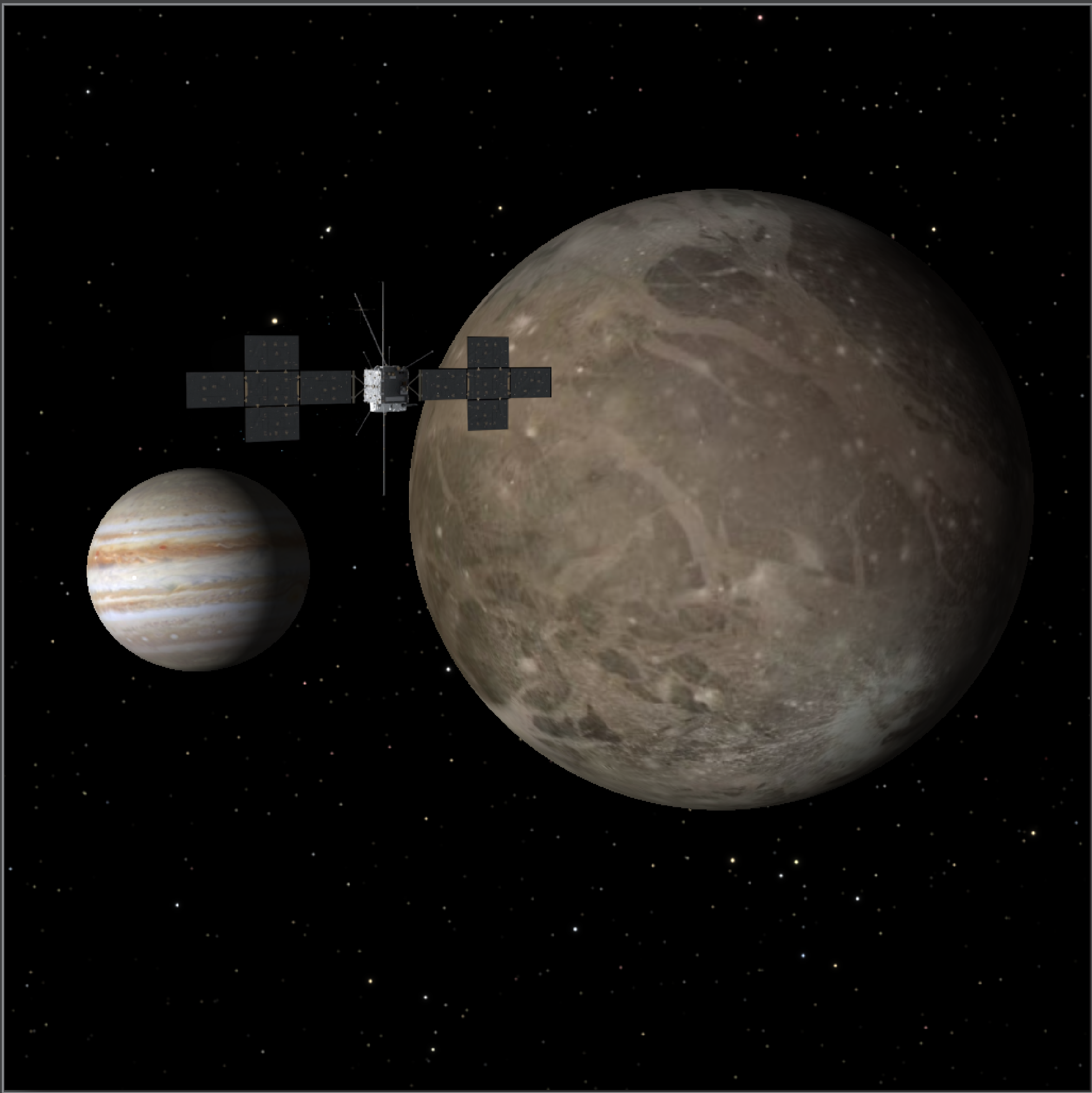
Journal for Occultation Astronomy

Volume 15 · No. 3 2025-03



Astrometry for ESA's Juice Mission - A Pro-Am Campaign

Dear reader,

Measurements of stellar occultations not only help to determine the physical sizes of asteroids and scan the atmospheres of planets and their moons, they also provide us with high-precision astrometry of these objects.

This astrometric data is important for missions into the depths of the solar system and is therefore an important component of Pro-Am campaigns. In the last issue of JOA, we reported on the successful observation of an occultation by (65803) Didymos, the target of the *DART* and *Hera* space probes. In this issue, Thierry Midavaine and the team at Paris Observatory call for observations of an occultation by Ganymede in October 2025 to help to guide ESA's *Juice* mission to its target.

But observations with precise time measurements are also in demand in the field of solar research. Costantino Sigismondi and his team used the partial solar eclipse on 2025 March 29 to determine the Sun's diameter.

In our 'Beyond Jupiter' series, Konrad Guhl introduces a TNO with a name that is difficult to pronounce and provides an overview of upcoming stellar occultations by this celestial body.

We can also report new discoveries of asteroidal satellites by occultation measurements. The European SODIS portal has received an update, and the worldwide community of stellar occultation observers will present results and share experiences on the ever-growing challenges in this field of astronomy at meetings in Europe, Japan and the USA in the coming months.

Good luck for your observations.

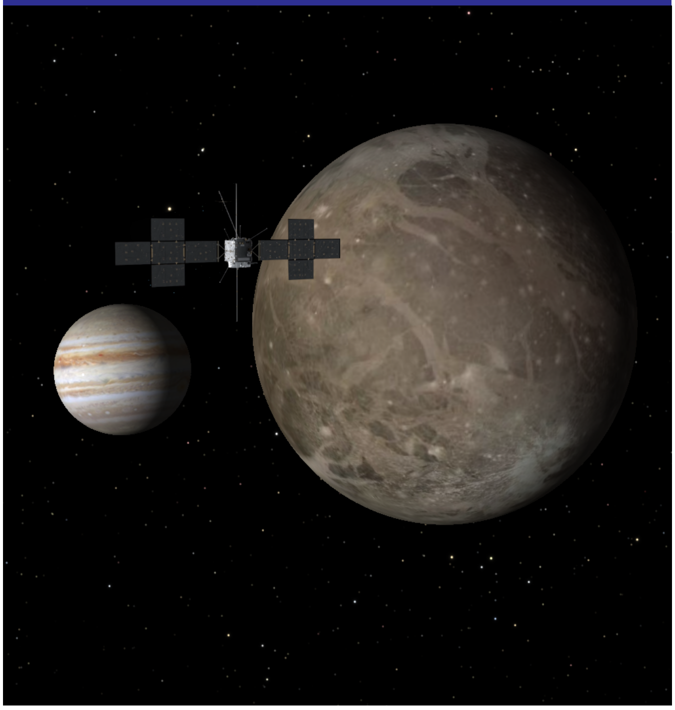
Oliver Klös

IOTA/ES, Public Relations

JOA Volume 15 · No. 3 · 2025 -3 $ 5.00 · $ 6.25 OTHER (ISSN 0737-6766)

In this Issue:

COVER



Artist's impression of the arrival of ESA's space probe *Jupiter Icy Moons Explorer* (*Juice*) at Ganymede. The measurements of a stellar occultation by Jupiter's satellite on 2025 October 14 will support the mission with high-precision astrometry for guidance of the probe. (Celestia 1.6.6.2., Juice animation: ESA with acknowledgement to ATG Medialab) (O. Klös)

Copyright Transfer

Rules for Authors

In order to optimise the publishing process, certain rules for authors have been set up how to write an article for *JOA*. They can be found in "How to Write an Article for *JOA*" published in this *JOA* issue (2018-3) on page 13. They also can be found on our webpage at https://www.iota-es.de/how2write_joa.html .

Journal for Occultation Astronomy

CALL FOR OBSERVATIONS:

Ganymede Occulting a Magnitude 7 Star - A Call for a European Campaign

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with
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ABSTRACT: An exceptional event is scheduled on 2025 October 14. Jupiter's satellite Ganymede III will occult a magnitude 7.5 star for observers in western Europe, causing a small drop in brightness of 0.1 magnitudes for up to 17 minutes. This occultation is motivating a campaign to achieve three ambitions. This paper shares all the data to allow you to join this "2025 Ganymede Campaign". Amateur and professional collaborations on stellar occultations by solar system bodies is a very active field in astronomy. Some of these events are important to motivate a wide mobilisation of the amateur community. Here, Ganymede, the star itself and the network of amateurs are the three targets of this campaign. This event seems obvious and a nice opportunity for a beginner to join the community, in fact this event is elusive to catch visually using a telescope. It requires a video recording to get the event from the processing and to deliver useful data.

Introduction

Thanks to the very successful Pro-Am collaborations in the field of occultations [1], a worldwide community of thousands of observers is ready to go to chase the shadow of a star cast onto the Earth by a solar system object (SSO).

Here seen from Europe, this is Ganymede III, magnitude 5.3, the third Galilean satellite of Jupiter which is meeting a bright star, magnitude 7 (HIP 37442) in the sky. Therefore, this event will allow us to update the position of Ganymede on its orbit with high accuracy.

ESA's *Jupiter Icy Moons Explorer*, or *Juice* space probe [2], on the way to explore Galilean satellites, will get an update of the current LTE Paris Observatory-released ephemerides. The star's large illuminance means an angular diameter of more than 0.1 mas (milli-arc second). The light curves will allow us to measure the size of the star's photosphere. The brightness of the event will allow every amateur instrumental setup to run at very high frame rates, therefore giving us the opportunity to reach the highest time accuracy. Thanks to the fact this event is covering most of western Europe, it could be recorded by most of the European-wide occultation community. It will allow us to check the absolute accuracy of all the observers and the opportunity to measure their discrepancies to correct their absolute latency in their reports for this event and also for future events.

Ganymede Event Motivations

Ganymede is the main goal of the European *Juice* mission. After a few years' tour around Jupiter (2031-2034), it will ultimately orbit around Ganymede (starting on December 2034) making a large number of measurements including radar sounding, altimetry, imaging and radio-science measurements. Like Europa, Ganymede is believed to harbour a global water ocean under its icy crust, making it a highly compelling Jovian object.

The interest in constraining Ganymede's position to a few kilometres is twofold. Firstly, the ephemeris of the moon is a key factor in the success of the *Juice* (ESA) and *Europa Clipper* (NASA) missions. During the insertion orbit of the probes, trajectory corrections are made to compensate for errors in the relative positioning of the moons. These corrections require propellant, which is very limited on board. In particular, a large error in the ephemerides would have major consequences for the continuation of these missions, and would be a bad omen for possible extended missions.

The occultation of October 14th will be an excellent opportunity to test the current accuracy of both American and European ephemerides. It is noteworthy that this observation will allow testing of both Ganymede and Jupiter ephemeris since stellar occultations provide right ascension and declination measurements.

The other objective is to constrain the amount of energy dissipated by tidal effects within the Jovian system. This energy dissipation takes place within the Galilean moons (particularly Io and Europa), but also within Jupiter itself. So, by obtaining a high-precision position of Ganymede (involved in a mean-motion orbital resonance with Io and Europa), it will be possible to further constrain the physics of this system.

Star Event Motivation

What about the star HIP 37442? Previous interferometric measurement gives an angular diameter of 0.45 mas. The spectral classification suggests the use of a Near IR sensitive camera with an R or I wide band filter to improve the sensitivity to the star's signature and to enhance event contrast.

Thanks to the angular motion of Ganymede at less than 1.4 mas/s, a 100 frames per second recording will allow us to sample the star with 0.014 mas steps. Any higher frame rate will improve the star surface sampling. Of course, the known spherical shape of Ganymede allows us to foresee the aspect angle of Ganymede's limb grazing the star's surface according to each observer's location. Therefore, it is nice to have a large number of observers spread over a wide latitude range. Thanks to the multi-chords recorded from various observer locations, we will be able to check if the star's shape is circular or ellipsoidal in cross section.

It seems difficult to go further from the recorded data, this is a giant K star, therefore we may only have small convective structures in the photosphere. As usual it will also be a nice opportunity to detect a stellar companion, if any. Whatever, we have to remember that the large Ganymede illuminance will contribute the noise from the photon noise and atmospheric turbulence and will give the limit of the photometric accuracies from the recorded light curves.

Observer Network Motivation

Most of the increasing number of the positively recorded asteroid occultations today are obtained by one or few observers [3],[4]. While the amateur instrumental setup is improving, thanks to the more and more sensitive CMOS Active Pixel Sensor (APS) used in the amateur astronomical cameras, we notice sometimes discrepancies in time stamping. Here, this event allows you to run your camera at a high frame rate, above 100 Hz, therefore giving you an opportunity to test your setup towards the milliseconds (ms) range. With the gathering of all the recorded time-stamped light curves, we will be able to qualify your effective latency you may subtract and estimate the final clocking jitter giving your ultimate timing accuracy! Within this ms accuracy range, latency and jitter come from several contributors:

- Does the embedded time-stamp indicate start, middle or end of the frame?
- Does the camera run in global shutter mode or rolling shutter mode (with the determination of the line on the frame recording the occulted star)?
- Does the PC trigger the start of the camera exposure or is a GPS-driven clock driving the camera with a trigger mode?
- What is the latency between the camera, and the computer linked through a bus, the control software and the video flux output and the digital recording on the hard drive?
- Which software and *Windows* / *Linux OS* are you using?
- Which camera configuration are you using: frames per second rate, full frame or windowing mode (region of interest), binning or not, 8-bit or 10 – 12 -16-bit digital dynamic?
- Which video format are you using? ADV, FITS, SER, AVI[1], RAW, ...
- Which device provides the time-stamping : Ethernet -Internet link to NTP, Internet link through mobile phone with NTP from Meinberg, GPS receiver delivering 1PPS (One Pulse Per Second) and the NMEA data, RF broadcast of DCF77 or ALS162, driving the PC Clock or driving the camera link or feeding a digital inserter. This time-stamping is done in the picture header or in a log file?

Of course, the still-efficient analogue video camera setup with video time inserter or time-stamping on the sound track are also very welcome!

Then through the processing pipeline relying on *PyMovie/ Tangra* up to the data delivery, the time-stamping process is to be kept and defined in the report. The final data are then submitted to the Lucky Star Occultation Portal [5] and the Stellar Occultation Data Input System (SODIS)[6], or other occultation Pro-Am collaborations, producing reports like Dave Herald's to:

- NASA's Planetary Data System, Small Bodies Node: Archive of all observations
- Minor Planet Center: Astrometry
- Central Bureau for Astronomical Telegrams : Asteroid satellite discoveries
- DAMIT: Asteroid shapes/diameters
- Journal of Double Star Observations (& from there, the Washington Double Star Catalog): Double star discoveries/ measurements

[1] Using *SharpCap*, AVI records are done generally with 30 fps. Problems will occure if CAM/grabber work with 25 fps. (C. Weber, SODIS)

It's worthwhile at the level of these programs or for IOTA and here IOTA/ES, or national observers' networks to feed a data base gathering the configuration and the accuracy of each observer. The purpose is to help them to improve their timing accuracy (latency to be subtracted and jitter). In France we are organising such a network called "Roadies" in the Gemini Pro-Am web portal [7]. The purpose is to improve the occultation observers' network in density and accuracy and emulate the occultation communities in each country.

The Event

Most of the key data related to this event are available from the Lucky Star project web page [8] and it provides a link to the latest prediction update.

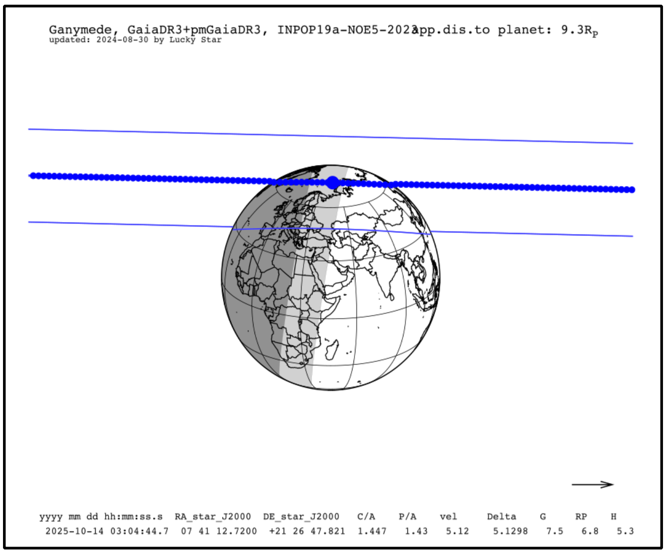

Figure 1a. Occultation by Ganymede (2025-10-14) from Lucky Star [8]

From Figures 1a, 1b, **please be aware** - the event occurs during the night of Monday the 13th of October into the morning of Tuesday the 14th before 3:00 UTC. Right Ascension (RA) and Declination (DE) are well defined, in fact the location of Jupiter and Ganymede are of course obvious to find. On that very night the Moon will be close to Jupiter (Figure 2). The star's G (Gaia panchromatic band) magnitude is 7.5 while its GBP magnitude (blue and green Gaia band) is 8.1, GRP magnitude (red and near infrared Gaia band) is 6.8, compared with Ganymede's magnitude 5.25 (from JPL Horizons). When Ganymede is in close proximity to the star, they will present a combined magnitude of 5.12 G (5.02 GRP), then during the occultation only Ganymede will be visible, giving a 0.1 mag drop in brightness in G and 0.2 mag drop in GRP (11.2% G, 19.3% GRP).

The apparent speed of Ganymede is 5.12 km/s, meaning a 100 Hz frame rate will give 51 m accuracy on the satellite geometry.

Figure 2. Field Of View (FOV) including the Moon and Jupiter (Stellarium display)

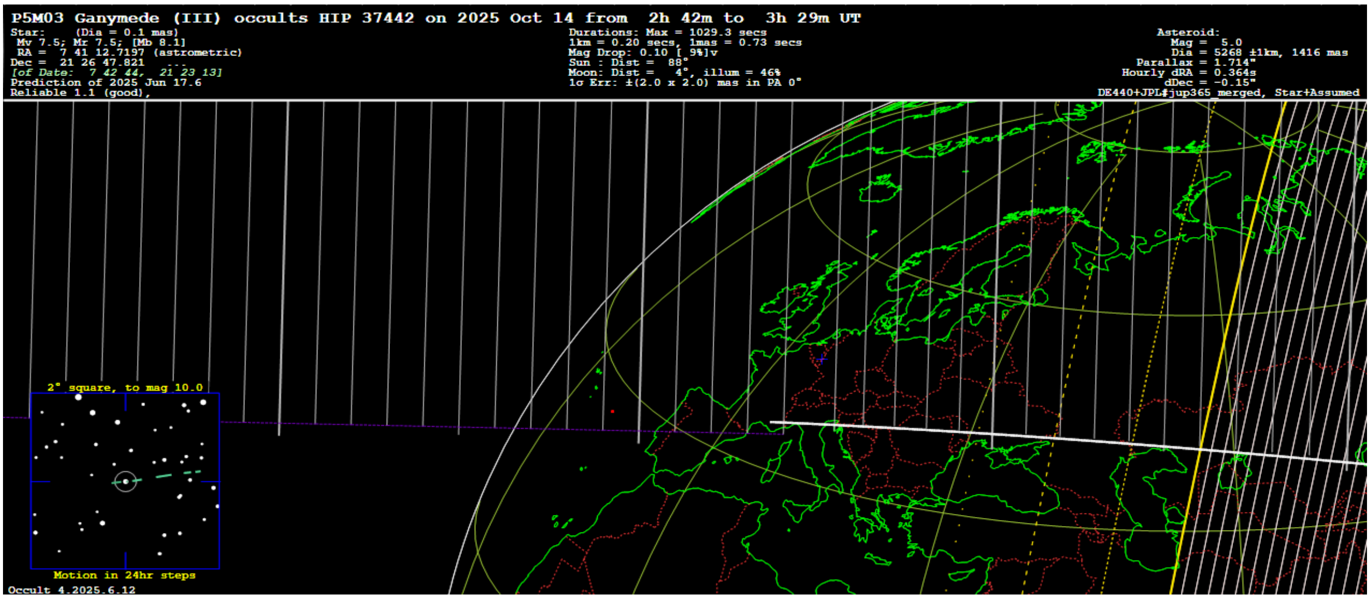

Figure 1b. Occult world map of the event. (Occult 4.2025.6.12)

Setup Configuration

To prepare for this 2025 Ganymede campaign you may find useful updated information on the Gemini portal on the web page dedicated to this campaign at [9] and Tables 1 and 2.

Satellite	V mag		Comment
	JPL Horizons	Stellarium	
Io I			Io is behind the planet during the event
Europa II	5.8	5.9	The preferred reference satellite to reduce the light curve
Ganymede III	5.25	5.31	The occulting body (the magnitude during the event)
Callisto IV	6.5	6.61	Useful to record if you have a large field of view

Table 1. V magnitudes of the satellites.

Occulted Star Magnitudes	G mag	Grp	Gbp
HIP 37442	7.5	6.8	8.1
Ganymede + HIP 37442 before and after the event	5.12	5.02	

Table 2. Magnitudes of the target star.

Due to the brightness of the event, choose and test the highest frame rate you can reach with your setup. 100 fps (frames per second) is in the range of most digital cameras with window selection (region of interest). Try to reach 200 fps or even more. Some cameras may reach 1000 fps, this ability will give us a greater order of magnitude in the occultation technique accuracies.

Figure 3. Occulted HIP 37442 star with surrounding stellar map (Lucky Star Aladin map), [8]

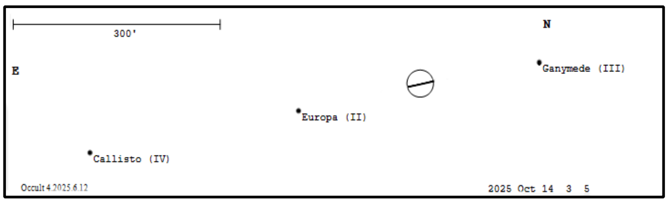

Figure 4a. Satellite configuration at the event time with a 300 arcsec scale. North at top. (Occult 4.2025.6.12)

We have no reference stars close to this occulted star (Figure 3) therefore it is mandatory to use a FOV able to record at least Europa II on the other side of Jupiter and then Callisto IV, if possible (Figures 4a, 4b). You have to test your trade-off between the fps rate and the field of view given by the windowing.

It could be preferable to rotate the camera field to position Ganymede and Europa away from the lines (or columns) illuminated by Jupiter's image.

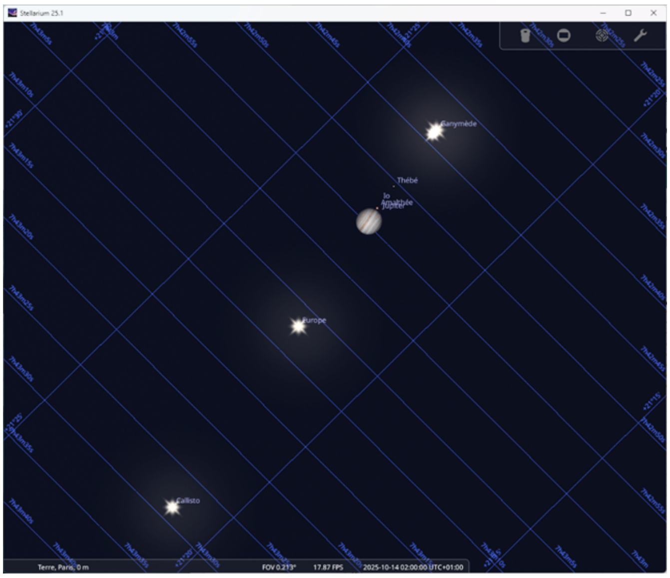

Figure 4b. FOV including Jupiter and Galilean Satellites at 3:00 UTC. Notice the close proximity of the star and Ganymede, Io is behind Jupiter. Zenith at top. (Stellarium display).

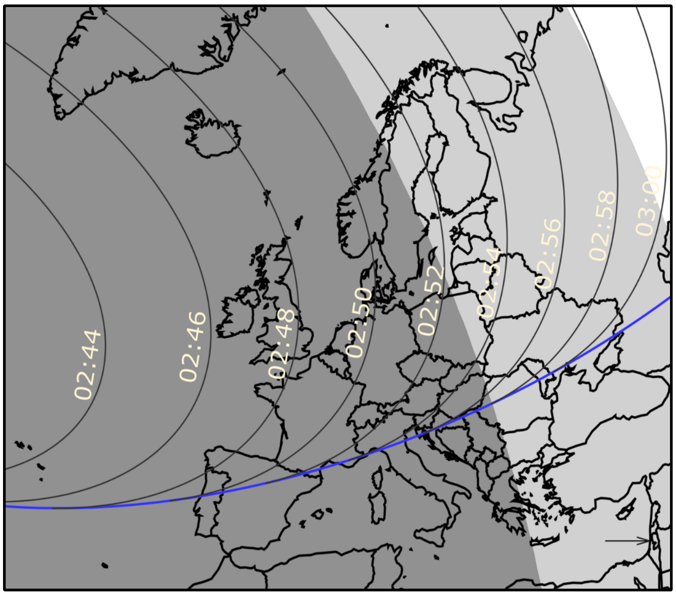

Figure 5. European map with immersion UTC isotime curves with 2 min steps. (LTE, Observatoire de Paris)

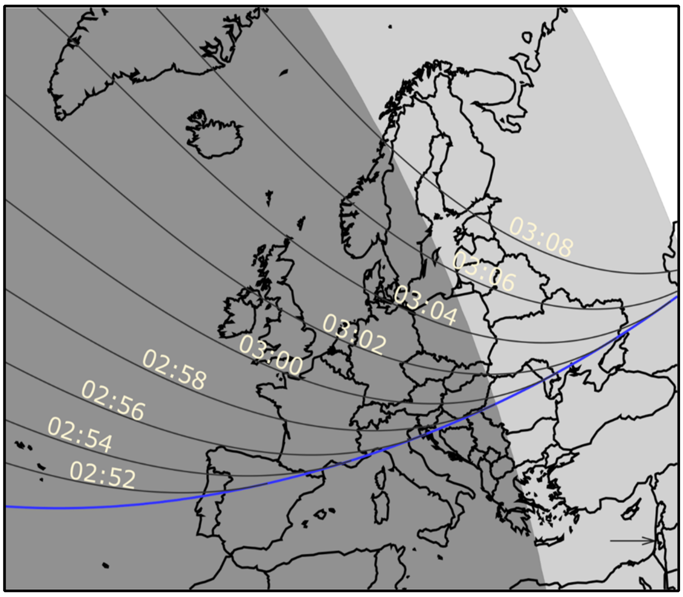

Figure 6. European map with emersion UTC isotime curves with 2 min steps. (LTE, Observatoire de Paris)

If you drive your camera with *SharpCap*, check the latest available version.

You have to define your final configuration, nights before the event. Record Ganymede with your complete instrumental setup to choose the right focal length, the filter (with enough signal, R or I is preferred or without filter for small telescopes) offset and gain and frame rate. Your digital signal has to be within the dynamic range of your setup output without any risk of signal saturation, because we are monitoring a small drop in brightness, around 10% - and the Signal to Noise Ratio (SNR) should be about 10.

Therefore, try a 10-bit, 12-bit or 16-bit setting (defined by your focal plane array and camera mode) running with your camera. Test the highest frame rate you can reach, if a similar frame rate is achieved, then keep this configuration. If the frame rate is less than half the 8-bit configuration, then choose the 8-bit high fps tuning.

No binning is preferred. Run your time-stamping device and your setup to check you don't have any dropped frames (maximum bus rate and hard drive access could be responsible for these dropped frames).

The noise statistic and temporal behaviour are interesting to record. Beyond the photon Poissonian noise, the star will bring a noise coming from the turbulence and seeing conditions in a bandwidth defined by the r0 (Fried diameter) and the wind speed. In using a high frame rate (above 100 Hz) you will be able to sample this noise. Due to the resolved angular size of Ganymede, if you use a more than 200 mm diameter telescope, you will meet a damped temporal noise attached to Ganymede.

Therefore before, during and after the occultation event, you may notice this interesting change in the behaviour of the noise in your light curve.

Due to an occultation duration of about 10 minutes or even up to 20 minutes from some northern locations, only the immersion (disappearance) and the emersion (reappearance) phases have to be recorded for at least 2 min around the predicted time of these two contacts from your location. You may obtain them from Figures 5 and 6 and accurately from [8] on the map in zooming in and clicking on your location.

If you are close to the grazing situation (the blue line on Figures 5 and 6) it's worthwhile to record continuously all along the event, including if you are just outside, to record the miss.

Before and after the event, record the signal of the sky background with the same configuration as dark frames and record flat frames within your configuration dynamic. These will allow improved data reduction for further processing.

Data Submission

We invite you to provide both your data and report to the Occultation Portal [5], (Figure 7) and to SODIS [6], (Figure 8). Check all the requested data when preparing your report. For the Occultation Portal, please submit your data only between -30 s to +30 s around the recorded immersion and emersion events to reduce the size of the files.

l'Observatoire de Paris PSL

Observers : ______________________________ Page ___ of ______

Telescope : ____________ Camera : __________ Laptop : __________ Track : _____________

UT date : ____________ Site Latitude: _______________ Longitude : __________ Altitude : ______________

Time setup : ______________ Temperature ______________ Wind speed / direction ______________

Time packed: ______________ RH % dew ______________ CCD temp ______________

Clouds : ______________ Barometer ______________ Seeing ______________

UT folder name	Object Name	Nexp/Duration	Exposure	Gain	Offset	Comments

Figure 7. Observing Log for Occultation Portal [5].

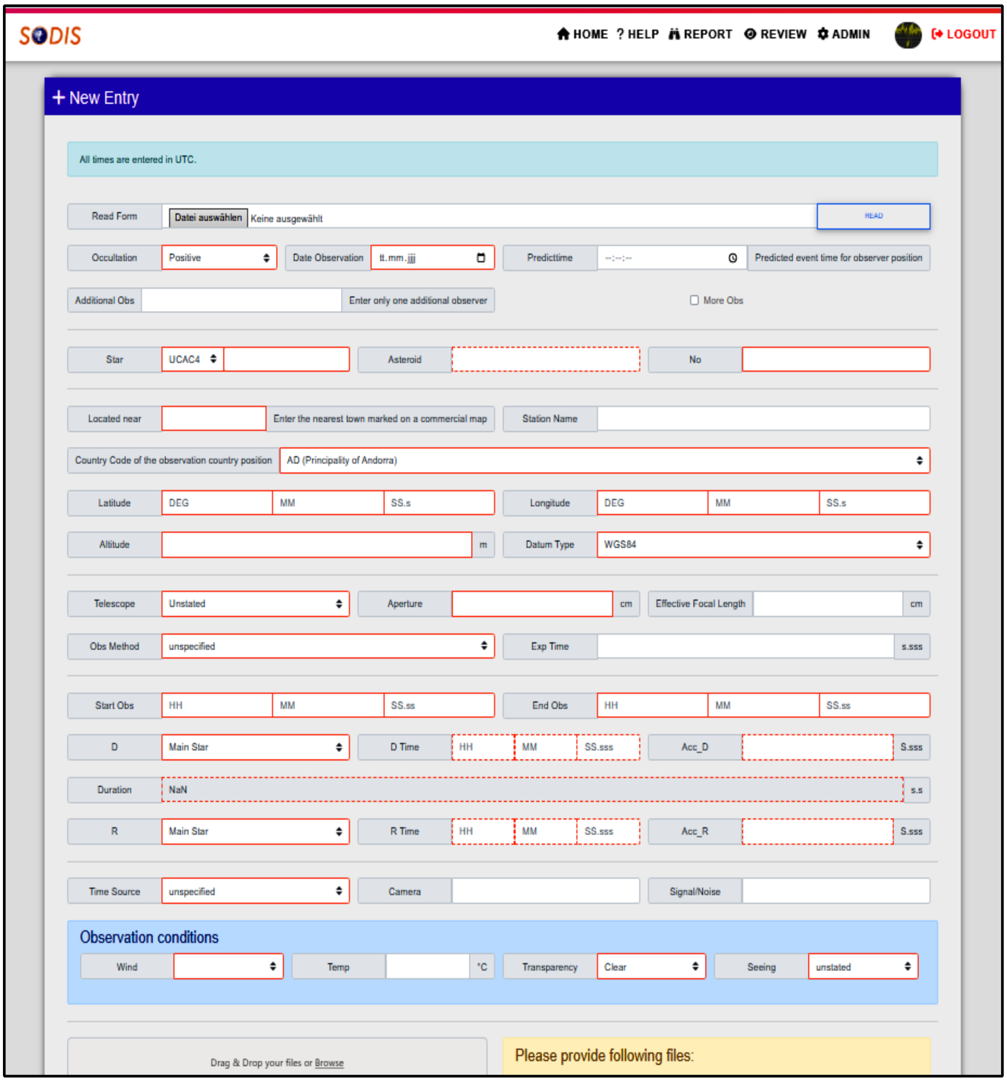

Figure 8. Screenshot of the SODIS report page [6].

The Occultation by Europa on 2025 Oct 13

It's noteworthy to share in addition, the same star will also be occulted by Jovian moon Europa from Central America the day before (Figure 9), [10]. Compared to the occultation by Ganymede the expected maximum duration of this event is much shorter due to the smaller size of Europa and the faster apparent speed of the satellite across the sky plane. Additionally, the event will happen much closer to bright Jupiter. Detail are listed in the header of Figure 10.

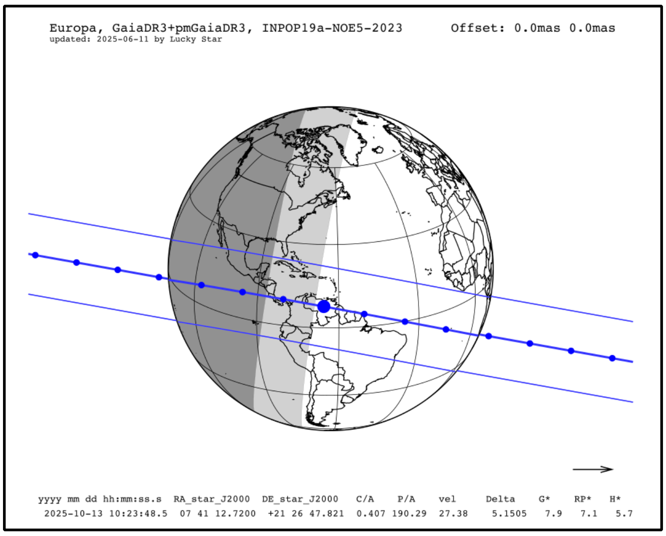

Figure 9. Europa will occult the same star the day before from Central America [10].

Conclusion

This 2025 Ganymede campaign is another exciting occultation campaign for Pro-Am collaborations. We will provide fundamental data for the *Juice* (ESA) and *Europa Clipper* (NASA) space probe missions. In addition, we will have the ability to accurately measure the diameter of the occulted star.

The latest information to prepare this event will be provided on the Gemini Web page [7]. We will schedule a Zoom meeting in September to share experience and feedback from previous campaigns, answer any questions or troubleshoot and help observers. The European organisations like IOTA/ES, Planoccult mailing list members and SODIS contributors or Lucky Star and *Lucy* campaign European observers are welcome to join this campaign. It gives in addition to each community and national organisation a way to check the individual accuracy of each observer. This could be a nice way to make an improvement to our occultation chaser networks!

Acknowledgements

Many warm thanks to Wolfgang Beisker, Konrad Guhl, Dave Herald, Oliver Klös, Alex Pratt and Christian Weber, for the accurate final review of this paper for JOA publication.

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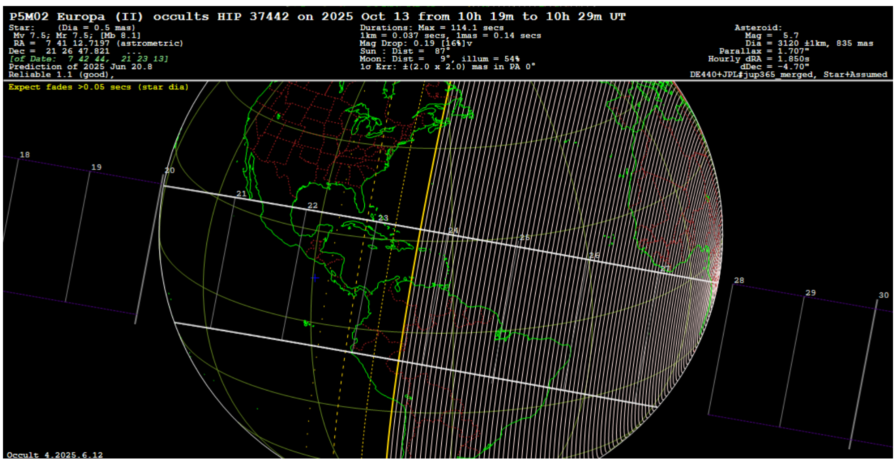

Figure 10. Detailed predicted path map for the occultation of HIP 37442 by Europa on 2025 Oct 13. (Occult 4.2025.6.12).

The Measurement of the Solar Diameter with the Partial Eclipse on 2025 March 29: What We Learned from the Observations

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ABSTRACT: The recent total eclipses (2013-2021) observed with increasing technological efforts, showed a rise of the solar diameter at 1 AU from 1919.26″(1891) to 1919.98″ (2021) or the solar radius from 959.63″ to 959.99″. In this paper we present the data of the last partial eclipse of 2025 March 29. The sudden change of luminosity as consequence of the totality is not present, and the only way to overcome the atmospheric turbulence is to fit with a parabola, the lunar profile's progression. These observations, possible thanks to a timely IOTA/ES Call for Observations, and their analysis are presented: the solar radius results as 959.73″±0.2″ showing the potential of this method.

Introduction

The variation of the solar diameter is a subject of study born in Rome in the second half of XIX century with Father Angelo Secchi (1818-1878) [1]. He raised the question of its variability during the solar cycle, finding an anti-correlation. The measurements continued during the XX century with meridian transits, as Secchi did, in Rome and Greenwich. In the last quarter of XX century the almucantarat transits take momentum with the solar astrolabes, modified by the original design of André Danjon (1890-1967) for the stars. Since 1978 the role of the total eclipses was recognized as fundamental in the investigation of the past values of the solar diameter, with an accuracy below one second of arc, or 1 part in 2000. The ON/OFF signal of the starting/end of the totality is determined from a celestial alignment and it is not influenced by the atmosphere. Also the measurements made onboard stratospheric balloons (SDS 1992-2011) or satellite (SOHO 1995-present) were aimed to overcome the atmospheric turbulence, which reduces drastically the required accuracy.

SDS confirmed, over almost two full solar cycles, a variation of the solar diameter (Egidi et al. 2006), [2] within 0.2″, while the transits of Mercury (2003 and 2006), [3] and Venus observed with SOHO (2003 and 2012) would not confirm variations within 15 km, or 10^{-7} radians, 0.02″. The experience in cases like that, where accurate experiments and analyses disagree, suggest more measurements, with more methods.

The partial solar eclipses, even being an alignment outside the atmosphere, have been considered too complicated for producing worthwhile results in the solar diameter variation's quest, because the lunar limb and the solar limb are blurred by the turbulence.

A similar phenomenon occurred in the famous Venus' transit of 1769, when Captain Cook and the Astronomer James Green observed the black-drop. This drop avoided an exact timing of the inner contacts of the planet's dark limb with the solar limb. Moreover, for Venus it was crucial also its atmosphere, whose role was recognized in 1761 by Michail Lomonosov (1711-1765). Nevertheless, Jay M. Pasachoff (1943-2022) demonstrated experimentally the optical origin of the black-drop with the transit of Mercury of 1999 observed with *TRACE* [4].

Since the transit of Venus of 2004 the idea of overcoming black-drop was exploited to define the contacts of the transit with more accuracy (Sigismondi, 2011), [5]. The extension to the partial solar eclipses is a natural consequence of such premises, and it would increase the number of datapoints of the solar diameter evolution.

To the central solar eclipses data (e.g. Lamy et al. 2015, [6]; Quaglia et al. 2021, [7]; Dunham et al. 2018, [8]; Quaglia et al. 2024, [9]; Quaglia et al. 2023, [10]; Dunham and Dunham 2024, [11]; Guhl 2023, [12]) we add some good examples of fruitful data also from partial solar eclipses. Notheworthy in this partial eclipse at 87% of the solar diameter covered, in Quebec, the inner corona was observed at sunrise (Carter, 2025), [13] for the first time ever.

The variations found in the solar diameter in many years of eclipse observations (Dunham et al. 2018), [8] may have reflected the methods, filters and the instruments used (Sigismondi, 2008), [14], as also appears in this paper when we compare different observations between them, but the advantage of the method presented here in the following section, is to overcome the turbulence with an extrapolating fit, already successful with the planetary transits.

Method: Overcoming Turbulence with a Parabolic Fit

The opportunity to exploit the technique developed to overcome the black-drop effect with the partial eclipse occurred on 21 June 2020. In Rome the eclipse was 2.5% and lasted less than half an hour (Sigismondi, Cicillini and Caldarella, 2021), [15, 16]

A video was recorded with a 76 mm reflector telescope, provided with a 520 ± 20 nm yellow filter and a mylar filter [17, 18]. A resolution of 0.6", significantly below the diffraction limit, was reached with such telescope, by using the technique of fitting the chords cut by the Moon on the Sun with a parabola as function of time. The zeroes of the parabola are the contact times.

The video was obtained filming at the eyepiece (afocal mode) with a smartphone.

The promising success of this first attempt was due to the Call for Observations published before the 29 March eclipse, to enjoy the full power of telescopes and skilled observers trained with the asteroidal occultations and total solar eclipses [19].

To this call have responded generously from the IOTA/ES Oliver Klös, Philip Denyer, Michel Giraud, Malcolm Jennings, Ferran Casarramona. The Italian students from the Nautical Institute of Ortona (guided by Angela Potenza and Pietro Di Pasquale) and the ones of Galilei Lyceum of Pescara (guided by Tiziana Pompa), were ready to observe in Abruzzo, Italy, close to the zero line of the eclipse, just off the coast in the Adriatic sea.

The weather of Italy and Germany was inclement. Beyond the Alps, in Ticino, the first and the last contacts were under the clouds, and only the maximum phase was recorded fruitfully (Figure 1).

The observations of Spain, France and England permitted to study better this method obtaining very useful data.

There are three kinds of data represented by short videos with time stamps:

1. Complete eclipse (t_1 and t_4)
2. Only one contact
3. Only the maximum phase (sequence of images)

The analyses have some differences

1. The parabolic reduction is made on 10 frames after t_1, and on 10 frames before t_4. It is necessary to see well the contact's points between the dark profile of the Moon and the solar limb, and to measure their length in pixel with accuracy. These points change continuously, so the lunar profile does not affect the final result. We can assume that the probability to have mountains and valleys is equal along the path and on the 10 frames there are some positive and some negative with respect to the mean lunar limb. The mean lunar limb is the reference with respect we calculate the start and the end of the eclipse. The algorithm is implemented in the website timeanddate.com and this has been used for the analysis presented in this article.

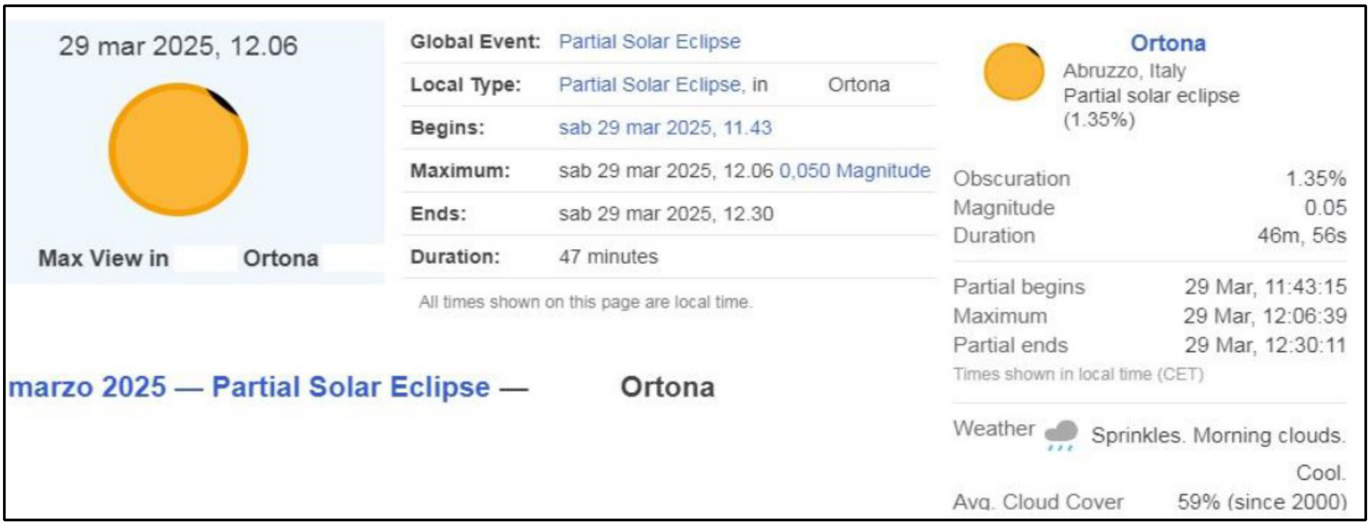

Figure 1. Grazing eclipse in Ortona – Italy, where to record the shortness of the eclipse, several students were ready to do the measurements, as well as in Pescara, 20 km North-West (Source: timeanddate.com)

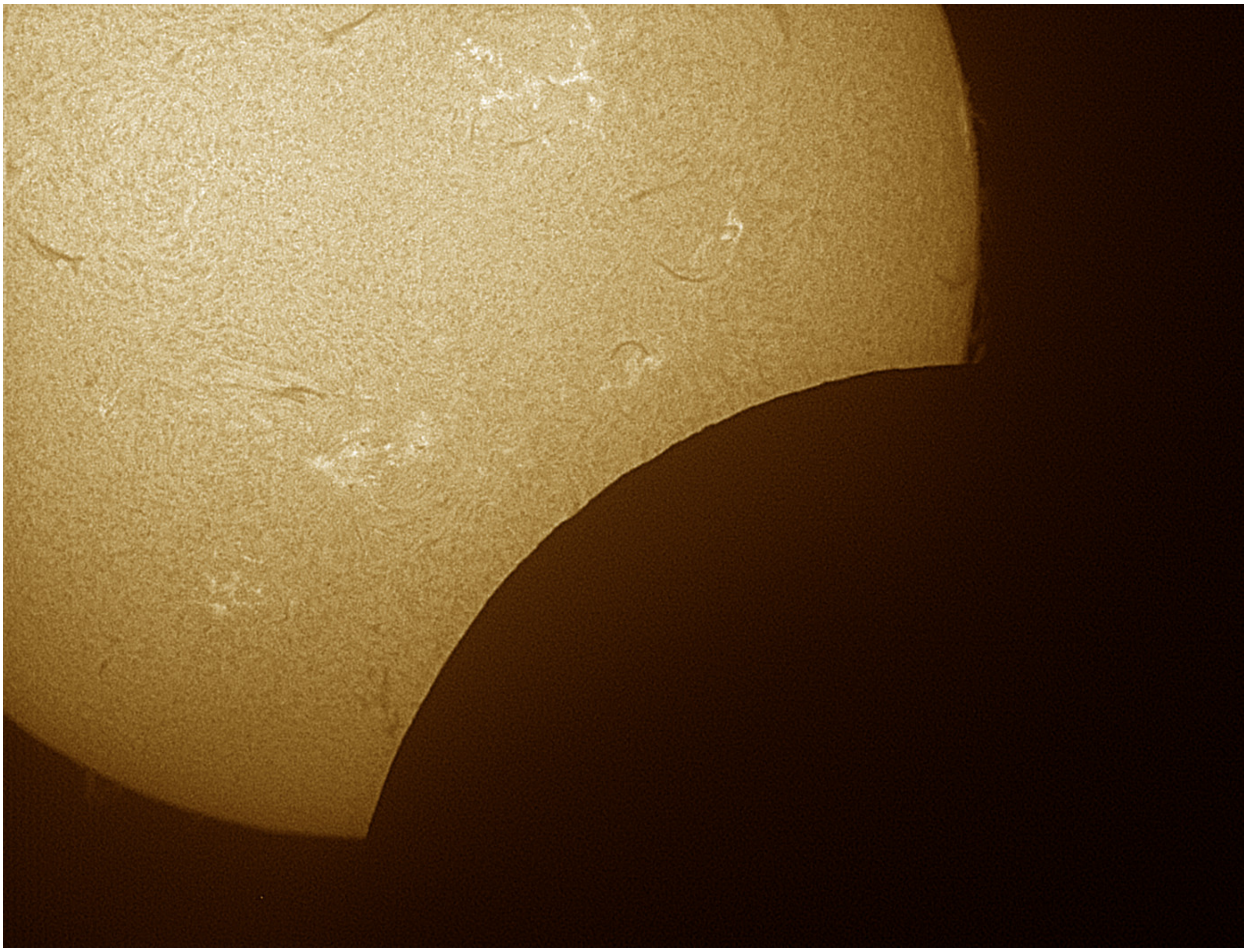

Figure 2. The eclipse at the IRSOL H-α guiding telescope, at the maximum phase of the eclipse 21%. The mountains of the lunar limb are clearly visible. Digital processing: Sabina Favore, IC Pieve del Grappa.

When both t_1 and t_4 (the external contacts, the only ones in a partial eclipse) are available we can compare the calculated times with the observed ones and the calculated duration with the observed one.

2. When only one contact is available we can assume that the ephemerides are correct and infer from the difference O-C (Observed time - Calculated one) if the Sun is larger or smaller than the calculated one. There is a larger uncertainty on the guess on the solar diameter with only one time.

3. Without contact times, the very tiny optical deformations of the telescope can produce a distortion below or near one arcsecond, that can't be eliminated by the fitting procedure, because we are not able to exploit fully the extra-atmospheric alignment of Sun and Moon in "sharp instants" like the external contacts. We will treat this case in another paper.

Figure 2 shows the solar eclipses at the maximum phase: the optical resolution is better than an apochromatic telescope because the H-α channel selects wavelengths only within 6562.8 ± 0.35 Å.

That's why the mountains of the lunar limb are so clearly visible. The telescope is diffraction limited, so for this instrument the limit is 1". A fit with N images, would produce an improvement in the resolution up to $1''/\sqrt{N}$ if the images sample enough completely the whole time range.

For the images in visible light, for which the diameter is slightly inferior than Hα, because the chromosphere –in Hα- is about 1" higher than the photosphere – in visible light-, the accuracy is similar because the aperture of the telescopes was ranging from 10 to 25 cm.

Results

Here are the analyses of four eclipses observed near the contacts times, the observations were recorded in video, with UTC time insertion.

Rochefort, FR

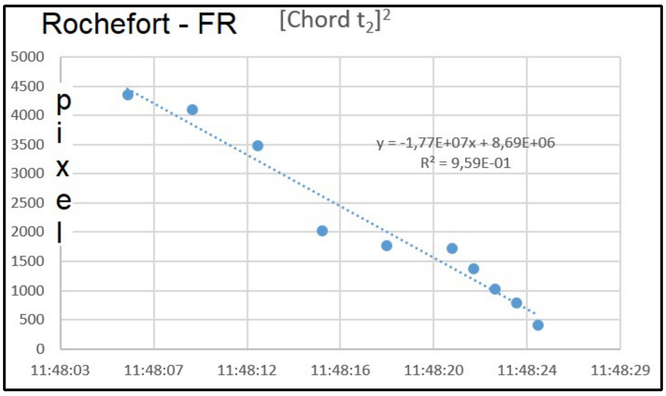

Figure 3. Second contact observed by Michel Giraud. Planetary camera (Zwo Asi224mc) on a Newtonian telescope (diameter 250 mm, focal length 1250 mm, equatorial Newtonian, homemade), filter Astrosolar (Baader), and IR-cut filter. Location: 17300 Rochefort, France. 45°55'49.3" N, 0°58'35.6" W.

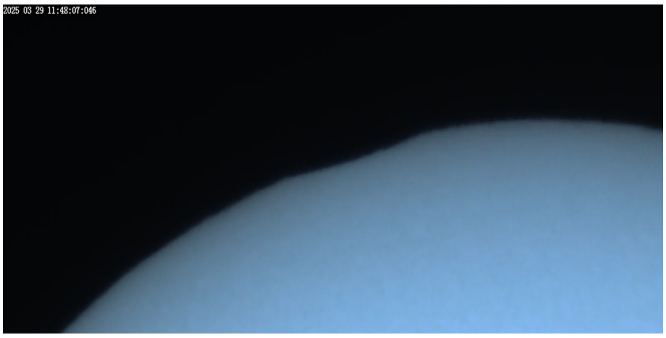

Figure 4. The unsaturated image near t_4.

A deviation from the line appears near the contact time. This result to be a rather general effect, but it does not affect the final result if there is enough sampling before t_4, or after t_1. With respect to the Call for Observations we should extend the time window at least to 4 minutes after the contact. Turbulence (seeing) and vibrations of the telescope produce the other oscillations (Figures 3, 4).

Hamsey Green, UK

The first contact graph is not affected by the bending near the fourth contact, because the data points start 3 minutes after t_1, the fit is accurate as well (Figures 5, 6).

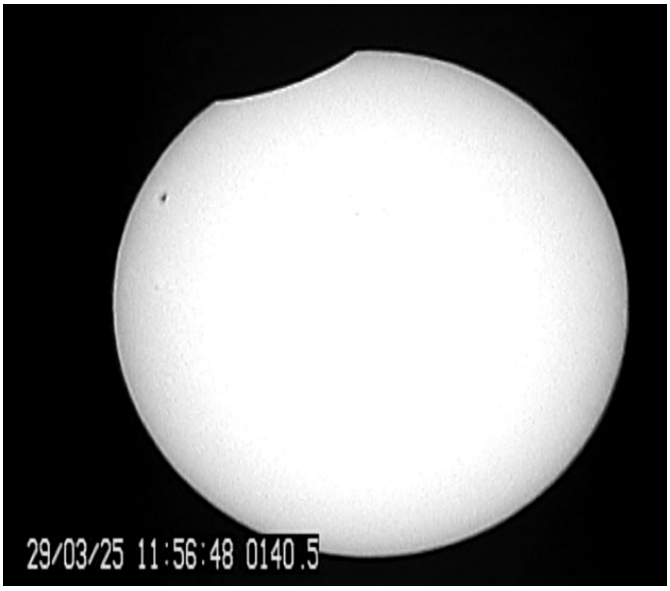

Figure 6. The full-Sun image near t_4 obtained by Jennings. It is heavily saturated near the centre.

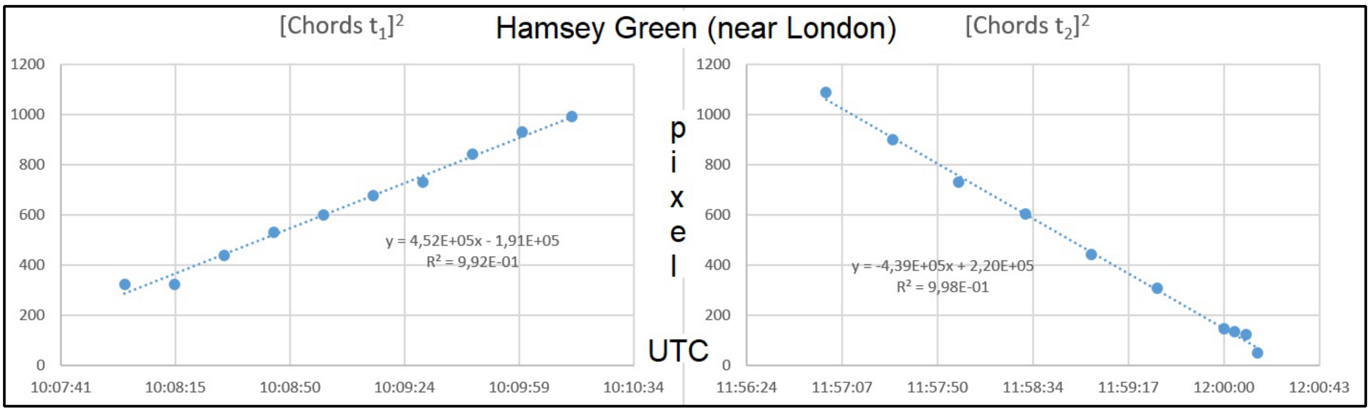

Figure 5. Both contacts observed by Malcom Jennings. Station: Hamsey Green (near London) 51°19'09.5" N, 0°04'01.5" W. Telescope: 10 cm diameter Newtonian, 40 cm focal length. Camera: Watec 910HX at prime focus, frame rate 1/25 s, exposure time 1/5000 s. Filters: Thousand Oaks solar filter + Moon filter.

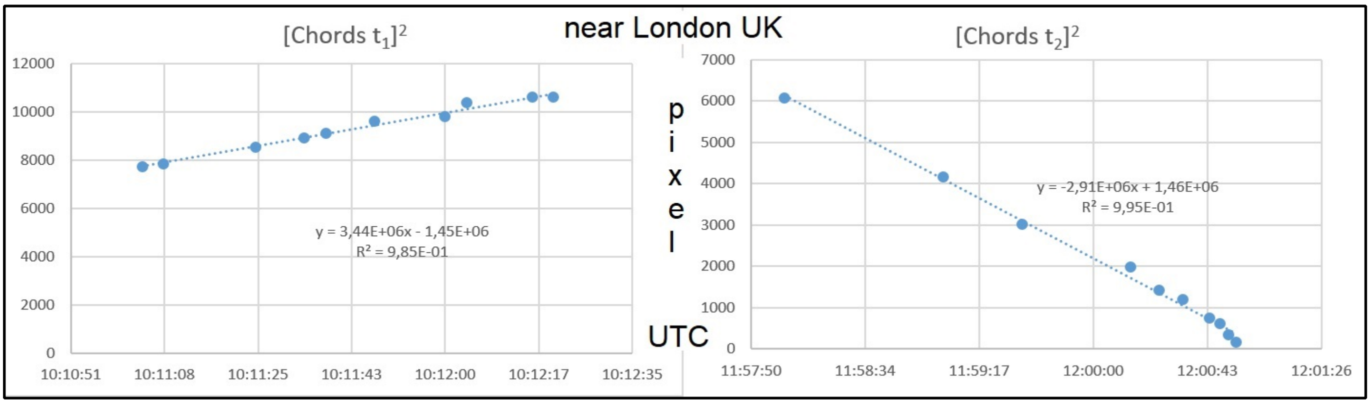

Figure 7. Observations made by Philip Denyer near London. Timing was done with a GPS video time inserter and recorded by a Watec 910 HX camera at 25 fps onto laptop with lossless codec using VirtualDub capture software. Baader solar filter was used over the aperture of the C9.25 telescope on a driven mount.

Near London, UK

The final bending near t_4 is evident, while it is not present after t_1 because the telescope was pointed there a bit later. This fact did not affect the final result (Figures 7, 8).

Las Negras, Almeria, ES

The final bending near t_4 is evident, while it is not present after t_1 because the telescope was pointed there a bit later. This fact did not affect the final result (Figures 9, 10).

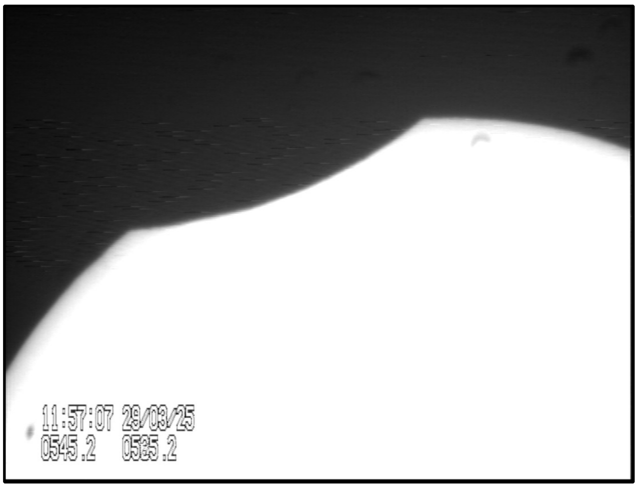

Figure 8. Image near t_4 obtained by Denyer, heavily saturated up to the limb.

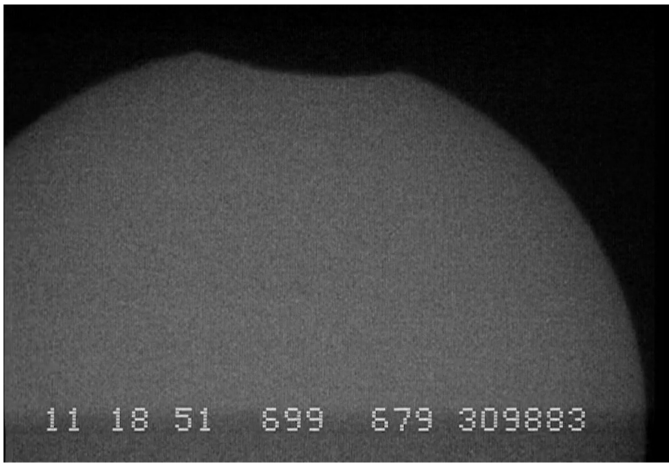

Figure 10. The image obtained by Casarramona near t_4: it is very dark.

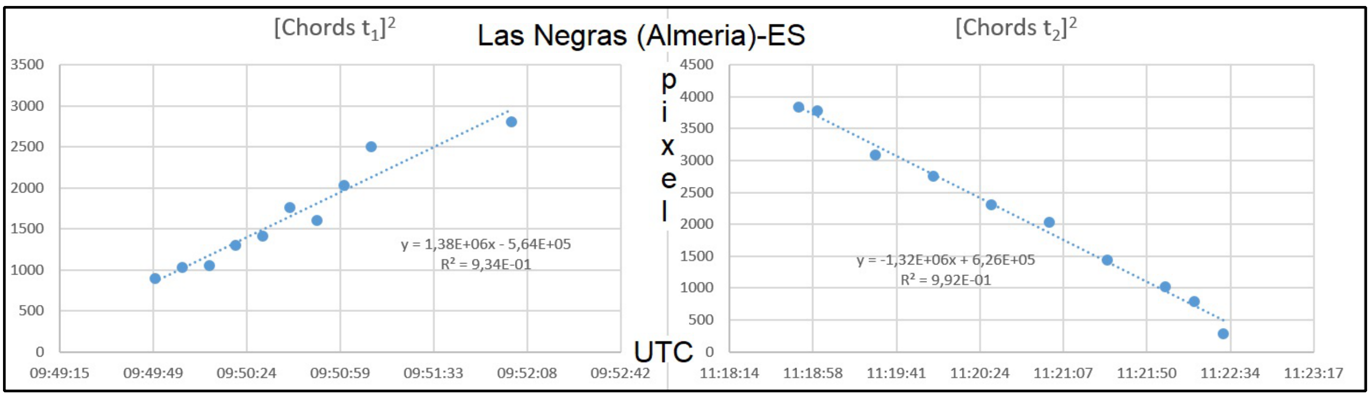

Figure 9. The observations made by Ferran Casarramona, of the Agrupació Astronomica de Sabadell, Spain. Location: 04116 Las Negras (Almeria) – Spain; Coordinates: 36°52'50.1" N, 2°00'54.8" W. Equipment: Newtonian 200mm F/4. Mylar filter + Baader H-Alpha Narrowband 7nm. Watec 910HX/RC. Exposure 1/100000, 50 frames per second.

Telescope Diameter	Figure	O-C Duration	Saturation	Diameter's Variations
250 mm f/5	3 / part	-10.2 s on t_4	No	-6 parts/2000
100 mm f/4	4 / full Sun	+10 s	Yes	+3 parts/2000
235 mm f/10 Mylar	5 / part	+10 s	Yes	+3 parts/2000
200 mm f/4 Mylar+Hα7 mm	6 / part	+0.57 s	No	+1 part/10000

Table 1. The results of the fit on the contacts timing, compared with the ephemerides.

Comments

Only doing the experiment with different instruments, we can demonstrate that the video of a partial eclipse contains useful information on the solar diameter. We found a recommendation for the next observation: the image of the Sun has not to be saturated; the limb darkening has to be visible in all its extent. It is better to use a narrow band filter.

In effect the most reliable result is the last one, with a solar diameter increased by +0.2″ with respect to the standard one at 1 AU.

The standard value of the solar diameter in the optical wavelengths is 1919.26″ or the radius is 959.63″.

The change in diameter of +0.2″ implies a radius increased by +0.1″. The error bar is derived by eliminating one different data each time and averaging the results.

The narrowband of 7 nm around the Hα centreline does not enable us to observe the plages in chromosphere, so we can consider that result as photospheric diameter.

From these four observations because of saturation (cases in Figures 6, 8) or because of lack of both diameter (case in Figure 3) only the last one (case in Figure 10) which appears as the darker one, gives results that are reliable.

The saturation "pours" photons outside the real limb, and the classical Watec 910HX produces a sort of artificial edge [1], outside the solar disk. For the other planetary camera of the case 2, without the first contact it is not possible to derive conclusions.

Conclusions

The eclipse of 2025 March 29 was an opportunity to measure the solar diameter in the hypothesis of a perfectly spherical Sun, by exploiting the timing of the two external contacts between the lunar and the solar limbs. Also the lunar limb, in the fitting procedure, is considered as smooth and spherical.

From the many observers involved in this experiment only four were under clear skies and provided their data to us.

[1] Something similar to the Gibbs' phenomenon in the Fourier transform of a Heaviside step function.

The three of them with complete eclipses with both external contacts t_1 and t_4 used the same camera Watec 910HX. Only in one case, when the solar disk was never saturated in the image, the obtained value of the solar radius is reliable and it is 959.73″±0.20″.

This is comparable in accuracy with the total solar eclipse of 1998 analysed by Dunham (2018), where the solar diameter resulted 959.79″±0.15″. This measurement may be also compatible with Quaglia et al. (2021) 959.95″±0.05″ obtained with the flash spectrum technique, and with more recent results (Quaglia et al. 2023, Dunham and Dunham 2023, Quaglia et al. 2024).

We learned that in the next Call for Observations for partial solar eclipse the duration of the video has to be longer than 3 minutes with the lunar limb still in the solar disk, 4 or 5 minutes. If the first contact has been lost for one or two minutes the measurement is still valid, if the Moon's profile is still completely inside the image: both cusps have to be visible, to determine the length of ten chords at least. Between full Sun in the video and only the eclipsed part of the solar image in view, the latter is preferred, probably because the intensity of the solar disk is furtherly reduced by a longer focal ratio.

Acknowledgements

To all the observers who participated in these experiments, also the ones clouded out. Without their efforts the study of the solar diameter by using partial eclipses would not have made a significant step forward. To Prof. Svetlana Berdyugina for the hospitality in IRSOL for the eclipse [20]. To Prof. Sabina Favore (IC Pieve del Grappa) for the digital treatment of the eclipse in Hα. We want to thank the referee for the added value given to this paper, with insightful suggestions.

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40 Years Ago – ASTBBS - A Pro-Am Message Service by Phone

From *Occultation Newsletter* Vol. 3 No. 12 (excerpt):

ABOUT ASTBBS

Joan Bixby Dunham

The Astronomy Bulletin Board System (ASTBBS) is a modification of the ABBS sold by the Washington Apple Pie. This bulletin board is intended for amateur and professional astronomers. The emphasis is on providing announcements of astronomical events, observations planned, and the results of observations. Message service is provided, but that is secondary to the announcements. Members of the ASTBBS may use the message service; members with privileges may upload files. Non-members may read messages, bulletins, and announcements, may download files, and leave the SYSOPs a message.

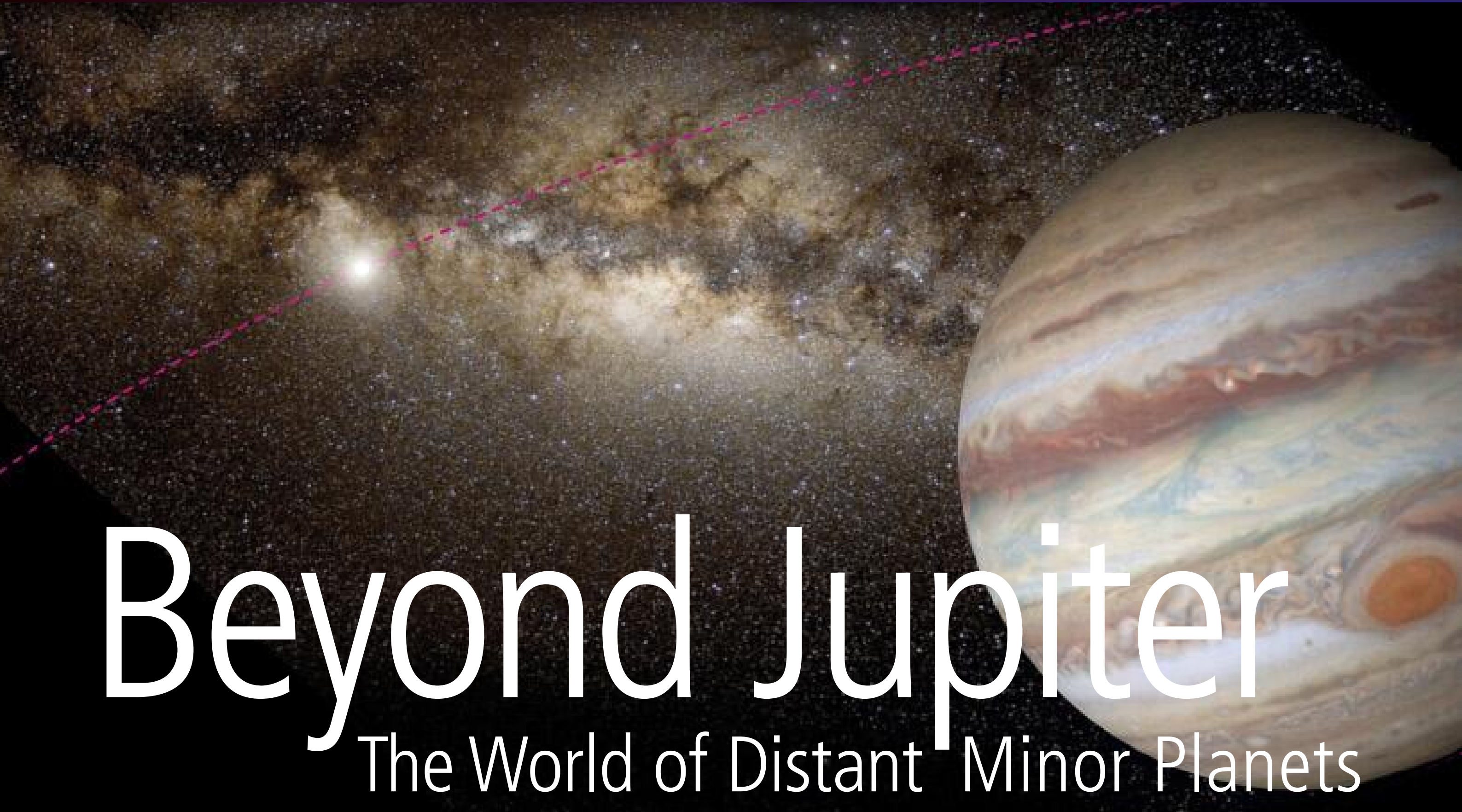
Information is provided on grazing occultation expeditions in the Mid-Atlantic states and from the Washington, DC, area; occultations by asteroids, Comet Halley, Comet Giacobini-Zinner; and meetings of the controlling organizations plus any public events on astronomy. Bulletins will be provided on novas, new comets, satellite barium cloud releases, etc.

The ASTBBS is provided for the National Capital Astronomers (NCA) and IOTA. Membership in both of these organizations is open to anyone, amateur or professional, with an interest in astronomy or in occultation observations. Any member of NCA or IOTA with a terminal and a modem can ask for an ASTBBS membership. Membership for others may be given at the discretion of the SYSOPs.

The ASTBBS is operational whenever the computer is not in use by the SYSOPs. If the phone is busy, the modem is in use. If the phone does not answer within four rings, you can assume that the computer is in use or the system has been turned off.

The equipment used for ASTBBS is an Apple II+ with two disk drives, an internal clock, and a US Robotics Password modem. This equipment is owned by the SYSOPs, and the service is provided free of charge. This equipment has some fairly significant limitations in both size and speed. The primary one of concern to ASTBBS members is that there is not much room to accept uploads, so the privilege to do that will not be distributed freely.

More exciting stories from the past – ***The Occultation Newsletter Heritage Project***
https://www.iota-es.de/on_heritage.html



Beyond Jupiter

The World of Distant Minor Planets

Since the downgrading of Pluto in 2006 by the IAU, the planet Neptune marks the end of the zone of planets. Beyond Neptune, the world of icy large and small bodies, with and without an atmosphere (called Trans-Neptunian Objects or TNOs) starts. This zone between Jupiter and Neptune is also host to mysterious objects, namely the Centaurs and the Neptune Trojans. All of these groups are summarised as "distant minor planets". Occultation observers investigate these members of our solar system, without ever using a spacecraft. The sheer number of these minor planets is huge. As of 2025 July 03, the *Minor Planet Center* listed 1968 Centaurs and 3712 TNOs.

In the coming years, JOA wants to portray a member of this world in every issue; needless to say not all of them will get an article here. The table shows you where to find the objects presented in former JOA issues. (KG)

In this Issue:

(229762) G!kkún‖'hòmdímà

Konrad Guhl · IOTA/ES · Berlin · Germany · kguhl@astw.de

ABSTRACT: Since 2016, the JOA regularly publishes portraits of objects beyond Jupiter's orbit. This short communication about the relatively bright scattered disk object, (229762) G!kún‖'hòmdímà tells the story of its discovery, the meaning behind its name and the nature of its orbit. The sizes and physical properties are derived from data published up to 2020.

No.	Name	Author	Link to Issue
944	Hidalgo	Oliver Klös	JOA 1 2019
2060	Chiron	Mike Kretlow	JOA 2 2020
5145	Pholus	Konrad Guhl	JOA 2 2016
5335	Damocles	Oliver Klös	JOA 2 2023
7066	Nessus	Konrad Guhl	JOA 1 2024
8405	Asbolus	Oliver Klös	JOA 3 2016
10370	Hylonome	Konrad Guhl	JOA 3 2021
10199	Chariklo	Mike Kretlow	JOA 1 2017
15760	Albion	Nikolai Wünsche	JOA 4 2019
15810	Awran	Konrad Guhl	JOA 4 2021
20000	Varuna	Andre Knöfel	JOA 2 2017
28728	Ixion	Nikolai Wünsche	JOA 2 2018
31824	Elatus	Konrad Guhl	JOA 2 2025
32532	Thereus	Konrad Guhl	JOA 1 2023
38628	Huya	Christian Weber	JOA 2 2021
47171	Lempo	Oliver Klös	JOA 4 2020
50000	Quaoar	Mike Kretlow	JOA 1 2020
53311	Deucalion	Konrad Guhl	JOA 2 2024
54598	Bienor	Konrad Guhl	JOA 3 2018

No.	Name	Author	Link to Issue
55576	Amycus	Konrad Guhl	JOA 1 2021
58534	Logos & Zoe	Konrad Guhl	JOA 4 2023
60558	Echeclus	Oliver Klös	JOA 4 2017
65489	Ceto and Phorcys	Konrad Guhl	JOA 1 2025
90377	Sedna	Mike Kretlow	JOA 3 2020
90482	Orcus	Konrad Guhl	JOA 3 2017
120347	Salacia	Andrea Guhl	JOA 4 2016
134340	Pluto	Andre Knöfel	JOA 2 2019
136108	Haumea	Mike Kretlow	JOA 3 2019
136199	Eris	Andre Knöfel	JOA 1 2018
136472	Makemake	Christoph Bittner	JOA 4 2018
174567	Varda	Christian Weber	JOA 2 2022
208996	2003 AZ_8	Sven Andersson	JOA 3 2022
341520	Mors-Somnus	Konrad Guhl	JOA 4 2022
471143	Dziewanna	Wojciech Burzyński	JOA 3 2024
486958	Arrokoth	Julia Perła	JOA 3 2023
-	2004 XR_{190}	Carles Schnabel	JOA 1 2022
541132	Leleākūhonua	Konrad Guhl	JOA 4 2024

The Discovery

The object was discovered on 2007 October 19 at Palomar Mountain (Observatory code 675), United States and received the preliminary designation, 2007 UK_{126} .The discovery was made with the 1.2 m *Oschin Telescope* by M. E. Schwamb, M. E. Brown, D. Rabinowitz and published on 2008 February 26 [1]. In our "Beyond Jupiter" article about (90377) Sedna in JOA 2020-03 you can find images of the telescope and dome. Andrew Lowe has found pre-discovery southern hemisphere *Digitized Sky Survey* images of the object taken from Siding Spring, Australia in 1982, 1993 and 1997, whilst Rob Matson found images from 2001–2002 in the *SkyMorph* database [2]. Permanent number (229762) was assigned on 2009 December 31 [3].

The Name

The object was named on 2019 April 06 for the mythological character, G!kún‖'hòmdímà from the Ju|'hoansi (!Kung) people of Namibia and some surrounding lands and who are indigenous hunter-gatherer cultures of the region [4]. The language of the Ju|'hoansi contains click-language consonants. For rendering these sounds in writing, the International Phonetic Alphabet (IPA) is used. It contains additional question marks, boxes, or other symbols added to the Unicode characters. To hear the pronunciation of the name you can use the link:

https://upload.wikimedia.org/wikipedia/en/3/3a/G%C7%83kun%C7%81%27homdima.ogg

Figure 1. An alternative artistic representation of "G!kún‖'hòmdímà" by Enzo Trenkner, exclusive for JOA.

Figure 1 shows an impression by the graphic artist Enzo Trenkner of G!kún‖'hòmdímà, the at-times beautiful aardvark girl of mythology who can appear in different stories of the indigenous people as a python and sometimes as an elephant. G!kún‖'hòmdímà defends her people and punishes wrongdoers using thorny spines, a magical oryx horn and raincloud full of hail.

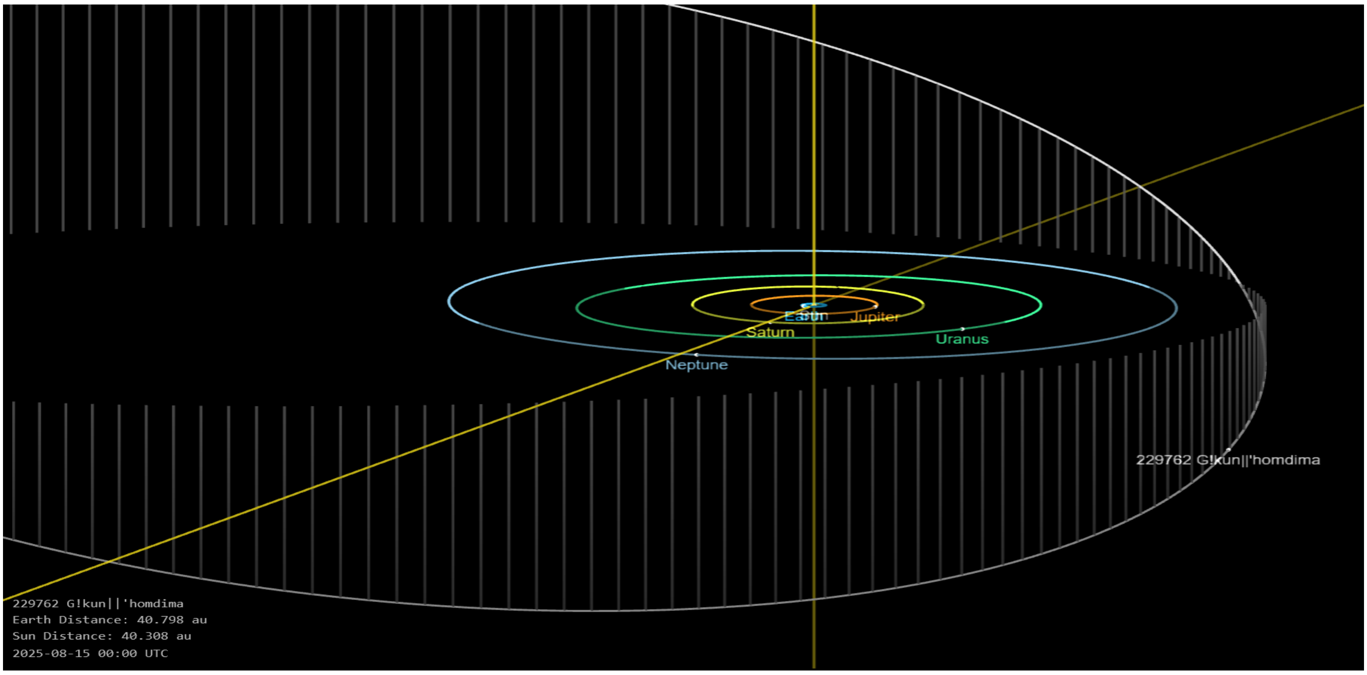


Figure 2. Orbit diagram and position of (229762) G!kún‖'hòmdímà on 2025 August 15.
(Source: NASA/JPL Small-body database lookup, https://ssd.jpl.nasa.gov/tools/sbdb_lookup.html#/?sstr=229762)

The Orbit

(229762) G!kún‖'hòmdímà has a well-defined orbit having astrometry spanning more than 42 years. Having an eccentricity of 0.496, its distance from the Sun varies between 37.6 au and 112 au. The orbit is inclined to the ecliptic by 23.3°. When first discovered its heliocentric distance was close to 46 au but since then it has been getting closer. Currently, its distance from the Sun is 40.3 au and it is almost 0.5 magnitudes brighter than when at discovery. The planet will reach perihelion in the year 2046 by which time it will attain a visual magnitude of 19.2 at opposition. Note that the entire orbit lies outside that of Neptune. The orbital period is 644 years [5] and so the object is a typical TNO.

Physical Characteristics

Observations made on ESO's *Very Large Telescope* (VLT) in 2008 to acquire photometric and spectroscopic data report an absolute magnitude H_V = 3.69 +/- 0.04 mag [6]. The current taxonomy of TNOs (based on colour indices) identifies 4 groups, namely:

- BB (neutral, or "blue" in colour)
- BR (intermediate "blue-red")
- IR (moderately "red")
- RR (very "red")

In [6], the authors classify 28 objects and cited 10 additional objects but only (229762) G!kún‖'hòmdímà did not fall within any of these four taxonomic classes.

A photometric observation to find a rotation period is published in [7] and gave a nearly flat light curve. The variation is only 0.03 ± 0.01 mag and the authors came to the conclusion that the rotation period is > 8h. In [8] published in 2017, the authors present the results of an occultation observed on 2014 November 15. One of the observations can be viewed as a time-lapse video in Figure 2 of [8].

The result of this triple chord occultation observation is an elliptical shape with dimensions of 645.8 ± 5.7 km × 597.8 ± 12.7 km. The exact determination of the size allowed the albedo of p_R = 19.5 ± 2.0 % (R-band) and p_V = 15.0 ± 1.6 % (V-band) to be determined using the absolute brightness.

The Satellite

The planet has one known satellite with the formal nomenclature S/2008 (229762) 1 and has been assigned the name G!ò'é!Hú, after the magical oryx horn wielded by G!kún‖'hòmdímà. The satellite was found in 2009 by analysing *Hubble Space Telescope* images [9]. It orbits in a prograde sense, on a circular or near-circular orbit with a period of 11.3 days and a satellite-planet distance of approximately 6000 km.

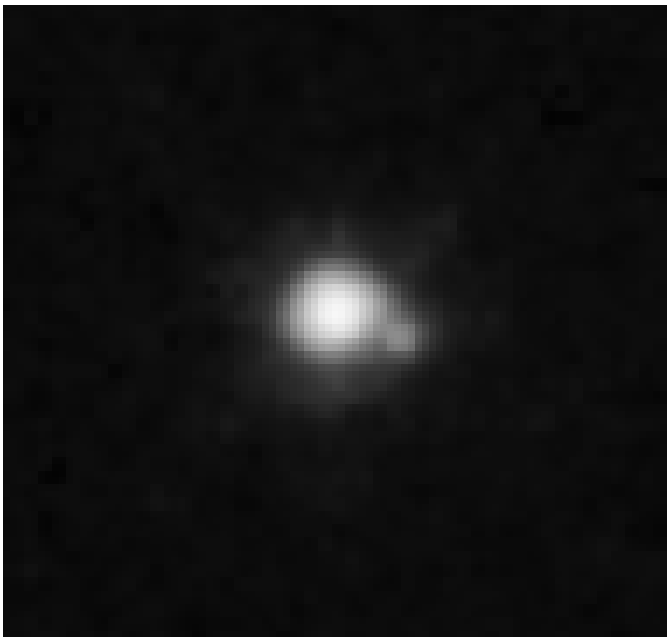


Figure 3. G!kún‖'hòmdímà and its satellite G!ò'é !Hú, imaged by the Hubble Space Telescope on 2018 January 2. Credit: HST

The magnitude difference between the satellite and the primary body is 3.24 ± 0.04 mag. The albedo of G!ò'é!Hú is different from the planet and more reddish, the diameter is calculated to be 142 ± 8 km.

Details of the 2014 November 15 Event

The Research and Education Collaborative Occultation Network (RECON) made a call for observations for an occultation of UCAC4 448-006503 (15.8 Vmag) by the TNO on 2014 November 15 and started an observation campaign with IOTA [10].

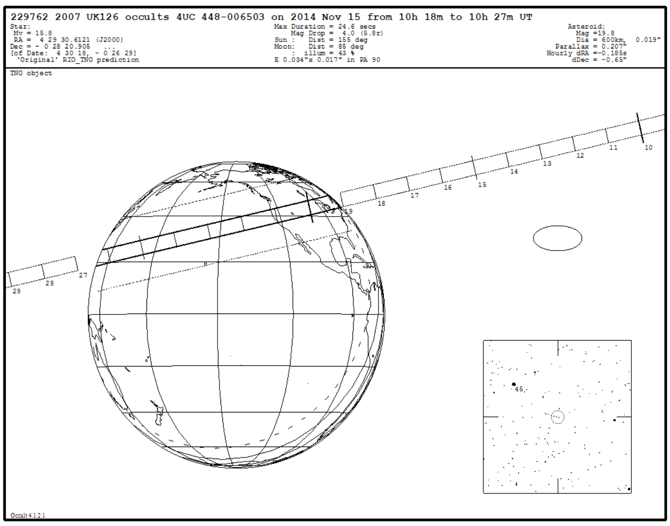


Figure 4. The shadow path of the occultation on 2014 November 15 predicted with data by the RIO team [11].

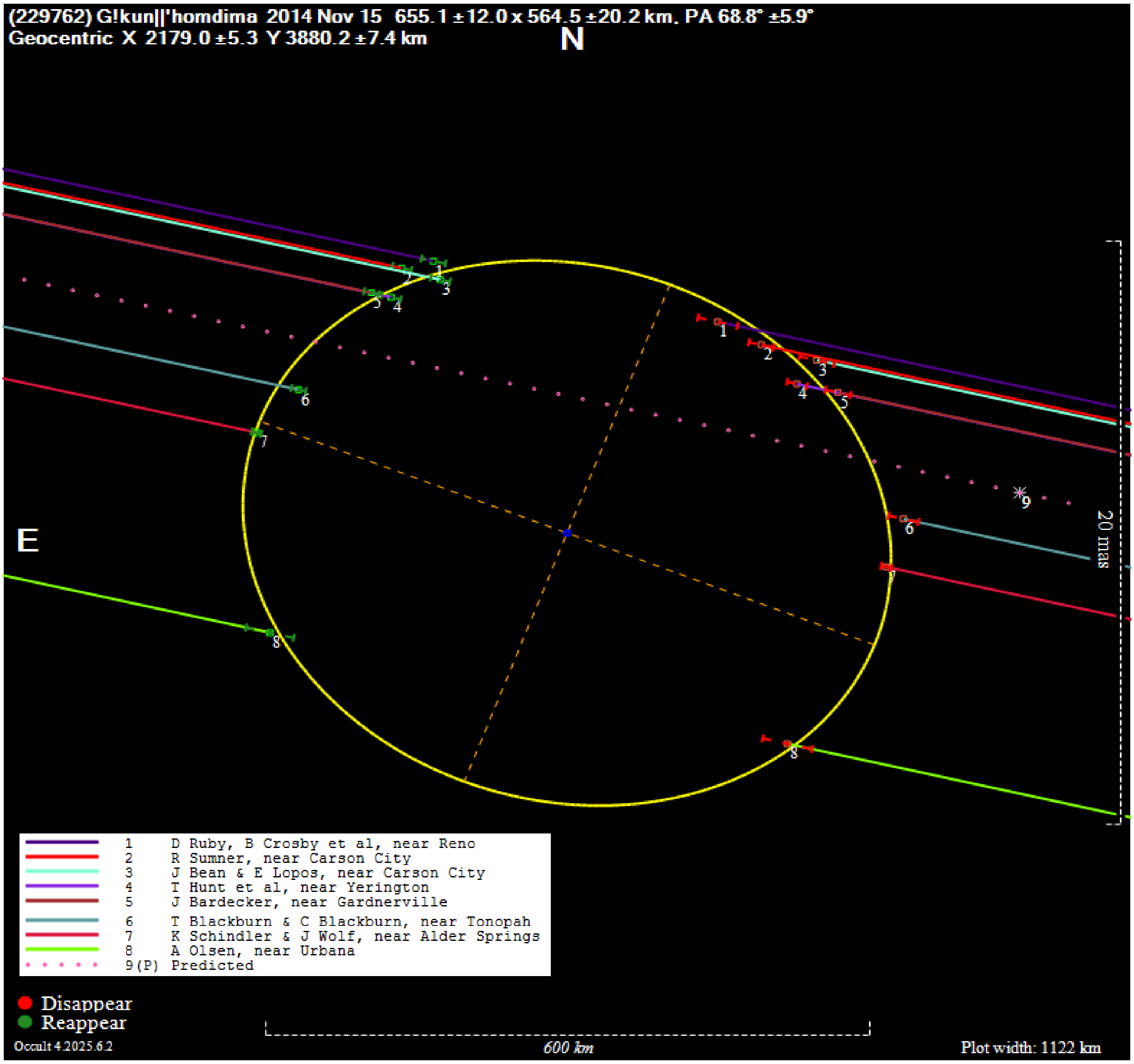


Figure 5. The shadow profile of (229762) G!kún‖'hòmdímà measured by eight stations on 2014 November 15. Source: Occult 4.2025.6.2.

The observing campaign was very successful. Eight positive observations with analogue video cameras and GPS time inserters are listed in the *Occult* database [12]. The used exposure times were from 2 s up to 4.3 s due to the faintness of the target star.

J. Bardecker reported just a few hours after his observation on IOTA's mailing list:

... I was literally was on the edge getting nothing. I had to record at X128 on the Mallincam (2.2 sec integration) to get down to 15.8 mag on the 12" SCT. Before I started recording, clouds where moving in from the SW. I was recording 5 min video segments starting 10 minutes before and after my predicted event (There is a possible documented satellite.) Near the end of the second segment I thought I noted a pretty clear "D" on the screen. Then as I was waiting for the "R", a meteor streaked across the field probably 6 to 8 pixels from the target star. When that integrated set cleared, the target star was there. Less than two minutes later, clouds had obscured nearly everything. The Tangra and AOTA analysis look good at just over 19 seconds duration. My first KBO !! [13]

Future Occultations

In this final section, several stellar occultations involving (229762) G!kún‖'hòmdímà predicted by the Lucky Star project [14] are presented.

For detailed planning of any observation of forthcoming events, please use updated predictions on the websites to obtain any last-minute updates.

• 2025

The Lucky Star project predicts three occultations of faint stars as shown in Figures 6 – 8 [10].

• 2026

No observable event.

• 2027

J. Desmars (Lucky Star project) searched for upcoming stellar occultations in 2027 for this paper [15]. He found one promising event on 2027 November 22. The predicted path of an occultation of a 13.6 Gmag star will cross northern Mexico and Florida (Figure 9). The wide 1-sigma error limits cover the US and parts of Canada in the north and southern central America and Colombia and Venezuela in the south.

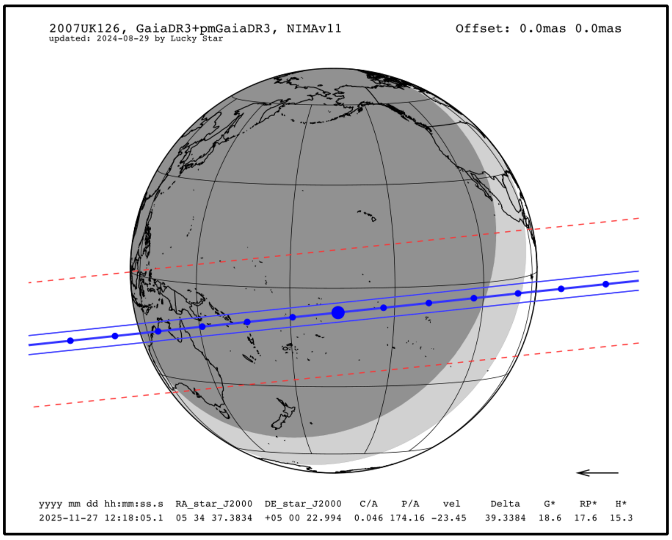


Figure 7. Lucky Star prediction for event 2025 Nov 27.

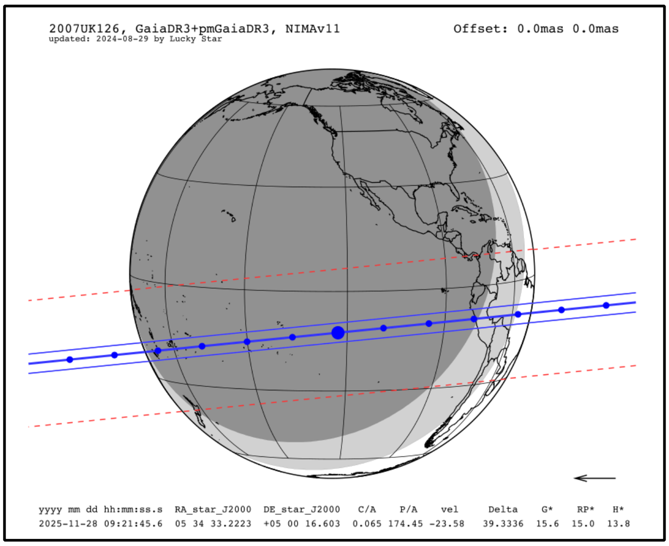


Figure 8. Lucky Star prediction for event 2025 Nov 28.

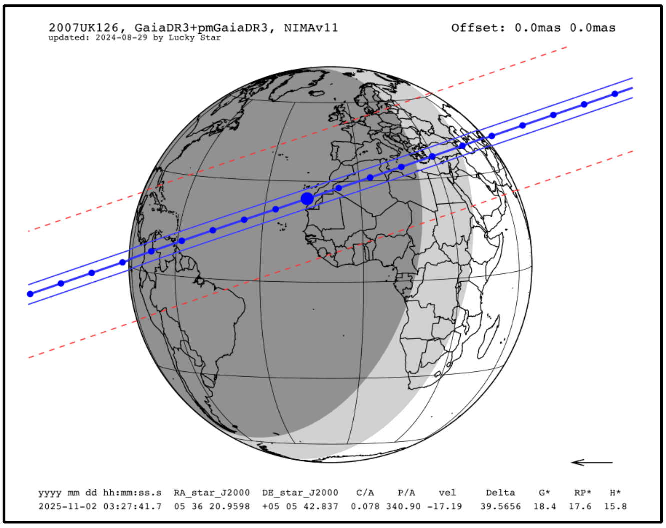


Figure 6. Lucky Star prediction for event 2025 Nov 02.

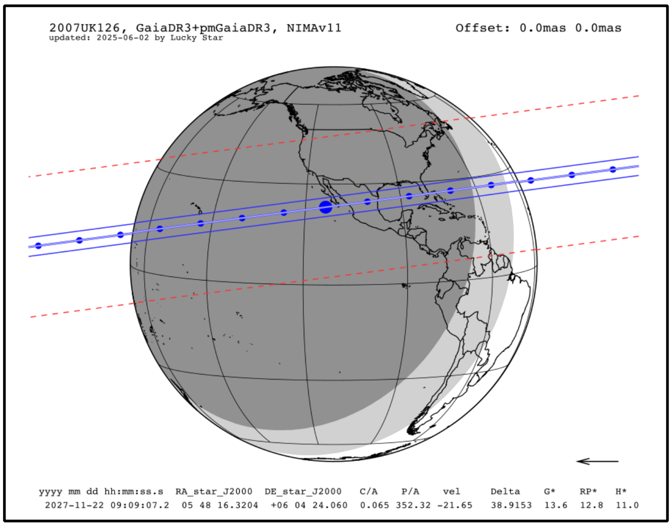


Figure 9. Lucky Star prediction for event 2027 Nov 22.

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[4] Minor Planet Circ. 112434
https://www.minorplanetcenter.net/iau/ECS/MPCArchive/2019/MPC_20190406.pdf
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[13] IOTAoccultations, Message 55893, Groups.io
https://groups.io/g/IOTAoccultations/message/55893
[14] ERC Project Lucky Star, https://lesia.obspm.fr/lucky-star/index.php
[15] Personal communication on 2025 June 02

Useful Links

Small-Body Database Lookup, NASA, JPL
https://ssd.jpl.nasa.gov/tools/sbdb_lookup.html#/
Spacewatch, Lunar & Planetary Laboratory, University of Arizona
https://spacewatch.lpl.arizona.edu/
IAU's Minor Planet Center
https://minorplanetcenter.net/

News

SODIS - Release of Version 2 and a New Quick-Start-Guide

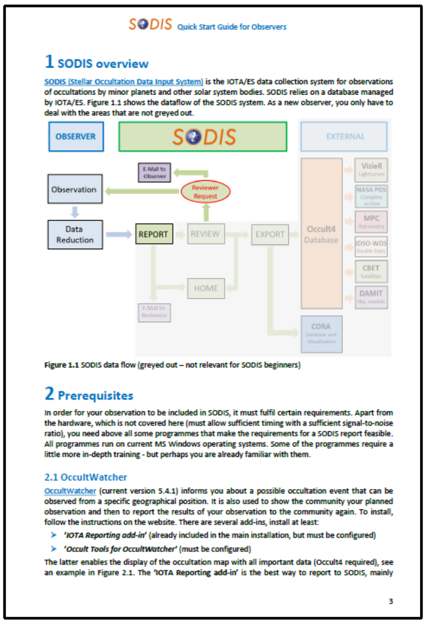
SODIS 2.0 was launched on 2025 June 1. The report page now contains information on which documents and graphics are to be submitted with an observation report. In addition, the input mask has been improved so that input errors of observers will be minimised. These improvements should also reduce the workload for reviewers.

Christian Weber (IOTA/ES), author of the *SODIS Observer Documentation*, has now created a *SODIS Quick Start Guide for Observers*. The new document is primarily aimed at new or less experienced observers and describes the minimum requirements for the preparation of SODIS reports.

The document is available at:

https://www.iota-es.de/sodis/SODIS_Quick-Start-Guide.pdf

(O. Klös)


SODIS Quick Start Guide for Observers

1 SODIS overview

SODIS (Stellar Occultation Data Input System) is the IOTA/ES data collection system for observations of occultations by minor planets and other solar system bodies. SODIS relies on a database managed by IOTA/ES. Figure 1.1 shows the dataflow of the SODIS system. As a new observer, you only have to deal with the areas that are not greyed out.

Figure 1.1 SODIS data flow (greyed out – not relevant for SODIS beginners)

2 Prerequisites

In order for your observation to be included in SODIS, it must fulfil certain requirements. Apart from the hardware, which is not covered here (must allow sufficient timing with a sufficient signal-to-noise ratio), you need above all some programmes that make the requirements for a SODIS report feasible. All programmes run on current MS Windows operating systems. Some of the programmes require a little more in-depth training - but perhaps you are already familiar with them.

2.1 OccultWatcher

OccultWatcher (current version 5.4.1) informs you about a possible occultation event that can be observed from a specific geographical position. It is also used to show the community your planned observation and then to report the results of your observation to the community again. To install, follow the instructions on the website. There are several add-ins, install at least:

- *'IOTA Reporting add-in'* (already included in the main installation, but must be configured)
- *'Occult Tools for OccultWatcher'* (must be configured)

The latter enables the display of the occultation map with all important data (Occult4 required), see an example in Figure 2.1. The 'IOTA Reporting add-in' is the best way to report to SODIS, mainly

3

News

Number of Discoveries of Asteroidal Satellites by Occultation Observations Rises Again

Dave Herald presented on the mailing lists in May and June 2025 more discoveries of satellites of asteroids.

Until 2025 June 17, there were 17 discoveries during occultation observations announced in CBETs. Six discoveries were added since the last issue of JOA. These new observations are presented here in chronologial order of their discoveries (Figures 1-6).

Each figure shows the plot of the profile with the recorded chords and an insert of the light curve of the detection of the satellite. Details about the sizes of the components, separation and position angle of the satellite can be found in the header of the plot. All plots and light curves are from the database of *Occult V4.2025.6.12*.

Access to the 50 most recent CBETs is available here:

http://www.cbat.eps.harvard.edu/cbet/RecentCBETs.html

(O. Klös)

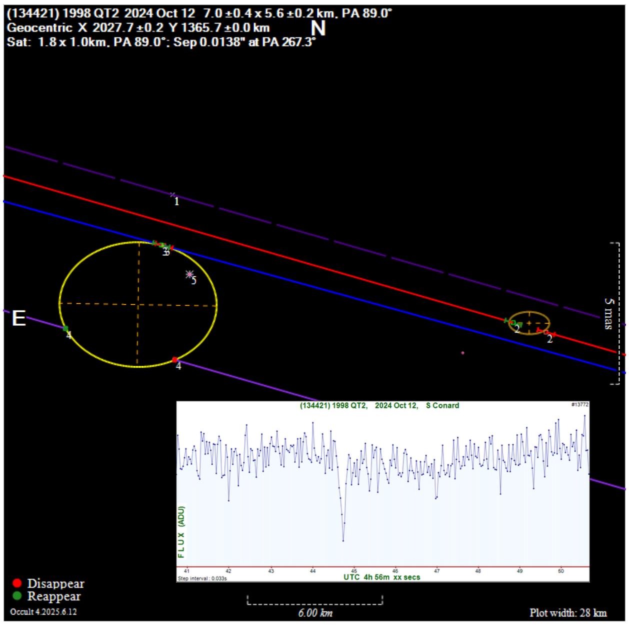


Figure 1. 2024 Oct 12: Profile of (134421) 1998 QT$_2$ and its satellite recorded by Steve Conard, who had set up two stations and detected the main body on chord #4. Greg Lyzenga provided chord #3. *(CBET 5556)*

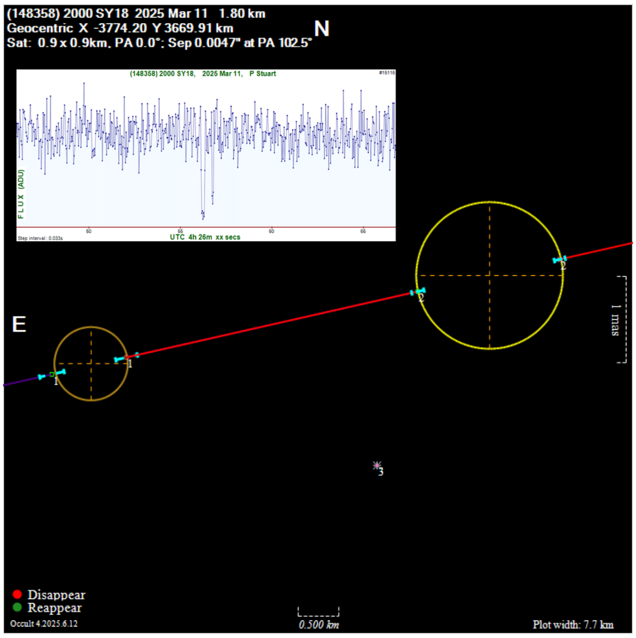


Figure 2. 2025 Mar 11: Binary asteroid (148358) 2000 SY$_{18}$ measured with a single chord by Phil Stuart (CBET 5544)

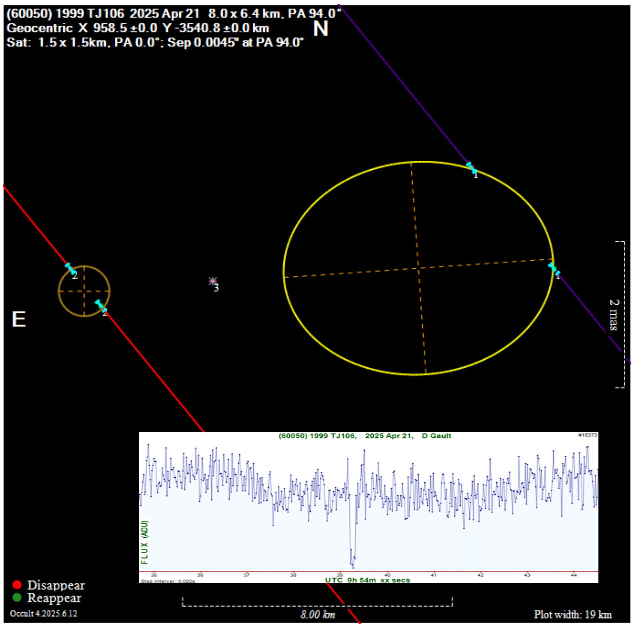


Figure 3. 2025 Apr 21: Dave Gault recorded an occultation by the satellite of (60050) 1999 TJ$_{106}$ while Peter Nosworthy got a chord by the main body. (CBET 5569)

News

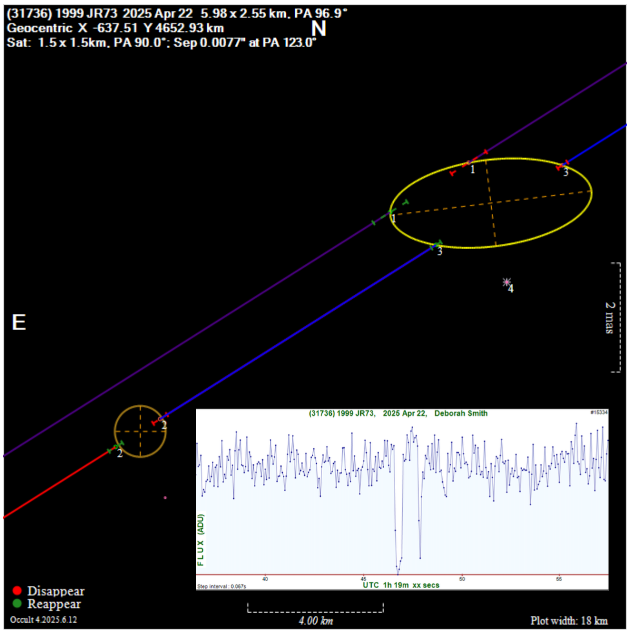


Figure 4. 2025 Apr 22: Profile of (31736) 1999 JR_{73} and its satellite recorded by two stations maintained by Deborah Smith. (CBET 5552)

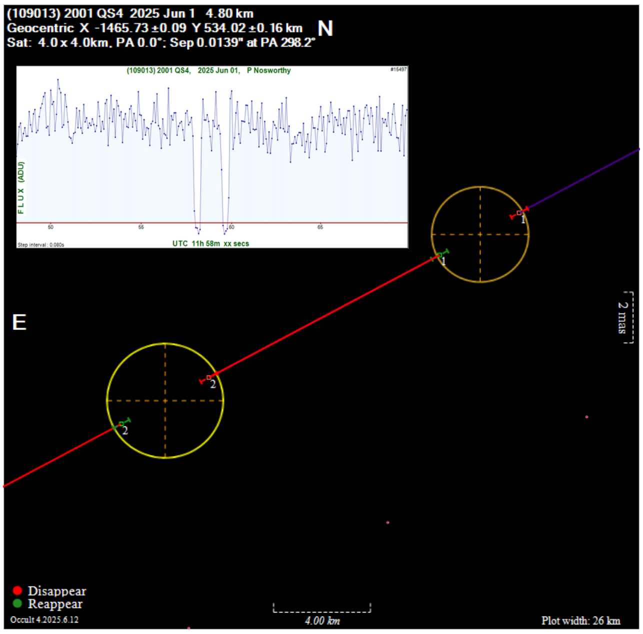


Figure 6. 2025 Jun 01: Peter Nosworthy discovered with this single chord observation the satellite of (109013) 2001 QS_4. (CBET 5571)

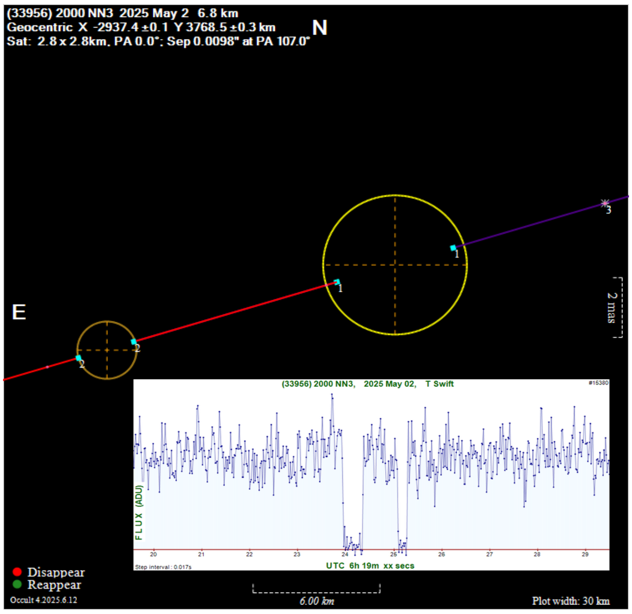


Figure 5. 2025 May 02: Ted Swift detected the satellite of asteroid (33956) 2000 NN_3 with a single chord. (CBET 5562)

Table 1. Binary asteroids discovered by occultation observations. The satellites of asteroids (5457) and (6326) have been unlikely near their greatest elongation at the time of the measurements. (Data compiled by Dave Herald)

Asteroid Number	Nominal Dia. (km)	Satellite Dia. (km)	Sep. of Centres (radii of main)
3927	4	1.5	~ 2.7
4337	19	12	~ 4.9
5232	12	8	~ 5.5
5457	21	2	> 1.8
6326	6.9	1.3	> 2.2
10424	6.5	2.1	~ 2.0
10430	5.7	4	~ 3.8
31736	4.5	1.5	~ 4.9
33956	6.8	2.7	~ 4.2
60050	7.2	1.4	~2.8
61784	5.2	1.8	~ 3.3
100624	16	4	~ 3.2
109013	4.8	4	6.2
127418	5.3	1.7	~ 3.6
134421	6.5	1.4	~ 4.6
148358	1.8	0.9	~ 3
172376	5.7	3.3	~ 5.4

Meetings

Presentations of the Trans-Tasman Symposium on Occultations (TTSO19) Are Uploaded

The 19th Trans-Tasman Symposium on Occultations was held in Whakatāne, New Zealand, on 2025 May 12. Steve Kerr, Trans-Tasman Occultation Alliance Director, and Murray Forbes have made video recordings of the presentations and PDF files of the slides available here:

https://occultations.org.nz/meetings/TTSO19/TTSO19.htm

The PDFs are linked by the author's names, clicking on the titles of the presentations will open the video recordings on YouTube.

(O. Klös)

NINETEENTH TRANS-TASMAN SYMPOSIUM ON OCCULTATIONS
in Whakatāne, NZ and via Zoom
2025 May 12
(Updated 07 Jun 2025)

UPDATE – 07 Jun 2025

The Trans-Tasman Occultation Alliance held the **Nineteenth Trans-Tasman Symposium on Occultations (TTSO19)** on 12 May 2025. TTSO19 was held in conjunction with the 2025 RASNZ Conference in Whakatāne, New Zealand. As well as the physical meeting, it was accessible online using Zoom.

A PDF of the presentation slides is linked from the 'Speaker' column. A video recording of the presentation is linked from the 'Title' column.

The Program for TTSO19 is as below:

UTC Sun 11/5/2025	AEST Mon 12/5/2025	NZST	Duration (min)	Speaker	Title	Description
21:00:00	7:00:00	9:00:00	0:10:00	S. Kerr	Welcome and Introduction	
21:10:00	7:10:00	9:10:00	0:30:00	S. Kerr	Round Up of TTOA Observing	Reviewing the results of observations by TTOA through 2024 with summary and statistics
21:40:00	7:40:00	9:40:00	0:40:00	D. Herald	Asteroidal Occultations	Stats, Issues and Results from 2024
22:20:00	8:20:00	10:20:00	0:30:00	Morning Break		
22:50:00	8:50:00	10:50:00	0:25:00	V. Bao	A beginners perspective on Occultations	
23:15:00	9:15:00	11:15:00	0:30:00	D. Herald	Occultation Astrometry by 'not-so-amateur' astronomers	The DART mission
23:45:00	9:45:00	11:45:00	0:30:00	M. Camilleri	It's about time!	How accurate and reliable is your timing source?
0:15:00	10:15:00	12:15:00	1:00:00	Lunch		
1:15:00	11:15:00	13:15:00	1:30:00	M. Camilleri	PC Disciplined Timing	A workshop (hands on encouraged) on setting up a GPS disciplined PC for occultation recording using digital cameras.
2:45:00	12:45:00	14:45:00	0:30:00	Afternoon Break		
3:15:00	13:15:00	15:15:00	0:30:00	D. Herald	Two Drop Lightcurves	Double stars, grazes and satellites
3:45:00	13:45:00	15:45:00	0:30:00	S. Kerr	Extracting better light curves	A walk through the various options in Tangra to get a better light curve from difficult videos.
4:15:00	14:15:00	16:15:00	0:30:00	S. Kerr	Upcoming Occultations and Campaigns	
4:45:00	14:45:00	16:45:00	0:10:00	S. Kerr	Wrap Up	

Screenshot of the webpage.

ESOP XLIV - Join in Person or Online

Keep in mind the deadline for ESOP XLIV in Poznań, Poland, on 2025 August 23-24.

Please register until 2025 July 31 if you plan to join ESOP XLVI in person or virtually.

https://esop44.iota-es.de/registration

Presenters of posters or lectures should provide an abstract until end of July to the following e-mail address:

44esop@gmail.com

The programme of the symposium will presented here:

https://esop44.iota-es.de/programme

(O. Klös)

Meetings

Invitation to the IOTA/EA FY2025/26 Annual General Meeting

The International Occultation Timing Association/East Asia (IOTA/EA) will hold the FY2025/26 Annual General Meeting on 2025 August 31 from 01:00 to 07:00 UT. As with the FY2024/25 meeting of IOTA/EA in August 2024, this year's meeting will be held remotely.

The meeting will include the agenda with voting by the full membership. In addition, there will be presentations by participants. A break of one hour is scheduled in the middle of the sessions.

Presentations may be given by non-members of IOTA/EA. The content of the presentation should focus on occultation predictions, observations, related activities and research using occultation phenomena in a broad sense. The duration of each presentation will be 15 minutes + 5 minutes for Q&A, but durations may be changed depending on the number of presentations. Oral presentations can be made in any language. It is recommended that slides be prepared in English. Please submit your presentations until 2025 August 10.

The meeting will be held via interactive remote access via Zoom. Please register for your participation. The maximum number of participants is 80. Participation is open to all, whether members or non-members, but members will be given priority if the number of participants exceeds the limit.

Simultaneously, a streaming via YouTube will be provided. Anyone interested in occultation astronomy is invited to watch the streaming.

Schedule and Deadlines (tentative):

- 2025 July 01: Registration opens
- 2025 August 10: Deadline for submitting presentations
- 2025 August 29: Deadline for registration

Please check the webpage of IOTA/EA for details and latest news:

https://www.perc.it-chiba.ac.jp/iota-ea/wp/

(O. Klös, IOTA/EA Circular 2025-06-01)

2025 IOTA North America Annual Meeting Is Scheduled

The 2025 annual meeting of IOTA will be an on-line-only event, via Zoom. It is scheduled for Saturday and Sunday afternoons in North American time, September 6th and 7th, from 4:00 PM EDT to 8:00 PM EDT. These times are from 20:00 UT on the 6th to 00:00 UT on the 7th, and from 20:00 UT on the 7th to 00:00 UT on the 8th.

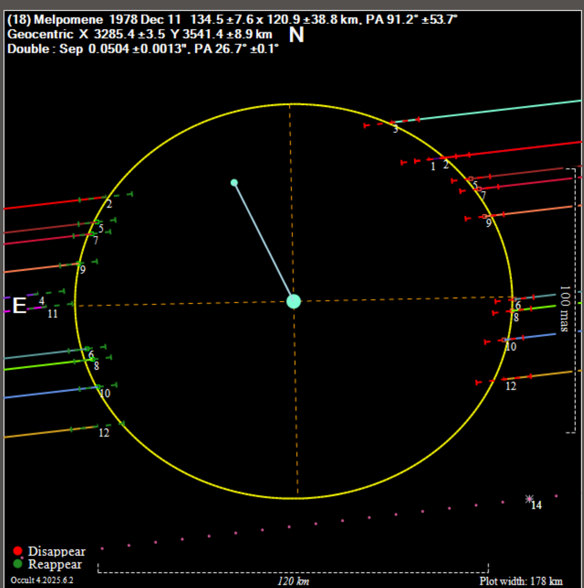
All who are interested in occultations are welcome to attend. The link to the Zoom meeting will be published on the IOTA message list each of the two days, one hour before each day's conference begins.

Roger Venable, acting President of IOTA

Fred Espenak

1953 – 2025

Fred Espenak (NASA Goddard Space Flight Center, CC 2.0)



Shadow profile of (18) Melpomene, 1978 December 11. Fred Espenak's chord is no. 4, Joan Dunham's is marked with no. 3. (Occult 4.2025.6.2)

"Mr. Eclipse", as Fred was known to many thousands of amateur astronomers around the world, passed away peacefully at his home in Portal, Arizona, on 2025 June 1.

Joan and I were very sorry to hear of his passing, as the three of us started work on the same day, in early July 1976, with Computer Sciences Corporation, a major contractor for NASA's Goddard Space Flight Center (GFSC), meeting each other at the new hires orientation meeting. That resulted in our career paths passing through GSFC, Joan in GSFC satellite operations and mine with the late Robert Farquhar working on the first halo-orbiting satellites, while Fred's time at GFSC is given in the Sky &Telescope obituary [1].

For a few years, Fred joined some of our grazing occultation expeditions in the Washington, DC region, and he tried to observe the first asteroidal occultation that we successfully observed (visually) on 1978 December 11 of an 8th mag. star by (18) Melpomene [2, 3]. Joan and Fred observed from sites about a mile apart in Columbia, Maryland, and both had some problems, with Joan timing the disappearance but missed the reappearance. It was the opposite for Fred, who timed the R but was too startled by the D and didn't call it out. That was the only asteroidal occultation that he ever observed.

The many eclipses that Fred observed are documented at:
https://www.eclipse-chaser-log.com/eclipse-log/59

David & Joan Dunham
IOTA

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Journal for Occultation Astronomy

IOTA's Mission

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.

The Journal for Occultation Astronomy (JOA) is published on behalf of IOTA, IOTA/ES and RASNZ and for the worldwide occultation astronomy community.

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Imprint

Publisher: International Occultation Timing Association/European Section e.V.
Am Brombeerhag 13, D-30459 Hannover, Germany
Responsible in Terms of the German Press Law (V.i.S.d.P.): Konrad Guhl
Editorial Board: Wolfgang Beisker, Oliver Klös, Alexander Pratt, Carles Schnabel, Christian Weber
Additional Reviewers: David Dunham, Dave Herald, Richard Miles Contact:joa@iota-es.de
Layout Artist: Oliver Klös Webmaster: Wolfgang Beisker
JOA Is Funded by Membership Fees (Year): IOTA: US$15.00 IOTA/ES: €20.00 RASNZ: NZ$35.00
Publication Dates: 4 times a year

Submission Deadline for JOA 2025-4: September 15

IOTA maintains the following web sites for your information and rapid notification of events:

www.occultations.org
www.iota-es.de
www.occultations.org.nz

These sites contain information about the organisation known as IOTA and provide information about joining.

The main page of occultations.org provides links to IOTA's major technical sites, as well as to the major IOTA sections, including those in Europe, East Asia, Middle East, Australia/New Zealand, and South America.

The technical sites hold definitions and information about all issues of occultation methods. It contains also results for all different phenomena. Occultations by the Moon, by planets, asteroids and TNOs are presented. Solar eclipses as a special kind of occultation can be found there as well results of other timely phenomena such as mutual events of satellites and lunar meteor impact flashes.

IOTA and IOTA/ES have an on-line archive of all issues of Occultation Newsletter, IOTA'S predecessor to JOA.

Journal for Occultation Astronomy
(ISSN 0737-6766) is published quarterly in the USA by the International Occultation Timing Association, Inc. (IOTA)
PO Box 20313, Fountain Hills, AZ 85269-0313
IOTA is a tax-exempt organization under sections 501(c)(3) and 509(a)(2) of the Internal Revenue Code USA, and is incorporated in the state of Texas. Copies are distributed electronically.

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The Journal for Occultation Astronomy (JOA) is not covenanted to print articles it did not ask for.

The author is responsible for the contents of his article & pictures.

If necessary for any reason JOA can shorten an article but without changing its meaning or scientific contents.

JOA will always try to produce an article as soon as possible based to date & time of other articles it received – but actual announcements have the priority!

Articles can be reprinted in other Journals only if JOA has been asked for permission.