

# The PLATO Mission

(PLAnetary Oscillations and stars)



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# The PLATO Satellite – ESA's M3 Mission



- PLATO: PLAnetary Transits and Oscillations of stars
- Launch Q4 2026 with Ariane 6 into orbit around L2 Earth-Sun Lagrangian point
- Multi-telescopes approach: 26 cameras
- High precision photometry :  $4 \le m_v \le 11$  (13)
- Precision of 50 ppm in 1 hour for  $mv \le 11$



ESA/OHB

The FoV is spread over: ~2 billion pixels (2 000 Mpx vs 98 Mpx for Kepler) ~6 600 cm<sup>2</sup> of sensitive area (2x Gaia)

Size of about 3.5 m × 3.1 m × 3.8 m (8.2 m solar array) Launch mass of 2165 kg, including consumables

# **The PLATO Methods**



- "PLAnetary Transits and Oscillations of stars" (PLATO) is a mission to detect and characterise exoplanets and their host stars.
- It is optimised to reach Earth like planets in the habitable zone of bright solar-like stars



## **Science Questions**

- How do planets and planetary systems form and evolve?
- Is our solar system unique and are there other systems like ours?
- Are there potentially habitable planets?
- What are planets made of?
- What are the properties of their host stars?





## **Science Objectives**

plato

Architecture, formation, evolution of planetary systems, and correlation with stellar parameters

Our Solar System in Context

Planet evolution with age

Additional planetary science (exo-moons, planets around evolved stars, albedo studies via secondary transits...)

Identification of good targets for spectroscopic follow-up of planet atmospheres

#### Internal structure of stars

Determination of bulk properties of thousands of exoplanets, including terrestrial planets in the <u>habitable zone of Sun-like stars</u>

Required planet properties accuracies:

- radius, 3% (5%)
- mass, 10%
- age, 10%

for an Earth-size planet orbiting a G0 dwarf star with V < 10 (11)

# Small planets in the habitable zone



Mass <15 M\_earth, radius <10R\_earth

#### 1.40 1.40 1.20 1.20 8 2tellar mass [M☉] 0.80 0.40 ⊕ ⊕ Planet radius [R Planet radius [R Masses Masses 6 0.80 1 3 3 5 5 7 7 9 9 0.40 0.40 11 11 2 2 13 13 0.20 0.20 15 15 0.05 0.05 5.0 5.0 1.0 0.02 0.1 2.0 0.02 0.1 1.0 2.0 Semi major axis [AU] Semi major axis [AU]

Rauer et al. submitted (arXiv: 2406.05447)

With <10% mass and <5% radius precisions

# Small planets in the habitable zone



Mass <15 M\_earth, radius <10R\_earth





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## Main sequence asteroseismology



Asteroseismic detections after 30d

Asteroseismic detections after 730d



Rauer et al. submitted (arXiv: 2406.05447)

# **The PLATO Instrument**





ESA/OHB

(vs 105 deg<sup>2</sup> Kepler)

# **Target Fields**



### Baseline Operation period: → 4 years

Nominal Mission operation plan: ▶ 2 "long pointings" of 2 years each

#### Options for mission extensions:

- Meet performance requirements until 6.5 years
- Consumables for 8.5 years mission duration



Rauer et al. submitted (arXiv: 2406.05447). See also Nascimbeni et al. 2025 (arXiv: 2501.07687) for a detailed description on the first target field.

# **Complementary Science**



#### • Other science topics:

- Reflected light from close-in giant planets
- Circumbinary planets, Exo-moons, rings, ...
- Planets around young and evolved stars
- Galactic Archeology, Clusters, Associations, AGN?
- Asteroseismology across HRD, for large range in Z
- Binaries & tidal evolution across HRD
- Accretion, debris disks & magnetism in YSO
- → Guest Observer program:
- > 8% of the science data rate for the Guest Observer Program.
- Participation is selected through ESA calls 6 months before launch!



Rauer et al. submitted (arXiv: 2406.05447)

# **Status Spacecraft**



- 24 FM cameras (out of 26) delivered to the prime.
- 2 Fast Camera flight models in final testing.
- Camera flight model integration on optical bench is in progress.
- **Project in schedule** for **planned launch date end 2026**.
- Contract with Arianespace signed for Ariane 6 launcher.



Thermal-vaccum test of PLATO optical bench and camera model @ ESA



Camera gallery...

## **The PLATO Mission Consortium**

Cesa

