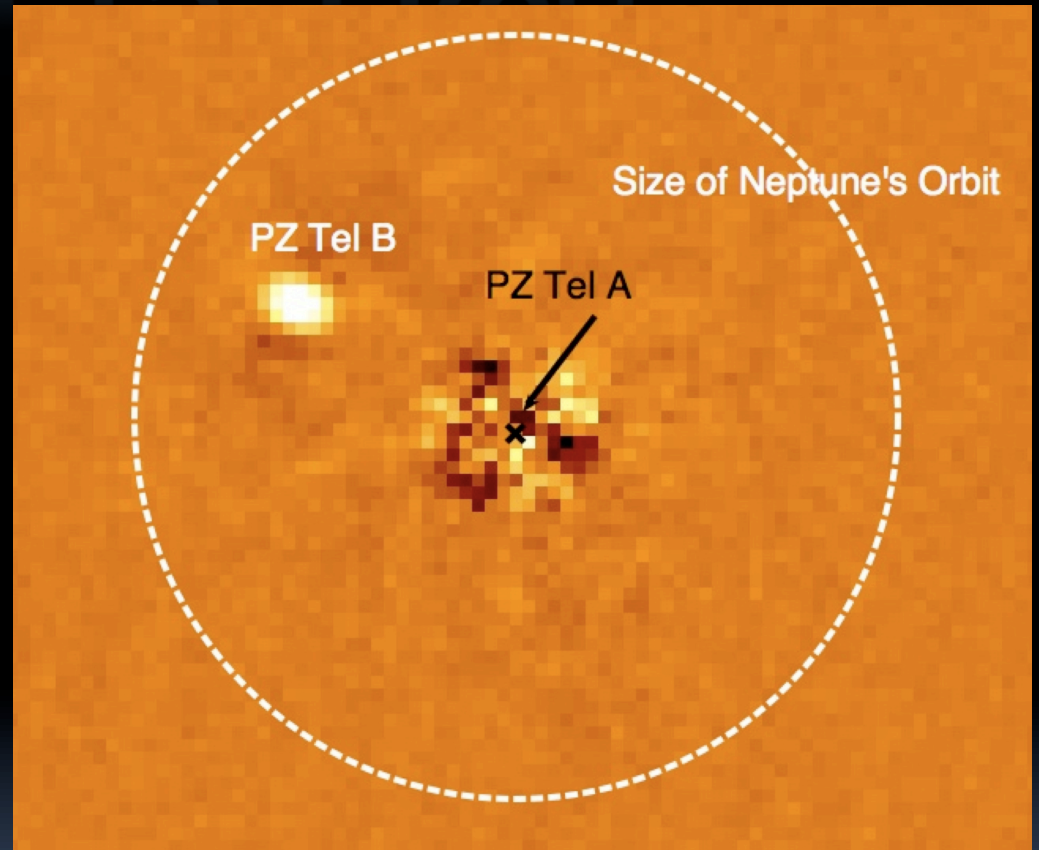


RECENT RESULTS FROM EXOPLANET IMAGING SURVEYS



Initial results from the NICI Campaign, the NACO
Large Program, and SEEDS

Beth Biller, MPIA

Ongoing Direct Imaging Surveys

NICI Science Campaign @ Gemini South –
230 stars, concluding 2012A, PI M. Liu

NACO Large Program @ VLT – 90 stars to
date, PI J.-L. Beuzit

SEEDS @ Subaru – ~70 stars observed to date, 5 year
project, PI M. Tamura

Anatomy

of a dedicated exoplanet imager

1. NGS Adaptive optics:

- *Increasing the contrast*

2. Coronagraphy

- *Boost dynamic range and contrast*

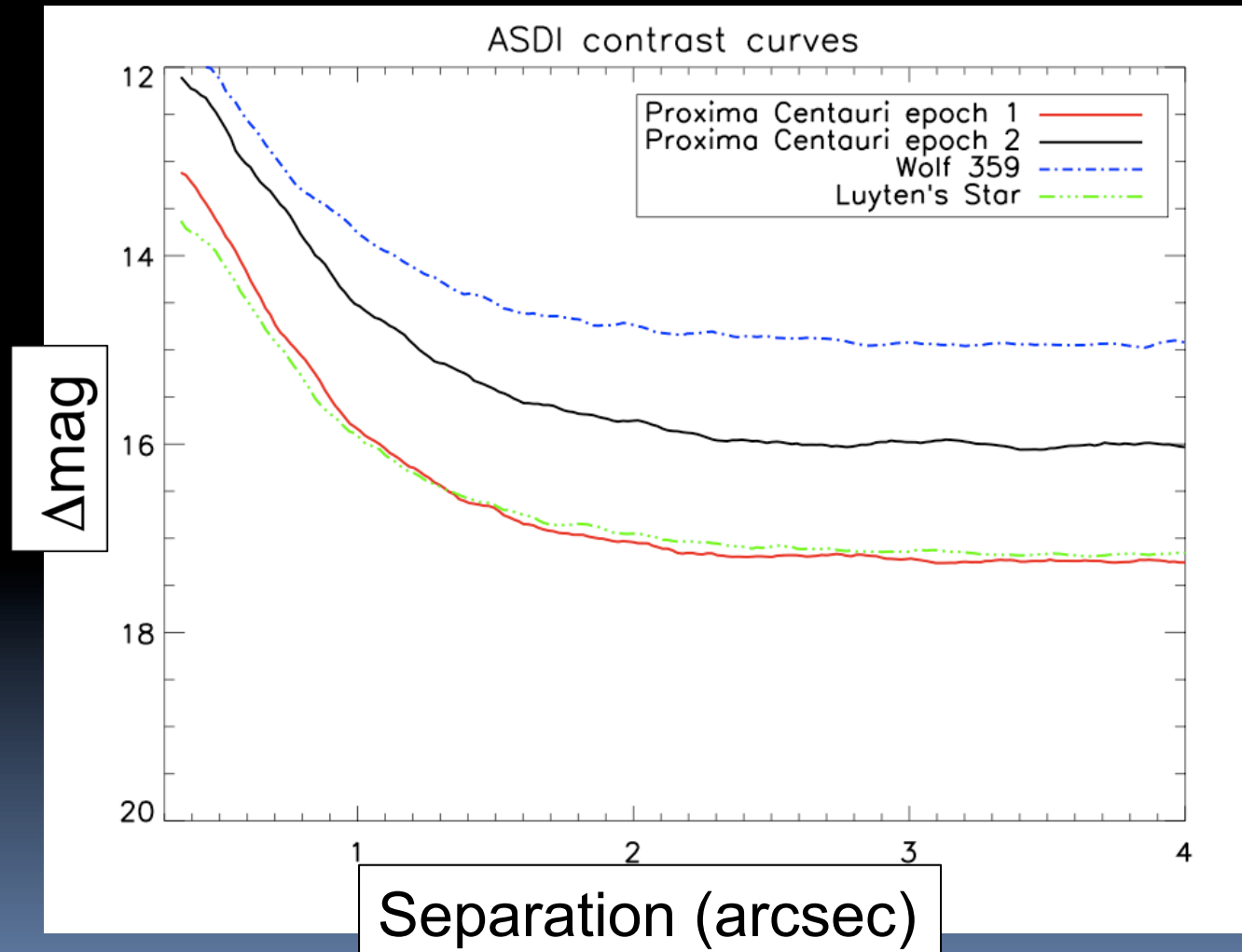
3. Spectral Differential Imaging (SDI)

- *Removing time-variable atmospheric speckles*

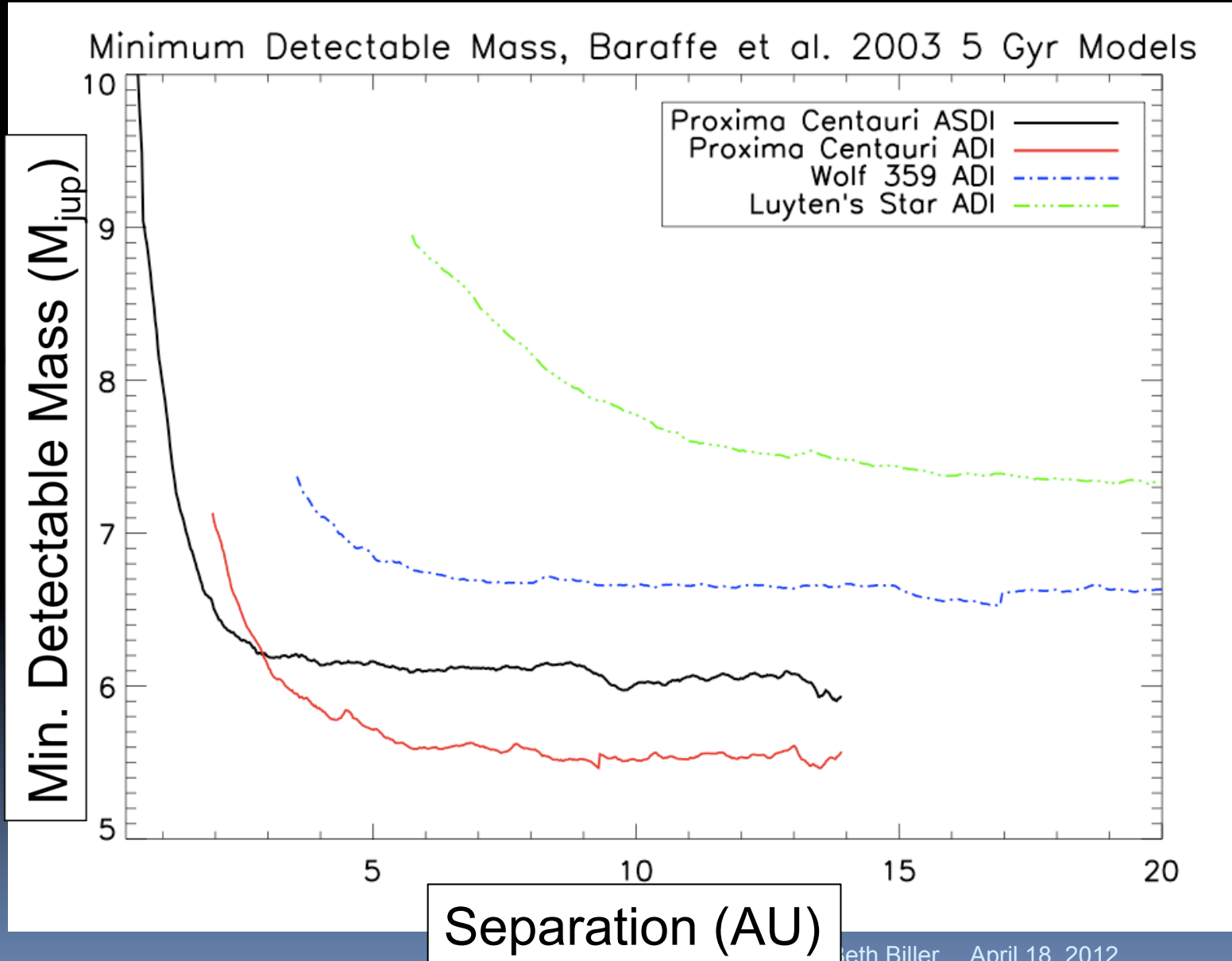
4. Angular Differential Imaging (ADI)

- *More PSF removal, suited for methane & non-methane*

Contrasts around the nearest stars with NICI



Minimum Detectable Masses

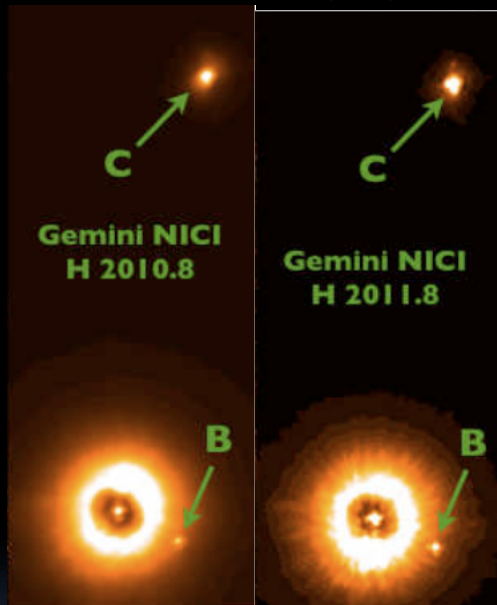


3 Brown Dwarf Discoveries with NICI

HD 1160BC

PZ Tel B

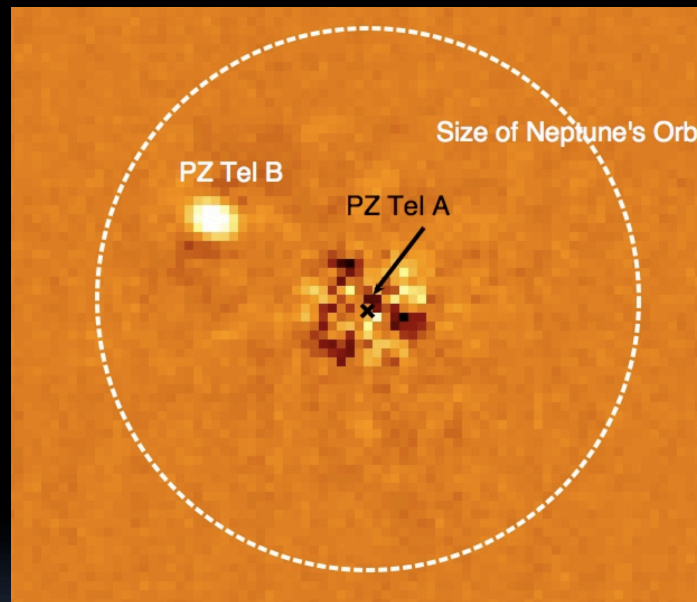
CD-35 2722 B



Nielsen et al. 2012

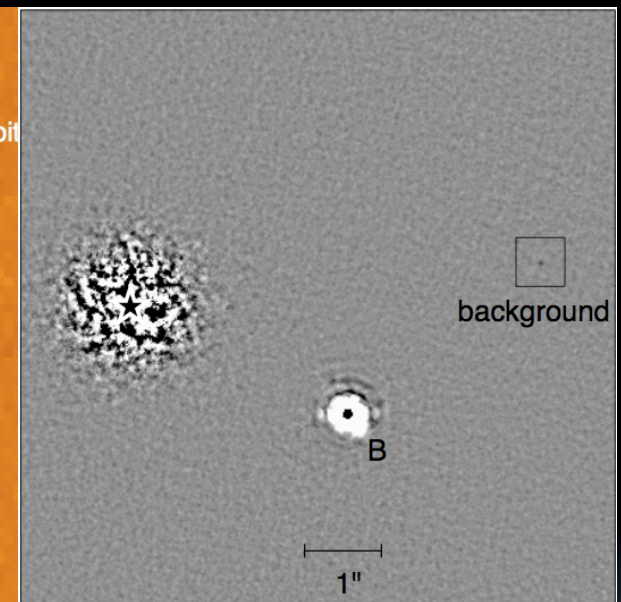
B: 81 AU sep.

C: 533 AU sep.



Biller et al. 2010,
confirmed by Mugrauer et al. 2010

17 AU sep.



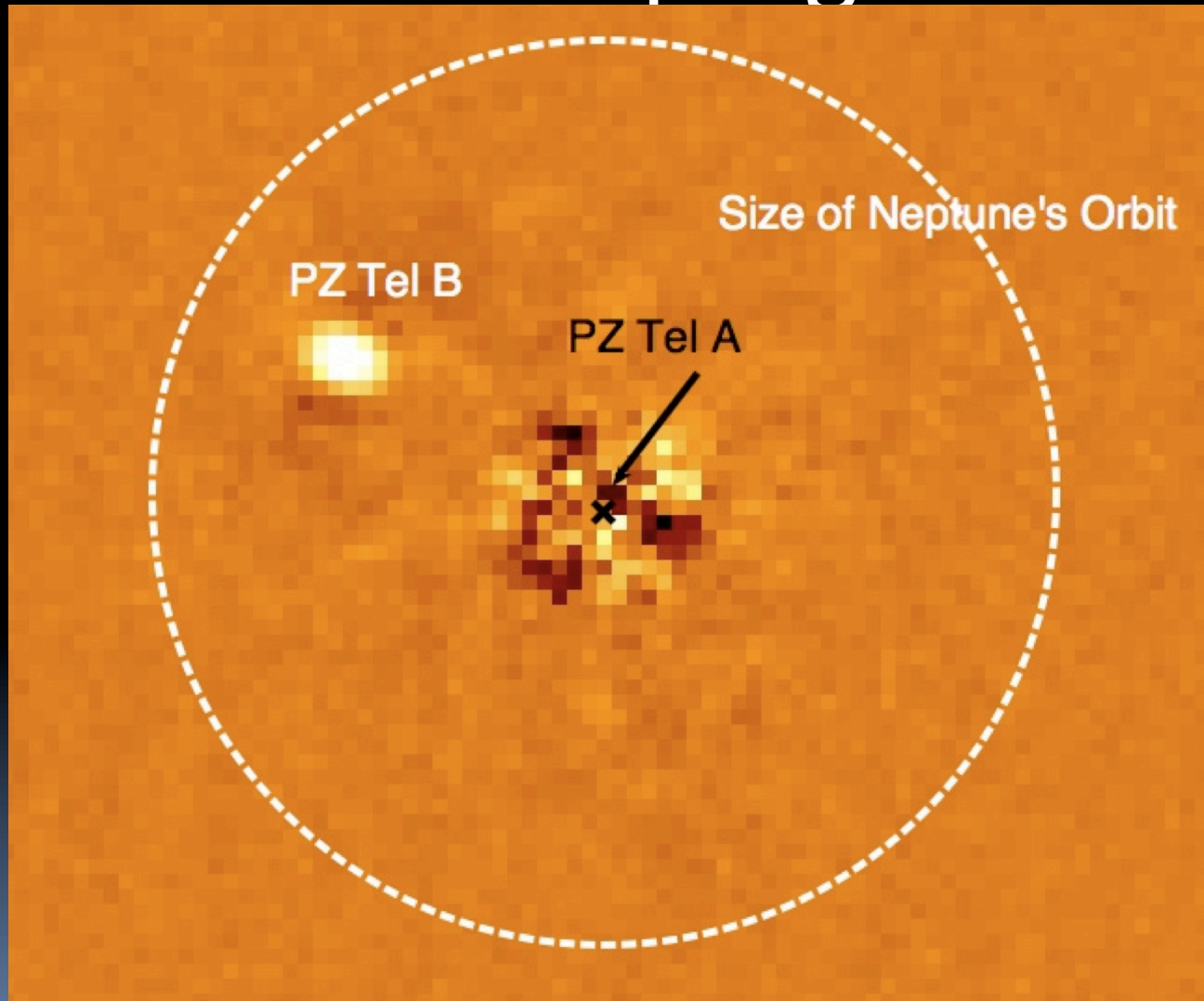
Wahhaj et al. 2011

67 AU sep.

Estimated masses: 30-40 M_{Jup}

PZ Tel B

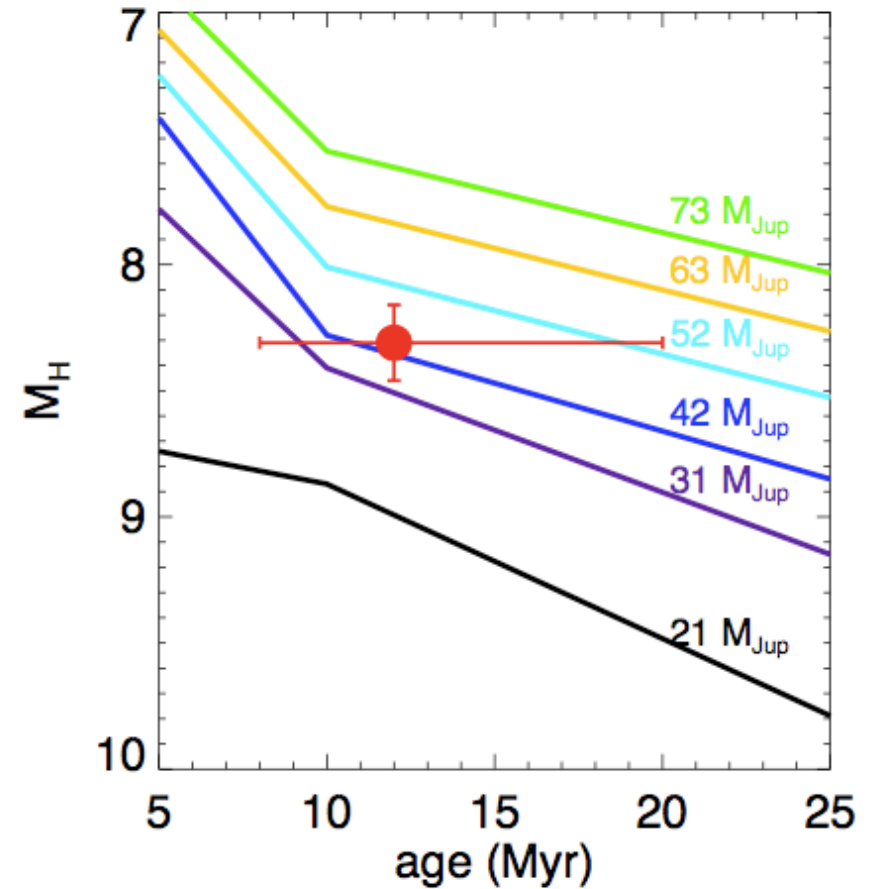
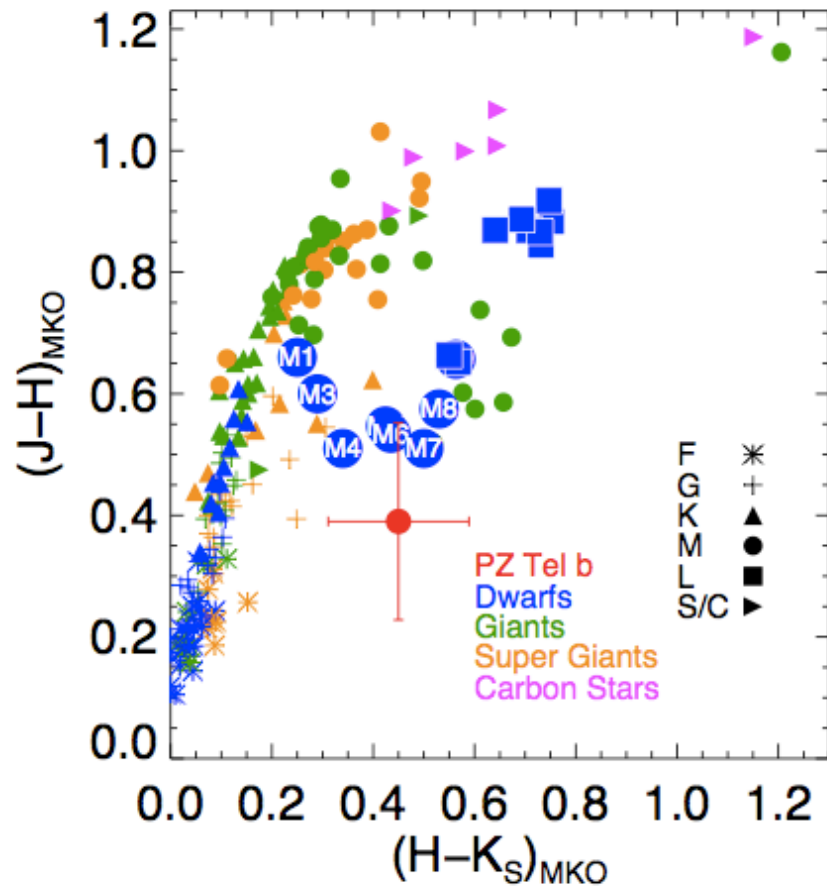
First NICI Campaign Discovery



Biller et al. 2010

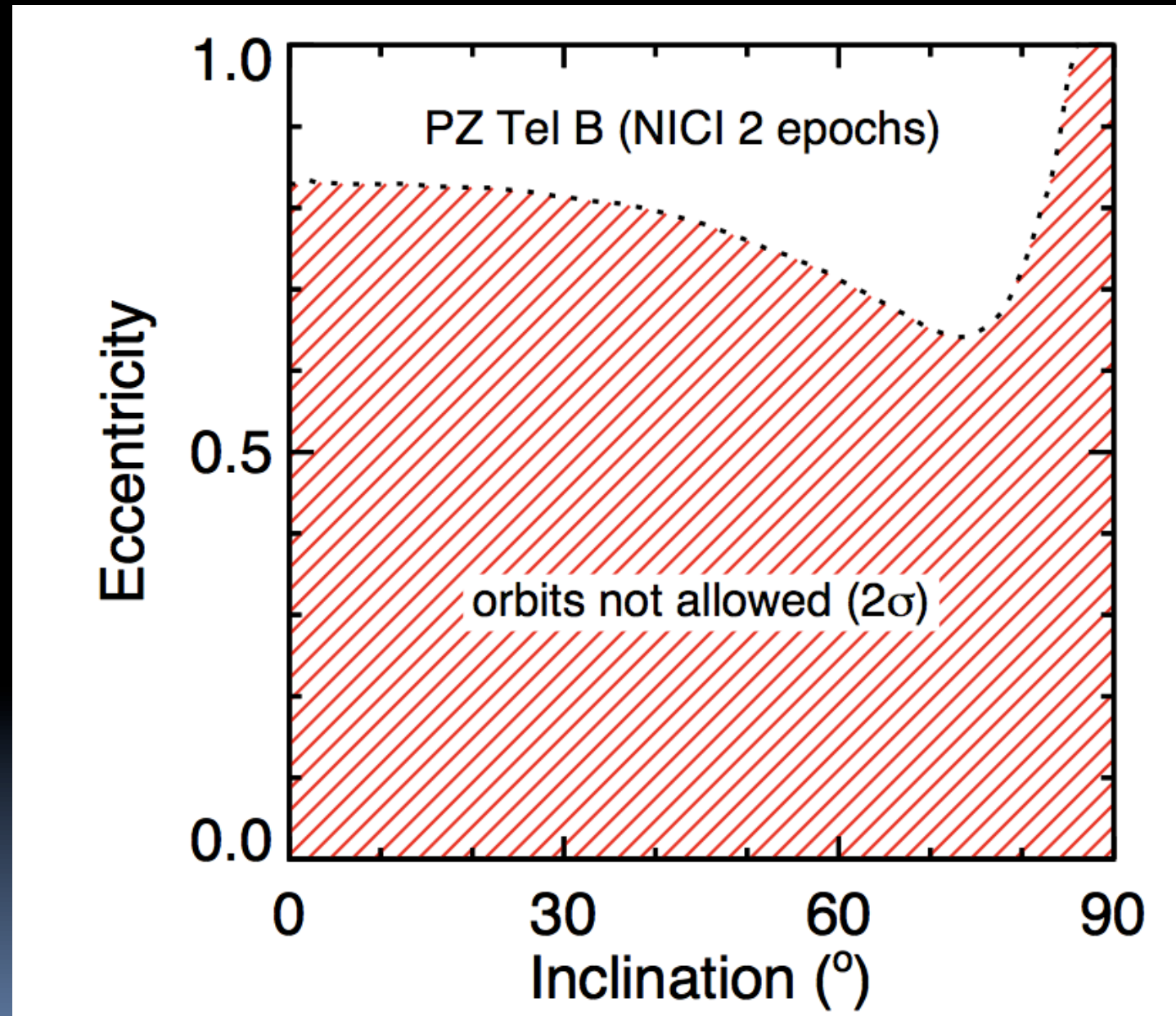
PZ Tel B: Photometry

Biller et al. 2010



Mass: $36 \pm 6 M_{\text{jup}}$ (Lyon/DUSTY evolutionary models)
Spectral Type: $M7 \pm 2$ (estimate from observed colors and mag)

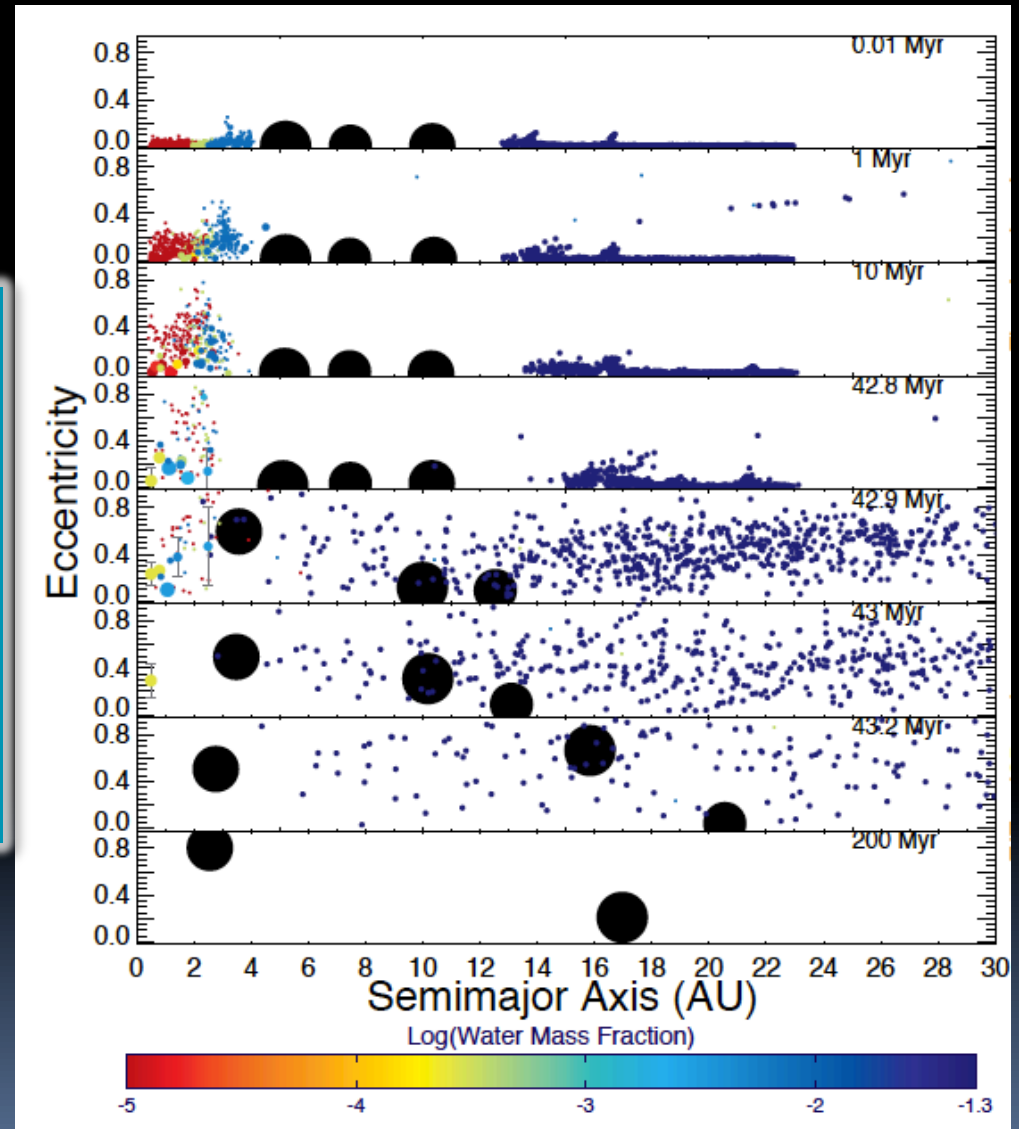
PZ Tel B: Orbital Constraints



Biller et al. 2010

Can Planets Survive in the PZ Te1 System?

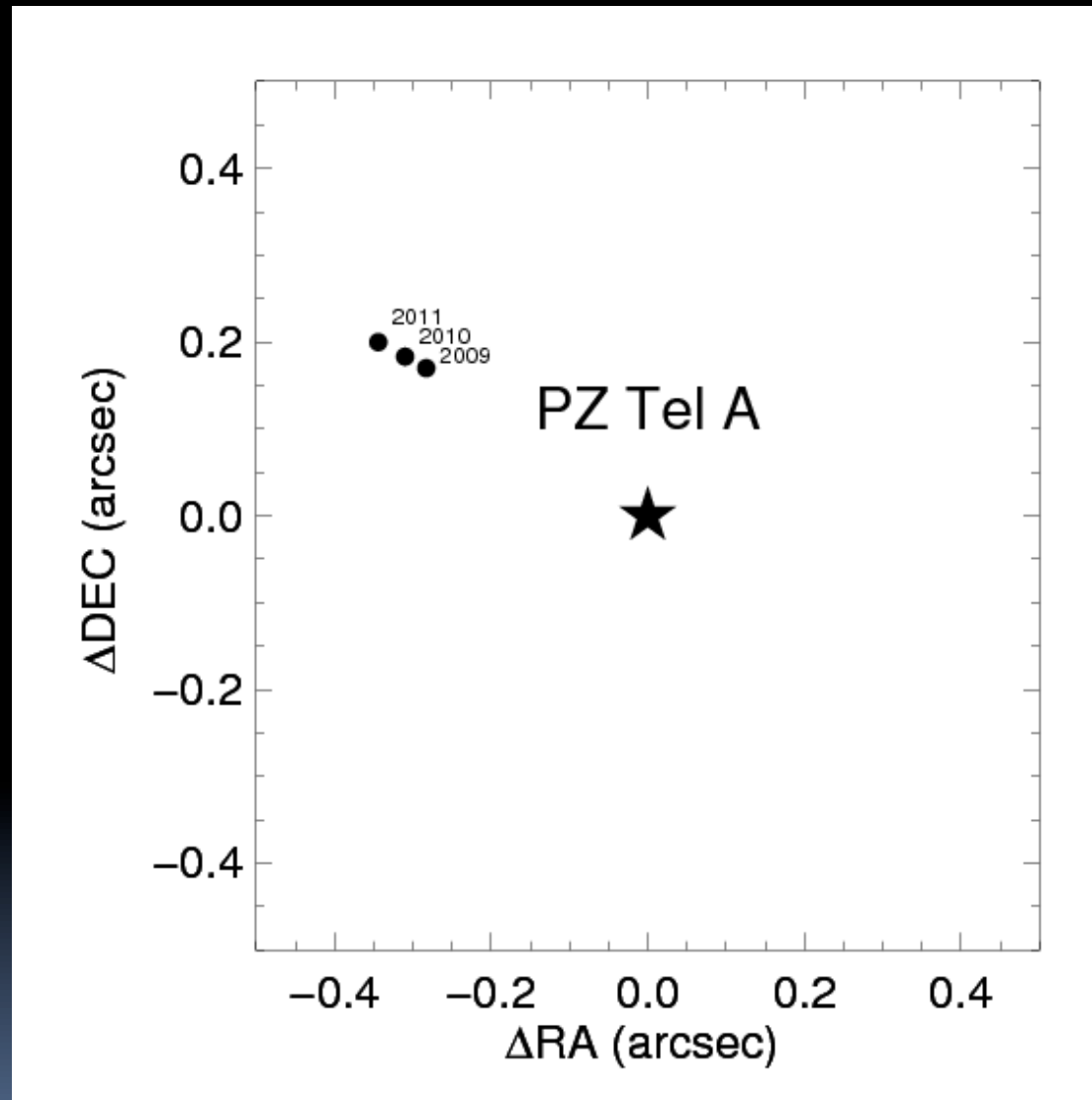
Multiple massive planets can effectively destroy other planets



Raymond et al. 2012

Beth Biller April 18, 2012

Ongoing Orbital Monitoring

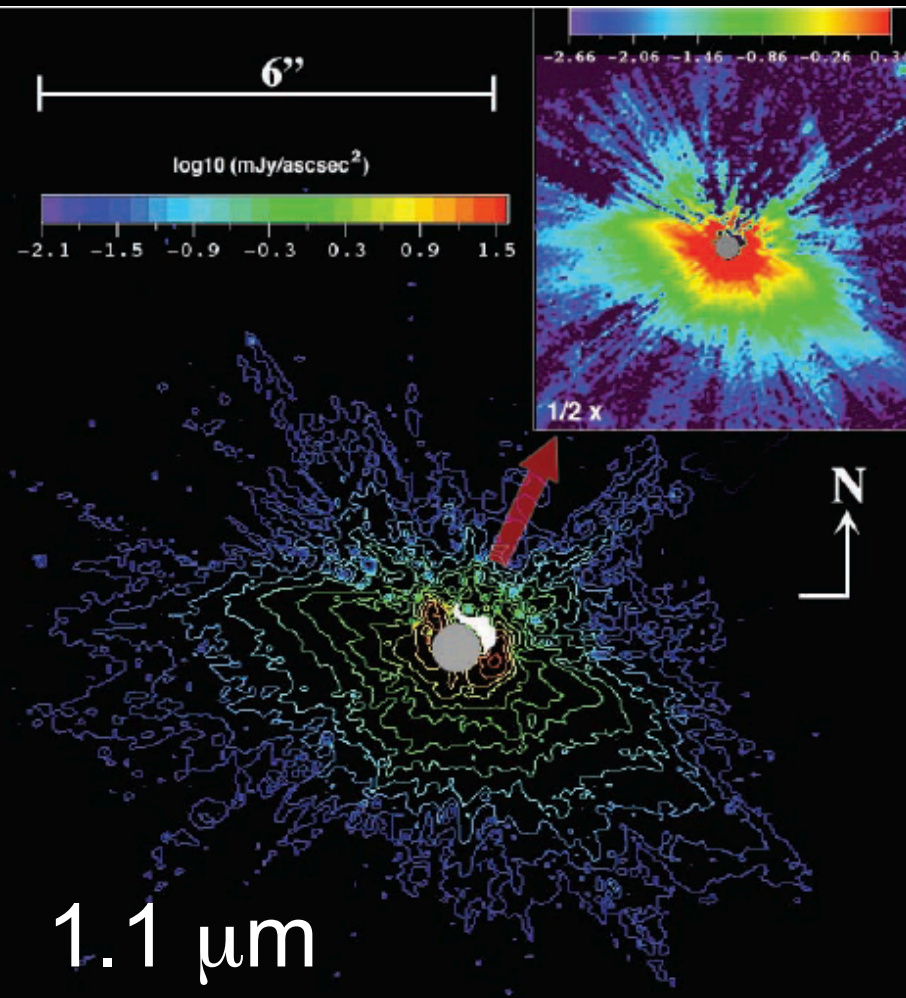


April 18, 2012

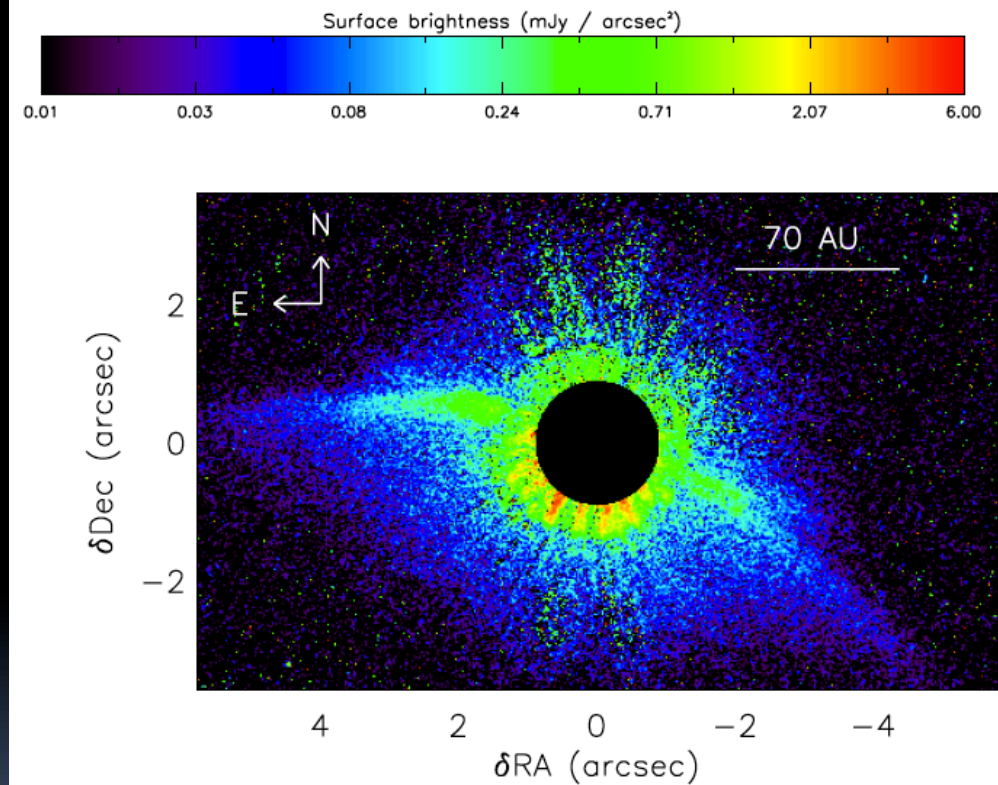
Beth Biller

Debris Disk Imaging with the NACO-LP

The Moth: HST imaging

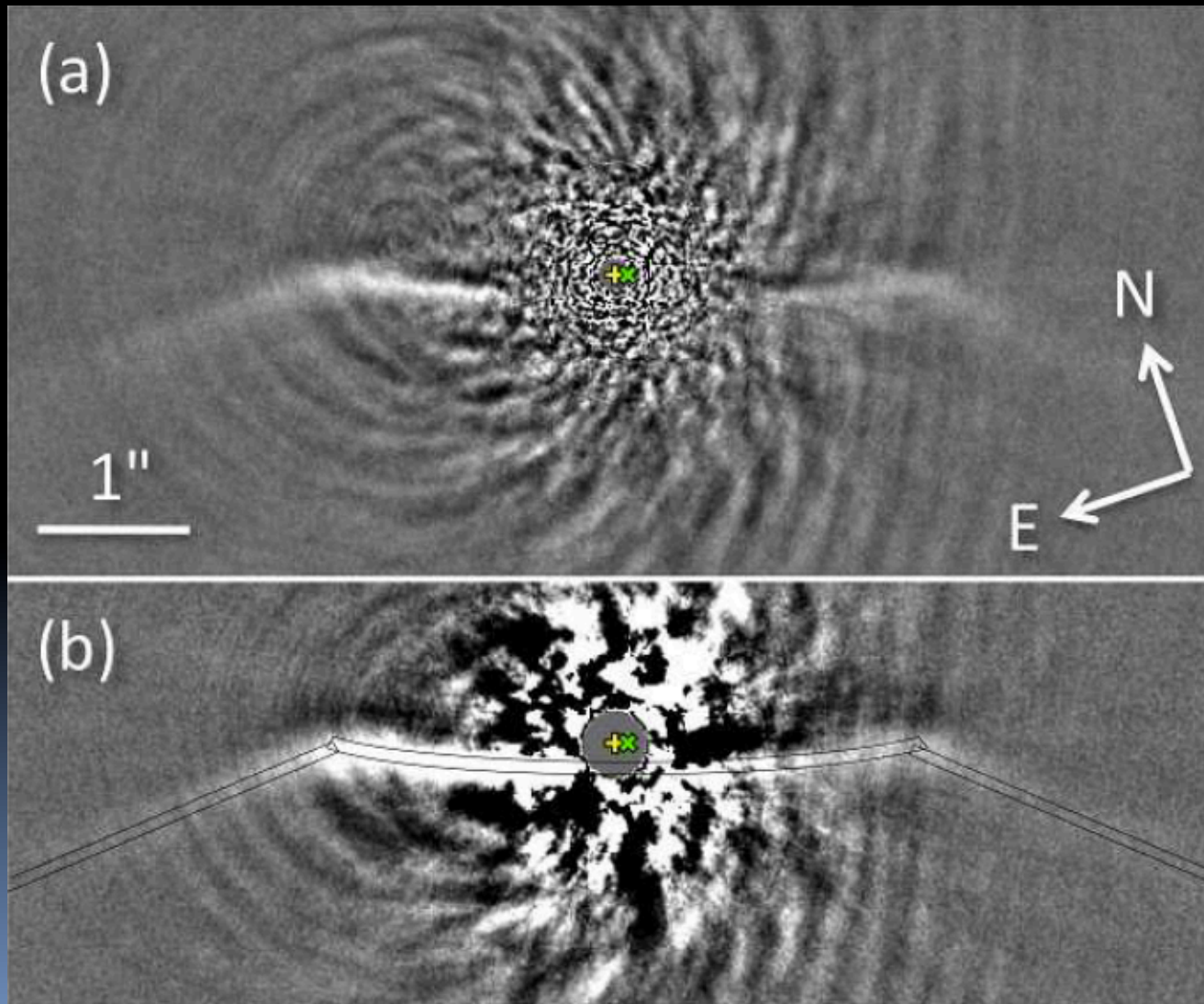


Hines et al. 2007



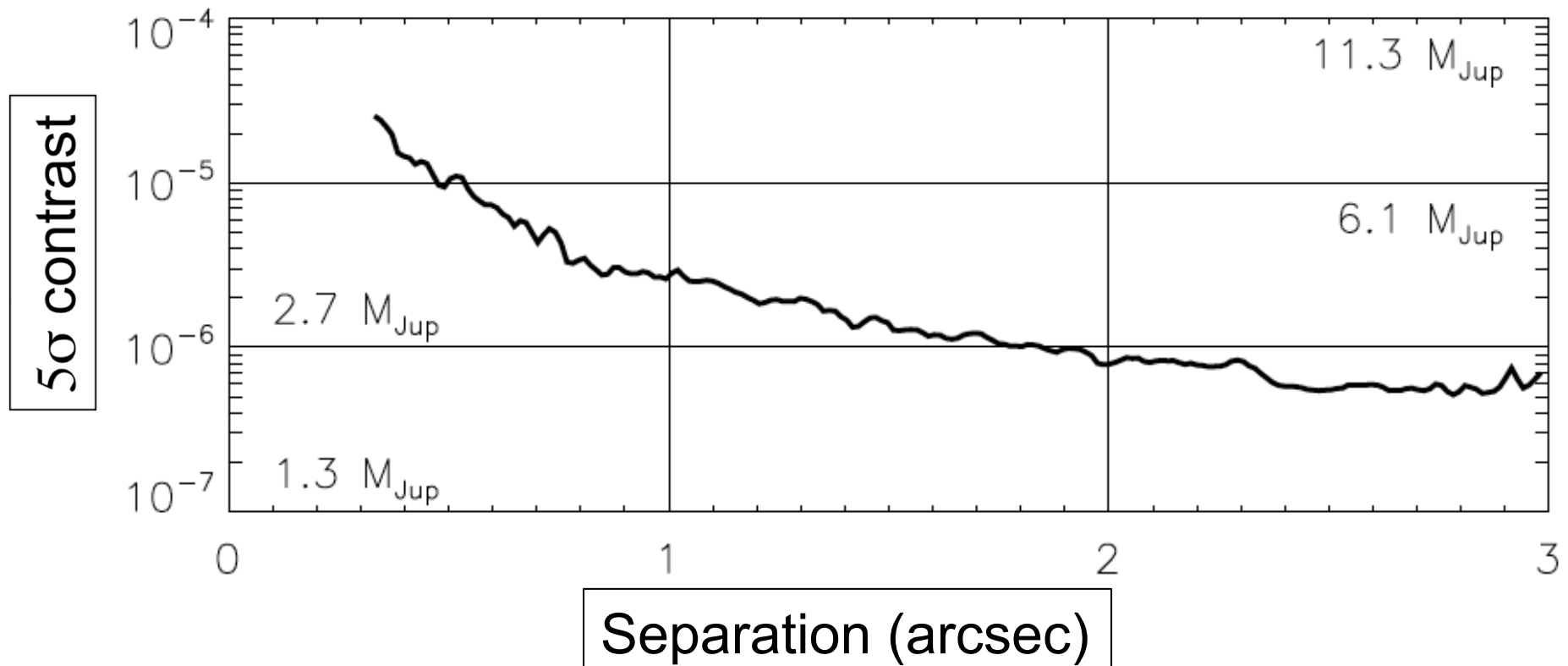
Maness et al. 2009

The Moth: Unprecedented Resolution with the NACO-LP



Offset
between
star and
disk
center

The Moth: Limits on Detectable Planets



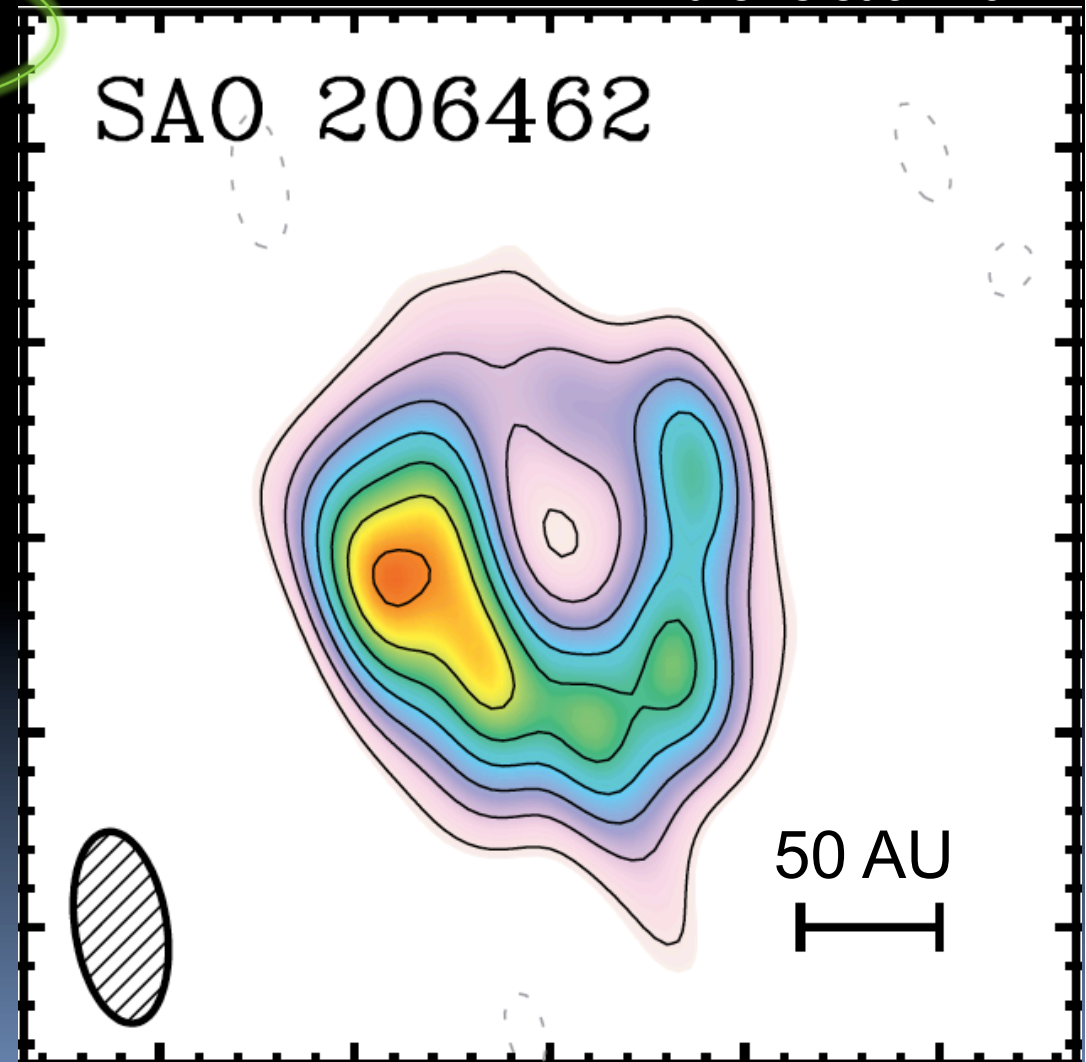
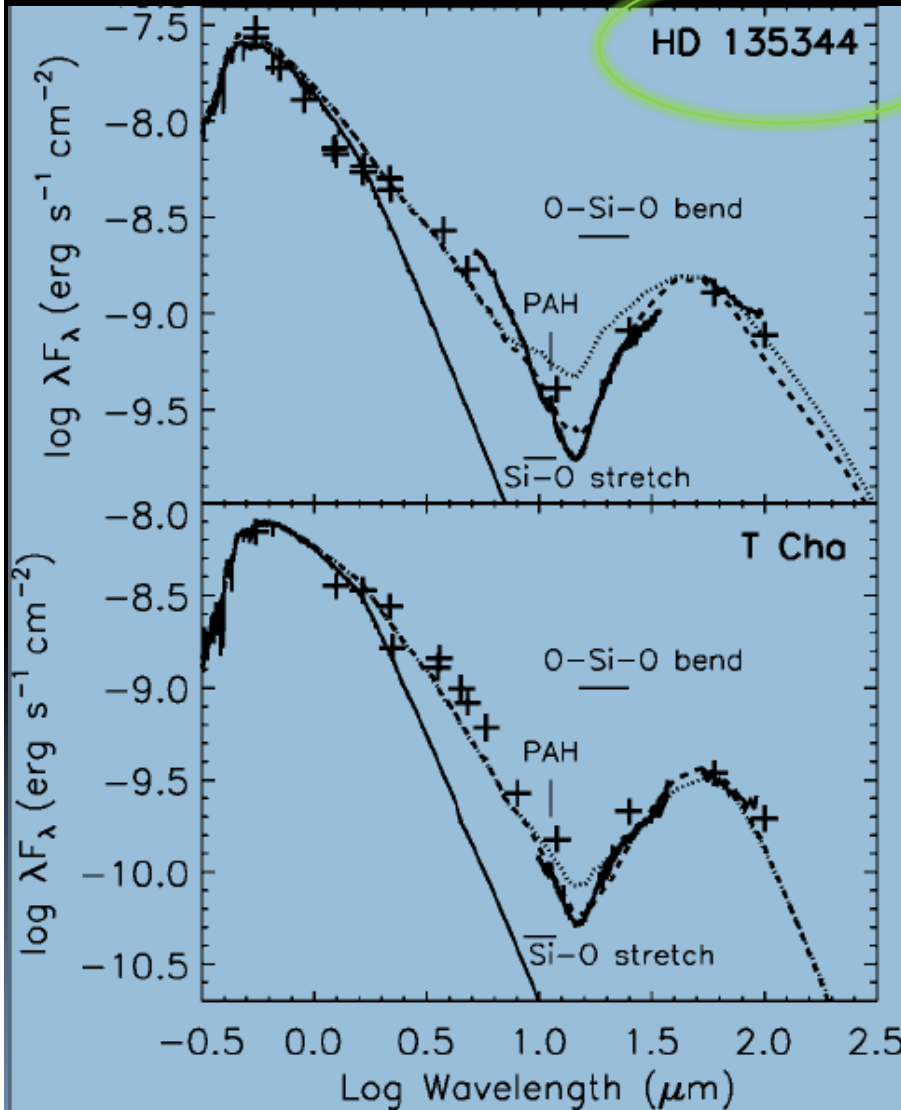
Transitional Disk Imaging with SEEDS

SAO 206462

Prediction: Gap

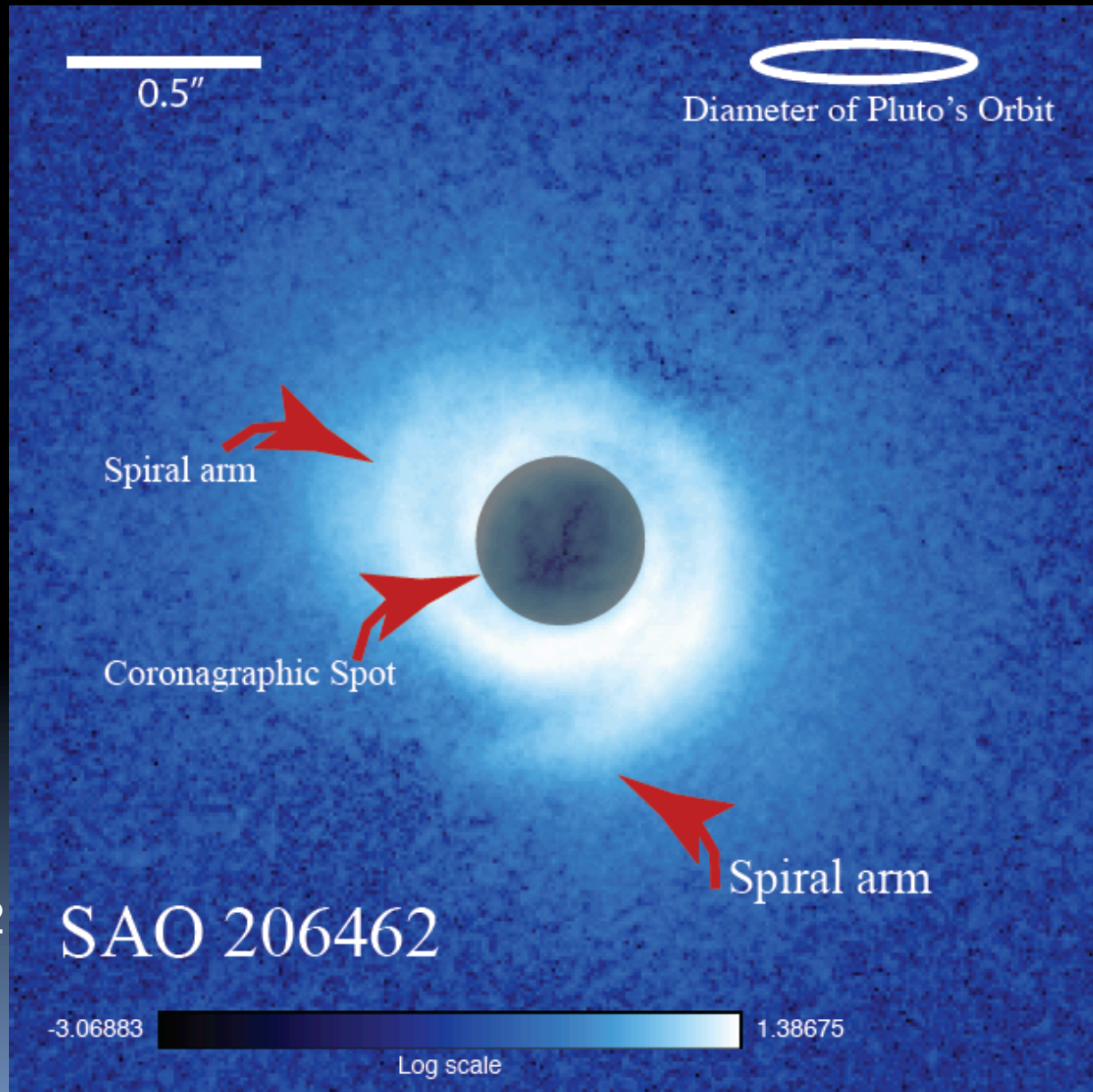
Brown et al. 2007

Andrews et al. 2011



SAO 206462

Observed: Spiral Arms

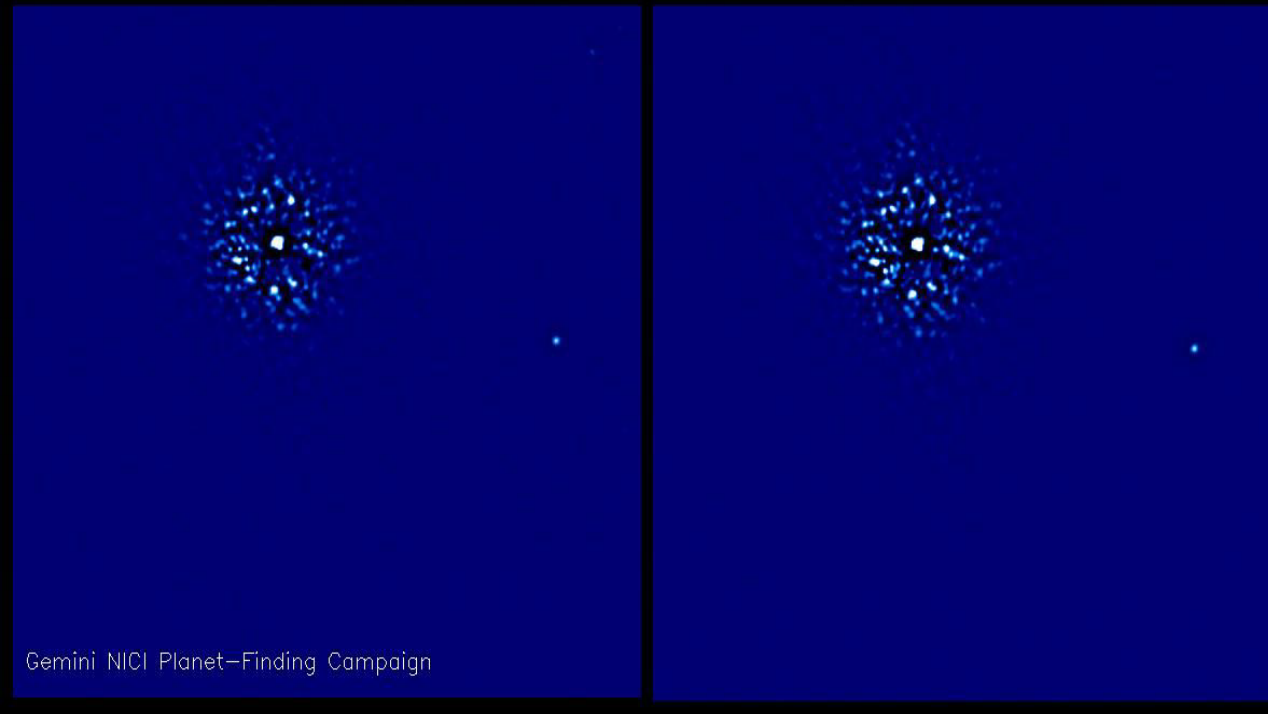


Muto et al. 2012

These discoveries are only a subset of the results from the NICI campaign, NACO-LP, and SEEDS – stay tuned for more results soon!

Angular Differential Imaging

e.g. Schneider et al 2003, Liu 2004, Marois et al 2006, Heinze et al 2008



Rotation on sky decorrelates
real objects from speckles

PZ Tel B: Astrometric Confirmation

