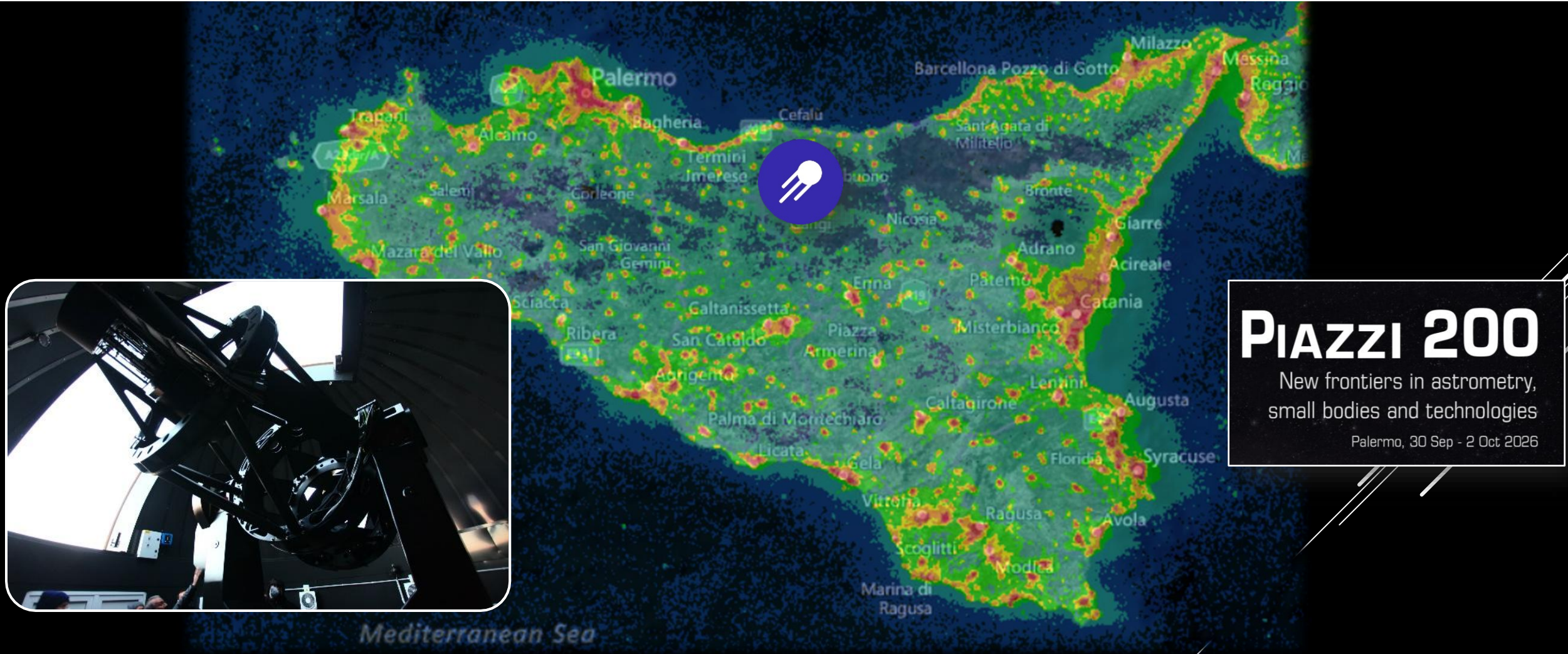


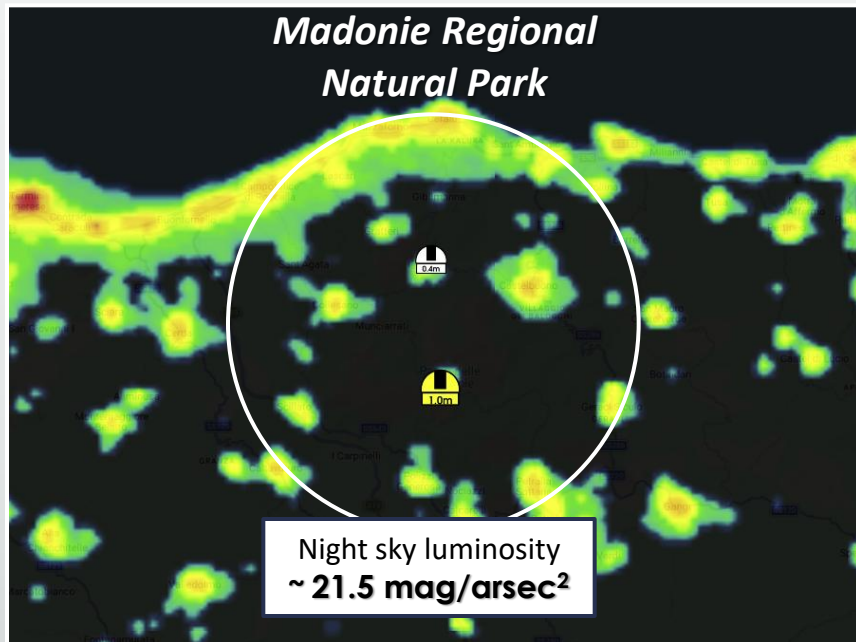
The Wide-field Mufara Telescope (WMT) as a strategic facility in the Mediterranean area for monitoring and discovering small bodies in the Solar System



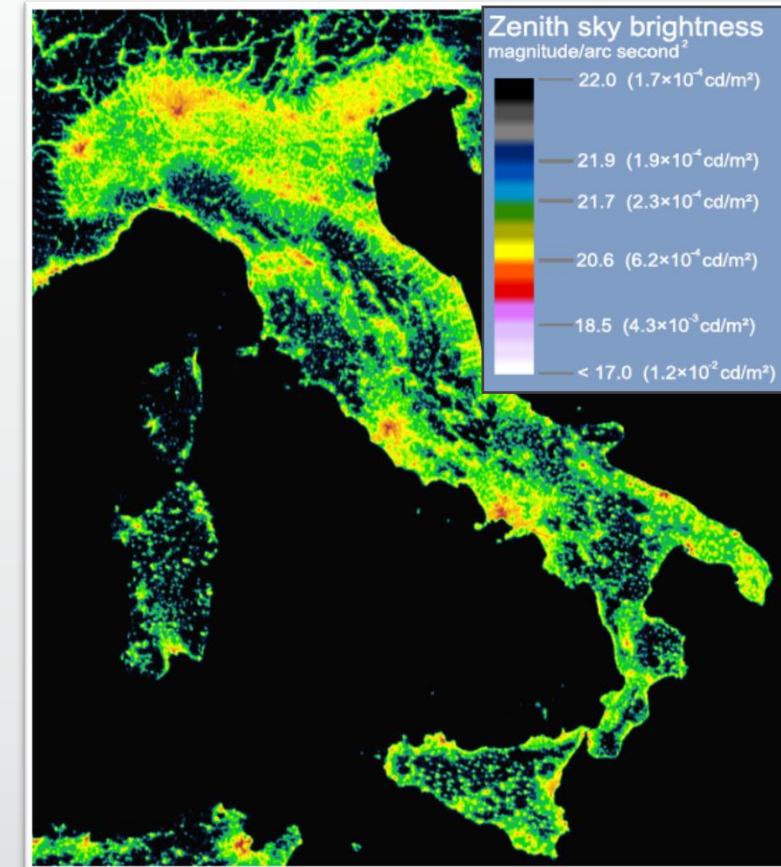
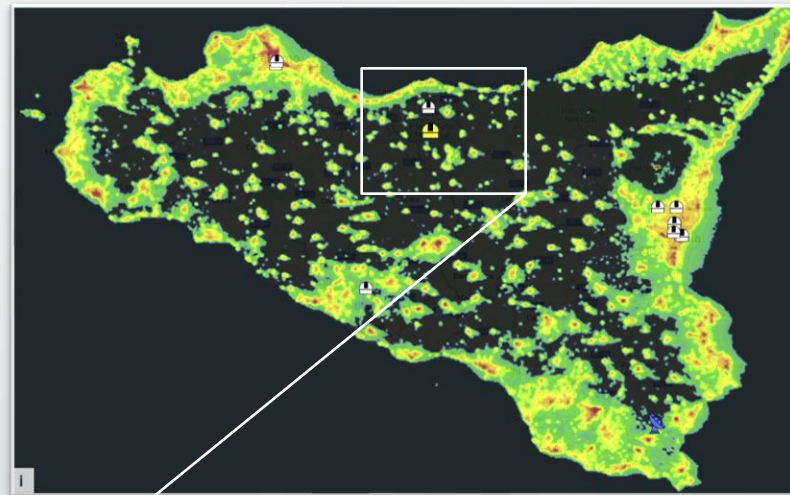
The **Madonie** park in Sicily: an excellent area for astronomical research

- Excellent night sky conditions.
- Very low **light pollution**.
- **>200 clear nights/year** (~60%)*.
- Low **latitude** (~38°).

(*) A. Di Cecco, E. Perozzi, C. Marzo, et al. (2019) - *Analysis of Italian sites for NEO and space debris observations with the ESA Fly-Eye telescope.*
ESA 1st NEO and Debris Detection Conference.

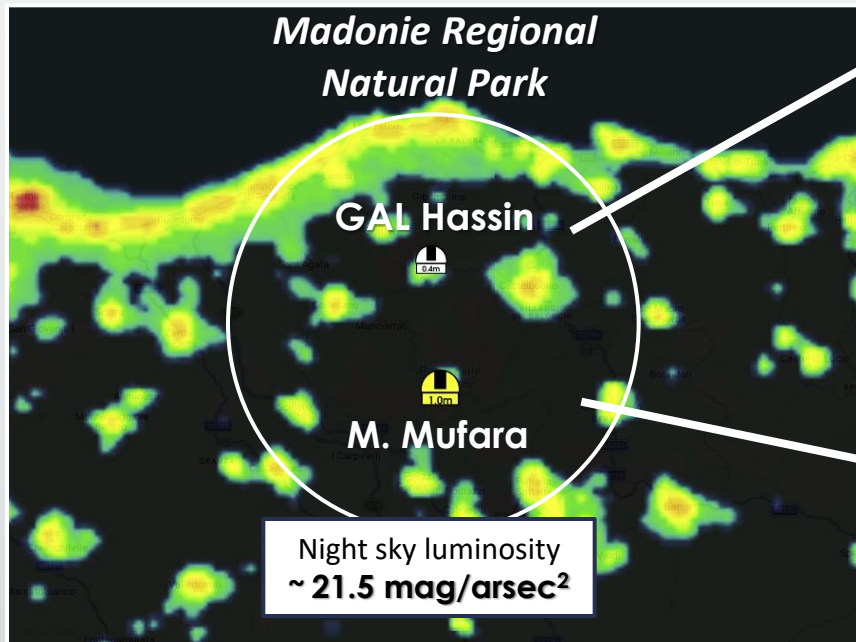


Sicily light pollution map (2025)
Source: <https://www.lightpollutionmap.info> (VIIRS)

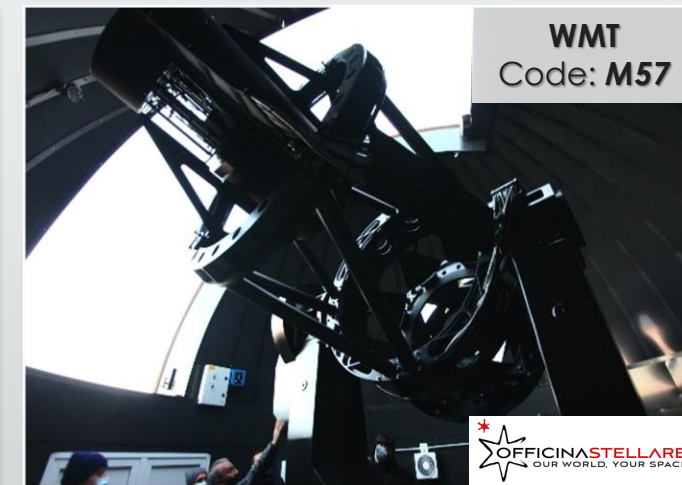


The **GAL Hassin** facilities for NEO monitoring

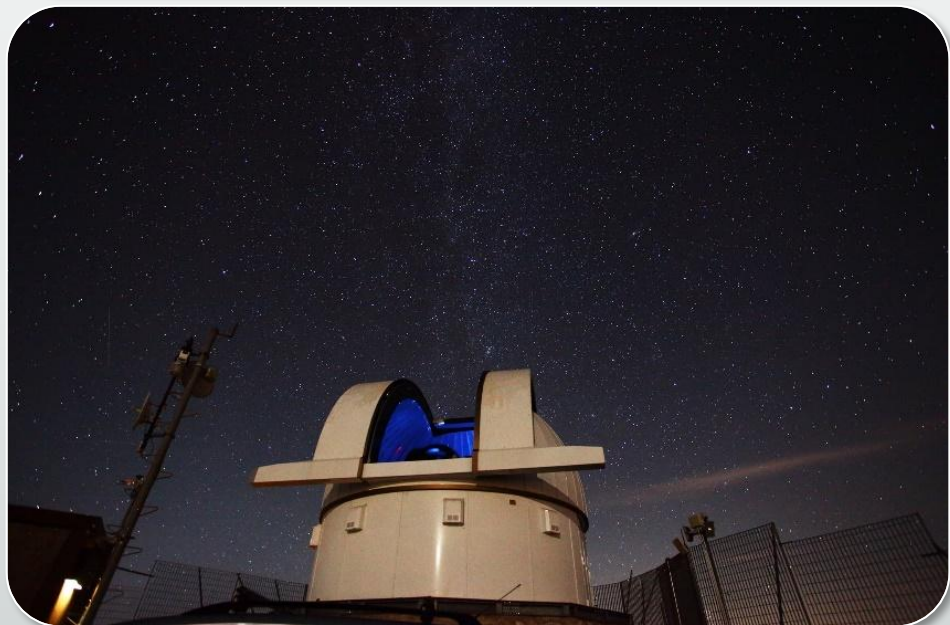
- Excellent night sky conditions.
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Sicily light pollution map (2025)
Source: <https://www.lightpollutionmap.info> (VIIRS)



The GAL Hassin facilities for NEO monitoring – **Wide-field Mufara Telescope (WMT)**

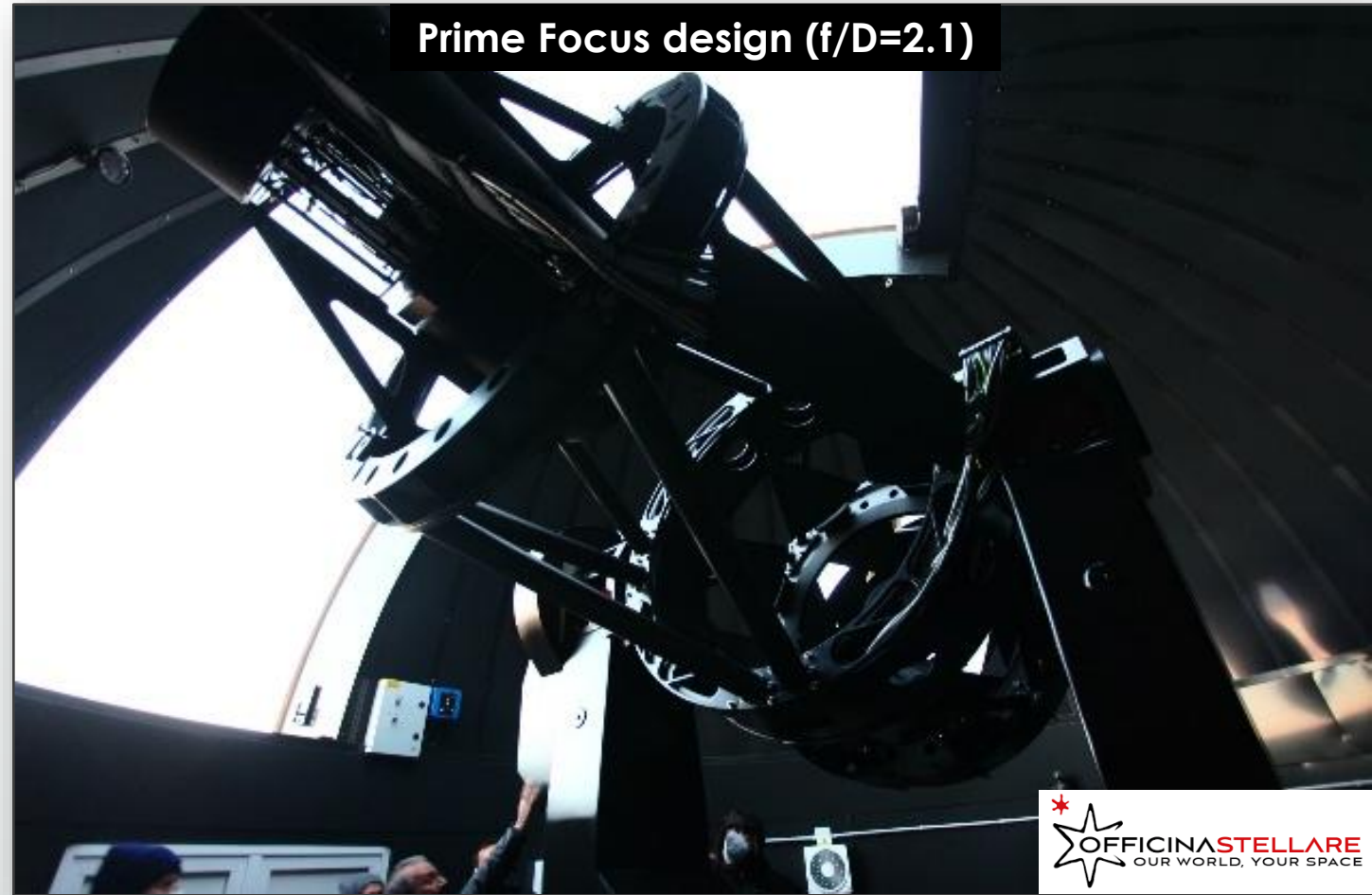


- Installed on Mt. Mufara (**1865 m** altitude).
- IAU observatory code: **M57** (Aug. 2023).
- **Remotely controlled** since July 2024.
- Operated via Python codes in **semi-automatic mode**.

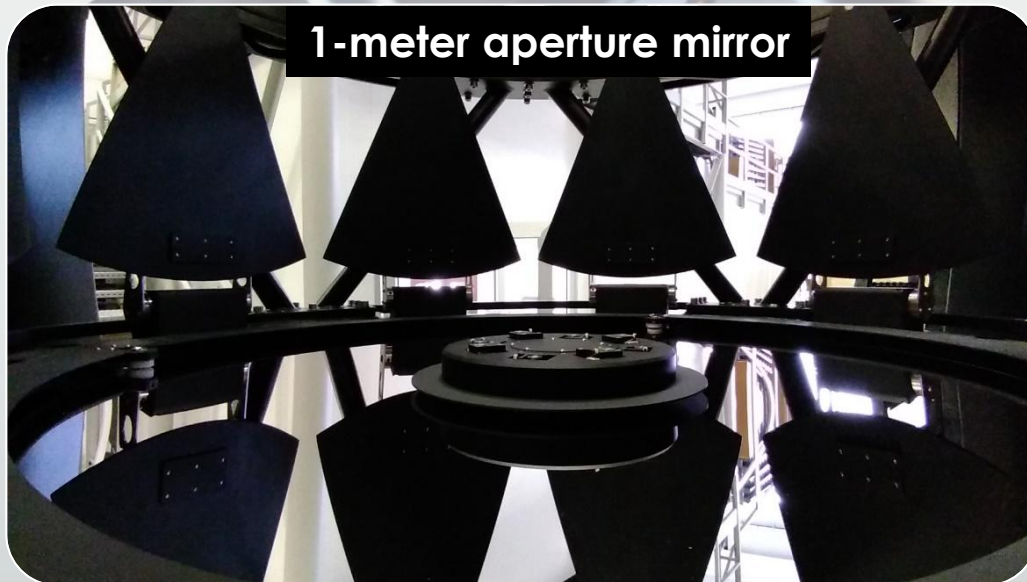
The **Wide-field Mufara Telescope** (WMT / M57) – Main characteristics



5 corrective lenses



Prime Focus design ($f/D=2.1$)

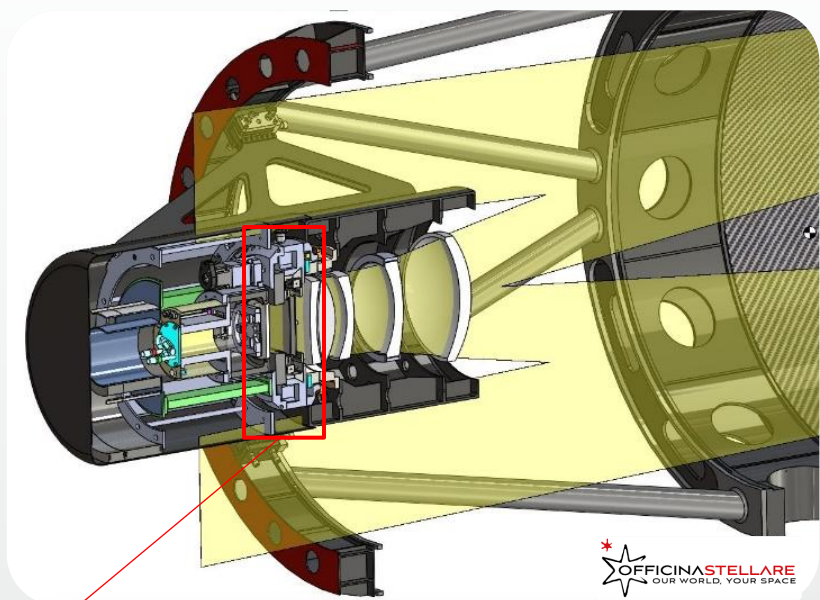


1-meter aperture mirror

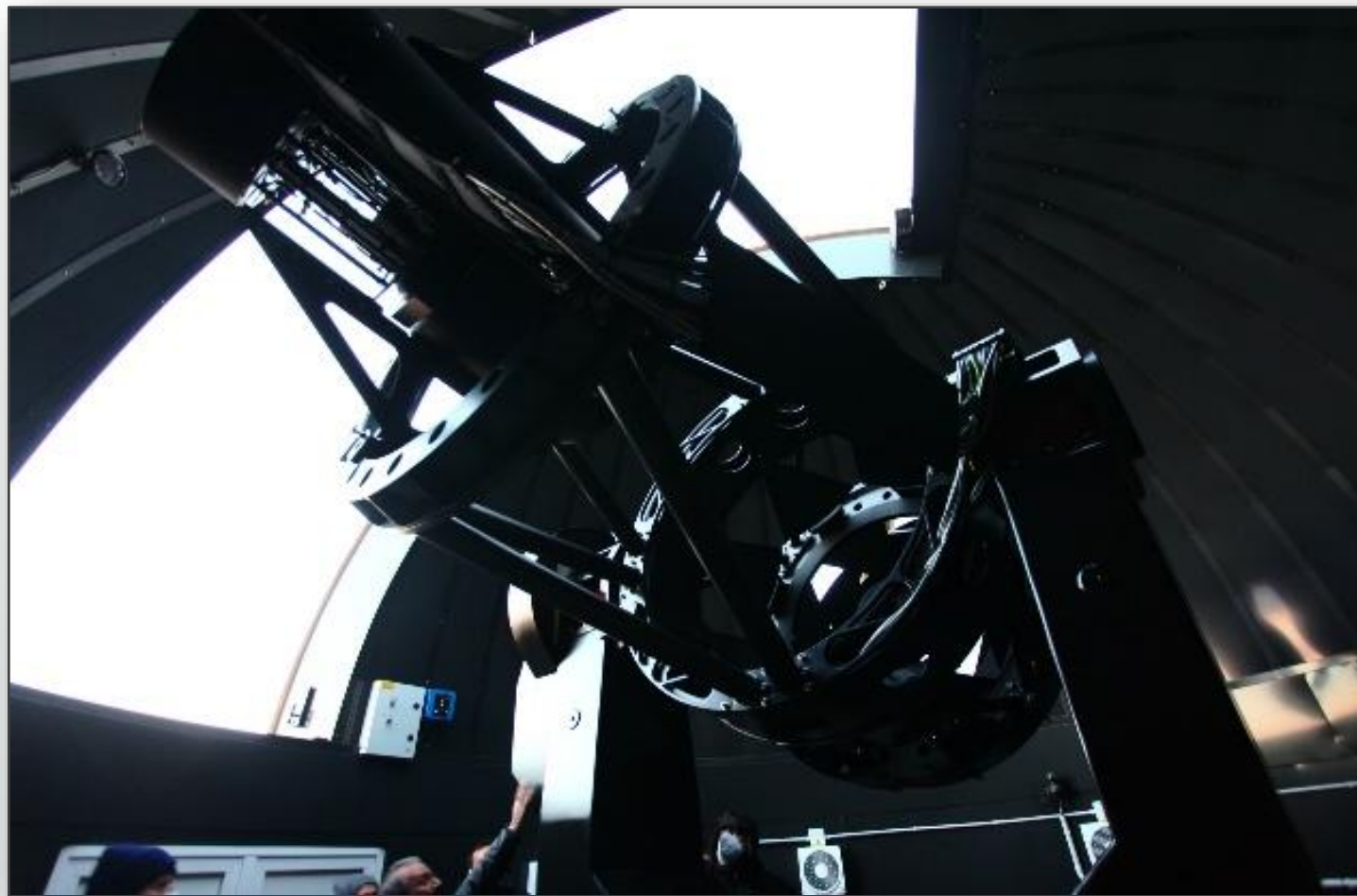
- Installed on Mt. Mufara (**1865 m** altitude).
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- **Remotely controlled** since July 2024.
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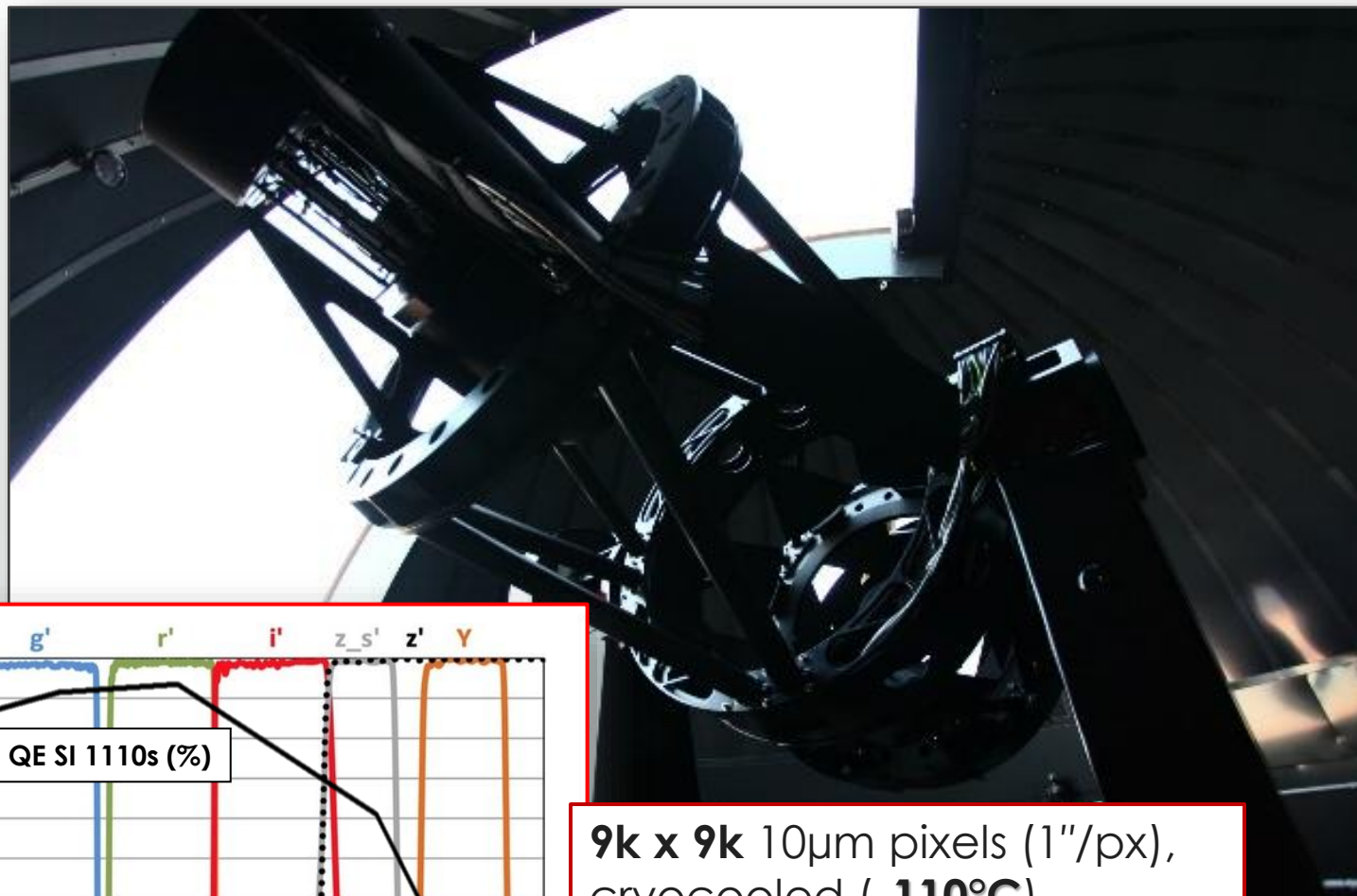
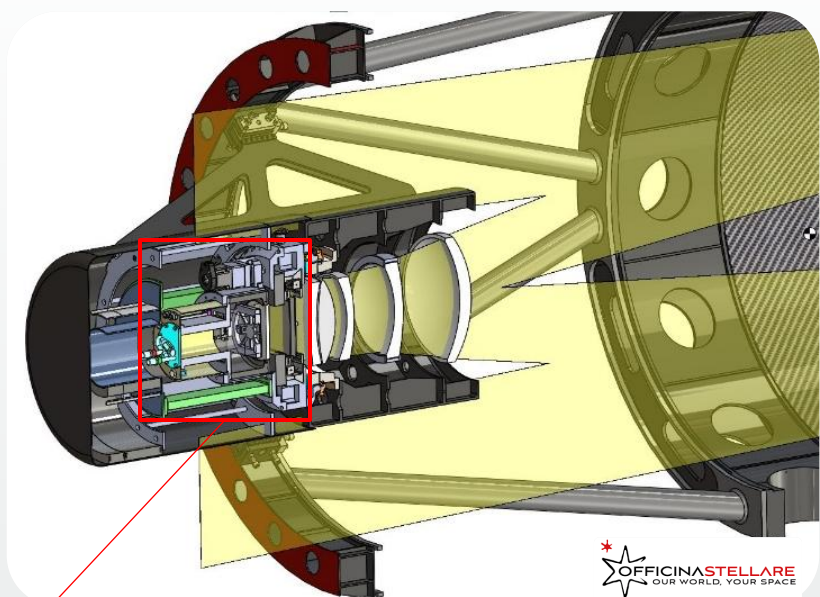
The **Wide-field Mufara Telescope** (WMT / M57) – Main characteristics



Equipped with **Sloan**
(**g'**, **r'**, **i'**, **z'**) and Clear **filters**.

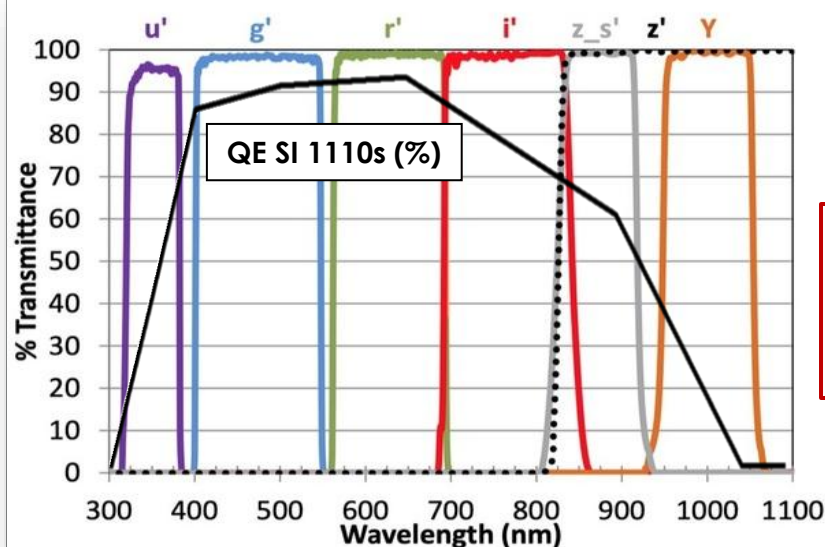
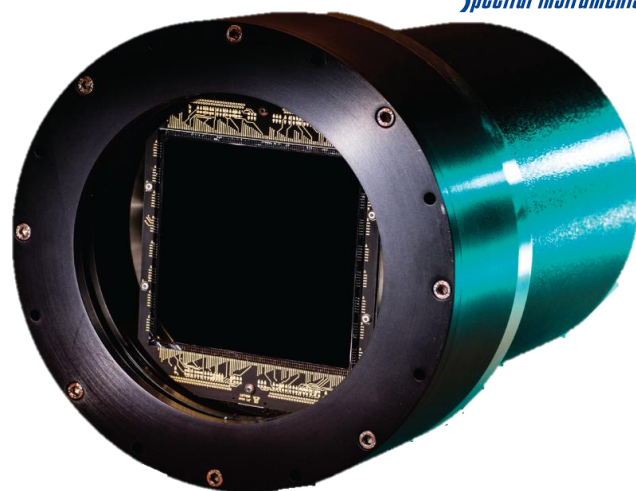


The Wide-field Mufara Telescope (WMT / M57) – Main characteristics



Model: SI 1110s

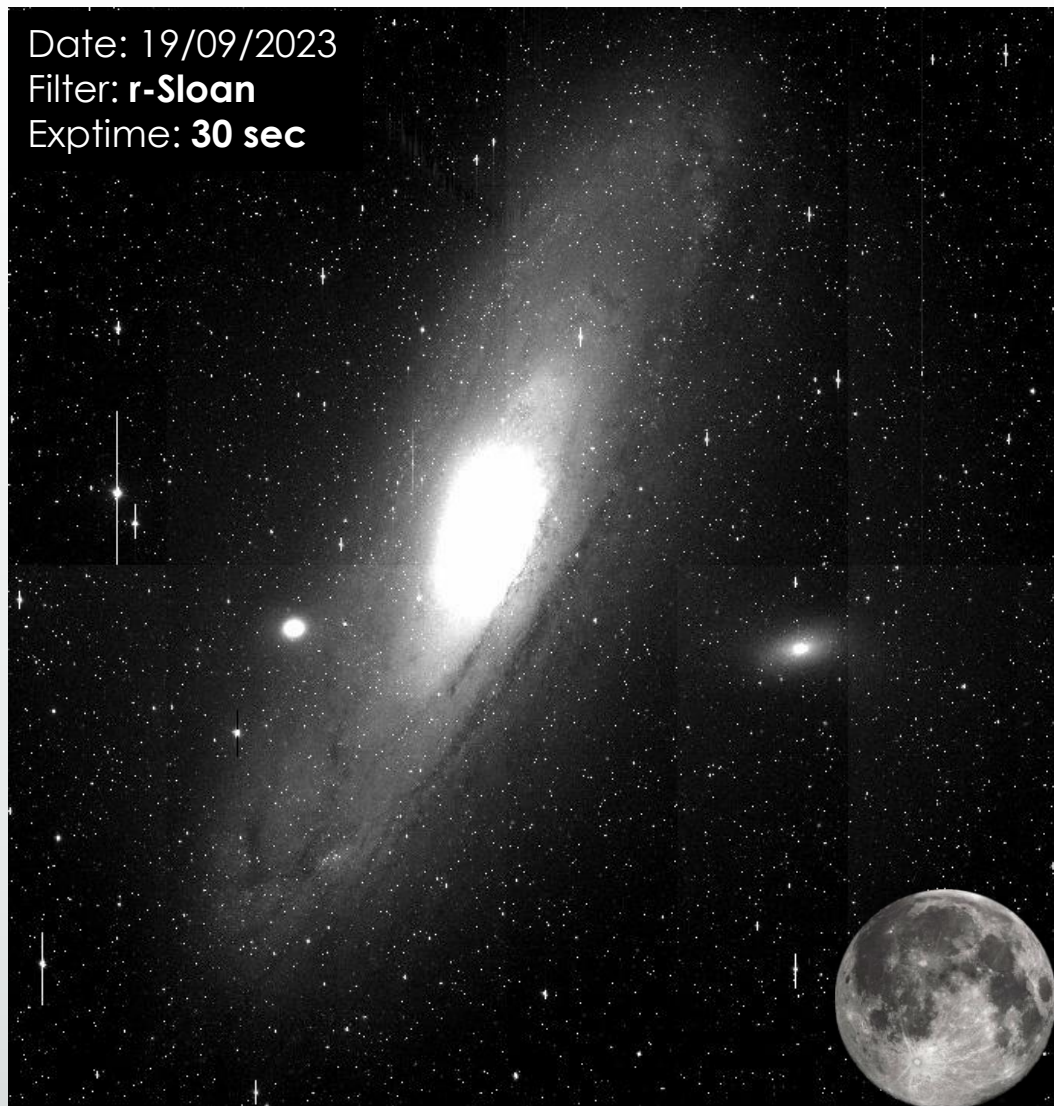

Spectral Instruments Inc.



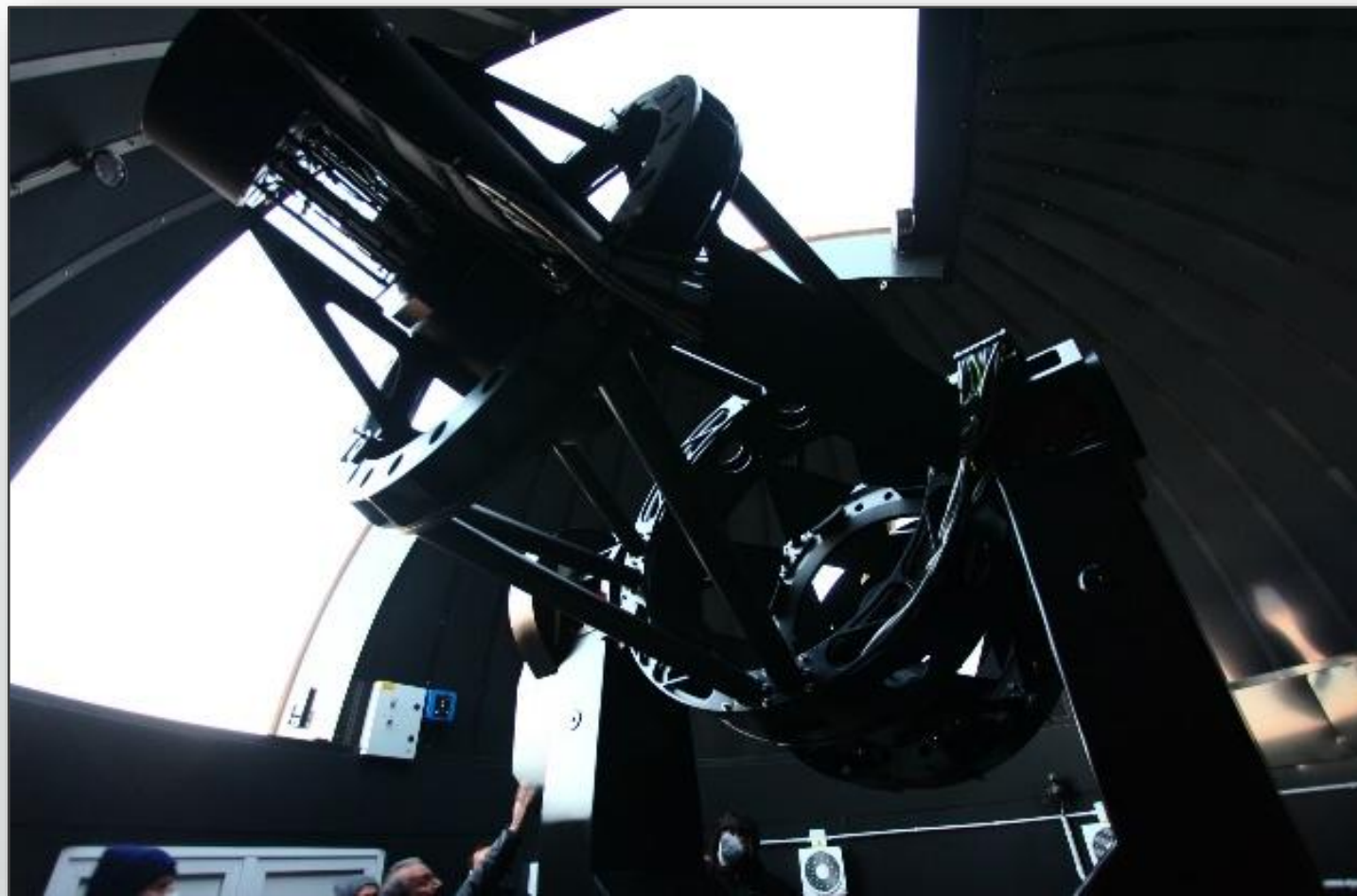
9k x 9k 10μm pixels (1"/px),
cryocooled (**-110°C**),
>90% QE CCD camera.

The **Wide-field Mufara Telescope** (WMT / M57) – *Field of view and sensitivity*

Date: 19/09/2023
Filter: **r-Sloan**
Exptime: **30 sec**



A WMT image is a mosaic of **16 chips**.



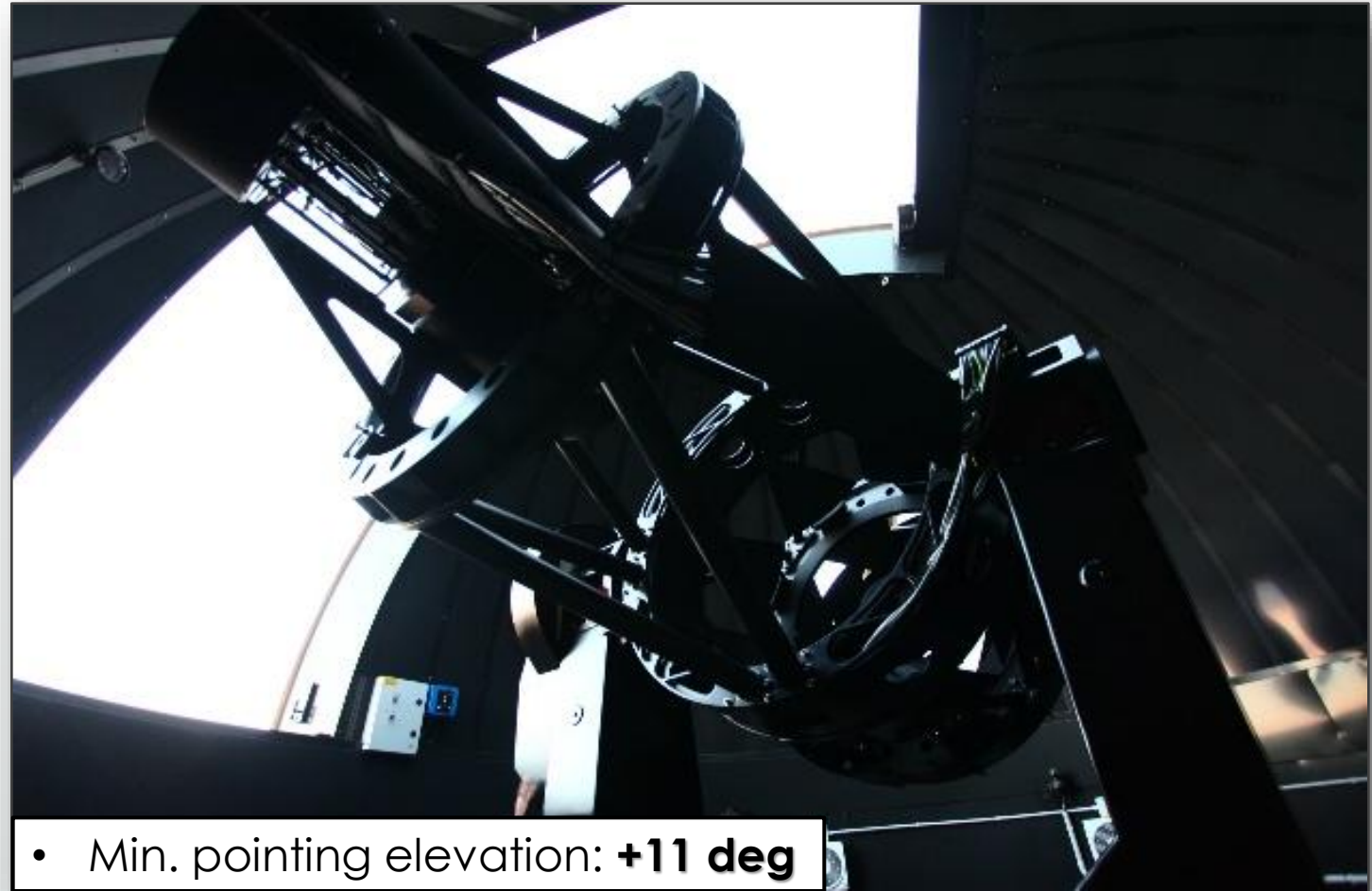
- Field of view: **2.5 x 2.5 deg, corrected**
- **V ~ 21 in 90 sec** (Clear filter)

The **Wide-field Mufara Telescope** (WMT / M57) – Low elev./solar elongation limits



Observational limits:

Min. declination: **-40 deg**



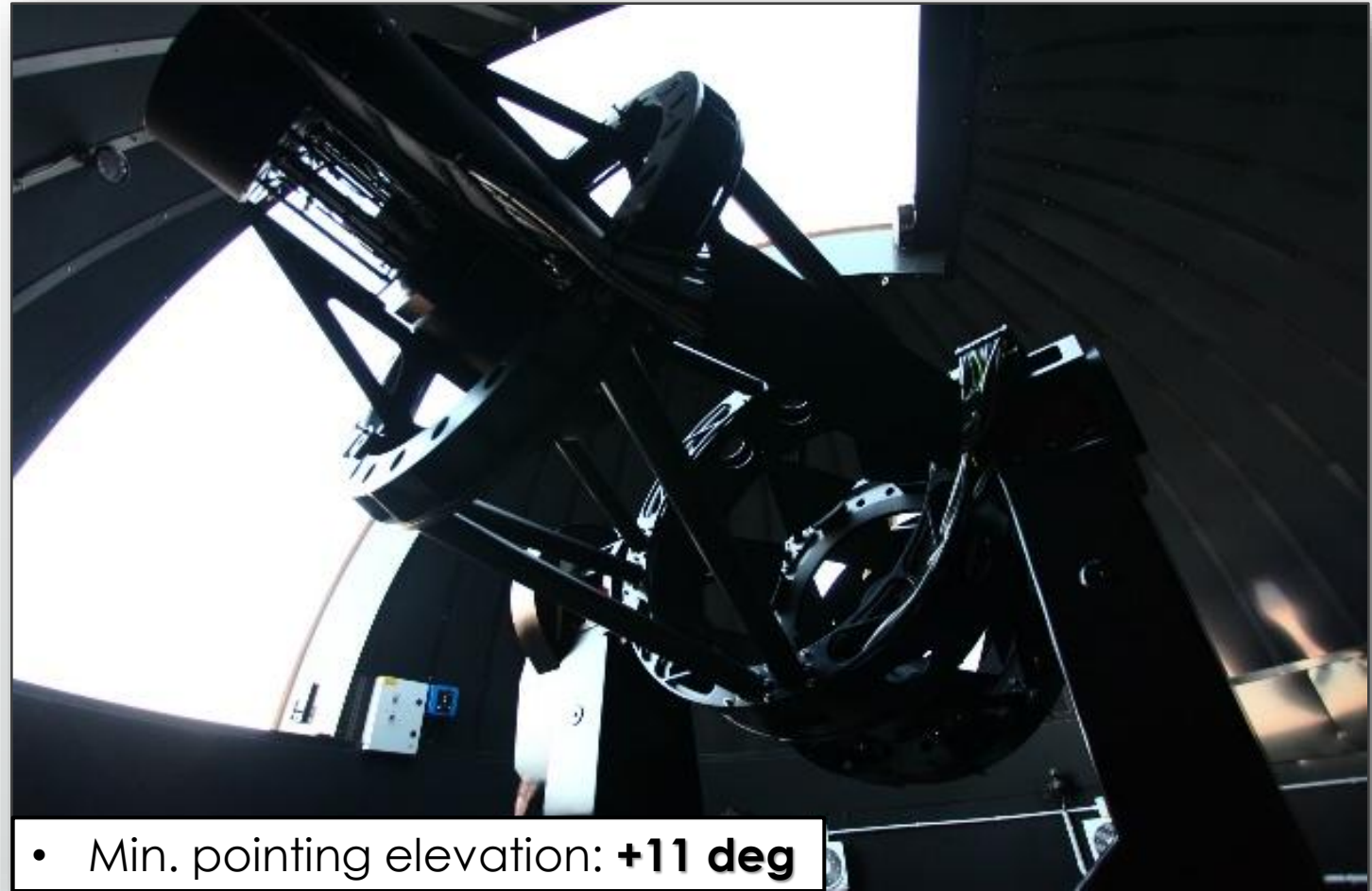
The **Wide-field Mufara Telescope** (WMT / M57) – Low elev./solar elongation limits



Observational limits:

Min. declination: **-40 deg**

Min. solar elongation: **~30 deg**



The **Wide-field Mufara Telescope** (WMT / M57) – *Low elev./solar elongation limits*

Apollo asteroid (676261)

Magnitude V ~ 21

Solar elongation: 35 deg

Elevation: 13 deg

Date: 2024 08 09.806942
RA: 11 44 48.18
Dec: +19 34 16.4
Mag: 20.6 G
Exp: 8.000m (24x20s)

Elong: 34.9 deg
Phase: 28.8 deg
Alt: 13.1 deg
Az: 284.6 deg
Earth: 1.885 AU
Sun: 1.202 AU
PABL: 182.6 deg
PABB: 22.0 deg
Speed: 1.47"/min
PA: 116.7 deg

Obs: A. Nastasi
Stn: M57
Tel: 1.00-m f/2.1 reflector
PSc: 1.96"/px
Cam: 149.7 x 149.9 arcmin



Main belt asteroid (58641)

Magnitude V ~ 20.4

Solar elongation: 29.6 deg

Elevation: 12.6 deg

Date: 2024 08 08.813278
RA: 11 00 52.41
Dec: +33 33 51.9
Mag: 20.1 G
Exp: 7.333m (22x20s)

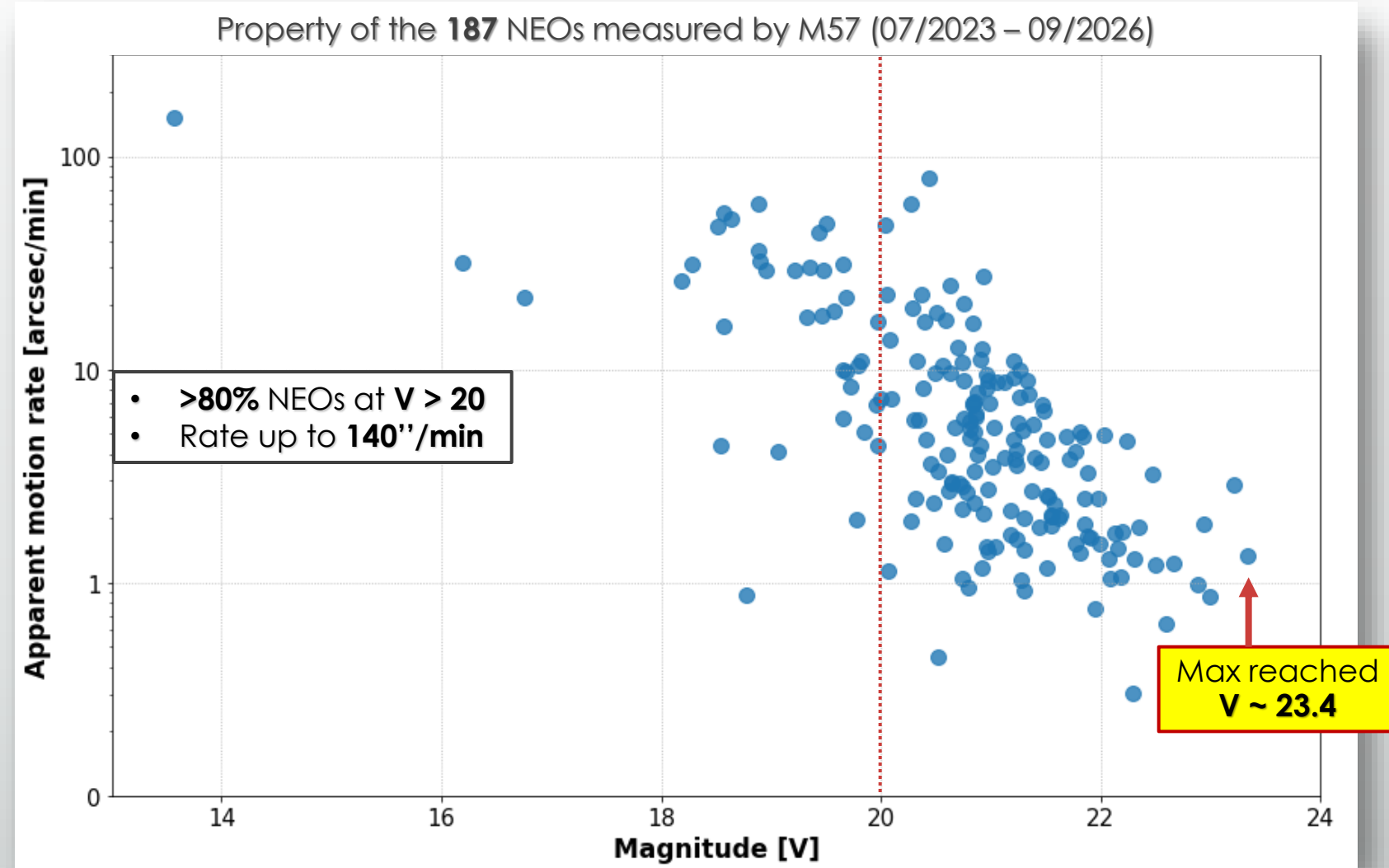
Elong: 29.6 deg
Phase: 9.8 deg
Alt: 12.6 deg
Az: 302.7 deg
Earth: 3.778 AU
Sun: 2.939 AU
PABL: 155.9 deg
PABB: 29.0 deg
Speed: 0.98"/min
PA: 119.2 deg

Obs: A. Nastasi
Stn: M57
Tel: 1.00-m f/2.1 reflector
PSc: 1.96"/px
Cam: 149.7 x 149.9 arcmin



The **Wide-field Mufara Telescope** (WMT / M57) – Main results

An ideal facility for **fast** and/or **faint** NEOs...



The **Wide-field Mufara Telescope** (WMT / M57) – *Main results*

An ideal facility for ***fast*** and/or ***faint*** NEOs...



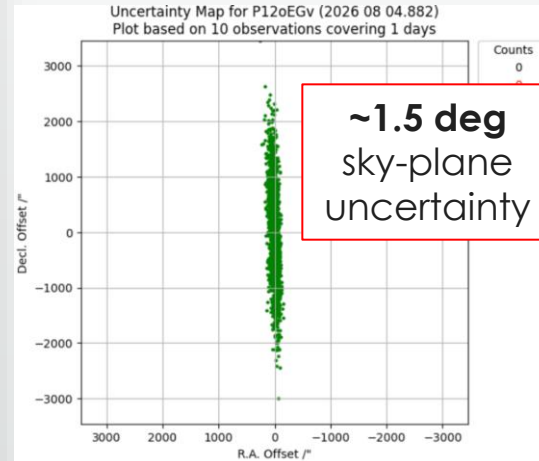
1. **CONFIRMATION** (NEO-CP)
2. **RECOVERY**
3. **PHYSICAL** (multi- λ) **CHARACTERIZATION**
4. **DISCOVERY**

The **Wide-field Mufara Telescope** (WMT / M57) – Main results

An ideal facility for **fast** and/or **faint** NEOs...



1. CONFIRMATION (NEO-CP)

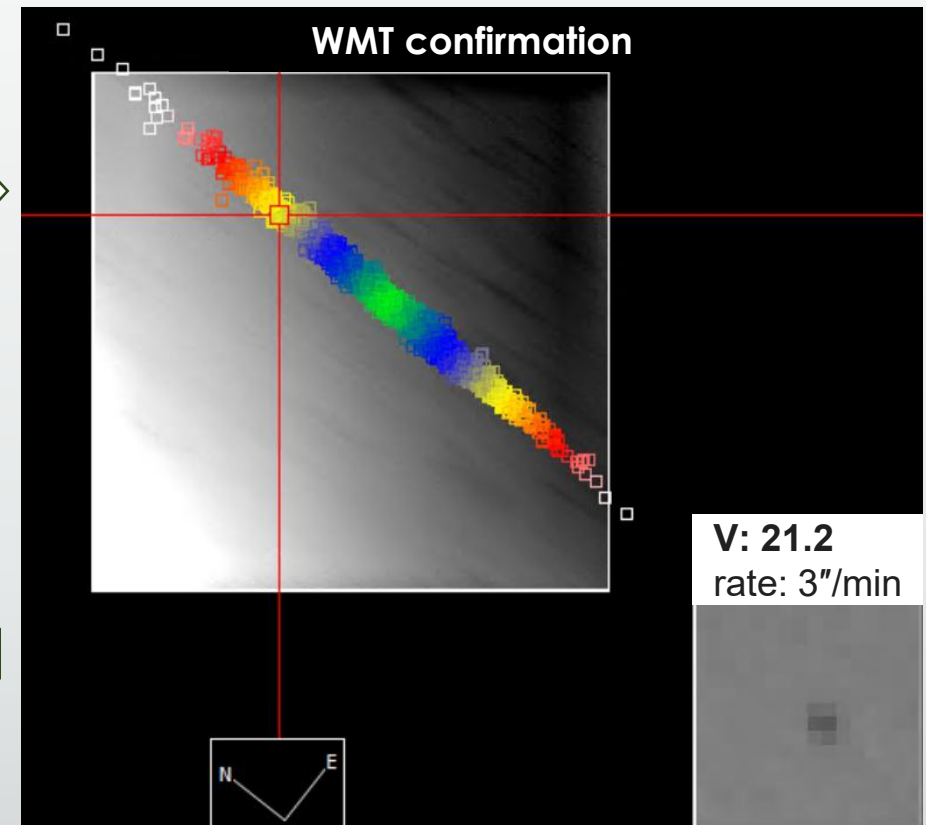
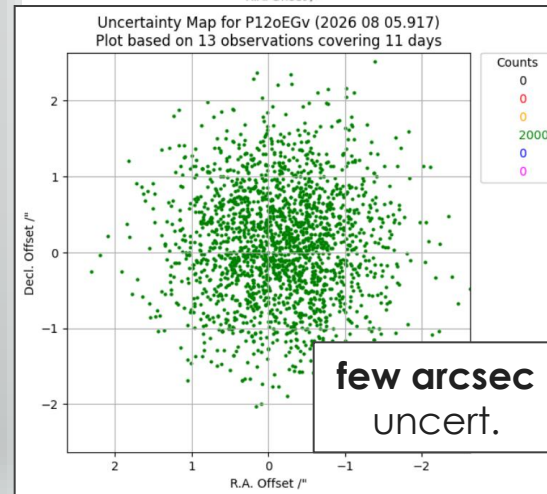
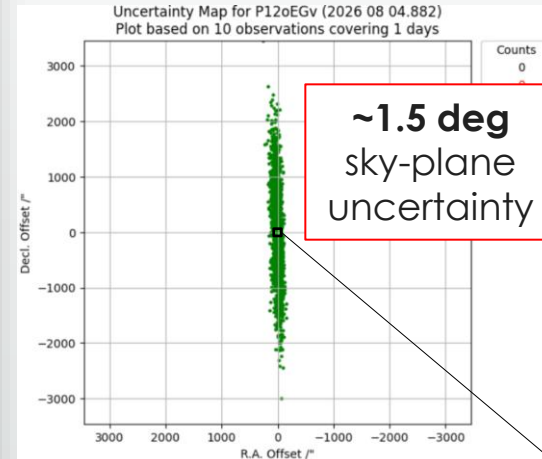


The **Wide-field Mufara Telescope** (WMT / M57) – Main results

An ideal facility for **fast** and/or **faint** NEOs...



1. CONFIRMATION (NEO-CP)

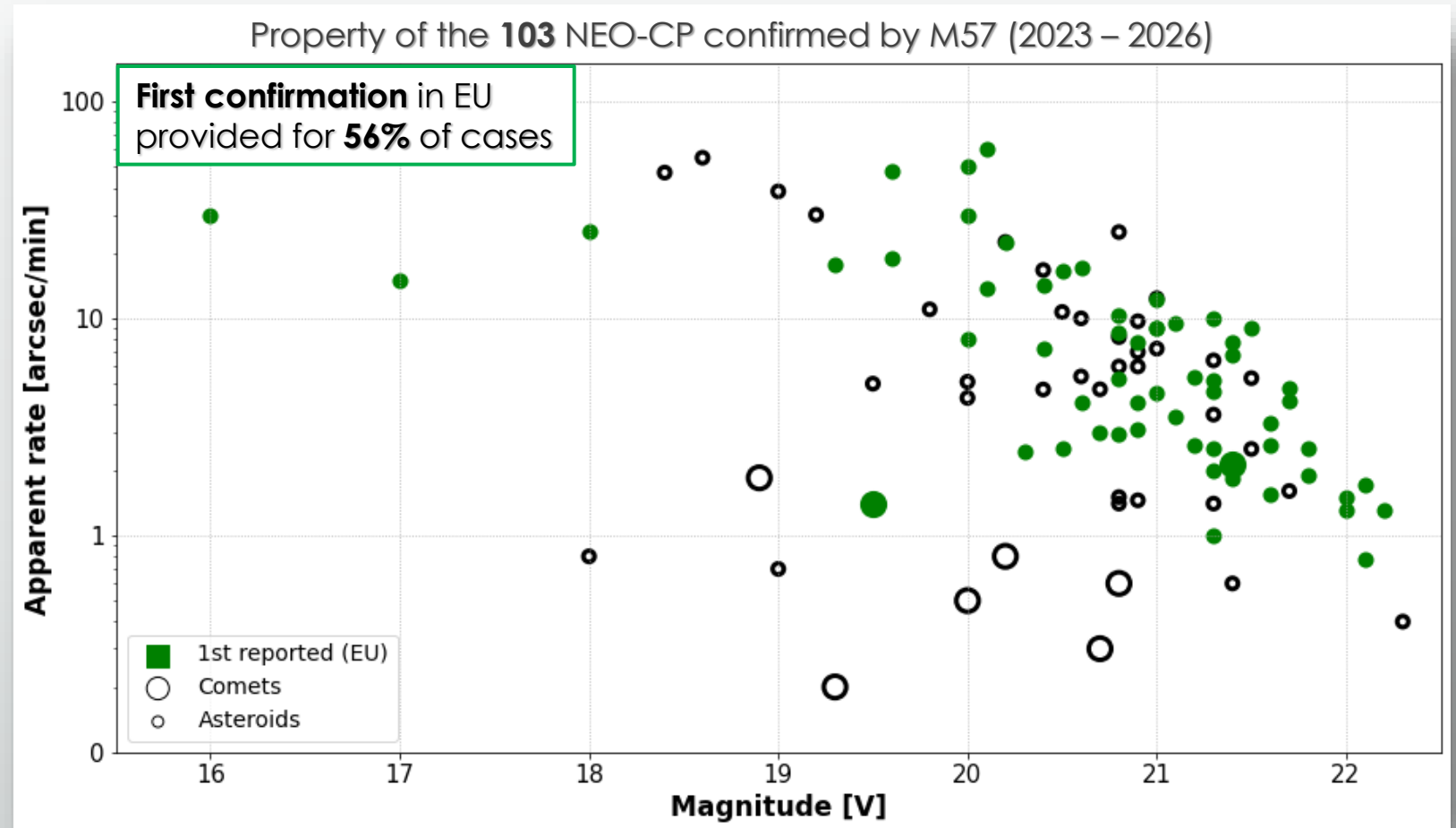


The **Wide-field Mufara Telescope** (WMT / M57) – Main results

An ideal facility for **fast** and/or **faint** NEOs...



1. CONFIRMATION (NEO-CP)



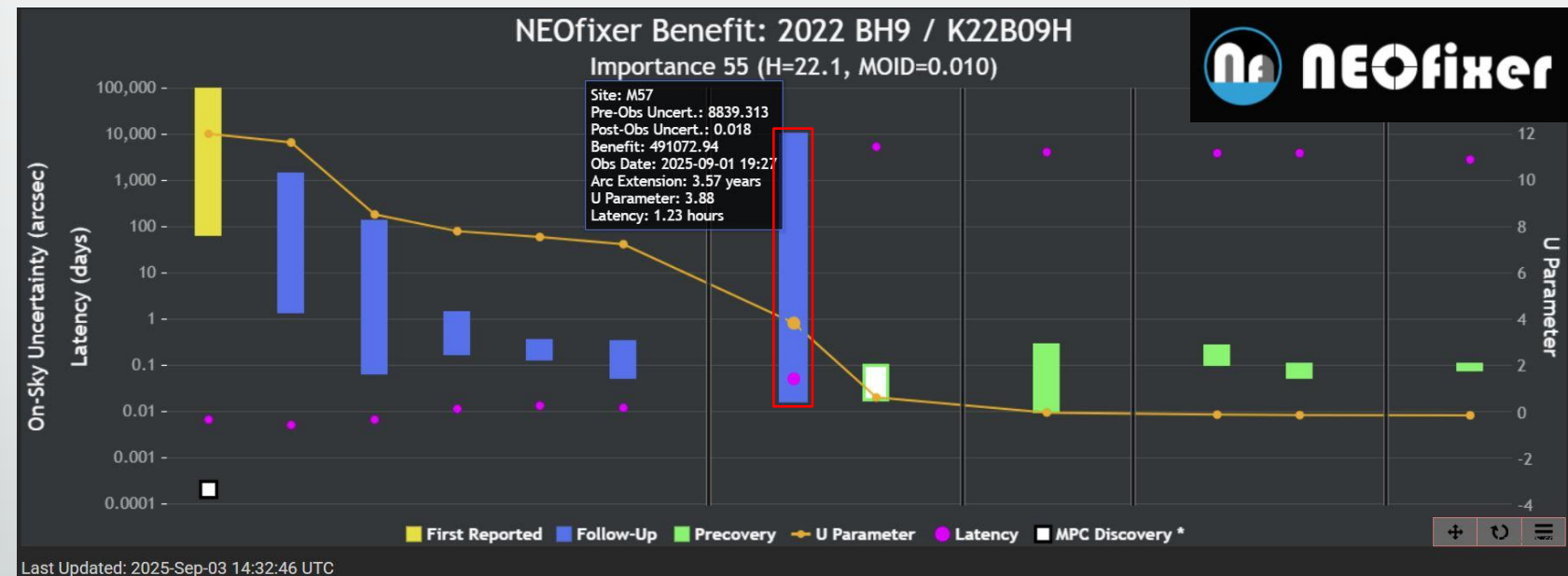
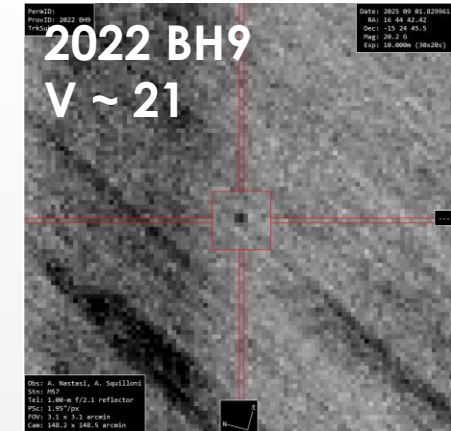
The **Wide-field Mufara Telescope** (WMT / M57) – Main results

An ideal facility for **fast** and/or **faint** NEOs...



2. RECOVERY

- The case of **2022 BH9** (2025/09/03):
 - Positional uncertainty drop: **~5 deg** → **~2 arcsec**
 - Then, **linkage** of observations from 2011, 2014, 2018
- Total arc extended from 7 days to **14 years!**



The **Wide-field Mufara Telescope** (WMT / M57) – Main results

An ideal facility for **fast** and/or **faint** NEOs...

2022BH7
V ~ 21



2. RECOVERY

20 NEOs recovered to date,

- Mag range: **20.0 - 23.4**
- Arc. extension range: **few days - 7 years**

Sources: *NEOFixer*, *MPC*, *NEODyS-2*

The **Wide-field Mufara Telescope** (WMT / M57) – Main results

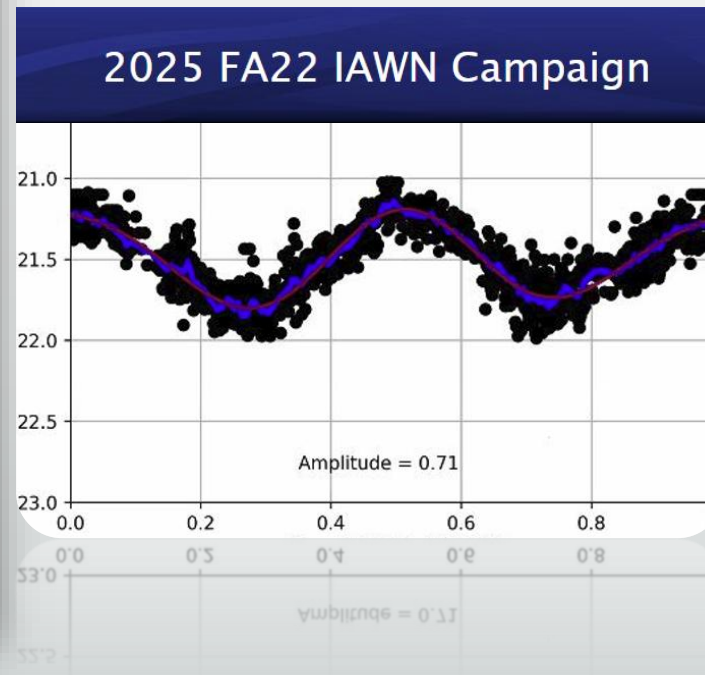
An ideal facility for **fast** and/or **faint** NEOs...



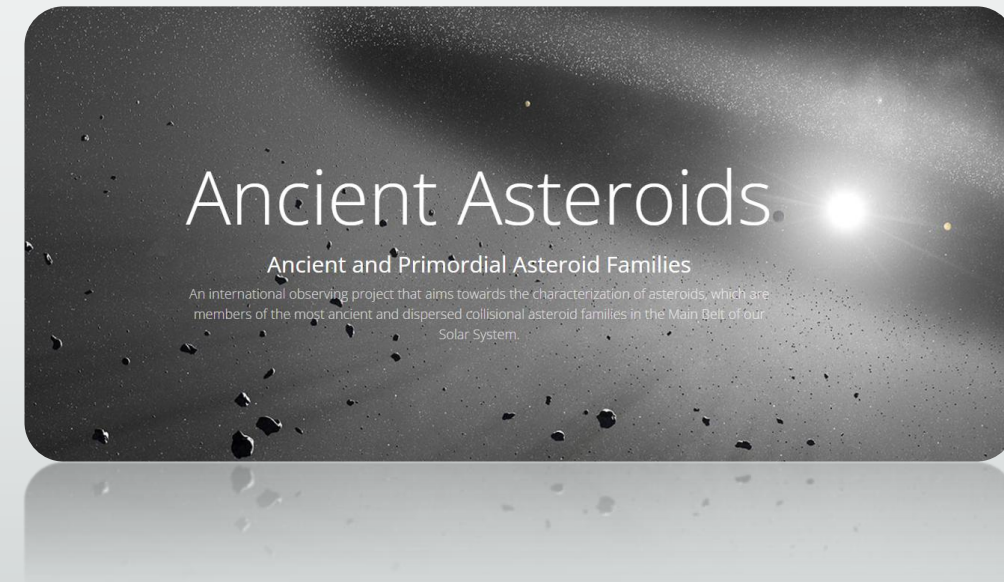
3. PHYSICAL (multi- λ) CHARACTERIZATION

- Asteroid **light curves**

2025 FA22 IAWN Planetary Defense Campaign.



Study of ancient collisional families in the Main Belt.



The Wide-field Mufara Telescope (WMT / M57) – Main results

An ideal facility for **fast** and/or **faint** NEOs...



3. PHYSICAL (multi- λ) CHARACTERIZATION

- Asteroid **light curves**
- **Multi-color photometry** of most interesting minor planets

Multiband Color Monitoring of 3I/ATLAS through Ground-Based Relay Observations

ARIEL GRAYKOWSKI ¹,¹ BRYCE BOLIN ²,² LAURA-MAY ABRON ³,³ FRANCK MARCHIS ^{1,4},^{1,4} MARTIN MAŠEK ⁵,⁵
FILIPP D. ROMANOV ⁶,⁶ AHMED. M. ABDELAZIZ ⁷,⁷ DIMITRIOS ATHANASOPOULOS ⁸,⁸ MATTHEW BELYAKOV ⁹,⁹
LUCA BUZZI ¹⁰,¹⁰ MICHAEL W. COUGHLIN ¹¹,¹¹ ERGÜN EGE ¹²,¹² NICOLAS ERASMUS ^{13,14},^{13,14} THOMAS M. ESPOSITO ^{1,4,15},^{1,4,15}
CHRISTOFFER FREMLING ^{16,17},^{16,17} JOSEP M. L. GARCIA ¹⁸,¹⁸ MAREK HUSÁRIK ¹⁹,¹⁹ OLEKSANDRA IVANOVA ^{19,20},^{19,20}
TAREK M. KAMEL ²¹,²¹ SERGEY KARPOV ⁵,⁵ MYUNG-JIN KIM ²²,²² TOMASZ KWIATKOWSKI ²³,²³ H.-J. LEE ²²,²²
SOFIA MYKHAILOVA ²³,²³ ALESSANDRO NASTASI ²⁴,²⁴ DAGMARA OSZKIEWICZ ²³,²³ JOHN W. PICKERING ^{25,26,27},^{25,26,27}
ALEXEY SERGEYEV ^{28,29},^{28,29} ROMAN TELESNIKOV ³⁰,³⁰ JOSEP M. TRIGO-RODRÍGUEZ ^{31,32},^{31,32} AL ALICEA ³⁰,³⁰ JIN BENIYAMA ²⁸,²⁸
OTABEK A. BURKHONOV ³³,³³ KAMOLIDDIN E. ERGASHEV ³³,³³ Y.H.M. HENDY ³⁴,³⁴ JEONG-HAN KIM ²²,²²
CHENG-HAN HSIEH ^{35,36},^{35,36} M. EMIR KENGER ^{37,38},^{37,38} THOMAS LEHMANN ³⁹,³⁹ IGOR LUK'YANYK ⁴⁰,⁴⁰ ALI TAKEY ³⁴,³⁴
DUŠAN TOMKO ¹⁹,¹⁹ MURAT TEKKESEINOGLU ³⁷,³⁷ SHANE WINTER ³⁰,³⁰ JOEL ALONZO ²⁷,²⁷ MICHAEL BEDDO ²⁷,²⁷
AXEL BIENEFELD ²⁷,²⁷ MARIO BILLIANI ²⁷,²⁷ JOHN K. BRADLEY ²⁷,²⁷ OLIVIER CLERGET ²⁷,²⁷ SABINE CREMER ²⁷,²⁷
NICOLAS DELAUNOY ²⁷,²⁷ JOSÉ DONAS ²⁷,²⁷ JOHN DUNN ²⁷,²⁷ JIŘÍ DVOŘÁČEK ²⁷,²⁷ MICHAEL EDWARDS ²⁷,²⁷ TAJ ENTABI ^{41,27},^{41,27}
RAFFAELE ESPOSITO ²⁷,²⁷ KAREN FISCHER ²⁷,²⁷ ROBERT FOSTER ²⁷,²⁷ EDWARD FRIDAY ²⁷,²⁷ KEIICHI FUKUI ²⁷,²⁷
FRANCOIS GAGNON ²⁷,²⁷ MATTHIEU GARISSON ²⁷,²⁷ GEORGE GHREICHI ²⁷,²⁷ PATRICE GIRARD ²⁷,²⁷ TATEKI GOTO ²⁷,²⁷
MICHAEL GRANT ²⁷,²⁷ CHRIS GREENFIELD ²⁷,²⁷ BRUNO CHILLET ^{42,27},^{42,27} JOSEF HANIS ^{43,27},^{43,27} JOHN HARRISON ²⁷,²⁷

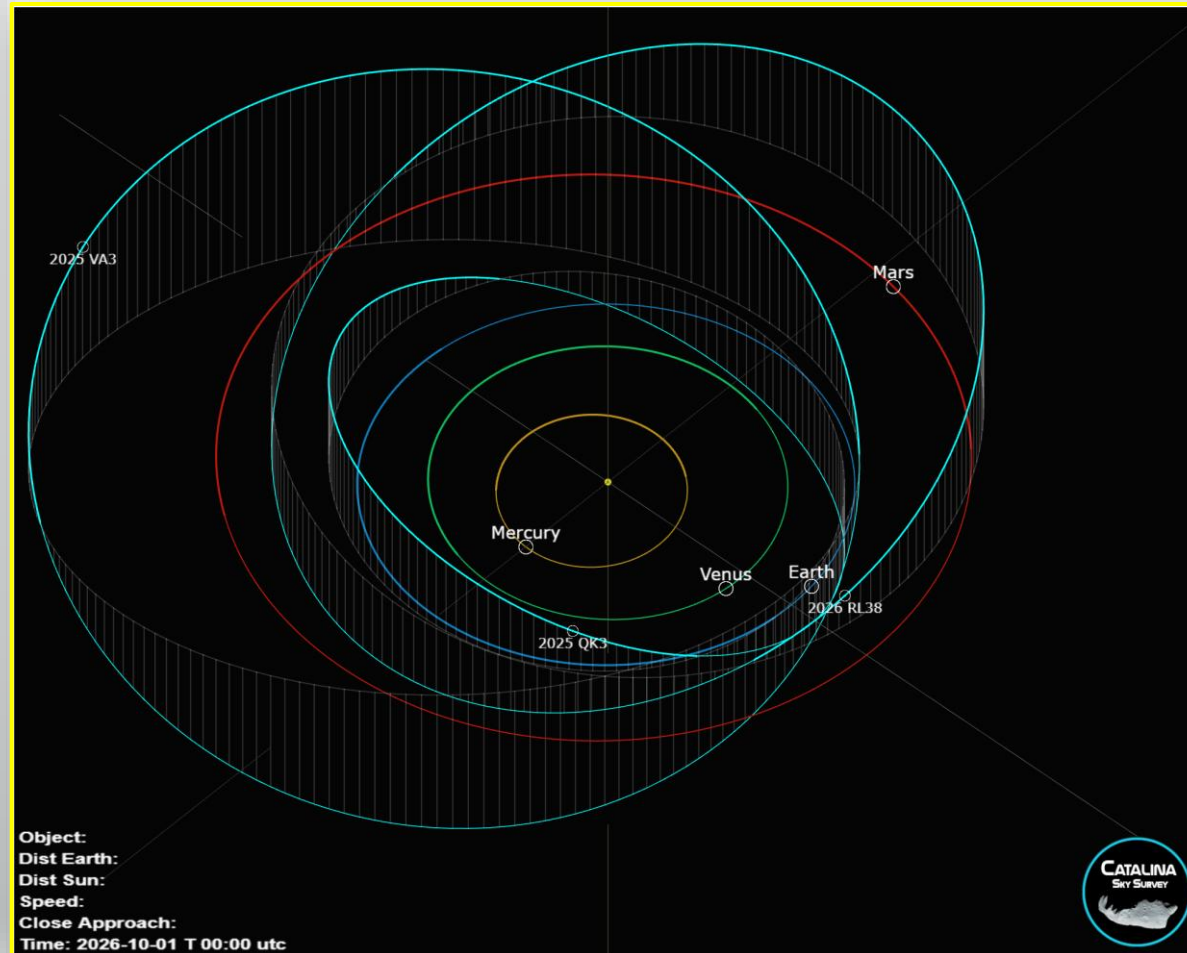
18 Sep 2026

The **Wide-field Mufara Telescope** (WMT / M57) – Main results

An ideal facility for **fast** and/or **faint** NEOs...



4. DISCOVERY



**THREE new near-Earth
asteroids discovered
to date:**

2025 QK3
(Aug. 21, 2025)

2025 VA3
(Nov. 13, 2025)

2026 RL38
(Sept. 10, 2026)

The **Wide-field Mufara Telescope** (WMT / M57) – Main results

An ideal facility for ***fast*** and/or ***faint*** NEOs...



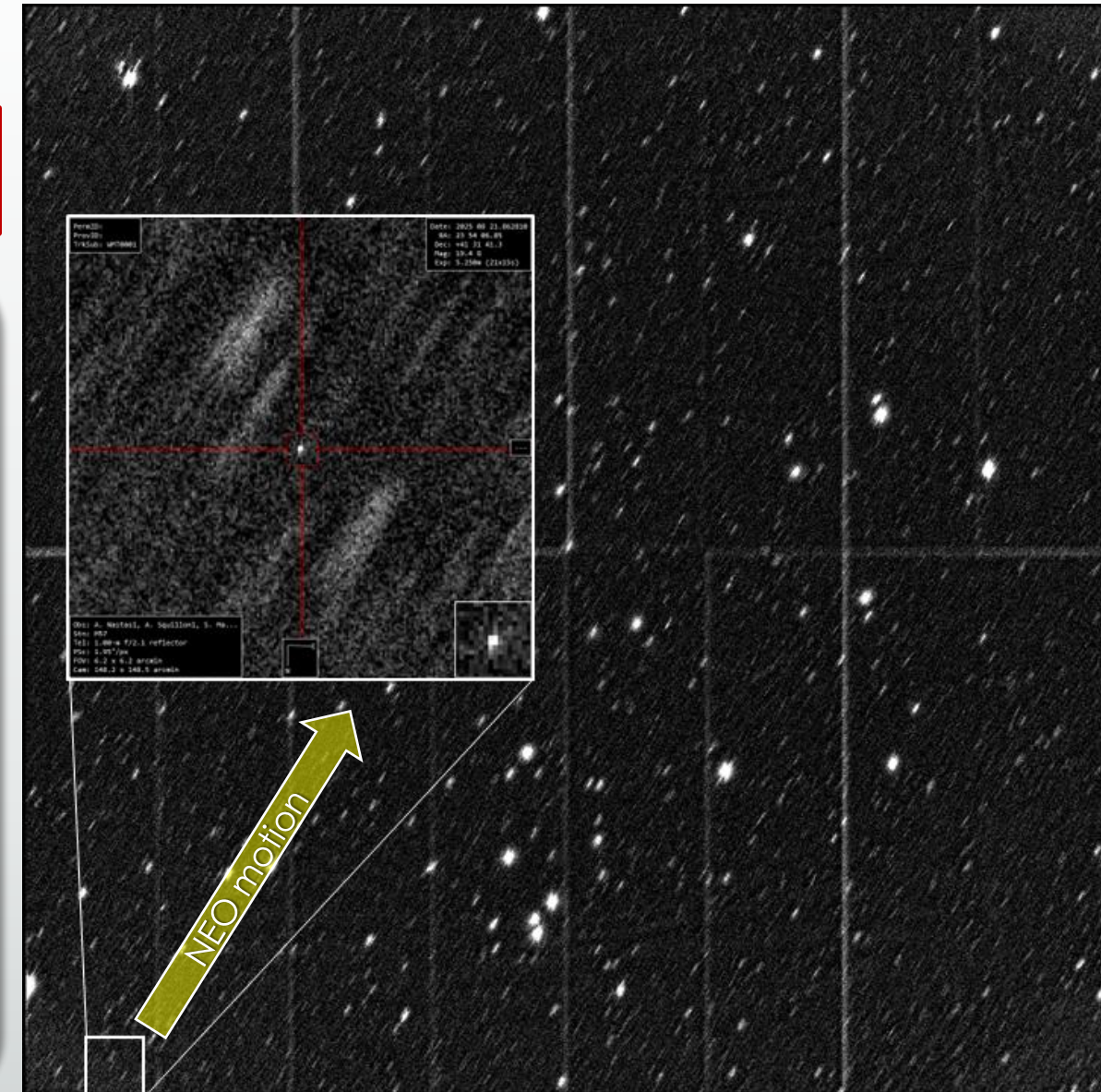
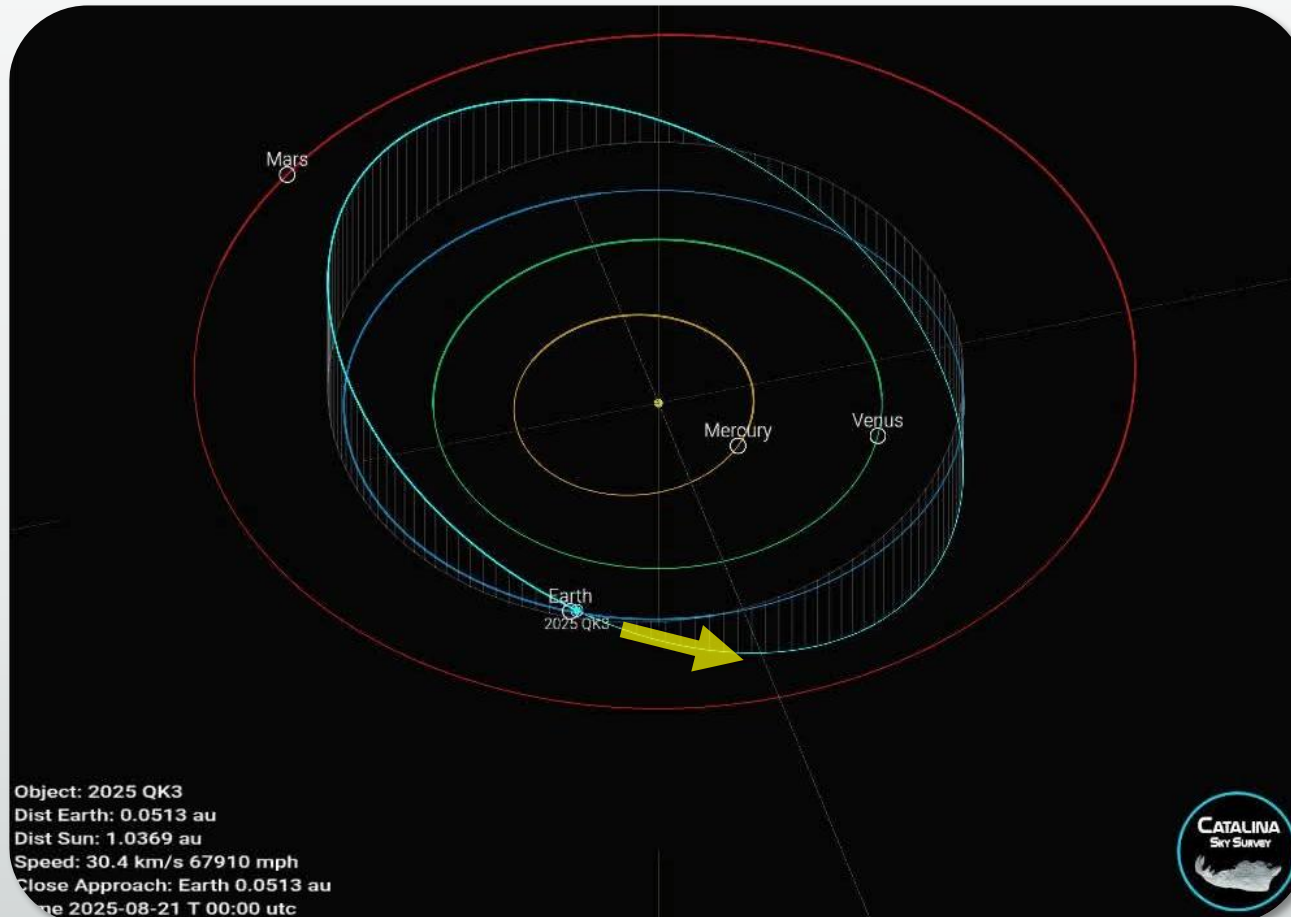
4. DISCOVERY

NEO ID	Discovery date	Estimated size	V mag at discovery	Rate at discovery	Earth dist. at discovery	Discovery method
2025 QK3	2025-08-21	50 m	20.4	14 "/min	18 LD	Synthetic tracking
2025 VA3	2025-11-12	25 m	20.0	50 "/min	13 LD	Deep learning algorithm
2026 RL38	2026-09-10	100 m	21.0	5 "/min	70 LD	Synthetic tracking

The Wide-field Mufara Telescope (WMT / M57) – Main results

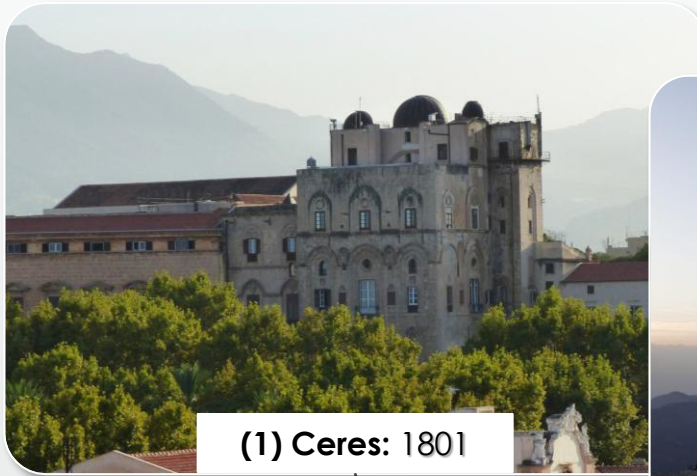
- **DISCOVERY** of the NEO **2025 QK3**

- The **first NEO** discovered from Sicily **ever**.
- The **first NEO** discovered from Italy after **19 years**.



The **Wide-field Mufara Telescope** (WMT / M57) – Main results

- **DISCOVERY** of the NEO **2025 QK3**



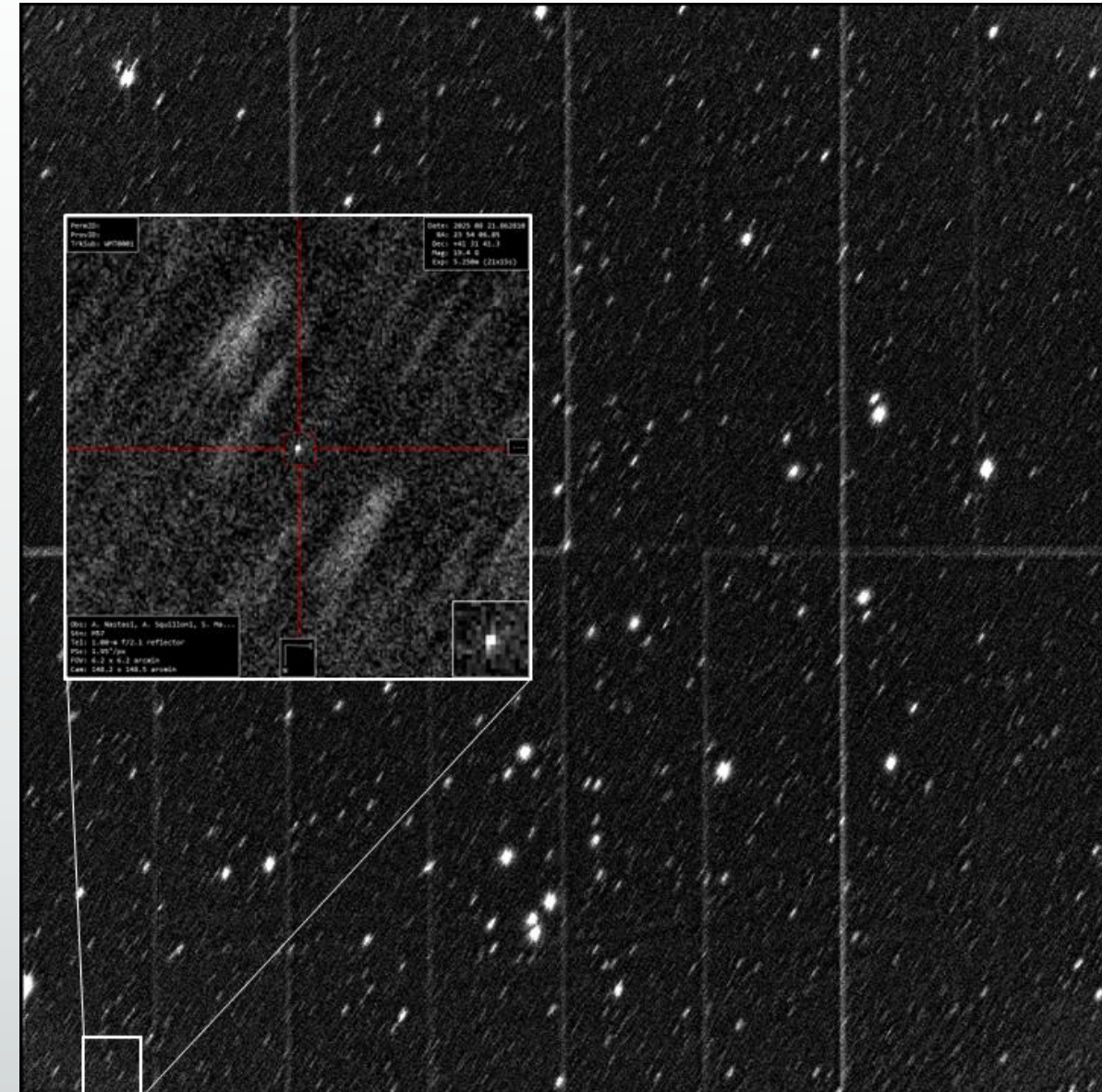
(1) Ceres: 1801



2025 QK3: 2025



After **224 years**,
a coming full circle...

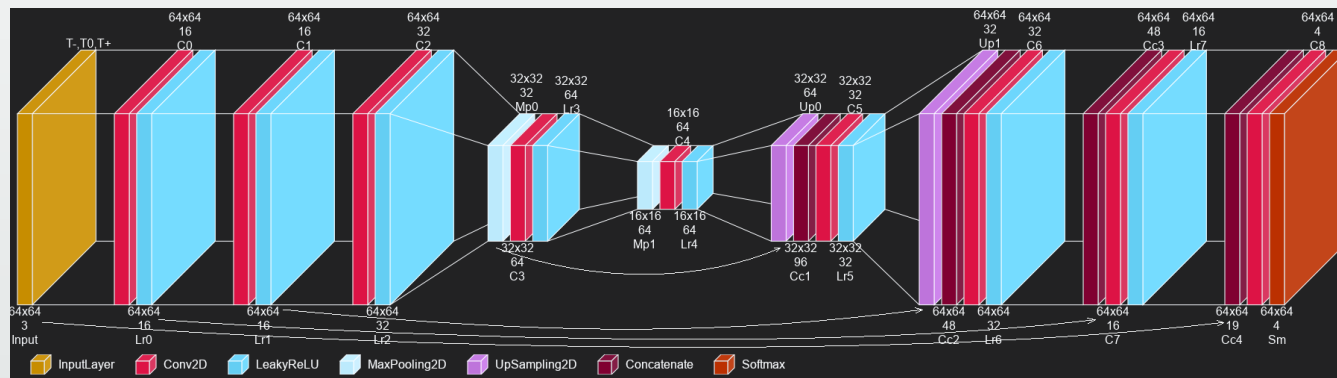


The **Wide-field Mufara Telescope** (WMT / M57) – Main results

- **DISCOVERY** of the NEO **2025 VA3**

A way to overcome the *trailing loss*...

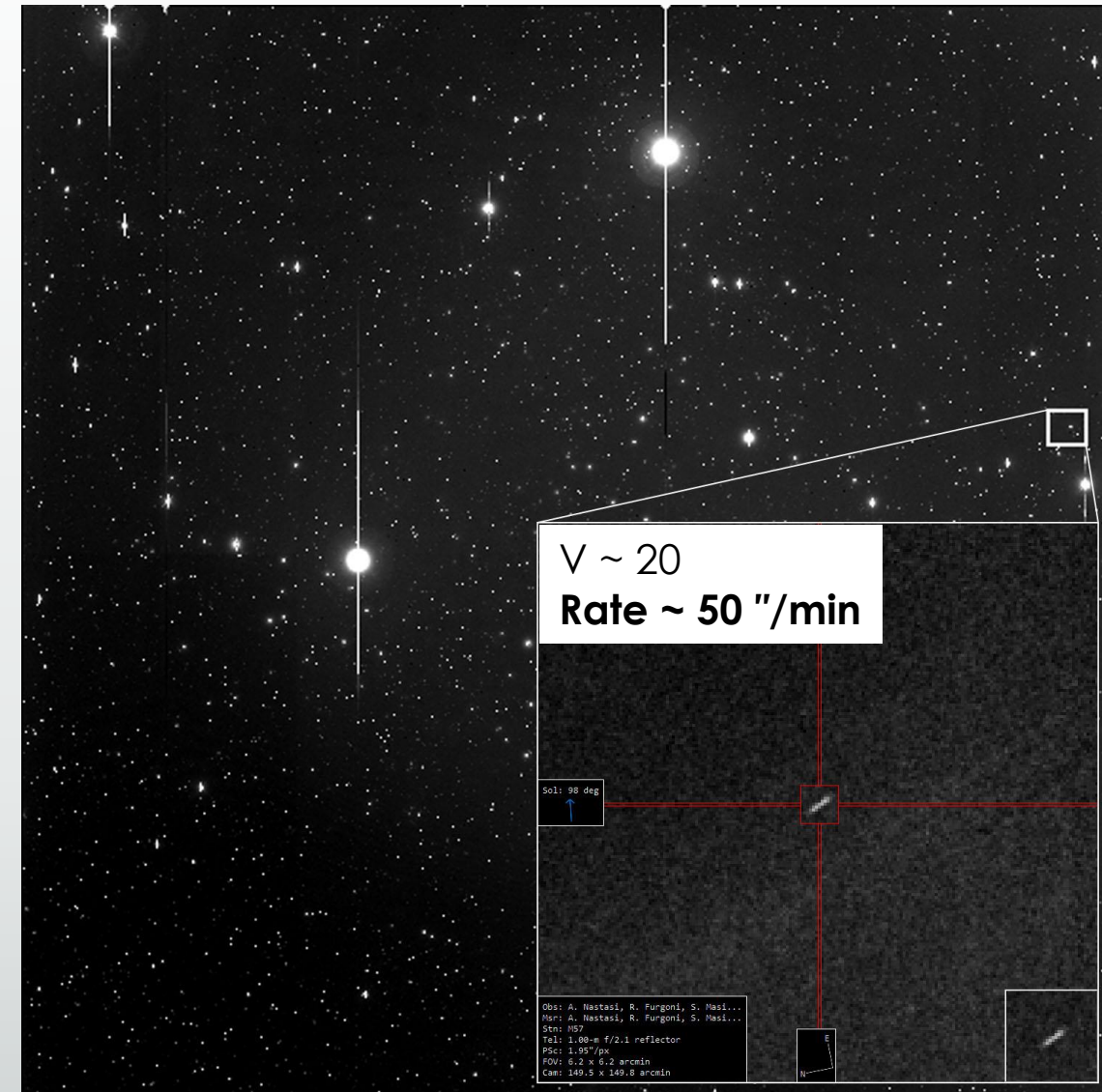
Spotted via **NEODetect**: a **deep learning** (CNN) software for detecting **faint trails** of *natural* and *artificial* objects, using a **real-time** detection framework.



Szabolcs Velkei, CEO

szabolcs.velkei@mi.services

<https://mi.services>



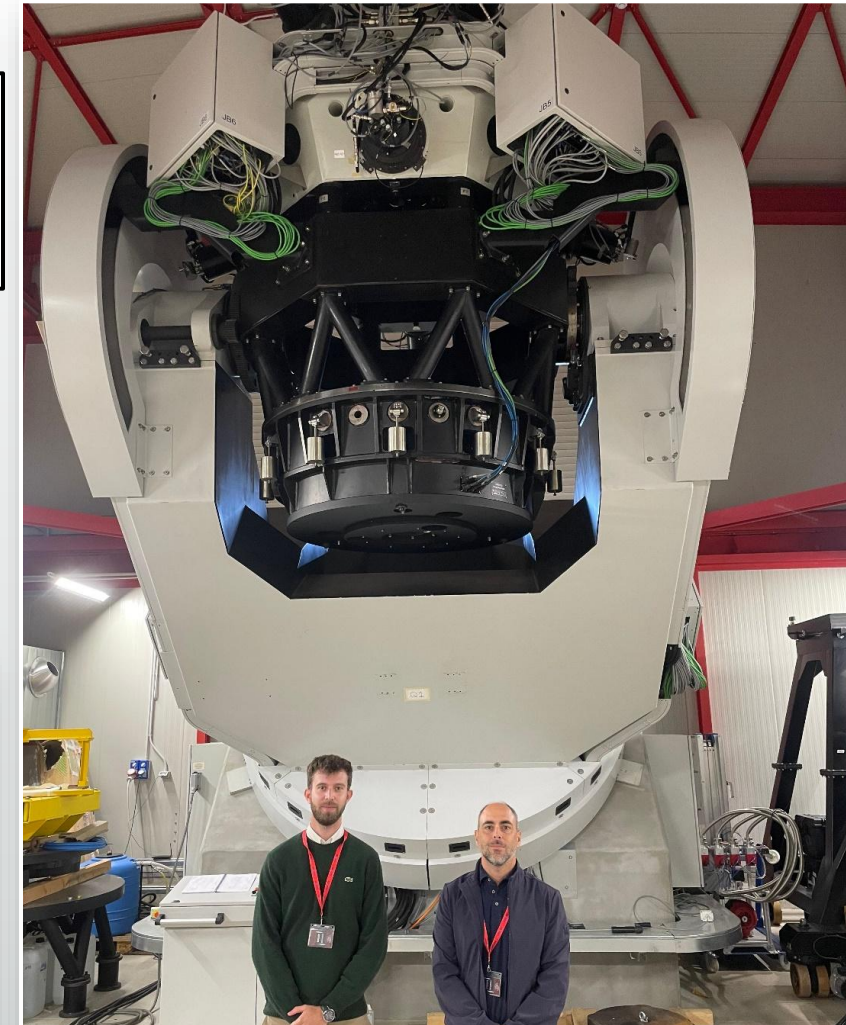
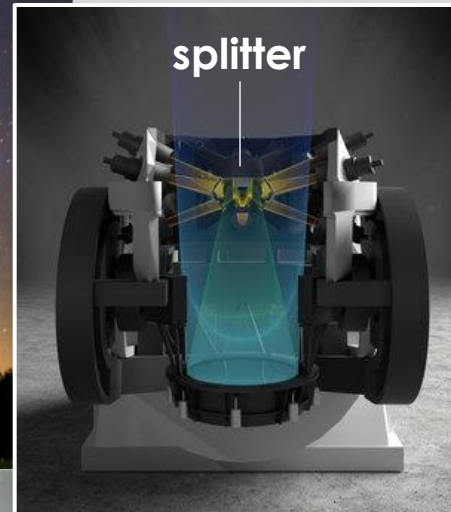
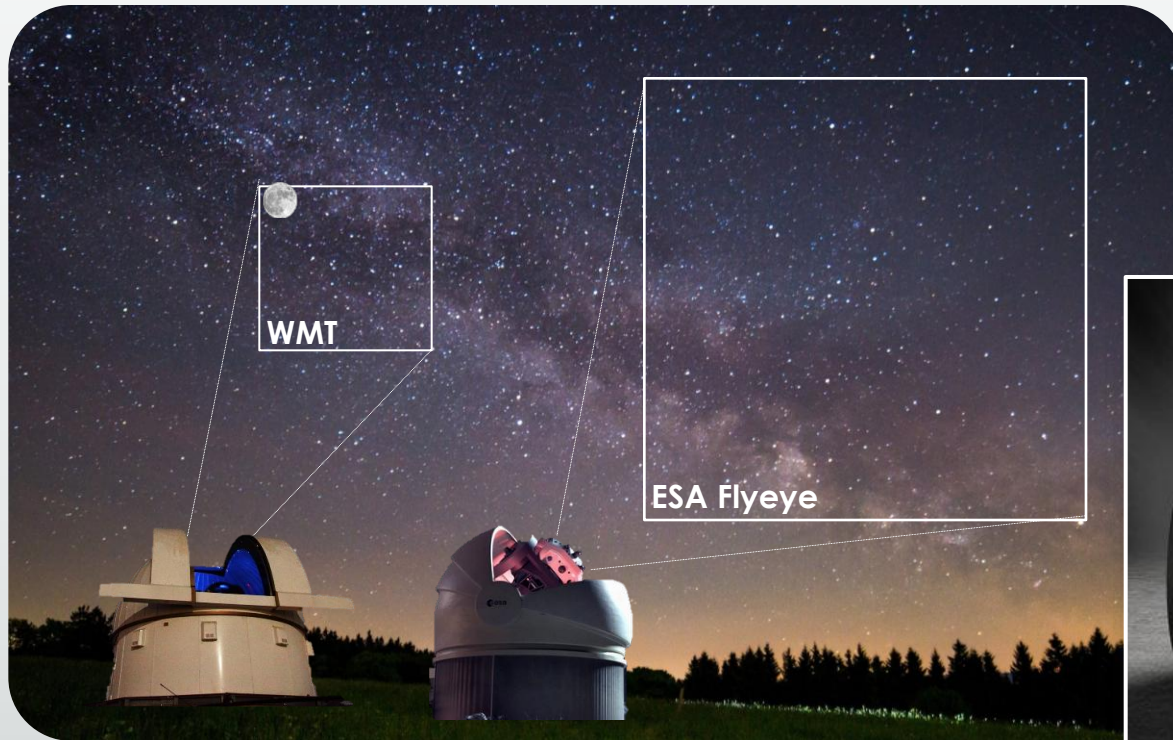
The forthcoming **ESA NEOSTEL** (*Flyeye*) telescope



The ESA *Flyeye* telescope

On Mt. Mufara, ESA is currently installing its optical telescope for hunting new *Near-Earth asteroids*: the **NEOSTEL - Flyeye**.

It will have a **1-m wide mirror**, and a field of view of **200x full moons**.



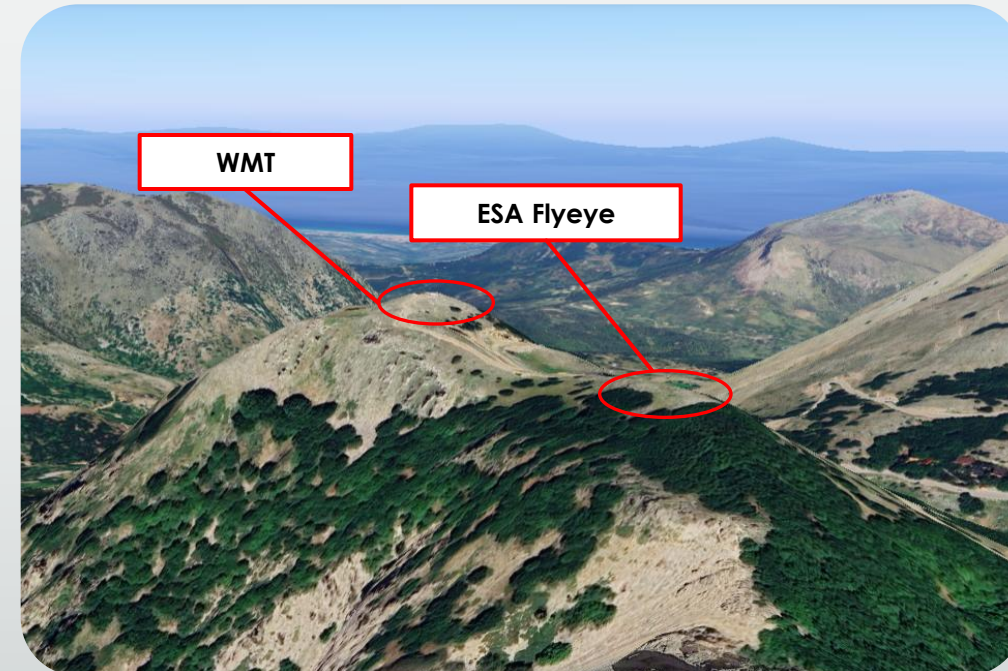
GAL Hassin visiting the Flyeye
ASI - Matera (May, 2026)

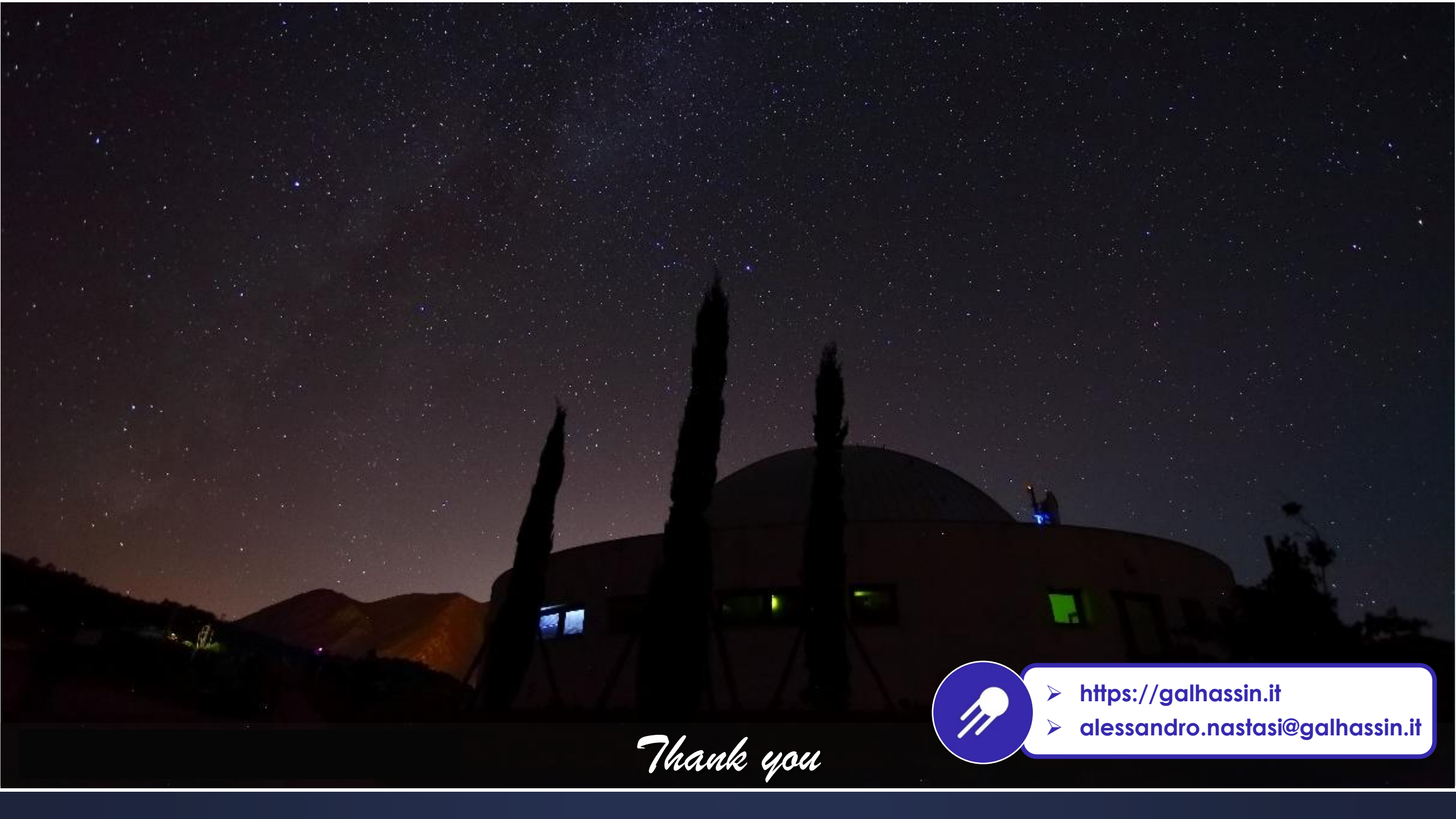
A **network** of wide field telescopes soon active in Sicily...

WMT & ESA NEOSTEL “Flyeye” will work in **synergy** as **complementary** facilities:

- **Simultaneous runs**, having the same weather conditions.
- WMT will offer prompt **confirmation** and **photometric characterization** of targets discovered by the **ESA Flyeye**.
- A unique network of **wide field** telescopes in the **Mediterranean area**.

Date: 04 Sept. 2026





Thank you

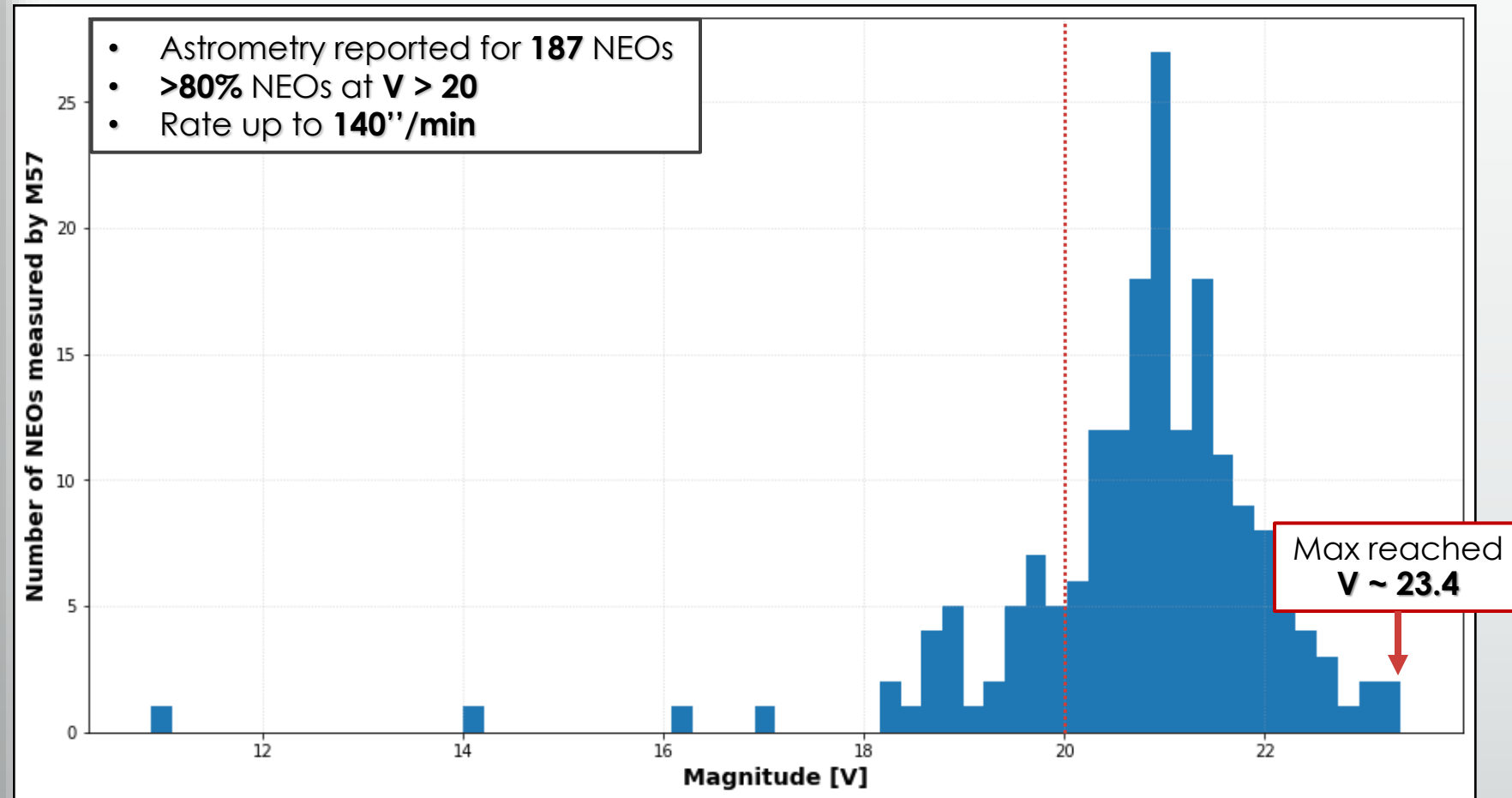


- <https://galhassin.it>
- alessandro.nastasi@galhassin.it

Additional information

The **Wide-field Mufara Telescope** (WMT – M57)

An ideal facility for **fast** and/or **faint** NEOs...



The GAL Hassin facilities for NEO monitoring – **Wide-field Mufara Telescope (WMT – M57)**

Night sky conditions on M. Mufara (as measured in 2017):

- 1/3 of photometric nights, with **seeing of ~1 arcsec** for more than 6 hrs per night;
- 1/3 of quasi-photometric nights;
- 1/3 not clear nights.

