Venus: End of Apparition Report Eastern Elongation 2011-2012.

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Abstract

Presented here is an end of apparition report based on the observations made by the author of Venus during the eastern elongation of 2011-2012. After some introductory remarks in §1, we examine the features observed on the disk in §2. In §3, the unilluminated disk and the Ashen Light is discussed, while in §4 we look at the limb band. Observations regarding the terminator of the planet are discussed in §5, and the polar regions in §6. In §7 we discuss the results of using the W#47 and W#21 filters. In §8 we give the plots of Theoretical phase vs. observed phase (in IL, W#47 and W#21). In §9 we comment on the transit of Venus which was glimpsed from the beach of Selsey in the UK. and finally in §10 we give some concluding remarks.

Start: 2012 January 02 **Finish:** 2012 May 26th

Greatest Eastern Elongation: 2012 March 27th

Number of Observations made: 23 **Number of Drawings made:** 44

Theoretical Phase (max)= 82%, *D*=13" **Theoretical Phase (min)**= 3.5%, *D*= 43.9"

Filters: W#47 (violet), W#21 (Orange), W#12 (Yellow), W#25A (Red)

Instruments Used:

- 203mm Newtonian Refl., (Knighton Observatory, Leicester UK)
- 317.5mm Newtonian Refl., (P Moore's Observatory, Selsey UK)

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1. Introduction

The 2011-12 eastern elongation of Venus was one of the best elongations in the general eight year cycle of evening elongations. The planet reached a good altitude and dominated the

evening sky with its brilliance. Indeed the author observed the planet on a number of occasions in full day light; the planet being very easy to detect in a bright sky.

A total of 23 observations were made of the planet, and 44 disk drawings were made of the planet. Disk drawings were made on Venus blanks (50mm in diameter), with the phase carefully drawn in at the telescope. Any surface features which were apparent were then added to the drawing. Neat drawings were made inside and added to the Venus Observing Book (Vol.2).

Phase estimates were made by measuring the disk drawings made at the telescope. Estimates were made in integrated light (IL) and also with the filters W#47 and W#21. Plot of IL against theoretical phase (along with W#47 vs. theoretical, and W#21 vs. theoretical) can be found in Section

2. Illuminated Disk

During the 2011-12 elongation, there were a number of interesting features present on the disk. As a rule, features took the form of grayish blue dusky patches or streaks, sometimes elusive. Often the cloud features appeared different when various filters were employed as is shown in figure 1:

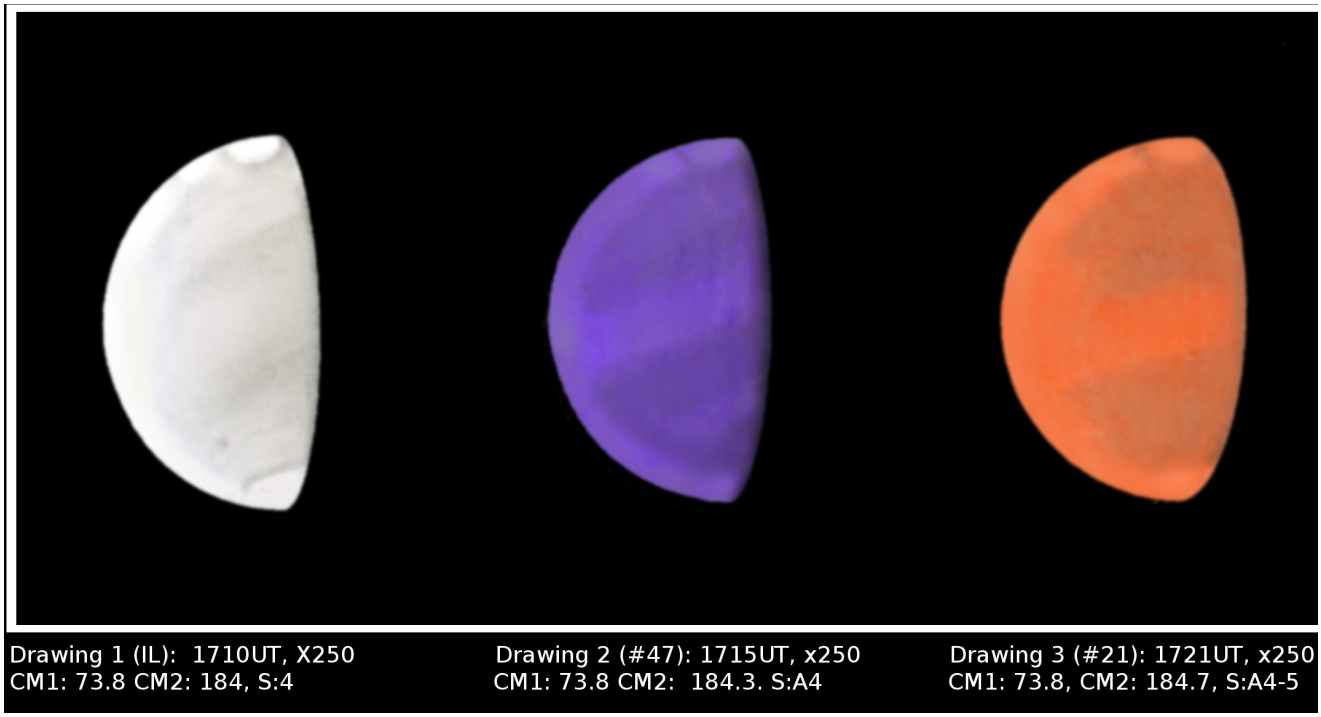


Figure 1: Three drawings of Venus made by the author on 2012 February 3rd with a 203mm Newtonian. Cloud features visible in IL take on different structures in W#47 and W#21.

Occasionally, particularly dark features were observed. On 2012 April 10th, some notable dark features were present on the disk (figure 2).

Figure 2: Drawing of Venus made by the author on 2012 April 10th with a 203mm Newtonian.

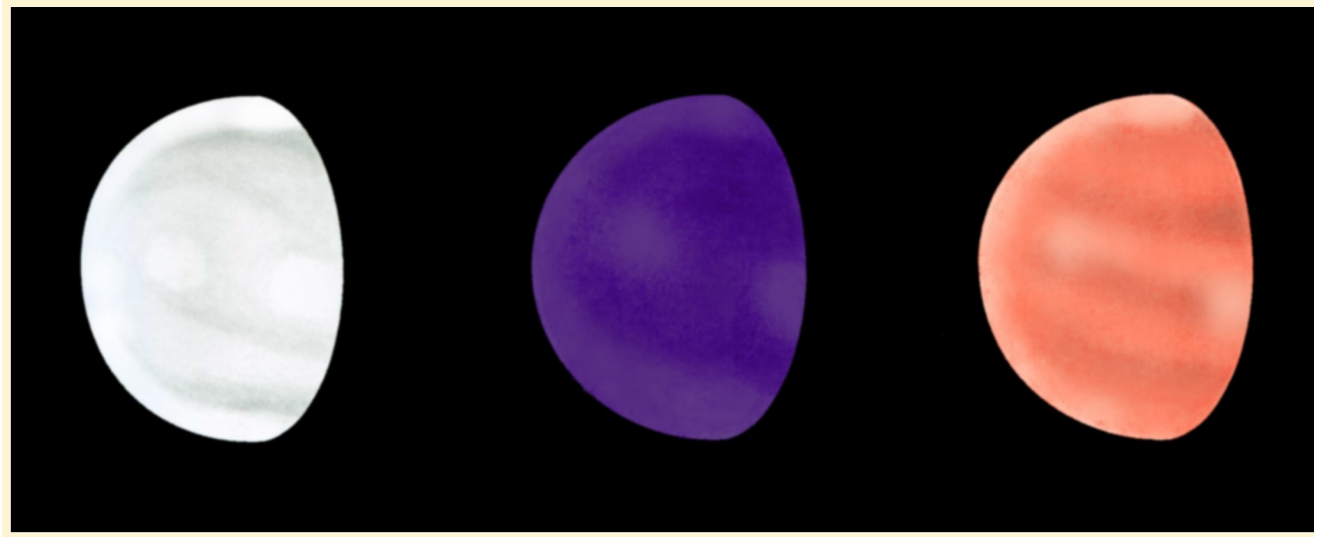
As well as streaks and dark regions, bright spots also appeared on the disk. On 2012 January 14th, two bright spots were visible on the disk (figure 3). The bright spots appeared both in IL and in the W#47 and W#21 filter suggesting they were a real feature. On 2012 February 19th, there appeared to be a bright spot situated quite close to the South Polar Region (figure 4). The spot was most prominent in IL, but was also detectable in the W#21 filter. It seemed less well defined in the W#47.

3. Unilluminated Disk & the Ashen Light

There was much speculation that this elongation might produce the controversial Ashen Light, the phenomena whereby the night side (or some portion) of the planet appears to be visible and glowing a greenish-grey colour . Although controversial, the light has persisted for many hundreds of years. One argument against the Ashen Light being a real phenomena is that it has never been imaged. However if we consider the number of people who image the planet when the phase is small, this is not surprising.

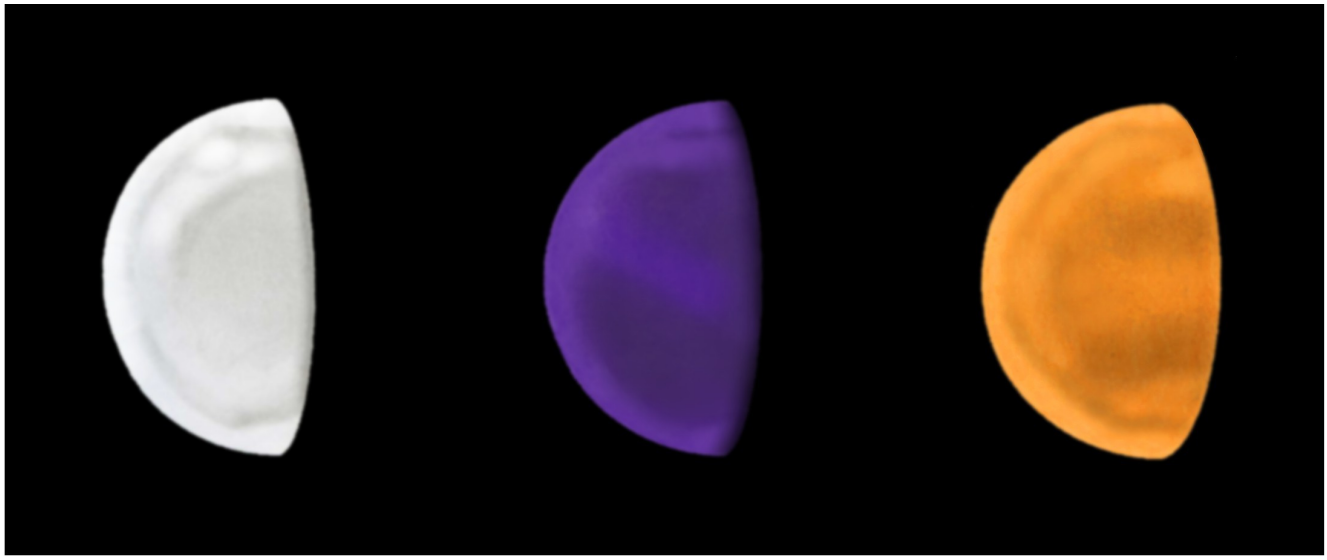
It is certainly true that when the crescent of Venus drops bellow 15%, it becomes incredibly brilliant, and causes all sorts of internal reflections inside the telescope (as the author can

attest!).



Drawing 1 (IL): 1653UT, x167 CM1: 20.1 CM2: 244.6 | Drawing 2 (#47): 1718UT, x167 CM1: 20.1 CM2: 246.1 | Drawing 3 (#25A): 1729UT, x167 CM1: 20.1 CM2: 246.8

Figure 3: A bright spot is present on the disk and appears in IL, W#47 and W#21 suggesting it is a feature of the Cytherean atmosphere. The observation was made by the author on 2012 January 14th with a 203mm Newtonian in reasonable conditions



Drawing 1 (IL): 1728UT, x250 CM1: 116.2 CM2: 135.3 S: AIII | Drawing 2 (W#47): 1809UT, x250 CM1: 116.3 CM2: 137.8 S:AIV | Drawing 3 (W#21): 1800UT x250 CM1: 116.3 CM2: 137.3, S:AIV

Figure 4: A bright spot situated near the SPC? Drawing made by the author on 2012 February 19th in fair conditions with a 203mm Newtonian.

Although there is not a great deal of analysis devoted to the subject, two papers which stand out are Richard McKim's Ashen Light report based on the observations of H. McEwen and P. Moore [1], and C Russell and J. Phillips analysis of the Ashen Light published in the journal for Advanced Space Research [2]. In particular, a statistical analysis done in [2] suggests the phenomena is real, rather than psychological in nature.

Indeed, if the phenomena was entirely physiological, one would expect two things to be the case:

- Firstly, one would expect those observers who reported the light to make repeat observations at similar phases of the planet for similar elongations. In fact this is rarely the case. Many observers who report the Ashen Light might go for many years before sighting it again. This would be true even if it was a rare physiological condition.
- Secondly the Ashen light ought to be observed during every elongation by a consistent number of observers. Again this is not the case. Indeed [2] suggests the light might be more prevalent in eastern elongations (though this may be due to the increased number of observers). It also seems that some decades have had more episodes of the Ashen Light reported than other decades.

If the light is indeed a real phenomena, then it must be admitted that the mechanism behind the phenomena has remained elusive. The author discounts the the explanation of the light being the result of the hot surface becoming visible through a thinning of the Cytherean the clouds due to the fact that any such photons transmitted in the event would be in the IR range of the spectrum and well beyond the capability of the human eye to detect.

The other explanation offered is the effect is caused by rapid lightening in the upper atmosphere of Venus. In particular Russell and Phillips [2] suggest this as the mechanism based on calculations undertaken by Williams *et al.* [3]. They suggest that if lightening were the cause, a flash would have to have an intensity of 10-1 W m-2. They conclude that if lightening is as frequent on Venus as it is the Earth, then the light from the ionization of Carbon Dioxide atoms would be visible.

If this is indeed the mechanism, then one would expect the 2011-12 elongation to produce the Ashen Light since we are approaching a solar maximum, and the atmosphere of Venus may well become more electrically charged due to the influx of charged particles from the active sun.

On 2012 April 25th an Ashen Light alert was sent by Richard McKim (director of the BAA's Mercury and Venus Section). In the alert it was reported that an experienced observer had seen the Light on 2012 April 24th from 2100UT. Alas the skies were cloudy in Leicester and the author was unable to observe the planet. Indeed conditions were poor from that point onwards, and only three more observations were made of the planet all in a light or twilight sky, and so the Ashen Light was neither observed nor suspected by the author.

4. Bright Limb Band

The bright limb band was always visible and complete. Towards the end of the elongation when the phase was small, this was all that was seen of the planet. An interesting phenomena was observed on the evening 2012 March 01. The author, using a 203mm Newtonian observed a bright 'wedge' shaped object in the bright limb band. The object encroached on the darker markings visible on the disk and was visible in both a W#47 and a W#21 filter (see figure 5)

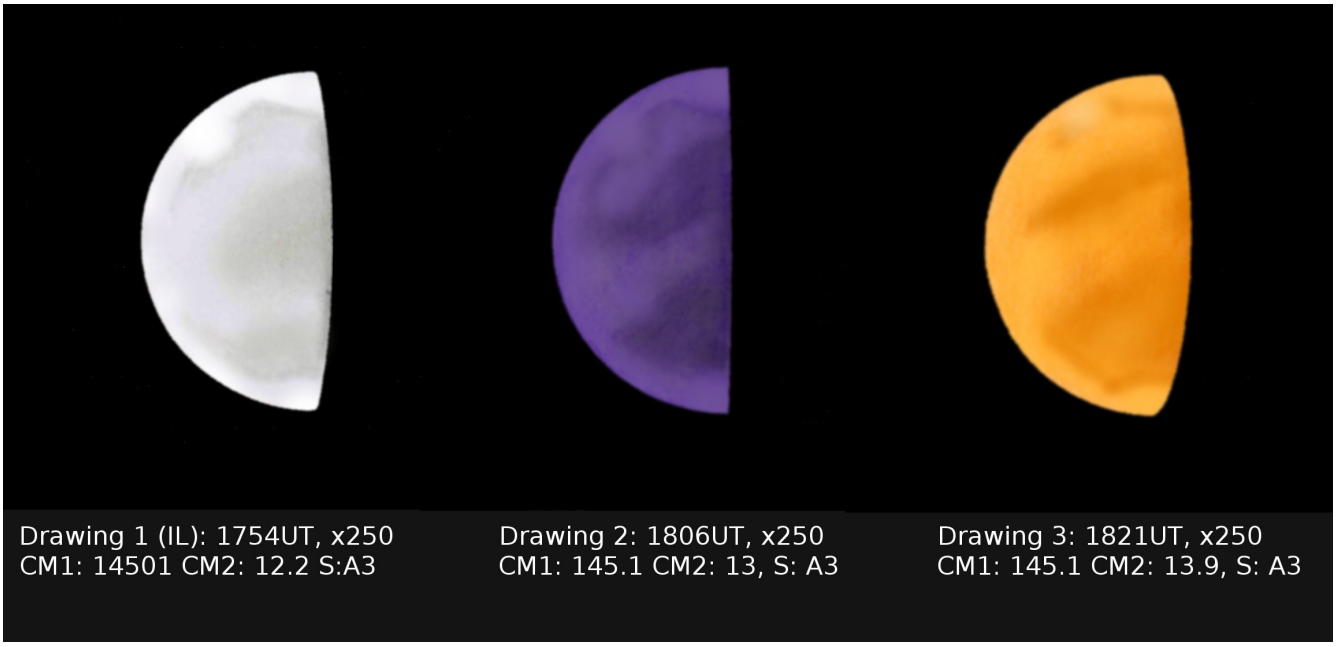


Figure 5: Unusual, bright 'wedge' shaped object observed on the evening of 2012 March 01 with a 203mm Newtonian. The marking was also present in both W#47 and W#21 filters

5. Terminator

The terminator of the planet was nearly always geometrically regular except for one occasion: on the evening of 2012 March 19th, when the planet appeared to be at dichotomy (although the theoretical phase was around 55%) an irregular terminator was seen (figure 6). Interestingly, the effect was more pronounced in the W#47 filter, and much less obvious in the W#21 filter. The effect in the IL observation seemed to be about halfway between W#21 and W#47.

Very often, a dark greyish shading was present on the disk very close to the terminator. The shading appeared to be variable and was striking on some occasions, but more elusive on others.

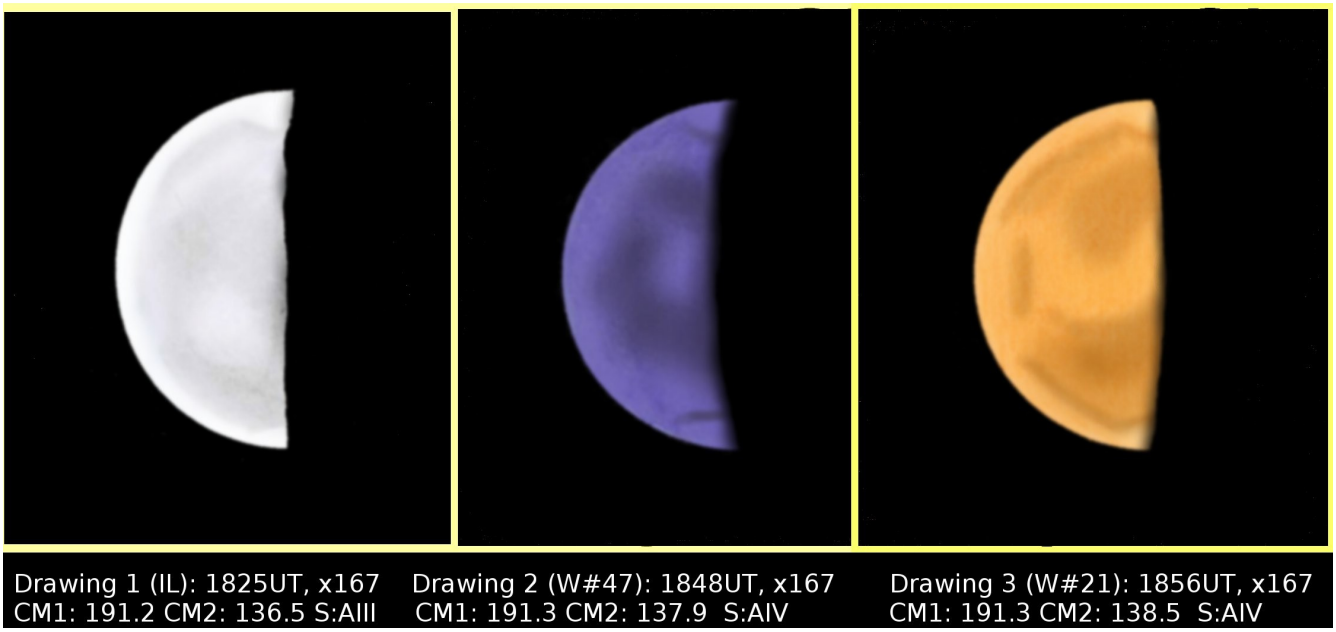


Figure 6: Three drawings showing an irregular terminator as observed by the author with a 203mm Newtonian on the evening of 2012 March 19th. Seeing conditions variable.

6. Polar Regions

Both the north and south poles of the planet usually consist of a bright polar hood which is bordered by darker 'cusp collars'. The polar hoods seemed to demonstrate some variability both in size and intensity during the 2011-12 elongation.

At the start of observations it seemed that the cusps were about equal in size, with the northern polar hood being being brighter. However as the elongation progressed, it appeared to be the case that the SPC increased in size and brightness becoming the more prominent and larger than its northern counterpart. It appeared that the southern cusp cap may have extended slightly onto the night-side on 2012 March 19th (see figure 6), however seeing conditions were highly variable on that evening, and it was impossible to be certain of this.

An interesting effect occurred on 2012 March 24th. On that evening it seemed that the north cusp cap was sharper than it's southern counterpart (see figure 7). This effect was also noted by R. McKim on the same evening [4].

As the phase of the planet becomes very small, the cusps of the planet extend around the planet. The author only observed this once on the last day of Venus observations. In the early evening of 2012 May 26th, it appeared that both the north and south cusp collars had extended by a few degrees. Seeing conditions were rather poor however, and it was impossible to make an exact measurement of the extensions.

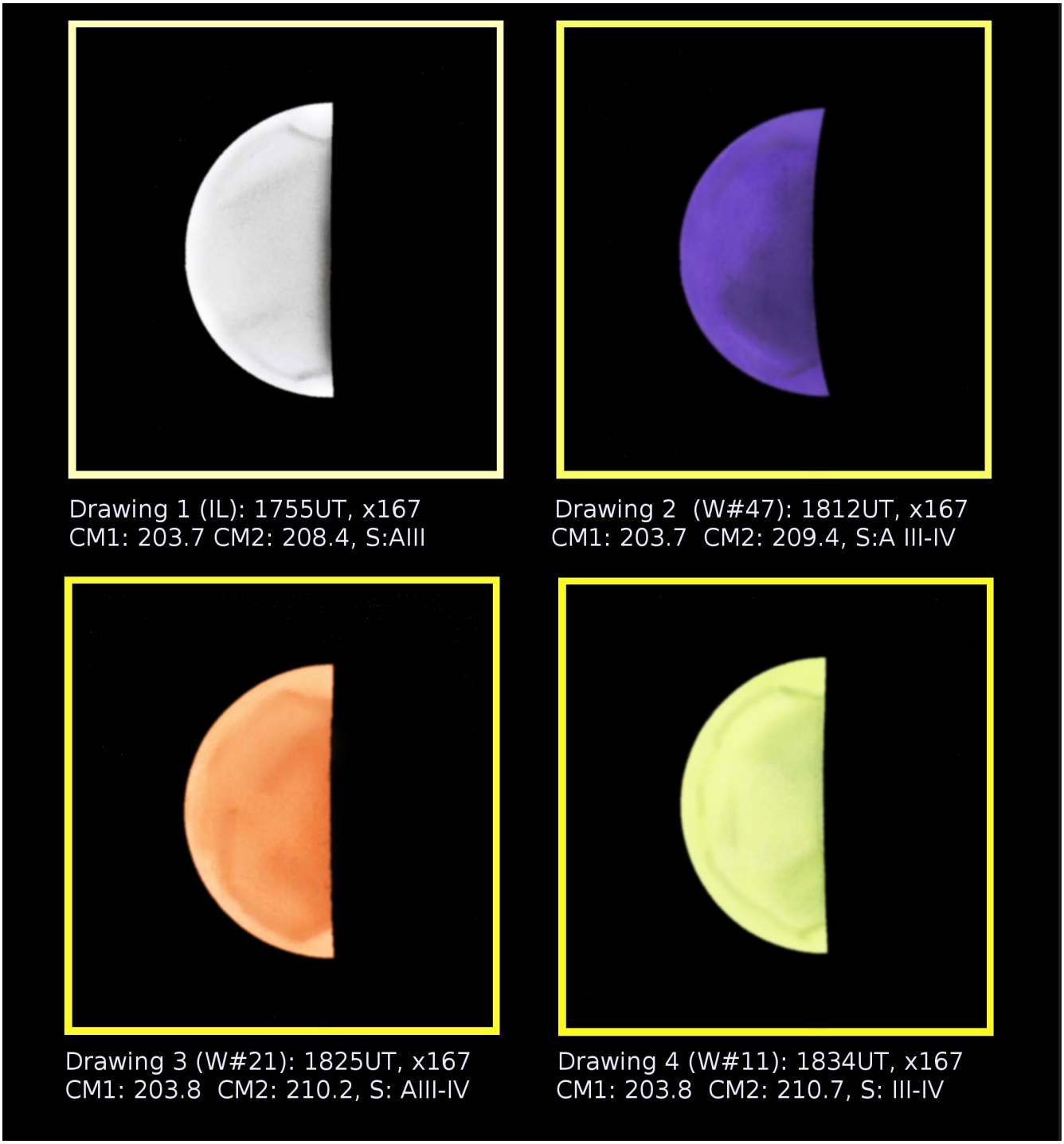


Figure 7: Observation of Venus made on 2012 March 24th by the author with a 203mm Newtonian. It appeared that the Northern cusp was sharper than the southern one.

7. Filter Work

Over the course of the elongation, the author made frequent use of a W#47 and W#21 to record the disk markings and to make phase estimates, and occasionally a W#12 and W#25A to extend the number of different wavelengths to observe the planet in. In general, markings in IL could appear quite different when observed in different filters. This being the result of restricting observations to a particular wavelength and thus observing different levels of the planet's atmosphere. It was always the case that the observed phase was much smaller than the theoretical phase in the W#47, and much closer to the predicted phase when a W#12 or W#21 filter was used.

8. Phase Estimates

Phase estimates were made in IL, and with a W#47 and W#21 filter. To ensure consistency, observations were made with the same telescope, eyepiece and filters. The results were as follows:

Venus Phase Measurements (IL)Eastern Elongation 2011-2012.

Paul G. Abel

All estimates made with at Knighton Observatory (203mm Newtonian Reflector)

Date	UT	CM1	CM2	Th (%)	IL (%)	DateTime
2012-01-02	17:30	347.7	283.6	82.4	82	02/01/2012 17:30:00
2012-01-11	17:03	12	344.4	80.1	78	11/01/2012 17:03:00
2012-01-14	16:53	20.1	244.6	79.3	76	14/01/2012 16:53:00
2012-01-23	17:44	44.4	31	76.7	68	23/01/2012 17:44:00
2012-02-01	16:41	68.4	8.4	74	64	01/02/2012 16:41:00
2012-02-03	17:10	73.8	18.4	73.4	61	03/02/2012 17:10:00
2012-02-19	17:28	116.2	135.3	67.8	63	19/02/2012 17:28:00
2012-02-24	17:44	129.4	210.6	65.8	64	24/02/2012 17:44:00
2012-03-01	17:54	145.1	12.2	63.4	56	01/03/2012 17:54:00
2012-03-05	16:55	155.3	35.6	61.7	56	05/03/2012 16:55:00
2012-03-09	18:28	165.8	348.9	59.9	54	09/03/2012 18:28:00
2012-03-19	18:25	191.2	136.5	55.1	50	19/03/2012 18:25:00
2012-03-24	17:55	203.7	208.1	52.5	50	24/03/2012 17:55:00
2012-04-05	19:32	233.2	174.4	45.6	42	05/04/2012 19:32:00
2012-04-10	21:06	245.1	253	42.3	38	10/04/2012 21:06:00
2012-05-10	20:22	306.7	319.1	17.9	12	10/05/2012 20:22:00
2012-05-12	19:12	309.8	126.6	16	10	12/05/2012 19:12:00
2012-05-26	17:17	328.1	237.5	3.8	3	26/05/2012 17:17:00

Table 1: Phase Estimates of Venus made by the author in Integrated Light

Venus Phase Measurements (W#47)Eastern Elongation 2011-2012.

Paul G. Abel

All estimates made with at Knighton Observatory (203mm Newtonian Reflector)

Date	UT	CM1	CM2	Th (%)	W47 (%)	DateTime
2012-01-14	17:18	20.1	246.1	79.3	76	14/01/2012 17:18:00
2012-02-01	17:01	68.4	9.6	74	61	01/02/2012 17:01:00
2012-02-24	18:00	129.4	211.5	65.8	60	24/02/2012 18:00:00
2012-03-01	18:06	145.1	13	63.4	52	01/03/2012 18:06:00
2012-03-05	17:27	155.3	357.9	61.7	51	05/03/2012 17:27:00
2012-03-09	18:43	165.8	349.8	59.9	50	09/03/2012 18:43:00
2012-03-19	18:48	191.2	137.9	55.1	47.5	19/03/2012 18:48:00
2012-03-24	18:12	203.7	209.4	52.5	47	24/03/2012 18:12:00

Table 2: Phase as measured with a W#47 filter

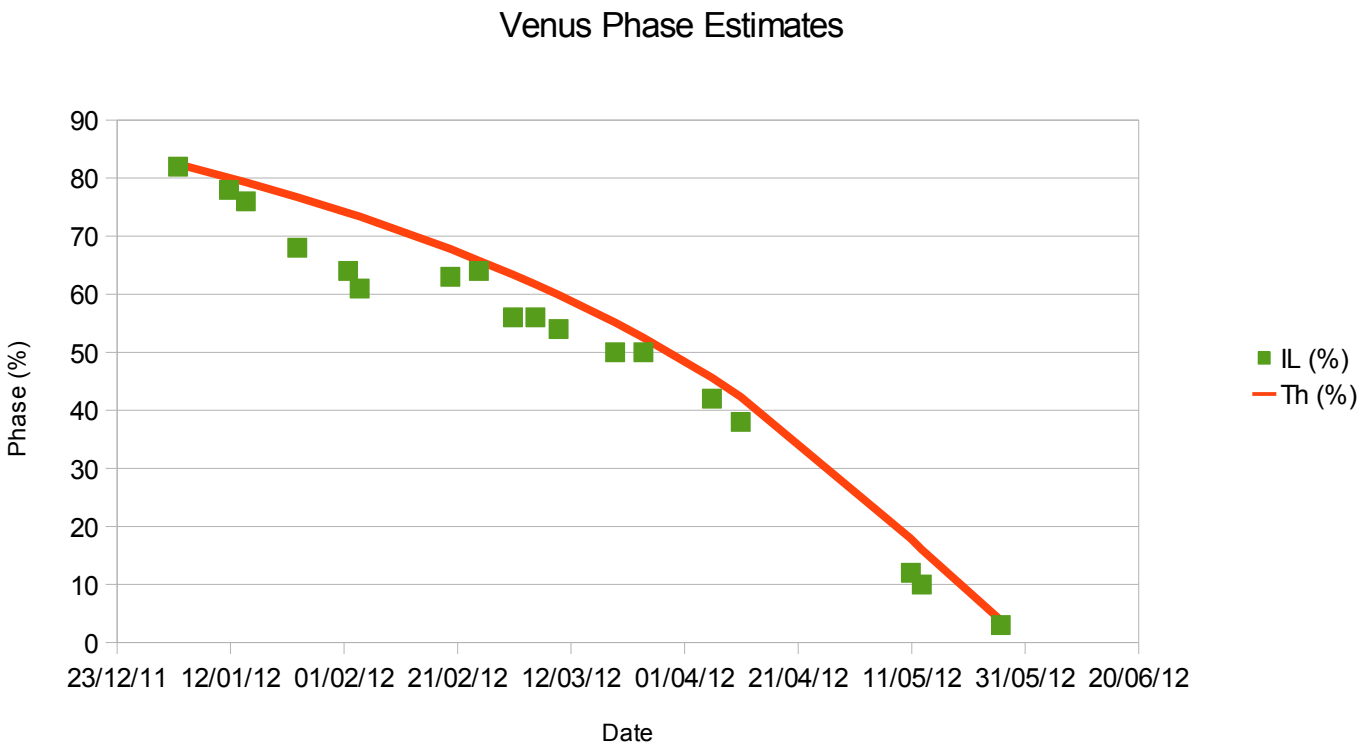
Venus Phase Measurements (W#21)Eastern Elongation 2011-2012.

Paul G. Abel

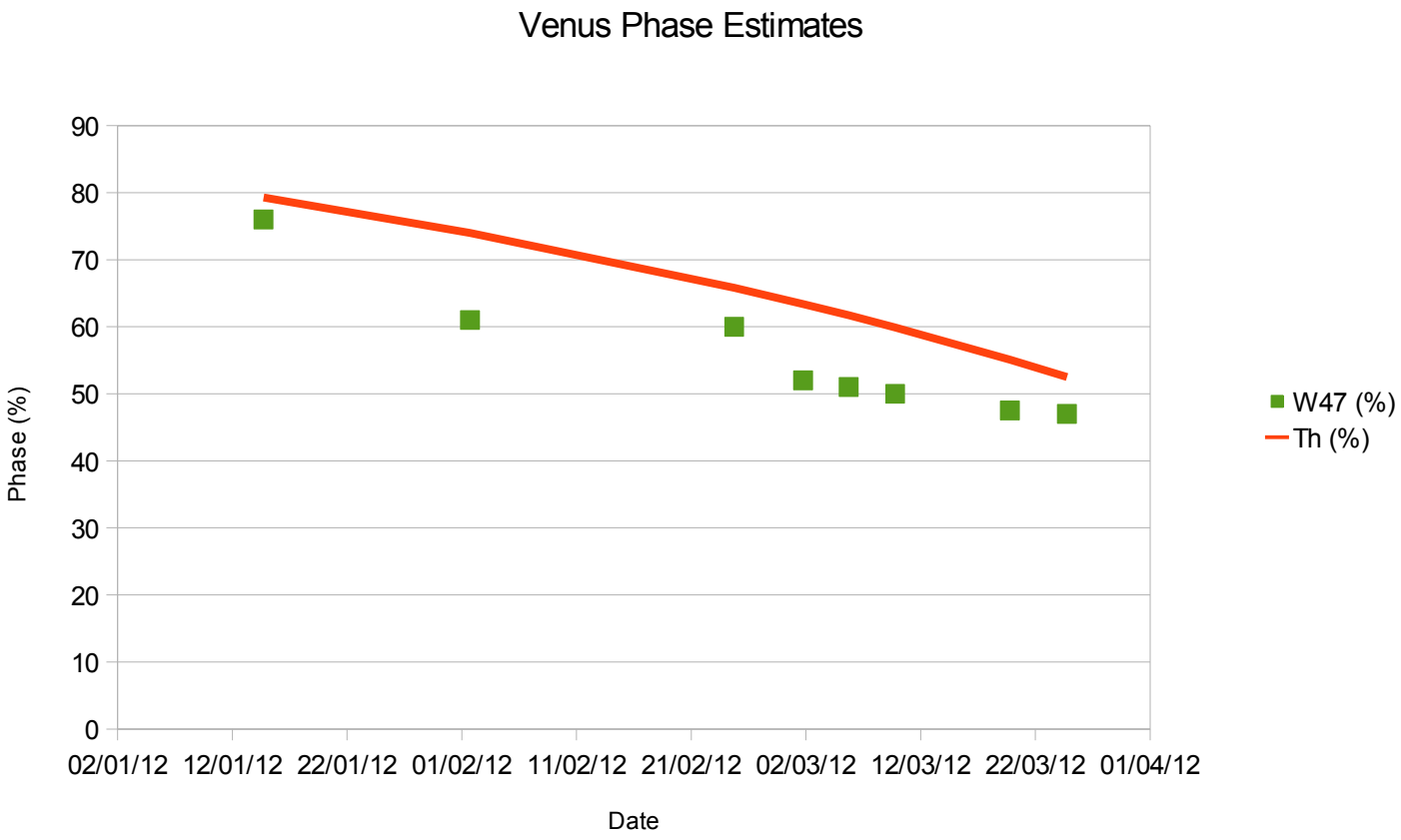
All estimates made with at Knighton Observatory (203mm Newtonian Reflector)

Date	UT	CM1	CM2	Th (%)	W21 (%)	DateTime
2012-01-14	17:29	20.1	246.8	79.3	76	14/01/2012 17:29:00
2012-02-01	17:18	68.4	10.7	74	67	01/02/2012 17:18:00
2012-02-24	18:25	129.4	213	65.8	65	24/02/2012 18:25:00
2012-03-01	18:21	145.1	13.9	63.4	60	01/03/2012 18:21:00
2012-03-05	17:39	155.3	358.7	61.7	56	05/03/2012 17:39:00
2012-03-19	18:56	191.2	138.5	55.1	54	19/03/2012 18:56:00
2012-03-24	18:25	203.7	210.2	52.5	50	24/03/2012 18:25:00

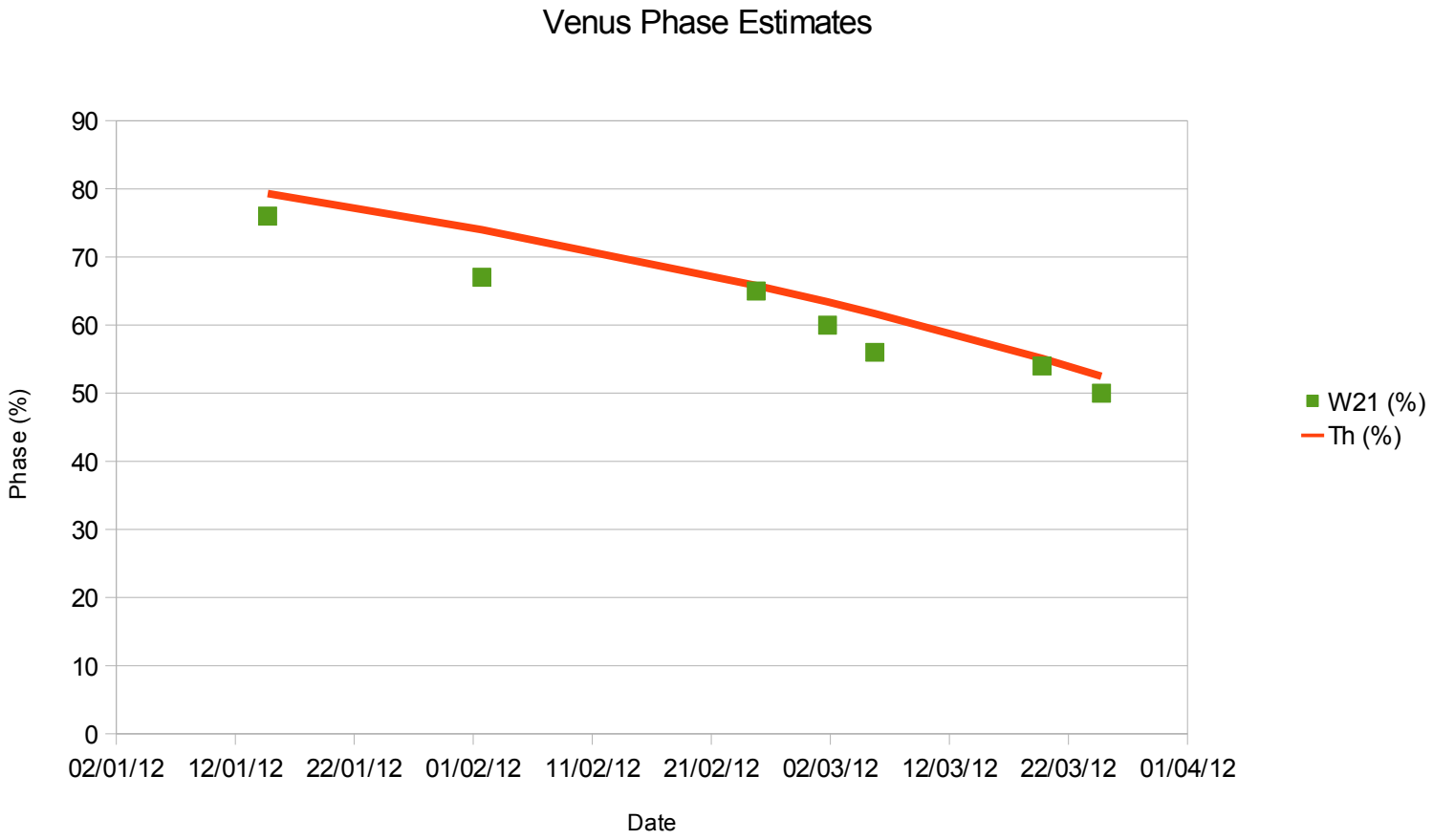
Table 3: Phase estimates made with a W#21 filter



Plot 1: Plot of Phase vs. Date. The green points are the observed phase in IL, the orange curve represents the theoretical phase.



Plot 2: Plot of Phase vs. Date. Phase measurements made with a W#47 filter are represented by green points, the orange curve is the theoretical phase.



Plot 3: Plot of Phase vs. Date. Here measurements of phase with a W#21 are given by the green points, the solid orange curve represents the theoretical phase.

9. Transit of Venus

On 2012 June 6th, Venus passed in front of the Sun. The next such transit will take place on 2011 December 10-11th so clearly this would be the last transit to be viewed for many generations.

In the event the author traveled to Selsey to view the transit there, and an article covering the event for the *Sky at Night* magazine by the author can be found here [5]. Although conditions were cloudy, in the early hours of the morning there was a slight clearing, and the author managed to see the transit. Alas the clear conditions did not last for long and there was no time to make a drawing.

10. Concluding Remarks

The 2011-12 elongation was an interesting one, and only hampered by poor weather in the UK. A number of interesting features were observed on the disk including spots, dark markings, and an irregular terminator. Although an Ashen Light alert was put out by the BAA's Mercury and Venus section, due to poor weather the author was unable to confirm it.

For much of the elongation it seemed that the south cusp cap was larger than it's northern counterpart.

Filters were very useful in this elongation, showing different cloud structures at different wavelengths. The phase of the planet always appeared to be much less than the the theoretical one. The phase was always smallest in a W#47 filter, and closer to the theoretical one in the W#12 and W#21 filters. Dichotomy appeared to occur (in IL) on 2012 March 24th.

A number of observations were made in a light sky, and the author intends to continue observing the planet in daylight hours so that coverage of western elongations can be made.

References

[1]. "*The Ashen Light: A Century of Observation by McEwen and Moore.*" R. McKim, JBAA, **117**, 5, 2007

[2]. "The Ashen Light," C. T. Russell & J. L. Phillips, Adv. Space. Res., **10**, 5, 1990.

[3]. *"The Transmission to Space of the Light produced by Lightning in the Clouds of Venus,"* M. A. Williams, L. W. Thomason, and D. M. Hunten, Icarus, **52**, 166-170, 1982

[4]. "Venus in 2011-'12: fourth interim report," R. McKim, JBAA, **122**, 3, 2012.

[5]. "Transit of Venus 2012," P. Abel, Sky at Night magazine website: http://www.skyatnightmagazine.com/feature/miscellaneous/transit-venus-selsey