

(New) Scientific Results from the Subaru Coronagraphic Extreme Adaptive Optics Project

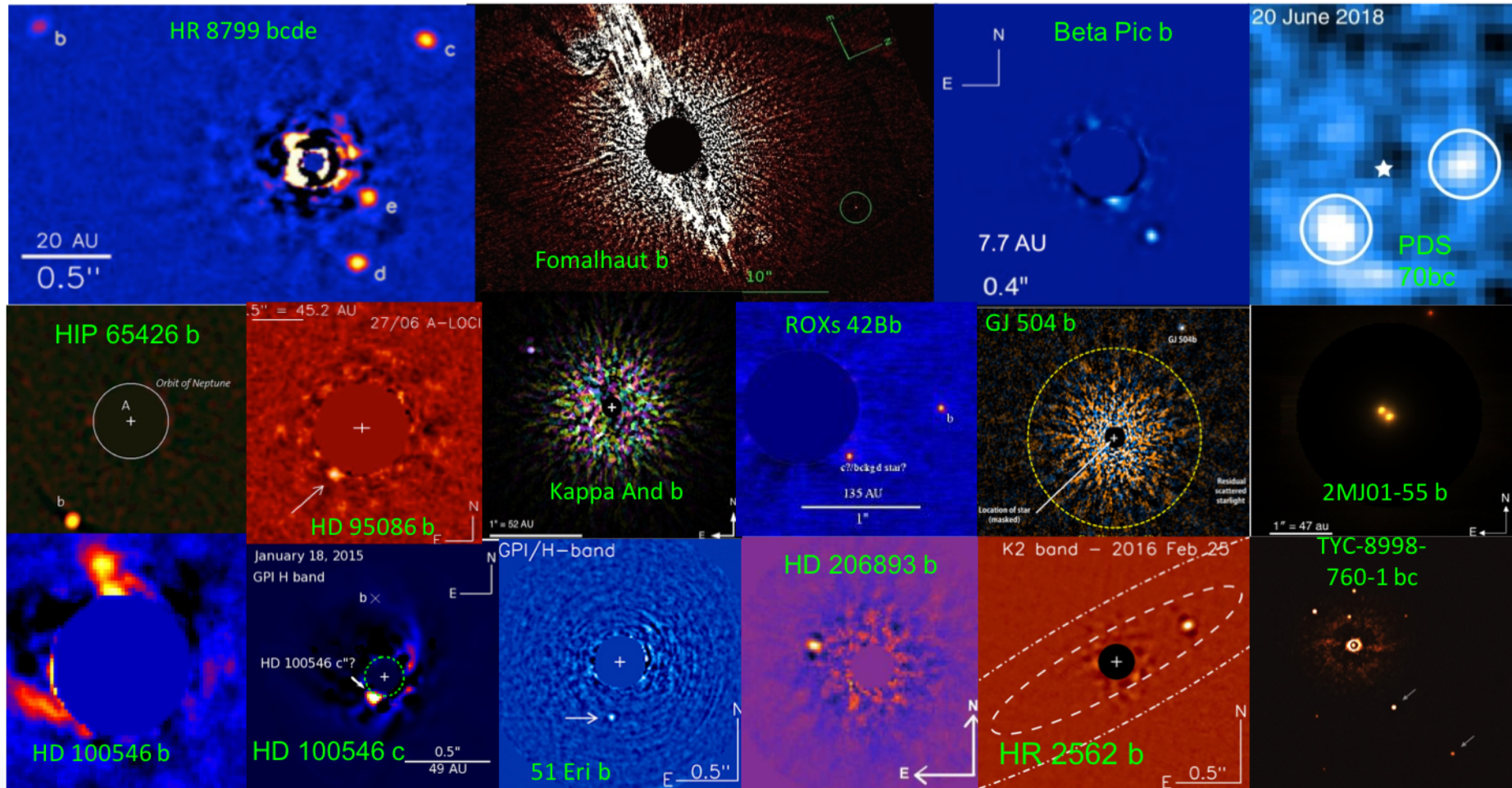


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Olivier Guyon, Julien Lozi, Vincent Deo, Sebastien Vievard, Ananya Sahoo, Tim Brandt, Jeff Chilcote, Masayuki Kuzuhara, + many other SCExAO and CHARIS instrument team members

(The Few) Directly Imaged Extrasolar Planets

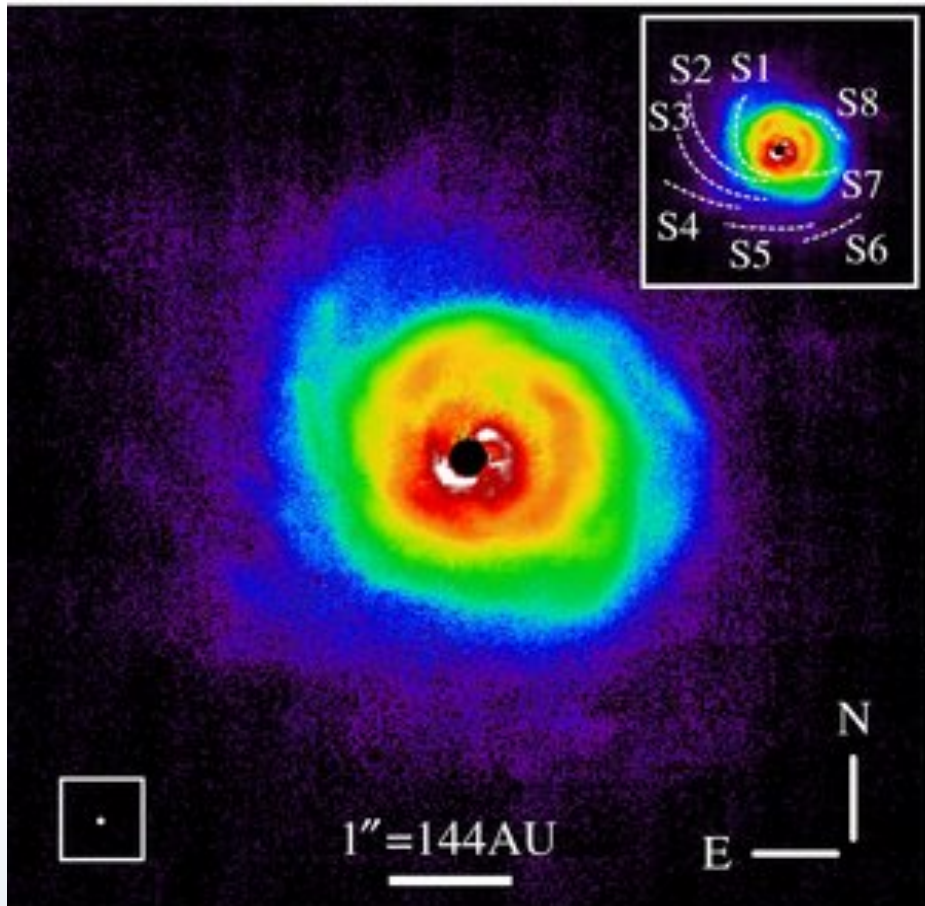


- Few detections: About 12-20 directly-imaged planets known so far
- Most are very massive ($M > 5$ jovian masses) and at wide separations (15-30 au; typically $\sim 0.5''$ - $1''$):

(Marois et al. 2008, 2010; Kalas et al. 2008; Lagrange et al. 2010; Keppler et al. 2018; Haffert et al. 2019; Chauvin et al. 2017; Rameau et al. 2013; Carson et al. 2013; Currie et al. 2014; Kuzuhara et al. 2013; Delorme et al. 2013; Quanz et al. 2013; Currie et al. 2015; Macintosh et al. 2015; Milli et al. 2015; Konopacky et al. 2016; Bohn et al. 2020)

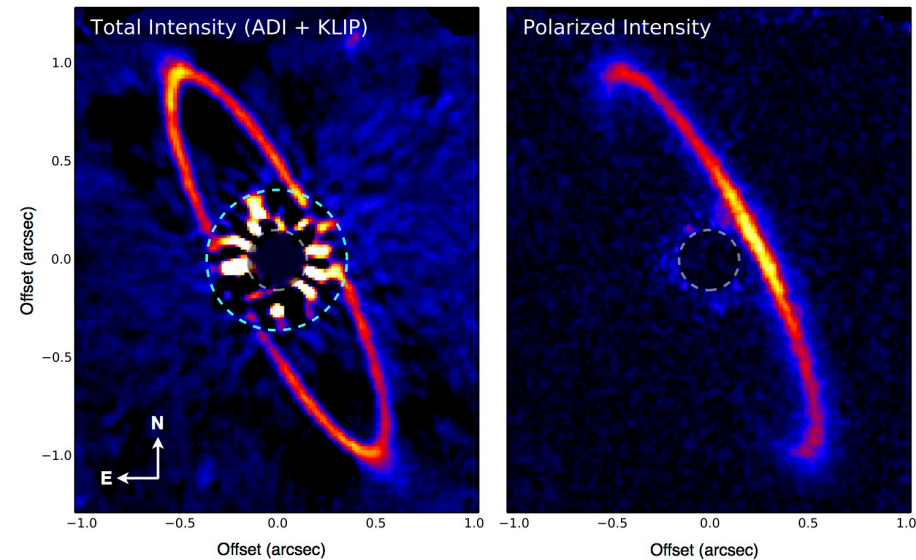
Planet-Forming Disks

AB Aur - Hashimoto et al. (2011)



- Protoplanetary Disk

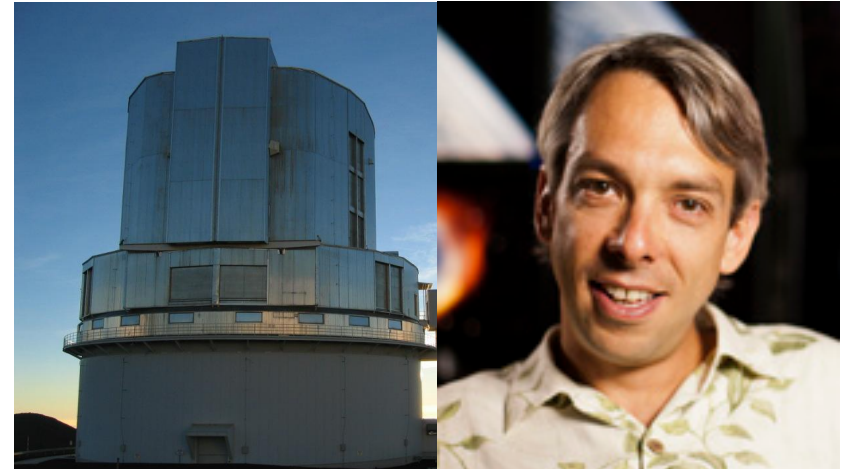
HR 4796A – Perrin et al. (2014)



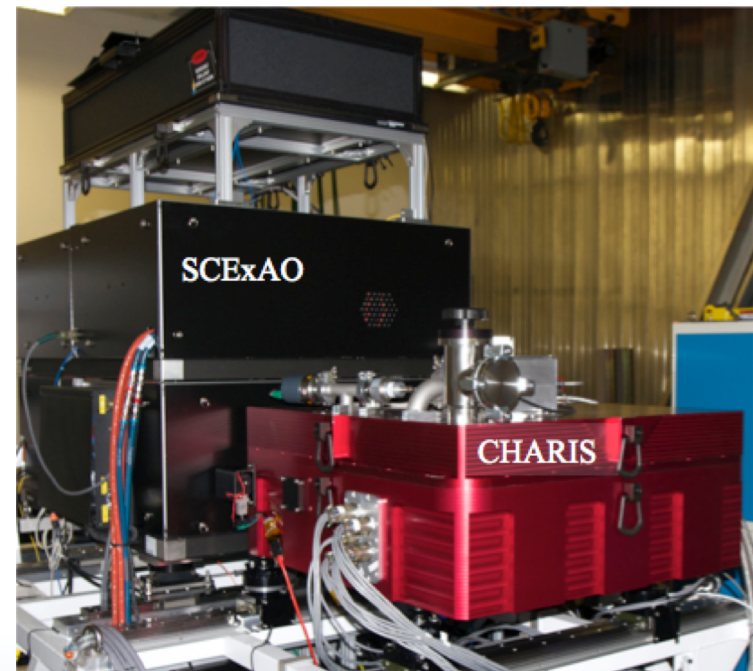
- (Kuiper belt-like)
Debris Disk

Project

- Extreme AO System for Subaru (PI Olivier Guyon)
- Pyramid Wavefront sensor, 2000 actuator DM, EMCCD camera
- Rapidly Corrects for Atmospheric Blurring: 1080 modes, 3.5+ kHz
- S.R. > 90% at H band

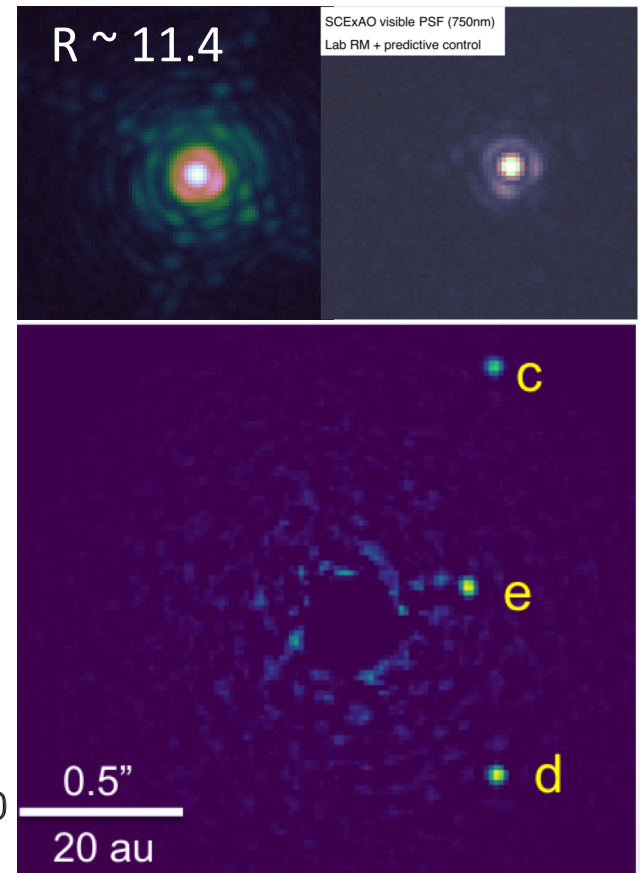
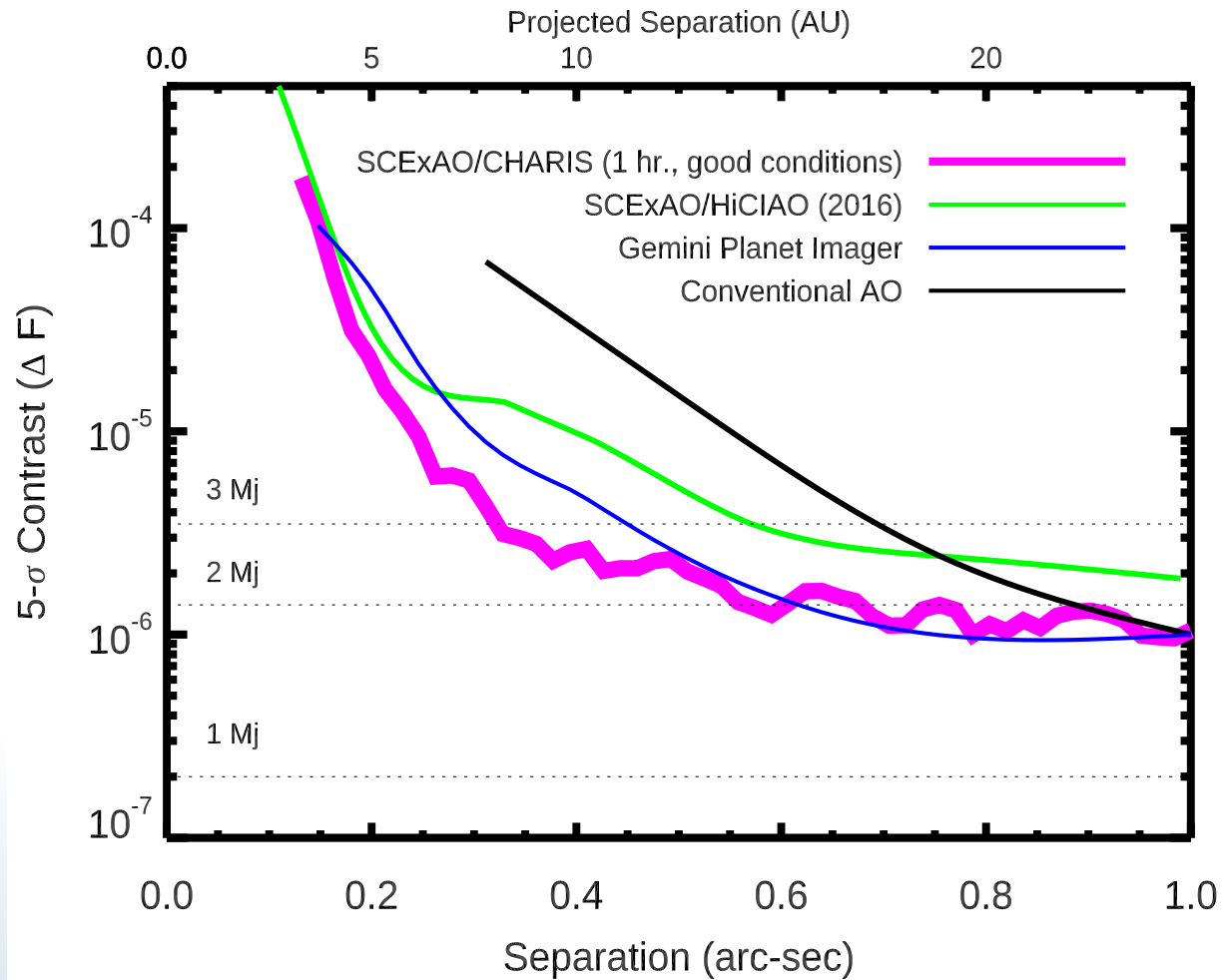


- Planet Imaging/Spectra:
CHARIS integral field spectrograph

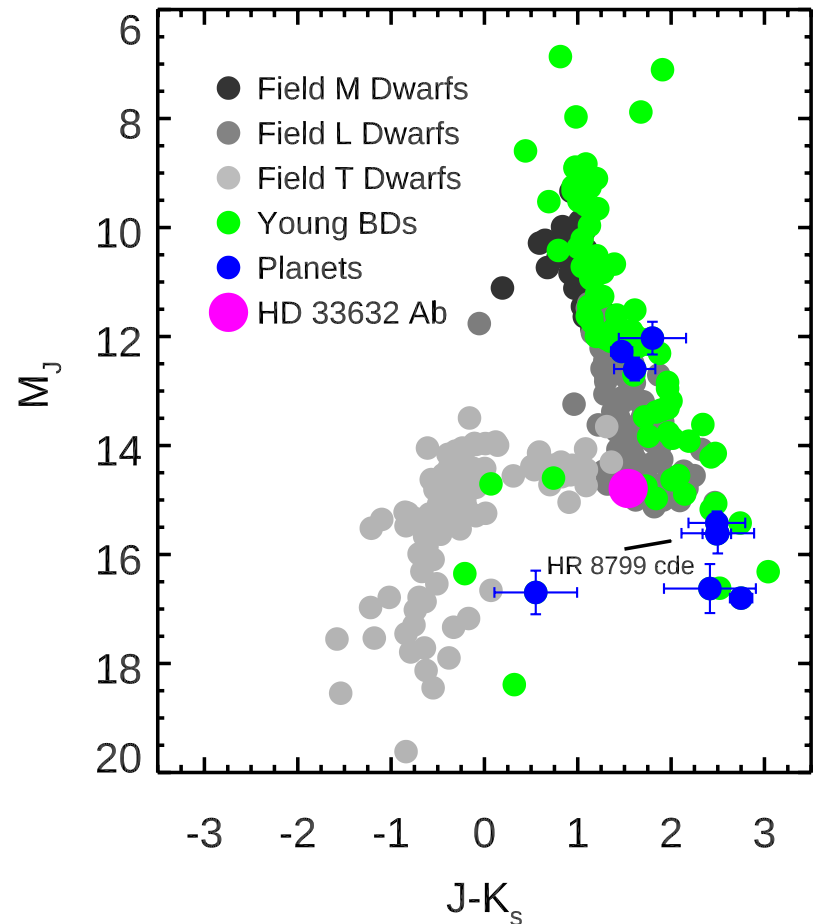
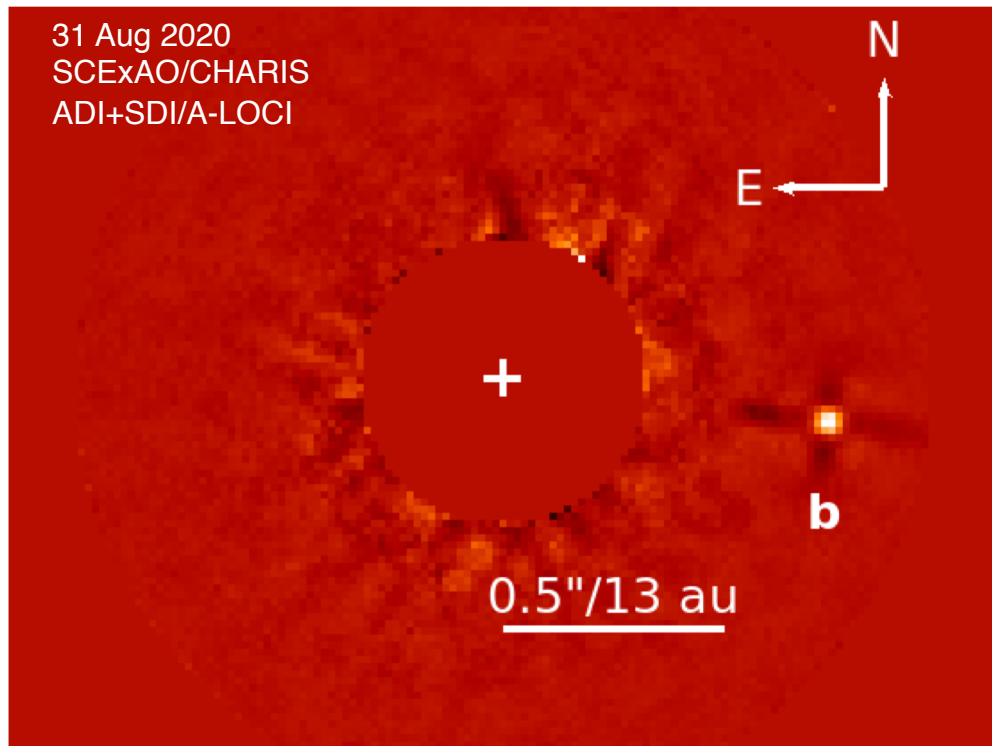


(see posters p07 – Guyon and p15-Lozi)

SCEXAO Project

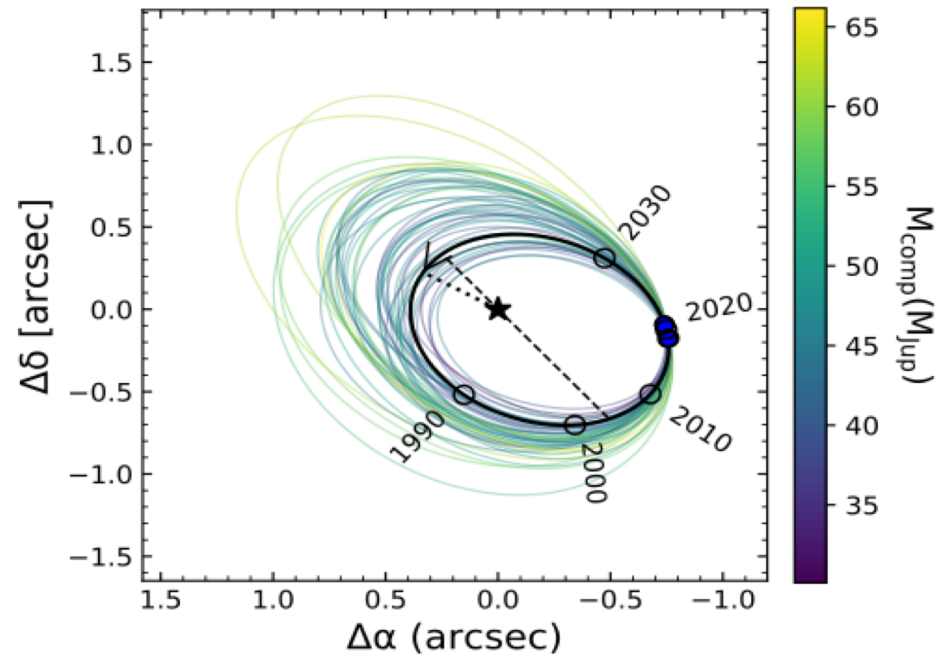
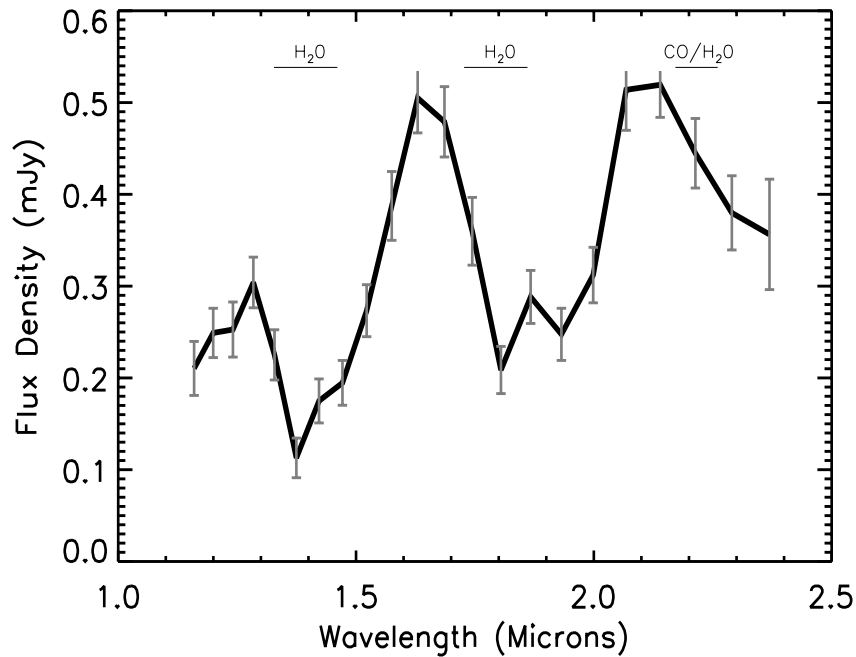


New Results: Discovery of HD 33632 Ab



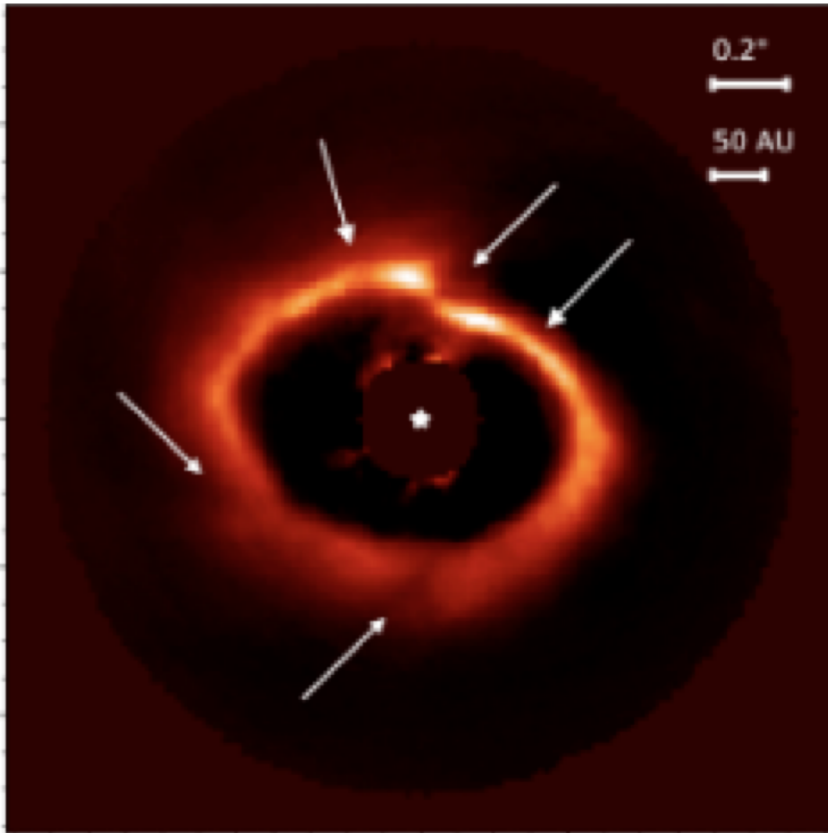
- A Faint Companion to a Nearby Sun-like Star
- Infrared colors similar to HR 8799 cde

New Results: Discovery of HD 33632 Ab

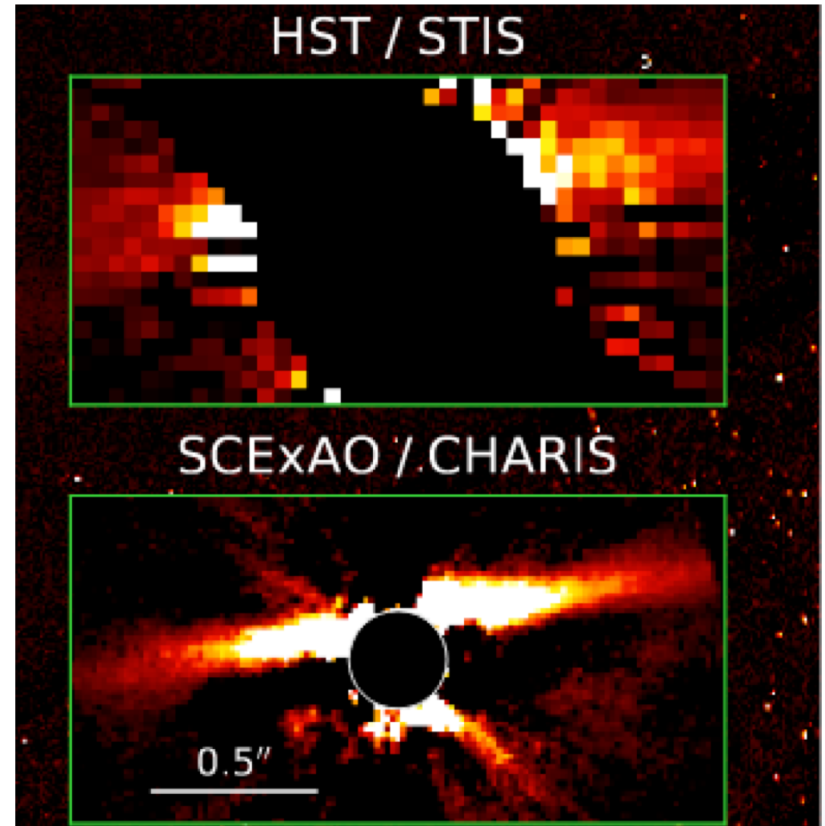


- L/T Transition Object (tracing the transition from cloudy to clear atmospheres)
- Dynamical mass of $\sim 46 M_{\text{J}}$
- Very low (planet-like?) eccentricity

New Results: Characterization of Planet-Forming Disks



HD 34700
Protoplanetary Disk

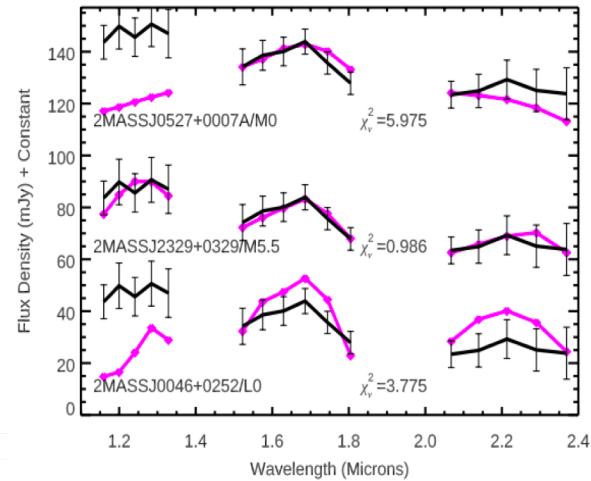
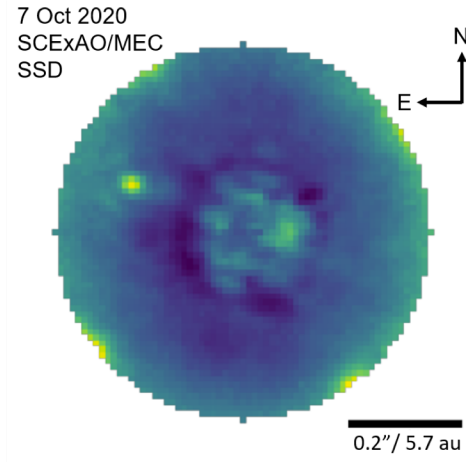


HD 15115 Debris disk

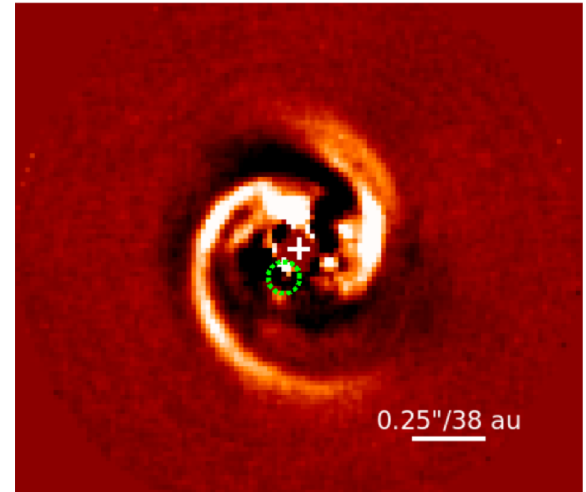
Upcoming Results

See P22-Steiger

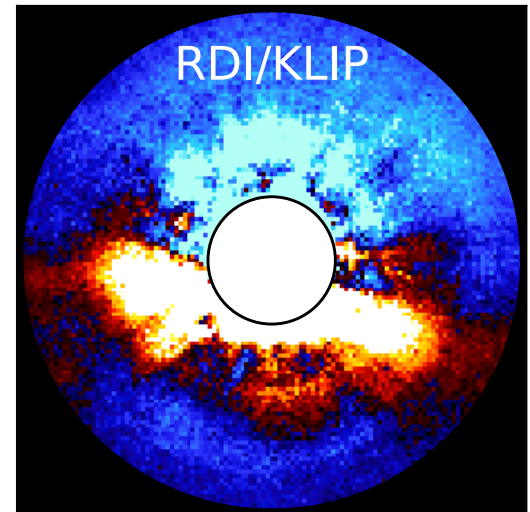
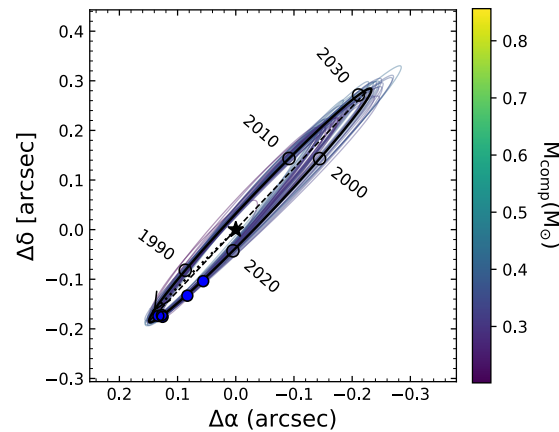
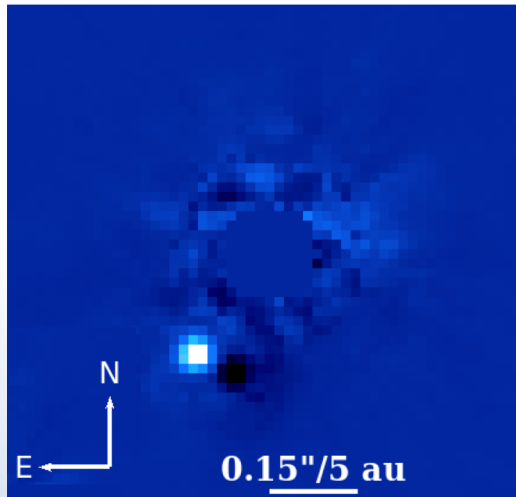
7 Oct 2020
SCEXAO/MEC
SSD



See P30-Uyama



See P13-Lawson



New Planet Discoveries (Needing Final Confirmation!)

REDACTED!

Request:

DDT/staff time in May + Open-Use Follow up in S21B

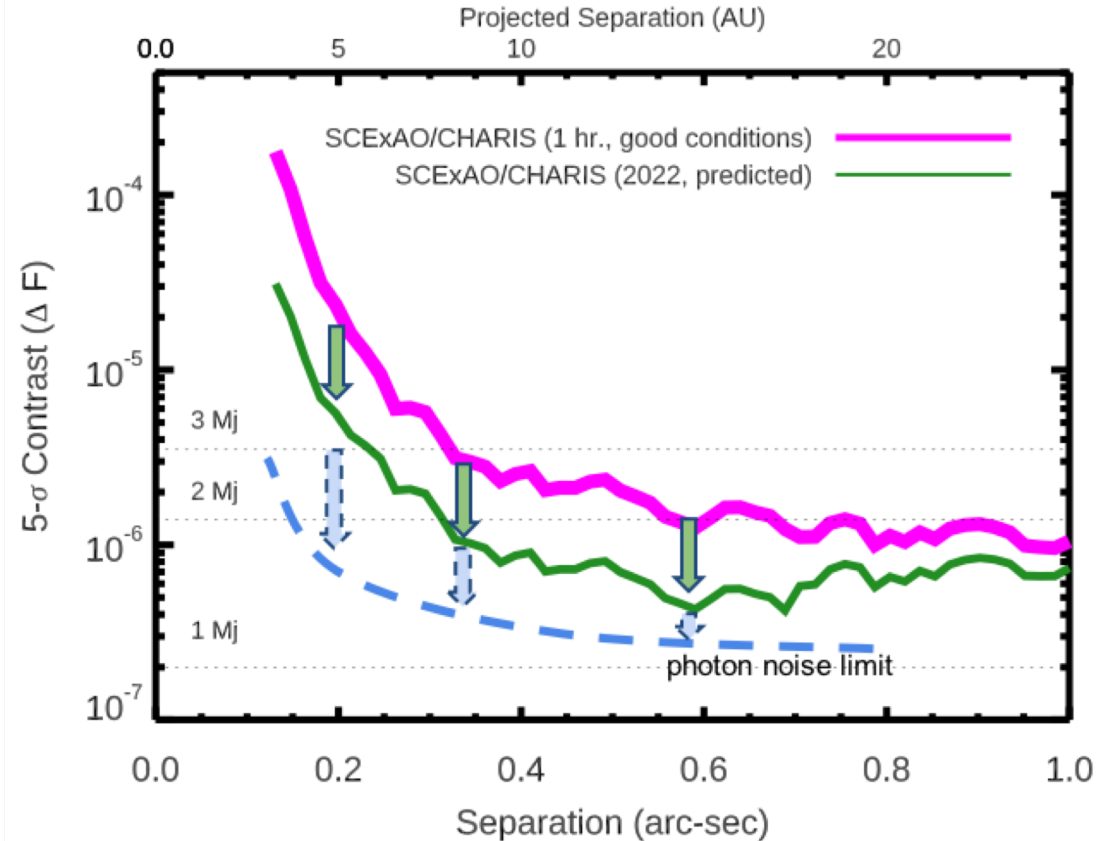
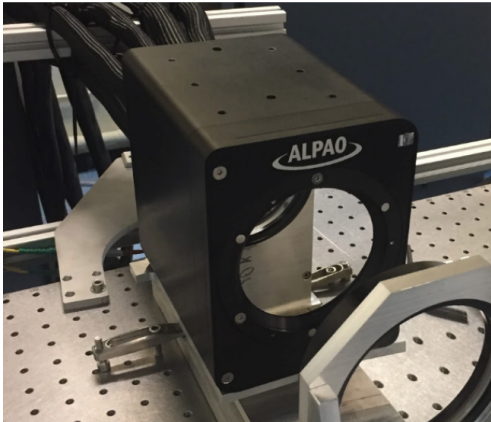
TOP PRIORITY in S21B for
SCExAO/CHARIS Consortium!
[& May 2021 time = needed]

Request:

Open-Use Follow up in S21B
[program was accepted in S20B but partially
weathered out]

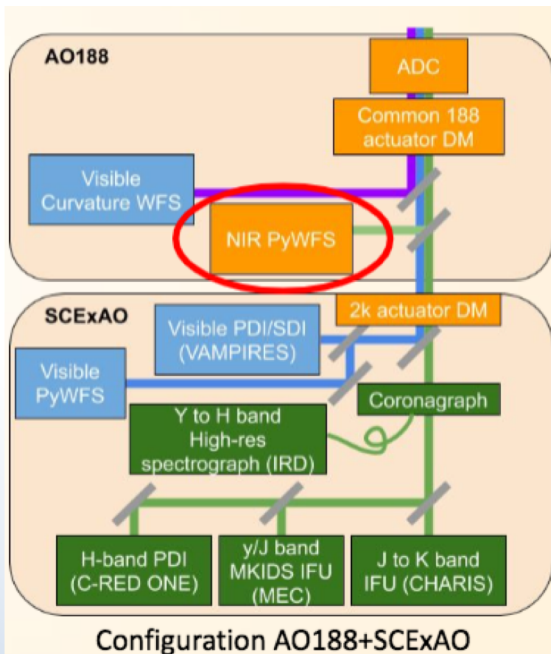
Cleared for Nature submission if confirmed

SCE_xAO: Upgrades in 2021



- Near-IR Pyramid WFS for “AO-188”
- AO188 will be replaced by 3200 actuator DM + EMCCD
- Factor of ~5-10 gain in contrast

Once performance demonstrated, warrants SSP or multiple Intensive Proposals



What can Subaru do make SCExAO better?

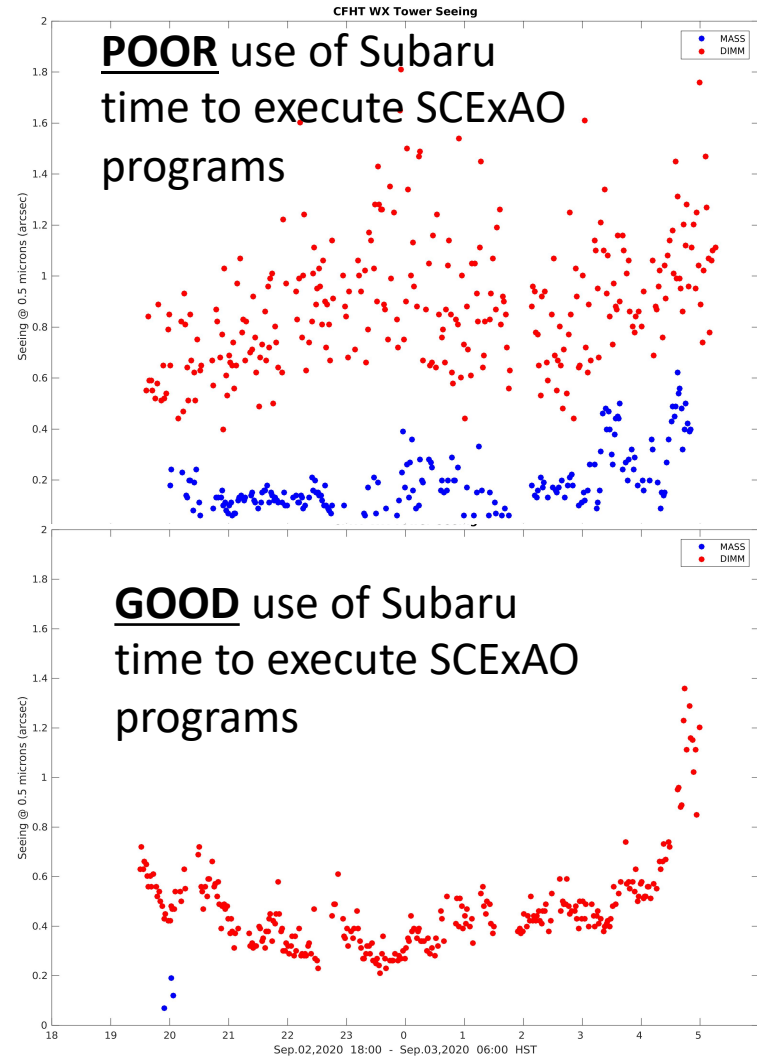
- 1. Queue mode
- 2. Queue mode
- 3. Queue mode
- 4. Queue mode
- ... and 5. Queue mode

SCExAO requires good seeing conditions for most programs

ESO-style queue mode scheduling between SCExAO and other instruments would ensure time optimally used

Step 0: SCExAO/IRD mini-queue

Invasiveness: minimal



What can Subaru do make SCExAO better?

- 6. Scheduling Flexibility between science and engineering within SCExAO nights:

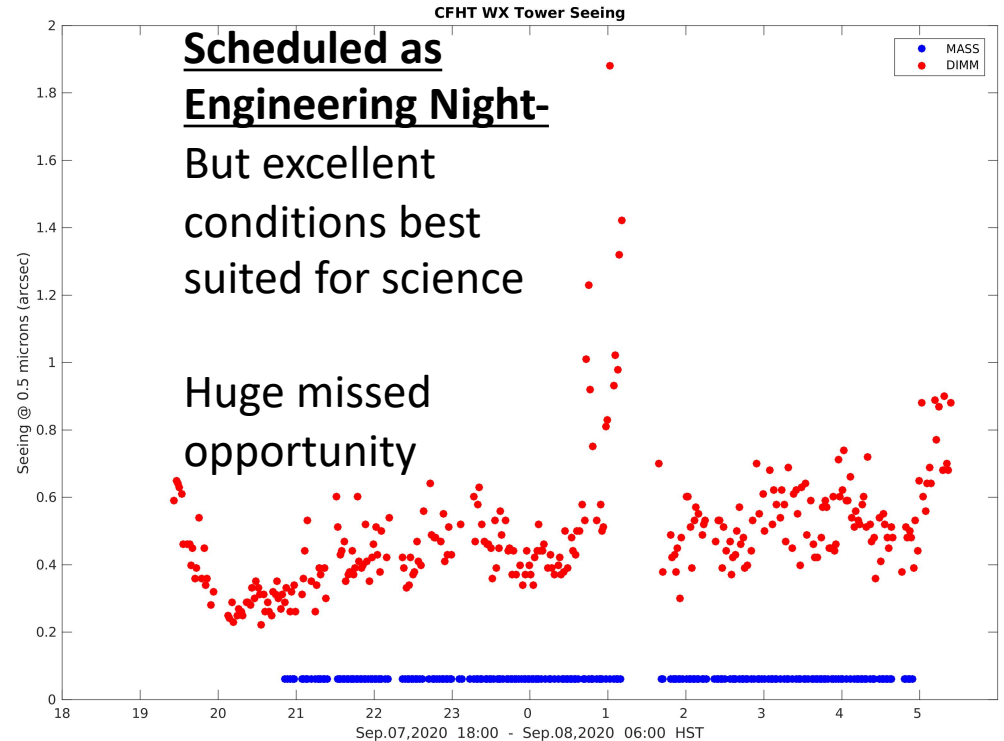
‘internal queue mode’

SCExAO team should be allowed to execute engineering OR science programs, depending on conditions

Invasiveness: minimal

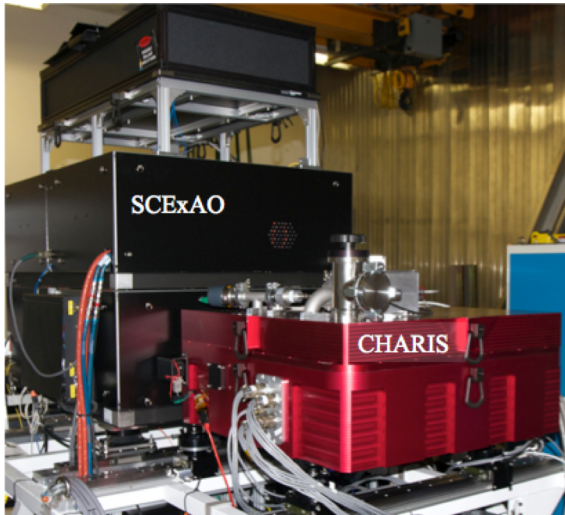
Just requires:

- performance requirements to be CLEARLY, quantitatively identified in Open Use Proposals
- multiple PIs to be “on call” for a given night



What can Subaru do make SCExAO better?

- 7. More engineering to improve core performance (i.e. just the AO)

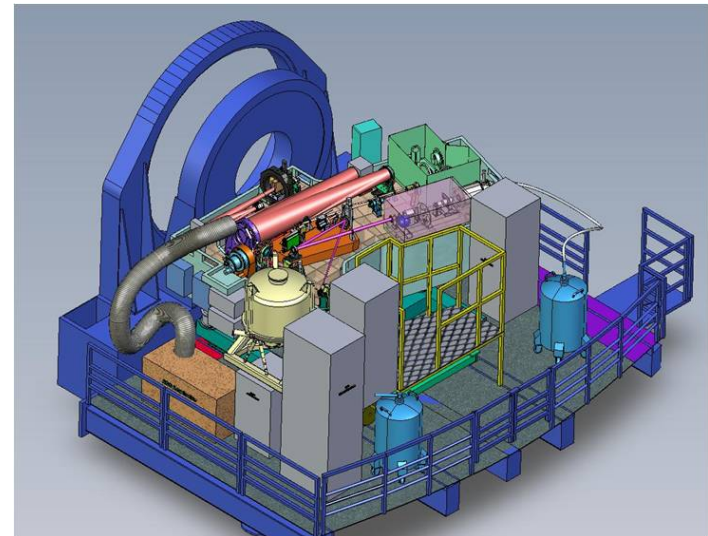


SCExAO – the world’s most advanced extreme AO system (cutting edge technology)

Invasiveness: minimal

Just requires:

- Periodic engineering time allocated & priority over ‘niche’/infrequently used modes: performance benchmarking, tuning, etc.



SPHERE – the world’s best performing extreme AO system (comparatively “vintage” technology 10 years behind SCExAO but engineered exquisitely)

Thank you, Subaru Staff!

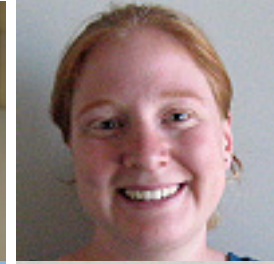
A few of the Subaru staff members [technicians, IT, engineers, day crew, office workers] who have whose amazing work has kept us running flawlessly during extremely difficult times from COVID-19 ...

We acknowledge the very significant cultural role and reverence that the summit of Mauna Kea holds within the Hawaiian community. We are most fortunate to have the privilege to conduct observations from this mountain and hope we have used these opportunities wisely.

We support and endeavor to contribute to respectful, effective stewardship of cultural, natural, and scientific resources that properly honors these lands.

We also acknowledge the critically important role of the current and recent Subaru Telescope kama'aina staff, especially during these challenging times presented by the COVID-19 pandemic. Their expertise and dedication is indispensable to the continued successful operation of the Mauna Kea Observatories.

This work is supported by NASA-XRP award 2XRP-0117, NASA-Keck grant #1611029 and by a NASA Senior Postdoctoral Fellowship,



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TMT Donates \$100K to The Food Basket

The Food Basket has experienced a greater demand f

Canada France Hawaii Telescope Corporation

April 1 · 🌐

A few of our planet friends headed up to the summit the other day to collect materials we had to donate to the North Hawaii Community Hospital! Huge Mahalo to the men and women who are working hard to protect the community and save lives!

