Images of Chi Cygni
a pulsation observed by interferometry

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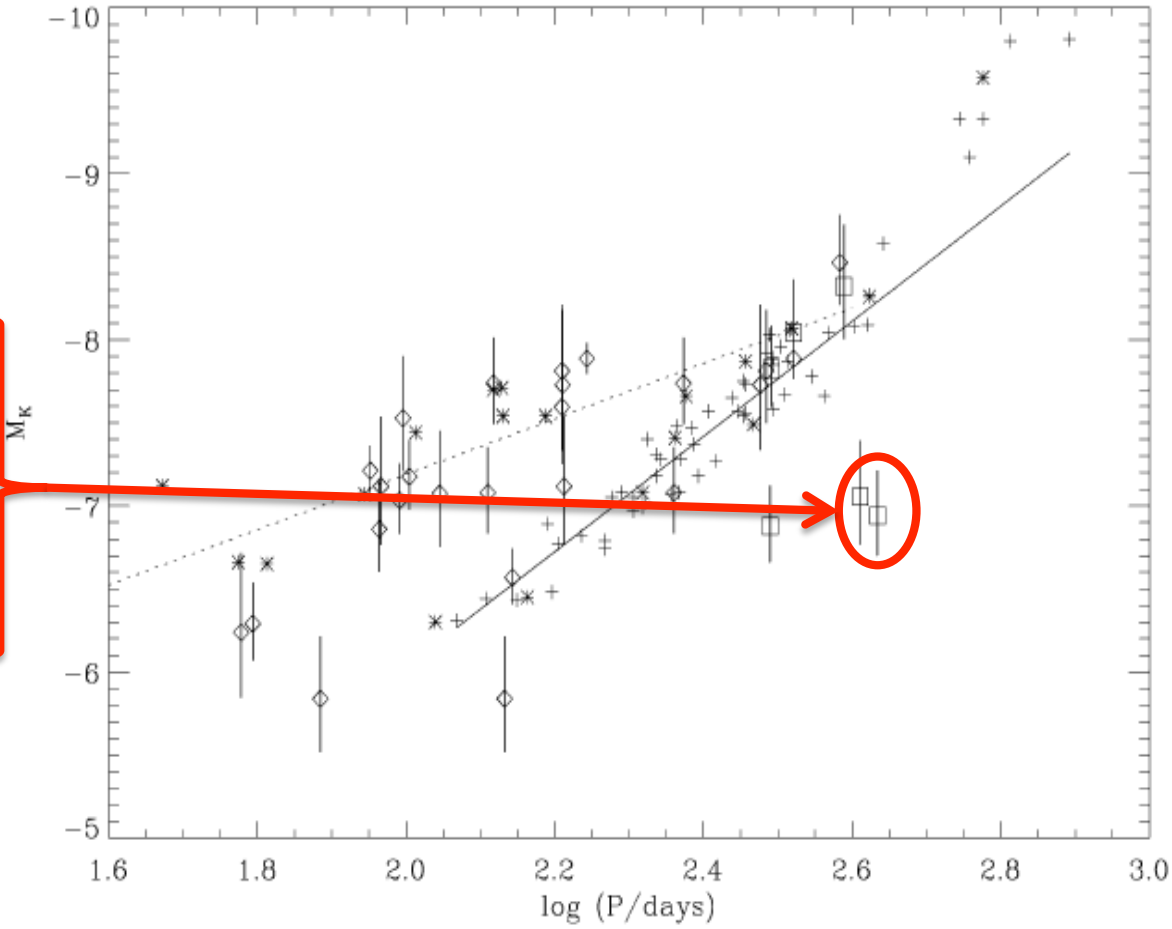
G. Perrin, S. Ridgway, S. Meimon,
W. Traub et al.

Chi Cygni

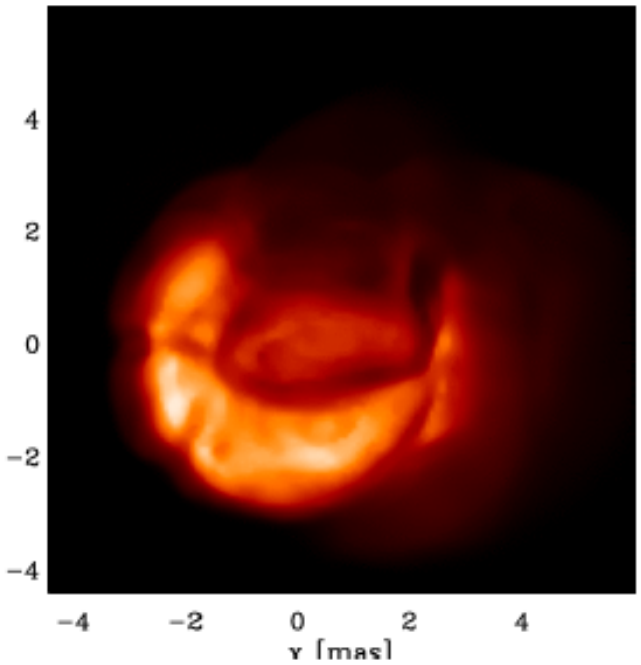
- Mira star. S-type.
- Period 408 days
- mK=-1.9 mag
- Distance: ~100pc

Perryman (1997)



Period/Luminosity by Bedding & Zijlstra (1998)

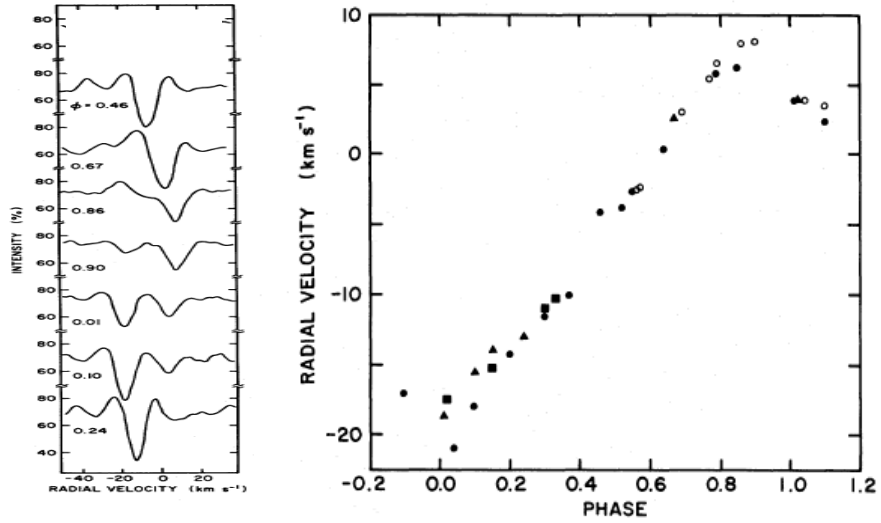
Chi Cygni, complex or not complex?



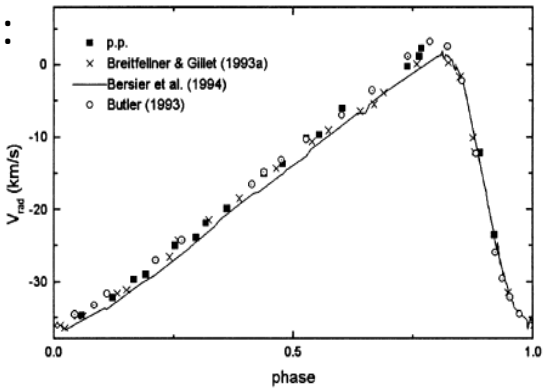
- 3D simulation VX Sgr

A. Chiavassa et al. (2010)

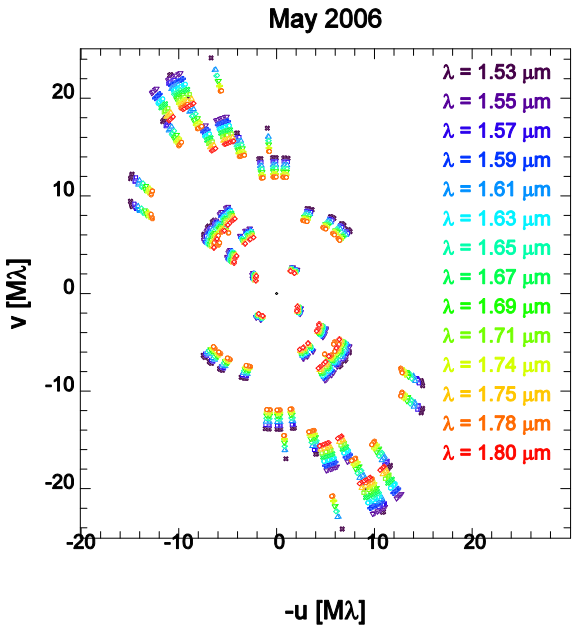
CO (Δv=3) velocity on Chi Cygni (Hinkle et al., 1982):



Atomic line velocity on the cepheid δ Cep (Kiss & Joszef):



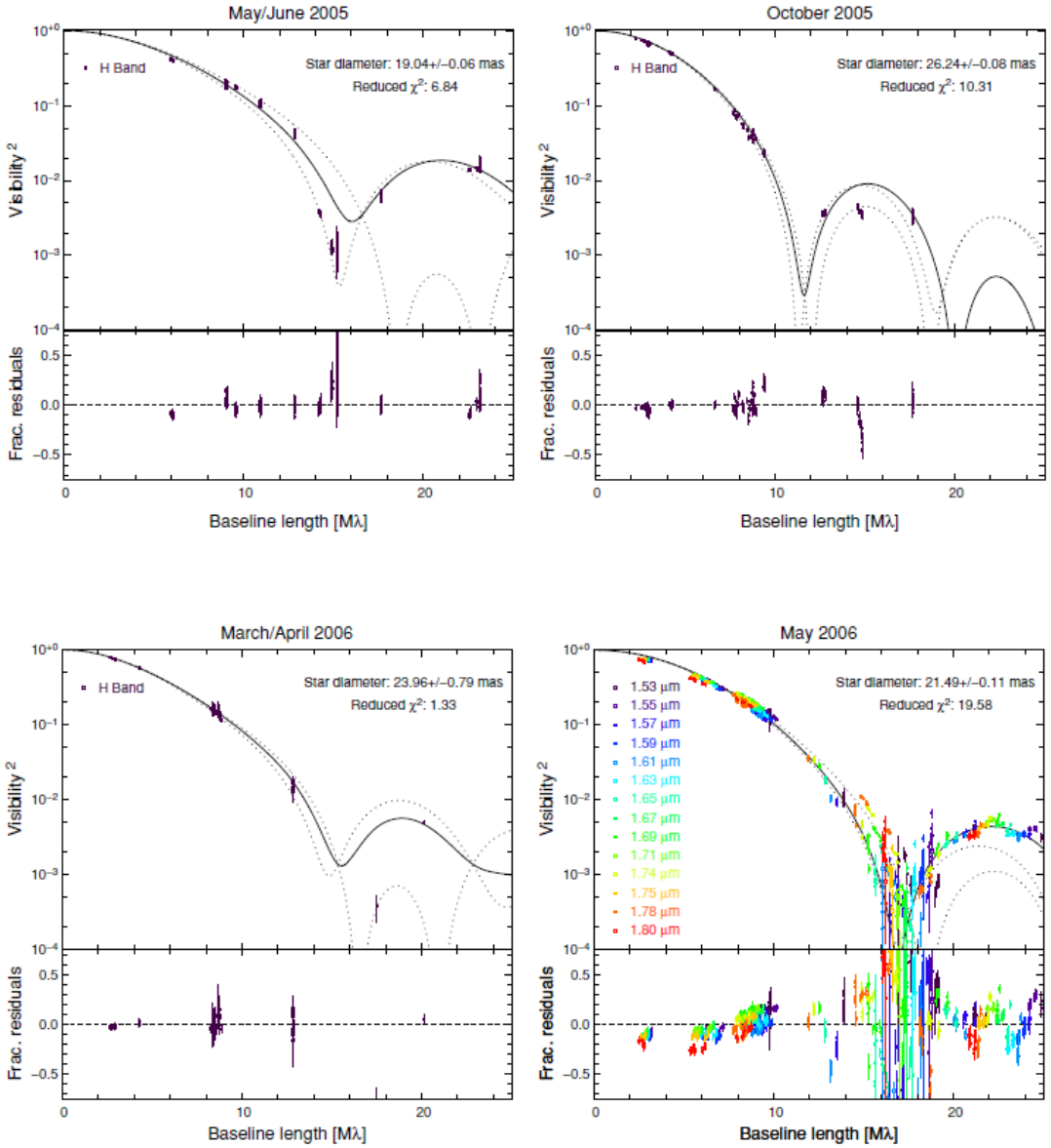
IOTA



- 3 telescopes with baseline length between 5 and 38 meters
- H band data
- Integrated optics beam combiner
- Dismounted in June 2006

Dataset:

- 4 epochs, covering almost 1 stellar cycle



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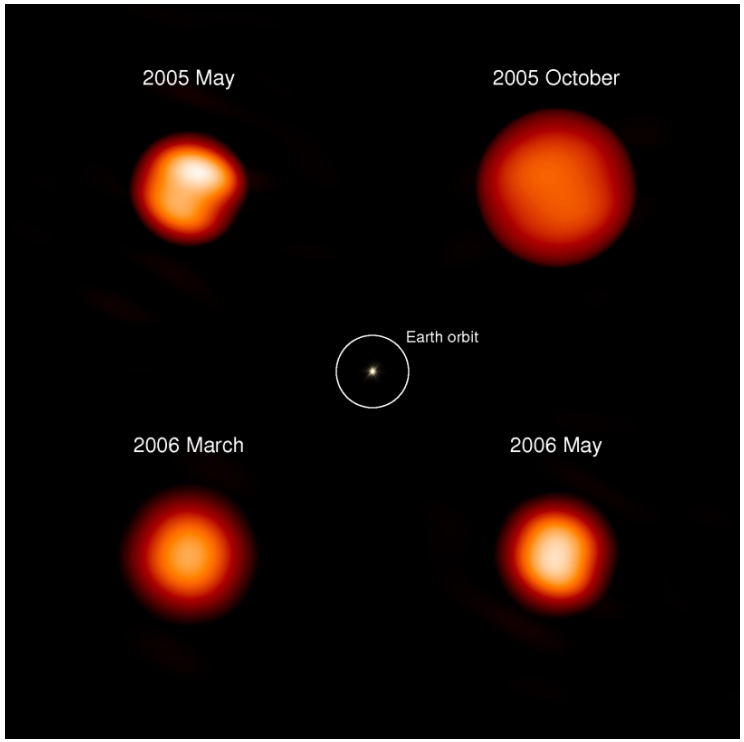


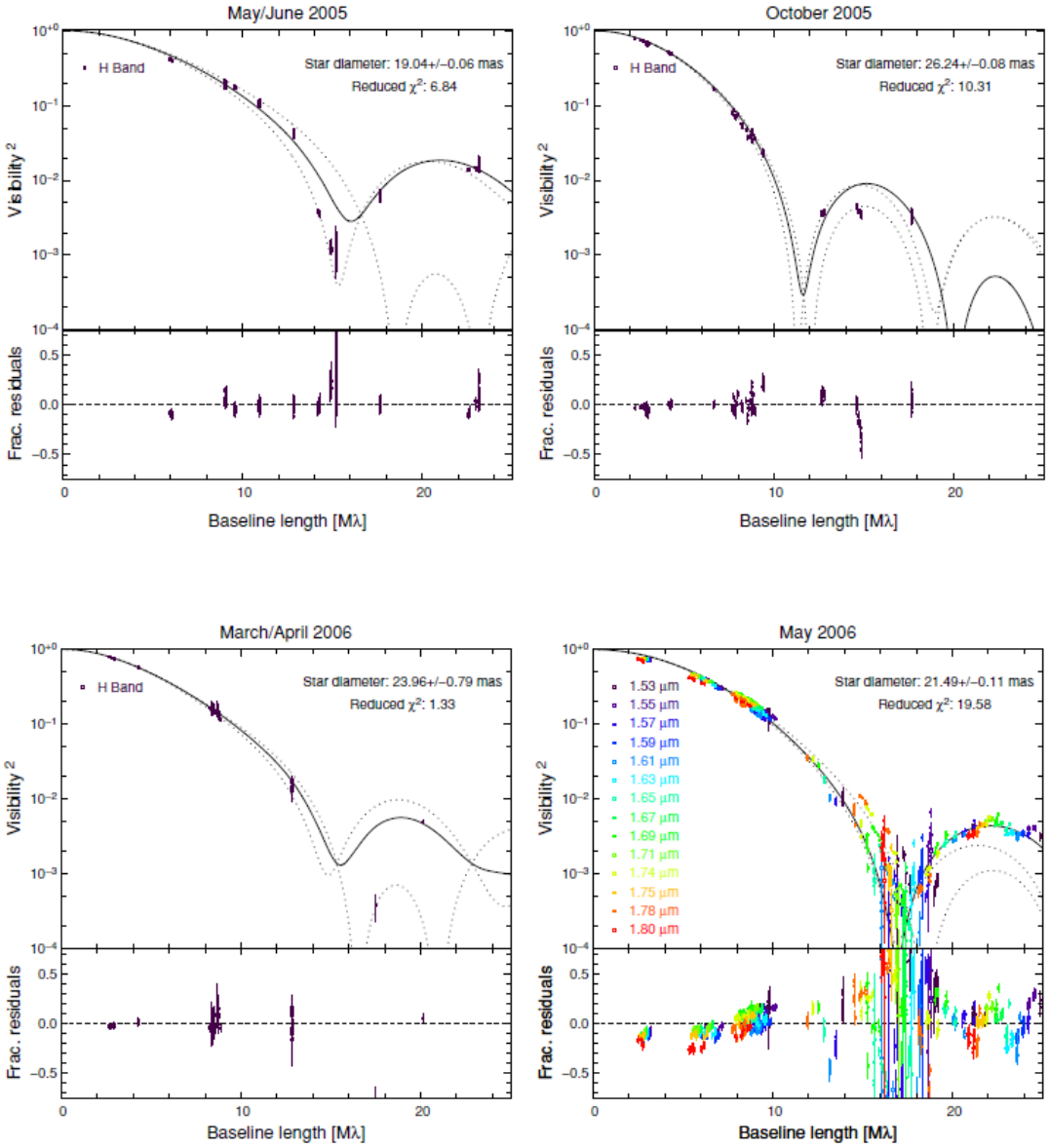
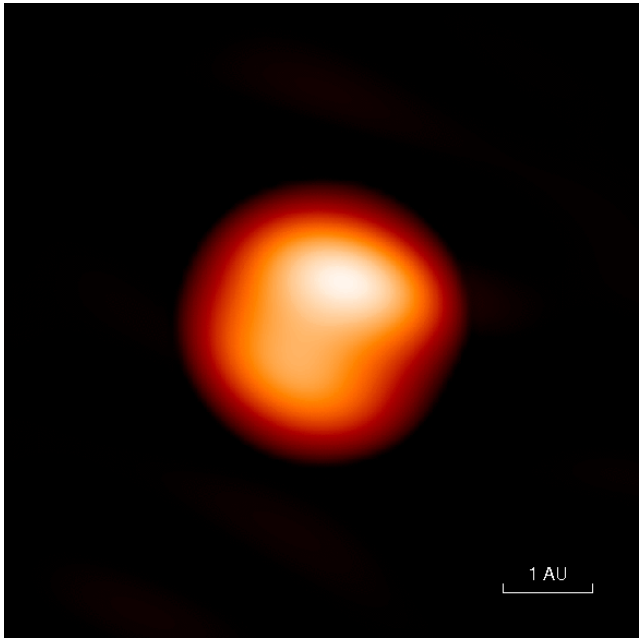
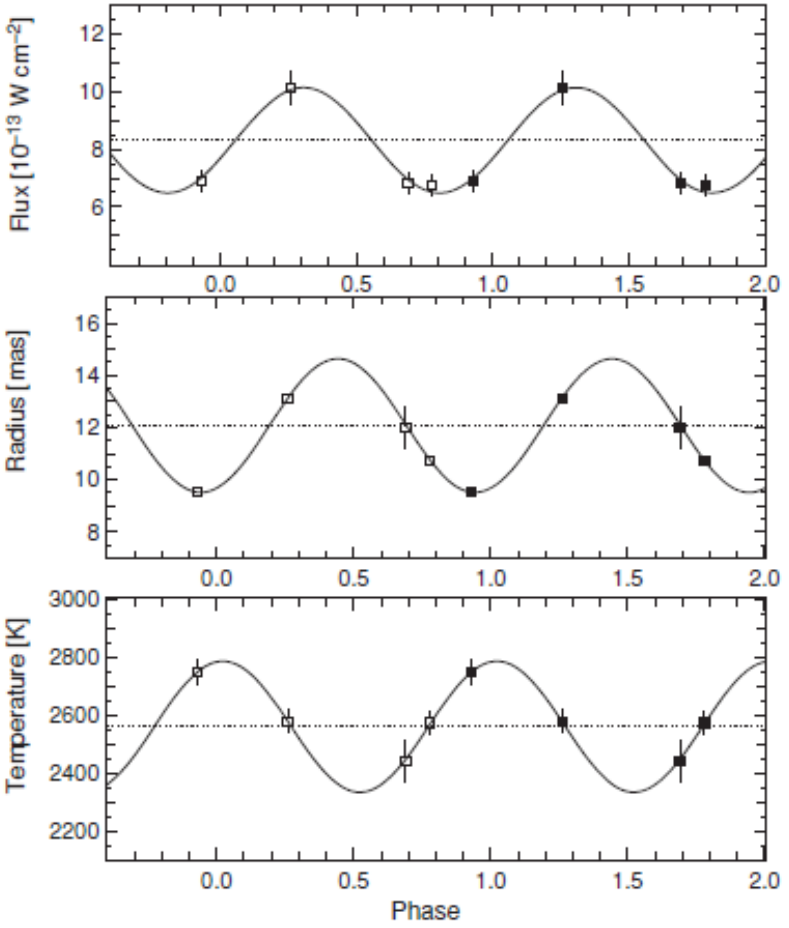


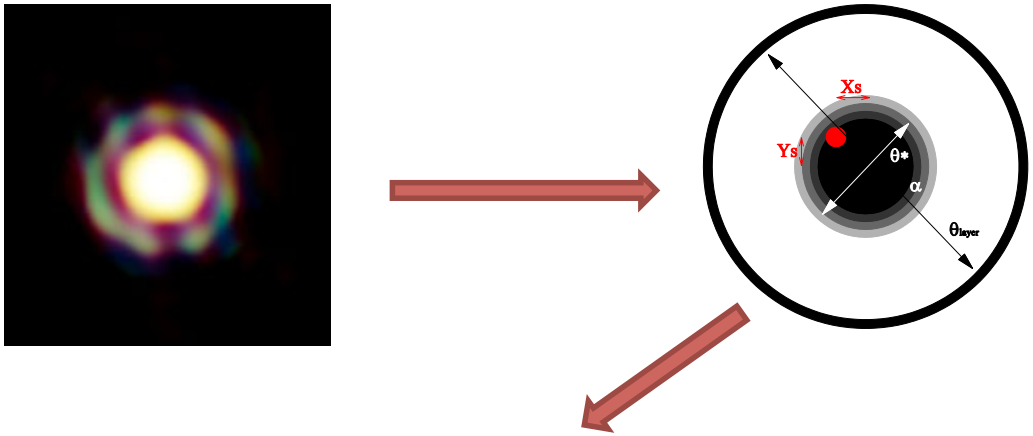
Image reconstruction software by E. Thièbaut

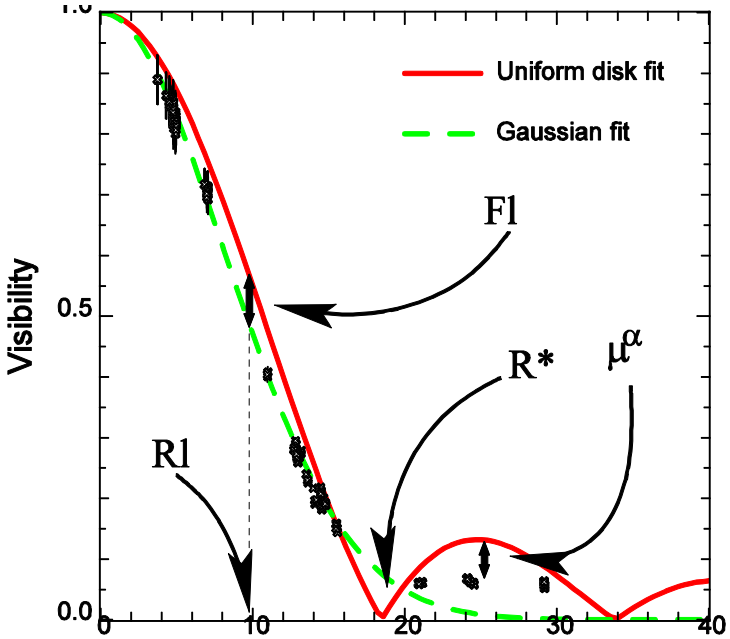
Parametric modeling

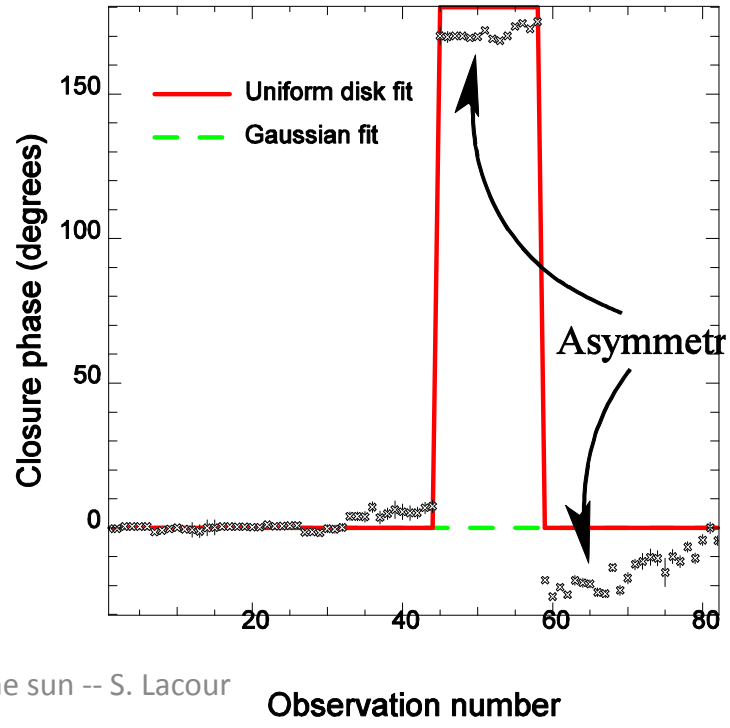




Parametric modeling

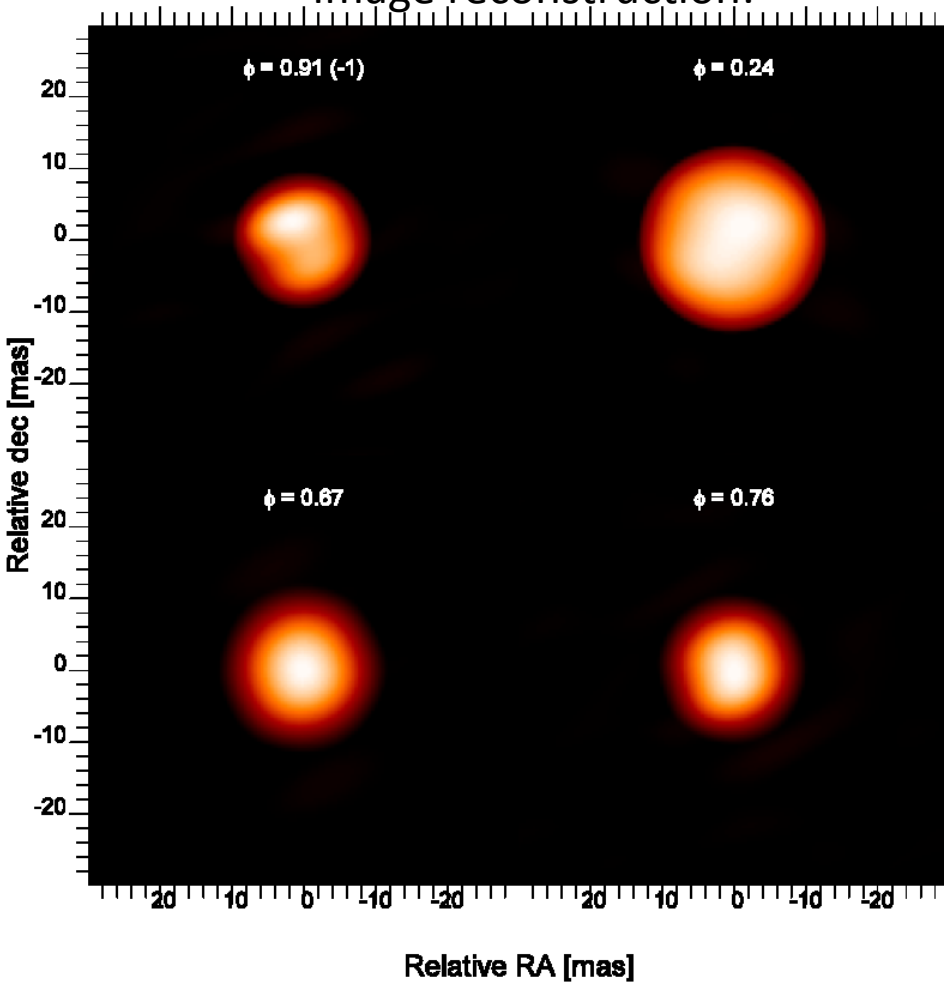




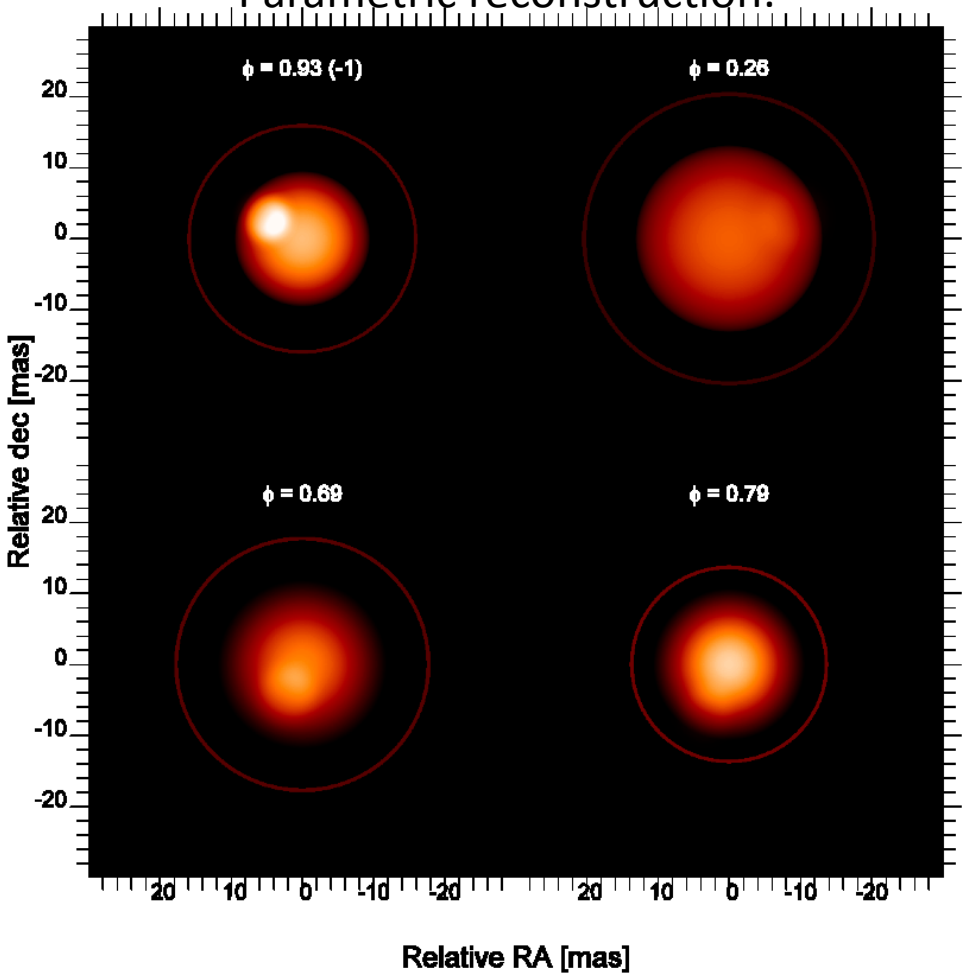


Parametric modeling

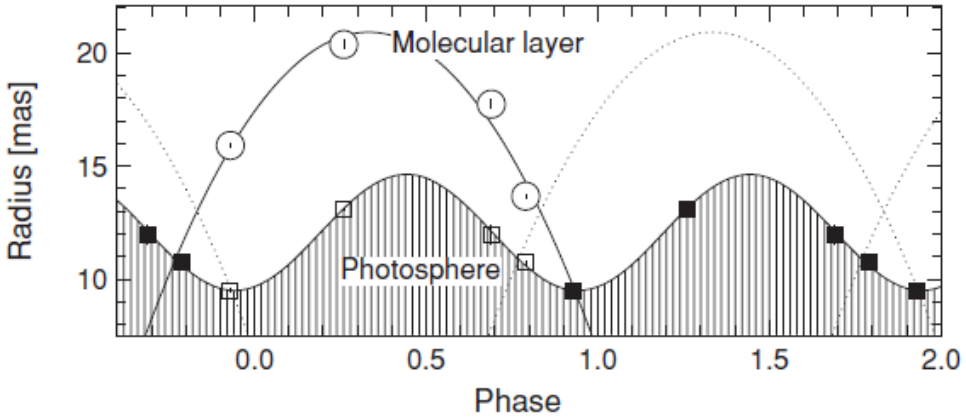
Image reconstruction:



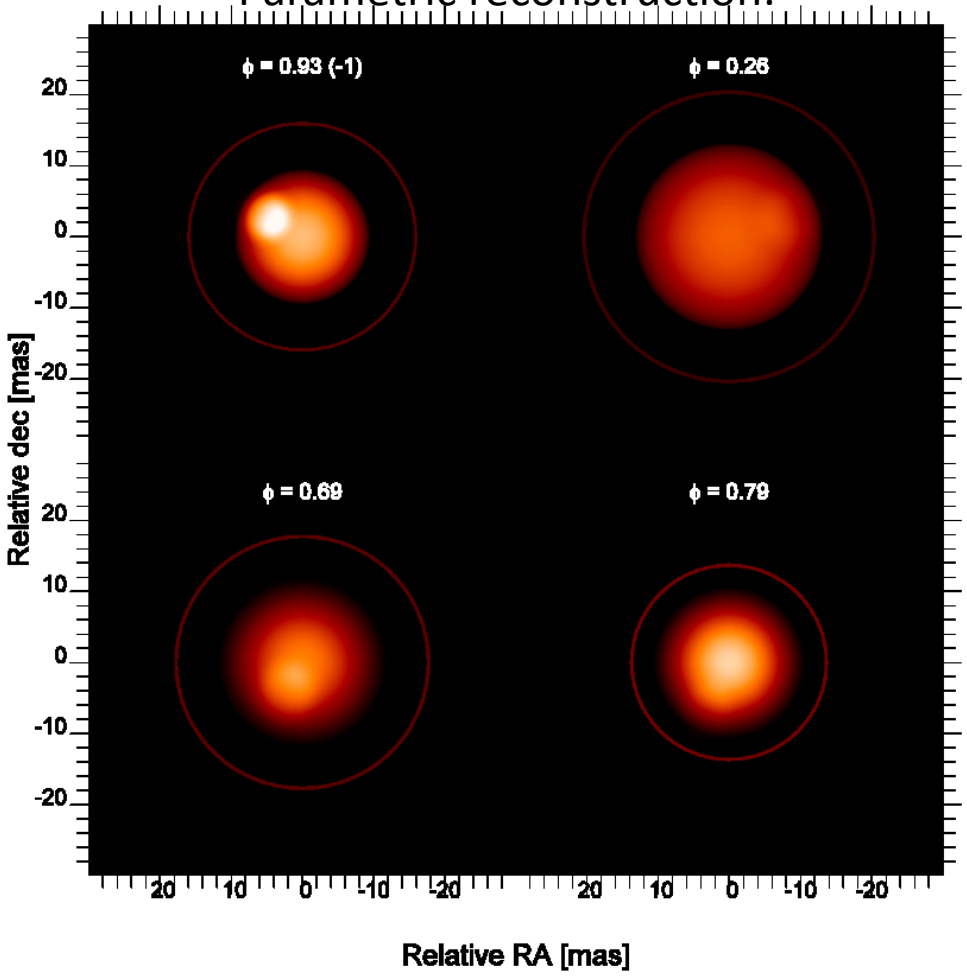
Parametric reconstruction:



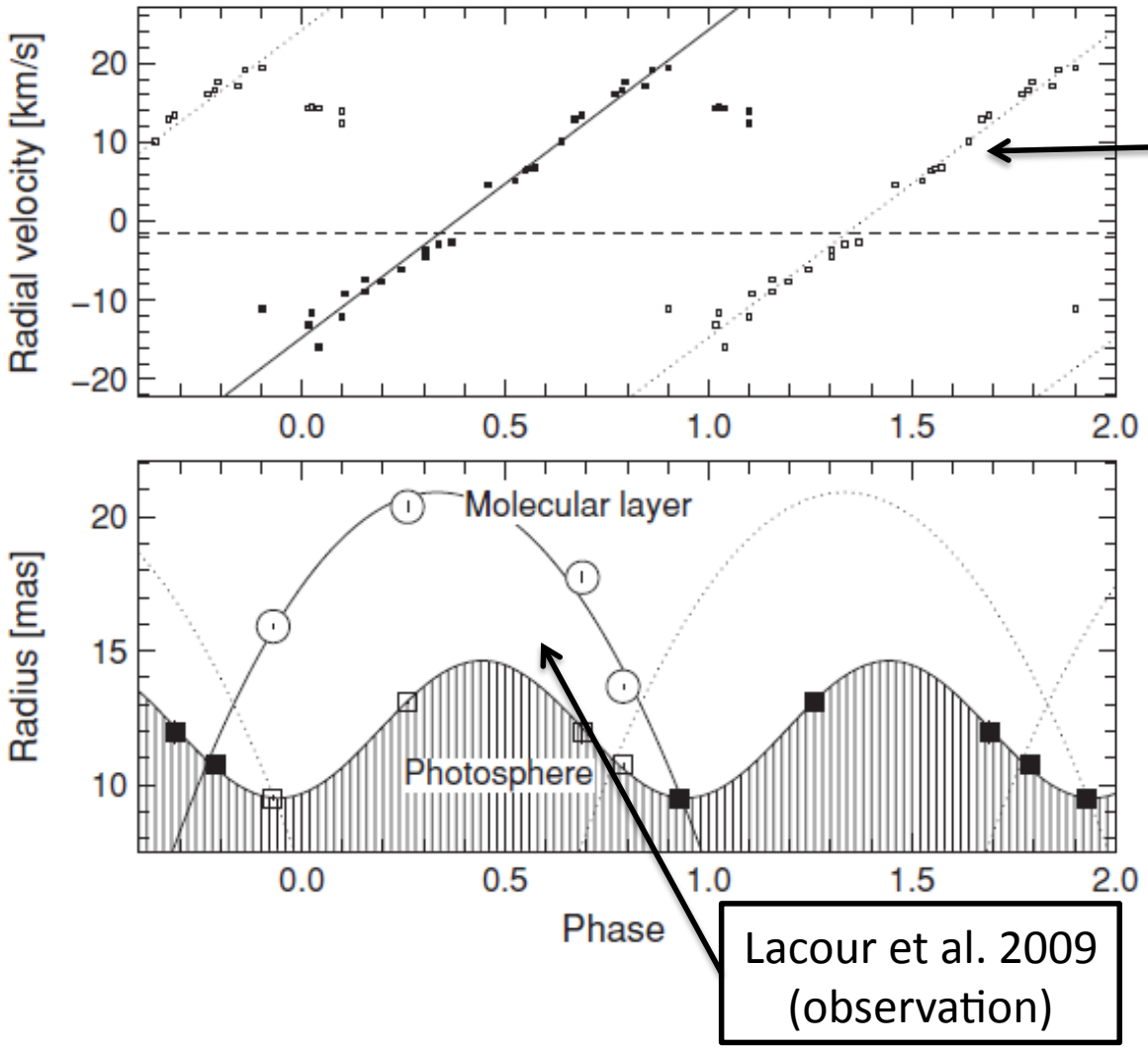
Time-evolution



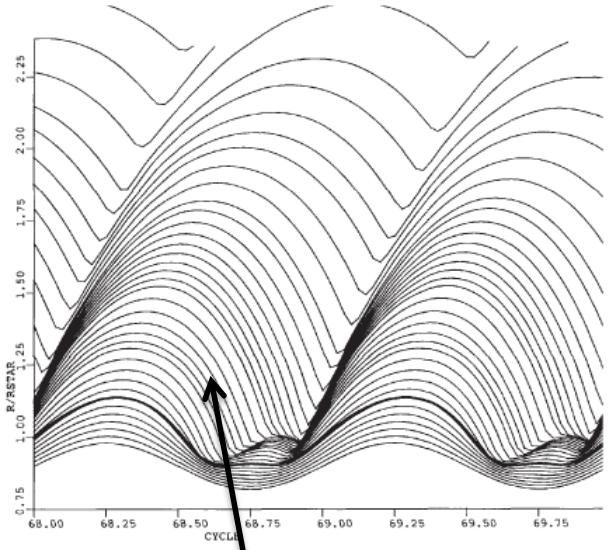
Parametric reconstruction:



Time evolution



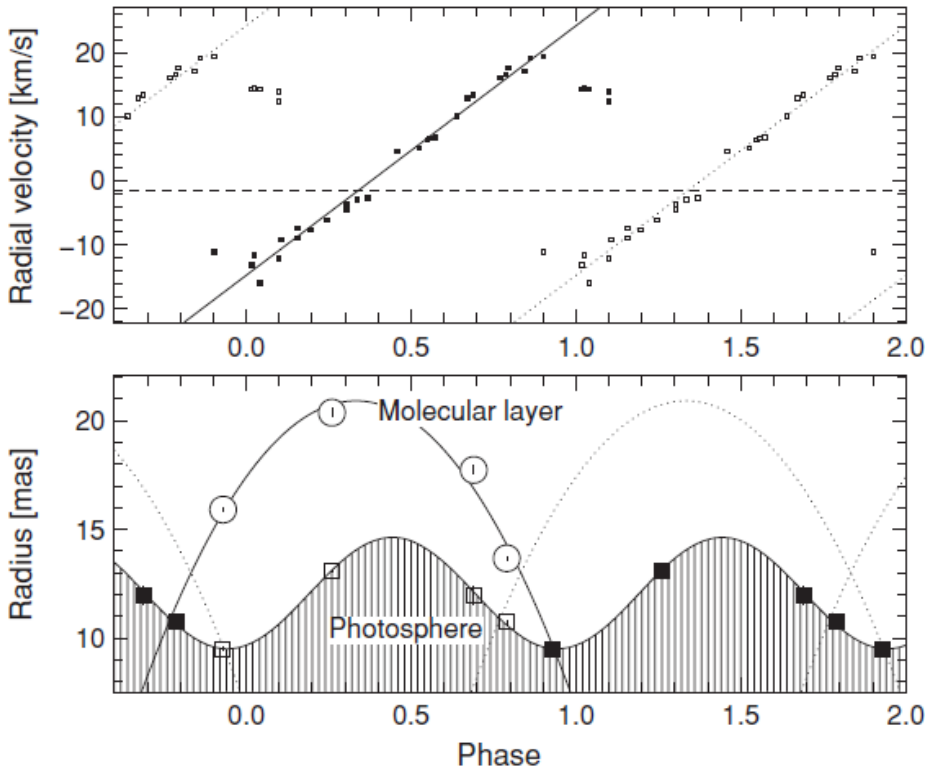
Hinkle et al. 1982 (observation)



Bowen 1990 (simulations)

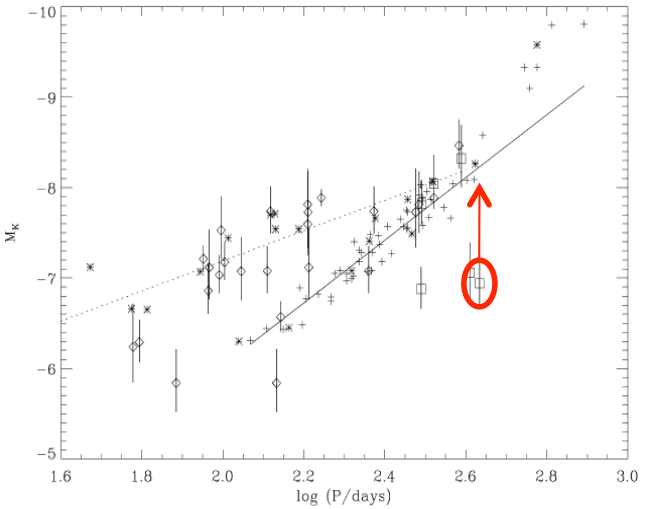
Lacour et al. 2009 (observation)

Time evolution

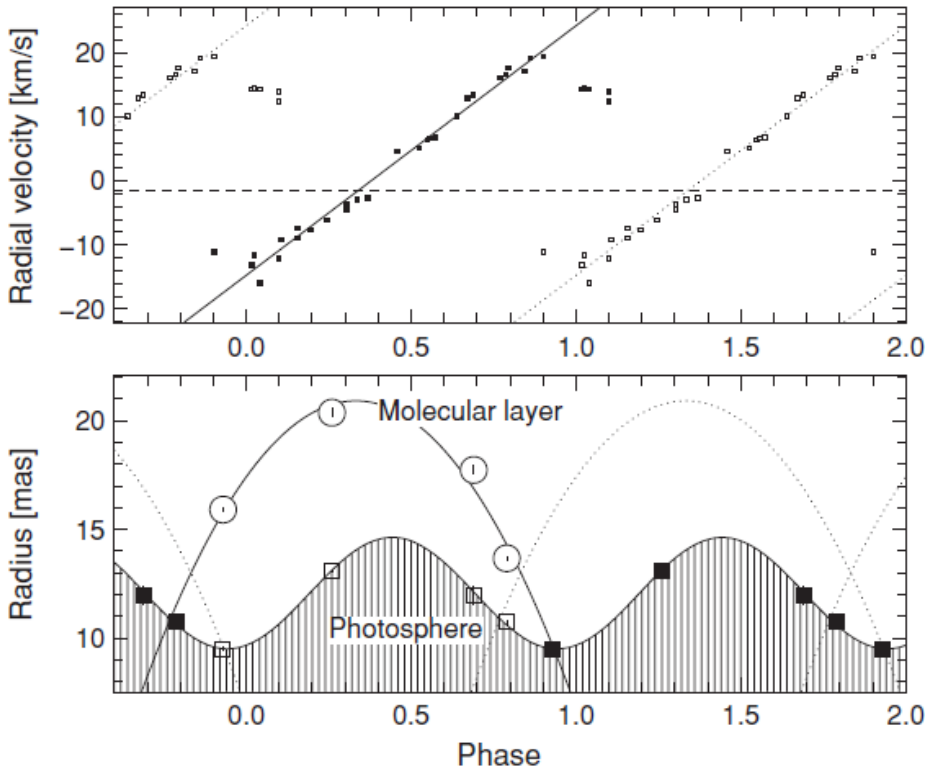


$$\text{parallax (mas)} = \frac{1}{p} \cdot \frac{g_{\text{angular}}\ (\text{mas/s}^2)}{g_{\text{radial velocity}}\ (\text{AU/s}^2)}$$

=> Distance ~200pc (5.9+/- 1.5 mas)



Time evolution



$$M_\star = \frac{g\, R_{\rm layer}^2}{G}$$

⇒Mass = 2.1 (+1.5-0.7) Msun

In agreement with the P/M/R relation:

$$\log(P) = -2.07 + 1.94\log(R/R_\odot) - 0.9\log(M/M_\odot)$$

Conclusion

- There is no reason to be afraid of simplistic geometrical model (at least, until observations start to disagree)
- IOTA does not exist anymore, but AMBER can do many things, eg, RR Sco: