ÖAW – AUSTRIAN ACADEMY OF SCIENCES

EXOPLANET CHARACTERISATION AND EVOLUTION

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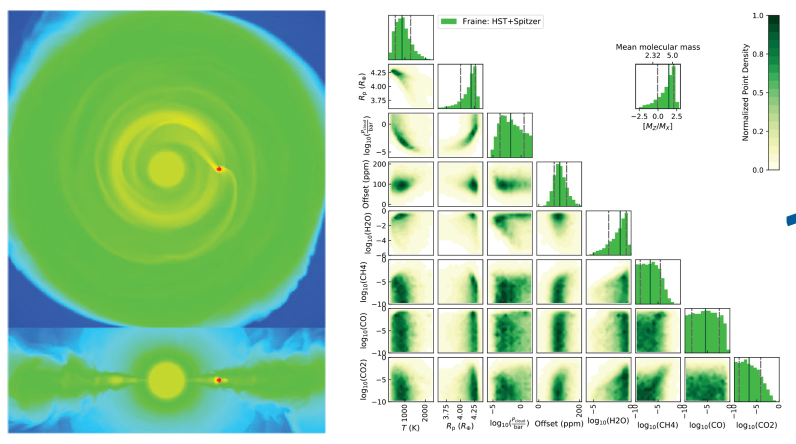
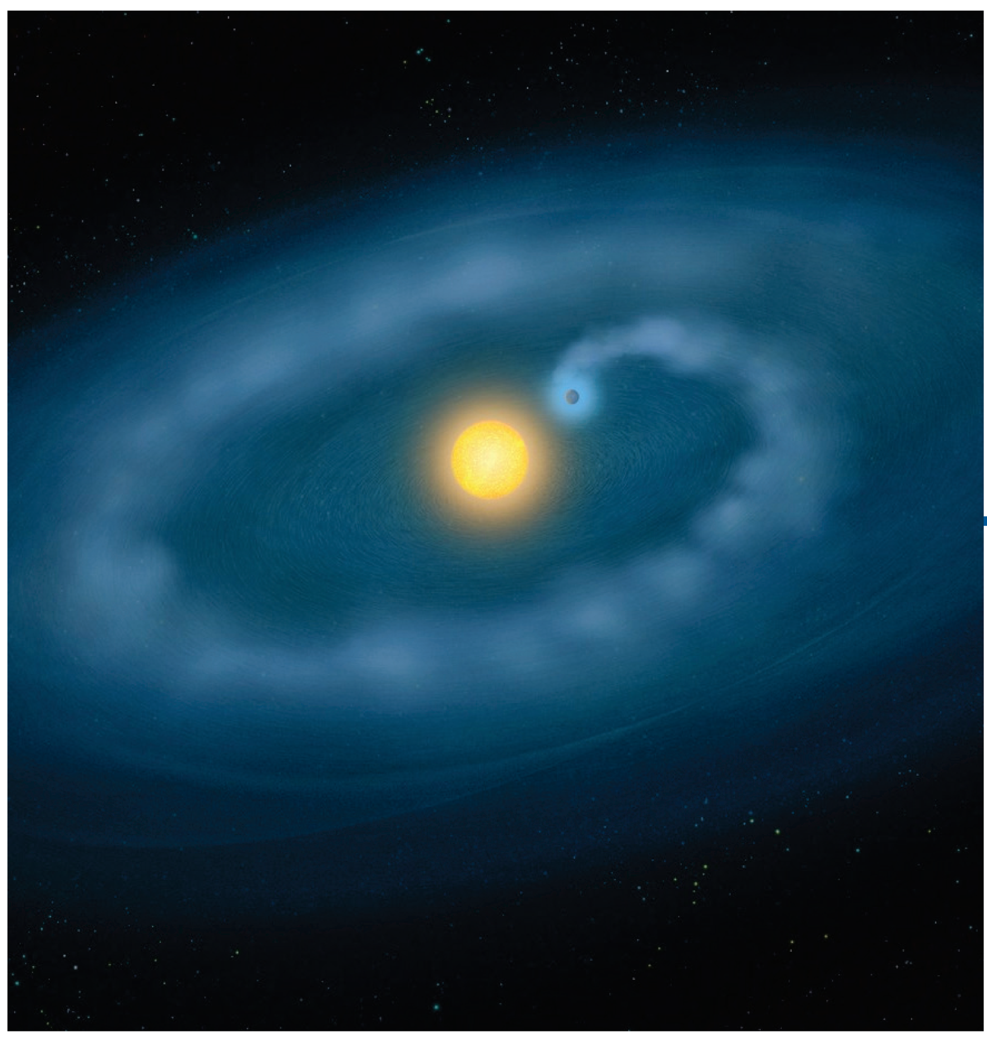
MORE ABOUT US

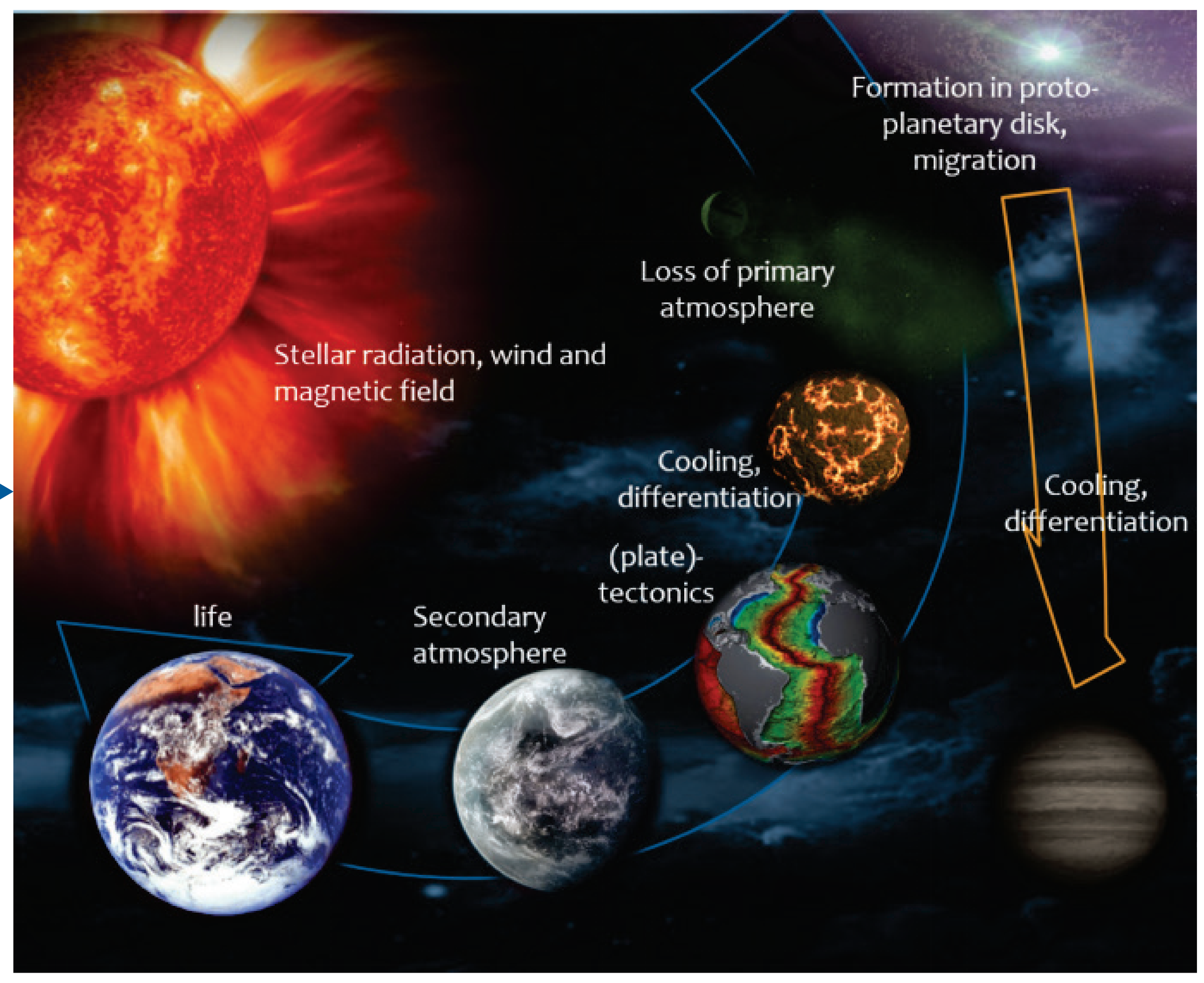
OBSERVATIONS (1)



THEORY (2)



ATMOSPHERIC PROPERTIES AND MASS LOSS (3)



ATMOSPHERIC EVOLUTION (4)

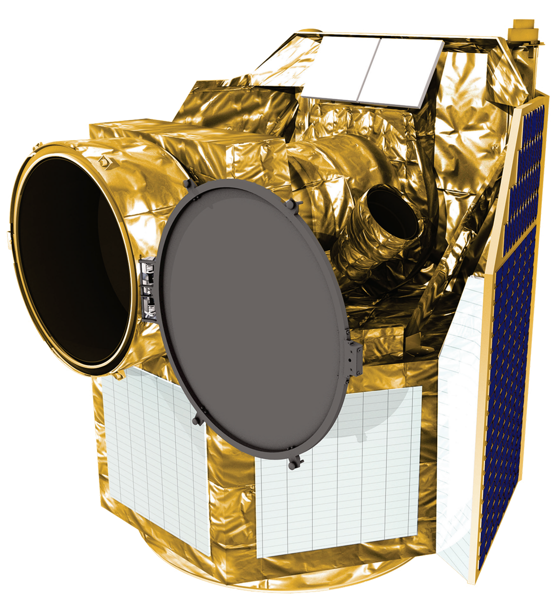
MAIN RESEARCH QUESTIONS

- **Which is the physical and chemical structure of exoplanetary atmospheres?**
- **How do exoplanetary atmospheres evolve with time?**
- **How do exoplanets interact with their host stars and how does this influence the evolution of exoplanetary atmospheres?**
- **Which is the impact of atmospheric evolution on the observed exoplanet population?**

MISSION INVOLVEMENT

CHEOPS (ESA) - 18 December 2019

- Optical transit photometry (targeted)
- Study the internal structure & atmospheric evolution of Neptune- to Earth-size planets; constrain atmospheric properties of close-in giant planets
- Development of the science program; determination of the host stars parameters; data analysis and interpretation

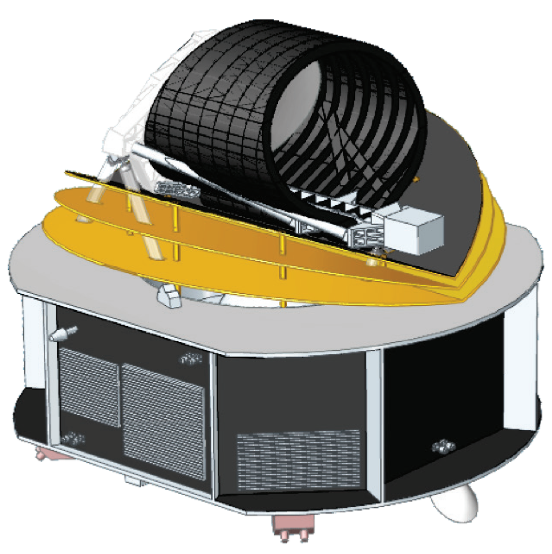


CUTE (NASA) - 27 September 2021

- Near-ultraviolet transmission spectroscopy
- Constrain the properties of the uppermost layers of exoplanet atmospheres to study loss and evolution
- Development of the data simulation, signal-to-noise calculator, data reduction/analysis pipeline; development of the science program; routine data quality checks; data analysis and interpretation

PLATO (ESA) - due for launch in 2026

- Optical transit photometry (survey)
- Search for exoplanetary transits and in particular of Earth-size planets orbiting Sun-like stars
- Development of some of the data interpretation tools; determination of the host stars properties



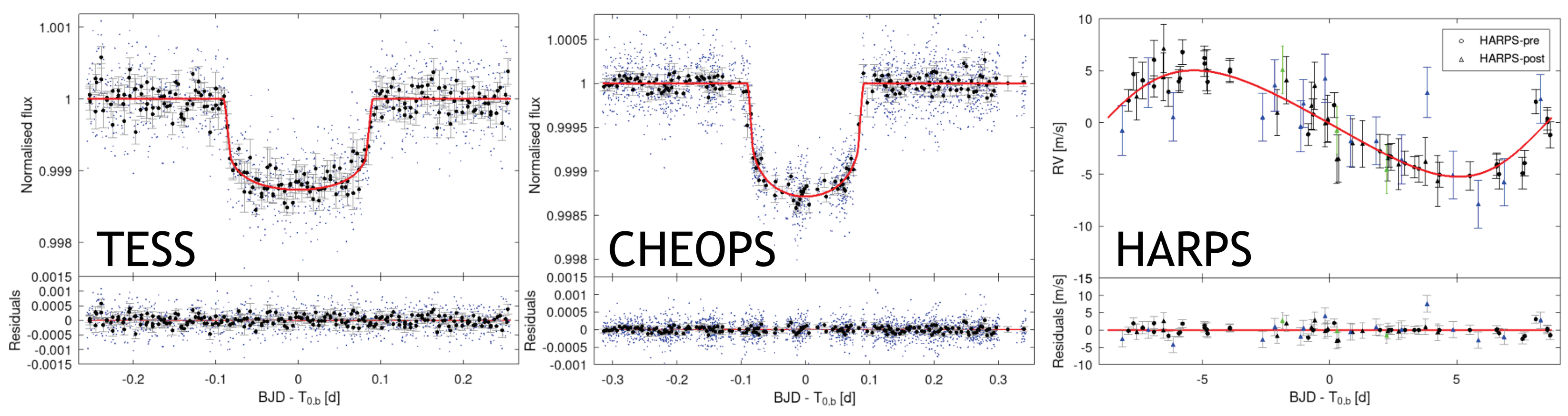
ARIEL (ESA) - due for launch in 2029

- Optical and infrared transmission spectroscopy
- Measure atmospheric chemical composition to constrain planet formation processes and location
- Development of data analysis & interpretation tools; determination of the host stars properties

CHARACTERISATION OF TOI-1055B WITH HARPS, TESS, AND CHEOPS (1,4)

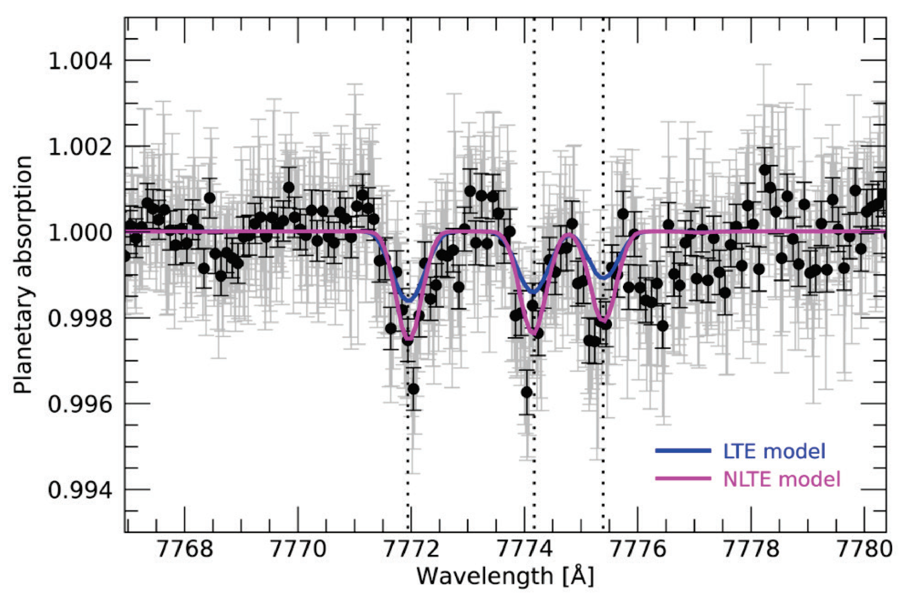
TOI-1055b is a Neptune-size planet on a 17.5-day orbit around a Sun-like star. From HARPS, TESS, and CHEOPS data, we derive a mass of $20.4\pm2.6\ M_\oplus$ and a radius of $3.490\pm0.067\ R_\oplus$, and thus a mean density of 2.65 ± 0.36 g cm^{-3}. Therefore, TOI-1055b likely hosts a substantial gas envelope of $0.41\pm0.27\ M_\oplus$ and a thickness of $1.05+/-0.29\ R_\oplus$.

Bonfanti et al. 2023, A&A.



OI DETECTION IN THE ATMOSPHERE OF THE HOTTEST KNOWN GIANT PLANET (1,2,3)

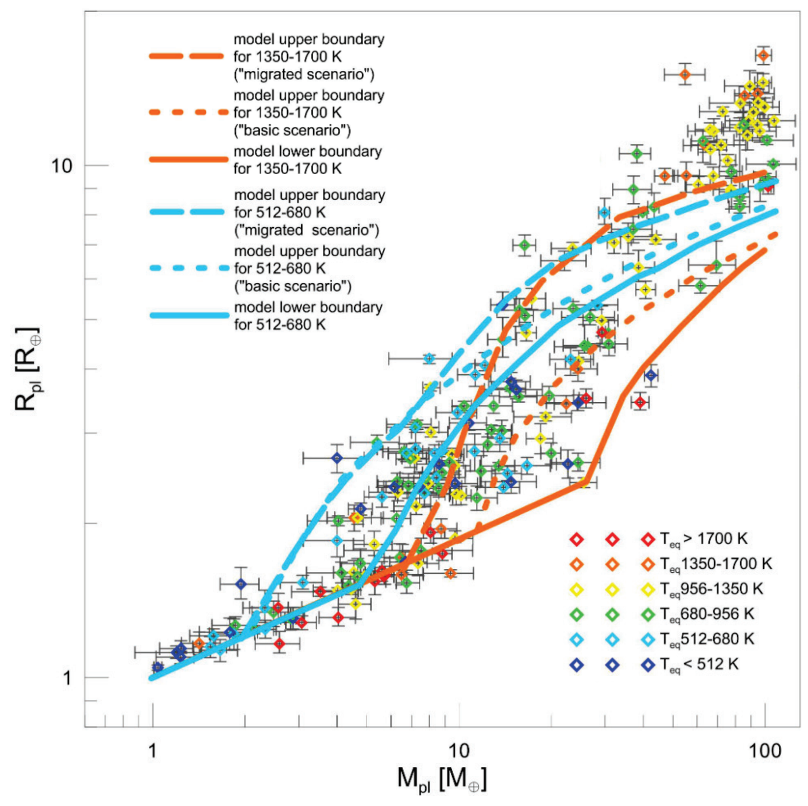
We detect the OI 777.4 nm triplet in the transmission spectrum of the ultra-hot Jupiter KELT-9b. Our NLTE radiative transfer model fits the data significantly better than the one computed assuming LTE. We derive a mass-loss rate of 10^8-10^9 kg s^{-1} and a micro- and macro-turbulence broadening of 3.0 ± 0.7 km s^{-1} and 13 ± 5 km s^{-1}, respectively, indicative of the presence of fast winds in the middle and upper planetary atmosphere.



Borsa, Fossati et al. 2021, Nature Astronomy.

MODELLING THE MASS-RADIUS RELATION OF INTERMEDIATE-MASS PLANETS (2,3,4)

Our planetary evolution models reproduce the observed mass-radius (MR) distribution, except for very close-in Saturn-mass planets and high-density warm (400-700 K) sub-Neptunes. We find that for $\leq 15\ M_\oplus$ planets the MR distribution depends on mass loss, while the formation parameters play a dominant role for more massive planets.



Kubyshkina & Fossati 2022, A&A.

2023

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