ECLIPSING BINARIES IN OPEN CLUSTERS

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Double Cluster in Perseus (NGC884/869) - 100mm f/5 Genesis APO Refractor piggybacked to a Meade 10" SCT -- 30min @ f/5 on hypered Fuji SHG-400 -- Hires Cropped by Andy Steere

Eclipsing binaries

- Spectroscopy gives masses and temperatures
- Photometry gives radii and relative brightnesses
- Get radii and masses to 1--2%

Open clusters

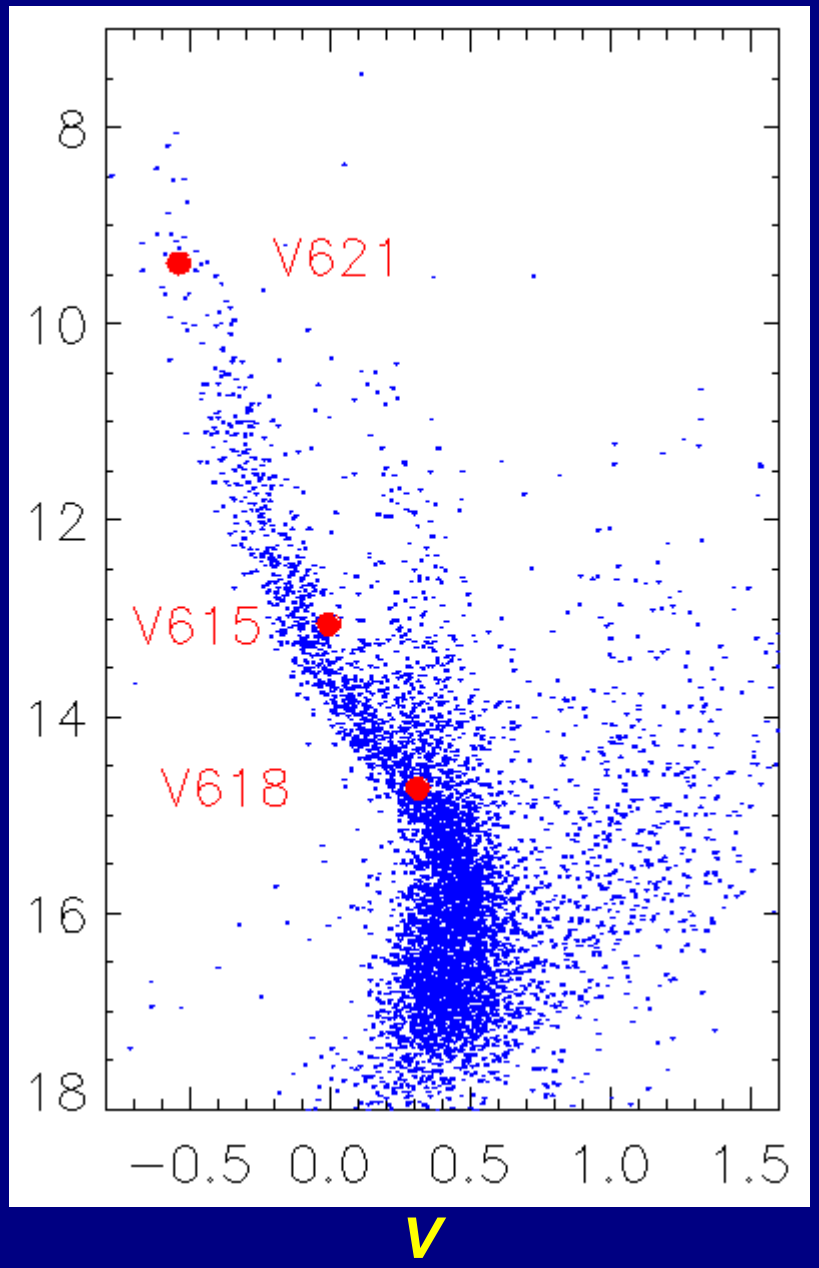
- Photometry gives age, reddening and metallicity
- Spectroscopy gives spectral types and membership

Eclipsing binaries in open clusters

- Masses, radii and temperatures of two stars
- Age and metallicity from cluster membership
- Test stellar models and find cluster distance

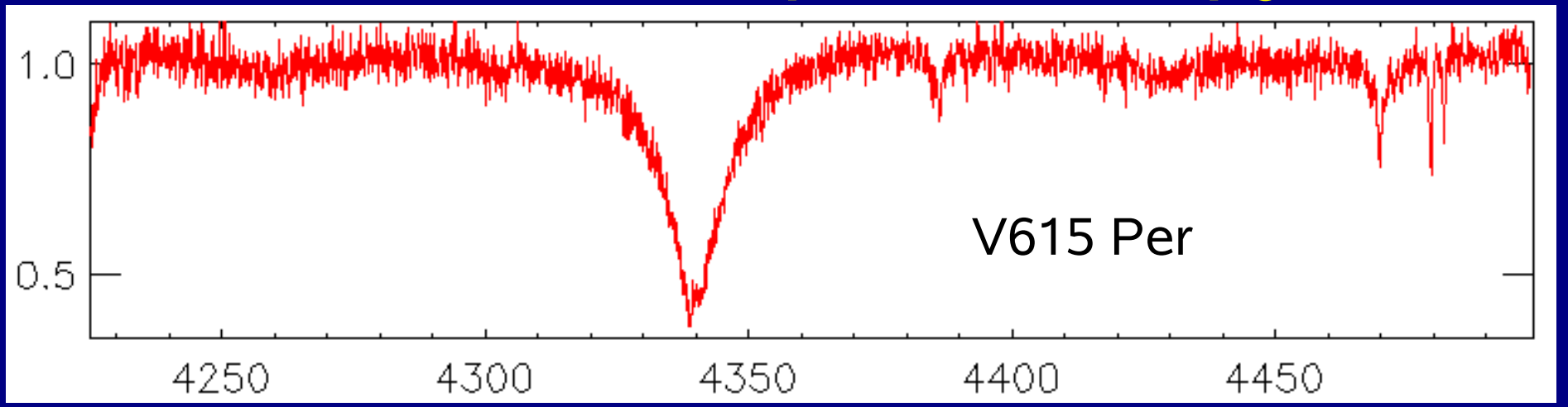
V615 Per and V618 Per in NGC 869

- Discovered by Krzesínski et al. (1999)
  - V615 Per: V = 13.0 B7V period = 13.7d
  - V618 Per: V = 14.6 A2 V period = 6.4d
- NGC 869 (h Per):
  - age = 12.5 ± 0.5 Myr
  - dm = 11.70 ± 0.5 mag.
  - metallicity: unknown

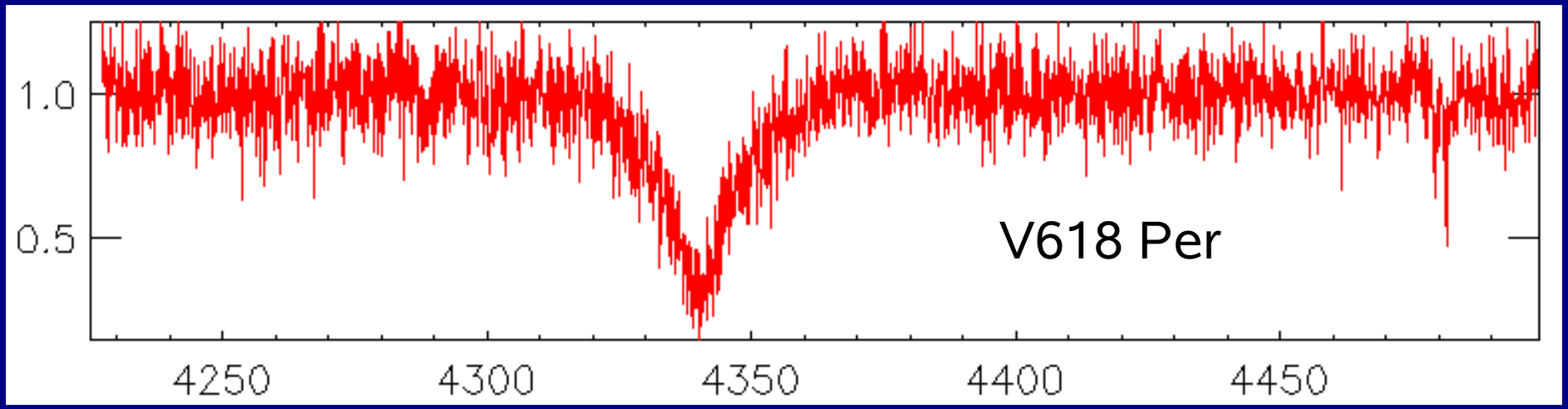


CMD from Keller et al. (2001)

Blue-band spectroscopy

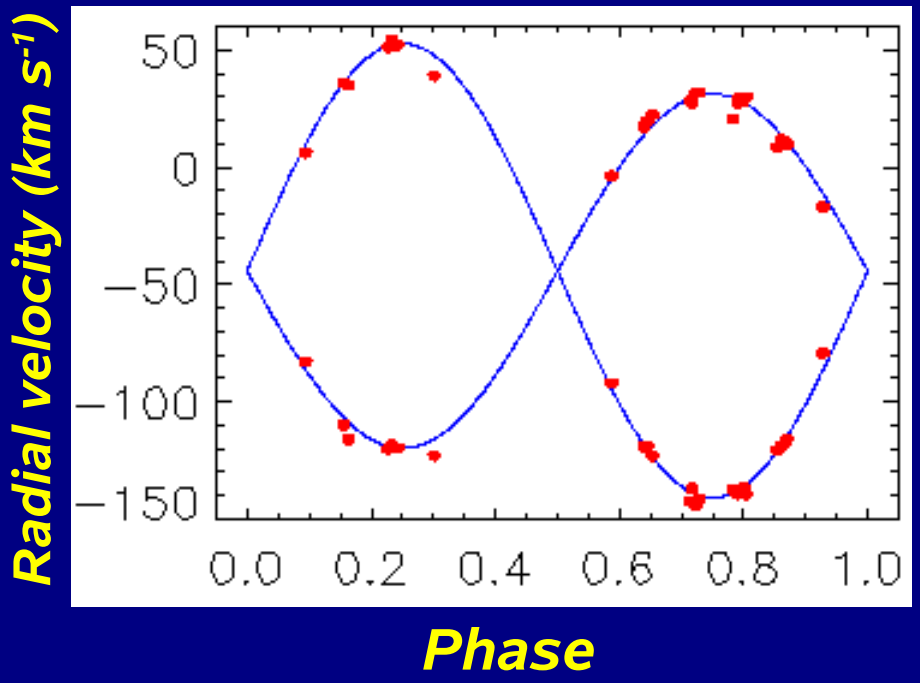


- 14 nights INT / IDS with resolution 0.2 Å
- 4240 to 4500 Å window contains Mg II 4481 Å , Hγ

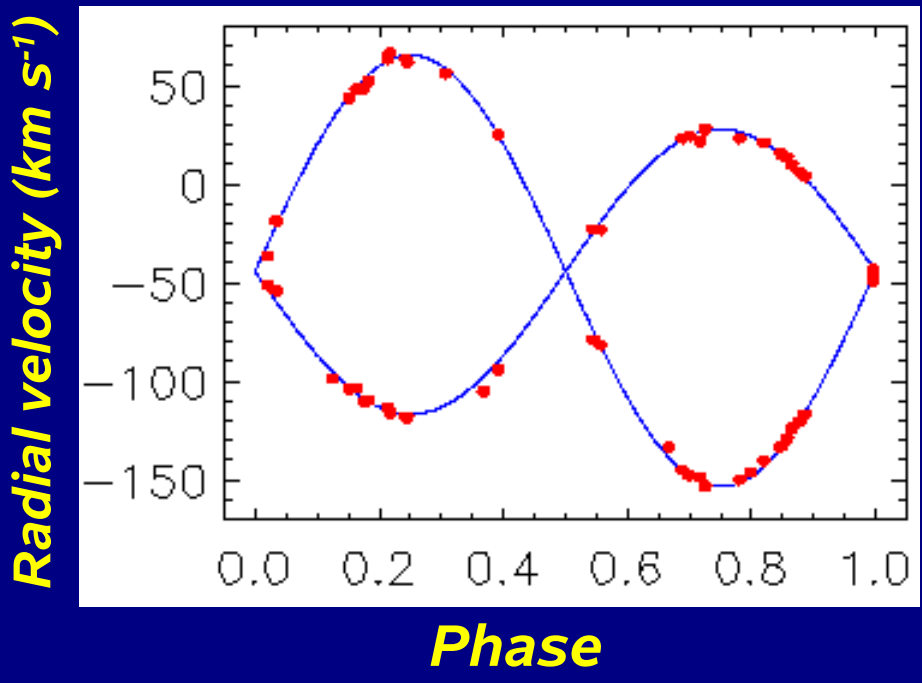


Spectroscopic orbits

V615 Per



V618 Per



- TODCOR cross-correlation algorithm for RVs
  - synthetic spectra
- SBOP used to derive spectroscopic orbit
  - circular orbits
  - systemic velocities confirm membership of NGC 869

Spectral synthesis

V615 Per:

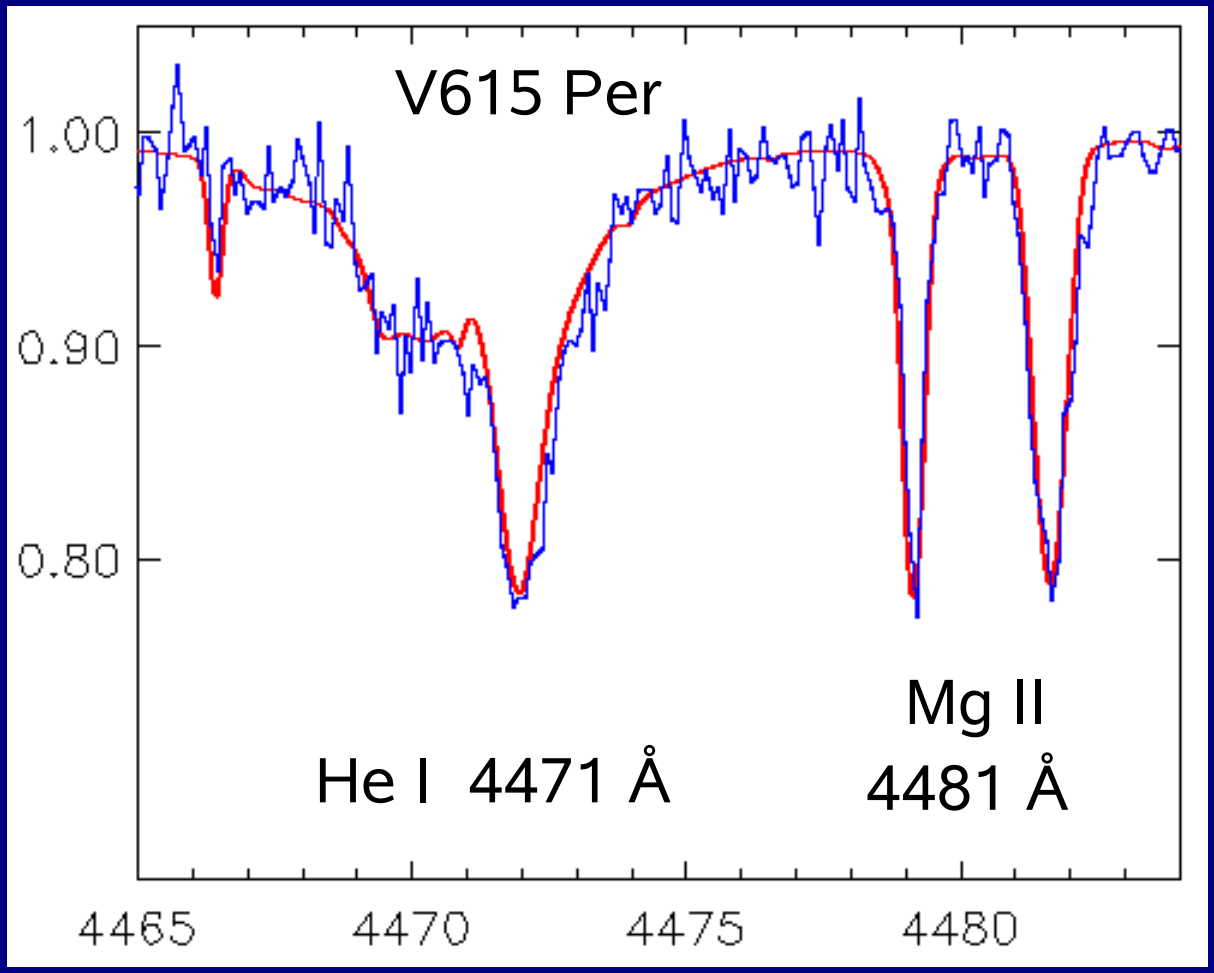
- 15000 ± 500 K
- 11000 ± 500 K

V618 Per:

- 11000 ± 1000 K
- 8000 ± 1000 K

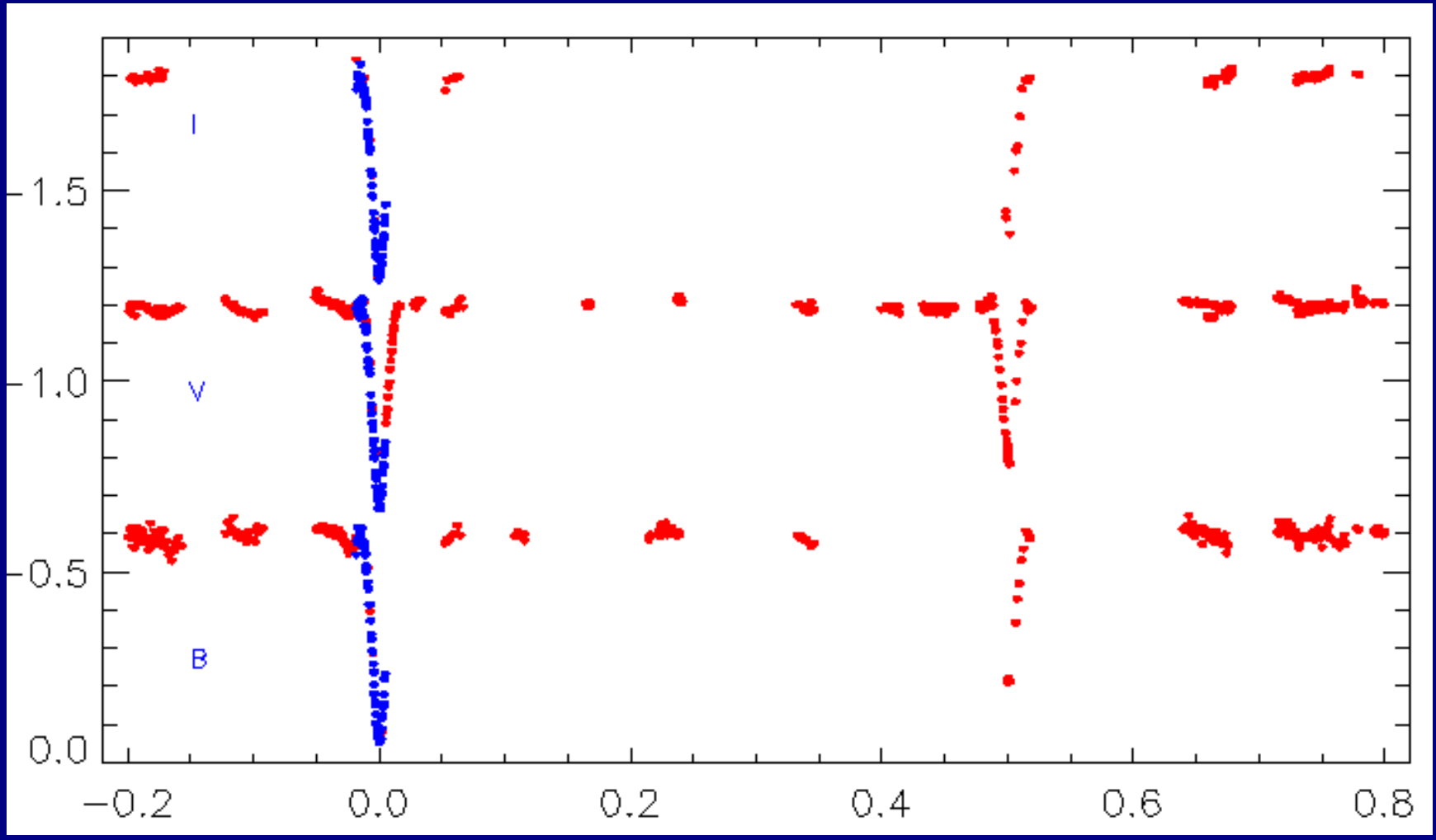
All four stars are slow rotators (10 to 28 km s^{-1})

- supports binary formation by delayed breakup (Tohline 2002)



Blue: average of four V615 Per spectra
Red: best fit

V615 Per light curves



- Discovery light curves from Krzesinski et al. (red)
- JKT service data of primary eclipse (blue)

V615 Per light curve solution

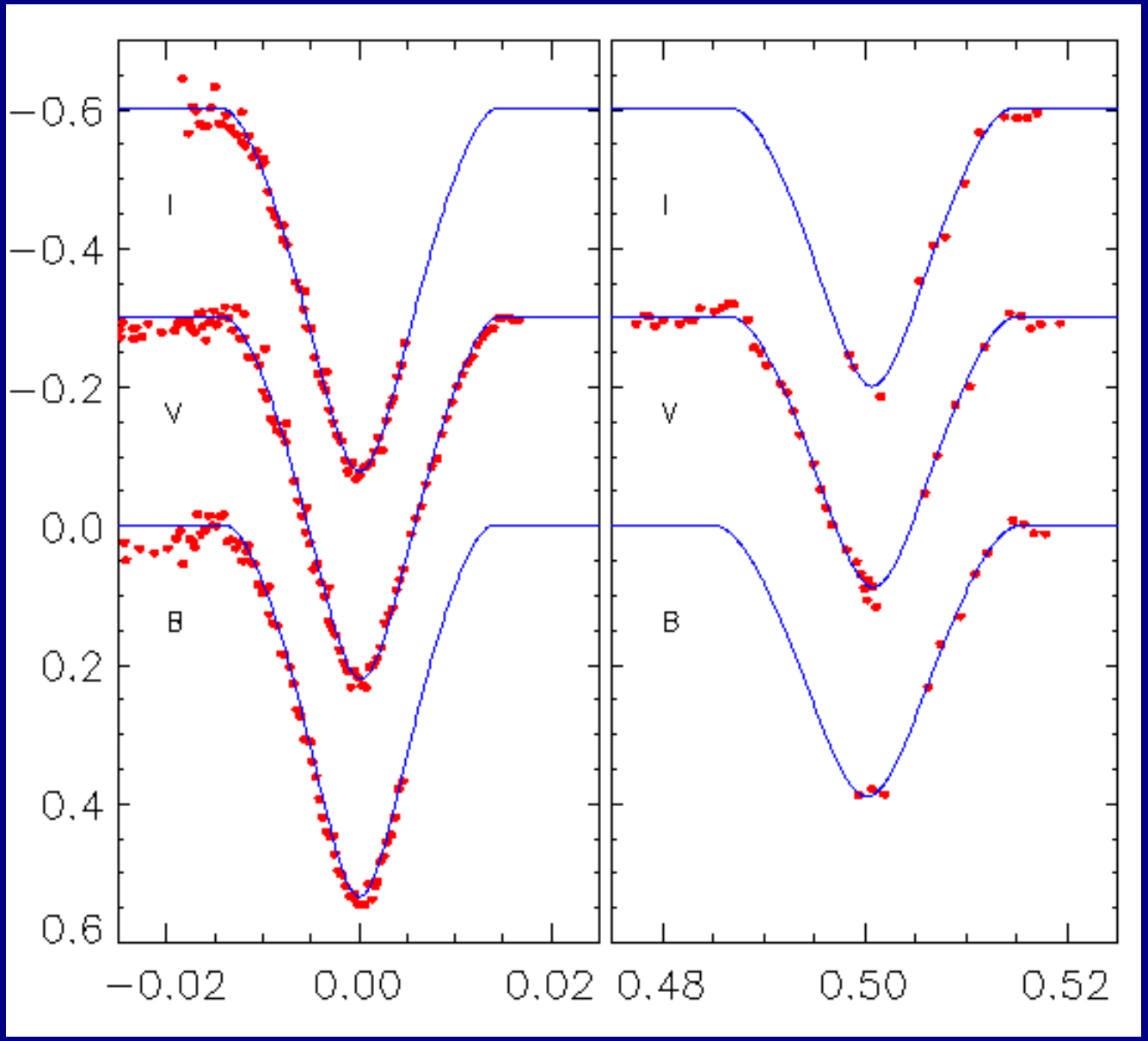
EBOP fit

e = 0.01± 0.01

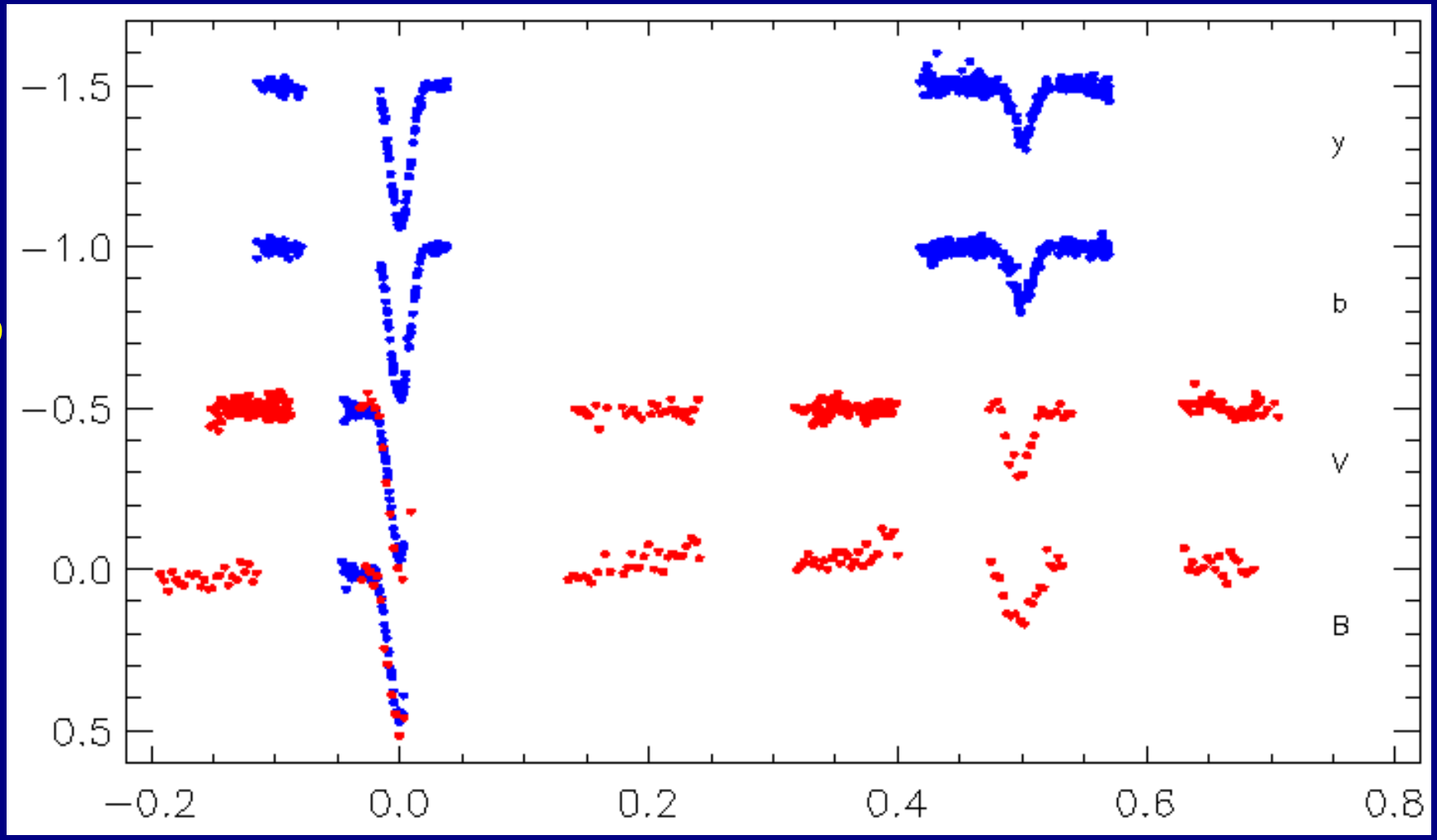
i = 88.8 ± 0.2

r_1 = 0.0491 ± 0.0030

r_2 = 0.0408 ± 0.0020



V618 Per light curves



- Discovery light curves from Krzesinski et al. (red)
- JKT data (blue) from service and observing run

V618 Per light curve solution

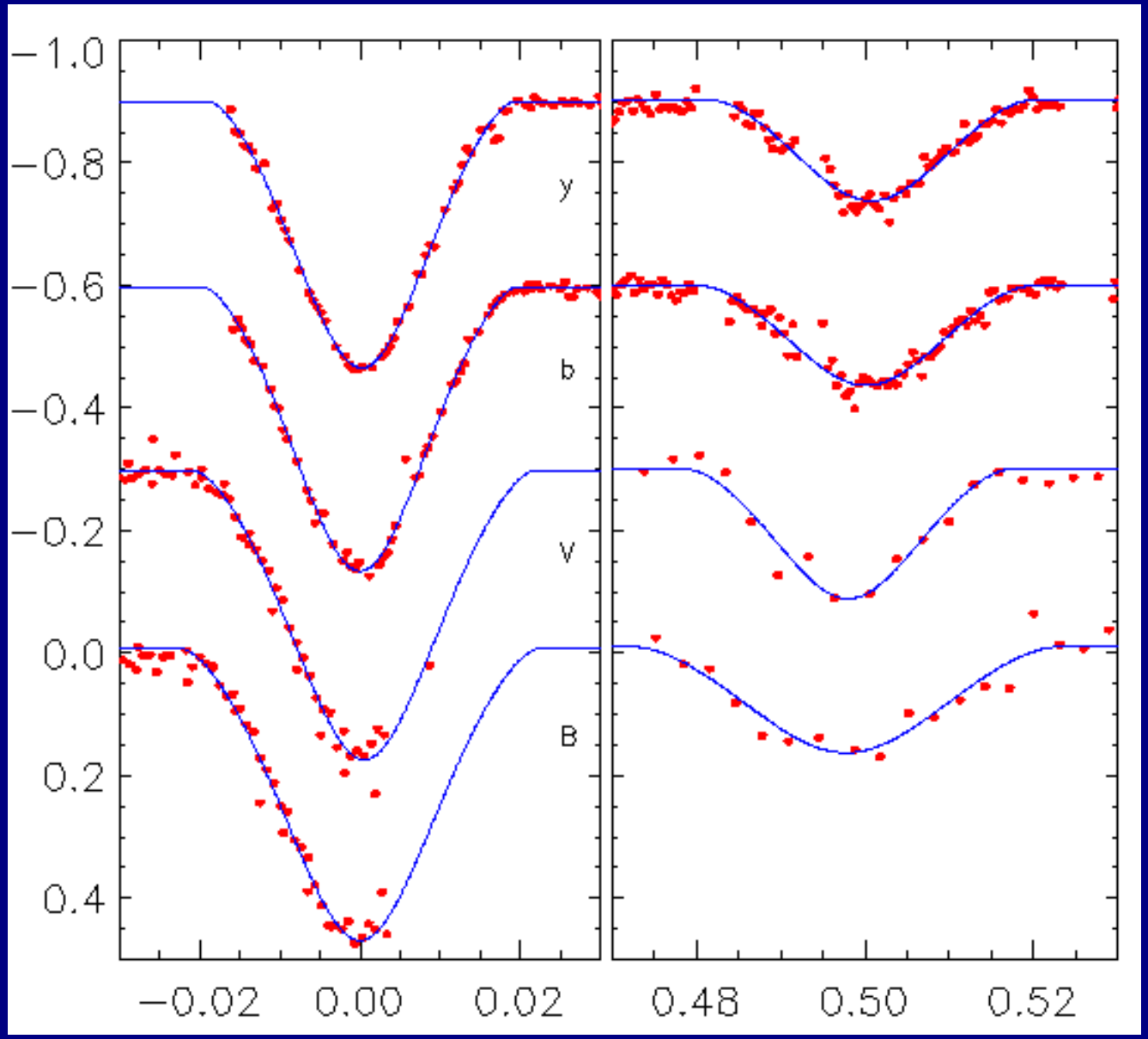
EBOP fit

e = 0.01± 0.01

i = 87.1 ± 0.5

r_1 = 0.072 ± 0.003

r_2 = 0.058 ± 0.003

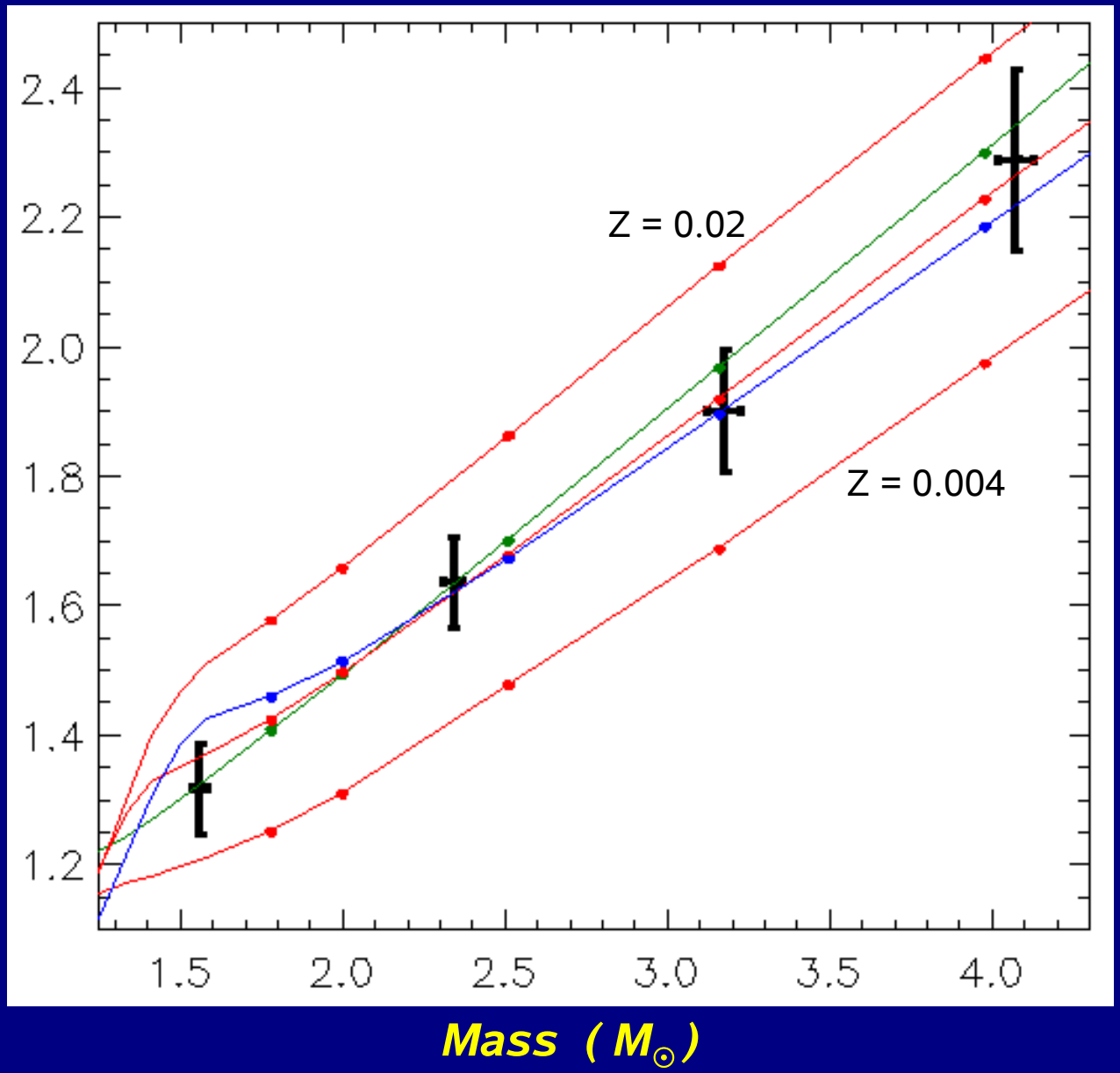


Models v. observations

Claret stellar models

- age 13 Myr
- Z = 0.01 also plotted with three helium abundances: low (green) high (red)

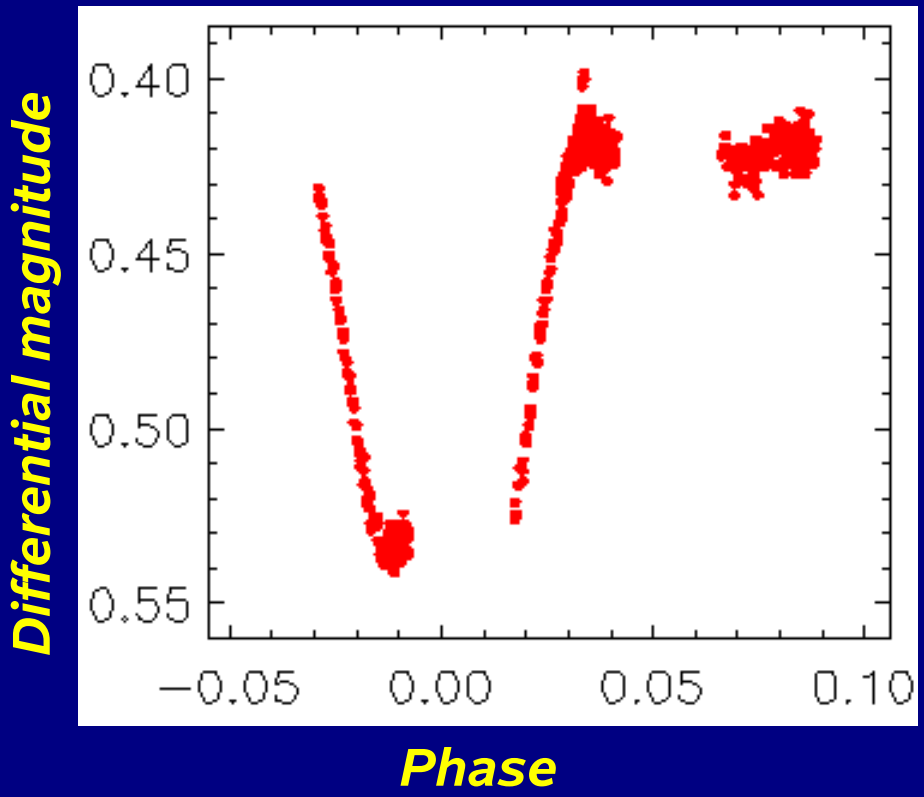
NGC 869 metallicity:
Z ≈ 0.01

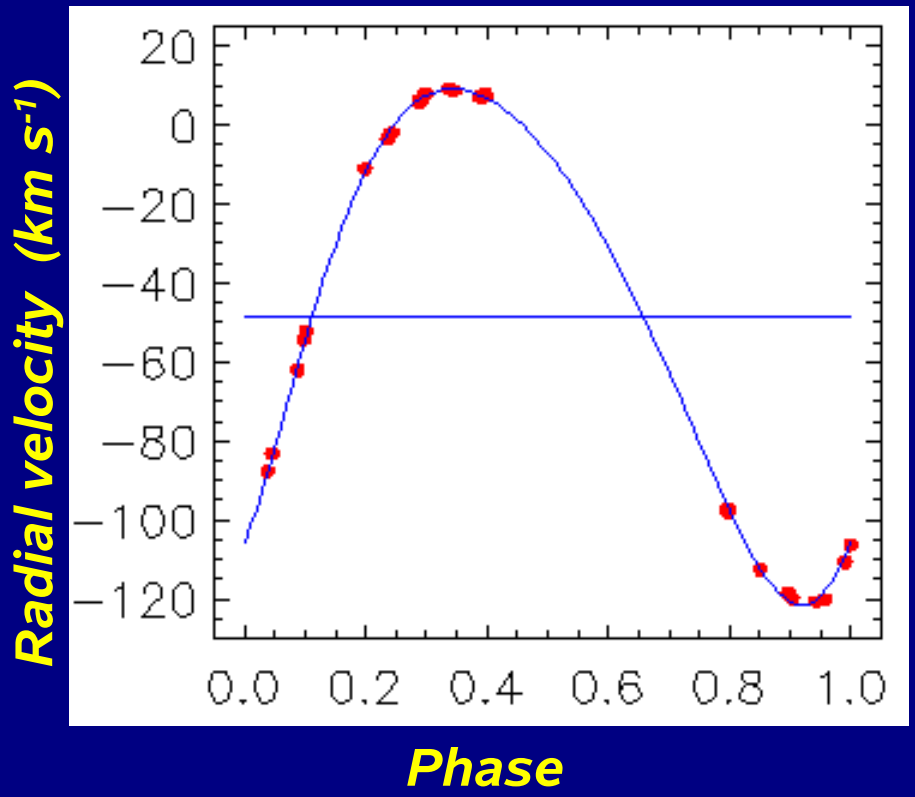


V621 Per in χ Per (NGC 884)

- Discovered by Krzesínski & Pigulski (1997)
- Two eclipses observed
  - 0.1 mag deep and total
  - 102.1 days apart

- 27 spectra show single lines
  - period ≈ 20.42 days
  - K = 65.38 ± 0.25
  - e = 0.174 ± 0.005
  - V = -47.73 ± 0.24





References

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