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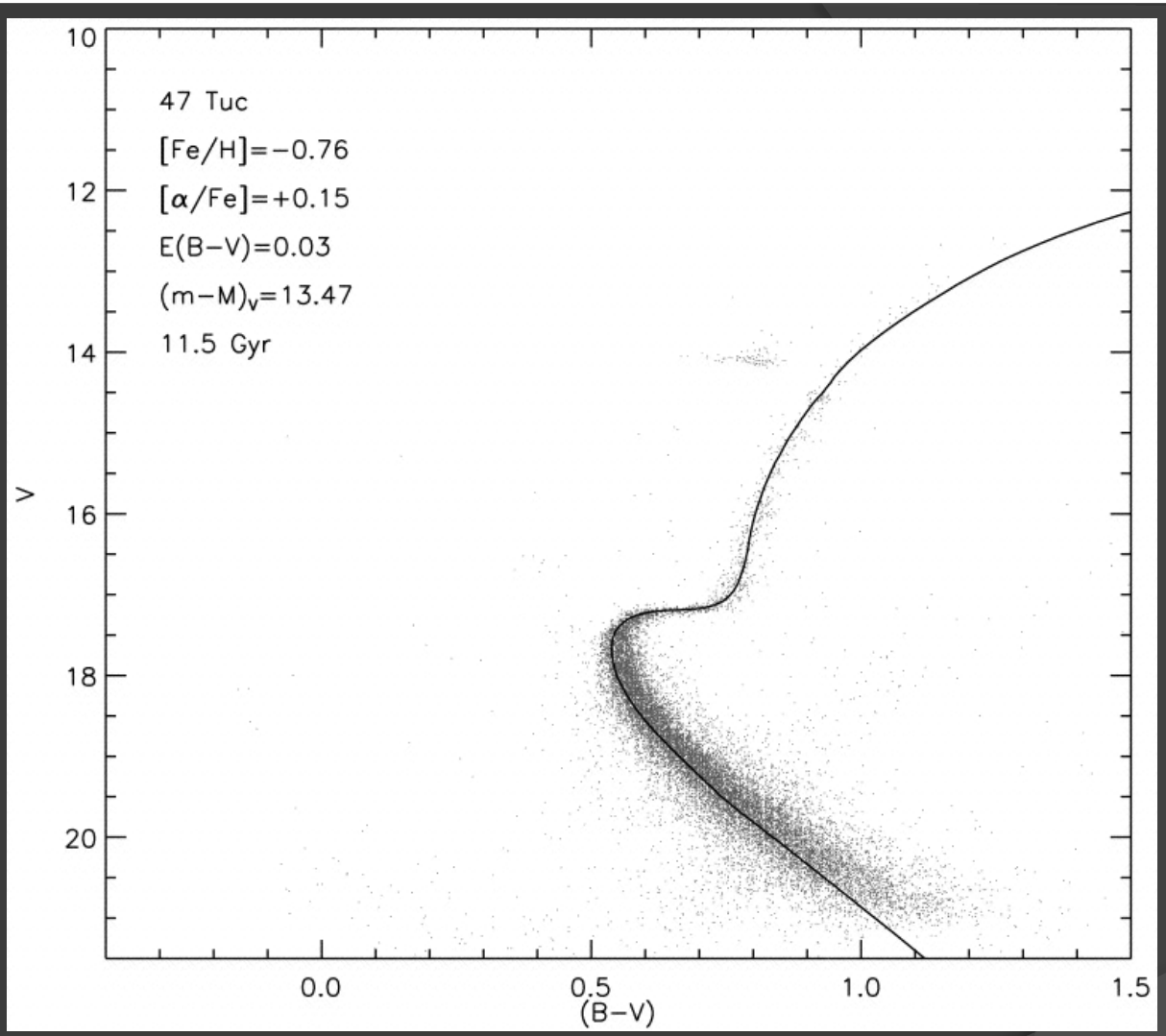
PHOTOMETRIC ANALYSIS OF BINARY STARS USING SPECKLE IMAGING

What have we seen so far?

- Speckle Imaging can provide:
  - Position angle
  - Separation
  - Magnitude difference
- Dynamical masses can be calculated for system with short-ish periods

Isochrones



- Yonsei-Yale (Y^2)
- Equal age points on an evolutionary track
- Older isochrones have redder turn-off points

Color Conversions

- Create calibration curves to convert colors
- Why do we need to convert colors?
  - System colors in Johnson Filter set
  - Magnitude differences in a Rochester Institute of Technology Filter set and a narrow band filter set

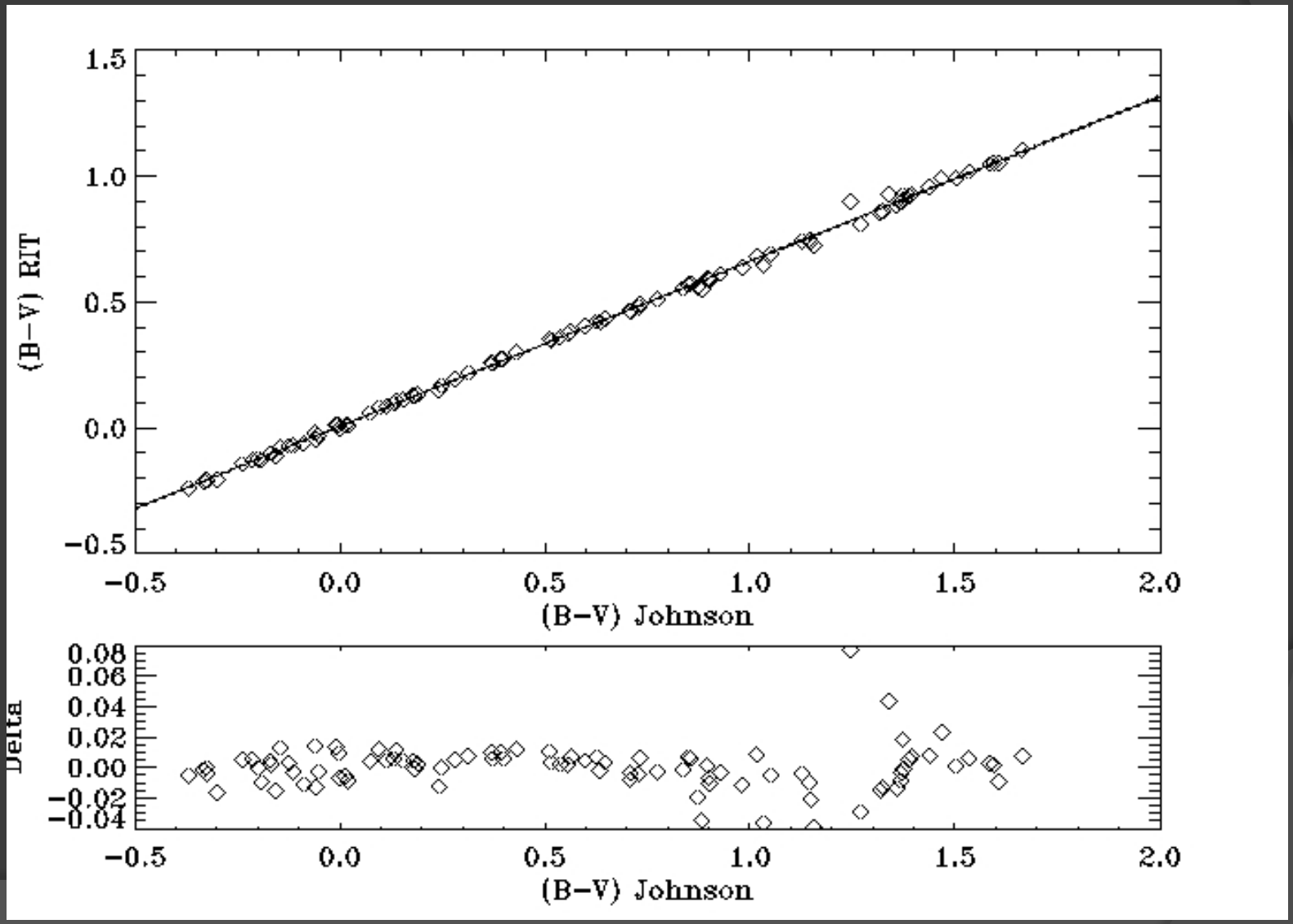
Calibration Curve Creation

- How do we create calibration curves?
  - Start with the Pickles Spectral Library
    - Contains 131 sample stellar spectra
  - Calculate magnitudes using filter transmission curves

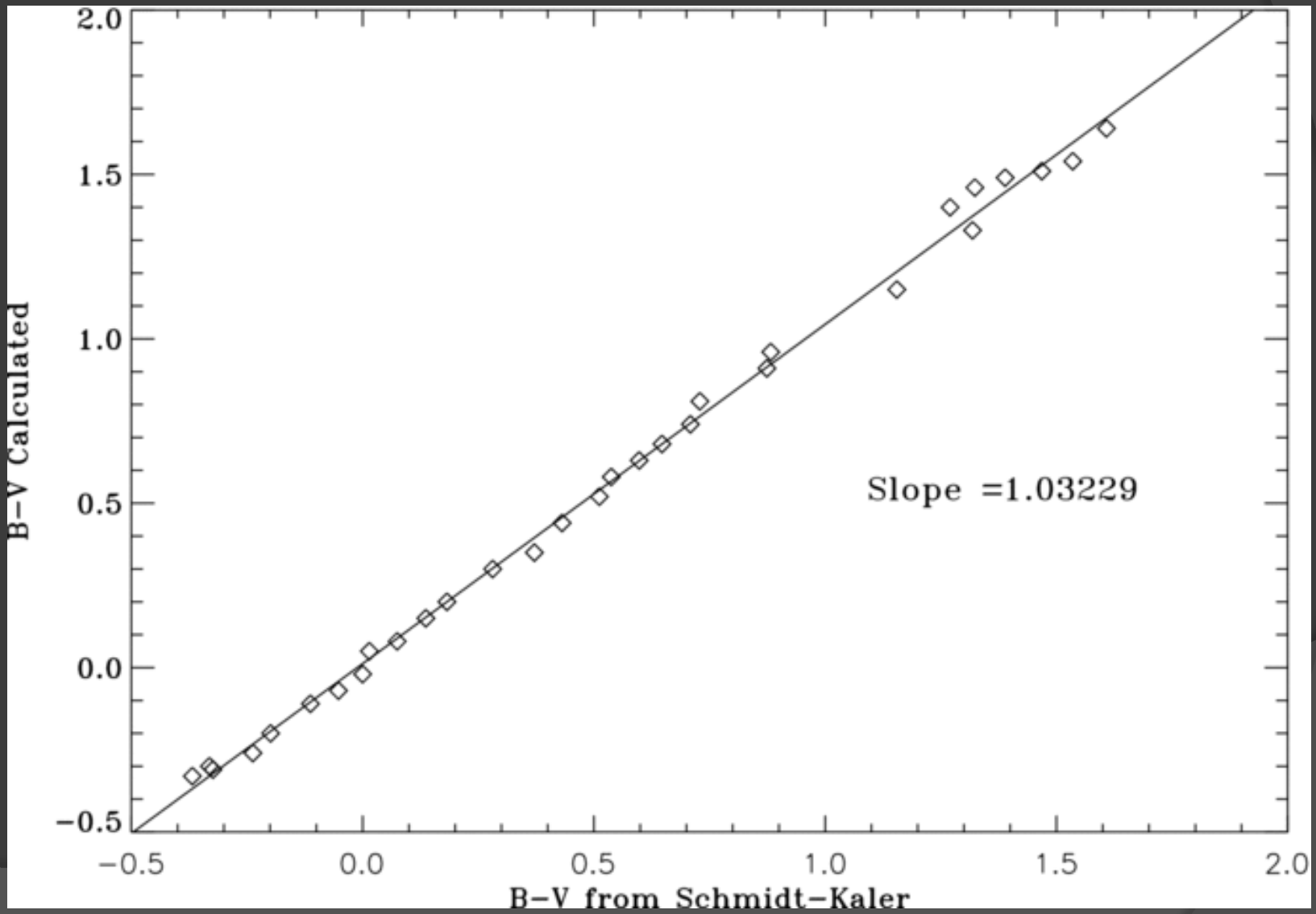
$$m_x = -2.5 \log (f_x) + \text{constant}$$

$$\text{where } f_x = \int_0^\infty S F_x A Q d\lambda$$

Calibration Curve Creation



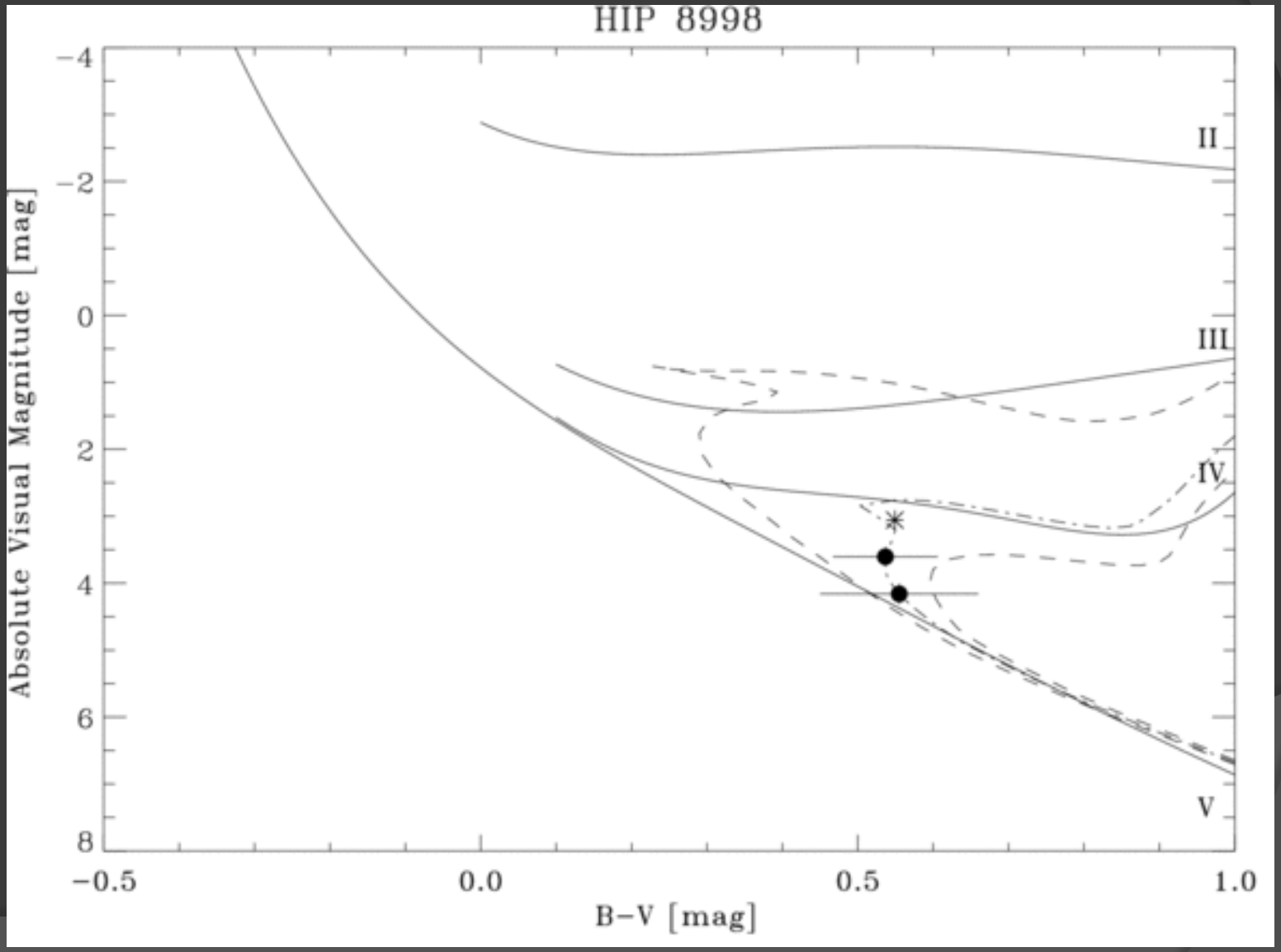
Testing Calibration



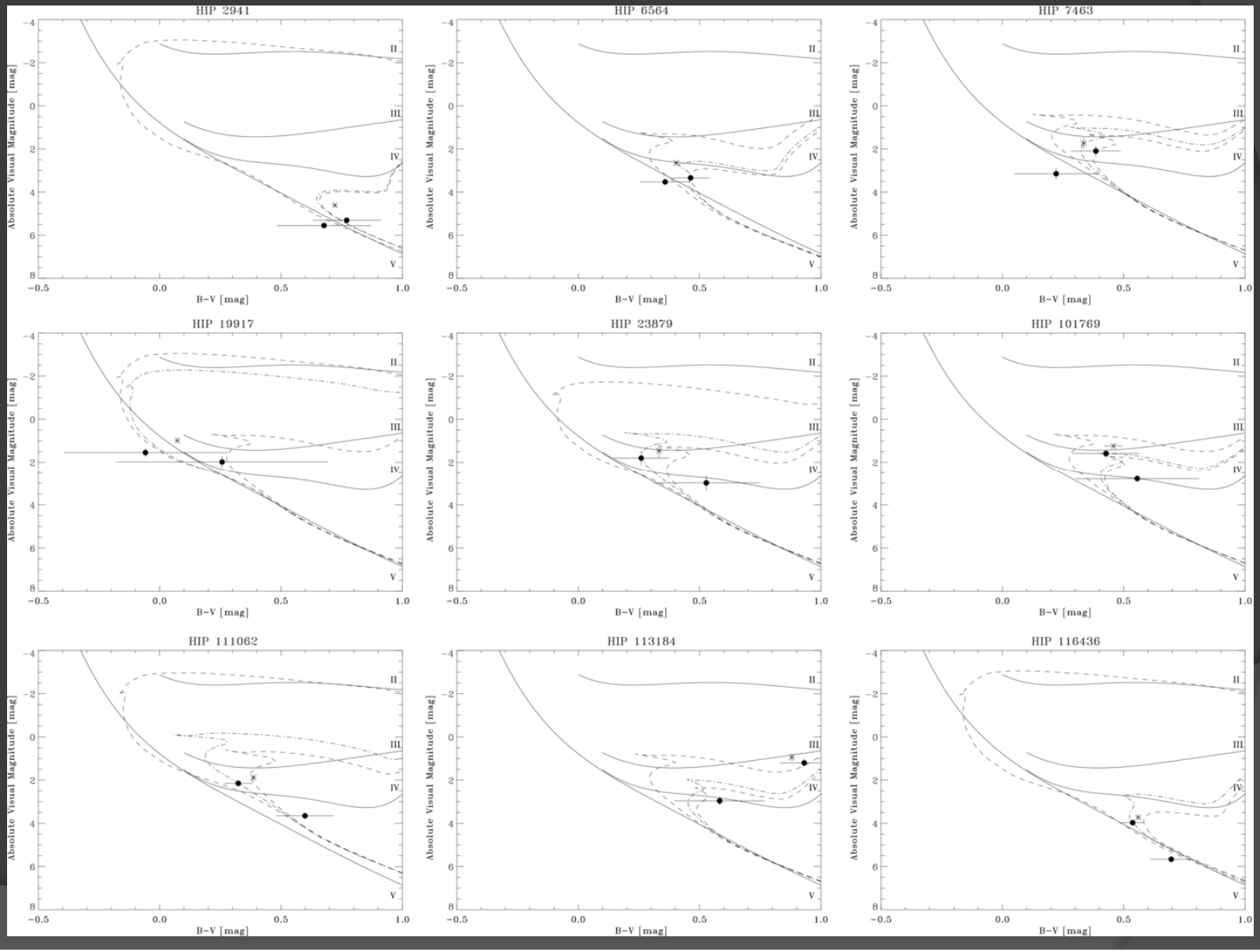
Determine Individual System Components

- Convert the system *V* and *B* − *V* values to instrumental values
- Combined with the speckle magnitude differences to obtain *component* magnitudes and colors in the speckle filters.
- Converted back to the Johnson system.

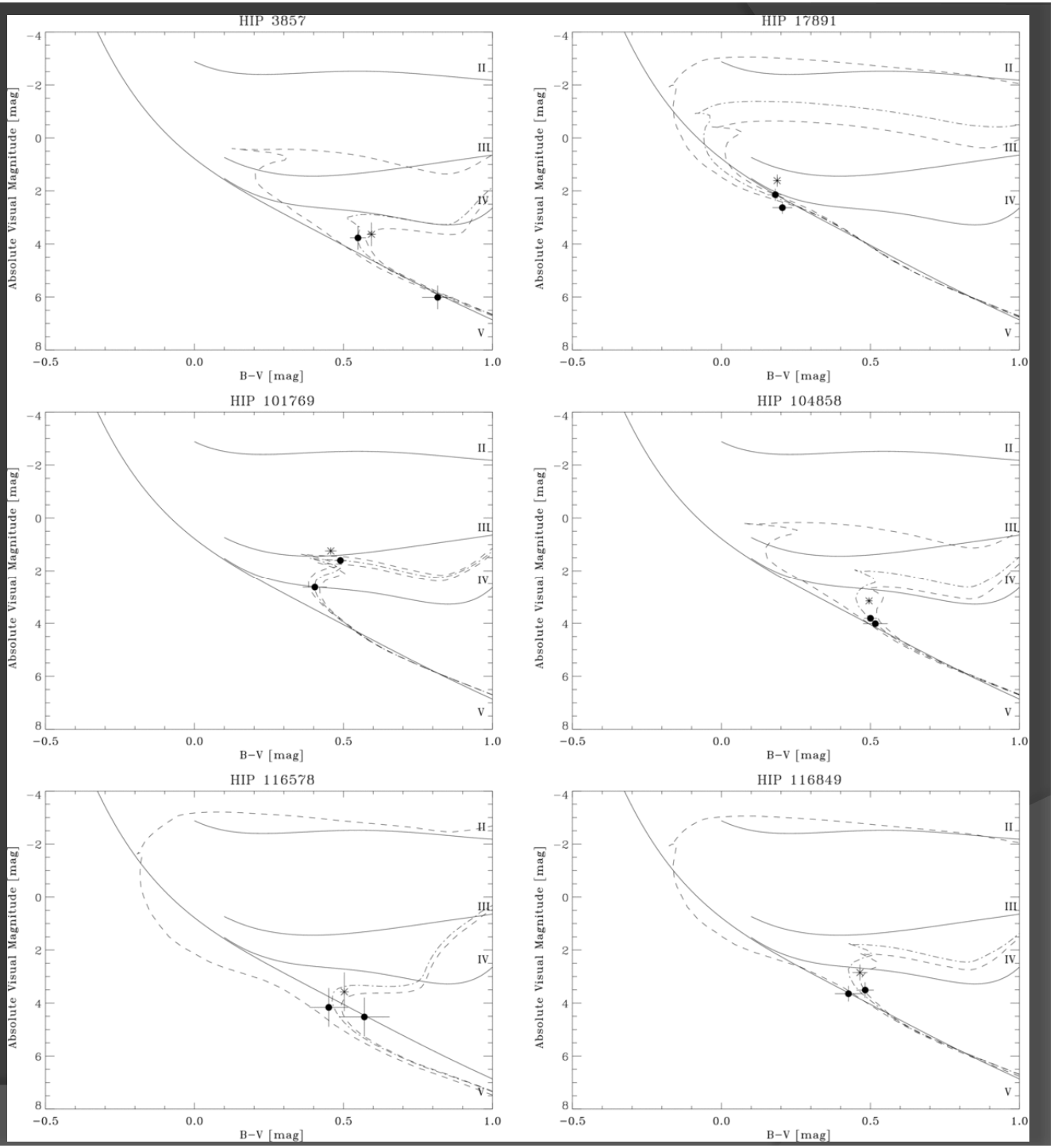
Fitting Isochrones



CTIO Results



WIYN Results



CTIO Results

Table 5
CTIO Mass Results Compared with Literature Values

HIP	Photometric Results		Dynamical Results		Orbit Reference
	Mass Fraction	Total Mass	Mass Fraction	Mass Sum	
2941	0.49 ± 0.01	1.76 ± 0.01	0.42 ± 0.02	1.77 ± 0.13	Pourbaix (2000)
6564	0.49 ± 0.01	2.44 ± 0.03	0.52 ± 0.03	2.73 ± 0.34[a]	Söderhjelm (1999)
7463	0.46 ± 0.01	3.15 ± 0.09	...	3.19 ± 0.72	Cvetković & Novaković (2006)
8998 (V,R)	0.48 ± 0.02	2.38 ± 0.05	[b]	2.05 ± 0.41[a]	Brendley & Mason (2007)
8998 (B,V)	0.48 ± 0.02	2.51 ± 0.05	"	"	"
14913 (V,R)	0.49 ± 0.002	2.61 ± 0.01	0.51 ± 0.05	2.84 ± 0.29[a]	Söderhjelm (1999)
14913 (B,V)	0.48 ± 0.02	2.72 ± 0.06	"	"	"
19917	0.47 ± 0.07	4.05 ± 0.34	...	5.14 ± 0.97[a]	Docobo & Ling (2006)
23879	0.45 ± 0.07	3.28 ± 0.28	...	5.45 ± 1.28[a]	Scardia et al. (2008)
32677 (V,R)	0.41 ± 0.07	6.15 ± 0.54	...	...	...
32677 (B,V)	0.39 ± 0.06	6.46 ± 0.57	"	"	"
101769	0.46 ± 0.01	3.22 ± 0.04	0.45 ± 0.02	3.25 ± 0.26[a]	Alzner (1998)
111062	0.43 ± 0.01	3.18 ± 0.06	...	3.52 ± 0.69[a]	Söderhjelm (1999)
113184	0.47 ± 0.02	3.04 ± 0.05	...	8.67 ± 2.22[a]	Brendley & Mason (2007)
116436	0.44 ± 0.01	2.08 ± 0.02	...	1.67 ± 0.21[a]	Heintz (1984)

Notes.
[a] The actual uncertainty is greater than that listed due to the fact that the orbital elements were published without uncertainties. The value given is solely due to parallax.
[b] A value is reported in Meyer (2002); however, it is aphysical, and has not been included.

WIYN Results

Table 6
WIYN Mass Results Compared with Literature Values

HIP	Photometric Results		Dynamical Results		Orbit Reference
	Mass Fraction	Total Mass	Mass Fraction	Mass Sum	
3857	0.42 ± 0.03	2.08 ± 0.10	...	...	...
17891	0.49 ± 0.06	3.43 ± 0.25	...	3.65 ± 0.50^{a}	Zirm & Horch (2002)
101769	0.46 ± 0.01	3.28 ± 0.04	0.45 ± 0.02	3.25 ± 0.26^{a}	Alzner (1998)
104858	0.49 ± 0.01	2.40 ± 0.02	0.484 ± 0.004	2.42 ± 0.11	Muterspaugh et al. (2008)
116578	0.48 ± 0.03	1.78 ± 0.08	...	...	...
116849	0.50 ± 0.02	2.56 ± 0.05	...	2.50 ± 0.44	Hartkopf et al. (1996)

Note. [a] The actual uncertainty is greater than that listed due to the fact that the orbital elements were published without uncertainties. The value given is solely due to parallax.