



Inspection & Characterization of Exoplanets' Host Stars

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Part 1. Dissertation Work





Current Project

- Observing exoplanets' host stars:
 - Confirming/refuting planetary status
 - Measuring star's central diameter
- Of 175+ known systems, 76 observable with CHARA
- Use intermediate and long baselines





Stars Mimicking Planets

- Planet hunters assume inclination is high
 - Probably true for most cases
 - But... they tended to ignore known SBs
- Raghavan et al. (2006) showed at least 23% of known exoplanet systems also have stellar companions



Stars vs. Planets

- Studies have shown that orbital element distributions for exoplanets and SBs are statistically identical (Stepinski & Black 2001)
- Models of 8 exoplanets as binary systems match observations (Imbert & Prévot, 1998)
 - 4-5% probability

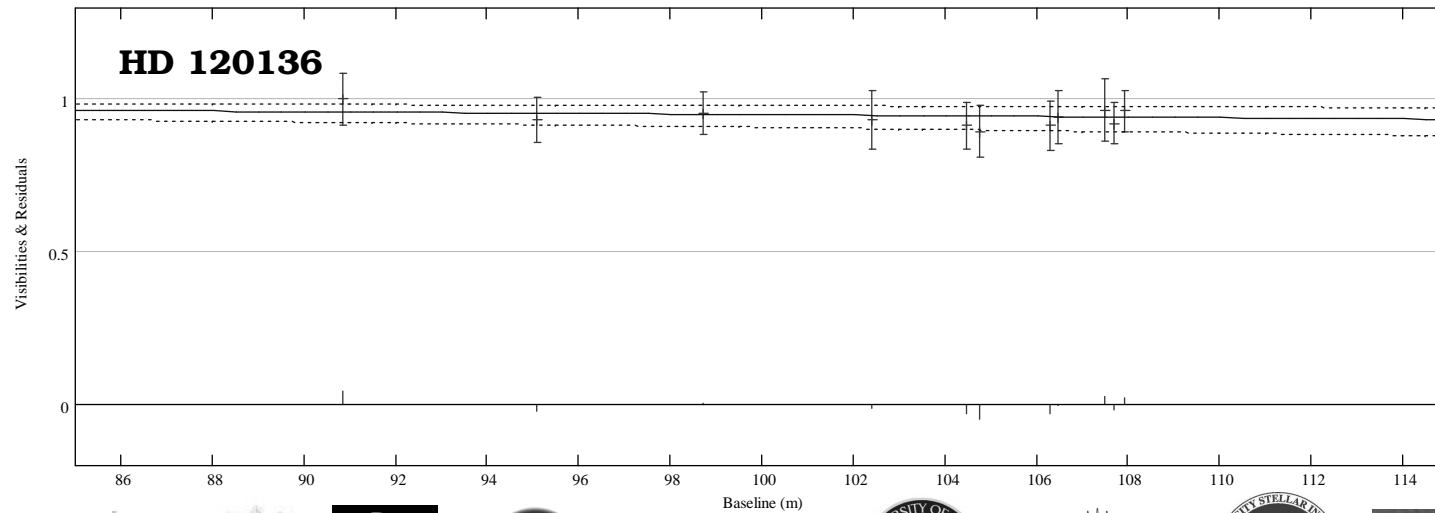
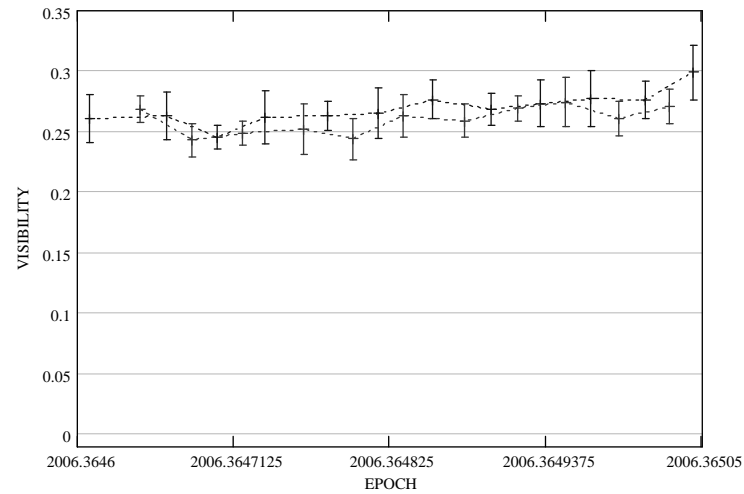


Results So Far

- 700+ observations of 35 systems
 - 3 spectroscopic binaries also observed
- 4 baseline combos used
- 20 host stars have diameters
 - Most within 5-15% error
- 19 need more observations



Example of Single Star

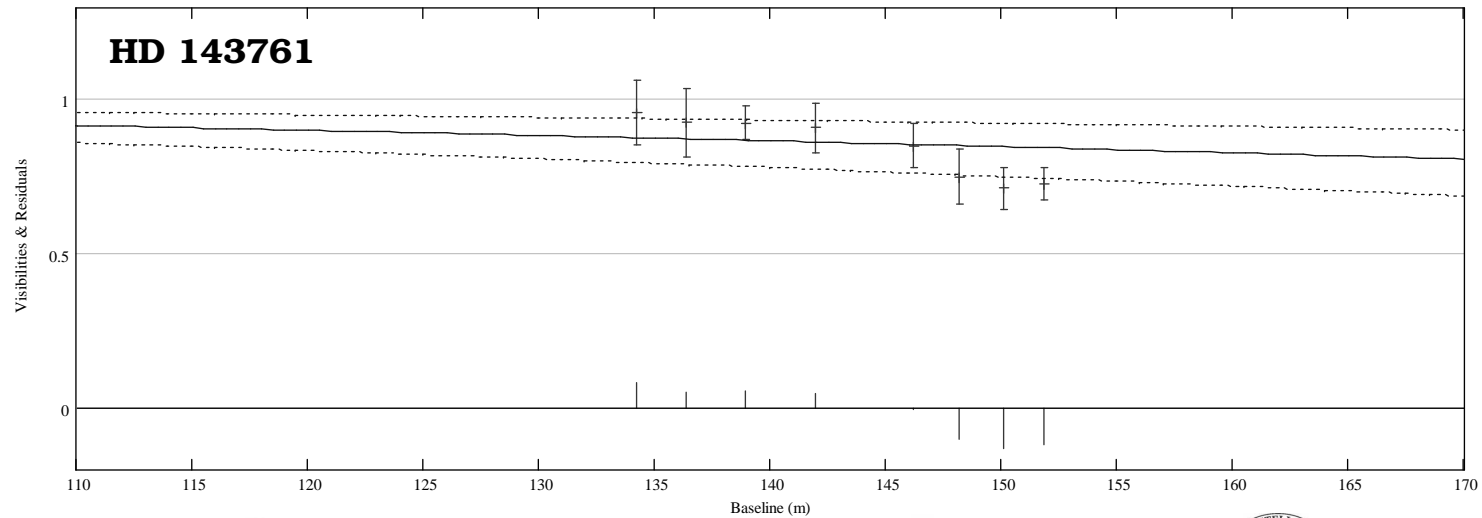
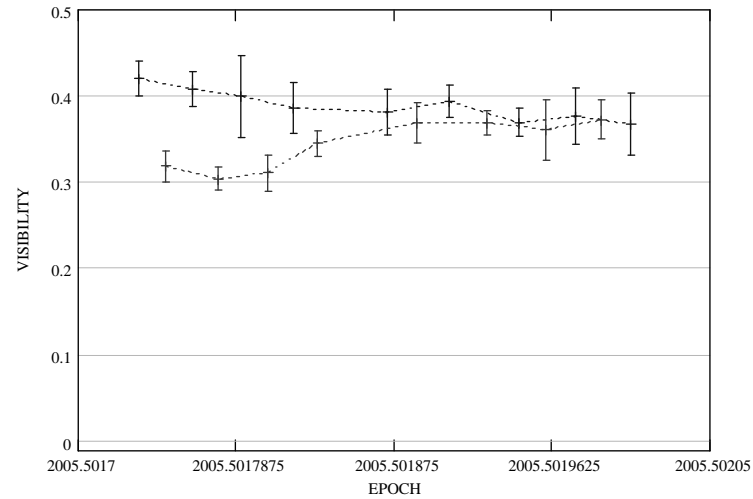


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Example of Odd Behavior





End State

- Looking to defend on June 7th
- Working on dissertation now
- Hope to continue this work post graduation





Part 2.

HD 189733





HD 189733

- Known transiting planet
- Discovered by Bouchy et al. (2005):
 - $R_{\text{star}} = 0.76 \pm 0.01 R_{\text{Sun}}$
 - Planet-to-star-radii ratio: 0.172 ± 0.003

$$R_{\text{planet}} = 1.26 \pm 0.03 R_{\text{Jup}}$$

- Bakos et al. (2006) refined planetary parameters:

$$R_{\text{planet}} = 1.154 \pm 0.032 R_{\text{Jup}}$$





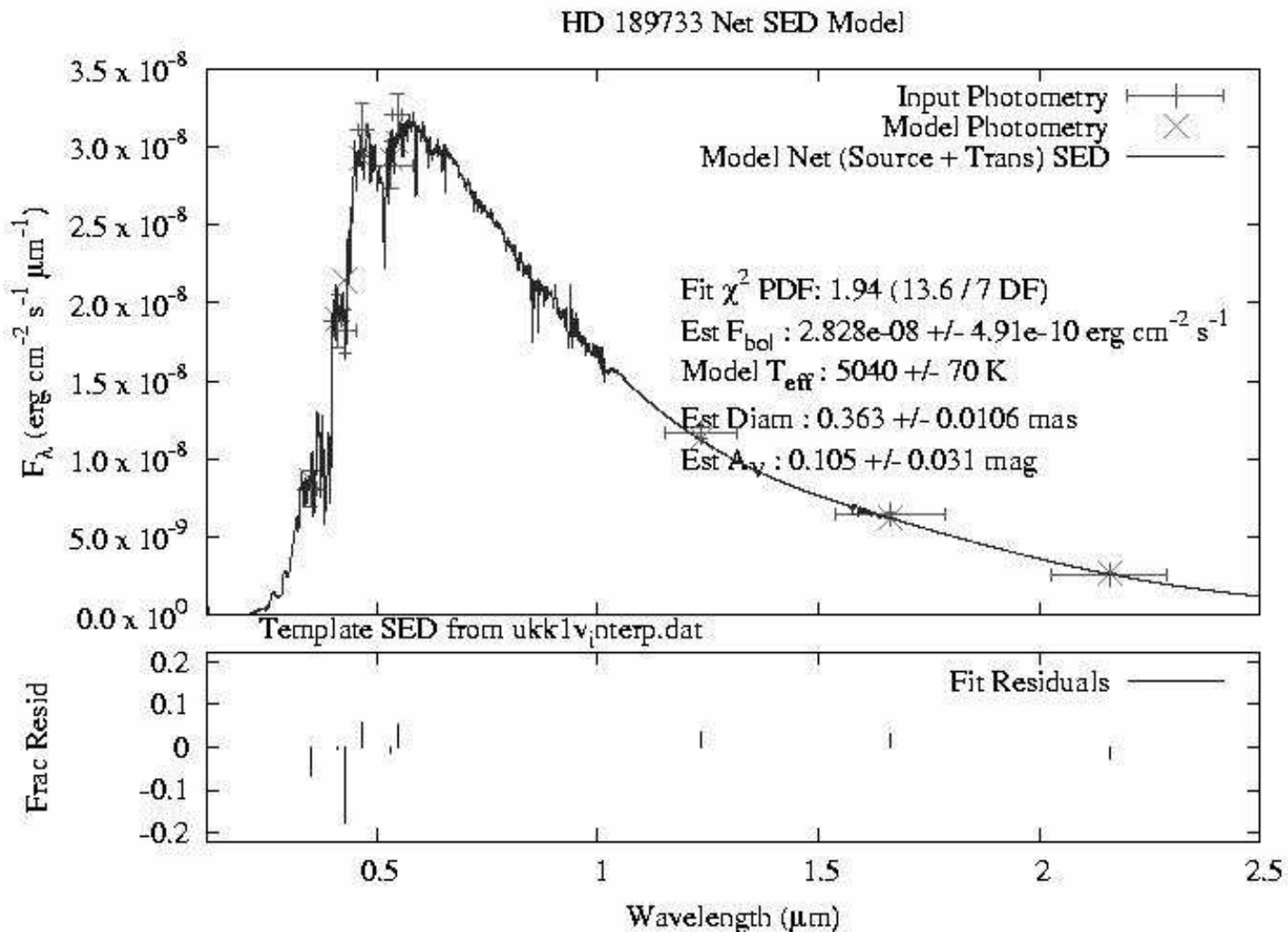
Why bother?

- Photometry used is... sketchy
 - Some values were extrapolated
 - Quoted diameter errors are way too small
 - Star is photometrically variable!
- First *direct* measurement of exoplanet
- Because we can





HD 189733 SED



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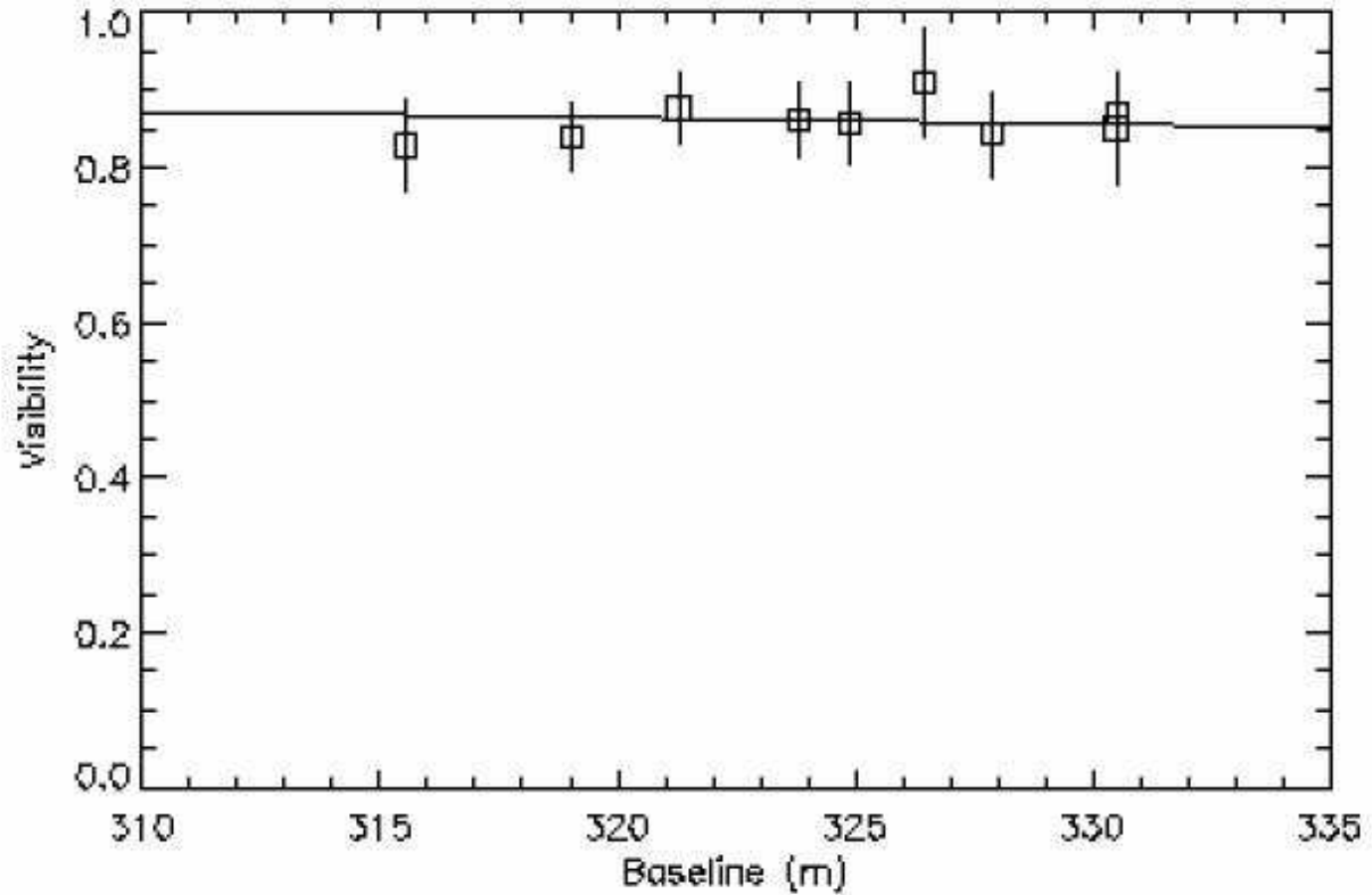
CHARA Observations

- Observed over several nights last summer
- Used H-band, S1-E1 baseline
 - Most sensitive to diameter measurements
- Used HD 190933 as calibrator
- Also observed using PTI





Calibrated Visibilities





Results

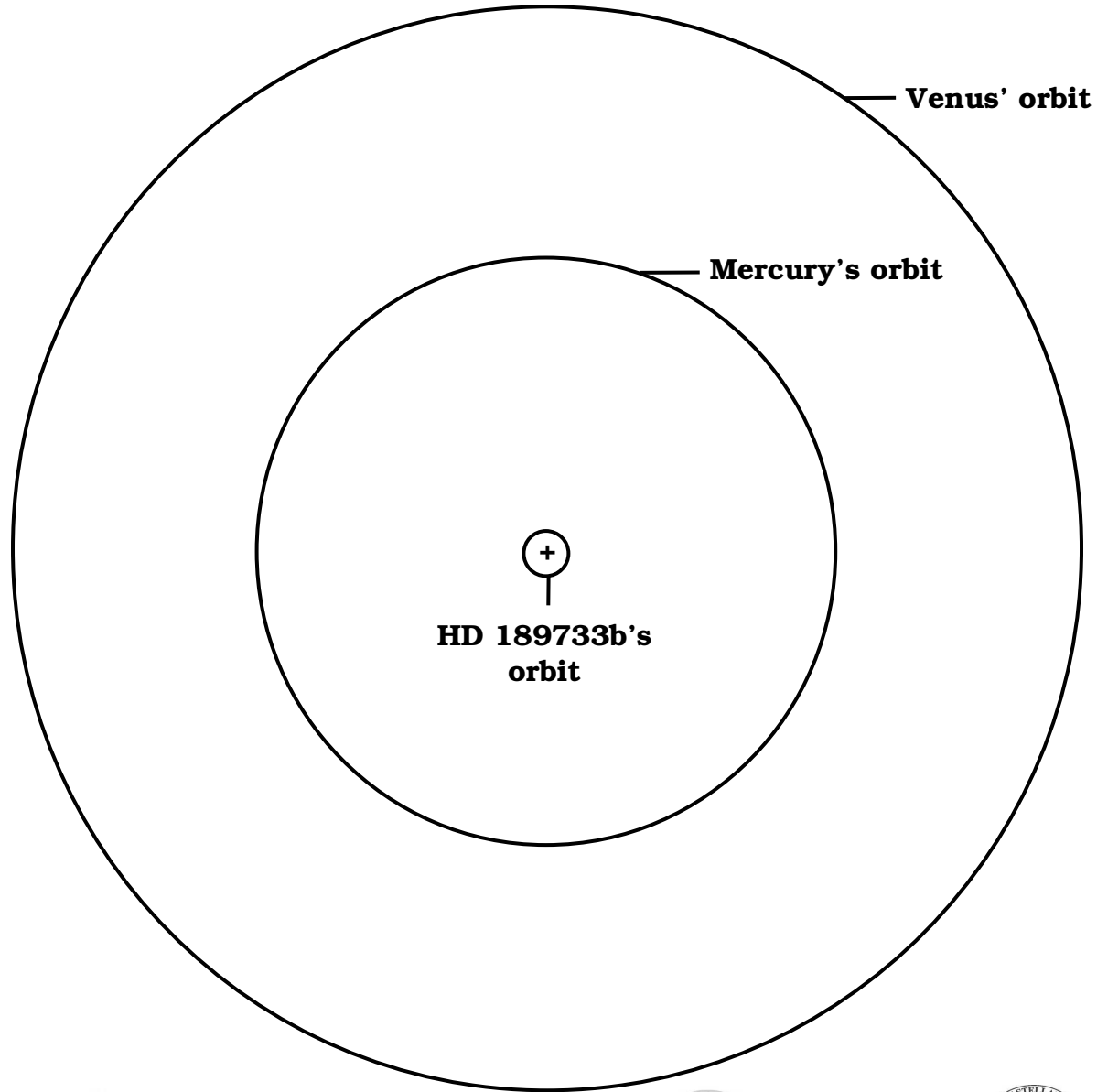
- $\Theta_{LD} = 0.376 \pm 0.031$ mas
- $\pi = 51.9 \pm 0.9$ mas
- $R_{star} = 0.779 \pm 0.066 R_{Sun}$

$$R_{planet} = 1.19 \pm 0.10 R_{Jupiter}$$

$$\rho = 0.91 \pm 0.23 \text{ g cm}^{-3}$$



CHARA Collaboration Year-Three Science Review



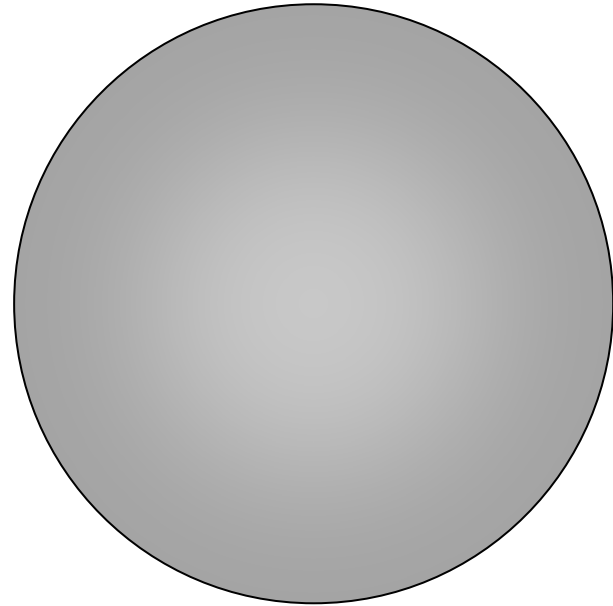


CHARA Collaboration Year-Three Science Review

Sun



HD 189733



Jupiter



HD 189733b





Paper Info

Direct Measurement of the Radius and Density of the Transiting Exoplanet HD 189733B with the CHARA Array

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M. Swain, N.H. Turner, L. Sturmann, J. Sturmann

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