5) Bellamy. Radcl. Obs. 1874 pag. 240.

Zeitdauer	Opposition	Beob. berücksichtigt
1874 März 24–Mai 12	März 17	März 24–April 16
1875 April 19–Juni 12	April 16	April 19–Mai 14
1874 März 24	$A = 37^{\circ}05$	$B = 34^{\circ}89$
25	37.33	34.76
31	37.88	34.92
April 8	36.53	34.44
10	37.45	35.55
16	38.20	36.61
20	37.19	35.21
1875 April 19	37.03	34.58
20	36.98	35.30
28	36.91	34.67
30	37.19	34.84
Mai 12	36.84	34.67
14	36.92	34.82
Mittel	37.19	35.02 (13)

Göttingen 1896 Juni 15.

6) Schur. S. oben pag. 227.

Resultat: $A = 37^{\circ}42$ $B = 35^{\circ}10$ (12)

Damit hat man nun folgende Uebersicht über die an grösseren Heliometern ausgeführten Messungen des Jupiterdurchmessers in der Nähe der Opposition:

	A	B	$1:\alpha$	Gew.
Bessel	37.66	35.24	15.6	2
Johnson	37.31	35.11	16.9	1
Winnecke	37.39	35.20	17.1	2
Main	37.14	34.94	16.9	1
Bellamy	37.19	35.02	17.1	1
Schur	37.42	35.10	16.2	2
Mittel m. Gew.	37.40	35.13	16.52	

Die Gewichte sind nach der Zahl der Beobachtungen und der inneren Uebereinstimmung geschätzt.

Wilhelm Schur.

Errors of Graduation of the Repsold Meridian Circle of the Lick Observatory.

By R. H. Tucker.

The following set of graduation errors has been determined by means of simultaneous readings of both circles. The instrument is especially adapted to this method, one circle being quickly and conveniently set to any desired reading, with respect to the other.

The process followed, has been: first, the measurement of the 45° divisions. Complete series were taken in both positions of the instrument, fixed circle East, and fixed circle West, for the purpose of strengthening this measurement. The determination of the 15° arcs follows, depending upon measurements from 0° and 45° . The 3° arcs are next determined, each measured from two of the 15° divisions.

These later series give new determinations of the 45° divisions; and the 3° series furnish, also, another determination of the 15° divisions. These values are then introduced, with their appropriate weights, and a recomputation of the 3° arcs is carried out. Up to this point, the 3° divisions of both circles have been measured, the determination for each circle being independent of the actual errors of the other.

The measurement of the intermediate 1° divisions of the fixed circle, A , has been made, by comparison of one of the 3° arcs of the movable circle, B , with A , through 90° of the latter; changing the position of B , one degree, for each series. The ninety series, thus observed, give the errors of the four 1° divisions of B , with considerable precision, and independent of the errors of A .

The series of 1° arcs furnish other determinations of each 3° division of A , measured from the two nearest 3° divisions. These have been included, with their proper weight, in the final values. This process, while changing the value first obtained but slightly, in general, has the

technical advantage of the employment of all available material for each correction. It renders somewhat more conspicuous the periodic character of the errors.

The agreement of the various measures has been satisfactory; and they afford the means of computing the probable errors of the final values. This has been done, also, by comparison of the results of individual series; and the probable errors are in accord with the quantities to be expected, from the combination of the accidental errors of observation, with the probable errors of the measurement of the graduations, used as standard. For the final corrections, the probable error increases from ± 0.011 for the divisions best determined, to ± 0.035 for the corrections to the intermediate 1° arcs.

The circles are two feet in diameter, and are graduated, alike, to every $2'$. The microscopes are 26 inches focal length, and have a power of 35 diameters. The threads are about $25''$ apart.

All necessary precautions and checks have been used throughout the work. The series have never more than barely exceeded an hour, each, in length; and have always been observed forward and back, in order to control changes in the position of the microscopes, and to eliminate those of a progressive character. Each determination rests upon series observed in opposite quadrants, for the elimination of circle flexure. This has however been measured, and the corrections are represented by the quantities:

$$\text{Circle } A \quad +0.08 \sin(R - 315^{\circ}) + 0.04 \cos(R - 315^{\circ})$$

$$\text{Circle } B \quad +0.02 \sin(R - 315^{\circ}) + 0.05 \cos(R - 315^{\circ})$$

where R is the reading of either circle, at the lower left hand microscope. The fixed circle reads 315° , when the telescope points to the zenith.

The table following gives the corrections due to graduation, for the mean of four divisions. The measurement has been made from 0° as a base. The mean of the corrections may then be adopted, as the most probable value of the error of 0° ; and the column of residuals will

represent the actual graduation corrections. The average residual for circle *A* is $\pm 0''.18$; and the probable error of a circle reading upon four divisions, due to graduation, would be $\pm 0''.15$.

For circle *B* the average residual is $\pm 0''.15$.

Circle <i>A</i>									Circle <i>B</i>		
0°	$0''.00$	$+0''.18$	30°	$-0''.18$	$0''.00$	60°	$+0''.11$	$+0''.29$	0°	$0''.00$	$+0''.10$
1	$+0.09$	$+0.27$	31	-0.02	$+0.16$	61	-0.02	$+0.16$	3	$+0.19$	$+0.29$
2	-0.15	$+0.03$	32	-0.24	-0.06	62	-0.19	-0.01	6	0.00	$+0.10$
3	$+0.22$	$+0.40$	33	-0.58	-0.40	63	-0.07	$+0.11$	9	$+0.04$	$+0.14$
4	-0.16	$+0.02$	34	-0.64	-0.46	64	-0.16	$+0.02$	12	$+0.14$	$+0.24$
5	-0.37	-0.19	35	-0.86	-0.68	65	-0.18	0.00	15	-0.29	-0.19
6	-0.30	-0.12	36	-0.70	-0.52	66	-0.12	$+0.06$	18	-0.06	$+0.04$
7	-0.26	-0.08	37	-0.44	-0.26	67	-0.40	-0.22	21	$+0.13$	$+0.23$
8	$+0.04$	$+0.22$	38	-0.26	-0.08	68	-0.25	-0.07	24	-0.05	$+0.05$
9	-0.06	$+0.12$	39	-0.21	-0.03	69	-0.33	-0.15	27	$+0.27$	$+0.37$
10	-0.12	$+0.06$	40	-0.41	-0.23	70	-0.42	-0.24	30	-0.17	-0.07
11	-0.08	$+0.10$	41	-0.31	-0.13	71	-0.26	-0.08	33	-0.34	-0.24
12	-0.23	-0.05	42	-0.39	-0.21	72	-0.40	-0.22	36	-0.44	-0.34
13	-0.36	-0.18	43	-0.46	-0.28	73	-0.14	$+0.04$	39	-0.37	-0.27
14	-0.46	-0.28	44	-0.46	-0.28	74	$+0.10$	$+0.28$	42	-0.39	-0.29
15	-0.33	-0.15	45	-0.52	-0.34	75	$+0.09$	$+0.27$	45	-0.07	$+0.03$
16	-0.48	-0.30	46	-0.22	-0.04	76	$+0.05$	$+0.23$	48	-0.08	$+0.02$
17	-0.50	-0.32	47	$+0.08$	$+0.26$	77	$+0.28$	$+0.46$	51	-0.29	-0.19
18	-0.41	-0.23	48	$+0.10$	$+0.28$	78	$+0.12$	$+0.30$	54	-0.28	-0.18
19	-0.47	-0.29	49	-0.04	$+0.14$	79	$+0.12$	$+0.30$	57	-0.02	$+0.08$
20	-0.19	-0.01	50	-0.19	-0.01	80	-0.08	$+0.10$	60	$+0.05$	$+0.15$
21	-0.17	$+0.01$	51	-0.22	-0.04	81	-0.02	$+0.16$	63	-0.17	-0.07
22	-0.33	-0.15	52	-0.38	-0.20	82	$+0.14$	$+0.32$	66	-0.22	-0.12
23	-0.19	-0.01	53	-0.18	0.00	83	$+0.25$	$+0.43$	69	-0.12	-0.02
24	-0.14	$+0.04$	54	-0.16	$+0.02$	84	$+0.12$	$+0.30$	72	-0.24	-0.14
25	-0.23	-0.05	55	-0.11	$+0.07$	85	0.00	$+0.18$	75	-0.08	$+0.02$
26	-0.46	-0.28	56	$+0.06$	$+0.24$	86	$+0.07$	$+0.25$	78	$+0.13$	$+0.23$
27	-0.22	-0.04	57	$+0.22$	$+0.40$	87	-0.06	$+0.12$	81	-0.02	$+0.08$
28	-0.11	$+0.07$	58	$+0.20$	$+0.38$	88	-0.22	-0.04	84	-0.13	-0.03
29	-0.19	-0.01	59	$+0.02$	$+0.20$	89	$+0.02$	$+0.20$	87	-0.03	$+0.07$
									88	-0.26	-0.16
									89	-0.18	-0.08
Mean $-0''.18$ Av. $\pm 0''.18$						Mean $-0''.10$ Av. $\pm 0''.15$					

This undertaking has been accomplished with the volunteer assistance of Professor *R. G. Aitken*, for the simultaneous reading of the circles. No single series has been discarded; but, one series of 45° arcs, and three

series of 1° arcs have been repeated, upon indications of larger accidental errors than usual, and the results combined with those of the original series. It has required, for the complete determination, 29000 microscope readings.

Lick Observatory, 1896 May 6.

R. H. Tucker.

Effemeride del pianeta (354)

per la quarta apparizione.

La seguente effemeride, valevole per 12^h t. m. di Berlino, ha per base il sistema di elementi da me pubblicato nel No. 3292 delle Astr. Nachr. (dove però in luogo di $\pi = 145^\circ 21' 4'' 84$ si deve leggere $\omega = 5^\circ 21' 4'' 84$) trasportato all'epoca della prossima opposizione in longitudine (5.5 Novembre 1896) con riguardo alle perturbazioni di Giove e Saturno.

Farmi conveniente di avvertire in questa occasione che la correzione di oltre 21^s in AR. risultante dalle osservazioni del 1895 (v. Astr. Nachr. 3304) per l'effemeride calcolata sullo stesso sistema è quasi interamente dovuta ad errore commesso nel trasporto del sistema all'epoca della terza apparizione.