

TARPIN *

Trans-Atlantic Research Program for Imaging New-worlds an International Research Project (IRP) from CNRS

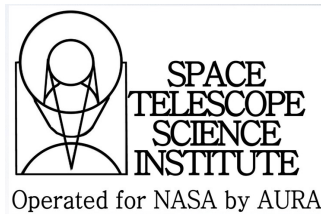
Conseil Académique de l'Université Côte d'Azur, 8 Juin 2023



* TARPIN, in south French language means : A lot, Very, ...

Ex: Tarpin Bien = Very Good !





ONERA

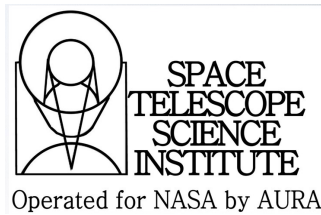
THE FRENCH AEROSPACE LAB



- **Co-PIs** **Marc Ferrari – Laboratoire d’Astrophysique de Marseille - LAM**
 Rémi Soummer – Space Telescope Science Institute - STScI

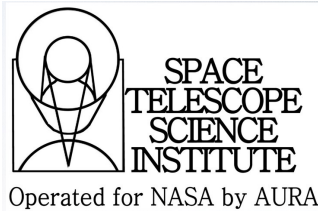
Laboratories involved :

- **LAM : Co-I Elodie Choquet**
High quality Optics, Data processing algorithms, Science, bench
- **LAGRANGE : Co-I Mamadou N’Diaye**
Coronagraphy, Wave-Front Sensing, Science, bench
- **ONERA : Co-I Jean-François Sauvage**
WFS, OA control loop and algorithms, System, bench
- **STScI : Co-I Laurent Pueyo**
Almost Everything ! + HiCAT bench !!



Background of collaboration

- 12 years of interactions, collaborations, contributions, exchanges !
- Several exchange of PhD/Post-doc and co-advice
 - Mamadou N'Diaye : LAM (Post-doc) → STScI (Post-Doc) → Lagrange Staff
 - Elodie Choquet : Paris Obs (PhD) → STScI (Post-doc) → JPL (Post-doc) → LAM Staff
 - Johan Mazoyer : OdP (PhD) → STScI (Post-doc) → JPL (Post-doc) → Paris Staff
 - Sylvain Egron : LAM/ONERA/STScI → Industry
 - Lucie Lebouleux : LAM/ONERA + STScI (PhD) → Paris (Post-doc) → Grenoble Staff
 - Iva Leginja : LAM/ONERA + STScI (PhD) → Paris (CNES Post-doc)
 - Raphael Pourcelot : LAM (internship) → Lagrange (PhD) → STScI (Post-doc)
 - Benjamin Buralli : Lagrange/STScI (PhD)
- Very efficient collaboration in terms of recruitment of research staff in France
- Allowing us to build a long-term collaboration



From the very beginning of the Makidon Lab.



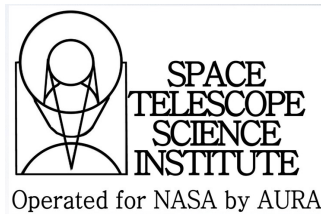
Dec. 2012



Feb. 2013



June 2014



ONERA

THE FRENCH AEROSPACE LAB



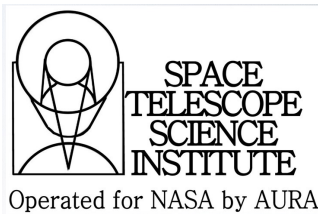
Background of collaboration

Framework

HiCAT bench @STScI and other dedicated testbeds in France (Mithic, SPEED, etc)

Main topics of collaboration

- Optical design and fabrication
 - Coronagraphy design and optimization
 - Wavefront sensing
 - Active/Adaptive Optics loop
 - Control-command algorithms
 - System-level studies
 - Data processing algorithms
 - Science



Background of collaboration: example

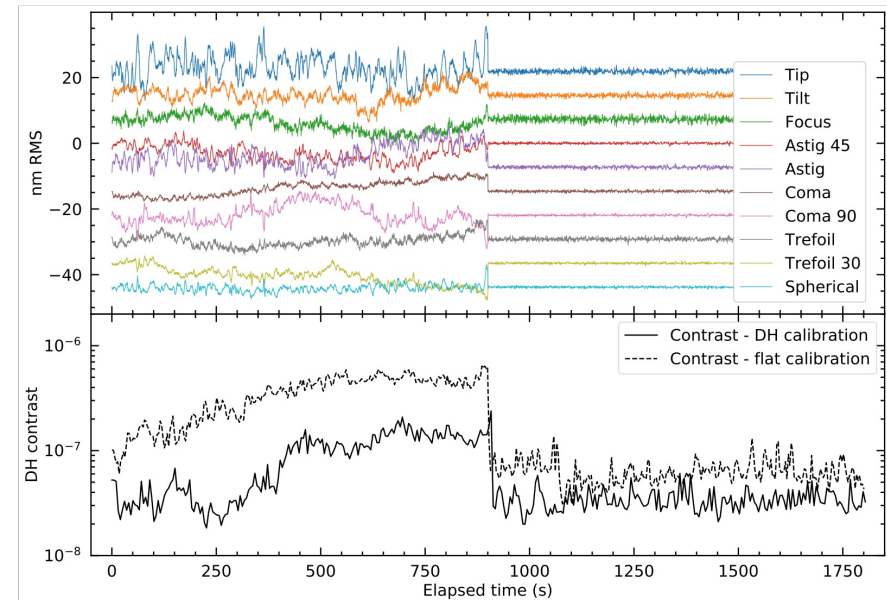
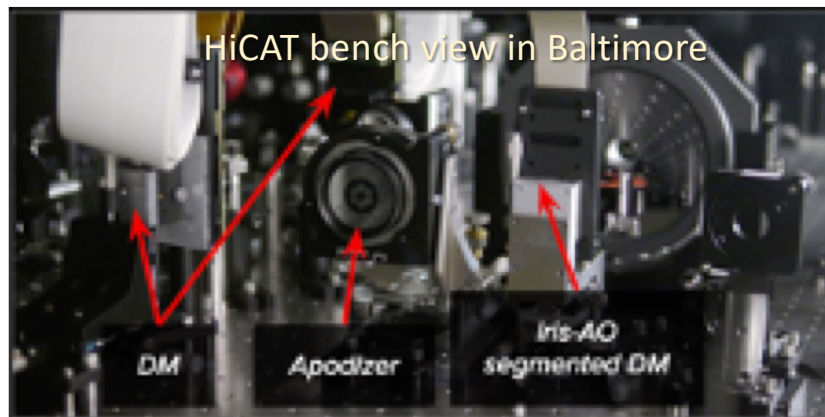
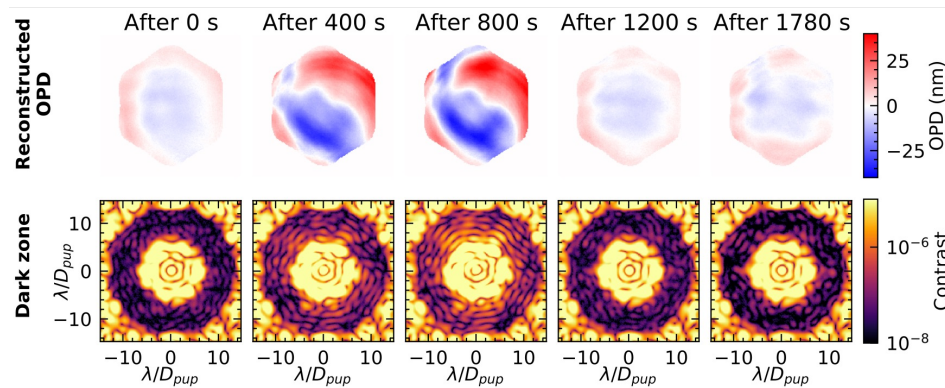
PhD @ UCA, 2020-2023

Co-supervision Lagrange-STScI

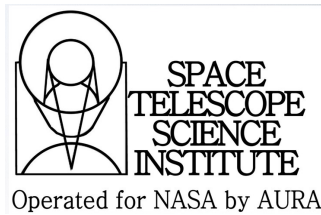


R. Pourcelot

Contrast maintenance with a control loop with a Zernike sensor



Pourcelot et al. A&A 2022, 2023 (including Lagrange, LAM, and ONERA and STScI)



ONERA

THE FRENCH AEROSPACE LAB



Context : Habitable Worlds Observatory

Preparation of future large mission for High-Contrast Imaging

Participation to HiCAT bench @ STScI since 2012 offered opportunities

→ Contribution to ROMAN ST CGI instrument

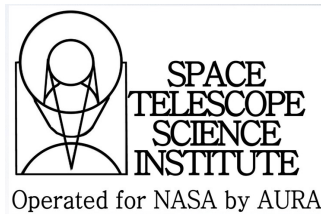
→ NASA LUVOIR STDT International Observers, CNES representative

Astro 2020 Decadal proposal : HWO

- Find and characterize an Exo-Earth !

→ Opportunity to contribute !





ONERA

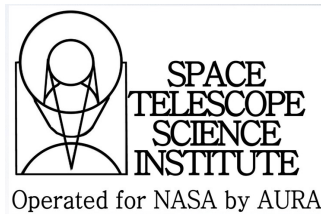
THE FRENCH AEROSPACE LAB



Context : Habitable Worlds Observatory

Preparation of future large mission for High-Contrast Imaging

- Technologies maturation
 - System demonstration
 - Science simulation
 - Performance estimation
-
- Address the 3 levels : Components, System and Science



ONERA

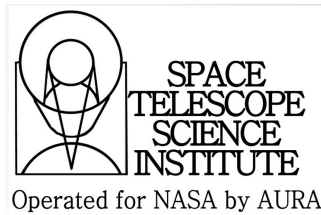
THE FRENCH AEROSPACE LAB



Context : Habitable Worlds Observatory

TARPIN : Five critical years (2023 - 2028) to

- Help to prepare for gates/milestones at NASA level
 - Built a French contribution to the mission proposal
-
- Need to strengthen / speed-up the exchanges
 - Train the young scientists who will use the instruments
 - Interact with agencies (NASA, CNES) and industry (Ball Aerospace, ThalesAleniaSpace...)



ONERA

THE FRENCH AEROSPACE LAB

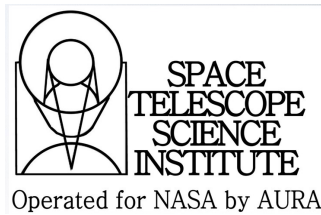


Work program – Some highlights

- Deliver the prototype of a segmented off-axis parabola for HiCAT2/ASSIST (super-polishing ongoing at LAM and partly funded by CNES)
- Development of new coronagraphic masks and wavefront sensors based on Zernike phase mask
- Development of new post-coronagraphic control algorithms for high contrast imaging
- Development of associated data processing algorithms (from JWST / ROMAN ST). Implementation of simulations for an HC instrument on HWO

2 or 3 PhDs in collaboration are foreseen

ex: Benjamin Buralli, PhD Lagrange (2023-2026), funded by Region SUD & TAS



ONERA

THE FRENCH AEROSPACE LAB



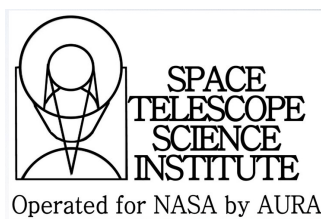
Work program

Organization of regular joint remote seminars with the STScI

Organization of Workshop and/or Summer School

- Attract support of the agencies for technologies maturation and mission contribution
- Motivate the interest of the scientific community
- Train the young researchers

Joint participation in the 2024 and 2026 editions of the Spirit of Lyot and SPIE Astronomical Instrumentation & Telescope conferences



ONERA

THE FRENCH AEROSPACE LAB



Thank you !