



**ESOP XLIV
Poznań**

23-24 August 2025



**Center of
Research in
Astronomy,
Astrophysics
and Geophysics
(Algiers
Observatory)**

The observation of quadruple-chords stellar occultation on February 18th, 2025 by the transneptunian object (468861) 2013 LU28 in the far southern of Algeria

Presented by :

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Associate Researcher in Astronomy

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Outline

- Introduction
- Positive Stellar Occultation by Psyche
- Positive Stellar Occultation by the NEA (2212) Hephaistos
- Positive Stellar Occultation by the TNO 2013 LU28
- Near Futur prospects
- Summary

A brief presentation of CRAAG (Algiers Observatory)

Center for Research in Astronomy, Astrophysics and Geophysics (ALGIERS Observatory)

Here are the instruments that we use for observation :

Instruments that we can be moved throughout Algiers Observatory

- Two Celestron 8 with CGEM mount
- Two Celestron 11 with CGEM mount
- One Celestron 11 with CGE Pro mount
- One Meade 12 LX200

Fixed Instruments at (CRAAG) - Algiers Observatory

- A 152 mm Apochromatique Refractor to observe the Sun
- A 200 mm Apochromatique Refractor guide F/D 9
- Richtey-Chretien Telescope 810 mm F=6400 mm



I lead a research in Algiers Observatory (CRAAG) team named

DyMOs Team :

Dynamics of small solar system bodies, **M**eteoritic **O**bservation and Stellar Occultations

Head of the team :

BABA AISSA Djounai (Researcher in Astronomy – Phd in progress)

Members :

BOUYAHIAOUI Zineddine (Researcher in Astronomy – Phd)

BOUDIBA Ghoulam Imad eddine (Engineer in Astronomy – Phd in progress)

-

GRIGAHCENE Zaki (Principal engineer in Astronomy)

Field of Research :

Observation and Characterization of Small bodies by Stellar Occultation

Observation and Characterization of Near Earth Asteroids by Stellar Occultation

Dynamics of small solar system bodies and specially Jupiter Trojan asteroids and calculation of orbital elements by observations

Observation of fireballs and tracking meteorites using a Network of All-Sky cameras

Atmospheric Entrance of Meteorites and Space objects Tracking using Infrasound devices

Photometric study of asteroids (In project)

Introduction

Since my last participation at ESOP 43 in Stuttgart (Germany) in August 2024, here are the main achievements we have accomplished in the field of stellar occultation by asteroids in Algeria.

- First, we wanted to organize the first international meeting on stellar occultations by asteroids in Algeria for observing the stellar occultation by the (16) Psyche asteroid in October 8th 2024 at Laghouat and Ghardaia (Algeria). Unfortunately, due to lack of funding, time, and organization, we instead settled for holding a Meeting with a single Special Guest Star : **Bernd Gährken** from Germany.



- Secondly, under the project I submitted to the Scientific Council of the Center for Research in Astronomy, Astrophysics and Geophysics (Algiers Observatory), which focuses on the study and observation of stellar occultations by small celestial bodies, we successfully observed a double stellar occultation by the near-Earth asteroid (2212) Hepaistos in December 11th at Laghouat in the south of Algeria.
- Thirdly, as part of our partnership with the **Lucky Star** project, we observed for the first time a positive quadruple stellar occultation by the TNO 2013 LU28 on February 18th, 2025, in Adrar in the extreme southern of Algeria.
- Finally, I will address the major astronomical events that will take place in Algeria, and I will conclude with a summary that will formally close this presentation.

Information on the motorized telescopes I have inventoried in Algeria

Department	Organism	Telescopes	Remarks
<u>Chlef</u>	League of Youth Scientific and Technical Activities	2 telescopes 2 Celestron Newton telescope (200 mm)	Without equatorial motorized mount They require to purchase two motorized equatorial mounts
<u>Laghouat</u>	Suhail Association for Astronomy and Space Sciences	5 telescopes 2 Newtonian Telescope (200mm) 2 Celestron 8 Edge HD 800 AVX GoTo <u>Dobsonian</u> motorized Telescope (350mm) Skywatcher <u>GoTo</u>	The two Newtonian telescope without motorized equatorial mount They require to purchase two motorized equatorial mounts Operational
Tamanrasset	League of Youth Scientific and Technical Activities	1 telescope Celestron 8 NexStar SE GoTo	Operational
Algiers	League of Young Amateur Scientists	1 telescope Celestron 11 CPC 1100 <u>GoTo</u>	The fork mount is out of service It requires to purchase a motorized equatorial mount
	Al-Biruni Astronomy Club	1 telescope Celestron 9.25 with EQ6 PRO Skywatcher mount <u>GoTo</u>	Operational
	CRAAG (Algiers Observatory)	6 telescopes 2 Celestron 8 CGEM <u>GoTo</u> 2 Celestron 11 CGEM <u>GoTo</u> - Celestron 11CGE PRO <u>GoTo</u> - Meade 12 LX200 Goto	The fork mount of the Meade is out of service It requires to purchase a motorized equatorial mount Operational for the others

Department	Organism	Telescopes	Remarks
Sidi Bel Abbes	League of Youth Scientific and Technical Activities	1 telescope Celestron 9.25 with CGE PRO <u>GoTo</u>	Operational
Annaba	Youth and Sports Office	1 telescope Celestron 11 Edge HD CPC 1100 <u>GoTo</u>	The fork mount is out of service It requires to purchase a motorized equatorial mount
Constantine	Sirius Astronomy Association	1 telescope Meade 12 LX200 Goto	Operational
Medea	League of Youth Scientific and Technical Activities	2 telescopes - Celestron 8 800 AVX GoTo - Celestron 11 CGE PRO GoTo	Operational
Oran	Private person	1 telescope Celestron 8 Edge HD CGEM GoTo	Operational
Bordj Bou <u>Arreridj</u>	Youth and Sports Office	2 telescopes 2 Skywatcher Newton telescope (254 mm)	They require to purchase two motorized equatorial mounts

I have inventoried **24 telescopes with motorized equatorial mount and an aperture equal to or greater than 200 mm** across the **Algerian territory** of which **18 are operated by amateur astronomers** from different clubs and associations.

Among these instruments, **nine telescopes** require either **minor or major repairs**.

5 WATEC 910 HX/RC Cameras with IOTA VTI Inserters

1 WATEC 120 N+ Camera with IOTA VTI Inserter



The positive observation of the stellar occultation by the (16) Psyche October 8th, 2024



People's Democratic Republic of Algeria
Under the high patronage of the wali of Laghouat



The Center of Research in Astronomy, Astrophysics and Geophysics



Organise with :
The Laghouat wilaya Youth and Sports Direction

With collaboration of :
Suhail Astronomical Association in Laghouat



The twelfth national Meeting for Observing Stellar Occultations by Asteroids

From 7th to 10th of October, 2024

Conferences, Expositions, workshops, observations

&

The observation of the occultation of the star HIP 102217
from Capricornus Constellation by (16) Psyche in October 8th, 2024
at 22h52mn local time in Laghouat and Ghardaia Wilayas

General informations of (16) Psyche asteroid

Asteroid **(16) Psyche** is one of the ten most massive asteroids in the main asteroid belt. It is over 200 km in diameter and accounts for just under 1% of the total mass of the asteroid belt. It was discovered **by Italian astronomer Annibale De Gasparis** on March 17, 1852, at the **Naples Observatory** and named after Psyche, a figure from Greek mythology.



Annibale de Gasparis
Italian astronomer
1935 - 2017

Orbital and Physical Characteristics of (16) Psyche

Orbital Parameters

- **Orbital period:** 5.5 years (2,042 days)
- **Orbital inclination:** 3.1°

Physical Properties

- **Mean diameter:** ~ 226 km
- **Approximate dimensions:** $278 \times 238 \times 171$ km
- **Density:** 3.99 ± 0.26 g/cm³
- **Rotation axis inclination:** 98° (retrograde rotation)

Notes:

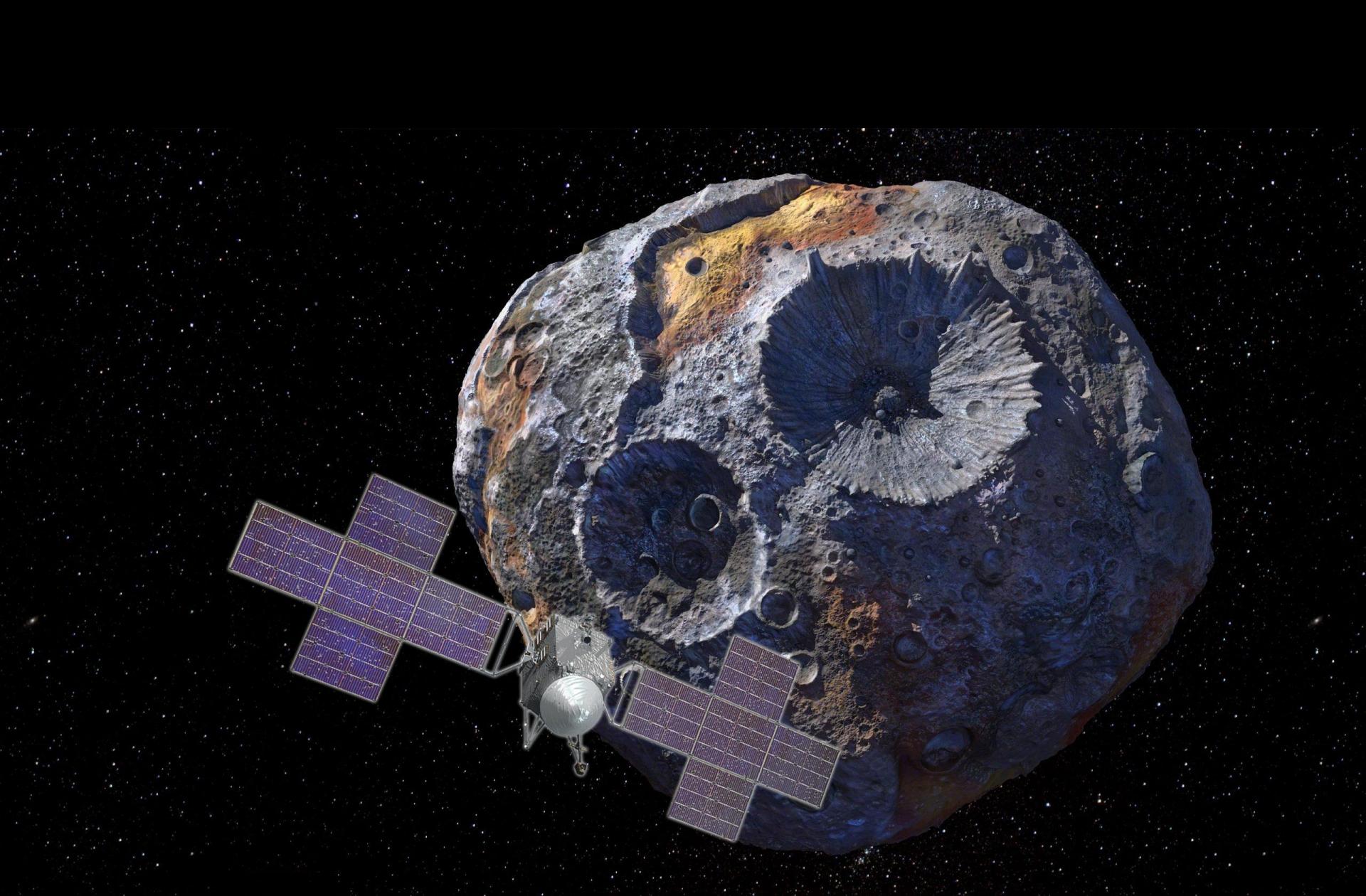
The dimensions and density suggest a mixed composition, likely consisting of both metal and silicate materials rather than a purely metallic core.

NASA Psyche Mission

- **Launch:** October 13th 2023 with a Falcon Heavy from Kennedy Space Center (LC-39A)
- **Arrival at Psyche:** **August 2029**
- **Scientific objectives:** Study the composition, internal structure, and history of Psyche to better **understand planetary core formation**.

Estimated Value

- Composition primarily of iron and nickel leads to hypothetical valuations of ~100,000 quadrillion USD, though practical extraction is currently infeasible.

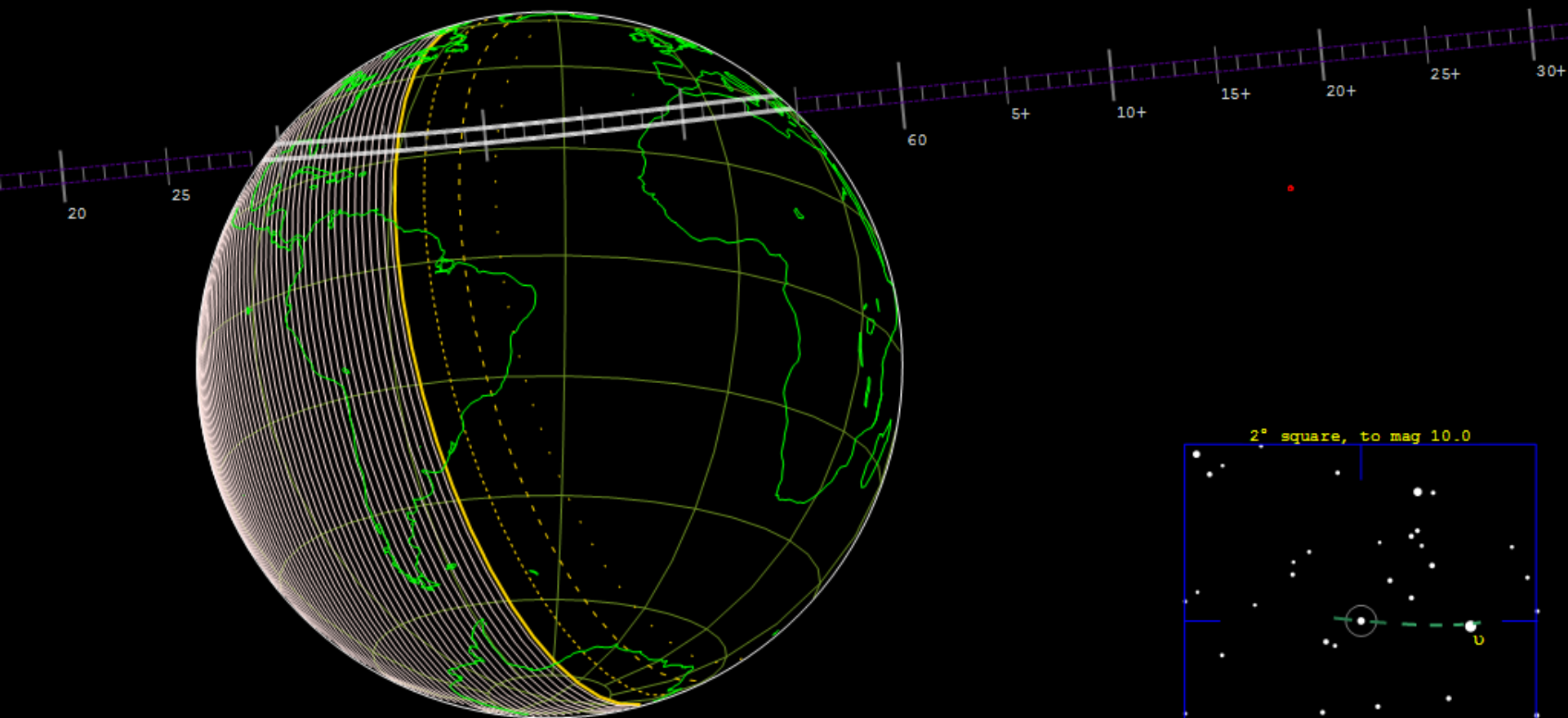


26 Psyche occults HIP 102217 on 2024 Oct 8 from 21h 29m to 21h 55m UT

```
Star: (Dia = 0.1 mas)
Mv 7.3; Mb 6.4; Mr 7.0
RA = 20 42 39.7790 (astrometric)
Dec = -18 6 34.715 ...
[of Date: 20 44 5, -18 1 16]
Prediction of 2022 Jul 20.9
Reliable 1.0 (good), DupSrc,
```

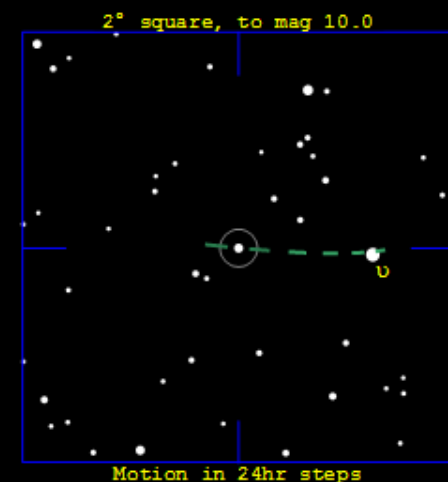
Durations: Max = 39.2 secs
1km = 0.16 secs, 1mas = 0.24 secs
Mag Drop: 3.6 [97%]v, 3.5 [96%]r
Sun : Dist = 13°
Moon: Dist = 45°, illum = 31%
Error 25.0 x 25.0 mas in PA 90°

```
Asteroid: (in DAMIT, ISAM)
Mag = 10.9
Dia = 249 ±14km, 164 mas
Parallax = 4.193"
Hourly dRA = 1.049s
dDec = 1.45"
Astorb2022 Jul 20, Star+PeakEphemUncert
```



ESOP XLIV, Poznan University, (Poland), August 2025

Occult 4.2022.7.24



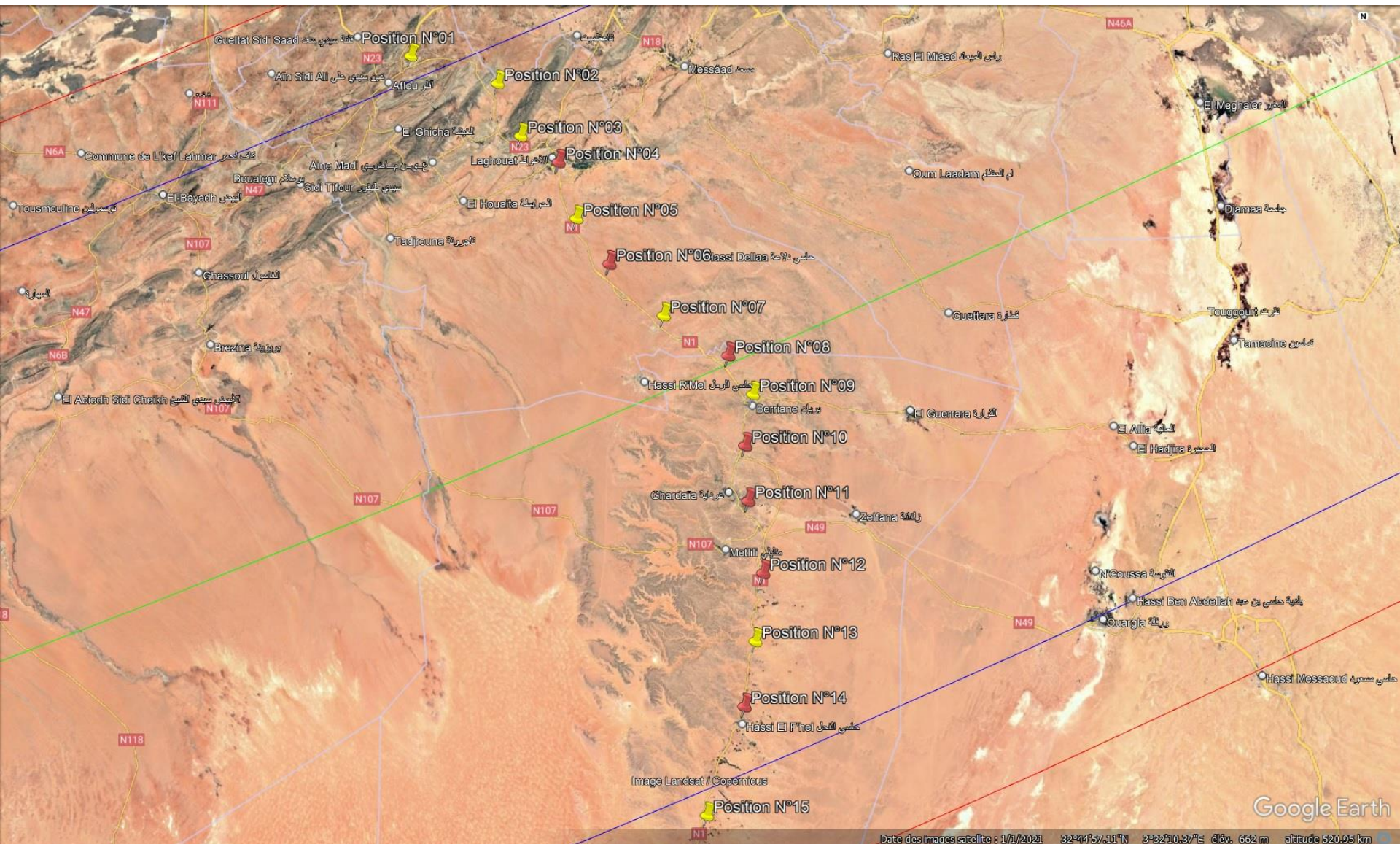








15 observation points spread across the departments of Laghouat, Ghardaia and El-Golea



Positive occultation of Psyche
In Berriane (Ghardaia)
Ghoulam Imad Eddine Boudiba Yahia & Al
Celestron 11 CGEM mount GoTo and Newton Telescope 115 mm

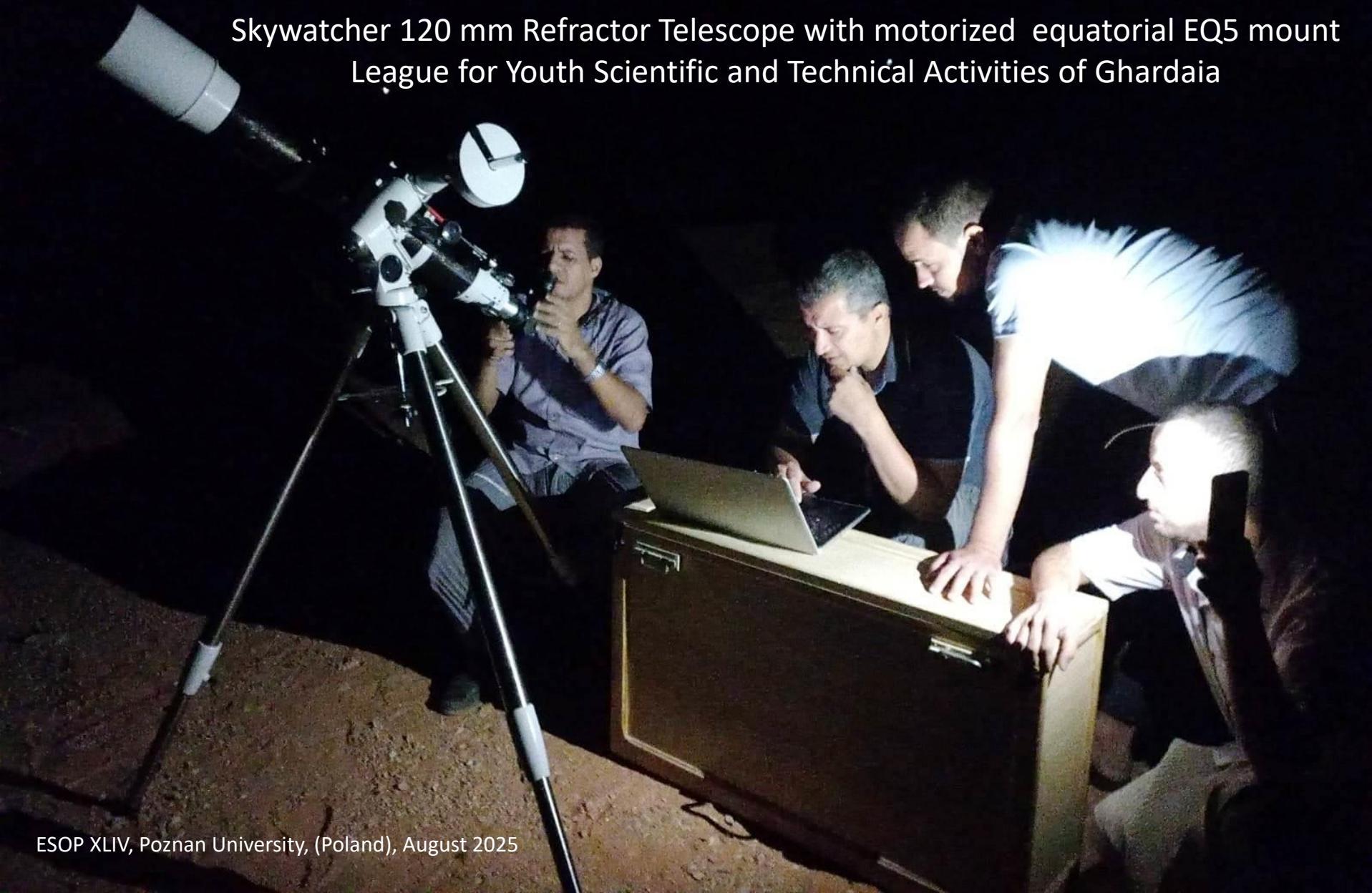


Positive occultation of Psyche
In Manssourah (Ghardaia)
Djounai BABA AISSA & Al
Celestron 11 CGEM mount GoTo



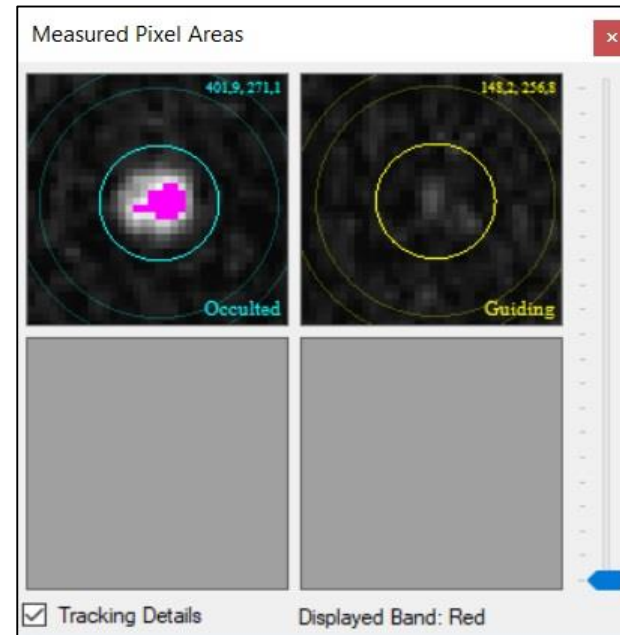
Naked Eye Positive occultation of Psyche
In Hassi Lefhel (El Golea)
Yahia Guellil & Al

Skywatcher 120 mm Refractor Telescope with motorized equatorial EQ5 mount
League for Youth Scientific and Technical Activities of Ghardaia



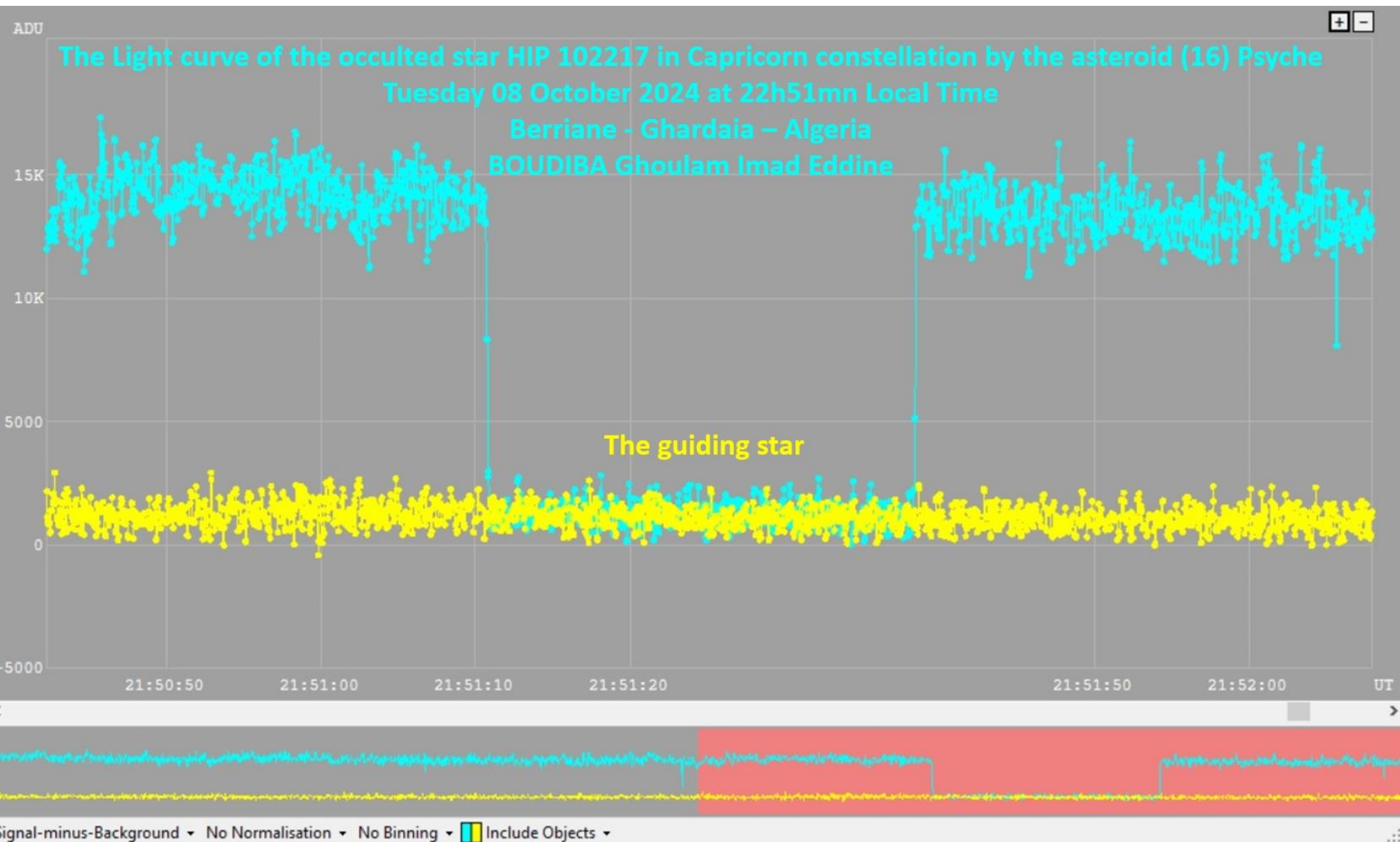
Satellites: 7 HDOP: 1.23
UTC: 21:53:39 2024-10-08
Latitude: 3250.4305 N
Longitude: 00341.9912 E
Altitude: 579.2 M MSL
WGS84 separation: 36.9 M

CPU clock 1000008 Hz
Err Transient
vSync 20000 CPU us
External PAL TVsafe
Last used 02h 2022-08-30



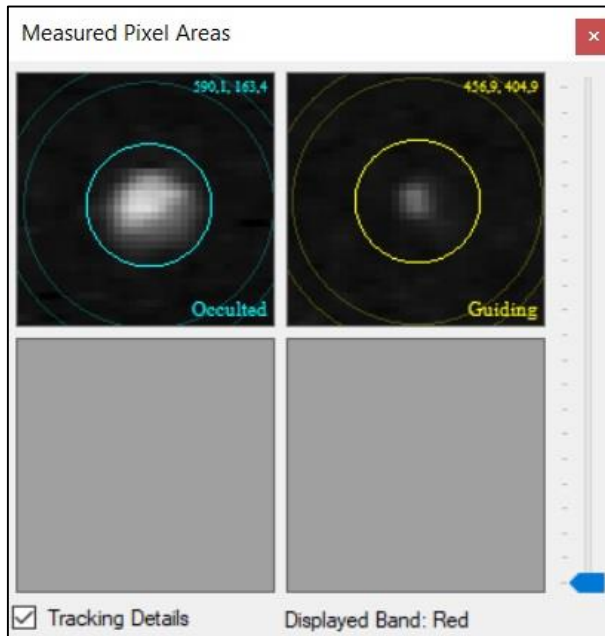
x=148.2: y=256.8
x=401.9: y=271.1

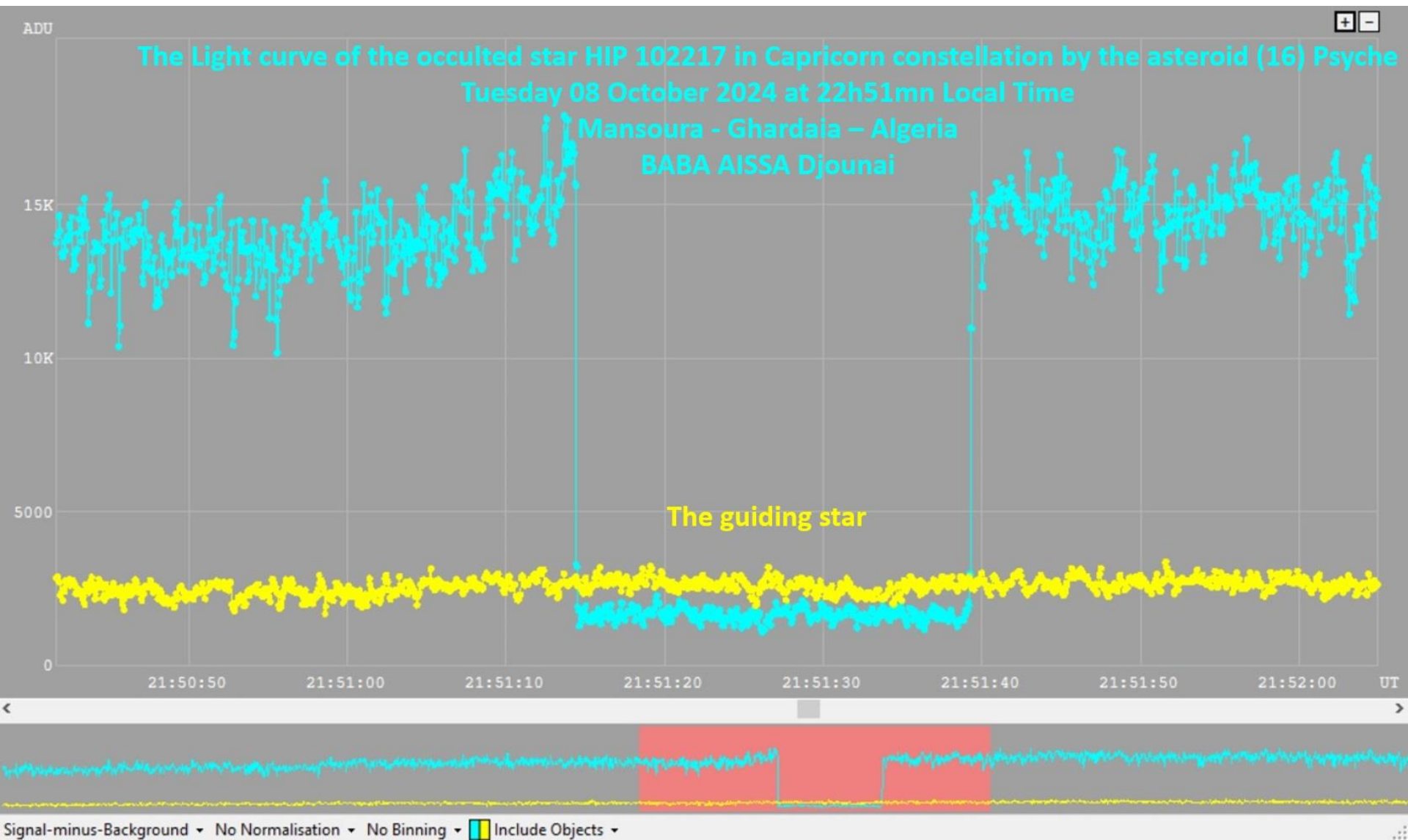
F7
21:49:16 6514 6714 42084

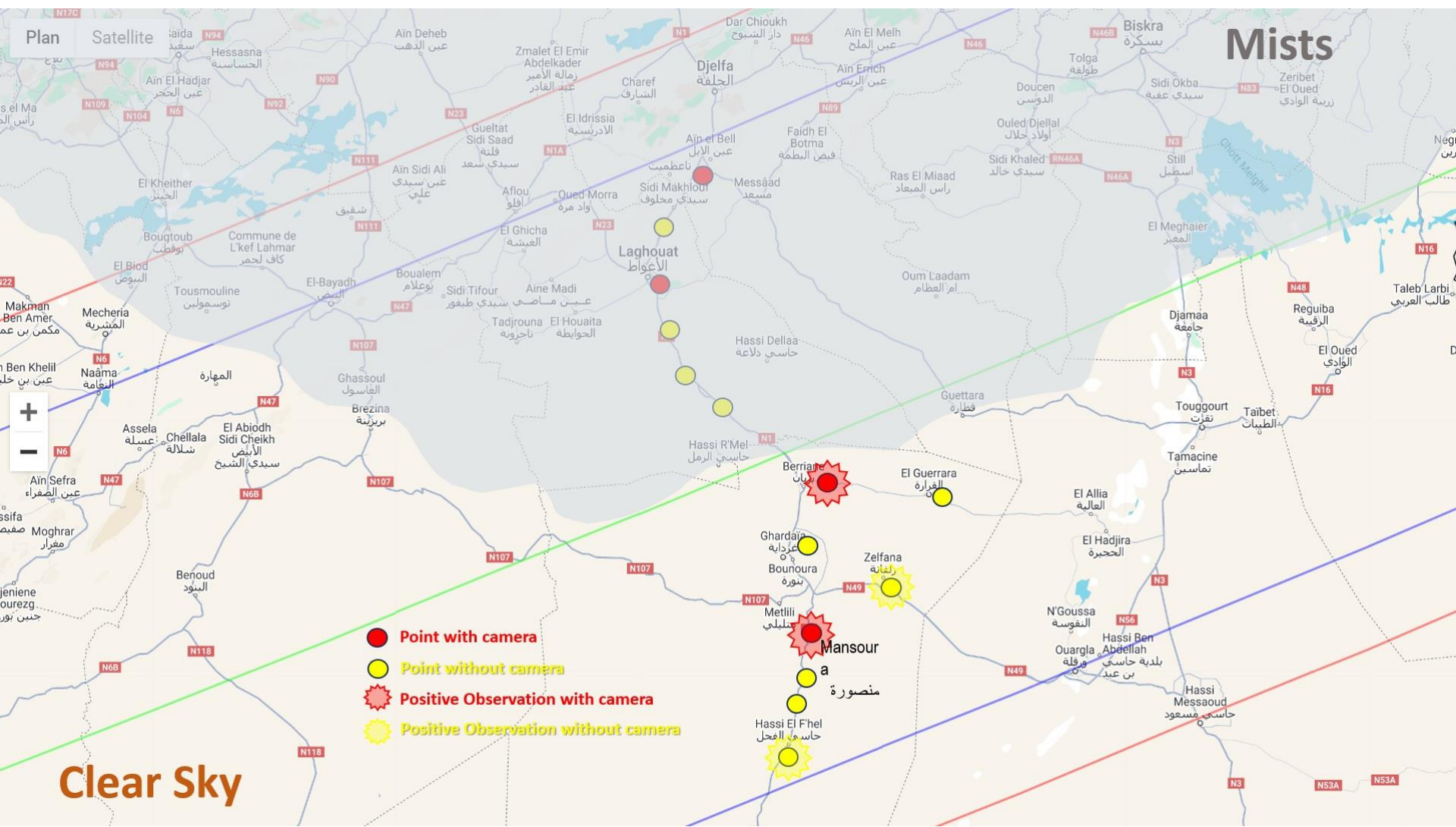


Satellites: 10 HDOP: 0.78
UTC: 20:46:31 2024-10-08
Latitude: 3155.0175 N
Longitude: 00332.1127 E
Altitude: 448.1 M MSL
WGS84 separation: 35.4 M

CPU clock 1000000 Hz
Err Transient
vSync 20000 CPU us
External PAL Fullscreen
Last used 15h 2023-12-05







The positive observation
of the stellar occultation
by the Near Earth Asteroid
(2212) Hephaios
December 11th, 2024

General informations of (2212) Hephaistos asteroid

Asteroid (2212) **Hephaistos** is an Apollo-type near-Earth asteroid, discovered on September 27, 1978, by the Ukrainian astrophysicist **Lyudmila Chernykh** at the **Crimean Astrophysical Observatory** using the **Zeiss 40 cm double astrograph**.

Its name originates from the Greek god Hephaistos, the deity of blacksmithing and volcanoes.

Although Hephaistos is classified as a potentially hazardous asteroid, it is not considered an imminent threat since computer simulations indicate no future collisions.

It is the largest member of the Hephaistos asteroid group, which also includes potential members such as **(85182) 1991 AQ**, **4486 Mithra**, and **the lost or disintegrated comet D/1766 G1 (Helfenzrieder)**.

Its considerable size makes it one of the largest known near-Earth objects.



Lyudmila Chernykh
Ukrainian astrophysicist
1935 - 2017

Orbital characteristics and physical properties of (2212) Hephaistos

Orbital Parameters:

Class: Apollo (Earth-crossing)

Orbital period: ~3.18 years (1,160 days)

Eccentricity: 0.8376

Inclination: 11.56°

Perihelion / Aphelion: 0.351 AU / 3.967 AU

Physical Properties:

Diameter: ~5.7 km

Spectral type: SG (transitional S/G)

Absolute magnitude: 13.87

Rotation period: ~20 hours

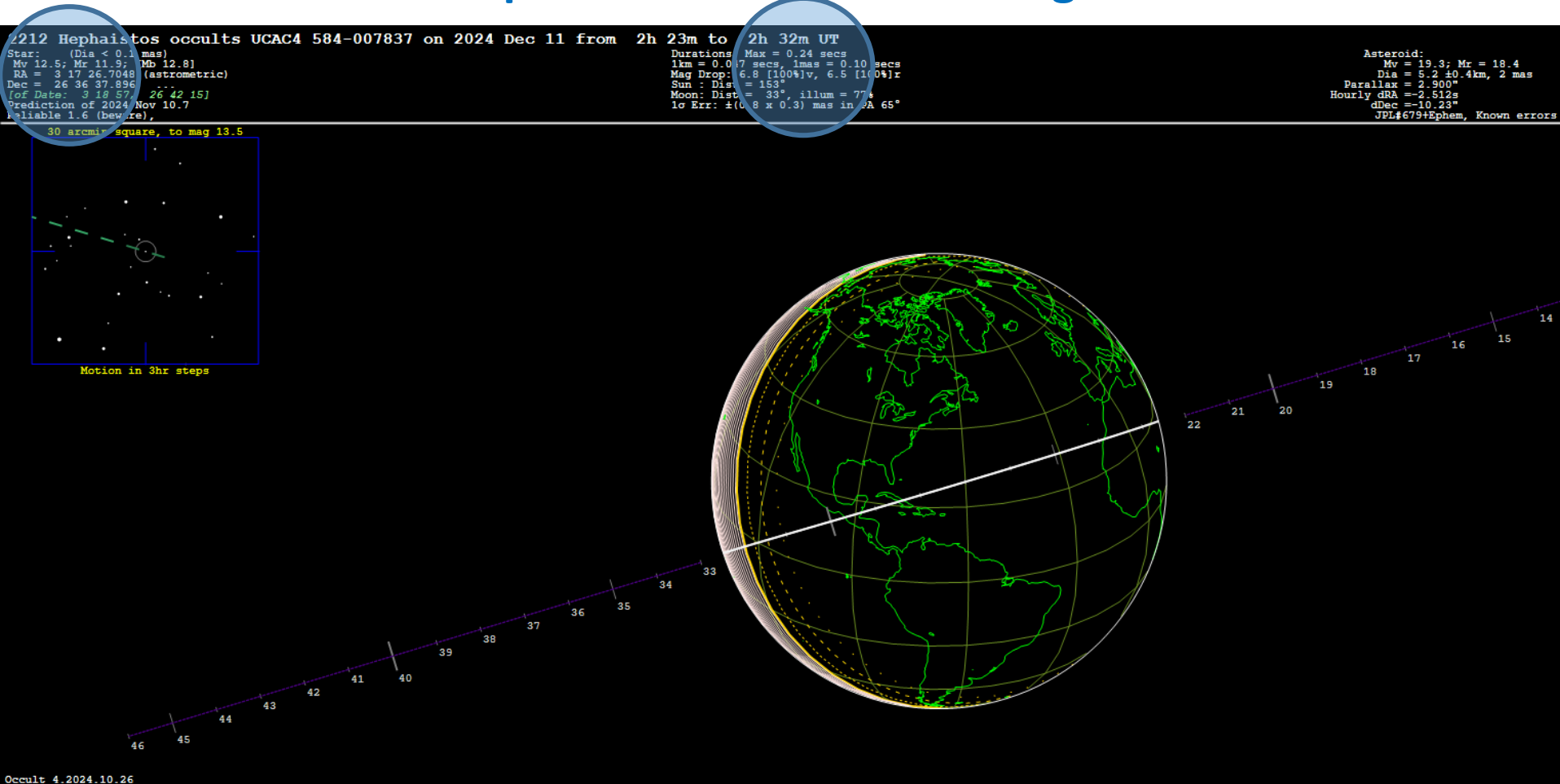
Notes:

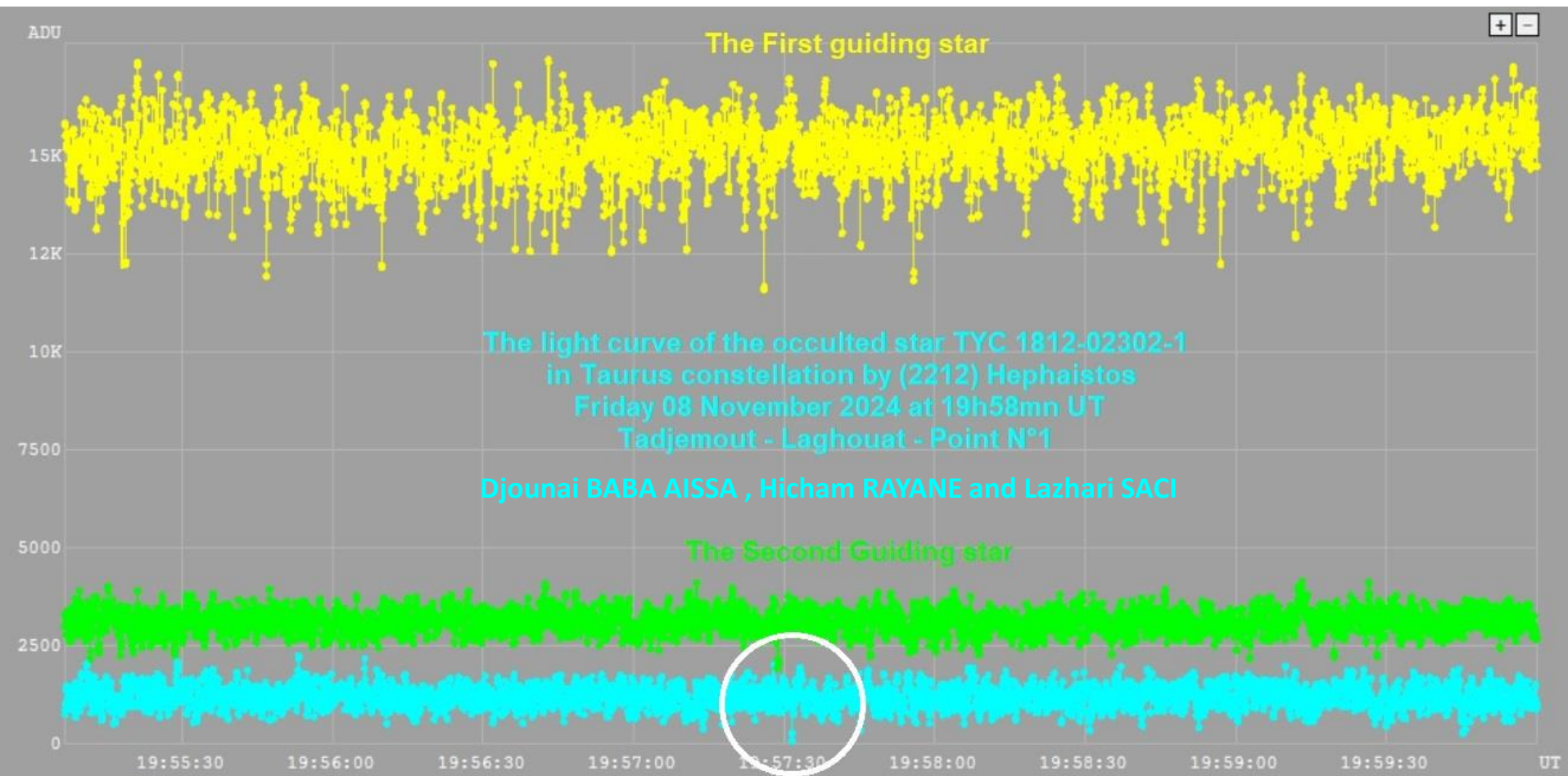
Largest member of the Hephaistos asteroid group. Not considered as a potentially hazardous object (PHO). Exhibits a highly eccentric orbit crossing the inner planets.

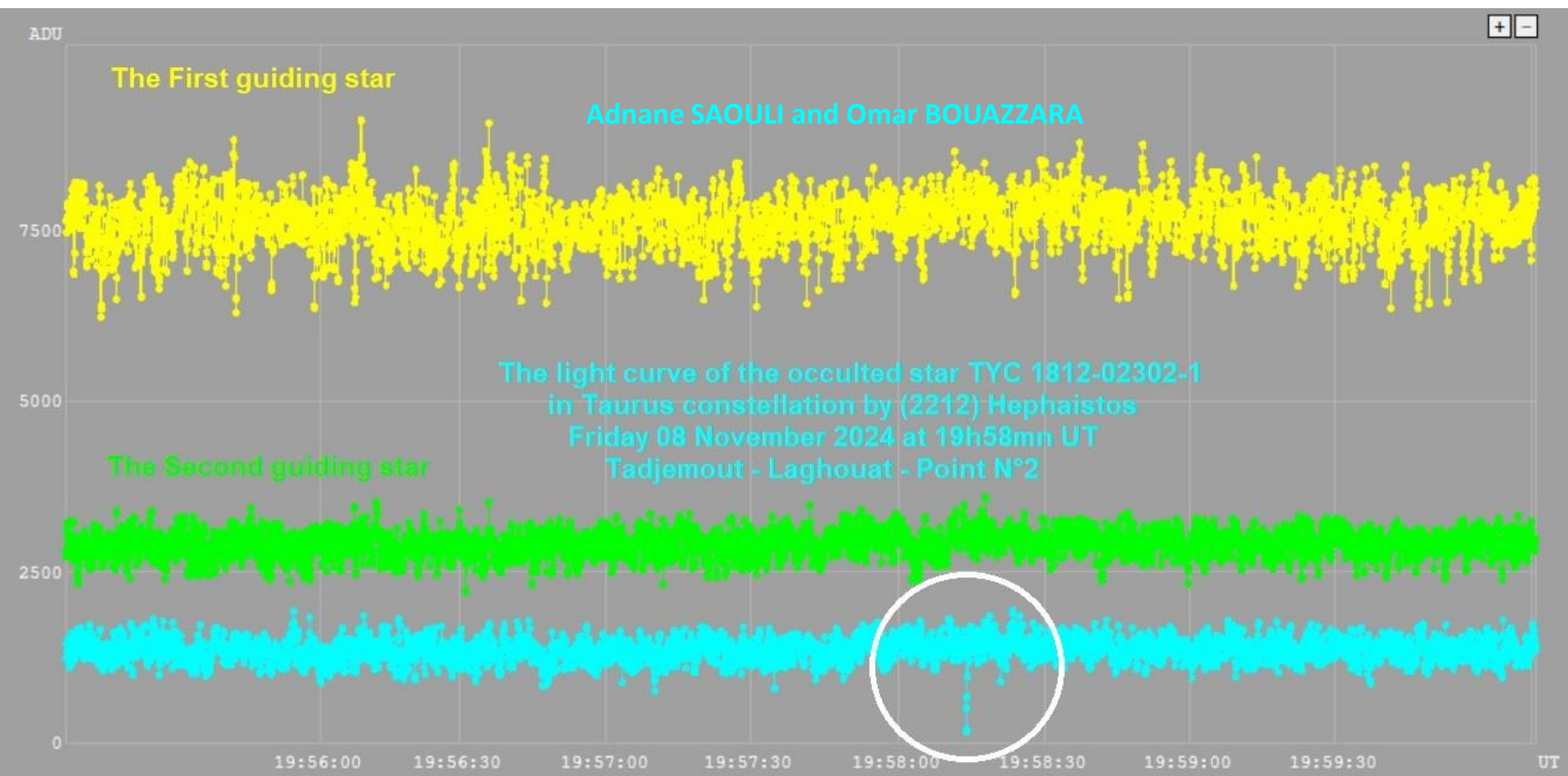
The stellar occultation by the NEA (2212) Hephaisostos

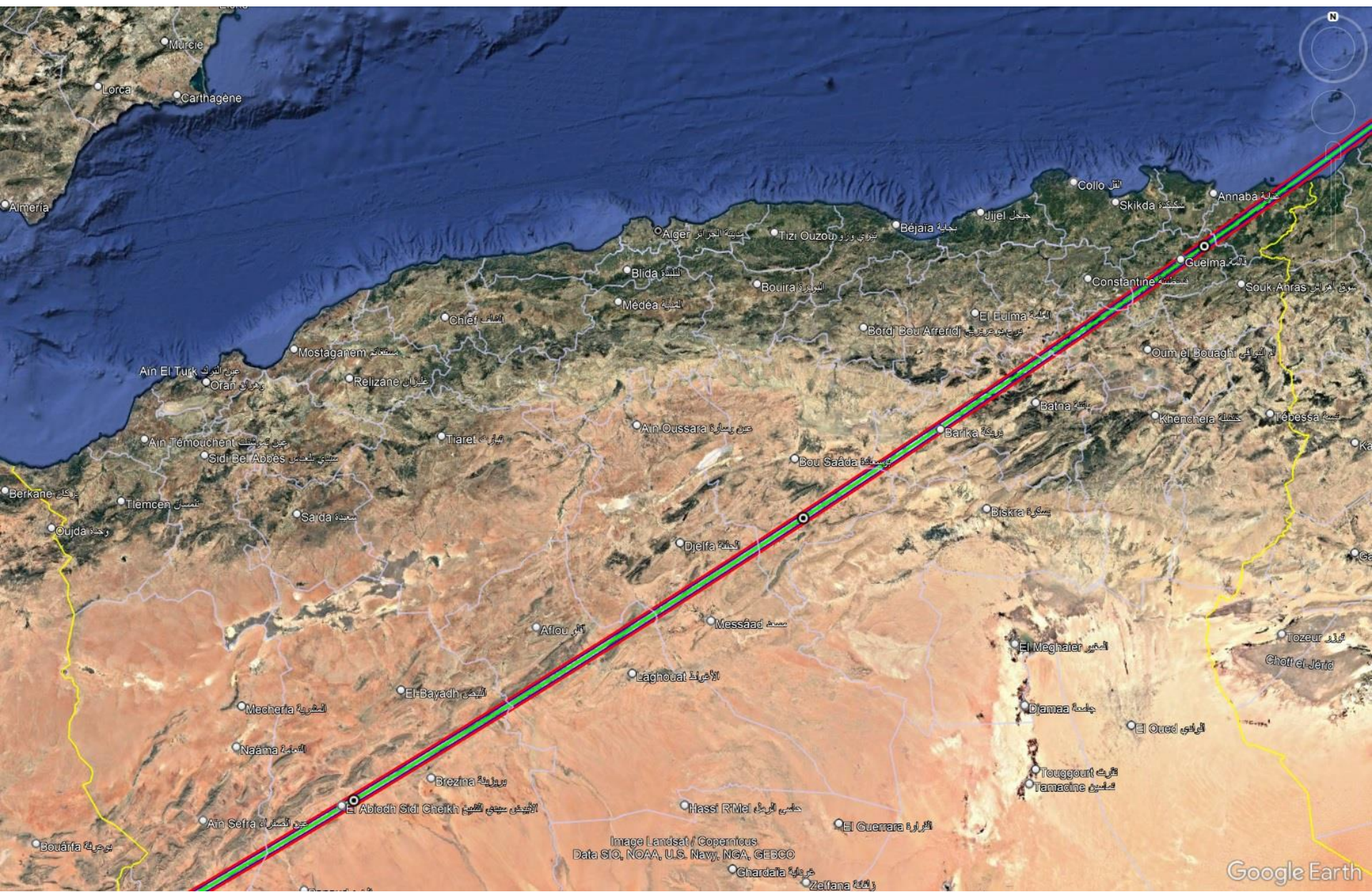
December 11th, 2024

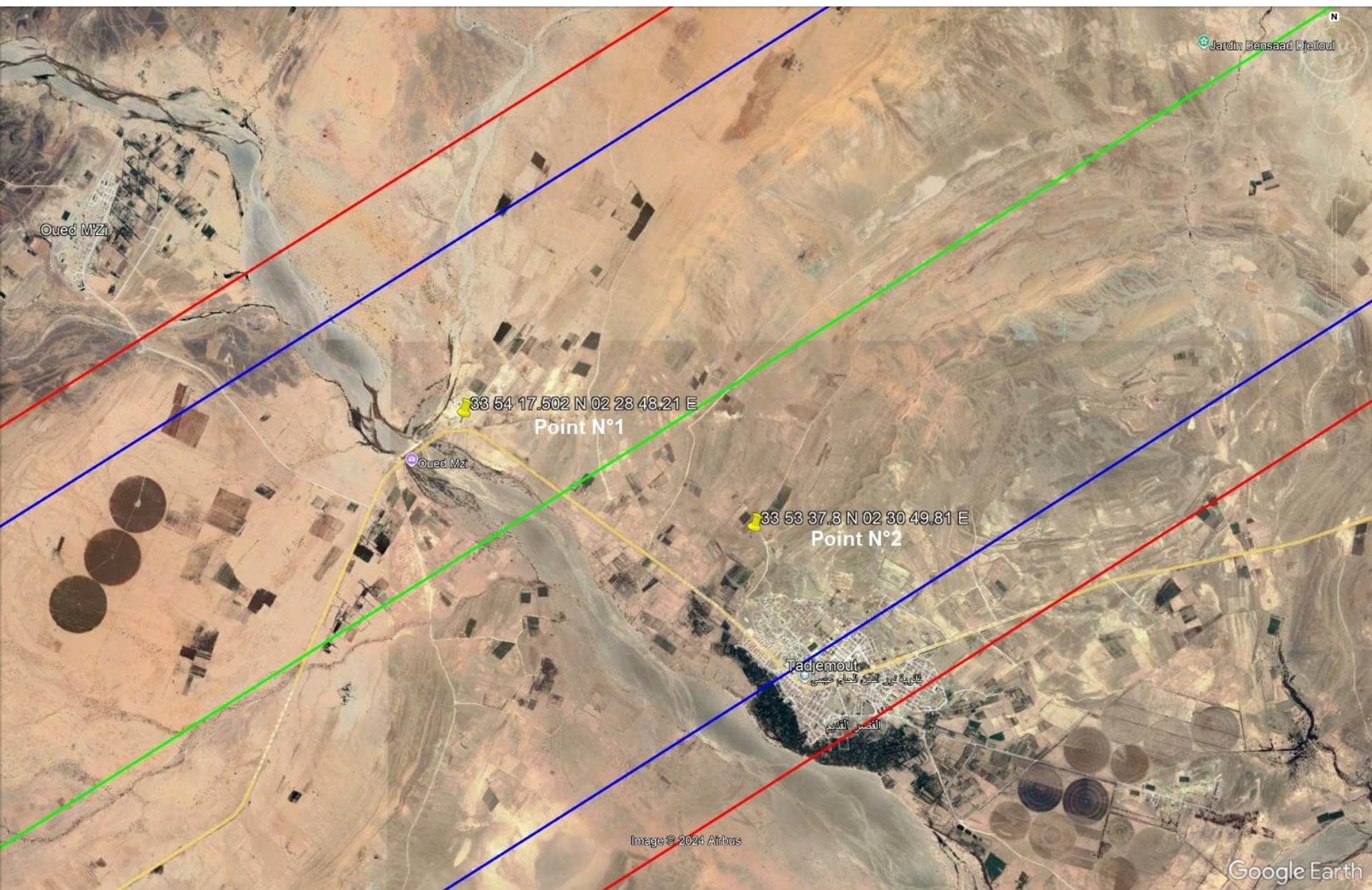
First positive observation in Algeria















GROUPE 02 OCCULTATION

The quadruple positive stellar
occultation by the TNO 2013 LU28
on February 18th, 2025
in the far southern of Algeria

The celestial body **2013 LU28** is a trans-Neptunian asteroid classified as a **centaur** due to its orbit, of the **Damocloid type** in the outer regions of the Solar System.

It has an **elliptical, highly eccentric, and retrograde orbit**, similar to those of periodic comets such as **Halley's Comet**, but without the coma or tail of a comet.

It was discovered on **June 8, 2013**, by astronomers of the **Mount Lemmon Survey** at the **Mount Lemmon Observatory** in Arizona, United States.

Out of more than one million asteroids observed to date, only about a hundred are known to have retrograde orbits. This object is one of the largest of its kind. The asteroids **2008 YB3** and **2011 MM4** show similar characteristics.

It has a diameter of about **110 kilometers**, based on an absolute magnitude of **8.1**, and an assumed surface albedo between **0.08 and 0.09**. Its **rotation period, pole orientation, and shape** remain unknown.

On **April 12, 2024**, the **James Webb Space Telescope** observed asteroid 2013 LU28 for **two hours, 57 minutes, and 32 seconds**. The telescope's **Mid-Infrared Instrument (MIRI)** was used in **medium-resolution spectroscopy mode** to track the asteroid as a primary moving target. The results are expected to be published later.

Astronomical Properties of Asteroid 2013 LU28

Orbital characteristics and physical properties:

Orbital period: 2,434 years

Diameter: ~110 km

Apparent diameter (February 2025): 17.8 milliarcseconds

Visual magnitude (February 2025): 18.2

Orbital eccentricity: 0.952

Orbital inclination: 125.3°

Perihelion distance: 8.73 AU ($\sim 1.306 \times 10^9$ km)

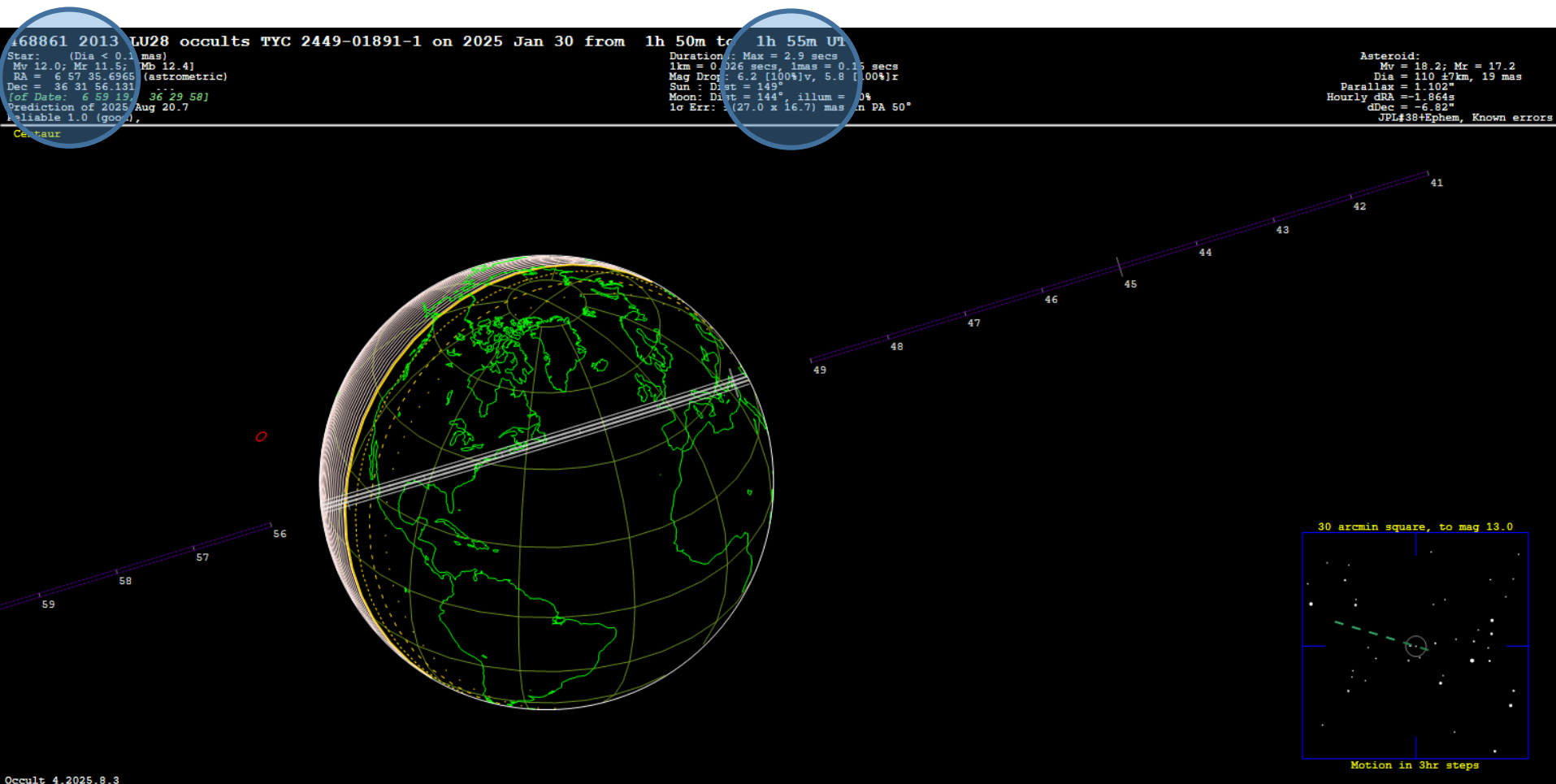
Aphelion distance: 358 AU ($\sim 5.356 \times 10^{10}$ km)

Estimated surface albedo: 0.08–0.09

This object exhibits a highly eccentric and inclined orbit, characteristic of distant transneptunian bodies, with a very low assumed albedo indicating a dark surface composition.

The stellar occultation by the TNO 2013 LU28 in January 30th 2025

First positive worldwide observation in United States in America



08 positive occultation

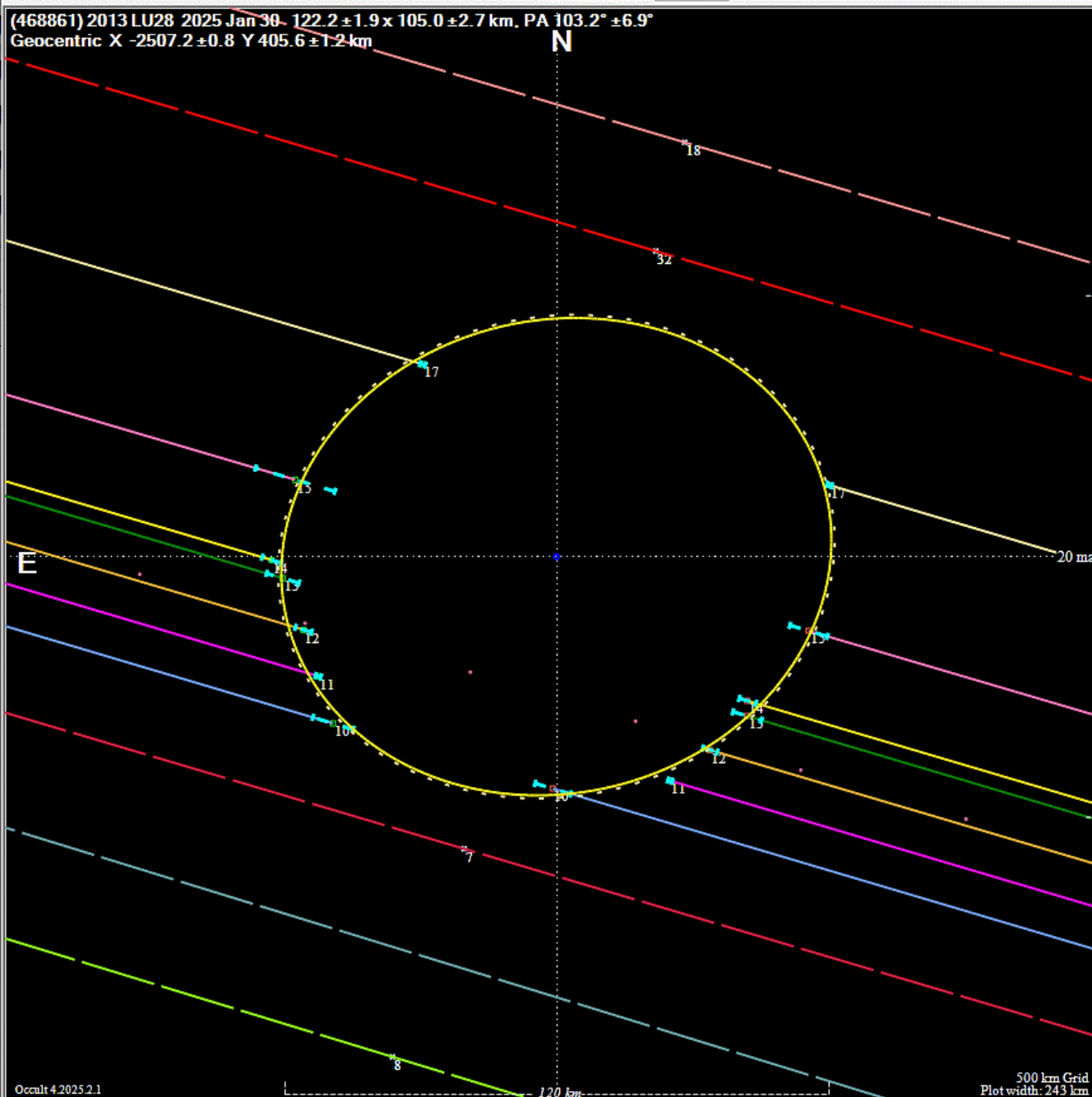
26 negative occultation

18 Overcast

02 Technical failures



(468861) 2013 LU28 2025 Jan 30 122.2 ± 1.9 × 105.0 ± 2.7 km, PA 103.2° ± 6.9°
Geocentric X -2507.2 ± 0.8 Y 405.6 ± 1.2 km



Find best fit

Center X 1.3 ☒ 0.0 Mass X 0.0

Center Y 4.4 ☒ 0.0 Mass Y 0.0

Major axis (km) 122.2 ☒ 0.0 Shape model ☐

Minor axis (km) 105.0 ☒ 0.0 a/b: 1.16, dMag: 0.16

Orientation 103.2 ☒ 0.0 Motion: 38.00 km/s

☐ Circular ☐ Use assumed diameter ☒ Include Miss events

Double stars - show ☒ Both ☐ Primary ☐ Secondary

Quality of the fit Limits on size, but no shape

☐ Flag for future review

Scale

Size ☒ normal ☐ x 2 ☐ x 5 Form opacity

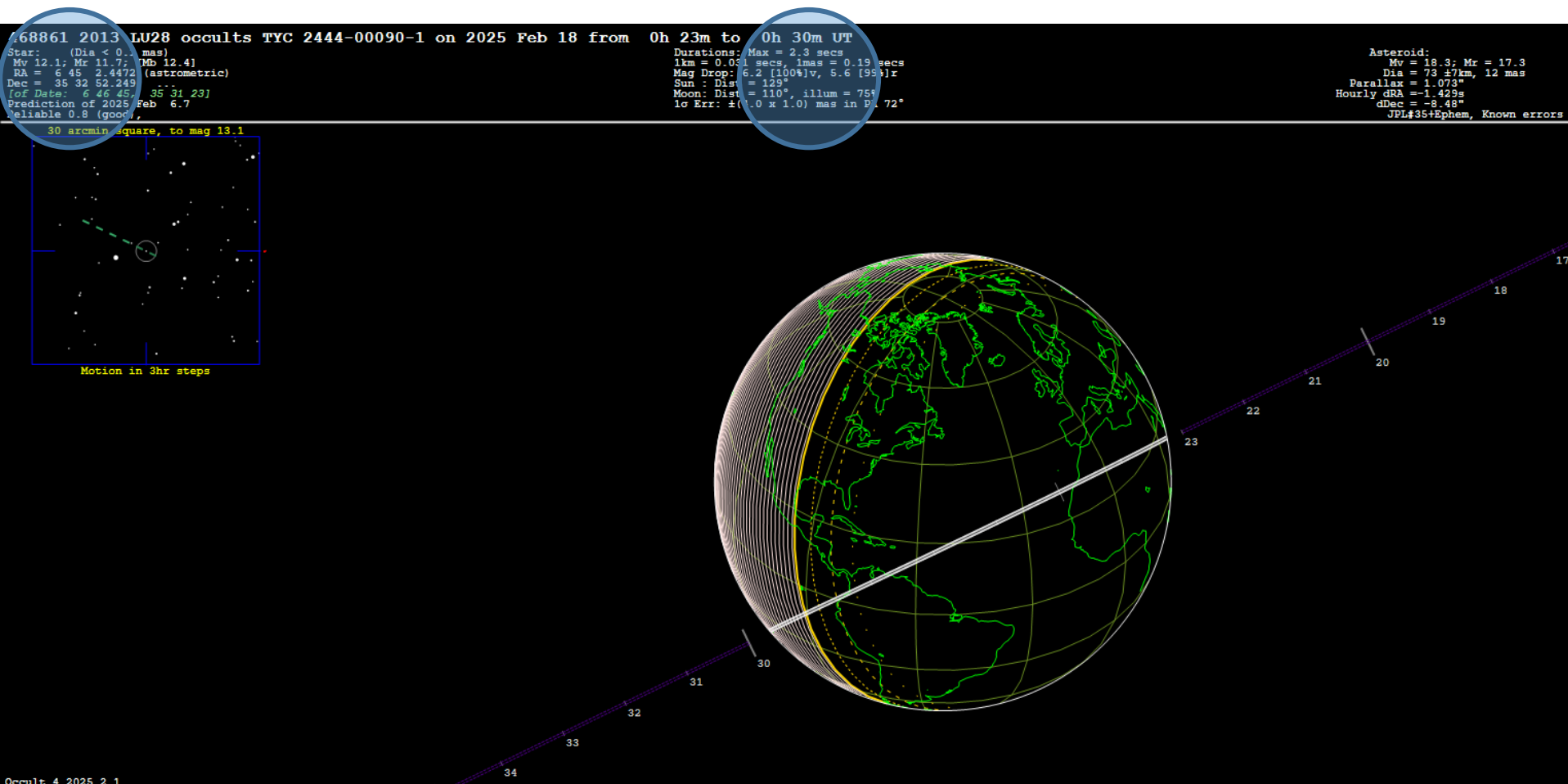
Scroll range x1.25 ☐

RMS fit 0.0 ± 1.8 km

1 (M)	V Nikitin, near Boulder, Co
2 (M)	W Beisker, near Tavera
3 (M)	A Noschese, near Pontecagn
4 (M)	V Ruckman, near Williamsbur
5 (M)	M Dunford, near Belmont, No
6 (M)	A Siakas, near Prodromos
7 (M)	W Zhang, V Sergienko et al,
8 (M)	Paolo Fini, near Impruneta
9	C Shryock, near Mt Rainier,
10	D Dunham & J Dunham, near C
11	R Kelley, near Silver Sprin
12	L Dorsey & N Smith, near Tr
13	K Hartnett, near Sunshine,
14	R McConnell, near Chattanoc
15	I Venzor et al, near Las Lo
16 (P)	Predicted
17	K Green, O Ashley et al, ne
18 (M)	A Foote & A Moore, near Wal
19 (M)	K Garg, C Dorsey et al, near
20 (M)	P Oakey & K Kennedy, near C
21 (M)	Jean-Francois Pittet, near
22 (M)	Tim Haymes, near Oxford
23 (M)	Joachim Siegert, near Urser
24 (M)	M Billiani, near Wien, Neuk
25 (M)	William Stewart, near Nantv
26 (M)	K Getrost, near Medina, Mi
27 (M)	J Hanus, near Bozkov
28 (M)	Jiri Kubanek, near Strasic
29 (M)	Alex Pratt, near Leeds
30 (M)	Peter Delincak, near Zakop
31 (M)	M Skrutskie, near Nederland
32 (M)	E Press & J Dipasquale, ne
33 (P)	Predicted

The stellar occultation by the TNO 2013 LU28 in February 18th, 2025

Quadruple positive observation in Algeria and One in Venezuela

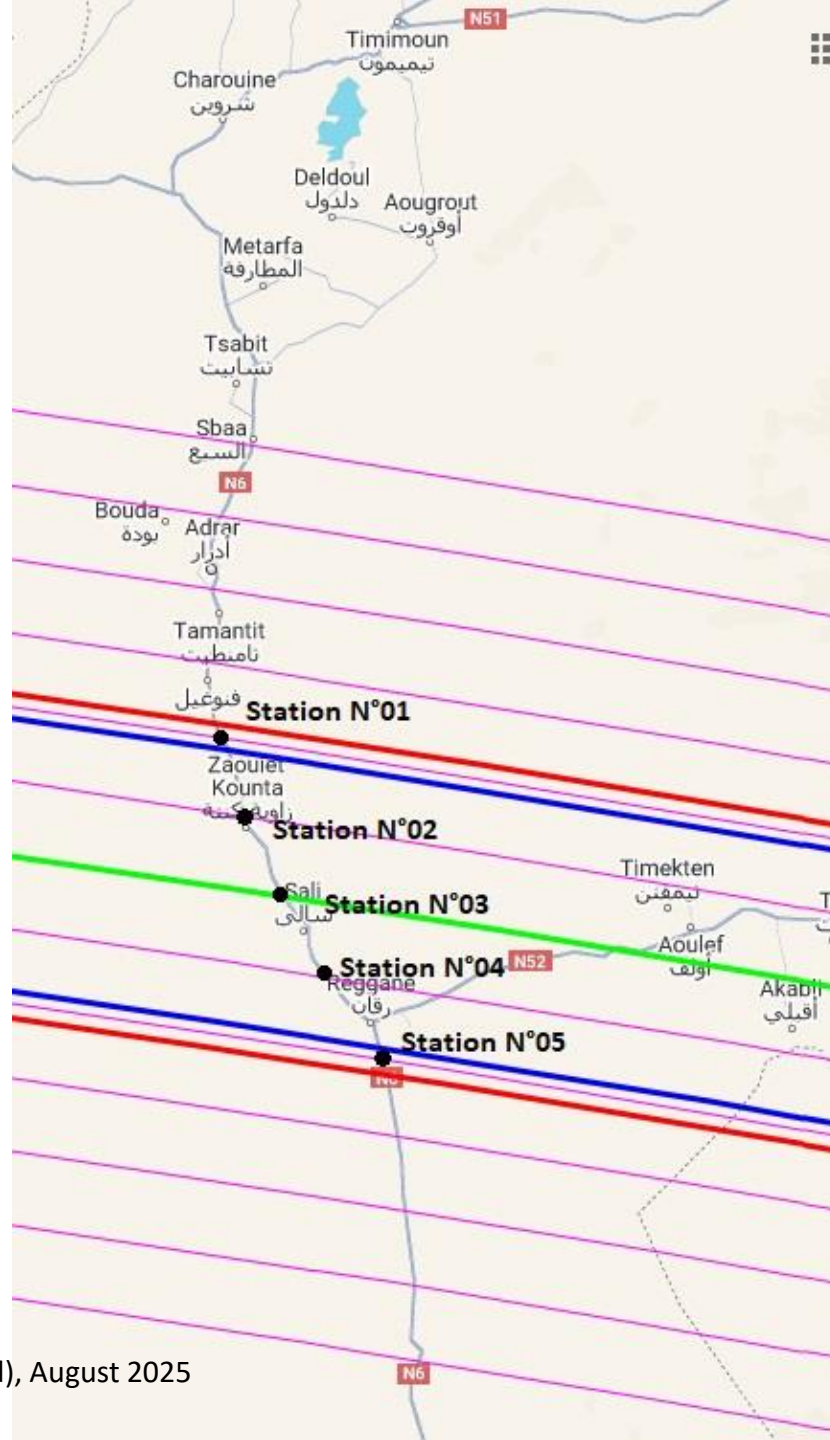


05 positive occultation

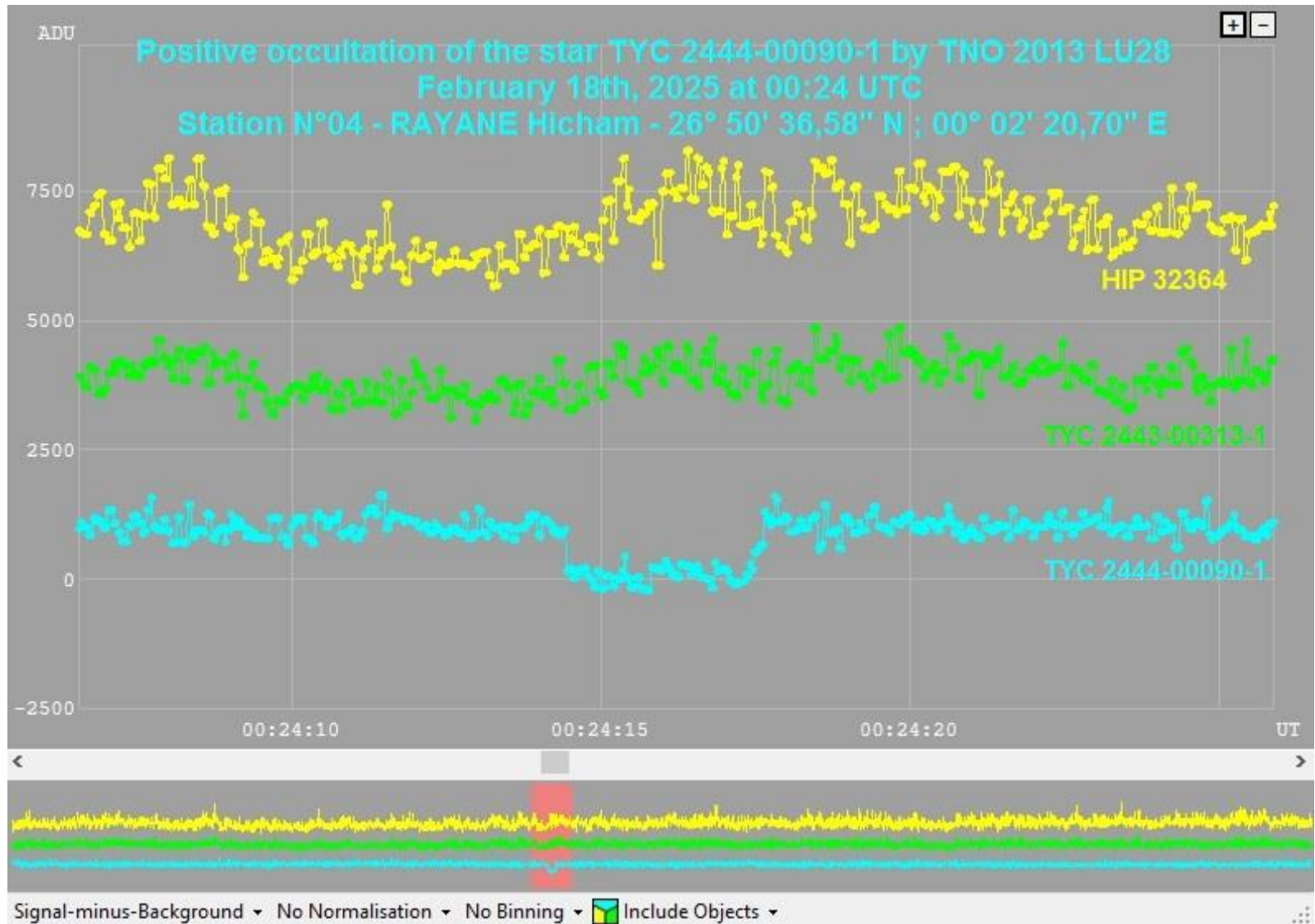
03 Overcast

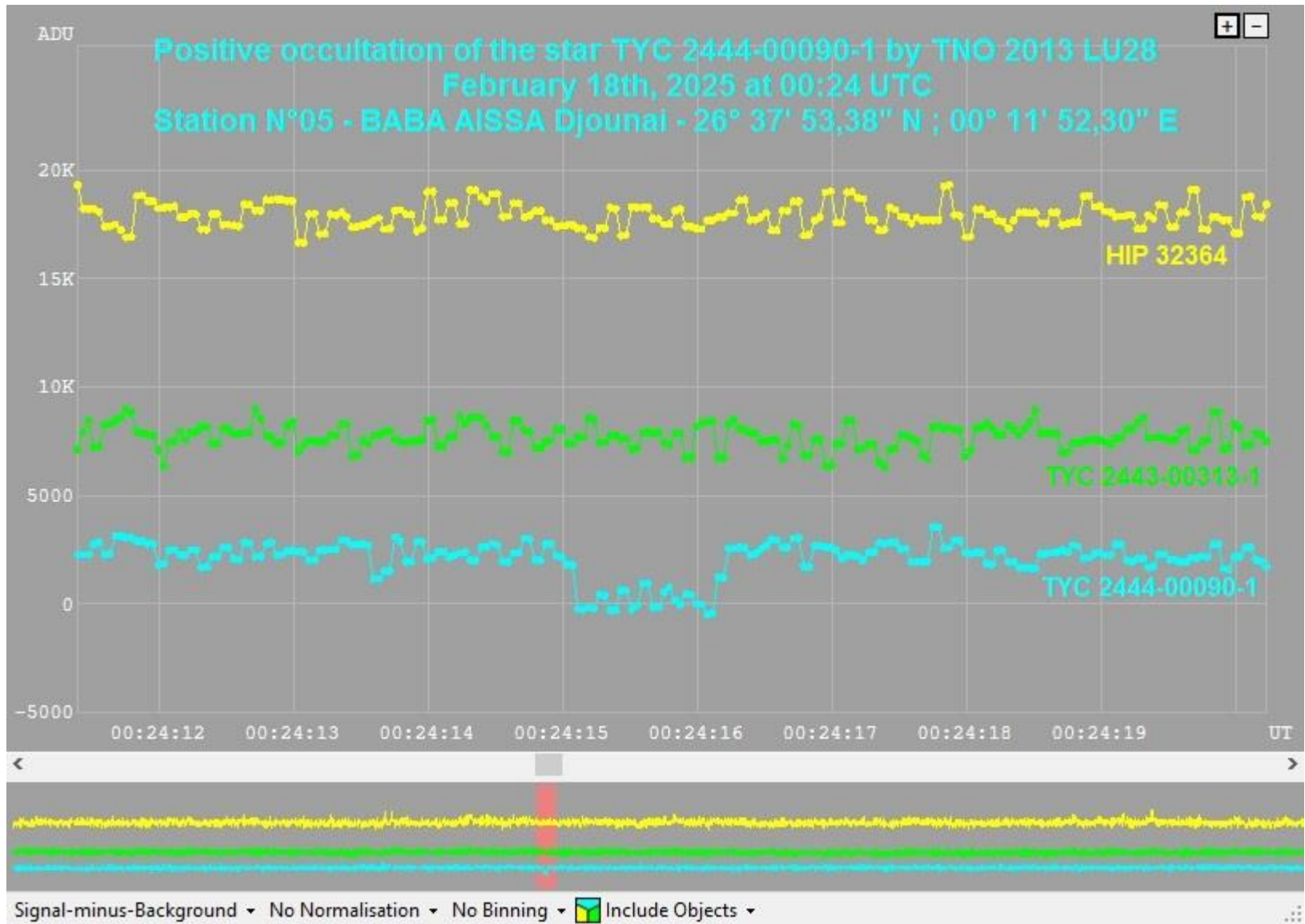
03 Technical failures

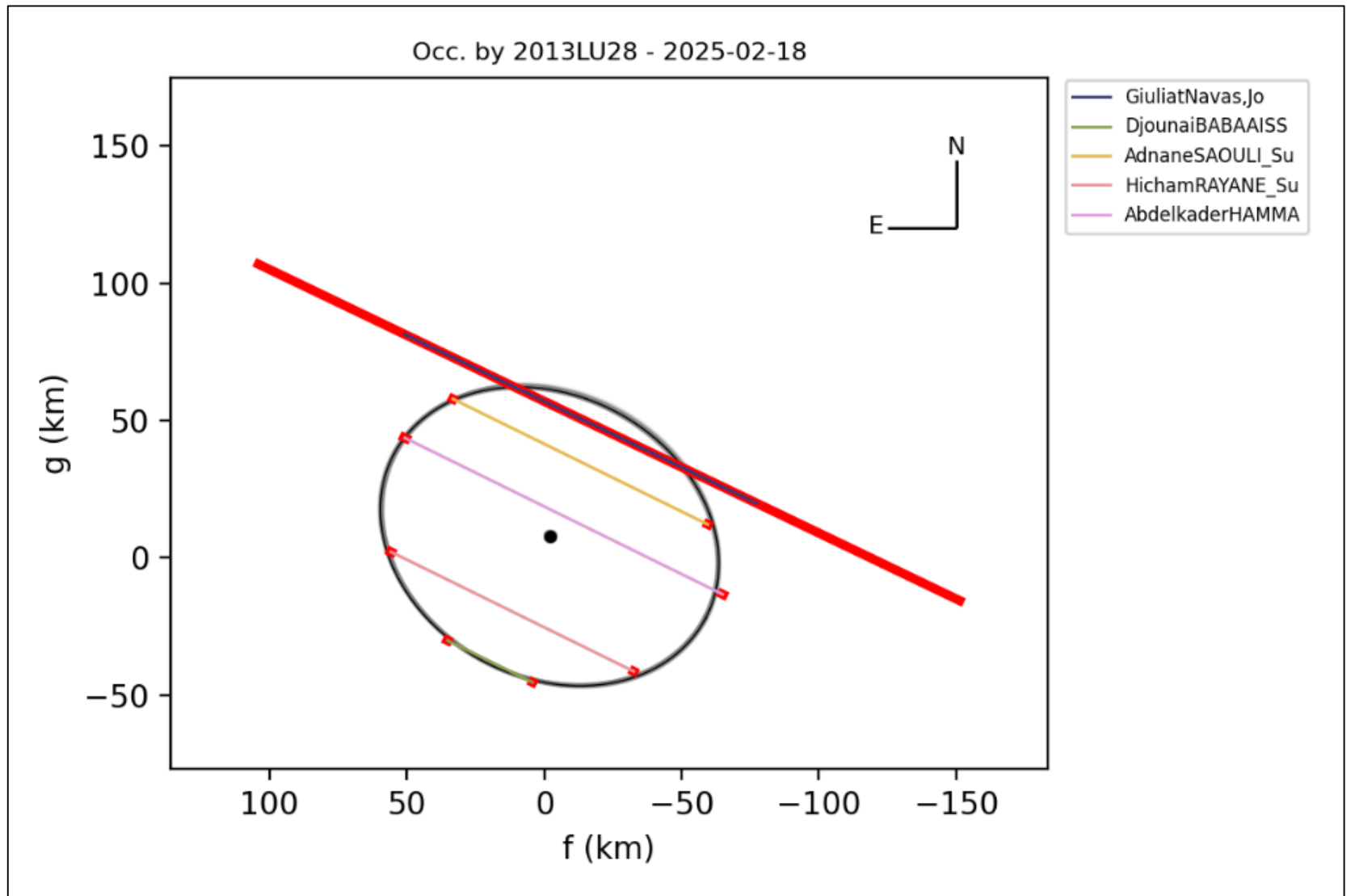






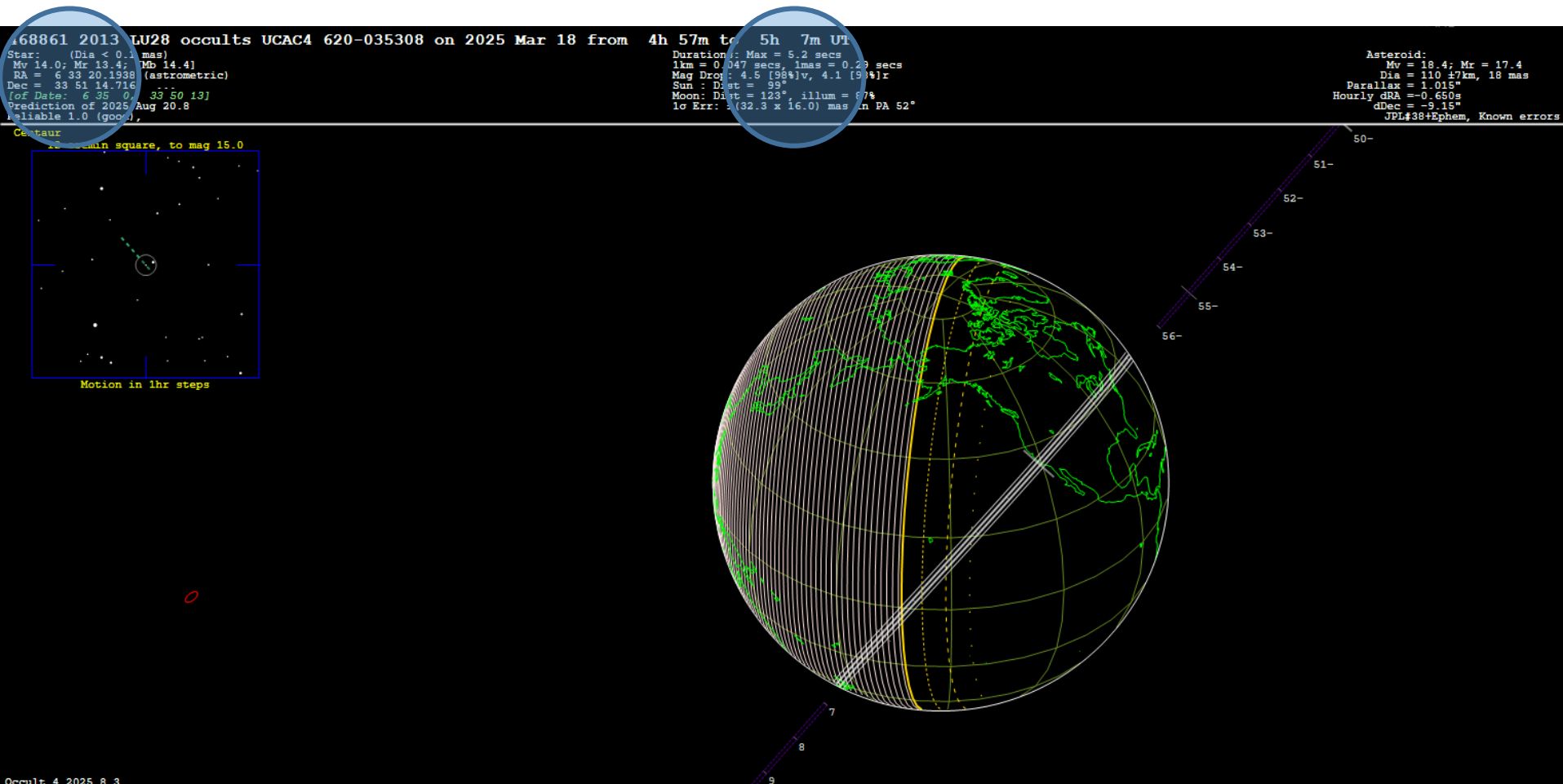




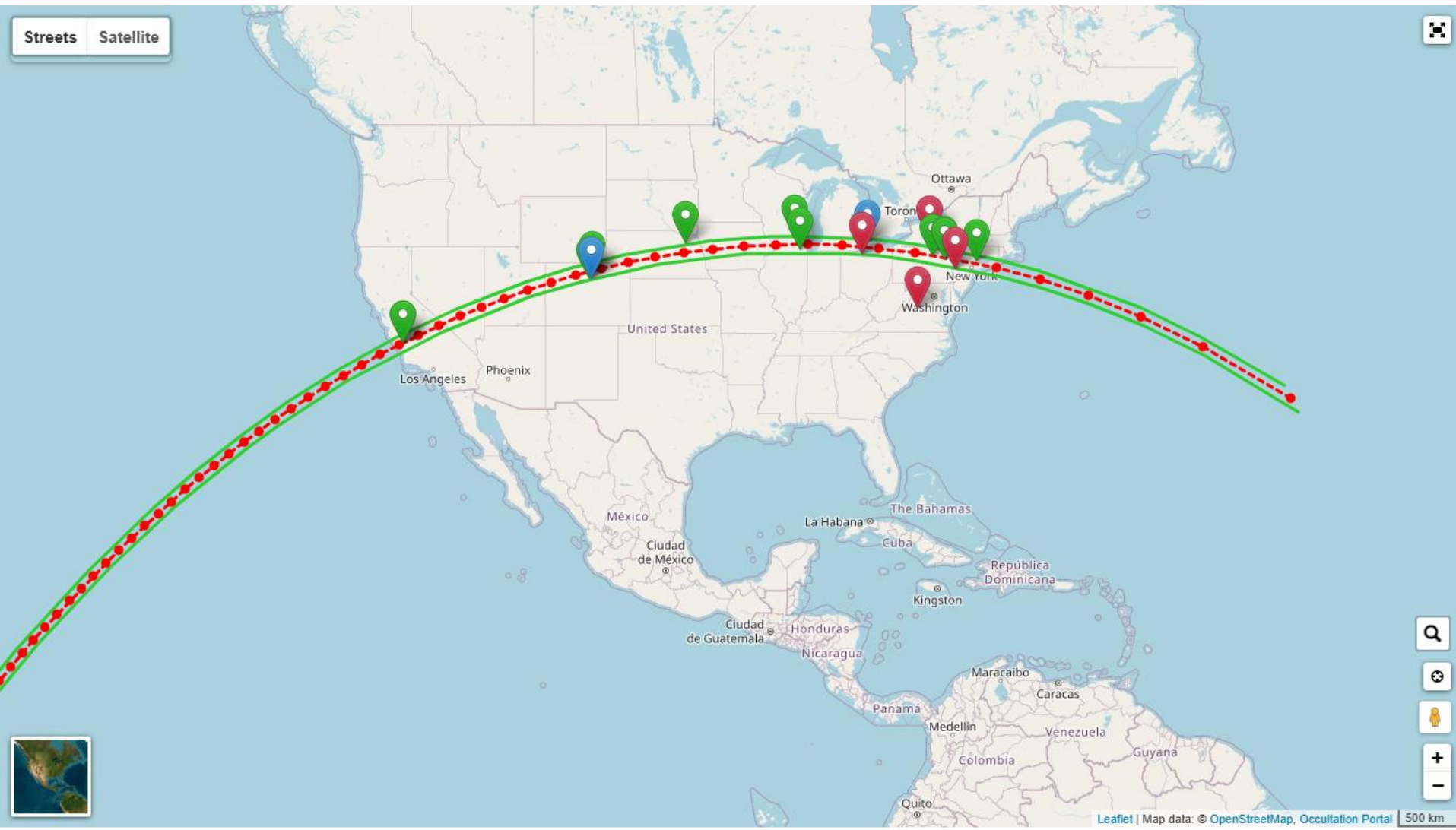


The stellar occultation by the TNO 2013 LU28 in March 18th 2025

8 Positive observation in United States in America



09 positive occultation
04 negative occultation



The Total solar eclipse of August 12th, 2026 Partial in Algiers (98%)

Total Solar Eclipse of 2026 Aug 12

Greatest Eclipse = 17:47:05.8 TD (= 17:45:53.3 UT1)

Eclipse Magnitude = 1.0386

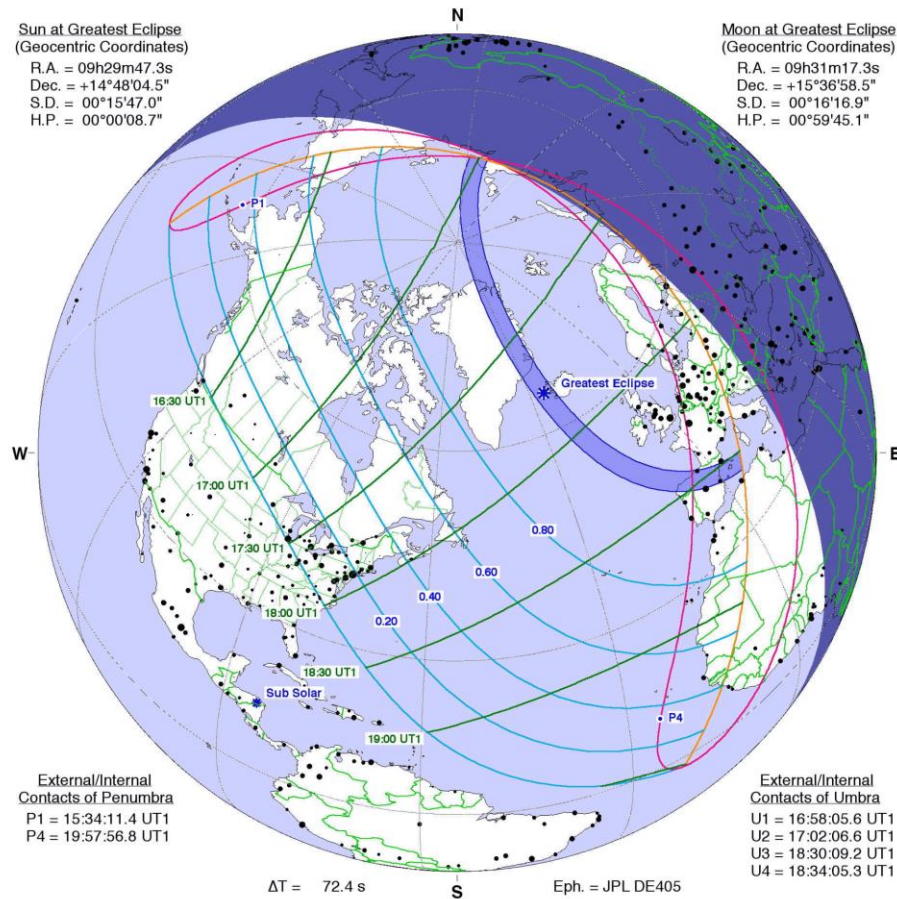
Saros Series = 126

Gamma = 0.8977

Saros Member = 48 of 72

Sun at Greatest Eclipse
(Geocentric Coordinates)
R.A. = 09h29m47.3s
Dec. = +14°48'04.5"
S.D. = 00°15'47.0"
H.P. = 00°00'08.7"

Moon at Greatest Eclipse
(Geocentric Coordinates)
R.A. = 09h31m17.3s
Dec. = +15°36'58.5"
S.D. = 00°16'16.9"
H.P. = 00°59'45.1"



External/Internal
Contacts of Penumbra
P1 = 15:34:11.4 UT1
P4 = 19:57:56.8 UT1

External/Internal
Contacts of Umbra
U1 = 16:58:05.6 UT1
U2 = 17:02:06.6 UT1
U3 = 18:30:09.2 UT1
U4 = 18:34:05.3 UT1

$\Delta T = 72.4$ s

Eph. = JPL DE405

Circumstances at Greatest Eclipse: 17:45:53.3 UT1

Circumstances at Greatest Duration: 17:44:41.5 UT1

Lat. = 65°13.4'N
Long. = 025°13.7'W
Path Width = 294.0 km

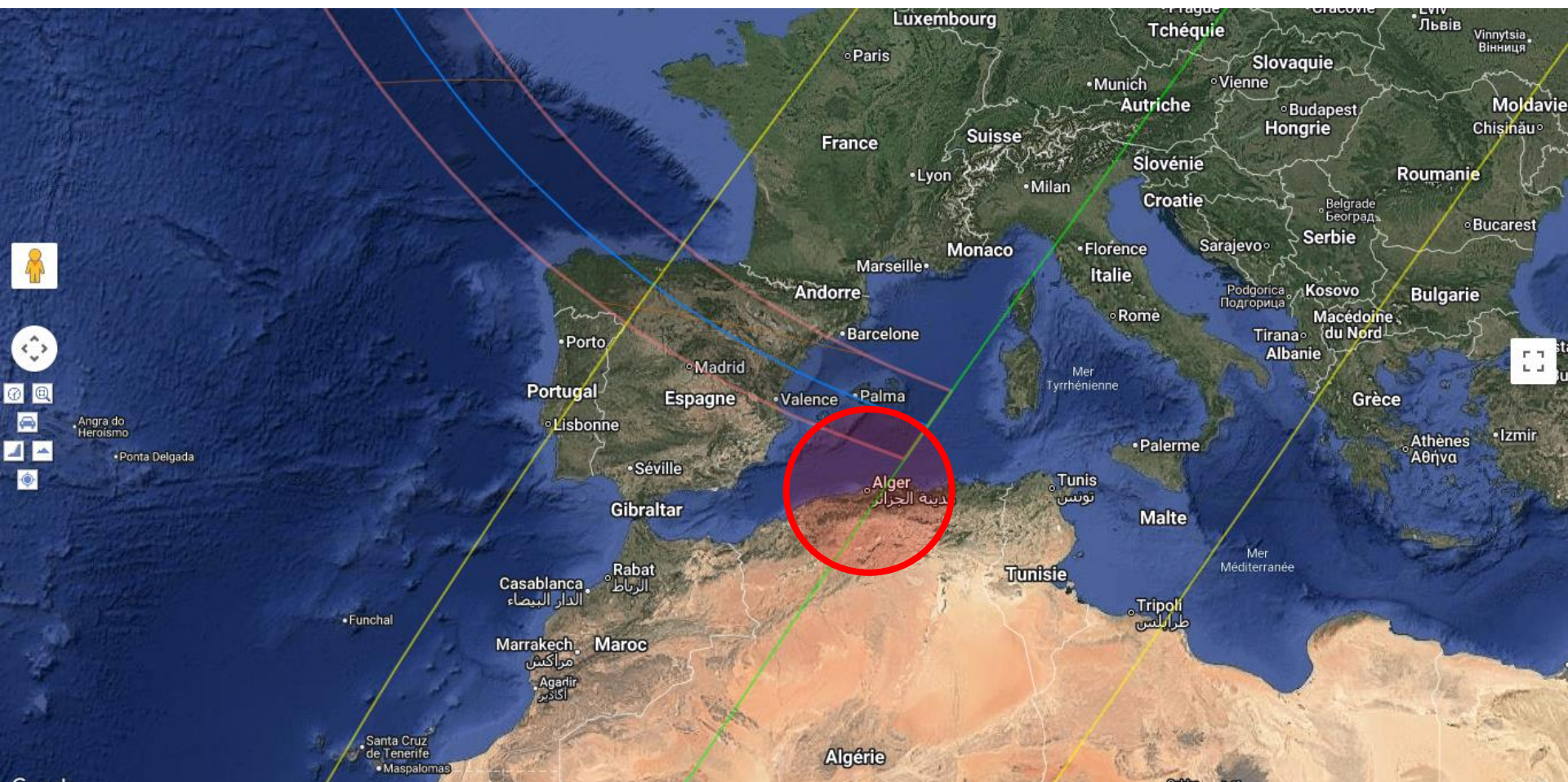
Sun Alt. = 25.8°
Sun Azm. = 248.4°
Duration = 02m18.2s

Lat. = 65°49.8'N
Long. = 025°29.1'W
Path Width = 292.9 km

Sun Alt. = 25.7°
Sun Azm. = 247.6°
Duration = 02m18.2s



©2016 F. Espenak
www.EclipseWise.com





Terre, Algiers, 113 m

FOV 31.2°

7.366 FPS

2026-08-12 19:34:42 UTC+01:00

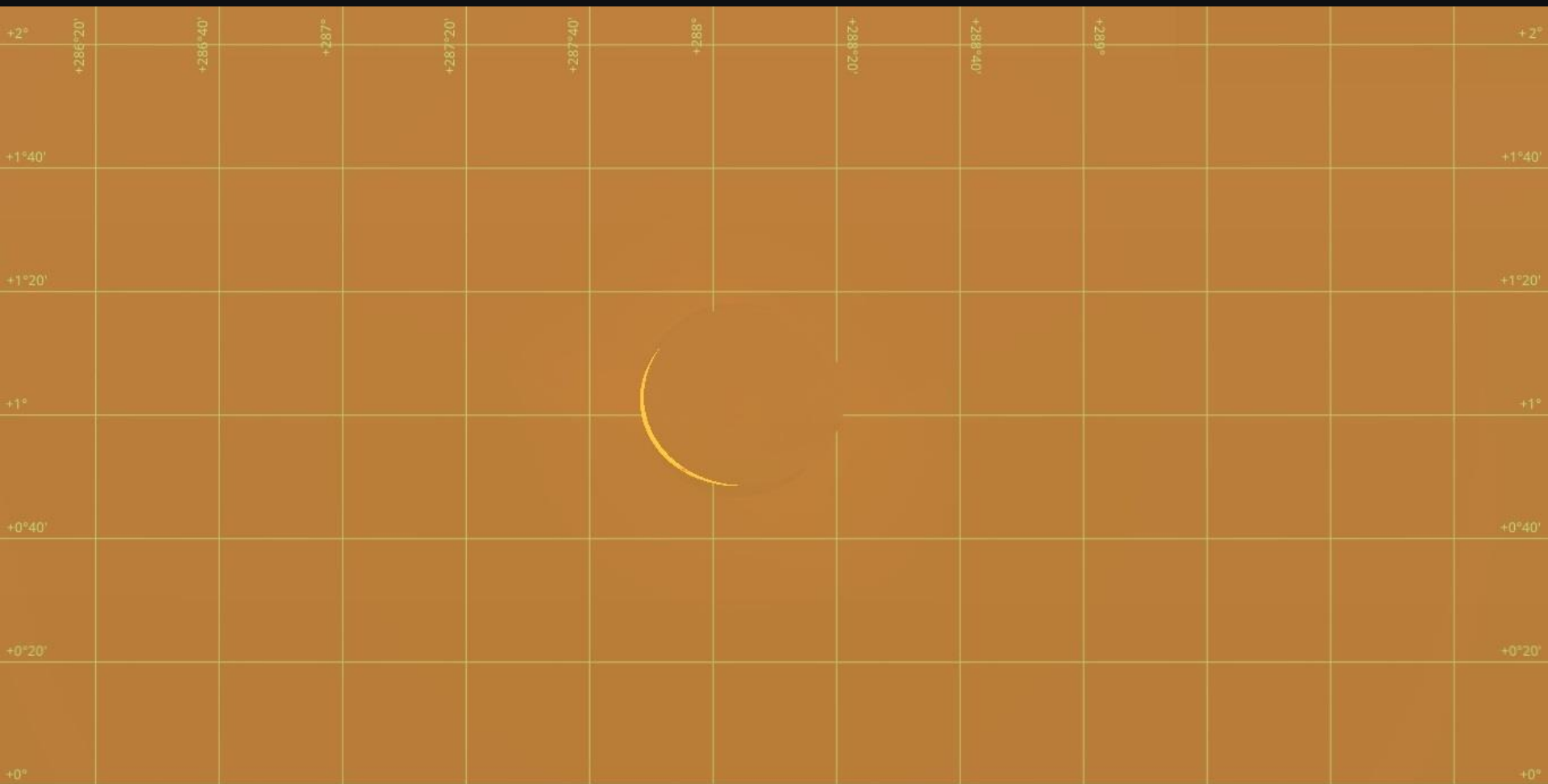


Terre, Algiers, 113 m

FOV 2.35°

5.204 FPS

2026-08-12 19:34:42 UTC+01:00



Terre, Algiers, 113 m

FOV 2.35°

5.53 FPS

2026-08-12 19:34:42 UTC+01:00

The Great total solar eclipse of August 02nd, 2027

Total Solar Eclipse of 2027 Aug 02

Greatest Eclipse = 10:07:50.2 TD (= 10:06:37.4 UT1)

Eclipse Magnitude = 1.0790

Saros Series = 136

Gamma = 0.1421

Saros Member = 38 of 71

Sun at Greatest Eclipse
(Geocentric Coordinates)

R.A. = 08h49m26.9s

Dec. = +17°45'41.3"

S.D. = 00°15'45.5"

H.P. = 00°00'08.7"

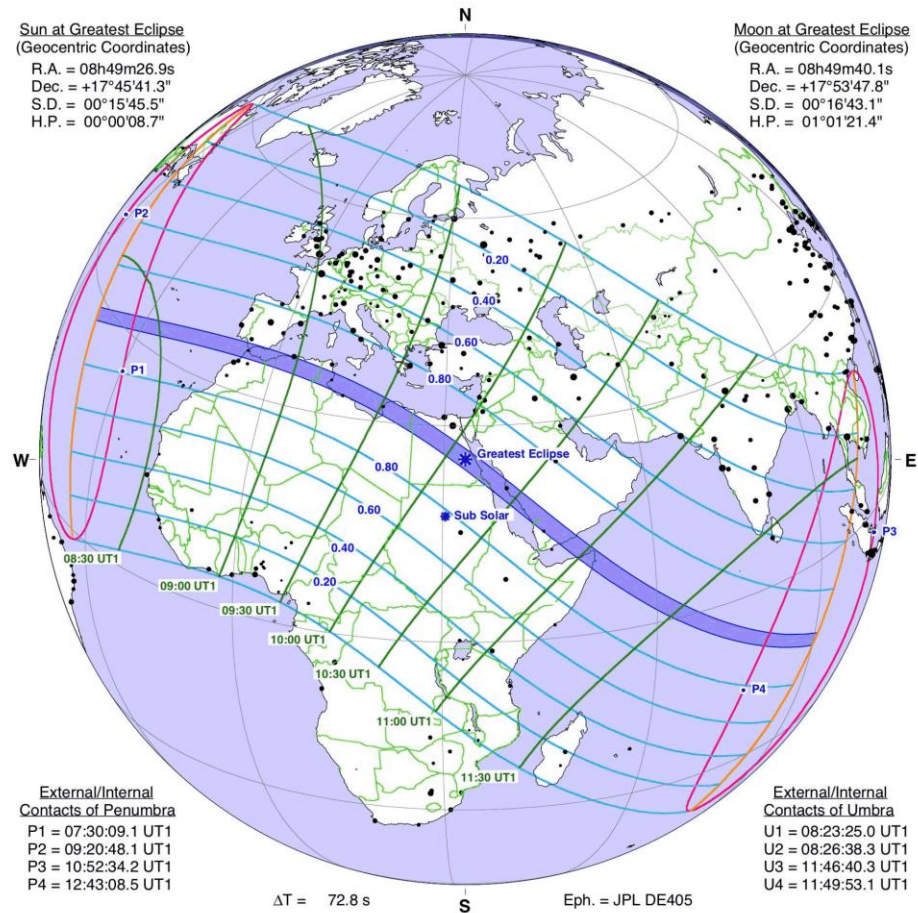
Moon at Greatest Eclipse
(Geocentric Coordinates)

R.A. = 08h49m40.1s

Dec. = +17°53'47.8"

S.D. = 00°16'43.1"

H.P. = 01°01'21.4"



Circumstances at Greatest Eclipse: 10:06:37.4 UT1

Lat. = 25°30.2'N

Long. = 033°11.0'E

Path Width = 257.7 km

Sun Alt. = 81.7°

Sun Azm. = 202.0°

Duration = 06m22.6s

Circumstances at Greatest Duration: 10:00:20.9 UT1

Lat. = 26°48.9'N

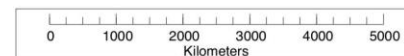
Long. = 031°07.9'E

Path Width = 257.2 km

Sun Alt. = 80.9°

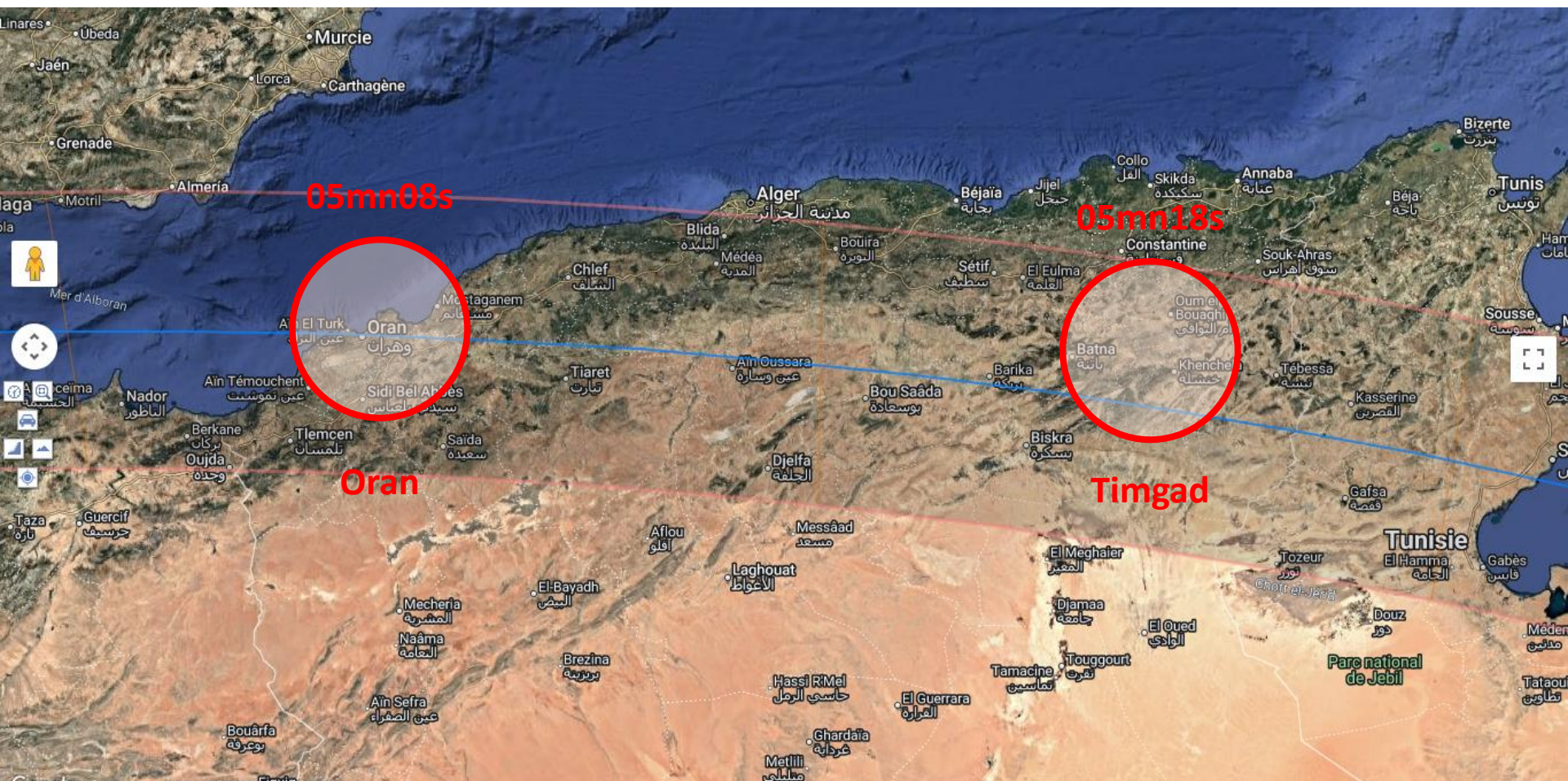
Sun Azm. = 177.8°

Duration = 06m23.2s



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Oran City



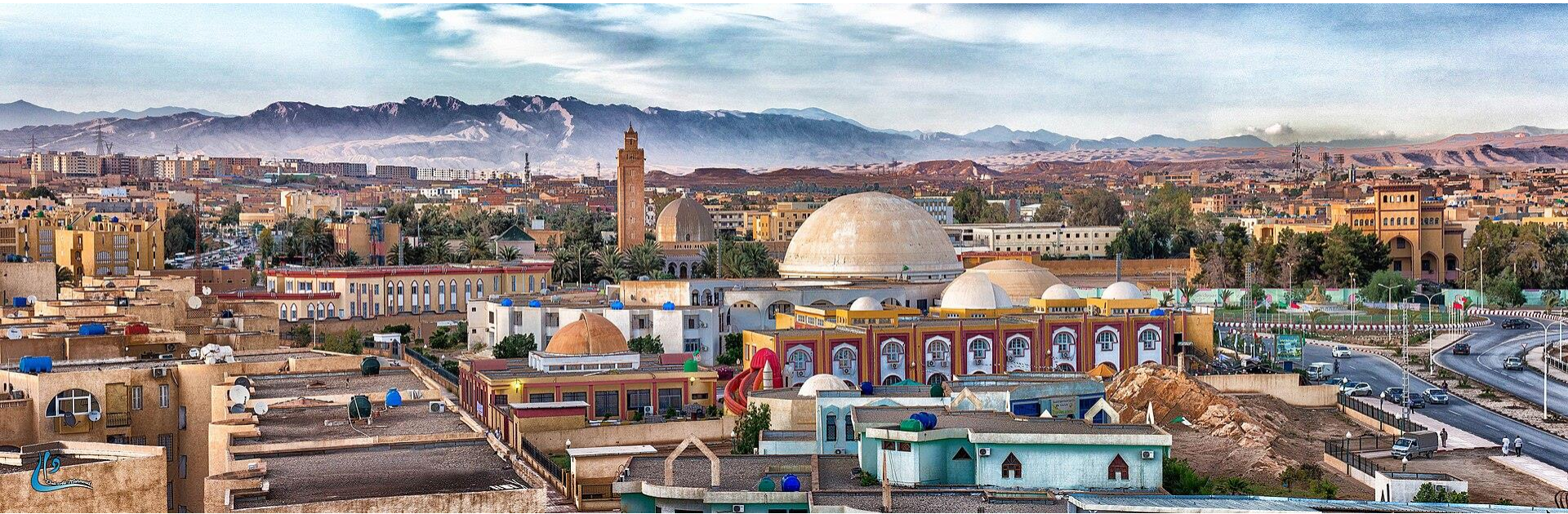
Timgad



Next interesting occultation to observe in Algeria with the amateur network in Astronomy

Preparation of the 13th National Meeting in occultations in Biskra (Algeria)

For observing the stellar occultation by the asteroid (1679) Nevanlinna
On October 17th, 2025



Preparation of the 13th National Meeting in occultations in Biskra (Algeria)

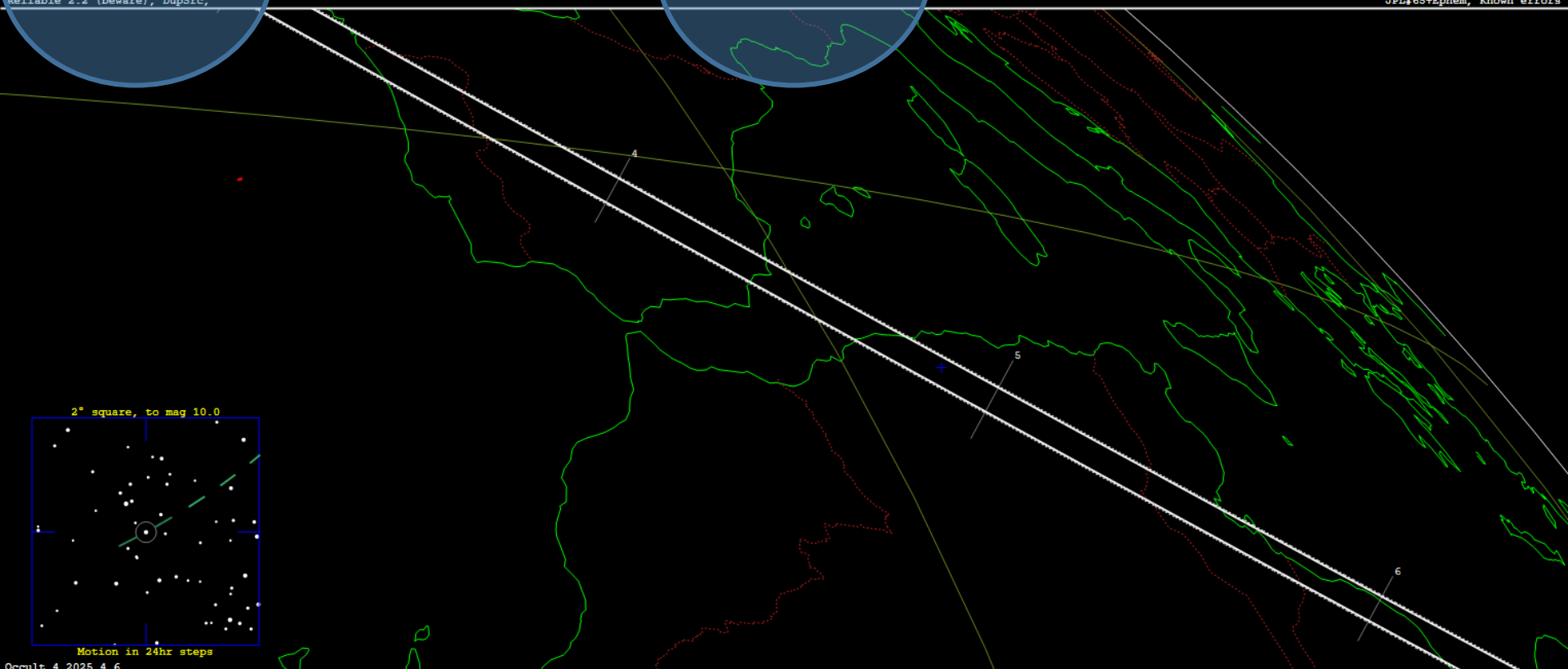
For observing the stellar occultation by the asteroid (1679) Nevanlinna On October 17th, 2025

(1679) Nevanlinna occults HIP 102389 on 2025 Oct 17 from 21h 59m to 22h 7m UT

Star: (Dia < 0.1 mas)
Mv 7.9; Mr 7.3; [Mb 8.3]
RA = 20 44 53.9184 (astrometric)
Dec = - 8 0 22.527
[of Dates: 20 46 17, - 7 54 42]
Prediction of 2025 Apr 6.4
Reliable 2.2 (beware), DupSrc,

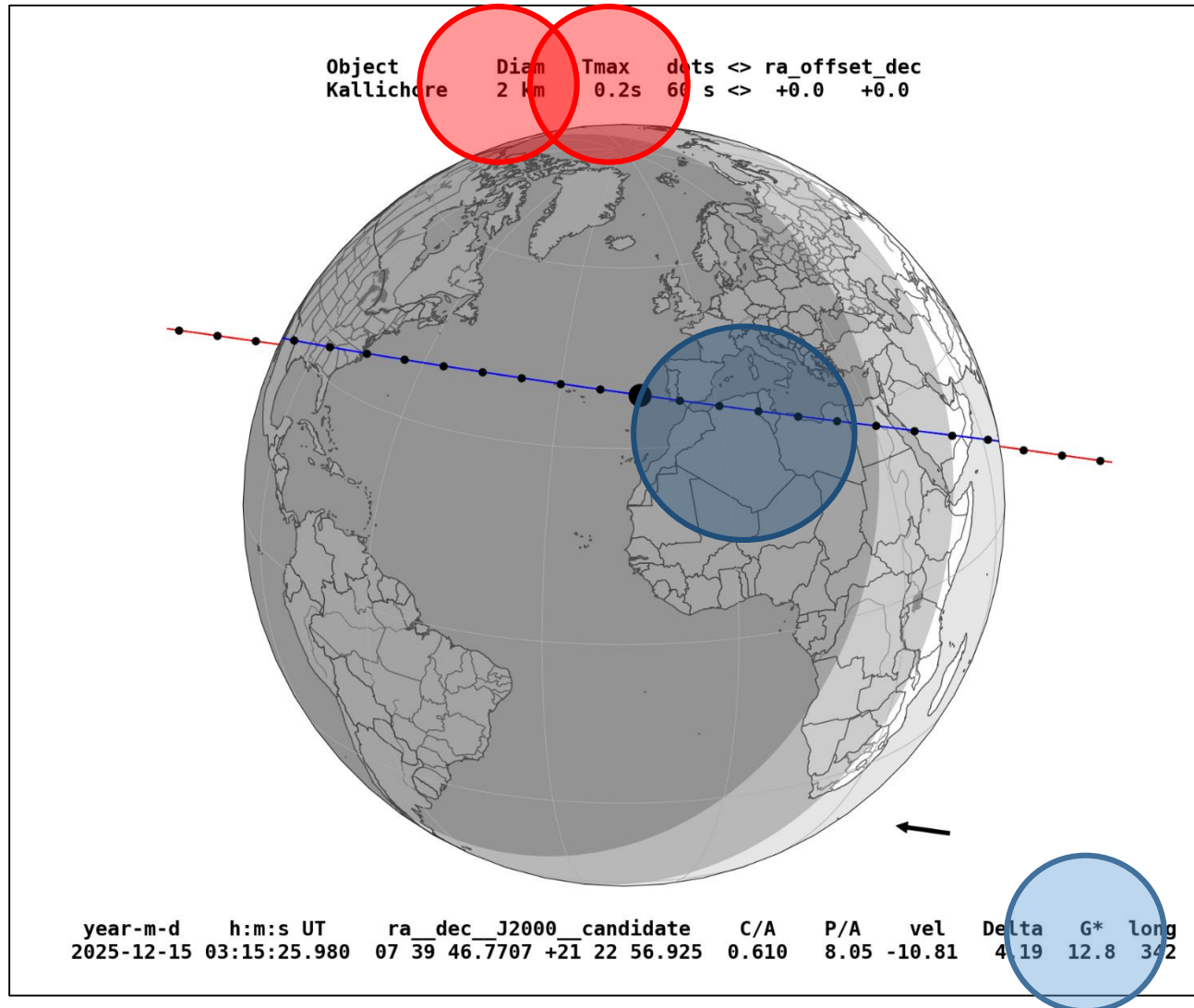
Durations: Max = 3.7 secs
1km = 0.078 secs, 1mas = 0.14 secs
Mag Drop: 8.0 [100%]v, 7.8 [100%]r
Sun : Dist = 106°
Moon: Dist = 146°, illum = 12%
1σ Err: ±(2.0 x 0.8) mas in PA 75°

Asteroid:
Mv = 15.9; Mr = 15.0
Dia = 47 ±3km, 27 mas
Parallax = 3.667"
Hourly dRA = 1.570s
dDec = -12.68"
JPL#65+Ephem, Known errors

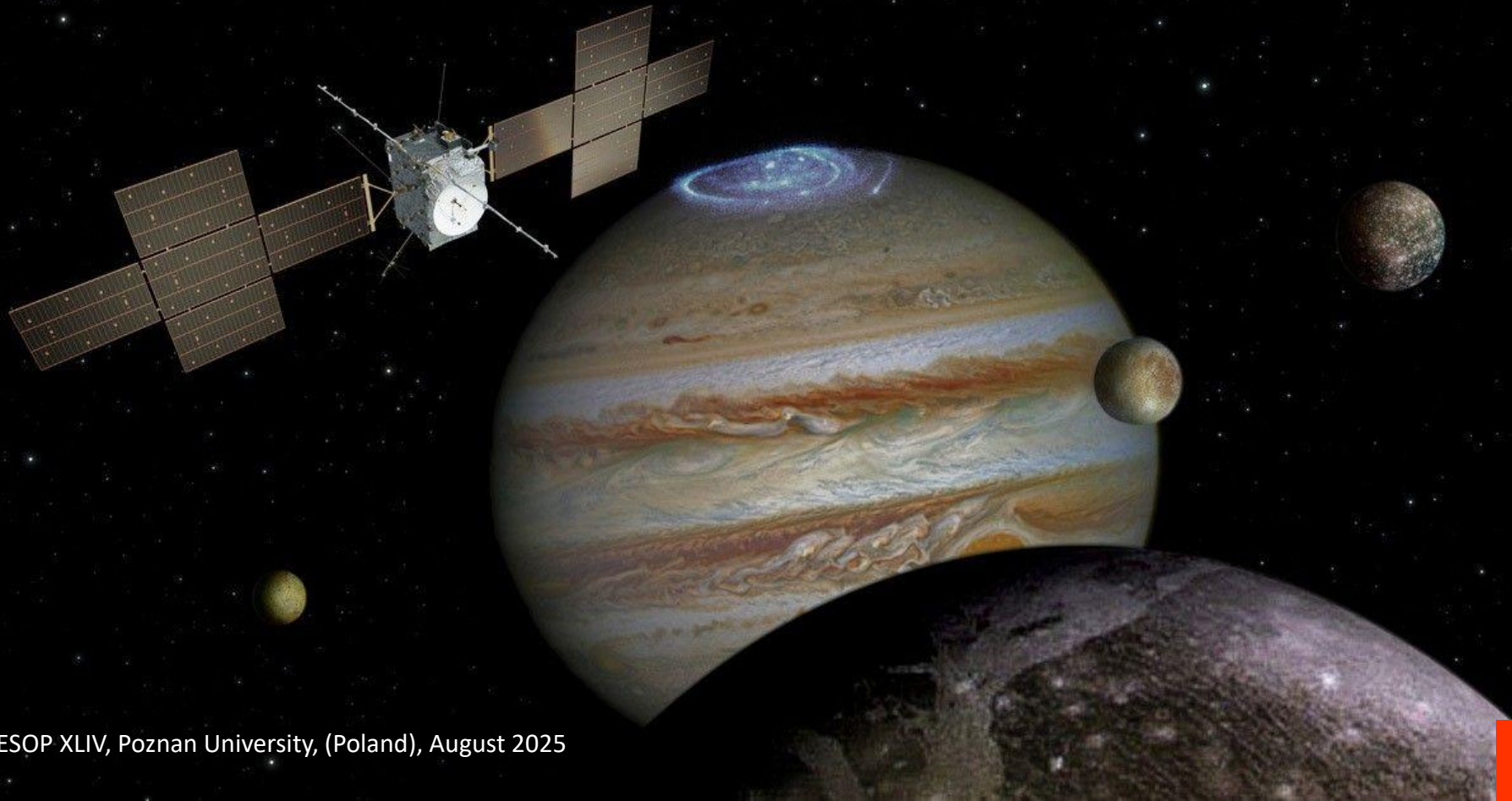


The stellar occultation by the satellite of Jupiter - Kallichore

December 15th, 2025



The satellite of Jupiter – Kallichore – will be fly by the JUICE european Probe in the 30s of the 21st Century



Summary

We are interesting by stellar occultation by asteroids by Near-Earth Asteroids, Trojans asteroids and TransNeptunian Objects.

We have been developing **Participative Astronomy in Algeria** for almost **10 years**, setting up **the first network for observing stellar occultations by asteroids in Algeria**. At first, observations were made with **the naked eye**, but now we have six cameras !

That's why we need **donations** of analog cameras as **Watec with IOTA VTI inserters to increase the number of chords**.

We also wish to create a relationship with other partners around the world and especially from IOTA in order to develop this research in Algeria.

**Thank you for
your attention!**

