

# First Results from the OASIS Survey for Discovering and Characterizing Extrasolar Planets by Direct Imaging and Astrometry

**Thayne Currie, Survey Principal Investigator  
(Subaru/U. Texas-Antonio)**

**[currie@naoj.org](mailto:currie@naoj.org)**

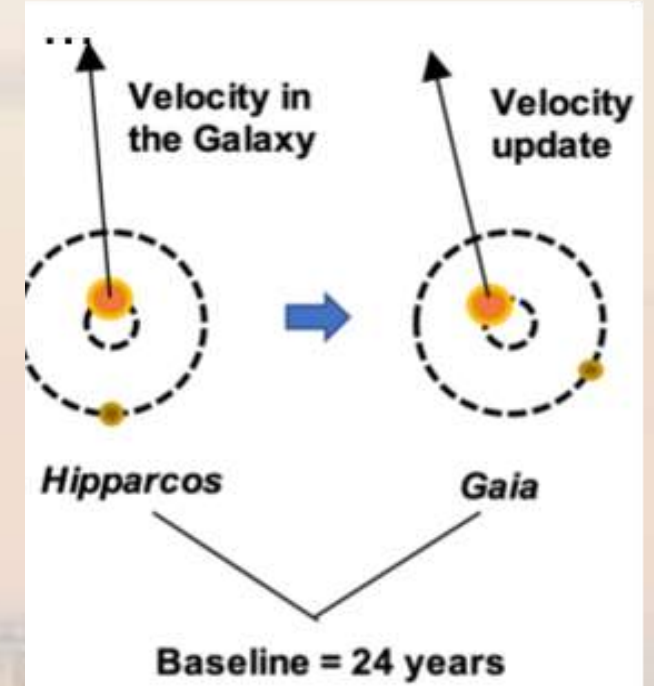
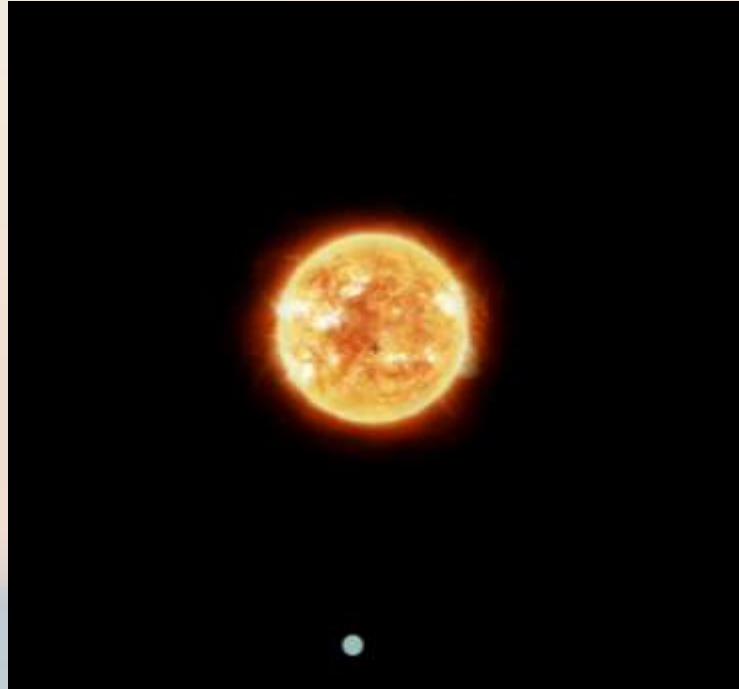
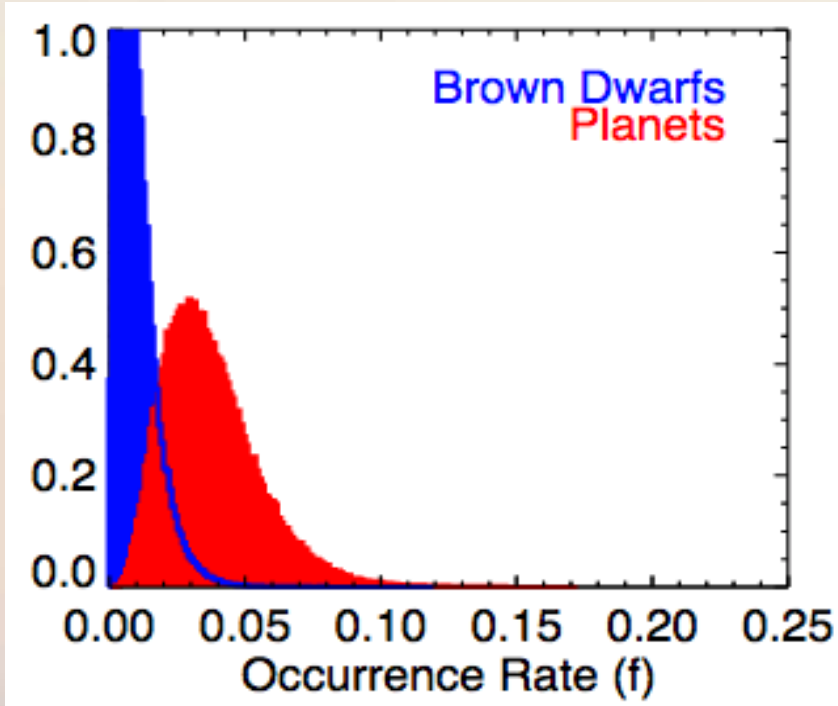
**Masayuki Kuzuhara, Survey Co-PI (NAOJ)**

# Outline

- Motivation, Basic Program Design, and Proof of Concept
- First Discoveries
- New, Unpublished Results
- Follow-Up Characterization
- Broad Scientific Goals and Outlook
- Areas for Improvement\*

\*Please fix low-wind effect and facilitate SCEXAO & CHARIS

# Motivation and Basic Program Design



## Previous Exoplanet Imaging Searches

- Large “unbiased/blind” surveys (e.g. GPIES, SPHERE/SHINE) few discoveries
- They yield limited knowledge of planet’s orbit and mass

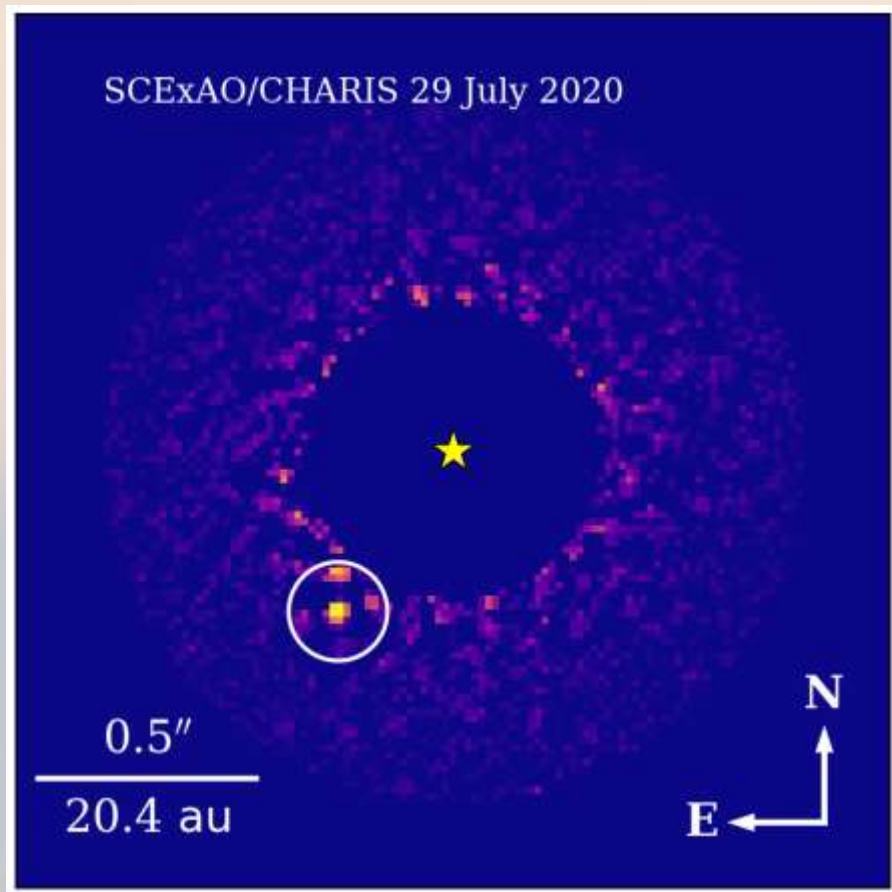
## A New Kind of Exoplanet Direct Imaging Search

- Precision Astrometry from Gaia & Hipparcos Identifies Stars That Are Being Gravitationally Accelerated by An Unseen Companion
- Target accelerating stars that are young enough to have imageable planets

# Accelerating Star Surveys: A Promising New Direction

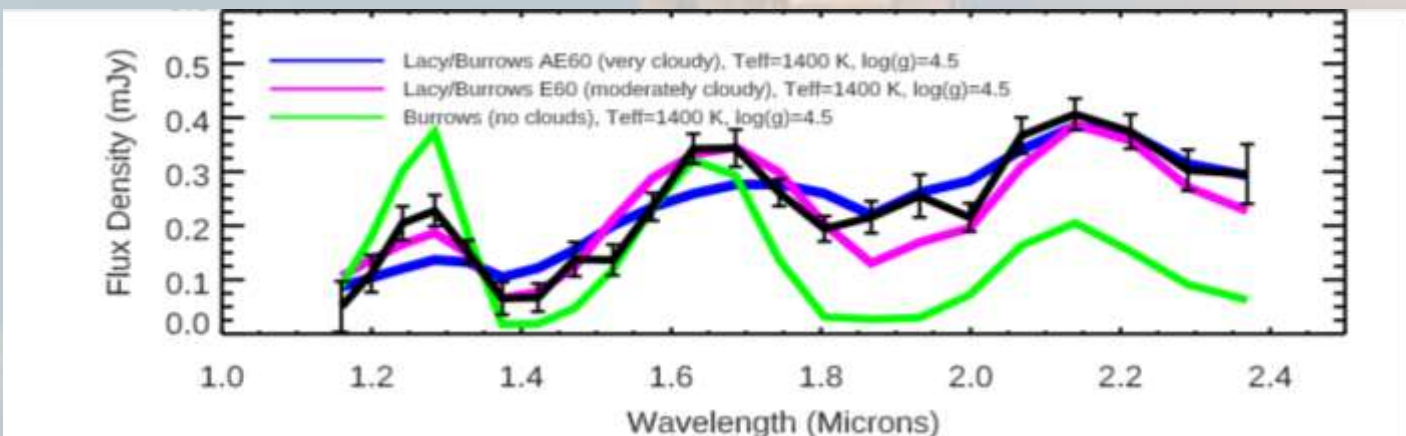
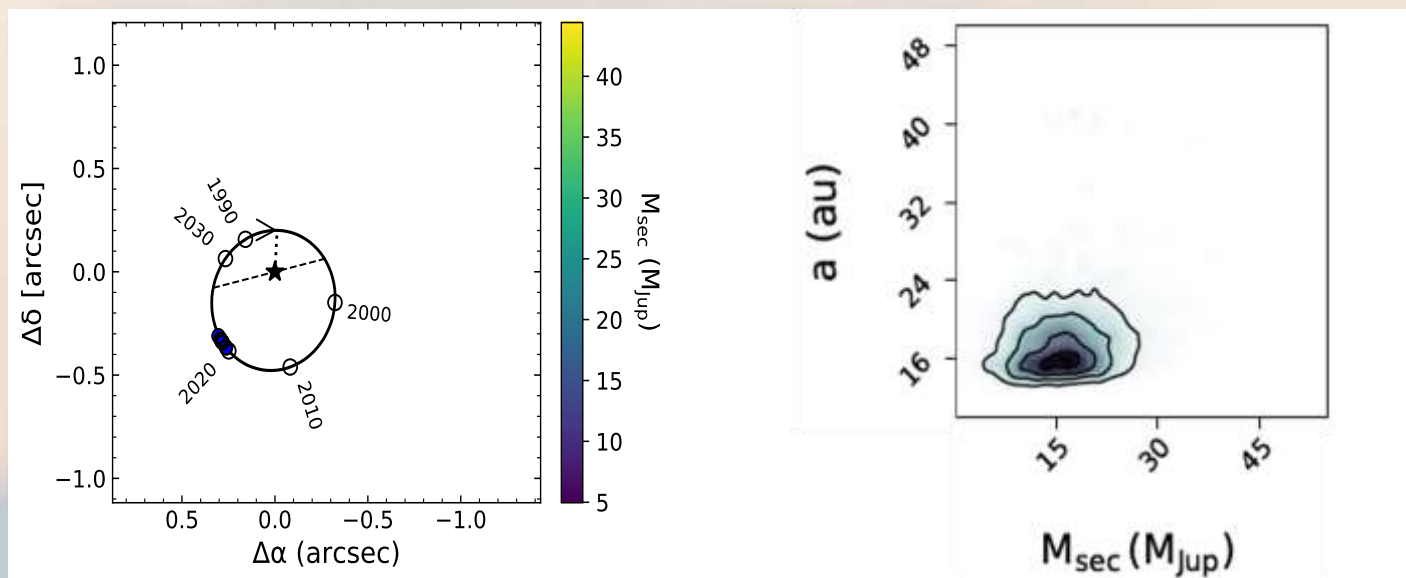
More Planet Discoveries

HIP 99770 b



Currie et al. 2023

Better Characterization



Currie et al. 2023

# Observing Accelerators with SCEXAO Imaging Survey (OASIS)

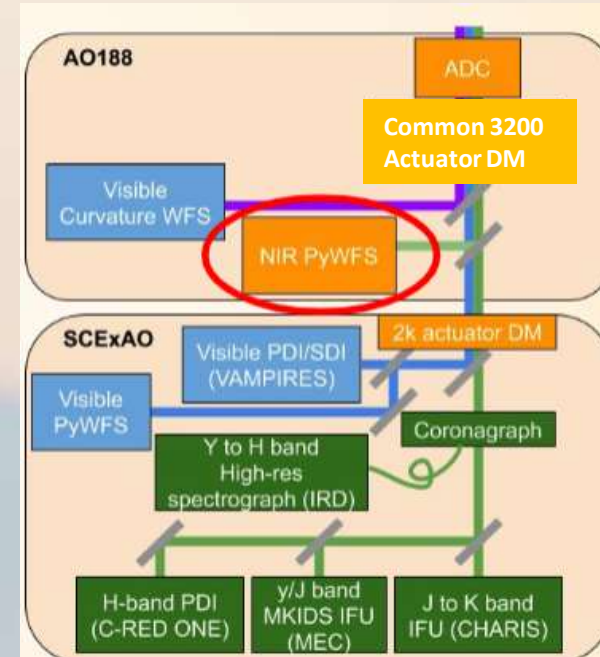
(PI. T Currie, Co-PI M. Kuzuhara)

## Instruments

- Subaru: two-stage extreme AO system  
AO3k+SCEXAO  
CHARIS IFS (1.1—2.4 microns)  
~1e-6 contrast at 0.4", ~1e-5 at 0.2"
- Keck/NIRC2 imaging at Lp (3.78 microns)

## Allocation

- 42 nights (34 on Subaru, 8 on Keck) + additional time –  
**this is the largest current exoplanet direct imaging search**

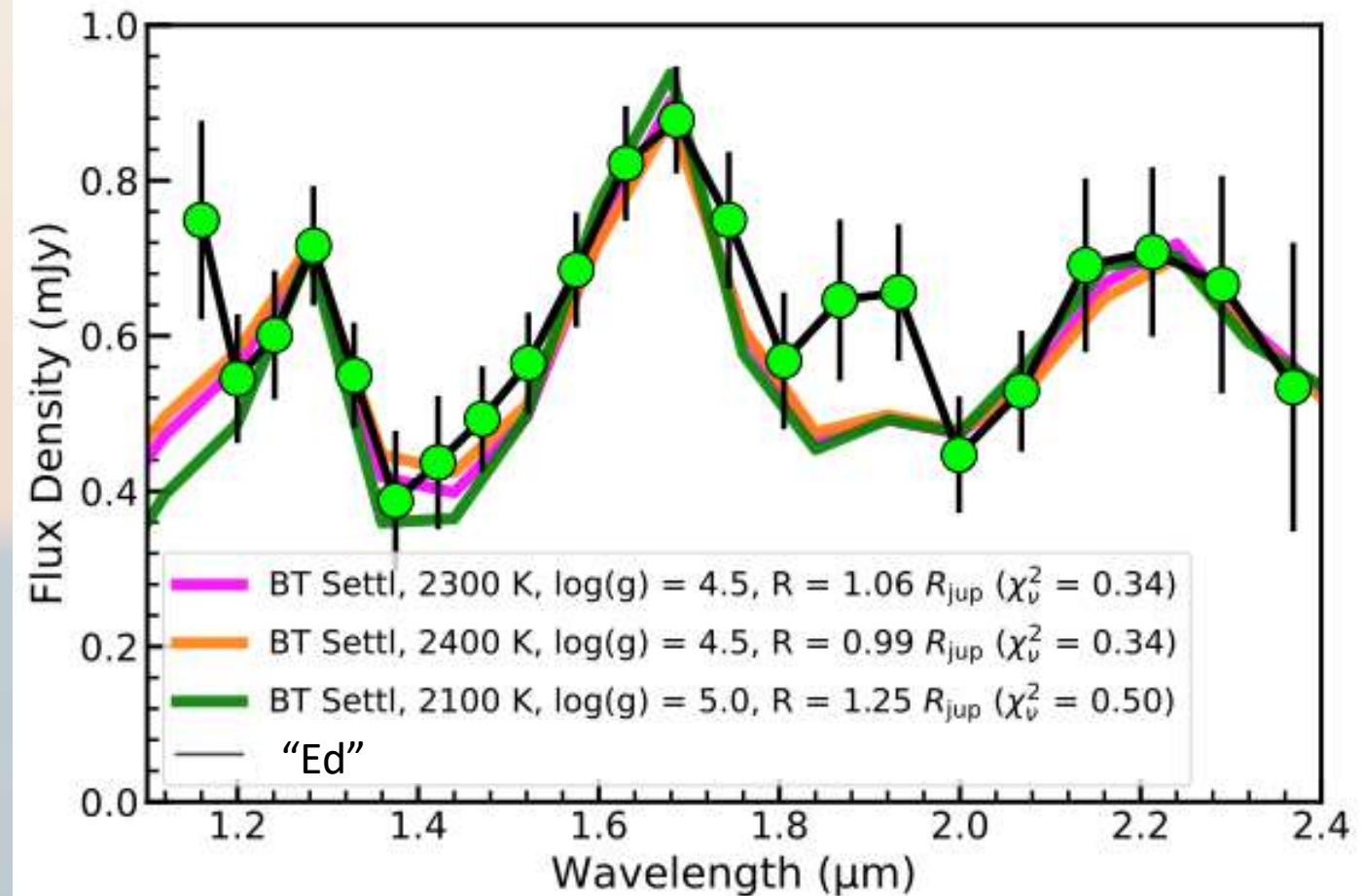
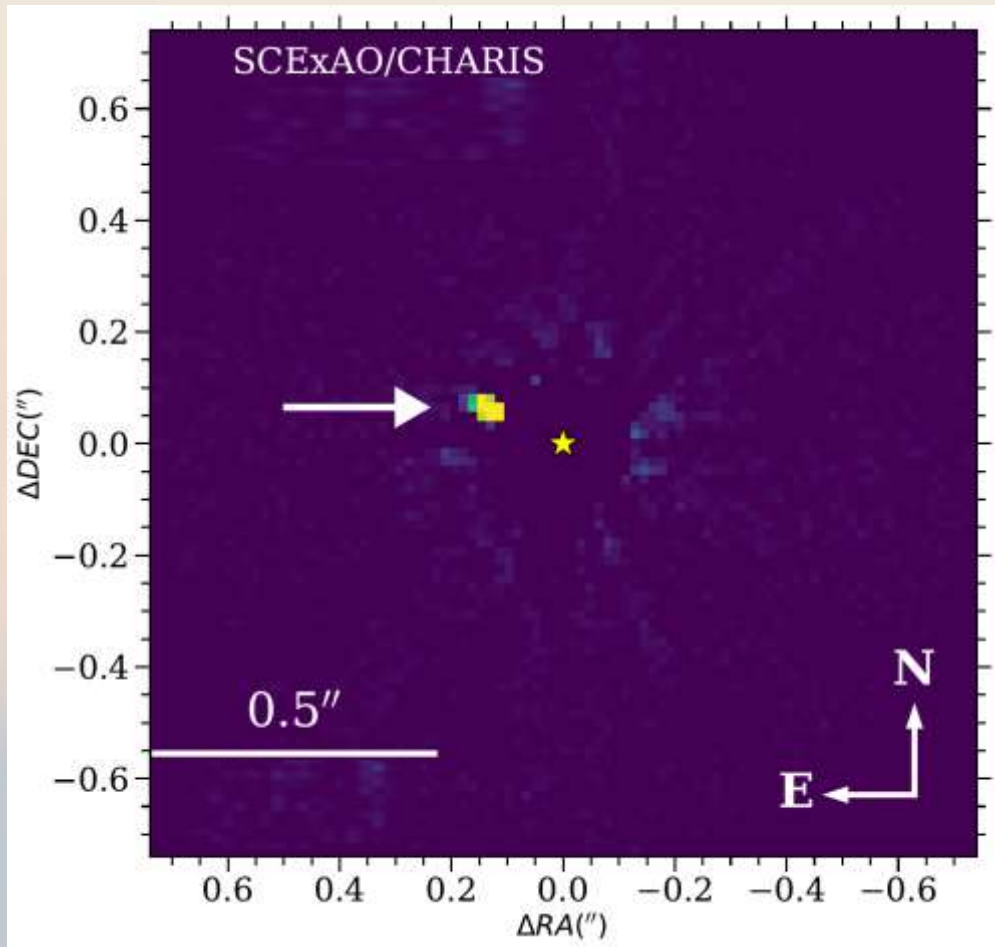


Credit: Maria Vincent (IfA)



Described in  
El Morsy et al.  
2024, SPIE

# OASIS discovery #1 : A New Planet – HIP 54515 b



Currie & Li et al. 2026, AJ 171, 5

orbits a very young A star that has never been the subject of a planet search before

~3--4  $\lambda/D$  separation!

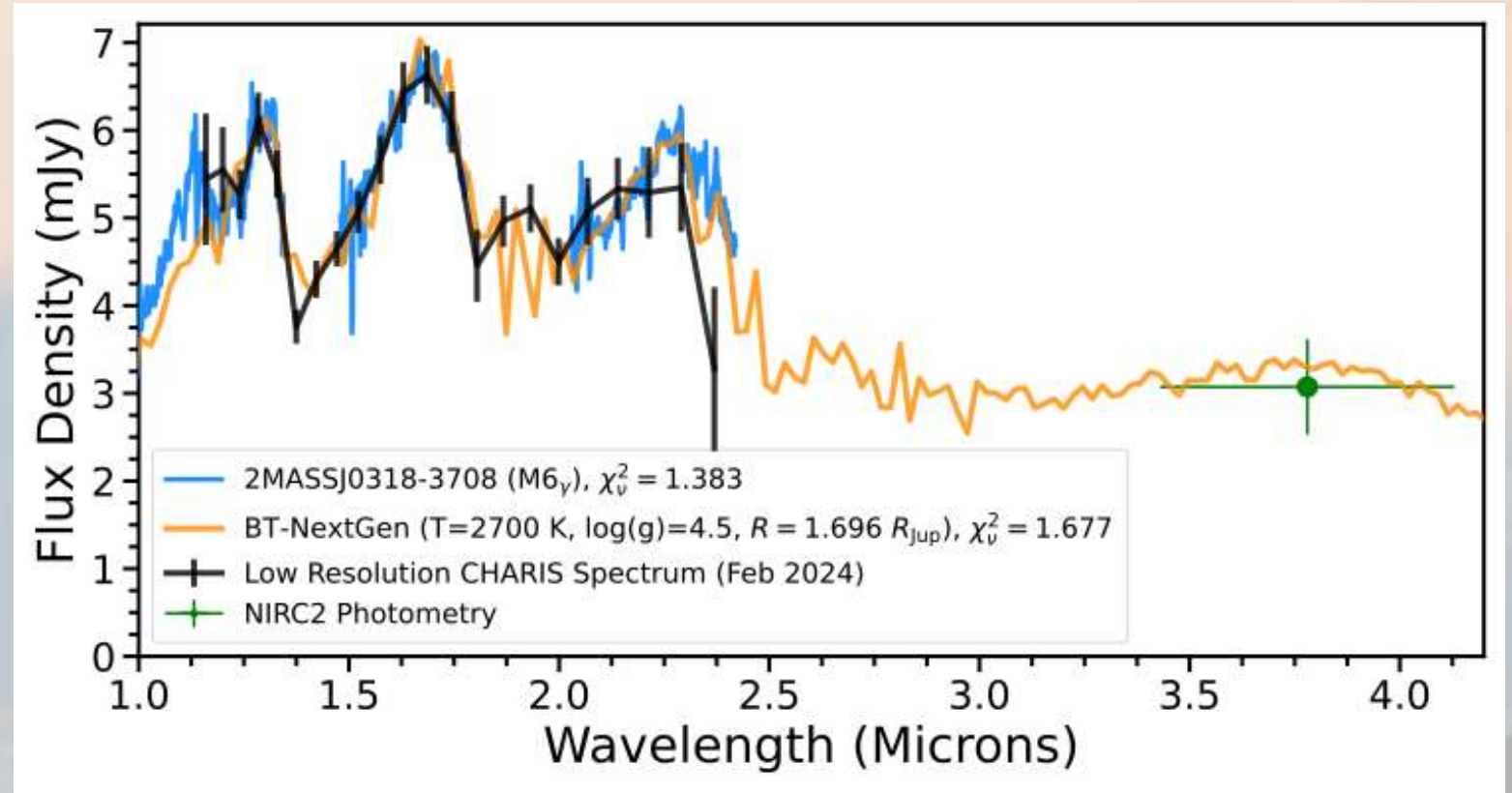
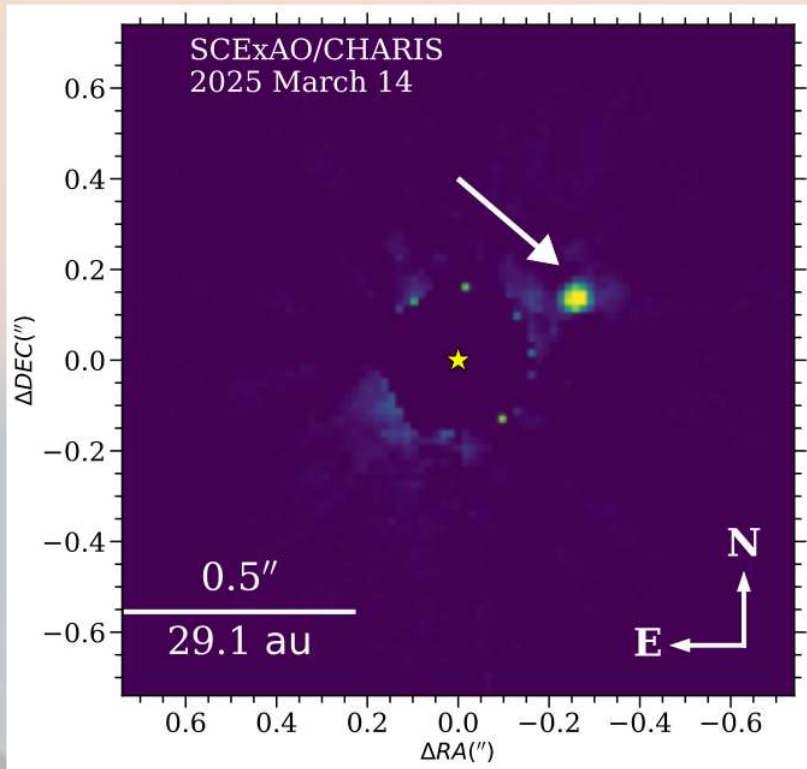
~2100-2400 K, M/L transition object

\*\*TC dedicates this work to the recently departed Wallace Ishibashi Jr, former OMKS cultural monitor and friend

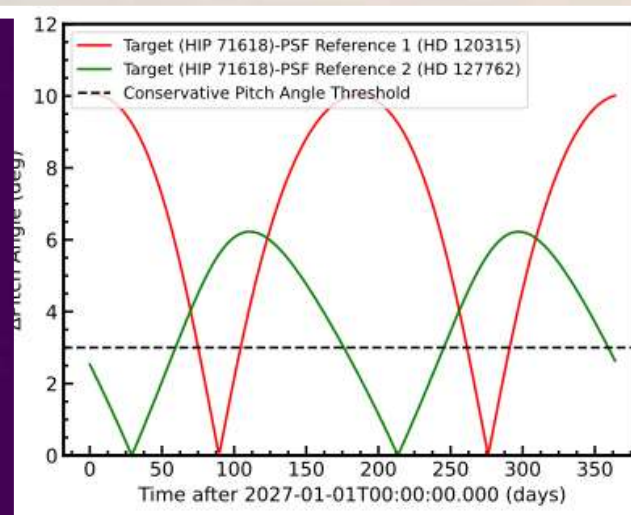
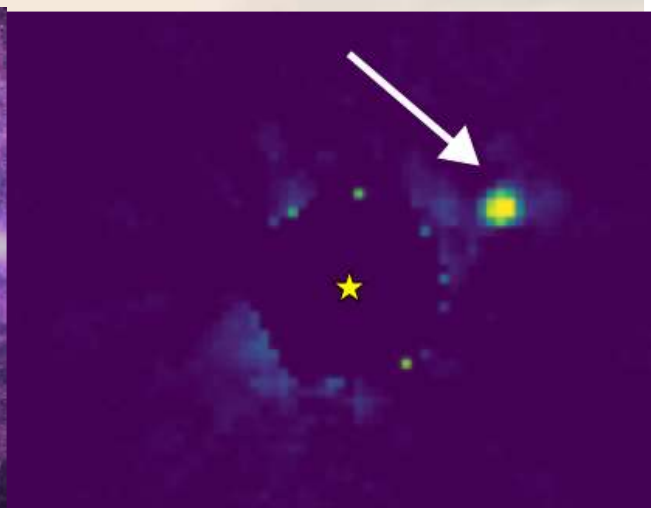
# OASIS discovery #2 – HIP 71618 B

## A (likely) brown dwarf companion suitable for Roman Coronagraph Technology Demonstration

Likely ~60-65 M<sub>J</sub> brown dwarf at ~11 au



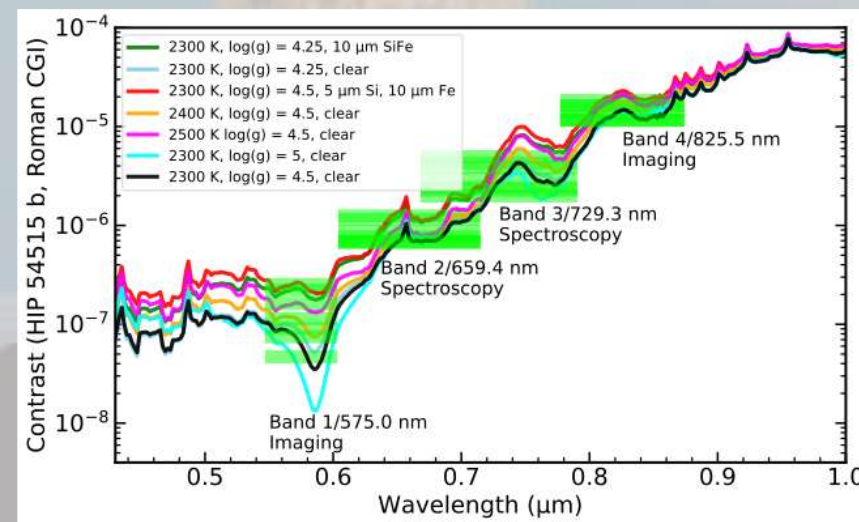
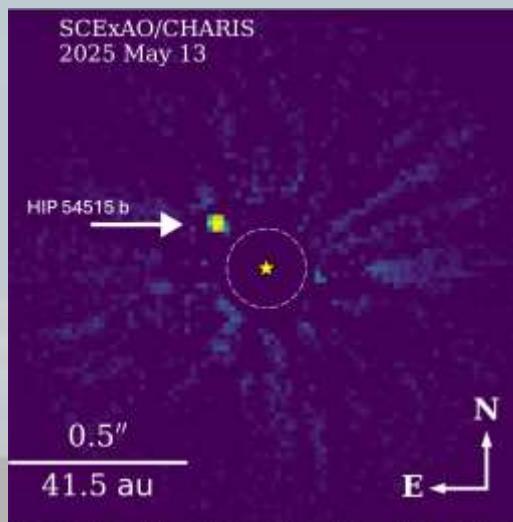
# OASIS: Ensuring the Success of the Roman Coronagraph



El Morsy et al. (2025)

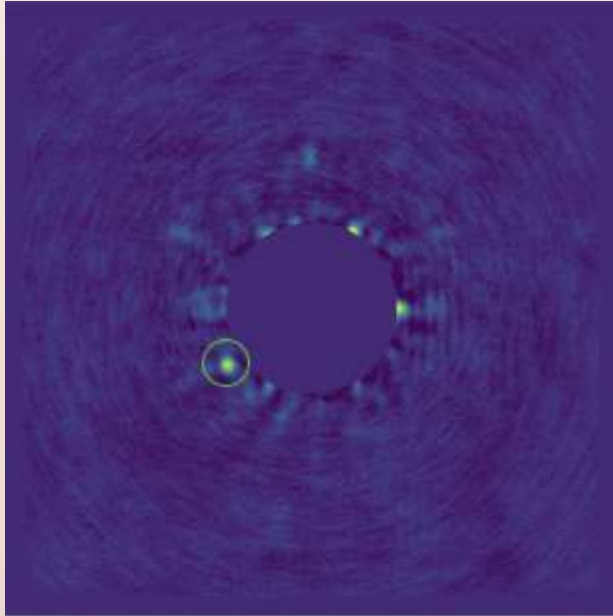
Both HIP 71618 and HIP 54515 chosen for Roman Coronagraph technology demonstration!

Currie & Li et al. (2026)

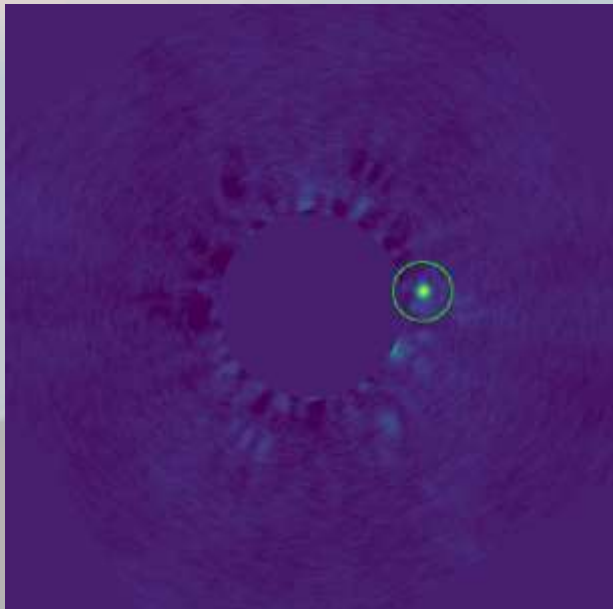


# New Discoveries

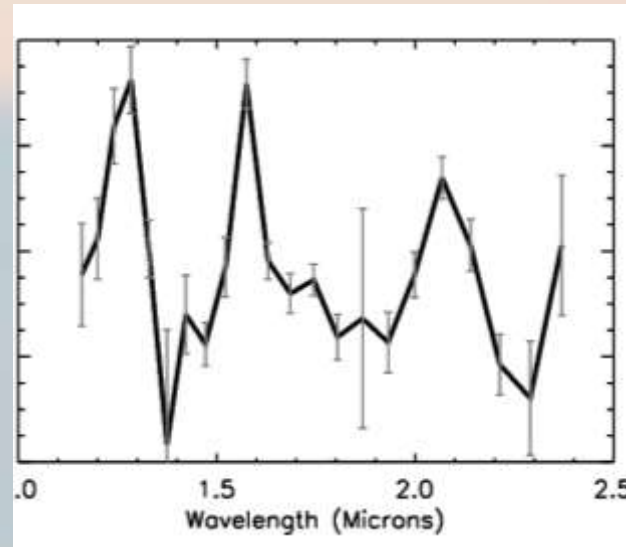
HIP xxxx B  
(Tobin et al.  
2026 under  
revision, to be  
resubmitted)



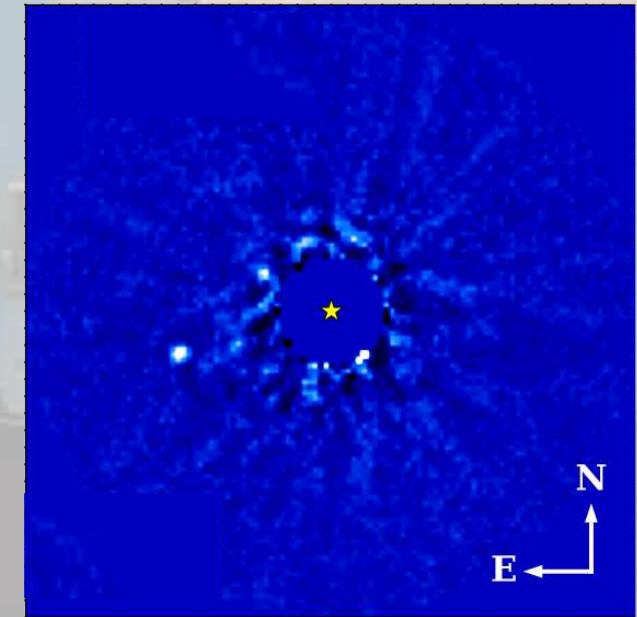
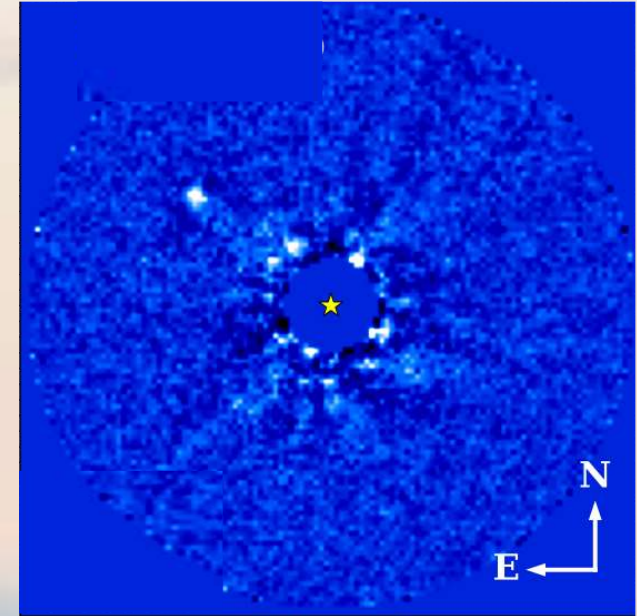
HIP xxxx B  
(Gu et al.  
2026 in  
prep)



HIP xxxx b  
new planet?  
(Kuzuhara,  
Brinjikji et al.  
2026 in progress)

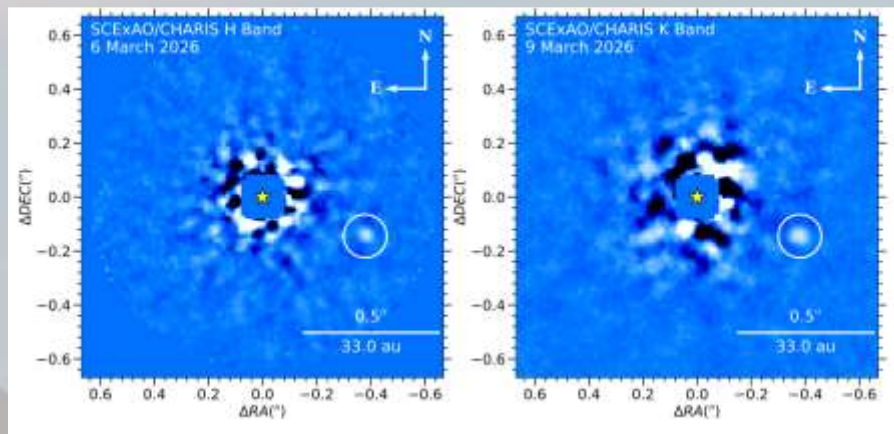
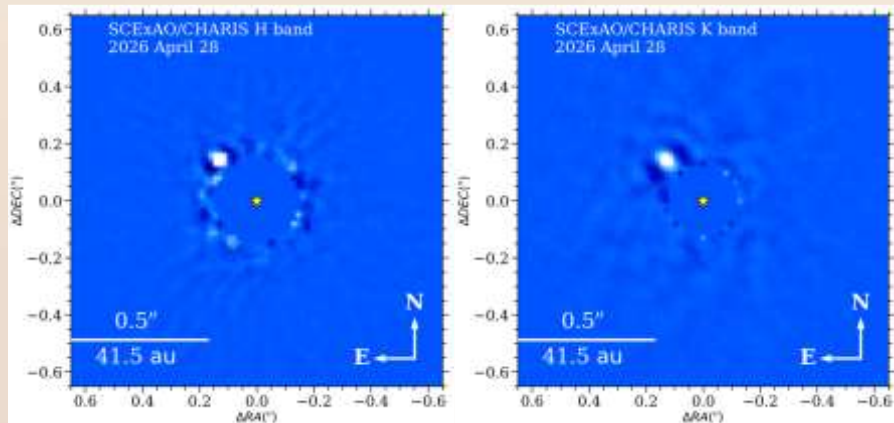


HIP xxxx B  
(OASIS team et al  
2026 in progress)

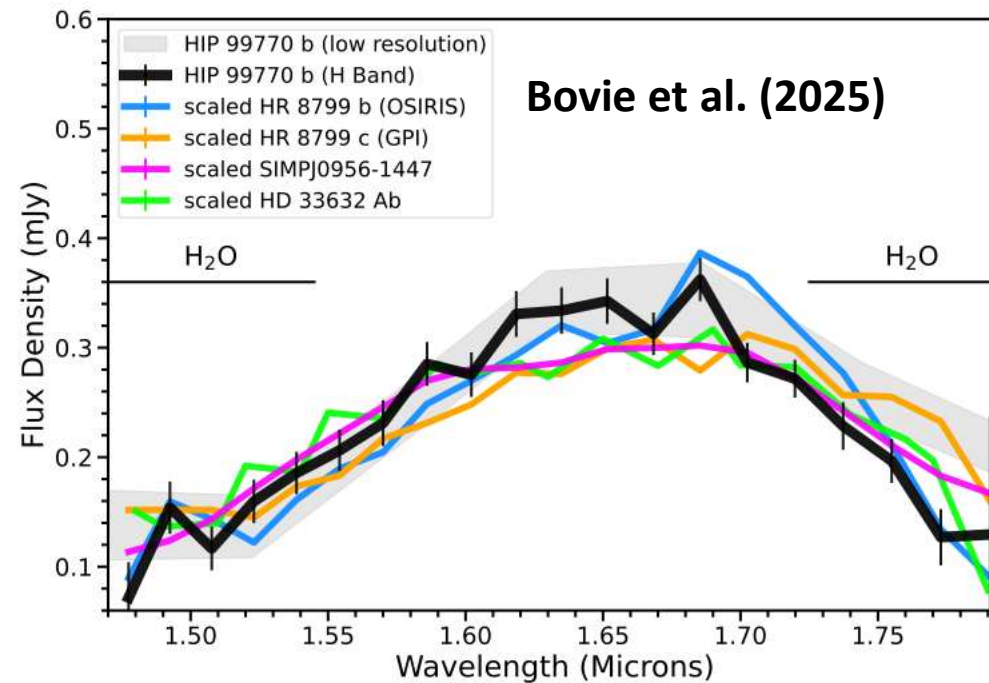


# Follow-Up Characterization at Higher Resolution

## HIP 54515 b follow up (Gu et al. in prep)



## HIP 39017 B follow up (Bovie et al. in prep)



## H and K band spectroscopy

- Probes surface gravity, carbon chemistry

## Dynamical Modeling with longer time baseline

- Improves constraints on orbits and masses

# Broader Scientific Impact

- Anchoring Luminosity Evolution Models

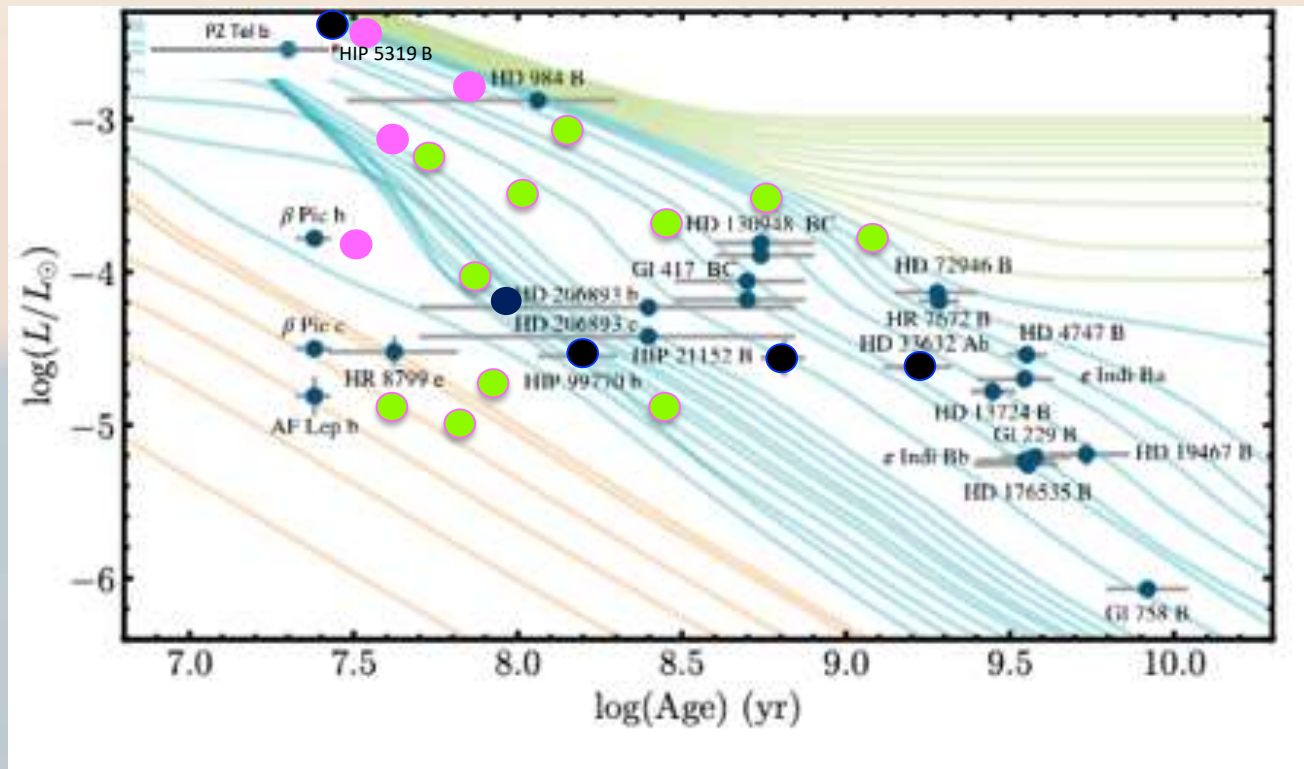
Measuring dynamical masses for many planets and low-mass brown dwarfs with different ages

→ empirically constrain gas giant luminosity evolution vs mass

- Evolution of Atmospheric Properties Vs. Mass

dynamical masses + atmospheres

→ how the atmospheres jovian exoplanets and low-mass brown dwarfs of different masses evolve with time

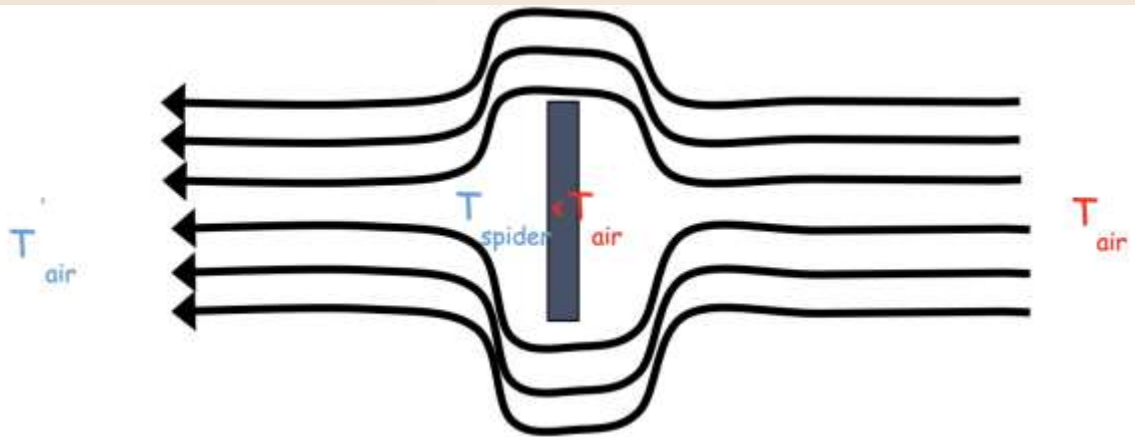


● Dark blue – published discoveries

● Magenta – unpublished discoveries

● Green – hypothetical results from survey

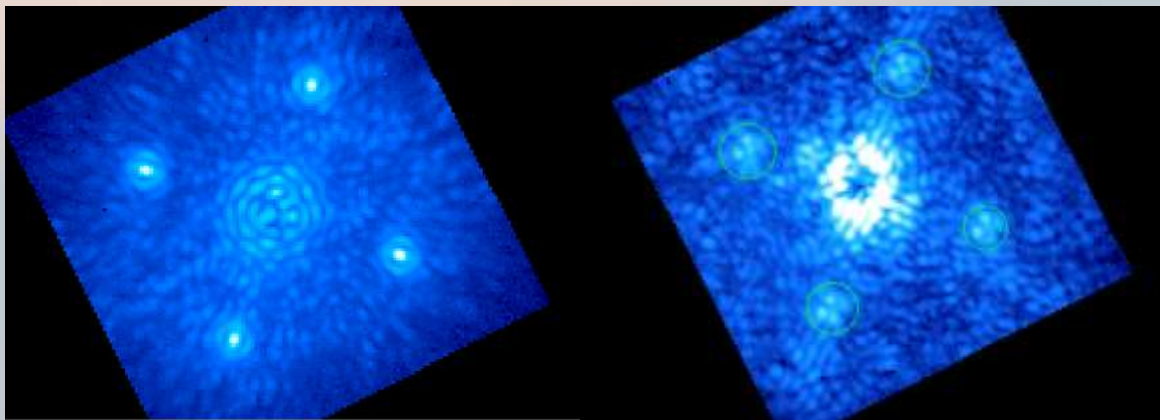
# Areas for Improvement: Low-Wind Effect



**NanoBlack coating on secondary spiders:**

**reduces LWE occurrence by a factor of ~6 with VLT (~3% now instead of 20%) (Milli et al. 2018)**

**Subaru: please coat at least 'part' of the secondary spiders to reduce incidence of Low-Wind Effect**



No Low-Wind Effect  
(Good Data)

Low-Wind Effect  
(Data Unusable)

**Low-Wind Effect has rendered >33% of OASIS clear nights unusable!!!!**

# Areas for Improvement: Staffing Pressure for SCExAO

## SPHERE extreme AO system

### *On-sky operation, final performance and future improvements*

T. Fusco\*<sup>a,b</sup>, J.-F. Sauvage<sup>a,b</sup>, K. Dohlen<sup>b</sup>, D. Mouillet<sup>c</sup>, J. Girard<sup>d</sup>, M. Kasper<sup>d</sup>, A. Costille<sup>b</sup>,  
C. Petit<sup>a</sup>, J-L Beuzit<sup>c</sup>, M. Suarez<sup>d</sup>, C. Soenke<sup>d</sup>, M. Downing<sup>c</sup>, P. Baudoz<sup>e</sup>, A. Sevin<sup>e</sup>,  
A. Baruffolo<sup>f</sup>, H.-M. Schmid<sup>h</sup>, B. Salasnich<sup>f</sup>, P. Puget<sup>c</sup>, F. Feautrier<sup>c</sup>, S. Rochat<sup>c</sup>, T. Moulin<sup>c</sup>, E.  
Hugot<sup>b</sup>, A. Vigan<sup>b</sup>, N. Hubin<sup>d</sup>, P. Puget<sup>c</sup>

- ESO has given substantial support for the operation of the SPHERE AO system as well as the science instruments (IFS, IRDIS, ZIMPOL)
- AO3K+ SCExAO: #3 most scheduled platform in S2026B but has two permanent staff: significant stress on personnel
- Some key support for SCExAO – (SCExAO alumni/collabs) (S. Vievard, N. Skaf) at no cost + paid current term scientists (G. Singh, S. Julliard)
- Some key support for CHARIS – instrument health & monitoring, calibration, data reduction, done from mainland and at no cost to Subaru (J. Chilcote, T. Currie)

Facilitizing SCExAO + CHARIS would help improve the performance, reliability, and scientific productivity of Subaru

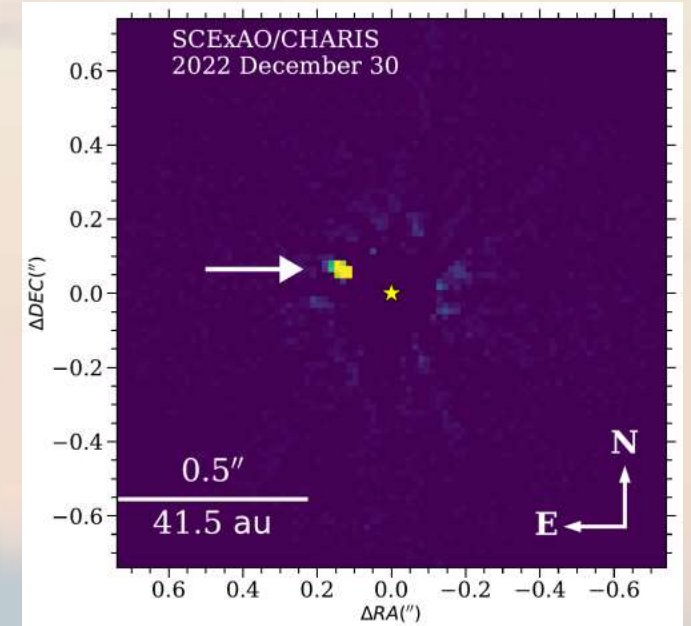
## Very Large Telescope SPHERE User Manual

Reference	PDM-ESO-254263 VLT-MAN-SPH-14899-0430	
Issue	P114.1	
Status	100% public release (P114_phase 2)	
Date of issue	2024-07-18	
Prepared	Date	Signature
J. Wafar, M. Jones, R. de Rosa, F. Rodic, M. van den Ancker, H. Böhm, J. Glöckner	2024-07-18	
Early contributors: D. Mouillet, J. Girard, D. Mouillet, J. Mill, A. Vigan, M. Kasper, R. Glöckner and the SPHERE consortium		



# Summary

- Motivation, Basic Program Design, and Proof of Concept
- First Discoveries
- New, Unpublished Results
- Follow-Up Characterization
- Broad Scientific Goals and Outlook
- Areas for Improvement\*



Please fix low-wind effect and  
facilitate SCEXAO & CHARIS

*Also, if you want help reducing CHARIS data  
please let me know! [currie@naoj.org](mailto:currie@naoj.org)*