

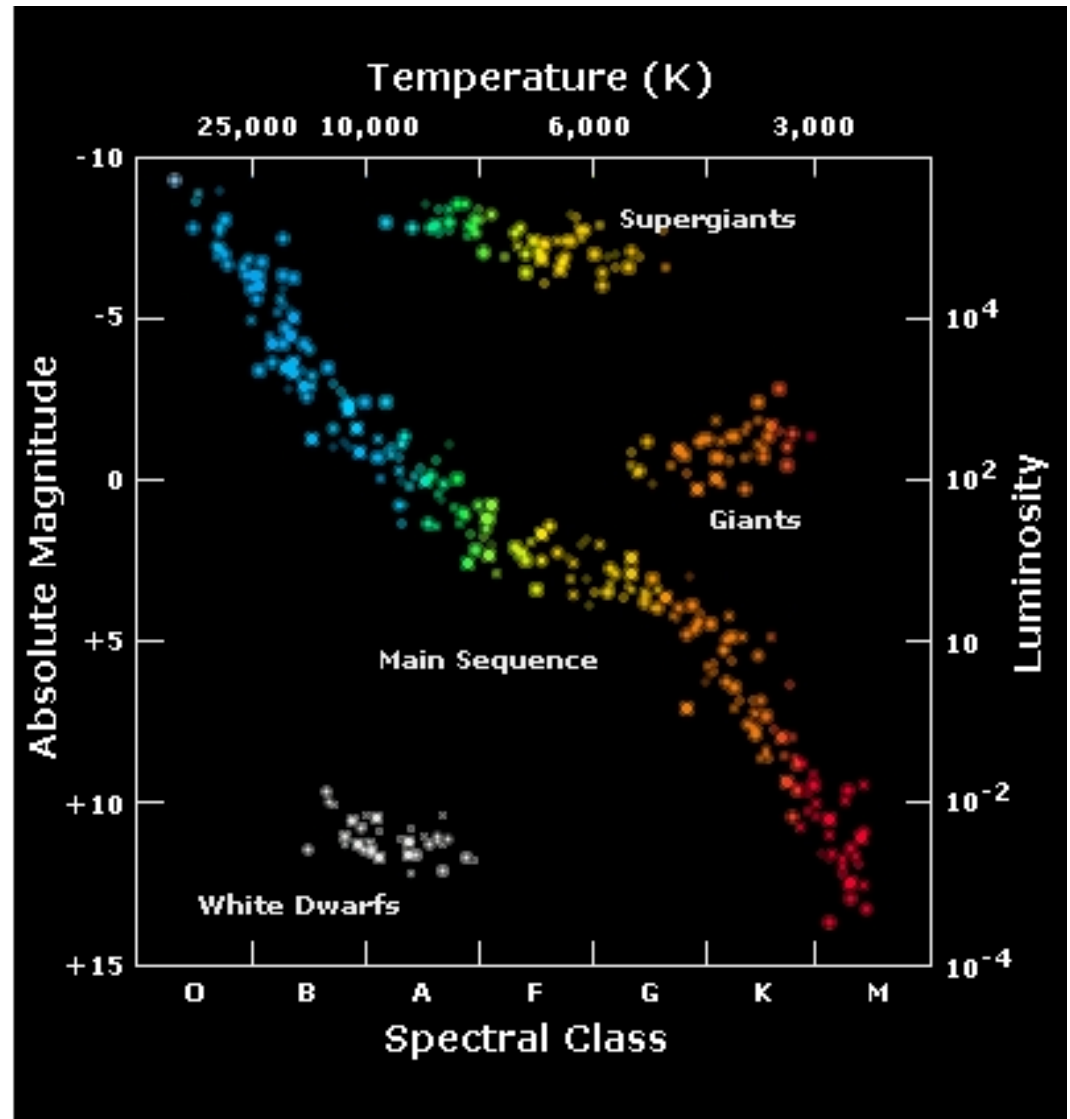
Fundamental Properties of O- and B-type Stars

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Our Goals

- Radius, temperature, mass, age
- Model dependent!
 - Color and spectra
 - Large errors in luminosity





Observationally determined properties

- Angular size + distance → Radius

» **Interferometry**

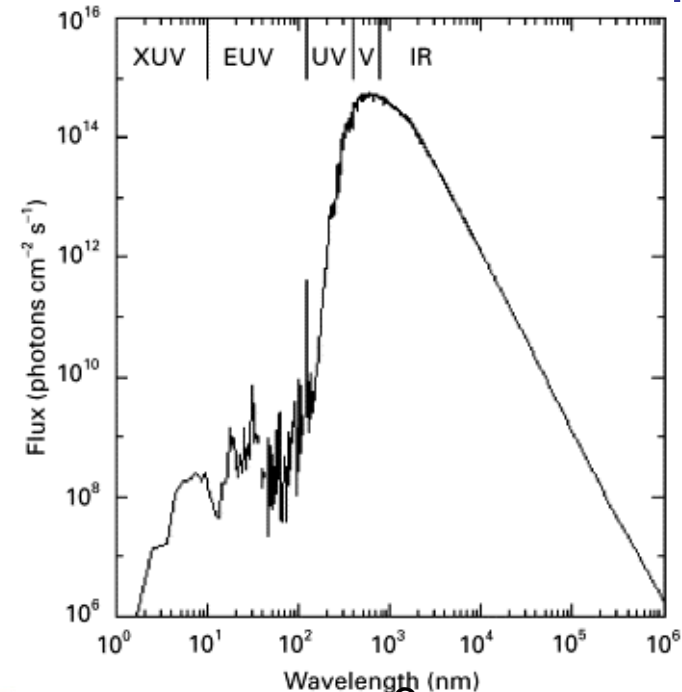


- Integrated flux + angular size → Effective Temperature

» **Spectrophotometry**

$$F_{obs} = \frac{1}{4} \alpha^2 F_{em}$$

$$F_{em} = \sigma T_{eff}^4$$





Data and results

Nights scheduled: 74
(from 2012-2016)

Nights with data: 28

Data on 35 stars

Diameters for 33 stars

(6 O stars – Menkhib, α Cam, λ Ori A, ζ Ori A, ζ Oph, 10 Lac)

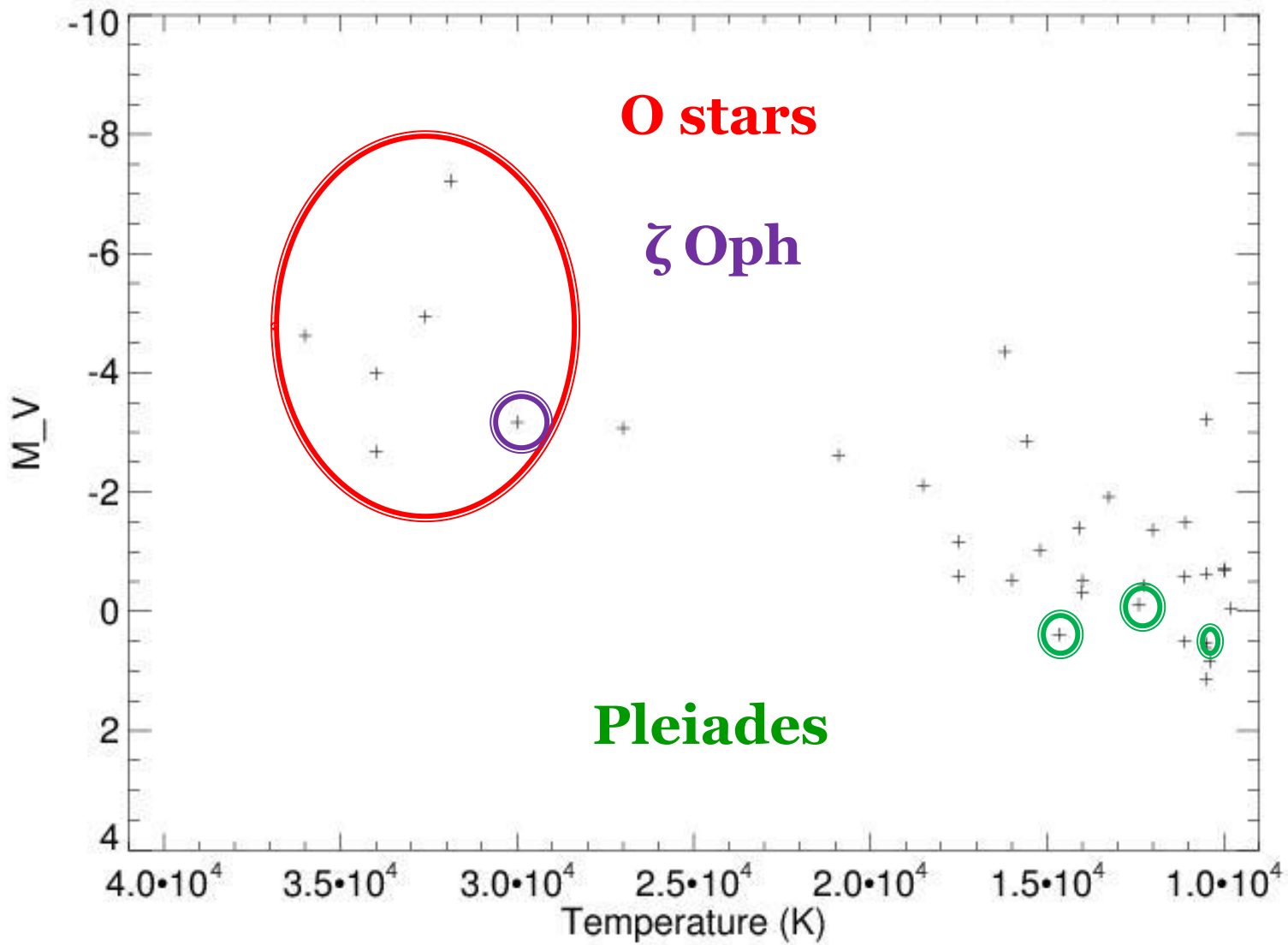




Sample Statistics

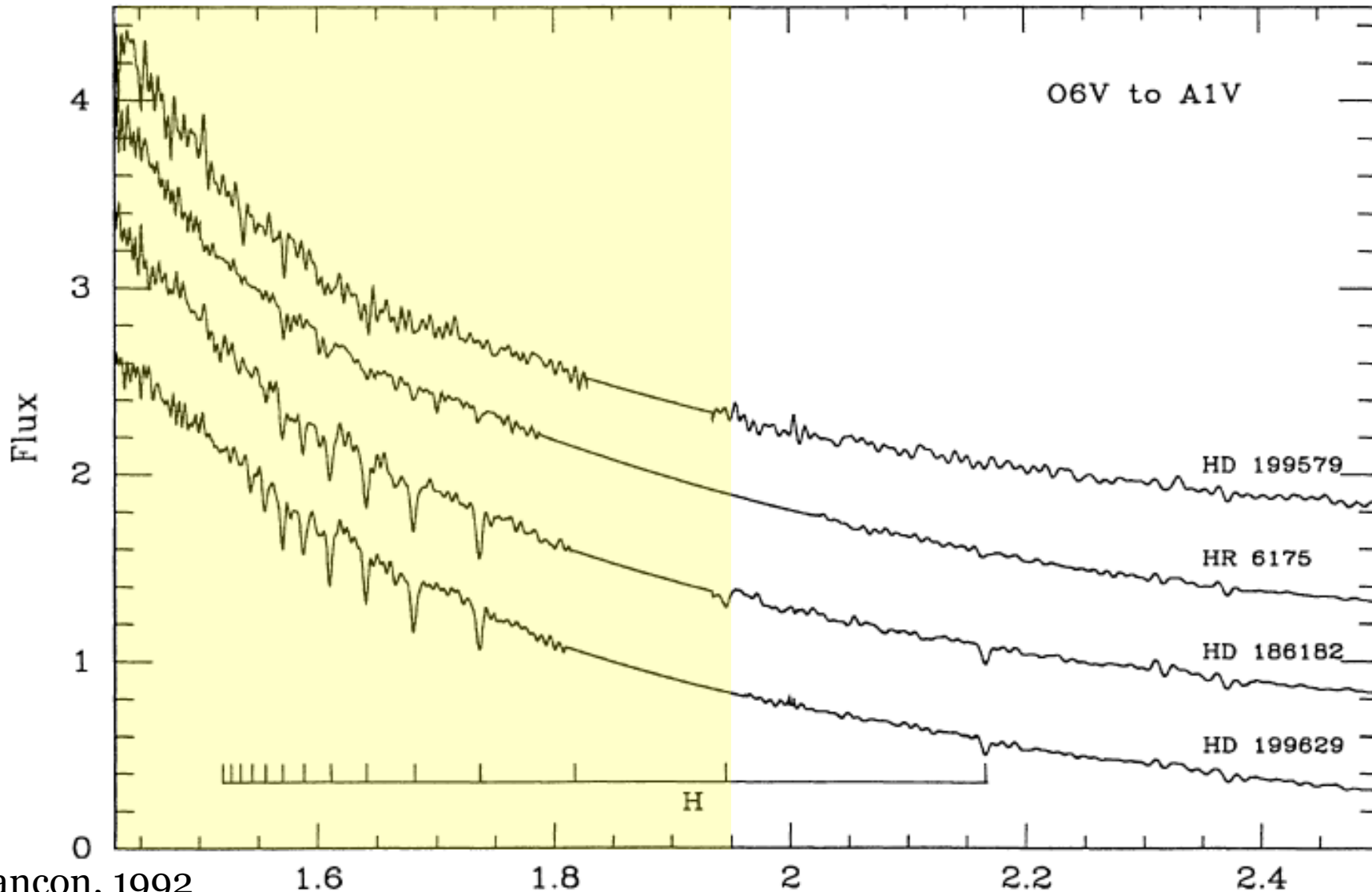
- 6 O stars, 29 B stars
- 0.2 to 1.11 milliarcseconds
- 29 to 2000 pc
 - 19 within 100 pc
- Luminosity classes:

V – 14 IV – 7 III – 11 II – 0 I – 3





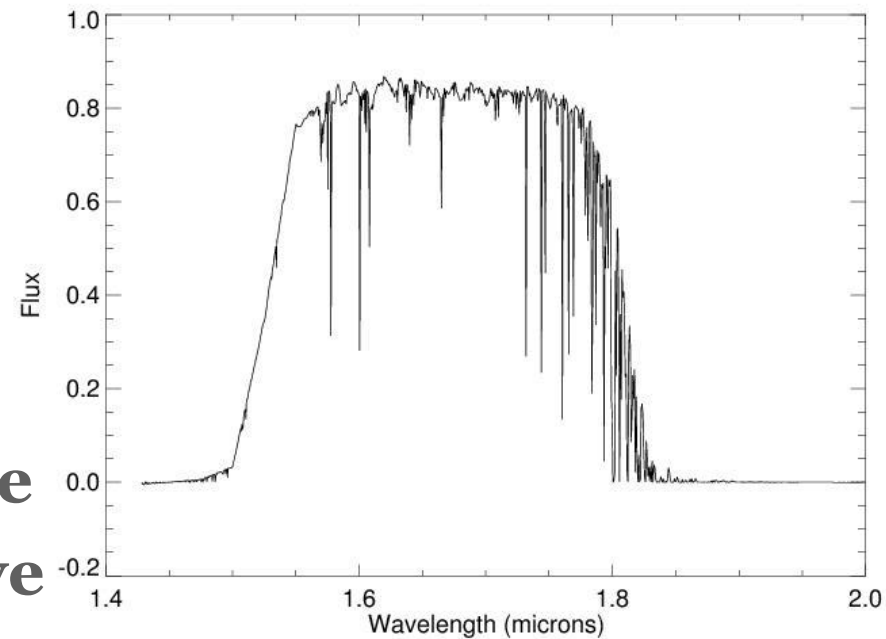
CLIMB H-Filter



Lancon, 1992

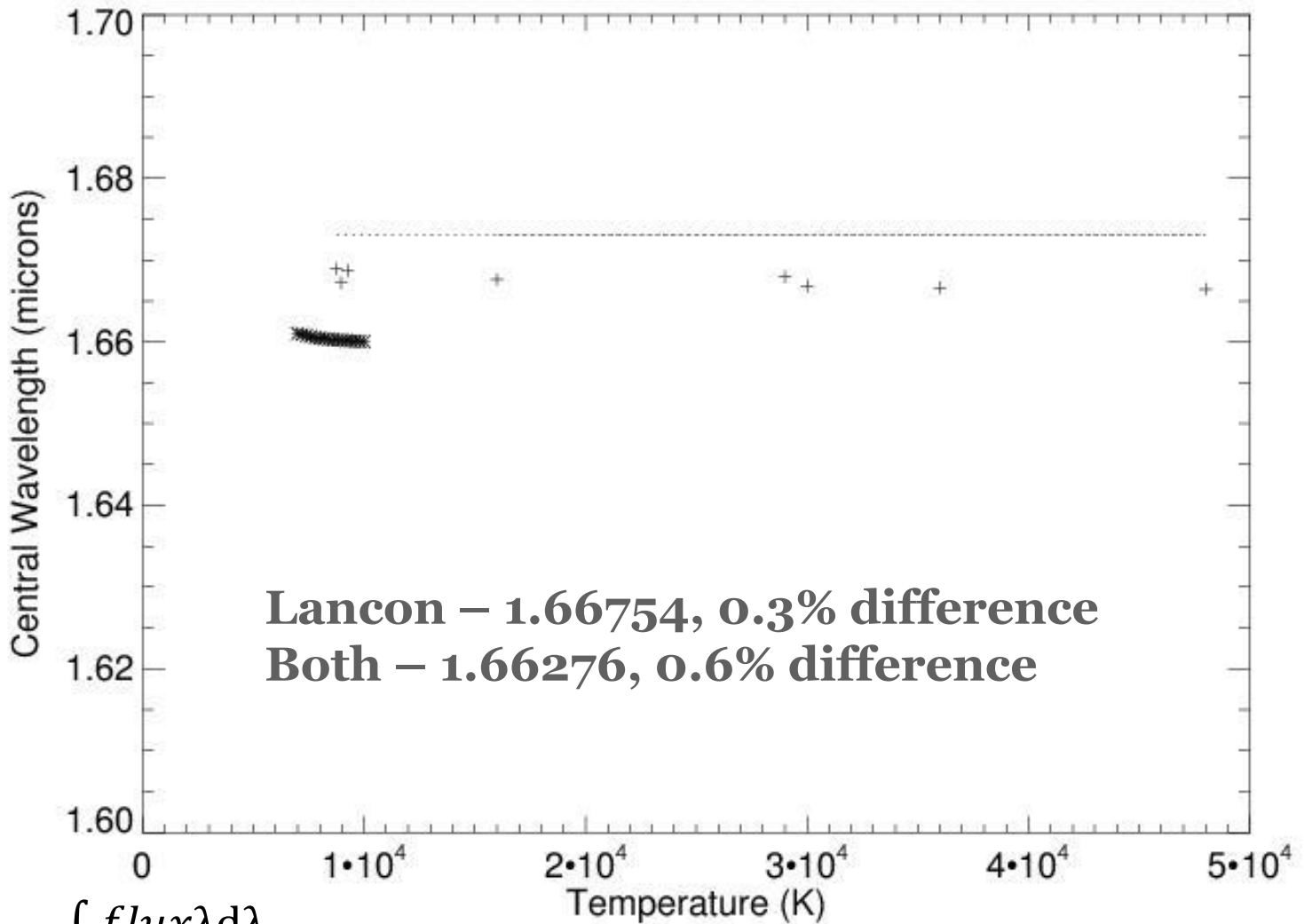


- **Spectral library from Lancon, 1992**
 - **O5V to A3V**
- **Synthetic spectra from NextGen models**
 - **7,000 to 10,000 K**
- **Multiply spectra by:**
 - **Filter transmission curve**
 - **Quantum efficiency curve**
 - **Atmospheric transmission**





Pipeline – 1.673 microns



$$centroid = \frac{\int flux \lambda d\lambda}{\int flux d\lambda}$$



Spectrophotometry

$$2.5 \log F_{obs} - 5 \log \frac{\theta}{2} + A_{\lambda} = 2.5 \log F_{model}$$

“known” model

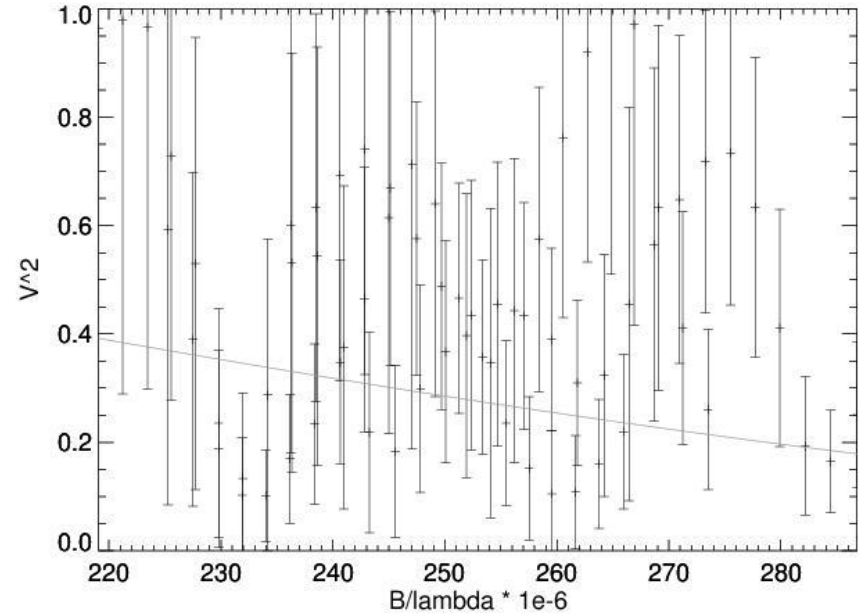
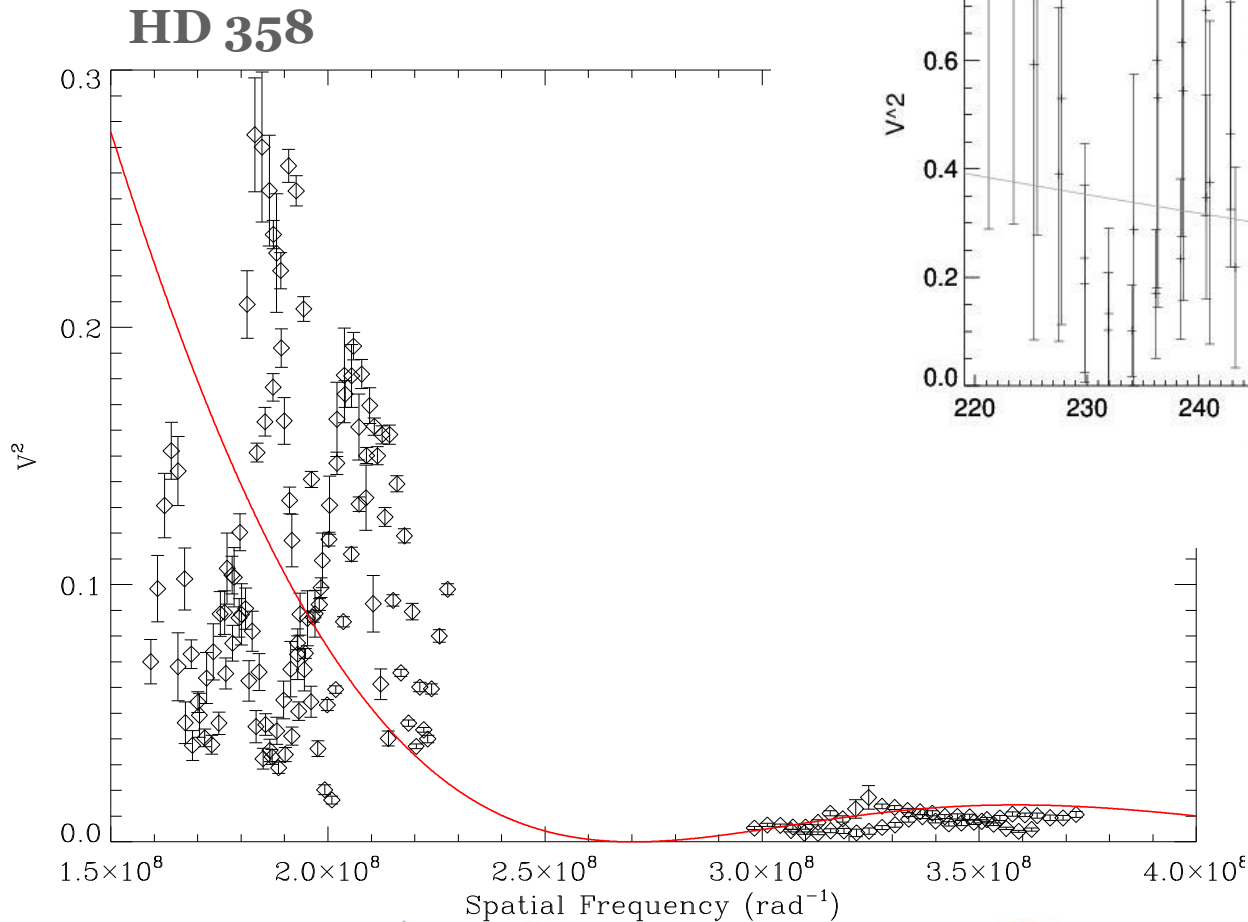
Evaluate over a grid of T_{eff} and form χ^2 between “known” and model as a function of T_{eff} (and $logg$)

Spectrophotometry

- **B stars – ATLAS9 models**
- **O and hottest B stars – TLUSTY models**
- **Short and long wavelength UV from IUE**
- **Optical from Burnashev et al., 1985**
- **IR points from 2MASS and WISE**



Binary stars



HD 3901



Close Companions

- 29% sample stars have known close companions
- Wide enough separation that fringe packets don't overlap
- Extra light from companions will lower overall visibility curve
- Fitted diameter will be smaller than true size
- Use companion's **separation, PA, delta mag and seeing** information to account for this effect



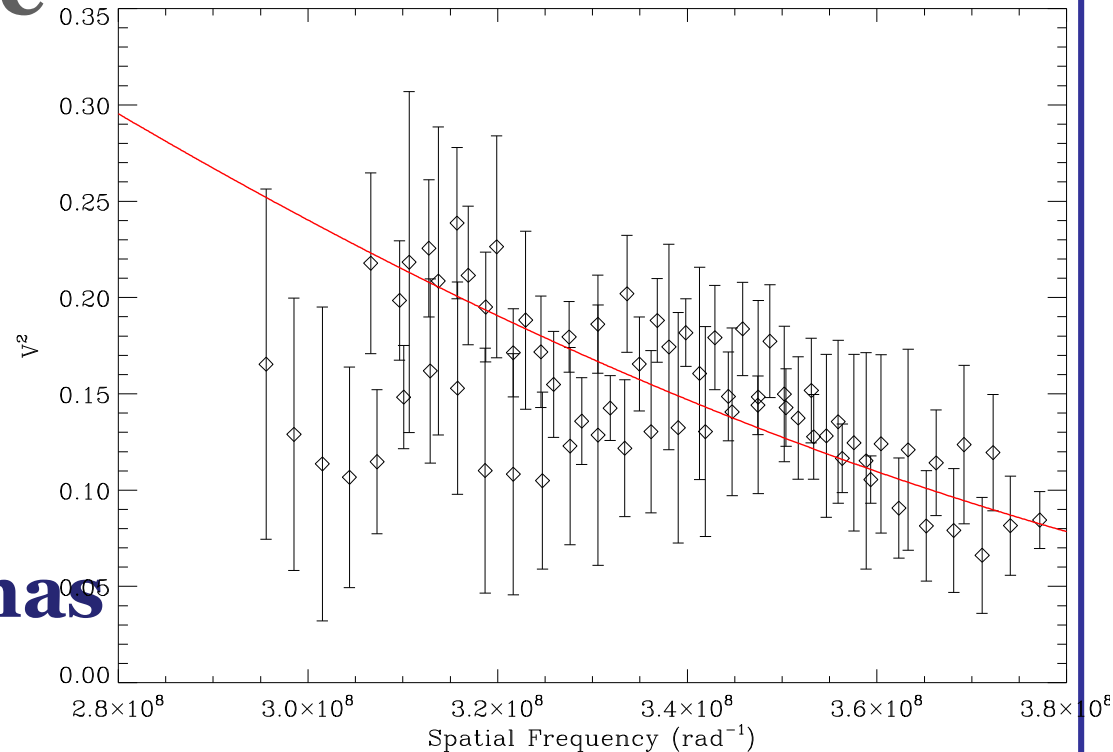
Pleiades Members

- 3 target stars in the Pleiades
- Maia (HD 23408) – 2 PAVO brackets
 - 0.44 ± 0.004 mas
- Electra (HD 23302) – 2 PAVO, 2 CLIMB brackets
 - 0.44 ± 0.008 mas
- Atlas (HD 23850) – 8 CLIMB brackets
 - 0.61 ± 0.02 mas



HD 149757

- Runaway O star
- Rapidly rotating at 320 km/s
- Nearby at 140 pc
- Often used as a calibrator
- Have data on one baseline
– 0.499 ± 0.009 mas





Future Work

- **Finish spectrophotometry code and fitting**
- **Make correction to sizes due to companions**
- **Fit binary stars**
- **O star paper**
- **B star paper**
- **Finish project and defend!**

A wide-angle landscape photograph of a valley at sunset. The sky is a gradient of blue, transitioning to orange and yellow near the horizon. A series of white dots forms a curved line across the sky, starting from the top left and ending near the horizon on the right. The foreground shows a valley with scattered trees and a winding path.

Questions?



Image Credits

- http://www.huffingtonpost.ca/2013/09/27/telescope-dynamic-structures_n_4006181.html
- <http://www.employmentcrossing.com/employers/article/900046349/Should-Your-Company-Have-a-Bad-Weather-Policy/>
- <https://apod.nasa.gov/apod/ap170302.html>

