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KG
11365
482



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KG 1365.482

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Harvard College Observatory,
Cambridge,
Mass.

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Contacts of Satellites I. & II.

Oct 1st — end Mar.	E.	4.667	5.333
2d — Nov 29th	"	4.655	5.345
	C.	5.6154	4.3846

2.6665	464.0
2.6725	470.4
2.6923	155.7

θ Orionis

	Calc	Obs.		
AB.	1.48	1.46	+02	.13
AC	1.49	1.47	+.02	.18
AD	2.58	2.62	-.04	.12
AE	.01	.17	-16	.14
BD	1.10	.92	+18	.06
CD	1.08	1.22	-13	.14
			55	77

Mean dev. ab. = .09 Mean dev last = .13

P.E. = m.D. $\frac{.8543}{\sqrt{n-1}}$

Certif Stars.

Mrs.	5.615
P	5.58
	5.567
S	5.619
u	5.534

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47	-3
64	+13
52	+1
53	+2
43	-8
40	-11
51	0
64	+13
45	-6
54	+3
45	-6
558	66

Reg. errors Cal.

$50.7 \pm 4.7 \pm 6.0$

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~~Ceres~~ Titania

α Leonis

eq	P	S	U	P, S, U		
	4.2			26.2		
	6.0			32.8		
			2.0			33.6
		2.8			23.8	
			3.0	23.6		
		6.4			6.8	
	8.0					17.2
	5.4			17.0		
			5.2			8.6
	6.0		3.0	12.8		16.8
29.6	29.6	9.2	13.2	225 112.4	112.4	30.6	76.2
9.2	5.92	4.6	3.3	15.3 30.6	22.5	15.3	19.0
13.2				19.0 76.2			
52.0 / 11		± 4.7		56.8 219.2		± 19.9	
4.7				~~sd~~ 19.9			

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	Diam Nunc	Planets.	
Mercury	2.992	2962	x for Calculation Oct. 1.1
Venus	7.660	7510	
Earth	7.918	7901	
Mars	4.211	4920	
Jupiter	86.000	85390	
Saturn	70.500	71904	
Uranus	31.700	33044	Mean 4" diam.
Neptune	34.500	36	

Newcomb	Nautical	British	American
9.36	4"69	5.555	5.054
9.42			
	4200		4510

2,842 ±.057

4200 : 5000

.45 - .2653
.25
.5153

3.24
17.8

.45.36
25
7036

469
47
516
563

.015

1.03
515

888
894

47 : 505 = 42 :

42
1010

1010
2020
21210
188
241
225
60

555
42
110

210
210
23310
188
451
443
80

47 | 2020
4920 | 0301 | 47
188 | 43
150

47 | 4510

1878phae.proj.483.

Rudi. Ex. (Ab. nach dem Mann. Regen. "44
" " " " " " Königsberg. 111

31700 : 601 = 4 :

2404 | 31,700 — 1 mile 00
2219 .075 .074
1850
1585

20

4200 : 56 = 25

145 | 4200
126 034
190

5.76 | .84
504 6,86
720
672
480

70500 : 20 = 270 :

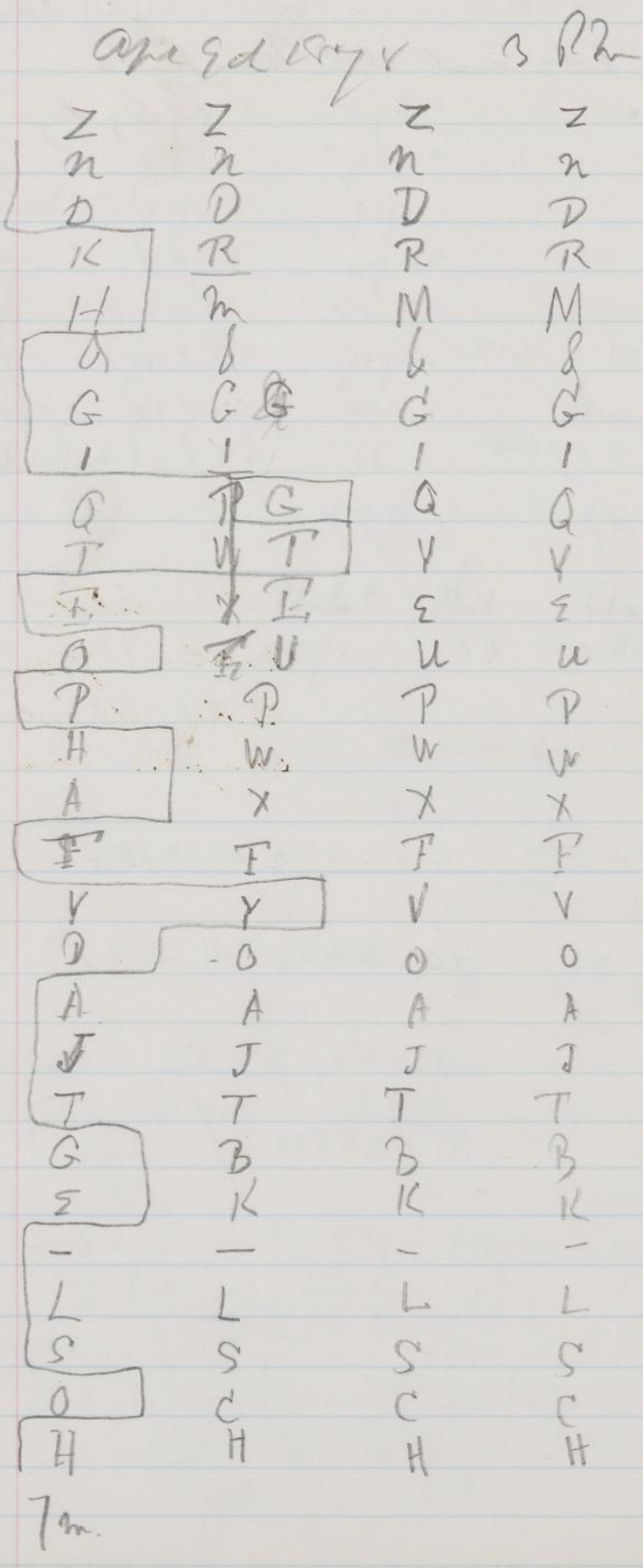
5,400 | 705
4935 076
4650

5.76
6,86

270 : 76 = 11 :
76
836 | 270
3

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April 9d 1878 3.10 R.A. 700 cms

Red.	Ob.								
D.	D.	D.							
W.	W.			y	h	S	Q	V	X
Y.	Y.		Y	I	L	?	G	y	E
X.	X.		L	I		?		y	
C.	C.					?		y	
B.	B.								
?.	?.	?	?						
J.	J.			T			G	y	
—.	—.								
F.	F.								
H.	H.								
I.	I.								
U.	U.								
Q.	Q.	G							
L.	L.								
T.	T.								
V.	Y.	y	y						
P.	P.								
O.	O								
K.	K.								
a.	a								
X.	E.								
M.	M.								
E.	E.								
Z	Z								
R.	R								
G.	G								
N.	N								

Visibility of last letter J on a side at distance 700 cms Angular diam 3'.4

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	L	51		L	
5.7		.00			
.8		20			
.9		22			
6.0		15			
1		45			
2		50			
3		50		00	
4		80	87	.05	
5	00	30	87	.03	
6	40	00		27	
7	04	30	119	44	
8	14	10	97	30	
9	36	92	129	16	
7.0	56	112	132	44	94
1	57		117	180	
2	70	97	142	133	92
3	85	163	167	80	96
4	60	134	177	76	101
5	122	133	202	80	93
6	114	132	194	107	141
7	113	175	194	90	136
8	104	225	187	143	187
9	159	200	234	103	162
8.0	146	223	195	140	176
8.1	164	200	247	170	217
2	136	242	257	187	189
3	173	300	222	182	191
4	183	272	284	185	241
5	237	278	290	196	248

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86	216	247	349	227	234
87	226	252	292	238	207
88	266	313	340	250	261
89	287	310	341	250	267
90	322	400	355	279	304
1	327	280	277	282	313
2	400		367	298	341
3	400	450	437		333
4	400	400	462	360	314
5	400		512	400	369
6	450	580	467		367
7	450			433	432
8					437

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5.7		4			
8		2			
9		5			
60		4			
1		4			
2		3			
3		1		1	
4		1	1	6	
5	2	1	2	6	
6	1	1		6	
7	7	4	5	5	
8	7	2	4	5	
9	15	9	6	10	
70	11	4	7	12	3
1	6		3	1	
2	4	4	6	3	8
3	4	3	1	5	7
4	1	5	1	7	12
5	4	6	4	6	5
6	7	4	4	7	5
7	7.6	2	3	3	9
8	5	4	1	6	4
9	7	4	3	3	2
8.0	7	3	5	10	13
1	5	1	2	1	1
2	5	2	2	3	6
3	6	1	4	4	5
4	7	4	4	11	5
5	4	5	3	5	7
6	12	4	8	9	4

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87	8	2	4	5	6	6
8	11	3	3	7	7	7
9	12	3	5	8	13	
90	6	1	6	8	14	
1	3	1	1	5	5	
2	1		2	6	7	
3	1	3	1		7	
4	1	1	2	4	6	
5	1		2	2	9	
6	2	2	3		3	
7	1			3	4	
8					1	

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466.8 = mean cent. for Hyp.

70.500

466.8 : 162.1 = 70.500 :

70.500 / 466.8
4664 — 151.03
23840
23340
4800
4668
1320

1621
157
1621
8105
1621
244771

76
15
39
789

245. miles ± 8

245 ± 8

28 1779
Saturn Oct. 8 17.30
18 16.86

162.1 : 34 =

467 : 162 = 34 : x
34
648
486
5508 / 467
467 .118 ±
838
467
3710

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Uranus

	α Leonis			Uranus		
P	S	u		P	S	u
55		~~43~~	+9	3.46		+51
54			+8	3.33		+38
		43	-3		2.37	-54
	44		-2		245	-50
39			-7	2.64		-31
		42	-4		2.58	-37
47			+1	2.68		-27
				3.51		+56
					3.56	+61
195	44	85	34	1562	245	4.51	409
487			4.9	3.124	245	2.937	

6.2 2 3.5

195
44
85
7|324
.463 ±.049

1562
245
857
2658|9
2.953

409|9
±454

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Vitamin

Ursae Majoris

		P	S	u
	+11	3.03		
	−12	3.80		
	+38			330
	+8		300	
	−16	276		
	−92		200	
	+26			266
	+42	334		
	−24			268
	+47	339		
	−76			216
11	392	1632	500	1080
	35.6			
		3.264	2500	2.700

Ursae Majoris

P	S	u
47		
64		
		52
	53	
		43
	40	
51		
64		
		45
54		
		45
280	93	185
.560	.465	.462

1632
500
1080
11 | 3212
2920

280
93
185
558
.507

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P	S	4
3.6		
4.2		
		20
	22	
2.8		
		30
1.4		
12.0	22	50
3.0	22	2.5

P	S	4
11.2		
28.8		
		10.4
	13.0	
15.2		
		17.4
10.0		
29.2		
		19.6
94.4	13.0	47.4
18.88	13.0	15.8

120
22
50
9 | 192
2.74

94.4
13.0
474
9) 1548
17.20

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155.7 : 1 = 31.700 : 2

31700 | 155.7
3114 | 203.6
580
4721
8790

203.6
292.0
4072
18324
4072
594.512

203.6
295.3
6108
10180
18324
4072
601208

		1st	PE. mean		1 rdg	
Radius						
Hygiea	= 1.62 ± 35.8	7.6	17		12.5	(21)
Ceres	= 295.3 ± 45.4	13.6	9		17.2	(3)
Vesta	= 292.0 ± 35.6	9.6	11		19.9	(27)
Miles						
Hygiea	= 270 ± 54	11			19	
Ceres	= 601. ± 93	31			36	
Vesta	= 595. ± 74	20			41	
Phobos	5.76 ± .9				.61	
	5.8 ± .9	.3			.6	

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lim mag. = 9.2 + 5 lgD

Miles	P.E. Mean	Mags.	
270 ± 11		.05	.041
601 ± 31		.05	.050
595 ± 20		.04	.034
5.8 ± .3		.05	.052

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	Reading	No	Mean Dev'n	Dev'n
~~Mean of all~~				
~~D~~ : P				
" " S				
" " U				
all	162.1	17	~~12.5~~	35.8

Obsn. at Lecnis.

P	.487	~~6~~ 7	3.0	
S	.44	1	2.2	—
U	.425	2	2.5	.005
all	.463	~~8~~ 9	~~.049~~ 2.74	±.049

Obsn. Literatus

P	3.124	5	18,88	
S	2.45	1	13.0	
U	2.837	3	15.8	
all	2.953	9	17.20	±.457

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Rhodes

6 5.6.5
2
—

Tilania Indg. d Lacuna

P	560	5	~~5.9~~ 5.9	
S	465	2	~~4.6~~ 4.6	
u	462	4	3.3	
all	50.7	11	4.7	6.0

Titania Evans

P	3264	5	22.5	
S	2500	2	15.3	
u	2700	4	19.0	
all	2920	11	19.9	35.6

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Mem Dec. Rhodes

98

100

116

38

105

84

143

479 205

.958 1.025

0.2095

0.2095

4.661

5.080 7.540

4.920 4.848

2.548

12.30 245.

25

270.

684 | 7

98

$9.^{\circ}2 \pm {}^{\circ}.98$

4200 3.6232

58 0.7634

7.1402

4.2804

5.720

14.30

$9.^2 : .98 = 576 : x$

98

1152

5.6448 | 9.2

552 614

124

92

328

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Olbers Titania

P	3.0	18.9
S	2.2	13.0
U	2.5	15.4

Ol.			Tit	
96656	0.4703		9.7050	0.4654
96656	0.470		9.705	0.4654
5615	5615		5615	5615
4.946	6.556	3444	5.025	6.546 3454
5.054	8.278	861	4.975	8.273 863
	4.501			4.501
12.63	2.779		12.44	2.774
	601.			595
1.610			1.521	
4.02			3.80	
	8.278			8.273
	0.602			.602
	8.880			8.875
	0.076			.075

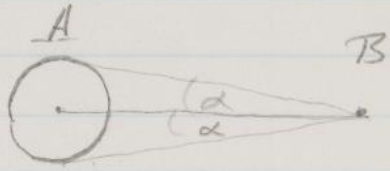
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Light of Companion of Sirius



2α = subtended by A from B

D, d = diameters A & B

I = light of A

l_D = " " B if all was reflected and diameter = D

l_d = " " " " " " " " " " " " " " d

C = coefficient of reflect.

l'_d = light of B = $l_d \times C = l_D \frac{d^2}{D^2} C$

$$\text{vers}\,\alpha = \frac{l'_d}{l_D} \cdot \frac{D^2}{d^2} \cdot C = 1 + \tfrac{1}{2}\tan^2\alpha = \frac{1}{8}\frac{D^2}{R^2}$$

$$d^2 = \frac{l_d}{l_D} \frac{D^2 C}{\text{vers}\,\alpha}$$

$$d = D\sqrt{\frac{l'_d\ C}{l_D\ \text{vers}\,\alpha}}$$

$$d = .01''\sqrt{\frac{.0001}{\text{vers}\,\alpha}} \qquad \tan\alpha = \frac{1}{1000}$$

If $\tan\alpha$ is small

$$\text{vers}\,\alpha = 1 - \sqrt{1-\tan^2\alpha} = 1 - \sqrt{1-x^2}$$

$$(1-x^2)^{\frac{1}{2}} = 1 - \tfrac{1}{2}x^2 + \&c$$

$$(1-a)^n = 1 - na + n\frac{n-1}{2}a^2$$

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$$\frac{1}{8}\frac{D^2}{R^2} = \frac{l'_d}{l_D}\frac{D^2}{d^2}C$$

$$d^2 = \frac{8 l'_d}{l_D} C R^2$$

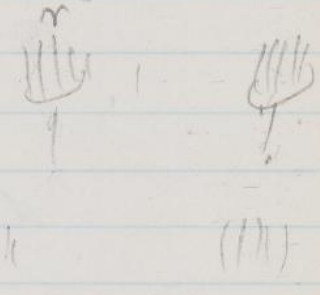
$$d = 2R\sqrt{\frac{2 l'_d}{l_D} C}$$

$$d = 20'' \frac{\sqrt{2}}{100} = .2\sqrt{2} = .28$$

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Probable Mean of Each measure
in divisions in total Cyclo.
& let of r readings each
$\Sigma r = m$
ε = prob. err. 1 reading
$\varepsilon\sqrt{r}$ = " " 1 set



P.E. Mean interval $= \frac{\varepsilon\sqrt{2r}}{m-r} = I$ $\quad E \propto \frac{\sqrt{r}}{m-r}$

$$\frac{dI}{dr} = \frac{-\varepsilon\sqrt{2}\,r^{\frac{1}{2}} - (m-r)\frac{\varepsilon\sqrt{2}}{2}r^{-\frac{1}{2}}}{(m-r)^2} = 0$$

$$\therefore \; -r^{\frac{1}{2}} - \tfrac{1}{2}(m-r)\,r^{-\frac{1}{2}} = 0$$

$$-r - \tfrac{1}{2}(m-r) = 0$$

$$\tfrac{1}{2}m - \tfrac{3}{2}r = 0 \quad \therefore \quad r = \frac{m}{3}$$

$$\frac{(m-r)\frac{\varepsilon\sqrt{2}}{2}r^{-\frac{1}{2}} + \varepsilon\sqrt{2}\,r^{\frac{1}{2}}}{(m-r)^2}$$

$$\tfrac{1}{2}(m-r) + r = 0$$

$m = 100$

r	ε
1	.0101
99	.03

$\frac{\sqrt{1}}{99}$ $\quad \frac{\sqrt{99}}{1}$

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Sharpless

$$I_1 = \frac{2\varepsilon \cdot m}{(m-r)^2}$$

$$(m-r)^{\cdot} + 2(m-r)r = 0$$

$$m - r + 2 - = 0$$

$$m = -r$$

$$\frac{dE}{dr} = \frac{(m-r)^2 + r - 2(m-r)}{(m-r)^2}$$

$$\frac{m-r+2r}{m-r} = 0 \qquad m - 3r = 0$$

$$W = \frac{m-r}{r}$$

$$W = m r^{-1/2} - r^{1/2}$$

$$W^2 = \frac{m^2}{r} - 2m + r$$

$$\frac{dw}{dr} = -\tfrac{1}{2} m r^{-3/2} - \tfrac{1}{2} r^{-1/2} = 0$$

$$-m r^{-1} - 1 = 0 \qquad m =$$

$$\frac{du^2}{dr} = -\frac{m^2}{r^2} + \qquad m = r$$

$$\frac{N' - V}{m-r}$$

$$m = 100 \qquad r =$$

$$\frac{\varepsilon\sqrt{\frac{2}{3}m}}{\frac{2}{3}m} = I_1$$

$$\frac{\varepsilon}{m}\sqrt{\frac{3}{2}} =$$

1.5

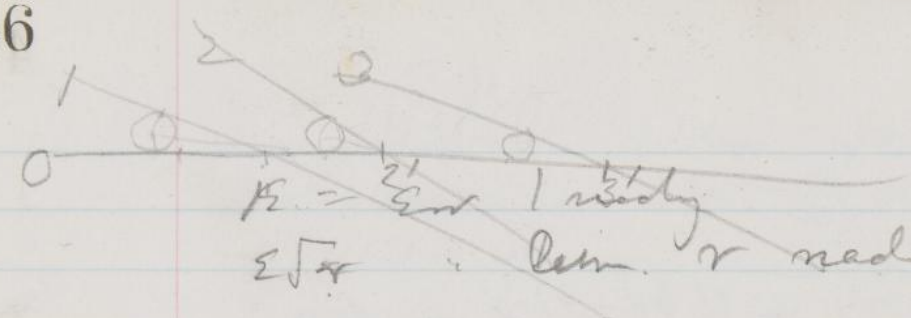
$$\frac{\varepsilon\sqrt{6}}{2}\frac{1}{\sqrt{m}} = I_1 \qquad \frac{\varepsilon}{\sqrt{\frac{2}{3}m}} =$$

.4 ε

$$\frac{1.225\,\varepsilon}{\sqrt{m}}$$

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$\Sigma \frac{\sqrt{n}}{n} = \Sigma n^{-\frac{1}{2}}$

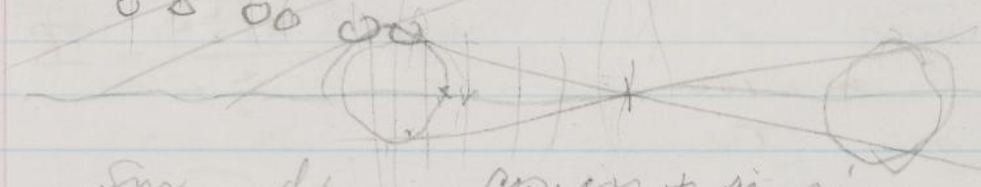
$W = (n-r) r_r = n r^{1/2} - r^{3/2}$

$0 = \frac{1}{2} n r^{-1/2} - \frac{3}{2} r^{1/2}$

$n = 3r$

$\frac{(51)-(1)}{50} \quad \frac{(52)-(2)}{2}$

$\frac{\Sigma(50) - \Sigma(1)}{(50)(50)} \quad \frac{n(50) - n(1)}{50}$



$\tan \Sigma = \frac{\sin}{\cos} \quad d\tan = \frac{\cos\cos + \sin\sin}{\cos^2} = \sec^2 = (1+\tan^2)$

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4	11	3	7	6	3	4	3	3
4	1	6	5	8	3	6	2	7
2	3	3	3	6	5	4	5	
4	3	5	3		8	4	6	5
3	3	2	4		5	2		4
5	4	5	6		6	4		
2	8	9	5		4	2		
3	4	3			4	3		
2	5	3				5		
3						4		
						3		
						6		
						5		
32	42	39	33	20	38	52	16	19

5	3	6	10	4
6	3	4	5	6
3	7	4	3	3
	4	3	5	3
	3		5	3
			4	6
				4
14	20	17	32	29

32
42
39
33
20
38
52
16
19
14
20
17
32
29

403 | 9
6
,045

90 Klaus. M.D. .184 P.E. 144,154
1027 Lets. P.E. .045
4166 Obs

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13	55	9	26	21	21	13	11	9
16	5	22	16	36	10	18	5	23
6	9	24	13	22	19	12	18	
14	12	19	12		27	14	23	16
14	9	9	13		20	6		13
16	15	20	21		29	14		
7	29	33	18		15	8		
13	16	12			19	12		
8	18	18				16		
12						14		
						9		
						22		
						19		
119	178	168	119	89	160	177	69	61

18	12	23	36	14	119	90
24	13	18	17	22	178	
12	27	15	11	13	168	
	16	12	19	10	119	
	14		17	12	89	1656 | 9
			14	22	180	184
				14	177	
54	82	68	114	207	60	900 + 127
					61	1027
55	1496 | 86				54	
33	86				82	
36	63(17				68	
36					114	
160					207	
					1656	
					77	

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		N		S	
5041	4982	2	25.05	73.05	6
4647	4.785	6	76.70	99.49	8
4953	4.908	8 |	101.75	172.54 |	14
4936	4.991		12.72	14	12.32
5118	4.963			32	
5191	5343			28	
4970	5095			45	
4773	4.898			42	
5079	4.889			34	
4920	4.885				
5079	5276				

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$x - y -$

$u - v = a$

$v - w = 2h$

$u - w = c$

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Eclipse of Jupiter III June 23d 78

Mean Light		Time.		Height	T-19.0°	CMT	T-19.0	
.983	9.6.3	26	26	85.1	−15.4	26h 10′	−17.0	.59
.948	88.8		45	98.2	13.5	29	15.1	.90
.905	80.4	27	8	79.4	11.2	52	12.8	.49
.843	69.6		36	69.0	8.4	27 20	10.0	.30
.806	64.0		52	50.9	6.8	36	8.4	.01
.766	58.4	28	11	58.4	4.9	55	6.5	.13
.745	55.6		27	55.9	3.3	28 11	4.9	.09
.726	53.2		44	70.5	1.6	28	3.2	.33
.711	51.4		59	52.1	−1	43	−1.7	.03
.695	49.6	29	18	42.9	+1.8	29 2	+.2	.11
.680	47.9		38	48.5	3.8	22	2.2	.02
.666	46.3		52	42.9	5.2	36	3.6	.01
.637	43.4	30	11	46.2	7.1	55	5.5	.06
.574	37.5		40	37.6	10.0	30 24	8.4	.20
.463	29.0		59	28.0	11.9	43	10.3	.35
.314	20.6	31	21	19.7	14.1	31 5	12.5	.50
.170	14.8		37	16.9	15.7	21	14.1	.55
8.903	8.0		54	16.2	+17.4	38	15.8	.56

27 1/2
554
277
3324
624
26592
6648
19944
2087.47 a m

7 24 43
+65
171.6
10,300 m

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from chart curve.

29m + A

177	~~29~~ 7	7		+2	+~~39~~
270	+119	119		+114	~~+79~~
147	+19	19		+14	+3
90	−10		10	−15	+2
3	−81		81	−86	+78
39	−26		26	−31	+1
27	−22		22	−27	−2
99	+67	67		+62	−70
3	−14		14	−19	−7
33	−31		31	−36	+58
6	+16	16		−11	−6
33	+3	3		−2	+23
18	+37	37		+32	−16
60	+24	24		+19	0
105	−2		2	−~~7~~	+3 ~~−2~~
150	−25		25	−30	+4
165	−24		24	−29	~~+6~~ −6
168	−10		10	−15	~~+10~~ −10

+292 245 10

+36

28m550 mD = 30e

PE = 26

+47 +5 537 | 18 / 30 (546, 445)

28m550 ±6.3

30

6.3

−102	−48		−1.5	−12
+114	+88			40
216	136			52

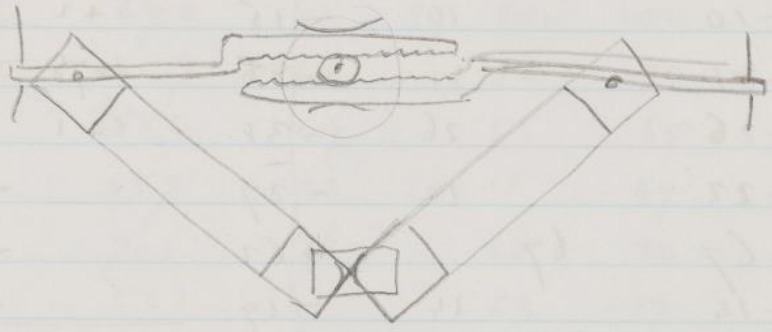
114
86
82
282

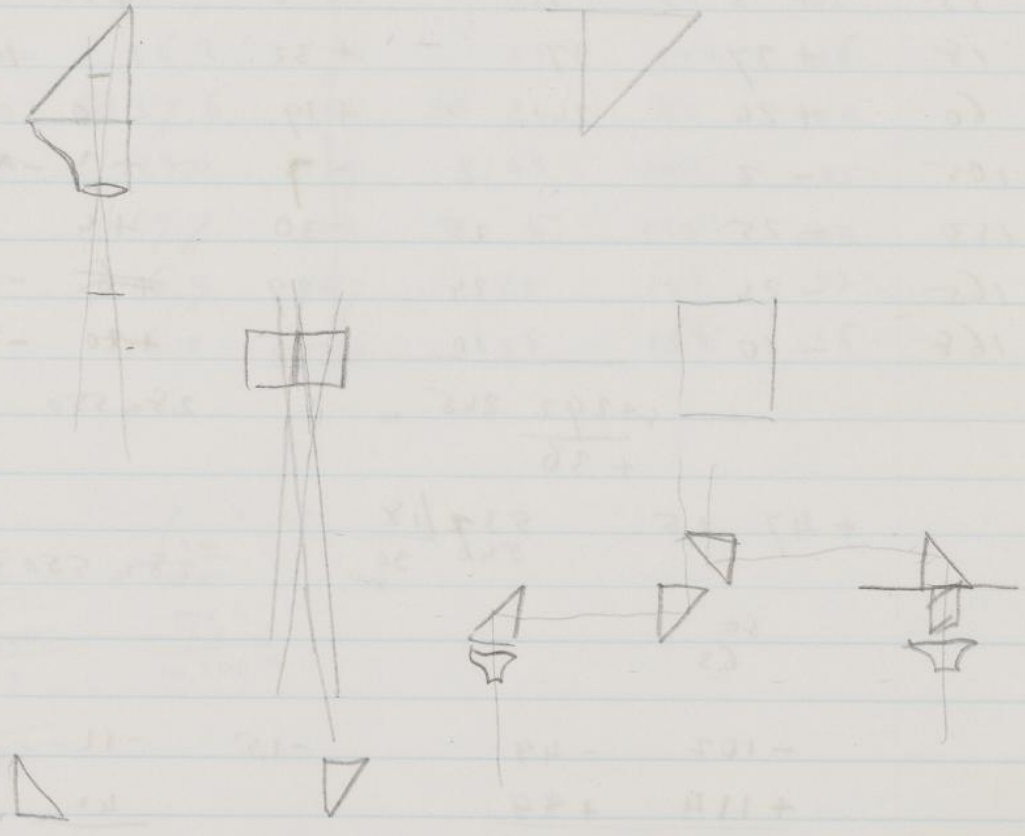
136 / 352 | 18 / 19

28m570 ±4.

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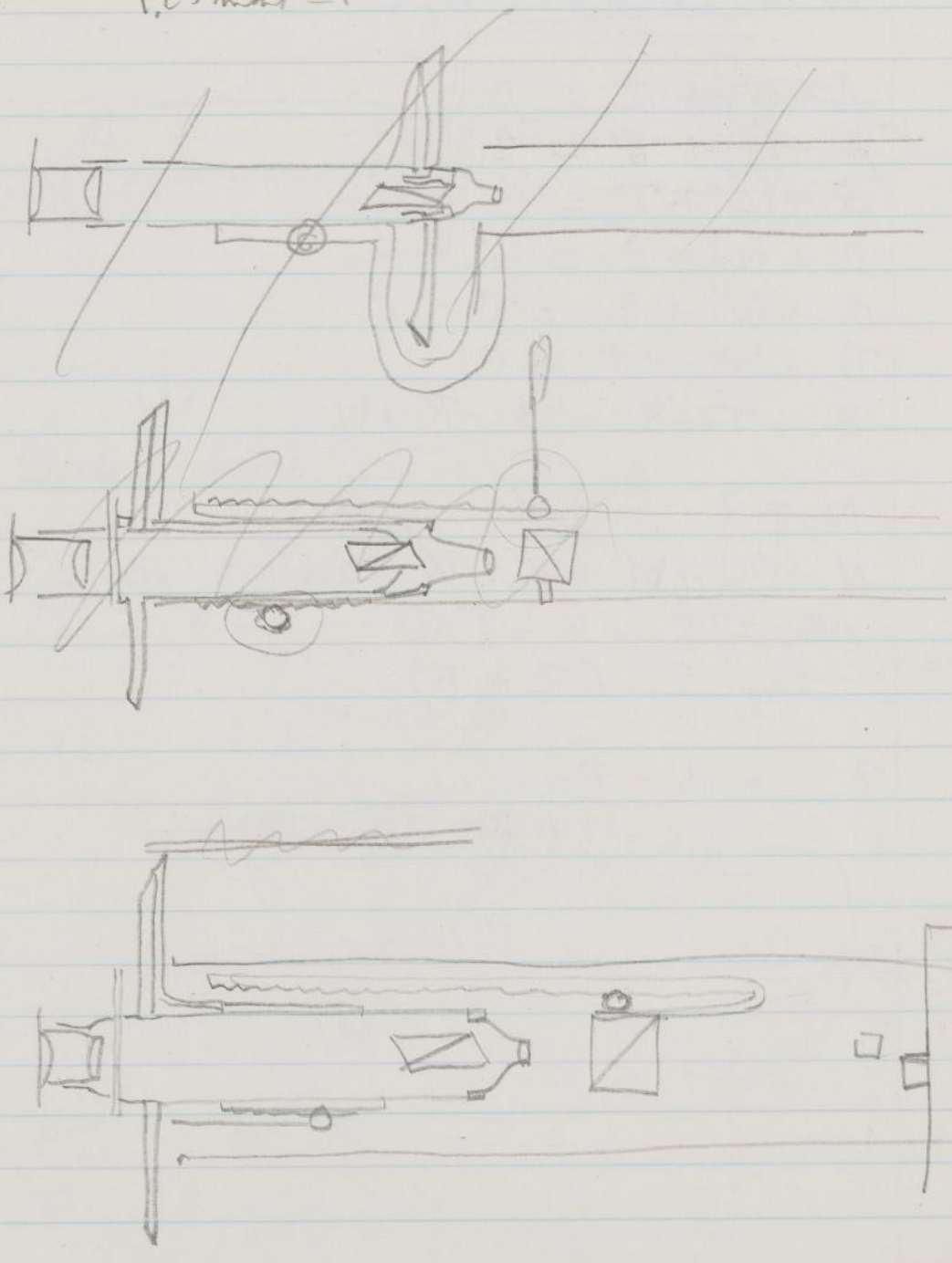
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3 tours = 60"

75 mm = 60"

1,25 mm = 1"



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Contact of Phot.

Three class ~~A, B, C~~

N = contact. O, B, C

~~A + N + R = B~~

~~A + N + S = C~~

~~B + N + T = C~~

O + N + R = B

O + N + S = C.

B + N + T = C

B + T - S = B - R + N

N = T - S + R

N + R + ~~N~~ + T = ~~N~~ + S

N = S - R - T

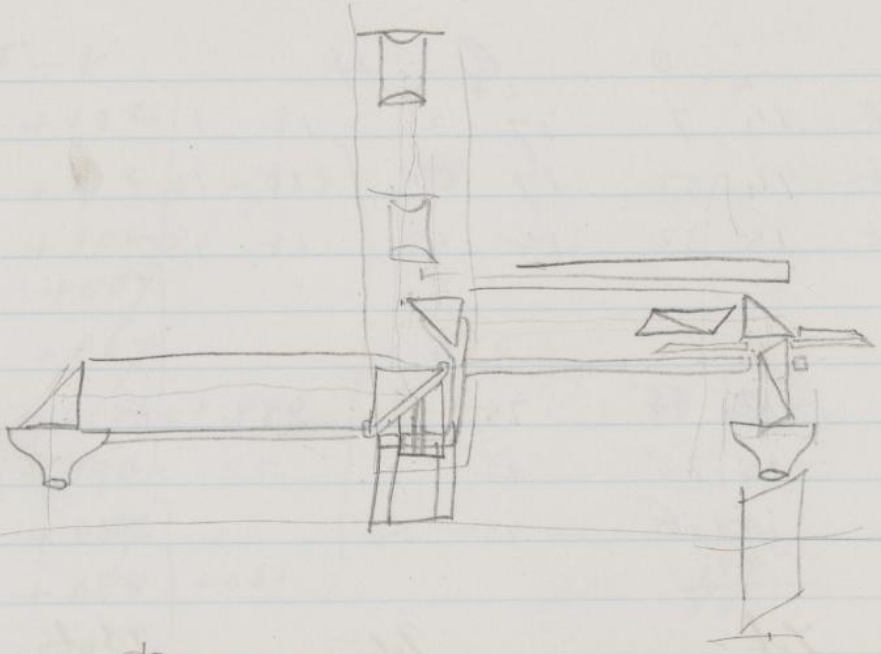
S - (R + T)

B = S - T

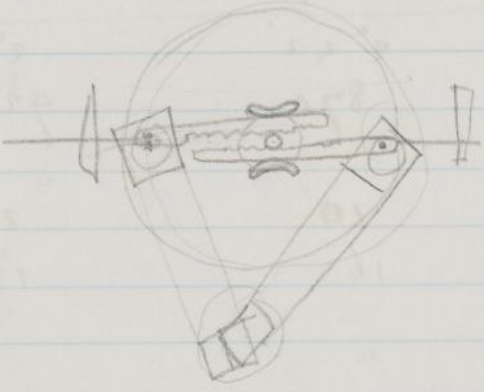
C = 2S - (R + T)

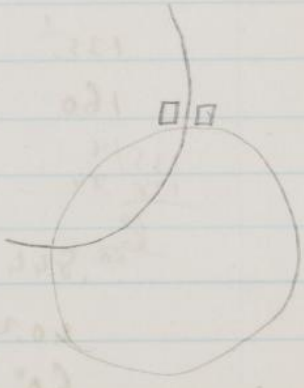
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Diffuse light Sun.
" " Moon
Nebulae & Star.
Coppar Class





January 1878

15 in.
.03

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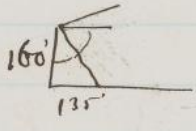
	☉	☿	♃
Oct 27th	14h 7	17h 2	18 1
Nov. 7th	14 51	17 54	18 10
Nov. 17th	15 32	18 49	18 18

−12° 55′	25 7	23 28
16 25	26 7	23 28
19 6	25 50	23 26

	7th.	9th	13th.
Ra ☉	18 0 12	18 10 23	18 30 39
☿	10 10	11 50	18 15 46
	+9m 58°	+1m 27°	−15s 23°
Dec ☉	26° 8	26 9	26 4
☿	23 28	23 27	23 27
	2° 40′	2° 42′	2° 37′
	598 ~~215~~	87	923
	135′	20′	209′
	160	162	157
	.844	.124	1.33
	40.2	7.1	53.1
	60°	93°	43°

49 30
24.75
.9045
.226

135 | 16
128 | .84
70
64
60



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J − V

7 Oct P +.122
S +.112 +.113
u +.104
9 Oct P +.009
" +.067
S +.115 +.070
u +.090
13 Oct S +.057
u +.088 +.061
P +.038

6 Oct S,u +.229
27 − 4 Oct +.081

17 Oct ? +.048

S − M

~~28 Aug.~~ ~~−.111~~
P +.019
16 Oct S −.046
P +.125
18 Oct S +.141
P +.071

.080

.080 2
4 5

339
280
183
802

~~111~~
92
228

97
111
528
132

183

76
205
281

70

ΣV .051
.132

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Zn 320.0 320.7

33.1	+.8	32.4	+ 2
- 33.9	-	34.6	
29.7	-	29.0	+ 5
- 28.8	-	29.5	
27.8	-	27.1	
- 23.0		23.7	
24.1	+1.1	23.4	
- 22.7	-	23.4	
22.6	-	21.9	
18.8		19.5	
16.0	-	15.3	
- 17.0	+1.0	17.7	+2.4
13.9	-	13.2	
- 12.7	-	13.4	+.2
13.0	+3	12.3	
11.5		12.2	
	3.2		5.3

366.5
36.65
329.85
349.1
358.2
354.3
35.4
142685
713.42
356.71

282.4
285.0 ~~356.3~~
4.3
4.6
2.0
183
283.66
356.97
73.31
63

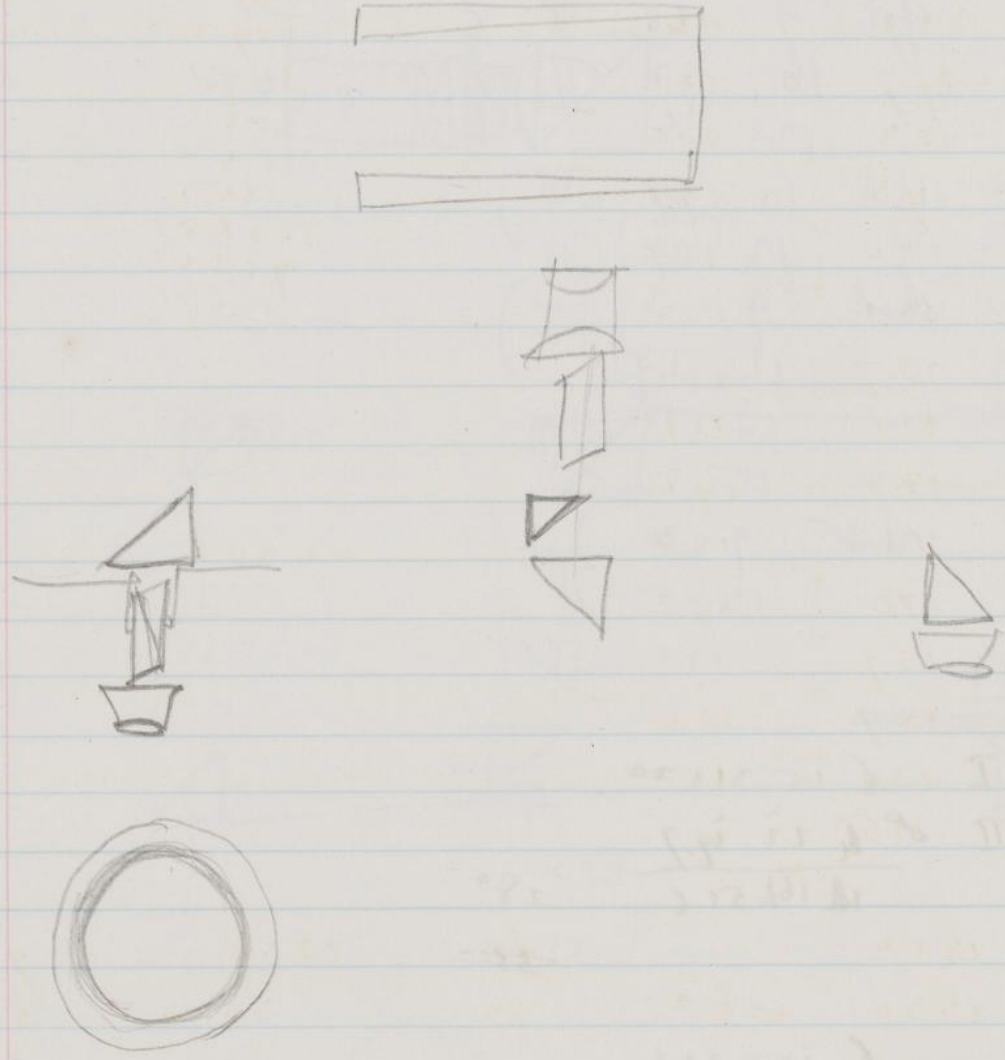
356.3
9.7
3.7
~~8.2~~
27.9
356.97

284.8
33
5.2
7.0
3.2
7.0
305
~~286.10~~
285.08

359.8
5.8
6.0
5.5
2.6
297
355.94
~~286.10~~

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c.z.t. Washington mean time.

July 4d 10h 2m III E
" 9d 9 55 I E
" 10 12 II) !
" 13 8) E
" 11d 10 28 III) 3.10
" 13 38
" 16d 9 3 I) 2.20
11 23
12 25) II 2.5
15 21
" 21d 9 20) IV 4.31
13 51

I 6 15 31.3 ~~20~~
II 8 4 22 39.7
1d 16h 51.6 28"

~~33~~

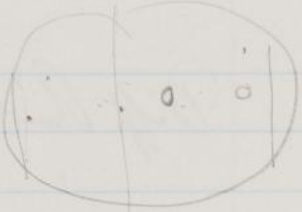
6 15 31.3
4 4 7.2
2d 11 24.1 163.1

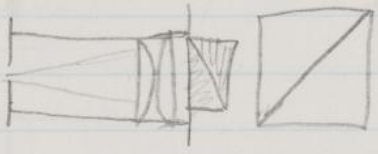
III 7 14 59.7
30 20 11.4
6 18 48.3
39" III 90"

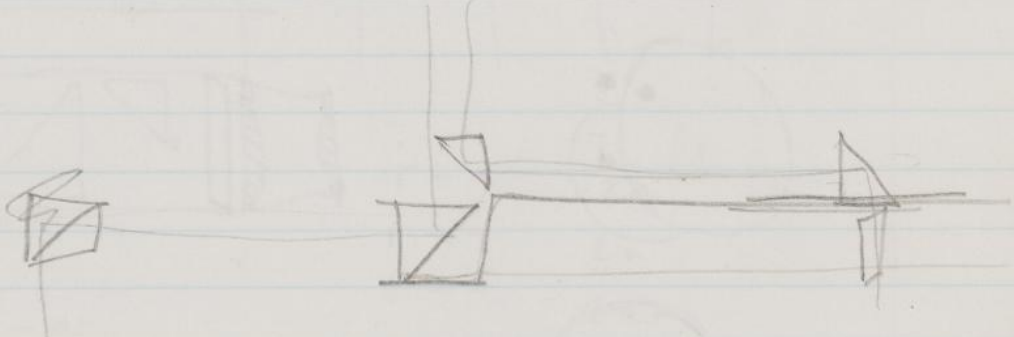
7d 14 59.7
6 17 ~~5.9~~
21 53.8 26".5

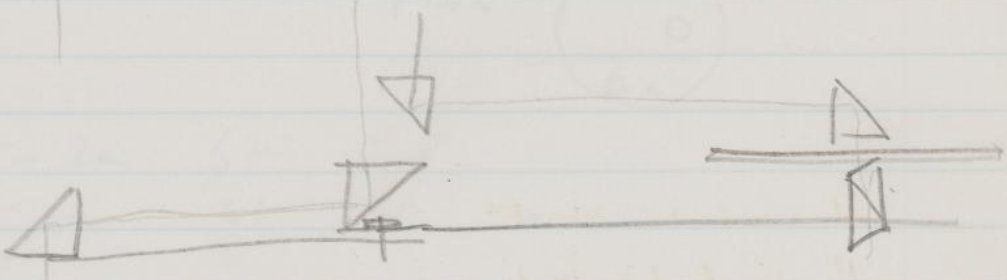
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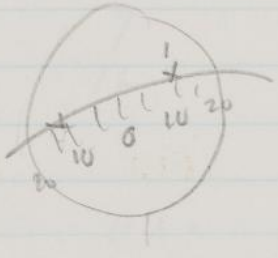
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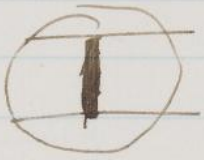


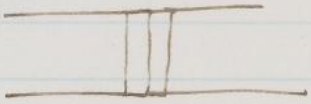


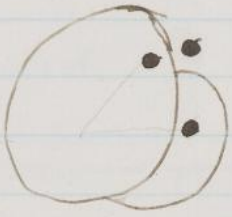
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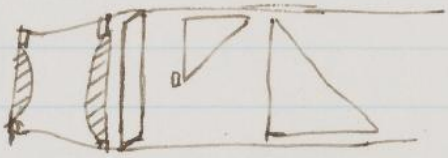
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Diff. Ants Sun.
Moon











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Parts Sund.
Diameter Sun.
Distance Stars.



0
$t-a$
$2t$
$3t-a$
$4t$

$t-a$ $2a$
$t+a$ $2a$
$t-a$ $2a$
$t+a$

$6a$

$4t-2a$ $6t$
$2t-a$ $2t$ a

0 9
9 11
20 9
29 11
40

0 $t+a$ $2a$
$t+a$ $t-a$ $2a$
$2t$ $t+a$ $2a$
$3t+a$ $t-a$
$4t$

$6t$
$4t+2a$

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Conclusion of I by 2h

235.9 2.3727
6828.64 3.8343

2.3727
3.8343
8.5384
1.5792
6.9592

Plate + 6.9592 − Red
1.407
8.366
.563
7.80
5.6

3.66

7.803
5.606

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Tests of Phot II

a. Accuracy 5m, 7m 9m 1 / — \

7m. Various positn angles
Mean of distant. 60" 20" 10" 5" 3"
Effect of Br. star on comparison

Focus within without

10 stars, 3 pairs. 3 dist. 4 bright

Log² D

2 log 45° = .0000 1° = .03
46° .0304
47° = .0606
48 = 0.912

40 Distances 60" 20" 10" 5" 3" 8 readgs each 2(4)
16 * 5m 1 \ — / 51 Cephei
32 * 7m turn round 1 \ — / 1 \ — / 2 Ursae
16 * 9m 1 \ — /
20 Change focus 5
Focus on A, on B
24 Effect of Br star on comp. 60" 20" 10" 5" 3" 0"
148

100 Repeat 10 stars

Limit of visibility

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Nov 19th 154
Ja 12
14
16

Dec. 19th 30
Jan 19th 61 56

56
38
336
168
2016 | 79
158
5
158 | 255
154
436 | 409
395
410

56/79 57/80 ×4÷ ×4÷ 228 28 256 154 410

12 30 30 40° 230
Ja 14th 31 27 49° 270
16th 33. 58° 380

2,314. | 72
216 | 32.1
154
144
100 | 642

656

6ur
55
322
322
354

2118
1765
2118
23.1568

72 : 2314 = .55

1157
1157
1.27 2.7 | 72
72 | 17.7
552
504
480

857

35.30
766
2118
2118
2471
2705

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354 × .643 = 227.622

354 × .755 = 267.270

354 × .848 = 300.192

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Obs. of γ & η Cephei

Feb 7th

b 2.076 P *
a 1.258 "
a 1.086 U 70" 30° . a
b 2.296 " 110" 30° + b

3.5 nearly same line equal bs. with b

Feb 27th

B 2.016 P η Cepth. *
C 1.312 .
: 1.00 U . c
B 2.070 . + b
1.486 P γ Cepth.
1.292 U

Mar 8th.

C 1.528 P η Cepth +
B 1.800 " . c
B 1.664 U . b
C 1.884 "

Feb 6th

γ Cephei.

a 90° 4'
b 180° 1.5 ſ-
c 270 4'
d 275 4.5
e 290 5' 3/4

5 more as distant as d & e

B 1.712 P
. 1.600 U 180° 1'

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March 31st. γ Cephei. Obs.

		Red field = 1.0		Mag.
a	140°	.5	3.0	11
	220	.7	4.2	12
b	220	.2	1.2	14
	215	.8	4.8	13
	240	.65	4.0	12
	240	.7	4.2	13
	300	.6	3.6	14

Sept. 28 1878 γ Cephei. R 47 132

10°	40'
10	60'
25	150'

Dec 13 1878 R 50 27

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Felicitas Comparison.

55 Arietis 3h 0 36.0 61 29.9
1 42.4 28° 30.1
3h 2 18.4 7.6
28° 36.7

3.585 28
28 1414
30180 112
7170 28
102.5480 112
28
3951.92
1414
23 23
3585 4242
115 28 28
325.22
184 5.4 ~~Corr~~ = +8'.2
115
69
8.2.45.5
1.4
122.5

Corr + 82.51, + 5'.4

3 2 28.4 28 36.7
1 82.5 5.4
3h 1m 55.90 28° 31.3
0 54.80 30.9

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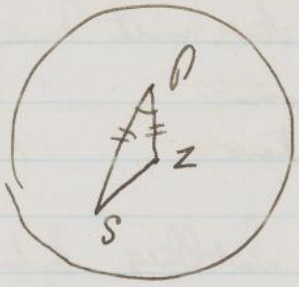
Meridian Obs. with Meridl Circle
D. M. Zones.
C. S. Stars.

Mars. Latt.
Rad. Stars

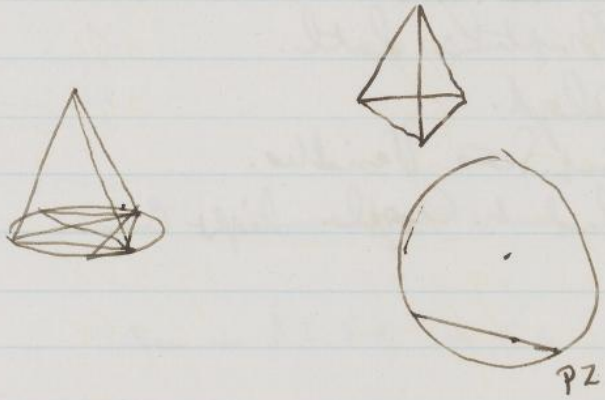
Jupiters Satellites Eclipses
" " Transits
Mimas. Hyperion.
Neptunes Latt.
Algol.
Comp. Stars Variables.
Reduct. Angles. Light Curves.

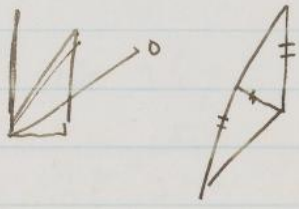
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Locus of S for equal angles of PSZ





lin plt:

lin SZ : lin hom. = hor dist : lin Rad. Aug.

$$\text{lin Rad. Aug.} = \frac{\text{lin hom.} \times \text{lin dist.}}{\text{lin SZ}}$$

$\rho \cos v = \rho_1 \cos v_1$

$\rho \sin v = \rho_1 \sin v_1 +$

$\sin v +$

109494
.007
109.501

30.007
109.494
50.662
110.210
300.373

√ 139.501 / 9.964

∫ 160.872 / 10.05

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20918
8 10 8

9.455
6 6 3

βV	βJ	SU	SJ	uV	VJ
.124	.092	.978	.228		.134
	.097	905	.111		
10.124	20.189	19.883	20.339		10.134

.932	.054	903	.015	.997	.101
986	.995	.061	.176	.074	.164
.048	981	.941	.998	.892	.980
.965	.003				
695	.743				
49.626	49.776	29.905	30.189	9.963	0.245
9.9252	9.9552	9.768	.063	9.988	.082
59.750	69.965	49.788	50.528		40379
9.958	9.994	9.958	10.106	9.988	10.095
10.011	10.037				

10.124	20189	49.626	49.776	270
19.883	20339	29.905	30.189	9.455
30.007	10134	29.963	30.245	20.918
30.002	50.662	109.494	.210 / 11	300.373
	~~.165~~	9.954	.019	
	.132	~~9954~~		
		109494		

109.494	.210	160.872	10.124
.007	.660	139.501	20.189
139.501 / 14	.870 / 16	~~160.054~~	19.883
10	.054	299.555 / 30	20.339
139.501 / 14		9.9852	10.134
9.964126		300.373	49.626
135			49.776
126			29.905
90			30.189
84			29.963
61			30.245
56			300.373
			5

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Hv. Comet No. 1. into S. Lo for Angelonia's
No Name R.A. Dec. 1 2 3 4 5 Mean

Reduced D.M.

	'54 Oct 2	'55 Nov 19	'56 Oct 28	Oct 31	57 Aug 25
S.T. Mean Hv	12 48 31	15 51 48	14 28 4	14 39 53	10 14 47
Greenwich					~~18 24~~
+	12 5 6	9 13 51	11 5 23	8 5 2	12 43 56
+	1 59	1 31	1 49	1 20	2 5
− 50.					
	0 50 31	1 17 ·5	1 35 11	22 46 10	23 0 43

	'58 Oct 12	'58 Nov 4	'59 Nov. 3	'61 Aug 14	Sept 29
	13 23 5	14 53 46	14 48 52	9 31	12 32
	10 17 23	8 37 6	12 4 41	13 7	9 49
	1 41	1 25	1 59	2	2
	23 42 4	23 32 12	2 54 47	22 40	22 23

= 36 36
5 8 12
28 24 Eq Gr. 50

1878phae.proj.1.403.

Algol Observations.

56 Aug 8	'57 Sept. 17.	'57 Nov 19	'58 Jan 7	'58 Jan 27	'58 Mar 11
	~~9 7 3~~ 11 45 28	15 53 51	19 7 3	20 25 54	23 15 26
	11 9 44	13 4 54	7 18 27	8 49 57	9 9 7
	1 50	2 9	1 12	1 27	1 3
	22 56 57	5 0 49	2 26 37	5 17 ~~13~~	8 25 31

~~Aug 9~~	'42 Oct-21	Dec 6
	13 58	16 59
~~Aug 9~~	12 6	8 59
	2	1
	2 6	1 59

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Coincidences of Mean & Sidereal Clocks

57	35	3	37	2	44	6	55
1	12	6	45	9	39		11
7	57		45		50		13
14	12		5		43		11
	17		9	27	54		53
26	26		57		47		
	23		5				
38	28						

a	B	aB		
~~5~~ 45	5 55	1 32	.251	+1
~~5~~ 45	6 11	1 42	.279	+29
~~6~~ 5	6 13	1 38	.268	+18
~~6~~ 9	6 11	1 26	.235	-15
~~6~~ 57	~~6~~ 53	1 28	.241	-9
~~6 5~~		1 24	.229	-21
			303	250 93
				250 ±.015

A		B	
-21	-.057	-11	-.031
-21	-.057	+5	+.014
-1	-003	+7	+.019
+3	+008	+5	+.014
-9	+.025	-13	-.036

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1979phae.proj.1.483.

+	108	+112	127	92
+	76	+80	95	
+	212	+116	131	
+	81	+85	100	
−	38	−34		
+	95	+99	114	
−	111	−107		
+	118	+122	137	
−	84	−80		
+	38	+42	57	
−	1	+3	18	
−	113	−109		
−	19	−15		
+	85	+89	104	
−	30	−26		
−	21	−17		
−	35	−31		
+	32	+36	51	
+	45	+49	64	
+	160	+164	179	
+	148	+152	167	
+	58	+62	77	
−	75	−71		
−	18	−14		
−	36	−32		
−	124	−120		
−	51	−47		
−	13	−9		
−	321	−317		
−	273	−269		

131
74
57
79
136

74
79
153

Σ+ 6.55
2.55
5.63
Σ− 13.13

16.73
300.373
1.012

300.373
Mean all 10.012
±.075

Σ+ ~~7.17~~
1.711
14.38
2249
±.075

10.012 ± .075
10.032 ± .061

300.373
586
299.787
9.993

8.48
8.49
25 | 16.97
.690 | 168
17

1.211
210
1421

300959
10.032

1.211
263
.948

11.38
5.86
5.52
2.70
8.32
17
9.49

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1878phae.proj,.483.

80 679

~~to 68?~~

+18	+114	-59		−
−10	−55	+52		−
+25	+109	+42		+
+18	+3	−69		+
+38	−68	−131		−
−87	−31	+77		−
−48	−152	−96	−96	−
−70	+12	+14	+14	+
−152	−25	−81	−81	+
−54	+18	−8	+112	+
+95	−86	−35	+65	
+60	−127	+146	+146	
+40	−6	+21	+21	
+46	+38	+28	+28	
+52	−70	+169	+169	
−37	+57	+72	72	
−48	+52	+143	143	
−119	+11			
+81	−13			
−95	−69			

ΣS 8.15

121
17 | 129.15
119
101
85
765

S .760

40.84

+4.73	+8.87	14.51	19.51	+177	22.28
5.20	10.22	13.99	18.99	−43	18.56
			38.5 | 57		
			.068		.16

473 657 12.28
6
18.28

520 1022 14.01
5
19013
18.52

Σ+ 18.28
Σ− 18.56
36.84 | 57
342 646
264
228
360

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9.33 10.02 7.48
124 109. 113
1-22 133.33 1190.2 1204.8
6.73
7.17
120.48
133.33
386.73 | 57
342
44 7
39 9
48 3
51 3

.067 | 7 √56
.058 | 7.48
5984.008

7.678
4.77

9.33
16.02
7.48
26.83
73
17
27.73

2.65
55
5765 | 5
M.721

9.33
20.25
27.73

10.02
109.2

11.52
12.24
13.46
14.59

27.73
359
386.73 | 57
342
44 7
39 9
48 3
45 6
27 0
.678 5

.961 2.40
927 2.32

Mea = .678 5 ± .065

V 3.34
26.45
38.44
28
3872

44 28
18 28

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J = .054 V .964

~~+70~~	
+38	+.160
+174	+14
+43	-59
+57	-32
+88	-61
0	+33
-39	~~+47~~
+47	+22
-59	+84
-73	+97
+122	+110
+110	~~77~~
-56	-23
-74	-78
-51	+1
-311	-269
Σ+ 371	321
671	521
Σ- 363	316
663	516

16 | ~~+026~~ / .064

16 | 1334 / .083128

1037 | 16 / 96 / 77 / .065

54 48

±083 ΣJ

±065 ΣV

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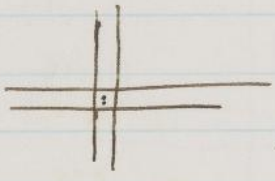
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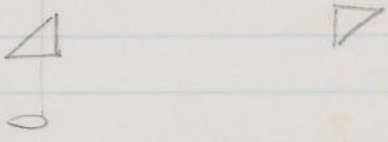
S − M +122
" +80
−47
+125
+141
+71

.80 $\frac{1}{25.4} = 30$

762" = 1Gn

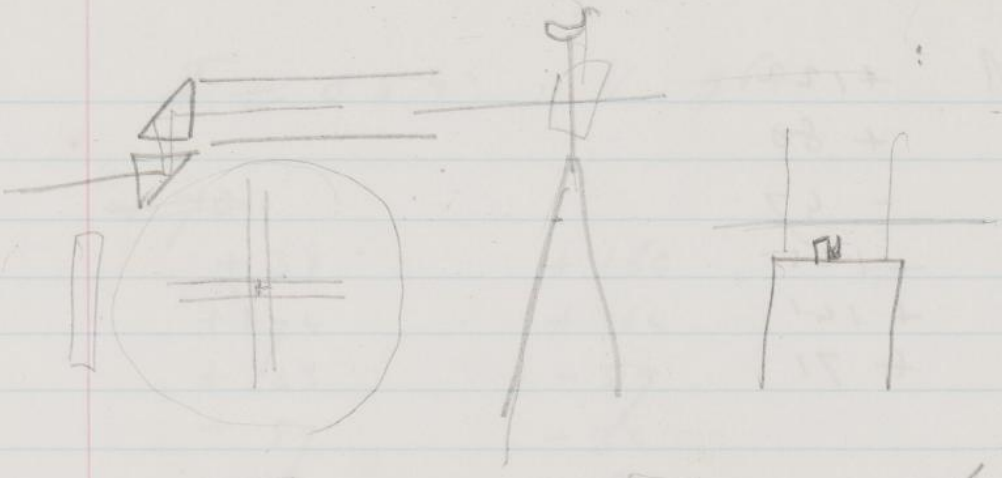
⊙ = 25"

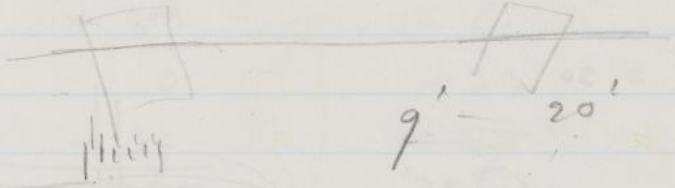


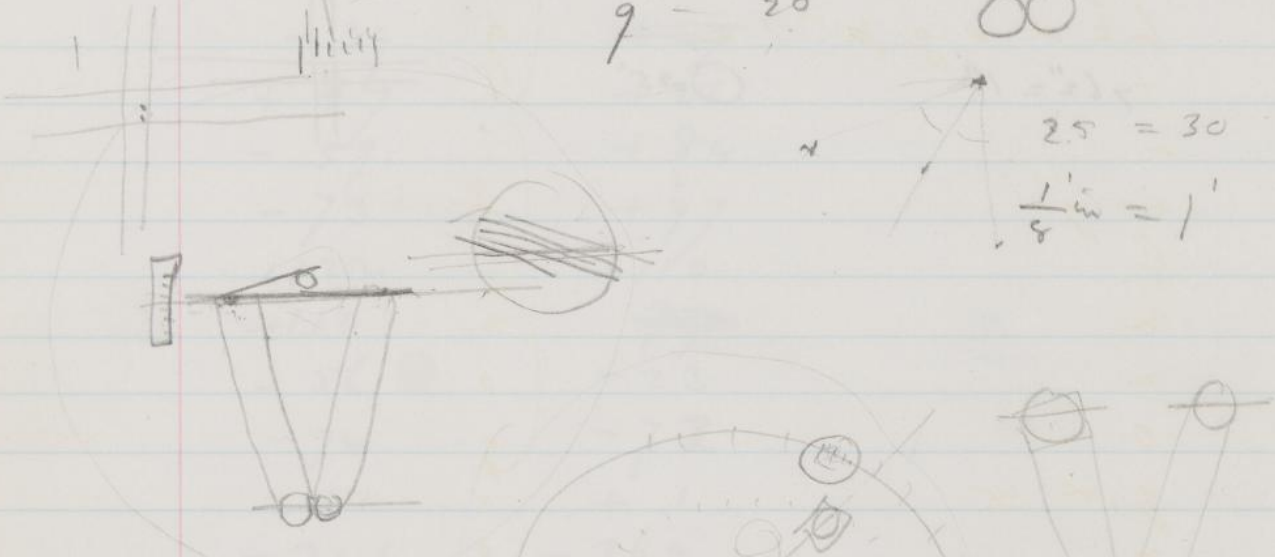


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39.4
9.6
34.4 ⊂ 10.6
17 : 5

1.7
9
15.3 mm.

a j k
b c d e g p t v z
f
h
i y
l
m
n
o
q, u w
r
s
x

f
g
h
i
k
l
m
o
q
r
s
t

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Change in Focus of large Equatorial due to distance.

682.8 cms

$\frac{1}{f} = \frac{1}{f'} + \frac{1}{D}$

$f'D = fD + ff'$

$f' - f = \frac{ff'}{D} = \frac{f^2}{D}$

$f \times \frac{f}{D}$

$D = 1 \text{ mile} = 160{,}000 \text{ cm}$

160000 | 683
1366 | 234.3
2340
2049
2910
2732
1740

46650 | 16
32 | 2.9
146

3 cms per mile

225

506 | 5280
.09 cms per
1.08 miles

3 cms. per 1 mile.

$\frac{3}{n}$ cms. per n miles.

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206,265 | 6882.85
.00331 | 6 18795
64033
618
22

1 cm = 5'

2 mm = 1'

6| 57.3
114.6 mm = 1 min.

1.91 mm = 1"

1.91 | 25.4
1778 .075 inch = 1 cm.
1320

$\frac{3 \text{ inch}}{40} = 1"$

.075
200
300
375
150
1905

$\frac{3}{4}$ inch = 10"

1.905 | 573
1719 .0332 rad = 1 sec
1860
1719
1410

.3 257
3
762 | 4
1.905 rad
3437
13335
5715
7620
5715
65-47285

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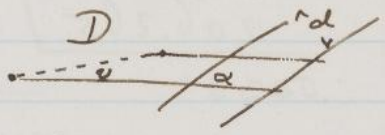
1878phae.proj..483.

$t_0 = t_0$

$t_1 = t_0 + \frac{d}{\sin\alpha}$

$t_2 = t_0 + D\cos v - D\sin v \cot\alpha$

$t_3 = t_2 + \frac{d}{\sin\alpha}$



$$\sin\alpha = \frac{d}{t_1 - t_0} = \frac{d}{t_3 - t_2}$$

$$\sin v = \frac{D\cos v - (t_2 - t_0)}{D\cot\alpha} = \tan\alpha - \frac{t_2}{D}$$

$$\tan\alpha - \frac{t_2}{D} \qquad \tan\alpha\left(\frac{D - t_2}{D}\right)$$

$$\underline{\sin\alpha} = \frac{d}{t_1} = \frac{d}{t_3 - t_2}$$

$$\underline{\sin v} = \tan\alpha\left(\frac{D - t_2}{D}\right) = \tan\alpha\left(1 - \frac{t_2}{D}\right)$$

$$\cos v\, dv = \frac{d\alpha}{\cos^2\alpha}\left(1 - \frac{t_2}{D}\right) \cdot \tan\alpha \frac{dt_2}{D}$$

$$\cos\alpha\, d\alpha = -\frac{d\, dt_1}{t_1^2}$$

$$0 = \frac{d\, dt_1}{t_1^2\cos^3\alpha}\left(1 - \frac{t_2}{D}\right) + \tan\alpha \frac{dt_2}{D}$$

$$0 = \frac{d(D - t_2)}{D t_1^2\cos^3\alpha}\, dt_1 + \frac{\tan\alpha}{D}\, dt_2$$

$$0 = d(D - t_2)\, dt_1 + t_1^2\cos^3\alpha \tan\alpha\, dt_2$$

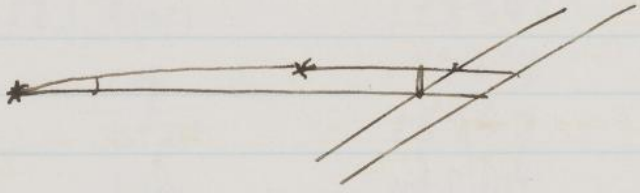
$$0 = d(D - t_2)\, dt_1 + t_1^2\cos^2\alpha \sin\alpha\, dt_2$$

$$\cos^2\alpha \sin^2 v = \sin^2\alpha - \sin^3\alpha = -\frac{D - t_2}{t_1^2}$$

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Alc. Rob. Phot-H R44, 104, 156
μ Sagit P. B,C ⊏ R44.182
II 203



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Sets of Lines by P.

0	86	881	597	6439	
1	84	1806	513	4350	
2	68	2749	496		
3	53	3283	~~1580~~ 53		
4	65	3866	1576 | 52.5		597
5	41½	4634	445		513
6	66	5178	2021		466
7	41	5626	172		445
8	40	6036	2193		
9	53	6439			
10	597				

10	64	6846
1	63½	7266
2	55	7717
3	67	8169
4	54	8603
5	48	9029
6	45	9500
7	29	9960
8	45	10310
9	39	10789
	513	

Obs. 1576 sets at 3000

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Aug. 17 to Nov 7th,
4443
2227

20	60	11283
1	60	11624
2	56	12034
3	50	12439
4	24	12838
5	49	13250
6	37	13667
7	40	14151
8	48	
9	42	
	466	
	~~476~~	
	470	

29

30	44		40	41
1	25		1	49
2	57		2	37
3	64		3	45
4	62			
5	7			
6	54			
7	53			
8	34			
9	50			
	445			

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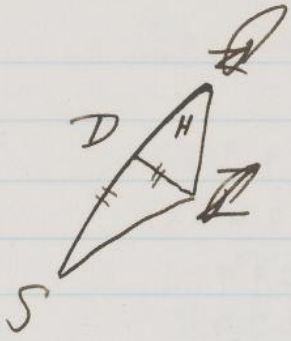
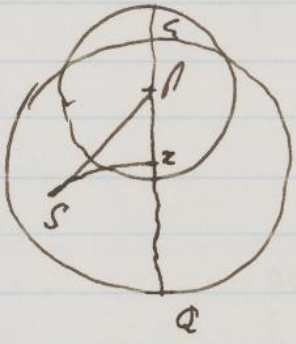
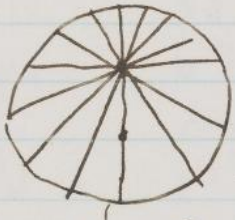


Table for PD and ZD Z

PD ZD Z Cos ZD

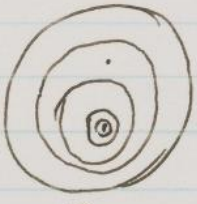




Hour Ang.



Declin.



Altitude



Azimuth





Paral. Ang.

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$\cot \frac{1}{2}(90° - \lambda)$

$\cot 45° - \frac{1}{2}\lambda$

$$\frac{\cot 45° - \cot \frac{1}{2}\lambda}{1 + \cot 45 \cot} = \frac{1 - \cot \frac{1}{2}\lambda}{1 + \cot \frac{1}{2}\lambda}$$

$$\frac{1-x}{1+x} - \frac{1+x}{1-x} \qquad 1-x-1-x$$

$$\frac{-2x}{1-x^2} \qquad \frac{2}{1-x^2}$$

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1878phae.proj.483.

	D.M.	A	H
1	4	6	5
2	27	29	29
3	79	89	83
4	229	271	256
5	679	800	720
6	2107	2340	2362
			3904
7.	8016		
7.5	14077		
8.	25320		
8.5	48246		
9.	101069		
9.5	314925		

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.60 .78 .70

.83

1.43 1.46 1.46

47

1.90 1.95 1.92

46

2.36 2.43 2.41

47

2.83 2.90 2.86

49

3.32 3.37 337

58

3.90
4.15 25
4.40 25
4.68 28
5.00 32
5.50 50

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1878phae.proj..483.

$r = 2.51 \qquad \log r = .4$

$\overset{.2}{\text{dist}}$ ratio: $\text{dist}(m+1) = 1 : \log^{-1}.3$

$.9$ = increase. log. per mag

1 mag. $\frac{1}{2}$

.04 8.6

1.4

2.8 7 mag.

a = absorption per unit dist = amt transmitted

a^D = amt trans at dist D

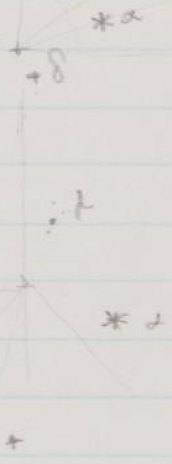
$I = a^D$

1

1878phae.proj.483.

Siedel Mag.

1	9.9319
1.2	9.5318
2.1	9.4637
2	
2.3	
3.2	8.8849
3	



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- Astr. Nach.
- Astron. Mem. Not.
  Observatory
  Register.
- Nature
- Amer. Journ. Sci.
  Trans. Journ.
- Comptes Rendus.
  Carl.
  Poggendorff.
- Vierteljahrsschrift

Amer. Acad. Almanac
Ind. Brit. Nautl. Almanac.
Cyon. de Temps
- Berlin Jahrbuch

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1878phae.proj..483.

Double Stars near Phact. M.

a. —
c. —
~~E~~ —
~~H~~ —

C a = Leah
D B = Mitchel Head
a B ~~C D~~ = Phact. Angles
~~E, F~~ = Phact. Ludwig
~~G, H~~ = Epsilon "

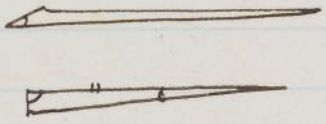
Positi		Phact
a	a	a
B	B	B
~~C~~	C	C
~~E~~	E	~~G~~ —
~~G~~	~~G~~ —	E —
b —	—	—
—	—	—
—	—	—
—		

Dillam

C	a
E	B
G	C
a	E
B —	G —
—	—
—	—
—	—

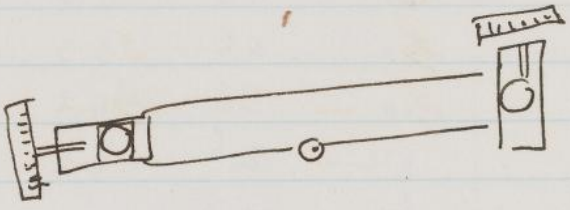
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1878phae.proj.1.483.



a.B Axe optique.
CD Rayon[s] moléc.
E Lame
F cloison
G Lame
H Plaque



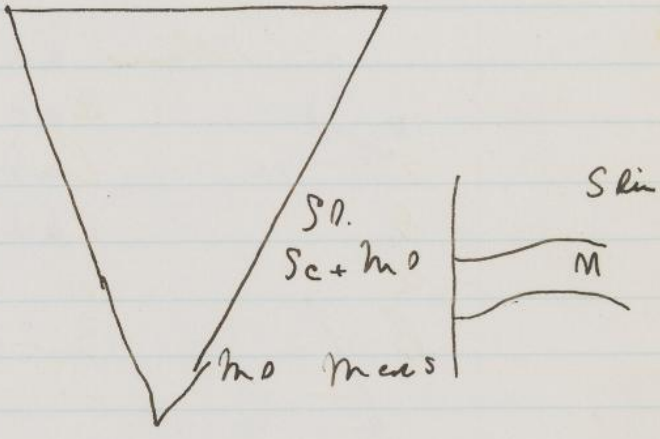


.....

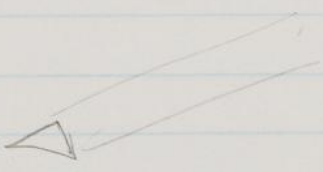
..



4" mal
1° = 1.5 mal



at 30' 1° = 30"
1' = .5



Bc + Bs

A

As + Bc

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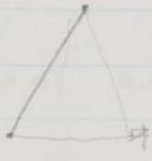
Errors of Chron. 151

Aug 6d 10 ~~54.8~~ 53
6h 9h
∴ 20h 20 53.9
35.9

alt.	Dec 20°	30°
0	7.6	8.6
10	6.5	7.4
20	5.5	6.3
30	4.6	5.3
40	3.6	4.3
50	2.6	3.3
60	1.3	2.3



ad bd cd
ac ba ca
ab bc cb
ad bd cd



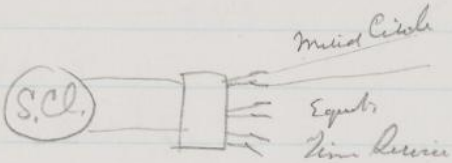
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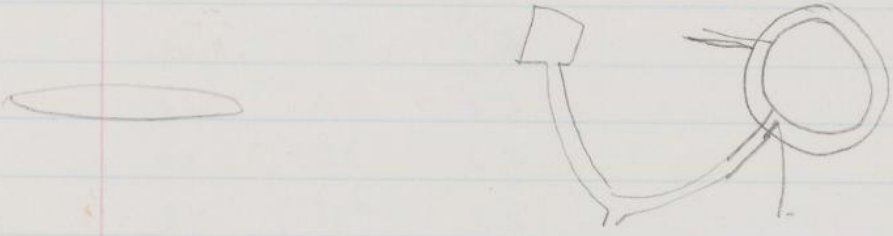
1878phae.proj.483.

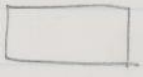
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1878phae.proj..483.

3.9.4.28
5 3







Batteries
Clocks
Chronographs
Asst.

Battery
Sid Cl.
Mural Circle
Chron.

Batt.
Sid Cl.
E & Equats
Chron.

7 | 11h 45m
5 | 18 28
1 | 17 17m

19.2 | 6.5
12.3 | .2
576 | 1.3
1152
384
19.2
24.2496

54
3
162
8
164
19.2

1.3

24.25
22.65
1.4

- 1.0
+ 1.7
.8
.7
.9
.6
2.6
.4
1.7
.8
1.12
1.12
.075
560
784
.0784 00

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1878phae.proj.1.483.

7d 11h 45m

	11	34		12	9			
		24			24			
7	11	10		11	45			
5	18	28		18	28			
1	16	42		1	17	17		

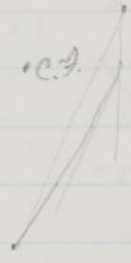
5 18 28

1 17

w.m.t.

						x'	y'	x'×1,26		x'×1,26 − 2,5
7	11	10	1	16	42	28.4	6.4	35.8	1".3	13".0
	11	45	1	17	17	19.1	6.5	24.1	1".3	1".3
				1	9	18.5	6.5	23.3	1.3	.5

254		191	
126		126	
1704		1146	
568		382	
254		191	
35.784		24.066	
22.8		22.8	
13.0		1".3	



z−α z z+α

$\frac{1}{2}+\alpha+\beta = \frac{1}{2}-\alpha+90°-\beta$

$\alpha+\beta = \frac{1}{2}90° = 45°$

34m = 11".7

7 11 45

7 12 54

1h 9m

18.5 65

1263

54.5 5

23.34

1878phae.proj..483.

Number Stars in Chronometer Circle.

1	1190	
1a	1150	
4	1560	
7	1875	
13	1820	
22	3205	
26		
27	1578	
28	1485	
29	1345	
29a	2114	
30	1548	
31	1554	Stars scattered
32	1847	
34	1130	Stars scattered
43a	1755	
49	2490	
50	1122	Stars very scattered
57	1730	
60	6558	Stars bright
61	1501	
63	2085	Stars Jr.
64	1358	
64a	2126	
72		

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1° = .075 mag.

2 Ura.

			R-M	R-45	+	mag R-M	
P	60"	~~47~~	.65	2.45	4	.049	.184
	20		.42	1.97	4	.031	.148
	10		.35	1.00	4	~~.075~~ .026	.075
	5		.35	.35	2	.026	.026
	2		1.62	1.62	2	.122	.122
						254	555
						.051	
S	60		1.47	1.47	2	.110	.110
	20		.50	2.80	4	.037	.210 ~~.037~~
	10		~~2.87~~	~~2.87~~	2	.065	.065
	5		.92	.92	2	.069	.069
	2		4.10	4.10	2	.307	.307
						.588	761 .152
						.117	
						781	
				maj. 5		.070	

51 Cephei.

P	90	.42	1.67	4
	180	.60	2.60	0
	135	1.40	1.40	2
	225	.85	1.30	0
		327		
		.817		
S	90	1.32	2.17	3
	135	3.82	4.12	1
	180	2.42	3.32	1
	225	1.00	4.95	0

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	λ		
0	.67	1.27	4
	.97	2.62	4
	1.07	2.97	4
	.47	1.92	0
	.90	3.15	0
	.50	2.55	0
	.80	4.10	0
	1.12	2.57	0
Sum			
Mean	.545	2.095	
	~~.xxx~~	~~.xxx~~	
	.068	.262	
	.051	.197	

P		
	1.02	2.57
89.3	1.60	5.05
	.82	2.47
	1.85	1.85
	5.29	11.94
	1.32	2.985

	.62	.62
	1.92	2.72
	.90	3.00
	2.37	2.52
	5.81	8.86
	1.45	2.215

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3.27

5.45

16 / 14.01 — 5.29

.87 — 128 / 121

.066 mgs.

14.01

21 / 16.55 — 2.54

80

.060

38" - 1"

23

15

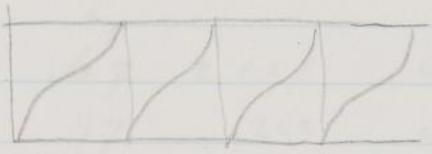
12 6 44

11 1 47

1 4 55

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1878phae.proj..483.

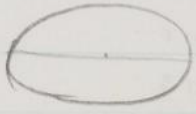


$\rho d v = d t$

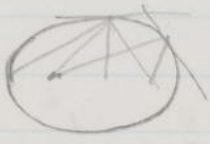


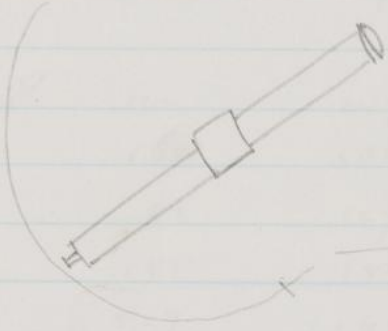
$\rho = a(1 - t \sin v)$

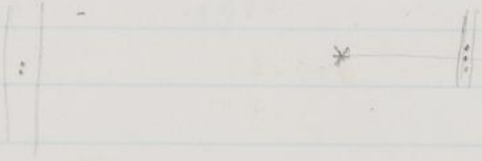
$t = f(v$



$at + b = f(v$







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1878phae.proj.483.

$I = \tan^2 v$

$m = \frac{\log I}{.4}$ ~~$\tan^2 v = 2.5 \log \tan^2 v$~~ $= 5 \log \tan v$

$dm = 5 \cot v \sec^2 v = 5 \frac{\cos v}{\sin v \cos^2 v} = \frac{10}{\sin 2v} = 10\, dv$

$\frac{dm}{dv} = 10$

$57.^{\circ}3 = 1$

$v = 1^{\circ}$ $\quad 10. \overline{)57.3}$

$\frac{573}{427^{0}}$ $.174$

$\frac{4011}{2590}$

$45^{\circ} = 000$

$\quad .030$

$x = \tan v$

$\frac{dx}{dv} = \sec^2 v = 1$

$dx = dv$

$dv = 1^{\circ} = .0174$

$\begin{array}{r} 1745 \\ 434 \\ \hline 6980 \\ 5235 \\ \hline 7579 \end{array}$

$\begin{array}{r} 015163 \\ .7581 \\ \hline .75 \end{array}$

$\begin{array}{r} .76186 \\ 15237^{2} \\ \hline .761^{8} \end{array}$

a B
+ +

$a = I \cos^2 v$

$B = I \sin^2 v$

$\frac{B}{a} = \tan^2 v$

$I = \tan^2 v$

$\log I = 2 \log \tan v$

$\frac{\log I}{.4} = M$

.017

$dM = \frac{.03}{\sin 2v}\, dv$ $\quad dM = \frac{.076}{\sin 2v}\, dv$

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-2	45.77	47.17	44.25
-1	47.57	48.35	44.82
0	47.32	46.10	43.70
+1	48.40	46.45	45.30
+2	47.65	48.37	45.35

Dist.

	P	S
60	+	+
20	+	+
10	+	−
5	−	−
3	+	−

		57	λ		m	
P	0	−	+	−	−	1
		−	+	−	−	1
	90	+	+	−	+	3
		−	−	−	+	1
S	0	−	−	+	+	2
		−	+	+	−	2
	90	+	+	−	+	3
		−	+	−	+	2

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Trans.

12	4	4	4	0	1	1	0	2	4
12	4	4	4	0	0	2	2	1	5
16	4	4	4	4	3	4	4	4	15
8	2	0	4	2	3	4	4	3	14

	0	45	90	135				
16	12	12	16	8	4	5	15	14
20			17				17	
20			16				12	
56			49				44	

: . .. :

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38.37	6.63	.508	+8	
41.15	3.85	29	-13	
38.57	6.43	48	+6	
38.70	6.30	47	+5	
38.55	6.45	49	+7	
40.02	4.98	38	-4	
42.03	2.97	23	-19	
39.00	6.00	45	+3	Combo
37.72	7.28	55	+13	÷ gave
40.17	4.83	36	-6	
		.420	.084	42 ± .09

$7^2/\frac{31}{2}$

$$B \sin^2(v - v_0) - A \sin^2(v - v_0 + \alpha)$$

$$\frac{a^2}{B^2} = \frac{\sin(v - v_0)\cos\alpha + \cos(v - v_0)\sin\alpha}{\cos v - v_0}$$

$$\frac{a^2}{B^2} = \left[\cot(v - v_0) + \sin\alpha\right]^2$$

$$\cot^2(v - v_0) + 2\sin\alpha$$

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P	S	U
-.05	+17	-.18
-.09	+.23	-.01
-.06	-.11	+05
+.19	+.09	-.07
-.002	+.09+	-.052

$\frac{1}{145}$
.05

95
055
040
-013

4	4	0	4	3	4	0	2	0	1	4	0
2	0	0	4	0	4	0	3	2	2	4	4
0	0	4	4	1	4	1	4	0	2	3	0
0	0	4	2	1	2	2	1	0	2	1	0
6	4	8	14	5	18	3	10	2	7	12	4

$\frac{32}{64}$ $\frac{36}{64}$ $\frac{25}{64}$

32
36
25
93
192

93 - 96

20	16	12	10
16	16	13	1
20	17	17	6
56	49	42	17
	+21	+14	-11

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1878phae.proj..483.

$a \pm \varepsilon \quad (b-a) \pm \varepsilon\sqrt{2}$
$b \pm \varepsilon$
$c \pm \varepsilon \quad (d-c) \pm \varepsilon\sqrt{2} \qquad (d-c)-(b-a) \pm \varepsilon\sqrt{4}$
$d \pm \varepsilon$

$\therefore$ Diff = two times = double prob. error.

.160
.67

		P	S	U	Mean.	
5	Dist.	.05	.20	.10	.12	~~.08~~
16	Orig.	.09	.17	.13	.13	.12
5	Var.	.16	8	.10	.11	
		~~.10~~				

.25	1.00	.50	
1.44	2.73	2.08	
.80	44	.50	
26/ 2.69	4.13	3.08	
	$\frac{26}{13}$	$\frac{26}{43}$	
.09	.15	.12	
	.12		

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Comparison of differences in units of reading of determinations of ST λ λ m.

Distance

	P	S	U
diff in ty	2.6	5.9	4.0
	1.7	.8	4.4
	.3	1.7	.8
	1.4	1.2	3.2
	5	16.4	1.6
5	6.5	26.0	140
	1.30	5.20	280
mag 2	.10	.40	.21
	.05	20	10

Area

P	S	U
1.5	2.5	6.8
6.5	1.0	.7
1.7	4.8	1.6
8.4	1.4	1.2
3.0	.7	30
21.1	10.4	13.3
4.22	2.08	2.66
.32	.16	.20

Angles

P

ST	λ	λ	m
1.9	.1	3.6	.5
2.4	1.9	1.8	.4
5.6	4.3	1.8	3.3
.4	1.9	2.7	5.0
10.3	8.2	9.9	9.2
2.6	2.0⅝	2.5	2.3

.23

.17

S

ST	λ	λ	m
3.3	7.3	4.9	.7
11.3	2.8	1.5	2.7
7.5	3.9	2.3	1.6
~~.6~~	~~7.6~~	.6	4.9
22.7	21.6	9.3	9.9
5.7	5.4	2.3	2.5

179

4.5

U

ST	λ	λ	m.
3.1	4.7	.9	8.2
2.6	1.5	6.0	.1
2.6	5.6	.8	3.9
3.1	.9	2	4.0
16.5	12.7	7.9	16.2
4.1	3.2	2.0	4.0

133

3.3

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Constant of I

Computed.		5.615			+.035
		5.593	.063		+.013
Arty Star	P	5.667	± .043		-.013
" "	S	5.620	± .083	5.580	+.040
" "	U	5.540	± .048		-.040
Sky	P	5.618	± .013		+.038
"	S	5.556	± .018	5.580	-.024
"	U	5.567	± .019		-.023
		141			213
					±.030

Alyth Mi.

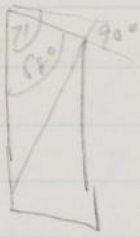
Aug. 22 10.6

25 7.4

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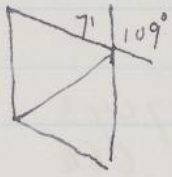
Nicol Prism

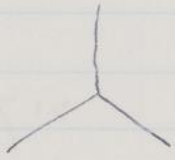


Angle Hemitrope = 74° 5 5'



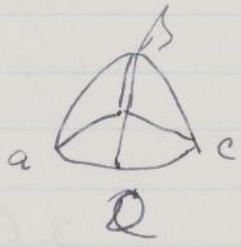






$aB = aC = BC = 105°\,5'$

$a = B = C = 71°$



Q

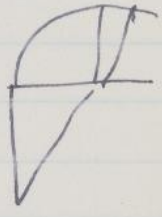
$\text{co-lin } a = \cancel{\text{Cot}}\ 105°\,5' \hookleftarrow 52°\,32'.5$

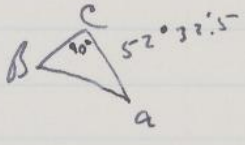
0.115673

$9.\cancel{6}15347$

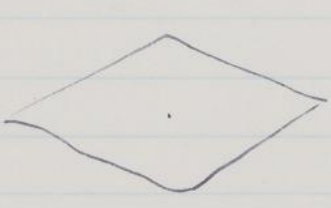
$9.530120 = 70°\,9'$

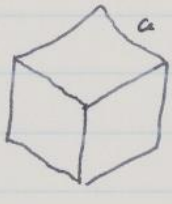






S.H.S. trans mit Amer. Acad.

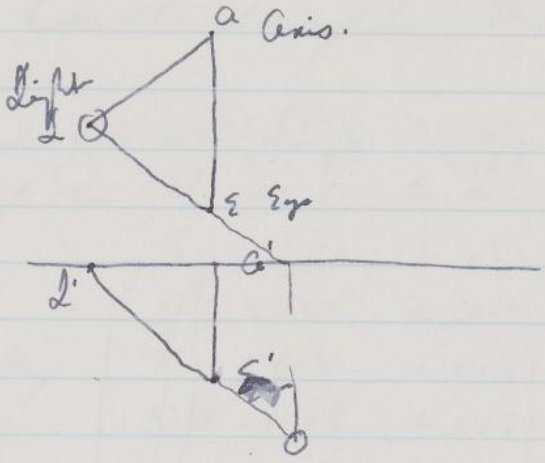


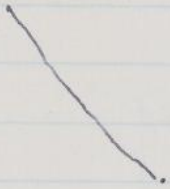




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475
34
7441

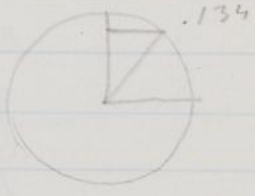
8308

317 ~~8.7465~~ 7.493
384 .662
407

8554
27
8527
.705

3.610 9.02 3.433
3.081 7 3.055
2.686 2.505
2.512 2.338
2.295 2.090

1/14



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Stars near Neptune 1878

					m	1878 0		
7.6	24	20	12°	2	25	56	12°	9'
9.0		32		49	26	8		55
8.9	25	22		57	28	58		3
7.8	27	28		31	29	4		37
9.0	28	19		17.9		55		24
8.5	29	12		16.	30	48		23
9.4	25	59		36.	27	35		43
9.5	26	17.		38.	29	53		45
	28	44 36	11	50	30	20 57		57

Mercurius Projektion.

360° =	19.3	9.65	10.0.
10 =	.58	2.9	3.0
20	1.15	5.7	6.0
30	1.73	8.6	9.0
40	2.40	120	12.4
50	3.13	15.7	16.2
60	4.10	205	21.2
70	5.40	270	27.9

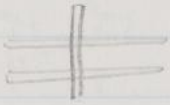
40 100. 14.4

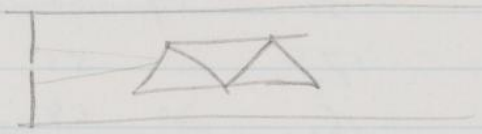
−30° =	9.0	−45°	14.2
+60° =	21.2	46.0	21.2
	30.2		35.4

36
36
216
104
1296

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ε Bootis	3.0	6.3	3"	3.3
21 Sagitt.	50	9.	2	4
8 Cygni	30	7.9	2	3.9
ε Drac.	4.0	7.6	3	3.6
φ Piscium	6.7	10.1	8	5.4
α Ursae Min.	2.0	9.0	18	7.0
δ Cephei	4.2	10.0	15	5.8
γ Cetii	30	6.8	3	3.8
β Orionis	40	8.0	9	7.0

				40
270	.08	.07	50	
	.00	.03		80
270°	.05	.09		220
270°	.01	.06	230	
	.035	.05		240
		.02		
		.03		
		.02		
		8 | 31		
		039		

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Errata.

R 30, 118
" " 118
" " 74
" 31 34
" " 4

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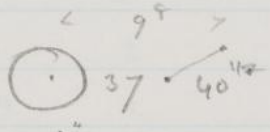
1878phae.proj.483.

Comput with Jupiter I Sept 1

32 10 15.5
31 5 36.3
1 4 39.2

-97" -3"
1.2 .2
1.16" -.6"
98" 7"





31 10 15.5
1 7 55
3 10.

98
59
39

49.3 58
12
986
49.3
59.16
22
37

.076 .076 9
4
.4446

76/44

19
.171

1878phae.proj.1.483.

11.32. 126.P

11.33.

11.44.

11.36 — 12 — 126.P

22 — 22 — 142.7

51 — 126.P

44 — 142.7

37 — 14 — 123.9

23 — 139.4

33 — 147.2

39 — 44 —

20

22

27

31

35

43

43

40 — 48 — 128.P

41 — 126.P

49 — 142.7

59 — 123.9

62 — 139.4

66 — 147.2

41 — 12 — 126.P

16 — 142.7

42 — 8 — 126.3

14 — 147.2

20 — 125.P

20 — 142.3

39 — 123.6

44 — 147.8

50 — 126.3

31 — 126.3

37 — 144.2

45 — 125.P

52 — 126.3

50 — 123.6

45 — 5 — 147.8

10 — 120.3

48. 48 — 127.3

59 — 147.1

61 — 125.6

16 — 142.3

20 —

30 — 142.3

32 — 147.8

44 — 142.3.

56 — 140.2

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No. No. Juden Mag. Mean Mean Diff
Comm. Int Diff.

No. No. Juden a b c. d. Mag. Mean Int. Diff.
Comm.

$\frac{a+c}{-b-d}$

a	~~m~~ $-a$ $-90°$	~~$-m+90 = -a$~~
b	~~$-m$~~ $+b$ $+90°$	~~$-m+90$~~
c	~~m~~ $-c$ $+90°$	~~$-m+90$~~
d	~~$-m$~~ $+d$ $-90°$	~~$-m+90$~~

a	$z-a-90°-m$	$= \varepsilon$
b	$-z+b+90°-m$	$= f$
c	$z-c+90°-m$	$= g$
d	$-z+d-90°-m$	$= h$

$\varepsilon + g = 2z - a - c - 2m = 0$
$f + h = -2z + b + d - 2m = 0$

$\varepsilon - g = c - a - 180°$
$f - h = d - b - 180°$

$(\varepsilon - g) + (f - h) = c - d - a + b = (b - a) - (d - c)$

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z

$$\tfrac{1}{2}(\alpha+\beta+\gamma+\delta) - \alpha - \gamma - \tfrac{1}{2}[(\beta-\alpha)+(\delta-\gamma)]$$

$$0 = \tfrac{1}{2}\alpha + \tfrac{1}{2}\beta + \tfrac{1}{2}\gamma + \tfrac{1}{2}\delta - \alpha - \gamma - \tfrac{1}{2}\beta + \tfrac{1}{2}\alpha - \tfrac{1}{2}\delta + \tfrac{1}{2}\gamma$$

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Contents.

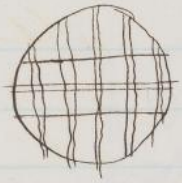
Distances
time transit two images

Coincidence from meters.

Zero of Position
Transit axis inclined wires .

Measures.
I. Angle
Inc. Dec.

II. Distances.



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α Androm.	2	11
51 Pisc	5 —	9
α Cass.	2	10
ρ Pers	5 —	10
α Ursa Min.	2	9
ψ Cass.	4	9
ν Cet	5 —	10
θ Persei	4	10
η "	4	8½
11 Cas.	5 —	10
2 Cam	5 —	9
o Persei	4	9
30 Cam	5 —	10
ζ Per.	3	9
ε "	3	8
40 Eri	4	9

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	R.A.		Dists.	Mag.		Est.
				Cl.		Dist.
ε Cael.	2	19	2", 8"	4.2	7.1	8.1
π Aurig.	2	42	3", 25"	4.9	8.4	10.2
o Orionis	5	32	11, 13	4.1	10.3	7.5
			30			7.0
11 Monoc.	6	25	2 7	5.0	6.0	6.5
θ Virginis	13	3	7 (65)w.	4.0	9.0	
16 Draconis	16	33	4, 90	5.2	6.0	6.0
39 Draconis	18	22	3, 89	4.7	7.7	7.1

Proposed Investigation.

1 Double Stars E. A > 5.1 A − B > 4.1

2. Brightness of Ceres, Pallas, Juno, Vesta. Uranus Neptune. Mod. K on (West) Equatorial (?)

3. Spectrum Colour Doubles β Cygni, γ Androm. ζ Cael.

4. Comparison Rg. Variables

" " " "

5. Other Stars.

6. New Stars.

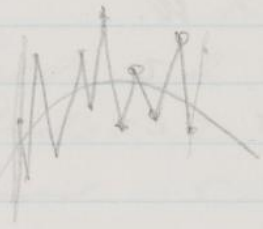
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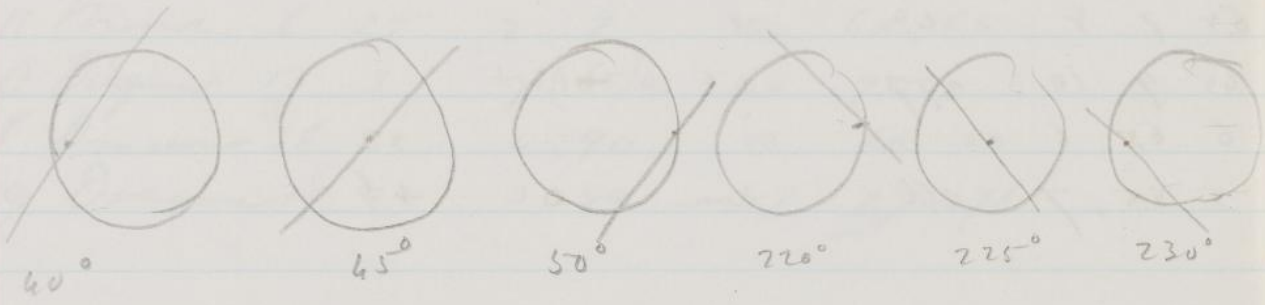
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Wolk.			C1-Pm	Σ	W.
4.5, 7, 9	2.26	3.43	+1.17	−1	−2
5, 8.5, 11	2.91	5.81	+2.9	−1.8	2.5
4 8					
7					
6.5 7 8	ab .49	bc .38			
45 9 10	3.77	5.+	+1.2 ±		
6 6.5 6					
5, 8.5, 7	2.66	[illegible]	0	+.6	

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~~29 0~~ 51
~~51 0~~

Zeros

39°	~~29~~	
41°	~~51~~	22
221	211	18
219	~~229~~	
		40

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P (before)

	Read	log. A	B	A − B	2(A − B)	
0.0	3.50	8.366	0.524	7.842	5.644	−26
	3.32	.	.521	.845	5.690	+20
5	2.33	8.183	.367	816	5.632	−38
10	1.85	8.082	.267	.815	5.630	−40
	1.28	7.980	.107	.873	5.746	+76
20	1.03	.882	.013	.869	5.738	+68
	93	.778	.968	.810	5.620	−50
30	72	.682	.857	.825	5.650	−20
	.62	.575	.792	.783	5.566	−104
40	.42	.479	.623	.856	5.712	+42
	.34	.377	.531	846	5.692	+22
50	27	.289	.431	.858	5.716	+46
					8036	452
					5.670	±038

B

~~1.54~~	~~.657~~	.657	~~.526~~ 709	.526	5.418		
378		.577	~~.606~~ 789	.606	.578	5.622	
247		393	.790	.689	.580	5.670	
198		.297	.785	.683	.570	9.952	
150		.176	.804	.706	.608	89.5	
114		.057	.825	.721	.650	9.953	
93		.968	.810	.714	.620	89.7	
71		.851	.831	.	.662		
60		.778	.797	.	.594		
52		.716	~~.763~~	.	.526		
32		.505	~~.872~~	.	.744		
27		.431	~~.858~~	.	.716		
					7266		
					5.622		

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347	.540	.826	−8	5.652
370	.568	.798	−36	.596
262	.418	.765	+31	.530
184	.265	.817	−17	.634
134	.127	.853	+19	.706
109	.037	.845	+11	.690
76	.881	.897	+63	.794
65	.813	.869	+35	.738
~~53~~	.724	.851	+17	.702
43	.633	.846	+12	.692
37	.568	.809	−27	.618
29	462	.827	−7	.654
		403	283	
		.834 ±.025		5.669 ± .050

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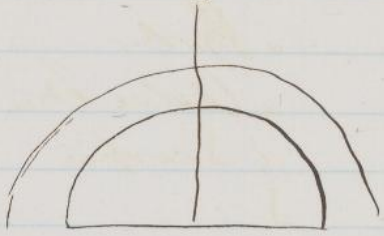
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Atmospheric Absorption.



Let I = true br. of star
I_z = br. at zenith dist z.
a = light transd by 1 km. atmos.
H = ht. atmos.
Thickness of atmos traversed by beam at zenith distance z = $H \sec z$

$$I_z = I\, a^{H \sec z}$$

$$\log I_z = \log I + H \sec z \log a$$

calling $H \log a$, coef. of atmos. absorp. $= C$

$$\log I_z = \log I + C \sec z$$

Mag. $M = .4 \log I$

$$M_z = M + C \sec z$$

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	R	ζ_R	$\zeta_{R_\odot}$	
α Bootis	.26	.415	.40	2.0
α Ursae Min.	.65	813	—	
β Scorpii				
δ "				
π "				
σ "				
α "				
τ "				
α Bootis	.18	.255		
η "	.42	.623	.368	1.8
α Ursae Min.	57	.708		
" " "	.49	.690	~~.02~~	
β " "	.55	.740	-.05	.2
γ " "	78	.892	-.20	1.0
α " "	.50	.699	~~+.32~~	
α Lyrae	.24	.380	+.32	1.6
α Bootis	20	.301	+.40	2.0
β Ursae Min.	.48	.681	+.02	.1
α Coronae	.45	.65	+.05	.25
α Scorpii	.43	63	+.07	.35
α Ursae Min	~~.58~~	.76	~~-.06~~	
α Lyrae	.26	.41	+.35	1.75
α Cyg.	.40	.60	+.16	.8
α Aq.	.33	.52	+.24	1.2
Jupiter	.11	.04	~~+.72~~	3.6
α Bootis	.26	.41		
η Bootis	80	90	.49	2.45

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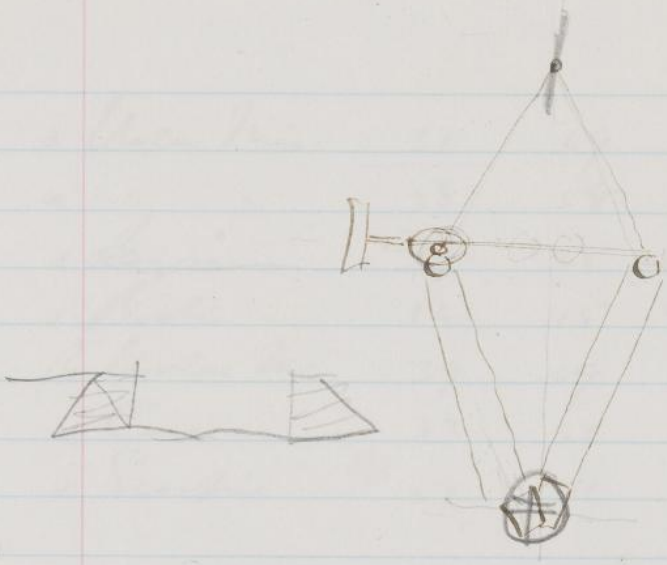
α	Ursae Min.	.31	.49		
α	" "	.38	.58		
α	Lyrae	.19	.28	+.30	1.5
α	Bootis	.14	.15	+.43	2.15
β	Ursae Min.	.39	.59	−.01	−.05
α	Coronae	.32	.57	+.07	+.35
α	Scorpii	.57	.71	−.13	−.65

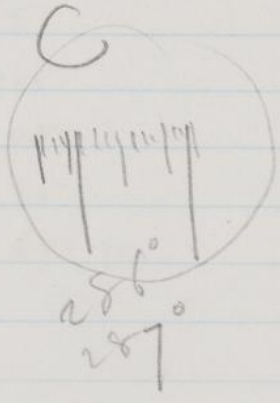
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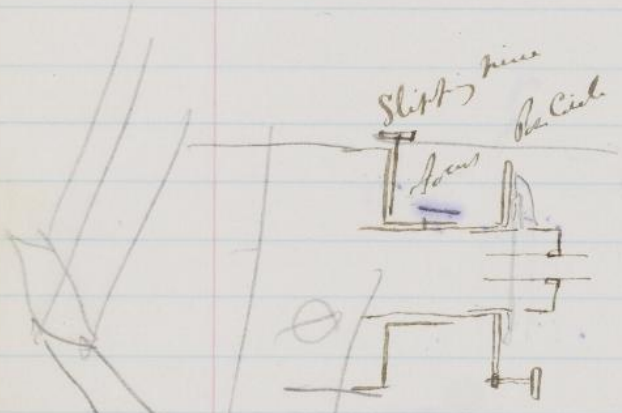
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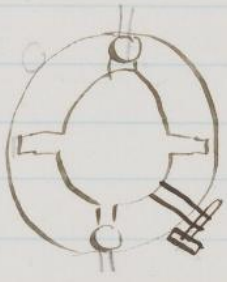
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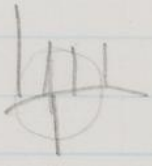
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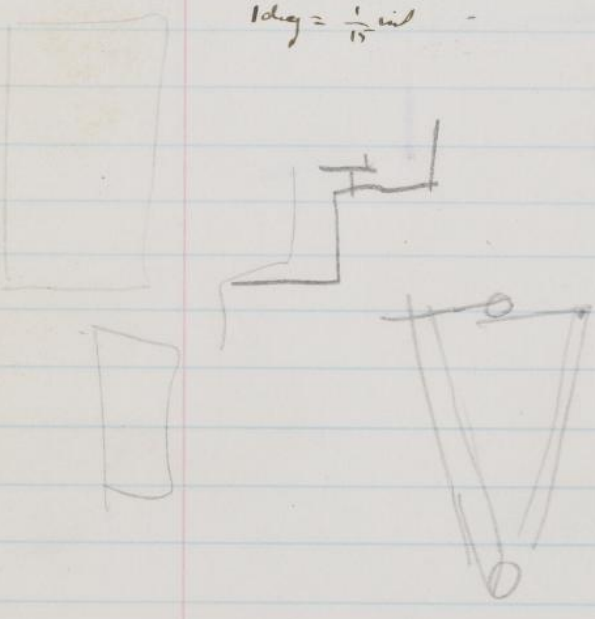






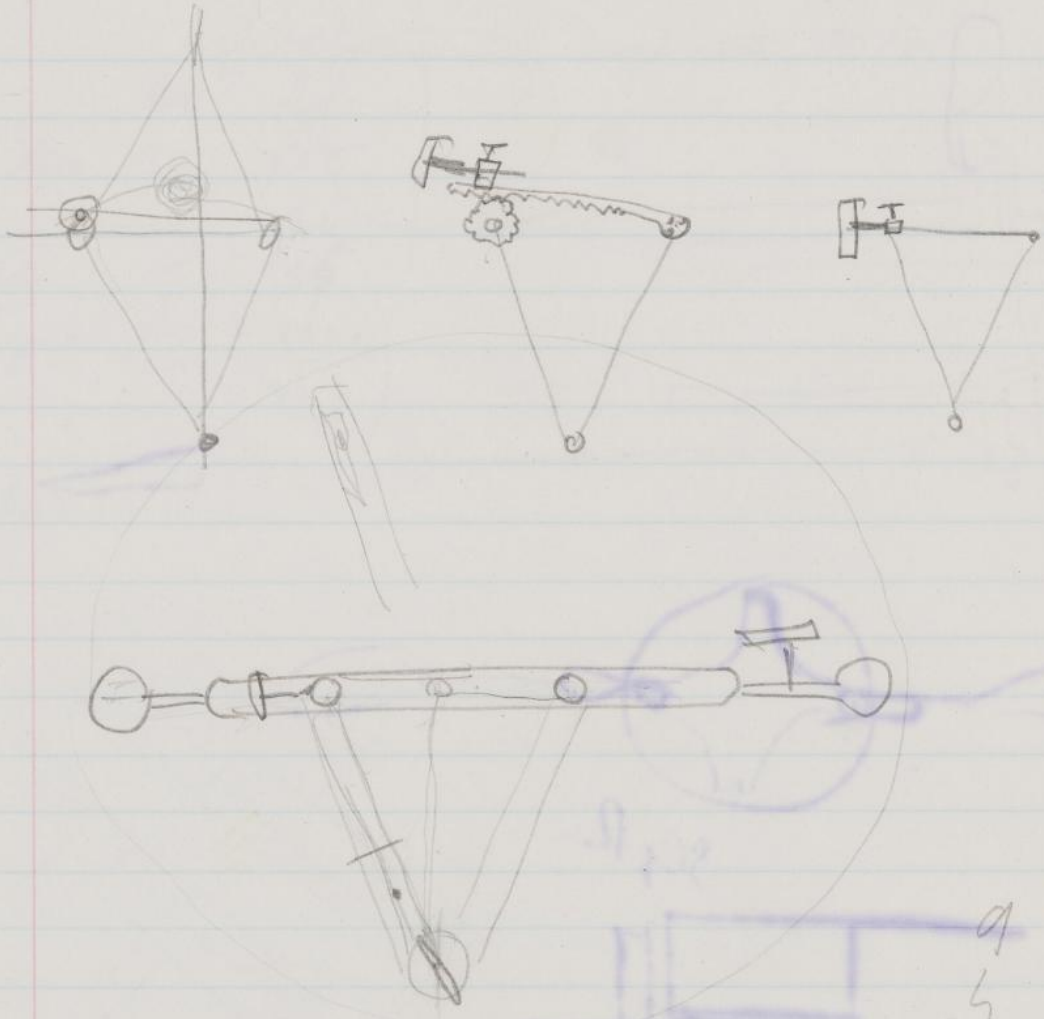






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1514

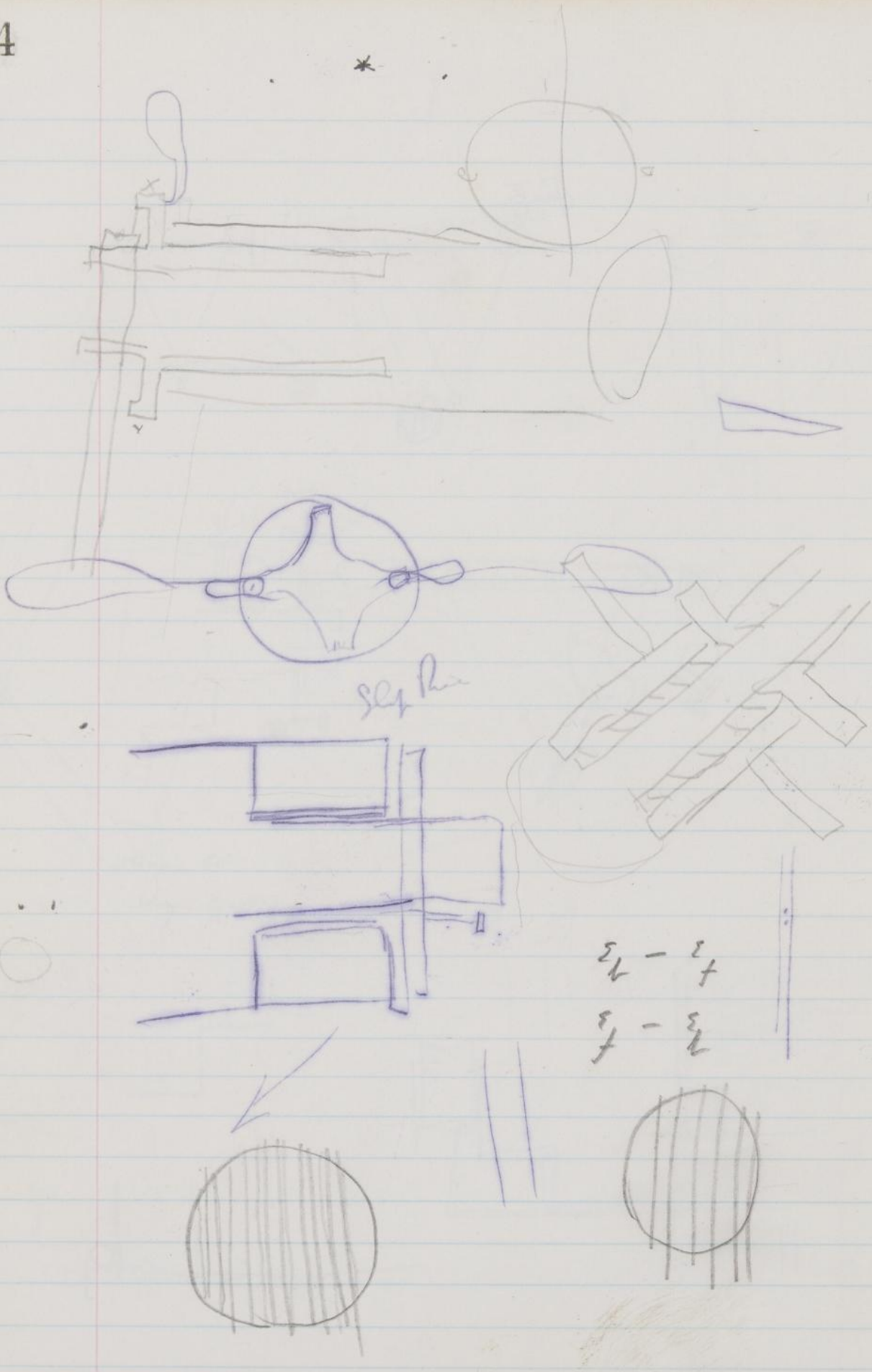
9
5
5

36
4
32

36
4,626
4

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1878phae.proj.1483.

Obs. remaining Sept 25th, 1878

	Pts	Obs
At Stars	37	185
Br.	6	24
Albra	9	36
W Equal	13	104
	25	349

Mapleton

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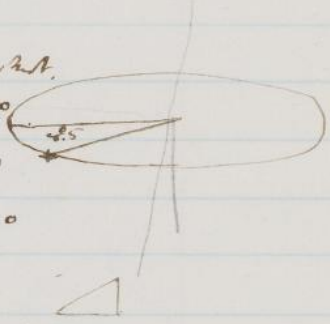
1878phae.proj..483.

Observations of Minos by L. Waldo.

					Mer. t.		Di.
22	7 / 58						
11	5	C.M.	1.6d	15.8	9.1 W	14.9 s.p	15.45p
11.1 / 47						En.	
21	14		17d	14.3	16.5 W.	17.8	
	20						
21	34						
29.6 / 47							

282.6 / 4.1

	Minos				Hav. Alt.
⊖	29.93	1.75	4.1	-2.2 h	35°
	Encl.			~~3.5 th~~ Hall.	11°
280	38"41	2.24	4.1	3.5 h	38°



	Sin.	Cos.		
35	.57	.82	1.1	24.6
11	.19	.98	.4	29.3
~~58~~	~~.67~~	~~.79~~	~~1.5~~	~~23.6~~
34	.62	.79	1.4	30.3
				21.



8.5

3 d Ch. Waldo Sept. 25, 1878. 12.5 clear ring 28

10.4 Hall.

12.5

27d0

.84

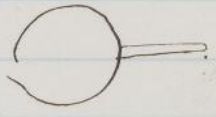
299

25.2

27.4

15.9 / 21 / 318 / 16 / 334

28. / 16 / 140 / 28 / 420 / 99 / 28



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Sept.
6ᵈ.0 (Pettup?)

p 266° 21' at 22ʰ 7ᵐ S.T. ~~Pettup~~

d = 1".191 = 29".2

17ᵈ 282° 6'

d 1".147 21ʰ 14ᵐ

28".0

24/3011.7
24
141.
120
219
192
27

24/2627.
24
10.95 27
216
110

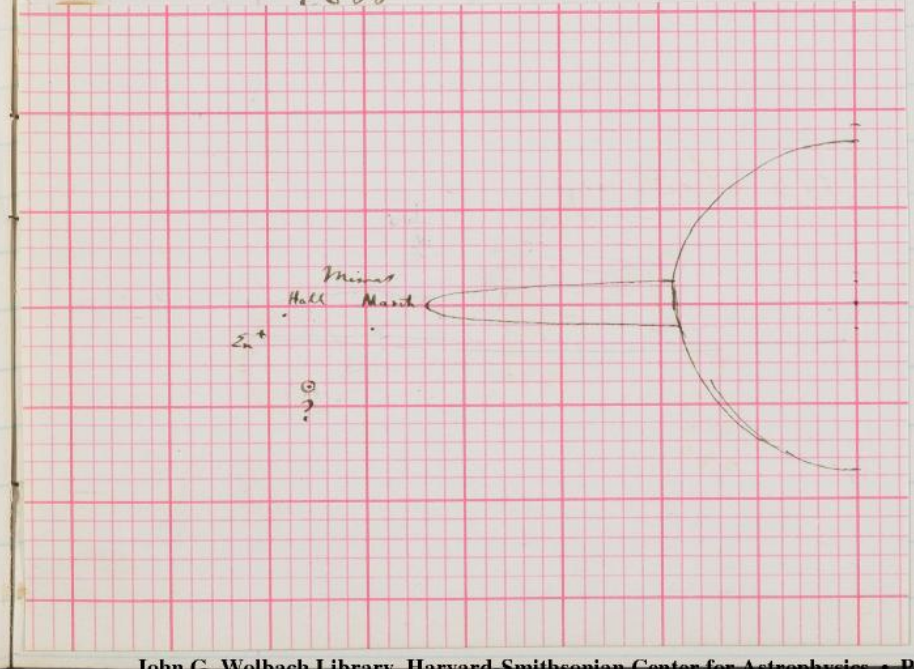
1.6
159
25.6
11.

15.9
22
318
318
350

1.6
10.9
35
545
327
381

384
74
3456
2688

8/224
28
14



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1878phae.proj..483.

24/381.9
24
141.
120
219
192
27.0

24/262.7
24
10.95 27
216
110

16
159
256
11.

15.9
22
318
318
336.0

1.6
10.9
35
545
327
38.1

384
74
3456
2688

8/224
28
14



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1878phae.proj..483.

Comparative Accuracy of Observations of Satellites of Mars.

Deimos.

	0	1	2	3	4	5	+	No.	Σ	Av.
Wash.	31	17	3			1		52	28	.54
Camb.	11	6	2	1				20	13	.65
Glas.	4	3	3					10	9	.90
Pul.		1	2	2	1			6	15	2.50
Conn.	5	3	2		1		12 / 42	11	11	1.00

Phobos.

Wash.	10	12	7	4	2	1		36	51	1.41
Camb.	6	2	1	1				10	7	.70
Glas.	1	2			4	1	18 / 5 / 6	3 / 8	13	2.62

Deimos. Distances

Wash.	29	14	4					47	22	.47
Camb.	6	6	4				12"	16	14	.83
Glas.	2	2	4	1				9 / 3	13	1.44
Pul.	1	1	4	3				9	18	2.00
Conn.	2		1					3	2	.67

Phobos.

Wash.	21	16	6					43	28	.65
Camb.	7	1					11 / 10	8	1	.12
Glas.	3	4		1				8	7	.83

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1878phae.proj.1.483.

	Wash	Camb.	Glas.	Pul.	Comm.
Dein.	.54	.65	.90	250	1.50
Rhd.	1.41	.70	262		
Dein	47	.83	1.44	200	.67
Rhd.	65	.12	.83		

Andr.

1	2	3	5	4
2	1	3		
1	3	4	5	2
2	1	3		

Dein.

Wash	32.3541	.0118	12.9531	.0142	3095313 3078456
Camb.	32.6089	.0454	13.0080	.0266	3023319 3039643
Glas	32.6052	.1008	12.5304	.0321	3024348 3.40 0630
Pul.	32.176	.121	~~12.9531 01~~		3146996
Comm					

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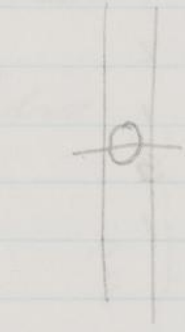
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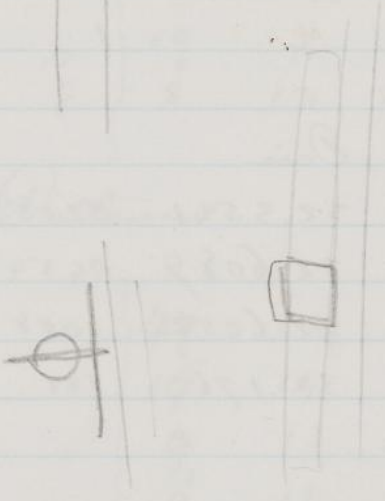
Cambridge

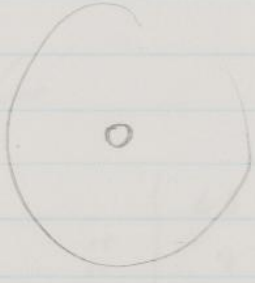
	Decrease.	° Abst.	Incr.	" Abst.
Σ +		7.33		
Σ −		3.85		
		3.48		
		11.18		
		1.°12		

7/10.89 6/5.99
1.56 1.00
.37 800
13) 4.87
39
97
97
1

1.56
.37







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1878phae.proj.1.483.

-2.05^{-}
$+.39$
$+12$
0
$+90$
$+100$
$+2.15^{-}$
$+1.16$
296
$.69$
$\overline{114.2}$

2.4 hours.
30
$\overline{72}$

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1878phae.proj..483.

β Lyrae.

1	12.603	.6506	3.253	3.25	.00
2	9.600	.7718	3.859	3.86	.61
3	11.748	.6818	3.409	3.41	.16
4	9.467	.7799	3894	3.89	.64

Sept. 25 10.0

26 7.2
4.7
26 2.7
25 1.80
16.7



Rhea 55°.44

cor.

~~8131~~
.567
~~45~~
2835
4536
48.195

24 | 79.69
3.32
76
72
49

3.32
16.7
2324
1992
332
55°.4 44

Rhea = 48".2 10" 10"+ *

22
26."
4
10.4
9"

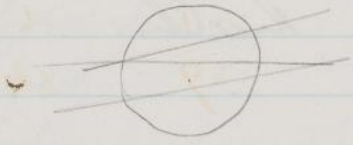
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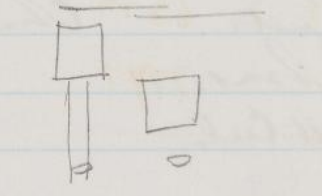
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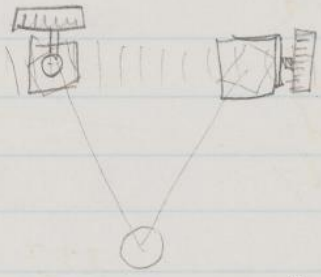


3/400

21"









1/2

13

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1878phae.proj..483.

Electrical Connections

Inst.	Clocks.	Chronographs.
Mer. Cir.	M. T.	W.
E. Equat.	S. T.	E.
W. Equat.	Chron.	Rail. Chron.
Rail. Instr.		
E. Transit-Circle		

Mer. Circle.	E. Equat.
S. Chron.	S. Chron.
W. Chron.	W. Chron.

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α Aquarii	20	11.2	65-4
57 Persei	5.0	9.0	27
α Cas.	2.5	10.0	
ρ Persei	4.7	10.1	8
α Ursae Min.	2.0	9.0	18
γ Cas.	4.4	8.9	32
ν Cyg.	5.0	9.6	8
θ Persei	4.2	10.0	15
η "	4.0	8.5	28
77 Aurig.	4.9	10.2	25
91 "	"	8.4	3
41 "	5.0	9.0	
2 Hor. Cam.	4.7	9.0	24

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1878phae.proj..483.

150 dias = 2 6.8 / 4 20.0 / 6 26.8

100 dias = 2 6.8 / 2 13.1 / 4 19.9

±126.8 / 133.1 / 260.0

90975 / 4426 / 135235

44.26 / 45.87 / 90.13 / 90.16

135.235 | 15 → 90.16 (135, 23, 15, 85)

86.0 / 85.0 / 87.0 / 90.5 / 83.5 / 89.0 / 41.0 | 24 → 24, 170, 168, 200, 192, 8

81.708 × 35

40854 | 7 → 5, 28.5978

13 / 1268 / 260 / 26 | 1268 → 104, 228, 208, 200, 182, 180 / 48.77

28.60 / 57.20 / 85.80

149054 / 554 / 94054 | 858 → 93,654, 937, 9 / 85800 | 6 → 85840, 8433, 1510, 937, 5730, 5622, 1080 / .9161

149002 / 554 / 936 | 858 → 9169, 8424, 1560, 936, 6240, 5616, 8240

117054 / 554 / 61.654 | 572 → 617, 92, 55246, 5553, 1710

5724 / 5553 / 1710 / 1234

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1878phae.proj.1.483.

55.4

50.4

.9161
.9169

Assumed z_{eb} = 53.8

149.054
53.8
95.254 | 858
9526 | 8558
.9014857 34
13600
9526
4074 0

44.26 | 48.8
4392 906
3400

1050
53.4
512

45.87 | 512
4668 9

.9014
.9013
.9051

149.002
53.8
95.2 | 858
.9013 8568
1200
952
248 0

117.054
53.8
63.254 | 57.260
.9051 56934
32600
31630
970 0

92.2 2
9
83.00
41.50
20.75
20.34
87.37
78633
39.31 | 415
19.65

2860 | 3195
2865 | 32
288 9.
150 -04

7863 | 83
747 947
393
332
610

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1878phae.proj..483.

79.33

Sept. 2
79.33
Sept. 81
Oct. 51
Nov. 19
79
Nov. 98
Dec 58
Jan 27

Sept 2 s
21
Oct. 11 n
31
Nov. 19 s
~~Dec~~ 19
Dec 29 n
Jan 7
Jan 27 s

3.073
~~28~~.8
309
89
2781
618
89.61

54 20 99
1 29 61
55 50.6 Ca.

2007
285
1604
1604
401
5774

9' 37,
36
3° 26' 24

1 m 30 s
9' 37"

897.6
53.82

648.6
38.78

57.4
.6
3444

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1878phae.proj.1.483.

48 6. 3° 57.0
1 30 9.6

49 36 3° 47.4

49 4 3 20.7 9 50 34 11.1
53 49 3 53.4 9 55 19 42.8
52 51 4 0.1 6.7 54 21 50.5
53 4 3 44.4 8 54 34 34.8

307
79
240 4m
20
8
1600" = 27'

30.73
27
21-51
6146
830 1.4

2505 52
27 79
27
540.
9'

1.3 9'
1852.5

		1.3		9				
Oct		59.6	2	49.5	23	58.3	2	40.5
Nov.	23	52.3	3	34.2		51.0		43.2
Dec	23	49.7	3	44.5		48.4		53.5
	23	58.2	2	57.5				
Nov	23	50.9	3	43.2				
Dec.	23	48.3	3	53.5				

9	46	41	15
8	51	26	45
7	51	39	48.4
	47.0		4°.2
7	51	6	4°.1
8	51	9	3.9

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1878phae.proj..483.

1013 Ursae

23 48 6
2 46
23 50 52

3 56 59
18 0
3 38 59

3.075
54
12300
15375
16605

77
25
54
3
1050
180

1879
1825
54

W. 23^h 1013

α 1825 $48^m\ 6^s.03$ δ 1825 $-3^\circ\ 56'\ 59''.9$

$3^s.075 \times 54 = 166.05$ $20.03 \times 54 = 1081.6$

α 1879 $50^m\ 52^s.08$ δ 1879 $-3\ 38\ 58.3$

$\frac{d\delta}{dt} = 20.06$ $501.6 \cos\alpha$

8.36

$d\delta_{25^m} = 8.36 \cos\alpha$

12.21
6) 3.05.1

3 30 5.09 5.05 3 28
40 4.80 4.95
50 4.49 4.85

18 19
3 28 68.2 67.8
52 67.5 67.0

67.5

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1878phae.proj.483.

79.0
25
265
20
530.
9'

3.075
265
15375
18450
6150
81.4875

1m
1 1/3 m
9'

5.6 4.4 158.
2.2 2 dia.

6.14
4000 . 1500

158. : .3 = 72,000
22,400/158
1

4.4

1.00 = dia 11 mag.

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Library.

1 Cyclopaedias Dict:

2 Standard Works

3 Monographs.

4 Star Catalogues

Double Stars
Nebulae

5 Transits Circles

6 Period. Ast:
A.N.

7 Nature
Phil. Mag
Comptes Rendus

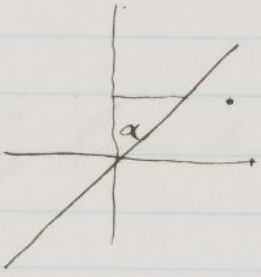
6 Mem. Astron.

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1878phae.proj..483.



$Dec' = Dec_{sun} \frac{1}{4} \sec \delta$

$Das = 4 \sec \delta \, Da$

$1 = R.A - Dec \tan \alpha$

$R.A - \frac{1}{4} \sin \alpha \cos \delta$

$1 = R.A. - 4 \sin \alpha \sec \delta \, d\delta$

$d\delta = \frac{R.A - T}{4 \sin \alpha \sec \delta}$

$\alpha = 90° - \delta$

$d\delta = \frac{RA - T}{4}$ ∴ Mark δ = declination

$1 = R.A - d\delta_s \tan \alpha$

$d\delta_s = 4 \sec \delta \, d\delta_1$

$d\delta_s = \frac{R.A - 1}{\tan \alpha}$

$d\delta_1 = \frac{R.A - 1}{4 \tan \alpha \sec \delta}$ $\tan \alpha = \cot \delta$

$d\delta_1 = \frac{R.A - 1}{4}$

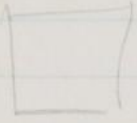
$d\delta_1 = \frac{R.A - 7}{4 \sec \delta}$

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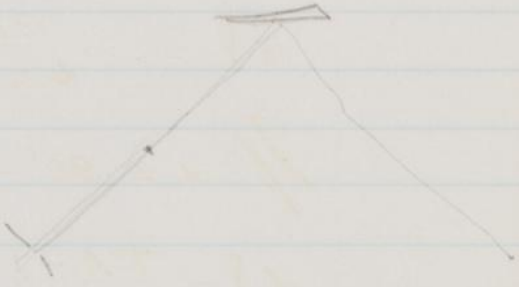
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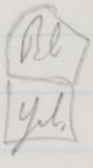
Name Mag. | R.A. astrog. Decl. | Chron. time Red R.A.

Number Decl. Wire ~~Decl.~~ Dec - R.A.









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1878phae.proj..483.

Pole Stars D.M. 89°

No.	Mag.	R.A. h m	n.P.D.	Ang.	Cin.	cos.		
1	9.5	0 11.1	23.8	~~3.87~~ 2	.066	.998	~~1.6~~ 1.15	23.8
3	8.8	1 49.6	30.8	27.4				
4	9.4	1 51.0	36.4	27.75				
9	9.1	4 49.6	32.9	72.40				
12	9.1	6 17.6	22.1	- ~~85~~.6	.997	.077	22.0	1.7
16								
17								
18	8.9	11 8.~~4~~	16.1	- 12.9	.223	.975	3.6	15.7
19								
20								
21								
23								
24								
25								
26	9.5	15 44.0	4.9	- 56.0	.829	.559	4.1	2.7
29	9.4	18 7.4	16.2	88.2	.999	.031	16.2	0.5
31								
33								
35	9.3	20 13.5	14.1	56.6	.835	.550	11.8	7.7
36								
tr. 37	9.3	22 6.7	12.0	28.3	.474	.880	5.7	10.6

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1878phae.proj..483.

0000) 1

0005
0050
0500
5002) 4

5500
5050
5005
0550
0505
0055) 6

5500
5050
5005
0550
0505

.00	1	4	0.5	0 5 10
.125	4	4	1.4,6,9	5 10
.25	3	3	2,3,7,8.	
.0	3			

0 5

1111	0	0
1112	5	12
1113	10	25
1121	5	12
1122	10	25
1123	15	37
1131	10	25
1132	15	37
1133	20	50

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0 5 10 15 20

5 10 15

10

0 10 10 20 25

10 15 20

15

10 15 20 25 30

15 20 25

20

15

0 5 10 15 20 25 30 35 40

1 2 3 2 1

2 4 6 4 2

3 6 9 6 3

2 4 6 4 2

1 2 3 2 1

1 4 10 16 19 16 10 4 1

0 .12 .25 .37 .5 .62 .75 .87 1

0,5 , 1 + 19 + 1 = 21

.12 4 16 + 16 + 4 = 40

.25 10 + 10 20

0 10.5

12 10

25 10

37 10

5 10.5

62 10

75 10

87 10

0 10

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Eclipses of Jupiter. IV

Washington 1878

Oct.	21	12	11	12.3	nv	6 2.5
		16	49	5.7	nv	
Nov.	7	6	21	10.9	*	5 3.5
		11	0	57.7		
Nov.	24	0	30	54.2		4 7.5
		5	12	12.8	*?	
Dec.	10	18	40	49.9		
		23	23	18.9		
	27	12	51	21.4		
		17	34	39.4		

1879

Apl.	23	20	0	52.4	D	
May	10	14	10	40.2	D	*?
"	"	18	47	24.6	R	
"	27	17	55	41.3	R	
June	29	20	42	48.6	D	
July	16	14	55	20	D	*
"	"	19	19	19.4	R	
Aug	2	9	47	30.4	D	
		13	27	38.8	R	*
Sept	21	15	51	35.7	D	
Oct	8	10	8	15.9	D	*
"	"	14	7	28.5	R	
"	25	4	26	24.7	D	
"	"	8	19	8.9	R	*
Dec.	14	11	23	30.2	D	
"	31	5	43	6.6	D	*
		9	4	39.2	R	

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1880

Jan 17 3 15 14.5 R

Apr.	26	14	8	49.1	D	21h	29.0m	
		16	2	17.5	R			
May	13	8	32	40.3	D	21	5.5	
		10	5	37.5	R			
"	30	2	58	49.0	D	20	10.8	
		4	5	13.4	R			
June	15	21	38	11.6	D	19	17.6	
		21	51	12.6	R			
July	12	13	15	59	—	18	22.6	+5.°5

No more visits until 188.

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1.636 8.364
1.752
1.496
1.354
1.072
.904
.794
.606
.528
.360
.218
.230
.106
.070
.130
.076
.006
.072

189
54
756
945
1020
17.0

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Pallas Oct 1878

λ Aq. 22 44 47
1 31
22 46 18

δ 22 34
72.5
9 =
8° 13,4

3,134 19
29 29
3
9.4.02
313
90.89

171
38
5516
9.2

λ	22	46	18		8°	13'4			
15 24	22	45	34		7	42.4	- 40	n	31.0
		45	0		6	32.0			
19 4	22	44	26		8	22.8	- 11 20	5	9'4

Weiss XXII

852 (9)	22	38	55		- 9	17.4		
855 (7.8)		39	13		9	2.0		
857 (7)		39	17		11	28.6		
864 (9)		39	45		9	57.9		
					12	16.3		
885					11	59.4		
					11	19.8		
896 (8.9)		41	6		8	23.0		
900 (8.9)		41	24		7	50.0		

(9)	41	39	7	53.8	130 0	2	36.7
(8.9)	41	24	7	50,0	- 125 0	2	40.5
λ 5	43	29	8	30.5			

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Juno (3)

32
27
248
64
92.8

1h 33m

17 29
153
34
593
10'

Pms = 1m 330 10'
59 47 20

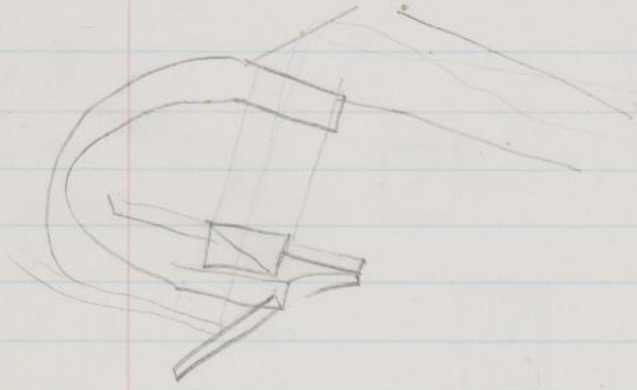
B.S. 7697 6½ 22 0 52 −11° 0.6 (1879.0
7703 7½ 22 0 20 10 38.4
(3) 1st obs 0 48 11 36.9

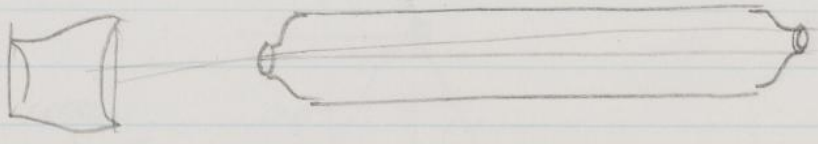
1 .
2 —
3 . .
4 . . .
5 . —
6 — .

7 . . . .
8 . . —
9 . — .
10 — . .
11 — —

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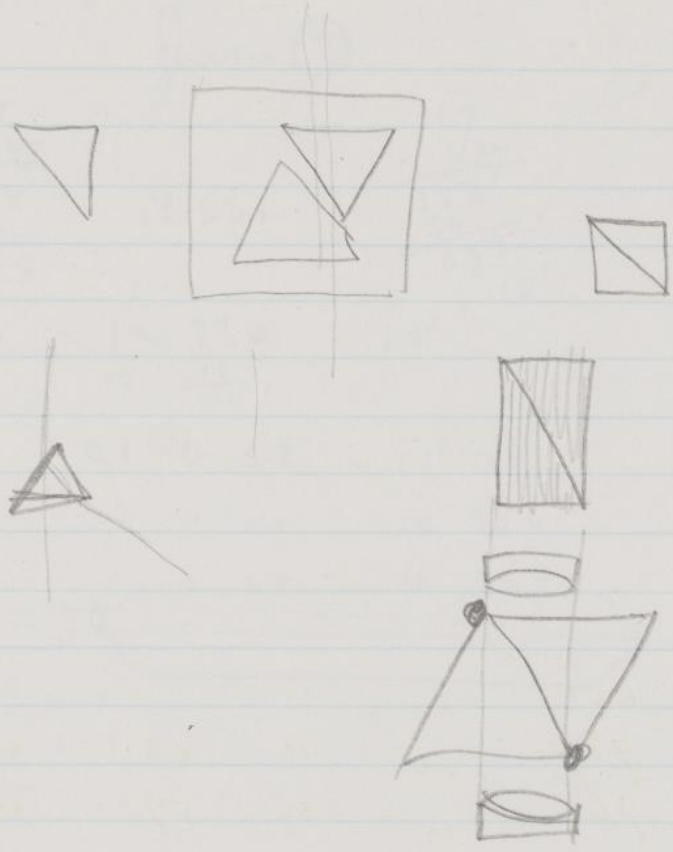
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$$203.5 : 57.3 = x : 111.8$$

$$x = \frac{203.5 \times 111.8}{57.3 \times 1440''}$$

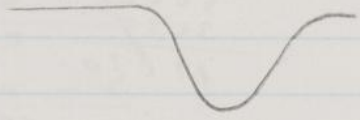
3.15836
1.75812
4.91648

Jupiters Satellites

	I	II	III	IV
Daily Motion	2.30854	2.00593	1.70171	1.33387
	2.04852	2.24996	2.45275	2.69797
	5.08352	5.08352	5.08352	5.08352
	9.44058	9.33941	9.23798	9.11536
" per min				
min per sec	.55942	66059	.76202	.88464
	3.62	4.56	5.78	7.64
Secs per "	217.2	274.8	346.8	460.8

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oo

0	100	.000	11			
1	97.6	.989	24	11	.03	35
1	92.2	.965	35	35	09	59
	85.2	.930	42	70	17	77
2	77.3	.888	59	112	28	101
	67.5	.829	73	179	43	132
3	57.0	.756	47	244	61	120
	50.9	.709	41	291	73	88
4	46.6	.668	15	332	83	56
	45.0	.653		347	87	15

0 – 1.5
1.5 – 3.5 2 hours. Variat
3.5 – 4
4 – 43

Mean vel. at 2h 3m
before & after
1h 50 min.
1 June 18 min.

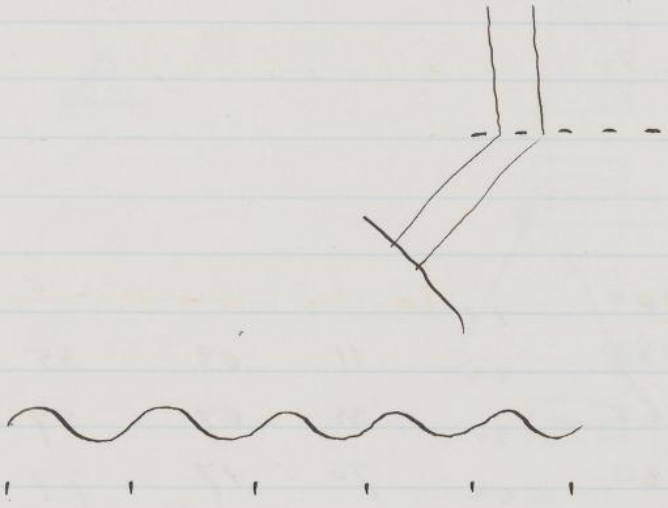
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6828 | 3437
6874 | 2.-.013
4600
3437
11630

1.987 | 254
1778 | 782
2090
2032
580

.078



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$$a - \frac{a+b+c}{3} = \frac{2a-b-c}{3}$$

$$\frac{2b-a-c}{3}$$

$$-\frac{2c-a-b}{3}$$

a b n. c

~~b a~~

$$\frac{2a+2b-2c}{3} = \frac{2}{3}(a+b-c)$$

$$\frac{a+b+\ldots g+h}{n} \qquad \frac{(n-1)a-b+c+2}{n}$$

$$g\Big(\begin{array}{ll} +(n-1)a-b-c- & -g-h \\ -\ a+(n-1)b-c- & -g-h \end{array}$$

$$r\Big(\begin{array}{ll} +\ a+b+c & +(n-1)g+h \\ +\ a+b+c & +\ g-(n-1)h \end{array}$$

$$(n-1)a-(g-1)a+ra$$

$$n-1-g+1+r$$

$$(n-g+r)(a+b+c+) \quad \cancel{g(g+h)}$$

$$-g-(n-1)+(r-1)$$

$$-g-n+r$$

$$-g-g-r+r$$

$$g+r-g+r$$

$$2r(a+b+c)-2g(g+h$$

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Mean deviation of 3 numbers.

a b c

$m = a-b \quad b-c = p$

a	b	o
$a - \frac{a+b}{3}$		$+2a-b$
$b - \frac{a+b}{3}$		$-a+2b$
$o + \frac{a+b}{3}$		$a+b$
		$\frac{2}{9}(a+b)$

$b = c+p$ $\qquad a-b = m$

$a = b+m =$ $\qquad a = b+a$

$\frac{2}{9}(b+m+b) \qquad \frac{2b+2m}{9}$

$\frac{2(8+1)}{9} = 2$

$\frac{2}{9}(2b+m)$

10 9 2
1 4

2
1 3
6 1

$\frac{2}{3}$

6.8 1
6.7 4
6.3

$\frac{3\times 9}{9}$

∴ Mean Dev. = ~~$\frac{2}{9}(2b+2m)$~~ $\frac{2}{9}(2m+p)$

where $m = a-b$, ~~and~~ $p = b-c$ and $m > p$

a, b, c = three numbers.

Example Find the mean dev. of 6.8 6.7 6.3

6.8 .1
6.7 .4
6.3 .4
9 2
9 | 18
Ans. .2

Common method

6.8	.2	6.8
6.7	.1	6.7 .4 .5
6.3	.3	6.3
3 | 19.8	3 | 1	9 2
6.6	.2	9 | 18
		.2

or. Mean dev. = $\frac{2}{9}(r+p)$ ~~which~~ where $r = a-c$

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a b c d e f g h i j | k l m n o | p q r s t

1 – 10, 10 – 20, 20 – 30 |
5 – 15

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	No Sol.	No obs.	Nights Moon	
Aug				
Sept-				
Oct-	297	2729	18	1304
Nov.	522	4033	14	1218
Dec.	711	5251	21	2075
Jan	1216	7326	18	1575
Feb	1536	8841	17	1883
Mar.	1988	10724	18	1608
Apr.	2355	12332	11	492
May	2497	12824	22	1087
June	2760	13911	22	1930
July	3096	15841	21	1287
Aug.	3373	17124	20	1334
Sept-	3690	18458	23	2094
Oct-	4131	20552	22	1545
Nov.	4443	22097		
Dec.				

729
1864.

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Polar Zone

α	88.8	2.0	<		
δ	86.269	4.5	<		
5-1	87.51	5.0	<		
2	88.112	6.5	<		

85° 19	5.0		RA α
86 16	7.5	? 6.0	
" 344	6.0	~~6.0~~	
" 272	6.0	near δ	
85.383	5.0		

88	2	8.8	
	4	7.5	near α
	9	8.0	
	10	9.0	
	71	6.5	
	76	8.0	near α
	77	8.5	
89	1	9.5 <	
	3	8.8 <	
	4	9.4	
	5	9.5	
	17	8.9	
	25	9.0	
	26	9.5 α <	
	29	9.4 α <	
	34	9.5	
	35	9.3 α <	
	37	9.3 <	

	7.5	9.0
89.2	9.2	
~~17~~ 89 17	8.9	
28	8.7	
36	9.5	
89 13	7.0	
14		
15		

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2.0			
4.5			
5.0	5.0	5.0	
	6.0	6.0	
λ 6.5			
6.5			
7.5			
8.0			
8.0			
8.5			
8.8			
8.8			
8.9			

2.0	88°.8	a	
4.5	86 .269	δ	
5.0	87.57	57	
6.5	88.112	λ	
7.5	" 4	num α	4
8.0	" 9		9
8.8	89.3		3
9.3	" 35	c	5
9.3	" 37	b	7
9.5	" 26	a	6
9.5	" 1	[illegible]	1

2.0	α
7.5	4
8.0	9
8.8	3
9.5	1
9.3	7
9.3	5
9.5	6
6.5	λ
4.5	δ
5.0	57
2.0	

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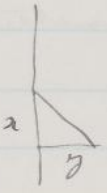
	Dn.	RA	Dn.	Mag.	RA°	hPD
88°	4	0 45.5	88° 14.6	7.5	11.4	105.4
	9	~~51~~ 51.1	29.2	8.0	27.8	90.8
89°	1	0 11.1	89 36.2	9.5	3.8 ×	23.8
	3	1 49.6	29.2	8.8	27.4	30.8
	26	15 44.0	55.1	9.5	56.0	4.7
	35	20 13.5	45.9	9.3	123.4	14.1
	37	22 6.7	48.0	9.3	151.7	12.0
	a	1 6.5	88 32.2	2.0	16.6	87.8
	2	20 8.5	52.5	6.5	122.1	67.5

79
55
24

	4	9	1	3	26	35	37
log lin	9.296	.669	8.121	.663	.748	.922	.676
log hPD	1.657	1.489	1.377	1.489	0.690	1.149	1.079
log lin + log hPD = log xy	0.953	1.158	0.198	1.152	0.438	1.071	0.755
xy	9.0	14.4	1.6	14.2	2.7	11.8	5.7
log cos	9.991	9.957	9999	9.948	9.748	9.741	9.945
log hPD	1.657	1.489	1.377	1.489	0.690	1.149	1.079
log x	1.648	1.446	1.376	1.437	0.438	0.890	1.024
x	44.5	27.9	23.8	27.4	2.7	7.8	10.6
+							
log x'	36.5	19.9	15.8	19.4	10.7 ~~15~~	.2	2.6
log x'	1.562	1.299	1.199	1.288	1.029	9.301	0.415
log y	0.953	1.158	0.198	0.152	0.438	1.071	0.755
log tan RA	9.391	9.859	8.999	9.864	9.409	1.770	0.340
RA	13°8	35.9	5.7	36.2	14.4	89.0	65.4
	0 55.2	2	22.8	2 24.8	57.6	5 56	4 21.6
						19	38.4
log lin RA.	9.377	9.768	8.997	9.771	9.396	0.080	9.959
log y	0.953	1.158	0.198	1.152	0.438	1.071	0.755
log hPD.	1.576	1.390	1.201	1.381	1.042	1.071	0.796
	37.7	24.5	15.9	24.0	11.0	11.8	6.2

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		R.A.	Dec.
.8	97'	0 49.2	88 22.3
2.0	83'	2 26.0	48.7
0.3	36'	0 22.8	89 44.1
2.4	23'	2 24.8	36.0
13'	11'	12 57.6	49.0
18n	12'		48.2
20	6½'		
		1 12.4 (14.4)	88 53.8
		19 43.6 (43.6)	40.2 (40.3) 56.5 (56.7)

	u	q	α	λ	α	
	9.296	9.669	9.457	9.928	9.286	9.456
	2.022	1.958	1.943	1.829	1.943	1.943
log y	1.318	1.627	1.394	1.757	1.229	1.399
	9.991	9.957	9.982	9.725		9.981
	2022	1.958	1.943	1827		1943
	2.013	1.915 (82.2)	1.925	1.554		1.924
x	103.0	~~65.3~~	84.1	35.8		83.9
x'	95.0	~~74.2~~ ~~57.3~~ 1.870	76.1	~~43.8~~	27.8	75.9
log x'	1.978	~~1.758~~	1.881	1.641	1.444	1.880
log y	1318	1.627	1394	~~1.757~~	1.757	1.399
	9.340	~~9.757~~ ~~9.869~~ 29.8	9.513	0.116	0.313	9.519
	12.3	~~36.5~~ 1 59.2	18.1	52.6	64.1	18.3
	0 49.2	2 26.0	1 12.4	~~3 30.4~~	4 16.4	1 12
					19 43.6	
	9.328	9.774	9.492	9.954		
	1318	1.627	1394	1.757		
	1.990	1.853	1.902	1.803		
	97.7	71.3	79.8	63.5		

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XI.

" Photometry Dubls. Clus, Nebulæ, Asteroids, Satellites

XII.

R Bess Cat. 72-3, 74-5

XIII. XIV.

R Cat. 76-7, CS. 78.

XV.

Whiston. Dubls Lat. Mers.

XVI.

R Zone

XVII.

R Zone

XVIII.

Photom Zone, C.S. Stars, Scale U.S.A.R.

XVIII XIX.

S Meteorol. 1840-80

XX.

B Radii, Jupiter's Satellites

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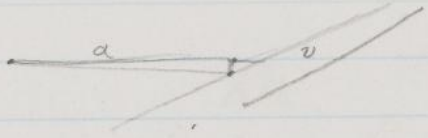
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		x	55 y	x+15'	1930 y+25
1.	9.9	-1.6	-23.8	13.4	1.2
18.	89	-3.6	+15.7	11.4	40.7
26	7.5	+4.1	+2.7	19.1	27.7
35	9.3	+11.8	-7.7	26.8	17.3
37	9.3	5.7	-10.6	20.7	14.4

1870 1930



15" = 1 sec

1° = 4 mi
1' = 4 sec

$t = D \cos\alpha + D \sin\alpha \tan v$ $\quad$ time = 4

$t = \frac{\alpha\delta''}{15} \sec\delta$

$D_{sec}'' = 4$

$t_1 = D + D\frac{\alpha}{v}v = t(1+\alpha v_1)$
$t_{11} \qquad\qquad\quad t(1+\alpha v_{11})$

$v' + v'' = \beta$

$t_1 + t_{11} = t(2 + \alpha\beta)$

~~$t_1 + t_{11} = t(2+$~~

$\alpha = \pm \frac{t_1 + t_{11} - 2t}{\beta t} = \alpha = 11.5\left(\frac{2t - t_1 - t_{11}}{t}\right)$

20 $\frac{1}{20}$

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Nov 12, 6.4. 1878.

12	6	24		12	6	24		
11	1	56		8	23	24		
1	4	28	I	3	7		II	
		95"			73"			

II means

$$t_1 = D\left(1 + \frac{\alpha}{v_1}\right) \qquad t_{11} = D\left(1 + \frac{\alpha}{v_{11}}\right)$$

$$\frac{t_1 v_1}{D} - \qquad v_1 t_1 = D v_1 + D\alpha$$

$$\alpha = v_1 \frac{t_1 - D}{D} \qquad v_1 = \frac{D\alpha}{t_1 - D}$$

$$\alpha = v_{11} \frac{t_{11} - D}{D} \qquad v_{11} = \frac{D\alpha}{t_{11} - D}$$

$$2\alpha\beta = D\alpha\left(\frac{1}{t_1 - D} + \frac{1}{t_{11} - D}\right) = D\alpha\left(\frac{t_1 - D + t_1 - D}{(t_1 - D)(t_{11} - D)}\right)$$

$$\alpha = \frac{\beta}{D}\left(\frac{(t_1 - D)(t_{11} - D)}{t_1 + t_1 - 2D}\right) \qquad \alpha^\circ = \beta^\circ \frac{(t' - 1)(t'' - 1)}{t' + t'' - 2}$$

$t_1 = 9$ 11 $t_{11} = 11$

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Prospective Photometric Observations.

I. Meridian Photometry.

All stars brighter than 5.0 from +90° to −20° 5 times
" " " " 6.5 3 "
Comparison stars for bright variables 10 times
Bright asteroids 10 "
Comparison stars. 5 times.

II. Equatorial. Photometry

Comparison stars for faint variables. Phot-K. 5 times
Nebulae
Stellar stars for Nebula Orion, Andromeda &c.

III Micrometry.

Mars. Satellites.
Asteroids. "
Diameter Sun

IV. Double Stars brighter than 5.0 in which diff of components exceeds 4 (?) mags
Dembowski's stars measured & date. Explain ellen.

Nov. 29.

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t

$$T = \frac{D''}{15 \cos \delta}$$

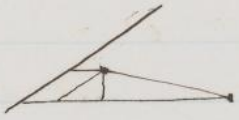


T $\quad D'' \cos v + D'' \sin v \cot \alpha$



$$T' = \frac{\cos \delta}{15}(D'' + D'' v \cot \alpha)$$
$$T'' = \frac{\cos \delta}{15}(D'' + D'' v' \cot(\alpha + \beta))$$





$$T' = T_0 (1 + v \cot \alpha)$$
$$T'' = T_0 (1 + (\beta - v) \cot(\alpha + \beta))$$

$$\cot(\alpha + \beta) = \frac{1 - \tan \alpha \tan \beta}{\tan \alpha + \tan \beta}$$

$$T' = 1 + (\beta - v) \cot \alpha$$
$$t' = 1 + v \frac{1 - \beta \tan \alpha}{\tan \alpha + \beta}$$

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Loss of Position.

Let T = time of transit over [illegible] with [illegible] to line of motion, $= \frac{D''}{15}\sec\delta$.

T' = the time $= (D''\cos v + D''\sin v \cot\alpha)\frac{\sec\delta}{15}$ / [illegible]

$= T(\cos v + \sin v \cot\alpha)$

$\frac{T'}{T} = t' = \cos v + \sin v \cot\alpha = 1 + v\cot\alpha$

$t'' = 1 + v\cot(\beta - \alpha)$

$\cot\alpha = \frac{1}{a}$

$t' = 1 + \frac{v}{a}$ $\quad a t' = a + v$ $\quad a = \frac{v}{t'-1}$

$t'' = 1 + \frac{v}{b-a}$ $\quad b t'' - a t'' = b - a + v$ $\quad a = \frac{v + b - b t''}{1 - t''}$

$a = \frac{v}{1-t''} + b$ $\quad b - a = \frac{v}{t''-1}$ $\quad a = b - \frac{v}{t''-1}$

$\frac{v}{t'-1} + \frac{v}{t''-1} = b$ $\quad v = b \div \left(\frac{1}{t'-1} + \frac{1}{t''-1}\right)$

$\frac{(t'-1)(t''-1)}{t''-1+t'-1}$ $\quad \frac{t't''-t''-t'+1}{t''+t'-2} = \frac{t't''-1}{t''+t'-2} - 1$

$1 + v\cot\alpha$

$1 + (v+\beta)\cot(\alpha+\beta)$

$t' = 1 + v\cot\alpha$

$t'' = 1 + (v+\beta)\frac{1 - \tan\alpha\beta}{\tan\alpha + \beta}$

$t' = 1 + \frac{v}{x}$ $\quad x = \frac{v}{t'-1}$

$t'' = 1 + (v+\beta)\frac{1 - \frac{v\beta}{t'-1}}{\frac{v}{t'-1} + \beta} = 1 + (v+\beta)\frac{t'-1-v\beta}{v + \beta(t'-1)}$

$(t''-1)t'v + t't''\beta(t'-1) = v.$

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Let $t' = \frac{T'}{T} - 1$ $\quad t'' = \frac{T''}{T} - 1$

$t' = \frac{v}{\tan\alpha}$ $\quad t'' = (v+\beta)\frac{1-\beta\tan\alpha}{\beta+\tan\alpha}$ $\quad \tan\alpha = a$

$\tan\alpha = \frac{v}{t'}$

$t'' = (v-\beta)\frac{1-\frac{\beta v}{t'}}{\beta+\frac{v}{t'}} = (v-\beta)\frac{t'-\beta v}{t'\beta+v}$

$t't''\beta + vt'' = vt' - \beta v^2 - \beta t' + \beta^2 v$

$t't''\beta + vt'' = vt' - \beta t'$

$v = \frac{t't''\beta + \beta t'}{t' - t''}$

$v^\circ = \frac{t''+t'}{t'-t''}$

$1^\circ = 1.5\ell$ on the equator.

$7.5\overline{)573}$ $\quad \frac{11.5}{7.5}\overline{)75}$ $\quad$ 1.5

$+.23 = \frac{v}{\tan\alpha}$

$-.25 = \frac{v}{\tan(15^\circ-\alpha)}$ $\quad \frac{1-\tan\alpha\tan 15^\circ}{\tan\alpha+\tan 15^\circ}$

$4.35v = \tan\alpha$ $\quad \frac{1-4.35v\,.268}{4.35v+.268} = -.25$

1

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$$t' = \frac{v}{x} \qquad t'' = v\,\frac{1+\tan\beta, x}{\tan\beta - x} = v\,\frac{1+\tan\beta\,\frac{v}{t'}}{\tan\beta - \frac{v}{t'}}$$

$$t'' = \frac{vt' - \beta v^2}{t'\beta - v} = \frac{vt'}{t'\beta - v}$$

$$t''t'\beta - vt'' = vt' \qquad v = \frac{t''t'\beta}{t'+t''} \quad , \beta\,\frac{t''t'}{t'+t''}$$

$$t' = \frac{v}{\alpha}$$

$$t'' = \frac{-v}{\beta + x} = \frac{-v}{\beta - \frac{v}{t'}} = \frac{-vt'}{\beta t' - v}$$

~~$t'x = v$~~ $\qquad \beta t't'' - t''v = -vt'$

$$v = \frac{\beta t't''}{t' + t''}$$

$t = T\cos v + T\sin\alpha$

$\tan 5^\circ = .087$

$10^\circ = .176$

$15^\circ = .268$

$1.Q. = \frac{v}{5^\circ}$ 1.

v ~~.268~~ × .23 × −.25 ÷ .48

~~5.087~~ × .77 × −.53 ÷ 1.30

10 ~~.176~~ × .54 × −.38 ÷ .92

1.000	1.000	9.699
9.813	9.079	0.045
9.398	9.431	8.000
0.046	9.409	7.968
0.257	9.919	7.712
1.81	0.83	.005
6	6	
1° 48′ 6	49′ 8	

9.428	1.176	.699 1.000
9.362	9.362	9.886 9.732
9.398	9.398	9.724 9.580
0.319	0.319	9.886 .036
8.507	0.255	0.195 0.348
	1.80	1.57 2.23
	6	6
	1° 48′	1° 34.2 13.8

1° 48′

1° 34′

2° 14′

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Data.

Star.

Transit = —

—

—

—

A.R. = 97° 7° 0', Dk = 97°.0 E =

E = 75°0 T' =

Zero. =

85° T' =

=

A.D. = Dk =

Angle R.D = . A.R. +

−

RD = +

−

A.D

Diclaun A.R = , RD +

−

A.R = +

−

Zero

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Law of Position.



$$T' = \frac{D''}{15} \text{ sec } \delta \left(\cos \alpha + \sin \alpha \cot \alpha \right)$$

$$T = \frac{D''}{15} \text{ sec } \delta$$

If v is small

$$T' = T \left(1 + v \cot \alpha \right)$$



$$\text{diff } \delta'' = (T' - T'') \tfrac{1}{2} \tan \alpha$$

$$v = \frac{T' - T''}{T' + T''} \tfrac{1}{4} \tan \alpha$$

$$v' = \frac{T' - T''}{T' + T''} \frac{3437}{4} \tan 5^\circ$$

$$.0875 \times 3437 = 75.16 \qquad 300.64$$

$$\begin{array}{r} 857 \\ \hline 7875 \\ 4375 \\ \hline 7000 \\ \hline 75.162 \end{array}$$

$$v' = 300 \frac{T' - T''}{T + T''}$$

$$\tfrac{1}{2} (T' - T'') \tan 5^\circ = \text{diff dec.}$$

$$3437 \frac{\frac{1}{2} T' - T''}{\frac{1}{2} T' - T''} \tan 5^\circ = v'$$

$$8 \overline{)3437} \quad 300.7$$

$$v' = 300 \frac{T' - T''}{T' + T''}$$

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1	Dec. 1 R 48,207	18.8	+1.0	+300.	18.4	-0.7	-210	
	β Cephei, P obs.	17.8	36.6	8'	19.1	37.5	6'	
2	" " R48,211	20.4	+1.0	300.	17.3	-3.6	1080	
	" " S obs	20.3	40.7	7'	20.9	38.2	28'	
3	Dec. 6, R 50,1	37.0	+.8	240	21.7	+2.7	810	
	β Cephei S obs	36.2	73.2	3'	19.0	40.7	20'	
4	Dec. 8 R 50,11.	39.6	1.4	420	35.8	7.5	2250	
	ε Draco P obs	38.2	77.8	6'	43.3	79.1	28	

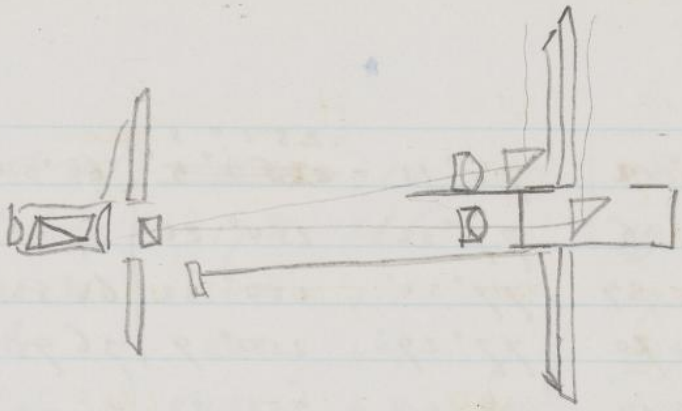
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97° 8'	97° 12	78° 11	~~251° 5'~~	65.52	102.57	
97 4'	6	77° 32'	250° 26'	37.05	28.47	14.23
97 7'	97 39	77° 52'	250° 32	65.83	102.78	
97 32'	20	77° 29'	250° 9	36.95	28.88	14.44
97 3'	23	78 44	251 33	67.00	104.24	
97 20'	~~97° 11~~	77 58	250 47	37.24	29.76	14.88
97 6'	38	189 52	2° 33	47.86 54.11	6.25	3.12
97° 32'	~~97° 19~~	917	2 58	54.04 47.77	6.27	3.13

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α Andromedae 0 3 25 +32 15" 1.2

May 14 Q May 25 S

17.5 108.8 17.8 105.0

126.3 122.8

163.8

No.	Date		Reading	Reading	Mag.	Obs.	Co
3856.	Nov. 14	α Andromedae	143.8	108.8	1.42		

No. Name R.A. Dec. Mag. | |

3600 ×

2200

1000

6800 15

68 pm night

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	Dr	a	H	
30			83	~~120~~
40	229	271	256	370
4.5	364			
5.0	679	800	720	1100
	1119			
6.0	2107	2340	2362	3600
	4121		3904	
7°	8016			

Comet cat. 3d mag and br. 50 stars 5 a night

539 stars. all Argl U. R.
Argl. Comp. Rh stars
Asteroids.

Argl U.R. 3206

bs. Corp Corr. Cam Mg



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Eclipses Jupitris Satellites

Q 2. 342

I	II	III	IV
8	7	39	ϕ
16	13	125	
2	10	90	
20	45	3	
9	24	257	
74	34	64	
49	27		
25	14		
7	41		
24	40		
10	255		
11	255		
14			
38			
11	I	23	538	23	17
28	II	10	255	25	18
38	III	4	257	64	46
27					
11					
9					
40					
56					
11					

23 | 538 — 46 — 78

14 | 23 — 14 — 90

17

14 | 64 — 46 — 56 — 80

178 pm.

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3437 / 6828 cms.

1' = .2 cms.

254

508

682.8 / 254

2.54. / 2

.3937 / 2

3438.

254

13752

17190

6876

873.2.52 | 682.8

873 6826

.06 6111

.078 ins 7150

1' = .078 ins.

$\frac{.078}{24} = \frac{x}{2400}$

312

156

187.2 = 1 min.

936. 5 min.

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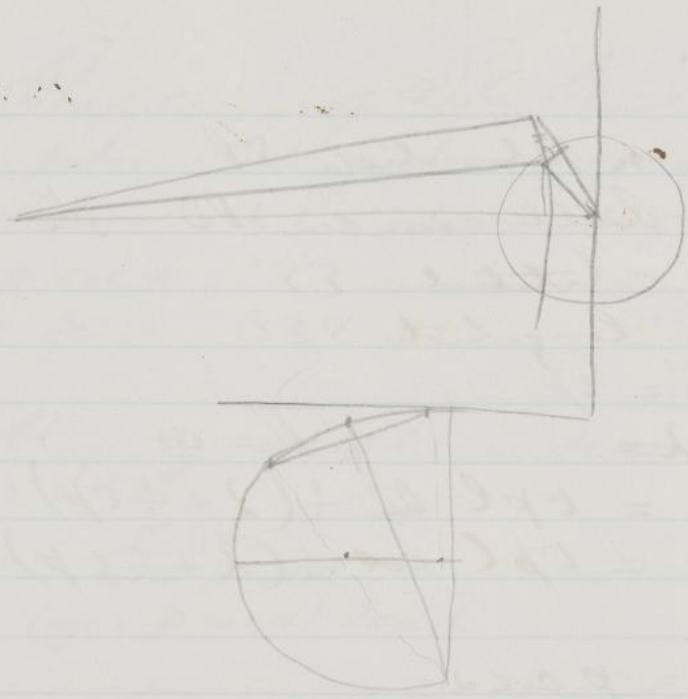
Eros of B 151

Dec.

10 d 20 h		-5.50
11		-3.6
15	3	23.0

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Let p α = [illegible] dist and RA of Sh [illegible]

p α = [illegible]

ω = obliq ecliq

π = [illegible]

t = time of year

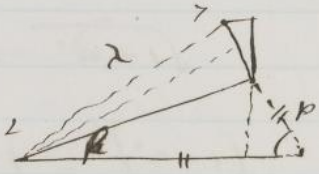
λ = [illegible]

$$\tfrac{1}{2}\left[\tan\tfrac{1}{2}(\omega+\lambda) + \tan\tfrac{1}{2}(\omega-\lambda)\right]$$

$$\lambda = \omega + p \sin\alpha$$

$$\tan\tfrac{1}{2}\left(2\omega + p\sin\alpha\right) + \tan\tfrac{1}{2}(p\sin\alpha)$$

$$\tfrac{1}{2}\left(\tan\omega + \tan\tfrac{1}{2}(p\sin\alpha)\right)$$



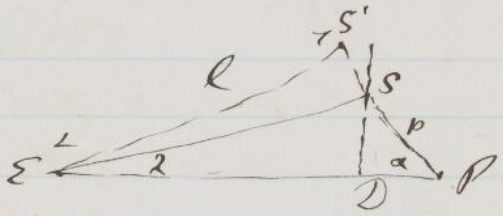
$$dx = t\,\lambda \sin\tfrac{1}{2}(\alpha + t\,\lambda)$$

$$dy = t\,\lambda \cos\tfrac{1}{2}(\alpha + t\,\lambda)$$

$\sin p =$

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p = polar dist. SP
α = Right ascension. SPD
l = Latitude. $\varepsilon S'$
λ = longitude. $S\varepsilon D$
$S\varepsilon S' = \epsilon p$

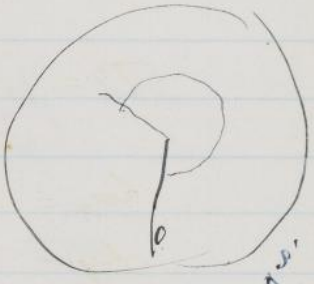
~~Think~~ $\varepsilon P = \omega$

$$dx = \epsilon p\, l \sin \tfrac{1}{2}(\lambda + \tfrac{1}{2}\epsilon p)$$
$$dy = \epsilon p\, l \cos \tfrac{1}{2}(\lambda + \tfrac{1}{2}\epsilon p)$$

$$x = p \cos\alpha$$
$$y = p \sin\alpha$$

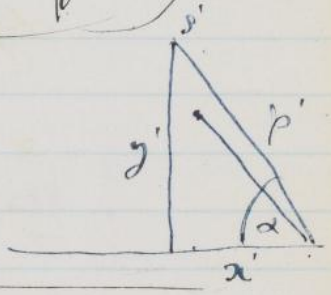
~~$l^2 \; p^2 \; \omega^2 = 2 p \omega \cos\alpha$~~

~~$\sin\lambda = \frac{p \sin\alpha}{l}$~~



$$\tan\lambda = \frac{p\sin\alpha}{\omega - p\cos\alpha}$$

$$l = (\omega - p\cos\alpha)\sec\lambda$$

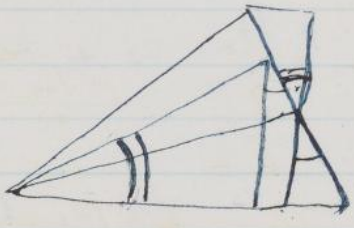


$$\sin\left(\frac{\lambda}{2} + \frac{\epsilon P}{4}\right) = \sin\frac{\lambda}{2}\cos\frac{\epsilon P}{4} + \cos\frac{\lambda}{2}\sin\frac{\epsilon P}{4}$$

$$\sqrt{1-a^2} = 1$$

$$(1-a^2)^{\frac{1}{2}} = 1 - \tfrac{1}{2}a^2$$

$$a^2 + n a^{2-1} x + \frac{n(n-1)}{1.2} x^2$$





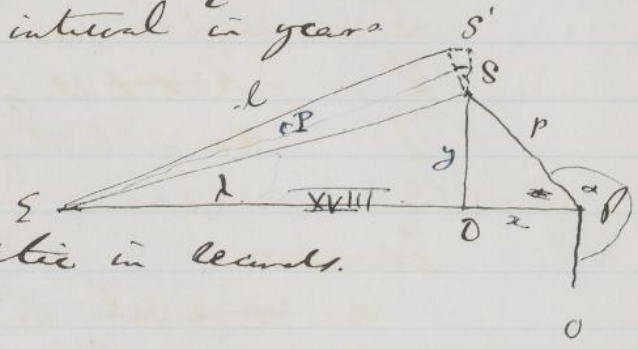
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Precession of the Stars.

p = annual proper dist in seconds of arc

α = R.A. $\quad t$ = interval in years



$x = p \cos \alpha$

$y = p \sin \alpha$

ω = Obliquity ecliptic in seconds.
$23°\,27'\,24''$

$\tan \underline{\lambda} = \dfrac{p \sin \alpha}{\omega + p \cos \alpha}$

$\underline{l} = (\omega + p \cos \alpha) \sec \lambda$

P = annual precession.

$\underline{dx} = t P l \sin \frac{1}{2}(\lambda + \frac{1}{2}(-P))$

$\underline{dy} = t P l \cos \frac{1}{2}(\lambda + \frac{1}{2}(-P))$

$x_1 = x + dx$

$y_1 = y + dy$

$\tan \underline{\alpha_1} = \dfrac{y_1}{x_1}$

$p_1 = x_1 \sec \alpha$

Less exact formulae.

$\lambda = \dfrac{p \sin \alpha}{\omega}$

$l = \omega + p \cos \alpha \qquad m = \lambda + \frac{1}{2} t P$

~~$dx = \frac{1}{2} t P (\omega + p \cos \alpha)(\frac{1}{2}\lambda + \frac{1}{2}(-P))$~~

~~$dy = t P (\omega + p \cos \alpha)\left[1 - \frac{1}{4}(\lambda + \frac{1}{2}(-P))^2\right]$~~

$dx = \frac{1}{2} t P l m$

$dy = t P l (1 - \frac{1}{4} m^2)$

Dec. 15, 1878.

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$\log p = 3.6077016$

$\log \tan \alpha \quad 9.7257324$

$\mu \log \tan \alpha \quad \log y \quad 3.3334340 \quad y = 2154.93$

9.9278230

$\mu \cos \alpha \quad \log x \quad 3.5355246 \quad x = 3431.81$

$\omega + \mu \cos \alpha \quad$ ~~3.8741411~~

$\omega + \mu \cos \alpha \quad 9.4592924 = \tan \zeta$

$\zeta = 16° 3' 47''$

$\cot \zeta \quad 9.9827043$

$\sec \zeta \quad 0.0172957$

~~$(\omega + \mu \cos \alpha) \cot \zeta = 3.8914368$~~

$\mu \log \tan \alpha \quad 3.3334340$

$\log (\omega + \mu \cos \alpha) \quad 4.9085808$

$\tan \zeta \quad 8.4248532 \qquad \zeta = 1° 31' 25''.0$

$\cot \quad 9.9998464$

$\sec \zeta \quad 0.0001536$

4.9085808

$(\omega + \mu \cos \alpha) \cot \zeta = 4.9087344 = \zeta$

84449.67

$x = 3431.81$

$\omega - \mu \cos \alpha = 81017.86 \qquad \log = 4.9085808$

$y \quad 2154.93$

36.37

1793.54

$x = 3431.81$

10.42

3421.39

3.2537101

3.5342026

9.7195075

37

549

$512 \mid 37$

$297° 39' 50''.7$

$19 \quad 39 \quad 22.8$

9.6691877

0.3308813

2537.10

0.5845230

3841.7

$1° 4' 1''.7$

$88° 55' 58''.3$

$7''$

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$\omega = 23^\circ\ 27'\ 29.''67$ $= 84449.''67$

$p = 1^\circ\ 7'\ 32.''30$ $4052.''30$

$\alpha = 302^\circ\ 7'\ 33.''00$

$P = 3.07091$

1.53546

4.60637

$\log P$ 920.1274

$\frac{1}{2}\log P$ $7'\ 40.''64$

$131\ 25.''6$

$1^\circ\ 39'\ 5.''6$ $\log m = 8.4597103$

$\log a = 9.9998196$

$2.96384\,91$

5.31443

$\log \frac{1}{P}$ 7.64942

4.90873

-2.55815

8.45971

$1,01786$ $10.''42$ $\log dy$

99982

$2.55779\,7$ $361.''37$ $\log dy$

~~$x' = 4041.88$ 3.6065835~~

~~$y' = 3070.42$ 3.4871978~~

~~9.8806143~~

~~$37^\circ\ 13'\ 20''$ $307^\circ\ 13'\ 20''$~~

7303
.56
438
365
4088
4090
3013
7103

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			Mg.
1.00	.000		13
.63	800	9600	14
.40	600	9.200	15
.25	.400		16
.16	.200		

4.00	10
2.50	11
1.60	12
1.00	13
.63	14
.40	15
.25	16
.16	17
.10	18
.06	19
.04	20

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