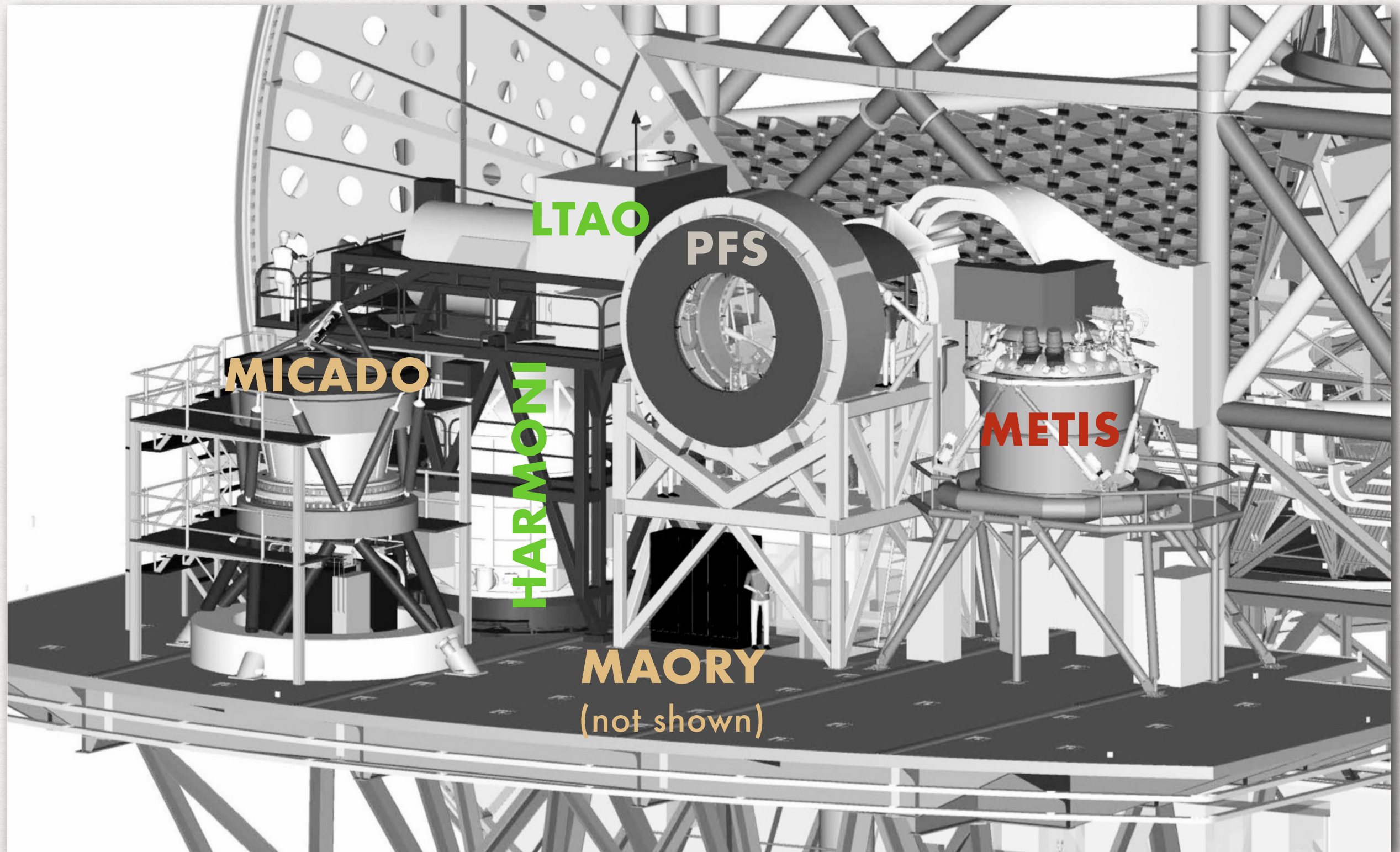


THE STAR CONTRIBUTION TO ELT/METIS

Olivier Absil

FIRST LIGHT INSTRUMENTS @ ELT



THE METIS CONSORTIUM: 9 PARTNERS

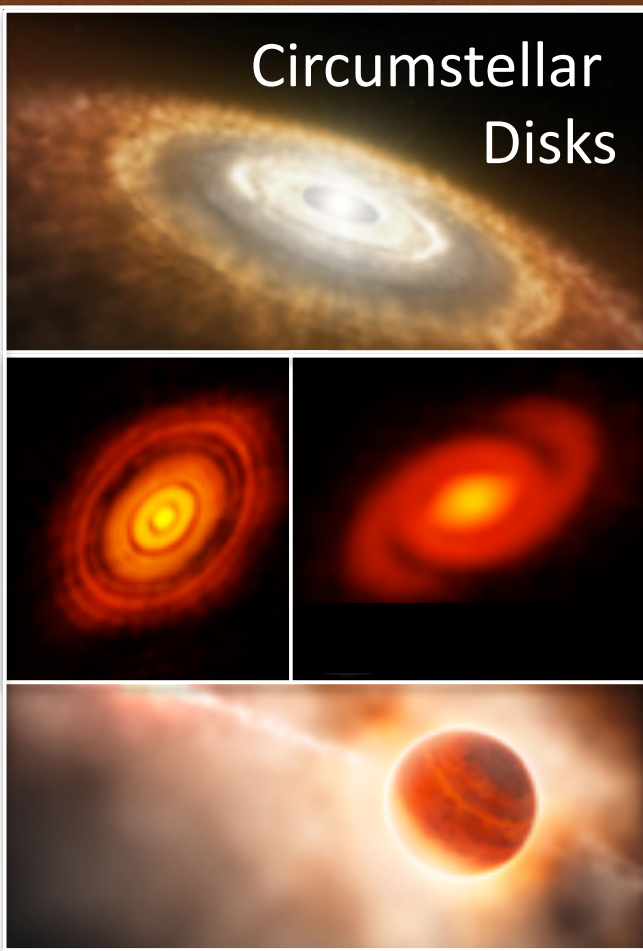


METIS Consortium meeting CM06 – May 14-17, 2018, Edinburgh

INSTRUMENT BASELINE

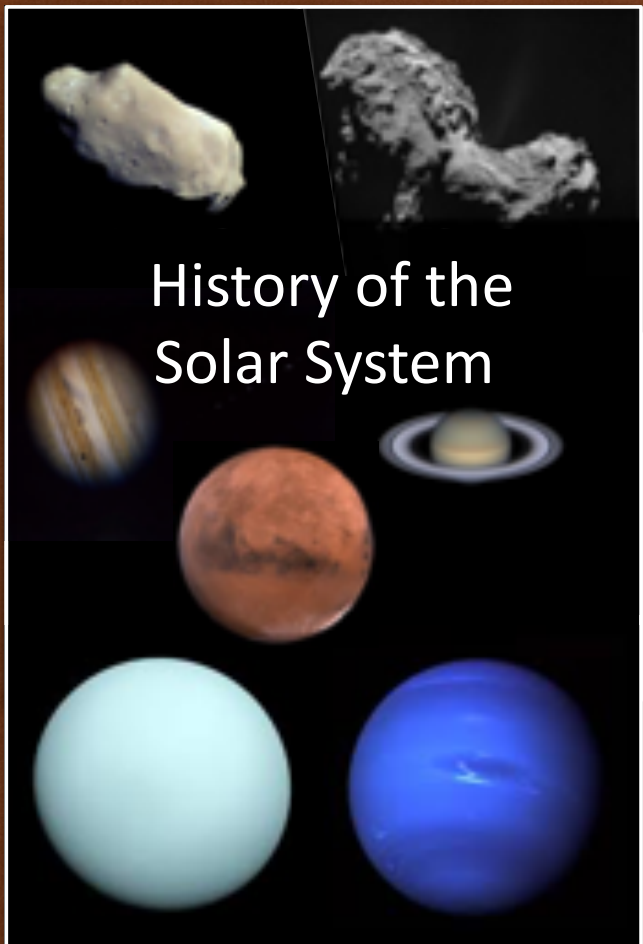
- ◉ **Imaging** at 3 – 19 μm . The imager (FoV $\sim 10''$) includes:
 - low resolution **slit spectroscopy**
 - **coronagraphy** for high contrast imaging
- ◉ **High resolution** ($R \sim 100,000$) **integral field spectroscopy** at 3 – 5 μm , over a FoV $< 1''$
 - incl. a mode with extended $\Delta\lambda_{\text{instant}} \sim 300 \text{ nm}$
 - can also be combined with **coronagraphy**
- ◉ All observing modes work at the **diffraction limit** of the 39m ELT with a single conjugate AO system.

Circumstellar Disks



Angular resolution: 20 mas at 3.5 μm

History of the Solar System



Exoplanets



Sensitivity: 21 mag (1 μJy) at L band

AGNs



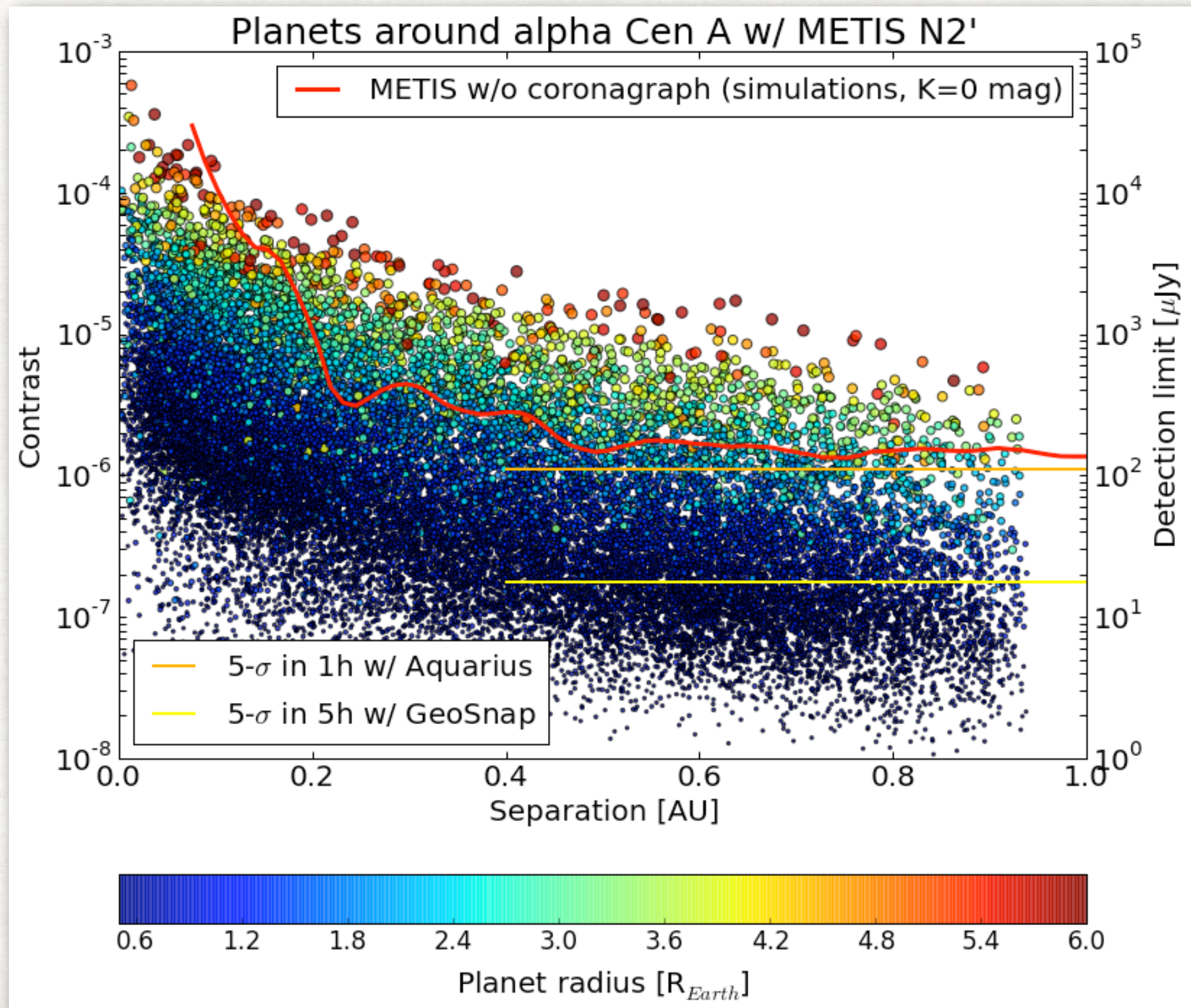
Star Formation & Stellar Clusters



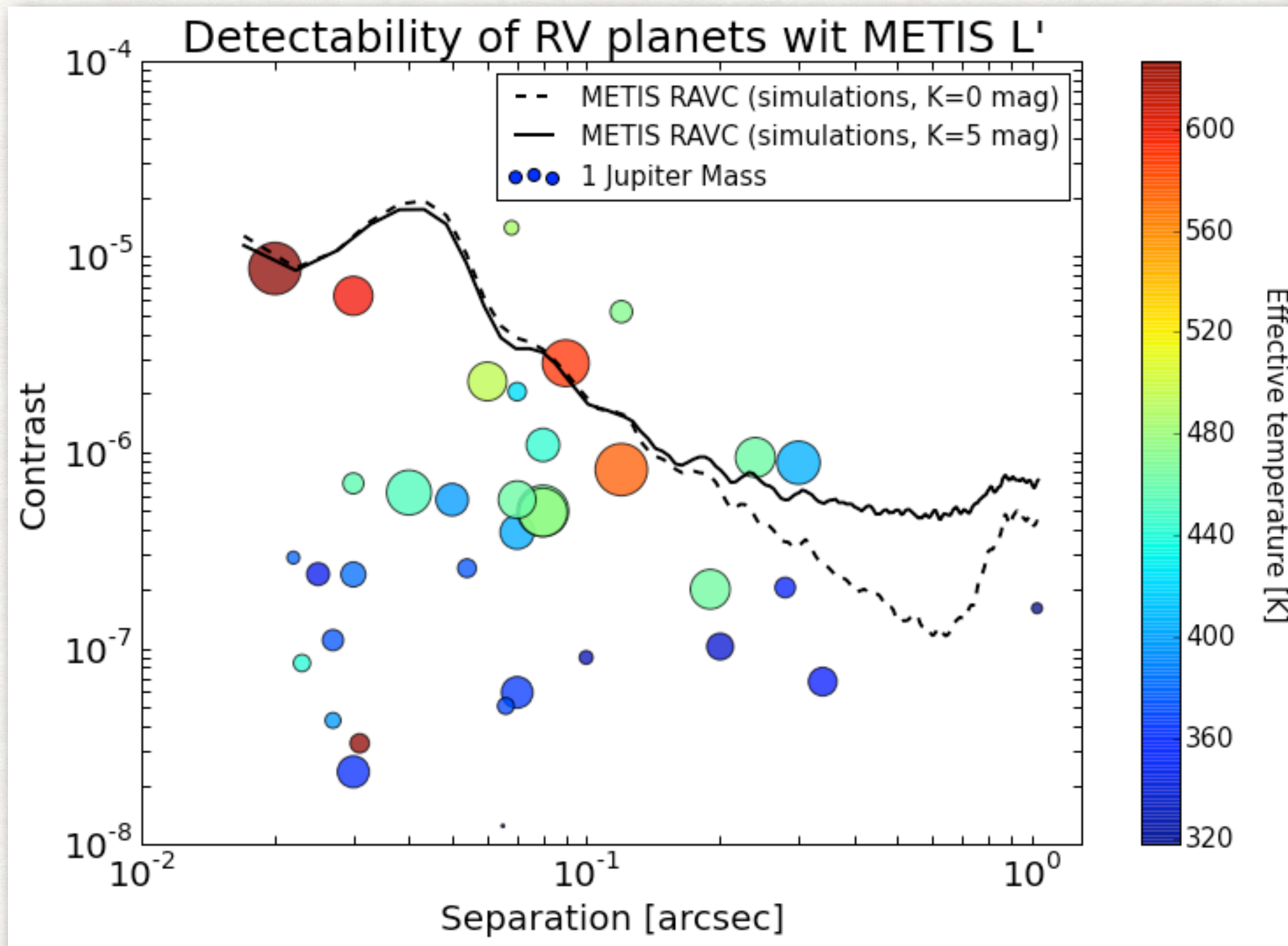
Evolved Stars



A SHOT AT EARTH-LIKE PLANETS



CHARACTERIZING RADIAL VELOCITY PLANETS

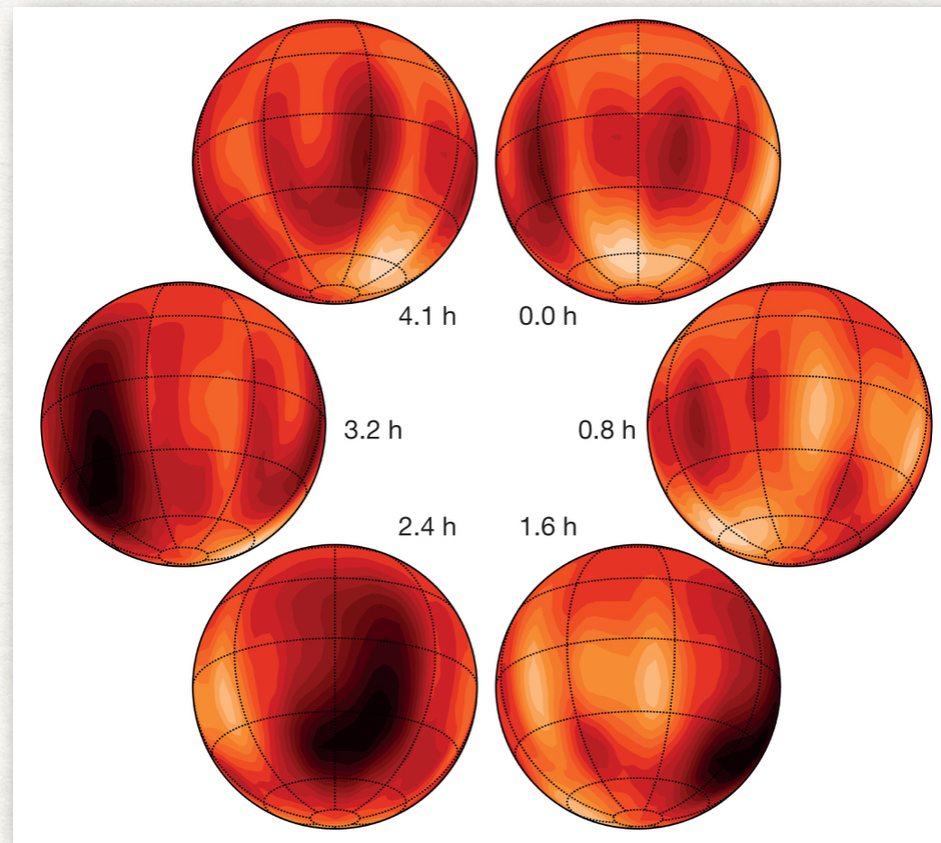


2D MAPS OF EXOPLANET ATMOSPHERES

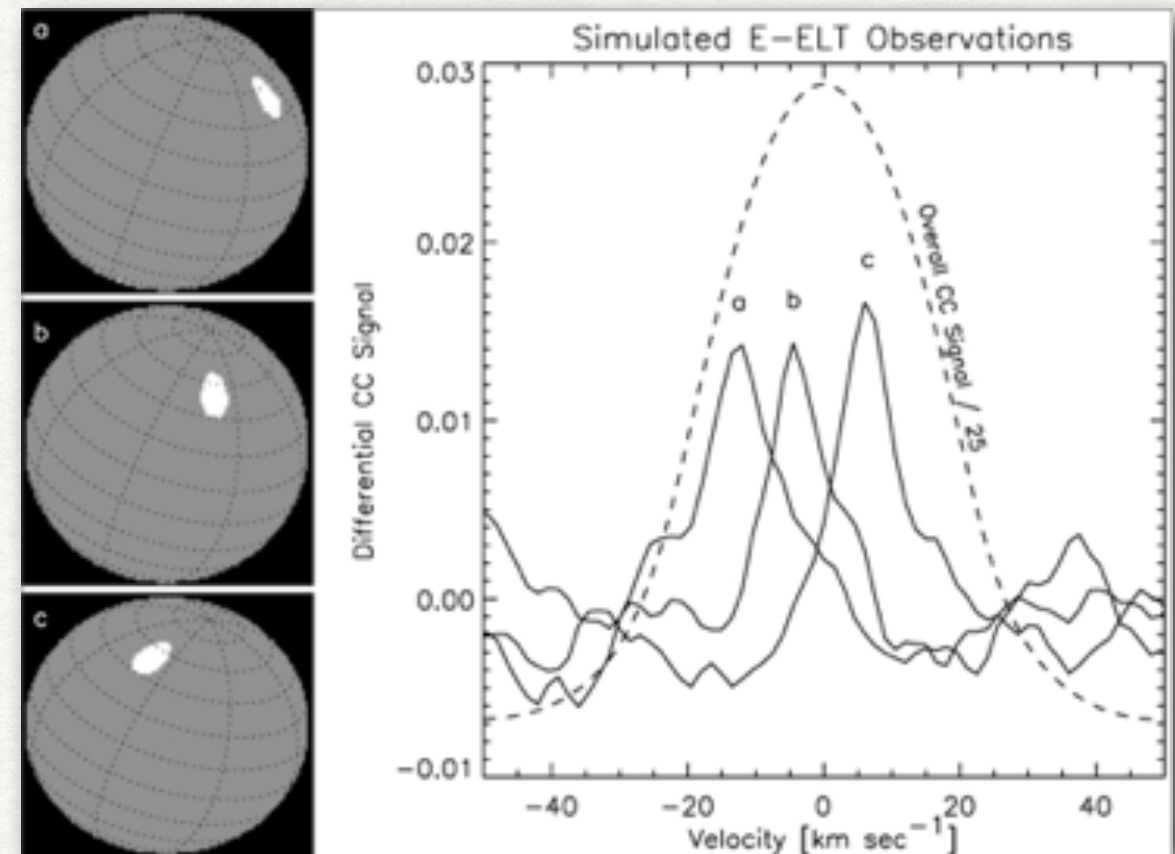
Leveraging the power of high contrast imaging + high-resolution spectroscopy

From brown dwarf atmospheres...

to atmospheres of giant planets!

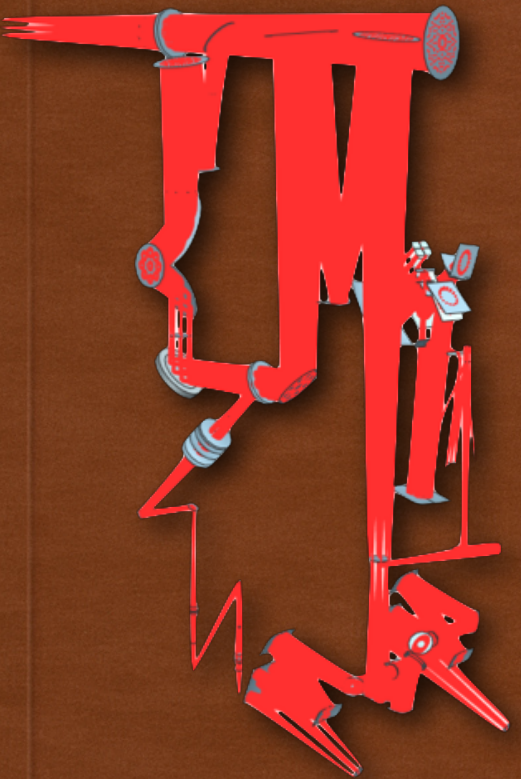
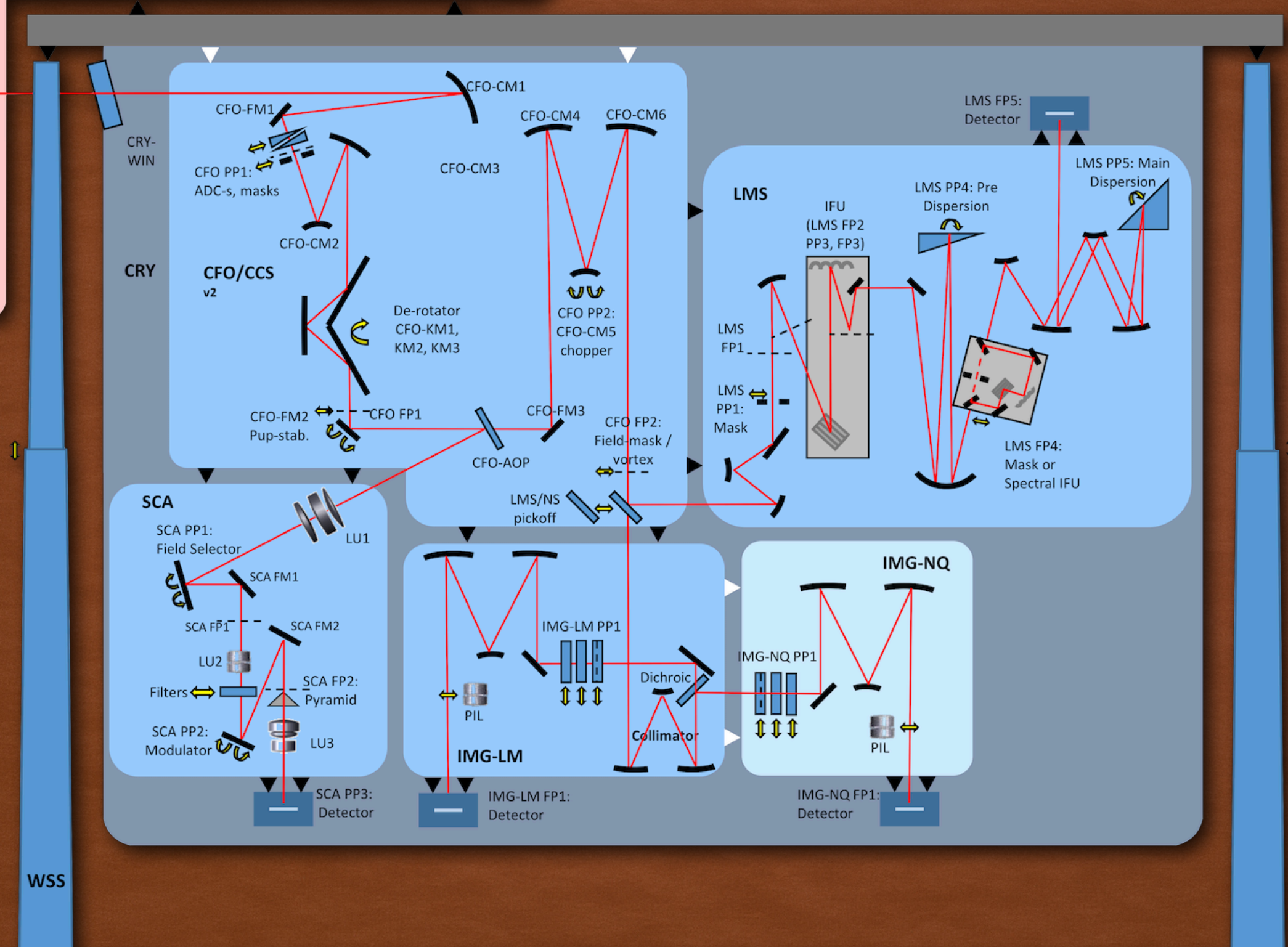
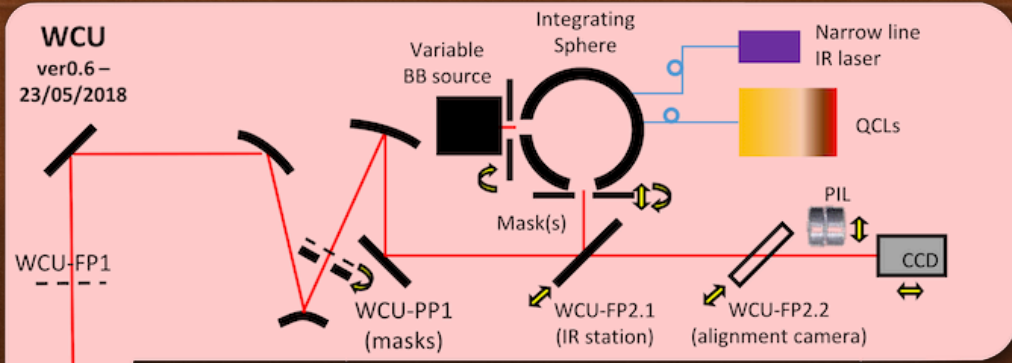
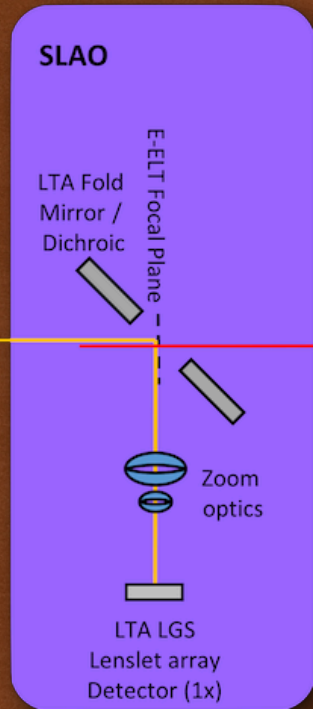


Crossfield et al. 2014 (Nature)

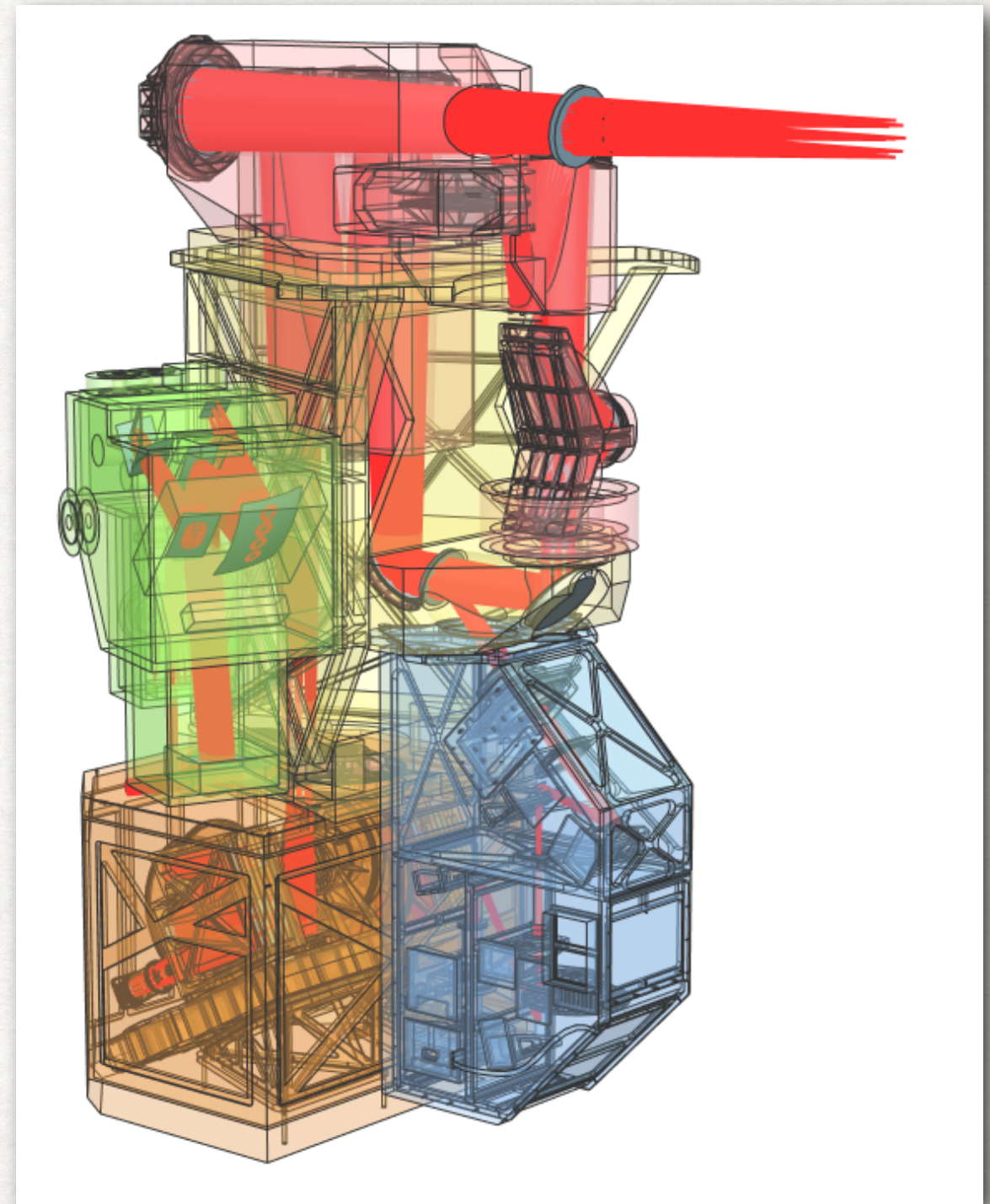
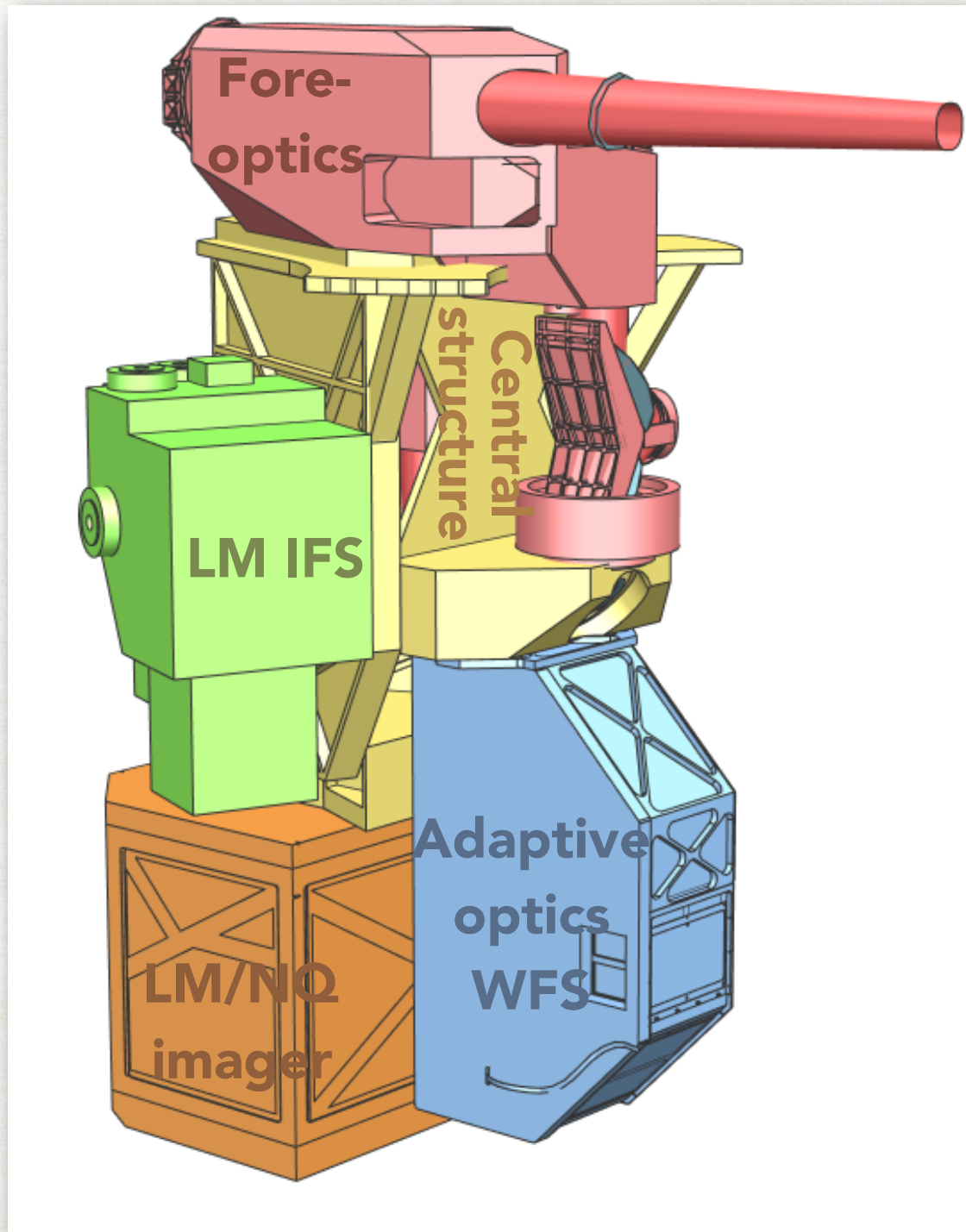


Snellen et al. 2014 (Nature)

OPTICAL SYSTEM OVERVIEW



OPTOMECHANICAL SYSTEM



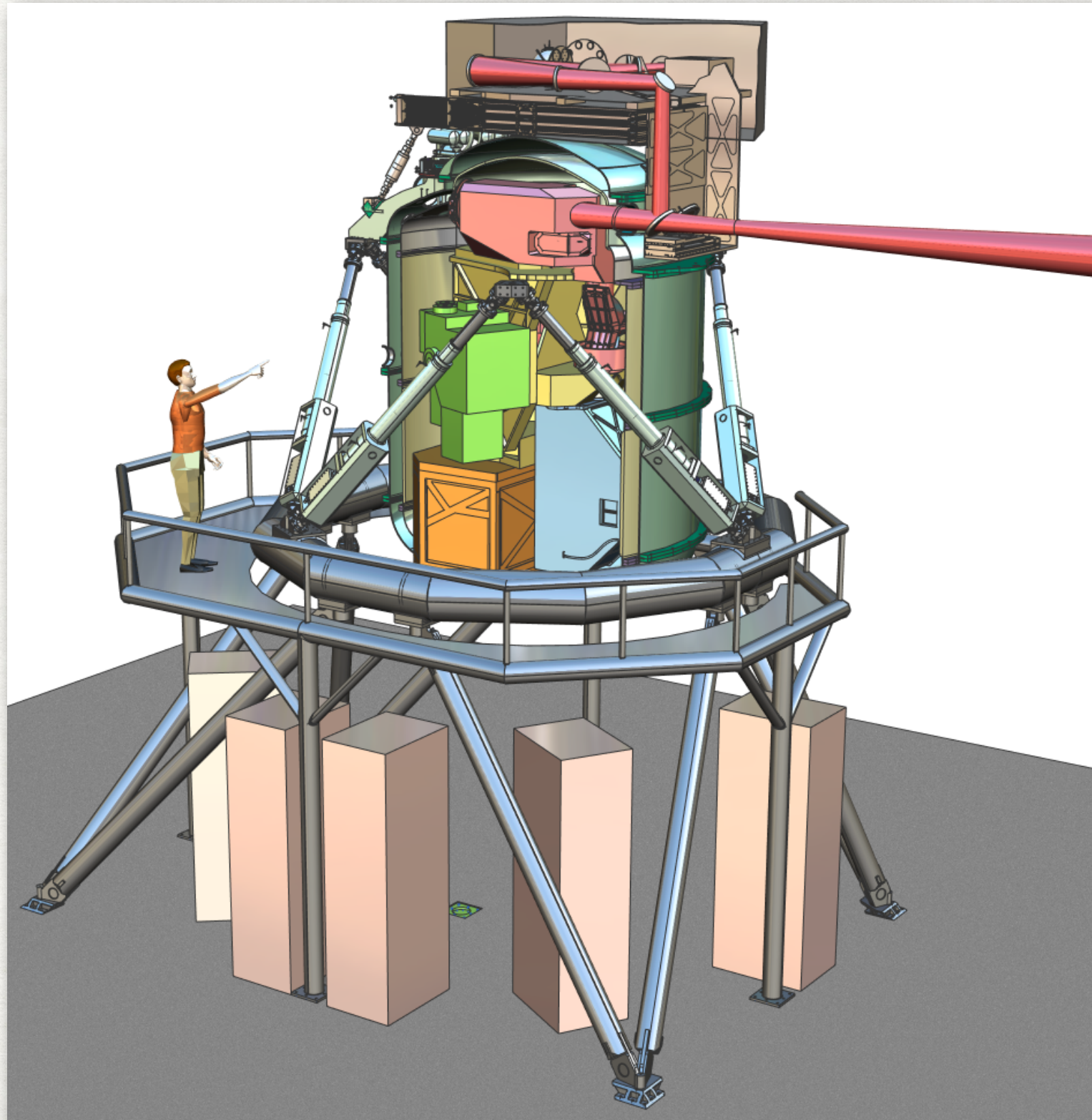
1:1 scale model



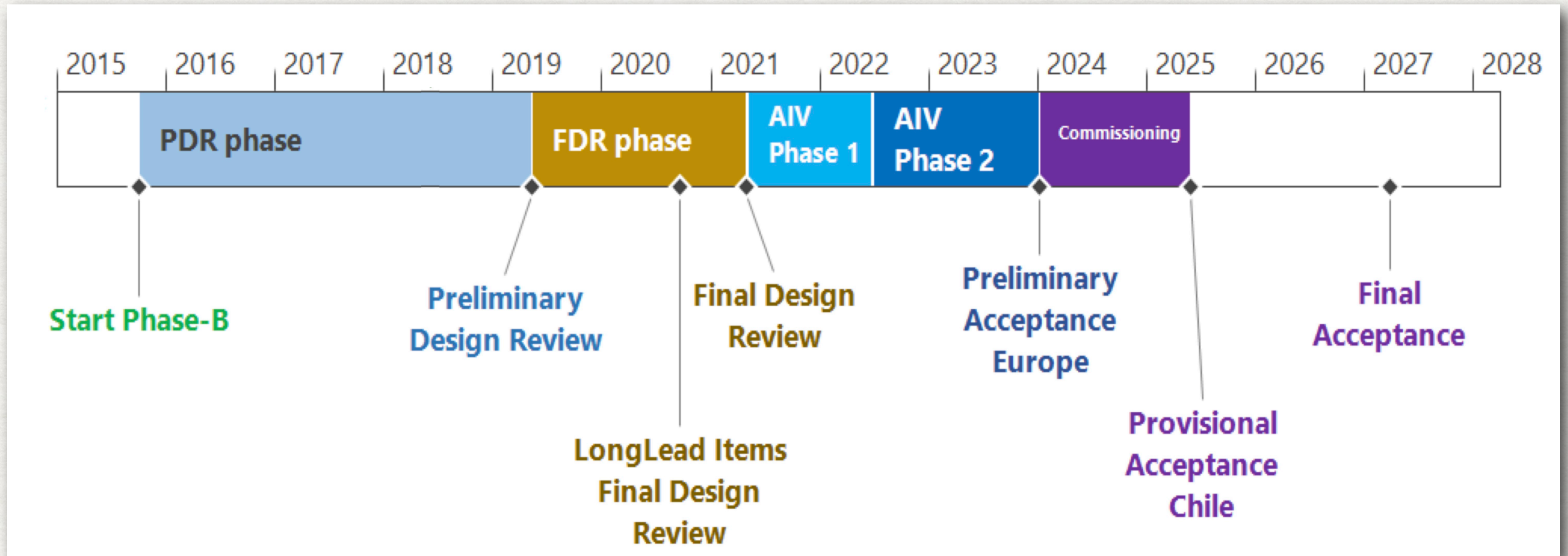
IT'S GOT
TO BE
BIG!

METIS PI

METIS ON THE ELT NASMYTH PLATFORM



METIS TIMELINE

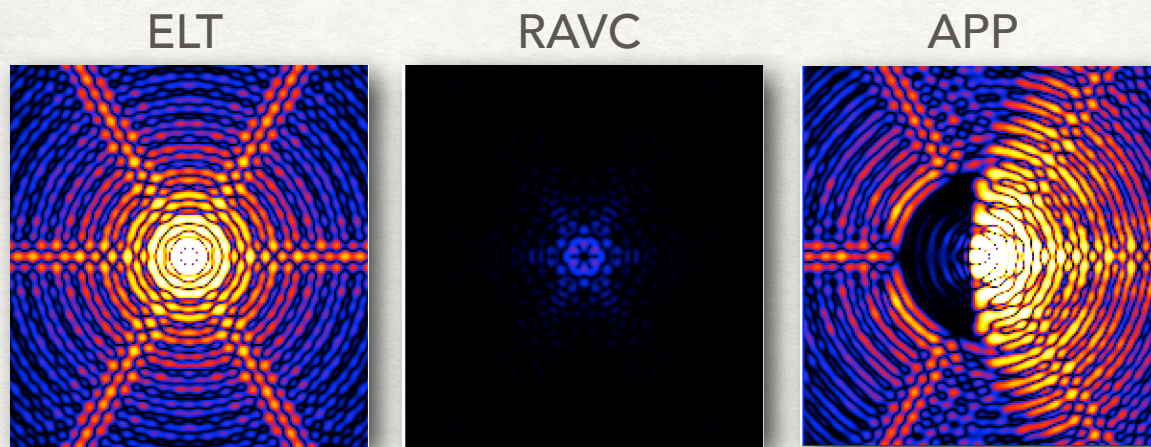
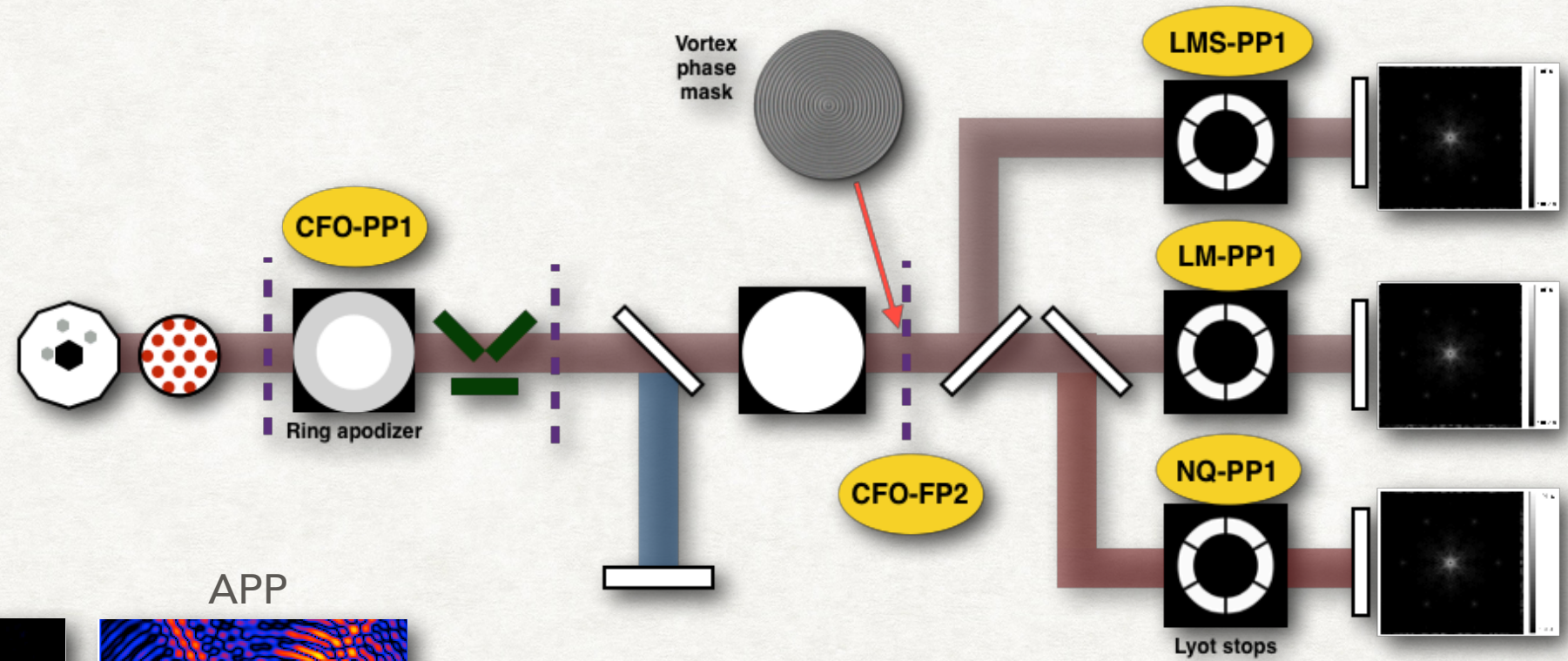


> 60 M€ budget
> 500 FTE from consortium

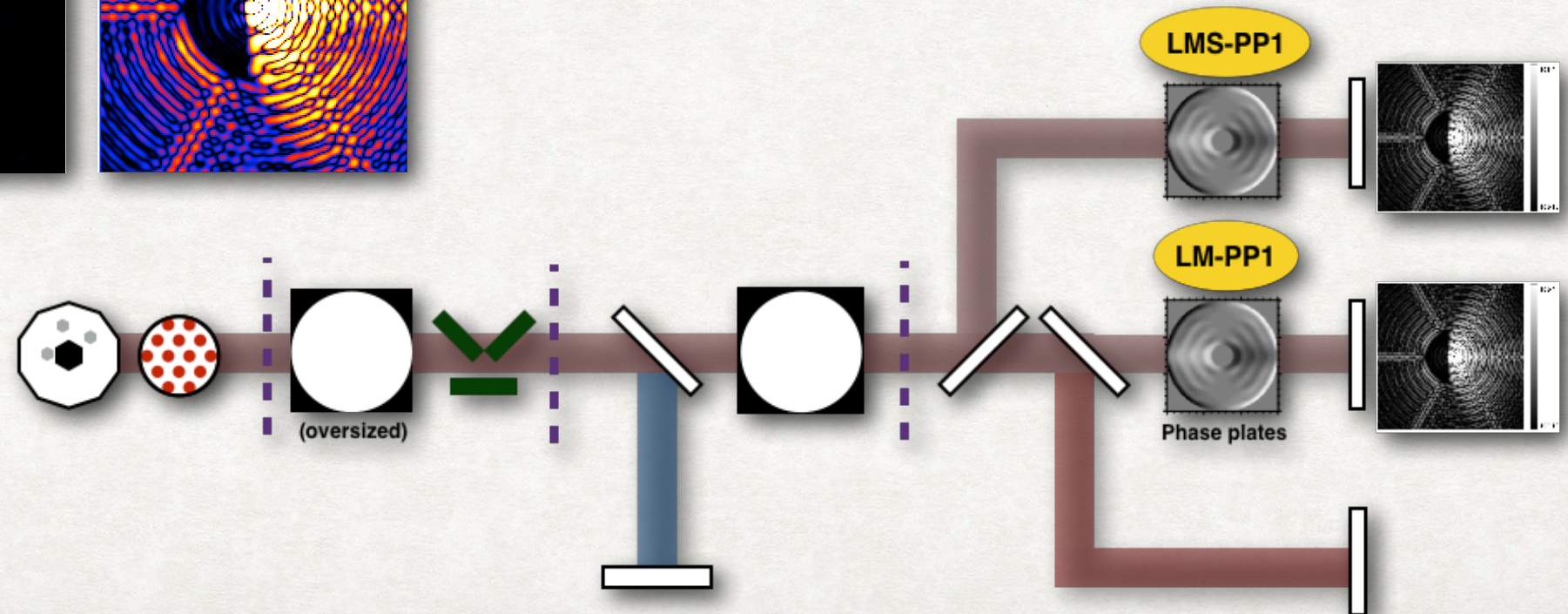
THE STAR CONTRIBUTION

METIS HIGH-CONTRAST IMAGING

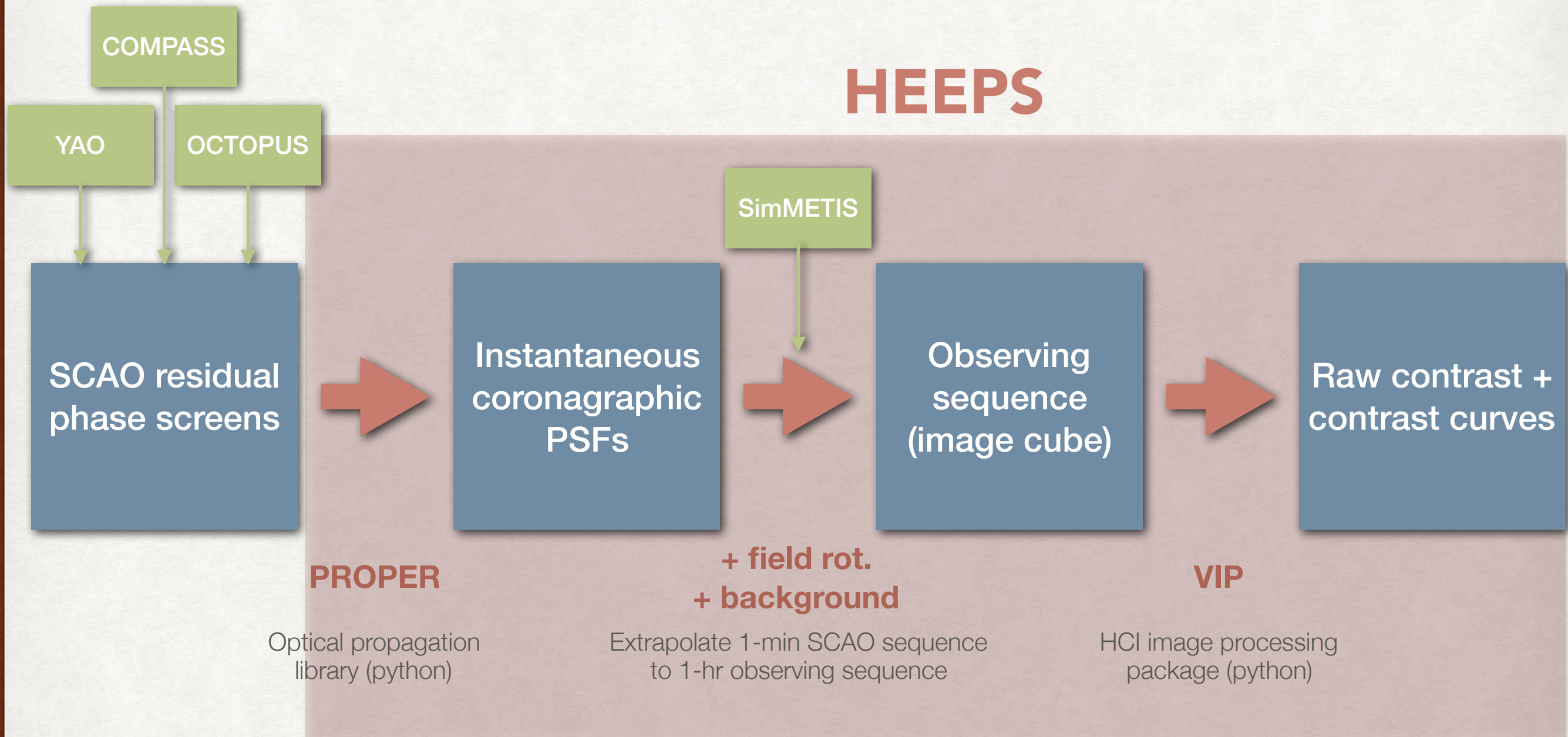
Ring-Apodized
Vortex Coronagraph



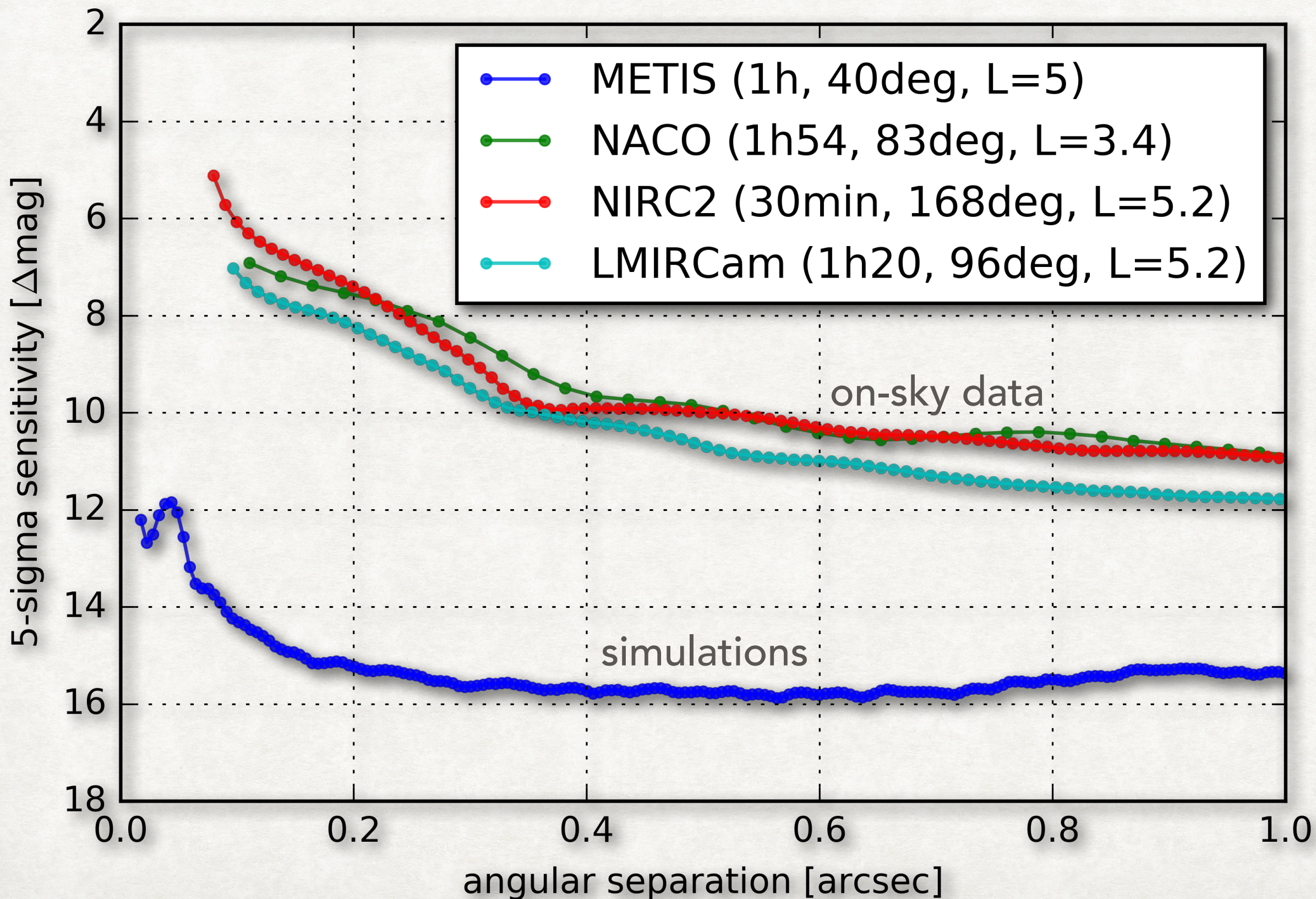
Apodizing
Phase Plate



END-TO-END PERFORMANCE SIMULATIONS

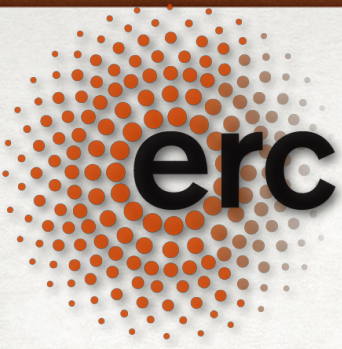


METIS vs 10M CLASS TELESCOPES



STAR IN METIS?

- ◎ STAR contribution (~250 man-month in 2015-2024)
 - HCI system lead
 - Performance simulations
 - Coronagraph design, manufacturing & testing
 - Participation to Assembly, Integration and Tests
 - Development of HCI-specific software
- ◎ Discussing entry in METIS consortium
 - Interest from both METIS and ULiège management
 - Would give GTO access to STAR scientists
- ◎ Recurrent problem in funding ground-based projects in FWB



PSILAB PERSPECTIVES



- Image processing with machine learning
 - Reformulate planet detection in supervised learning framework
 - Merge HCI and HR spectroscopy in common ML framework
 - Reprocess archival databases
 - Search for first rocky planet with Breakthrough Watch

- Advanced wavefront control
 - Use deep neural networks for focal plane wavefront sensing
 - Learn atmospheric parameters to feed AO predictive control

- Make the most of METIS