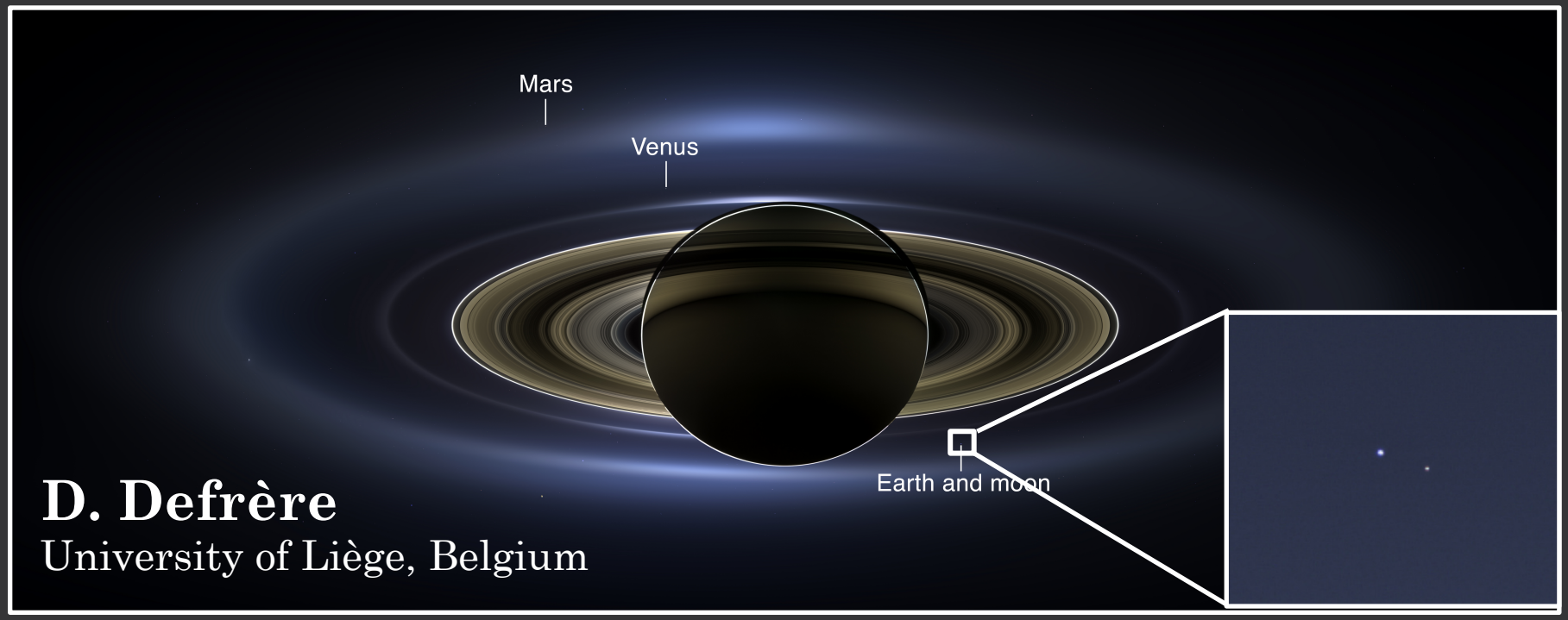
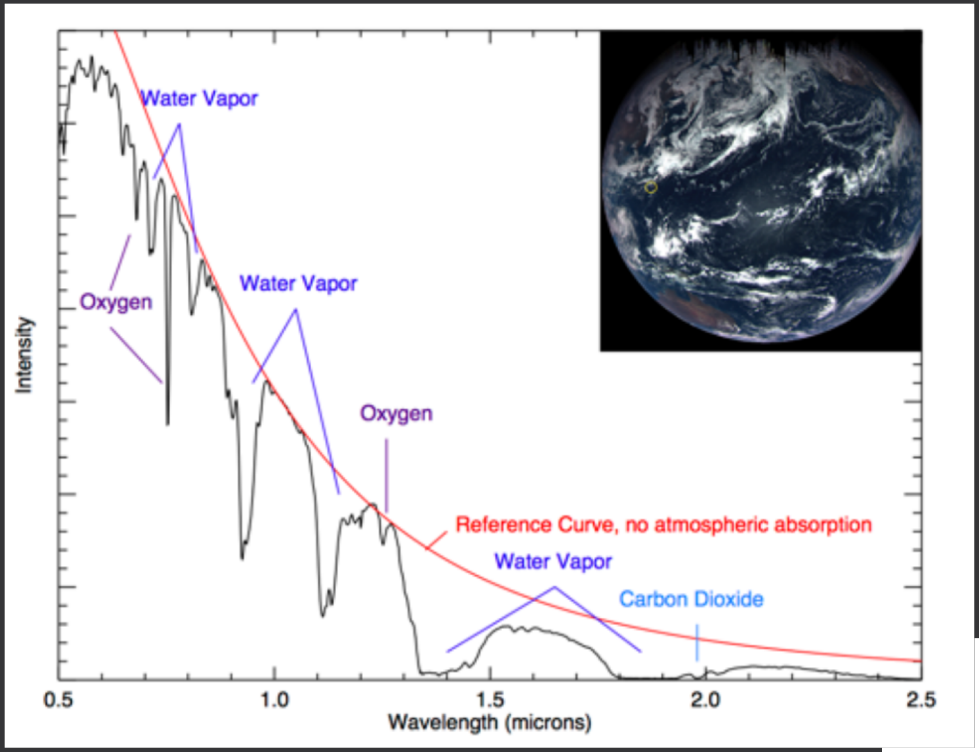
LIFE
Large Interferometer For Exoplanet



D. Defrère
University of Liège, Belgium

STAR meeting -- February 4th 2019 -- Liège

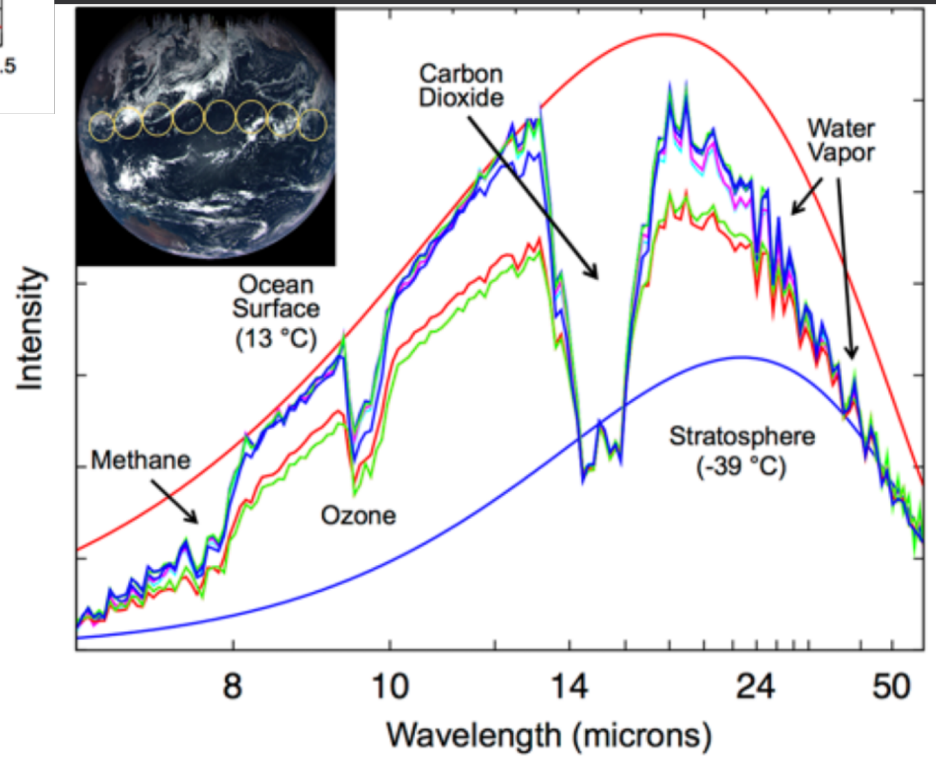


OSIRIS-Rex **optical** spectrum

- Evidence of gas-phase H_2O over the entire planet.
- Substantial concentration of O_2

OSIRIS-Rex **infrared** spectrum

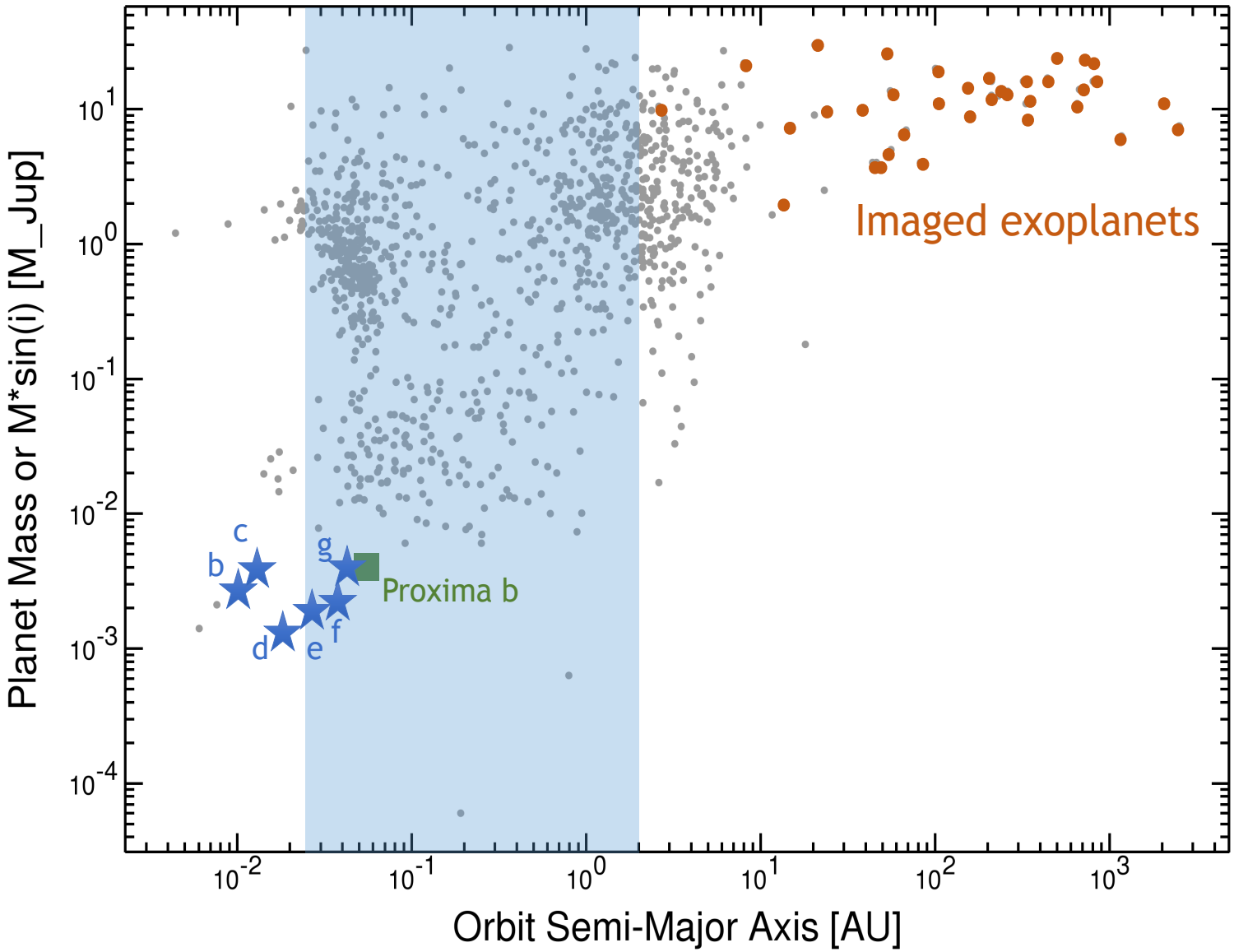
- Evidence of CO_2, O_3 , CH_4, and H_2O
- Atmosphere transparent between 8.3 and 12.5 µm (probe of surface temperatures)



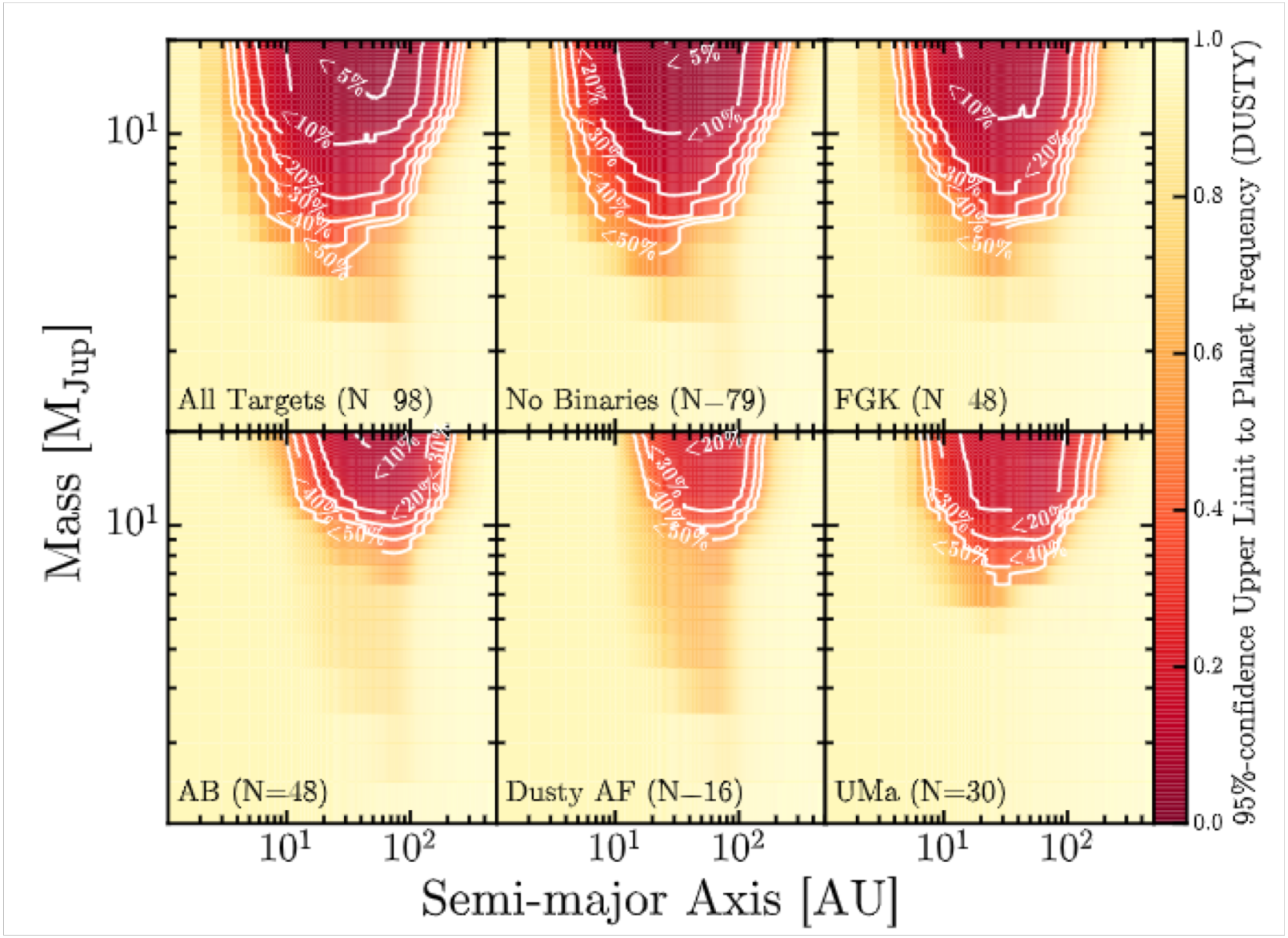
Lauretta et al. 2018

Credit: NASA/Goddard/University of Arizona/Arizona State

Current status

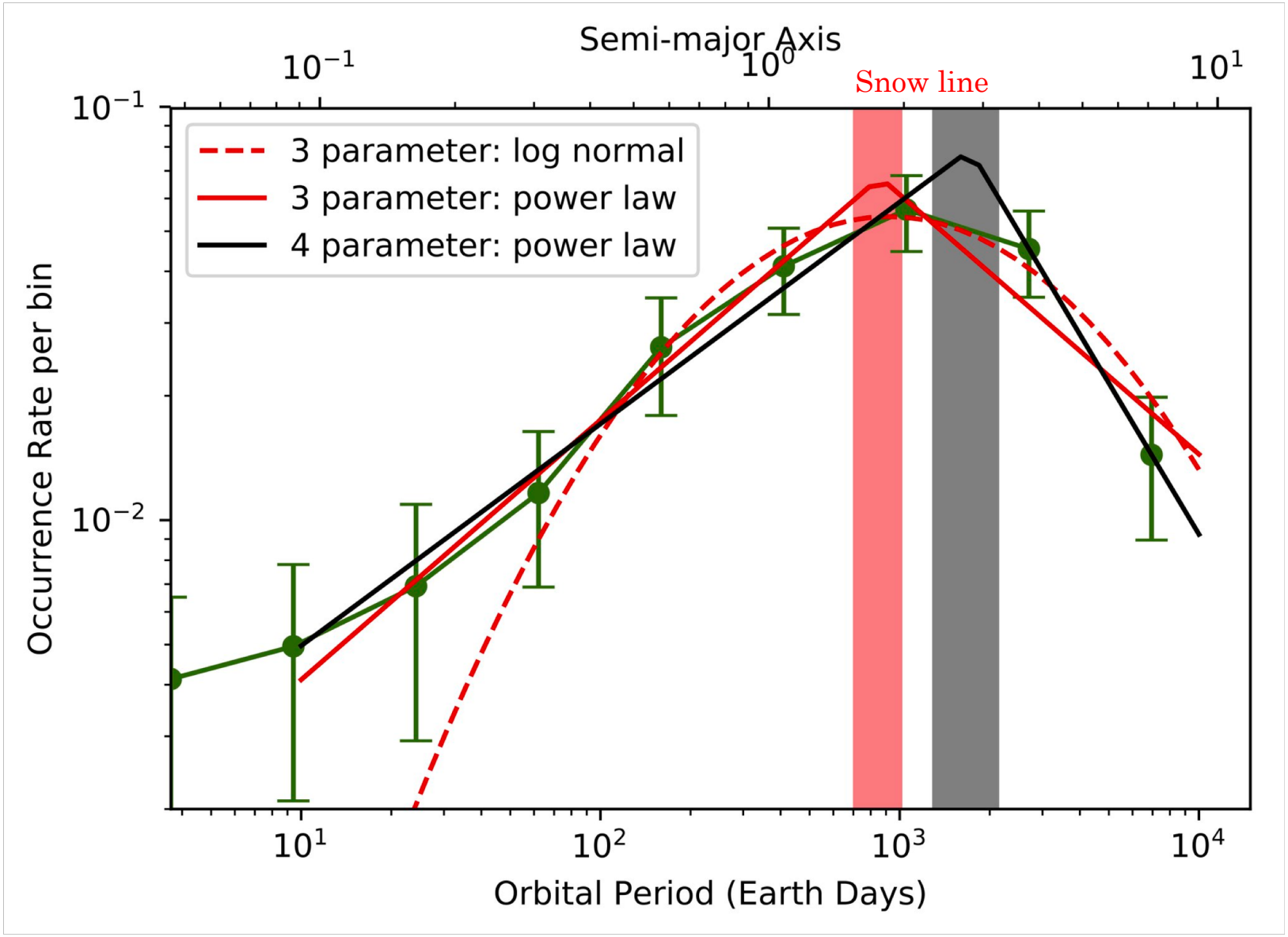


Current status



LBT survey (Stone et al. 2018)

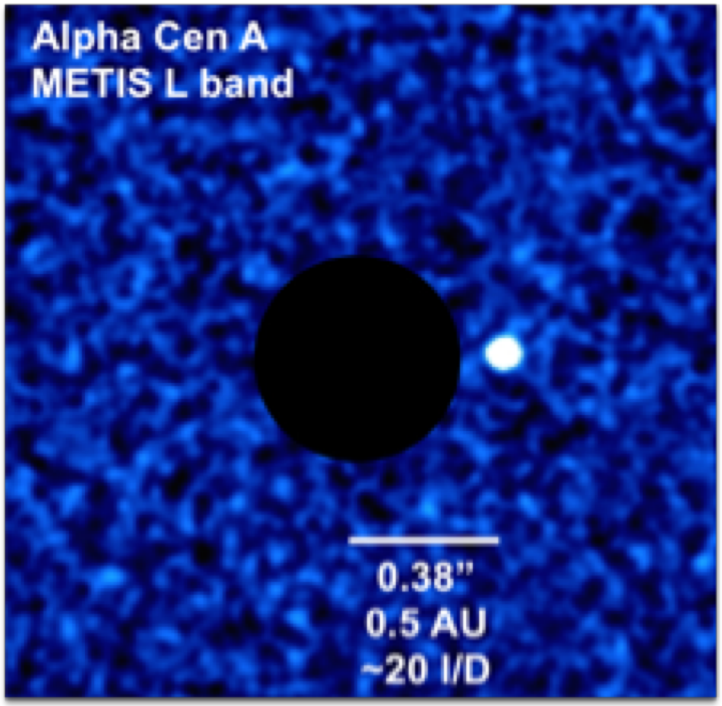
Current status

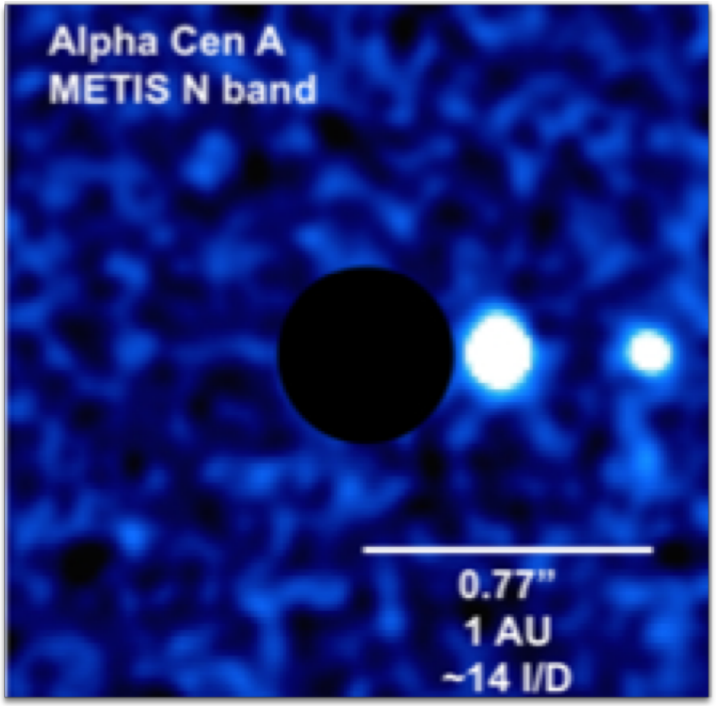


(Mulders et al. 2019)

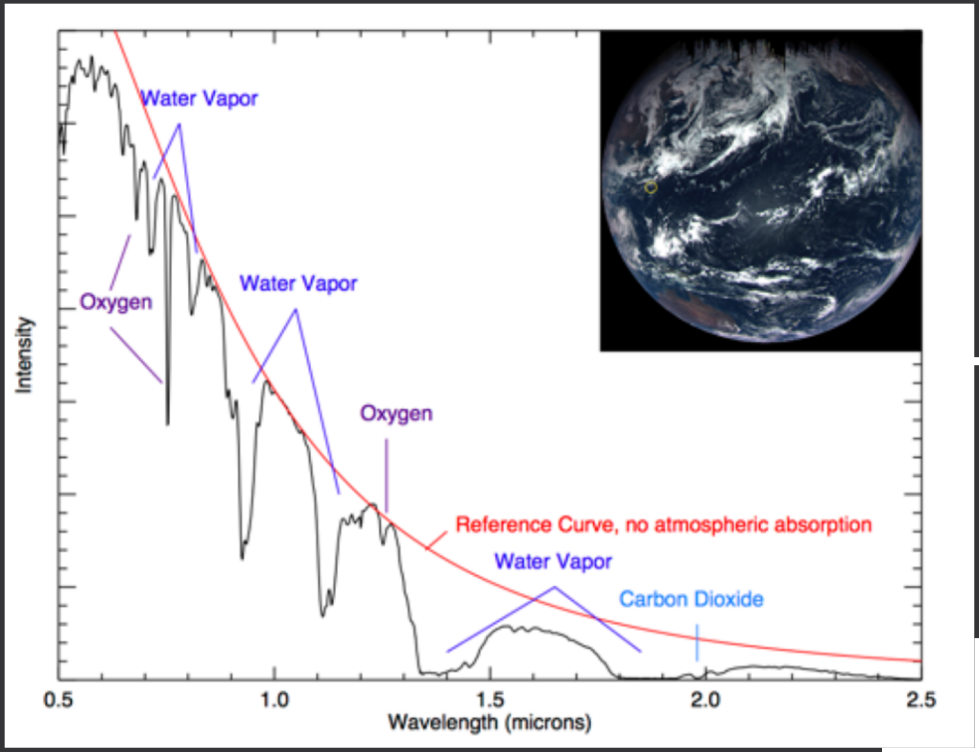
The “near” future

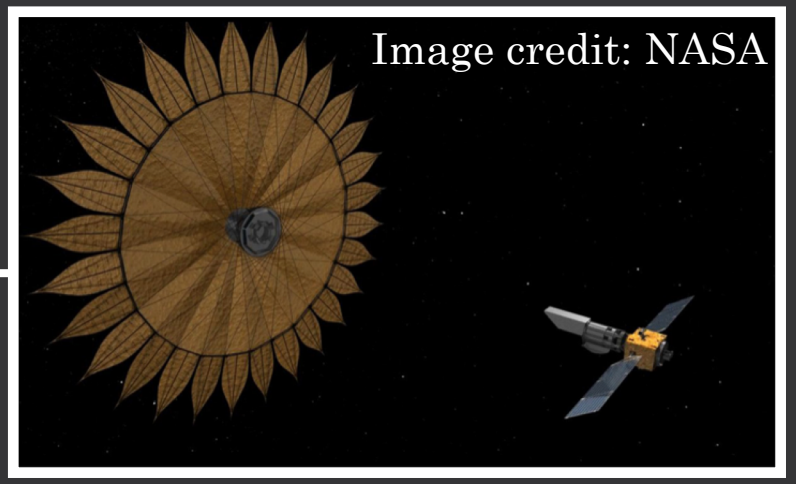
METIS
Mid-infrared
E-ELT Imager and
Spectrograph

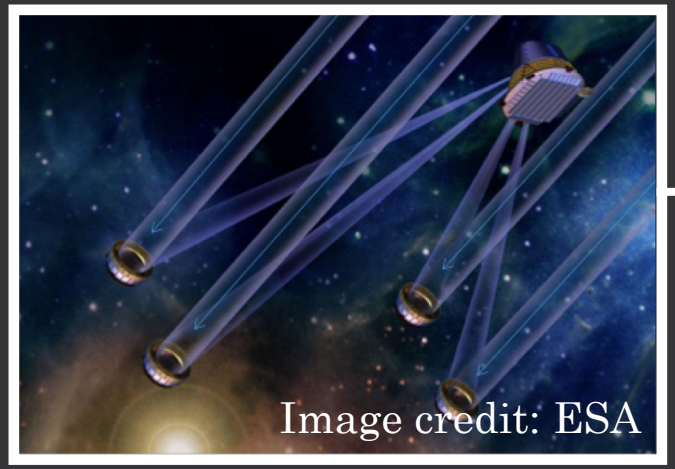


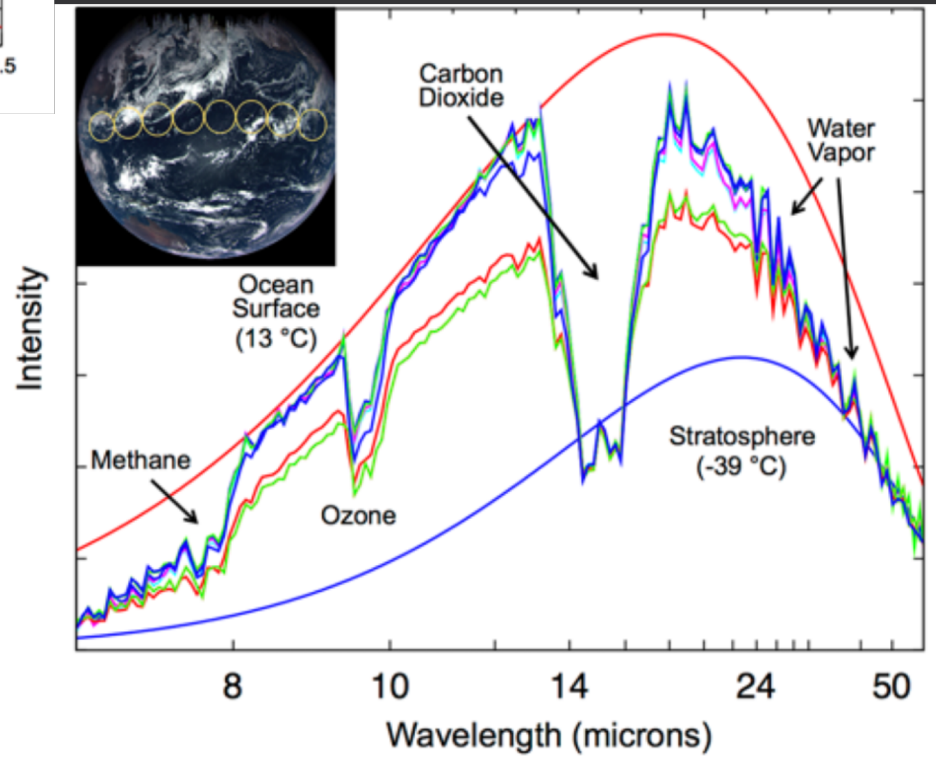


Quanz et al. 2015









Lauretta et al. 2018

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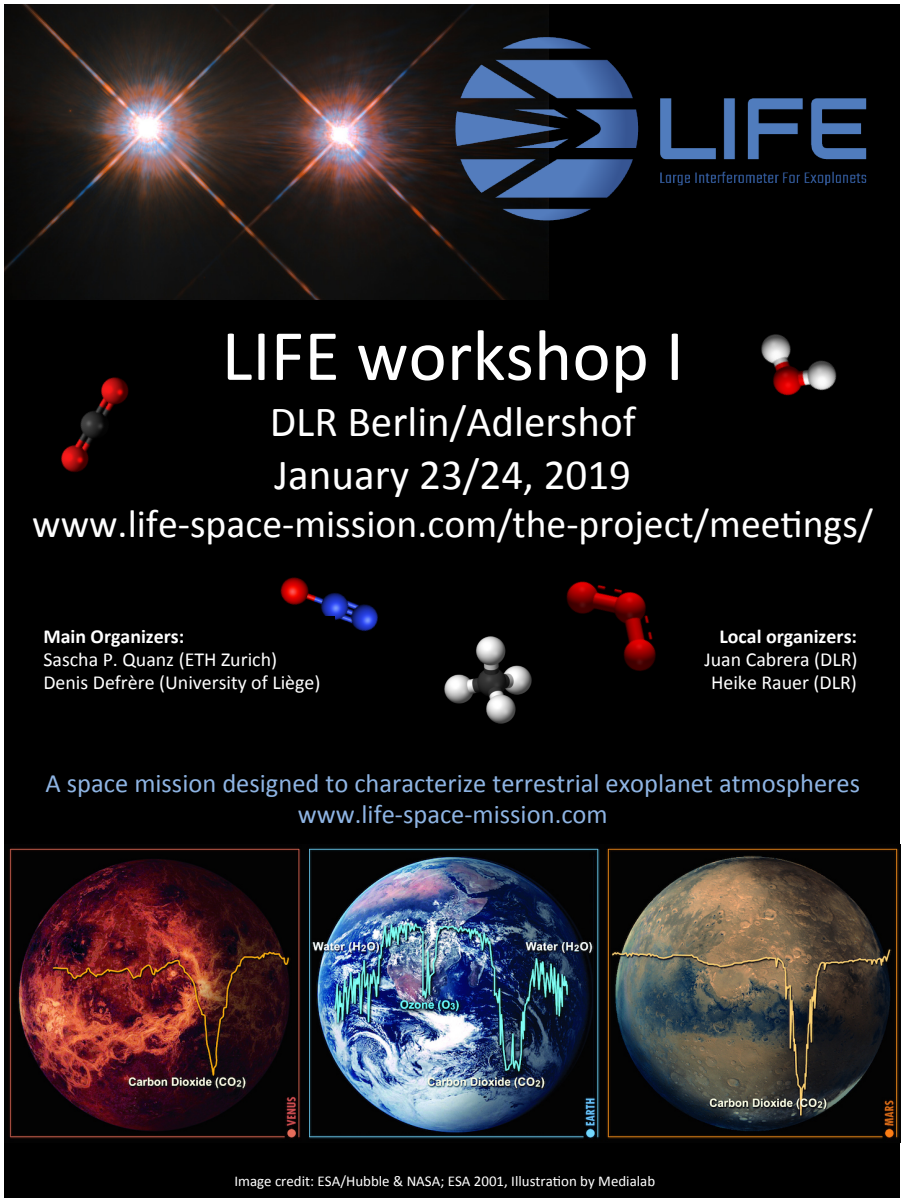
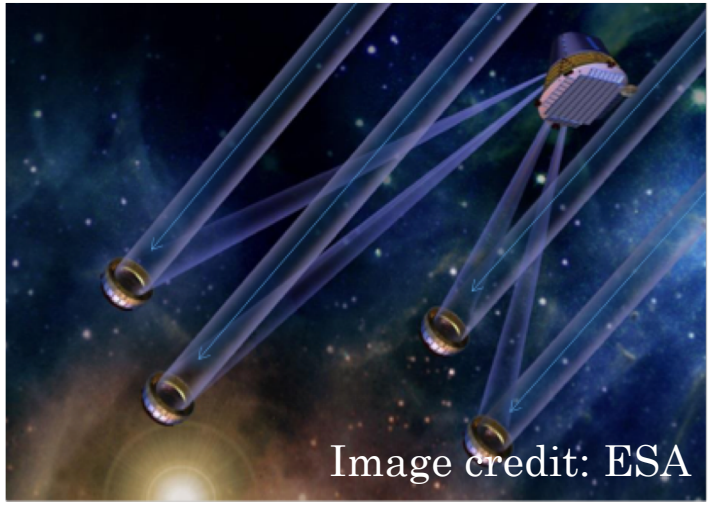
The LIFE project

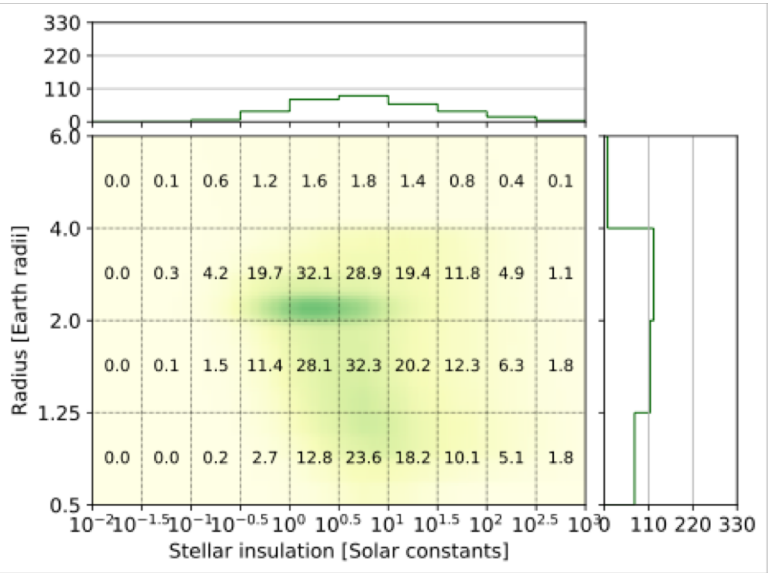




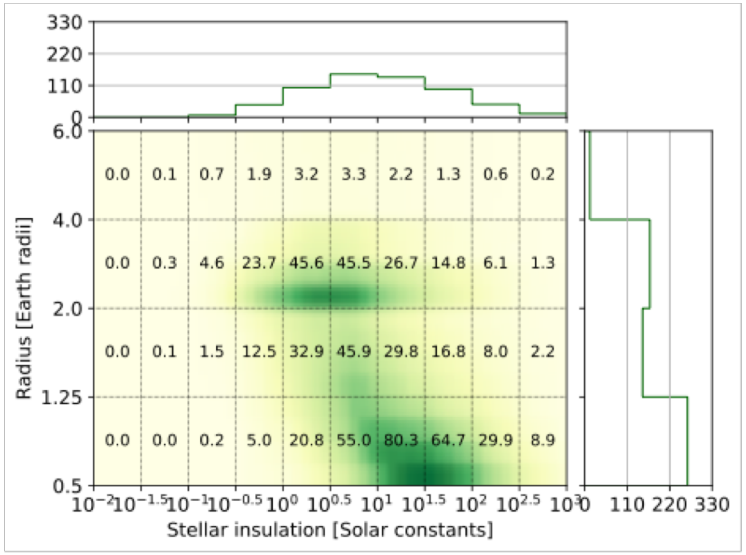
The LIFE project

- Monte-Carlo simulations based on Kepler statistics (Kammerer et al. 2018):

Population 1:
Burke et al. 2015 / Fressin et al. 2013 / Dressing & Charbonneau 2015

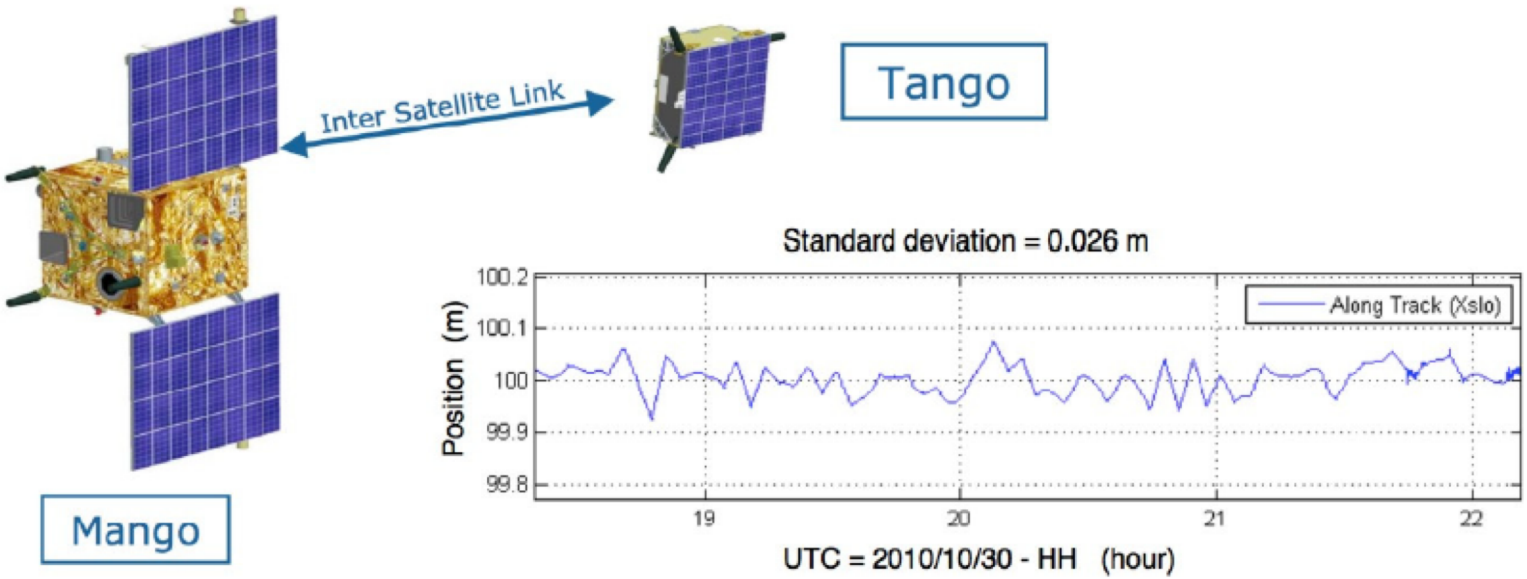


Population 2:
Hsu et al. 2018 for solar type stars (based on Q1-Q16)



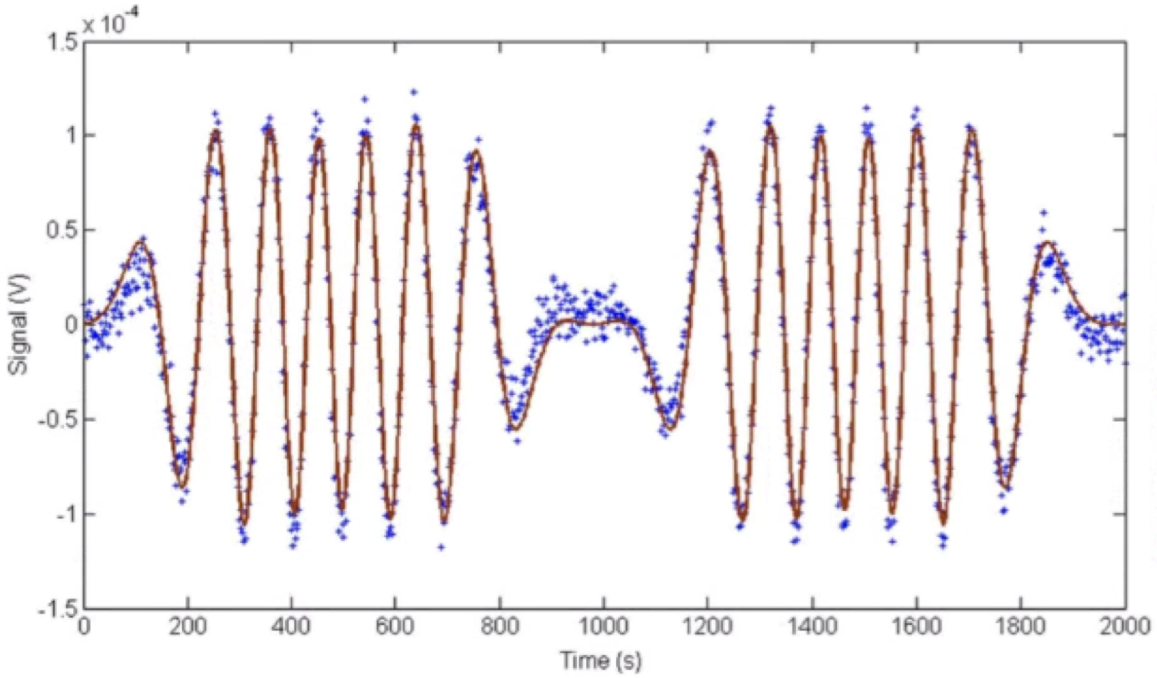
A space-based MIR could detect hundreds of planets…

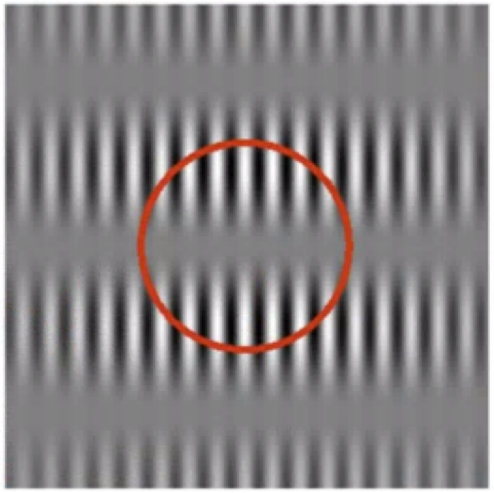
Technology readiness: formation flying



- Demonstration with PRISMA (2 spacecraft)
- RMS of a few cm, over 4 hours (limited by accuracy of radio sensor)
- PROBA-3 in 2021 (goal 100 μm RMS)

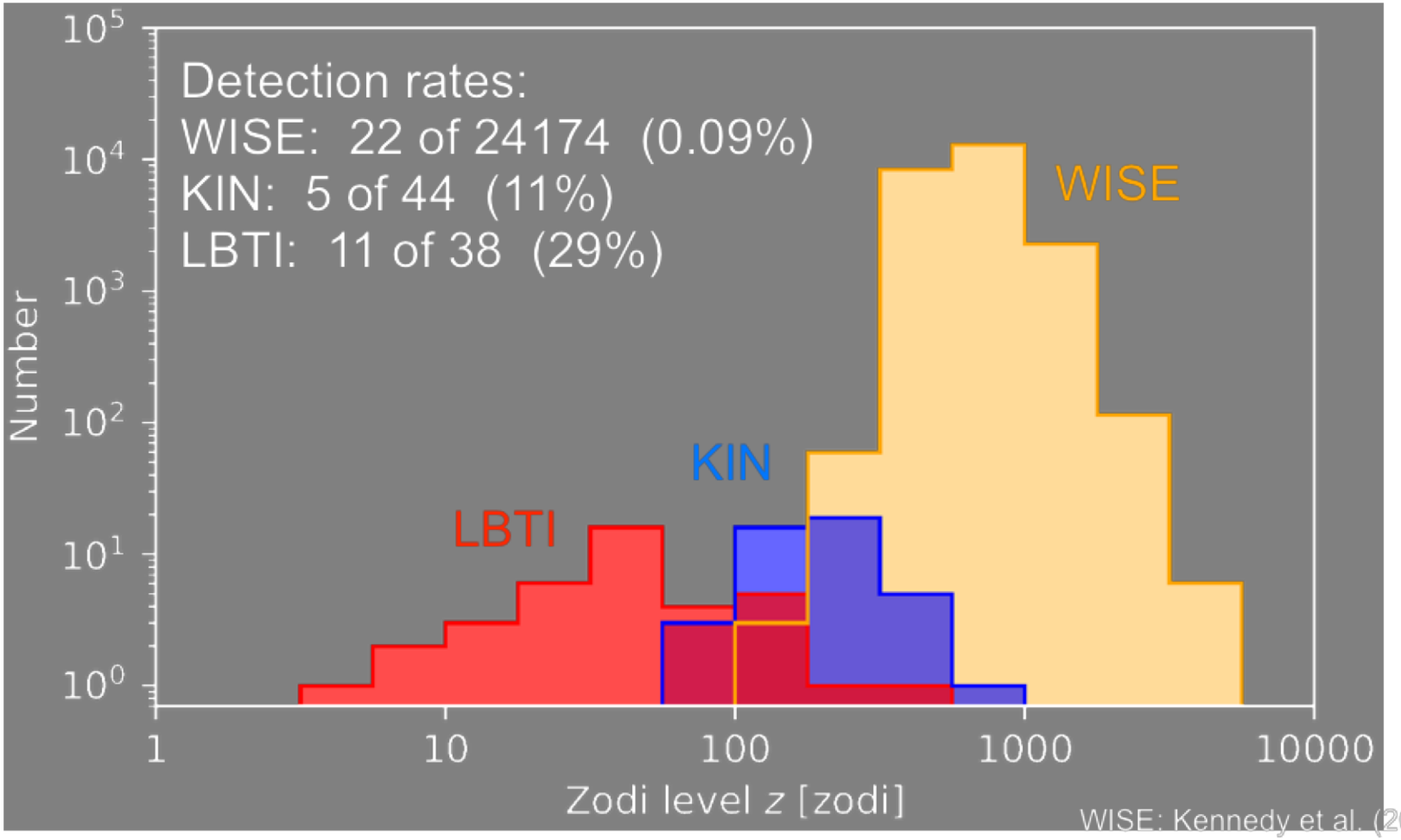
Technology readiness: starlight suppression





- Demonstration at JPL (Martin et al. 2012)
- Null depth of 8×10^{-6} (requirements 10^{-5}), 10^{-8} (after post-processing)
  - 10% bandwidth (10 microns)
  - Room temperature

Technology readiness: ground-based nulling

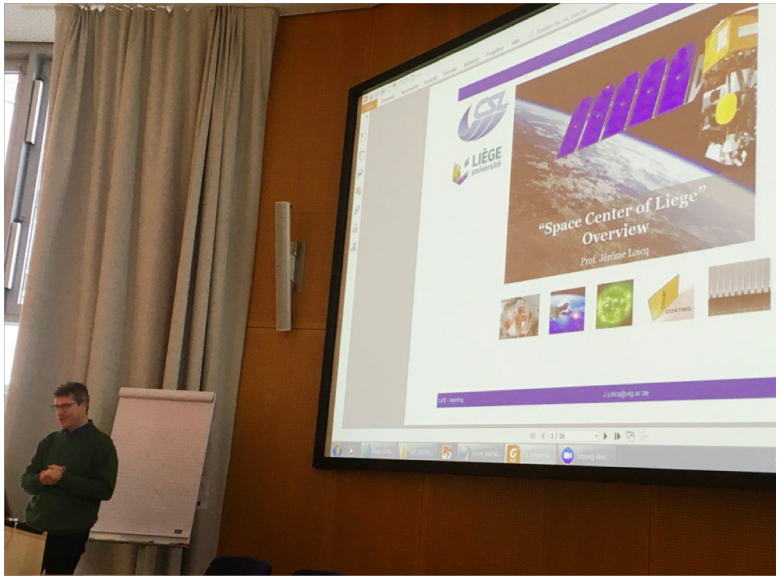


WISE: Kennedy et al. (2013)
KIN: Mennesson et al. (2014)
LBTI: full survey

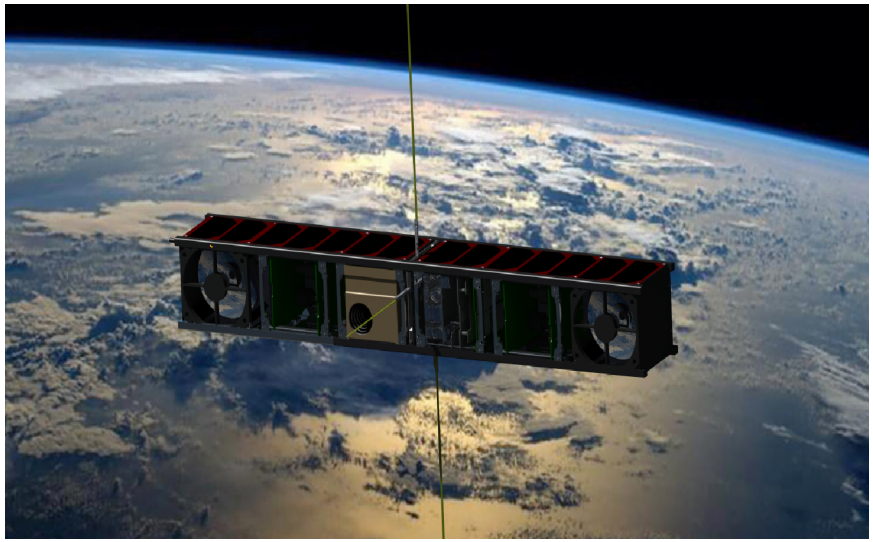
WISE: Kennedy et al. (2013)
KIN: Mennesson et al. (2014)
LBTI: Ertel et al. (2018)

Current activities @ STAR

- Technology preparation @ CSL
- Technology demonstration on CubeSats (C. Dandumont PhD thesis)
- Ground-based demonstrator on the VLTI



J. Loicq presenting CSL activities at the kickoff meeting



First-S concept (Lacour et al.)

Hi-5: LIFE demonstrator

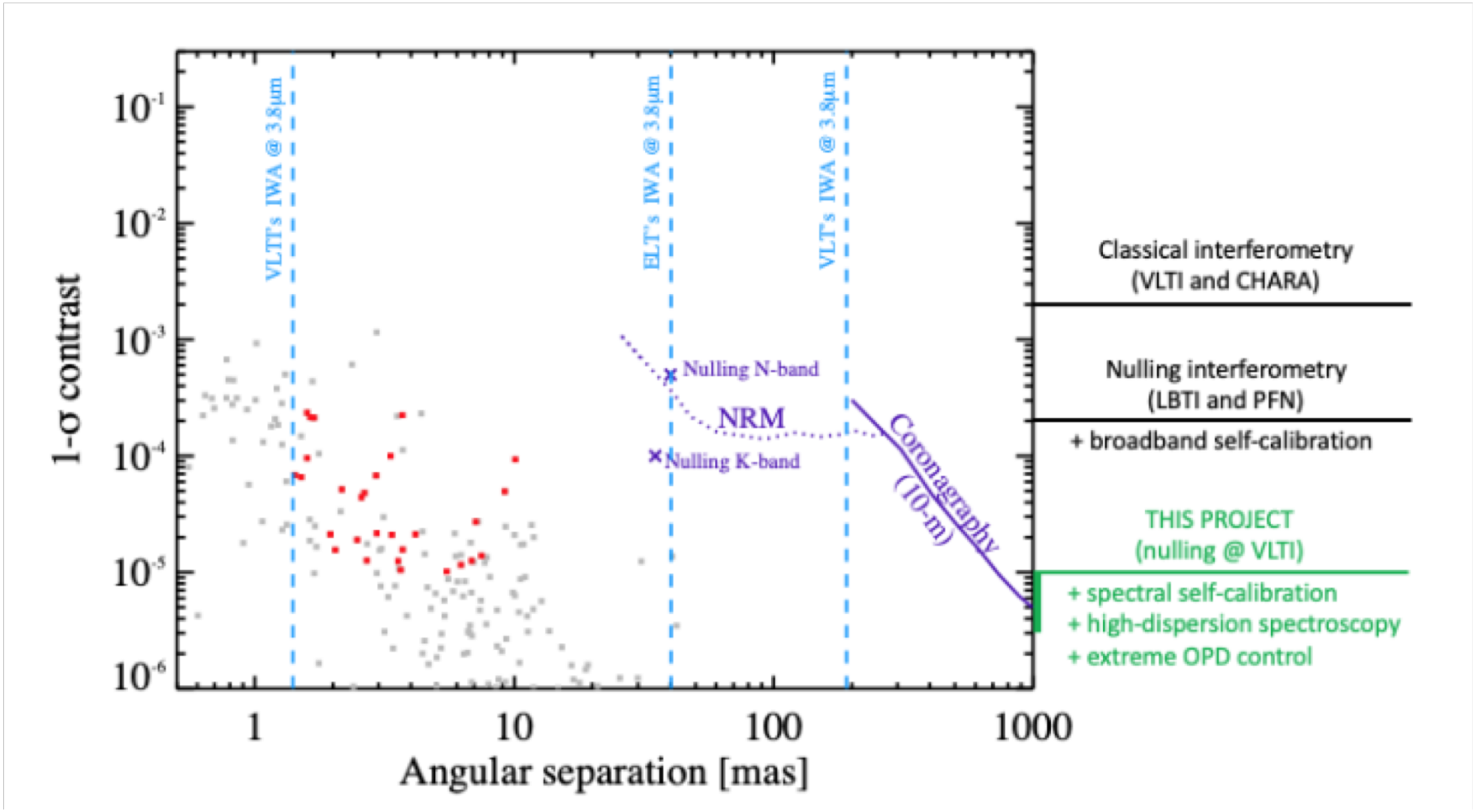
Hi-5

High-contrast Interferometry
up to 5 microns

- L/M-band high-contrast interferometry on the VLTI (Defrère et al. 2018)
- Leverage the angular resolution of the VLTI and nulling interferometry
- EU-funded for a design study led by the University of Liege

VLTI (Cerro Paranal, Chile)

Technology readiness: ground-based nulling



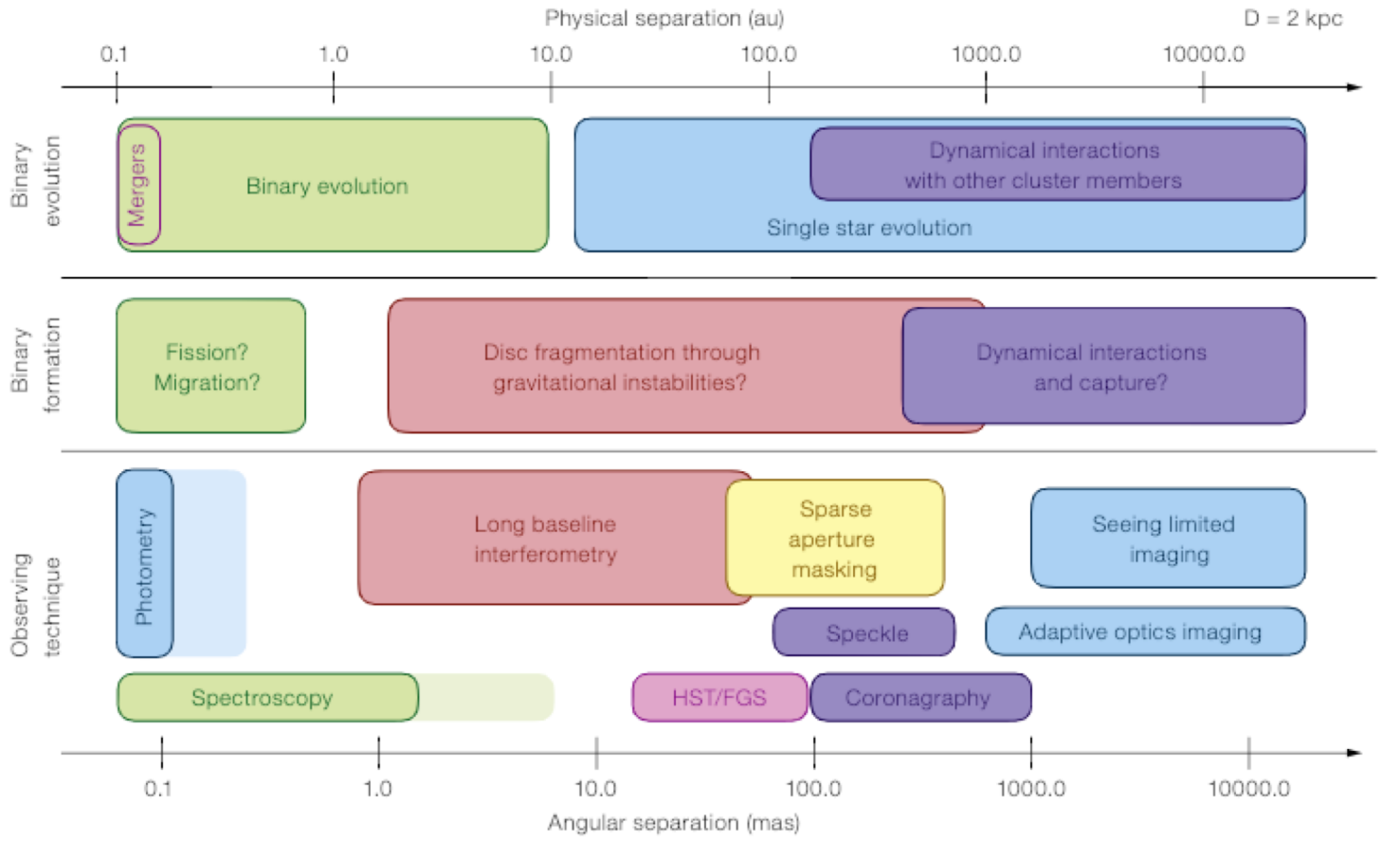
Hi-5 kickoff meeting

- Hi-5 kickoff meeting held in Liège in October 2017;
- Meeting website with presentations: http://www.biosignatures.ulg.ac.be/hi-5/index.html

A couple of pictures taken during the meeting. Left, the team in the beautiful "Horloge" room of our downtown campus. From left to right around the table, J. Surdej, T. Boulet, M. Ireland, G. Martin, S. Minardi, J.-P. Berger, B. Norris, P. Bendjoya, A. Matter, E. Serabyn , W.C. Danchi, O. Absil, A. Gallene, and K. Tristram. Right, picture taken in front of the building on the second day. From left to right, E. Pedretti, A. Mérand, J.-P. Berger, G. Martin, S. Minardi, E. Huby, O. Absil, M. Ireland, T. Boulet, E. Serabyn, D. Defrère, W.C. Danchi, B. Norris, F. Henault, K. Tristram, L. Labadie, A. Gallenne, G. Orban, M. Reggiani, J.-U. Pott, and S. Kraus.

The future of the VLT

- The Very Large Telescope in 2030 (June 2019)
- Ideas for new science case requiring milli-arcsecond resolution? Contact me!



Mérand 2018

*for hot O-type stars at a typical distance of 2 kpc.

VLTI expertise center now in Liège

• Integrate and disseminate knowledge being developed across the community, ensuring long-term sustainability;

• Support observing proposal preparation and data reduction;

• Co-organize (with ESO) VLTI community days and the EII meetings, bringing together 15 countries, and ESO and ESA, as well as the radio/mm interferometry community;

• Exchange experience and coordinate with the radio/mm interferometry community, when possible in conjunction with ALMA centres of expertise.