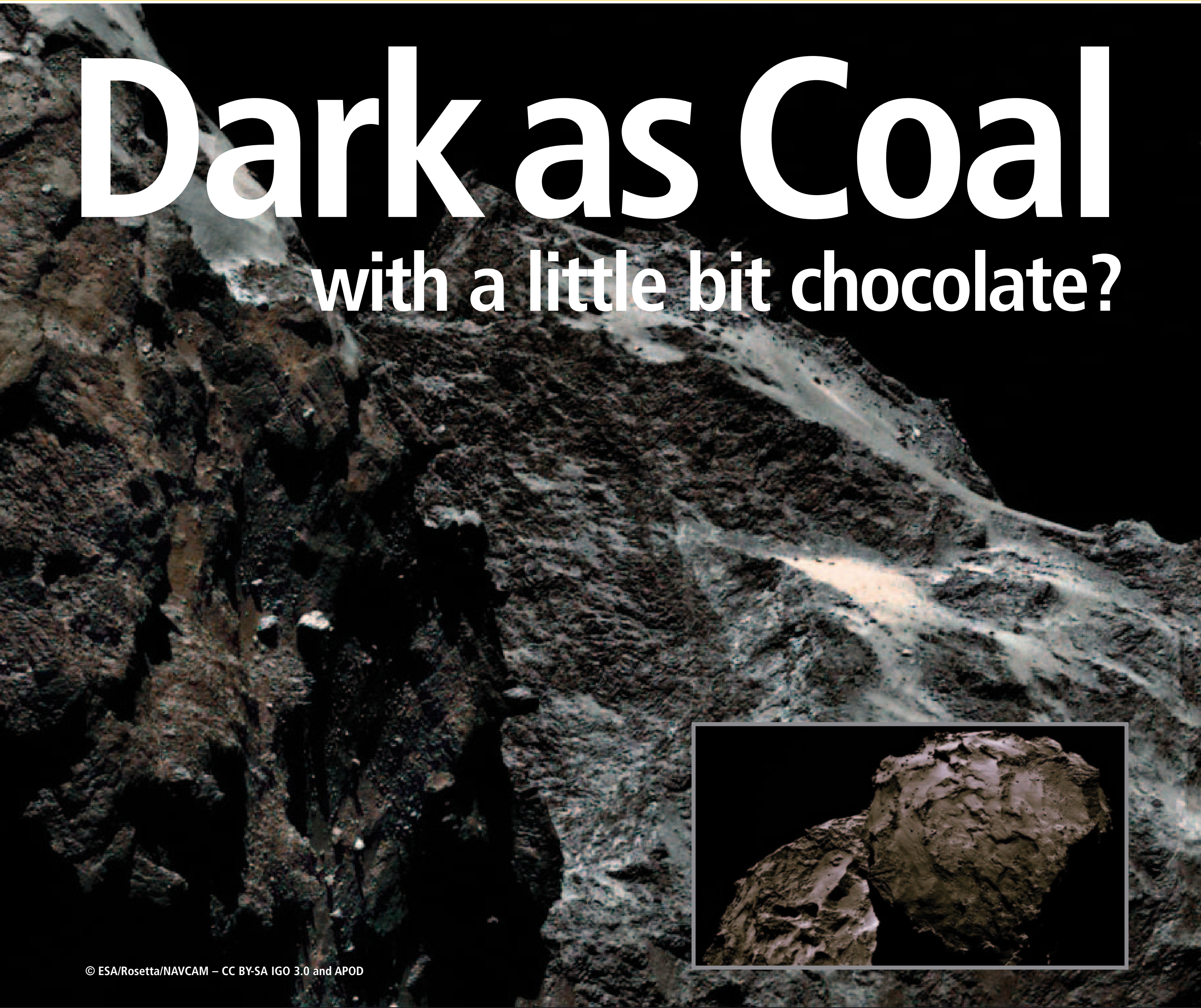
Journal for
Occultation Astronomy
2014–04
FORMERLY OCCULTATION NEWSLETTER

Dark as Coal

with a little bit chocolate?



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Spacecraft Rosetta continues to approach, circle, and map Comet Churyumov-Gerasimenko. Crossing the inner solar system for ten years to reach the vicinity of the comet last month, the robotic spacecraft continues to image the unusual double-lobed comet nucleus. The reconstructed-colour image featured, taken about 10 days ago, indicates how dark this comet nucleus is. On average, the comet's surface reflects only about four percent of impinging visible light, making it as dark as coal. Comet 67P/Churyumov–Gerasimenko spans about four kilometres in length and has a surface gravity so low that an astronaut could jump off of it. In about two months, Rosetta is scheduled to release the first probe ever to attempt a controlled landing on a comet's nucleus.

Journal for Occultation Astronomy

Dear reader,

Again ESOP XXXIII has been a very successful meeting. A lot of very interesting reports had been presented – for sure one of the most impressive results was the presentation of the discovery of the rings of Chariklo. But a lot of different topics were shown too, like future predictions of minor planet occultations in 2015.

Details will be given within this or the next issue.

ESOP XXXIV will take place in Hannover, Germany starting as usual at the end of August.

From time to time it happens that a stellar occultation will occur at dawn or dusk or even during daytime. Friedhelm Dorst successfully observed occultations of brighter stars by the Moon in daylight hours, even during a solar eclipse! An occultation of Venus by the Moon happened this year during the partial solar eclipse on October 23rd (which took place in the central Pacific) – this is not an important occultation but it's of general interest concerning possible future daylight occultations, regarding it as a test for scientific events.

Hans-J. Bode
(Editor in chief)

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In this issue:

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Journal for Occultation Astronomy

Observing at the Limit – The Occultation by (393) Lampetia

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Abstract

From time to time asteroids are brighter than the stars they will occult. This happened with the occultation by (393) Lampetia on 2014 September 29. The 10.8 mag asteroid occulted TYC 1175-01154-1, a 11.9 mag star, with a drop in magnitude of only 0.3. A challenge for my setup and my first positive since November 2011. [1]

At the Limit

The limiting magnitude for my outdated camera 2006X (a housed version of the famous 1004X) with my system (10" LX200 Classic, with focal reducer ~f5) is about 11.5 mag depending on the colour index of the star and the altitude at the time of occultation. Therefore, observing a 11.9 mag star is a real challenge and mostly impossible. I was lucky that the asteroid (393) Lampetia had a magnitude of 10.8 mag on the night of occultation. So the combined light of the two objects would collectively be 10.5 mag with an expected drop of about 0.3 mag. Only the asteroid would be visible on the video recording during the occultation.

The Preparation

Unfortunately, the weather forecast was not good for this night. The station list on "Occult Watcher" showed several observers clouded out, with 100% cloud cover for my station. While I was setting up my telescope in the evening around 20 UT the sky was clear only in the zenith. Haze covered the sky at altitudes lower than 60 degrees above the horizon. I made my 2-star-alignment very early because I feared that the transparency would get worse in the following hours. I wanted to locate the target star as early as possible. Alignment worked without any problems, my technical setup was running fine. I could see the target star as a very faint dot on the screen of my Notebook. Was this dot the target star? No, this was not the target star - it was the asteroid! I covered the lens of the telescope to protect it from dew. Now I had to wait. Would the sky clear up or would the haze get thicker or even the clouds predicted by the weather forecast come in?

The Observation

Twenty minutes before the occultation I went out again. No clouds, but the haze was still there. The target area in Pegasus was now higher in the sky. The stars in Pegasus were changing in brightness. This was the edge of the haze. I slewed the LX200 again to the coordinates of the target star using "High Precision Pointing" to be sure that the target area was still in the video frame. But no star was visible on the screen of the Notebook. I enhanced the image using contrast and brightness. Finally just minutes before the occultation, I was able to see the asteroid/star and the reference star in the video field again. I looked up at the sky, the haze was almost gone from the target area. I started the recording in VirtualDub and was watching the screen. At the expected time of occultation I noticed a dimming of the target. Was it real or wishful thinking? I was not sure. So I kept the recording running for another minute.

The Evaluation

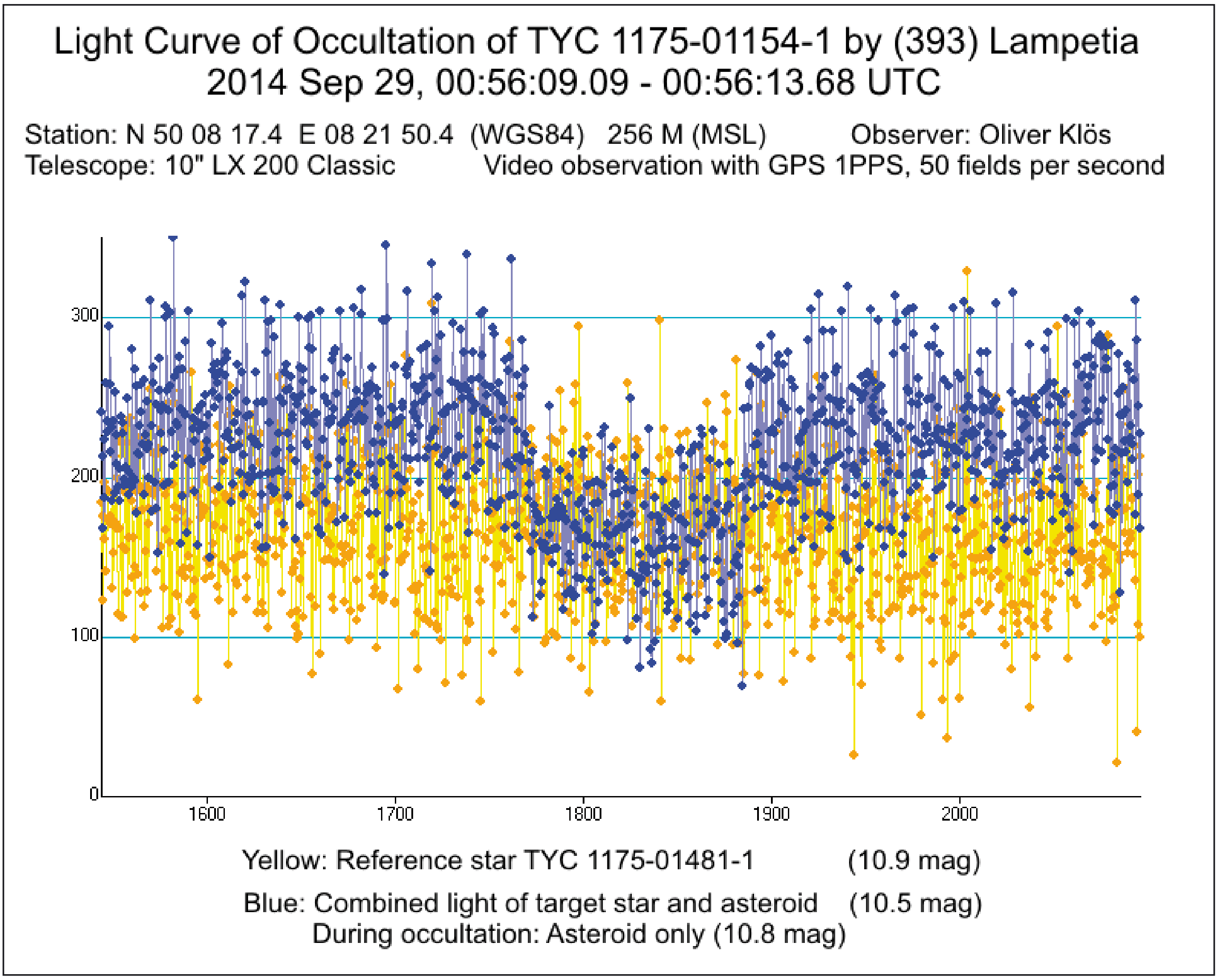
After returning inside my house I made a first check of the recording. Yes, there was an occultation! It was hard to see, but noticeable. A first estimate of the duration was about 5 seconds. I reported this to the "Occult Watcher" community. In the following days I used LIMOVIE and OCCULAR to get the best result from my observation. The video was analysed from time insert 00:56:00 to 00:56:23. Fortunately LIMOVIE could anchor on the objects without any changes of contrast and brightness. The measurement was very noisy but OCCULAR was 100% confident of the event. The times provided by OCCULAR were checked with the real time inserts of the fields. They were correct.

Occultation Data

The station

Station inside predicted path calculated by Steve Preston, 2014 Aug 03
Chord + 28 (Surface: 46 km from centre line)
Probability: 80.8 %
Expected time of occultation for station: 00:56:08 UT
(Data from "Occult Watcher")

The evaluation with OCCULAR (all times UT)
Start: 00:54:58
D : 00:56:09.085 +- 0.025
R : 00:56:13.677 +- 0.025
End : 00:57:02
Duration of Occultation: 4.592 sec +- 0.05
Mid-event: 00:56:11.381
SNR 0.89
Magnitude drop: 0.37 (predicted 0.34)
A short transition of 8 frames at disappearance



The Lonely Observer?

I was waiting for other observers announcing positive observations on "Occult Watcher". Unfortunately, most of them seemed to be clouded out or were discouraged by the weather forecast in OW. Finally Wolfgang Rothe from Berlin announced a positive observation, with even a longer duration than mine. I was happy not to be the lone observer of this event.

Something New About (393) Lampetia?

Eric Frappa of euraster.net calculated Lampetia's profile of at least 93 km using the two chords which were measured from this event. [2] An occultation in May 2009 gave a profile of 133 x 119 km. [3] Light curves of (393) Lampetia showed amplitudes of 0.12 to 0.20 mag and an unusually slow rotation period of about 38.5 hours. [4] Unfortunately the measurements of this event could not provide any improvement of the asteroid's profile. More than two positive chords are needed for this task.

What I have learned?

1. Never trust the weather forecast. If it doesn't match in the evening, it could be different in the night too.

2. It is possible to evaluate a recording of a drop of only 0.3 mag, even with outdated equipment.

Reference

[1] Klös, O. The Occultation by (22) Kalliope and its Satellite Linus at 2011 November 22, Journal for Occultation Astronomy, 2012-02, p.3-5

[2] Frappa, E. - European Asteroidal Occultation Results - www.euraster.net - 2014

[3] Herald, D., OCCULT, Database of Asteroid Observations

[4] Holliday, B. Photometry of Asteroid 251 Sophia, 393 Lampetia, and (20898) 2000 WE147, September 2000 through January 2001, The Minor Planet Bulletin, Volume 28, p.26-28

Journal for Occultation Astronomy

Lunation 1136: Lunar Occultations of Close Double Stars for Europe

October	
d P	Star
25 D	2209cK4
26 d	2331cK1
27 D	2497SG1
27 d	X 42087DG2
27 d	X 42128DA5
27 d	X140849D
27 d	X141055D
28 D	2658cF8
28 d	161160cB9
28 d	161202SF5
28 d	161229cB3
28 d	161255SB2
28 d	161257cF7
28 d	161399cA0
28 d	161400cK0
29 D	2826cF0
29 d	X 45748DF8
29 d	X166346D
30 d	2968SB9
30 d	163371cF6
30 d	163460SG0
31 d	164213cG
31 d	164222SG0

November	
d P	Star
1 D	3247cG5
1 d	145886cG0
1 d	145921cK0
1 D	145938cF2
1 d	145984cG5
2 D	146456cK4
2 d	146531cG0
3 d	128481dF0
4 d	109616cG0
5 D	148DA0
5 D	247cF2
5 d	110038cG0
5 d	110097cK0
5 d	110183cK2
5 d	X 57368D
6 d	384cF7
6 d	92729cA5
7 r	523cA5
8 r	93914dG2
8 r	93933cG1
8 r	93936cG8
8 r	94019cK5
8 r	X 5185cA5
8 r	X 70478c
8 r	X 70512c
9 R	814SB5
9 r	94117SK0
9 r	94189cF8
9 r	94621cK7
9 r	X 7257DF8
9 r	X 76175D
10 R	878cF0
10 R	1003SF6
10 r	94779cM2
10 r	94796cA2
10 r	94862SA5
10 r	94865cF8
10 r	94903cB9
10 r	94922cF8
10 r	95615cG5
10 r	95645cF5
10 r	95683dA0
10 r	95748SA0
10 R	95759SG5
10 r	95775cK0
10 r	X 7449cA2
10 r	X 7727M
10 r	X 7818cA
10 r	X 76960d
10 r	X 77295C
10 r	X 78346c
10 r	X 78512c
10 r	X 88064c
11 r	1039cF5
11 R	1096SK3
11 R	1104cF4
11 R	1106SA3
11 r	95941cG5
11 r	96002cB9
11 r	96753cK0
11 r	96810cK2
11 r	96817cA
11 r	X 9426cK0
11 r	X 92270c
12 R	1147cA1
12 R	1234cA1
12 r	97074cG5
12 r	97094c
12 r	97564S
12 r	97574cG0
12 r	97609cF5
12 r	97618SF5
12 r	X101999c
13 r	1281cK0
13 R	1332cK5
13 R	1341SA5
13 r	97721cF5
13 r	97890cK0
13 r	98178cK0
13 r	X109088D
13 r	X109089D
14 R	1359cB8
14 r	98312c
14 r	98437DF5
14 r	X113265d
15 R	1546cK0
15 R	117942cG5
15 r	117957cG5
16 r	1558cK0
16 r	118454cG0
17 r	1685cG9
18 r	1787cF2
18 R	138647dG4
19 r	139163cF2
20 r	158261dA0
21 r	2114SA*
21 r	X130028D

Journal for
Occultation Astronomy

Light Curves Needed for Occultation by (216) Kleopatra

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Abstract

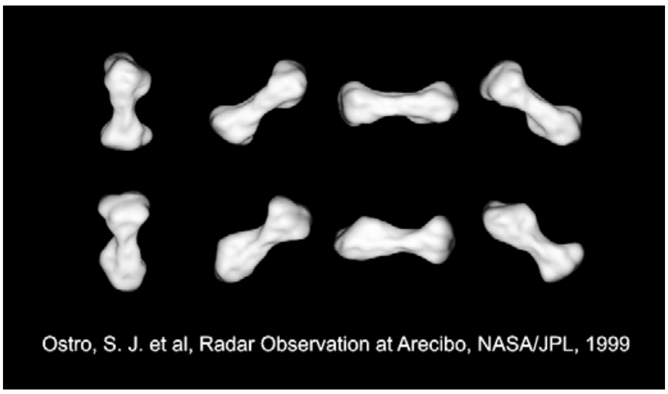
The minor planet (216) Kleopatra is one of the most interesting bodies in the main belt because of its unusual shape and the two satellites circling the asteroid. An occultation by (216) Kleopatra of a bright 8 mag star will happen in March 2015. The shadow paths of the asteroid and the two satellites will be crossing Europe. The dog-bone shape of (216) Kleopatra gives a large uncertainty about the real path width of the shadow of the main body. New light curves of (216) Kleopatra are needed for a more accurate prediction.

The Asteroid

The M-type asteroid (216) Kleopatra was discovered by Austrian Johann Palisa in the year 1880 in Pola, Austria. It's spinning around its axis in about 5.4 hours. (216) Kleopatra got very early special attention by observers due to its unusual light variations. The amplitude of these variations could be as large as 1.2 mag. [1] The cause for these variations could be an unusual shape or two bodies circling very close to each other.

In 1980 an occultation by (216) Kleopatra was observed for the first time. Observers from Canada and the U.S.A. measured a profile of 124 x 88 km. This profile seems to be nothing special; the mystery of the light variations was not solved. [2] In 1991 there was another very successful observation of an occultation. This time eight observers from the U.S.A. reported a positive observation. The obtained profile showed a cigar-like profile of (216) Kleopatra. [3]

The real shape was finally revealed in 1999. Steve J. Ostro and his team made radar observations with the antenna at Arecibo. The radar images resolved Kleopatra as a single body with the unusual shape of a "dog-bone". [4]

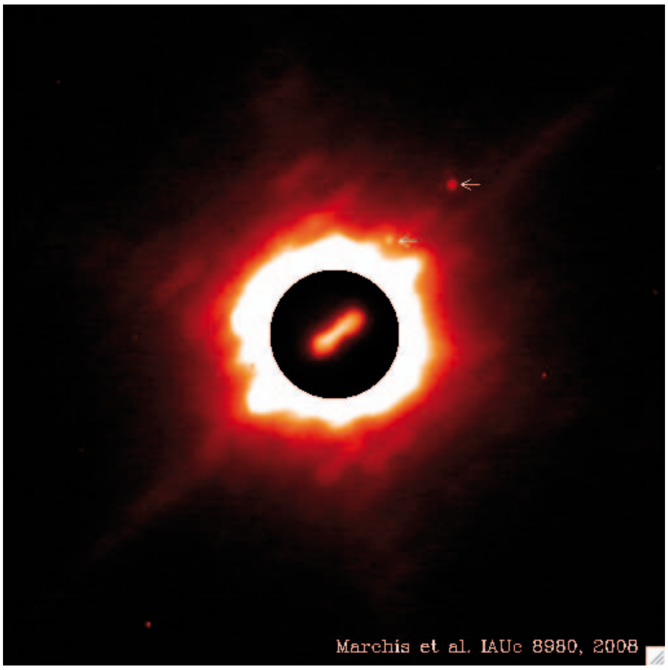


Ostro, S. J. et al, Radar Observation at Arecibo, NASA/JPL, 1999

Another very successful occultation observation campaign was achieved on Christmas Eve in 2009. 12 chords were obtained from observers in the U.S.A., again showing a very elongated shape of (216) Kleopatra. This was the last occultation observed to date. [5]]

The Moons

Kleopatra returned again to the astronomical headlines in 2008. Franck Marchis and his team discovered two moons circling this unusual asteroid while using the adaptive optics of the Keck II telescope at Hawaii. [6] These small moons, 9 and 7 km in diameter, were named after the twins Alexander Helios and Kleopatra Selene born to the Queen of Egypt. It's possible that one of the moons was observed before as a blink at the occultation in 1980. Two observers, Gerry Rattley and Bill Cooke, reported a possible secondary event of less than one second duration at stations about 600 metres apart. [7]



Marchis et al. IAUc 8980, 2008

The Occultation in March 2015

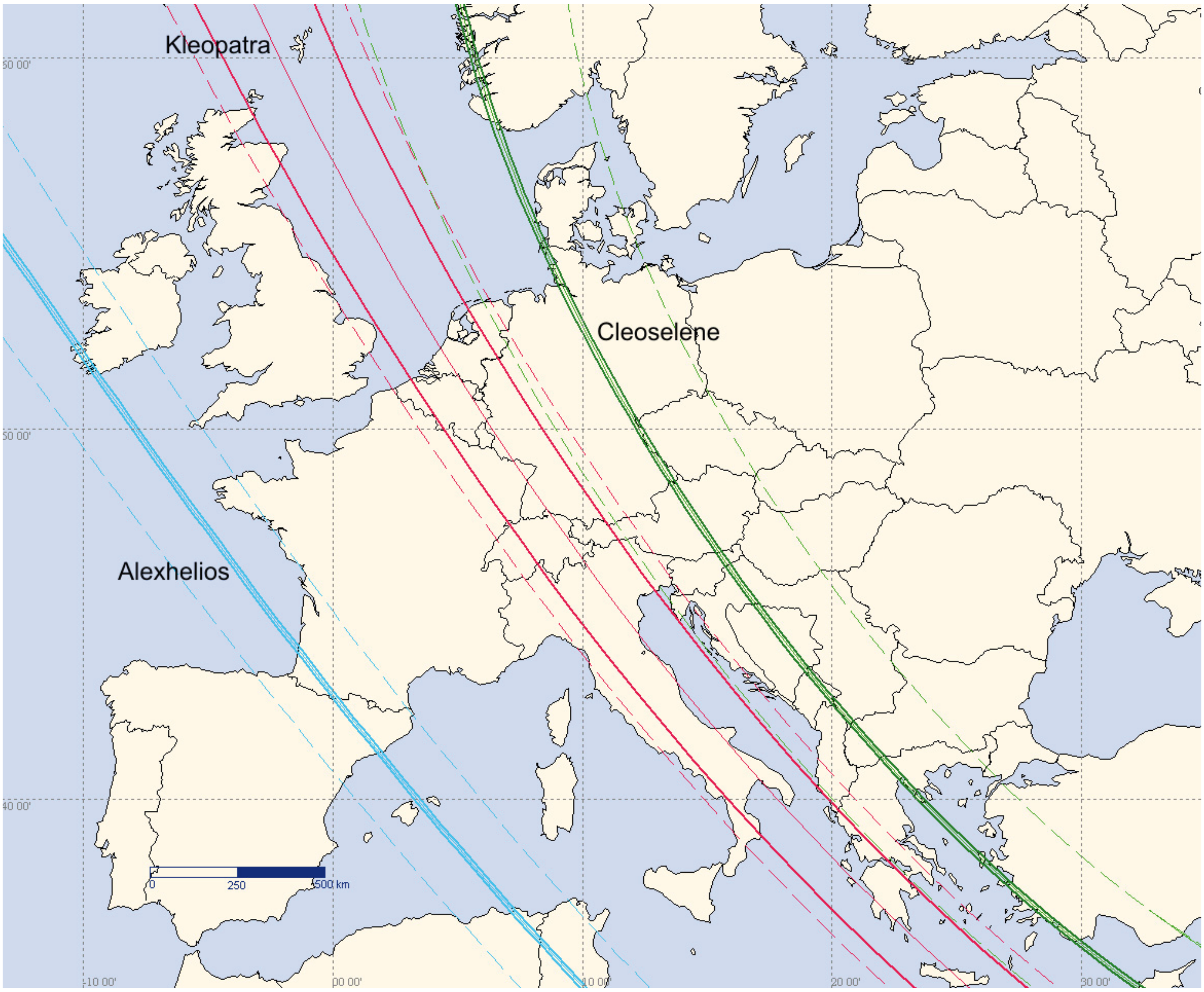
The occultation on 2015 March 12 gives the best opportunity to obtain another profile of the main body and - for the first time - accurate measurements of the positions of the satellites by observing an occultation. According to the preliminary prediction by Steve Preston published in April 2014 the shadow of Kleopatra will cross the Earth starting at

01:03 UT over the Arabian Peninsula and moving across Europe at 01:08 UT. Finally, the star will be too low to observe while crossing the sea between Iceland and Norway. [8]

I have made the calculations myself of the shadow paths of the moons with data from IMCCE and Miriade using OCCULT and shifted the paths to match Steve Preston's prediction of the main body. So this is a very preliminary prediction. Path shifts, especially for the moons, should be expected in the weeks before the occultation.

The shadow of Alexhelios is supposed to cross Europe over eastern Spain and western France.

It is possible that a positive observation could be obtained from the Balearic Islands and in Southwest Ireland. Cleoselene's shadow may cross countries in the southeast and centre of Europe.

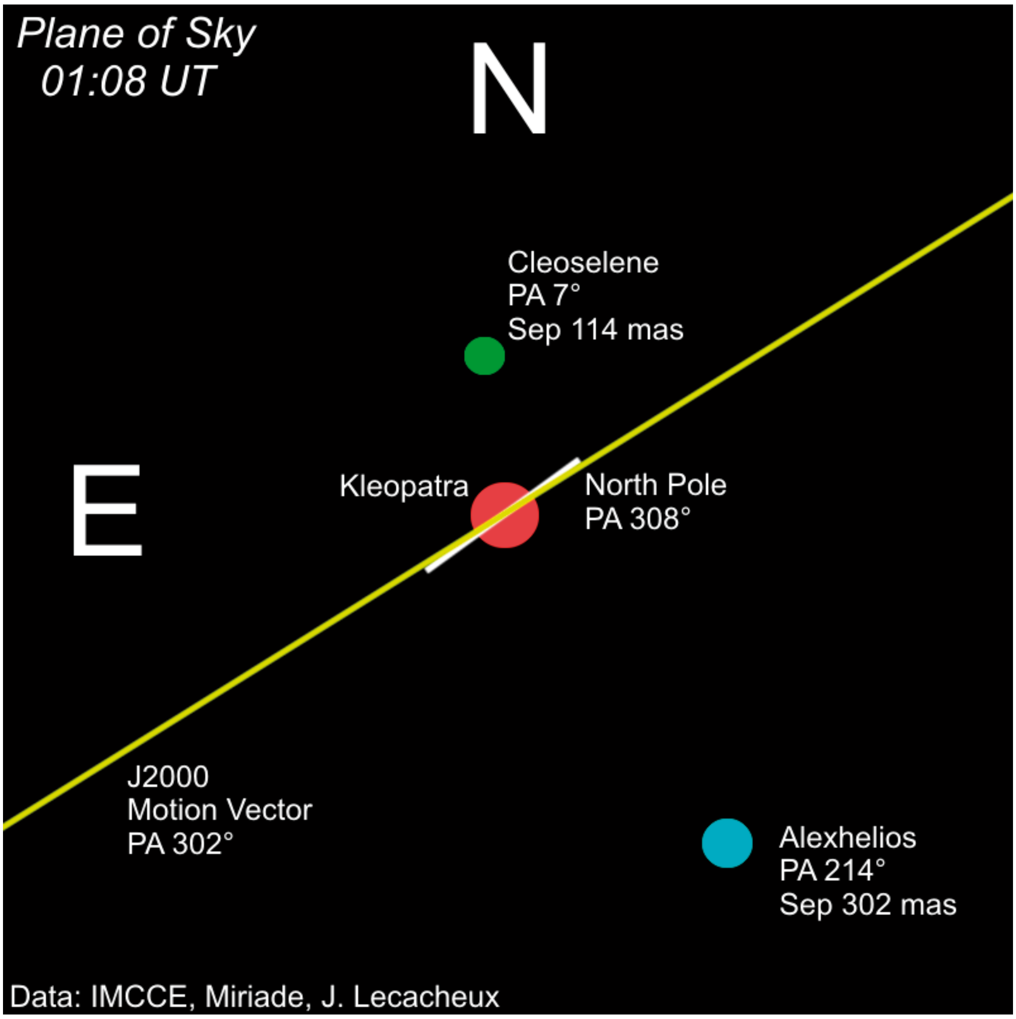


The Target Star

Occultations by (216) Kleopatra have been observed nine times, but the target star was never that bright. HIP 54599 is a F8 star in the constellation Crater with a Vmag of 7.98. The star will be at an altitude of 27deg at azimuth 208 deg (for a location at Lat 50 deg, Long 6.4 deg). The 67% sunlit Moon will not disturb the observation; it is 70 deg away from the target area.

The Width of the Main Path

Kleopatra's north pole will be at a PA of 308° at the time of occultation. The J2000 motion vector is calculated with a PA of 306°. [9] So the movement of the shadow of Kleopatra will be nearly identical with its spinning axis. Therefore it is important to know which side of the asteroid will cast a shadow on Earth. Will it be the elongated or the small side? This makes a very large difference to the width of the path. While



the short profile will cast a shadow of only about 90 km, a shadow of the elongated profile could be more than twice that wide!

New Light Curves Are Needed!

Is it possible to make a reliable estimate of which profile will be facing toward Earth at the time of occultation? Unfortunately not. The latest light curves of Kleopatra are several years old and extrapolating these data would not give a reliable result. [10], [11] But this valuable information can be provided from new light curves.

Therefore new light curves are wanted of this remarkable asteroid. The prediction of the path width could be improved with this new data. Please observe (216) Kleopatra in the coming months and share your photometric data.

Acknowledgements

I want to thank Jean Lecacheux for providing data and discussing the possibility of predicting the orientation of Kleopatra during the occultation, Steve Preston for his prediction of the event and Franck Marchis for his permission to use the image of the asteroid's moons.

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[1] Descamps, P. et al.
Triplicity and physical characteristics of Asteroid (216) Kleopatra, Icarus, Volume 211, Issue 2, p. 1022-1033

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Prediction for Occultation by (216) Kleopatra, 2015 March 12

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Personal e-mail, June 2014

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Asteroids and comets rotation curves, CdR – (216) Kleopatra

Journal for Occultation Astronomy

The first observed asteroidal occultation

Dave Herald

When was the first successful observation of an asteroidal occultation? This simple question has some interesting history behind it, which I will explore in this article.

The effort to observe an occultation by an asteroid commenced in 1952 by Gordon E. Taylor of the H.M. Nautical Almanac Office, when he started publishing predictions in the annual Handbook of the British Astronomical Association.

The first 'successful' observation was reported in the Feb 1962 issue of The Observatory, where Gordon states:

… it was not until 1958 that the first recorded observation of such an occultation was secured. The observation – of Juno occulting the star B.D. +6° 808 on 1958 February 19 – was made by Per-Åke Bjorklund and Svend Aage Müller of Malmö, Sweden. They noted the duration of the occultation as 7.2sec. As this was the only observation, only a minimum value for the diameter of Juno could be derived.

(Modern identifiers of B.D. +6° 808 are SAO 112328, and TYC 0110-00632-1.)

These are the only details known of this observation. In particular, the observing site is known only by the town location, and only the duration of the event is provided (not the actual event times).

The status of this being the first observed asteroidal occultation was not queried for 45 years – until IOTA commenced reporting astrometry derived from asteroidal occultations in 2007. The Minor Planet Center conducts a validity check of all reported astrometry, and the astrometric position derived from this occultation observation was incompatible with all other astrometry of Juno. The necessary implication is that an occultation was not actually observed. So what does a review of this observation disclose?

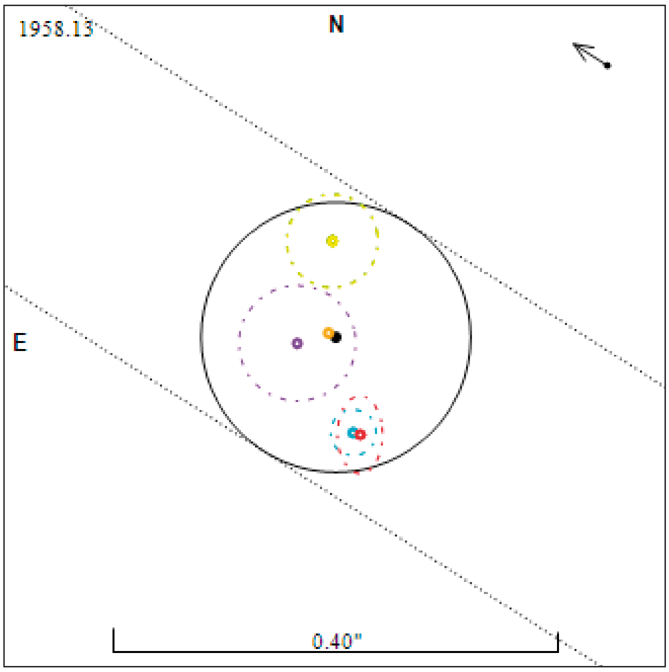


Fig 1 Catalogue comparison of the star for the 1958 occultation. The dotted circles are the uncertainty ellipses for the star position as given in several catalogues.

The best way of investigating the circumstances of an event is to generate a 'post-diction'. Unlike a prediction, a post-diction has the advantage of a reliable ephemeris of the asteroid based on astrometry made both before and after the event. That is, the uncertainties in the position of an asteroid in a post-diction are very much smaller than for a prediction. The primary source of uncertainty is the star position, and in this case a catalogue comparison (Fig 1) shows that the uncertainty in the star position is considerably less than the path width.

The post-diction of the event is shown in Fig 2, with the path passing over Greenland, then to the north of Sweden. The observing location is marked with a circled cross. The predicted magnitude drop is 0.7, with a maximum duration of 18.6 secs.

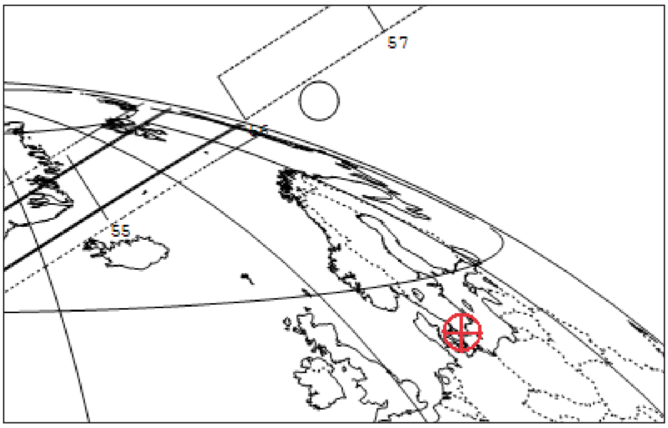


Fig 2. Post-diction of the 1958 occultation by Juno

Fig 2 indicates the 1-sigma uncertainty in the path location is less than half a path width. The observing site (Malmo) was located about 5 path widths south of the path – much further than the expected uncertainty. With an apparent diameter of 0.243", the asteroid missed the star as seen from Malmo by a little over 1 arc sec. This distance is far too great to be explained by catalogue or ephemeris uncertainties. It is inconsistent with an occultation occurring at Malmo.

So why did the observers think they observed an occultation? Firstly, the minimum separation would have been too small to have allowed the star and asteroid to be resolved in typical amateur telescopes available at the time. Secondly, the altitude of the star at Malmo at the time of the observation was 24 deg – raising the question of whether the atmosphere was steady during the event. Thirdly, while a magnitude drop of 0.7 can be observed visually, this is not easy if the star needs to be monitored for a lengthy period of time – which would have been the case, given the uncertainty in the predictions in those early years. With the benefit of hindsight, it seems that the most likely explanation for the reported occultation is that the observers mistook a variation in atmospheric seeing for an occultation.

The next "observed" asteroidal occultation was also reported in the Feb 1962 issue of **The Observatory.** The event was observed photoelectrically, leaving little doubt that a 'real' occultation was observed. It is appropriate to reproduce here some of the report in **The Observatory.**

Observations of the Occultation of BD -5° 5863 by Pallas

By S.D Sinvhal, N.B.Sanwal and M.C.Pande
Uttar Pradesh State Observatory, Naini Tal, India

An occultation of the star BD -5° 5863 by Pallas on 1961 October 2 had been predicted. Subsequently, a circular to that effect was received by us from Mr G.E. Taylor of the Royal Greenwich Observatory. At the Uttar Pradesh State Observatory the occultation was observed both visually and photoelectrically.

The visual observations were carried out on a 15-inch reflector with a focal length of 225 inches. While the emergence of the star from behind the planet could be timed with some certainty, its immersion could not be judged accurately since one could not be certain at any instant that the dimming of light had reached a stage beyond which the light would not decline further. As such the visual observations, as compared with the photoelectric ones…, were considerably in error.

The photoelectric observations were carried out on a 10-inch refractor using a photometer with a V filter and a 1P21 photomultiplier. The output was fed to a {chart} recorder {… which} was run at its fastest speed. The timings were noted on a Cambridge pen chronograph…. One second on the chronograph tape averaged 26.75mm. A second pen on the chronograph as well as the side pen on the {chart} recorder were operated by a common switch {this gave the link between the recordings of the photoelectric output, and the time signal} … The following results have finally been obtained:-

Start of Occultation: UT 1961 October 2^d 18^h 56^m $56^s.23$
Duration of occultation: $25^s.54$
The chart recording is shown in Fig 3.

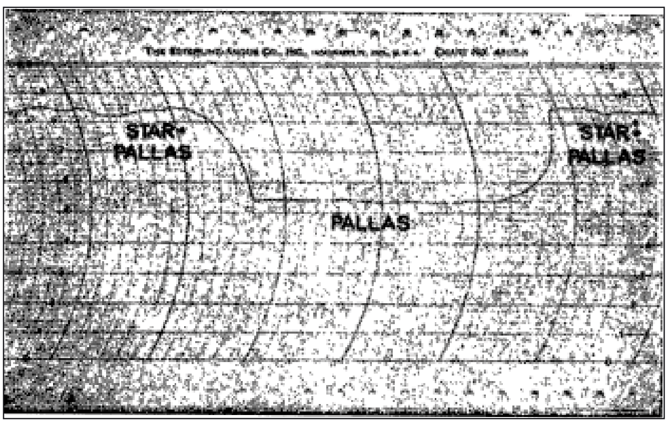


Fig 3. Chart recording of the 1961 occultation

The report gives the site location as 79° 27′ 57″.0 E, 29° 23′ 15″.5 N, with the source being given as 'Survey of India Six-inch Naini Tal Guide Map, First Edition'.

Also reported (by Gordon Taylor) were miss observations from the Cape, and Johannesburg, observatories. From the observations Gordon deduced the diameter of Pallas was 'at least' 430km, and compared this to the then best available diameter derived from micrometer measurements of 490km. [The modern value is 498km.]

Fig 4 is a 'post-diction' of the event. It shows that the path would have fallen south of the Cape and Johannesburg observatories in South Africa.

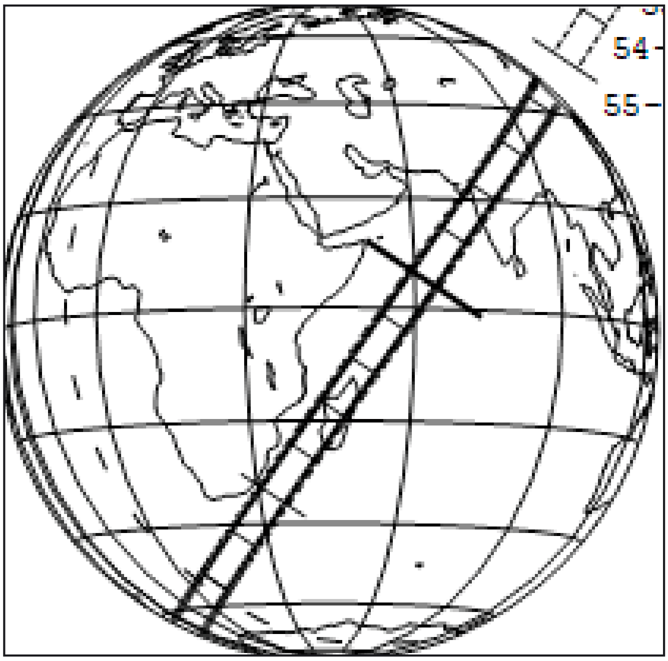


Fig 4. Post-diction of the 1961 occultation

Fig 5 shows the location of the path over India in greater detail. This post-diction was generated using the UCAC4 catalogue. It shows the Uttar Pradesh State Observatory, marked with a circled cross, to be just inside the predicted path.

The post-dicted maximum duration of the event is 33.0 secs. The reported duration was 25.5secs – a value which indicates the observing site was about 0.19 path widths in from the path edge, consistent with the location of the site compared to the post-dicted path location.

In summary, there is no reason to doubt that the observers at Uttar Pradesh State Observatory (UPSO) successfully recorded an occultation by Pallas on 1961 Oct 2 – making this event the first observation of an asteroidal occultation.

The observation was made using a chart recorder – well before the advent of digital electronics and CCD detectors. The chart recording clearly shows significant latency in the photometric system (or perhaps the chart recorder), with the movement of the pen from the full light level to the occulted light level extending over about 4 line intervals on the chart. The fact of latency is evident from the way the light curve drops and rises. Indeed, the D and R curves are quite unlike anything

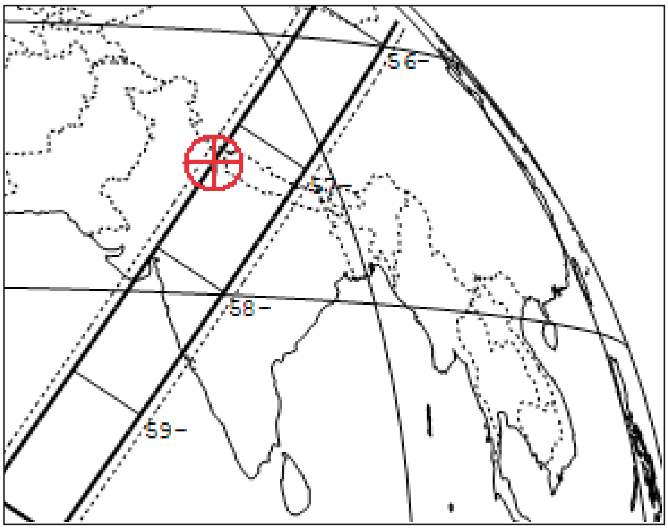


Fig 5. Location of the post-dicted path of the 1961 occultation over India

we see with CCD detectors when Fresnel diffraction or stellar diameter is involved. Since the occultation extends for some 20 line intervals (as measured from the start of the drop to the start of the rise), and the reported duration was 25 secs, it may be deduced that it took some 5 seconds for the recording to move between full light and occulted light.

Fig 6 GoogleEarth image of the reported site location

Combine this with the fact that the events occurred at the beginning of the fall, and the beginning of the rise, and that those locations on the light curve are not well defined – and one might conclude that the 'real' timing precision from the chart recording may be no better than about 0.5 secs, and not the 0.01 secs given in the reported time and duration.

The site coordinates given in the report are stated to have been derived using a six-inch to a mile 'Survey of India Naini Tal Guide Map'. The WGS84 coordinates corresponding to the cited site coordinates are Longitude 79° 27′ 51.2″ Latitude 29° 23′ 15.5″. The GoogleEarth image for this location is shown in Fig 6.

The location is on the side of a hill adjacent the village of Naini Tal, with no sign of an observatory – which raises the question of whether the quoted coordinates are reliable. An internet search for Uttar Pradesh Observatory leads to the Aryabhatta Research Institute of Observational Sciences (ARIES), which has an observatory close to Naini Tal. Their web site gives the following description of their telescopes:

"The ARIES which was started with a 25 cm reflactor (sic) in 1955, installed four telescope namely 104 cm, 56 cm, 52 cm and 38 cm till 1972, for cometary, planetry, galactic and extragalactic research. The 25 cm telescope was very useful in the initial photographic and photoelectric programmes. Presently, the 15 cm reflector acquired in 1960 and 25 cm telescope are being used for acquring the ever curious visitor to ARIES with hevenly bodies.

"The 38 cm, f/15 reflector telescope (Fecker,USA) installed in 1961 at Manora Peak has German mounting. The 52-cm reflector telescope (Cox, Hargreaves and Thomson Ltd, UK) also installed in 1961 at Manora Peak has an equatorial fork mounting. The telescope has f/13 folded Cassegrain and f/70 Coude focii and is functioning since 1968. The 56-cm reflector telescope has f/15 folded Cassegrain on a fork mounting. These telescopes are going to be modernised so that they can be used for studies of variable stars, comets and earth's atmosphere."

From this one can positively relate the '15-inch reflector with a focal length of 225 inches' in the observation report with the '38cm F/15 reflector installed in 1961 at Manora Peak', and the '10-inch refractor' with the "25 cm reflactor" (sic) with which the observatory started in 1955. That is, the reported observations were clearly made with telescopes belonging to what is now called ARIES.

However, does this mean the observations were made at the current location of that observatory, which is located several km south of Naini Tal? The answer to this can be found in the History section of the ARIES web site. The observatory was originally located at Varanasi – a long distance from its present location at Manora Peak (near Naini Tal). The move from Varanasi is described as follows:

> *In November 1955, the UPSO was shifted over from Varanasi to a small cottage at Debi Lodge, half way up to Snow View from the Lake Bridge at Nainital. UPSO moved to Manora Peak (longitude 79° 27′ E, latitude 29° 22′ N, altitude 1951 meters), south west of Nainital and situated at a distance of 9 km from the Nainital town...*

Associating this information about the moves of the observatory with the details of the observatory's telescopes, my interpretation of the circumstances is:

- The telescope used to make the photoelectric recording had been in use since 1955 at Debi Lodge. While that telescope was moved to Manora Mountain, the date of that move is not known. An inspection of the GoogleEarth images shows that the reported coordinates for the observation are consistent with the described location of Debi Lodge (half way up to Snow View – a peak overlooking Naini Tal). That is, the photoelectric observations were most likely obtained from Debi Lodge, with the telescope being moved to Manora Mountain at a later date.

- The 38 cm telescope was installed at Manora Peak in 1961 – the year of the observation. There is nothing to suggest this telescope was ever located at Debi Lodge. It follows that the visual observations were made at Manora Mountain, at Longitude 79° 27′ 29.2″ E, Latitude 29° 21′ 31.6″ E, Altitude 1936 m. (WGS84).

Relevant to the visual observation, the post-diction magnitude drop is a mere 0.5 magnitude – which indicates the visual observation would have been quite difficult. Also relevant is that the observations were made near the edge of the path (a fact not known at that time), such that the times from stations located several km apart can be significantly different. Unfortunately the times of the visual observation were not reported, with the report stating that "the visual observations, as compared with the photoelectric ones…, were considerably in error." We can only speculate whether the 'apparent' error in the visual times was caused by the low magnitude drop, the effects of fading, or whether the visual times were in fact correct (the differences from the photoelectric recording being caused by the different distance from the path edge).

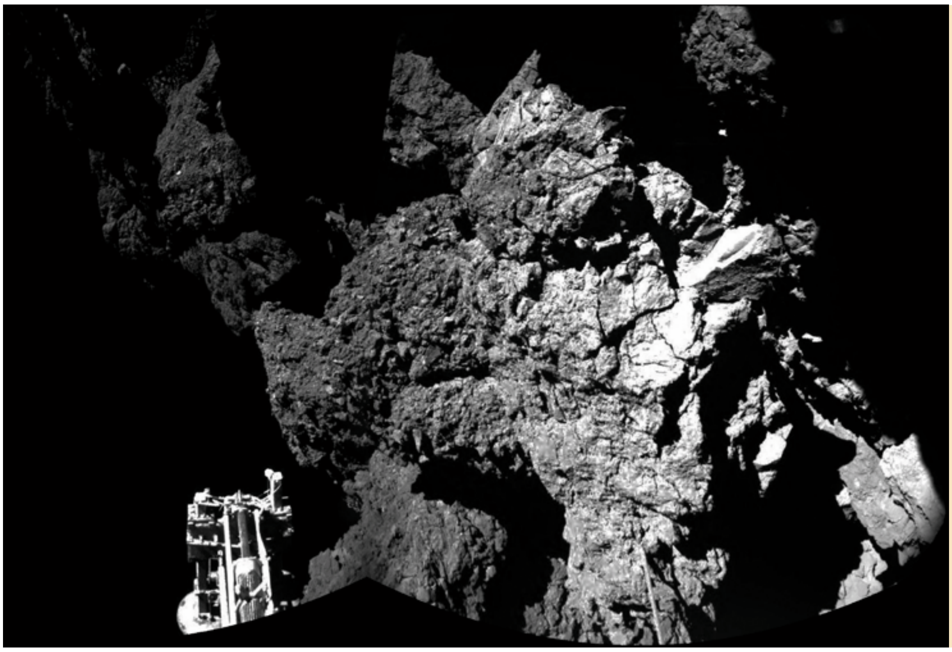
Conclusion

The first asteroidal occultation was observed in India on 1961 Oct 2. It was an occultation of the 9th magnitude star SAO146311 (= TYC 5237-01223-1, HD 215764) by (2) Pallas. The event was observed from two nearby locations:

- a photoelectric observation using a 10″ refractor with a 1P21 photomultiplier and a chart recorder. The location was 'Debi Lodge' at Longitude 79° 27′ 51.2″ Latitude 29° 23′ 15.5″, altitude 2090m, and lasted for a reported 25.5 seconds; and

- a visual observation using a 15″ reflector located on Manora Mountain at Longitude 79° 27′ 29″ E, Latitude 29° 21′ 32″ E, Altitude 1936m. The D event was apparently gradual – which is consistent with the location being near the path limit. No times are available for the visual observation.

The observers were S.D. Sinvhal, N.B. Sanwal and M.C. Pande.

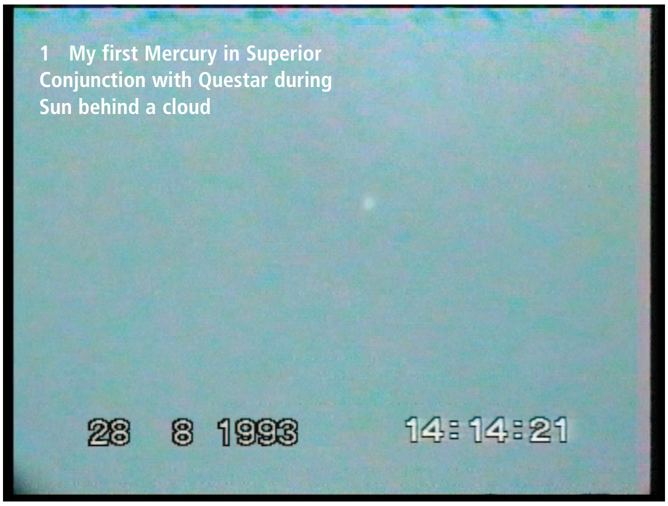


The Rosetta Mission lander is safely on a comet. One of Philae's feet appears at the bottom left of this spectacular image of the surface of C67/P Churyumov-Gerasimenko. Still a happy lander, Philae bounced twice before settling and returning images from the surface, travelling a kilometre or so after initially touching down at the targeted site Agilkia.
A surface panorama suggests that the lander has come to rest tilted and near a shadowing wall, with its solar panels getting less illumination than hoped. Philae's science instruments are working as planned and data is being relayed during communications windows, when the Rosetta spacecraft is above the lander's new horizon..

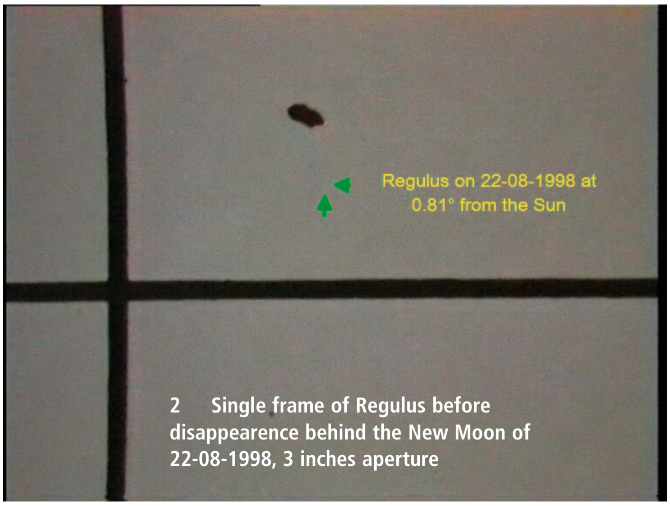
Journal for Occultation Astronomy

Observations of Planets and Stars near the Sun

Friedhelm Dorst · 10-24-2014



1 My first Mercury in Superior Conjunction with Questar during Sun behind a cloud



2 Single frame of Regulus before disappearence behind the New Moon of 22-08-1998, 3 inches aperture

Abstract

Most amateur astronomers are familiar with the knowledge that Venus can be spotted in the daylight sky with the naked eye, not only at the time of maximum brightness. Some people may also have seen Jupiter close to the Moon in daytime and sometimes even Mars is bright enough for finding it unaided during daylight. Moreover, Sirius (picture 16) near 90° elongation and Canopus (which is always close to 90° from the Sun) can be easiest seen during daylight when traced from dawn until after sunrise. Good eyesight is necessary to perform the same with Alpha Centauri (Toliman), Arcturus and Vega; the latter two might need the darker skies at a high mountain elevation and dedicated observers might add some more examples to a "to do" list.

My observations with various telescopes and binoculars during nearly half a century have progressively shown that even small aperture telescopes are sufficient to see planets and stars at close vicinity to the Sun, provided that mandatory eye-safety precautions have been met. Similar precautions apply for electronic recording with digital cameras or camcorders.

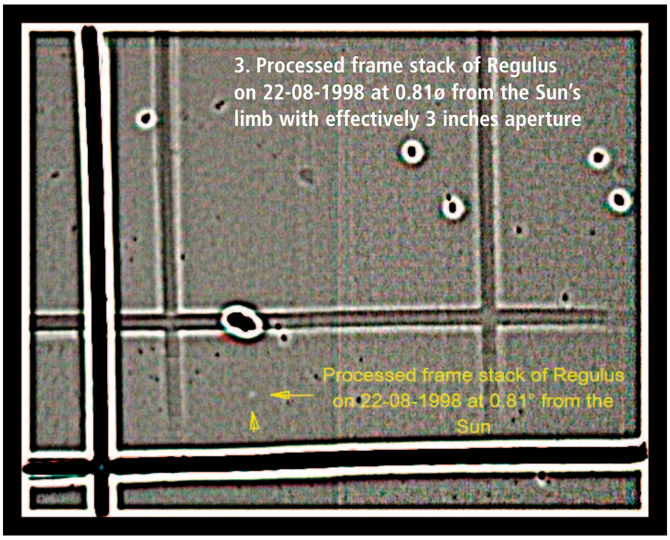
Planets close to the Sun

Daylight observations of Venus with the naked eye have been my focus since 1960 but I did not succeed in trying this before August 1962 in Switzerland. Jupiter followed in November 1963 and Mars in July 1971 (the latter two shortly before their perihelic opposition - each remaining visible well until after sunrise). Concerning Jupiter, it has proved true that its best naked-eye season is near its quadrature with the Sun at some 95° to 100° elongation where the sky exhibits almost its darkest blue and Jupiter's stellar magnitude is not too far from opposition brightness.

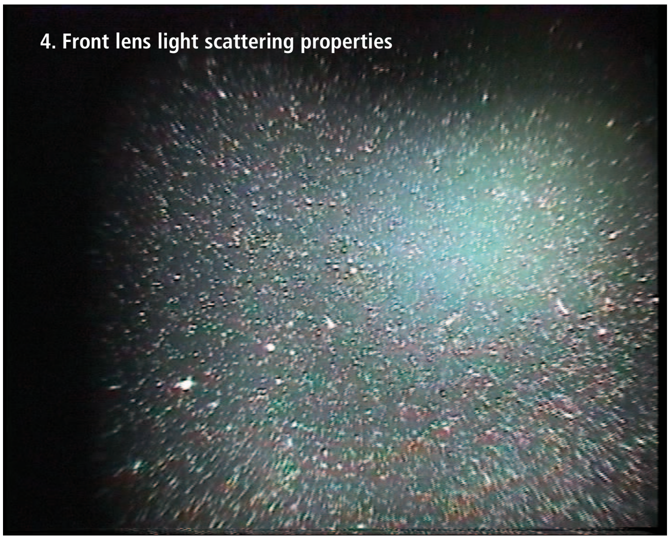
The use of binoculars (be they mounted on a tripod or hand held) was another way for me to maintain this passion until 1968 when I got access to telescopes with polar alignment. This tool, of course, was a bi step forward to systematically search and find stars in the daylight sky and when Venus began to approach superior conjunction with the Sun (20 June 1968 with Venus skimming some 3' north of the Sun's limb) became curious how close to the Sun I might detect its disklet of only some 10 arc seconds wide. One challenge before this attempt was the desire to watch the conjunction of Venus and Saturn <16° west of the Sun on 23 April 1968, when Saturn could indeed be glimpsed with a Questar at 40x magnification, incredibly faint and tiny around 10 hours U.T. in the late morning sky with Saturn only some 0.8° from Venus!

With studying astronomy at that time the small Questar 3.5" of the University of Münster was at my disposal and my private instruments comprised two pairs of binoculars (a Japanese 8 x 30 and a German 22 x 80 binocular with tripod adapter) and – considering the lack of a rigid mount – a self-constructed 8"-Newtonian at my home (with a rectangular tube) with an uncomfortable 2 m focal length, the latter instrument had to be leant against a chair for aligning it on a celestial object! The Questar observations of Venus were terminated during late May 1968 since the Sun's reflected image became projected on the corrector surface possibly heating it too much (Decades later this precaution proved unnecessary for my personal Questar). From then on, both binoculars were used when protected from a reliably shaded Sun (by chimneys, roofs or trees) and this worked to as close as 1.4° from the Sun's limb with one lens of my 22 x 80 instrument remaining covered for the reason of too large a parallax, otherwise the remaining lens would have caught direct sunlight.

Despite some forward-scattering haze in the afternoon of 16 June and stopping down the aperture to 44 mm (thus delivering just a 2 mm



3. Processed frame stack of Regulus on 22-08-1998 at 0.81ø from the Sun's limb with effectively 3 inches aperture



4. Front lens light scattering properties

wide exit pupil) and reducing the field of view to a few arc minutes only (by staying some 20 cm behind the eyepieces and protecting the skin around my eyes with a white tissue, suitably perforated for my eyes!!!, never attempt to take that risk!) I became surprised how clear the planet appeared at just 0.8° solar limb distance ("SLD") with the full Sun inside the original field of view (3.7° field diameter). This procedure was, of course, extremely dangerous and only a very careful positioning of my eyes prevented a fatal mishap since solar filters were too opaque to also show Venus!

On 23 June my Newtonian (stopped down to 50 mm aperture and waiting until after the Sun had left the field of view at 111x magnification) showed a very pale Venus at 41' SLD shining faintly only through a foreground "storm of myriads of aerosol particles". The latter is a common problem near the Sun at all seasons - but particularly during spring and summer - thus spoiling much of the contrast otherwise possible.

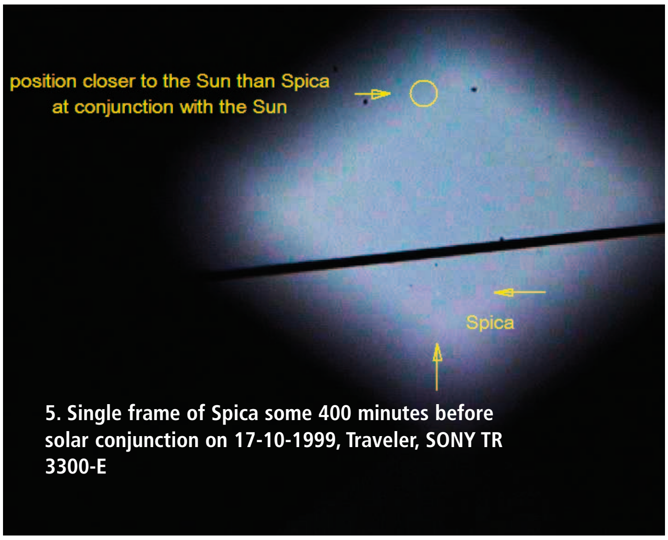
During these Venus observations it became obvious that it can require much practice to get accustomed to the rather different kind of daylight perception of stars, since (in my experience) the technique of averted vision fails to improve the perception of a faint stellar image. On the other hand, it can happen that one also fails to perceive a star at first and later on one wonders why it had not become obvious a few minutes before. This is impossible to occur for night vision of stars against a dark sky background. One additional problem occurs when gazing into the dull uniform blue of the field of view. This may initiate the drift of one's personal eye focus from its average adjustment. The latter can be avoided by use of a reticle eyepiece where the cross hairs will serve as a focal point for maintaining one's sharp vision.

Since the sky is strikingly bright near the Sun it is very wise to cover the front lens with an ND filter (my favourite one has proved to be an ND3 filter) combined with stopping down the front lens aperture. This not only offers some eye protection but also protects cemented eyepieces from too much heating in the case that the Sun has entered the field of view for a raw positioning with one's eyes watching obliquely from afar.

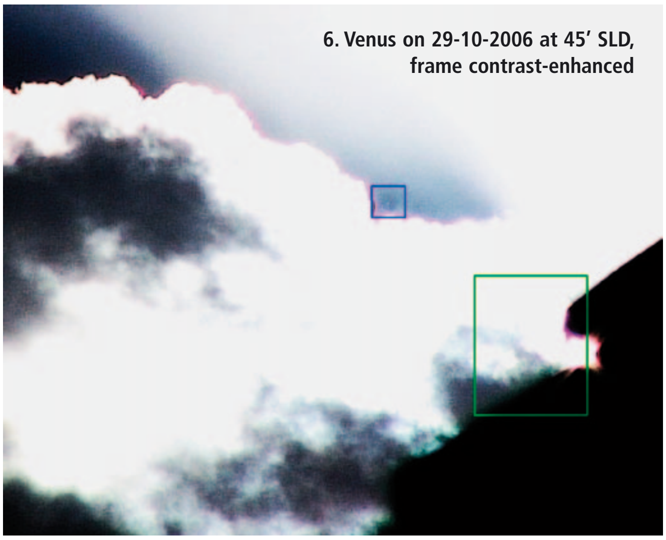
6 years later on 5 November 1974 (1 day before superior conjunction) I happened to detect Venus just less than 35' northwest of the Sun's limb with my 8 x 30 binocular on a tripod - once more using only its left front lens (then shut down to 20mm). The latter two procedures became necessary for three reasons: 1. To avoid direct sunlight falling into the other light path when I used the slit rim of the observatory dome in Münster to occult the Sun. 2. The other front lens would have been partly sunlit for the same parallax reason. 3. Stopping down the aperture reduced the apparent sky brightness for eye comfort, since (although remaining dangerous!) no filter was used. Nevertheless, it was fortunate to detect the steady planet "point" (consider 8 x magnification only!) within the "milky way" of trailing aerosol particles.

For beginners it can only be recommended to first try Venus approaching the Sun's vicinity from day to day because of the planet's unparalleled brightness and its high surface brightness as well (the latter being important for telescopic observation at higher magnifications when the planet exhibits a distinct small disk). Do not begin such an observation before the Sun has been made "undangerous" by keeping it safely outside the light path!

Observations at close proximity to the Sun's limb can profit from unusual measures: on 17 January 1994 (superior conjunction day) Venus was 0.7° south of the Sun's limb. Placing Venus towards the field centre of my Questar 3.5" by applying differential coordinates relative to the Sun (solar filter used during centreing the lower solar limb!!!) did not show anything of Venus with a 16mm eyepiece after removal of the solar filter with replacement by a Questar ND 2.4 filter), since the remaining light scatter spoilt the image contrast. The only route to success seemed to be to make a shift of Venus' (and the Sun's!) position upward to higher (though unsharp) parts of the eyepiece field hoping for then considerably reduced light scattering and so perhaps gaining sufficient contrast. This idea worked, for within a few moments Venus' disk became apparent and a gradual subsequent shift back to the field centre did not completely extinguish the now extremely pale planetary disk at 81x magnification. I most probably would never have found the



5. Single frame of Spica some 400 minutes before solar conjunction on 17-10-1999, Traveler, SONY TR 3300-E


6. Venus on 29-10-2006 at 45' SLD, frame contrast-enhanced

planet in the initial supposed central field position. This example shows that even a deterioration of image sharpness due to limited eyepiece field correction was more than compensated for by the gain in contrast, thus considerably facilitating this successful observation!

Interestingly, shortly before the recent partial solar eclipse of 23-10-2014 Venus was occulted by the Moon as seen from Nauru Island and the Marshall Islands for instance, but since such an event is widely considered to be radically unobservable nobody will have watched it with an appropriate optical device, although it could have been performed at a Venus SLD of a "generous" value of some 0.9°!

Also, Mercury at superior conjunctions became interesting in the 1970s when Münster Observatory got its 6"-refractor. On 7 October 1971 I could see the small disk at 74' SLD with 78 x magnification and on 21 May 1973 correspondingly at 62' SLD - both observations performed with an ND2 filter held in front of the eyepiece.

Nevertheless, it has proved that the image contrast is noticeably better when omitting the filter and stopping down the aperture instead, which may become recommendable (other precautions performed – namely a reliable guiding of the telescope) when electronic recording is being considered.

Stars close to the Sun

Telescopic observations of bright stars close to the Sun can become a different matter since their appearance is point-like in comparison to planets. This introduces problems in the case of strong lateral scintillation which can erase the star whereas a planetary disk looks to be only wiggling but remains visible because of its apparent width. I have experienced with my Questar that Procyon on conjunction day (21 July) – then some 16° from the Sun – became distinctly visible and when looking again after a while it remained undetectable for some 1 minute and once more a while later it had returned again to its initial visibility. Intermediate strong scintillation very probably was responsible for this partial failure. This experience once again teaches: one must not give up!

To more examples: when I first tried to see Aldebaran with my 6"-refractor on 30 May 1997 (when 5.3° from the Sun's limb 3/4 days before conjunction) I looked in vain for more than 3 hours at full aperture. Then a last attempt was successful with surprising clarity – especially when applying a yellow filter. I gradually closed down the aperture to 30 mm and since no smaller diaphragm was actually available for me I can only guess which smaller aperture might have been the limit on that day (Years later 20mm aperture was the limit!). See figure 15!

The second – now a counter-example – was an observation of Regulus with my Traveler (4.1") on 18 August 1997 at 3.9° SLD. After pointing the telescope at the calculated differential coordinates to the Sun (the latter strongly filtered, of course!) I at once perceived Regulus just in the field centre (no reticle eyepiece!) – surely a rare occasion of luck compared with another Regulus observation 10° from the Sun: the Sun's limb was very unsteady because of strong air turbulence that day. So I expected to see Regulus wildly scintillating - if at all visible. After several minutes of fruitless search I detected an absolutely steady white point - Regulus! Returning to the strongly filtered Sun its undulating rim had not changed its appearance – please explain this contradicting experience! So expect the seemingly impossible sometimes – be it helpful or leaving one with disappointment instead!

3. Photographic and video documentation

The availability of digital SLR photographic equipment and camcorders finally opened the door for successful documentation of situations which may demand an immediate reaction to unexpected opportunities like a sudden gap in the clouds!

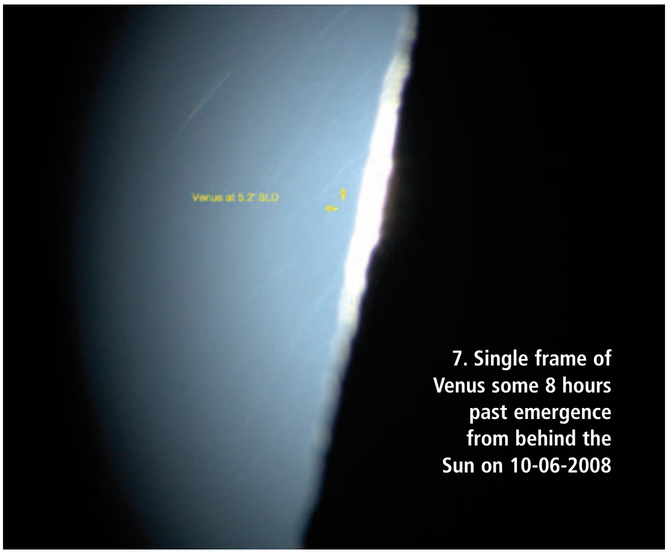
Except for Venus inferior conjunction photographs of the late 1960s through telescope eyepieces and corresponding camcorder videotaping in 1991 (Video8-format then) with Venus > 8° from the Sun, real solar vicinity capturing had to wait another 2 years.

My first such opportunity was the Mercury superior conjunction of 28 August 1993 with the planet some 100' northwest of the Sun's limb when a cloud occulted the Sun (figure 1). This lucky present prevented

Editorial note: The views and comments in this article are the responsibility of the author.

JOA and IOTA do not encourage any daylight observation that is a risk to your eyesight.

Please exercise the utmost caution if you attempt any observations near the Sun!



7. Single frame of Venus some 8 hours past emergence from behind the Sun on 10-06-2008

intense instrumental stray sunlight during videotaping Mercury through the reticle eyepiece of my Questar 3.5". The cloud shadow onto the haze layers below considerably enhanced the contrast of Mercury.

Moreover, due to the shadow of the cloud the aerosol particles were also in shadow. Thus, they now no longer rivalled with Mercury due to the lack of forward scattering of sunlight which otherwise enabled them to sometimes even become dominant in the solar vicinity, affecting the search for Mercury!

The obscuration of the Sun by contours of buildings or natural outlines can be planned in advance in order to profit from the protection against instrumental stray light otherwise originating from direct solar illumination of the front lens. As mentioned above, occultation by clouds delivers better contrast but remains a matter of luck. It can be stated that this is the only example in astronomy where the often-heard wish to others, namely "clear skies!" might sound unfriendly to the addressee! Clear skies are very much desirable, of course, but the solar disk should at least be clouded (so far as necessary for success). A few examples will follow below.

Even the most jubilant description (and related pictures) of the planet claimed to be close to the Sun is no proof for others except when the images are showing Venus or Mercury simultaneously together with the (correctly exposed) solar disk. This idea headlined my activities around Venus' superior conjunction on 31 March 2005. A Nikon D1 body equipped with a 400mm f.l. lens and suitably opaque clouds in front of the Sun allowed unfiltered snapshot sequences, with some successful pictures showing a pale Venus together with at least a substantial part of the Sun's limb which were now usable to measure the elongation of Venus expressed in parts of the apparent solar radius. So, pictures of this kind do not need f.l. data of the lens for a correct proof of the claimed SLD.

Conjunction day (31 March 2005) did not offer any clouds, so Venus was observed at noon with a minimum SLD of 62' using my 8 x 40 binocular on a tripod with the Sun behind a lantern head.

The next day Nikon D1 exposures with 280 mm f.l. and the Sun behind a high pine tree (faintly shining through the needles) were some substitute for cloud-assisted pictures. Also, this way videotaping with a 2x-teleconverter (effecting a 110mm f.l.) showed Venus distinctly with even shorter f.l. adjustments being successful at an SLD of now 64'.

This experience with my camcorders only (no telescope in front to look through) became my favourite recording mode, especially when HDV camcorders entered the scene the following year.

When Venus once more got close to the Sun in late October 2006 clear days allowed compact digital cameras with 51mm f.l. to capture Venus at 1.9° SLD with the Sun shining through a tree. The camcorder used documented dramatic effects of sudden cloud shadows and in one case on 29 October (1 day past Venus' closest solar passage) the planet appeared for 0.5 second only in a partially shadowed miniscule cloud gap together with the Sun at 45' SLD (figure 6). That rather instantaneous chance could not have been realised with a digital camera of that time since the reaction time between spotting Venus and pressing the button would have been too long (If Venus had been perceived at all !).

4. Special results

My plans to observe a Regulus grazing occultation by the New Moon of 22 August 1998 in Central Australia with the Lion's star only 46' from the Sun's limb were a matter of doubt and controversy since there were no experiences at all for such an ambitious observation with modest means like my Astrophysics "Traveler"(4.1" aperture).This plan even initiated a related OCCULTATION NEWSLETTER cover image and a correspondence on page 15 of that July issue, 1998.

I only knew that Prof. Max Waldmeier of the renowned ETH Zürich, Switzerland, had photographed Regulus successfully at conjunction (12' from the Sun's limb) in 1937 with a coronagraph. I no longer know the source of this report which contained a picture of this unique achievement.

My optimism was only supported by my Venus observation of November 1974 (see above) now extrapolated to a larger aperture, greater separation from the Sun, higher altitude of the star and the experience that my Hi8-camcorder would see more than my point-limited eye attention could perceive, whereas my camcorder can preserve its perception and is focussing its attention on a whole (although strongly restricted) field of view at once.

The predicted northern limit of the grazing occultation was submitted to me by Jean Meeus (Belgium, sending an occultation visibility chart) and Dr. Eberhard Riedel, who sent the geodetic coordinates of the northern limit. It crossed the Stuart Highway near the Taylor Creek close to the Osborne Range and its communication tower (Military). When drawing the line on a 1:50,000 map obtained in the Geodetical Map Centre at Alice Springs I unfortunately had made a scale error mistaking cm for mm, which displaced the line some 1,200 metres farther south and so probably cast me into the total occultation path. I noticed this error only on occultation day with no further chance to make a sufficiently accurate daylight polar alignment of my mounting at a new site farther north.

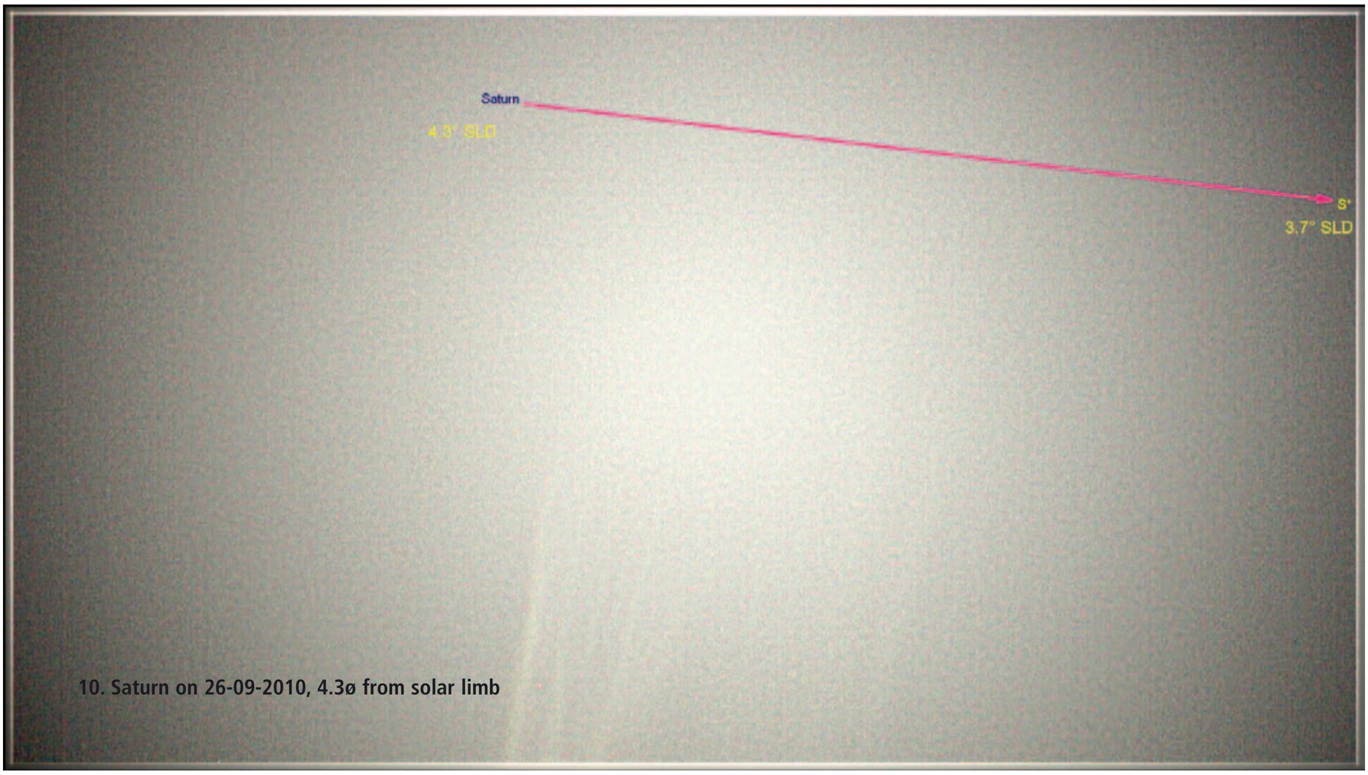
The annular solar eclipse on that day could be seen as a partial one with a maximum magnitude of > 38% and I hoped to better find the star with this small contrast-enhancing assist. The weather had become mainly clear on August 21 but hazy clouds crossed the Sun several times with fields of cirrus fortunately remaining lower in the eastern sky. At some time I believed to have spotted Regulus (perhaps really due to moments of constructive scintillation) but an attempt to confirm this (suggestively wished-for) impression failed. So I often recalibrated the focus with the filtered Sun, centred the star's position by switching off the power for a calculated duration and videotaped the field around the reticle cross centre many times hoping to at least see the star later during replay. The resolution of the camcorder screen did not allow me to see the star and thus I gave up becoming a witness of the event lying ahead. Nevertheless, I continued videotaping and concluded the session some 10 minutes after the predicted certain emergence of Regulus. After my return to Germany I found a 108 seconds (with several interruptions!) lasting video sequence with Regulus very faintly scintillating stationary near the field centre (figures 2 and 3 resp.) and I realised only later that the field diaphragm not only kept the Sun just from the reticle plate as necessary but also effected an aperture stop from 4.1″ to just 3″ as could be later derived from the exit pupil comparison. The two Regulus pictures were obtained during the fading eclipse at 19% magnitude and some 8% obscuration with an even lesser illumination loss when taking into account the solar limb darkening effect. It can be stated that the eclipse at that instant was not crucial for the camcorder to capture Regulus.

During this active recording phase I also took a short video sequence of the front lens from behind in order to judge the scattering of light originating from the lens surface impurities under these special phase angle conditions and became shocked by its overwhelmingly striking appearance (figure 4) being negligible at Sun elongations of say only 5°. The related brightening of the eyepiece field may have amounted to an estimated well > 1 stellar magnitude thus having contributed to a considerable contrast loss, which otherwise would surely have changed the matter!

Although the value of my video recording is zero with respect to the ambition to derive an especially precise relativity shift of Regulus by this method, it remains remarkable that a 3″ aperture is able at all to spot Regulus 0.81° from the Sun's limb and I am confident that a 6″

8. Mercury at 1.73ø SRD before sunrise on 27-06-2010 at 78mm f.l.

09. Mercury at 1.87ø SRD after sunset on 29-06-2010 at 78mm f.l.



10. Saturn on 26-09-2010, 4.3ø from solar limb

refractor could have recorded the event (the more so if my instrument had been brand-new) with sufficient precision and that Regulus would have become perceptible, thus being continuously monitored by the camcorder around the hoped-for multiple occultation.

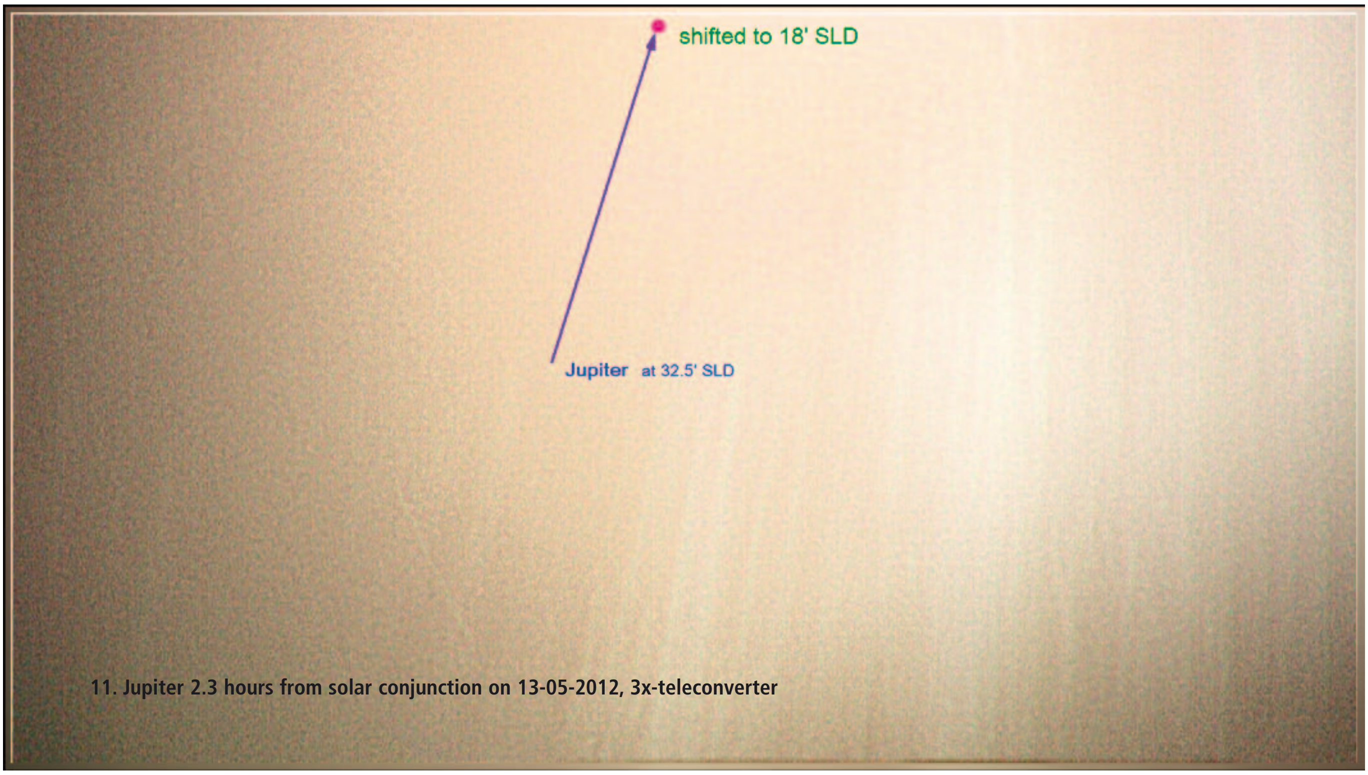
Apart from this very special application it remains interesting to me whether Max Waldmeier's achievement can be realised even without the use of narrow spectral filters.

In 1999 just on conjunction day (17 October) the weather cooperated to find Spica with my Traveler with the same optical equipment used at Taylor Creek. The star was some 400 minutes from conjunction instant (figure 5) and 1′ farther from the Sun than possible (taking into account the differential refraction, the separation from the Sun's limb was just 1.8°). Seeing the flickering star contributed to a barely describable feeling. Shifting the star (by imagination) to the upper part of the recorded section of the field of view would place Spica closer to the Sun than it can get at all at the actual conjunction which, of course, has the value of a real conjunction observation.

The year 2008 offered a nearly central occultation of Venus by the Sun from 8th through 10th June. The disappearance took place soon after sunrise on 8 June in questionable weather and low elevation. The emergence on 10 June had occurred before sunrise and it would become a tantalising challenge when first sight could be heralded. It was my friend Tobias Kampschulte who informed me by e-mail that he had succeeded at an SLD of only 3.4′ in the morning at his home in Bonn in slightly hazy weather. He used a short f.l. Williams Optics ED refractor (80 mm aperture) equipped with a Herschel wedge, ND3 filter and a homemade metal field barrier. My Questar was equipped with an ND 1.8 filter (64 x) and a chromium metal filter on one half of the reticle plate of my 16mm f.l. eyepiece causing strong solar reflections on the metal layer which flooded the optics with considerable stray light. No trace of Venus was visible until some 4.5′ SLD when I gave up this observing mode. Also, a detailed analysis of videotaping through the eyepiece did not reveal any trace of Venus.

Since the horizontal position angle of Venus approached 270° during the next hours I decided to use the vertical contour of a 20 m high building to block the Sun. Moreover, I stopped down the aperture of my camcorder teleconverter(1.7 x) from full aperture (70 mm) to only 30mm, in order to get more unvignetted angular space between the Sun's limb and Venus. The first video sequence was also the first successful one, beginning at <5.2′ SLD hinting at the possibility that at least 3′ separation only at that instant could also have been successful (figure 7). A nominal ND3 Filter (measured to be ND 2.7 only) and two internal filters (ND 0.75 each) protected the CMOS chip against heat from the Sun's limb and resulted in exposure values from 1/3 s to 1/50 s, the longer of which caused "straw-like" aerosol trails, whereas Venus remained a slowly pacing disclet thus not difficult to be distinguished from the disturbed aerosol trails. Since the atmosphere was a bit hazy at my home and at Bonn as well, Tobias Kampschulte judged the minimum separation between Venus and the Sun's limb as 1′ for his equipment under ideal weather conditions - especially if colour filters further enhance contrast.

Technical progress enabled me to use a 3x-magnifying teleconverter now even resolving the disk of Mercury at superior conjunction. On the occasion of Whitsuntide Sunday 2012 (May 27) Mercury passed within just < 15′ north of the Sun's limb (figure 12). The same building that served for the "Venus apparition" in 2008 now became a Sun eclipser



11. Jupiter 2.3 hours from solar conjunction on 13-05-2012, 3x-teleconverter

with its horizontal roof and Mercury near its perihelion provided enough light to appear through the aerosol foreground even in DV record mode! Two years before, on 27th and 29th June 2010, excellent weather allowed me – just adjacent to Superior Conjunction day (28 June) – to try a last dawn and a first dusk observation respectively (figures 8 and 9).

Evaluation of the brightness distribution within the video field of 27 May 2012 resulted in a possible successful separation observation of only 6′ between Mercury and the Sun. An attempt to confirm this optimistic estimate the following year (Mercury slipped behind the Sun for roughly 1/2 day on 11 to 12 May 2013 in Australia 2 days after the annular solar eclipse near Tennant Creek) was ruined by a permanently rainy day in Alice Springs.

The next chance to try a separation between Mercury and the Sun of <15′ came on 26 April the following year (now with a solar eclipse only 3 days after the event) and this time Alice Springs fortunately donated excellent weather all day and an unexpected clear success (hinting on a < 2′ separation between Sun and Mercury probably also being recordable under the actual weather conditions and with a higher building's contour [in order to occult the Sun with a smaller vignetting space between Mercury and the Sun]). Figures 13 and 14 testify to this estimate.

What about Jupiter and Saturn? Concerning Saturn, I could not surpass my above Questar observation near Venus in 1968, and Jupiter's least angular distance to the Sun's limb in full daylight - although with no front lens shading – has been 5.1° on 7 March 2010 with Mercury nearby.

Videotaping a guided Jupiter and Saturn offers the possibility of processing frame stacks. This tool lets us considerably shrink the elongation limit with my following preliminary results: With an unshaded front lens of my 3x-teleconverter, my camcorder shows Jupiter to some 1.5° separation from the Sun's limb and with shading probably less. Dark cloud shadows on 13 May 2012 enabled me to record Jupiter 2.3 hours before solar conjunction at a separation of 32.5′ from the Sun's limb, with the option of 18′ SLD only at a favourable displacement of Jupiter within the frame (figure 11).

Saturn could be identified on stacks some 7.5° from the Sun's limb with an unshaded lens, and using a cloud shadow in 2011 allowed Saturn to come out on the processed stack at 4.3° from the Sun's limb with the option of 3.7° that day if displaced instead to a frame edge (picture 10).

I believe that a solar conjunction picture of stacked frames of Saturn could have profited from a similar shading by a massive cloud at the then large conjunction distance of 2.0° from the Sun's limb. At larger ring plane angles the Seeliger Effect would brighten Saturn's ring system near solar conjunction and thus might deliver sufficient image contrast against the surrounding sky for Saturn to even appear at < 2° SLD!

5. Summary and outlook

Attempting a synopsis of these results for an outlook, I dare to state that this documentation promises the potential to achieve more challenging goals. Moreover, lunar occultations of stars and planets by the New Moon principally look observable with modest equipment concerning the necessary focal lengths and front lens apertures.

Unfortunately, the near future will offer few such lunar occultations and the need for very exquisite meteorology rarely coincides with those events. But nevertheless: on 19 October 2199 a Spica occultation by the

12. Single frame of Mercury on 27-05-2012, some 72 minutes past minimum SLD

New Moon just at Spica's conjunction with the Sun will be visible in Canada (Calgary and Winnipeg are situated in the path). "Clear skies!" in the above sense should then hopefully prevail!

If one is content with lesser proximity to the instant of solar conjunction there is something more in the bag for the near future: Aldebaran will be occulted on 04-06-2016 from Boston, Mass. and many more places in the USA, and Mexico City will experience a Regulus occultation on 21-08-2017 (total solar eclipse in the US!) not far from the northern limit of the occultation path, with Regulus only 0.9° from the Sun's limb!

Chasing stars and planets near the Sun surely is, and probably will, remain exotic. As for myself, the dangerous practices of my "storm and riot" phase have long since gone. Nevertheless, it is (and remains for me) a rewarding feeling to push forward the frontiers, knowing that the value mainly remains a personal one and perhaps may be, or may become so, for a few specialists only.

I do not expect a scientific payoff from these kinds of observations and all these conjunctions can be better simulated in a planetarium. On the other hand: In my opinion the "reality show" in the actual sky remains unsurpassed and some more goals cry out to be attempted! This is worth being performed, but only **with no omission of regards to safety and all precautions being taken!**

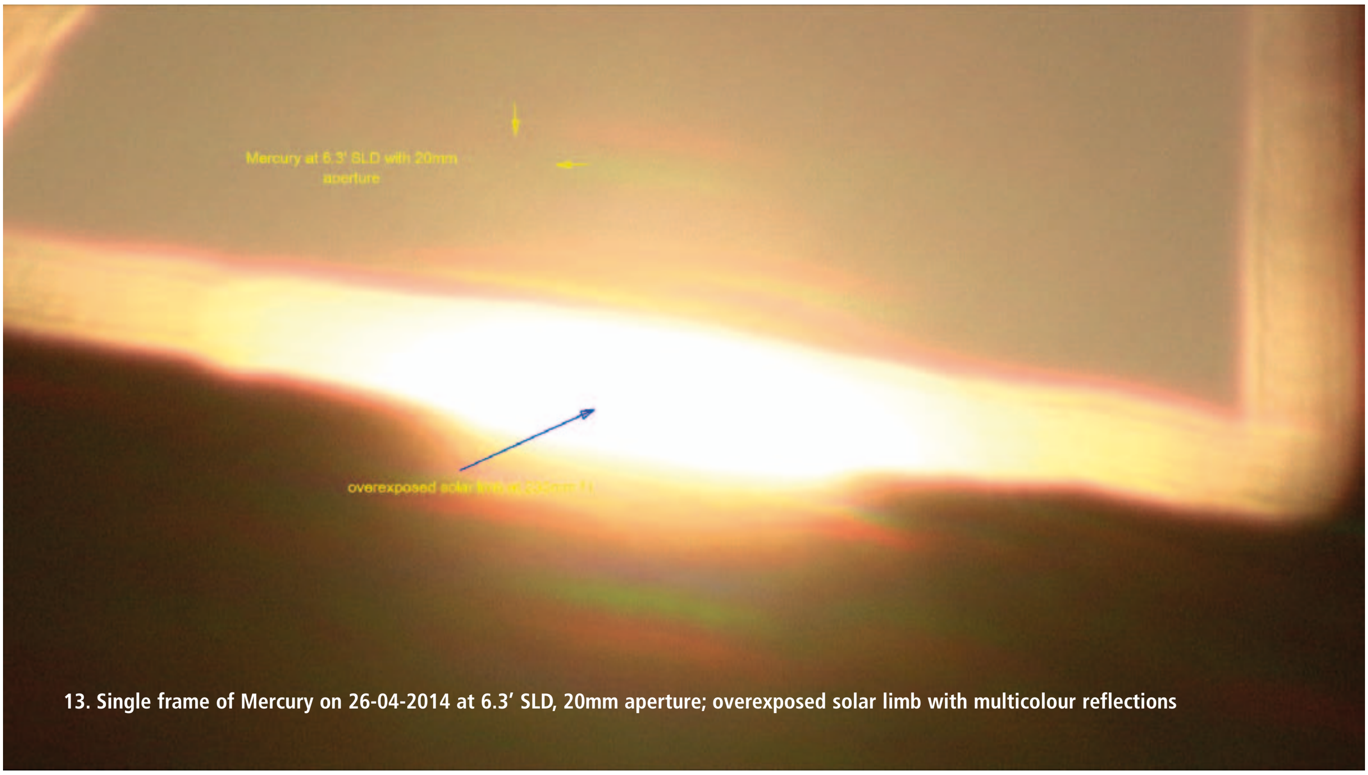
References

None of these observations have been published previously anywhere. The (raw) occultation predictions of Venus (23-10-2014), Aldebaran (04-06-2016), Spica (19-10-2199) and Regulus (21-08-2017) have been calculated using the program "Starry Sky Backyard".

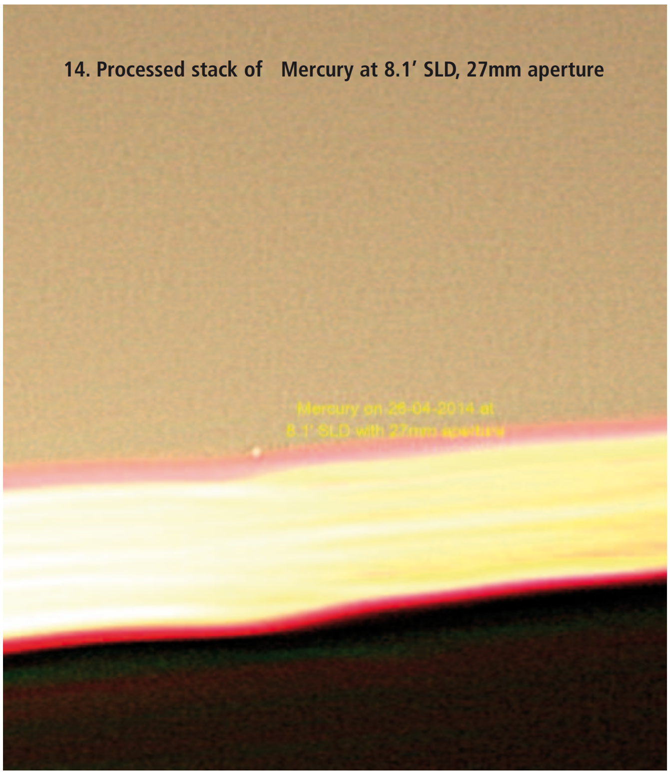
Editorial note: The views and comments in this article are the responsibility of the author.

JOA and IOTA do not encourage any daylight observation that is a risk to your eyesight.

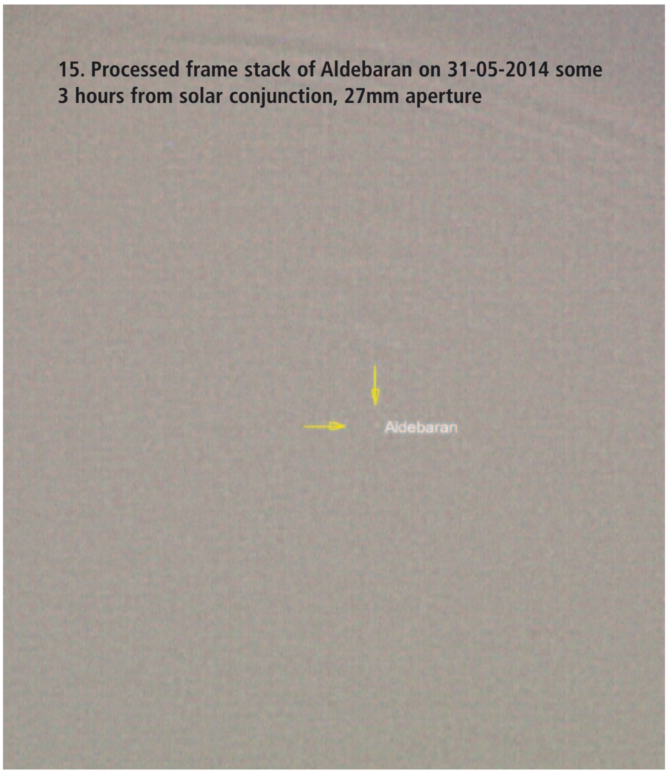
Please exercise the utmost caution if you attempt any observations near the Sun!



13. Single frame of Mercury on 26-04-2014 at 6.3' SLD, 20mm aperture; overexposed solar limb with multicolour reflections

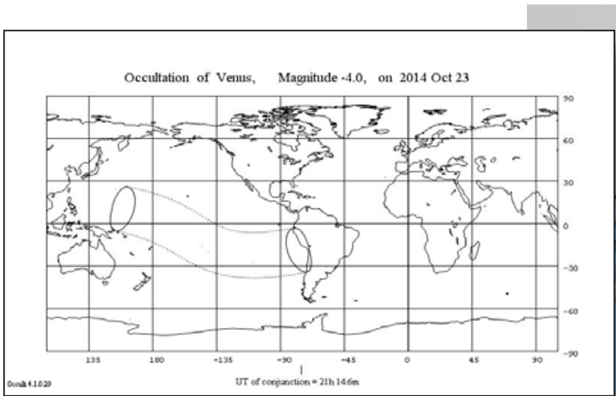


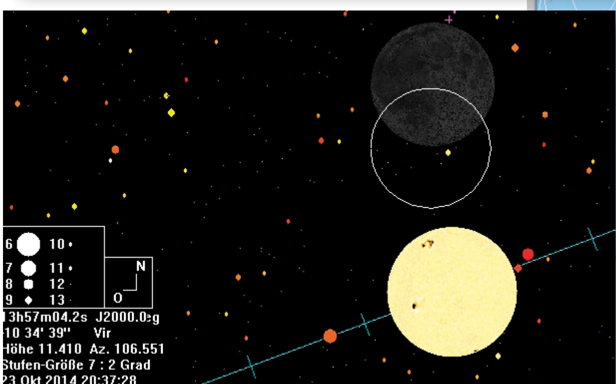
14. Processed stack of Mercury at 8.1' SLD, 27mm aperture

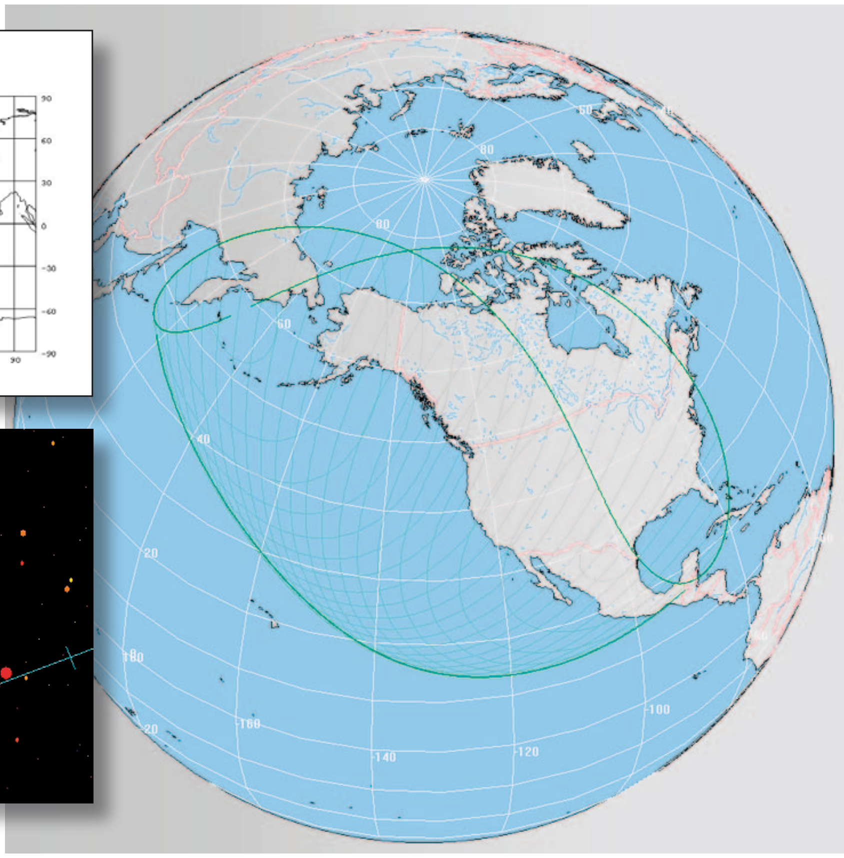


15. Processed frame stack of Aldebaran on 31-05-2014 some 3 hours from solar conjunction, 27mm aperture

16. Single shot of Sirius on 06-07-2014 taken with 78mm f.l., 28mm aperture, camcorder photo mode.BMP








We wish you
a merry christmas and
a happy new year!
...good luck for many
successful observations.

Journal for
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The International Occultation Timing Association, Inc. was established to encourage and facilitate the observation of occultations and eclipses. It provides predictions for grazing occultations of stars by the Moon and predictions for occultations of stars by asteroids and planets, information on observing equipment and techniques, and reports to the members of observations made.

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