

51 Pegasi b

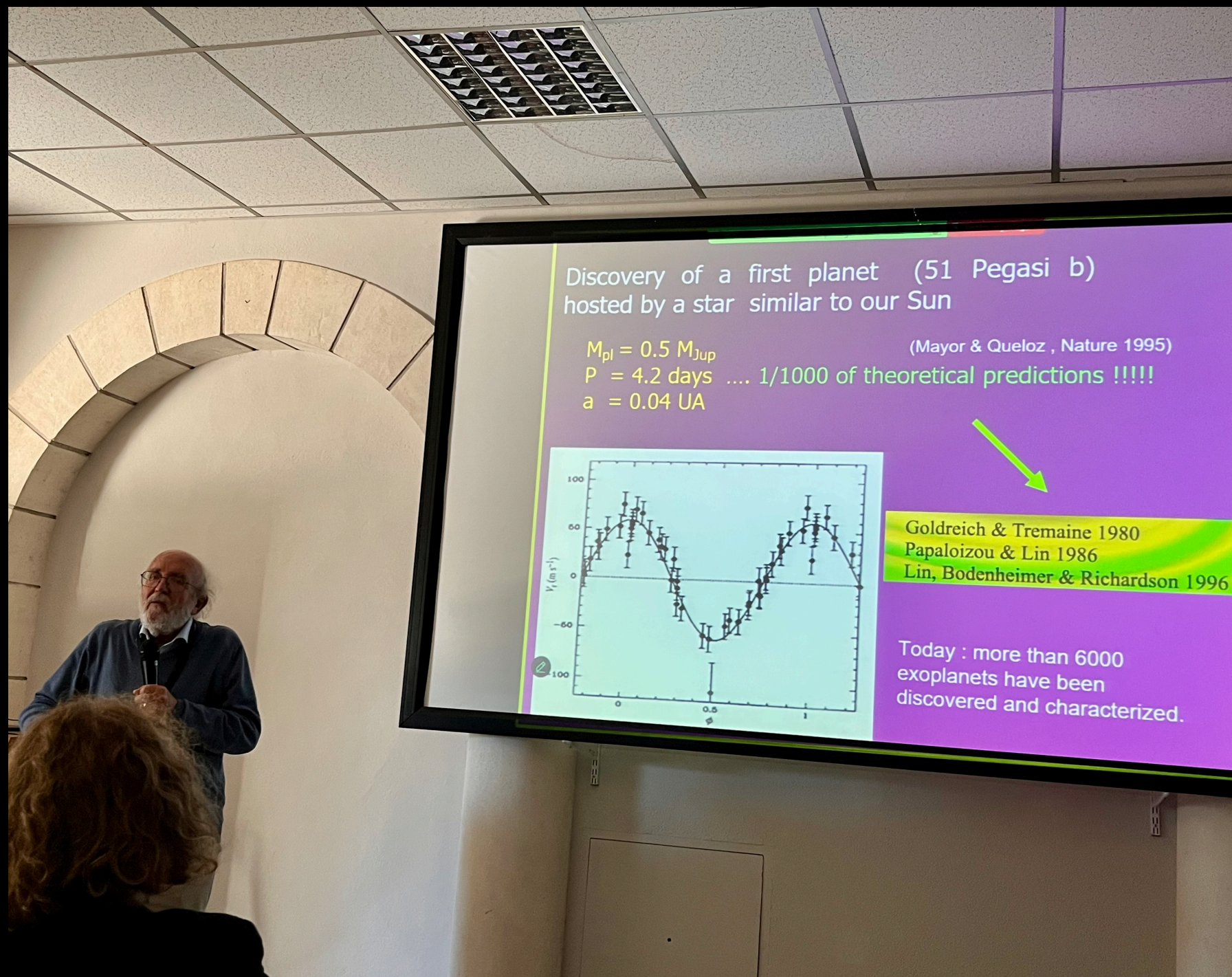
The Past 30 Years and the Next 30 Years



Lauren's totally completely unbiased view of the conference*, **

*not necessarily representative of the opinions of the SOC or other conference attendees

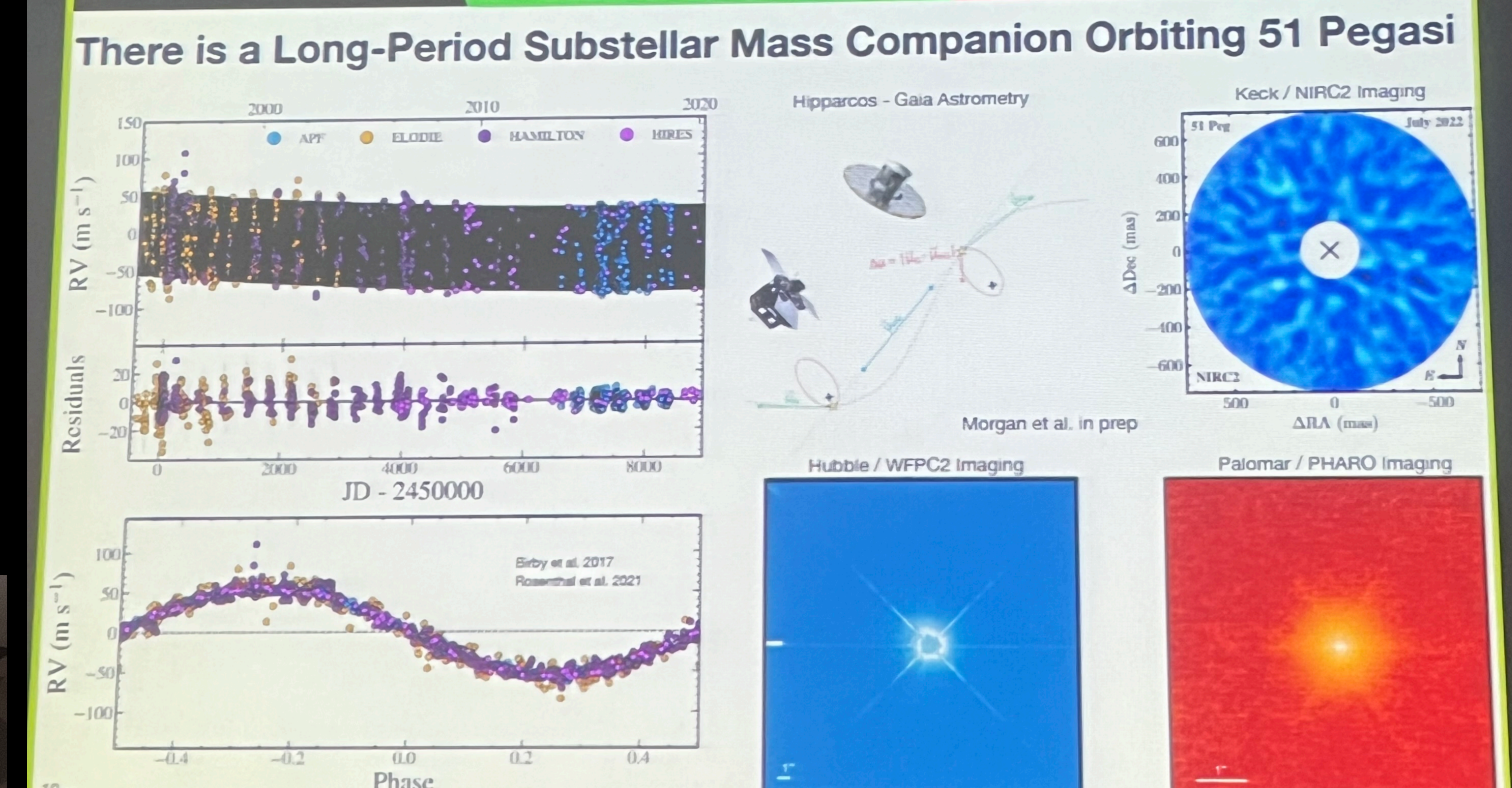
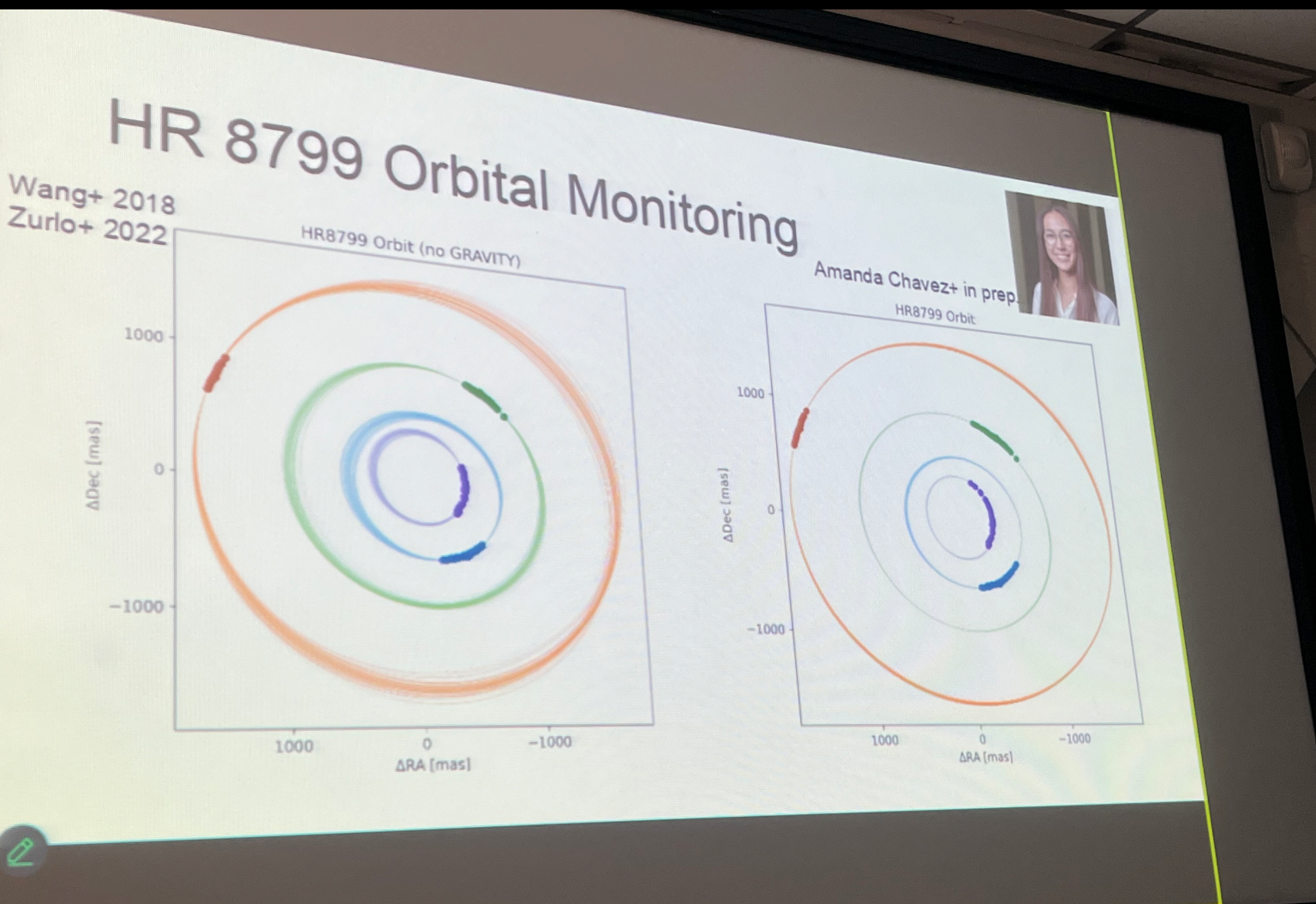
**with contributions from the participants of 51 Pegasi b 30th birthday conference





As Time Goes By...

New planets, new ideas



Pushing sensitivity

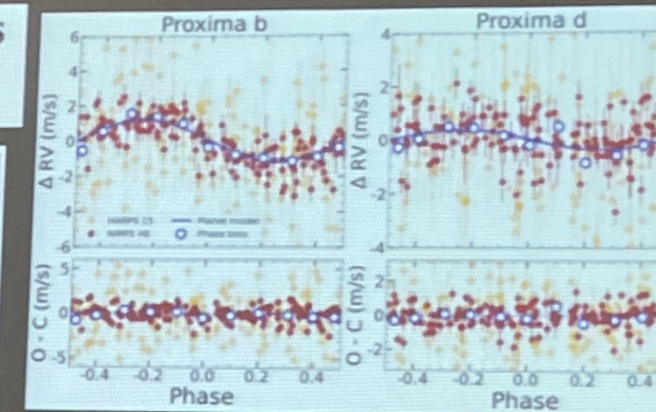
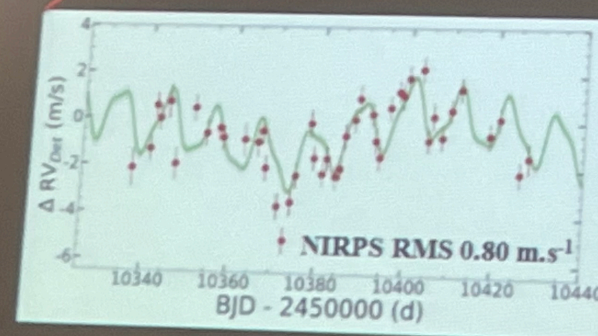
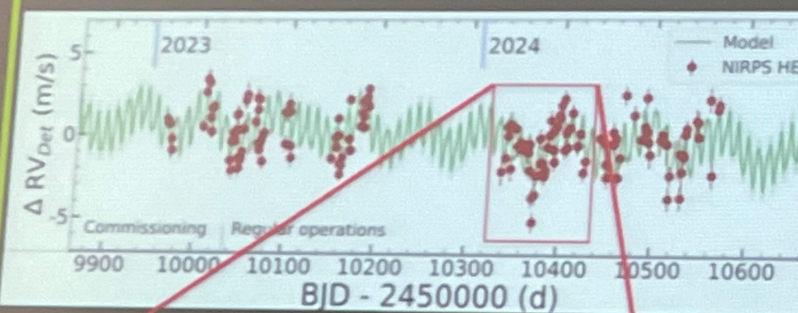
Hard work, time, and caffeine

- 300 m/s (1977) to < 0.5 m/s (today)



SPECTRO	year	precision	Telescope	
CORAVEL	1977	300 m/s	1 m	OHP
ELODIE	1994	13 m/s	1.9 m	OHP
CORALIE	1998	6 m/s	1 m	ESO Chile
HARPS	2003	1 m/s	3.6 m	ESO Chile
HARPS-N	2013	1 m/s	3.5 m	IAC La Palma
ESPRESSO	2018	0.1 m/s	8.2 m (x4)	ESO Chile

Diving into the planetary system of Proxima with NIRPS
Breaking the metre per second barrier in the infrared
Suarez Mascarenos, Artigau, Mignon, et al. 2025, A&A, 700, A11



Proxima
M5.5V H=4.8 V=11.1
d = 1.3 pc

$P_b = 11.18$ days
 $K_b = 1.15 \pm 0.11 \text{ m.s}^{-1}$ (NIRPS only)
 $K_b = 1.226 \pm 0.062 \text{ m.s}^{-1}$ (ALL)
 $m_b \sin i = 1.055 \pm 0.055 M_\oplus$

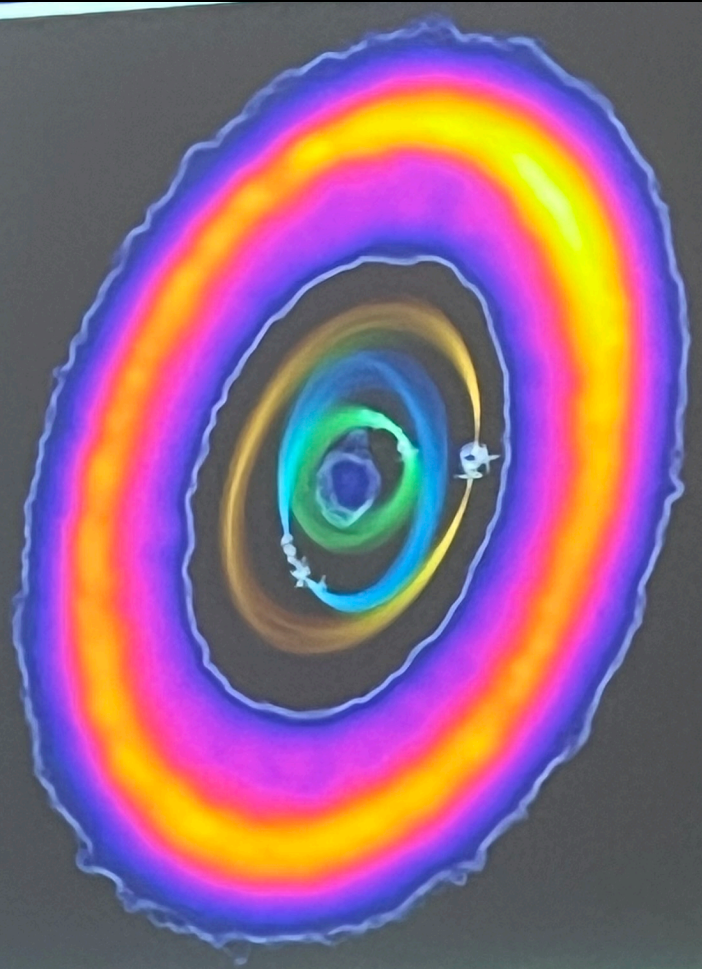
$P_d = 5.123$ days
 $K_d = 0.32 \pm 0.14 \text{ m.s}^{-1}$ (NIRPS only)
 $K_d = 0.392 \pm 0.057 \text{ m.s}^{-1}$ (ALL)
 $m_d \sin i = 0.260 \pm 0.038 M_\oplus$

Pushing sensitivity

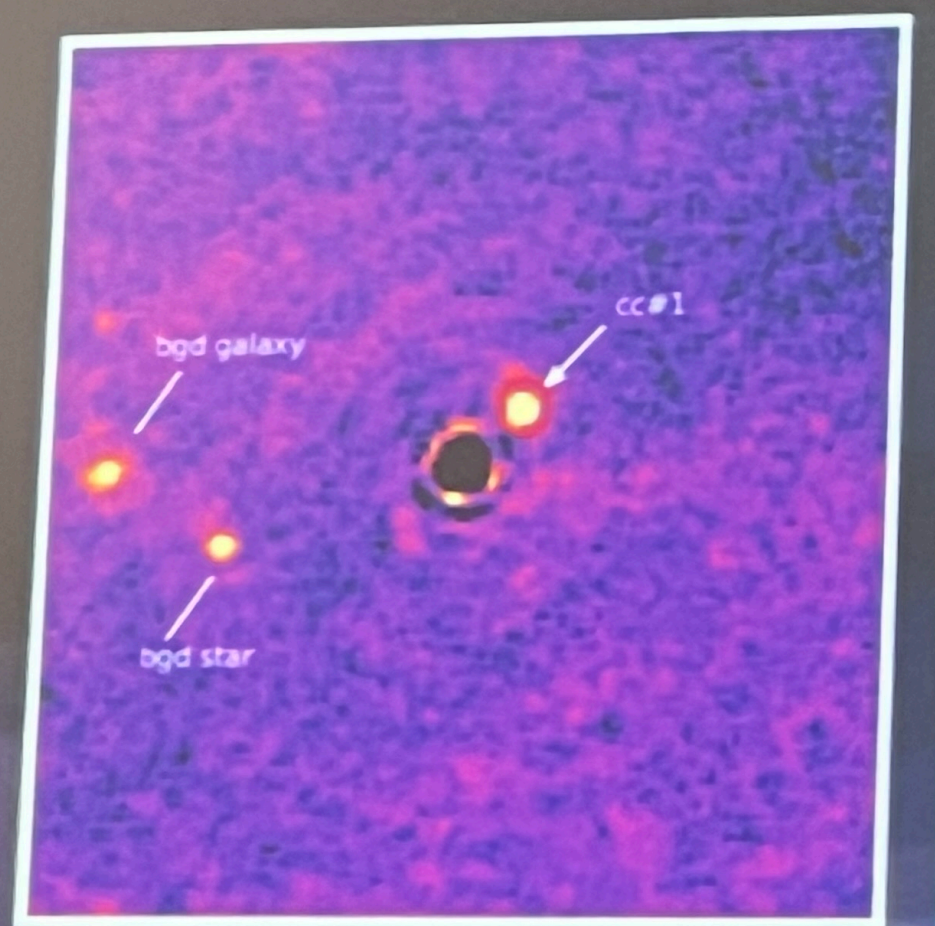
The path to HWO/LIFE

- Major strides with JWST, ALMA, Gravity+

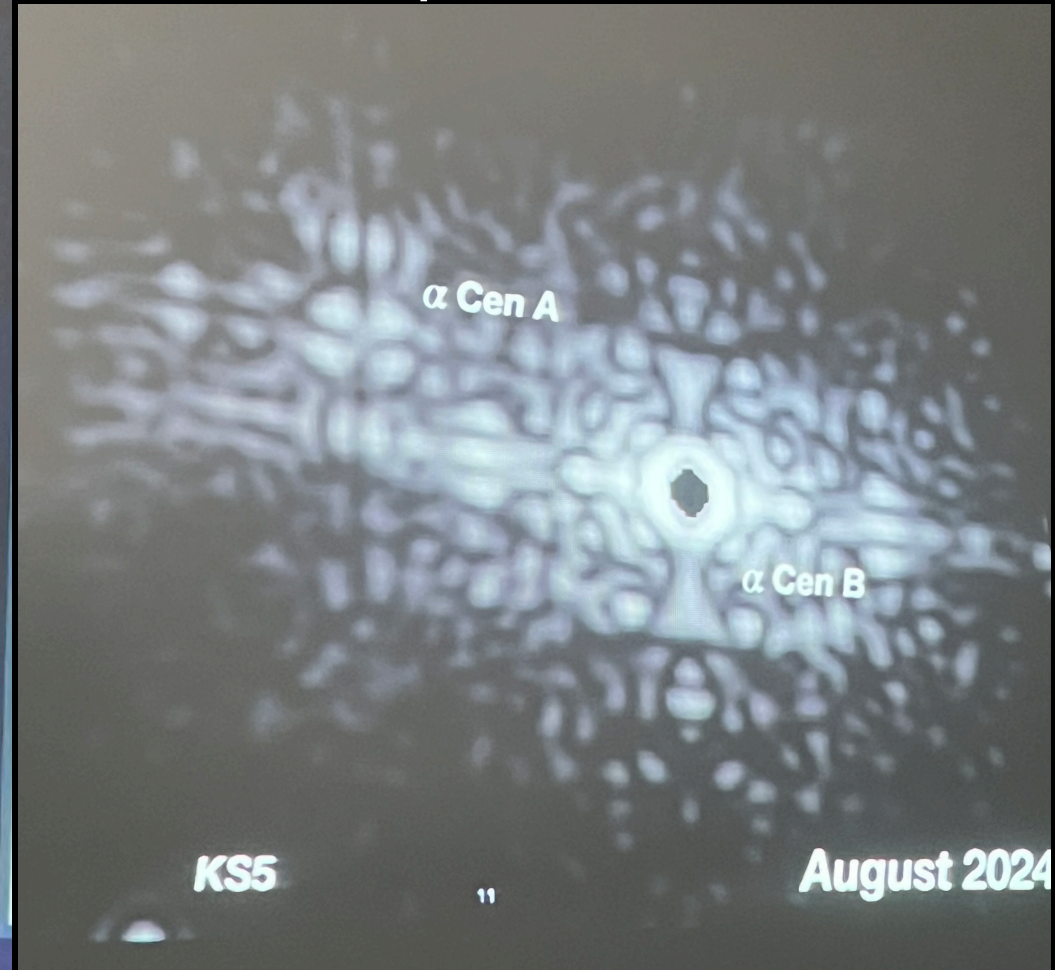
PDS-70 d?



TWA-7b?

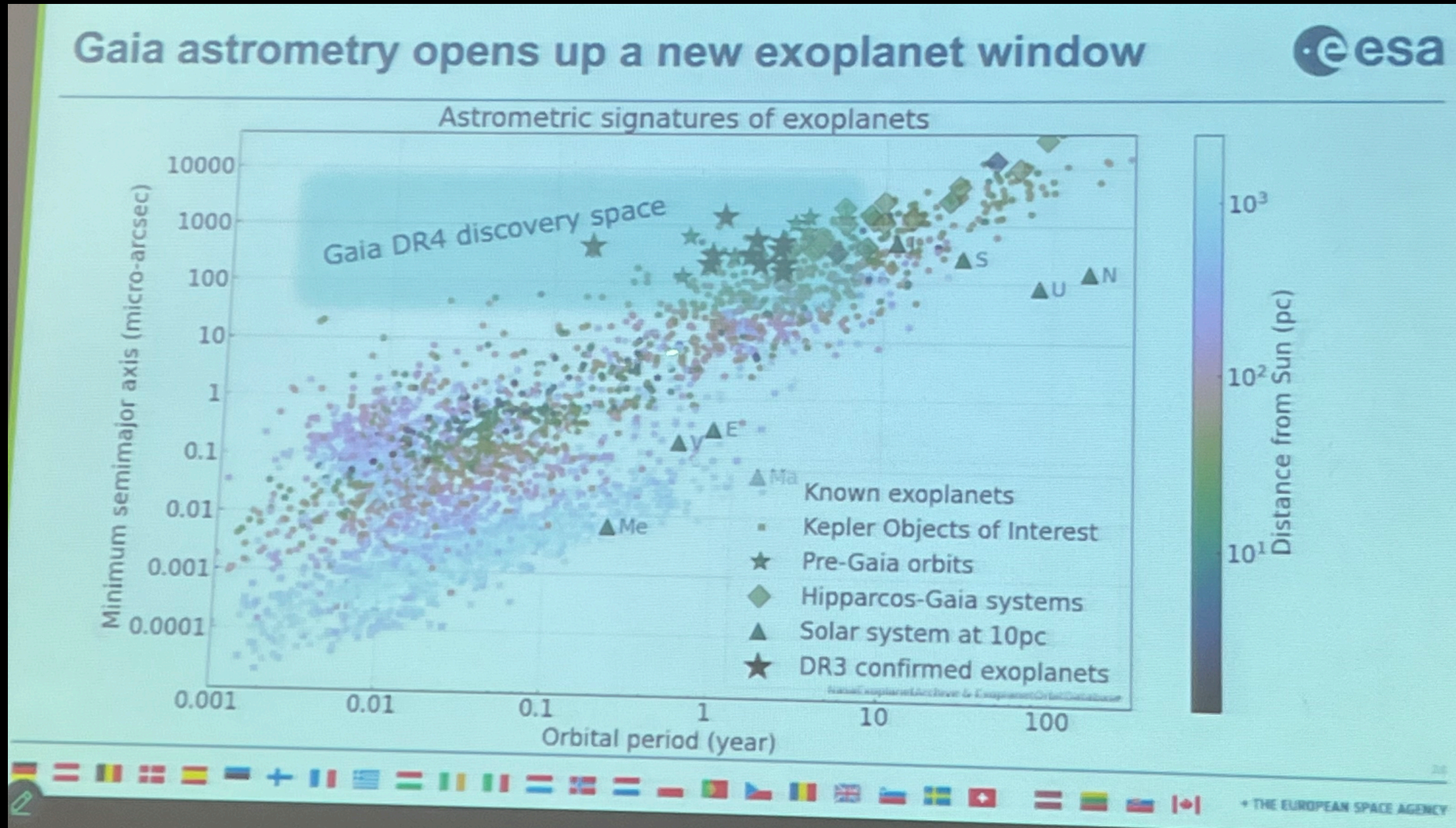


Alpha Cen Ab?



Most mentioned upcoming facility: Gaia

Honorable mentions: Roman, Euclid, PLATO, ELT, Theia, HWO, LIFE

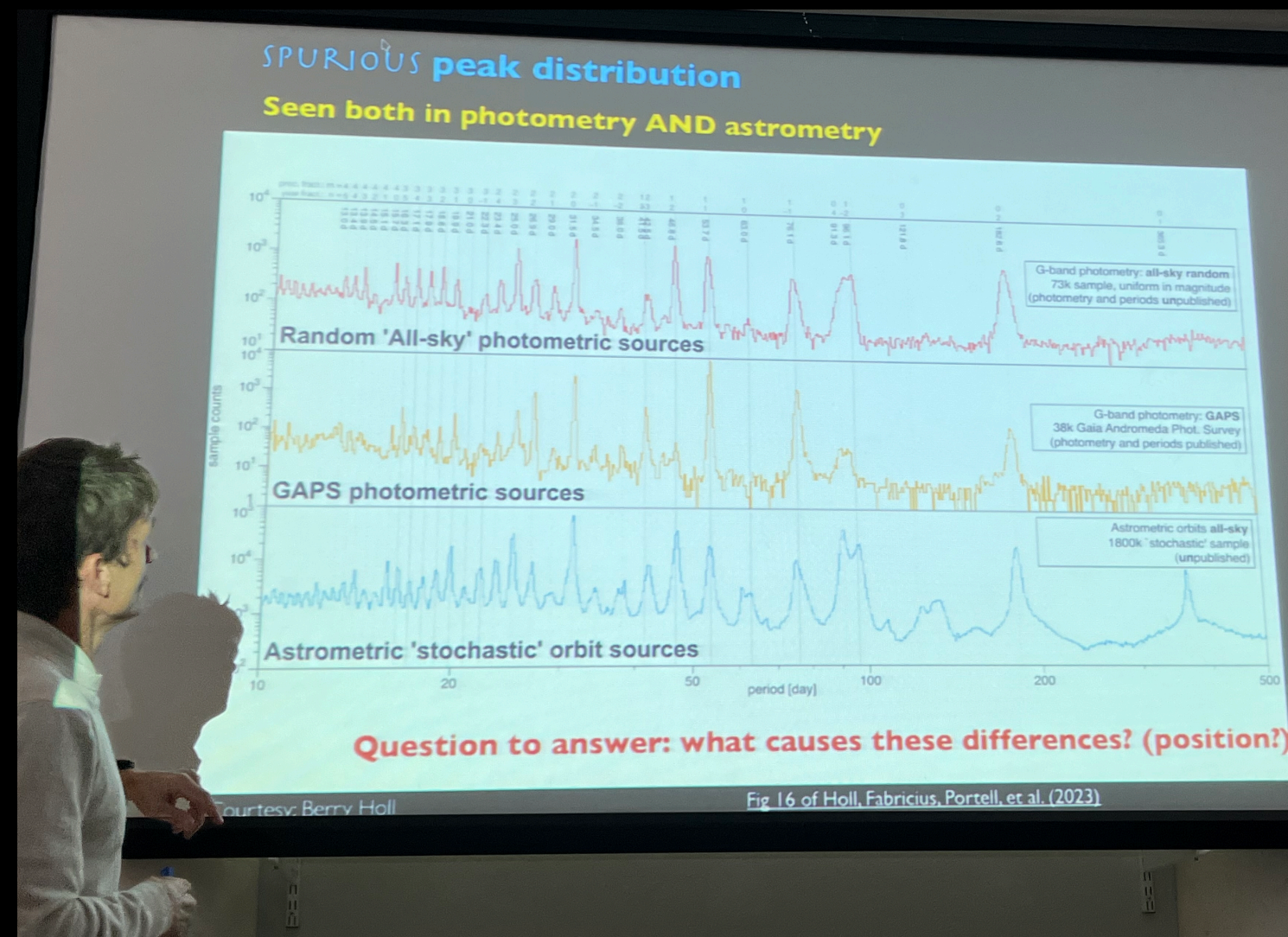


How to Avoid False Positives in the Gaia Era

Beware of spurious peaks!

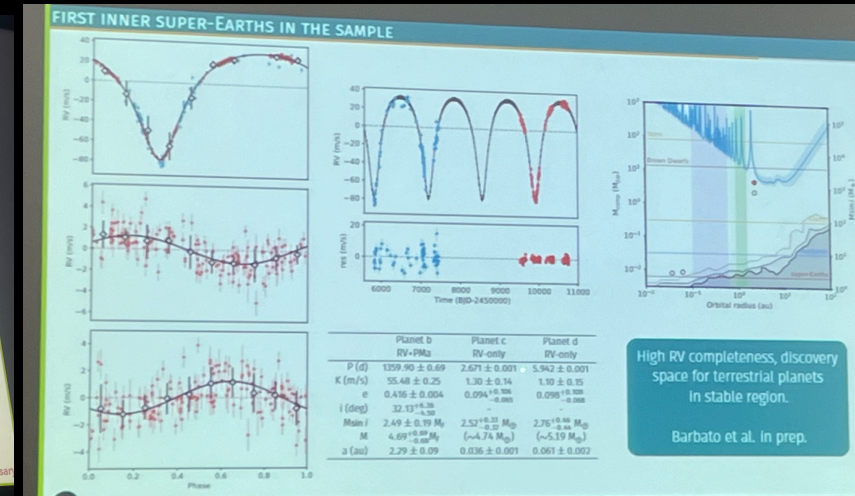
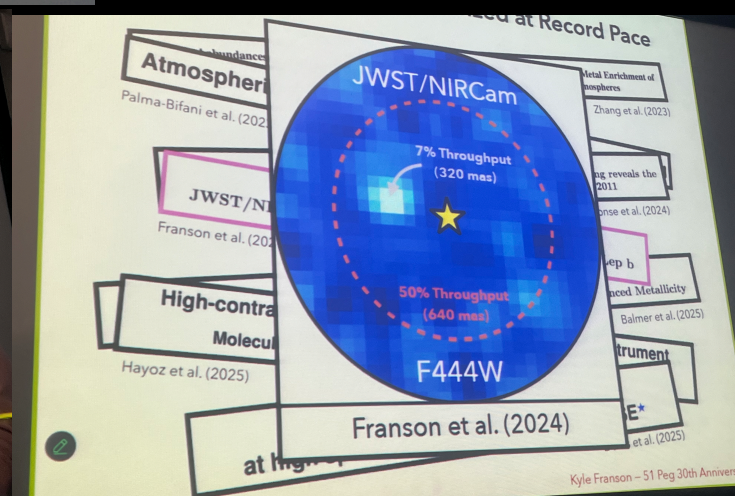
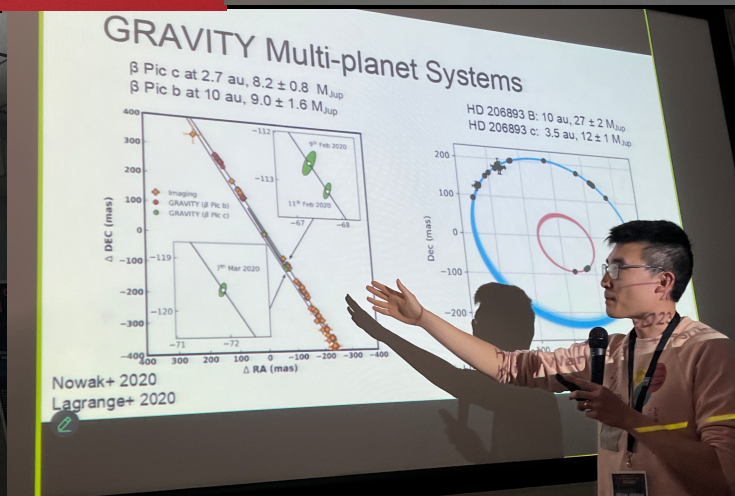
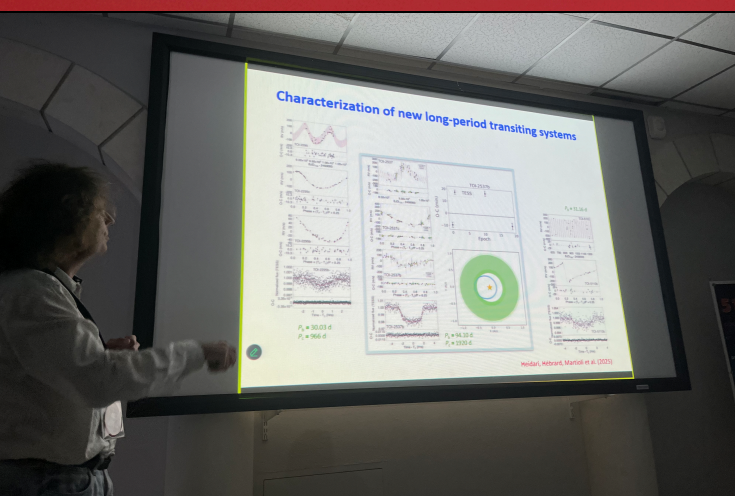
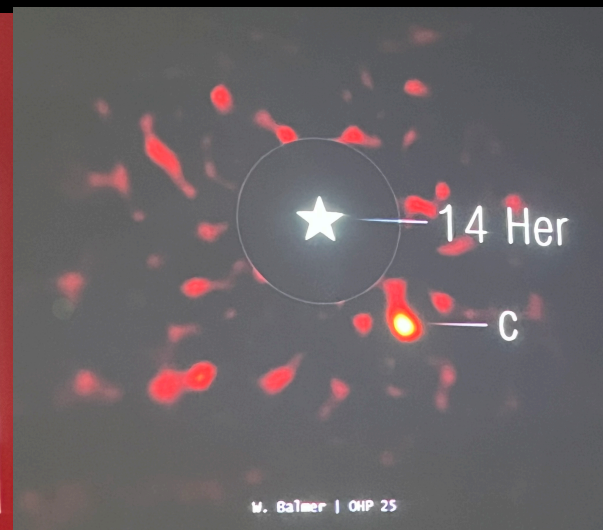
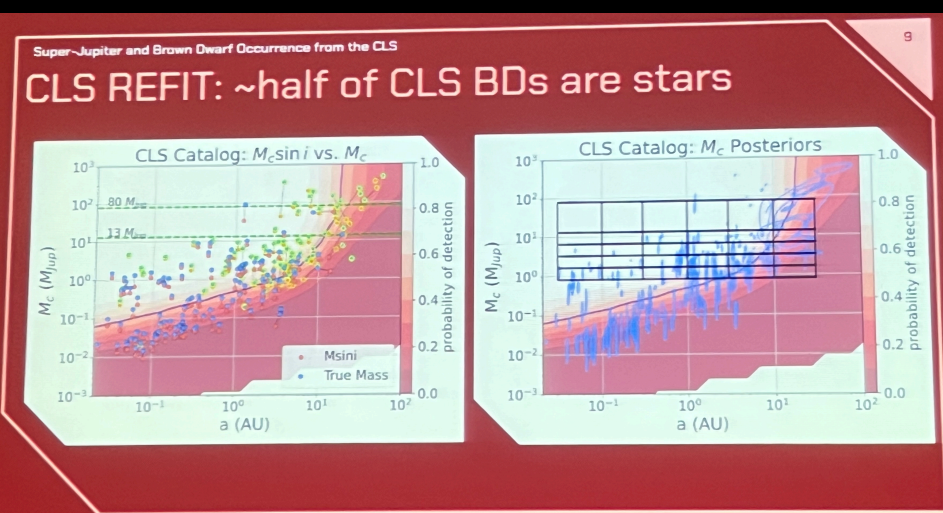
Merci beaucoup to Damien Ségransen, J. B. Delisle, & Johannes Sahlmann!

- Extended or non-point sources (galaxies, close binaries) + 106 degree angle between cameras = trouble
- Spurious peaks near ~93 days and harmonics
- Can include in model
- Another idea: check candidate signals with RVs

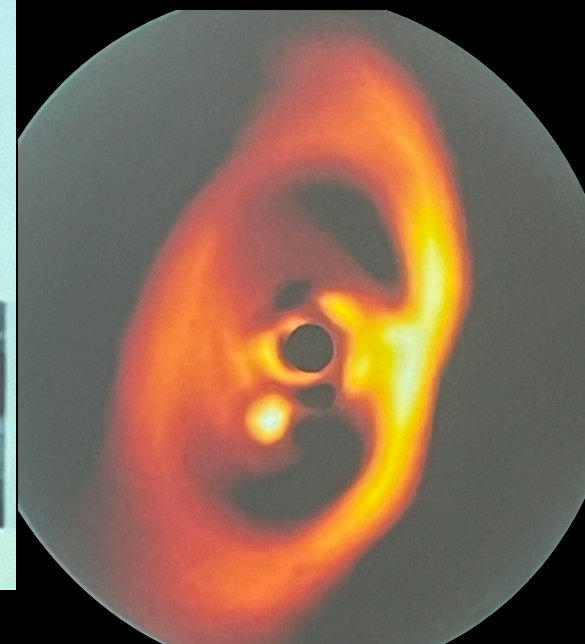
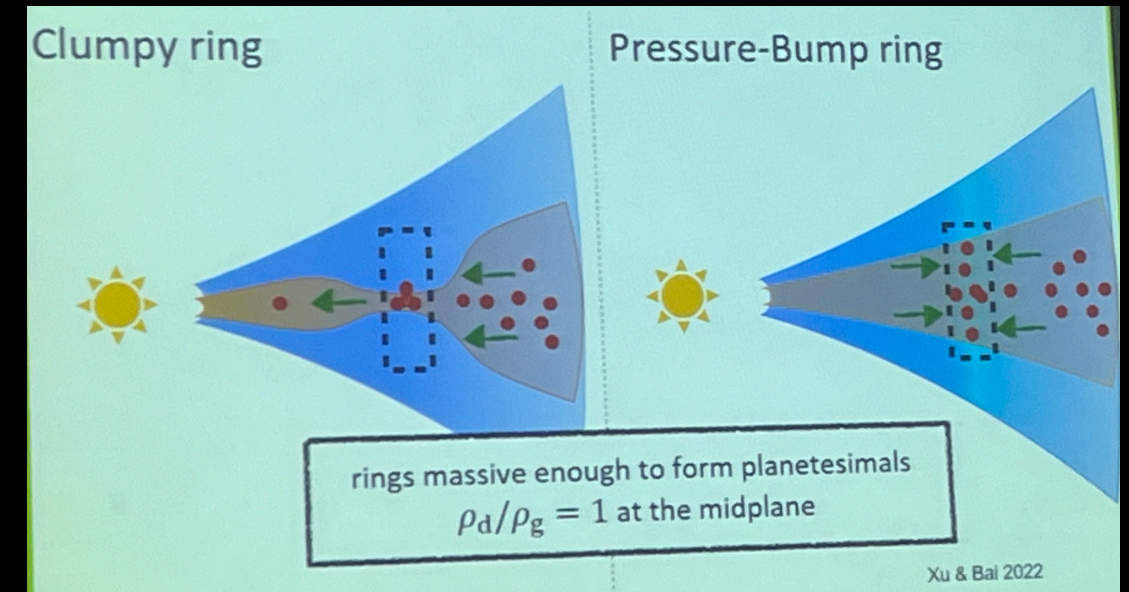
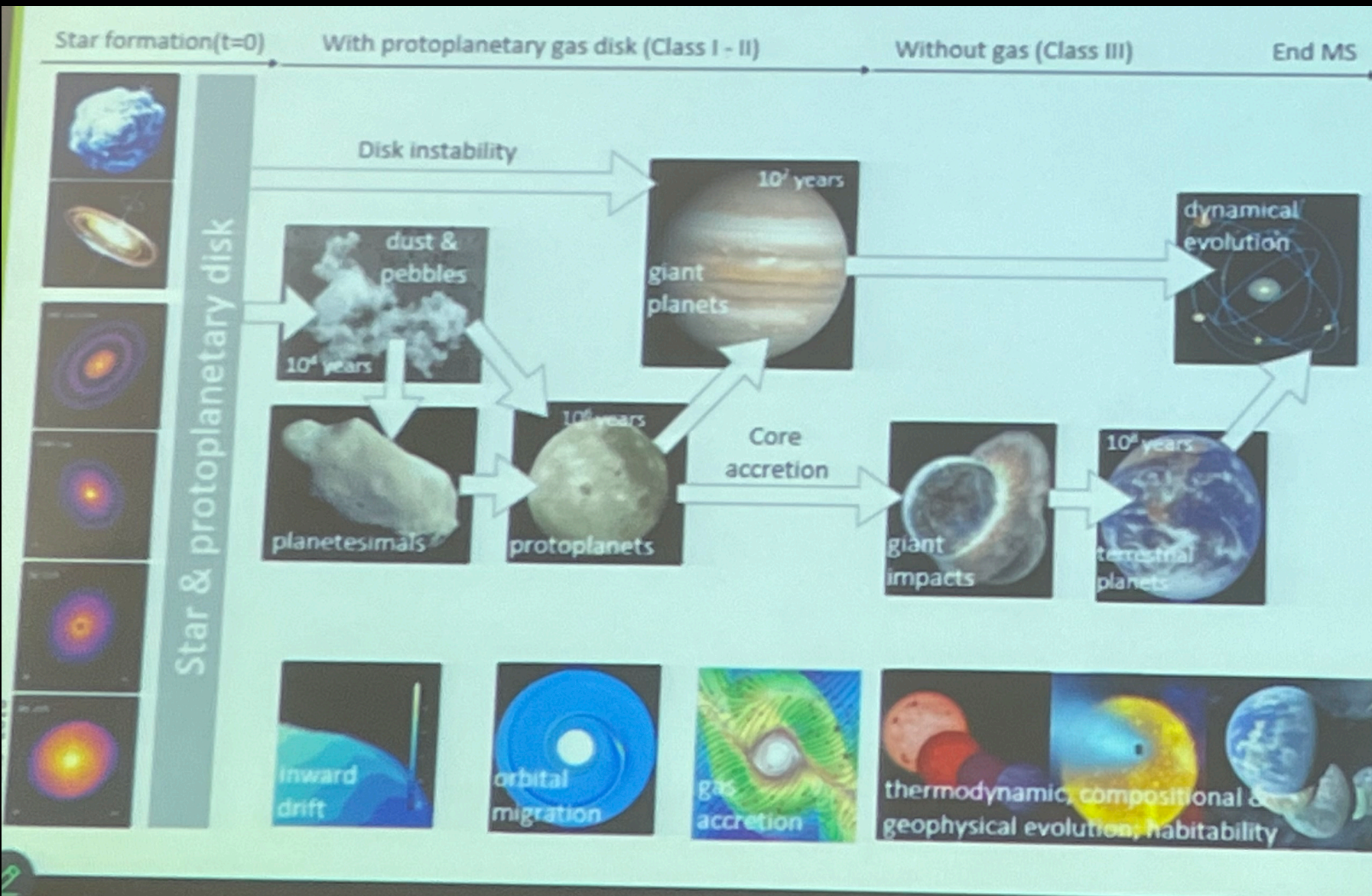


3D Orbits

- Typically from combinatorics of detection methods: RVs, Astrometry (Gaia), Astrometry (Direct Imaging), Interferometry, Transits
- Why: True Masses! Accurate planet occurrence! More dynamics!



Pushing theories of planet formation

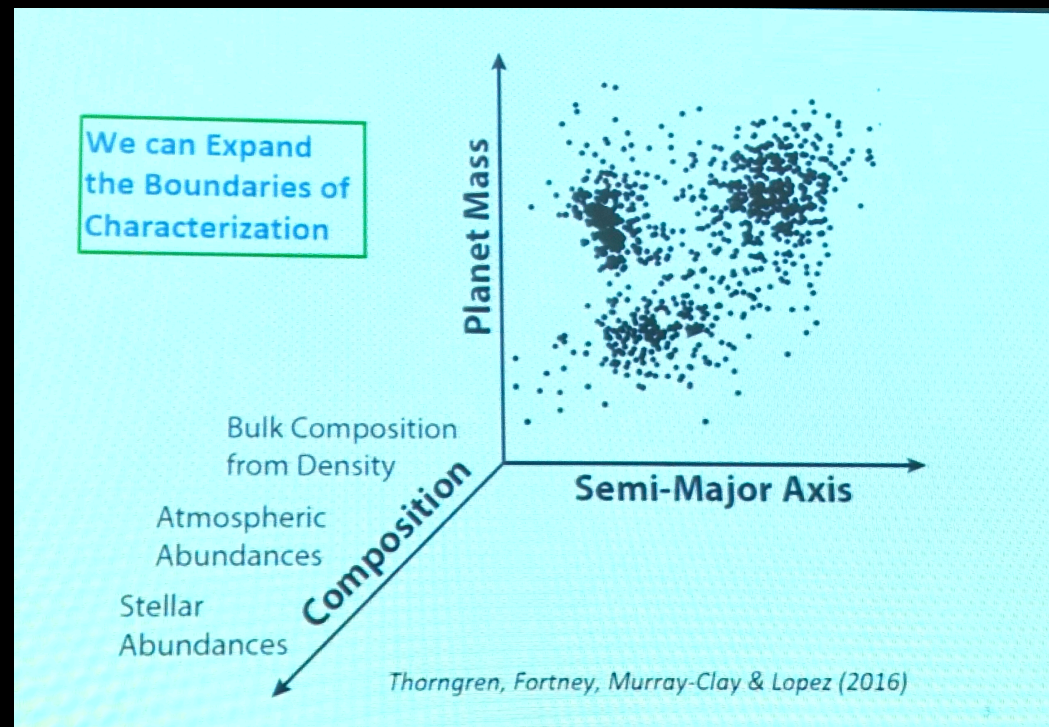


Atmospheres

Giant planets, planetary mass companions, and isolated brown dwarfs offer **HIGH** signal-to-noise

Models must handle what is coming now (JWST) and soon (ELTs), aka the **high resolution domains (spectral, spatial, time)** for **cooler, smaller planets**

Atmospheres are **complex**, they have **mixing, clouds, non-equilibrium chemistry**



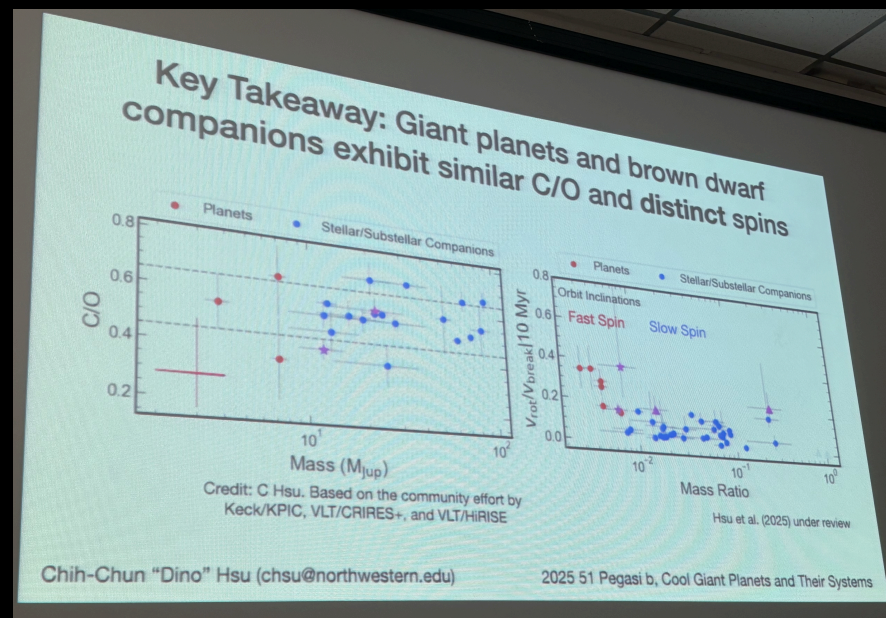
Atmospheres

1-39 m class telescopes with instruments across a **wide range of wavelengths** all have a crucial role to play in exoplanetary atmospheric science

Population studies needed to link to **planet formation**

Combining **spin, architecture, and composition** tells a more complete story of a planet's history

We would like **surface / interior** measurements

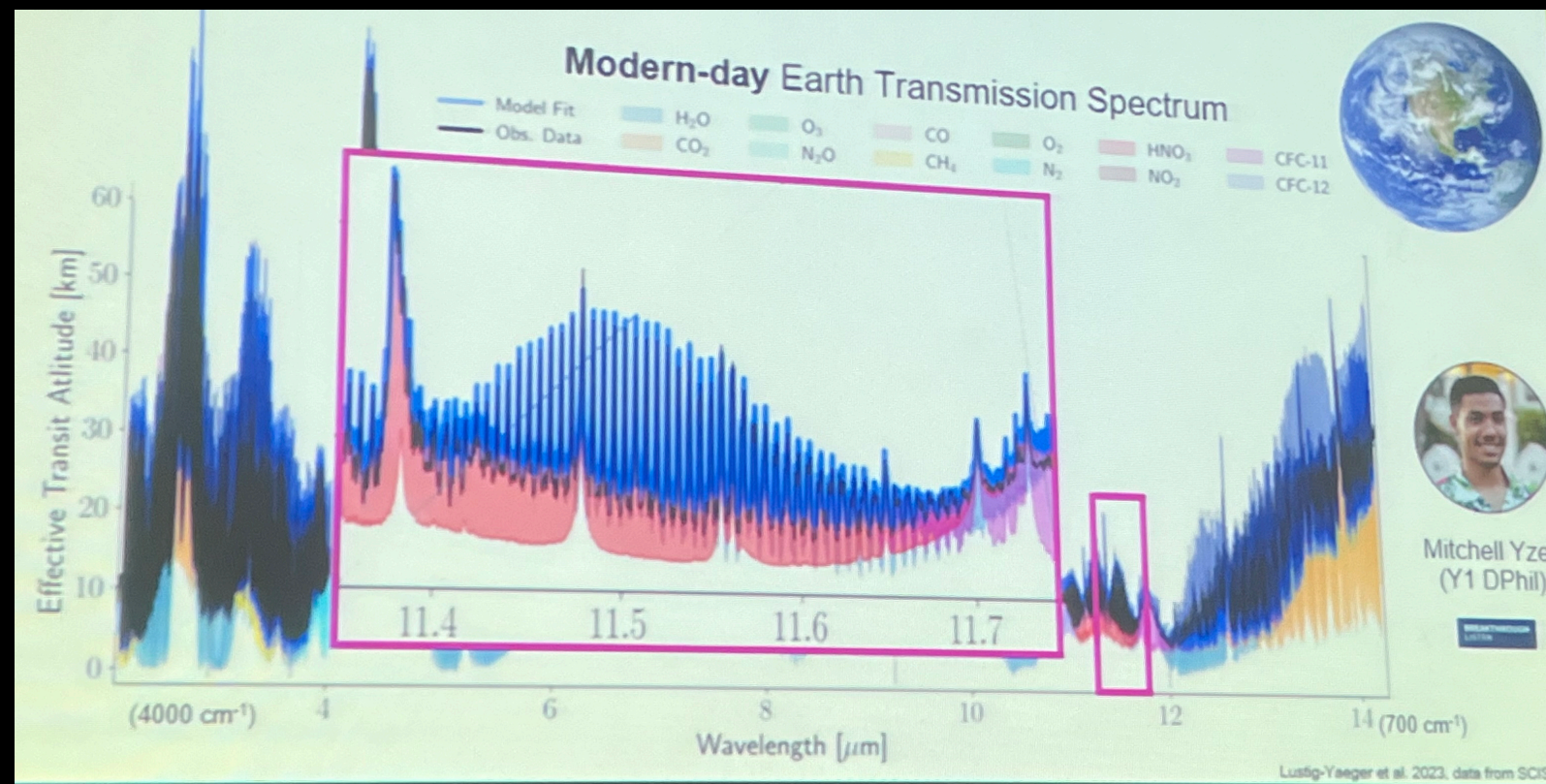
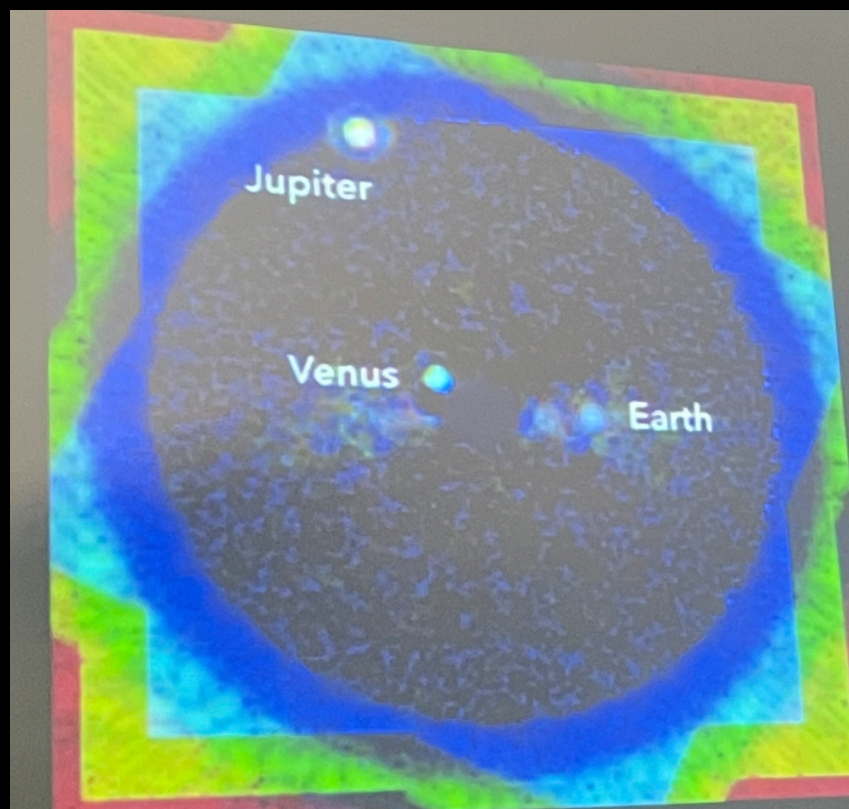


*Where are the
exomoons...?*



Prospects for HWO/LIFE?

The most reliable biosignature →



Bonne anniversaire

🎉 **51 Peg b!** 🎉

