# Simulations, analysis, and procedures definition for alignment, test and calibration of complex Adaptive Optics systems in the framework of the new generation of telescopes and instruments

NATIONAL INTEREST PHD IN TECHNOLOGIES FOR FUNDAMENTAL RESEARCH IN PHYSICS AND ASTROPHYSICS
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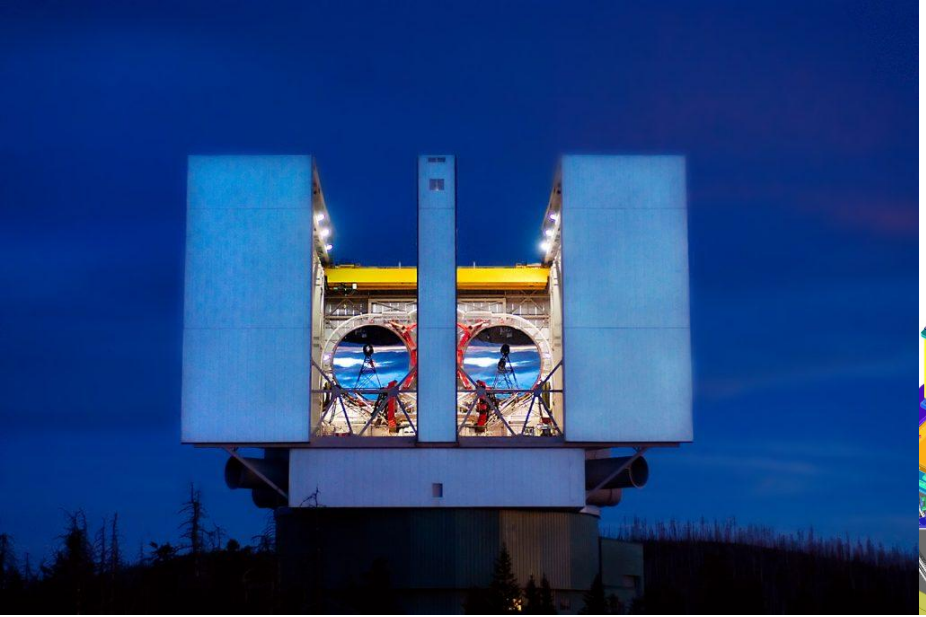
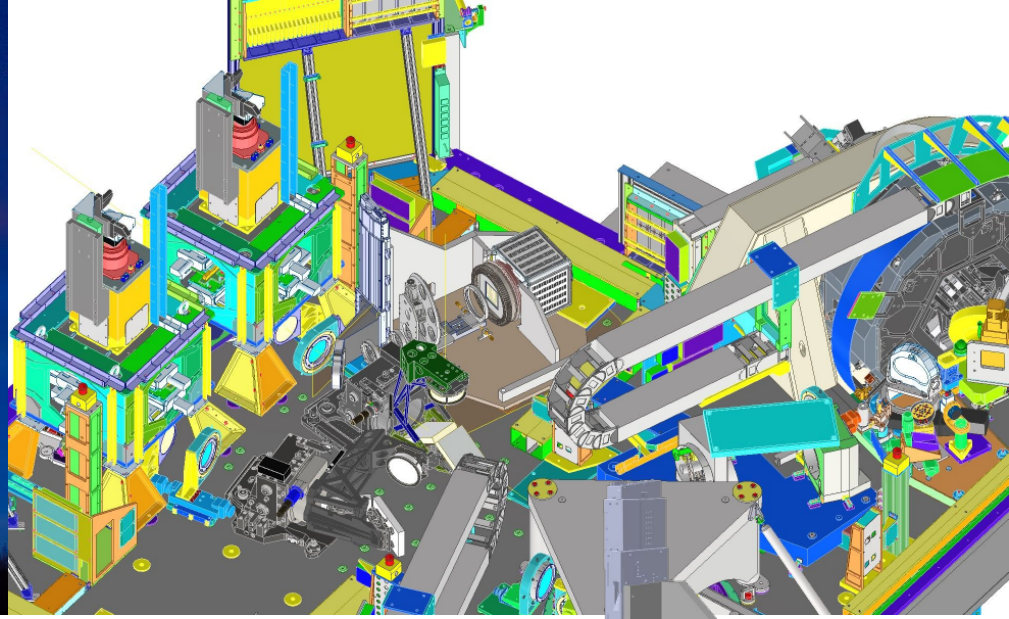
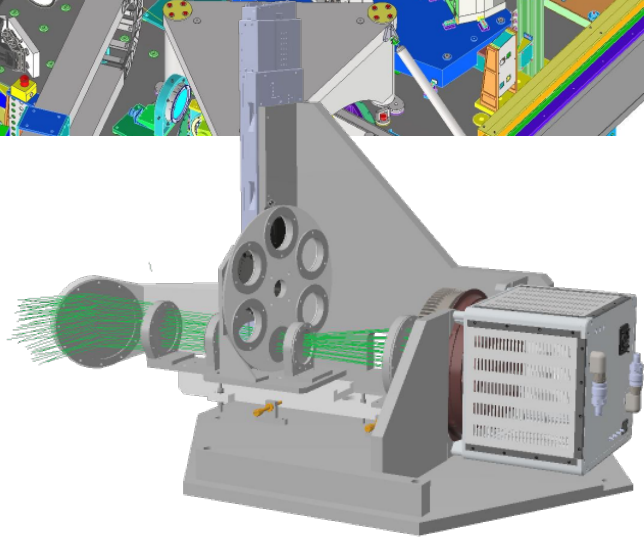
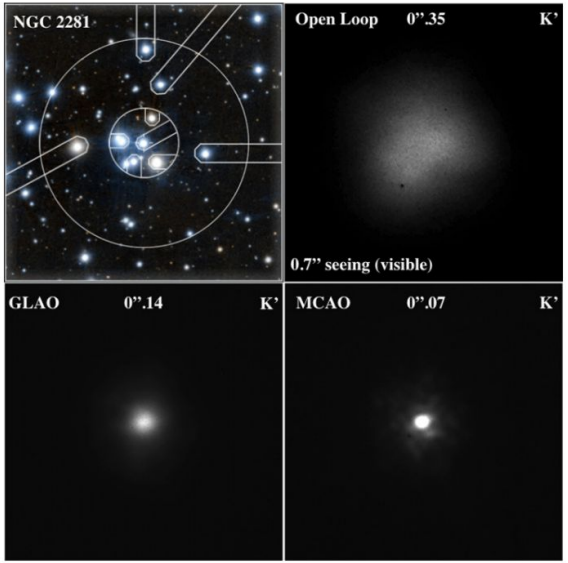
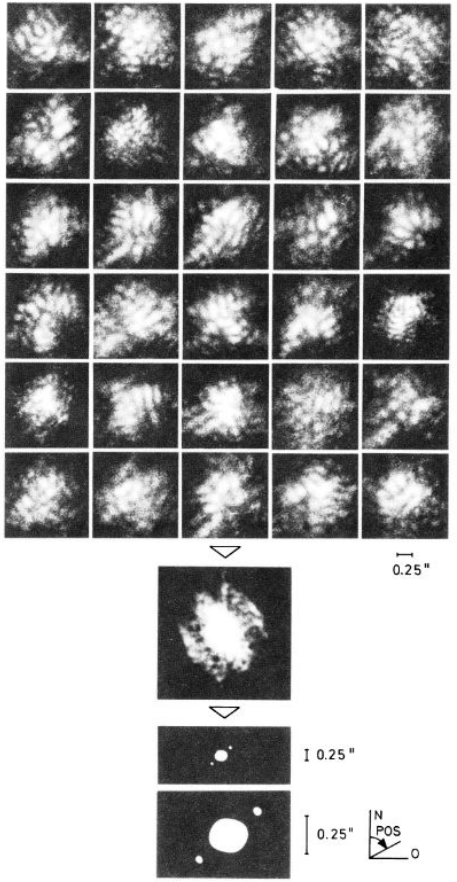




- LBT INterferometric Camera - Near-InfraRed / Visible Adaptive iNterferometer for Astronomy (LINC-NIRVANA)
- NirvanaVIS
  - Wide Field Visible Imager



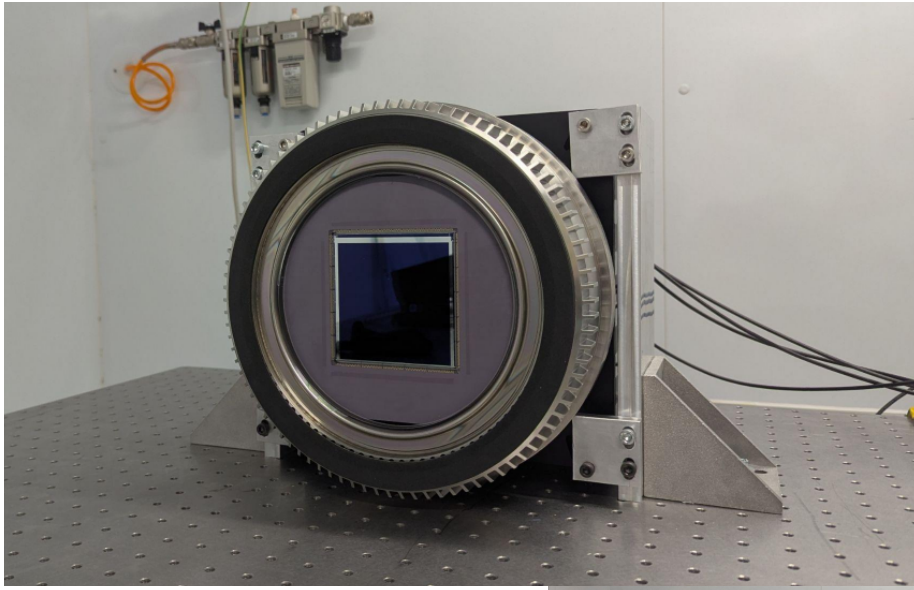


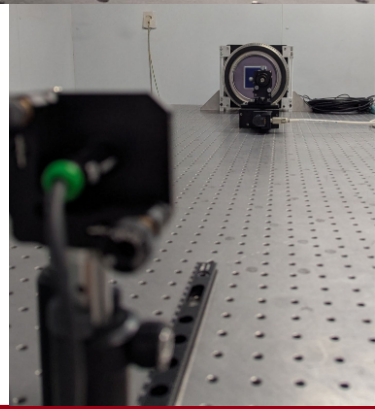




- Ground-layer Adaptive Optics (GLAO)
- Speckle imaging
  - Speckle Holography
  - Speckle Interferometry
- Near-diffraction limited imaging

# Detector Characterization

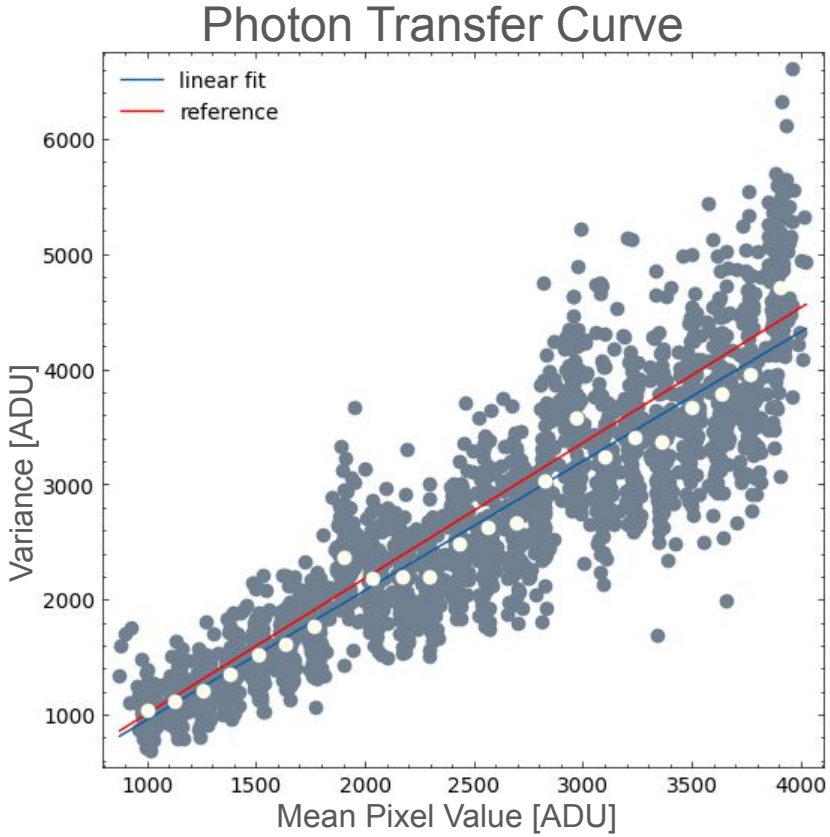
- Teledyne COSMOS-8k
  - 8120x8120px sCMOS array
- Testing Run @ OAPD
  - Noise Sources (dark current, read noise)
  - Light Sensitivity (gain, linearity)
  - Isolation (cross-talk, blooming, parasitic light sensitivity, persistence)
  - Uniformity





# Detector Characterization - Gain

- Conversion from ADU to electrons
- Photon Transfer Curve
- Important for further characterization



# Non-Common Path Aberrations

- LINC-NIRVANA designed for referencing to HLWFS
- Complicates NCPA Characterization for NirvanaVIS
  - Calibration Unit after GLWFS
  - GLWFS located at the edge of the bench
  - Calibration sources designed for small FoV

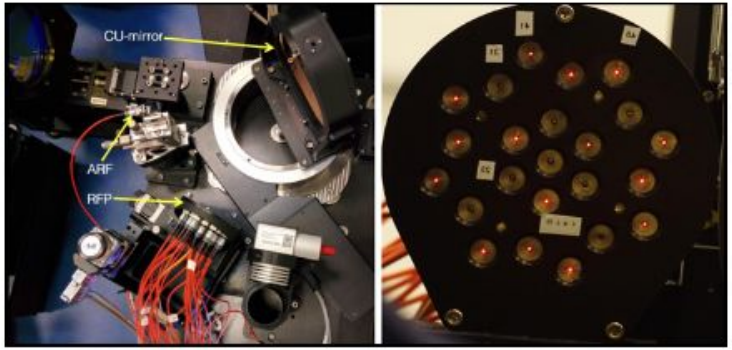
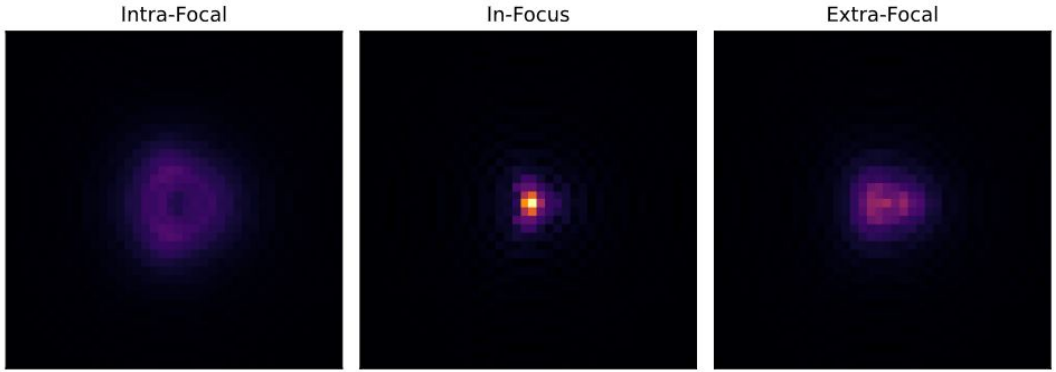
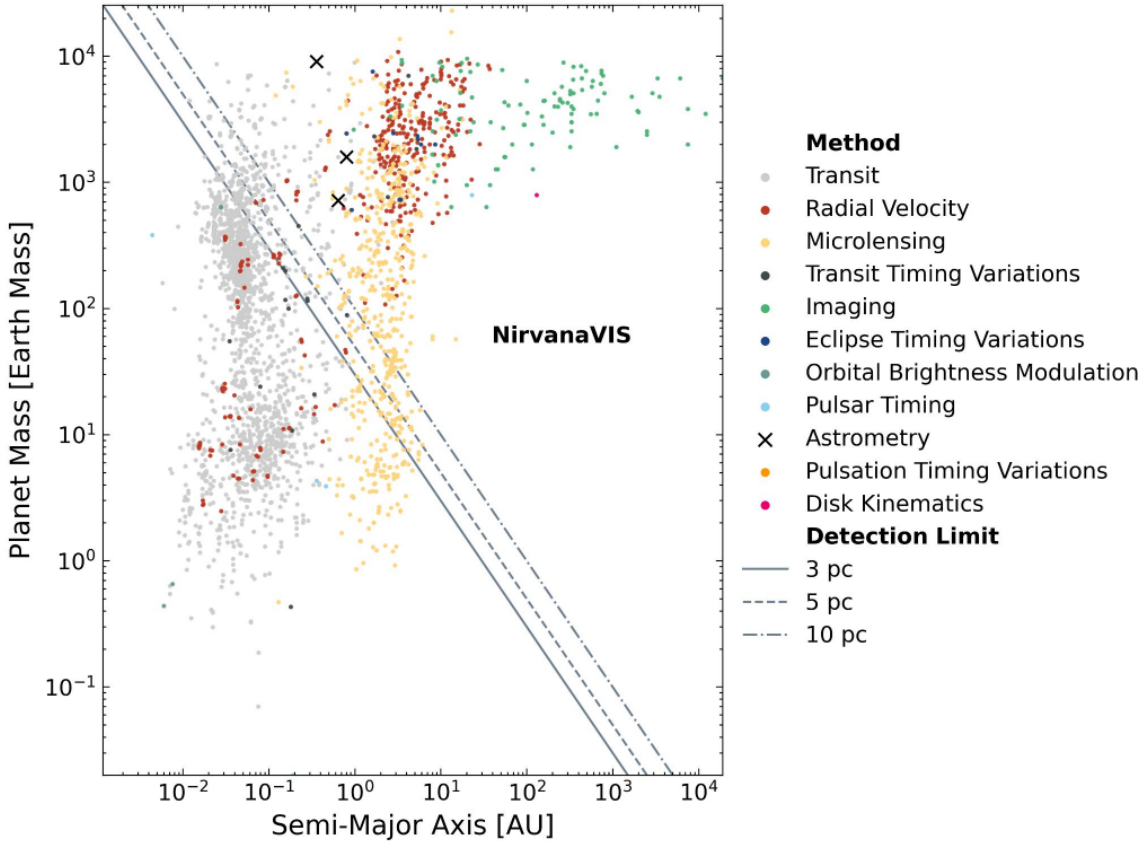



**Figure 3.6:** *left*: Calibration unit on the LN bench. The calibration unit consists of Calibration Unit folding mirror (CU-mirror), Absolute Reference Fiber (ARF) and Reference Fiber Plate (RFP). *right*: Front view of the RFP. Some of the fibers are (red) illuminated.



# Science Case

- Astrometric detection of exoplanets
  - Inclination independent
- Existing detections using HST



# Courses and Schools

- Adaptive Optics for Astronomy [EXAM PASSED]
- Radio and Optical Interferometry [ATTENDED]
- Astronomical Sites' Characterization* [ATTENDED]
- Hands-on Machine Learning with Python* [ATTENDED]

- European Adaptive Optics Summer School - June 2025
  - Institut d’Optique, Paris-Saclay
  - Poster Presentation: “NirvanaVIS: AO-Assisted Wide Field Speckle Imaging at LBT”

*part of unipd’s Astronomy PhD Program