PLATO: An ESA mission to search for habitable exoplanets orbiting Sun-like stars


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*http://plato.mri.esa.int/web/plato

Summary
PLATO (PLANetary Transits and Oscillations of stars) is the third medium class mission (M3) in ESA’s Cosmic Vision Programme. Scheduled to launch in 2026, PLATO’s main objective is the study of down to Earth-size planets orbiting up to the habitable-zone of Sun-like stars. PLATO will be complementary to TESS, which focuses primarily on shorter period planets and therefore explores the habitable zone of late type dwarf stars.

At present the transit method is the only proven technique that allows us to detect and characterise rocky, long period planets. PLATO will use the transit method for the detection and characterisation of exoplanets, combined with the asteroseismic analysis of their host stars. PLATO’s core observing sample will consist of bright Sun-like stars of m_r < 11, which will enable us to determine with unprecedented accuracy stellar ages and the bulk properties of small planets, including their masses from radial velocity measurements at ground-based observatories.

For statistical studies, PLATO will also monitor a large sample of Sun-like stars with m_r < 13 and a sample of cool late-type dwarfs with m_r < 16, along with a small sample of bright stars distributed over the HR diagram observed in two colour bands. The nominal duration of the mission is 4.25 years, with consumables available for 8.5 years. The mission is currently in development, phase B2.

Objectives

- Determine the ages (< 11), which will enable us to determine with unprecedented accuracy stellar ages and the bulk properties of small planets, including their masses from radial velocity measurements at ground-based observatories.
- For nominal science mission:
  - 2 long pointings lasting 2 years each (fields with outer dark blue areas)
  - Alternative scenarios:
    - 1 pointing lasting 3 years + 1 year step-and-stare (outer dark blue fields) + any of the other fields
    - 1 long pointing lasting 4 years
- The final strategy will be decided 2 years before launch
- Red areas: CoRoT fields
- Yellow area: Kepler field
- Green areas: K2 fields

Spacecraft

- Mass: ∼2200 kg (including 80 kg launch vehicle adapter and 126 kg propellant and system/ maturity margins)
- Power generation: 2200 W
- Telemetry through X and K-band
- Average downlink capacity: ∼435 Gb per day
- Launch with Ariane 6.2 in 2026 into an orbit around L2
- Mission nominal science operations: 4 years
- Satellite/instrument designed to last with full performance for 6.5 years
- Consumables will last 8.5 years
- 90° rotation around the line of sight every 3 months

Observation strategy

PLATO will determine:
- radii (3% accuracy)
- masses (10% accuracy)
- ages (10% accuracy)

for Earth-size planets orbiting 60 dwarf stars with m_r < 10

Stellar samples

- Spectral type: M, F, G, K, and M
- Overlapping photometric passbands for different spectral types
- Two time-scales:
  - Core sample: 25 s for stars with m_r ≤ 16
  - Statistical sample: 25 s for stars with m_r ≥ 16
- Integration of the “fast cameras” CCDs (4x4 1480x1480 pixels)

Data Products

- Level-0: Imagettes of selected targets for all individual telescopes
- Level-1: Validated light curves and centroided curves of selected targets for all individual telescopes
- Level-2: Calibrated light curves and centroided curves per target, corrected for instrumental effects
- Level-3: Planetary transit candidates and their parameters

Ground-Based Observations Programme

- The team performing these observations for the prime sample (GOP Team) will be selected through an open call by ESA
- The issue of the AO is planned for 3 years (TBC) before the PLATO launch
- The GOP Team will organise their respective telescope resources and execute the observations following the PLATO Mission Consortium requirements

References


D.O.