CHAPTER IX.

SATELLITES OF SATURN.

In the autumn of 1877, measurements were undertaken of the light of the satellites of Saturn. The inner satellites were identified, and their positions determined by the very convenient ephemerides of Marth. It is much to be desired that similar ephemerides should be published for the three outer satellites. Measurements were obtained on twenty-eight evenings between Oct. 1, 1877, and Jan. 28, 1878, of the seven outer satellites of Saturn. Hyperion, the faintest of all, was easily observed even in strong moonlight. The minuteness of Mimas, the innermost of the satellites, and the proximity of Saturn, render it a difficult object. Although looked for repeatedly, it was not seen until Dec. 22, 1877, and was then too faint to be satisfactorily measured. It was again detected on the following evening, and its identity thus established. The cause of the difficulty was at length found in an error in the published ephemeris, which required a correction of nearly two hours. The satellite was therefore so near the ring at the predicted time of its elongation as to be almost invisible. The next year, applying this correction, Mimas was seen repeatedly in the computed position with sufficient distinctness for measurement. Generally several of the satellites were measured on the same evening to determine their relative light, and to eliminate the error incident to a direct comparison with Saturn. On the evening of Nov. 24, 1878, all eight satellites were visible. I obtained a setting of each satellite in turn, and repeated this five times. The relative brightness is thus found in a satisfactory manner.

A large number of measurements were made of Iapetus, the outer satellite, to measure the variations in light to which this body is known to be subject. Observations were made on twenty nights in the first year, and on one hundred and one in the second year. To eliminate systematic errors, the plan was adopted during the later observations of measuring on every evening a star having approximately the brightness of the satellite. The star Weisse 23^h 1013, having a position R.A. $= 23^h\ 50^m\ 40^s$ (1880.0) and Dec. $= -3°\ 40'.0$ (1880.0) is conveniently situated for this purpose, as it is near the stationary point of Saturn, and the planet was accordingly within one or two degrees of it for several months. North preceding this star, which will be designated

as a, is another called b, of about the thirteenth magnitude, having a position R.A. = $23^h\,50^m\,33^s$ (1880.0) and Dec. = $-3°\,38'.7$ (1880.0). Star b was observed on almost every clear evening after Oct. 2, 1878, until the approach of Saturn to the Sun rendered the further measurement impossible. Some measurements were also obtained of star a. A comparison of these measurements with those of Iapetus on the same evening by the same observer eliminates many of the sources of error which otherwise might affect the result.

But few observations of Enceladus, Tethys, Dione, Rhea, and Titan were made in 1878, as it was thought that the observations of 1877 would determine their light with sufficient precision.

Ledgers of the satellites are given in Table XLIX. The first four columns give a number for reference, the number of Table I., the date, and the hour. The column headed Longitude gives approximately the angular distance the satellite has moved since its last superior conjunction with Saturn. An angle 90° therefore denotes that the satellite is at its following elongation, 270° at its preceding elongation. The next three columns give the mean reading, the product of its logarithm by five, and the constant. When the observations were made with Photometer E, the first of these quantities was corrected by subtracting the zero given in Appendix D from the reading given in Table I. The next column gives the difference in magnitude of the objects, found, as is shown on page 206, by subtracting five times the logarithm of the reading from the constant. The next column gives the correction for the ring of Saturn, found as on page 99. Subtracting these quantities from those given in the preceding column gives the next column, which equals the difference in magnitude of the satellite and ball of Saturn, supposing that the ring was removed. The residual of this quantity from its mean, and the initial of the observer, are given in the last two columns.

In the case of Iapetus the residuals are not taken from the mean, on account of the variation in light of this satellite. The difference between the observed difference of magnitude and that found by computation from the formula deduced on page 265 is given instead.

TABLE XLIX.

OBSERVATIONS OF THE SATELLITES OF SATURN.

No.	No. in Table I.	Date.	Hour.	Longitude.	Reading.	Diff. in Magn. of Images.	Constant.	Diff. in Magn. of Objects.	Corr. for Ring.	Corr. Diff. in Magn.	Resid.	Obs.
				°								
MIMAS. (1878.)												
1	4042	Sept. 25	9.8	80	.83	9.60	11.10	11.50	.12	11.38	−.53	P.
2	4043	" "	10.1	90	.72	9.29	"	11.81	.12	11.69	−.22	U.
3	4261	Oct. 14	7.9	110	.67	9.13	"	11.97	.10	11.87	−.04	U.
4	4378	Oct. 21	7.6	260	.81	9.54	"	11.56	.09	11.47	−.44	U.
5	4379	" "	8.0	270	.89	9.75	"	11.35	.09	11.26	−.65	P.
6	4560	Nov. 13	9.9	80	.58	8.82	"	12.28	.07	12.21	+.30	U.
7	4562	" "	10.1	90	.64	9.03	"	12.07	.07	12.00	+.09	S.
8	4564	" "	10.3	90	.60	8.89	"	12.21	.07	12.14	+.23	P.
9	4569	" "	10.8	100	.63	9.00	"	12.10	.07	12.03	+.12	U.
10	4570	" "	10.9	100	.66	9.10	"	12.00	.07	11.93	+.02	P.
11	4577	Nov. 14	9.3	90	.54	8.66	"	12.44	.07	12.37	+.46	P.
12	4578	" "	9.3	90	.45	8.26	"	12.84	.07	12.77	+.86	U.
13	4579	" "	9.3	90	.60	8.89	"	12.21	.07	12.14	+.23	U.
14	4580	" "	9.5	100	.52	8.58	"	12.52	.07	12.45	+.54	P.
15	4597	Nov. 23	8.3	280	.89	9.75	"	11.35	.07	11.28	−.63	P.
16	4605	Nov. 24	6.3	270	.70	9.23	"	11.87	.07	11.80	−.11	P.
17	4608	" "	7.0	280	.78	9.46	"	11.64	.07	11.57	−.34	S.
18	4614	" "	7.5	290	1.02	0.04	"	11.06	.07	[10.99]		P.
19	4615	" "	7.8	290	.65	9.06	"	12.04	.07	11.97	+.06	P.
										11.91	±.33	
ENCELADUS. (1877–78.)												
				°								
1	345	Oct. 7	9.7	320	2.89	2.30	13.50	11.20	.13	11.07	−.33	P.
2	346	" "	9.8	320	3.35	2.62	"	10.88	.13	10.75	−.65	S.
3	409	Oct. 13	10.0	100	2.14	1.65	"	11.85	.14	11.71	+.31	U.
4	410	" "	10.3	110	2.13	1.64	"	11.86	.14	11.72	+.32	P.
5	431	Oct. 17	8.9	60	2.57	2.05	"	11.45	.14	11.31	−.09	P.
6	436	" "	9.5	70	1.91	1.40	"	12.10	.14	11.96	+.56	U.
7	464	Oct. 22	7.7	280	2.60	2.07	"	11.43	.15	11.28	−.12	P.
8	662	Nov. 19	8.7	90	2.74	2.19	"	11.31	.16	11.15	−.25	P.
9	665	" "	9.0	90	2.57	2.05	"	11.45	.16	11.29	−.11	P.
10	4561	Nov. 13	10.0	90	.83	9.60	11.10	11.50	.07	11.43	+.03	U.
11	4563	" "	10.2	100	.78	9.46	"	11.64	.07	11.57	+.17	S.
12	4565	" "	10.3	100	.78	9.46	"	11.64	.07	11.57	+.17	P.
13	4618	Nov. 24	7.8	80	.84	9.62	"	11.48	.07	11.41	+.01	P.
										11.40	±.24	
TETHYS. (1877–78.)												
				°	′							
1	298	Oct. 1	7.8	290	3.89	2.95	13.50	10.55	.12	10.43	−.03	P.
2	299	" "	7.8	290	3.75	2.87	"	10.63	.12	10.51	+.05	P.
3	300	" "	8.0	290	4.85	3.43	"	10.07	.12	9.95	−.51	U.
4	301	" "	8.1	290	4.70	3.36	"	10.14	.12	10.02	−.44	U.
5	302	" "	8.3	290	3.58	2.77	"	10.73	.12	10.61	+.15	S.
6	303	" "	8.5	290	3.77	2.88	"	10.62	.12	10.50	+.04	U.

No.	No. in Table I.	Date.	Hour.	Longitude.	Reading.	Diff. in Magn. of Images.	Constant.	Diff. in Magn. of Objects.	Corr. for Ring.	Corr. Diff. in Magn.	Resid.	Obs.
					TETHYS (continued).							
				°								
7	307	Oct. 1	9.3	300	4.27	3.15	13.50	10.35	.12	10.23	− .23	P.
8	311	" "	9.4	300	4.29	3.16	"	10.34	.12	10.22	− .24	S.
9	314	" "	9.8	300	5.05	3.52	"	9.98	.12	9.86	− .60	U.
10	404	Oct. 13	9.1	70	3.80	2.90	"	10.60	.14	10.46	.00	P.
11	405	" "	9.3	70	4.29	3.16	"	10.34	.14	10.20	− .26	U.
12	429	Oct. 17	8.8	110	4.06	3.04	"	10.46	.14	10.32	− .14	P.
13	435	" "	9.4	110	3.36	2.63	"	10.87	.14	10.73	+ .27	U.
14	628	Nov. 16	9.1	70	4.51	3.27	"	10.23	.16	10.07	− .39	P.
15	630	" "	9.2	70	4.82	3.41	"	10.09	.16	9.93	− .53	U.
16	667	Nov. 19	9.4	290	3.07	2.44	"	11.06	.16	10.90	+ .44	U.
17	669	" "	9.7	290	2.09	1.60	"	11.90	.16	11.74	+1.28	S.
18	675	Nov. 20	6.2	90	1.48	.85	"	12.65	.16	12.49	+2.03	S.
19	676	" "	6.4	90	3.76	2.88	"	10.62	.16	10.46	.00	P.
20	715	Dec. 1	7.0	40	1.70	1.15	11.10	9.95	.15	9.80	− .66	S.
21	1011	Dec. 22	7.1	80	1.35	.65	"	10.45	.13	10.32	− .14	P.
22	1013	" "	7.9	90	1.29	.55	"	10.55	.13	10.42	− .04	P.
23	1016	" "	8.4	90	1.08	.17	"	10.93	.13	10.80	+ .34	S.
24	4616	Nov. 24	7.8	260	1.53	.92	"	10.18	.07	10.11	− .35	P.
										10.46	± .38	
					DIONE. (1877–78.)							
				°								
1	308	Oct. 1	9.3	260	3.33	2.61	13.50	10.89	.13	10.76	+.19	P.
2	312	" "	9.4	260	3.38	2.64	"	10.86	.13	10.73	+.16	S.
3	315	" "	9.8	260	4.18	3.11	"	10.39	.13	10.26	−.31	U.
4	330	Oct. 5	8.8	60	2.84	2.27	"	11.23	.13	11.10	+.53	P.
5	331	" "	9.0	70	3.29	2.59	"	10.91	.13	10.78	+.21	P.
6	332	" "	9.1	70	3.51	2.73	"	10.77	.13	10.64	+.07	S.
7	333	" "	9.2	70	3.35	2.62	"	10.88	.13	10.75	+.18	U.
8	408	Oct. 13	9.9	40	3.95	2.98	"	10.52	.14	10.38	−.19	U.
9	411	" "	10.3	50	4.39	3.21	"	10.29	.14	10.15	−.42	P.
10	425	Oct. 17	7.3	200	1.82	1.30	11.20	9.90	.14	9.76	−.81	U.
11	432	" "	9.0	210	2.55	2.03	13.50	11.47	.14	11.33	+.76	P.
12	440	" "	9.7	210	2.99	2.38	"	11.12	.14	10.98	+.41	U.
13	462	Oct. 22	7.6	140	3.86	2.93	"	10.57	.15	10.42	−.15	P.
14	550	Nov. 7	8.1	80	4.26	3.15	"	10.35	.16	10.19	−.38	P.
15	552	" "	8.3	80	4.02	3.02	"	10.48	.16	10.32	−.25	U.
16	557	" "	9.0	90	3.34	2.62	"	10.88	.16	10.72	+.15	S.
17	4617	Nov. 24	7.8	280	1.35	.65	11.10	10.45	.07	10.38	−.19	P.
										10.57	±.32	
					RHEA. (1877–78.)							
				°								
1	309	Oct. 1	9.3	240	5.58	3.73	13.50	9.77	.13	9.64	−.24	P.
2	313	" "	9.4	240	4.80	3.41	"	10.09	.13	9.96	+.08	S.
3	316	" "	9.8	240	5.48	3.69	"	9.81	.13	9.68	−.20	U.
4	403	Oct. 13	9.0	110	4.88	3.44	"	10.06	.14	9.92	+.04	P.
5	406	" "	9.5	110	5.87	3.84	"	9.66	.14	9.52	−.36	U.
6	424	Oct. 17	7.1	60	2.50	1.99	11.20	9.21	.14	9.07	−.81	U.
7	428	" "	8.8	70	5.44	3.68	13.50	9.82	.14	9.68	−.20	P.
8	434	" "	9.3	70	4.65	3.34	"	10.16	.14	10.02	+.14	U.

No.	No. in Table I.	Date.	Hour.	Longitude.	Reading.	Diff. in Magn. of Images.	Constant.	Diff. in Magn. of Objects.	Corr. for Ring.	Corr. Diff. in Magn.	Resid.	Obs.
					RHEA (continued).							
9	453	Oct. 18	9.6	° 150	6.28	3.99	13.50	9.51	.14	9.37	− .51	P.
10	455	" "	9.7	150	4.80	3.41	"	10.09	.14	9.95	+ .07	P.
11	463	Oct. 22	7.6	100	5.59	3.74	"	9.76	.15	9.61	− .27	P.
12	703	Nov. 30	6.8	330	1.17	.34	11.10	10.76	.15	10.61	+ .73	S.
13	705	" "	7.2	330	1.01	.02	"	11.08	.15	10.93	+1.05	U.
14	717	Dec. 1	7.8	50	1.35	.65	"	10.45	.15	10.30	+ .42	U.
15	719	" "	8.0	50	1.85	1.34	"	9.76	.15	9.61	− .27	P.
16	4619	Nov. 24	7.8	140	1.47	.84	"	10.26	.07	10.19	+ .31	P.
										9.88	± .36	
					TITAN. (1877–78.)							
1	347	Oct. 7	10.0	° 200	10.85	5.18	13.50	8.32	.14	8.18	− .32	P.
2	348	" "	10.1	200	8.12	4.55	"	8.95	.14	8.81	+ .31	S.
3	398	Oct. 13	7.5	330	10.91	5.19	"	8.31	.14	8.17	− .33	P.
4	401	" "	7.8	330	7.88	4.48	"	9.02	.14	8.88	+ .38	U.
5	423	Oct. 17	7.0	60	4.22	3.13	11.20	8.07	.14	7.93	− .57	U.
6	433	" "	9.1	60	11.23	5.25	13.50	8.25	.14	8.11	− .39	P.
7	442	" "	10.0	60	11.83	5.36	"	8.14	.14	8.00	− .50	U.
8	460	Oct. 22	6.4	170	7.96	4.50	"	9.00	.15	8.85	+ .35	P.
9	670	Nov. 19	9.9	90	3.14	2.48	11.20	8.72	.15	8.57	+ .07	U.
10	671	" "	9.9	90	3.62	2.79	"	8.41	.15	8.26	− .24	S.
11	672	" "	10.0	90	3.19	2.52	"	8.68	.15	8.53	+ .03	P.
12	704	Nov. 30	6.9	330	1.52	.91	11.10	10.19	.15	10.04	+1.54	S.
13	714	Dec. 1	6.9	0	2.41	1.91	"	9.19	.15	9.04	+ .54	S.
14	1197	Dec. 28	8.4	250	2.92	2.33	"	8.77	.13	8.64	+ .14	P.
15	3464	Aug. 7	13.5	220	3.00	2.39	"	8.71	.18	8.53	+ .03	P.
16	4586	Nov. 15	7.3	320	3.77	2.88	"	8.22	.07	8.15	− .35	P.
17	4587	" "	7.3	320	4.47	3.25	"	7.85	.07	7.78	− .72	U.
18	4620	Nov. 24	7.8	160	3.03	2.41	"	8.69	.07	8.62	+ .12	P.
										8.50	± .38	
					HYPERION. (1877–78.)							
1	304	Oct. 1	8.6	° 240	1.18	.36	13.50	13.14	.13	13.01	+ .20	P.
2	305	" "	8.9	240	2.31	1.82	"	11.68	.13	11.55	−1.26	S.
3	306	" "	9.1	240	.92	9.82	"	13.68	.13	13.55	+ .74	U.
4	310	" "	9.3	240	1.34	.64	"	12.86	.13	12.73	− .08	P.
5	317	" "	9.8	240	2.01	1.52	"	11.98	.13	11.85	− .96	U.
6	318	" "	10.0	240	1.09	.19	"	13.31	.13	13.18	+ .37	P.
7	319	" "	10.3	240	1.89	1.38	"	12.12	.13	11.99	− .82	S.
8	323	Oct. 5	7.5	310	1.61	1.03	"	12.47	.13	12.34	− .47	P.
9	325	" "	7.7	310	1.01	.02	"	13.48	.13	13.35	+ .54	U.
10	334	" "	9.4	310	1.53	.92	"	12.58	.13	12.45	− .36	P.
11	335	" "	9.5	310	1.37	.68	"	12.82	.13	12.69	− .12	S.
12	519	Oct. 30	7.8	10	2.13	1.64	"	11.86	.15	11.71	−1.10	P.
13	520	" "	7.9	10	2.17	1.68	"	11.82	.15	11.67	−1.14	U.
14	549	Nov. 7	8.0	150	1.19	.38	"	13.12	.16	12.96	+ .15	P.
15	553	" "	8.5	150	1.34	.64	"	12.86	.16	12.70	− .11	U.
16	556	" "	8.9	150	1.49	.87	"	12.63	.16	12.47	− .34	S.

No.	No. in Table I.	Date.	Hour.	Longitude.	Reading.	Diff. in Magn. of Images.	Constant.	Diff. in Magn. of Objects.	Corr. for Ring.	Corr. Diff. in Magn.	Resid.	Obs.
					HYPERION (continued).							
				°								
17	664	Nov. 19	8.9	350	1.72	1.18	13.50	12.32	.16	12.16	− .65	P.
18	3749	Sept. 7	10.0	250	.58	8.82	11.10	12.28	.15	12.13	− .68	P.
19	3750	" "	10.1	250	.44	8.22	"	12.88	.15	12.73	− .08	S.
20	3970	Sept. 20	10.5	110	.61	8.93	"	12.17	.13	12.04	− .77	P.
21	3971	" "	10.6	110	.41	8.06	"	13.04	.13	12.91	+ .10	U.
22	4120	Sept. 30	8.6	280	.28	7.24	"	13.86	.12	13.74	+ .93	S.
23	4121	" "	8.7	280	.30	7.39	"	13.71	.12	13.59	+ .78	P.
24	4140	Oct. 1	9.5	290	.34	7.66	"	13.44	.11	13.33	+ .52	P.
25	4141	" "	9.5	290	.28	7.24	"	13.86	.11	13.75	+ .94	S.
26	4377	Oct. 21	7.4	270	.47	8.36	"	12.74	.09	12.65	− .16	U.
27	4380	" "	8.3	270	.48	8.41	"	12.69	.09	12.60	− .21	P.
28	4383	" "	8.9	270	.39	7.96	"	13.14	.09	13.05	+ .24	S.
29	4407	Oct. 22	9.6	290	.48	8.41	"	12.69	.09	12.60	− .21	U.
30	4434	Oct. 28	10.8	30	.50	8.49	"	12.61	.08	12.53	− .28	P.
31	4441	Oct. 29	8.2	50	.47	8.36	"	12.74	.08	12.66	− .15	P.
32	4446	Nov. 1	6.5	100	.32	7.58	"	13.52	.08	13.44	+ .63	P.
33	4447	" "	6.7	100	.30	7.39	"	13.71	.08	13.63	+ .82	U.
34	4448	" "	7.0	100	.25	6.99	"	14.11	.08	14.03	+1.22	S.
35	4458	Nov. 2	8.0	110	.36	7.78	"	13.32	.08	13.24	+ .43	P.
36	4518	Nov. 7	9.3	200	.58	8.82	"	12.28	.08	12.20	− .61	P.
37	4519	" "	9.4	200	.43	8.17	"	12.93	.08	12.85	+ .04	U.
38	4566	Nov. 13	10.5	300	.45	8.27	"	12.83	.07	12.76	− .05	P.
39	4567	" "	10.6	300	.40	8.01	"	13.09	.07	13.02	+ .21	S.
40	4568	" "	10.7	300	.34	7.66	"	13.44	.07	13.37	+ .56	U.
41	4599	Nov. 23	8.5	110	.42	8.12	"	12.98	.08	12.90	+ .09	P.
42	4600	" "	8.7	110	.37	7.84	"	13.26	.08	13.18	+ .37	S.
43	4607	Nov. 24	6.7	130	.36	7.78	"	13.32	.08	13.24	+ .43	S.
44	4609	" "	7.2	130	.41	8.06	"	13.04	.08	12.96	+ .15	P.
45	4621	" "	7.8	130	.41	8.06	"	13.04	.08	12.96	+ .15	P.
										12.81	± .47	
					IAPETUS. (1877–79.)							
				°								
1	256	Sept. 24	7.3	260	15.53	2.86	10.70	13.56	3.21	10.35	− .09	P.
2	266	" "	9.3	260	15.46	2.87	"	13.57	3.21	10.36	− .08	P.
3	267	" "	9.4	260	16.51	2.73	"	13.43	3.21	10.22	− .22	S.
4	324	Oct. 5	7.5	310	5.34	3.64	13.50	9.86	.13	9.73	− .73	P.
5	349	Oct. 7	10.2	320	3.91	2.96	"	10.54	.13	10.41	− .07	P.
6	350	" "	10.3	320	4.14	3.08	"	10.42	.13	10.29	− .19	S.
7	399	Oct. 13	7.6	340	4.35	3.19	"	10.31	.14	10.17	− .39	P.
8	400	" "	7.7	340	4.73	3.37	"	10.13	.14	9.99	− .57	U.
9	430	Oct. 17	8.9	0	2.63	2.10	"	11.40	.14	11.26	+ .56	P.
10	441	" "	9.8	0	2.64	2.11	"	11.39	.14	11.25	+ .55	U.
11	452	Oct. 18	9.6	10	3.80	2.90	"	10.60	.14	10.46	− .33	P.
12	454	" "	9.7	10	2.72	2.17	"	11.33	.14	11.19	+ .40	P.
13	461	Oct. 22	7.5	20	3.26	2.57	"	10.93	.15	10.78	− .13	P.
14	548	Nov. 7	7.9	100	2.50	1.99	"	11.51	.16	11.35	− .41	P.
15	551	" "	8.2	100	2.90	2.31	"	11.19	.16	11.03	− .73	U.
16	555	" "	8.7	100	4.15	3.09	"	10.41	.16	10.25	−1.51	S.
17	626	Nov. 16	9.0	140	2.10	1.61	"	11.89	.16	11.73	+ .54	P.
18	632	" "	9.3	140	2.80	2.24	"	11.26	.16	11.10	− .09	U.
19	663	Nov. 19	8.8	150	2.96	2.36	"	11.14	.16	10.98	− .06	P.

No.	No. in Table I.	Date.	Hour.	Longitude.	Reading.	Diff. in Magn. of Images.	Constant.	Diff. in Magn. of Objects.	Corr. for Ring.	Corr. Diff. in Magn.	Resid.	Obs.
					IAPETUS (continued).							
				°								
20	666	Nov. 19	9.2	150	1.51	.89	13.50	12.61	.16	12.45	+1.41	U.
21	668	" "	9.5	150	1.93	1.43	"	12.07	.16	11.91	+ .87	S.
22	674	Nov. 20	6.0	160	1.78	1.25	"	12.25	.16	12.09	+1.18	S.
23	677	" "	6.5	160	2.14	1.65	"	11.85	.16	11.69	+ .78	P.
24	701	Nov. 30	6.6	200	1.27	.52	11.10	10.58	.15	10.43	− .13	S.
25	702	" "	6.7	200	1.03	.06	"	11.04	.15	10.89	+ .33	U.
26	713	Dec. 1	6.8	210	1.06	.13	"	10.97	.15	10.82	+ .30	S.
27	716	" "	7.5	210	1.13	.27	"	10.83	.15	10.68	+ .16	U.
28	718	" "	7.9	210	1.16	.32	"	10.78	.15	10.63	+ .11	P.
29	954	Dec. 16	9.0	280	1.35	.65	"	10.45	.14	10.31	− .13	S.
30	1012	Dec. 22	7.8	300	1.44	.79	"	10.31	.13	10.18	− .27	P.
31	1014	" "	7.9	300	1.25	.48	"	10.62	.13	10.49	+ .04	P.
32	1015	" "	8.3	300	1.34	.64	"	10.46	.13	10.33	− .12	S.
33	1042	Dec. 23	6.2	310	1.37	.68	"	10.42	.13	10.29	− .17	P.
34	1043	" "	6.3	310	1.20	.40	"	10.70	.13	10.57	+ .11	S.
35	1196	Dec. 28	8.2	330	1.26	.50	"	10.60	.13	10.47	− .05	P.
36	1259	Jan. 5	6.7	10	.93	9.84	"	11.26	.11	11.15	+ .36	P.
37	1260	" "	6.8	10	.78	9.46	"	11.64	.11	11.53	+ .74	S.
38	1301	Jan. 12	6.8	40	.85	9.65	"	11.45	.10	11.35	+ .16	S.
39	1352	Jan. 16	6.2	60	.54	8.66	"	12.44	.09	12.35	+ .83	S.
40	1353	" "	6.4	60	.73	9.32	"	11.78	.09	11.69	+ .17	P.
41	3463	Aug. 7	13.3	240	1.72	1.18	"	9.92	.18	9.74	− .71	P.
42	3465	" "	14.0	240	1.23	.45	"	10.65	.18	10.47	+ .02	S.
43	3466	" "	14.0	240	1.62	1.05	"	10.05	.18	9.87	− .58	P.
44	3543	Aug. 14	10.3	270	1.49	.87	"	10.23	.17	10.06	− .37	P.
45	3544	" "	10.3	270	.95	9.89	"	11.21	.17	11.04	+ .61	S.
46	3545	" "	10.4	270	1.41	.75	"	10.35	.17	10.18	− .25	U.
47	3659	Aug. 29	9.8	340	1.72	1.18	"	9.92	.14	9.78	− .78	P.
48	3660	" "	9.9	340	1.45	.81	"	10.29	.14	10.15	− .41	U.
49	3691	Aug. 31	9.5	350	1.30	.57	"	10.53	.14	10.39	− .23	P.
50	3709	Sept. 1	10.0	350	1.58	.99	"	10.11	.14	9.97	− .65	P.
51	3745	Sept. 6	9.8	20	.87	9.70	"	11.40	.14	11.26	+ .35	P.
52	3746	" "	9.9	20	.57	8.78	"	12.32	.14	12.18	+1.27	S.
53	3747	" "	9.9	20	.91	9.79	"	11.31	.14	11.17	+ .26	U.
54	3748	Sept. 7	9.9	20	1.01	.02	"	11.08	.13	10.95	+ .04	P.
55	3751	" "	10.2	20	.72	9.29	"	11.81	.13	11.68	+ .77	S.
56	3771	Sept. 8	10.8	30	1.18	.36	"	10.74	.13	10.61	− .43	P.
57	3772	" "	10.8	30	1.16	.32	"	10.78	.13	10.65	− .39	P.
58	3773	" "	10.9	30	.83	9.60	"	11.50	.13	11.37	+ .33	S.
59	3796	Sept. 9	10.3	30	.66	9.10	"	12.00	.13	11.87	+ .83	S.
60	3797	" "	10.3	30	.75	9.38	"	11.72	.13	11.59	+ .55	P.
61	3798	" "	10.4	30	.87	9.70	"	11.40	.13	11.27	+ .23	U.
62	3837	Sept. 14	9.8	50	.61	8.93	"	12.17	.13	12.04	+ .69	S.
63	3838	" "	9.9	50	.72	9.29	"	11.81	.13	11.68	+ .33	P.
64	3860	Sept. 15	9.7	60	.59	8.85	"	12.25	.13	12.12	+ .60	S.
65	3861	" "	9.8	60	.68	9.16	"	11.94	.13	11.81	+ .29	P.
66	3878	Sept. 16	10.0	60	.60	8.89	"	12.21	.13	12.08	+ .56	S.
67	3879	" "	10.1	60	.72	9.29	"	11.81	.13	11.68	+ .16	U.
68	3880	" "	10.2	60	.74	9.35	"	11.75	.13	11.62	+ .10	P.
69	3896	Sept. 17	8.9	70	.56	8.74	"	12.36	.13	12.23	+ .57	S.
70	3897	" "	9.0	70	.74	9.35	"	11.75	.13	11.62	− .04	P.
71	3898	" "	9.1	70	.75	9.38	"	11.72	.13	11.59	− .07	U.
72	3927	Sept. 18	10.1	70	.64	9.03	"	12.07	.13	11.94	+ .28	P.
73	3928	" "	10.2	70	.72	9.29	"	11.81	.13	11.68	+ .02	S.

No.	No. in Table I.	Date.	Hour.	Longitude.	Reading.	Diff. in Magn. of Images.	Constant.	Diff. in Magn. of Objects.	Corr. for Ring.	Corr. Diff. in Magn.	Resid.	Obs.
					IAPETUS (continued).							
				°								
74	3929	Sept. 18	10.3	70	.76	9.40	11.10	11.70	.13	11.57	− .09	U.
75	3944	Sept. 19	10.0	80	.95	9.89	"	11.21	.13	11.08	− .68	U.
76	3945	" "	10.0	80	.85	9.65	"	11.45	.13	11.32	− .44	S.
77	3946	" "	10.1	80	.87	9.70	"	11.40	.13	11.27	− .49	P.
78	3972	Sept. 20	10.7	80	.92	9.82	"	11.28	.13	11.15	− .61	U.
79	3973	" "	10.7	80	.93	9.84	"	11.26	.13	11.13	− .63	P.
80	3996	Sept. 22	9.3	90	.77	9.43	"	11.67	.12	11.55	− .25	P.
81	3997	" "	9.3	90	.63	9.00	"	12.10	.12	11.98	+ .18	S.
82	4016	Sept. 23	9.4	90	2.01	1.52	"	9.58	.12	9.46	−2.34	P.
83	4017	" "	9.5	90	2.24	1.75	"	9.35	.12	9.23	−2.57	U.
84	4044	Sept. 25	10.3	100	1.04	.08	"	11.02	.12	10.90	− .86	S.
85	4045	" "	10.5	100	.84	9.62	"	11.48	.12	11.36	− .40	P.
86	4046	" "	10.6	100	.87	9.70	"	11.40	.12	11.28	− .48	U.
87	4058	Sept. 27	8.9	110	.90	9.77	"	11.33	.12	11.21	− .45	U.
88	4059	" "	9.0	110	.77	9.43	"	11.67	.12	11.55	− .11	P.
89	4080	Sept. 28	9.1	120	.89	9.75	"	11.35	.12	11.23	− .29	P.
90	4081	" "	9.2	120	.74	9.35	"	11.75	.12	11.63	+ .11	S.
91	4100	Sept. 29	8.7	120	.90	9.77	"	11.33	.12	11.21	− .31	P.
92	4101	" "	8.9	120	.80	9.52	"	11.58	.12	11.46	− .06	S.
93	4118	Sept 30	8.1	130	.89	9.75	"	11.35	.12	11.23	− .12	P.
94	4119	" "	8.2	130	.79	9.49	"	11.61	.12	11.49	+ .14	S.
95	4138	Oct. 1	9.3	130	.69	9.19	"	11.91	.12	11.79	+ .44	S.
96	4139	" "	9.3	130	.82	9.57	"	11.53	.12	11.41	+ .06	P.
97	4149	Oct. 2	8.8	140	.86	9.67	"	11.43	.11	11.32	+ .13	P.
98	4150	" "	8.8	140	.74	9.35	"	11.75	.11	11.64	+ .45	S.
99	4168	Oct. 4	9.8	150	.84	9.62	"	11.48	.11	11.37	+ .33	S.
100	4169	" "	9.9	150	.80	9.52	"	11.58	.11	11.47	+ .43	P.
101	4187	Oct. 6	7.2	160	.61	8.93	"	12.17	.11	12.06	+1.15	S.
102	4188	" "	7.8	160	.73	9.32	"	11.78	.11	11.67	+ .76	P.
103	4191	" "	8.3	160	.67	9.13	"	11.97	.11	11.86	+ .95	S.
104	4227	Oct. 10	8.5	170	.85	9.65	"	11.45	.10	11.35	+ .56	P.
105	4230	" "	8.8	170	1.22	.43	"	10.67	.10	10.57	− .22	U.
106	4231	" "	9.8	170	.94	9.87	"	11.23	.10	11.13	+ .34	S.
107	4245	Oct. 13	6.8	190	1.23	.45	"	10.65	.10	10.55	− .07	P.
108	4248	" "	7.6	190	1.24	.47	"	10.63	.10	10.53	− .09	S.
109	4253	Oct. 14	6.9	190	1.17	.34	"	10.76	.10	10.66	+ .04	U.
110	4259	" "	7.7	190	1.34	.64	"	10.46	.10	10.36	− .26	P.
111	4262	" "	8.5	190	1.24	.47	"	10.63	.10	10.53	− .09	S.
112	4282	Oct. 15	8.8	200	1.09	.19	"	10.91	.10	10.81	+ .25	U.
113	4283	" "	8.9	200	1.58	.99	"	10.11	.10	10.01	− .55	S.
114	4287	" "	9.1	200	1.51	.89	"	10.21	.10	10.11	− .45	P.
115	4301	Oct. 16	7.2	200	1.70	1.15	"	9.95	.10	9.85	− .71	U.
116	4306	" "	7.7	200	1.43	.78	"	10.32	.10	10.22	− .34	P.
117	4319	Oct. 17	7.3	210	2.39	1.89	"	9.21	.09	9.12	−1.40	S.
118	4320	" "	7.4	210	1.34	.64	"	10.46	.09	10.37	− .15	U.
119	4323	" "	7.6	210	2.00	1.50	"	9.60	.09	9.51	−1.01	P.
120	4364	Oct. 20	8.3	220	1.83	1.31	"	9.79	.09	9.70	− .78	S.
121	4365	" "	8.4	220	1.78	1.25	"	9.85	.09	9.76	− .72	P.
122	4373	Oct. 21	7.0	220	2.02	1.53	"	9.57	.09	9.48	−1.00	S.
123	4376	" "	7.3	220	1.48	.85	"	10.25	.09	10.16	− .32	U.
124	4381	" "	8.3	220	1.93	1.43	"	9.67	.09	9.58	− .90	P.
125	4392	" "	10.0	220	.61	8.93	8.72	9.79	.09	9.70	− .78	P.
126	4393	Oct. 22	6.1	230	1.69	1.14	11.10	9.96	.09	9.87	− .59	P.
127	4396	" "	6.3	230	1.74	1.20	"	9.90	.09	9.81	− .65	S.

No.	No. in Table I.	Date.	Hour.	Longitude.	Reading.	Diff. in Magn. of Images.	Constant.	Diff. in Magn. of Objects.	Corr. for Ring.	Corr. Diff. in Magn.	Resid.	Obs.
					IAPETUS (continued).							
				°								
128	4397	Oct. 22	6.5	230	1.65	1.09	11.10	10.01	.09	9.92	− .54	U.
129	4420	Oct. 26	7.4	250	1.52	.91	"	10.19	.08	10.11	− .33	P.
130	4432	Oct. 28	10.6	260	1.43	.78	"	10.32	.08	10.24	− .20	P.
131	4438	Oct. 29	8.1	260	1.64	1.07	"	10.03	.08	9.95	− .49	U.
132	4439	" "	8.1	260	1.73	1.19	"	9.91	.08	9.83	− .61	P.
133	4444	" "	9.6	260	1.75	1.21	"	9.89	.08	9.81	− .63	S.
134	4449	Nov. 1	7.1	270	1.23	.45	"	10.65	.08	10.57	+ .14	S.
135	4452	" "	7.2	270	1.25	.48	"	10.62	.08	10.54	+ .11	P.
136	4453	" "	7.3	270	1.40	.73	"	10.37	.08	10.29	− .14	U.
137	4455	Nov. 2	7.7	280	1.46	.82	"	10.28	.08	10.20	− .24	P.
138	4467	Nov. 3	6.0	280	1.39	.71	"	10.39	.08	10.31	− .13	P.
139	4470	" "	6.2	280	.79	9.49	"	11.61	.08	11.53	+ .09	S.
140	4471	Nov. 4	7.8	290	1.31	.59	"	10.51	.08	10.43	− .01	P.
141	4474	" "	8.0	290	1.19	.38	"	10.72	.08	10.64	+ .20	U.
142	4475	" "	9.5	290	1.18	.36	"	10.74	.08	10.66	+ .22	S.
143	4533	Nov. 8	6.6	310	1.32	.60	"	10.50	.07	10.43	− .03	S.
144	4534	" "	6.8	310	1.48	.85	"	10.25	.07	10.18	− .28	P.
145	4537	" "	7.4	310	1.10	.21	"	10.89	.07	10.82	+ .36	U.
146	4538	Nov. 10	5.8	320	1.47	.84	"	10.26	.07	10.19	− .29	P.
147	4541	" "	6.0	320	1.41	.75	"	10.35	.07	10.28	− .20	S.
148	4548	Nov. 12	7.7	330	1.55	.95	"	10.15	.07	10.08	− .44	P.
149	4551	" "	7.8	330	1.41	.75	"	10.35	.07	10.28	− .24	U.
150	4557	Nov. 13	6.9	330	1.48	.85	"	10.25	.07	10.18	− .34	S.
151	4559	" "	7.2	330	1.59	1.01	"	10.09	.07	10.02	− .50	U.
152	4572	Nov. 14	6.7	330	1.40	.73	"	10.37	.07	10.30	− .22	P.
153	4573	" "	6.7	330	1.32	.60	"	10.50	.07	10.43	− .09	S.
154	4576	" "	7.2	330	1.59	1.01	"	10.09	.07	10.02	− .50	U.
155	4584	Nov. 15	7.2	340	1.29	.55	"	10.55	.07	10.48	− .08	P.
156	4588	" "	7.4	340	1.23	.45	"	10.65	.07	10.58	+ .02	U.
157	4590	Nov. 16	7.8	340	1.39	.71	"	10.39	.07	10.32	− .24	P.
158	4592	" "	8.3	340	1.42	.76	"	10.34	.07	10.27	− .29	S.
159	4598	Nov. 23	8.5	20	1.14	.28	"	10.82	.07	10.75	− .16	P.
160	4601	" "	8.8	20	.96	9.91	"	11.19	.07	11.12	+ .21	S.
161	4606	Nov. 24	6.6	20	1.29	.55	"	10.55	.07	10.48	− .43	S.
162	4610	" "	7.2	20	1.11	.23	"	10.87	.07	10.80	− .11	P.
163	4622	" "	7.8	20	1.01	.02	"	11.08	.07	11.01	+ .10	P.
164	4623	Nov. 26	6.8	30	1.19	.38	"	10.72	.07	10.65	− .39	U.
165	4626	" "	7.1	30	.80	9.52	"	11.58	.07	11.51	+ .47	P.
166	4627	Nov. 29	5.6	40	.69	9.19	"	11.91	.07	11.84	+ .65	P.
167	4629	" "	5.7	40	1.04	.08	"	11.02	.07	10.95	− .24	S.
168	4631	" "	8.9	40	1.18	.36	"	10.74	.07	10.67	− .52	S.
169	4632	Nov. 30	6.0	50	1.03	.06	"	11.04	.07	10.97	− .38	S.
170	4635	" "	6.2	50	1.04	.08	"	11.02	.07	10.95	− .40	P.
171	4640	Dec. 1	8.6	50	.61	8.93	"	12.17	.07	12.10	+ .75	S.
172	4641	" "	8.6	50	.94	9.87	"	11.23	.07	11.16	− .19	P.
173	4644	Dec. 6	6.3	70	.66	9.10	"	12.00	.07	11.93	+ .27	S.
174	4647	" "	6.4	70	.67	9.13	"	11.97	.07	11.90	+ .24	P.
175	4648	" "	6.5	70	.80	9.52	"	11.58	.07	11.51	− .15	U.
176	4659	Dec. 8	6.2	80	.61	8.93	"	12.17	.07	12.10	+ .34	P.
177	4662	" "	6.3	80	.60	8.89	"	12.21	.07	12.14	+ .38	S.
178	4663	Dec. 11	7.4	100	.92	9.82	"	11.28	.08	11.20	− .56	U.
179	4665	Dec. 13	6.4	110	2.45	1.95	14.00	12.05	.08	11.97	+ .31	S.
180	4668	" "	6.7	110	2.98	2.37	"	11.63	.08	11.55	− .11	U.
181	4669	" "	6.9	110	.78	9.46	11.10	11.64	.08	11.56	− .10	S.

No.	No. in Table I.	Date.	Hour.	Longitude.	Reading.	Diff. in Magn. of Images.	Constant.	Diff. in Magn. of Objects.	Corr. for Ring.	Corr. Diff. in Magn.	Resid.	Obs.
					IAPETUS (continued).							
				°								
182	4672	Dec. 13	7.2	110	.72	9.29	11.10	11.81	.08	11.73	+ .07	U.
183	4674	Dec. 14	5.6	110	.87	9.70	"	11.40	.08	11.32	− .34	P.
184	4675	" "	5.6	110	.73	9.32	"	11.78	.08	11.70	+ .04	S.
185	4678	" "	6.0	110	2.79	2.23	14.00	11.77	.08	11.69	+ .03	P.
186	4679	" "	6.0	110	2.73	2.18	"	11.82	.08	11.74	+ .08	S.
187	4681	Dec. 16	6.0	120	3.33	2.61	"	11.39	.08	11.31	− .21	P.
188	4684	" "	6.3	120	3.23	2.55	"	11.45	.08	11.37	− .15	S.
189	4686	" "	6.5	120	.79	9.49	11.10	11.61	.08	11.53	+ .01	P.
190	4687	" "	6.5	120	.76	9.40	"	11.70	.08	11.62	+ .10	S.
191	4689	" "	6.7	120	.85	9.65	"	11.45	.08	11.37	− .15	U.
192	4691	" "	7.0	120	2.35	1.86	14.00	12.14	.08	12.06	+ .54	U.
193	4700	Dec. 17	9.3	120	.89	9.75	11.10	11.35	.08	11.27	− .25	P.
194	4702	" "	9.5	120	.79	9.49	"	11.61	.08	11.53	+ .01	U.
195	4704	" "	9.7	120	3.89	2.95	14.00	11.05	.08	10.97	− .55	P.
196	4706	" "	9.8	120	3.24	2.55	"	11.45	.08	11.37	− .15	U.
197	4708	Dec. 18	5.7	130	2.71	2.16	"	11.84	.08	11.76	+ .41	P.
198	4710	" "	6.0	130	.61	8.93	11.10	12.17	.08	12.09	+ .74	P.
199	4716	" "	6.7	130	2.21	1.72	14.00	12.28	.08	12.20	+ .85	U.
200	4718	" "	8.3	130	.92	9.82	11.10	11.28	.08	11.20	− .15	U.
201	4720	Dec. 19	7.1	130	.97	9.93	"	11.17	.08	11.09	− .26	U.
202	4722	" "	7.3	130	2.77	2.21	14.00	11.79	.08	11.71	+ .36	U.
203	4725	" "	7.6	130	3.04	2.41	"	11.59	.08	11.51	+ .16	P.
204	4727	" "	7.7	130	.70	9.23	11.10	11.87	.08	11.79	+ .44	P.
205	4729	Dec. 20	8.0	140	3.12	2.47	14.00	11.53	.08	11.45	+ .26	P.
206	4730	" "	8.2	140	.77	9.43	11.10	11.67	.08	11.59	+ .40	P.
207	4732	Dec. 22	8.2	150	.72	9.29	"	11.81	.09	11.72	+ .68	P.
208	4734	Dec. 23	6.6	150	.77	9.43	"	11.67	.09	11.58	+ .54	P.
209	4737	" "	6.8	150	.76	9.40	"	11.70	.09	11.61	+ .57	U.
210	4738	" "	7.1	150	3.42	2.67	14.00	11.33	.09	11.24	+ .20	U.
211	4741	" "	7.4	150	3.59	2.78	"	11.22	.09	11.13	+ .09	P.
212	4742	Dec. 24	7.0	160	.94	9.87	11.10	11.23	.09	11.14	+ .23	U.
213	4745	" "	7.2	160	1.16	.32	"	10.78	.09	10.69	− .22	P.
214	4747	" "	7.4	160	3.67	2.82	14.00	11.18	.09	11.09	+ .18	P.
215	4748	" "	7.5	160	3.29	2.59	"	11.41	.09	11.32	+ .41	U.
216	4751	Dec. 25	6.1	160	4.80	3.41	"	10.59	.09	10.50	− .41	P.
217	4752	" "	6.2	160	.82	9.57	11.10	11.53	.09	11.44	+ .53	P.
218	4755	" "	6.5	160	.94	9.87	"	11.23	.09	11.14	+ .23	U.
219	4756	" "	7.3	160	3.76	2.88	14.00	11.12	.09	11.03	+ .12	U.
220	4758	Dec. 26	6.2	160	4.03	3.03	"	10.97	.09	10.88	− .03	P.
221	4761	" "	6.7	160	4.02	3.02	"	10.98	.09	10.89	− .02	U.
222	4762	" "	6.8	160	1.26	.50	11.10	10.60	.09	10.51	− .40	U.
223	4767	" "	7.1	160	1.25	.48	"	10.62	.09	10.53	− .38	P.
224	4768	Dec. 28	9.4	170	1.04	.08	"	11.02	.09	10.93	+ .14	P.
225	4770	Dec. 29	5.9	180	1.06	.13	"	10.97	.09	10.88	+ .18	P.
226	4772	Dec. 30	7.7	180	1.06	.13	"	10.97	.09	10.88	+ .18	U.
227	4775	" "	8.1	180	1.23	.45	"	10.65	.09	10.56	− .14	P.
228	4776	" "	8.5	180	3.98	3.00	14.00	11.00	.09	10.91	+ .21	U.
229	4779	Dec. 31	6.0	190	1.13	.27	11.10	10.83	.09	10.74	+ .12	P.
230	4780	" "	6.7	190	1.22	.43	"	10.67	.09	10.58	− .04	U.
231	4782	Jan. 3	5.8	200	1.41	.75	"	10.35	.09	10.26	− .30	S.
232	4785	" "	6.1	200	1.23	.45	"	10.65	.09	10.56	.00	P.
233	4786	" "	6.3	200	4.20	3.12	14.00	10.88	.09	10.79	+ .23	S.
234	4788	Jan. 5	5.6	210	1.25	.48	11.10	10.62	.10	10.52	.00	S.
235	4791	" "	6.4	210	3.49	2.71	14.00	11.29	.10	11.19	+ .67	S.

No.	No. in Table I.	Date.	Hour.	Longitude.	Reading.	Diff. in Magn. of Images.	Constant.	Diff. in Magn. of Objects.	Corr. for Ring.	Corr. Diff. in Magn.	Resid.	Obs.
					IAPETUS (continued).							
				°								
236	4793	Jan. 5	6.7	210	1.14	.28	11.10	10.82	.10	10.72	+ .20	P.
237	4794	Jan. 6	7.1	210	3.45	2.69	14.00	11.31	.10	11.21	+ .69	S.
238	4796	" "	7.4	210	1.18	.36	11.10	10.74	.10	10.64	+ .12	S.
239	4800	" "	7.8	210	.77	9.43	"	11.67	.10	11.57	+1.05	U.
240	4801	" "	7.9	210	1.17	.34	"	10.76	.10	10.66	+ .14	P.
241	4802	Jan. 7	5.9	220	1.67	1.11	"	9.99	.10	9.89	− .59	S.
242	4805	" "	6.2	220	1.65	1.09	"	10.01	.10	9.91	− .57	P.
243	4806	" "	6.4	220	5.67	3.77	14.00	10.23	.10	10.13	− .35	S.
244	4808	" "	6.7	220	1.43	.78	11.10	10.32	.10	10.22	− .26	U.
245	4810	Jan. 10	5.7	230	.75	9.38	"	11.72	.11	11.61	+1.15	S.
246	4813	" "	5.9	230	1.07	.15	"	10.95	.11	10.84	+ .38	P.
247	4814	Jan. 12	6.4	240	1.05	.11	"	10.99	.11	10.88	+ .43	P.
248	4817	" "	6.7	240	1.03	.06	"	11.04	.11	10.93	+ .48	S.
249	4818	" "	7.0	240	3.53	2.74	14.00	11.26	.11	11.15	+ .70	S.
250	4820	Jan. 13	7.4	250	2.15	1.66	11.10	9.44	.11	9.33	−1.11	U.
251	4821	" "	7.5	250	1.47	.84	"	10.26	.11	10.15	− .29	P.
252	4824	" "	8.3	250	1.59	1.01	"	10.09	.11	9.98	− .46	S.
253	4826	Jan. 18	5.8	270	3.54	2.74	14.00	11.26	.12	11.14	+ .71	S.
254	4828	" "	6.3	270	1.27	.52	11.10	10.58	.12	10.46	+ .03	S.
255	4831	" "	6.5	270	1.64	1.07	"	10.03	.12	9.91	− .52	P.
256	4832	Jan. 19	5.7	270	1.37	.68	"	10.42	.12	10.30	− .13	P.
257	4833	" "	5.9	270	.90	9.77	"	11.33	.12	11.21	+ .78	S.
258	4836	" "	6.3	270	3.19	2.52	14.00	11.48	.12	11.36	+ .93	S.
259	4838	Jan. 20	5.9	280	1.10	.21	11.10	10.89	.12	10.77	+ .33	P.
260	4839	" "	6.0	280	.82	9.57	"	11.53	.12	11.41	+ .97	S.
261	4842	Jan. 23	6.2	290	2.14	1.65	"	9.45	.12	9.33	−1.11	P.
262	4845	" "	6.5	290	1.33	.62	"	10.48	.12	10.36	− .08	S.
263	4846	" "	6.8	290	1.26	.50	"	10.60	.12	10.48	+ .04	U.
264	4848	Jan. 24	7.0	300	1.65	1.09	"	10.01	.13	9.88	− .57	P.
265	4849	" "	7.0	300	1.56	.97	"	10.13	.13	10.00	− .45	U.
266	4850	Jan. 25	6.4	300	1.29	.55	"	10.55	.13	10.42	− .03	P.
267	4853	" "	6.7	300	.82	9.57	"	11.53	.13	11.40	+ .95	S.
268	4854	Jan. 26	5.9	310	1.17	.34	"	10.76	.13	10.63	+ .17	P.
269	4855	" "	6.0	310	.76	9.40	"	11.70	.13	11.57	+1.11	S.
270	4858	Jan. 29	6.1	320	1.16	.32	"	10.78	.13	10.65	+ .17	P.
271	4859	" "	6.2	320	.91	9.79	"	11.31	.13	11.18	+ .70	S.
272	4862	Jan. 30	6.2	320	1.10	.21	"	10.89	.14	10.75	+ .27	P.
273	4865	" "	6.4	320	1.25	.48	"	10.62	.14	10.48	.00	S.
274	4866	" "	6.7	320	1.44	.79	"	10.31	.14	10.17	− .31	U.
275	4868	Jan. 31	7.2	330	1.10	.21	"	10.89	.14	10.75	+ .23	S.
276	4871	" "	7.5	330	1.21	.41	"	10.69	.14	10.55	+ .03	U.
277	4872	" "	7.5	330	1.16	.32	"	10.78	.14	10.64	+ .12	P.
278	4874	Feb. 3	6.4	340	1.23	.45	"	10.65	.14	10.51	− .05	S.
279	4875	" "	6.4	340	1.18	.36	"	10.74	.14	10.60	+ .04	P.
280	4876	Feb. 4	6.1	350	1.04	.08	"	11.02	.14	10.88	+ .26	P.
281	4879	" "	6.6	350	.53	8.62	"	12.48	.14	12.34	+1.72	S.
282	4880	" "	6.7	350	.95	9.89	"	11.21	.14	11.07	+ .45	S.
283	4881	" "	6.8	350	1.21	.41	"	10.69	.14	10.55	− .07	U.
284	4882	" "	6.9	350	.96	9.91	"	11.19	.14	11.05	+ .43	U.
285	4884	Feb. 7	6.3	0	.83	9.60	"	11.50	.15	11.35	+ .65	S.
286	4885	" "	6.4	0	1.04	.08	"	11.02	.15	10.87	+ .17	P.
287	4888	" "	6.8	0	.96	9.91	"	11.19	.15	11.04	+ .34	U.
288	4893	Feb. 8	6.7	0	.85	9.65	"	11.45	.15	11.30	+ .60	P.
289	4895	Feb. 9	6.2	10	.89	9.75	"	11.35	.15	11.20	+ .41	P.

No.	No. in Table I.	Date.	Hour.	Longitude.	Reading.	Diff. in Magn. of Images.	Constant.	Diff. in Magn. of Objects.	Corr. for Ring.	Corr. Diff. in Magn.	Resid.	Obs.
					Iapetus (continued).							
				°								
290	4896	Feb. 9	6.8	10	.90	9.77	11.10	11.33	.15	11.18	+ .39	S.
291	4903	Feb. 10	6.5	10	.80	9.52	"	11.58	.15	11.43	+ .64	P.
292	4906	Feb. 12	6.8	20	1.00	.00	"	11.10	.16	10.94	+ .03	S.
293	4909	" "	7.2	20	.94	9.87	"	11.23	.16	11.07	+ .16	U.
294	4910	Feb. 14	6.3	30	.87	9.70	"	11.40	.16	11.24	+ .20	P.
295	4911	" "	6.4	30	.51	8.54	"	12.56	.16	12.40	+1.36	S.
296	4912	" "	6.6	30	.69	9.19	"	11.91	.16	11.75	+ .71	S.
297	4913	" "	6.6	30	.94	9.87	"	11.23	.16	11.07	+ .03	P.
298	4921	" "	7.2	30	.82	9.57	"	11.53	.16	11.37	+ .33	U.
299	4922	" "	7.3	30	.88	9.72	"	11.38	.16	11.22	+ .18	U.
300	4925	Feb. 15	6.7	40	.52	8.58	"	12.52	.16	12.36	+1.17	S
301	4926	" "	6.8	40	.87	9.70	"	11.40	.16	11.24	+ .05	P.
302	4927	" "	6.9	40	.85	9.65	"	11.45	.16	11.29	+ .10	S.
303	4928	" "	6.9	40	1.05	.11	"	10.99	.16	10.83	− .36	P.
											± .39	

The observations made with Photometer D, which have already been used in Table XXIV., have been omitted in Table XLIX. As they have served to determine the constant of the photometer, it did not seem advisable to use them a second time in measuring the light of the satellite. This objection does not apply to the measurements of Iapetus with Photometer D, which are therefore inserted, and reduced in the manner already described. As the comparison is made with Mars instead of Saturn, the difference in magnitude between Mars and the ball of Saturn is inserted in the tenth column instead of the correction for the ring. Set 18 of the measures of Mimas is not used in the mean. It consisted of a single setting which was seen to be too large, and the set was accordingly recommenced. Giving it a weight proportional to the number of settings, it would, if retained, only diminish the mean by one one-hundredth of a magnitude. Sets 17 and 18 of Tethys evidently make the satellite too faint; but they are retained, since no sufficient reason can be offered for their rejection. Other observations on the same evening give to the satellite its usual brightness. A curious discrepancy is found in sets 82 and 83 of Iapetus. The satellite appeared unusually bright, and large readings were obtained both by Mr. Upton and myself. As the law of variation of the light was not at that time known, it was assumed that the satellite had attained its full brightness suddenly. The following sets, however, show that the true brightness was probably less by two magnitudes than that observed. It is possible that a star was used for comparison instead of Saturn; but this does not seem probable, as no star of sufficient brightness was near.

The measurements of stars *a* and *b* are given in Table L. The columns have in

general the same meaning as in Table XLIX. The column giving the longitude is omitted, and that giving the correction for the ring contains also a correction for the distance of Saturn. The correction for the distances of the satellites is the same as that for Saturn, and therefore need not be applied in Table XLIX. But since the light of a star is independent of the position of the planet, we must in Table L. reduce the light of Saturn to that which it would have when at its mean distance from the Sun and Earth.

Let S represent the light of Saturn at a distance r from the Sun and a distance Δ from the Earth; let S_0 denote its light when at its mean distance a from each. Then $S_0 = S\frac{r^2\,\Delta^2}{a^4}$, and the difference in magnitude of S_0 and S will equal $2.5\,(\log S - \log S_0)$ $= 5\,(2\log a - \log r - \log \Delta)$. This correction added to the correction for the ring is that given in the tenth column.

Two additional columns have been added to the Table to show the corresponding measures of Iapetus. They give the difference in brightness of Iapetus and the star, when both are measured on the same night by the same observer. A positive sign denotes that Iapetus is the fainter. When an observer obtained more than one set in an evening, the comparison was made between those in which the conditions were as nearly as possible the same, as, for instance, with the same photometer, with the prism in the same position, or with star a out of the field. The last column gives the residual from a value obtained by computation, by means of the formula given on page 265. The mean of the two corresponding observations of Iapetus has been used in sets 4 and 14 of star a, and sets 60 and 64 of star b. In reducing set 4 of star b, No. 4191 is used instead of 4187, as the latter was interrupted by clouds, and contains only three readings.

TABLE L.

COMPARISONS OF STARS WITH SATURN.

No.	No. in Table I.	Date.	Hour.	Reading.	Diff. in Magn. of Images.	Constant.	Diff. in Magn. of Objects.	Corr. for Ring and Dist.	Corr. Diff. in Magn.	Resid.	Obs.	Iapetus — Star.	Resid.
						STAR *a*. (1878.)							
1	4145	Oct. 2	8.5	2.19	1.70	11.10	9.40	−.35	9.05	+ .53	S.	+2.59	− .12
2	4148	" "	8.6	2.82	2.25	"	8.85	−.35	8.50	− .02	P.	+2.82	+ .11
3	4190	Oct. 6	8.0	2.27	1.78	"	9.32	−.34	8.98	+ .46	P.	+2.69	+ .26
4	4192	" "	8.5	1.79	1.26	"	9.84	−.34	9.50	+ .98	S.	+2.36	− .07
5	4247	Oct. 13	7.0	1.78	1.25	"	9.85	−.32	9.53	+1.01	S.	+1.00	−1.14
6	4250	" "	7.8	2.87	2.29	"	8.81	−.32	8.49	− .03	P.	+2.06	− .08
7	4284	Oct. 15	9.0	2.13	1.64	"	9.46	−.32	9.14	+ .62	S.	+ .87	−1.21
8	4303	Oct. 16	7.5	4.28	3.16	"	7.94	−.32	7.62	− .90	U.	+2.23	+ .15
9	4304	" "	7.6	3.07	2.44	"	8.66	−.32	8.34	− .18	P.	+1.88	− .20
10	4366	Oct. 20	8.6	2.63	2.10	"	9.00	−.30	8.70	+ .18	S.	+1.00	−1.00
11	4367	" "	8.6	3.08	2.44	"	8.66	−.30	8.36	− .16	P.	+1.40	− .60
12	4374	Oct. 21	7.1	2.26	1.77	"	9.33	−.30	9.03	+ .51	S.	+ .45	−1.55
13	4375	" "	7.3	3.39	2.65	"	8.45	−.30	8.15	− .37	U.	+2.01	+ .01
14	4382	" "	8.4	3.80	2.90	"	8.20	−.30	7.90	− .62	P.	+1.68	− .32
15	4394	Oct. 22	6.1	3.36	2.63	"	8.47	−.30	8.17	− .35	P.	+1.74	− .24
16	4395	" "	6.2	2.65	2.12	"	8.98	−.30	8.68	+ .16	S.	+1.13	− .85
17	4445	Oct. 29	9.7	5.11	3.54	"	7.56	−.27	7.29	−1.23	S.	+2.52	+ .56
18	4457	Nov. 2	7.8	2.90	2.31	"	8.79	−.26	8.53	+ .01	P.	+1.67	− .29
19	4612	Nov. 24	7.3	3.42	2.67	"	8.43	−.18	8.25	− .27	P.	+2.65	+ .22
20	4765	Dec. 26	7.0	3.35	2.62	"	8.48	−.08	8.40	− .12	P.	+2.30	− .13
21	4766	" "	7.1	3.60	2.78	"	8.32	−.08	8.24	− .28	U.	+2.46	+ .03
									8.52	± .43			± .44
						STAR *b*. (1877–79.)							
1	4146	Oct. 2	8.6	.67	9.13	11.10	11.97	−.35	11.62	+ .18	S.	+ .02	+ .23
2	4147	" "	8.6	.60	8.89	"	12.21	−.35	11.86	+ .42	P.	− .54	− .33
3	4171	Oct. 4	10.1	.63	9.00	"	12.10	−.35	11.75	+ .31	P.	− .28	+ .08
4	4172	" "	10.1	.58	8.82	"	12.28	−.35	11.93	+ .49	S.	− .56	− .20
5	4189	Oct. 6	8.0	.63	9.00	"	12.10	−.34	11.76	+ .32	P.	− .09	+ .40
6	4193	" "	8.6	.59	8.85	"	12.25	−.34	11.91	+ .47	S.	− .05	+ .44
7	4228	Oct. 10	8.6	.65	9.06	"	12.04	−.33	11.71	+ .27	P.	− .36	+ .25
8	4229	" "	8.7	.57	8.78	"	12.32	−.33	11.99	+ .55	U.	−1.42	− .81
9	4232	" "	10.0	.44	8.22	"	12.88	−.33	12.55	+1.11	S.	−1.42	− .81
10	4246	Oct. 13	6.8	.60	8.89	"	12.21	−.33	11.88	+ .44	S.	−1.35	− .57
11	4249	" "	7.7	.70	9.23	"	11.87	−.33	11.54	+ .10	P.	− .99	− .21
12	4254	Oct. 14	7.0	.80	9.52	"	11.58	−.32	11.26	− .18	U.	− .60	+ .18
13	4260	" "	7.8	.70	9.23	"	11.87	−.32	11.55	+ .11	P.	−1.19	− .41
14	4263	" "	8.6	.90	9.77	"	11.33	−.32	11.01	− .43	S.	− .48	+ .30
15	4285	Oct. 15	9.0	.99	9.98	"	11.12	−.32	10.80	− .64	S.	− .79	+ .05
16	4286	" "	9.1	.90	9.77	"	11.33	−.32	11.01	− .43	P.	− .90	− .06
17	4288	" "	9.3	.73	9.32	"	11.78	−.32	11.46	+ .02	U.	− .65	+ .19
18	4302	Oct. 16	7.3	1.11	.23	"	10.87	−.32	10.55	− .89	U.	− .70	+ .14
19	4305	" "	7.6	1.18	.36	"	10.74	−.32	10.42	−1.02	P.	− .20	+ .64
20	4321	Oct. 17	7.5	.91	9.80	"	11.30	−.31	10.99	− .45	U.	− .62	+ .26
21	4322	" "	7.5	1.01	.02	"	11.08	−.31	10.77	− .67	P.	−1.26	− .38
22	4398	Oct. 22	6.6	1.01	.02	"	11.08	−.30	10.78	− .66	U.	− .86	+ .08
23	4421	Oct. 26	7.5	1.16	.32	"	10.78	−.29	10.49	− .95	P.	− .38	+ .58
24	4433	Oct. 28	10.7	.84	9.62	"	11.48	−.28	11.20	− .24	P.	− .96	.00

No.	No. in Table I.	Date.	Hour.	Reading.	Diff. in Magn. of Images.	Constant.	Diff. in Magn. of Objects.	Corr. for Ring and Dist.	Corr. Diff. in Magn.	Resid.	Obs.	Iapetus — Star.	Resid.
					STAR *b* (continued).								
25	4437	Oct. 29	7.8	.93	9.84	11.10	11.26	−.27	10.99	− .45	U.	−1.04	− .08
26	4440	" "	8.2	.92	9.82	"	11.28	−.27	11.01	− .43	P.	−1.18	− .22
27	4450	Nov. 1	7.2	.82	9.57	"	11.53	−.26	11.27	− .17	S.	− .70	+ .27
28	4451	" "	7.2	.73	9.32	"	11.78	−.26	11.52	+ .08	P.	− .98	− .01
29	4454	" "	7.5	.73	9.32	"	11.78	−.26	11.52	+ .08	U.	−1.23	− .26
30	4456	Nov. 2	7.8	.84	9.62	"	11.48	−.26	11.22	− .22	P.	−1.02	− .06
31	4468	Nov. 3	6.0	.66	9.10	"	12.00	−.26	11.74	+ .30	P.	−1.43	− .47
32	4469	" "	6.1	.71	9.26	"	11.84	−.26	11.58	+ .14	S.	− .05	+ .91
33	4472	Nov. 4	7.9	.59	8.85	"	12.25	−.26	11.99	+ .55	P.	−1.56	− .60
34	4473	" "	7.9	.66	9.10	"	12.00	−.26	11.74	+ .30	U.	−1.10	− .14
35	4476	" "	9.6	.68	9.16	"	11.94	−.26	11.68	+ .24	S.	−1.02	− .06
36	4490	Nov. 5	9.4	3.54	2.74	14.00	11.26	−.25	11.01	− .43	P.		
37	4491	" "	9.5	3.22	2.54	"	11.46	−.25	11.21	− .23	U.		
38	4492	" "	9.6	3.35	2.62	"	11.38	−.25	11.13	− .31	S.		
39	4532	Nov. 8	6.5	.79	9.49	11.10	11.61	−.24	11.37	− .07	S.	− .94	.00
40	4535	" "	6.8	.94	9.87	"	11.23	−.24	10.99	− .45	P.	− .81	+ .13
41	4536	" "	7.3	.72	9.29	"	11.81	−.24	11.57	+ .13	U.	− .75	+ .19
42	4539	Nov. 10	5.9	.97	9.93	"	11.17	−.23	10.94	− .50	P.	− .75	+ .17
43	4540	" "	6.0	.89	9.75	"	11.35	−.23	11.12	− .32	S.	− .84	+ .08
44	4549	Nov. 12	7.7	.94	9.87	"	11.23	−.22	11.01	− .43	P.	− .93	− .05
45	4550	" "	7.8	.75	9.38	"	11.72	−.22	11.50	+ .06	U.	−1.22	− .34
46	4556	Nov. 13	6.8	1.29	.55	"	10.55	−.22	10.33	−1.11	S.	− .15	+ .73
47	4558	" "	7.1	.92	9.82	"	11.28	−.22	11.06	− .38	U.	−1.04	− .16
48	4571	Nov. 14	6.6	.68	9.16	"	11.94	−.21	11.73	+ .29	P.	−1.43	− .55
49	4574	" "	6.9	1.10	.21	"	10.89	−.21	10.68	− .76	S.	− .25	+ .63
50	4575	" "	7.1	.92	9.82	"	11.28	−.21	11.07	− .37	U.	−1.05	− .17
51	4581	Nov. 15	6.7	5.17	3.57	14.00	10.43	−.21	10.22	−1.22	S.		
52	4582	" "	6.9	4.09	3.06	"	10.94	−.21	10.73	− .71	U.		
53	4583	" "	7.0	3.85	2.93	"	11.07	−.21	10.86	− .58	P.		
54	4585	" "	7.2	.87	9.70	11.10	11.40	−.21	11.19	− .25	P.	− .71	+ .13
55	4589	" "	7.5	.72	9.29	"	11.81	−.21	11.60	+ .16	U.	−1.02	− .18
56	4591	Nov. 16	7.9	.95	9.89	"	11.21	−.21	11.00	− .44	P.	− .68	+ .16
57	4593	" "	8.4	1.21	.41	"	10.69	−.21	10.48	− .96	S.	− .21	+ .63
58	4596	Nov. 23	8.1	.93	9.84	"	11.26	−.18	11.08	− .36	P.	− .33	+ .16
59	4602	" "	8.9	.99	9.98	"	11.12	−.18	10.94	− .50	S.	+ .18	+ .67
60	4611	Nov. 24	7.3	.88	9.72	"	11.38	−.18	11.20	− .24	P.	− .30	+ .19
61	4624	Nov. 26	6.9	.90	9.77	"	11.33	−.17	11.16	− .28	U.	− .51	− .15
62	4625	" "	7.0	.76	9.40	"	11.70	−.17	11.53	+ .09	P.	− .02	+ .34
63	4628	Nov. 29	5.7	.66	9.10	"	12.00	−.16	11.84	+ .40	P.	.00	+ .21
64	4630	" "	8.8	1.10	.21	"	10.89	−.16	10.73	− .71	S.	+ .58	+ .79
65	4633	Nov. 30	6.1	.67	9.13	"	11.97	−.16	11.81	+ .37	S.	− .84	− .79
66	4634	" "	6.2	.79	9.49	"	11.61	−.16	11.45	+ .01	P.	− .50	− .45
67	4642	Dec. 1	8.7	.94	9.87	"	11.23	−.16	11.07	− .37	P.	+ .09	+ .14
68	4643	" "	8.7	.76	9.40	"	11.70	−.16	11.54	+ .10	S.	+ .56	+ .61
69	4645	Dec. 6	6.4	.78	9.46	"	11.64	−.14	11.50	+ .06	S.	+ .43	+ .17
70	4646	" "	6.4	.92	9.82	"	11.28	−.14	11.14	− .30	P.	+ .76	+ .50
71	4649	" "	6.6	.70	9.23	"	11.87	−.14	11.73	+ .29	U.	− .22	− .48
72	4660	Dec. 8	6.3	.67	9.13	"	11.97	−.13	11.84	+ .40	P.	+ .26	− .10
73	4661	" "	6.3	.79	9.49	"	11.61	−.13	11.48	+ .04	S.	+ .66	+ .30
74	4664	Dec. 11	7.5	1.04	.08	"	11.02	−.13	10.89	− .55	U.	+ .31	− .05
75	4666	Dec. 13	6.5	2.36	1.86	14.00	12.14	−.12	12.02	+ .58	S.	− .05	− .31
76	4667	" "	6.7	3.10	2.46	"	11.54	−.12	11.42	− .02	U.	+ .13	− .13
77	4670	" "	7.0	1.07	.15	11.10	10.95	−.12	10.83	− .61	S.	+ .73	+ .47
78	4671	" "	7.1	.86	9.67	"	11.43	−.12	11.31	− .13	U.	+ .42	+ .16
79	4673	Dec. 14	5.4	.96	9.91	"	11.19	−.12	11.07	− .37	P.	+ .25	− .01
80	4676	" "	5.6	.86	9.67	"	11.43	−.12	11.31	− .13	S.	+ .39	+ .13

No.	No. in Table I.	Date.	Hour.	Reading.	Diff. in Magn. of Images.	Constant.	Diff. in Magn. of Objects.	Corr. for Ring and Dist.	Corr. Diff. in Magn.	Resid.	Obs.	Iapetus — Star.	Resid.
					STAR *b* (continued).								
81	4677	Dec. 14	6.0	4.11	3.07	14.00	10.93	−.12	10.81	− .63	P.	+ .88	+ .62
82	4680	" "	6.1	3.40	2.66	"	11.34	−.12	11.22	− .22	S.	+ .52	+ .26
83	4682	Dec. 16	6.1	3.12	2.47	"	11.53	−.11	11.42	− .02	P.	− .11	− .23
84	4683	" "	6.2	4.61	3.32	"	10.68	−.11	10.57	− .87	S.	+ .80	+ .68
85	4685	" "	6.5	.73	9.32	11.10	11.78	−.11	11.67	+ .23	P.	− .14	− .26
86	4688	" "	6.6	1.03	.06	"	11.04	−.11	10.93	− .51	S	+ .69	+ .57
87	4690	" "	6.8	1.00	.00	"	11.10	−.11	10.99	− .45	U.	+ .38	+ .26
88	4692	" "	7.1	3.04	2.41	14.00	11.59	−.11	11.48	+ .04	U.	+ .58	+ .46
89	4701	Dec. 17	9.4	.75	9.38	11.10	11.72	−.11	11.61	+ .17	P.	− .34	− .46
90	4703	" "	9.6	.74	9.35	"	11.75	−.11	11.64	+ .20	U.	− .11	− .23
91	4705	" "	9.7	4.32	3.18	14.00	10.82	−.11	10.71	− .73	P.	+ .26	+ .14
92	4707	" "	9.9	3.36	2.63	"	11.37	−.11	11.26	− .18	U.	+ .11	− .01
93	4709	Dec. 18	5.9	2.91	2.32	"	11.68	−.10	11.58	+ .14	P.	+ .18	+ .23
94	4711	" "	6.1	.62	8.96	11.10	12.14	−.10	12.04	+ .60	P.	+ .05	+ .10
95	4717	" "	6.8	3.89	2.95	14.00	11.05	−.10	10.95	− .49	U.	+1.25	+1.30
96	4719	" "	8.4	.98	9.96	11.10	11.14	−.10	11.04	− .40	U.	+ .16	+ .21
97	4721	Dec. 19	7.1	.89	9.75	"	11.35	−.10	11.25	− .19	U.	− .16	− .11
98	4723	" "	7.4	3.14	2.48	14.00	11.52	−.10	11.42	− .02	U.	+ .29	+ .34
99	4724	" "	7.5	2.77	2.21	"	11.79	−.10	11.69	+ .25	P.	− .18	− .13
100	4726	" "	7.7	.67	9.13	11.10	11.97	−.10	11.87	+ .43	P.	− .08	− .03
101	4728	Dec. 20	7.7	2.78	2.22	14.00	11.78	−.09	11.69	+ .25	P.	− .24	− .03
102	4731	" "	8.2	.80	9.52	11.10	11.58	−.09	11.49	+ .05	P.	+ .10	+ .31
103	4733	Dec. 22	8.3	.68	9.16	"	11.94	−.09	11.85	+ .41	P.	− .13	+ .23
104	4735	Dec. 23	6.6	.69	9.19	"	11.91	−.08	11.83	+ .39	P.	− .25	+ .11
105	4736	" "	6.7	.88	9.72	"	11.38	−.08	11.30	− .14	U.	+ .31	+ .67
106	4739	" "	7.2	3.44	2.68	14.00	11.32	−.08	11.24	− .20	U.	.00	+ .36
107	4740	" "	7.3	2.82	2.25	"	11.75	−.08	11.67	+ .23	P.	− .54	− .18
108	4743	Dec. 24	7.1	.92	9.82	11.10	11.28	−.08	11.20	− .24	U.	− .06	+ .43
109	4744	" "	7.2	.81	9.54	"	11.56	−.08	11.48	+ .04	P.	− .79	− .30
110	4746	" "	7.3	2.86	2.28	14.00	11.72	−.08	11.64	+ .20	P.	− .55	− .06
111	4749	" "	7.6	3.73	2.86	"	11.14	−.08	11.06	− .38	U.	+ .26	+ .75
112	4750	Dec. 25	6.0	4.04	3.03	"	10.97	−.08	10.89	− .55	P.	− .39	+ .10
113	4753	" "	6.3	.70	9.23	11.10	11.87	−.08	11.79	+ .35	P.	− .35	+ .14
114	4754	" "	6.4	.93	9.84	"	11.26	−.08	11.18	− .26	U.	− .04	+ .45
115	4757	" "	7.4	3.37	2.64	14.00	11.36	−.08	11.28	− .16	U.	− .25	+ .24
116	4759	Dec. 26	6.3	3.35	2.62	"	11.38	−.08	11.30	− .14	P.	− .42	+ .07
117	4760	" "	6.6	3.18	2.51	"	11.49	−.08	11.41	− .03	U.	− .52	− .03
118	4763	" "	6.9	.98	9.96	11.10	11.14	−.08	11.06	− .38	U.	− .55	− .06
119	4764	" "	7.0	.75	9.38	"	11.72	−.08	11.64	+ .20	P.	−1.11	− .62
120	4769	Dec. 28	9.4	1.18	.36	"	10.74	−.07	10.67	− .77	P.	+ .26	+ .87
121	4771	Dec. 29	6.0	.83	9.60	"	11.50	−.07	11.43	− .01	P.	− .55	+ .15
122	4773	Dec. 30	7.9	.69	9.19	"	11.91	−.07	11.84	+ .40	U.	− .96	− .26
123	4774	" "	7.9	.86	9.67	"	11.43	−.07	11.36	− .08	P.	− .80	− .10
124	4777	" "	8.5	2.98	2.37	14.00	11.63	−.07	11.56	+ .12	U.	− .65	+ .05
125	4778	Dec. 31	5.9	.90	9.77	11.10	11.33	−.06	11.27	− .17	P.	− .53	+ .25
126	4781	" "	6.8	.92	9.82	"	11.28	−.06	11.22	− .22	U.	− .64	+ .14
127	4783	Jan. 3	6.1	.77	9.43	"	11.67	−.06	11.61	+ .17	S.	−1.35	− .51
128	4784	" "	6.1	.88	9.72	"	11.38	−.06	11.32	− .12	P.	− .76	+ .08
129	4787	" "	6.5	3.44	2.68	14.00	11.32	−.06	11.26	− .18	S.	− .47	+ .37
130	4789	Jan. 5	5.8	.86	9.67	11.10	11.43	−.06	11.37	− .07	P.	− .65	+ .23
131	4790	" "	5.9	.81	9.54	"	11.56	−.06	11.50	+ .06	S.	− .98	− .10
132	4792	" "	6.6	3.12	2.47	14.00	11.53	−.06	11.47	+ .03	S.	− .28	+ .60
133	4795	Jan. 6	7.3	2.73	2.18	"	11.82	−.05	11.77	+ .33	S.	− .56	+ .32
134	4797	" "	7.5	.66	9.10	11.10	12.00	−.05	11.95	+ .51	S.	−1.31	− .43
135	4798	" "	7.5	.89	9.75	"	11.35	−.05	11.30	− .14	P.	− .64	+ .24
136	4799	" "	7.5	.55	8.70	"	12.40	−.05	12.35	+ .91	U.	− .78	+ .10

No.	No. in Table I.	Date.	Hour.	Reading.	Diff. in Magn. of Images.	Constant.	Diff. in Magn. of Objects.	Corr. for Ring and Dist.	Corr. Diff. in Magn.	Resid.	Obs.	Iapetus — Star.	Resid.
						STAR *b* (continued).							
137	4803	Jan. 7	6.0	1.16	.32	11.10	10.78	−.05	10.73	− .71	S.	− .84	+ .08
138	4804	" "	6.2	1.04	.08	"	11.02	−.05	10.97	− .47	P.	−1.06	− .14
139	4807	" "	6.5	2.80	2.24	14.00	11.76	−.05	11.71	+ .27	S.	−1.58	− .66
140	4809	" "	6.8	.80	9.52	11.10	11.58	−.05	11.53	+ .09	U.	−1.31	− .39
141	4811	Jan. 10	5.8	.44	8.22	"	12.88	−.05	12.83	+1.39	S.	−1.22	− .28
142	4812	" "	5.9	.69	9.19	"	11.91	−.05	11.86	+ .42	P.	−1.02	− .08
143	4815	Jan. 12	6.5	.74	9.35	"	11.75	−.04	11.71	+ .27	P.	− .83	+ .12
144	4816	" "	6.6	.65	9.06	"	12.04	−.04	12.00	+ .56	S.	−1.07	− .12
145	4819	" "	7.0	2.78	2.22	14.00	11.78	−.04	11.74	+ .30	S.	− .59	+ .36
146	4822	Jan. 13	7.6	1.15	.30	11.10	10.80	−.04	10.76	− .68	P.	− .61	+ .35
147	4823	" "	7.7	1.14	.28	"	10.82	−.04	10.78	− .66	U.	−1.45	− .49
148	4825	" "	8.3	.94	9.87	"	11.23	−.04	11.19	− .25	S.	−1.21	− .25
149	4827	Jan. 18	6.0	2.94	2.34	14.00	11.66	−.03	11.63	+ .19	S.	− .49	+ .48
150	4829	" "	6.4	1.23	.45	11.10	10.65	−.03	10.62	− .82	S.	− .16	+ .81
151	4830	" "	6.5	1.27	.52	"	10.58	−.03	10.55	− .89	P.	− .64	+ .33
152	4834	Jan. 19	6.0	.58	8.82	"	12.28	−.03	12.25	+ .81	S.	−1.04	− .07
153	4835	" "	6.1	.77	9.43	"	11.67	−.03	11.64	+ .20	P.	−1.34	− .37
154	4837	" "	6.4	2.27	1.78	14.00	12.22	−.03	12.19	+ .75	S.	− .83	+ .14
155	4840	Jan. 20	6.1	.55	8.70	11.10	12.40	−.03	12.37	+ .93	S.	− .96	.00
156	4841	" "	6.1	.79	9.49	"	11.61	−.03	11.58	+ .14	P.	− .81	+ .15
157	4843	Jan. 23	6.3	1.10	.21	"	10.89	−.03	10.86	− .58	P.	−1.53	− .57
158	4844	" "	6.4	1.14	.28	"	10.82	−.03	10.79	− .65	S.	− .43	+ .53
159	4847	" "	6.9	.89	9.75	"	11.35	−.03	11.32	− .12	U.	− .84	+ .12
160	4851	Jan. 25	6.5	.81	9.54	"	11.56	−.02	11.54	+ .10	P.	−1.12	− .17
161	4852	" "	6.6	.57	8.78	"	12.32	−.02	12.30	+ .86	S.	− .90	+ .05
162	4856	Jan. 26	6.2	.46	8.31	"	12.79	−.02	12.77	+1.33	S.	−1.20	− .26
163	4857	" "	6.3	.69	9.19	"	11.91	−.02	11.89	+ .45	P.	−1.26	− .32
164	4860	Jan. 29	6.4	.79	9.49	"	11.61	−.02	11.59	+ .15	S.	− .41	+ .51
165	4861	" "	6.5	.84	9.62	"	11.48	−.02	11.46	+ .02	P.	− .81	+ .11
166	4863	Jan. 30	6.2	.90	9.77	"	11.33	−.02	11.31	− .13	P.	− .57	+ .35
167	4864	" "	6.3	.79	9.49	"	11.61	−.02	11.59	+ .15	S.	−1.11	− .19
168	4867	" "	6.7	.81	9.54	"	11.56	−.02	11.54	+ .10	U.	−1.37	− .45
169	4869	Jan. 31	7.3	.96	9.91	"	11.19	−.02	11.17	− .27	S.	− .42	+ .46
170	4870	" "	7.4	.65	9.06	"	12.04	−.02	12.02	+ .58	U.	−1.47	− .59
171	4873	" "	7.5	.92	9.82	"	11.28	−.02	11.26	− .18	P.	− .62	+ .26
172	4877	Feb. 4	6.2	.62	8.96	"	12.14	−.02	12.12	+ .68	P.	−1.24	− .46
173	4878	" "	6.4	.68	9.16	"	11.94	−.02	11.92	+ .48	S.	− .85	− .07
174	4883	" "	7.1	.85	9.65	"	11.45	−.02	11.43	− .01	U.	− .88	− .10
175	4886	Feb. 7	6.6	.50	8.50	"	12.60	−.01	12.59	+1.15	S.	−1.24	− .54
176	4887	" "	6.7	.80	9.52	"	11.58	−.01	11.57	+ .13	U.	− .53	+ .17
177	4889	" "	6.9	.80	9.52	"	11.58	−.01	11.57	+ .13	S.		
178	4890	" "	7.0	.71	9.26	"	11.84	−.01	11.83	+ .39	U.		
179	4891	" "	7.0	.80	9.52	"	11.58	−.01	11.57	+ .13	P.		
180	4892	" "	7.1	.57	8.78	"	12.32	−.01	12.31	+ .87	P.	−1.44	− .74
181	4894	Feb. 8	6.9	.85	9.65	"	11.45	−.01	11.44	.00	P.	−1.14	− .44
182	4897	Feb. 9	6.9	.57	8.78	"	12.32	−.02	12.30	+ .86	S.	−1.12	− .51
183	4898	" "	7.0	.83	9.60	"	11.50	−.02	11.48	+ .04	P.	− .28	+ .33
184	4899	" "	7.0	1.09	.19	"	10.91	−.02	10.89	− .55	P.		
185	4900	" "	7.0	.99	9.98	"	11.12	−.02	11.10	− .34	P.		
186	4901	" "	7.1	1.01	.02	"	11.08	−.02	11.06	− .38	S.		
187	4902	" "	7.2	.89	9.75	"	11.35	−.02	11.33	− .11	S.		
188	4904	Feb. 10	6.6	.60	8.89	"	12.21	−.01	12.20	+ .76	P.		
189	4905	" "	6.6	.66	9.10	"	12.00	−.01	11.99	+ .55	P.	− .56	+ .05
190	4907	Feb. 12	6.9	.69	9.19	"	11.91	−.01	11.90	+ .46	S.	− .96	− .47
191	4908	" "	7.0	.85	9.65	"	11.45	−.01	11.44	.00	U.	−1.37	− .88
192	4914	Feb. 14	6.7	.70	9.23	"	11.87	−.02	11.85	+ .41	S.	− .10	+ .26

No.	No. in Table I.	Date.	Hour.	Reading.	Diff. in Magn. of Images.	Constant.	Diff. in Magn. of Objects.	Corr. for Ring and Dist.	Corr. Diff. in Magn.	Resid.	Obs.	Iapetus — Star.	Resid.
STAR *b* (continued).													
193	4915	Feb. 14	6.8	.82	9.57	11.10	11.53	−.02	11.51	+ .07	P.	− .44	− .08
194	4916	" "	6.8	.63	9.00	"	12.10	−.02	12.08	+ .64	P.	− .84	− .48
195	4917	" "	6.9	.40	8.01	"	13.09	−.02	13.07	+1.63	S.	− .67	− .31
196	4818	" "	6.9	.44	8.22	"	12.88	−.02	12.86	+1.42	S.		
197	4919	" "	7.0	.68	9.16	"	11.94	−.02	11.92	+ .48	U.	− .70	− .34
198	4920	" "	7.1	.66	9.10	"	12.00	−.02	11.98	+ .54	U.	− .61	− .25
199	4923	Feb. 15	6.5	.72	9.29	"	11.81	−.01	11.80	+ .36	P.	− .56	− .35
200	4924	" "	6.6	.49	8.45	"	12.65	−.01	12.64	+1.20	S.	− .28	− .07
									11.44	± .39			± .36

The variations in the light of Iapetus may be determined either from the comparisons with Saturn given in Table XLIX., or from those with star *b* given in Table L. The advantage of the second of these methods is that as both objects are measured under very similar conditions, the observations are differential, and many of the sources of systematic error are eliminated. On the other hand, as two sets are required for each determination, we should expect an increase in the errors which are purely accidental. The results deduced by the two methods are given in the two parts of Table LI. The observations were first arranged in groups, placing together those in which the longitudes lie between 345° and 15°, 15° and 45°, &c. The mean longitude of each group will therefore nearly equal the number given in the first column, 0°, 30°, &c. The next four columns give the number of sets contained in each group, the mean difference in magnitude, the residual of the latter from its mean value, and the number corresponding to this residual. This is found in the usual way for reducing magnitudes to numbers, by multiplying by —0.4, and taking the antilogarithm. In the next column these numbers are divided by their mean, and multiplied by 100. They then show the observed light of Iapetus in any part of its orbit, its mean light being taken equal to 100.

We must now determine the equation of the curve which shall represent the variation in light, and thus obtain a means of computing the change of the light of Iapetus in different portions of its orbit. The most common explanation of the cause of this phenomenon is, first, that Iapetus, like our moon, rotates upon its axis and revolves in its orbit in the same time; and, secondly, that one part of the satellite reflects less light than the other. The simplest case is that in which the axis is perpendicular to the line of sight, and one hemisphere is uniformly light and the other dark, the line of separation of the two passing through the poles. In this case, let L represent the light when Iapetus is at a point of its orbit at an angular distance v from that in which

half of the bright and dark hemispheres are visible. Let a represent the mean brightness, or that when $v = 0$, and let b' represent the amount of increase or diminution in light; the light reflected when the bright hemisphere is towards the observer will then equal $a + b'$, that received from the dark hemisphere will equal $a - b'$, and $L = a + b' \sin v$. If v is measured from any other point in the orbit, or if v is the longitude, and Iapetus does not have its average light at superior conjunction, we shall have $L = a + b \sin v + c \cos v$, in which b and c are constants depending on the brightness of the two hemispheres and the angular distance of the point of average light from the conjunction.

Another hypothesis assumes that the satellite is not spherical, so that in turning it presents a disk of varying size. The problem here becomes very complex on account of the varying reflection at different angles of incidence. In general, there would be two maxima and two minima in each revolution, and the variation would be approximately represented by the terms $d \sin 2v + e \cos 2v$. If both causes act, no serious error will be introduced by adding the terms, or writing $L = a + b \sin v + c \cos v + d \sin 2v + e \cos 2v$. This equation is also that which we might assume empirically as the probable form of periodic variation.

We may now determine by the method of least squares the most probable values of a, b, c, d, and e, either from the comparison with Saturn or from that with star b. Forming the twelve equations of condition, we find that if we give equal weights to each, the normal equations become extremely simple. Owing to the symmetrical form of the equations of condition, all the coefficients but one become zero in the normal equations, and the most probable values of a, b, c, d, and e, are thus deduced directly. This also shows that each coefficient is independent of all the others. Substituting the values derived from the comparisons with Saturn and with star b we obtain,—

$$L = 100 - 54 \sin v - 7 \cos v + 3 \sin 2v - 1 \cos 2v,$$
$$L = 100 - 48 \sin v + 6 \cos v + 1 \sin 2v + 16 \cos 2v.$$

If curves are constructed with abscissas equal to the variations of light, it will be seen that the comparisons with star b give much more accordant results than those with Saturn. If, therefore, we give double weight to the second of the above equations we obtain $L = 100 - 50 \sin v + 2 \cos v + 2 \sin 2v + 10 \cos 2v$. The coefficients of $\cos v$ and $\sin 2v$ are so small compared with the differences of the two formulas that they may be neglected and the value $L = 100 - 50 \sin v + 10 \cos 2v$ adopted as representing the true variation in light.

The seventh column of Table LI. gives the light in each portion of the orbit computed by the above formula, assuming that its mean brightness equals 100. The eighth column gives the difference between the sixth and seventh columns, or the

observed *minus* the computed brightness. The next column gives the first differences of the eighth column, or each residual *minus* that following it. Since the variation is periodic, the reading corresponding to 0° is taken from that corresponding to 330°. The last three columns give the corresponding quantities expressed in magnitudes. The numbers in the seventh column are reduced to magnitudes and entered in column ten. In the first part of the column they are subtracted from 15.80, so that their mean shall be 10.89, like the observed mean given in column three. In the second part of the column, the computed magnitudes are subtracted from 4.40, so that their mean shall equal —.51. The residuals and differences are then found from these quantities, as in columns eight and nine.

TABLE LI.

VARIATION IN LIGHT OF IAPETUS.

Long.	No. of Sets.	Diff. in Magn.	Residuals.			Percentages.			Magnitudes.		
			Magn.	Number.	Per Ct.	Comp.	Resid.	Diff.	Comp.	Resid.	Diff.
Comparison with Saturn.											
°											
0	20	11.07	+.18	.85	77	110	−33	−17	10.70	+.37	+.14
30	35	11.27	+.38	.70	64	80	−16	− 6	11.04	+.23	+.01
60	22	11.74	+.85	.46	42	52	−10	−45	11.52	+.22	+.92
90	18	11.10	+.21	.82	75	40	+35	+37	11.80	−.70	−.71
120	36	11.53	+.64	.55	50	52	− 2	+19	11.52	+.01	−.31
150	33	11.36	+.47	.65	59	80	−21	−16	11.04	+.32	+.28
180	15	10.74	−.15	1.15	105	110	− 5	−30	10.70	+.04	+.25
210	33	10.31	−.58	1.71	155	130	+25	+ 8	10.52	−.21	−.07
240	15	10.31	−.58	1.71	155	138	+17	+25	10.45	−.14	−.19
270	25	10.49	−.40	1.45	132	140	− 8	−10	10.44	+.05	+.08
300	21	10.42	−.47	1.54	140	138	+ 2	−14	10.45	−.03	+.12
330	30	10.37	−.52	1.61	146	130	+16	+49	10.52	−.15	−.52
	303	10.89	±.45	1.10	100	100	±16	±23	10.89	±.21	±.30
Comparison with Star *b*.											
°											
0	10	− .93	−.42	1.47	134	110	+24	+21	−.70	−.23	−.18
30	17	− .41	+.10	.91	83	80	+ 3	0	−.36	−.05	+.03
60	7	+ .04	+.55	.60	55	52	+ 3	+ 4	+.12	−.08	−.09
90	3	+ .41	+.92	.43	39	40	− 1	+ 6	+.40	+.01	−.13
120	26	+ .26	+.77	.49	45	52	− 7	− 1	+.12	+.14	+.06
150	25	− .28	+.23	.81	74	80	− 6	−13	−.36	+.08	+.16
180	15	− .78	−.27	1.28	117	110	+ 7	+13	−.70	−.08	−.12
210	21	− .84	−.33	1.36	124	130	− 6	− 1	−.88	+.04	+.01
240	10	− .92	−.41	1.46	133	138	− 5	+ 8	−.95	+.03	−.06
270	17	− .87	−.36	1.39	127	140	−13	−24	−.96	+.09	+.18
300	13	−1.04	−.53	1.63	149	138	+11	+21	−.95	−.09	−.16
330	21	− .81	−.30	1.32	120	130	−10	−34	−.88	+.07	+.30
	185	− .51	±.43	1.10	100	100	± 8	±12	−.51	±.08	±.12

The accordance of the computed and observed variations in light may be tested by means of the above residuals. If all systematic error is eliminated, the residuals will follow the laws of accidental errors. As the order of the positive and negative residuals would then be determined by chance, the number of changes of sign should equal about one-half the number of residuals. If much less than one-half, the positive residuals must accumulate in one part of the orbit and the negative in another, or the computed values differ systematically from the observations. On the other hand, if the number of changes of sign is too great, it shows that the curve has been made to follow the observations too closely. That is, the computed curve has been made to follow sinuosities in the observed curve really due to errors of observations. By assuming a sufficient number of arbitrary constants, a curve could be computed which should agree almost exactly with the observations, and yet might not represent the true variation as well as a simpler curve which would eliminate a great portion of the accidental errors. Each group of twelve residuals happens to give six changes of sign, or exactly the correct number.

A severer test is afforded in the first differences of the residuals. If these are arranged according to accident, the difference of any two should, on the average, equal their mean value multiplied by the square root of two. The mean of the numbers in the ninth and twelfth columns should therefore equal those of the columns preceding them multiplied by the square root of two. This condition is fulfilled almost exactly in each portion of the Table. Both of these tests show that there is no perceptible systematic difference between the observed and computed values, and that a formula has been adopted containing as many arbitrary constants as the observations would justify.

The absence of the term $c \cos v$ shows that if the variation in light is due to unequal brightness of the two hemispheres of Iapetus, one half of each will always be turned towards Saturn. In other words, it would present to an observer at the north pole of Saturn the appearance of a half moon, the semicircle to the right being about four times as bright as that to the left.

Some doubt is thrown on the term $e \cos 2v$, since the comparisons with Saturn do not confirm its presence. Since the value of e is positive, it cannot be supposed to indicate that Iapetus is elongated in the direction of Saturn, although a slight elongation of this kind is probably implied in the assumption that the satellite turns once on its axis during each of its revolutions. An elongation sufficient to produce this effect might be caused by the attraction of Saturn, but it would be far too small to be perceptible photometrically. To make $e = +10$ the equatorial diameter of the satellite turned towards Saturn should be exceeded by that at right angles to it in the ratio of 9 to 11; so great a difference does not seem probable. The term $e \cos 2v$ could

also be accounted for by two bright or dark spots on the satellite. A dark spot on one side covering less than a hemisphere would also give a variation in light closely resembling that given by the formula. The most natural explanation, however, is that the dark and light portions are irregularly distributed on Iapetus, like the land and water on our Earth, and that one hemisphere is, on the whole, much darker than the other. The smaller variations may be assumed to be such that the formula given above represents them closely.

Equal weight is here given to the mean of the observations of each group. The residuals given to Table XLIX. could be somewhat reduced by adopting a formula found by giving to each group a weight proportional to the number of sets of which it was composed. A still further reduction might be made by assuming that the error in magnitudes was independent of the brightness. Evidently the absolute light would then be determined with much greater precision when Iapetus was faint. The weight would be equal to the square of the differential coefficient of the magnitude in terms of the light. As this coefficient will be inversely proportional to the light, the weight would become proportional to the number of sets divided by the square of the light. This would assign to the different sets a very different effect on the mean, as each of the observations at the preceding elongation would have about one-twelfth of the weight of one of those at the following elongation, so that we should make twelve times as many of the former as of the latter. As the observations were not planned in this way, it appears to be a little safer to give equal weights to each group.

The measurements show that the total change in the light of Iapetus is much less than is commonly supposed. This is probably due to two or three causes. The difference of a magnitude in the scale in common use for very faint stars corresponds to a much smaller change in light than that used for bright stars on which it is intended to be based. It has been shown, page 185, that even the scale of Struve increases more rapidly than the logarithmic scale of Pogson. Accordingly the difference in magnitudes between the maximum and minimum light would be estimated as a greater quantity than that given in the Table. Iapetus at its maximum can be seen with a smaller telescope than Rhea. The light of the latter is, however, apparently greatly diminished by the proximity of Saturn.

In Table LII. a comparison is made of the measurements of the satellites of Saturn. The consecutive columns give a current number, the name, the number of sets, the mean difference in magnitude as given in Table XLIX., this difference expressed in logarithms, the light of the ball of Saturn being taken as unity, and the ratio of the light of the ball to that of the satellite. The next two columns give the average deviations in magnitude of the separate sets, and the probable error of the mean, assuming that there is no systematic error. The last five columns give various expressions for

the diameter of the satellite on the supposition that its albedo equals that of Saturn. Each is followed by an expression for the probable error reduced to the same unit. The units adopted are, as in Table XLIII., the diameter of the planet, the second of arc seen from the mean distance of the planet and from a distance equal to that of the satellite from the centre of the planet, the kilometre, and the mile. The solar parallax is assumed as before to be 8″.80, and the equatorial semidiameter of the Earth 6377 kilometres, or 3963 miles. From the data of the Nautical Almanac, the mean diameter of Saturn at the distance unity has the value 156″.18, which is adopted in the computation. The corresponding numbers of kilometres and of miles are respectively 113176 and 70334. Since the equivalent diameters are measures of light and not of actual distances, two additional lines have been added corresponding to the maximum and minimum brightness of Iapetus.

TABLE LII.

DIMENSIONS OF SATELLITES OF SATURN DERIVED FROM PHOTOMETRIC OBSERVATIONS.

No.	Name.	No. of Sets.	Mean Diff. in Magn.	Log.	Ratio.	Av. Dev.	Prob. Error.	Equivalent Diameter.				
								In Diam. of Saturn.	Angle at Mean Dist.	Angle at Centre of Planet.	In Kilometres.	In Miles.
1	Mimas .	18	11.91	5.236	58080	.33	.07	.0042±.0001	.068±.002	522±17	470±15	292± 9
2	Enceladus	13	11.40	5.440	36310	.24	.06	.0052±.0001	.086±.002	515±14	594±16	370±10
3	Tethys .	24	10.46	5.816	15280	.38	.07	.0081±.0003	.132±.004	640±21	916±30	570±18
4	Dione .	17	10.57	5.772	16900	.32	.07	.0077±.0002	.126±.004	475±15	871±28	542±17
5	Rhea . .	16	9.88	6.048	8954	.36	.08	.0106±.0004	.173±.006	469±17	1197±44	745±27
6	Titan .	18	8.50	6.600	2512	.38	.08	.0200±.0007	.327±.012	381±14	2259±83	1406±52
7	Hyperion	45	12.81	4.876	133000	.47	.06	.0027±.0001	.045±.001	43± 1	310± 9	193± 5
8	Iap.(mean)	303	10.80	5.680	20890	.39	.02	.0069±.0001	.113±.001	45± 0	783± 7	486± 4
9	" (max.)		10.44	5.824	15000			.0082	.134	54	925	574
10	" (min.)		11.80	5.280	52480			.0044	.071	29	494	307

The mean difference in magnitude between Saturn and Iapetus adopted in Table LII. is that corresponding to the mean brightness of the satellite, and not to 10.89, the mean of the differences in magnitude given in Table LI. The latter value is not employed in Table LII., because the variation in the observed brightness of Iapetus is large and not referable to error of observation. Hence, undue weight would be given to measurements made when the satellite was faint, if the mean of the differences in magnitude was adopted as a measure of the mean difference in light. Accordingly, the required difference in magnitude is that corresponding to a light of 100 or 15.80 $-5.00 = 10.80$. Only the first part of Table LI. is used in finding this number, because a determination deduced from the second part would be, in fact, dependent upon the preceding one.

Except in the case of Iapetus, Table XLIX. exhibits no striking instance of a change in the light of any satellite depending upon its position in its orbit. But since the maxima and minima of the light of Iapetus coincide with its elongations, it seems worth while to inquire whether any of the other satellites appear to be brighter at one elongation than at the other. This, indeed, is the only way in which the possible variations of Mimas and of Enceladus can be exhibited, since these satellites could be observed only near their elongations. Accordingly, the results of the observations made on each satellite in the preceding and in the following halves of its orbit have been collected and compared. The quantities obtained by subtracting the mean difference of magnitude between Saturn and a preceding satellite from that between Saturn and the same satellite when following the planet are as follows: Mimas, +.52; Enceladus, +.48; Tethys, +.08; Dione, −.06; Rhea, −.41; Titan, −.15; Hyperion, +.06. The computed difference between the elongations of Iapetus is + 1.36, a much larger quantity than any of those just given. The error due to the position of the prism, noted on page 222, should give a positive value to all these differences were there no other cause of variation. The effect would be most marked with the five inner satellites, since in observing them Saturn was always covered by the prism, which was placed approximately in opposite positions at the preceding and following elongations. The variation in the signs seems to show that this source of error is nearly insensible. Of the seven satellites, only three give a difference large enough to suggest any cause but accident. In them the number of sets in the following half of the orbit is only six, three, and five, or is insufficient to determine the light with precision. It is possible that Mimas, like Iapetus, is brighter when preceding than when following Saturn; but the observations of the other satellites do not justify the inference that their light varies in different parts of their orbits.

In the years 1877 and 1878 the correction for the ring of Saturn was small, since the Earth was nearly in its plane. The observations should be repeated some years hence when the Earth is at its greatest distance from the plane of Saturn's equator. The correction for the ring will then attain its maximum value of nearly one magnitude. If the satellites are spherical their light will be unchanged, while as that of Saturn is increased, the observed difference in magnitude will be increased.

It is perfectly possible, although not probable, that one or more of the satellites may be surrounded by a ring like that of Saturn. In this case the same correction for ring should be applied both to satellite and planet, or their difference in magnitude should remain unchanged. A variation in the relative dimensions of the ball and ring of the satellite might give to this correction any assumed value. A decided flattening of the poles of the satellite would produce a similar effect.