The 2018–'19 eastern & western elongations of Venus

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A report of the Mercury & Venus Section. Director: P. G. Abel

Presented here is a report covering observations of Venus during the 2018–'19 eastern and western elongations. Part I concerns observations made by Section members during the eastern elongation, while Part II deals with the western elongation. Images and drawings submitted to the Section are presented for analysis and various aspects of the planet's appearance during the period considered are commented upon.

Part I: The 2018 eastern elongation of Venus

The 2018 eastern elongation was a poor one for UK-based observers, with the planet situated low down in the summer skies. In spite of its altitude, a small number of dedicated observers made frequent observations covering much of the elongation. Most of those received by the Section were good-quality images showing Venus in both UV and IR wavelengths. Some visual observations were also received and as we shall see in this report, they compare quite favourably to images taken in UV. A list of contributing observers (along with their instrumentation and location) for both the eastern and western elongations is given in Table 1.

Table 1. Observers of Venus, 2018–'19

Observer	*Location*	*Instrument*	*Elongations*[+]
P. G. Abel	Leicester, UK	203mm Newtonian	A, B
G. Adamoli	Verona, Italy	125mm MCT, 235mm SCT	A, B
M. Arauju	Evóra, Portugal	203mm SCT, 279mm SCT	A
D. Arditti	Edgware, UK	355mm SCT	A
D. Basey	Norwich, UK	358mm Newtonian	A, B
C. Dole	Newbury, UK	180mm MCT	A, B
D. Graham	Yorkshire, UK	230mm MCT	A
C. Briden	York, UK	90mm OG	A
R. Hill	Tucson, USA	203mm MCT	A
S. Kidd	Herts, UK	355mm SCT	A
W. Leatherbarrow	Sheffield, UK	300mm SCT	A
M. Lewis	St. Albans, UK	222mm Newtonian	B
N. MacNeill	Wattle Flatt, Australia	356mm SCT	B
R. J. McKim	Peterborough, UK	90mm OG	A, B
E. Morales	Aguadilla, Puerto Rico	305mm SCT	A
D. Neichoy	Göttingen, Germany	C8 (203mm SCT)	A, B
R. Palgrave	Newcastle, UK	355mm SCT	A, B
D. Peach	Southampton, UK	Chilescope	A

[+] A= 2018 E, B= 2018–'19 W.

SCT and MCT = Schmidt–Cassegrain and Maksutov–Cassegrain telescopes, respectively.

Venus passed through superior conjunction on 2018 Jan 9. At such times Venus, the Sun and the Earth lie on a straight line, with the Sun between Venus and the Earth. The planet emerged into our evening skies and achieved a modest altitude. During this time, a number of observers sent in valuable observations showing Venus at high phase. The situation did not last however and by early May, the planet was very low down by sunset.

Theoretical dichotomy (half phase) occurred on 2018 Aug 15 and Venus reached greatest eastern elongation on Aug 17, when it was situated 46° east of the Sun. The planet continued to draw closer to Earth, now presenting its distinctive crescent phase to telescopic observers. Finally, Venus reached inferior conjunction (passed between the Sun and the Earth) on 2018 Oct 26; this marked the start of the 2018–'19 western elongation with the planet located in the morning skies.

Cloud features

It is often said that the telescopic view of Venus is disappointing, with the planet showing little more than a blank white disc. While it is true that cloud markings of the Cytherean atmosphere are somewhat elusive, those observers sensitive to the blue end of the spectrum will be able to see the distinctive 'Y'-shaped cloud markings and other bright spots and streaks which come and go.

Many imagers now have access to good-quality UV and IR filters. Observations made in these wavelengths are invaluable, frequently revealing interesting structures and details which are invisible to the human eye.

A number of observations from when Venus presented a high phase show cloud formations. Araújo's image (Figure 1a), obtained using a UV filter on 2018 Mar 25, shows a 95% illuminated

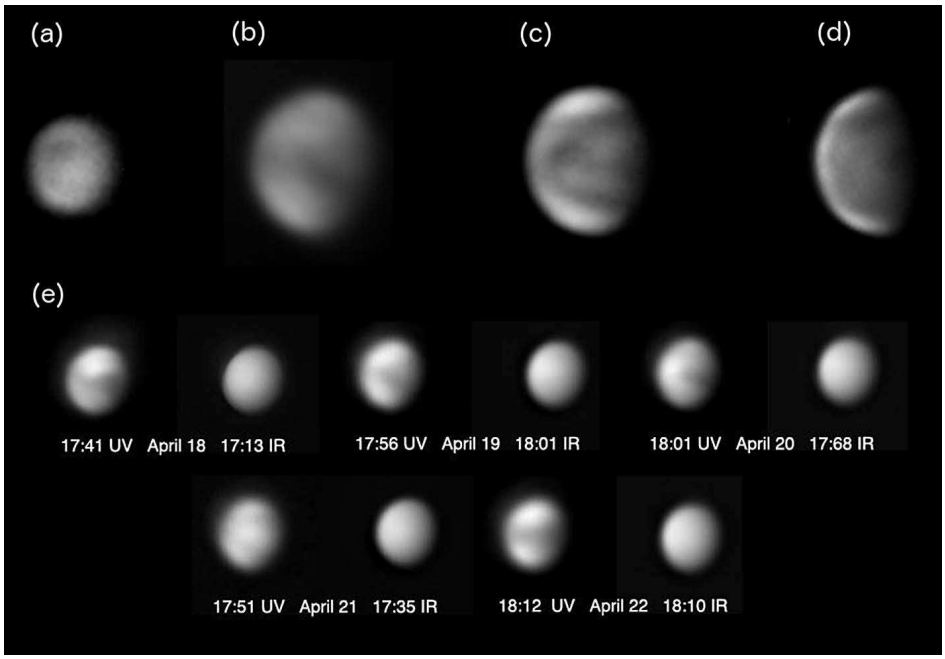

Figure 1. A selection of 2018E images showing interesting features on the disc.

(a) 2018 Mar 25, 17:59 UT; 203mm SCT & Astrodon UV filter. *Miguel Araújo*

(b) 2018 Apr 19, 18:44 UT; 180mm Mak.–Cass. & Baader U Filter. *Chris Dole*

(c) 2018 May 8, 02:16 UT; 203mm Mak.–Cass. & Astrodon Venus UV filter. *R. Hill*

(d) 2018 Jun 22, 18:55 UT; 300mm OMC & UV filter. *William Leatherbarrow*

(e) 2018 Apr 18–22; 14-inch, 355.6mm SCT, Astronomik 742nm filter & Astrodon 'Venus' filter. *David Arditti*

Venus with a prominent dark marking in the far south, and more subtle shadings in the north.

Arditti took a good series of images on 2018 Apr 18–22 in both UV and IR (Figure 1e). This sequence is interesting and shows the apparent rotation of a dark cloud along the equator. While the feature is striking in UV, it is entirely absent in IR images taken at about the same time. On 2018 Apr 19, Dole took a good UV image of Venus (Figure 1b) showing the same dark marking as recorded by Arditti.

Similar dark features were recorded by visual observers around this time: Abel made a series of filter drawings (Figure 2a), showing dark markings which were more prominent when viewed in the W47 (Wratten number) violet filter. On 2018 May 8 McKim observed dark markings, his drawing of which (Figure 2c) compares nicely to the same features imaged by Hill in UV (Figure 1c). In his drawing on 2018 Jun 22 (Figure 2b), Graham observed dark markings in the far south along with prominent shading close to the terminator; again this compares very favourably to the UV image taken by Leatherbarrow on the same day (Figure 1d).

Cusp caps & collars

The cusp caps are bright regions covering the north and south poles. Telescopically they can resemble large polar ice caps – indeed, before spacecraft visited the planet, this was one theory advanced to account for them. The current model suggests that the caps are composed of bright clouds. The cusp collars are dark bands close to the base of each cap, containing regions of cooler air and polar vortices.

It is known that the polar regions of Venus are extremely dynamic, with large bright clouds forming and dissipating over intervals of a few hours. This phenomenon was recorded by the ESA *Venus Express* mission,[1] which also revealed the surprising existence of a cold atmospheric layer some 130–140km above the polar regions, with a temperature of about –157°C.[2]

Both cusp caps and collars were present throughout the elongation and were recorded by imagers and visual observers. The cusp caps were not constant in either size or intensity; sometimes both appeared equal, and on other occasions one cap was larger or more prominent than the other.

Figure 3 illustrates the different appearances of the cusp caps and collars. Leatherbarrow's image (Figure 3a) has bright cusp caps, with perhaps the northern one being slightly more prominent. In Dole's image (Figure 3b) the southern cusp cap seems to be absent, while the northern is present. Graham observed a bright north polar cap which seemed to extend beyond the terminator (Figure 3c). In fact it is clear from all of the images and drawings given in this paper that the cusp caps and collars varied considerably throughout the elongation.

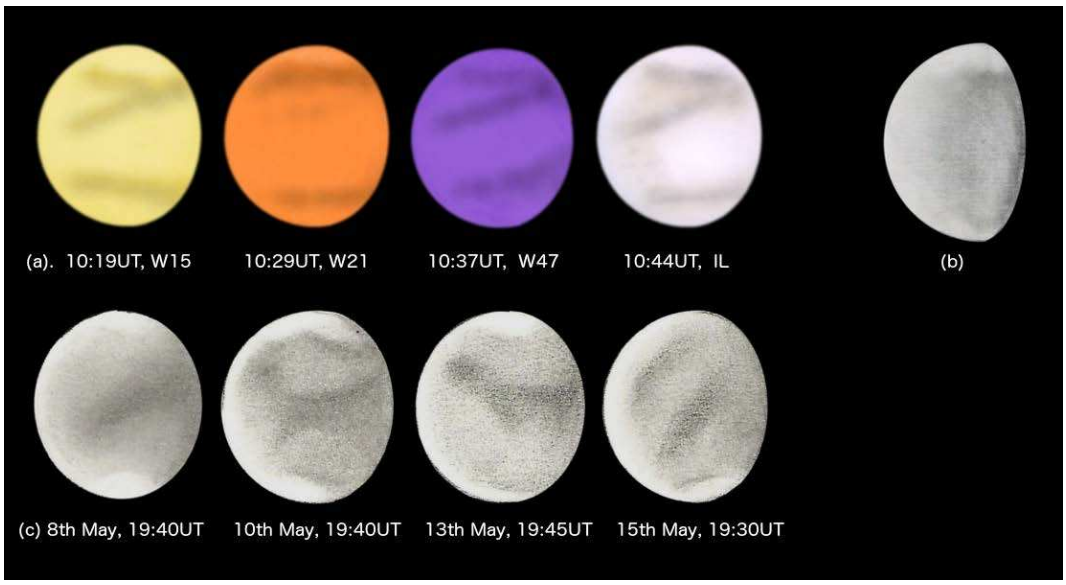

Figure 2. Visual observations of Venus in 2018E.

(a) 2018 Apr 5; 203mm Newtonian; ×111 & 162 (filters and UT given in figure). *Paul G. Abel*

(b) 2018 Jun 22, 18:15 UT; 230mm MCT; ×155. *David Graham*

(c) 2018 May 8–15; 76mm OG; ×120. *Richard McKim*

Dichotomy

One of the aims of the Section is to use visual observations to determine the date of observed dichotomy – the time when Venus appears to be 50% illuminated. Theoretical dichotomy took place on 2018 Aug 15, however the Schröter effect would have made Venus appear to be at half phase some time before the theoretical date. The usual method of determining the true date is to plot the observed phase against time, of as many visual observers as possible, and extrapolate from the graph the date at which a phase of 50% was (or would have been) observed.

Unfortunately, by this date Venus was very poorly placed in the sky and so few observations were sent to the Section during the critical time. The Director was unable to access Venus at this stage due to the low altitude; McKim was the only visual observer to obtain a reasonable number of visual observations of a suitable quality, allowing for a reasonable measurement of the phase.

McKim's observations would seem to place dichotomy on 2018 Aug 11 (Figure 4). A number of imagers sent in UV observations around this time (Figure 5) and these observations support this date as about the time dichotomy would have been visually observed.

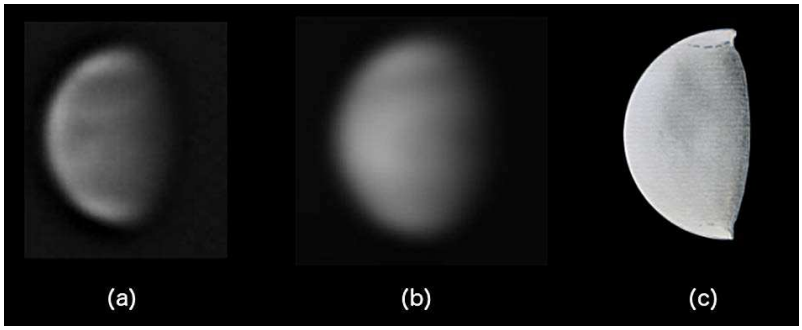

Figure 3. Bright cusp caps and prominent collars.

(a) 2018 Jun 14, 18:18 UT; 300mm Mak.–Cass.; ASI 290 MM UV. *William Leatherbarrow*

(b) 2018 May 22, 20:21 UT; 180mm Mak.–Cass.; ASI 290 MM & Baader U (350nm UV). *Chris Dole*

(c) 2018 Jul 19, 18:40 UT; 230mm MCT. *David Graham*

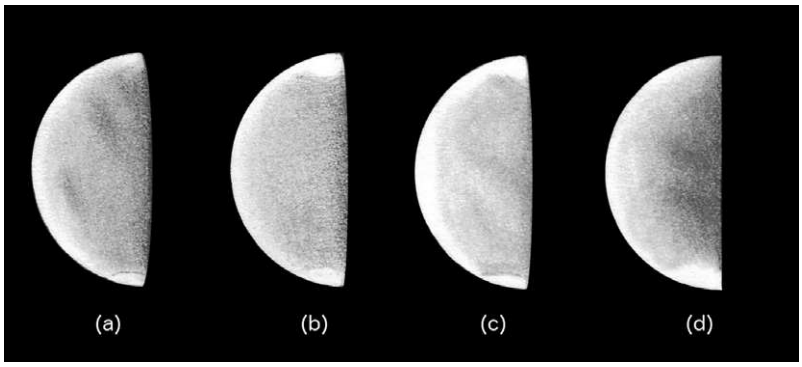

Figure 4. A series of drawings made by Richard McKim with a 76.2mm OG (×120), which would place the date of dichotomy around 2018 Aug 11. **(a)** 2018 Aug 3, 19:50 UT. **(b)** 2018 Aug 4, 19:48 UT. **(c)** 2018 Aug 6, 19:47 UT. **(d)** 2018 Aug 11, 18:40 UT.

Nightside observations

A number of IR filters and cameras are now available to amateur astronomers and their introduction into the field is to be welcomed. Such devices will greatly increase the scope of amateurs who wish to investigate the nightside of Venus. Indeed, fascinating results have already been obtained by Australian amateurs Anthony Wesley and Phil Miles,[3,4] whose images may be the first to record active volcanoes on the nightside of the planet.

During the 2018 eastern elongation, the Director received no images of the nocturnal hemisphere. This is not surprising, since it can only be imaged when Venus is in the crescent stage and at this time the planet was at a very low altitude.

Inferior conjunction

Dole successfully managed to take an image of the planet around this time (Figure 6), showing the very thin crescent with no apparent cusp extensions.

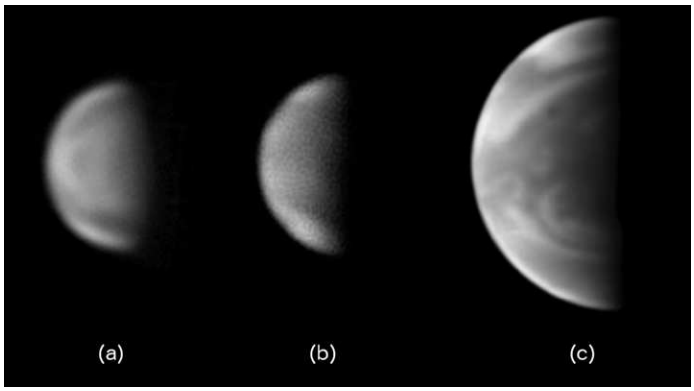

Figure 5. A series of images taken by a number of Section members around the time of dichotomy. These observations seem to indicate that Aug 11 is a reasonable estimate for visually observed dichotomy.

(a) 2018 Jul 12, 19:04 UT; 279mm SCT; ASI 290 MM & Astrodon UV filter. *M. Araújo*

(b) 2018 Aug 4, 02:22 UT; 203mm Mak.–Cass.; Skyris 445 & Astrodon Venus UV filter. *R. Hill*

(c) 2018 Aug 5, 22:35 UT; Chilescope. *D. Peach*

Figure 6. Image of Venus taken by Chris Dole close to the time of superior conjunction, on 2018 Oct 26 at 12:29 UT.

This marks the end of the 2018 eastern elongation and the beginning of the 2018–'19 western elongation.

Part II: The 2018–'19 western elongation

Western elongations tend to attract fewer observers than eastern ones; matters were made worse by the low altitude of the planet for much of the elongation. As a result, far fewer observations were received by the Director compared to the previous eastern elongation.

A small group of Venus observers (Table 1) did manage to send in a number of observations, and although coverage of the planet is far from complete, there are enough observations to allow for a general discussion on its appearance and behaviour in the 2018–'19 western elongation.

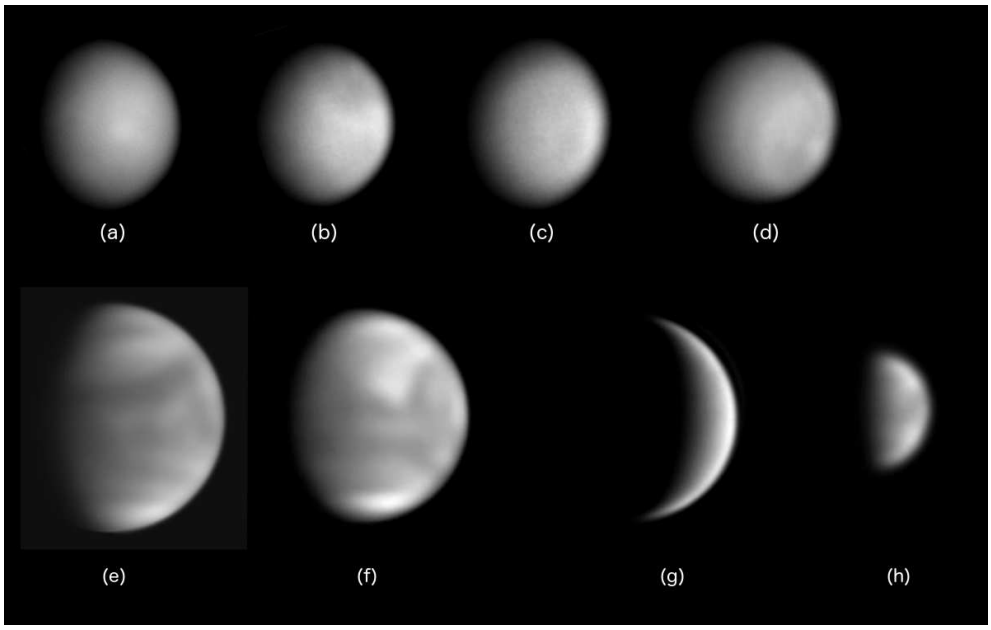

Figure 7. A selection of images taken by Palgrave (a)–(d), MacNeill (e)–(f) and Dole (g)–(h).

(a) 2019 May 15, l0:58 UT; 355mm SCT; ZWO ASI 224 MC-S; F IR 850nm.

(b) 2019 May 16, 07:09 UT; 355mm SCT; ZWO ASI 224 MC-S; F IR 850nm.

(c) 2019 May 22, 06:52 UT; 355mm SCT; ZWO ASI 224 MC-S; N IR 685nm.

(d) 2019 May 29, 0559UT; 355mm SCT; ZWO ASI 224 MC-S; N IR 685nm.

(e) 2019 Mar 11, 20:01 UT.

(f) 2019 Apr 20, 20:33 UT.

(g) 2019 Dec 4, 06:49 UT; 180mm Mak.–Cass.; Baader U (350nm UV).

(h) 2019 Jan 30, 07:40 UT; 180mm Mak.–Cass.; Baader U (350nm UV).

Cloud markings

A number of interesting cloud formations were recorded by observers during the elongation. Observers who recorded the planet in UV obtained the best images of the cloud markings, and those visual observers sensitive to shorter wavelengths were also able to make out some interesting cloud structures. Figure 7 shows a number of images displaying a variety of phenomena. Figure 7a–d is a series of IR images taken by Palgrave. Although cloud markings are harder to see in IR, some darker markings can be made out. Of interest are the bright spots visible on the limb of the planet.

MacNeill recorded some striking cloud details as shown in (e)–(f); the familiar 'Y'-shaped cloud band is quite evident in (e). Dole's image of the planet in the crescent stage, (g), shows the dark terminator shading well, and a broad dark equatorial band is present in an observation made in (h).

Visual observers also recorded interesting cloud bands, with many of the drawings sent in by Adamoli, Basey, McKim, Neichoy and the Director. The form and structure of the cloud markings in a number of the drawings are quite similar to those recorded by imagers using UV filters.

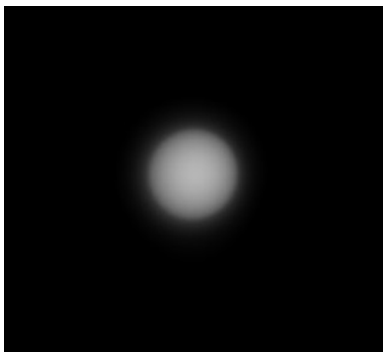

Figure 9. IR image of Venus at superior conjunction on 2019 Aug 14, 09:34 UT with a 180mm Mak.–Cass.; W25 filter & IR cut. *Chris Dole*

Cusp caps & collars

As in the previous elongation, both the cusp caps and collars varied in intensity and size. Both Adamoli and the Director recorded the caps varying in size and brightness; Adamoli frequently recorded both collars.

Early in the elongation Dole recorded a bright southern cap (Figure 7h), but later it seemed that the northern cap had become brighter. MacNeill's image (Figure 7f) shows a bright northern cap, and a similar view was recorded by the Director around this time. Overall, it seems that the northern cusp cap may have been larger and brighter than the southern, but there are too few observations to make any definite conclusions.

Dichotomy

Theoretical dichotomy occurred on 2019 Jan 5, with greatest western elongation occurring on Jan 6. Unfortunately, very few visual observations were received around this time, and many of them were affected by poor seeing.

Due to cloudy conditions, the Director was unable to observe the planet before dichotomy. McKim made a good series of drawings shortly after dichotomy (Figure 8). McKim's drawings would imply that observed dichotomy took place sometime between Jan 9 & 14.

Nightside observations

No observations of the nightside of Venus were submitted. Similarly there were no reports of the Ashen Light communicated to the Director.

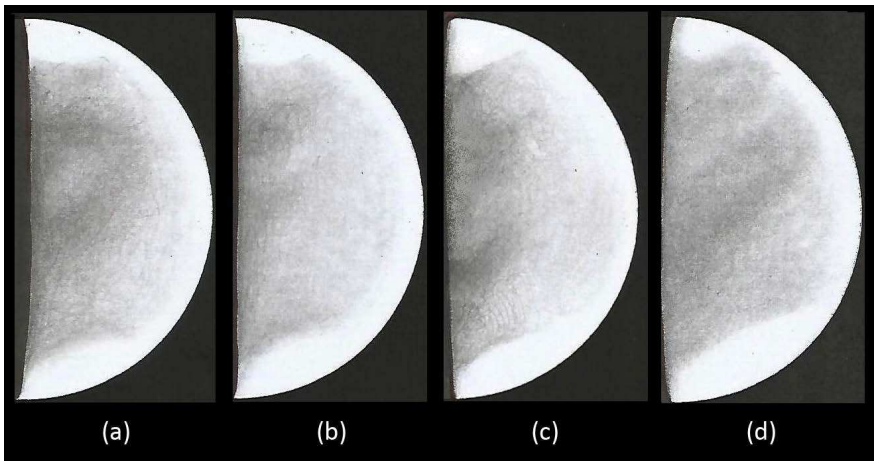

Figure 8. A series of drawings made by Richard McKim shortly after dichotomy, using a 75mm OG; ×120. **(a)** 2019 Jan 8, 07:45 UT. **(b)** 2019 Jan 9, 07:45 UT. **(c)** 2019 Jan 14, 07:40 UT. **(d)** 2019 Jan 17, 07:40UT.

Superior conjunction

On 2019 Aug 14, Venus passed through superior conjunction and this brought to a close the 2018–'19 western elongation. At this time Dole obtained an excellent image of the planet (Figure 9). His image, made in IR, shows Venus at almost full phase when the planet was just 1.3° west of the Sun.

Conclusions

Although both the 2018 eastern and 2018–'19 western elongations were poor ones for UK observers, a small number of Section members succeeded in providing reasonable coverage of the planet. Observations continue to show that UV imagers and visual observers sensitive to shorter wavelengths can record the darker markings in the Cytherean atmosphere, some of which display considerable structure.

The cusp caps and collars continue to show variability, and from the observations received it seems that during both elongations, on average, the northern cusp cap was more frequently the larger and brighter.

Although it was not possible to give an exact date of dichotomy in either elongation due to the lack of observations, it does seem clear that dichotomy followed the usual rule of being earlier in the eastern elongation and later in the western; this is particularly evident in McKim's drawings made around the time of dichotomy.

No nightside observations were communicated to the Director in either elongation and there seem to be no reports of the Ashen Light being observed. Recording the nightside requires imaging of the planet in IR during the crescent stage, and in both elongations the planet was rather low down – this no doubt accounts for the paucity of observations.

Both inferior and superior conjunctions were observed by Dole – observations of Venus made during this time are particularly challenging given the small separation between Venus and the Sun.

On 2019 Aug 14, the new 2019–'20 eastern elongation of Venus began. This is a good elongation for UK observers, with the planet well-placed in the evening sky. The Director hopes that Section members will continue to communicate their observations to him, and that those BAA members who have not observed Venus much before will try to do so as it becomes prominent over the next few months. As ever, the Mercury & Venus Section will be happy to support both regular and new observers of our enigmatic neighbour.

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References

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