

KG  
11365  
175

H.21

Vol. 6  
Equatorial Irradiance  
February 15 1857 - May 13 1857



KG-11365, 175

Height of Observatory  
above level of Sea -  
Vide March 4<sup>th</sup> 1857 -





KG-11365,175













1857. February 15<sup>th</sup>

	Bond	Struve	D B. - S.	Bond	Bessel	D B. - B.
semiaxis major of outer ellipse of A	20".047	20".047	0".000	19".655	19".655	
" " " " inner " "	17.701	17.644	+ 0.057			
" " " " outer " B	17.240	17.237	+ 0.003			
" " " " inner " "	13.151	13.334	- 0.183			
" " " " outer " C						
" " " " inner " "						
" " " " ball	8.580	8.995	- 0.415	8".412	8".527	- 115
	Struve	Bessel	S - B.	Bond	Secchi	B - Se
semi major axis of outer ellipse of A	19".655	19".655		20".330	20".330	
" " " " ball	8.839	8.527	+ 0.312	28".770	8.844	- 072

## Equatorial observations

for the first half of 1857

Pl.	d. rate	12 March
Saturn	R - 0.46 + 5.40	9.27.3 + 19°.34.1
Procyon	7 <sup>h</sup> .32 <sup>m</sup> + 5°.35'	meas. 10, 15.4 + 15.2.2
Star CCXC	7 <sup>h</sup> .21 <sup>m</sup> + 21°.11'	12.9.58.8 12°.32.9
Venus		11.31.3 + 8°.22'
Harvard Line catalogue		10 <sup>h</sup> .58 + 12.8
Nebulae in Orion catalogue		10.20 10.38
Alcor		



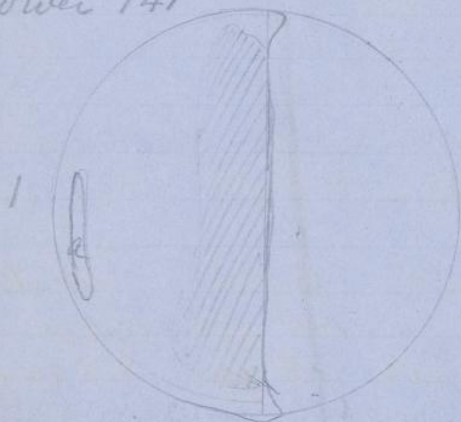
1857 - February 21<sup>st</sup> 1<sup>h</sup>. 50 + sidereal time Chm. 235

Venus.

Definition not good - High westerly wind

3<sup>h</sup> 40<sup>m</sup> ± m. s. t.

power 141



1<sup>h</sup> 59<sup>m</sup> - Horns protruding slightly as in Fig. Hardly any gibbosity Shading hard to define

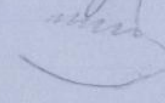
2<sup>h</sup> 5<sup>m</sup>. There appears to be the faintest possible elongated spot at a - clouds passing

2<sup>h</sup> 8<sup>m</sup>. Cannot define shading - 2<sup>h</sup> 13<sup>m</sup> There is

certainly a "renflement" au milieu de la corde. With a

power of 206, Planet looks more yellow than with 141. Cannot define shading. Horns presenting the appearance as in fig 2. Southern one more pointed than northern - vision deteriorating (and increasing)

2<sup>h</sup> 19<sup>m</sup>. North horn suddenly sliced off

Thus  fig 3 Can see nothing of spot a - 2<sup>h</sup> 24 Tried power 141 again Definition not better and light from

planet painful to the eye - 2<sup>h</sup> 26<sup>m</sup> with power 206

There is a white spot in ~~north pole~~ <sup>south horn</sup>. This pole is

sliced off as well as the northern one They protrude



very little <sup>horns</sup> south pole exaggerated north pole flat  
 base. from a 66 <sup>by 4</sup> 2<sup>h</sup>. 31 did on no occasion  
 today see outline of dark part. - Vision bad.

E C	2 <sup>h</sup> 35 <sup>m</sup> 00 <sup>s</sup>	2 <sup>h</sup> 35 <sup>m</sup> 40 <sup>s</sup>
Chr 236	2 <sup>h</sup> 35 <sup>m</sup> 19 <sup>s</sup> . 6	2 <sup>h</sup> 36 <sup>m</sup> 00 <sup>s</sup> 19 <sup>s</sup> . 9

Am not satisfied with observations. The changes  
 in the horns were so slight that I do not believe  
 the micrometer could have measured any of them.  
 The atmosphere was tremulous. - I have more confidence  
 in observation of 2<sup>h</sup>. 19<sup>m</sup> than the other. S. C.

3<sup>h</sup>. 30<sup>m</sup> Both <sup>horns</sup> poles seem sliced off. While trying  
 to make sure of a white spot near south horn at 3<sup>h</sup>. 30<sup>m</sup>  
 50<sup>s</sup> ± noticed distinctly a notch near South horn at less  
 than one fourth <sup>of diameter of planet</sup> from apex - clouding up. S. C.







## Orion.

5

Definition is bad — It was sometime before I could make out the companion of a. Its light appears to be of a whitish hue. The companion to d was immediately seen its light has a slight red tinge — star e was in a continual blue owing perhaps to vision. The diagram was drawn at the instrument. While examining a saw k by indirect vision. Could not see it directly for a long time even by putting a and e out of the field. Saw it however at last and have no doubt of its existence. There <sup>now & then</sup> seemed to be something near x — the companion of a would be easily seen if it were not so near its primary. If this star be the 6th star it is much harder to make out than the 5th. Lassell says the contrary in the *Astron. Notices* for January 9th 1857 —

J. C.

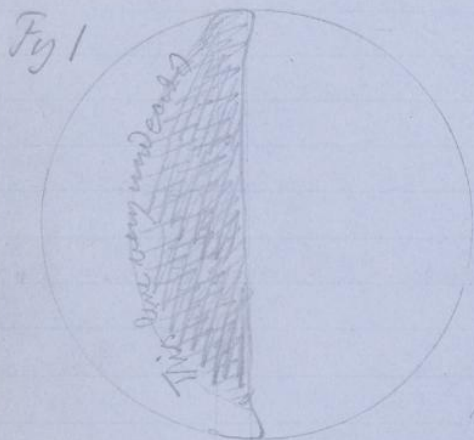
NB. That k is the star (s) reported "invisible" by M. O. Stone Feb 21 1857.



857 February 24<sup>th</sup> Tuesday  $\Delta 46.5$   
 Atmosphere tremulous

Venus R  $1^h 20^m$   $\Delta + 10^\circ 30'$   
 236 21<sup>h</sup> 00<sup>m</sup> 00<sup>s</sup> 21 1 24.5  
 8 C 20<sup>h</sup> 59. 35.7 21<sup>h</sup> 1<sup>m</sup> 00<sup>s</sup>  
 24.3 24.5

The planet is nearly 4 hours west of the meridian and definition too disturbed for nice observations.



Venus is too bright to use power 144.

The effect is painful to the eye

21<sup>h</sup> 35<sup>m</sup> with power 206 the

south horn seems dusky and north

horn bright as in fig 1. I do not think

that a full half of the planet is illuminated - This shading of south horn may be owing to tremor in the atmosphere

21<sup>h</sup> 38<sup>m</sup> I am sure the north horn is the brightest decidedly. The cord seems crooked - but vision is not sufficiently good to determine the place - 21<sup>h</sup> 45<sup>m</sup> The

different shading in the horns are optical illusions as the north pole becomes of the color of the south pole &

the horn becomes white when the planet is to the south of the center of field of view - vision too bad for observations



$1^h 9^m + 10^s$  The northern horn is certainly sliced off - the  
 south horn is pointed but neither project  $1^h 11^m 30$  the  
 $1^h 11^m 30$   
 north horn is pointed  $1^h 19^m$  N.H. protruding more than  
 S.H. Shading too indefinite to be sketched.  $1^h 19^m$  a  
 northern horn protruding southern one entirely sliced off -  
 This is a good observation.  $1^h 21^m$  N. horn diminishing  
 I have this moment saw for the first time today the  
 center of the planet, <sup>Venus transiting</sup>  $1^h 23^m$  within 10s. Southern horn  
 suddenly pointed  $1^h 26$  S.H. rounded off. N.H. protruding  
 $1^h 32^m$  Venus well seen. Southern horn rounded off. Northern one  
 slightly protruding. Shading perfectly uniform  $1^h 44$  - clouding  
 up. good vision. horns protrude but very little - too small a quan-  
 tity to be well measured. The shading ~~has~~ is very slight & perfectly uniform.  
 $1^h 47$ , the shading does not quite reach over  $\frac{1}{2}$  of bright disc.

201.3

Diameter on micra scale ( $4.35'' - 5.00''$ )  $0.25''$  (between  
 the 2 horns)

236.	$2^h 2^m 0$	$2^h 2^m 24.5$
68	$2^h 1^m 35.5$	$2^m 0$
	24.5	

Very unsatisfactory results. The changes not sufficient to  
 decide upon anything. At a casual glance horns were  
 not visible. I noticed however their dark boundaries  
 as represented in fig 2.  $21^{st}$  Venus is the most trying object  
 possible - no sharp lines to it - everything undecided. C



1857 February 25<sup>th</sup> Wednesday

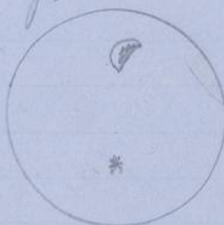
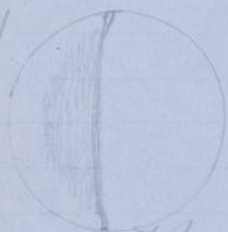
Bad definition

## Venus

6<sup>h</sup> + ? m, st

Planet seen after sunset - About 28" in diameter as measured on mica scale - from horn to horn. These are very small. Planet has the

form given it in fig 1. There was a star in field with Venus of about the eleventh mag then. I noticed about 3 weeks ago (?) a star not quite in the field with Venus (?) of the same magnitude or perhaps 1 mag brighter. If I recollect right their respective positions were

1857 February 25<sup>th</sup> Ash Wednesday

## Saturn

5<sup>h</sup> to 6<sup>h</sup> $\frac{1}{2}$  sidereal time

The definition is quite bad. The shadow is perhaps broader than before. Saw left hand faint penumbra-like shadow. It does not reach across the ring B nor on Ring A. The ring A is faintly seen above the shadow. The vision was not sufficiently good to make anything more out of the planet. Does the ball overlap as much of ring A as 2 weeks ago.



Saturn

Feb 25<sup>th</sup>

Under bad definition could discern the edge of ring at above the southern limit of shadow.



1857 February 26<sup>th</sup>

## Venus

very bad definition

5  $\frac{1}{2}$  sidereal time

Planet is painfully bright. I imagined I could see contours but am by no means certain of it. There is a disagreeable purple light round the planet owing to its low altitude.

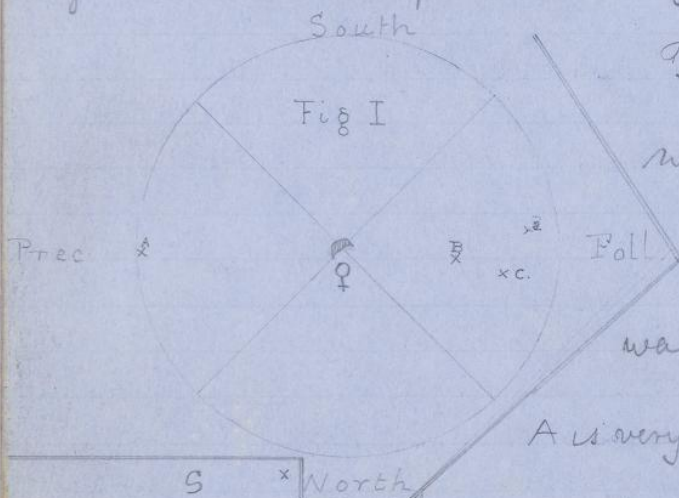


Fig 1 shows the position of Venus with regard to the 3 stars A, B, and C

as seen with the finder. The star *a* was not visible with it. The star

A is very coarse ← \* \* \* triple; the

two largest ones pointing in the direction of Venus and having nearly

the same declination. Fig 2 represents

Venus and a star 10-11<sup>th</sup> mag - with a power of 141. Measured in mica scale very roughly the difference of declination was (star 7'.3"

Venus 1'.53") 5'.1". The difference in R without chronometer was 17 sec.

A little more than one field South of it are stars as in figure

Venus seen through mica scale has a green halo. There

is a star near *x* very small - not measured



1857 February 27<sup>th</sup>

Venus

Very bad definition

$$R = 1^h 30^m$$

$$S + 11^h 46^m$$

$$286 = 1^h 3^m 0^s \quad 1^h 3^m 29^s 3 \quad 1^h 4^m 29^s 3$$

$$EC = 1^h 2^m 30^s 5 \quad 1^h 3^m 0^s 0 \quad 1^h 4^m 00^s$$

$$29^s 5$$

$$1^h 25^m$$

Very tremulous - can make nothing out of it

Venus transited at  $1^h 34^m 19^s 5$  by telescope -  $1^h 41^m$  N. horn pointed

Southern rounded off - vision too bad to continue observation

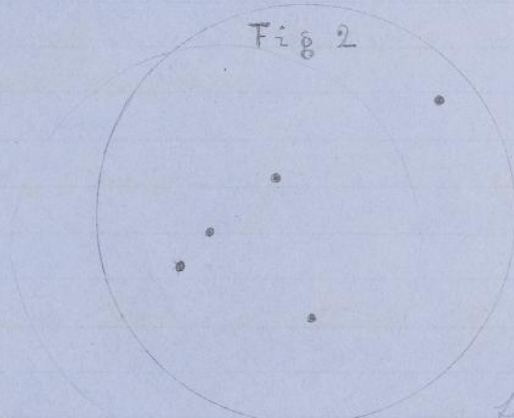
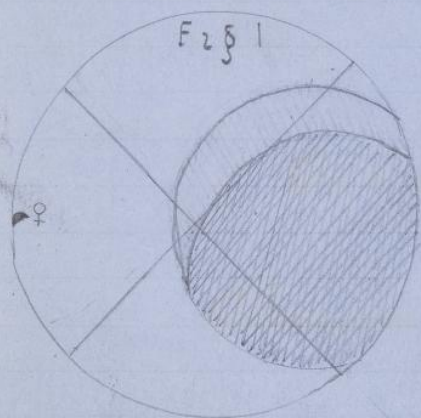
 $1^h 43^m$  Diameter between 2 horns on micrometer scale  $27''.5$ 

Fig 1 represents  
Venus and the moon  
as they appeared,  
somewhere about  
seven o'clock, in the

field of the finder. Recognised all the stars of Fig 1 and 2 of the 26<sup>th</sup> - Venus  
is near a small star tonight thus \*

measured on micrometer scale  
the difference in declination was ( $\text{♀ } 5^h 43'' * 6^h 00''$ ): star  $0'.17''$  north of Venus

The difference in R was: star preceding Venus  $14^h 5$  - Fig 2 shows the  
star near which Venus will probably be tomorrow night. Did at  
no moment see any part of the dark part or of the contour of night side of  
planet



1857 February 27<sup>th</sup>

Good definition - a slight haze.

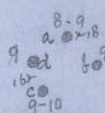
Trapezium

in

Orion

Pr.

Fol.



The diagram was made much more rapidly than on the 23<sup>d</sup>.  
 The 5<sup>th</sup> and 6<sup>th</sup> stars were both seen immediately, very distinctly. The companion of d is very nearly half way between d and c thus <sup>od</sup> did not notice any peculiar color tonight to it. The companion of a is <sup>oc</sup> the distance of a's apparent disc from it. I thought for one moment that there was a second companion to a thus <sup>ax</sup>. With power 401 did not however even suspect it, though I could be seen by glimpses. The haze was unluckily beginning to get thicker. Tried 316 but without success then 141 again and with this power I imagined once more that I got a glimpse at it. It may be an optical illusion. Nothing could be seen of star k. With 401 suspected the faintest possible thing at z - e was bright and without any blur  
 (S. Ark. Nach 1091)

J. C.

1857 February 27<sup>th</sup> Friday

Saturn

observed but haze is too thick to do

anything. Ray A seen above shadow

J. C.



1857

13

February 24<sup>th</sup> 7<sup>58</sup> PM

After tantalizing me for an hour  
Saturn went into dense clouds - & Venus  
did the same. Vision was pretty good  
in glimpses between clouds - The apex  
of the shadow is  $0''.2$  from center edge of  
ring A.

G.P.B.

March 1<sup>st</sup>

Occultation of Pleiades.

Observations prevented by Snow Storm.



Tues March 3<sup>rd</sup> 1857 - 8 PM -

The shadow does not extend to the  
outer edge of A. ring B. The apex pre-  
ceding is visible below the line of the  
principal division between A & B

Ball Definition succeeded -

G. P. B



# Observatory above Sea

March 24<sup>th</sup> 1857

From a paper on file Mr F. W. Bardwell C. E. gives as the elevation of the bench-mark to which his levellings in (1855?) for the height of the upper face of granite blocks (the largest square blocks at base of pilasters) at front door of Observatory

Height of bench mark above mean between high and low water at Dry Dock	10.04
Surface of block above mark	65.0
Block above mean between high & low water	75.04

Bench mark above high tide	5.32
" low "	14.76
Mean	10.04

By Daily observations at ~~4<sup>h</sup> 10<sup>h</sup>~~ A.M. & ~~4<sup>h</sup> 11<sup>h</sup>~~ 4 times a day in the month of Feb. 1857.

Custom of Barom. in East Transit Room. new position Oct 31 1861  
above Block

75.04  
3.92  
78.96

Gardner & Stimpson Jan. 1850

78.63



1857 March 4<sup>th</sup> —First day of the first year of the reign of James Buchanan

President of all the United States

**S**aturn.Very good definition throughout  
and now and then exceedingly fine

Power 688

The new spring governor clock mounted today by Alvan Clark & sons carried the telescope on this its experimental trial remarkably well so that the planet was kept in the field perfectly steadily and without jumping

Outer ring A This ring is more uniform in color than ordinarily. The seam is very hard to make out, or rather there seems to be no proper seam but merely a slight increase of color shade from the sides to the interior of the ring. This ring struck me also as being rather brighter than it generally is

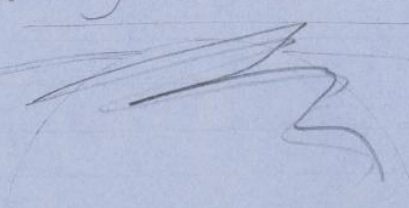
Division of rings A and B is not thoroughly elliptical I examined it with special reference to this and certainly tonight as on former ones I think that both the inner and outer ellipses are somewhat irregular at and within 20 degrees of the East and West points on both sides



It is well seen and well defined across the ball but the southern hemisphere is <sup>nevertheless</sup> a little better defined and perhaps slightly broader than the northern one. Its color is uniform.

Ring B The shading on this ring did not extend over more than two thirds of its breadth at major axis if as much. It is uniform. I see no trace of division on it - its inner edge is certainly not white. It could be traced with ease round the minor axis of ring.

Ring C is equally well seen on both sides. It does not quite cover one half of interval between ball and ring B. Its outer and inner ellipses are quite sharp. There is no trace of a separation between this ring and ring B. When it crosses the ball its ellipses did not appear as sharp as I expected, more so on its inner than on its outer one.

Ball. Is admirably seen. It does not overlap ring A by more than one third  of its minor axis breadth though not a casual glance it might seem to

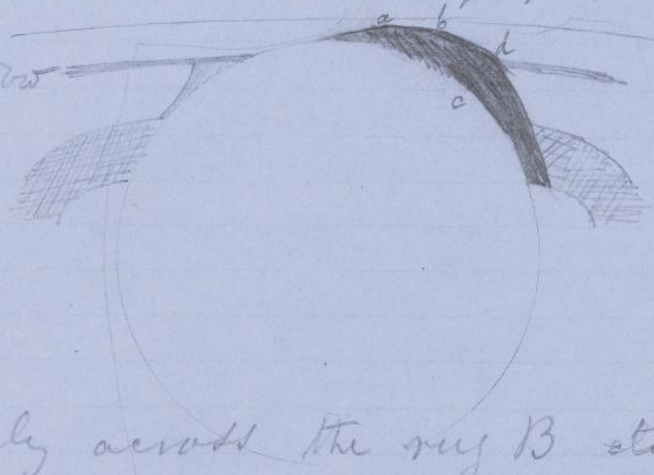
The polar regions and equatorial belt are of the same intensity of shade, they are however very slightly darker than the intermediate region. Between



There is a narrow girdle often noticed before. It could not be traced up to the limb of ball. If that had been possible it would probably have met them on the line of contact of ring C. There was no peculiar color to belts.


### Shadows



I am very happy that the left hand shadow is visible. It is very faint and considerably broader rings than



tends entirely across the ring B to the inner ring C as in figure. It is slightly concave to the planet. It is seen above the <sup>right hand</sup> shadow. This one is pretty uniform in contour throughout. There are however breaks to the regularity of figure at a and b. The ring it is seen above the shadow. Between a and b the bright rim of it seen above is fully once and a third as broad as division of rings at point d. The broadest part of shadow is between c and d where it is once and a fourth as broad as inner ring C at its minor axis. The point of shadow is immediately over apex of ball. It is in no way connected with preceding shadow. There is at



& something that I could not make out to my satis-  
 faction. It seems as if there were there a curved faint  
 penumbra partly adhering to division of ring and partly to  
 shadow ~~thus~~  at ~~mm~~. This penumbra was not seen  
 south of the division but entirely north of it.

The moon is <sup>about</sup> ~~not more~~ than  $3^\circ$  from planet  .



1857 March 4<sup>th</sup>

This evening the Messrs Clark had put the new spring-governor clock for the Equatorials in condition for a preliminary trial although not yet adjusted for exact performance.

The trial was extremely satisfactory. & we obtained some fine views of Saturn under a power of 688.

Saturn. very fine vision

The shadow at its apex b, considerably to the right hand of the apex of the ball overlaps the ring. A leaving a margin on its outer edge a little broader than the division at minor axis.

At c (div. of ring) is the broadest part = A at minor axis

The general outline of shadow to right of ball is nearly regular - perhaps there may be a very slight distortion at c as if the division of ring were there blacker. Shadow throughout black & on it the outline of ball is finely projected. without any apimelation in tint or shading.

At a on the preceding side. is a ghost-like shade preserving the usual outline but extending across the whole breadth of B. at-



Though very narrow excepting near the division where it is broadest & perhaps of a deeper shade, but in every part the shading is very faint although in moments of very fine definition the outline as represented in the figure is distinct. I was much impressed with the fact that the outline was preserved so perfectly while the depth of the shade was so much less than we have been accustomed to see.

The multiple belts seen Jan 30 & Feb 14<sup>th</sup> cannot be made out. (But possibly a lower power might have revealed more shadings that could be distinguished with 688.) The dark Eq belt seemed more deeply shaded as marked in figure above it ~~only~~ a very narrow dark belt was seen all the southern hemisphere is shaded but the polar circle is about as dark as darkest part of the Equatorial belt. perhaps darker.

The seam in outer ring is scarcely discernible. Inner half of B is strongly shaded



but the step like shadings could not be made out. attention was however most given to the appearance of the shadows.

G.P.B.

The ball overlaps Ring A by  $\frac{1}{3}$  or  $\frac{1}{4}$  of breadth of A at minor axis. The shadow is seen on the ring C. but on the preceding side of the ball only on B.



a has the usual outline but is exceptionally faint excepting near the division. Ghost like a quite remarkable under the last definition.

March 4<sup>th</sup> 1857





1857 March 6<sup>th</sup>

236	24 <sup>h</sup>	24 <sup>m</sup>	24 <sup>s</sup>	35.2
2C	4 <sup>h</sup>	23 <sup>m</sup>	25 <sup>s</sup>	
236	4	26	35.4	35.4
2C	4	25	00	

# Venus

R 1<sup>h</sup> 55<sup>m</sup>  
 S + 14° 52'

Vision is not bad though there is a high wind.

5<sup>h</sup> 30<sup>m</sup> 30<sup>s</sup> a quick change in the southern horn from being cut off to a point this is a good observation — Can see no spot on planet



5<sup>h</sup> 35<sup>m</sup> vision deteriorating very fast can not observe to advantage.

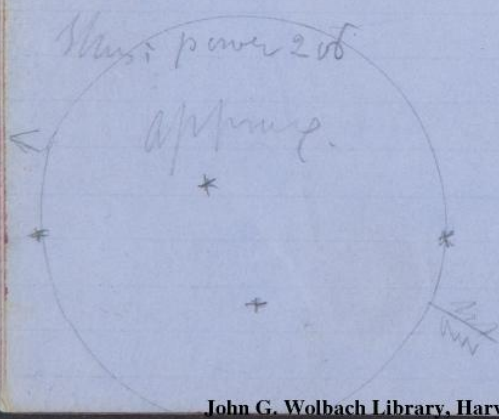
5<sup>h</sup> 54<sup>m</sup> —  
 5<sup>h</sup> 55<sup>m</sup>

this north, pointed; south horn, cut off  
 Both horns rounded off.

6<sup>h</sup> 0<sup>m</sup> — There is the faintest visible star about  $\frac{1}{2}$  field preceding about 20° South of Venus. with power No 2 —  
 Venus tomorrow night will probably be near 4<sup>th</sup> star.

thus power 2 of

approx.



S. C.

236	6.27	00	
2C	6	26.24.7	35.3
285	27	35.3	35.3
2C	6	27	00



1857 March 6<sup>th</sup>

Trapezium in Orion

e is characteristically brighter than a tonight. At glimmers could see star k again. It appeared reddish. ~~5<sup>th</sup>~~ <sup>17<sup>th</sup></sup> star very well seen. 6<sup>th</sup> star seen for one moment. Did not see anything in the place of z of February 27<sup>th</sup>. Vision decidedly bad.

J. C.



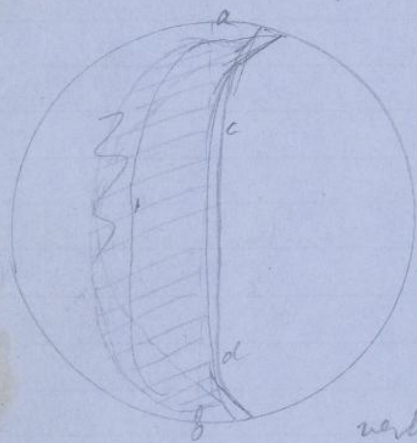
1857 March 10<sup>th</sup>  
 Venus

8C  
 Chron. 236 5<sup>h</sup> 25<sup>m</sup> 21<sup>s</sup> 7<sup>3</sup> 38<sup>3</sup>

8C 5<sup>h</sup> 26<sup>m</sup> 00<sup>s</sup> 0  
 236 5<sup>h</sup> 26<sup>m</sup> 38<sup>s</sup> 3

5<sup>h</sup> 1<sup>m</sup> 30 Remarkably steady cannot see anything like a contour to dark disc

5<sup>h</sup> 3<sup>m</sup> horns equally well seen both pointed



5<sup>h</sup> 5<sup>m</sup> places a and b seem whiter

than the rest of the planet

shadow uniform no spots on it

5<sup>h</sup> 7<sup>m</sup> 30<sup>s</sup> I think the diameter a

very little curved outwards as line c d in fig

5<sup>h</sup> 9<sup>m</sup> South pole more rounded off than northern one

5<sup>h</sup> 13<sup>m</sup> I see no signs of a spot anywhere

5<sup>h</sup> 15<sup>m</sup> Vision deteriorating. Can make nothing out of planet

5<sup>h</sup> 18<sup>m</sup> Measured diameter on micrometer scale bad vision

either 29" or 30" probably nearer this last one

5<sup>h</sup> 20<sup>m</sup> To day have seen no vestige of unilluminated disc

5 21 Southern horn seems rounded off - vision getting

blurred for observations



The planet was again observed at about  
6h 30<sup>m</sup> Sidereal time. It was then too low  
for making out anything and thick passing haze  
was very annoying. I thought at one moment  
that ~~the~~ between two clouds I perceived quite a  
respectable size star at 5 times the diameter  
of planet from it nearly in the direction  
of diameter of illuminated disc but  
of this I am by no means certain  
S.C.



1857 March 10<sup>th</sup>

G. P. B. obs

Hazy  
Occultation12 7<sup>h</sup> 236

occultation was lost owing to thick haze  
 The star was first seen at about  $236.7^{\circ} 45' 46''$   
 10' perhaps after immersion. It was then very faint

1857 March 10<sup>th</sup>

Power 316

**Saturn.** Everything seems propitious for  
 good vision and yet it is quite indifferent. The ring is  
 seen above shadow. The preceding shadow was easily  
 seen ~~except just near C I did not see it then~~  
 There is something the matter with the following one at its junction  
 with division; but I could not make out what it was

The southern half struck me as being the blackest part of ~~it~~  
 Could not distinguish any of the new belts - owing perhaps  
 to bad definition. ~~For this reason can I~~ cannot decide ~~any~~ at all as to the  
 amount the ball encroaches on ring A.



P.S. The south preceding side of division of ring seems near the  
 ball seemed darker than the corresponding following side



1857 March 12<sup>th</sup>

Power ~~600~~ 401?

Mr Clark and son put up the clock work. It carried the telescope remarkably well. Put it on Saturn could see no motion either way for 15 minute. Then turned it to middle star of Orion's belt very bad seeing. For about 20 minute could not see any gain. Then star was found a little behind the wire. Set it again, and it did not get off for for 10 more minute during which observation was continued. - Very bad vision -

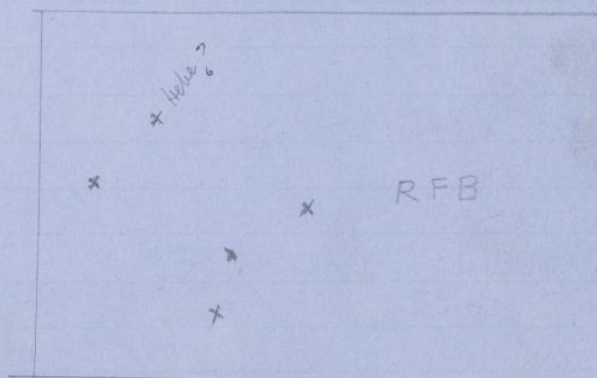
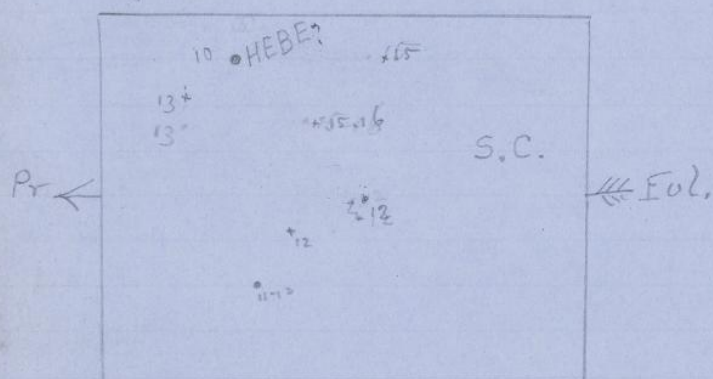
The uniformity of the motion of clock during 20<sup>min</sup> as above stated was also witnessed by Mr. R. F. Bond.



857 March 12<sup>th</sup> Bright moon

# Search after Hebe?

Stars in field 10<sup>h</sup> 03<sup>m</sup> 10<sup>s</sup> time Chr 236

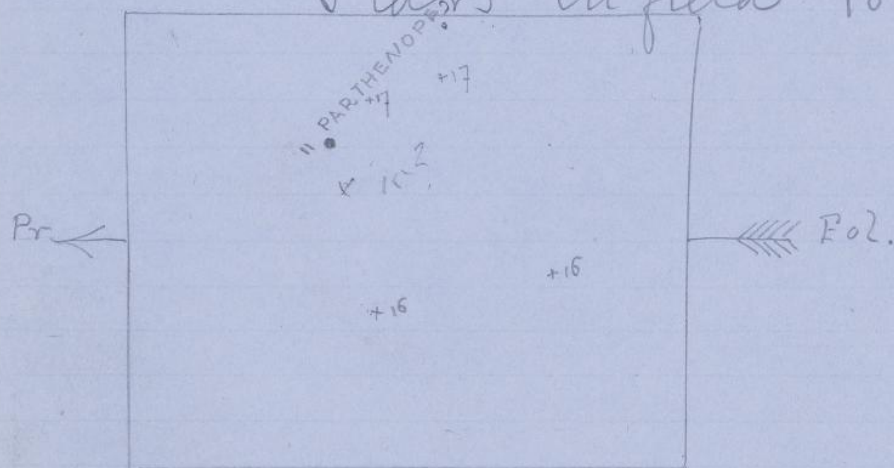




1857 March 12<sup>th</sup>

# Search after Parthenope

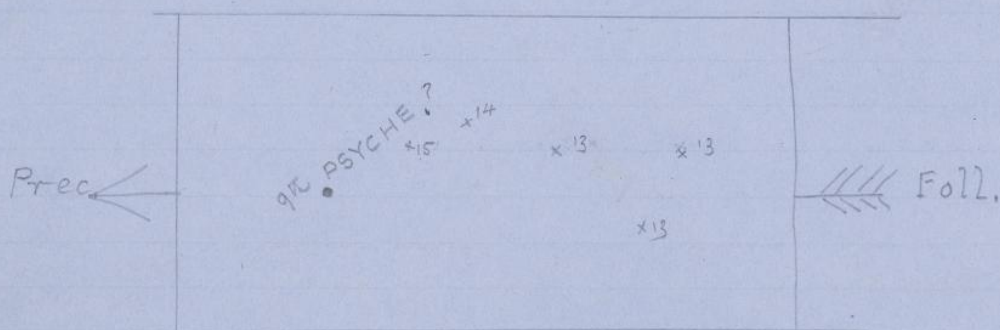
Stars in field 10<sup>h</sup>, 20<sup>m</sup> Sid time Ch 236



1857 March 12<sup>th</sup>

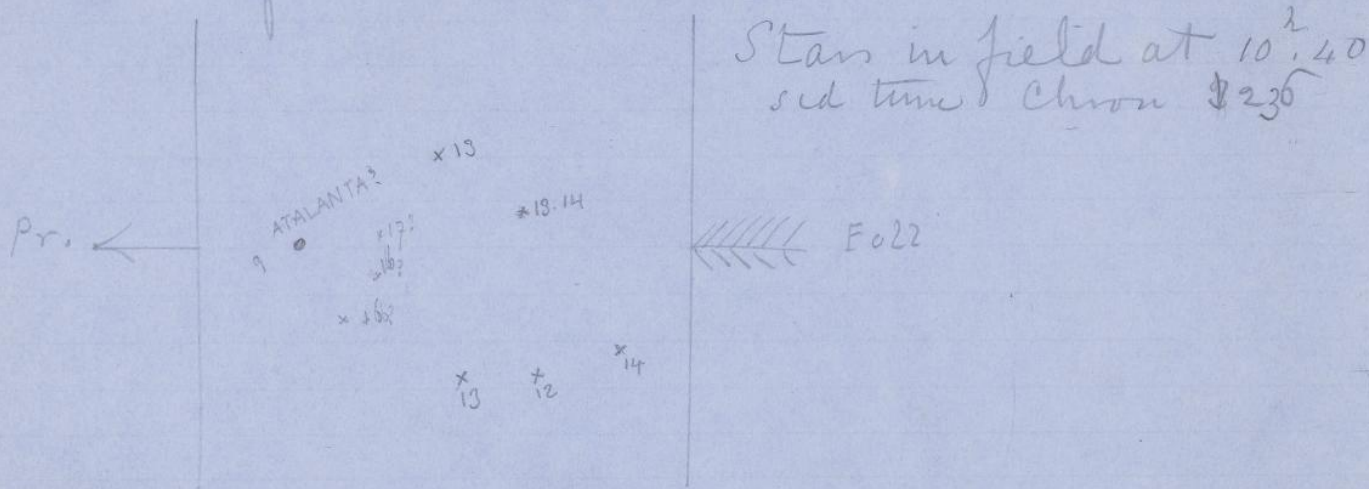
# Search after Psyche

Stars in field at 11<sup>h</sup>, 20<sup>m</sup> Sid time Ch 236

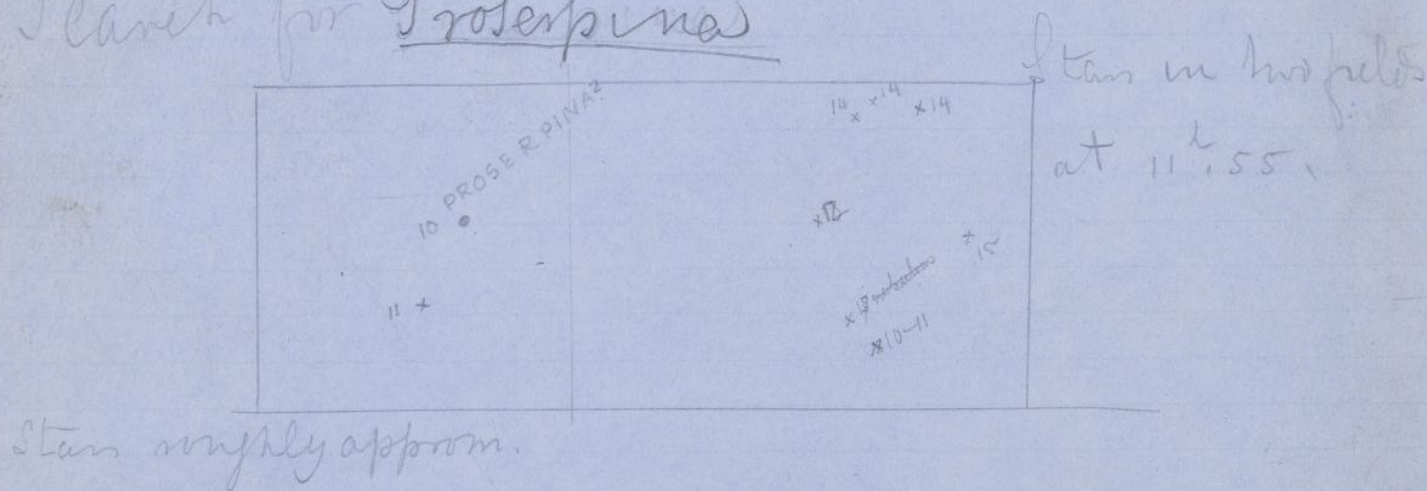




1857 March 12<sup>th</sup>  
Search for Atalanta



1857 March 12<sup>th</sup>  
Search for Proserpina





## Occultation of Spica

1857 March 12<sup>th</sup>

Chronometer 236

Imerson

G. P. B. — great equatorial <sup>236=</sup> 13<sup>h</sup>. 20<sup>m</sup>. 20<sup>s</sup>. 5<sup>u</sup>  
 minus 4 beats

S. C. finder 13<sup>h</sup>. 20<sup>m</sup>. 14<sup>s</sup> lost  
 in the light of moon — by 236 — ~~W~~ Northern  
 H. P. T. Christoph 13<sup>h</sup>. 19<sup>m</sup>. 32<sup>s</sup> hr 424

236 ~~22~~ 13 35 00 0  
 424 13 34 19.8  
 - 40<sup>m</sup> 4  
 236 fast + 21.04  
 424 slow + 19.36

EC. 13 .. 25.00.0  
 236 13 .. 25.39.2  
 39.2  
 18.16  
 21.064

13 19 32  
 40<sup>m</sup> 4  
 13<sup>h</sup> 20<sup>m</sup> 12<sup>s</sup> 4

Mr Paine with

Arnold 1678 M.A.T. 14 15<sup>m</sup> 00  
 M.S.C. 14 15 33 3TP

14 15 00  
 14 15 33 5 RFB

Josep. 13<sup>h</sup>. 57<sup>m</sup>. 14<sup>s</sup> 0 # by Mr Paine

14



# Occultation of Spica

## March 12/13 1857.

$\begin{array}{r} 1.. 20..28 \\ 13 \quad 20 \quad 18 \\ \hline \text{Cal approx Immersion} \quad 74.. 40 \quad 46 \end{array}$

### Emission

L. E. Sid. Chro No 236.  
 14<sup>h</sup> 40<sup>m</sup> 34.5 - 4 beats 40.32<sup>m</sup> 5 QPB  
 Finder 14<sup>h</sup> 40<sup>m</sup> 32.3 no del. J.C.

$\begin{array}{r} 5/6 \\ 236 \end{array}$

H.P.T 2<sup>h</sup> 40<sup>m</sup> - 23 beats chr 424

5:1:23:9.12

46

= 2<sup>h</sup> 39<sup>m</sup> 50.88

+ 40.7

H.P.T 2<sup>h</sup> 40.31.58 no del

At 15<sup>h</sup> 24<sup>m</sup> Sid

236 was 39.2 part of EC

236

~~226~~ 15<sup>h</sup> 30 00 0

424 15 29 19.3

40.7

March 12<sup>th</sup>

C.C. Slow of Sidereal time at 5<sup>h</sup> 25<sup>m</sup> 18.10 N.E.B. by 3 Stars.  
 " " " " " " 12.44 - 18.16 R.F.B. by 5 Stars.

The rate of C.C. is, losing daily - 0.11

Mean Solar clock fast at 9 Am - 7.17.17

gaining daily

.37

MC at Immersion + 1.17.17

.18

6

24

1.17.17

+ 1.17.17



1857

March 12<sup>th</sup> 14<sup>h</sup> 15<sup>h</sup> M. J. - 1678 slow of clock M. E. 0' 33.4  
 15 23 34.9

Immersion of Spica by 1678 at 13<sup>h</sup> 57' 14.0, perhaps 3 or 4 15.1 etc  
 Emission 15 17 18.0 minimum -  
 M. C. tower of Observatory

See results. sixteen pages ahead.

Permittance of Spica

R. F. B.

1857 March 12<sup>th</sup>

M. J. C. 14.47. =

201 = 7.30.29.8

M. C. - 14.47.0  
 7.17.43

14.45.42.57

201 = 7.30.29.8

201 Slow of Cam 7.15.12.77

M. J. C. = 15.26. =

201 = 8.09.30.0

15.26.00  
 1.17.48

15.24.42.55

201 = 8.09.30.00

201 Slow 7.15.12.55

M. M. One

Emission by Cam No 201 at 8.01.27.0 10 beats off = 4 seconds

Chronometers used in the above observations

No 236. Sidereal - gaining daily -

424. Sidereal -

1678. Mean Solar losing daily - 24<sup>s</sup>

201. Mean Solar -

14<sup>th</sup> Am 236 - 22.33.0

424 - 22.32.14.8

March 14.9 Am E. C. - 22.24.0

424 - 22.23.54.5



1857 March 14<sup>th</sup>

Examined to

night. the stars about Venus for an hour or two  
to see if any partook of its motion ( $8^{\circ}$  hourly) but  
none were found.

Two fields following Venus

Angle of pos  $87^{\circ}.45'$

Following	no	6.59	$7^h 40^m$ in sid time	S.P.B. dr
a	12	a-b	$11\frac{1}{2}$ beats	$11\frac{1}{2}$
b	12	<del>b-c</del>	1 "	
c	12	<del>c-d</del>		
d	8	b-d	35 beats	35.2
e	11	d-e	$8\frac{1}{2}$ "	$8\frac{1}{2}6$
f	11	e-f	$23\frac{1}{2}$ "	$23\frac{1}{2}$
g	12	f-g	$35\frac{1}{6}$ "	$34\frac{1}{6}$

No motion in  $10^m$  in above stars S.C

At $7^h 20^m$	$\alpha$	10	} 42-41 beats
	$\beta_2$	16	
	$\gamma$	11	} $69\frac{1}{2}$ - $69\frac{1}{2}$
	$\beta_1$	$\approx 16$	} 39-38 faint at $7^h 35^m$ $37\frac{1}{4}$ beats
	$\beta_2$	$\approx 16$	

South S.P.B

12	$a^2$	} 28 beats	28 beats
	a		
10	$a^3$	} 11 beats	10 beats then obs is lost
	a		



11  $\frac{1}{2}$  32

$\delta$  11  $\frac{1}{2}$   
 $\epsilon$  16  
 $\zeta$  16  
 $\eta$  15  
 $\theta$  15

$\delta \zeta = 32$  beats at 7<sup>h</sup> 46<sup>m</sup>

36

$\delta \epsilon = 6$

8

$\zeta \theta = 40$  at 7<sup>h</sup> 50<sup>m</sup>

$\zeta \eta = 32$

7<sup>h</sup> 52

63

7<sup>h</sup> 55

$a^2$   
 $a$  } 28

$a^2$   
 $a$  } 11

South S. P. B.

Exu

March 14<sup>th</sup>

At Naut. Al. Office

Mr. Aylwin with Hedges' Quadrant found the alt. of Sun at 4<sup>h</sup> 3<sup>m</sup> to be 31°. Mr. A. stated that with a well-adjusted Quadrant he would guarantee to give the latitude or longitude within 5' certainly (I think he said within 3'). The longitude equally well with the latitude. The circle would serve equally well with the sun.



857 March 14<sup>th</sup>Search after Hebe and trial of  
clock

R 9.27.8 D + 19°.28.7

9 23 2 20 22 8

4 6

54' 4"

REB

Early mkt - 0<sup>m</sup> 46

+ 5'.44

1<sup>m</sup> 3.8

1 6'.23

R 9<sup>h</sup>.26<sup>m</sup>.4 D + 19°.44'9

At 9.07 Star <sup>Hebe</sup><sub>Asteroid</sub> bisected Pendulum allowed to  
go home

At 9.31 Star bisected

At 9.46 Star still bisected 15 minutes

15 minutes

At 9.50 Star shows nearly 1 hundred of the mic wire 2 minutes

At 10.00 Star ~~shows~~ on the wire a way of lights on the 10 minutes  
following side of the wire10<sup>h</sup> 5<sup>m</sup> Star bis. wire. Star susp. fast? 5 minutes10<sup>h</sup> 72<sup>m</sup> Pulling wrong end to wind up threw  
clock out - The star was made to bis. again



1857 Mch 14<sup>th</sup> continued v Leonis  
or Leonis

At 10<sup>h</sup> 38<sup>m</sup> star bisected

At 10<sup>h</sup> 55<sup>m</sup> star slow 6 or 8 breadths of micrometer wire  
17 minutes

At 11<sup>h</sup> 2<sup>m</sup> star bis.

11<sup>m</sup> star just off the wire slow.

Examined star carefully for companion. There  
are none above the 18<sup>th</sup> mag. for the vision  
was such that I could not well have missed  
them had there been any. S-C.

The effect of refraction is to be applied to the  
above observations

1857 March 17<sup>th</sup>

Mr Clark brought out weights for new equatorial clock  
He filed off the end of pendulum rod.



# 1857 March 14<sup>th</sup> Search after Hebe

a 12    b 12    c 12    d 12    e 12

g 12  
f 12    h 12    i 12    j 12  
k 12    l 12    m 12  
n 12    o 12    p 12

11<sup>h</sup> 00<sup>m</sup> sid time Chron 286

a-b 11<sup>h</sup> 00<sup>m</sup> 51<sup>1</sup>/<sub>2</sub> beats 52<sup>1</sup>/<sub>2</sub>  
a-c 82 beats 82<sup>1</sup>/<sub>2</sub>  
c-d 87<sup>1</sup>/<sub>2</sub> 87<sup>1</sup>/<sub>2</sub>  
d-e 101<sup>1</sup>/<sub>2</sub> 101  
10 18

f-h 38 37<sup>3</sup>/<sub>4</sub>  
f-i 43<sup>1</sup>/<sub>2</sub>  
h-i 5<sup>3</sup>/<sub>4</sub>  
10<sup>h</sup> 26<sup>m</sup>

i-k 28<sup>1</sup>/<sub>2</sub>  
l-m 39 39  
k-m

n-o  
m-p  
h-i 5<sup>1</sup>/<sub>2</sub>  
l-o 45<sup>1</sup>/<sub>2</sub>    l-k 28  
l-p 51<sup>1</sup>/<sub>4</sub>

a-m 3<sup>1</sup>/<sub>2</sub>  
o-p 15

Star a at 11<sup>h</sup> 38<sup>m</sup> went to his. wire

12<sup>h</sup> 0<sup>m</sup> clock fast 12 seconds of arc (or star slow)



12<sup>h</sup> 5<sup>m</sup>

a-b 52

a-c 82 $\frac{1}{2}$ c-d 37 $\frac{1}{2}$ d-e 101 $\frac{1}{2}$ 12<sup>h</sup> 10<sup>m</sup>

f-h 38

f-i 43 $\frac{1}{2}$ h-c 5 $\frac{1}{2}$ 

L-K 28

L-m 38 $\frac{1}{2}$ 

12, 12

~~f-h~~ h-c~~f-i~~ c-o 45 $\frac{1}{2}$ ~~h-c~~ L-p 6217 $\frac{1}{2}$ on 3 $\frac{1}{2}$ off 16 15 $\frac{3}{4}$ 12<sup>h</sup> 24<sup>m</sup>

Hebe is not among them. Star

p being the only one where there can be the slightest doubt of stability in the hour's obs.

The position of stars c to p seem to correspond well with March 12<sup>th</sup> except with respect to the 2 stars immediately north of Hebe. Tonight they were very nearly equidistant. Then

10. marked Hebe on the 12<sup>th</sup>

12. The star is missing on the 12<sup>th</sup>

XX. ~~Other~~ carefully recorded on the 12<sup>th</sup>



1857 March 16<sup>th</sup>Venus

8+ m s. t. ?

2 stars near planet one preceding  
9<sup>th</sup> May; the following one 11<sup>th</sup>. In  
10 minute Venus had moved from 61 to 63 beats  
from the first - The following being then at 152  
beats from the preceding one as at beginning of obser-  
vation. Vision tremulous - planet low S.C



1857 March 16<sup>th</sup>

entered copied on March 17<sup>th</sup>. 43  
any diff. <sup>was</sup> between this and copy  
put in with "communion de cause"

# Saturn

Powers 141 and 401

Definition <sup>7<sup>h</sup> 30<sup>m</sup></sup> and <sup>8<sup>h</sup> 30<sup>m</sup></sup> m.s.t. quite good

~~With power 141 belts no trace of belts on planet~~

Ring A. I am pretty certain that the <sup>seem</sup> division of rings is yet there though it is quite a difficult object. The inner ~~part~~ half of <sup>seem</sup> slightly brighter than outer half and nearly. This division is nearer the inner ellipse than the outer. This ring is plainly seen above the shadow. The bright rim is about  $\frac{1}{2}$  or  $\frac{2}{3}$  of division of ring at major axis.

Ring B. The outer part of the ring is the brightest part of the system. At 7<sup>h</sup> 30 m.s.t. I could not see the slightest trace of any division to the shading of the ring. It seemed uniform entirely round the ball from limb to limb & but ~~rather~~ at 8<sup>h</sup> 30 I thought I could distinguish a slight line quite near the inner edge, giving perhaps a very



lightly rotated due to the immediate inner rim  
Division of rings I cannot help thinking that  
the outer and inner ellipses are not concentric at  
least. It strikes me that an optical illusion would  
not have the tenacity that their appearance present  
especially as two nights running do not by any means  
identical - the parts near the major axes varying  
continually. To night I could not satisfy myself  
which half was the plainest or the best defined. In  
one moment I incline in favor of the south  
preceding quadrant.

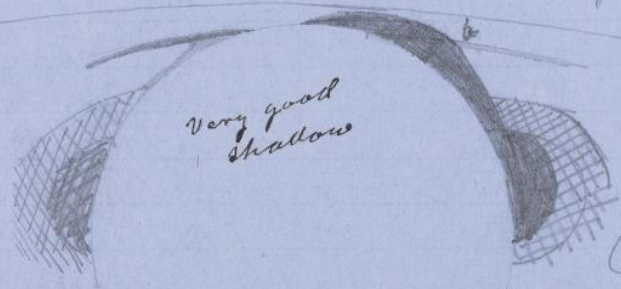
Ring C was well seen. Is quite bright when it  
crosses the bulb. Has no particular color. It  
~~extended~~ <sup>is</sup> very nearly one exactly  $\frac{1}{2}$  of current  
certainly not more than half. Is the ring not  
darker near the ~~an~~ <sup>an</sup> than it was 2 years ago  
There is no difference of shading between the 2  
rings sides. It is contiguous to my B. Cannot  
see the slightest trace of a separation between them.



The Ball With 141 ~~no stars~~ the new  
 there was no trace of any of the new belts.  
 With 401 the equatorial belt is darkest in  
 the centre. It fades off on both sides and is not  
 as well seen near the limbs. The girdle is yet  
 visible - but south of it the belts are only seen  
 occasionally nor could I in any instance follow  
 them to the limbs. They ~~seem~~ crowded together near the  
 antarctic circle and did not remind me of the  
 ones that have ~~of late~~ been observed of late. There  
 is perhaps a slight increase of color on the  
 preceding side. The equatorial belt has the  
 slightest possible tinge of red. I cannot make out  
 whether ~~the~~ it is darker than the polar regions or not.  
 The zone north of it is not quite as bright  
 as the outer half of the ring Po. As the power  
 increases the bright parts of the system of Saturn  
 assume a more yellowish look the ring as well  
 as the equatorial zone. The outline of the ball per-  
 fectly regular. The equatorial diameter evidently the greatest.  
 The ~~quadrant~~ zone is little less bright even to limbs.



The Shadows. The preceding one is immediately and easily seen. I do not think it quite as broad near division of ring as some time ago. It is darker than before and could be seen up down to ring C. The division of rings is fairly visible above it. To the right the shadow leaves the ball at the apex and extends by a curve



to division of rings. The bright rim of it seen above (and tonight very well seen) ~~set~~ is equal in breadth to  $\frac{1}{2}$  or  $\frac{3}{4}$  of division of ring at axis major. The breadth of the shadow at the division is just so much larger than inner ring C as to make the difference visible. Here it is broadest. On <sup>some parts of</sup> ring A however it is nearly as broad. The curve throughout is not a regular one. The ball does not overlap more than one third of ring A.

S. B.



1857

March 16<sup>th</sup>

Saturn

47

seen with 401

Saw the planet under good defini-  
tion with 401  $\alpha$  141

I examined carefully with 141. to see whether a lower power gives greater distinctness or not to the belts & faint shadings on the ball but it was thought that they were better seen with 401.

The shadow above & to the right hand of the ball is now larger than we have yet seen it. it approaches the outer edge of it so nearly as to leave only a very narrow margin  $\frac{1}{2}$  as broad as principal division between A and B at axis major.

It is plainly seen on the preceding side, but is not

by any means as dark or intense

there as on following side where it is black

The principal belts are as follows

- 1) The white equatorial zone
- 2<sup>nd</sup>) The dusky
- Eg. belt  $\alpha$  <sup>lighter near limbs &</sup> divided faintly by a lighter band  $\wedge$  - <sup>parallel to its length</sup>
- 3<sup>rd</sup>) a faintly dusky region above which is  $\wedge$  a narrow
- 4) decided dark belt half way from projection of ring
- to apex of ball.
- 5) The S Polar region is dark as



There may be other faint shadings not distinctly made out.

G.P.B.-

1857 March 18<sup>th</sup> Power 141 Sat. seen between 2 clouds

The exterior part of ring B is the brightest part of the planet - clouded up before anything else could be made out  
J.C.







1857.

## For Immersion of Spica.

1857. March 12<sup>th</sup>. at 13<sup>h</sup> 20<sup>m</sup>

C. b. Slow of Cambridge sidereal time	- 18.16
Sid. Chron. No. 236. Fast of sidereal time	+ 21.04
" " " 424. Slow of sidereal time	- 19.36
Mean Solar. Chron. No. 1678. Fast of C. m. solar time	+ 45.01
M. T. C. fast of Cambridge mean solar time	+ 1.17.41

For Emergence of Spica.  
March. 12. at 14<sup>h</sup> 40<sup>m</sup>.

C. b. Slow of Cam. sid. time	- 18.17
Sid. Chron. No. 236. Fast of Sid. time	+ 21.03
" " " 424. Slow of Sid. time	- 19.38
Solar " - 1678 - Fast of mean Solar time	+ 44.00
M. Clock - Fast of Mean solar time	+ 1.17.43
Solar Chron. 201 - Slow of mean Solar time	- 7.15.12.50

R. T. Paines computed time of Immersion. 13<sup>h</sup> 56<sup>m</sup> 04<sup>s</sup> m. solar time  
 " " " Emergence 15<sup>h</sup> 16<sup>m</sup> 18<sup>s</sup> " " "

Observed time of Immersion m. solar - G. P. B. 13.56.34.56  
 f. b. 30.06  
 R. T. P. 32.49  
 H. P. T. 28.48  
 Mean - 13.56.31.39

Observed time of Emergence. m. solar G. P. B. 15.16.34.92  
 f. b. 35.22  
 R. T. P. 34.00  
 R. F. B. 35.50  
 H. P. T. 35.47  
 Mean - 15.16.35.02



Occultation of Spica March 12<sup>th</sup>

G.P.B. 23 ft. Equatorial

Immersion B.L.

Chro. 236 -- 13<sup>h</sup> 20<sup>m</sup> 20.5minus 4 beats = -2

13 .. 20 .. 18.5

236. fast - 21.04Sid. time of Immersion - <sup>24</sup>13 .. 19 .. 57.46Sid. time m. noon 23 .. 21 .. 05.48

13 .. 58 .. 51.98

Correction - 2 .. 17.42

Mean solar time of Imm. 13 .. 56 .. 34.56

Emission

G.P.B. 23 ft. Equatorial

By Chro. 236 -- --

minus 5 beats

<sup>h m s</sup>  
14 .. 40 .. 34.5- 2.5

14 .. 40 .. 32.0

236 fast

21.03Sid. time of Emission - <sup>24</sup>14 .. 40 .. 10.97Sid. t. noon 23 .. 21 .. 05.48

15 .. 19 .. 05.49

Cor.

- 2 .. 30.57

mean solar time of Em. 15 .. 16 .. 34.92

S.C. with 4 ft. Refractor.

Chro. No 236 -- 13 .. 20 .. 14.00

236. fast 21.04Sid. t. imm. <sup>24</sup>13 .. 19 .. 52.96Sid. t. m. noon 23 .. 21 .. 05.48

Sid. interval 13 .. 58 .. 47.48

Cor - - 2 .. 17.42

m. solar time imm. 13 .. 56 .. 30.06

S.C. with 4 ft. Finder.

By Chro. 236 -- -- 14 .. 40 .. 32.3

236 fast 21.03Sid. time of Emission - <sup>24</sup>14 .. 40 .. 11.27

23 .. 21 .. 05.48

Sid. interval 15 .. 19 .. 05.79

Cor. - 2 .. 30.57

mean solar time Emission 15 .. 16 .. 35.22

R.T. Paine. 54 inch Refractor

Solar Chro. 1678. -- 13 .. 57 .. 14.0

1678 fast of m. solar. t 45.01

13 .. 56 .. 28.99

gn. 3.5 too early, R.T.P.'s note 3.50

13 .. 56 .. 32.49

R.T. Paine. 54 inch Refractor

Chro. 1678. -- <sup>h m s</sup>15 .. 17 .. 18.01678. fast on solar time - 44.0

mean solar time of emission 15 .. 16 .. 34.00

R.F.B. with Lerebours - 5 ft. Refractor.

Chro. 201. 8 .. 01 .. 27.00

10 beats off - - 4.00

8 .. 01 .. 23.00

201. Slow of m. solar time + 7 .. 15 .. 12.50

mean solar time emission 15 .. 16 .. 35.5

H.P.T. Christophe Reflector

Sid. Chro. 424 -- 13 .. 19 .. 32.0

424. Slow 19.36Sid. time of imm. <sup>24</sup>13 .. 19 .. 51.36

23 .. 21 .. 05.48

Sid. interval 13 .. 58 .. 45.88

Cor - - 2 .. 17.40m. solar time of Imm. 13 .. 56 .. 28.48

H.P.T. Christophe Reflector.

Sid. time emission - <sup>24</sup>14 .. 40 .. 11.47

23 .. 21 .. 05.48

15 .. 19 .. 05.99

2 .. 30.52

mean solar time emission 15 .. 16 .. 35.47



857 March 26<sup>th</sup> ~~Reflexion~~ definition  
 powers 141, 401, & 688 8h 30m m.s.c.

# Saturn

Ring A With 401 I am pretty certain that I saw a division rather nearer the inner edge than the outer with 401. It was ~~more~~ seen with less difficulty ~~with power~~ on the following side. <sup>where it appears also narrower and darker</sup> With 141 I could see nothing of it - the ring struck me under this power as being very bright - when I applied 688 the atmosphere <sup>was</sup> too tremulous to do anything.

Division of ring The division seemed regular throughout tonight. <sup>except perhaps in the n.f. quadrant near division of ring</sup> The narrow part of southern half is plainer than <sup>the</sup> corresponding northern half <sup>part of</sup> but the broad parts of north preceding and north following quadrants are darker and broader than <sup>the corresponding</sup> the opposite southern part.

Ring B The shading is <sup>not uniform</sup> ~~varied~~ but I cannot make out the different waves. Its outer rim is the brightest part of the planet.



Ring C Is quite well seen and at least as bright and distinct on the preceding as on the following side. ~~I suspect the~~ It is of a uniform greyish color. Cannot separate it from my B Crescent. I suspect the preceding one to be slightly broader than following one.

Ball. The ball does not overlap the outer ring by more than one quarter of it at minor axis. The bright zone is very nearly twice as broad as my C at minor axis. Between the equatorial belt and the antarctic circle there is one faint belt. In and near this circle however belts a number of belts seem crowded together. None of them could be seen up to the limb of ball globe - They were first seen with power 401 and afterwards with 141 at the same time that the division in outer ring was not to be made out.

Shadows. The preceding shadow is plainly seen and does not seem to have altered since

last observed. The following one appears to have a tendency to strike out far to the right without



part was at  
partly in ring A  
it in ring B



27 March 1857 Comet - Dr. Arrest;  
~~New~~ Telegraphic dispatch

Newark

Rec. Boston Nov 27 1857. 10 o'clock 40 min.  
 To Dr B. T. Gould

or Prof. W. C. Bond

Cambridge - by Omnibus

I observed a comet last evening at eight o'clock  
 thirty minutes - It right ascension one  
 hour twenty one minutes & increasing  
 North declination forty six degrees forty two  
 minutes. It is bright and looks like an unre-  
 solved star cluster

R van Arsdale

39 25 dly

Same as Dr. Arresty



March 31<sup>st</sup> 1857

Meiss Whipple commenced  
Daguerrotyping Fine evening but  
they came late & the Moon was low.  
Time for 30<sup>8</sup>.



April 2<sup>nd</sup> 1857Polhymnia

Cor. of Eph. 57

 $\frac{14}{15} \Delta \alpha + 4^s \Delta \delta - 0.2$ 

$$\begin{array}{r} 171^{\circ} 56' 9'' \\ 11^{\circ} 24'' \end{array}$$

$$\begin{array}{r} 3 \dots 44.6 \\ 11 \dots 27 \dots 44.6 \end{array}$$

$$\begin{array}{r} 40.7 \\ 171^{\circ} 45' 59'' \\ 11 \dots 24 \end{array}$$

$$\begin{array}{r} 10' 10'' \\ 3 \dots 3.9 \\ 11 \dots 27 \dots 03.9 \end{array}$$

Berlin Midnight

April 1

11<sup>h</sup> 27<sup>m</sup> 45<sup>s</sup>Dec + 4<sup>h</sup> 6<sup>m</sup> 44<sup>s</sup>

2

11<sup>h</sup> 27<sup>m</sup> 04<sup>s</sup>4<sup>h</sup> 10<sup>m</sup> 42<sup>s</sup>

19.9

33

597

597

6567

10<sup>h</sup> 57<sup>m</sup>24) 41<sup>s</sup> (1.7

24

170

168

 $\frac{4}{24}$ 82 Leonis 7<sup>th</sup> mag.
$$\begin{array}{l} \alpha \quad 11^{\text{h}} 18^{\text{m}} 18^{\text{s}} \\ \delta \quad +4^{\circ} 05' 16'' \end{array}$$
85<sup>h</sup> 54<sup>m</sup> 44<sup>s</sup>4 05<sup>m</sup> 16<sup>s</sup>Hourly motion in R - 1.7<sup>s</sup>  
Dec + 10<sup>m</sup>

$$\begin{array}{r} 11 \dots 27 \dots 00 \quad 4^{\circ} 12' \\ 1 \quad 42 \quad 11 \\ 11 \quad 25 \quad 18 \quad 4 \quad 23 \end{array}$$

$$\begin{array}{r} 1825.0 \quad 11^{\text{h}} 24^{\text{m}} 20.06 \quad 3.086 \end{array}$$
+ 4<sup>h</sup> 19<sup>m</sup> 41.4<sup>s</sup> - 19<sup>m</sup> 82<sup>s</sup> 0<sup>h</sup> 05<sup>m</sup> 5<sup>s</sup>

$$\text{pre} \quad 1 \dots 38.75 \quad 32$$
- 10<sup>m</sup> 34.6 - 1
$$1857.0 \quad 11 \dots 25 \dots 58.81 = A \quad 6 \quad 17 \quad 2$$
+ 4<sup>h</sup> 09<sup>m</sup> 06.8<sup>s</sup> = A = 8<sup>m</sup> 19<sup>s</sup> 83<sup>s</sup>

$$A \text{ to } B \quad 1 \dots 4.4 \quad 9 \quad 25 \quad 8$$
- 17<sup>m</sup> 50<sup>s</sup> 32
$$11 \dots 27 \dots 03.2 = B \quad 9 \quad 8 \quad 7 \quad 5 \quad 2$$
3<sup>h</sup> 51<sup>m</sup> 17<sup>s</sup> = B = 7<sup>m</sup> 39<sup>s</sup> 66<sup>s</sup>

$$\begin{array}{r} A \text{ to } C \quad 2 \dots 55.6 \\ 11 \dots 28 \dots 54.4 = C \end{array}$$

A to C

$$\begin{array}{r} - 3 \quad 29 \\ + 4 \dots 05 \dots 38 = C = 8^{\text{m}} \end{array}$$

$$\begin{array}{r} 5949 \\ 634.56 = 10^{\circ} 34.6' \end{array}$$

Planet at 8<sup>h</sup> 23<sup>m</sup> m. t. = 9<sup>h</sup> Sid should follow A by 1<sup>m</sup> 05<sup>s</sup> and is 1' 53" north of it



9 31.39.1

3 31

 $A = 131^{\circ} 30'$   
 $C =$ 
 $9 \dots 28^m \dots 43^s \dots 5 - 10 \text{ beats}$   
 $9 \dots 31 \dots 38$ 
 $7^h 00$   
 $3 \dots 28$ 
 $A = 9 \dots 33 \dots 44.0 - 4 \text{ beats}$   
 $p \dots 34 \dots 45.0 - 4$ 
 $4 \ 10$   
 $7 \ 50$   
 $3 \ 40$ 
 $A \dots 35 \dots 12.0 - 4$   
 $p \dots 36 \dots 13.5 - 4$ 
 $p \text{ follows } a \quad 34 \text{ beats at } 9^h 38^m$ 
 $A \quad 10 \dots 18 \dots 42.0$   
 $43.5$ 
 $\text{Diff } R \text{ of } A \text{ and } p = 12^{\text{h}} \text{ mag } d.R$ 
 $p \text{ N of } A$ 
 $A = 11 \dots 31 \dots 36.3 \quad 32 \dots 37.5 \quad 1 \dots 1.2$   
 $*p = \dots 48.2 \quad 32 \dots 49.5 \quad 1 \dots 1.3$ 
 $44.77$   
 $.98$   
 $.98$ 
 $33 \dots 30.7 \quad 34 \dots 32.3 \quad 1 \dots 1.6$   
 $42.5 \quad 34 \dots 44.3 \quad 1 \dots 1.8$ 
 $273$   
 $44 \ 91$   
 $67.57$   
 $22 \ 66$ 
 $23.5 \quad 25.0$ 
 $16.5 \quad 18.1 \quad 1 \dots 1.6$   
 $28.6 \quad 30.0 \quad 1 \dots 1.4$ 
 $226.6$   
 $4.5$   
 $222.1$   
 $3^h 42.1$ 
 $\leftarrow A = 8^{\circ}$   
 $*$ 
 $6) 29$   
 $1 \dots 01.48$ 
 $*q \quad 2^h 09'$   
 $*p \quad 5 \ 55$   
 $3^h 46$



April 2<sup>nd</sup>  $\gamma$  is Polkynania  
 Exceptionally faint from Moonlight (half moon)  
 At 11<sup>h</sup> 5<sup>m</sup> of 236

$\gamma$  precedes  $\rho$  by  $3 \frac{6}{10}$  beats by 5 obs  
 = 1.80

$\gamma$ south of $\rho$ at	11 <sup>h</sup> 14 <sup>m</sup>	78.97	Zero	78.94
	11 <sup>h</sup> 18	79.35		67.57
	11 <sup>h</sup> 20	78.83		11.37
	11 <sup>h</sup> 23	78.63		2.3
	7.5	4) 378		11.4
	1.9	78.94		= 1.51.4

At 11<sup>h</sup> 28<sup>m</sup> of 236

$\gamma$  prece  $\rho$  by  $4 \frac{8}{10}$  beats by 5 obs  
 = 2.40

42  
 17  
 42  
 34  
 68  
 714

56.85	11 <sup>h</sup> 47	Good	
67.57	48	57.12	$\gamma$ S of $\rho$
1072	50	56.74	
2.1	11 <sup>h</sup> 48	56.70	
105.1 = 1.45.1		2.56	

At 11<sup>h</sup> 54<sup>m</sup>  $\gamma$  precedes  $\rho$  by 5.8 beats  
 = 2.90

Zero

67.57  
 57  
 519  
 55

Mean 67.57



1857 April 2<sup>nd</sup> PolymniaObservations reduced to 11<sup>h</sup> 28<sup>m</sup> of 236

Dif. R.

γ precedes p <sup>b</sup> by	1.80 + 0.68 = 2.48	5 obs
"	2.40 + 0.00 = 2.40	"
"	2.90 - 0.71 = 2.19	"
	107	
Mean	At 11 <sup>h</sup> 28 <sup>m</sup> 00 <sup>s</sup>	2.36 15 obs

Dif Dec

γ South of p <sup>b</sup>	1 <sup>m</sup> 51.4 - 1.5 = 1 <sup>m</sup> 49.9	4 obs
"	1 <sup>m</sup> 45.1 + 5.0 = 1 <sup>m</sup> 50.1	3 "
Mean	1 <sup>m</sup> 50.0	7 "

236 is 1<sup>m</sup> 03<sup>s</sup> east of EC  
 EC is 0<sup>m</sup> 21<sup>s</sup> slow of Sid. Time  
 236 " 0<sup>m</sup> 42<sup>s</sup> east of " "

	11 <sup>h</sup> 28 <sup>m</sup> 00 <sup>s</sup>	
Sid. Time	11 <sup>h</sup> 27 <sup>m</sup> 18 <sup>s</sup>	0 <sup>m</sup> 43 <sup>s</sup> 06.4
	0 <sup>m</sup> 43 <sup>s</sup> 53	46.7
	10 <sup>h</sup> 43 <sup>m</sup> 25 <sup>s</sup>	0 <sup>m</sup> 43 <sup>s</sup> 53.1
	1 <sup>m</sup> 48 <sup>s</sup>	
M.S.T.	10 <sup>h</sup> 41 <sup>m</sup> 40 <sup>s</sup>	

Polymnia ~~±~~ 18571857 April 2<sup>nd</sup> 10<sup>h</sup> 41<sup>m</sup> 40<sup>s</sup> M.S.T.

Planet precedes star b	by 0 <sup>m</sup> 02 <sup>s</sup> 36	15 obs
" South of "	1 <sup>m</sup> 50 <sup>s</sup> 0	7 "
Star b follows star a	by 1 <sup>m</sup> 01 <sup>s</sup> 48	6 obs
" North "	3 <sup>m</sup> 42 <sup>s</sup> 1	3 "

b is a small star of 12<sup>m</sup> mag.a is Weisse, H. XI. 442 of the 8<sup>th</sup> magnitude

The planet was very faint & difficult to observe on account of the bright moonlight. It was recognised with certainty by its motion relatively to the stars during the observations.



1857 April 3<sup>rd</sup>

61

Mrs Whipple & Black photographing  
by collodion process (gun cotton & ether)

The night was hazy. - They commenced  
about 8 P.M. - Definition good - Lunar halo

April 4<sup>th</sup> Photography 8<sup>h</sup> to 9<sup>h</sup> P.M.

Atmosphere hazy with cirrus -  
Collodion process took about 13<sup>s</sup>. Got some  
improved pictures at primary focus of object  
glass - Clock motion adjusted this morn-  
ing by R.F.B. - & is very exact. - Being  
now regulated to the moons motion -

The Photographs obtained on the evenings of  
the 3 & 4<sup>th</sup> were improvements on those formerly taken,  
inasmuch as the evenings were favourable.



1857

April 6<sup>th</sup> 7<sup>th</sup> and 8<sup>th</sup> Messrs. Whipple & Black are  
are fitting another Eye piece, which consists of the  
large lens ordinarily used by them in Daguerreotypes  
with an adapter to our twenty three foot Refractor.

April 9<sup>th</sup>. The telescope requires new counter  
poising throughout by weights of from  
60 to 100 lbs.

The adjustments for this purpose  
have taken up two or three evenings which  
have been however either cloudy or hazy

Telescope could not be used on Saturn

There were some occasions of good  
definition to judge from the appear-  
ance of the sky & the state of the atmos-  
phere - temperature wind &c -



1857 April 16<sup>th</sup> Much cloudy weather has prevented observations on Saturn since we left off photographing the Moon of this month — Tonight had a very imperfect view of the shadow — which now appears more distorted at the division than it has recently been. But the vision was too imperfect for its form to be well made out — <sup>ball</sup> G. P. B.

April 18<sup>th</sup> Saturn again examined at different times for one or two hours. But the image was never well defined — The following shadow is quite broad & has a strongly marked distortion in its outline — if it be not rather the effect of the wretched definition.

The outer edge of the ring A <sup>prec shadow</sup> very evidently has the form a b

The preceding shadow is possibly on the ring B & not on the division but this is uncertain



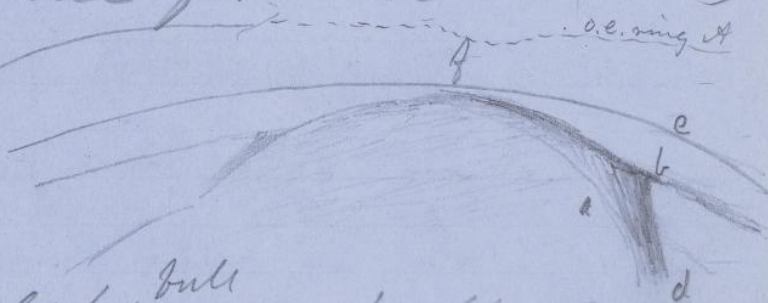
G. P. B.



Saturn  
April 25<sup>th</sup> 1857

6<sup>h</sup> 45<sup>m</sup> m.s.t.

~~See~~ Definition. Tolerably good for the first time for several weeks. Outline of ring A is slightly distorted at J thus



The ball overlaps <sup>ball</sup> one half of outer ring perhaps more. The preceding shadow is distinctly visible & extends I think just up to the division. It is not seen on Ring A. nor on more than one half of B.

The following shadow starts from apex of ball its outer edge approaches very close to the outer edge of ring A. But there is certainly a fine thread of the outer rim of A still uncovered. This is perhaps not wider than  $\frac{1}{2}$  of division at Minor axis.

In following shadow  $ab = bc$

But at the point where <sup>the</sup> outline meets that of the ball. Their mutual inclination is small & the point of crossing is uncertain. From b to d



From b to d the outline is ~~nearly straight~~ but slightly concave.

The outline from b to f is made out with difficulty

There is a dark spot at b <sup>Ly. P. 2-</sup> at intersection with division but ~~this~~ may be an illusion

                      
                      
Dac



Photography  
Daguerrotype

1857 April 25<sup>th</sup>

<sup>8 to 9</sup> Mr Black came up  
at 8 P.M. and took three photo-  
graphs of Castor - The best was  
taken in 30<sup>s</sup> the others in 45<sup>s</sup> and 60<sup>s</sup>  
The elongation in each was  
quite evident.

April 27<sup>th</sup> Fine night very  
clear & good definition. Took  
by collodion process (gum cotton in ether) several  
photographs of the Swan which was too  
low say about 25°? Best one at 8<sup>h</sup> 15<sup>m</sup> m.s.t.  
when sky was very clear & limb steady.  
But time of exposure was 1<sup>m</sup> 20<sup>s</sup>!!  
The most important  
sweep of the evening was in obtain-  
ing a fine impression from Mizar  
(4<sup>th</sup>?) and its companion 5<sup>th</sup> magnitude  
3<sup>rd</sup>



and a more distant star of 5<sup>th</sup> mag. (Alcor)  
 of the companion a very perfect & distinct  
 image was taken - Of Alcor there was  
 some doubt owing to spots on the glass  
 plate which might be confounded with  
 it. But a daylight examination will test  
 this.

Mizar & its companion distant 14"  
 were beautifully distinct



Time of exposure 1<sup>st</sup> 20<sup>s</sup> about but no  
 short time was tried & probably a much  
 shorter exposure would have answered  
 as it was the shortest was the best - The  
 altitude must have been above 70°

The clock had only been approx-  
 imately changed, from ~~sidereal~~ to lunar  
 to sidereal motion -

G. P. B.



1857 April 28<sup>th</sup> Photography

3.5. 8<sup>h</sup> to 10<sup>h</sup> PM

A very fine evening -

The images of the Moon taken by the collodion process were probably the best we have yet obtained - but the time required for exposure was, about a minute -  
The Moon is still too low -

alt 50° to 60° Arcturus was taken perfectly in 15<sup>s</sup>!

Mizar in (45<sup>s</sup>?) very good -

Tried the Cluster in Hercules without success -

The large image of the Moon magnified 4 times was imperfect from motion in declination & R during exposure of 5<sup>m</sup>

G.P.B

P.S April 29<sup>th</sup> 5<sup>h</sup> PM Mr Clarke has just brought up some measures of the photographic images of Mizar & Alcor of April 27<sup>th</sup> reduced on next page -



## Immersion of 47 Geminorum

1857 April 28<sup>th</sup>

Observed with Finder - G.P.B.

By 236 - 11<sup>h</sup> 23<sup>m</sup> 52.0<sup>s</sup> - 8 beats

		4.0
11 <sup>h</sup> 23 <sup>m</sup>		48.0

EC	11 <sup>h</sup> 27 <sup>m</sup> 00.0
236	11 <sup>h</sup> 28 <sup>m</sup> 31.4

Chemical Focus used April 27, 28,  
29, 30 was 21.5 of scale on tube



Measure on the Photograph  
of Sirius and Alcor taken on  
April 27<sup>th</sup> 1857 Read off by Mr. Clarke. with  
Reading Microscope

Sirius to Alcor

Sirius to Companion

14 rev. and	304.5 <sup>0</sup>	0 rev	109.25
"	303.6		110.5
"	303.5		110.5
"	303.0		110.3
"	303.6		110.3
	<u>5 132</u>		<u>8</u>
	303.6		110.2

8" = 1" 1 Rev =  $\frac{1}{16}$  of an inch -

Prob. error in 16 rev =  $\frac{1}{100}$  of an inch

$$\begin{array}{r} 360 \overline{) 303.6} \quad (0.8433 \\ \underline{2880} \\ 1560 \\ \underline{1440} \\ 1200 \\ \underline{1080} \\ 1200 \end{array}$$

$$\begin{array}{r} 360 \overline{) 110.2} \quad (0.3061 \\ \underline{1080} \\ 220 \\ \underline{2160} \\ 400 \\ \underline{360} \end{array}$$

$$\begin{array}{r} 14.8433 \\ 0.3061 \\ 0.020622 = \end{array}$$

$$\begin{array}{r} 660 \overline{) 14.843} \\ 30 \overline{) 3.711} \\ \underline{690} \quad 0.928 \end{array}$$

Smallest Dist. 690"  $\frac{14.23}{690} = 1.15318$

$$\begin{array}{r} 4 \overline{) 0.02062} \quad 4 \overline{) 0.3061} \\ \underline{4 \overline{) 0.000165}} \quad \underline{4 \overline{) 0.07652}} \\ 0.0012 \quad 0.01913 \end{array}$$

Letter on next  
page



# Alcor from Mizar

BAC Mizar  $R = 13^h 17^m 52.59^s$   $ABD = 34^{\circ} 17' 23.5''$   
 " Alcor "  $= 13^h 19^m 12.49^s$   $= 34^{\circ} 13' 45.0''$   
 $\quad \quad \quad 119.60$   
 $\quad \quad \quad 79.90$   
 $\quad \quad \quad 3.38.5$   
 $\quad \quad \quad 180$   
 $\quad \quad \quad 218.5$

$79.90 = 1.90255$   
 $15^{\circ} 1.17609$   
 $34^{\circ} 15' 04'' \tan 9.75037$   
 $2.82901 =$

Angle of Pos Mizar & Alcor =  $218.5$   
 $17^{\circ} 56.55'' \tan 9.51044$   
 $= 72^{\circ} 03' 05'' \cos 9.97833$   
 $\quad \quad \quad 2.82901$   
 BAC  $709.05 = 2.85068$

## By 12 year Cat

Dif R  $1^h 19^m 67^s$  cor for prece to 1857  
 $79.67$   
 $1195'' = 3.07737$   
 $9.75037$   
 $2.82774$   
 Dif Dec =  $3^{\circ} 40.3''$   
 $180$   
 $220.3$

Ac cord  $= 672.6$  square  $= 452391$   
 $\Delta \delta = 220.3$   $= 48532$   
 Mizar to Alcor Dist (med)  $= 707.8$   $= 500923$

log  $= 2.84991$   $= 2.84991$   
 $8.131433$   $14.847 = 1.17153$   
 $1.16424$   $1.67838$   
 Mizar to Comp.  $14'' 60$   
 By Photograph  $1^{rev} = 47.68$

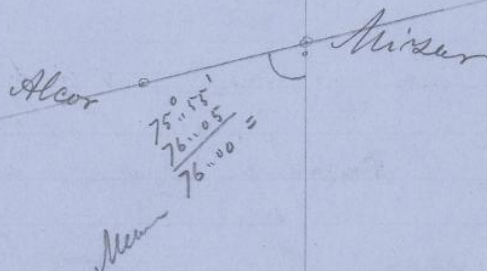
Mizar to Alcor  $= 707.8 \sin = 7.53549$   
 $0.828 = 0.894 \text{ inches} = 9.95134$   
 $270.4 \text{ } 260.7 = 2.41585$



Angle of position of  
Mizar & Alcor Length 71<sup>.0</sup> 42'  
" " " " " " " " " " "  
" " " " " " " " " " "

Pre page 72.. 83

$$\begin{array}{r} 72^{\circ} 03' \\ 76^{\circ} 00' \\ \hline 148^{\circ} 03' \end{array}$$
 Angle D  
 Pt of mixer & comp





# Results of Photograph of Mizar

By Photograph	Angle of Pos	$148^{\circ}.0^{*}$
	Distance	$14''.6$

By Stomve	$147^{\circ}.8$
	$14''.3$

Angles ~~And~~ distances were read off from  
a single plate (original image on  
glass) The angles by ~~original~~ protractor

---

1857 April 29<sup>th</sup>

We got a single photograph  
of the Moon tonight in an opening between  
the clouds



April 29<sup>th</sup> 36 half turns of pendulum of Eq. Clock  
brought it to lunar motion (including parallel...)

## Photography

1857 April 30<sup>th</sup>

Another very fine night perfectly clear & very little wind.

Took 5 or 6 very fine impressions of the Moon at about 8 P.M. the best yet - exposure 45<sup>s</sup>. (Why so long?)

The clock going admirably - & the slow motion in declination being supplied by a gentle pressure.

We next took a great many images of Mizar (10 or 12)<sup>s</sup>  
 Shortest exposure 30<sup>s</sup> image faint.  
 Longest " 120 " dark

To prove the identity of Alcor & to obtain the direction of diurnal motion we proceeded as follows.



The coated glass plate was inserted & exposed to the light of Mizar say  $60^s$ . The light was then cut off the plate remaining unchanged & the telescope moved by the slow motion screws in R and another image taken some hrs 3 or more - Forming images thus

1<sup>st</sup> impression

x Alcor

Mizar \*

2<sup>nd</sup>

x Alcor

\* Mizar

Once or twice 3 were taken close to each other in succession. By which we hope to find the little star x between Mizar & Alcor Thus: -

x Alcor

\* Mizar

Next set on Arcturus and made the following experiments two or three times repeated

The plate was set in & exposed  $2^s$  or  $5^s$  & then the light was cut off & the telescope

x x



moved say 1<sup>st</sup> in R & then the plate was  
 exposed 5<sup>s</sup> - again 10<sup>s</sup> - 15<sup>s</sup> - 20<sup>s</sup> &c  
 The 5<sup>s</sup> exposure was exceedingly  
 perfect very small round & distinct  
 but not dark brown as was the 40<sup>s</sup>  
 The latter was larger & less distinct  
 Arcturus  
 Actually much more perfect . . . . .

This change of images on the same  
 plate is exceedingly important as a  
 means of recognising small stars which  
 might otherwise be confounded with  
 spots on the coating or glass.

Also to give the direction of the  
 diurnal motion and a scale of the  
 value of measures of distance. So by means  
 of the slow motion screw an arc of 10' for  
 instance may be measured with great pre-  
 cision probably within 1". Represented by the  
 distance of the two successive images apart  
 & the line joining them is the arc  
 of declination.



## Photography

77

N.B. make the clock go fast or slow  
a very little & then the stars will be  
printed in lines giving the  $\text{dip. R}$

The direction of diurnal motion & the  $\text{dip}$   
Dir. besides ensuring the <sup>identity</sup> ~~places~~ of each  
star.

Any considerable improvement  
in the sensitiveness of the present pho-  
tographic processes will revolutionize  
practical Astronomy. Such an  
improvement which would enable  
us to take stars of the  $10^{\text{th}}$  mag. in  
a second or two in a practicable way



# Photography (Cannot find these plates)

1855 May 5<sup>th</sup> We obtained to night be-  
sides some fair pictures of the Moon a  
beautiful series of Mars & Aln  
& were taken on the same plate at in-  
tervals 5<sup>s</sup>, 10, 15, 20, 25, 30 (35 & 60?)

All the images of Mars & in number were got  
of the companion & 5 of Mars

The most important result was the  
minutestrep & clearness of the images taken quick  
in the shortest time.

Our purpose must be to get a  
series of 5 or 6 impressions on the same  
plate a very short & then at longer times  
& select those at the right exposure. The  
line of the images gives the circle of declination  
their distance the scale of distances

N.B. We have never yet thor-  
oughly adjusted the <sup>Chemical</sup> focus for fixed stars.



1855 May 6<sup>th</sup>

# Photography

79

We took some fine series of  
Mizar again least exposure tried  $\frac{1}{4}$   
gave an image - <sup>nearly</sup>  $\frac{1}{2}$  full moon light

Exp. 4. 8. 12. 16. 20. 24  
(A) (B) (C)

Another plate which proved to be badly  
coated gave two ~~exposed~~ images exposure  
each 2<sup>m</sup> 30<sup>s</sup> each to try the 8<sup>th</sup> mag star  
near Alcor but the <sup>star</sup> ~~star~~   
plate was bad.

Took several of  
the Moon in short exposure from 3<sup>s</sup> to  
15<sup>s</sup>. That in 3<sup>s</sup> was light but the outline  
apparently perfect Moon nearly full

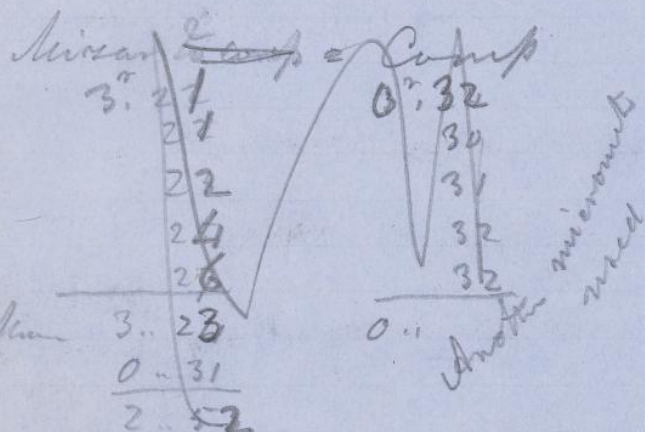


Vide observations made May 22<sup>nd</sup> repeating these measurements with other apparatus. Having suspicions that in consequence of the necessity of not altering the focus of the reading microscope of the transit circle the measures of May 7<sup>th</sup> were not perfectly reliable. Moreover the thickness of the glass must have brought the images nearer or further from the splitflap of microscope & thus have varied the angles measured.

Photographic images of Sirius read off with reading microscope & of Transit Circle

not very round

Plate I April 27



Good image round

Plate II April 28

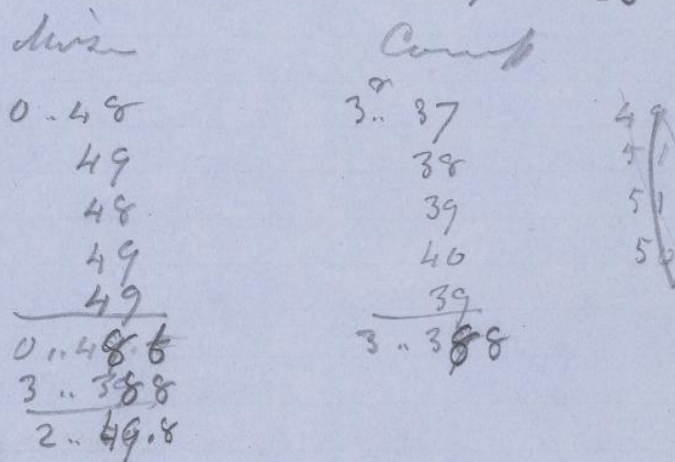
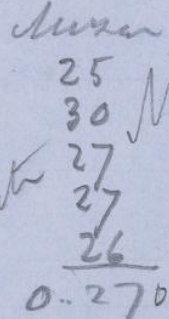
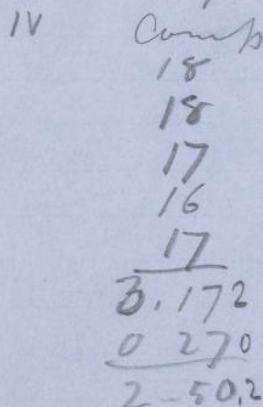


Plate IV April 30<sup>th</sup> small



Plate moved moved



Plate

was Plate VI faint

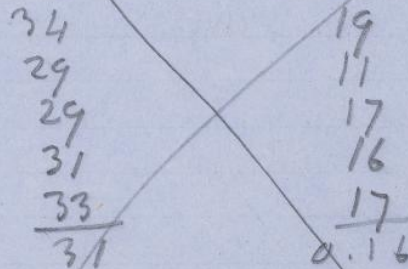


Plate moved



65  
66  
66

Comp  
50  
49  
50  
50  
51

Moved

Plate VI

April 27

Mizar

15

15

17

17

23 moved

0. 17.4

3

7

8

6

7

3. 06.2

0. 17.4

2. 48.8

Plate moves but these  
measurements of VI & I  
were made alternately  
on Mizar and on Comp.

Obsd May 8<sup>th</sup>

Plate VII images small.

Plate VII May 6<sup>th</sup>

Plate I April 27

Comp

7

9

8

8

8

0. 8.0

2. 55.4

2. 47.4

54

56

55

55

57

2. 55.4

Taken

alternately

Mizar

28

28

27

28

28

0. 27.8

0. 41.0

2. 46.8

Comp

39

40

42

12

42

0. 41.0

Plate IV

Mizar

53

52

54

55

53

0. 53.4

0. 39.0

2. 45.6

Comp

39

39

38

40

39

0. 39

On plate VII are 3 images capable of measurement

A B & C

Plate VII - B

Mizar

Comp

04

19

24

40

6

21

25

42

7

23

24

40

7

20

23

39

9

20

26

40

06.7

20.6

24.4

40.2

24.4

40.2

2. 42.3

Plate VII, C

Mizar

Comp

35

51

35

51

34

51

37

51

33

51

3. 32.8

0. 51.0

2. 43.8

II Apr 28

Mizar

Comp

8

21

8

23

11

23

11

24

13

24

3. 10.2

0. 23.0

0. 47.3



The diameter of the companion of Mizar for an exposure of  $15^s$  is  $0.12^d = 1.0''$

That of Mizar is  $= 5.0$

Plate I  
Moon

57  
57  
60  
61  
61  
59.2  
59.8  
49.4

07  
10  
11  
9  
12  
9.8

Plate VI  
comp

08  
09  
9  
10  
14  
10.0  
23.4  
23.4

27  
25  
24  
19  
22  
23.4

Results of Preceding Measurements

The measures are in revolutions and sixtieths of revolutions of the screw of Micrometer A.

The plane of the photographic <sup>image</sup> was made brought into the same plane with the plane of the arc of the circle from which the value of a revolution has been deduced. so that the value ascribed requires no correction.

After reducing the readings to their arc values.

Micrometer A

50° 5' = 5.05  
60 5' = 5.05  
60 5' = 5.03  
90 5' = 4.56  
100 5' = 4.55  
40 5' = 5.03

Def 5' val for  $t = 9$

val for Mean  $\frac{5}{1.01} \frac{5.08}{1.01} = 308 \text{ div}$

$308 \text{ div} = 300''$

168  
14

1.6  
28  
128  
32  
4

974  
6  
5844

308 ) 300 ( 97.4  
2772  
2280  
2156  
1240

974  
308  
7792  
2922  
295942

278  
162  
440

div = 0.974  
1'' =



$$\begin{array}{r} 1800 \\ 224 \\ \hline 2096 \end{array}$$

$$\begin{array}{r} 98 \\ 3 \\ \hline 294 \end{array}$$
83  
38

At middle of graduations

The radius of Transit circle is by arc of  $60^\circ$   
 $R = \frac{1898}{1898}$  revolutions of the micrometer screw of the Great Equatorial - Two opposite arcs gave the same result

1" of Microscope A at distance of photographic image =  $60'' = 58.4''$  1 div =  $0.974''$

The first measurements on May 7 are not used because the plate was found to move while measuring afterwards this was attended to -

$$\begin{array}{r} 16 \\ 50 \\ 21 \\ \hline 91 \\ 53 \\ \hline 144 \end{array}$$

Results

Plate I April 27

$$\begin{array}{r} 2'' 47.4 \\ \hline 49.4 \\ 2'' 48.4 \\ \hline = 2' 43.9 \end{array}$$

Plate II April 28

$$\begin{array}{r} 2'' 47.2 \\ \hline 2'' 47.2 \\ \hline 2' 42.7 \end{array}$$

Plate IV April 30

$$\begin{array}{r} 2'' 45.6 \\ \hline 2'' 41.1 \\ \hline 2'' 41.1 \end{array}$$

Plate VI April 27

$$\begin{array}{r} 2'' 48.8 \\ \hline 46.6 \\ 2'' 47.7 \\ \hline 2'' 43.2 \end{array}$$

Plate VII A May 6

$$\begin{array}{r} 2'' 46.8 \\ \hline 2' 41.3 \end{array}$$

Plate VII B May 6

$$\begin{array}{r} 2'' 42.3 \\ \hline 40.4 \\ 2'' 41.3 \\ \hline 2' 37.0 \end{array}$$

Plate VII C May 6

$$\begin{array}{r} 2'' 43.8 \\ \hline 5 \\ 2' 39.5 \end{array}$$



$$R = \begin{array}{r} 2' . 42'' \sin = 7.19612 \\ 1898 = 3.27830 \\ 0.47442 \\ 0.30103 \\ \hline 0.17339 \end{array}$$

$$\begin{array}{r} 14.81 \\ 30 \\ \hline 14.61 \end{array}$$

$$1.491 \text{ ~~44~~$$

$$\begin{array}{r} \sin 1' 6.46373 \\ \hline 4.20103 \\ 6.76476 \\ 2.7 \quad 0.43136 \\ \hline 7.19612 \end{array}$$

$2' . 42'' . 0$  are on the transit circle is equal to 1491 revolutions of Micrometers of the Great Equatorial

$$\begin{array}{r} \text{Reduced to chemical focus } = 14.61 \\ \text{of circle} = 14.55 \end{array}$$

$$R \quad 3.27830 \text{ " are of } 1' = 5.411 = 0.73329$$

$$2 \text{ } \int 14.61$$

$$\begin{array}{r} 0.17339 \\ 2.7 \quad 0.43136 \\ \hline 74203 \end{array}$$

The above furnish the following results of the photographic measurements of Mizar

$$\begin{array}{rcl} \text{April } 27^{\text{th}} & \text{Distance of Mizar to companion} & = 14.78 \\ \text{" } 28^{\text{th}} & & = 14.67 \\ \text{" } 30 & & = \end{array}$$







Vide Obs. of May 22 & 23<sup>rd</sup>

## Results of foregoing Pho.

## Measurements of Photographic images

Plate					cor. to chem. focus	True photographic distance
I	April 27 <sup>th</sup>	Companion to Mizar	=	14".78 - 0".06	=	14".72
VI	" 27	"	=	14.72	"	= 14.66
II	" 28	"	=	14.67	"	= 14.61
IV	" 30	"	=	14.53	"	= 14.47
VII A	May 6	short exposure	"	= 14.55	"	= 14.5049
" B	" 6	short exposure	"	= 14.16	"	= 14.10
" C	" 6	short exposure	"	= 14.38	"	= 14.32
		Mean		14.54	"	= 14.48

\* The above include errors of reading off by reading Microscope (The method of illuminating & the focus could be much improved)

May 9<sup>th</sup> I find that the chemical focus is  $\frac{1}{10}$  longer than the optical focus and therefore the above distances are to be ~~increased~~ <sup>diminished</sup> in the proportion  $\frac{271}{270} \cdot \frac{270}{271.2} = 1 - \frac{1.2}{270}$  cor. =  $(14.6) \times \frac{1}{270} = -0.06$

The distance of Mizar & comp. in inches was 0.0191  
If we take 6" for the natural focus of the eye we have  
 $\frac{0.0191}{6.0000} = \frac{191}{60000} = 0.00318 = \sin. \phi$

$\phi$  being the apparent angle viewed at 6" distance

$\phi = 11'.04'' = 664''$ . Hence  $\frac{14.5}{664} \cdot \frac{664.0}{14.5} = 45.8 = \text{No. of}$

times magnifying the image is magnified. at the original focus viewed at a dist. of 6"

\* Probably the thickness of the glass plate makes some difference in the above measures. The thinnest plate ought to give the smallest distances



81 Virgins 6/7 x 8<sup>th</sup> Dist 3"

R 13<sup>h</sup> 30<sup>m</sup>  
- 7<sup>m</sup> 08<sup>s</sup>

16.7  
17  
1169  
167  
2839

4.42

9<sup>h</sup> 06

x Bootis p 315

p 321 , 323

185 May 8<sup>th</sup> Photography

A fine evening

Walter Black came up at 9 P.M. we took  
at exposures of 30<sup>s</sup> 22 3 images of  
Lion on Plates 1. 2. 3. 4

- |   |                |        |                                      |
|---|----------------|--------|--------------------------------------|
| 1 | Focus division | 22 1/2 | Next best after 3 or 4               |
| 2 | "              | 23 1/2 | bad no 3 images                      |
| 3 | "              | 20 1/2 | On the whole, the best - one perfect |
| 4 | "              | 19 1/2 | Larger than 1 but very good.         |
| 5 | See next page  |        |                                      |

From comparing the different images  
we concluded to adopt the focus reading 21.0 (which  
on the following day I found to give the chemical  
focus 1.2 from the optical.

N.B. By subsequent examination the long focus  
No. 4 gave round & very strong images. but somewhat  
enlarged

After careful examination 3 gave the  
most perfect image. 4 had two <sup>good</sup> fine images  
part of the differences may be due to time of exposure  
atmosphere &c.

\* Given to Miss Mitchell to take to Europe July 1857.



## Photography

Full moon.

calm.

~~1055 May 8<sup>th</sup>~~~~Full night See previous page~~

we then took plate 5 as below - next  
 we gave about 1<sup>m</sup> exposure for the double star  
 \* 69 P XIV - Bootis - Smyth p 321.

R 14<sup>h</sup> 16<sup>m</sup> Dec 9<sup>o</sup> 6' N. Bright moonlight. Could  
 not find the images by lamplight.

Took the full moon in the center at 11<sup>h</sup> P.M.  
 "moon" "a ~~star~~ negative" in 4<sup>s</sup>  
 and two outlying in less than 1<sup>s</sup> say  $\frac{3}{4}$  of a second.

Mizar

Plate 5.	1 <sup>st</sup> Exposure	= 0.30 <sup>s</sup>	Focus at 21
"	2 <sup>nd</sup>	= 3 " 30	
"	3	= 3 " 30	
"	4	= 3 " 30	
"	5	= 0 " 30	

\* By daylight the images of this  
 star were found very decided but no com-  
 panion could be detected without a magnifying glass.

Its magnitude by Struve is the 5.6<sup>th</sup>. Just  
 visible by full moon light.  
 Companion is differently estimated from 7<sup>th</sup> to 8.9<sup>th</sup>  
 I should have called it 7.8<sup>th</sup>.



To night we adjusted the focus by the  
star Mizar & finally determined upon  
the reading of the focus scale = 21.0 divisions<sup>+</sup>  
The coating of the plate being at the time 4.5<sup>in</sup>  
from the nearest face of the focus tube (at the  
outer face of screw)

I take the reading, 21 div on focus  
scale to be 1.1<sup>in</sup> further out than for use  
for the wire micrometer. The face of  
screw is 4.4<sup>in</sup> from plane of wires of  
micrometer so that the chemical focus  
is longer than optical by  $4.5 + 1.1 - 4.4 = 1.2$ <sup>in</sup>  
(Mr Whipple used 1<sup>in</sup>  $\frac{1}{4}$ )

\* In July & perhaps before we use always  
22.5 for focus reading

July 6 1850 Found 21.7 for focus reading

$1^d = 0.155$ <sup>in</sup> Hence by above measures Chem. focus  
is  $1.2 - 0.155 = 1.0$ <sup>in</sup> longer than optical.



1857 May 13<sup>2</sup>

$\frac{1}{2}$  Bootis mag. 4.5<sup>2</sup> & 6-7, 7"

1857 May 13 = 8<sup>h</sup> 49<sup>m</sup> 58<sup>s</sup> 16" 62° 58' 37" 1  
 No. 9474 7 53 46 62 55  
 9626 9 9 0 13.43 62 57 39.4

hly m in R + 37°  
 " " Dec - 40"

Comet north following star a 9<sup>th</sup> may

236 + 1<sup>m</sup> 26.5

Chromen 236

EE 13.. 5.. 000  
 236. 13.. 6 52.2



# Brosens Comet periodic

diff. dec.	G.P.B. obs.	Zero of position = 125.05
236 = 12 <sup>h</sup> 18 <sup>m</sup> 19.2		47.74
236 = 12 <sup>h</sup> 20 <sup>m</sup> 7.6		5 47.99
236 = 12 <sup>h</sup> 21 <sup>m</sup> 51.8		48.01

## Diff R.

12 <sup>h</sup> 27 <sup>m</sup> 9.0	27 30.6
19.5	42.2
28 4.5	28 27.0
14.7	37.9
29 14.0	29 36.8
24.5	48.0
30 24.0	30 49.6
34.4	59.0

Zero after observations

67.10  
67.8  
67.9

236 = 12 <sup>h</sup> 34 <sup>m</sup> 19.5	48.39
236 = 12 <sup>h</sup> 35 <sup>m</sup> 1.3	48.64
236 = 12 <sup>h</sup> 37 <sup>m</sup> 2.4	48.82
236 = 12 <sup>h</sup> 37 <sup>m</sup> 2.8	
236 = 12 <sup>h</sup> 37 <sup>m</sup> 2.8	

Plan of Star \*

$$236 = 12^h 42^m 37^s \quad \text{of } 242^\circ 47'$$

$$h = \frac{3 \cdot 47 \cdot 20}{8 \cdot 55 \cdot 12}$$

Note there is a star of h 7th mag 12' north of star a and follows it by about 4m

Comet is m. f. \*. Light but little concen-  
trated & inclining to be faint



1857 May 15<sup>th</sup>

The first student made a  
presentation towards the end of course  
discussion

---







# For Daguer Photography

- x  $\alpha$  Leonis
- 6 "
- x Polaris
- 40241 Cephei
- 5 Herculis
- x  $\alpha$  Ophiuchi
- x 2 Bootis
- x  $\beta$ ? Herculis
- x  $\gamma$  " 17<sup>h</sup> 17<sup>m</sup> Dec 37.° 20'
- 2 Leonis
- 7 Leonis
- $\alpha$  Cor. Bor.















To determine some points with regard to Saturn such as its Shadow  
 disappearance of rings - resolution - satellites exact measure of moons & Enceladus  
 Neptune - Both Satellites - ring  
 Venus - satellite - resolution spots  
 Mars - resolution & satellite  
 Uranus - satellite & resolution  
~~Neptune~~ Mercury resolution  
 Asteroids - figures of fragments if any have satellite

Nebulae. Resolution & drawing

Spectrum of the universe - Galaxy Milky way and  
 heavens  
 Photography of the Moon & if possible of the larger planets



1857phae, proj. 175B  
Cassini says  $1650 \pm$  that Saturn is used up  
includes to determine the <sup>material</sup> mass of the ring

When the expedition is ended - instrument to detect  
observe ~~name~~ zones - for future expedition







40,  $\frac{1}{2}$  turns of pendulum series  
of Equatorial Clock change clock  
motion from sidereal to lunar



1857phae.proj...1752