The LEECH Survey to Directly Image Exoplanets with LBTI

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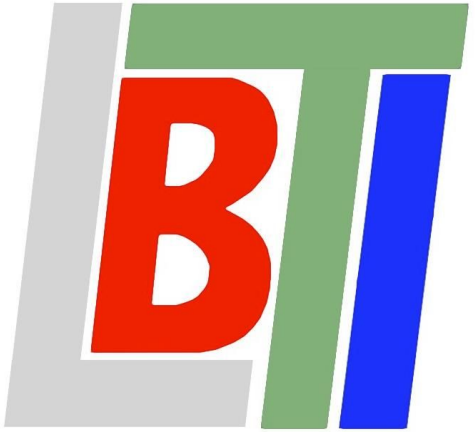
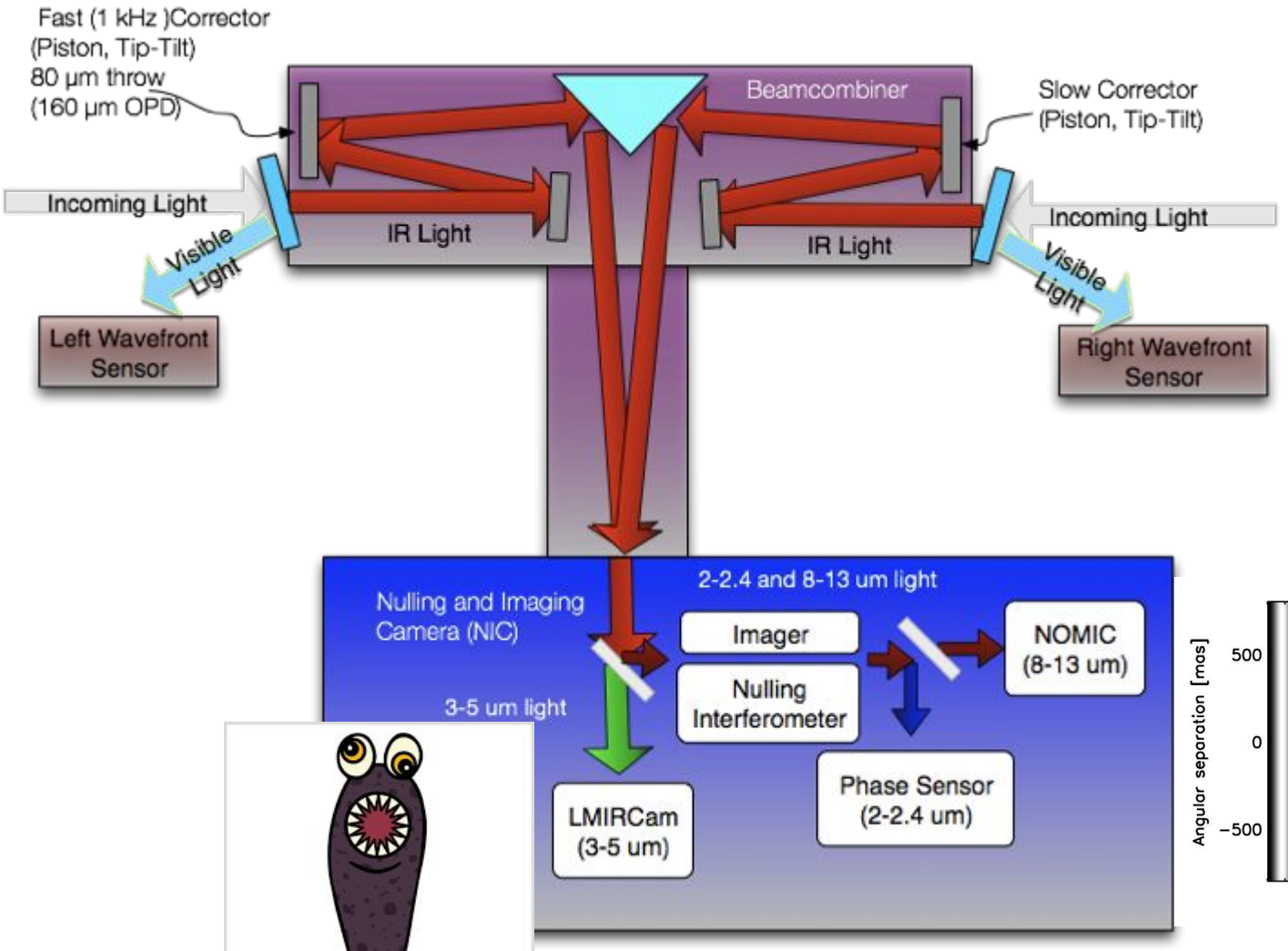


LBTI and LEECH



Organization

1)What is Direct Imaging and Why do it?

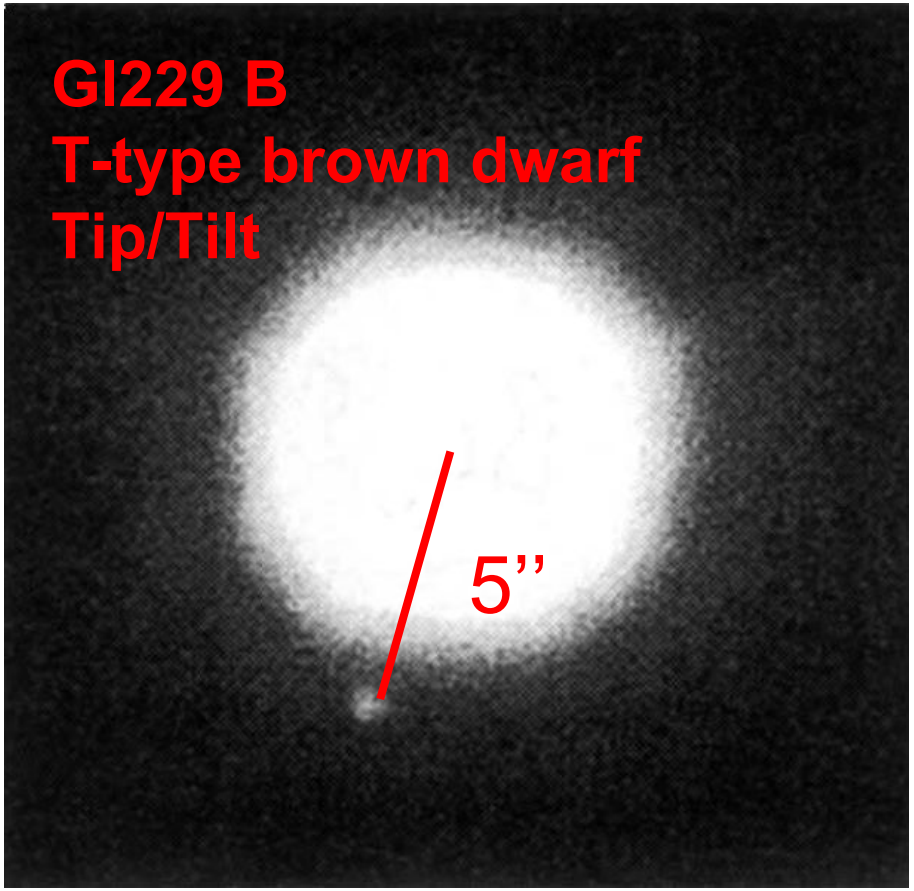
2)Thermal-Infrared Direct Imaging with LBTI

3)Samples of Initial Results from LEECH

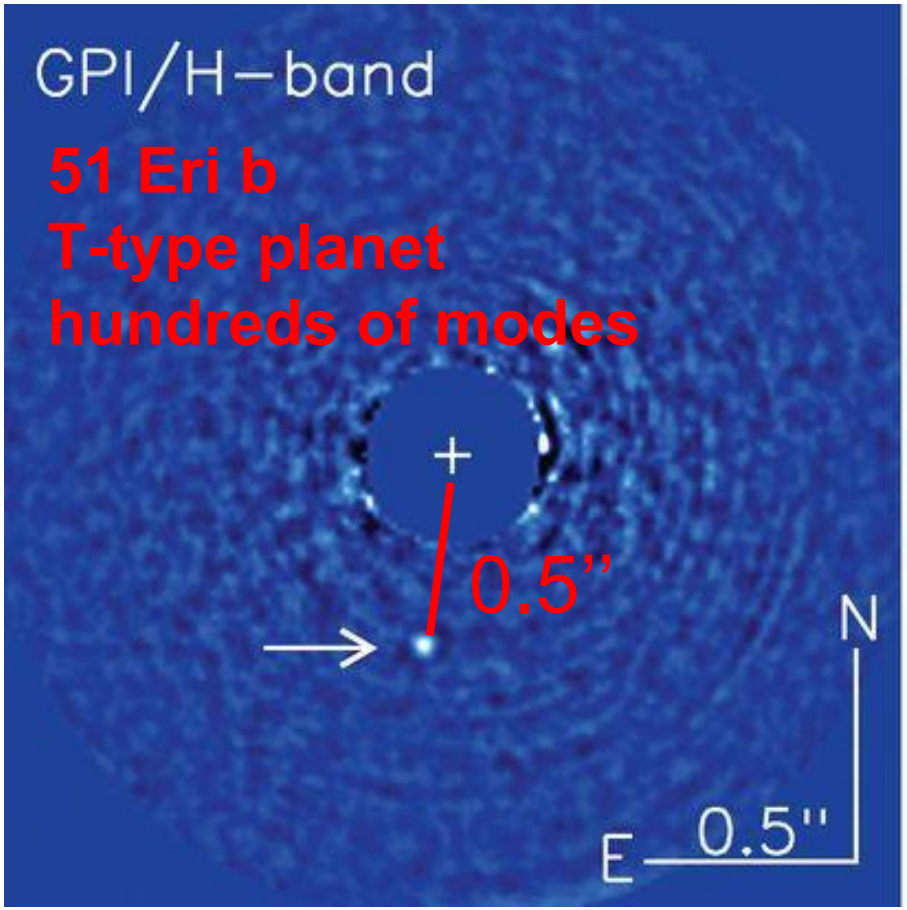
Intro: What is Direct Imaging?

Spatially resolving light of self-luminous objects from their stars

(In the future, reflected light)



Nakajima+1995



Macintosh+2015

Intro: Why Direct Imaging?

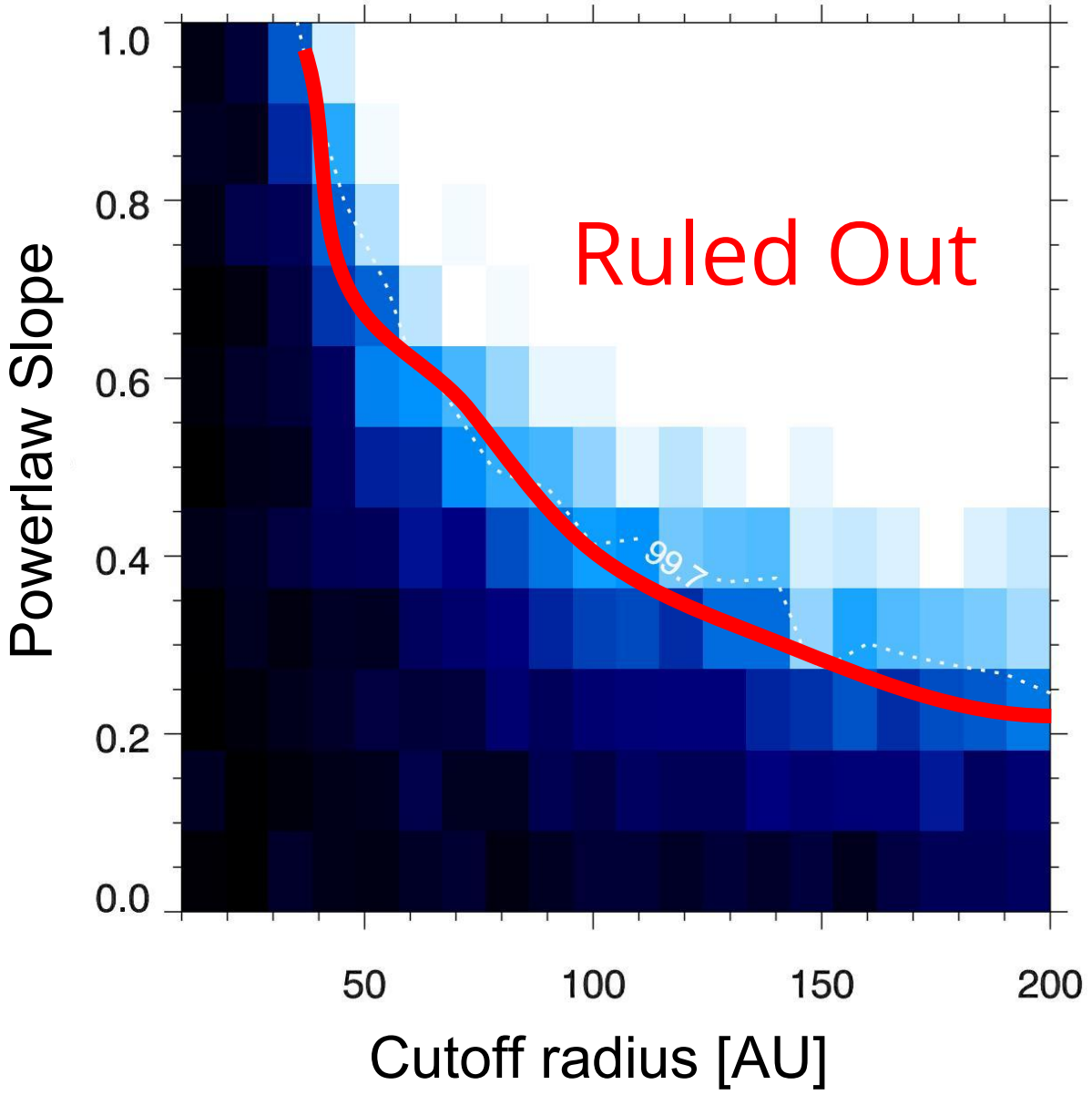
RV surveys suggest
$dN/d\ln(a) \propto a^{\beta}$
is ***increasing*** with a

Can this be extrapolated to larger semi-major axes?

Where is the peak of the semi-major axis distribution?

What do our constraints tell us about planet formation and orbital evolution?

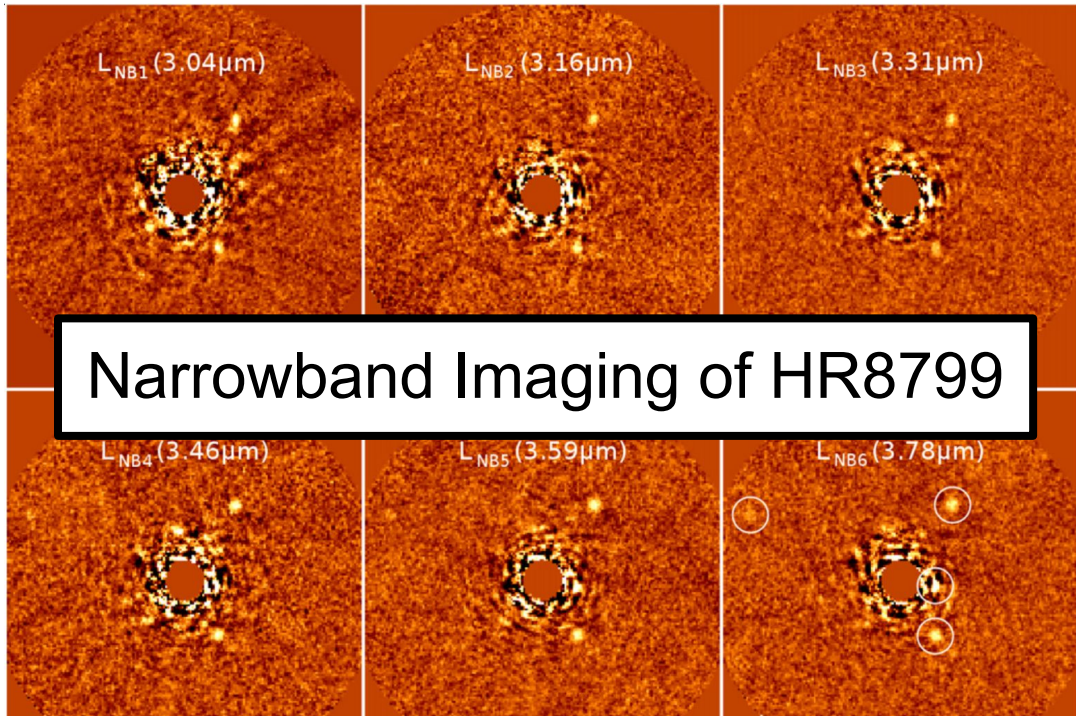
Reggiani et al. 2016

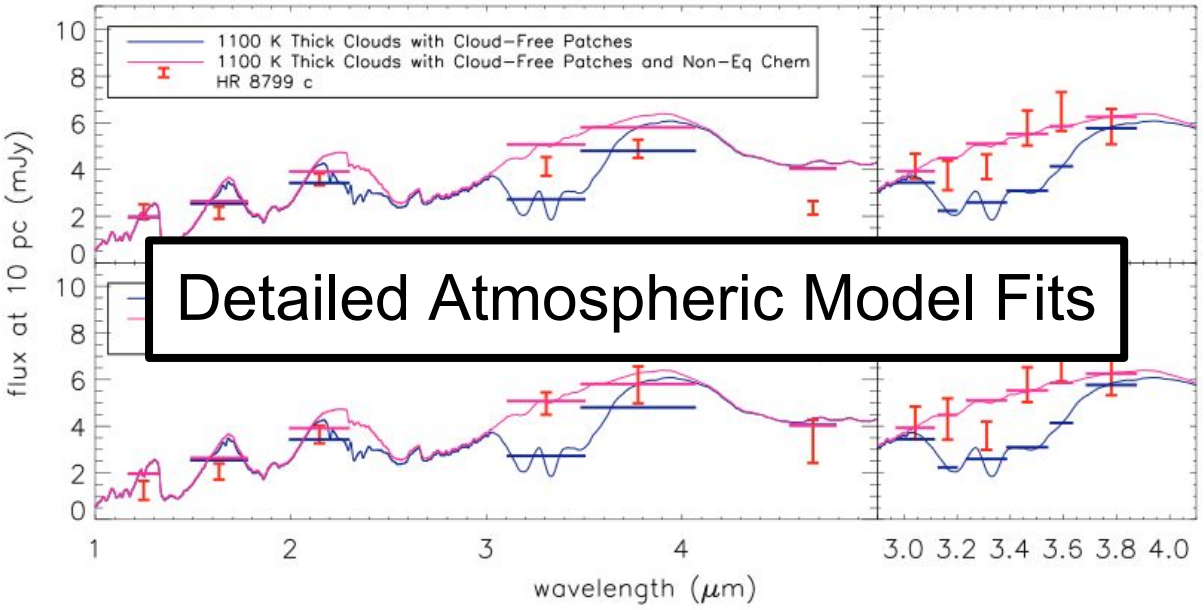


Intro: Why Direct Imaging?

Detailed characterization of discoveries:

- luminosity
- clouds
- chemistry
- gravity





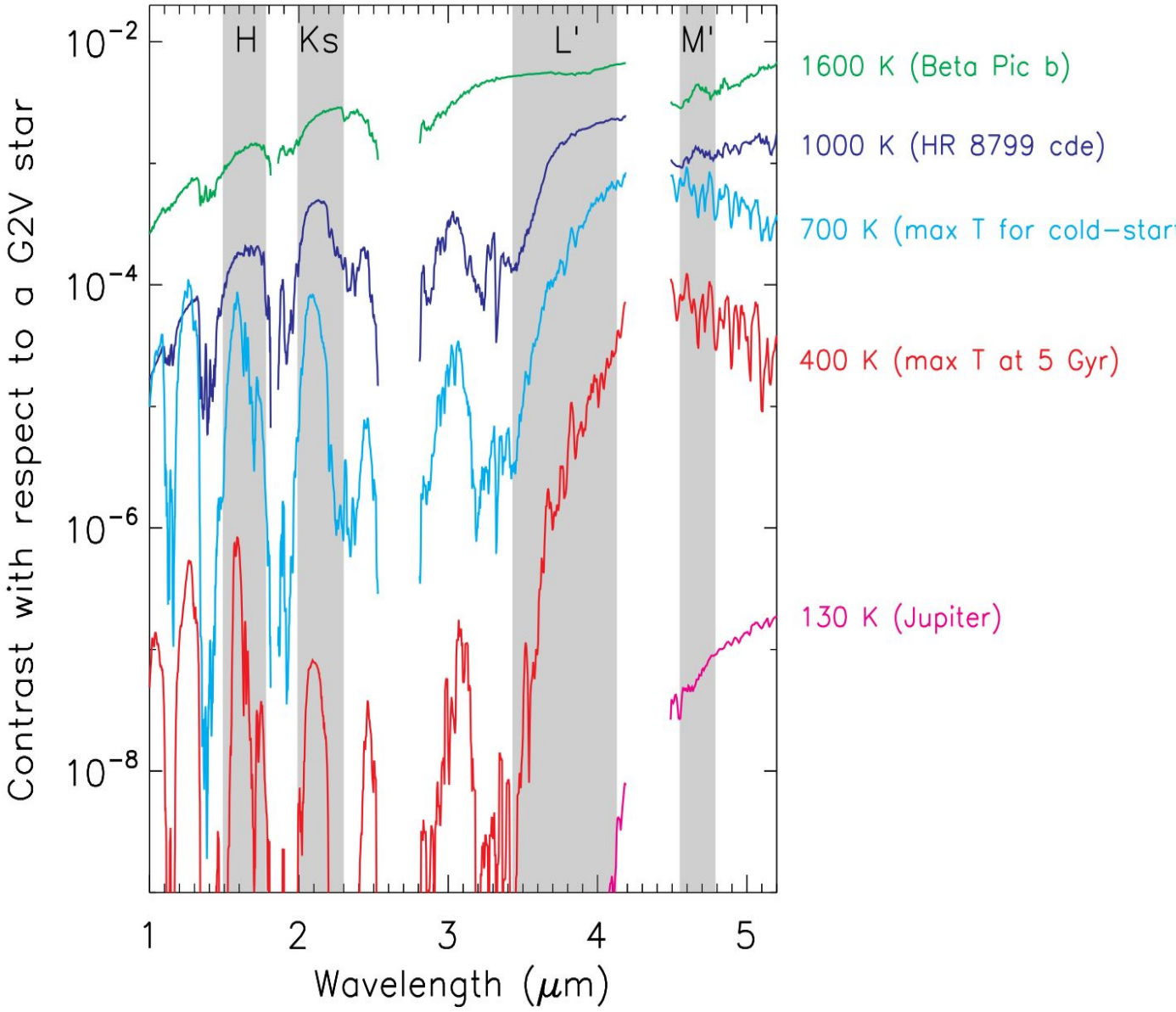
Skemer et al. 2014

2) Thermal-Infrared Direct Imaging with LBTI

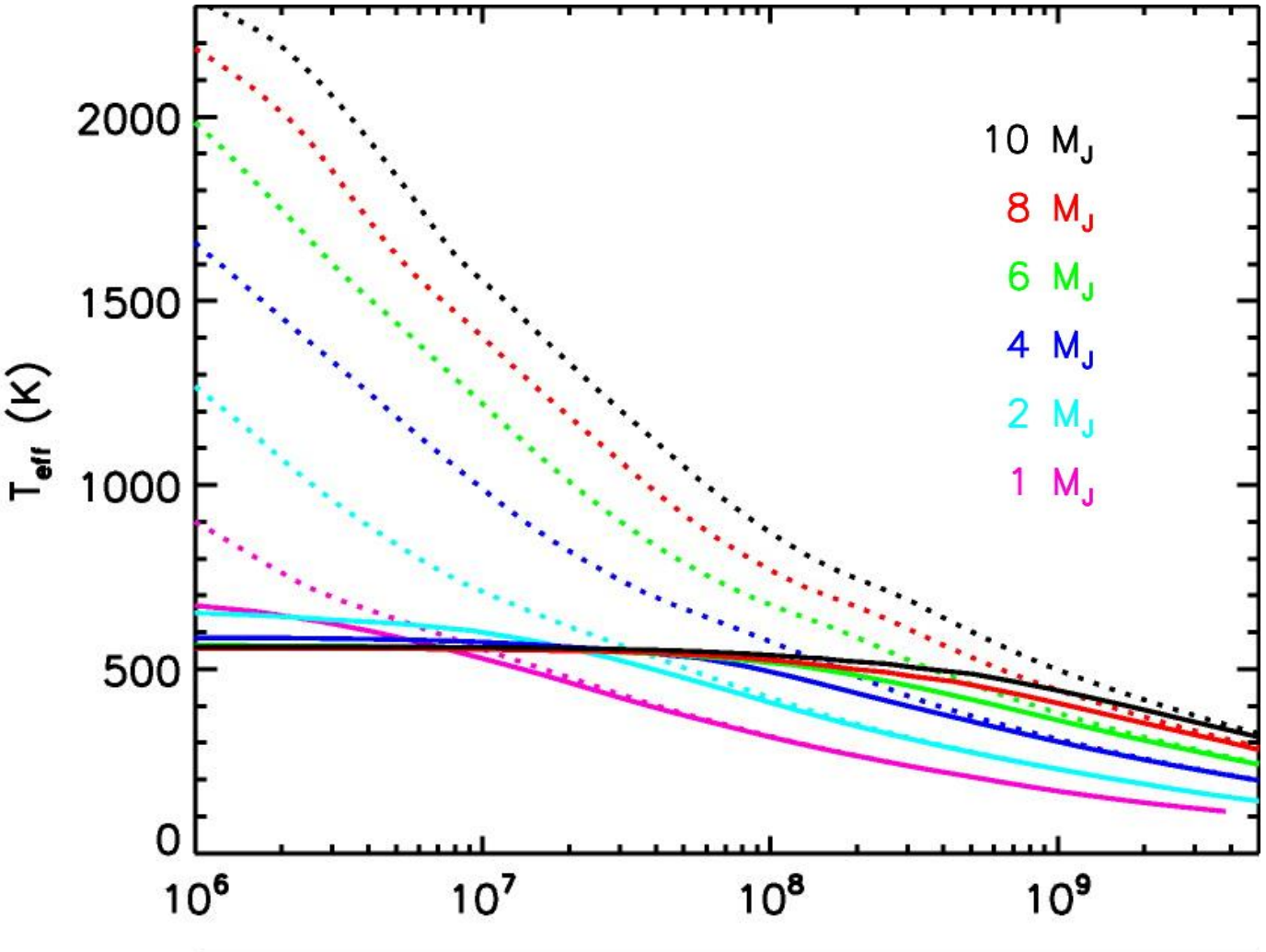
LEECH: Benefits of L'

Reduced contrast especially for **cool** planets

Near peak of cool-planet SEDs empirical constraint on L_{bol}



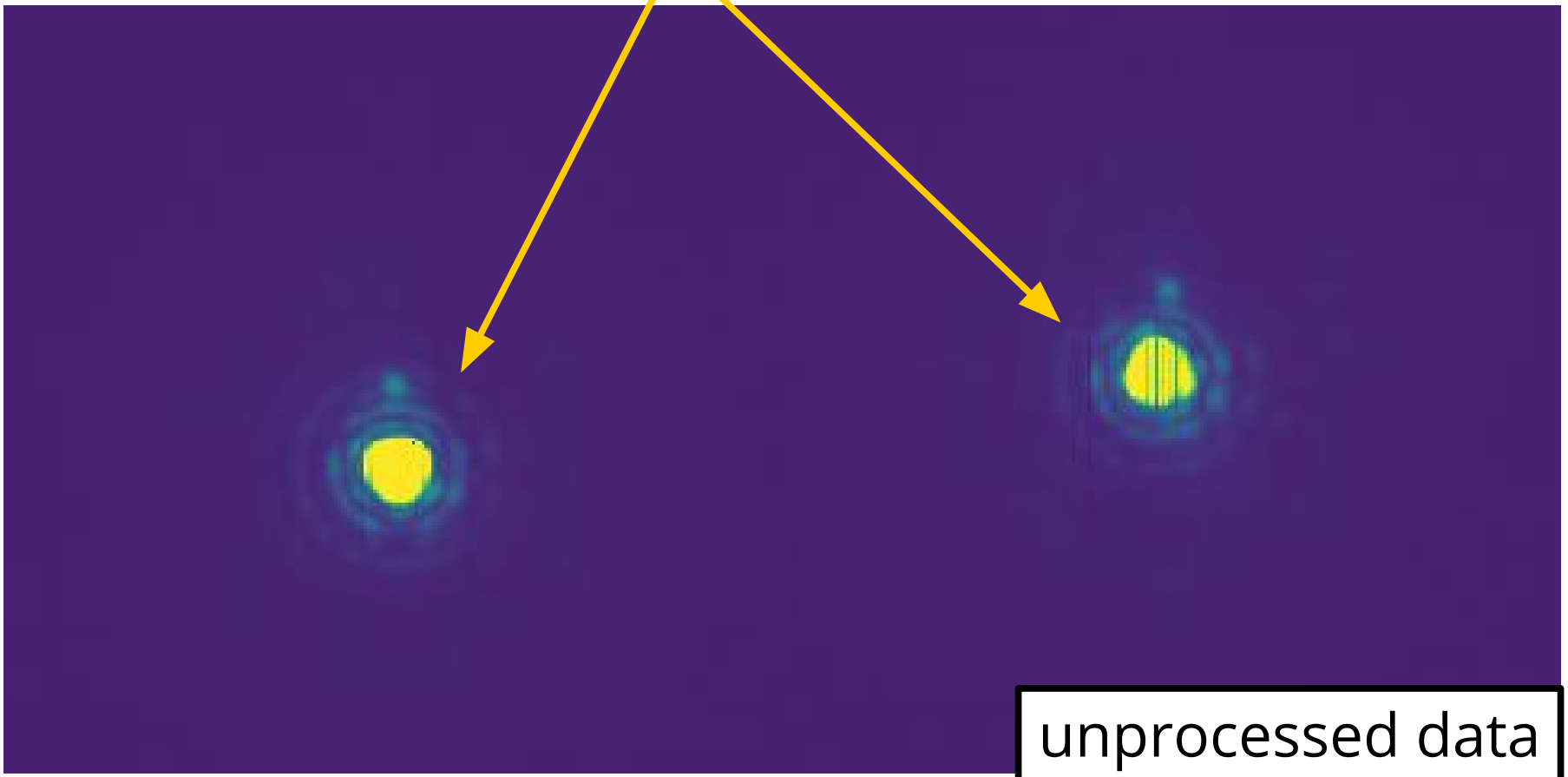
Low T_{eff} means Low-Mass, Old, or Cold-start



Fortney et al. 2008

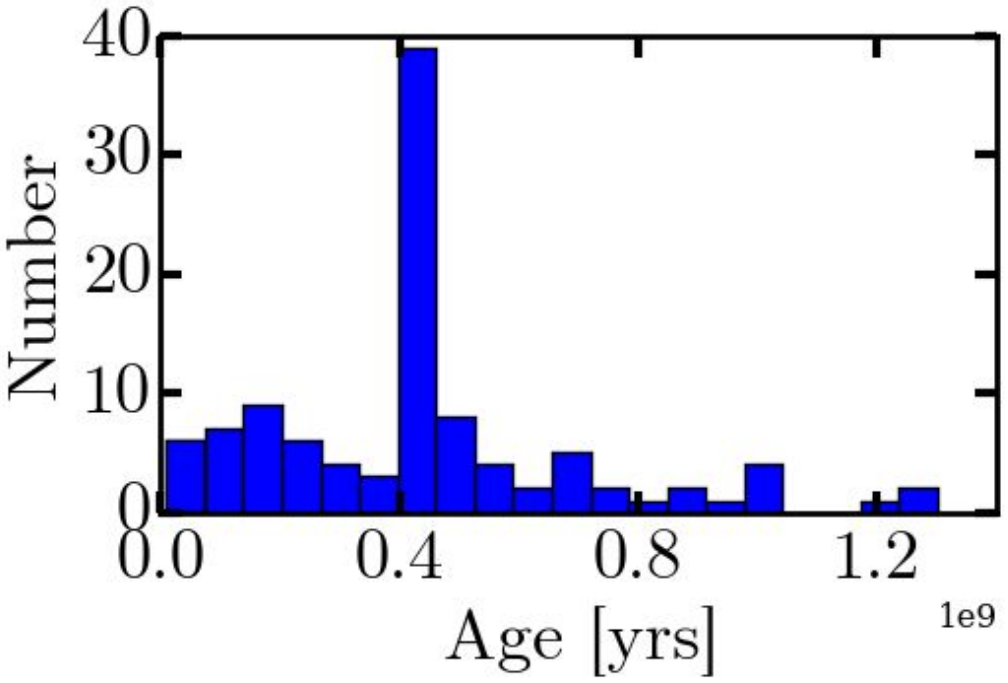
Dual Aperture Imaging Provides Immediate “Follow-Up”

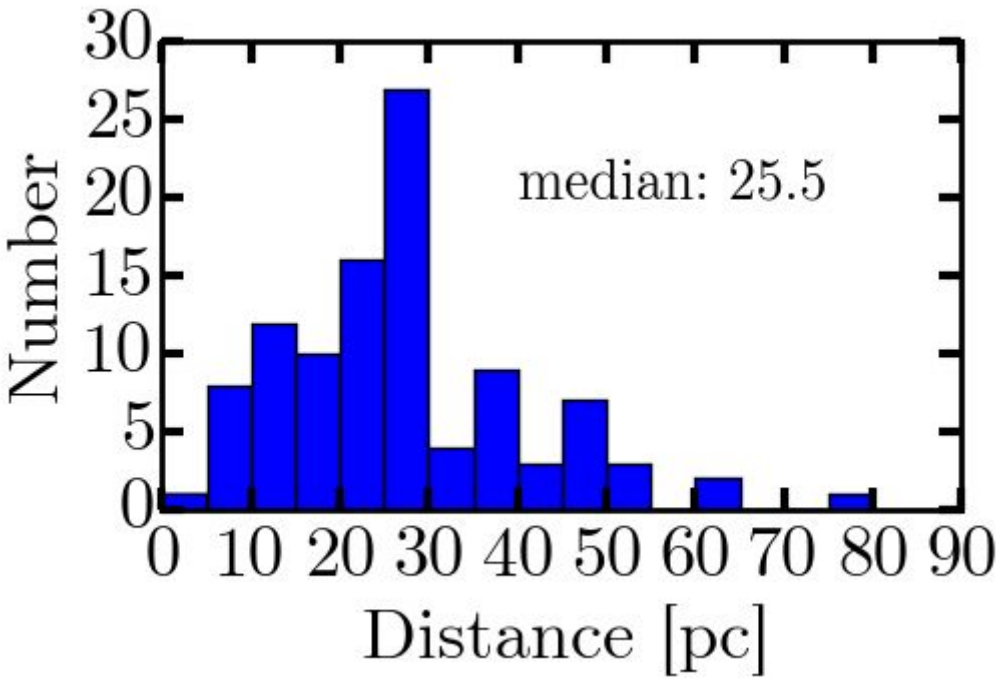
Each side of the telescope has independent speckle pattern:
Higher Contrast!



unprocessed data

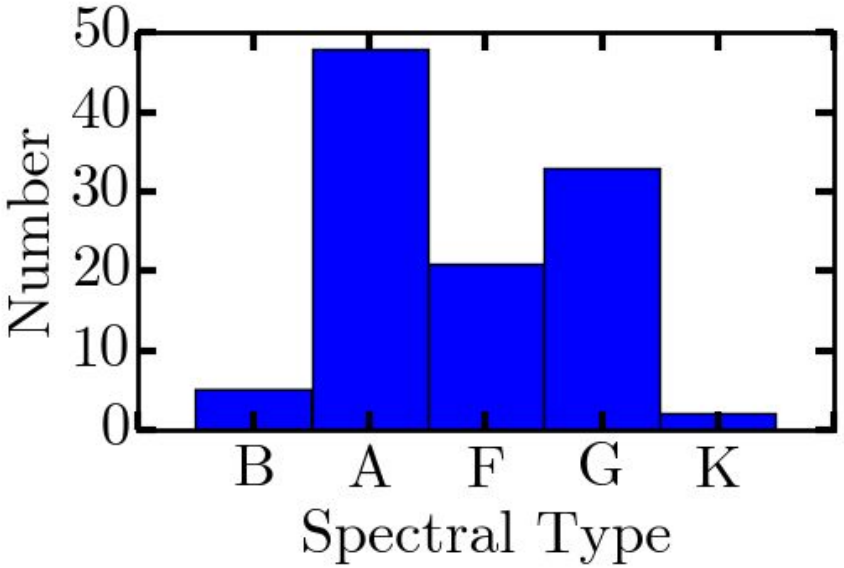
LEECH Survey



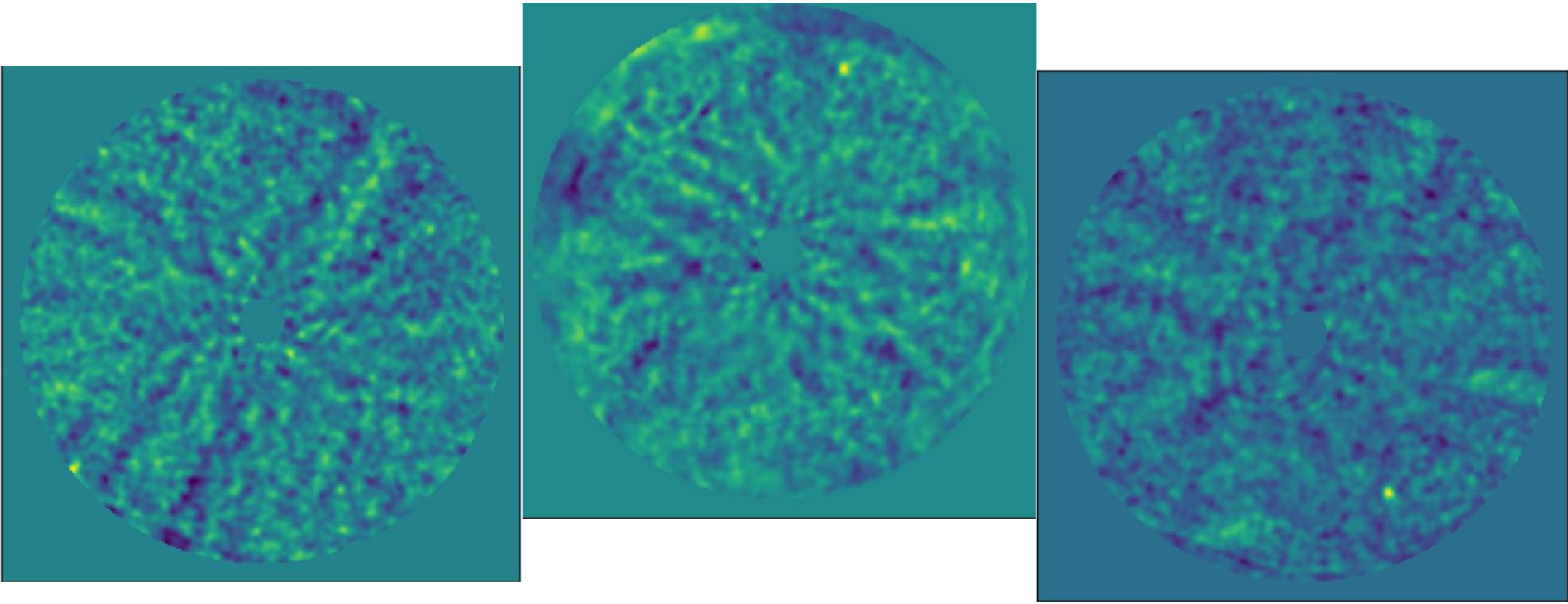


100 targets
(varying data quality)

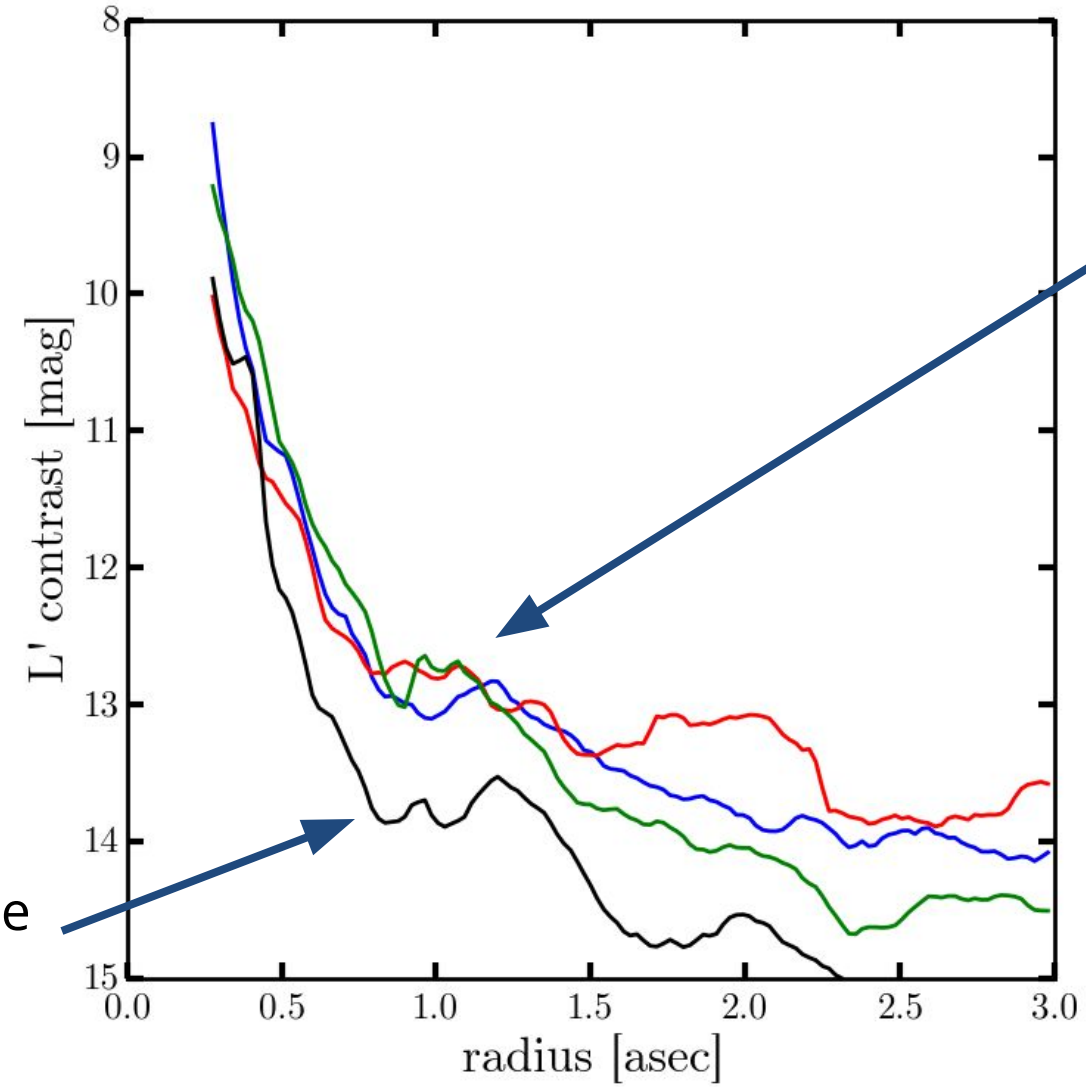
~15 binaries
(emphasized during poor seeing)



LEECH: No new planets
A few background objects…
We also discovered some binaries



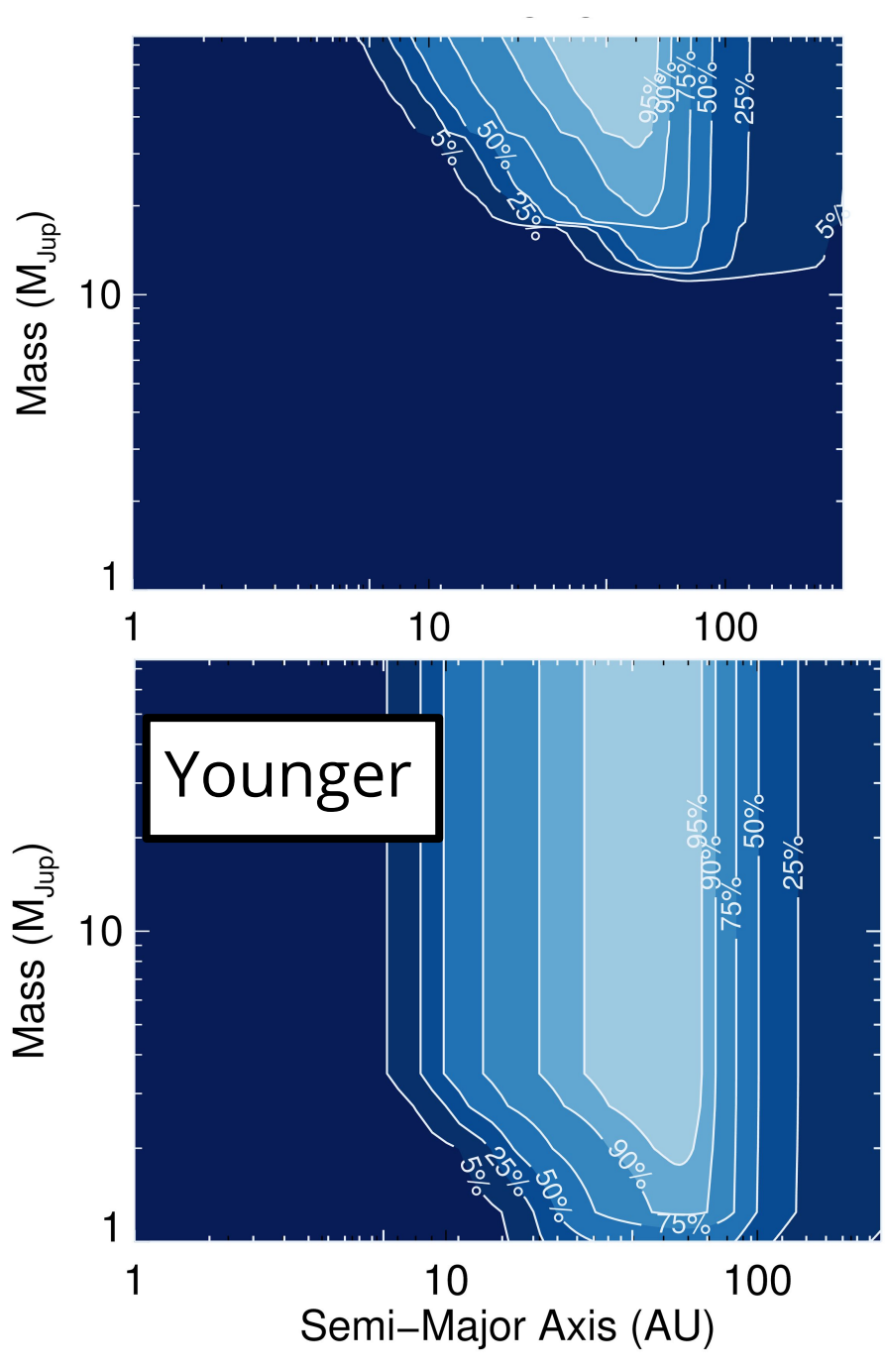
LEECH: Contrast Curves

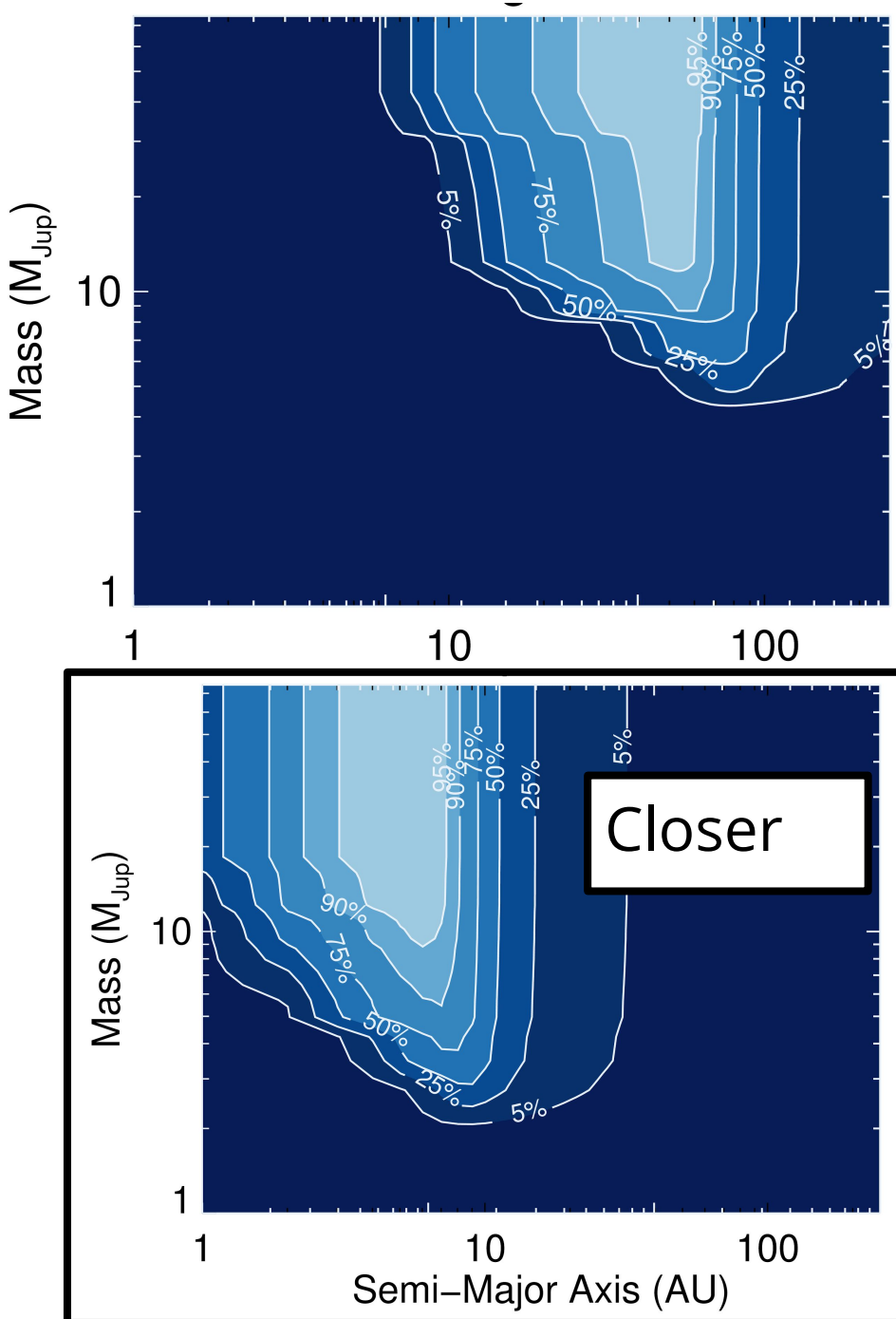


Average performance

Good performance

LEECH: Mass Sensitivity





Stay Tuned for Full Survey Results!

Conclusions 1

- Direct imaging surveys constrain planetary distribution functions to guide models of formation and evolution
- Directly imaged planets can be studied in detail to learn about the physical processes at work in their atmospheres

Conclusions 2

- LEECH obtained high-contrast thermal infrared images using the LBT twin adaptive secondaries
- No new planets found
- 100 contrast curves being analyzed to constrain wide-orbit exoplanet population