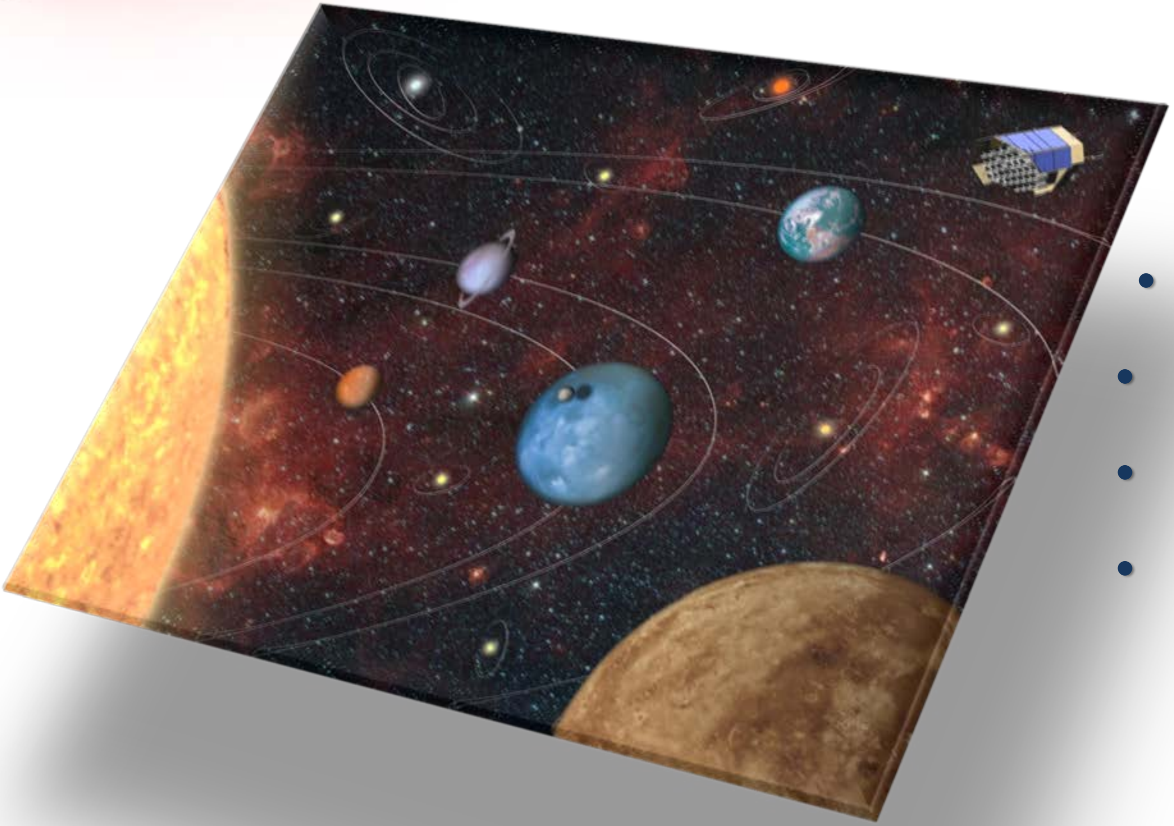
# The Mission PLATO 2.0

(PLAnetary Transits and Oscillations of stars)



- ESA selected M3 Mission
- Currently in Phase B1
- Mission adoption in 2016
- Launch in 2024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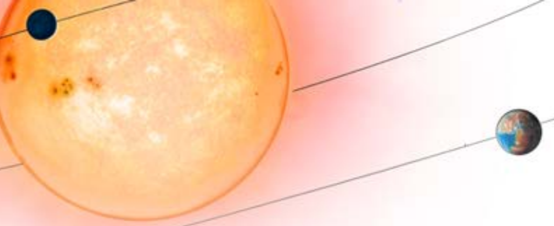
**and the PLATO 2.0 Team**

# PLATO 2.0 Scientific Motivation

**PLATO Objectives:**

- **Characterize planets for their density and age to explore planet diversity and:**
  - **detect and characterize terrestrial planets in the habitable zone**
  - **constrain planet formation and evolution processes**
- **Stellar science**
- **Complementary science**



# The Methods

## Characterize bulk planet parameters

**Accuracy around solar-like stars for PLATO 2.0:**

- **Radius (~2%)**
- **Mass (~10%)**
- **Age (~10%)**

**For bright stars (4 – 11(13) mag)**

The PLATO mission has two elements:

- Photometry from space
- Spectroscopy from gound

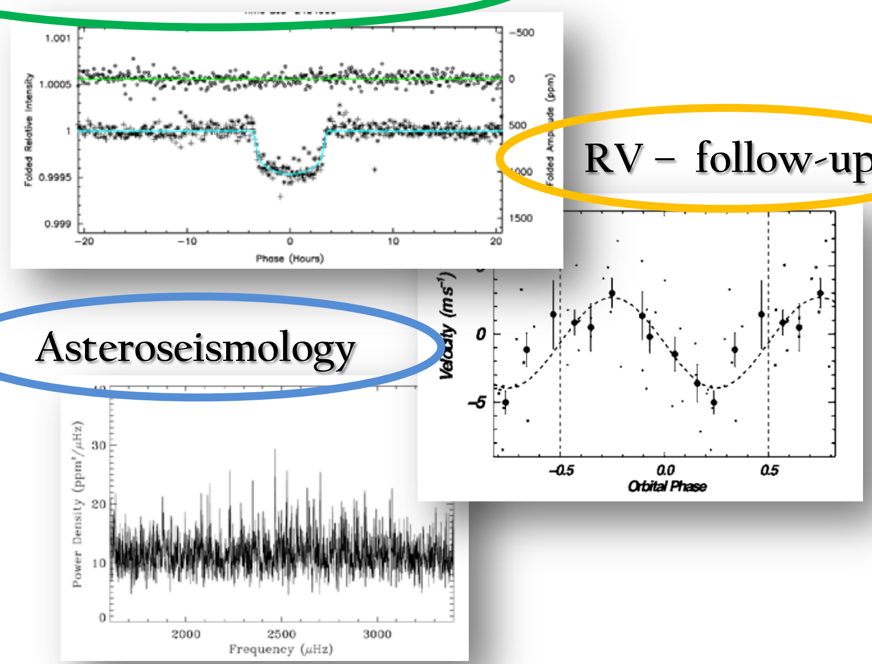
## Techniques

***Example: Kepler-10 b (V=11.5 mag)***

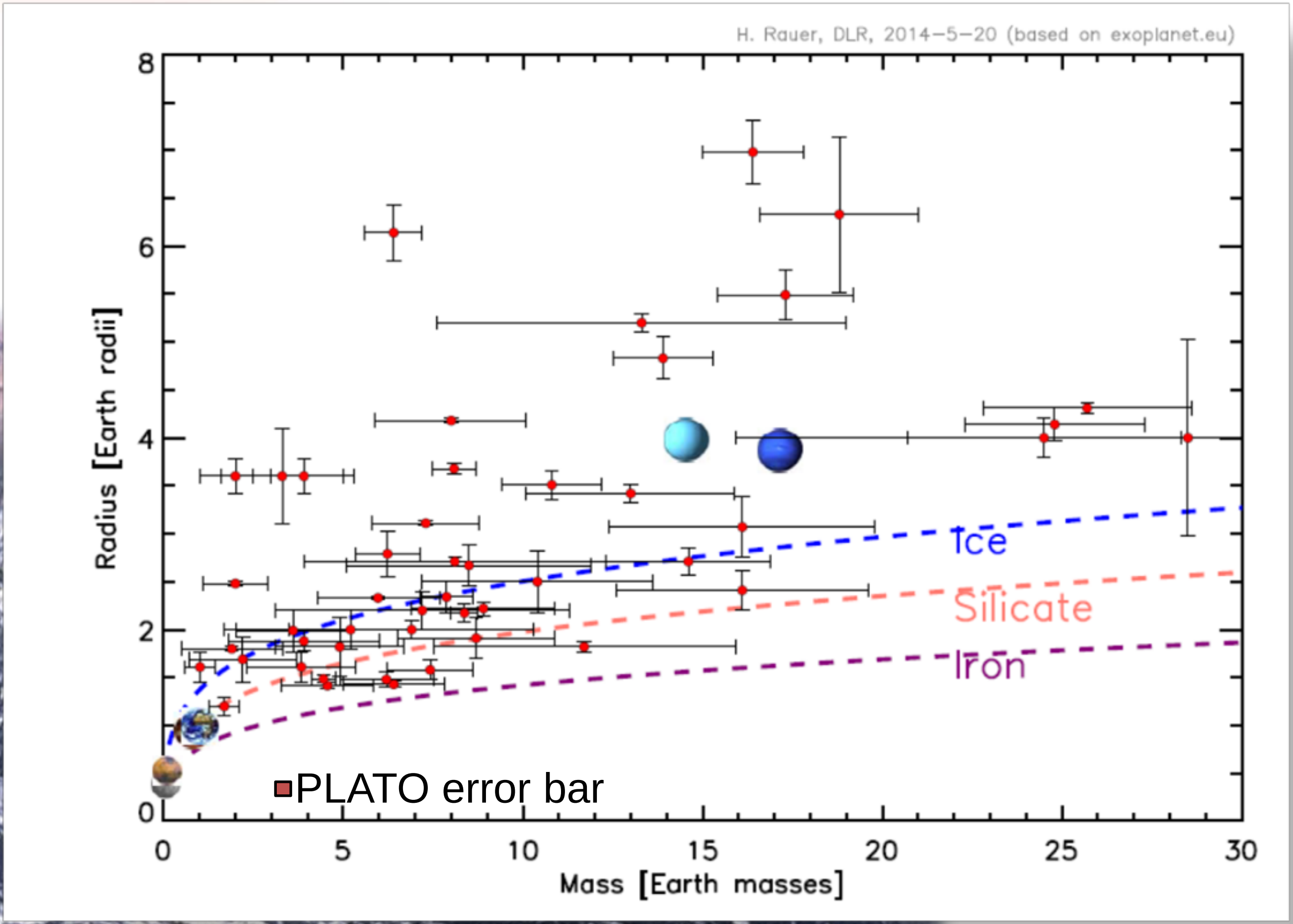
Photometric transit

RV – follow-up

Asteroseismology



# Diversity of „super-Earths"




Status:

- Large diversity in masses and radii
- Individual planets have large error bars

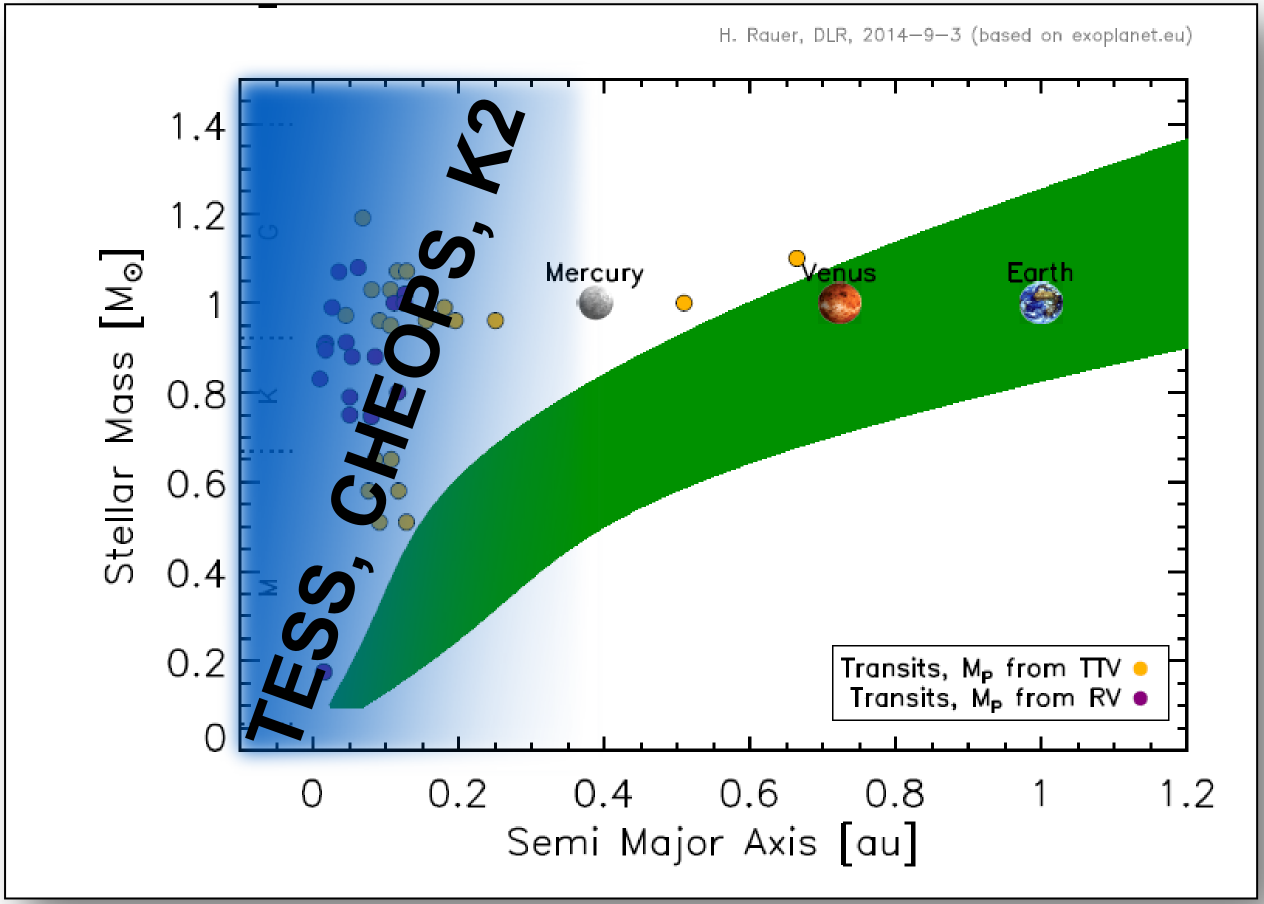
**→PLATO goal:**

Masses: 10%

Radii: 2%

# Prospects: Characterized „super-Earths“ in their habitable zone

## „Super-Earths“ with characterized radius and mass

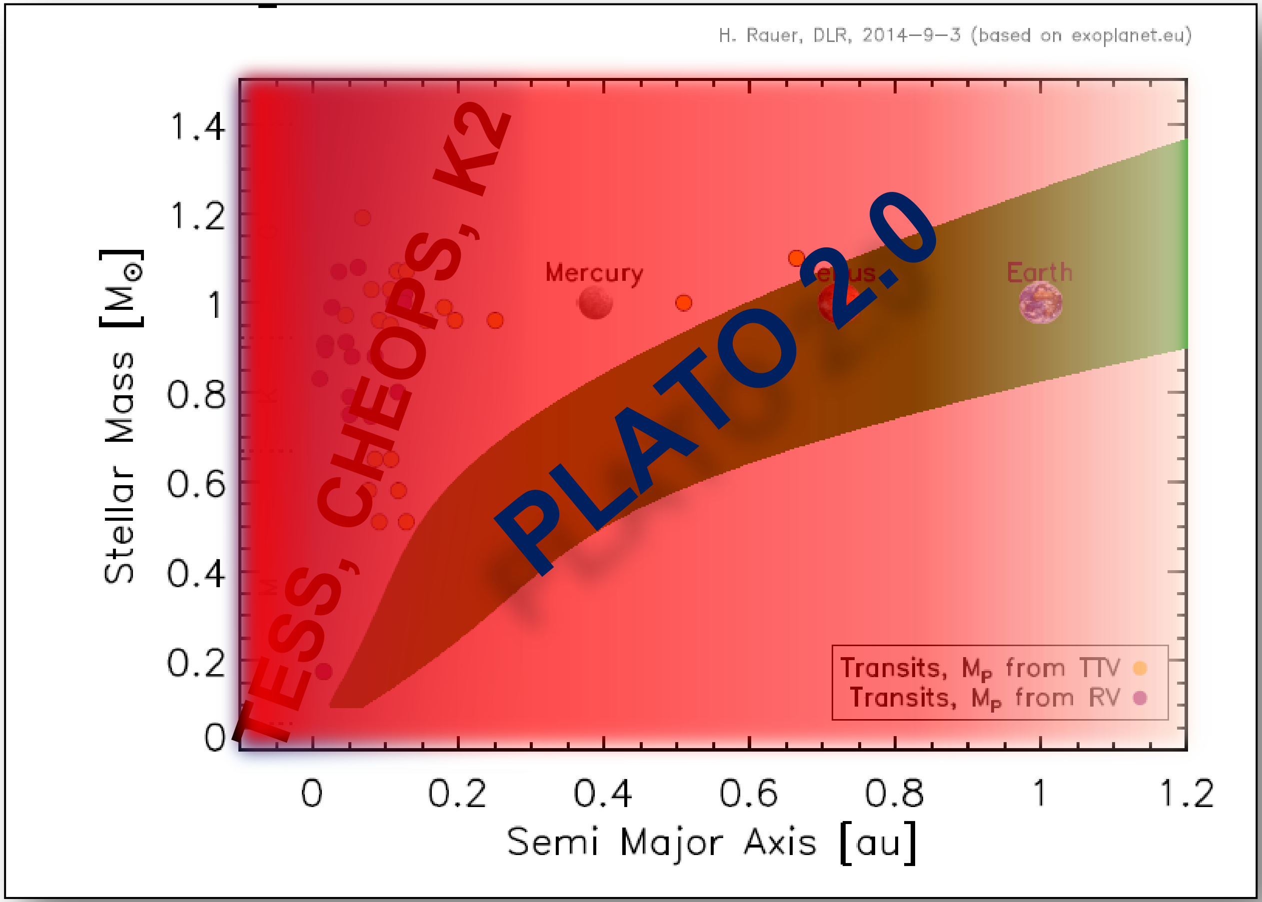



TESS ecliptic poles

- TESS, CHEOPS, K2 will mainly cover orbital periods up to ~80 days

# Prospects: Characterized „super-Earths“ in their habitable zone

## „Super-Earths“ with characterized radius and mass




TESS ecliptic poles

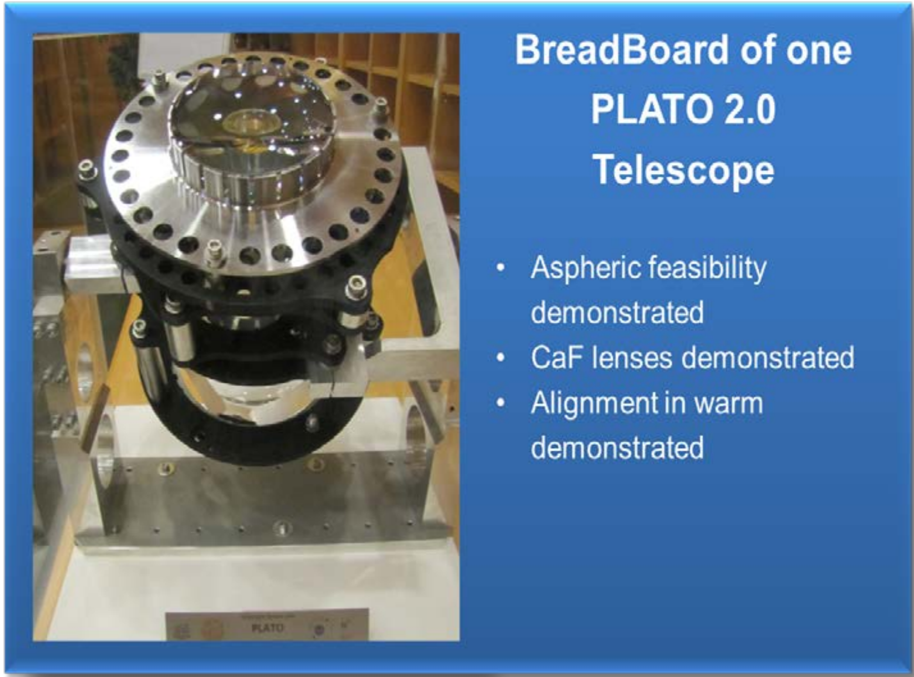
- PLATO 2.0 goal: Detect and characterize planets up to the habitable zone of solar-like stars.

# The PLATO 2.0 instrument

- A multi-telescope instrument (34 telescopes)
- Wide field-of-view combined with large dynamic range
- L2 orbit

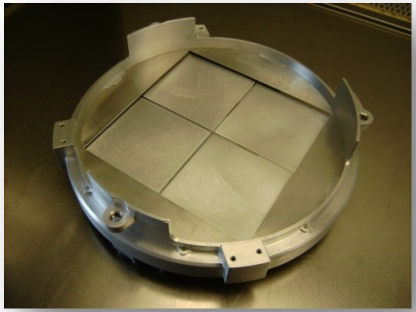
# The „normal" cameras

- 32 „normal" cameras
- 12cm aperture telescopes
- Operate in "white light"
  (500 – 1000 nm)
- Dynamical range: ~8 ≤ $m_V$ ≤ 13
- Total Field-of-View: ~49°x 49°



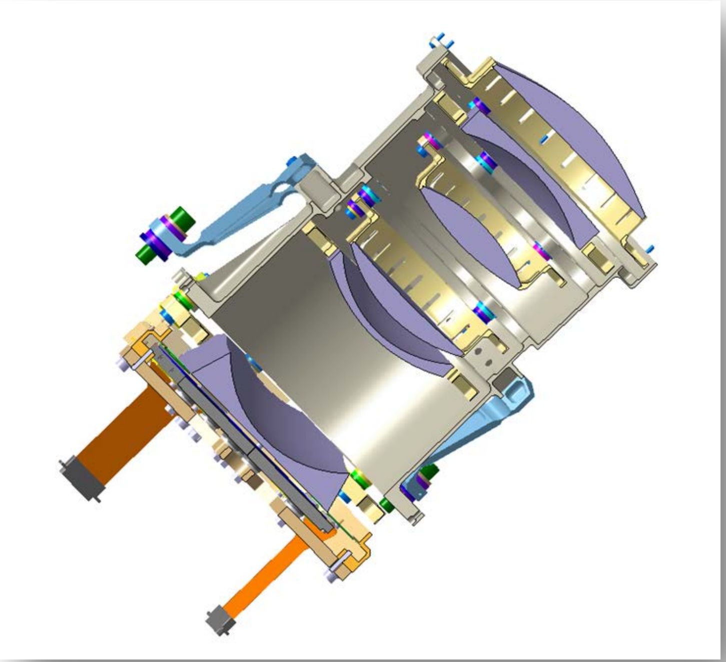

R. Ragazzoni

- CCD: 4510×4510px (x4)
- Pixels size: 18 μm square, 15 arcsec/px
- Read-out cadence: 25 sec



# The „fast“ cameras

- 2 „fast“ cameras
- Each telescope has one broadband filter:
  one „red“and one „blue“ telescope;
  exact filter bandpasses are tbd.
- Otherwise identical to normal cameras
- Read-out cadence: 2.5 sec in frame
  transfer mode

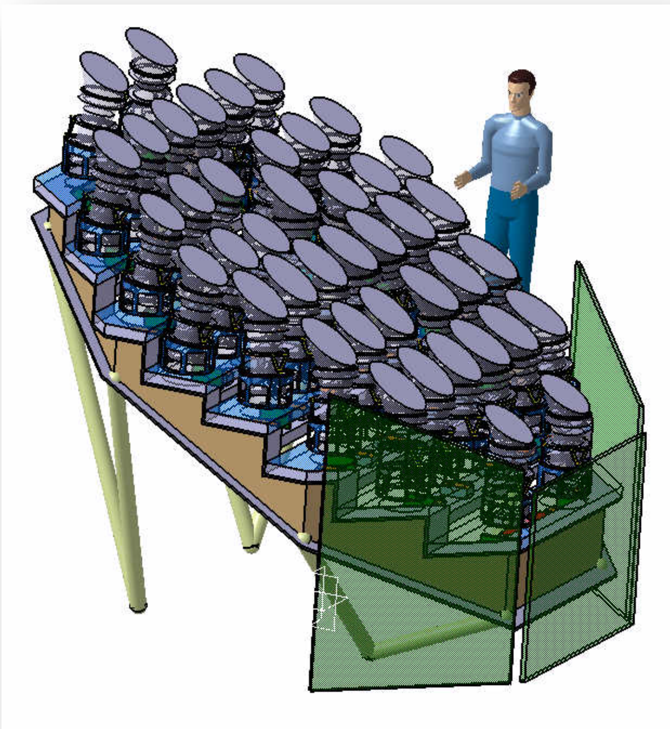


R. Ragazzoni

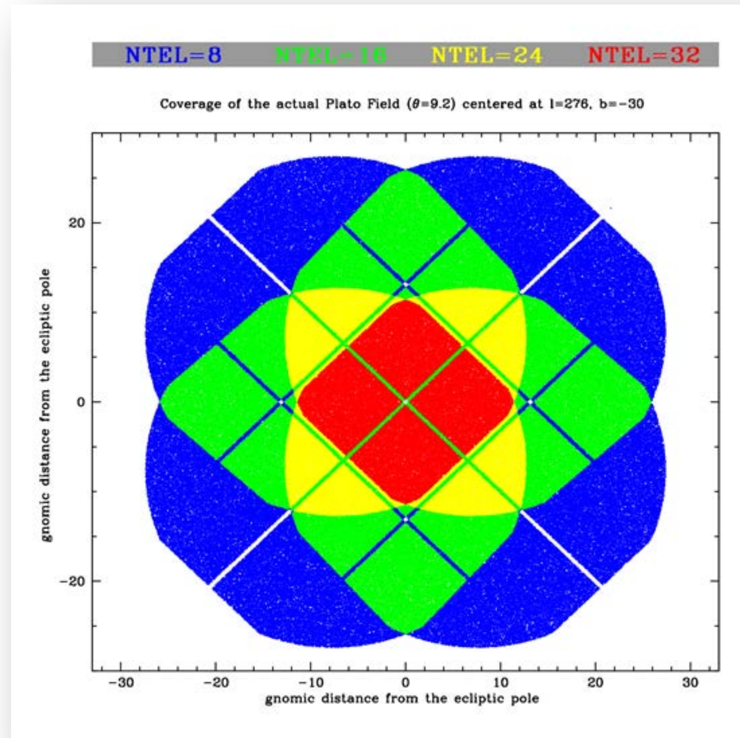
- Purpose:
  - **Fine guiding**
  - Photometry of the brightest stars (<~8 mag)

# PLATO 2.0 Instrument

Mounting on optical bench,
Design study (final tbd):



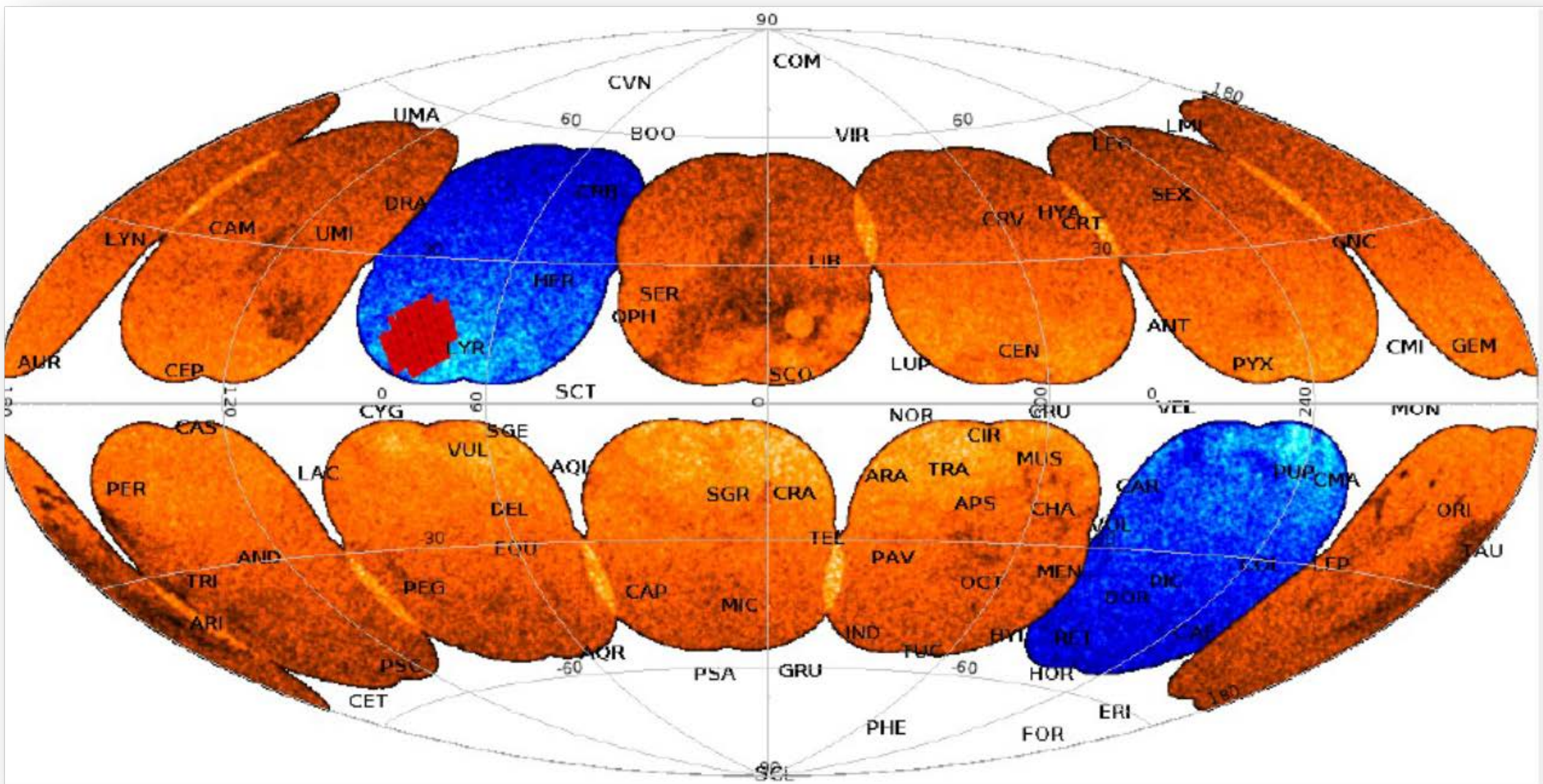
Field-of-view:




Telemetry using K band: 436 Gbit/day

# PLATO 2.0 Sky

- A baseline observing strategy has been defined for mission design:
  - 6 years nominal science operation:
    - 2 long pointings of 2-3 years
    - step-and-stare phase (2-5 months per pointing)
- The final observing strategy will be fixed ~3 yrs (tbd) before launch.



V. Nascimbeni, GP. Piotto

# Total Stellar Samples requirements

| long pointings | step & stare | mag | Noise in central field | spectral type |
| --- | --- | --- | --- | --- |

P1: 20 000 stars

P2: 1 000 stars

**Exoplanet characterization and asteroseismology**

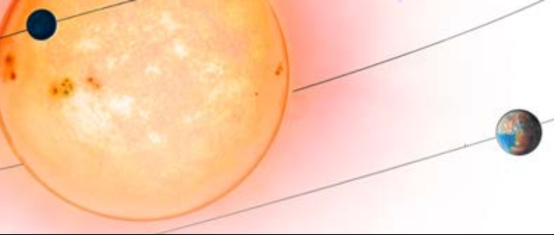
P4: 5 000 stars
V<16

**M dwarf host star sample**

P5*: 245 000 stars

**Exoplanet statistics and stellar science**

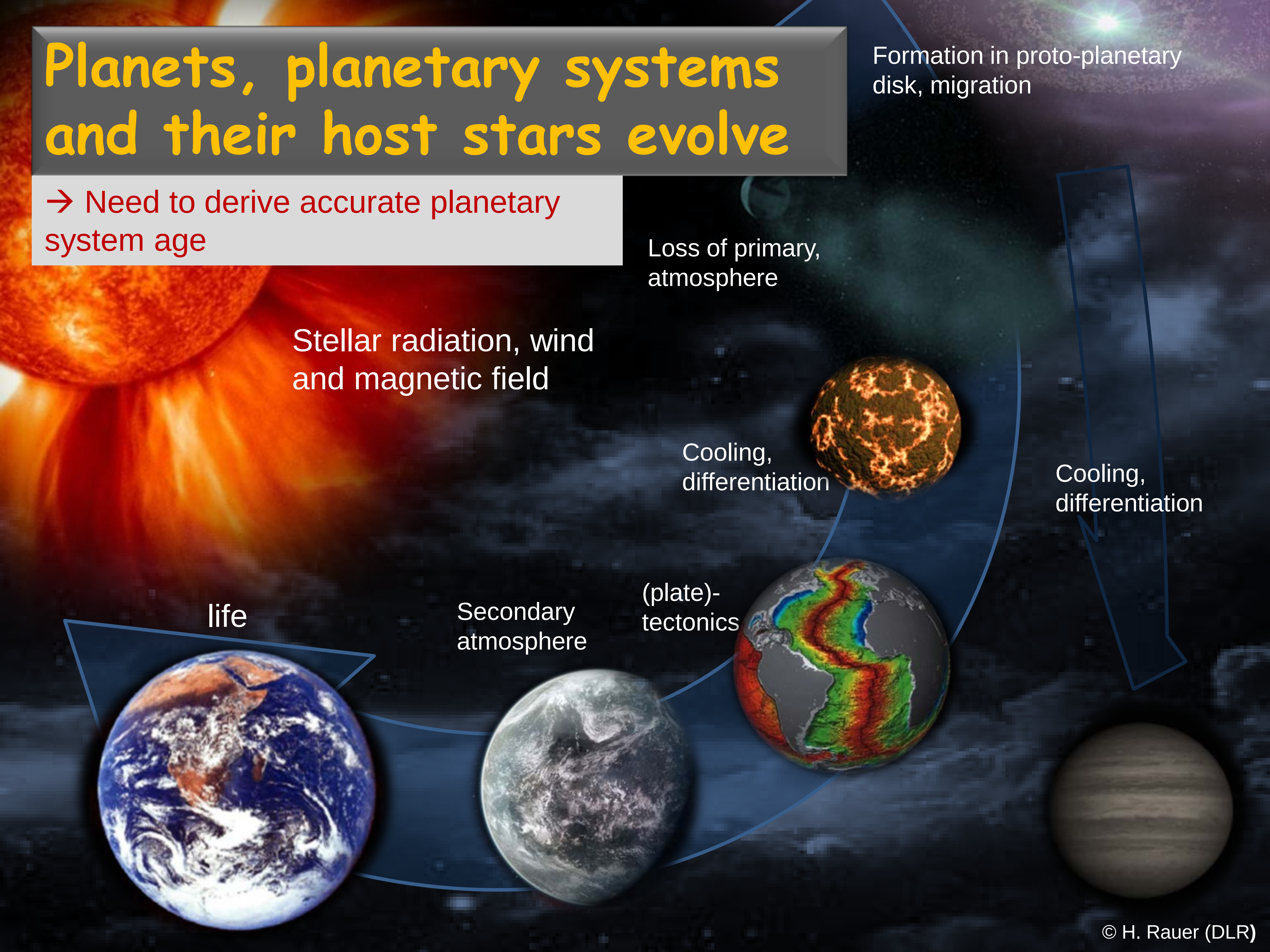
No requirements, adding these leads to ~1,000,000 lightcurves total



# Total Stellar Samples requirements

| long pointings | step & stare | mag | Noise in central field | spectral type | Data download for core sampel |
|---|---|---|---|---|---|
| P1: 20 000 stars | P1: 66000 stars | V<11 | 34 ppm | F5/K7 | Imagette 25s |
| P2: 1 000 stars | P3: 3 000 stars | V<8 | 34 ppm | F5/K7 | Imagette 2.5s, 25s |
| P4: 5 000 stars V<16 | 5000 stars V<15 | V<15 V<16 | 800 ppm | M | Imagette 25s |
| P5*: 245 000 stars | P1: 881000 stars | V<13 | | F5/K7 | Light curves, 600s, 50s |

(Pink boxes:) No requirements; adding these leads to ~1,000,000 lightcurves total


Planets, planetary systems and their host stars evolve
→ Need to derive accurate planetary system age
Formation in proto-planetary disk, migration
Loss of primary, atmosphere
Stellar radiation, wind and magnetic field
Cooling, differentiation
Cooling, differentiation
(plate)-tectonics
Secondary atmosphere
life
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# Exoplanet Space Missions and Space Observatories