The 2019 transit of Mercury

Paul G. Abel

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

Presented here is a short report discussing the observations communicated to the Director regarding the transit of Mercury which occurred in 2019. A number of interesting features were recorded by those BAA members who were able to observe the transit, which was a difficult one for UK-based observers.

Introduction

On 2019 Nov 1 the innermost planet, Mercury, passed across the face of the Sun. This astronomical event is known as a transit and is a phenomenon unique to the inferior planets, Mercury and Venus. While transits of Venus are comparatively rare, those of Mercury are much more frequent. The previous transit of the planet occurred on 2016 May 9 and was well observed from the UK by BAA members.[1]

The 2019 transit of Mercury occurred in winter for UK-based observers – this meant a greater likelihood of poor weather and of course the Sun was lower in the sky. Weather conditions were indeed rather bad, with heavy rain and wind over much of the country, but nonetheless a number of observers did manage to see either part or all of the transit. Those members who communicated their observations to the Section are listed in Table 1.

The exact times of the transit were given in the BAA *Handbook*.[2] First contact, when Mercury appeared to touch the SE limb of the Sun, was predicted to occur at 12:35:26 UT. Just before then, observers using telescopes fitted with H-alpha filters would have been able to observe the planet against the Sun's spicule layer. A spicule is a region of hot plasma in the chromosphere of the Sun, typically about 500km in diameter and only visible in H-alpha.

Once on the solar disc, Mercury proceeded (at a somewhat leisurely pace) to move in a straight line towards the NW limb, with the point of greatest transit predicted at 15:19:47.4 UT. Last contact, which marks the point where Mercury has left the solar disc and is on the NW limb, was due to occur at 18:04:14 UT.

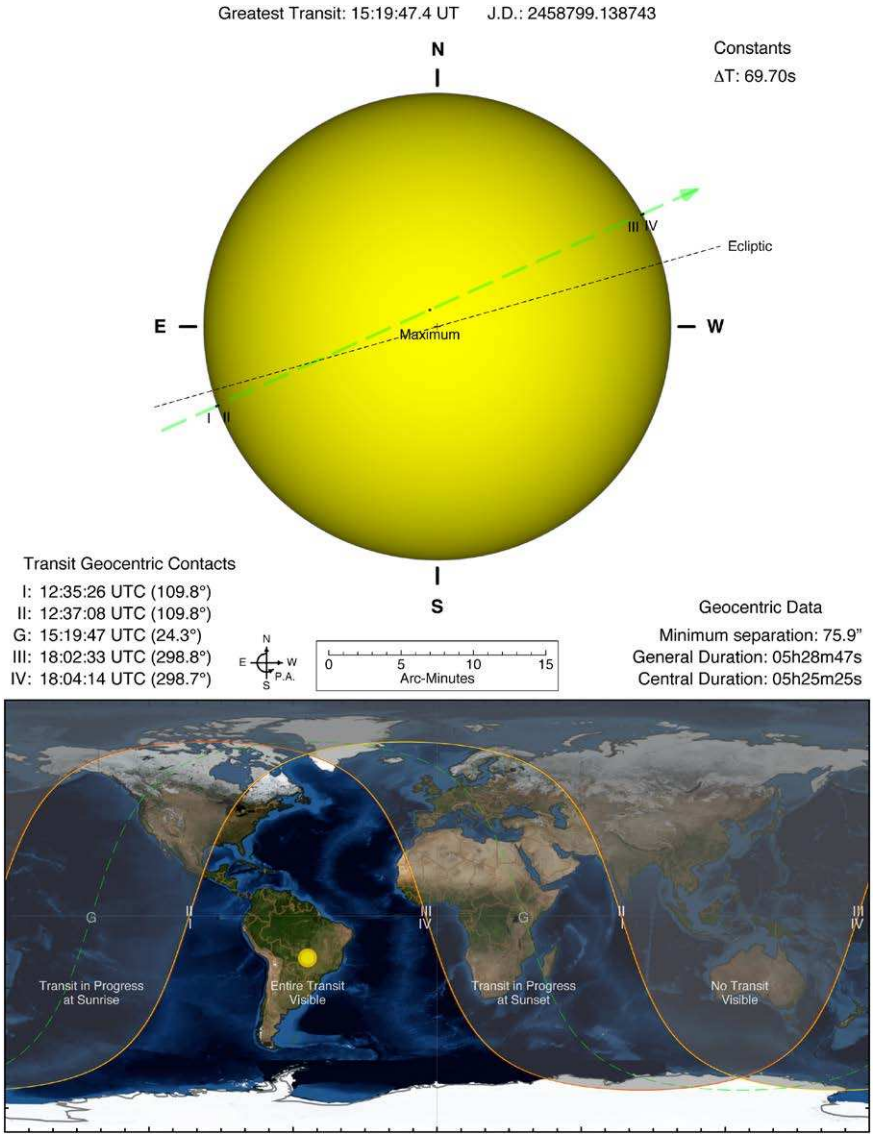

Figure 1. Geocentric diagram and visibility map, showing the details of the transit and its visibility across the Earth. *Mercury Venus Transit Maestro, Xavier M. Jubier (http://xjubier.free.fr/)*

For observers based in the UK the final part of the transit could not be observed, as last contact occurred after the Sun had set; as a result the duration of the transit for London was 3h 58m 25s. As can be seen in Figure 1, the transit was in progress at sunset for most of Europe and Africa. However, for some eastern parts of Canada and the US, and all of South America, the whole event could be viewed. For Australia, Russia and the Asian subcontinent, the transit could not be observed.

Members' observations of the transit were presented in issue 2 of *Messenger*, the Section newsletter.[3] This included an account written by the Mercury Coordinator, Chris Hooker, who together

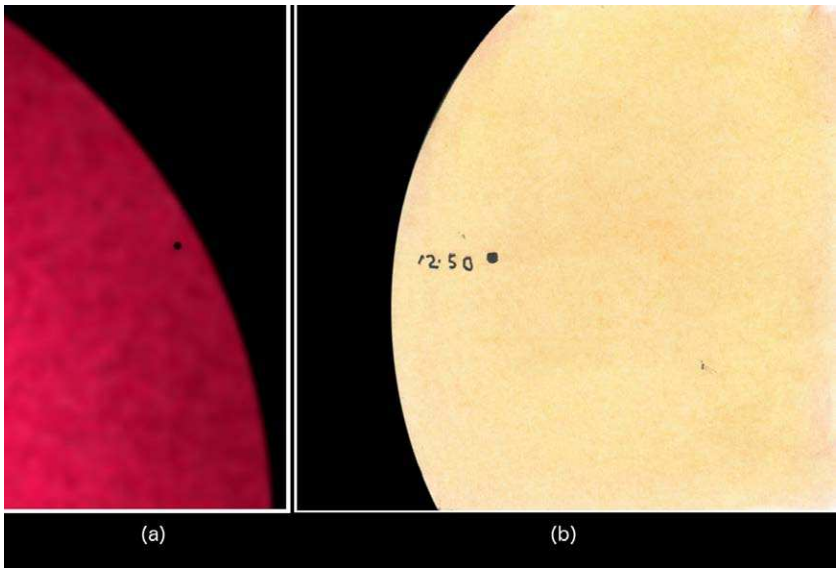

Figure 2. Two drawings made by the Director and Alan W. Heath. **(a)** H-alpha drawing showing Mercury close to the limb near the start of the transit, at 12:37 UT. 40mm PST; ×44 (south is up). *P. G. Abel*. **(b)** White-light drawing made at 12:50 UT with a 76mm OG; ×90 (north is up). *A. W. Heath*.

Table 1. Observers of the 2019 Nov 11 transit of Mercury

Observer	*Location*
Paul Abel	Leicestershire, UK
David Arditti	Edgware, UK
Ella Bryant	Bristol, UK
Peter Carson	Essex, UK
Alan Dowdell	Stoke Andover, UK
Dave Eagle	Raunds, UK
Gary Gawthrope	Florida, USA
Massimo Giuntoli	Italy
Brian Halls	West Sussex, UK
Alan W. Heath	Nottinghamshire, UK
Derek Hufton	UK
Nick James	Chelmsford, UK
Ron Johnson	Surrey, UK
Manos Kardasis	Greece
Pete Lawrence	Leicestershire, UK
Jack Martin	Essex, UK
Dave McCraken	Lincoln, UK
Rob McKay	Havant, UK
Peter Meadows	Essex, UK
German Morales	Bolivia
Andrew Paterson	Hampshire, UK
David Scanlan	Hampshire, UK
Michael Stephanou	Athens, Greece
Nick Turner	Cheshire, UK

with other members of Newbury Astronomical Society visited the Francis Baily Primary School in Thatcham to allow the children at the school to observe the transit. Good weather conditions prevailed and they were able to see most of the ingress phase, during which time a five-minute video was recorded through a Meade LXC-10 SCT with a Baader AstroSolar filter. This video is available to view at the Section website.

The observations

Although poor conditions prevailed, a total of 24 contributors managed to make observations of the transit. Four Section members submitted visual observations; these were Heath, Meadows, Scanlan and the Director. The Director (observing with Pete Lawrence) made a number of visual observations in H-alpha. It was particularly hoped that Mercury could be seen visually against the spicule layer of the Sun, however unfortunately the skies were insufficiently clear to permit this. Figure 2a shows a drawing made by the Director at the start of the transit.

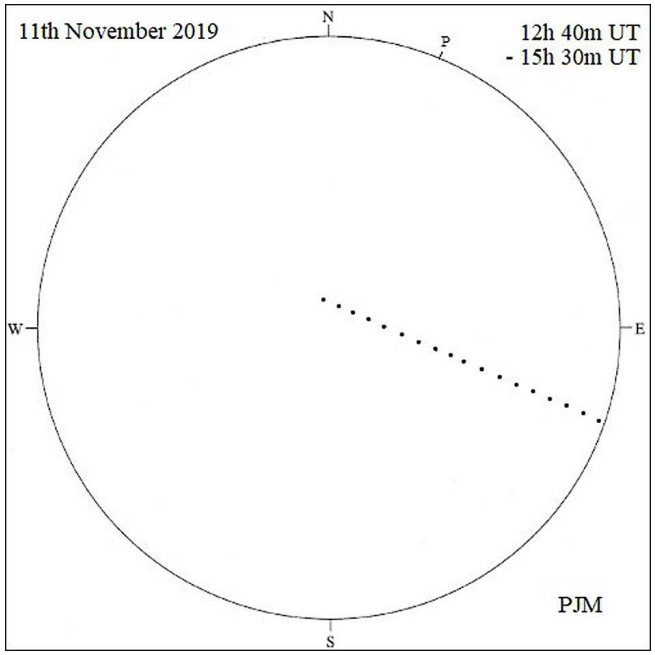

Figure 3. A time series showing the progress of Mercury from 12:40 UT to 13:50 UT (north is up). The drawing was made using an 80mm OG. *P. Meadows*

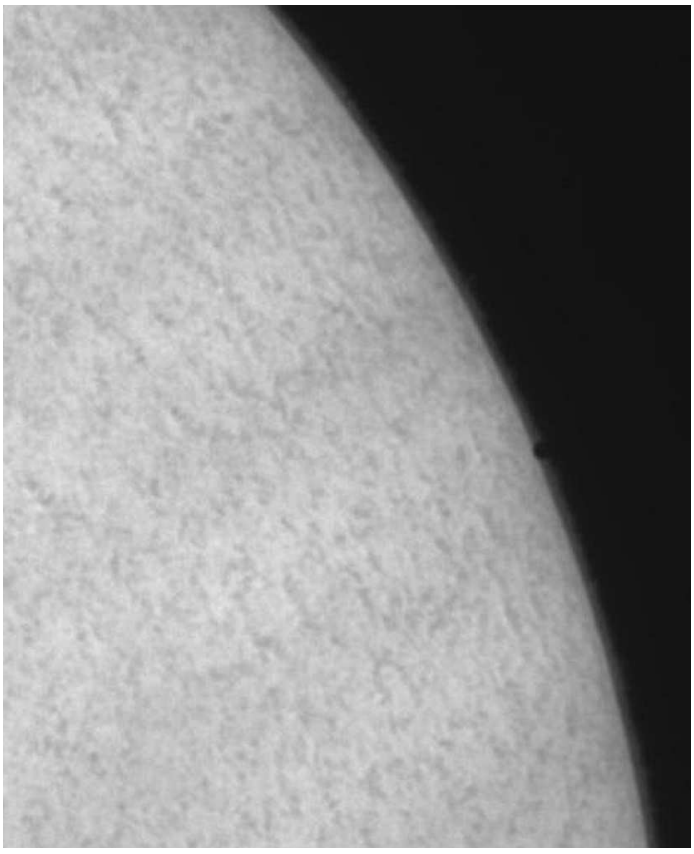

Figure 4. Mercury against the spicule layer of the Sun (south is up). Image taken at 12:36 UT, with a 100mm OG stopped down to 50mm and a Lunt H-alpha filter. *D. Arditti*

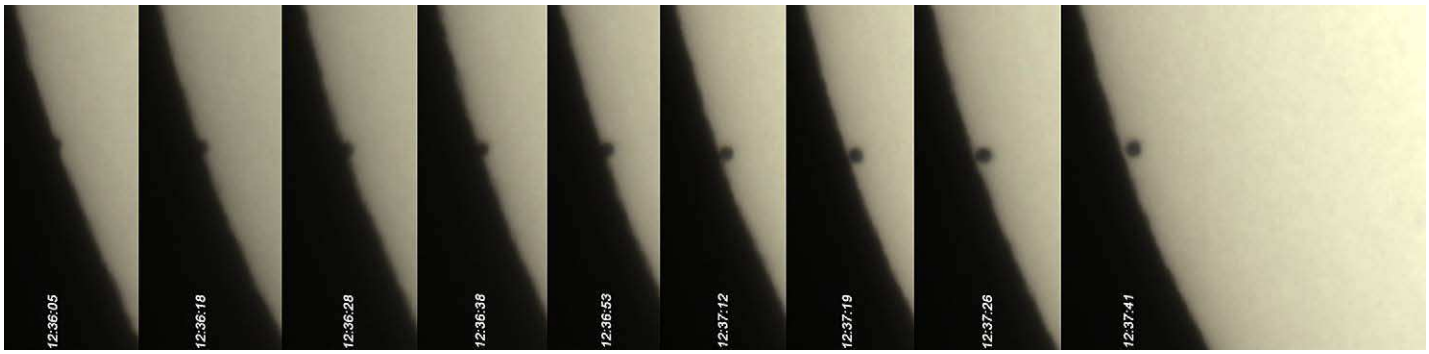

Figure 5. A time series showing the start of the transit in white light (north is up). At 12:36:05 UT, the disc of Mercury is partly on the SE limb. The end of the series at 12:37:41 UT shows the planet completely on the solar disc. The image was captured using a 150mm SCT with an AS129AMC camera. *N. James*

Veteran observer Alan W. Heath also battled with poor conditions, which prevented him from observing the start. However, a cloud break did occur at 12:50 UT and Heath made an integrated light (IL) drawing of Mercury against the solar disc, shown in Figure 1b.

Both Meadows and Scanlan completed time series drawings which showed the progress of the transit. Figure 3 shows the series made by Meadows, who was able to observe past the point of greatest transit and who made the longest visual observing run. No drawings were submitted showing Mercury against the spicule layer of the Sun, and no visual observations of the 'black drop effect' were reported to the Director.

A number of observers did manage to image Mercury against the spicule layer, and a particularly good example of this was obtained by David Arditti; this is shown in Figure 4. Here Mercury can be seen as a perfectly black circle, silhouetted against the jets of plasma forming the spicule layer of the chromosphere.

Nick James obtained a good time series showing the start of the transit in integrated light. His sequence is given in Figure 5 and shows the small black disc of Mercury slowly progressing onto the south-eastern limb of the Sun. No black drop effect is visible in the images captured by James.

A number of high-resolution images of the transit were also submitted by Section members, particularly captured at the start of the event. Figure 6 shows three such images. In Figure 6a, Stephanou's image shows Mercury not long after second contact; the granulation of the solar disc is well shown in this image. Lawrence's image in Figure 6b also shows the granulation, along with the spicule layer and a number of small prominences. Eagle's image in Figure 6c is another fine example, showing Mercury close up against the solar disc. The bright ring around the planet in all such images is an artefact of the image processing.

It is unfortunate that there were no sunspots present within high-resolution images, as this would have allowed interesting comparisons between the relative darkness of Mercury and sunspots on the solar disc.

It would seem that not long after the start of the transit, weather conditions over much of the UK worsened. However, there were breaks in the cloud allowing a small number of observers to continue making observations. Figure 7 shows three such observations. Figure 7a is Ella Bryant's image, which nicely shows Mercury and a number of prominences. Alan Dowdell's white-light image is given in Figure 7b. Brian Hall's image in Figure 7c shows Mercury as a small sharp disc set against the solar granulation, as good seeing appeared in his location, while Jack Martin's image in Figure 7d was taken less than an hour before the point of greatest transit.

Two observers did manage to obtain images showing the end of the transit: Gary Gawthrope, who was visiting Florida, USA; and German Morales, who is based in Bolivia. In Figure 8a, Gawthrope's image shows Mercury close to the Sun's north-western limb as it approaches third contact, while Morales' image in Figure 8b shows the planet just on the solar limb at a point between third and fourth contact.

Conclusions

Although transits of Mercury are of little scientific value, they are rare enough to make them worthwhile phenomena to observe.

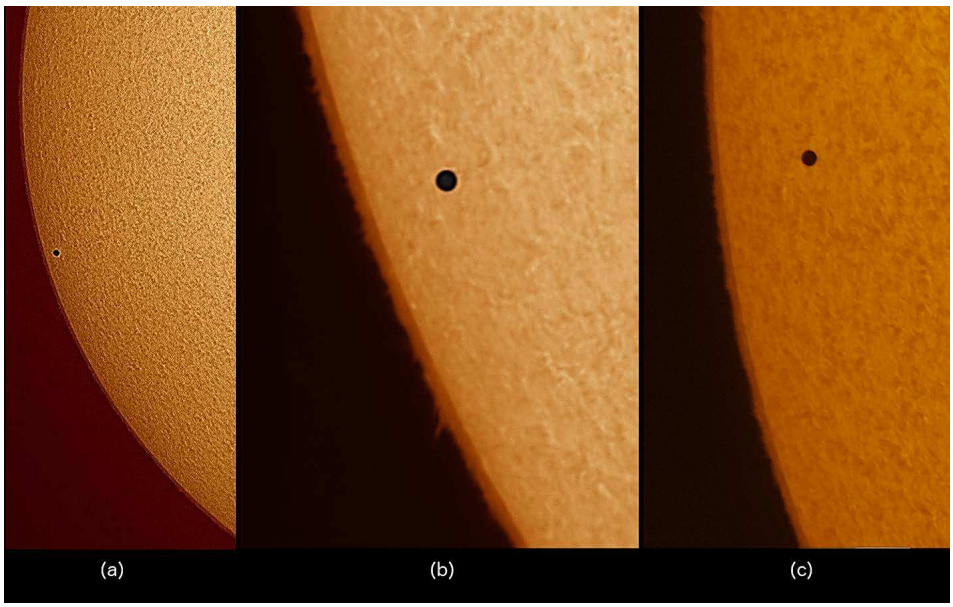

Figure 6. Three high-resolution images of the transit (north is up). In these images the granulation of the Sun is clearly seen, along with the spicule layer and small prominences. **(a)** Shortly after second contact, 12:39 UT; Lunt LS100 THa, H-alpha. *M. Stephanou.* **(b)** Mercury and the Sun's atmosphere, 12:42 UT; C14 and various filters. *P. Lawrence.* **(c)** The Sun's atmosphere and granulation with Mercury, 12:46 UT; Sky-Watcher Evostar 120 Quark. *D. Eagle*

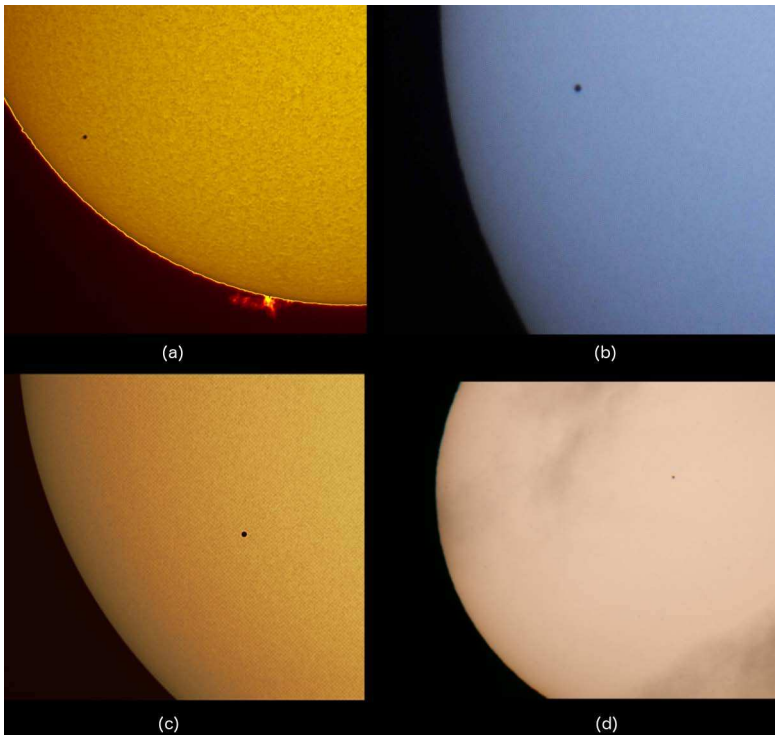

Figure 7. Three images showing the progress of the transit (north is up). **(a)** Mercury and an impressive solar prominence at 12:53 UT. Lunt 60mm solar telescope. *E. Bryant.* **(b)** A white-light image made at 13:11 UT, with a 1000mm Russian MTO *f*/10 photographic lens and solar filter. *A. Dowdell.* **(c)** Better weather conditions and good seeing shows Mercury as a sharp disc in this image taken at 13:28 UT. ZWO colour camera, solar wedge and continuum filter mounted on a 152mm OG. *B. Halls*. **(d)** Mercury about 42 minutes before the point of greatest transit, 14:37 UT; Megrez 90 and Lunt solar wedge. *J. Martin.*

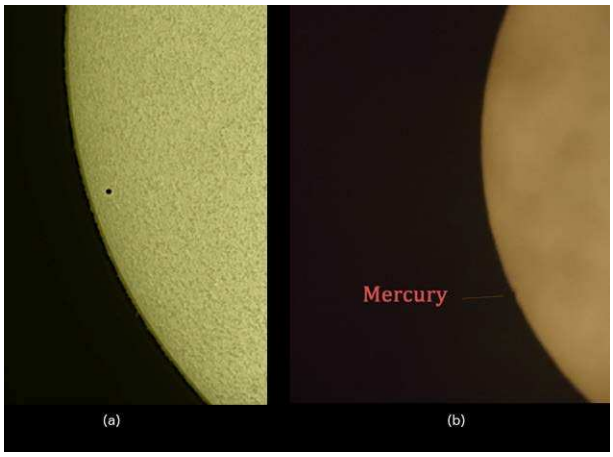

Figure 8. Two images showing the end of the transit (south is up). **(a)** Mercury approaching third contact, 17:57 UT; Takahashi Sky 90. *G. Gawthrope.* **(b)** Mercury between third and fourth contact, 18:02 UT. *G. Morales.*

A number of interesting events can be recorded, such as the planet against the spicule layer and the comparison of its appearance with sunspot groups when they are present on the disc.

The 2019 transit of Mercury was a difficult one for UK-based observers. In particular, poor weather conditions meant many members were only able to observe parts of the transit. However, enough members submitted observations that good coverage of most of the event was obtained. Visual observers submitted drawings of the start of the transit in white light and H-alpha; time series were also provided. High-resolution images showed Mercury and details in the solar disc at a number of points in the transit, while BAA members abroad were able to send observations showing its end.

The next transit will occur on 2032 Nov 13. Again, UK-based observers will not be able to view the whole event as it will have started by the time the Sun rises in the UK. No doubt the difficult conditions will not deter those determined observers whose observations allowed this report to be produced.

Address: School of Physics & Astronomy, University of Leicester, University Road, Leicester, LE1 7RH *[paul.abel@yahoo.co.uk]*

References

1 McKim R. J., 'The elongations of Mercury 2007–2016, and the 2016 solar transit', *J. Brit. Astron. Assoc.*, **124**(4) 209–216 (2017)
2 *Handbook of the British Astronomical Association*, 2019
3 *Messenger* (the BAA Mercury & Venus Section newsletter), issue 2 (2019 December)

Received 2020 Feb 15; accepted 2020 Mar 25