.79 as the average of 7 observations from March 27 to April 23. An ingenious observation by White on April 12 appears to demonstrate conclusively that the Crape Band was wider than Cassini's at the ansae on that date. He placed the wire of a homemade filar micrometer tangent to Cassini's at the ansae and found this division to be about 1/2 to 3/4 as wide as the wire. He then placed the same wire tangent(?) to the Crape Band and found this feature to be "definitely wider" than the wire. The seeing was splendid, and a power of 200X was employed.

In several recent issues we have discussed the nature of the Crape Band and have found evidence that it is really the shadow of Ring C, or of Rings B and C. (It would presumably be the latter at present; for shadows have been thrown southward since February 18, 1949.)

E. K. White has now reported an observation which appears quite to clinch the argument; we quote part of a letter from him on April 8: "A fine view of Saturn on March 27 [March 28 by U.T.] causes me to write you a surprising observation of the Crape Band and one I have suspected from earlier good views in March; yet I was not sure enough of them to report. I feel confident that the Crape Band at the limbs is about 25% wider than the Crape Ring there. It is continuous with the ring along the northern edge but above it on the southern edge... I now am convinced that we see the shadow of Rings B and C while the sun is less distant south of the ring plane than we are [true since February 18]. I wonder if others can confirm, or have confirmed, this observation. My friend Chandler was observing with me and was even more certain of the Band's extension southward from Ring C off the ball than I was!" We congratulate Messrs. White and Chandler on their excellent view and significant observation.

A number of observers have perceived on Saturn features suitable for central meridian transits, and hence for rotation-period determinations. E. Pfannenschmidt tells us that German observers in January and February very frequently remarked white areas, sometimes bordered with dark edges or bands, in the Equatorial Zone and the South Temperate Belt. They also often found dents, spots, and darker areas in the South Equatorial Belt. Oberndorfer at 22^h on February 7, using a 4-inch telescope, noted "a large white area of great brightness" in the North Polar Region; it lay on the lower left edge of the disc (probably a simply inverted view) and was about as wide as the Equatorial Zone. T. R. Cave observed near 8^h on January 15 a narrow darkish marking in the S. E. B. near the C. M. (12-inch refr.) and near 5^h45^m on March 31 saw an oblong dark mark on the south edge of the Crape Band and almost on the C. M. (8-inch refl.) Drawings by T. Cragg from February 21 to March 14 show bright areas in the E. Z. and darker spots in the S.E.B. Unhappily, the two or more C. M. transits necessary to give a rotation-period are apparently lacking in all cases. Hare and Haas suspect that marks suitable for such transits have been more difficult to observe and/or less numerous during the present 1948-9 apparition than during those of 1946-7 and 1947-8.

Observations of Saturn received during the last month largely confirm appearances described in earlier issues, and we shall try to avoid repetition. The South Equatorial Belt is definitely more conspicuous in some views than in others, perhaps because its aspect is different in different longitudes. Hare in March made the S.E.B. 4/5 as wide as the E.Z. Hare sees wider spaces 15 to 25 degrees of longitude apart in the delicate Equatorial Band. This E.B. was revealed for the first time to Bartlett on March 9, when he thought it very thin but darker than the S.E.B.; this view was surely very creditable for a 3.5-inch reflector. It is here interesting that Hare wrote on March 28 that he thought that the E.B. was continuing to darken, having been about equal to the S.E.B. on March 16. Bartlett writes that he agrees with Hare and Haas that the North Temperate Belt was fainter in February than in December-January. Haas found it to grow even less conspicuous in March and April; it is perhaps now discontinuous, but it

may be rather dark where present. It appears confirmatory that Bartlett on March 31 saw no belts north of the rings in a dense haze, which did permit two southern belts to be remarked with ease. Bartlett wrote on March 20 that he was finding the shaded North Polar Region very variable, considerably more so than the South Polar Region, which was "variable enough." A North North Temperate Belt sometimes faintly visible in March may well be a darker edge of this shading. Several observers agree that the S. P. R. is darker than the N. P. R. (because the south pole is tipped toward us?). Bartlett and T. R. Cave observed in March a South Temperate Belt near the middle of the very wide South Temperate Zone, the space between the South Equatorial Belt and the South Polar Band. Drawings by T. Cragg in February and March show in the southern part of this zone one or two thin and faint dark belts and one or two sometimes discontinuous brighter zones. These far southern marks were perhaps rapidly variable. In a fine view of Saturn with the Griffith 12-inch refractor at 8^h on January 15 Cave recorded a "minute but intensely bright white south polar cap."

On April 5 Reese wrote: "My observations indicate that Rings A and B (both in the ansae and in front of the globe) have been growing dimmer relative to the glo e since March 8." Have others found such an effect? Different observers agree that the Third Division is more conspicuous, or easier to see, than Encke's Division. (On March 6 only Cragg disagreeingly observed Encke's without seeing the Third.) On January 15 with a 12-inch refractor Cave described the Third Division as "never so well seen before", and on March 31 with an 8-inch reflector he noted it to be "very prominent." The 12-inch refractor on March 12 revealed to Cragg once more the Fourth Division in the outer part of Ring B, and he expresses his opinion that this feature is surely real. On March 31 Cave, using an 8-inch reflector at 252X in fair to good seeing, noted that the Sixth Division in Ring C was "seen quite definitely at extreme ansae" and lay 4/10 of the way from the outer edge of Ring C to the inner. A number of readers have directed our attention to the fact that this Sixth Division is shown on a drawing by R. Proctor reproduced on pg. 33 of F. L. Whipple's Earth, Moon, and Planets. No date of the drawing is given; but it must have been made no more recently than 1886, for the same drawing appears in the New Edition of Proctor's Other Worlds than Ours, which was published that year. A quotation from pp. 213-4 of Volume I of the Sixth Edition of T. W. Webb's Celestial Objects is very interesting: "At its first discovery [Ring C's] Dawes, and Otto Struve at Pulkova (the Czar's observatory), with the superlative achromatic by Merz, 22 /3 ft. focus, 14 9/10 in. aperture, considered it to be divided in two by a dark line; but this has not been seen since [up to when?] ; nor is it certain whether there is a division between it and B, or whether it is fainter towards it inner edge." We appear to have here nineteenth century observations of our Fifth and Sixth Divisions and of Cragg's reported dimness of the inner edge of Ring C (pg. 9 of March issue). The editor would suggest that the Fifth and Sixth Divisions are permanent features in the rings and that their usually escaping detection is hardly surprising.

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