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Micrometrical Measures of the Equatorial Diameter of Saturn, and of his System of Rings

made with the 26 inch Refractor of the U. S. Naval Observatory, Washington.

By *T. J. J. See.*

The following observations of Saturn were taken by daylight, either shortly before, or immediately after the setting of the Sun. The process of measurement was the same as that employed in the case of Jupiter (A. N. 3757). The limb of Saturn appeared perfectly sharp and distinct. I have never seen better definition on any object. The observations were so timed that on the whole the field illumination had just the right intensity. The concluded equatorial diameter is $17''.240 \pm 0''.006$. It is difficult to see how this value can be subject to an uncertainty of more than $\pm 0''.02$; which

would mean that Saturn's diameter is accurate to $\frac{1}{862}$ part of the whole. The second table gives some diameter measures made at night, and therefore affected by the full amount of the irradiation. The diameter now deduced from the night measures is $17''.804$. These observations were taken soon after dark and are strictly analogous to those made in daylight. Very great care was exercised to free the settings from systematic errors, and measures were taken only in perfect seeing.

Table I. Measures of the Equatorial Diameter of Saturn by Daylight, Washington, 1901.

No.	Wash. M. T. 1901	D_o	Corr. for Phase	D_o'	D_r	$D_o - D_c$	See- ing	Cell	Power	Remarks
1	Sept. 21 5 ^h 49 ^m	16".78	+0".04	16".82	17".29	+0".05	5	4	388	Irradiation wholly insensible. Planet sharp at the limb and pale yellow, in greenish yellow field
2	" 5 55	16.75	+0.04	16.79	17.26	+0.02	5	4	388	[same
3	" 5 59	16.83	+0.04	16.87	17.34	+0.10	5	4	606	Tried higher power; appearance about the
4	" 6 2	16.67	+0.04	16.71	17.17	-0.06	5	4	606	Excellent measures
5	Sept. 22 5 57	16.72	+0.04	16.76	17.26	+0.02	5	4	388	Good seeing
6	" 6 3	16.87	+0.04	16.91	17.41	+0.17	5	4	388	
7	Sept. 23 5 46	16.31	+0.04	16.35	16.86	-0.37	5	4	388	Saturn very faint
8	" 5 48	16.67	+0.04	16.71	17.23	-0.01	5	4	388	
9	" 5 51	16.58	+0.04	16.62	17.10	-0.10	5	4	388	
10	" 5 53	16.70	+0.04	16.74	17.26	+0.02	5	4	388	Excellent measures throughout. Irradiation wholly insensible
11	" 5 56	16.56	+0.04	16.60	17.12	-0.12	5	4	388	[brighter
12	" 6 1	16.70	+0.04	16.74	17.26	+0.02	5	4	388	Irradiation insensible, but planet getting
13	Sept. 24 5 41	16.31	+0.04	16.35	16.89	-0.34	5	5	388	Planet faint, but sharp at limb
14	" 5 46	16.55	+0.04	16.59	17.14	-0.10	5	5	388	
15	" 5 51	16.58	+0.04	16.62	17.17	-0.07	5	5	388	
16	" 5 56	16.52	+0.04	16.56	17.11	-0.13	5	5	388	All excellent measures [0".10
17	" 6 2	16.72	+0.04	16.76	17.31	+0.07	5	5	388	Slight irradiation at either limb, perhaps
18	Oct. 6 5 26	16.22	+0.04	16.26	17.13	-0.10	5	5	388	Image very good
19	" 5 27	16.25	+0.04	16.29	17.17	-0.07	5	5	388	
20	" 5 29	16.25	+0.04	16.29	17.17	-0.07	5	5	388	
21	" 5 31	16.36	+0.04	16.40	17.28	+0.04	5	5	388	Splendid measures
22	" 5 33	16.37	+0.04	16.41	17.29	+0.05	5	5	388	
23	" 5 36	16.36	+0.04	16.40	17.28	+0.04	5	5	388	The middle ring is of the same brightness as the ball of Saturn; outer ring two thirds as bright

No.	Wash. M. T. 1901	D_o	Corr. for Phase	D_o'	D_r	$D_o - D_c$	See- ing	Cell	Power	Remarks
24	Oct. 6 5 ^h 38 ^m	16.36	+0.04	16.40	17.28	+0.04	5	5	388	
25	" 5 40	16.38	+0.04	16.42	17.30	+0.06	5	5	388	
26	" 5 42	16.46	+0.04	16.50	17.38	+0.14	5	5	388	
27	" 5 44	16.45	+0.04	16.49	17.37	+0.13	5	5	388	Excellent measures throughout. Seeing 5, but occasionally a little tremulous
28	Oct. 7 5 31	16.34	+0.04	16.38	17.29	+0.04	5	5	388	Excellent measures
29	" 5 32	16.38	+0.04	16.42	17.33	+0.08	5	5	388	Image good, and great care exercised not to measure it too closely
30	" 5 34	16.38	+0.04	16.42	17.33	+0.08	5	5	380	
31	" 5 36	16.45	+0.04	16.49	17.40	+0.15	5	5	388	
32	" 5 37	16.40	+0.04	16.44	17.35	+0.10	5	5	388	
33	" 5 39	16.43	+0.04	16.47	17.38	+0.13	5	5	388	If anything diameters a little large
34	" 5 40	16.38	+0.04	16.42	17.33	+0.08	5	5	388	
35	" 5 41	16.40	+0.04	16.44	17.35	+0.10	5	5	388	
36	" 5 42	16.43	+0.04	16.47	17.38	+0.13	5	5	388	
37	" 5 44	16.39	+0.04	16.43	17.34	+0.09	5	5	388	Diameters today certainly not too small; very probably a little large
38	Oct. 8 5 19	16.25	+0.04	16.29	17.22	-0.02	5	5	388	
39	" 5 21	16.27	+0.04	16.31	17.24	0.00	5	5	388	Splendid measures
40	" 5 22	16.24	+0.04	16.28	17.21	-0.03	5	5	388	
41	" 5 23	16.26	+0.04	16.30	17.23	-0.01	5	5	388	Consider these the most exact measures I ever made on Saturn: conditions simply perfect
42	" 5 24	16.24	+0.04	16.28	17.21	-0.03	5	5	388	Splendid measures; must be very near the ultimate truth
43	" 5 25	16.31	+0.04	16.35	17.28	+0.04	5	5	388	
44	" 5 26	16.28	+0.04	16.32	17.25	+0.01	5	5	388	Saturn continues of just the right brightness; image could not be better
45	" 5 27	16.31	+0.04	16.35	17.28	+0.04	5	5	388	
46	" 5 28	16.25	+0.04	16.29	17.22	-0.02	5	5	388	The finest set of measures I ever made on Saturn. Conditions perfect. Thin clouds kept Saturn at uniform and just the proper brightness throughout the observations
47	" 5 29	16.31	+0.04	16.35	17.28	+0.04	5	5	388	
48	Oct. 10 5 35	16.25	+0.04	16.29	17.27	+0.03	5	5	388	Excellent
49	" 5 37	16.24	+0.04	16.28	17.26	+0.02	5	5	388	
50	" 5 39	16.29	+0.04	16.33	17.32	+0.07	5	5	388	
51	" 5 44	16.29	+0.04	16.33	17.32	+0.07	5	5	388	
52	" 5 47	16.29	+0.04	16.33	17.32	+0.07	5	5	388	
53	Oct. 11 5 22	16.17	+0.04	16.21	17.23	-0.01	5	5	388	Very excellent measures
54	" 5 25	16.17	+0.04	16.21	17.23	-0.01	5	5	388	
55	" 5 26	16.15	+0.04	16.19	17.21	-0.03	5	5	388	
56	" 5 28	16.13	+0.04	16.17	17.19	-0.05	5	5	388	Image a little tremulous
57	" 5 29	16.14	+0.04	16.18	17.20	-0.04	5	5	388	
58	" 5 30	16.18	+0.04	16.22	17.24	0.00	5	5	388	Splendid seeing
59	" 5 31	16.15	+0.04	16.19	17.21	-0.03	5	5	388	
60	" 5 34	16.12	+0.04	16.16	17.18	-0.06	5	5	388	
61	" 5 36	16.20	+0.04	16.24	17.26	+0.02	5	5	388	Splendid set of measures made with image a little off the wires; can hardly image how the conditions could be more favorable
62	" 5 38	16.22	+0.04	16.26	17.28	+0.04	5	5	388	
63	Oct. 16 4 46	16.08	+0.04	16.12	17.27	+0.02	5	5	388	Planet very faint, but seeing is splendid
64	" 4 48	16.04	+0.04	16.08	17.23	-0.02	5	5	388	
65	" 4 50	16.07	+0.04	16.11	17.26	+0.01	5	5	388	Disc faint, but limb excellent
66	" 4 52	16.09	+0.04	16.13	17.28	+0.03	5	5	388	
67	" 4 54	16.04	+0.04	16.08	17.23	-0.02	5	5	388	Excellent measures

No.	Wash. M. T. 1901	D_o	Corr. for Phase	D_o'	D_r	$D_o - D_c$	See- ing	Cell	Power	Remarks
68	Oct. 16 4 ^h 56 ^m	16.05	+0.04	16.09	17.24	-0.01	5	5	388	Planet coming out brighter, limb sharp
69	" 4 58	16.08	+0.04	16.12	17.27	+0.02	5	5	388	
70	" 5 0	16.08	+0.04	16.12	17.27	+0.02	5	5	388	
71	" 5 2	16.06	+0.04	16.10	17.25	0.00	5	5	388	Magnificent seeing
72	" 5 4	16.05	+0.04	16.09	17.24	-0.01	5	5	388	
73	" 5 6	16.09	+0.04	16.13	17.28	+0.03	5	5	388	
74	" 5 8	16.06	+0.04	16.10	17.25	0.00	5	5	388	Measures of the highest accuracy
75	" 5 9	16.08	+0.04	16.12	17.27	+0.02	5	5	388	
76	" 5 11	16.12	+0.04	16.16	17.31	+0.06	5	5	388	
77	" 5 12	16.10	+0.04	16.14	17.29	+0.04	5	5	388	
78	" 5 14	16.07	+0.04	16.11	17.26	+0.01	5	5	388	Planet of just the right brightness; excellent
79	" 5 15	16.07	+0.04	16.11	17.26	+0.01	5	5	388	
80	" 5 17	16.09	+0.04	16.13	17.28	+0.03	5	5	388	
81	" 5 18	16.06	+0.04	16.10	17.25	0.00	5	5	388	Splendid observations; definition perfect
82	" 5 20	16.07	+0.04	16.11	17.26	+0.01	5	5	388	Magnificent seeing; never saw it better

$$\text{Mean } D = 17.240 \pm 0.006 = 119247 \pm 42 \text{ km.}$$

Table II. Measures of the Equatorial Diameter of Saturn by Night, Washington, 1901.

No.	Wash. M. T. 1901	D_o	Corr. for Phase	D_o'	D_r	$D_o - D_c$	See- ing	Cell	Power	Remarks
1	Sept. 25 6 ^h 12 ^m	16.95	+0.04	16.99	17.57	-0.23	5	5	388	Splendid seeing; the images are very calm, and well defined. Still some daylight when this measure is made
2	" 6 14	16.98	+0.04	17.02	17.59	-0.20	5	5	388	
3	" 6 17	17.04	+0.04	17.08	17.66	-0.14	5	5	388	Not yet perfectly dark, although planet is bright
4	Oct. 1 6 4	17.08	+0.04	17.12	17.89	+0.08	5	5	388	Planet very bright, but it is not quite dark
5	" 6 6	17.06	+0.04	17.10	17.87	+0.06	5	5	388	
6	" 6 9	17.10	+0.04	17.14	17.91	+0.10	5	5	388	
7	" 6 11	17.00	+0.04	17.04	17.81	0.00	5	5	388	Splendid seeing, almost perfect measures
8	" 6 14	17.08	+0.04	17.12	17.89	+0.08	5	5	388	Excellent measures throughout
9	Oct. 8 6 54	16.76	+0.04	16.80	17.76	-0.04	5	5	388	Splendid seeing; image beautifully defined
10	" 6 57	16.74	+0.04	16.78	17.74	-0.06	5	5	388	
11	" 6 59	16.74	+0.04	16.78	17.74	-0.06	5	5	388	
12	" 7 2	16.79	+0.04	16.83	17.79	-0.01	5	5	388	The most exact measures I ever made on Saturn
13	" 7 4	16.75	+0.04	16.79	17.75	-0.05	5	5	388	Very excellent measures throughout
14	Oct. 11 6 0	16.76	+0.04	16.80	17.85	+0.05	5	5	388	Seeing a little tremulous
15	" 6 2	16.73	+0.04	16.77	17.82	+0.02	5	5	388	
16	" 6 4	16.79	+0.04	16.83	17.88	+0.08	5	5	388	Seeing 5, occasionally 4
17	" 6 6	16.79	+0.04	16.83	17.88	+0.08	5	5	388	
18	" 6 8	16.75	+0.04	16.79	17.84	+0.04	5	5	388	Excellent measures
19	Oct. 16 5 46	16.56	+0.04	16.60	17.78	-0.02	5	5	388	Seeing excellent
20	" 5 48	16.69	+0.04	16.73	17.91	+0.11	5	5	388	
21	" 5 49	16.60	+0.04	16.64	17.82	+0.02	5	5	388	Steady, but occasionally a little disturbed
22	" 5 52	16.62	+0.04	16.66	17.84	+0.04	5	5	388	
23	" 5 54	16.62	+0.04	16.66	17.84	+0.04	5	5	388	
24	" 5 56	16.61	+0.04	16.65	17.83	+0.03	5	5	388	
25	" 5 58	16.57	+0.04	16.61	17.79	-0.01	5	5	388	Limb sharp and well defined
26	" 6 2	16.57	+0.04	16.61	17.79	-0.01	5	5	388	Splendid measures
27	" 6 3	16.59	+0.04	16.63	17.81	+0.01	5	5	388	
28	" 6 6	16.63	+0.04	16.67	17.85	+0.05	5	5	388	Measures on the whole excellent

$$\text{Mean } D = 17.804 \pm 0.011 = 123148 \pm 76 \text{ km.}$$

The following determinations of diameter, by the filar micrometer, are thought to afford a fair comparison of the results obtained by previous observers.

Authority	Epoch	Equatorial Diameter	Remarks
W. Struve	1826	17".991	Dorpat 9 inch, 6 n, filar micrometer
Encke	1838	17.677	Berlin 9 inch, 11 n, filar micrometer
Galle	1839	17.906	Berlin 9 inch, 6 n, filar micrometer
O. Struve	1851	17.61	15 inch refractor at Poulkova
Jacob	1853	17.86	6.2 inch refractor at Madras, 4 n
Jacob	1856	17.969	5 n, at Madras
Secchi	1856	17.661	10 n, good conditions
Secchi	1856	17.689	11 n, at Rome
O. Struve	1882	17.76	15 inch Refractor at Poulkova, less than 10 n
A. Hall	1884-7	17.72	13 n, 26 inch refractor at Washington
H. Struve	1894	17.579	26 n, Poulkova 30 inch refractor
Lewis & Dyson	1895	17.754	13 n, Greenwich 28 inch refractor
Barnard	1895	17.744	12 n, 36 inch refractor at Lick
Barnard	1895	17.875	9 n, 36 inch refractor at Lick
Mean $D = 17.771$			Each value having weight unity

It will be seen that the mean is 17".771, in close agreement with that in table II. Different systems of weights would give slightly different results, but almost any equable system would tend to increase this mean a little. Under the circumstances perhaps it would not be rash to adopt 17".80 as the equatorial diameter of Saturn, when observed in large refracting telescopes at night. Accordingly the irradiation is

$$I = D_n - D_d = 0.56.$$

This value has been confirmed by some experiments with the wires when illuminated to the same intensity as the ball of Saturn, which made the irradiation 0.55 ± 0.02 . In his researches on the theory of the satellites of Saturn, Prof. Hermann Struve used for the diameter of Saturn the value 17".30; which is approximately a mean between his value 17".58 obtained with the Poulkova 30 inch refractor with colored field illumination in 1894, and that of Bessel, 17".05, found with the Königsberg heliometer in 1835. In order to judge of the tendency of heliometer measures on Saturn, one should have independent determinations by several observers. Unfortunately Bessel's work thus far stands almost alone.*) But on account of the great labor which he bestowed upon the investigation, it may doubtless be taken as representing the best work with that type of instrument. By comparing the daylight diameter found above with Bessel's heliometer value, it appears that the heliometer systematically measures Saturn smaller than its probable diameter by 0".19. In the paper on the Diameter of Jupiter (A. N. 3757), several sets of heliometer diameters of that planet are given. On account of their discordance I hesitated to form a mean, and adhered to Bessel's original value, 37".60. Prof. Schur, however, has weighted all these observations and deduced the mean 37".40. As the results of Johnson, 37".38; Bellamy, 37".00; Main & Bellamy, 37".16, are somewhat less con-

sistent than the rest, I now prefer to reject them altogether, and take a mean of the results of Bessel, 37".60; Schur, 37".43; Winnecke, 37".43; and Schur, 37".42; which leads to a value of 37".47. Using this value it appears that the heliometer diameter of Jupiter is 0".18 smaller than the filar micrometer diameter in daylight (37".65). Are these remarkable deviations, —0".18 in first instance, —0".19 in the second, for two similar planets like Jupiter and Saturn, wholly accidental, or are they due to some constant cause? So far as can be judged the uncertainty attaching to the diameter of Jupiter will probably not exceed ± 0.04 . The coincidence therefore is not due to defective knowledge of the daylight diameters of these planets, and probably should be ascribed either to a real tendency of the heliometer, or to a defect in Bessel's diameter of Saturn, based on 70 nights' work, which seems very improbable. On account of the interest attaching to the outstanding 0".19, further heliometer measures of the diameters of Jupiter and Saturn would perhaps be worth making.

The measures of the ring system made last year are in the main perfectly satisfactory. During the present opposition therefore attention was confined to the reinvestigation of particular points, and to the making of measures in daylight, with a view of finding the constants of irradiation.

a) Width of Dusky Ring.

In the determination of this element made last year, it was pointed out that the width is greater than was indicated by the measures, of which the mean was 2".685. During the past summer measures were taken on six nights of exceptional definition, when the dusky ring could be seen and measured close up to the planet. These results are as follows:

*) Main measured the diameter of Saturn with the Oxford heliometer on 10 n, in 1862; but the results are too discordant to be of use here. His result when reduced to the usual distance, 9.5389, is 16".88.

Table III.

Width of Saturn's Dusky Ring, observed at Night, Washington, 1901.

Wash. M. T. 1901	s_o	s_r	$s_o - s_c$	See- ing	Cell	Power	Remarks
May 15 15 ^h 36 ^m	2".83	2".79	+0".04	5	4	606	Ring almost touches Saturn, est. to fill 0.75 of the space; probably a little space next to globe perfectly black
June 27 13 5	2.86	2.71	-0.04	5	4	388	Dusky ring certainly occupies 0.7 of the space next to the planet
27 13 16	2.90	2.75	0.00	5	4	388	Magnificent seeing; the planet is sharp like an engraving
28 11 59	3.00	2.85	+0.10	5	4	388	Excellent seeing
30 11 22	2.88	2.73	-0.02	5-4	4	388	Seeing changeable
July 21 10 47	2.84	2.70	-0.05	4-5	4	388	Splendid definition; excellent measures on preceding side
Aug. 7 9 45	2.82	2.71	-0.04	5	4	388	Faint ring on preceding side occupies fully 0.5 of the space, and fades away gradually

$$\text{Mean } s_r = 2".749 \pm 0".014 = 19014 \pm 96 \text{ km.}$$

External Diameter of Saturn's outer Ring, observed in Daylight, Washington, 1901.

Wash. M. T. 1901	D_o	D_r	$D_o - D_c$	See- ing	Cell	Power	Remarks
Oct. 8 5 ^h 33 ^m	37".80	39".96	-0".01	5	5	388	Seeing 5, absolutely perfect
» 5 34	37.80	39.96	-0.01	5	5	388	Never saw the seeing better on any object
» 5 35	37.79	39.95	-0.02	5	5	388	Rings have just the right brightness
» 5 36	37.78	39.94	-0.03	5	5	388	The finest measures I ever made on Saturn's rings
» 5 37	37.78	39.94	-0.03	5	5	388	Splendid set of measures which may be perfectly depended on
Oct. 16 5 22	37.20	39.87	-0.11	5	5	388	Seeing very good, but a little tremulous
» 5 26	37.31	39.98	0.00	5	5	388	
» 5 28	37.28	39.95	-0.03	5	5	388	Can not see the edge with perfect sharpness at moments
» 5 30	37.33	40.00	+0.02	5	5	388	
» 5 31	37.37	40.04	+0.06	5	5	388	A little blurred
» 5 32	37.32	39.99	+0.01	5	5	388	

$$\text{Mean } D_r = 39".971 \pm 0".009 = 276444 \pm 62 \text{ km.}$$

External Diameter of Dusky Ring, observed in Daylight, Washington, 1901.

Wash. M. T. 1901	D_o	D_r	$D_o - D_c$	See- ing	Cell	Power	Remarks
Oct. 8 5 ^h 38 ^m	24".52	25".91	+0".03	5	5	388	Splendid measures, seeing 5, perfect
» 5 39	24.51	25.90	+0.02	5	5	388	Magnificent seeing
» 5 41	24.49	25.88	0.00	5	5	388	Never saw the rings better
» 5 43	24.45	25.84	-0.04	5	5	388	
» 5 45	24.50	25.89	+0.01	5	5	388	Measures may be perfectly depended on

$$\text{Mean } D_r = 25".884 \pm 0".008 = 179017 \pm 57 \text{ km.}$$

When the seeing was best, estimates last year and this year agreed in making the dusky ring cover from 0.66 to 0.75 of the whole space between its outer border and the globe of Saturn. The present series of measures make the ring occupy just 66 per cent of this space; I therefore adopt the result as fixing the borders of the dusky ring with the desired accuracy.

b) External Diameter of the outer Ring by Daylight.

This was measured on two days of exceptional definition as indicated in Table III.

From this it appears that the probable width by day-

light is 39".971, with an uncertainty of perhaps $\pm 0".05$. The width found by a long series of night observations made last year, when a slight error of reduction is corrected, is 40".274. From this it appears that the constant of irradiation for the outer ring is 0".303, or 0".15 in either direction. The irradiation for Saturn's globe being 0".56, the value 0".30 for the outer ring confirms the result of several estimates of the relative brightness of these two parts of the ball and ring system. Careful estimates made the outer ring $\frac{1}{2}$ to $\frac{3}{5}$ as bright as the ball of the planet. Accordingly, the above value of the irradiation of the outer ring may, I think, be depended upon as essentially accurate.

c) Brightness of the Central Ring.

This was always estimated at about the same brightness as the globe of Saturn; when its lustre was rated below that of Saturn, it was considered only very slightly fainter. Under the circumstances, I have adopted for the irradiation of the central ring the constant 0".50, or 0".25 in either direction.

d) Width of the Encke and Cassini Divisions.

These are given by last year's work, when corrections

for irradiation are applied. Thus the Encke division at night had a width of 0".107, and when irradiation of +0".303 is applied, the resulting width of the Encke division is 0".410. In case of the Cassini division the corrections for irradiation are +0".15 + 0".25 = +0".40, and the corrected width of the division, 0".818. The Cassini division is therefore a little wider than the diameter of the satellite Titan. Applying these corrections for irradiation, the concluded dimensions of the entire ball and ring system of Saturn are as follows:

	As observed at night	As corrected for irradiation
External diameter of the outer ring	40".274	39".971 = 276474 km
Internal diameter of the outer ring, or external diameter of Cassini's division	34.757	34.605 = 239358
Diameter of the centre of Encke's division	37.747	37.747 = 261090
Width of Encke's division	0.107	0.410 = 2836
Total width of the outer ring	2.758	2.455 = 16981
Width of the outer part of the outer ring	1.237	0.934 = 6460
Width of the inner part of the outer ring	1.414	1.111 = 7685
Width of Cassini's division	0.418	0.818 = 5658
External diameter of central ring	33.921	33.671 = 232898
Internal diameter of central ring, or external diameter of dusky ring	25.932	25.932 = 179368
Width of central ring	3.995	3.745 = 25904
Internal diameter of dusky ring	20.434	20.434 = 141339
Width of dusky ring	2.749	2.749 = 19014
Black space between Saturn's globe and dusky ring	1.315	1.597 = 11046
Equatorial diameter of Saturn	17.804	17.240 = 119247
Assumed oblateness of Saturn (H. Struve's value)	0.1013	
Polar diameter with this oblateness	16.005	15.494 = 107167
Assumed mass of Saturn (H. Struve's value)	1:3495.3	
Resulting mean density of the planet		0.7105 (water = 1)

In concluding this paper acknowledgements should be made to Mr. *Gustave Harrison*, who has assisted on the great equatorial in most of the observations of the past five months. Besides aiding in the care of the instrument, he

has usually recorded the measures, and thus enabled the observer to work rapidly during the moments of good seeing, upon which all the planetary work so entirely depends.

U. S. Naval Observatory, Washington, D. C., 1901 Oct. 26.

T. F. F. See.

Micrometrical Measures of the Diameter of Uranus

made with the 26 inch Equatorial of the U. S. Naval Observatory, Washington.

By *T. F. F. See.*

The following observations of the diameter of Uranus were made during the opposition of 1901. The season on the whole was somewhat unfavorable, but on a few nights very excellent definition was obtained. The best of these

nights was Aug. 18th, when the image of Uranus was the finest I have ever seen. It happens that the mean diameter resulting from measures on all the nights is the same as that afforded by the five sets of measures made on this date.

Table I. Micrometer Measures of the Diameter of Uranus, Washington, 1900-01.

Wash. M. T.	I D_o 90°-270°	II D_o 0°-180°	I D_r	II D_r	I $D_o - D_c$	II $D_o - D_c$	Seeing	Cell	Power	Remarks
1900										
Aug. 25 7 ^h 25 ^m	3".33	3".35	3".28	3".30	-0".18	-0".10	5	3	888	Magnificent images, meas. excell. Disc almost as bright at edge as in centre, sharp & perf. round
1901										
May 14 13 40	3.60	3.59	3.40	3.39	-0.06	-0.01	4	4	606	Disc absolutely round, no markings of any kind