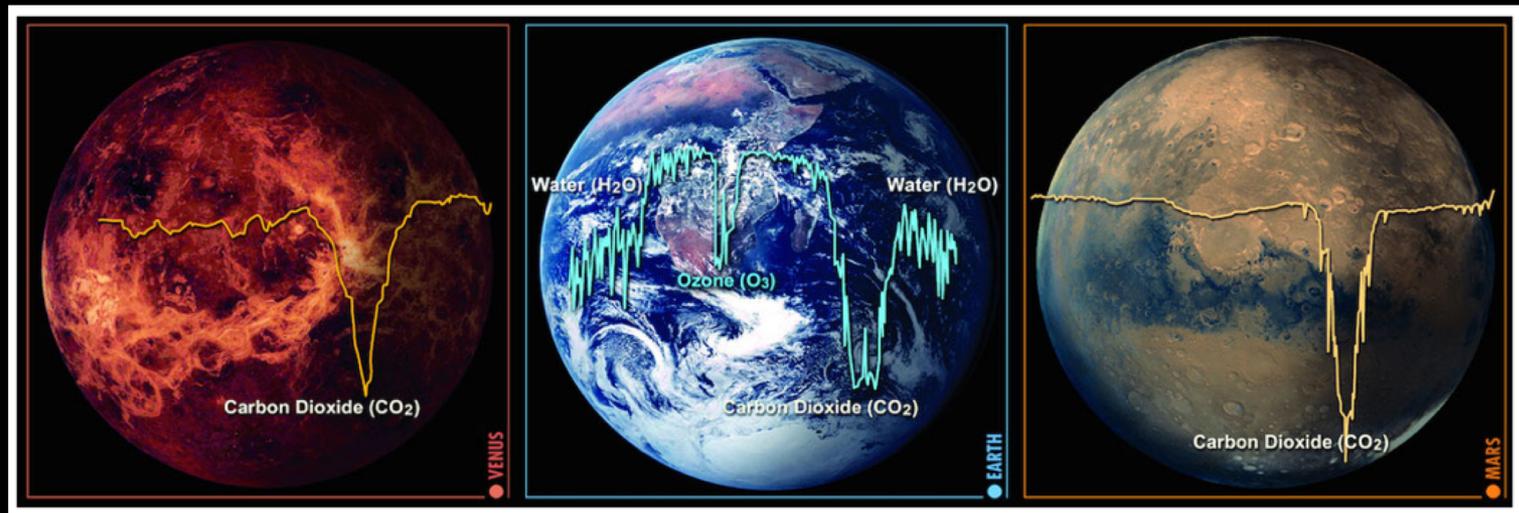


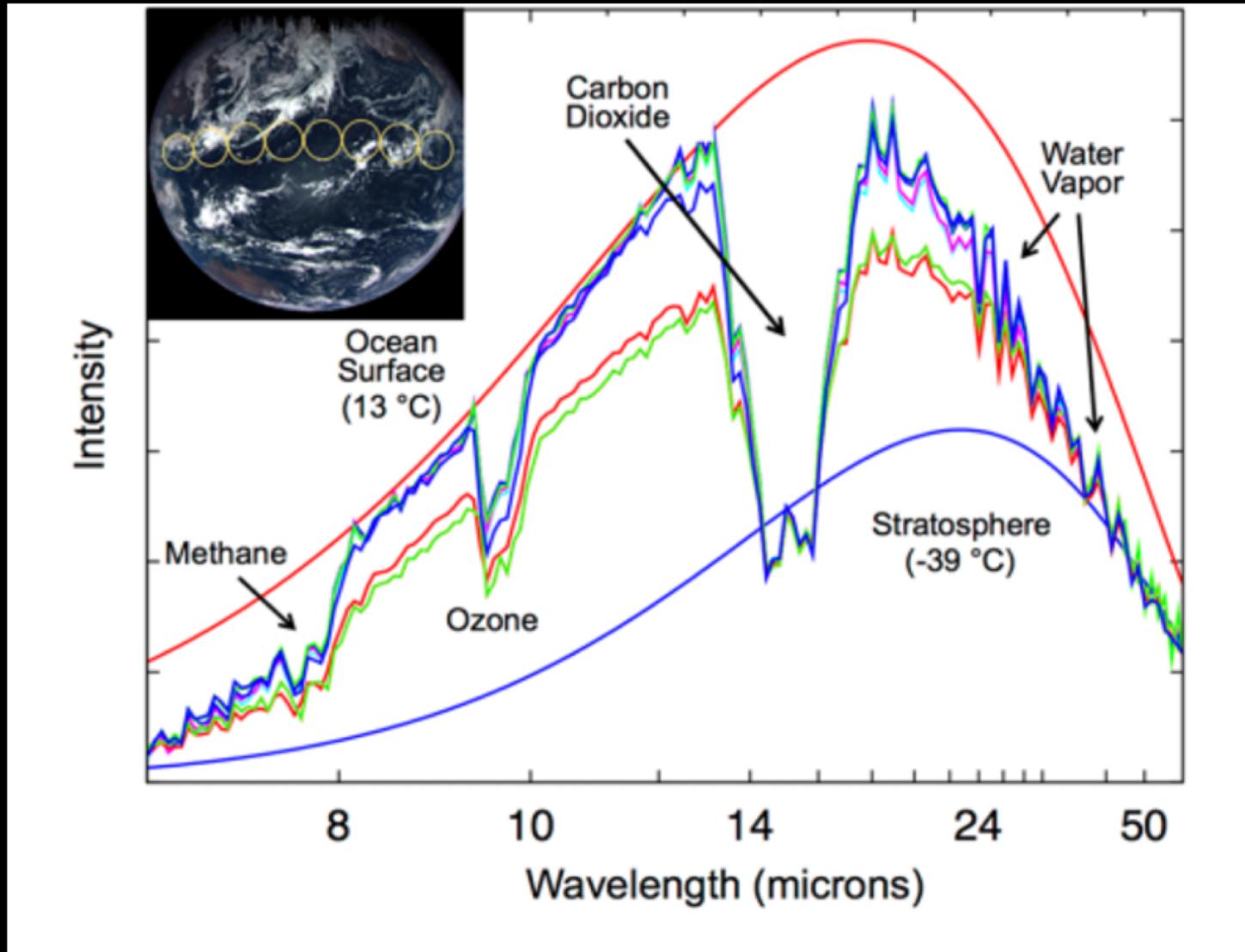
Exoplanet imaging by interferometry: diversity, habitability, and biosignatures

D. Defrère

STAR Institute, PSILab group, Liège Space Center

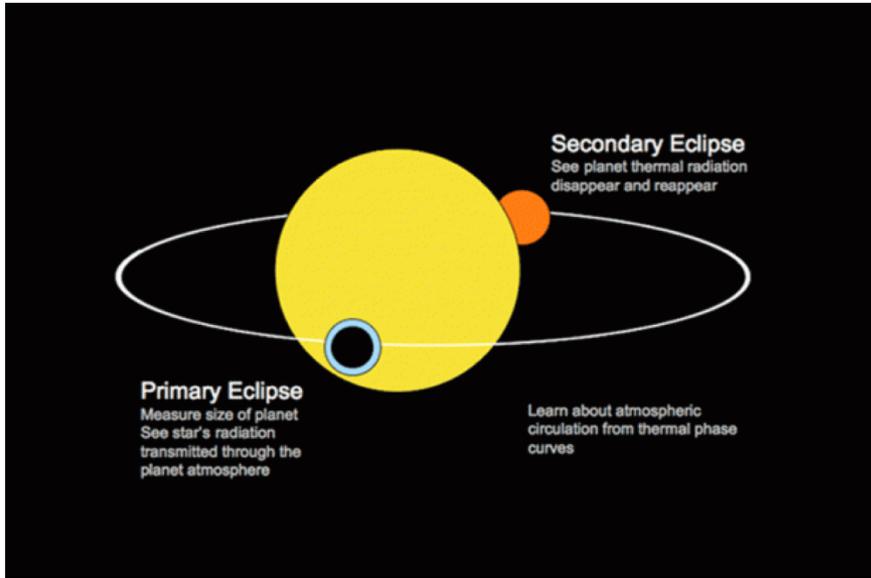


Earth observed from outer space

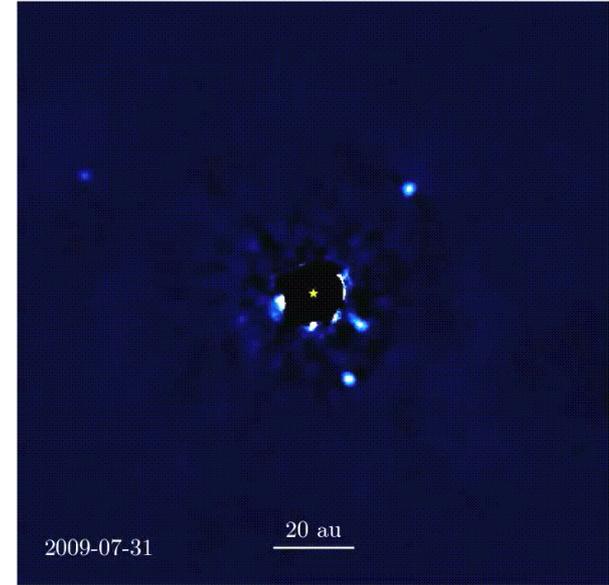


Exoplanets: How to measure their photons?

Time differential techniques

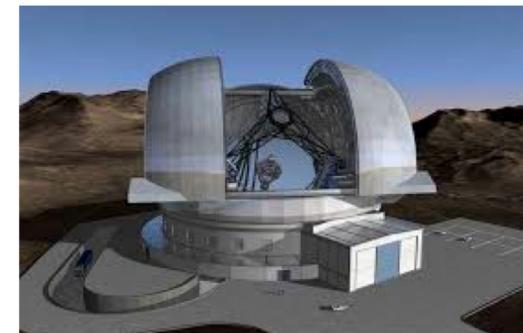


Angular differential techniques

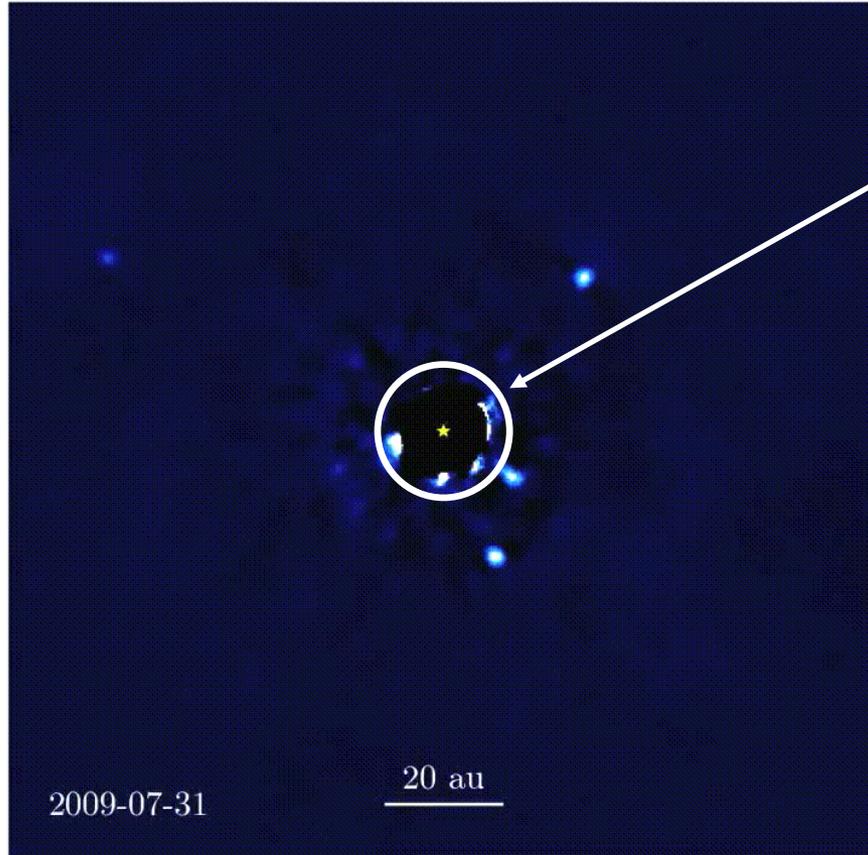


ELT

(see Olivier Absil's talk)

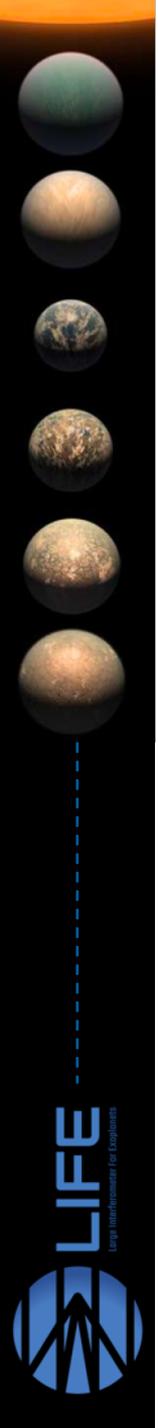


Interferometry: why?



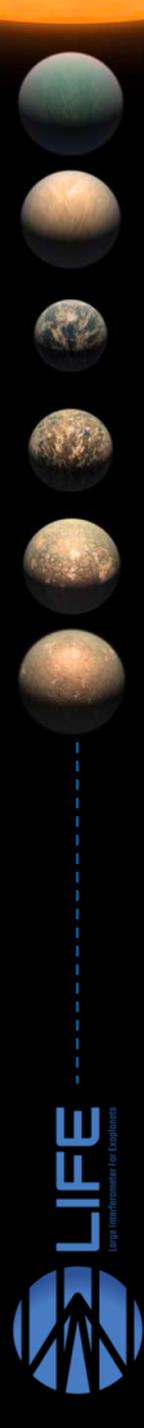
Zone probed by
interferometry

- **Habitable zone** of nearby Sun-like stars;
- Peak of the exoplanet occurrence distribution.



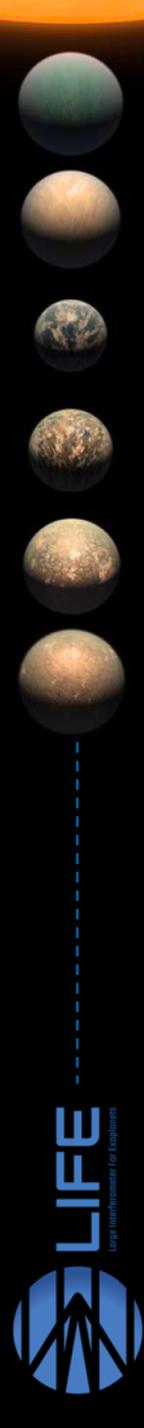
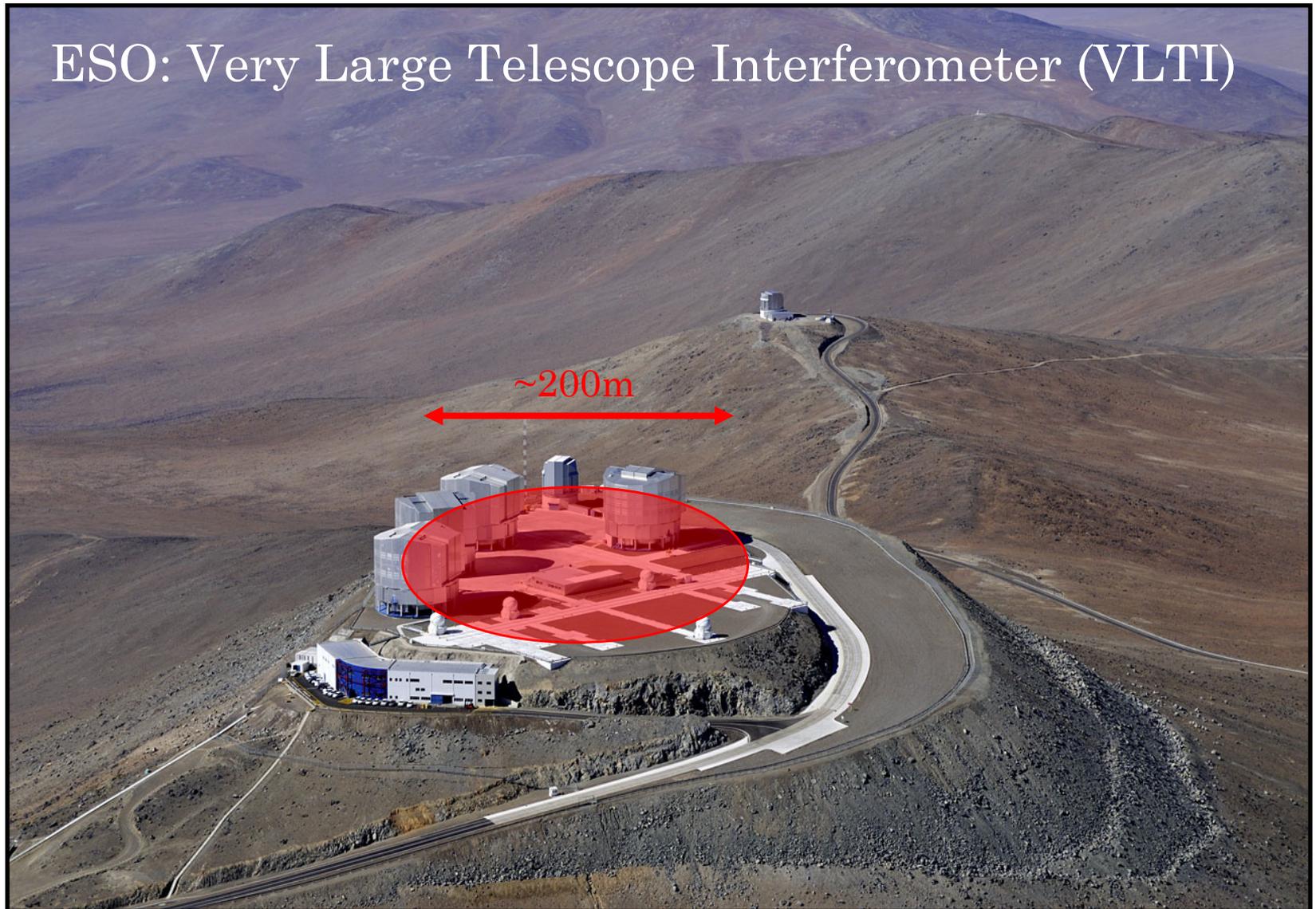
Interferometry: how?

ESO: Very Large Telescope Interferometer (VLTI)



Interferometry: how?

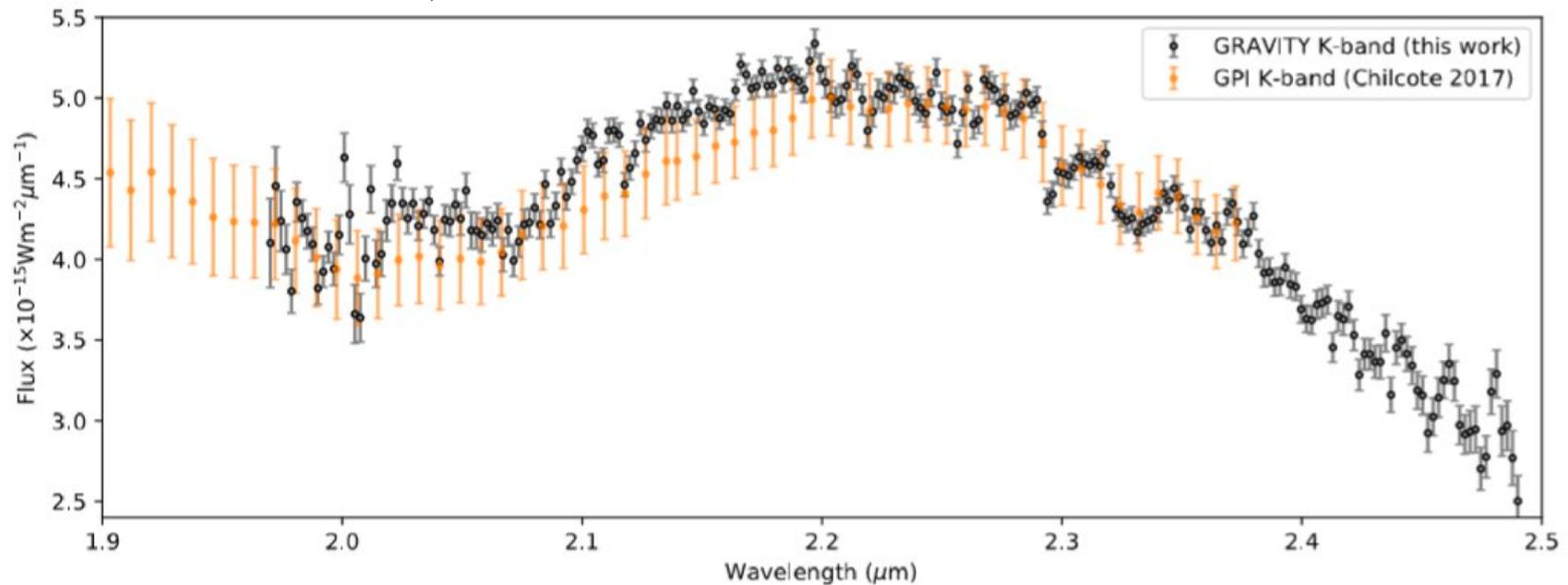
ESO: Very Large Telescope Interferometer (VLTI)



Interferometry: a new paradigm

β Pic b with VLTI/GRAVITY

Lacour et al. 2019, Nowak et al. 2019



- $\sim 5x$ more precise photometry
- Detection of CO and H₂O!
- Extreme astrometric precision

Interferometry: short-term prospects

Hi-5 (Defrère et al. 2018), a new high-precision interferometric instrument for the VLTI

- Increase the number of observable targets
- Precision spectroscopy and astrometry
- Constrain planet formation models
- Received fundings by ERC ((2020-2025))

Hi-5

High-contrast Interferometry
up to 5 microns



Interferometry: long-term prospects

Hi-5

High-contrast Interferometry
up to 5 microns



Demonstration of data
acquisition and data
processing techniques

- Space version of SCIFY
- Uliège Technical lead
- Submitted to “Voyage 2050”



AMBITION

- 3x number of targets -
- Precision spectroscopy -
- Precision astrometry -
- Planet formation models -



AMBITION

- Terrestrial exoplanets -
- Habitability -
- Biosignatures -
- Prevalence of Life -



Europe is a strong position to lead this effort

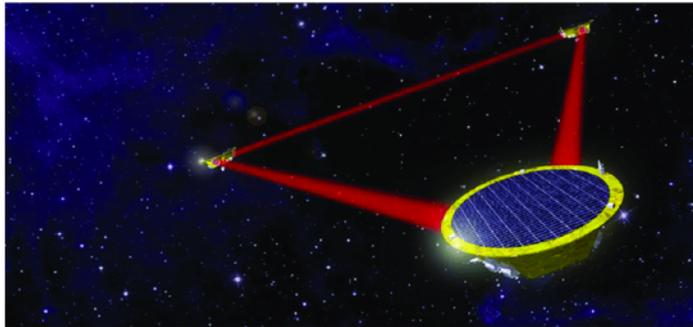
Formation flying – Proba 3



Precision interferometry (ESO's VLTI)



Space interferometry -- LISA

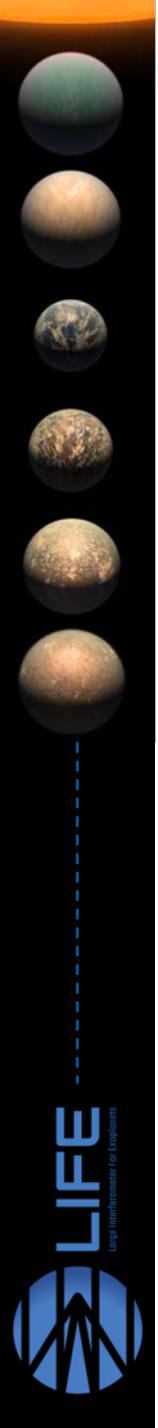


MIR instruments



Cryogenics (ESA's Herschel)





Thank you!