



# The Massive Interacting Binary Star MWC 314

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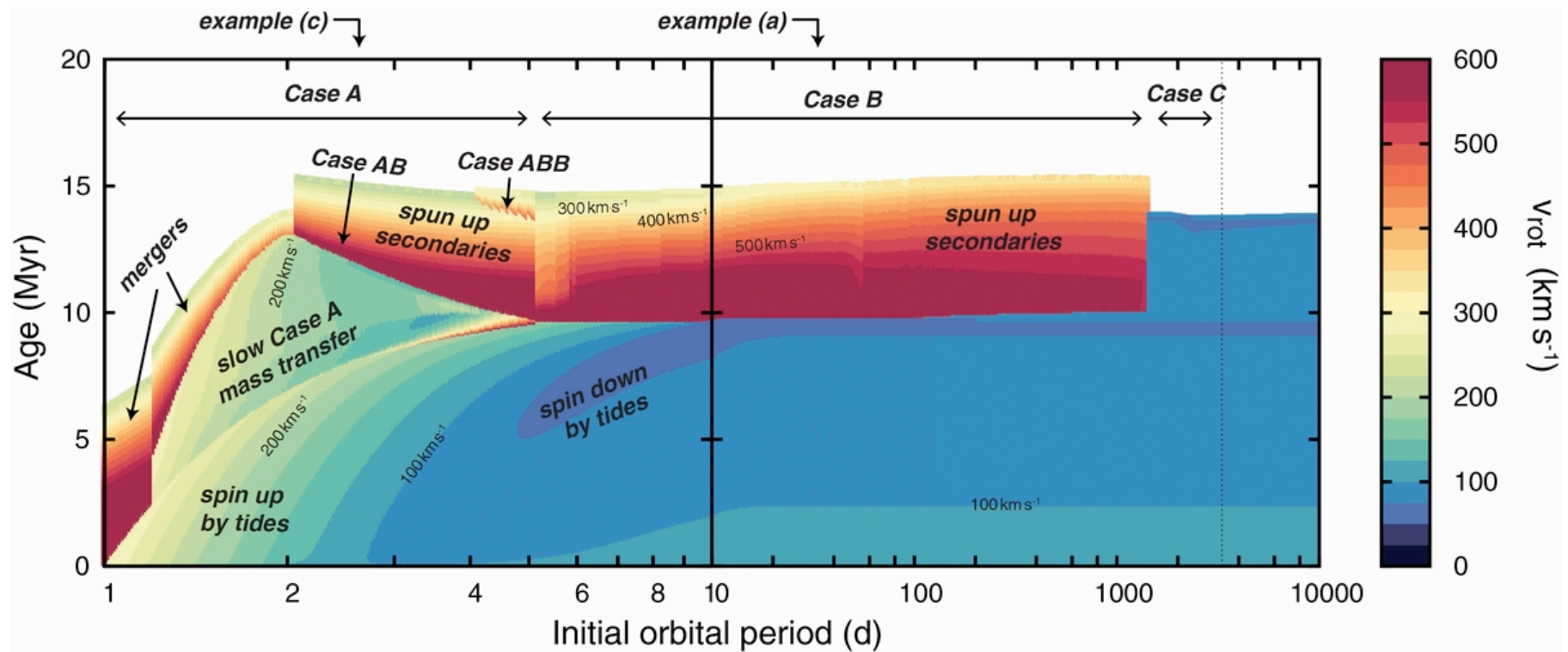
Observatoire  
de la COTE d'AZUR



# Binary Star Evolution

- Massive stars often found with companions
- Majority will interact at some point

De Mink et al. (2013): 20 + 15 solar mass binary






CHARA 2015 Towards Adaptive Optics at CHARA

<http://www.eso.org/public/videos/eso1230b/>



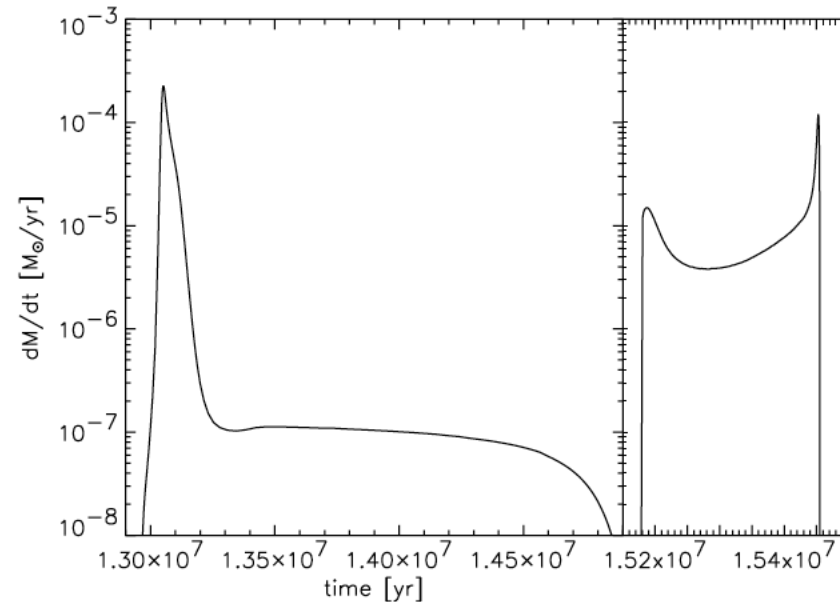


**Binary Evolution:**  
**rapidly rotating B star +**  
**NS (BeXRB)**  
**He ( $\phi$  Per, FY CMa, 59 Cyg)**  
**WD ( $\alpha$  Leo, MAXI J0158-744)**  
**[or merger]**



# Systemic Mass Loss

- Separation decreases with RLOF until mass ratio reversed
- Mass transfer rate spikes at smallest separation
- Accretion limited once gainer reaches critical rotation
- Mass lost to system?



**Fig. 2.** Mass transfer rate as function of time for our Case A system No. 31 (initial masses are  $12 M_{\odot}$  and  $7.5 M_{\odot}$ , the initial period is 2.5 d; cf. Table 3 in Sect. 4) The left panel shows the rapid and slow Case A mass transfer, the right panel shows the ensuing Case AB mass transfer

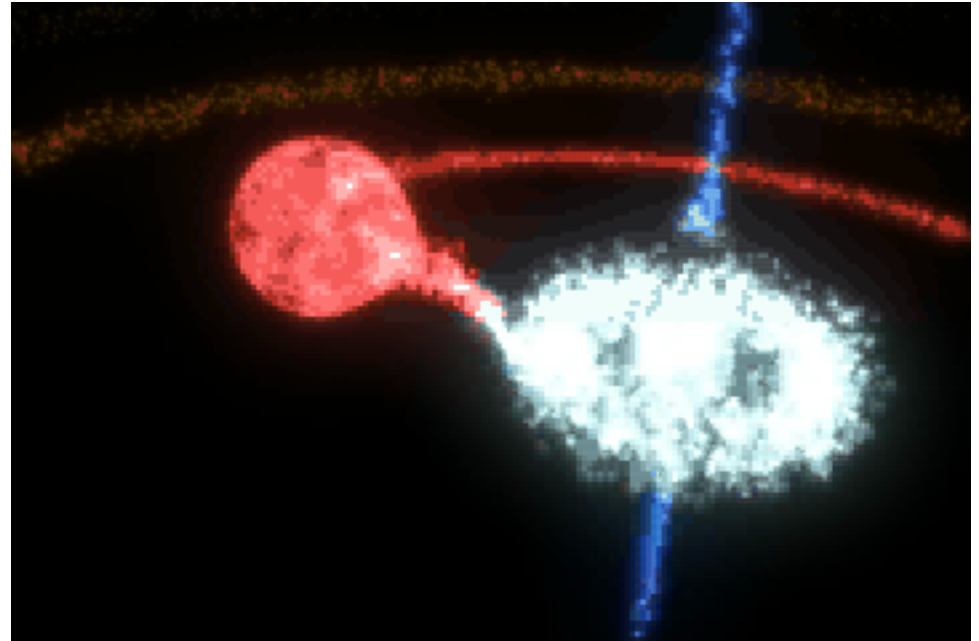
Wellstein et al. 2001





# W Serpentis Binaries

- Luminous binaries with mass gainer hidden in torus
- Best known:  
 $\beta$  Lyrae  
B6-8 II +  
unseen companion  
2.8 + 12.7 solar masses  
 $P = 12.94$  d



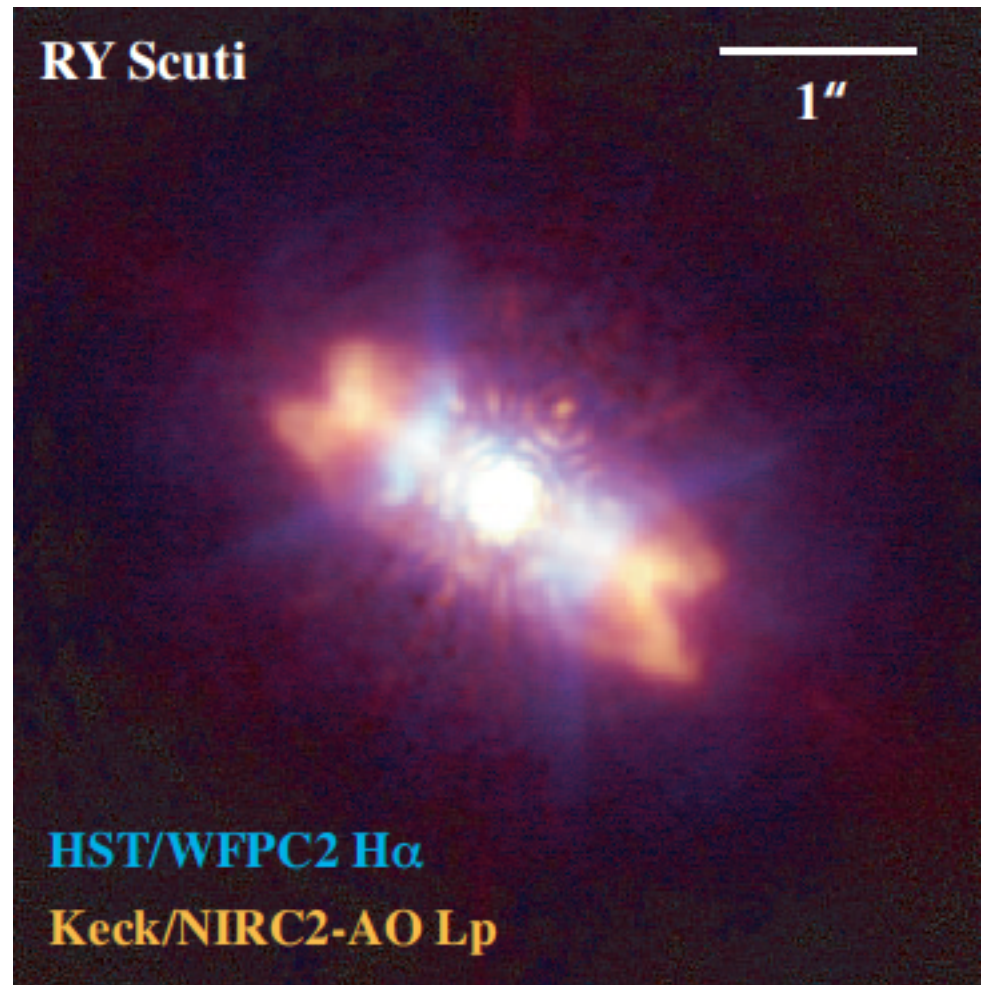
Zhao et al. 2008

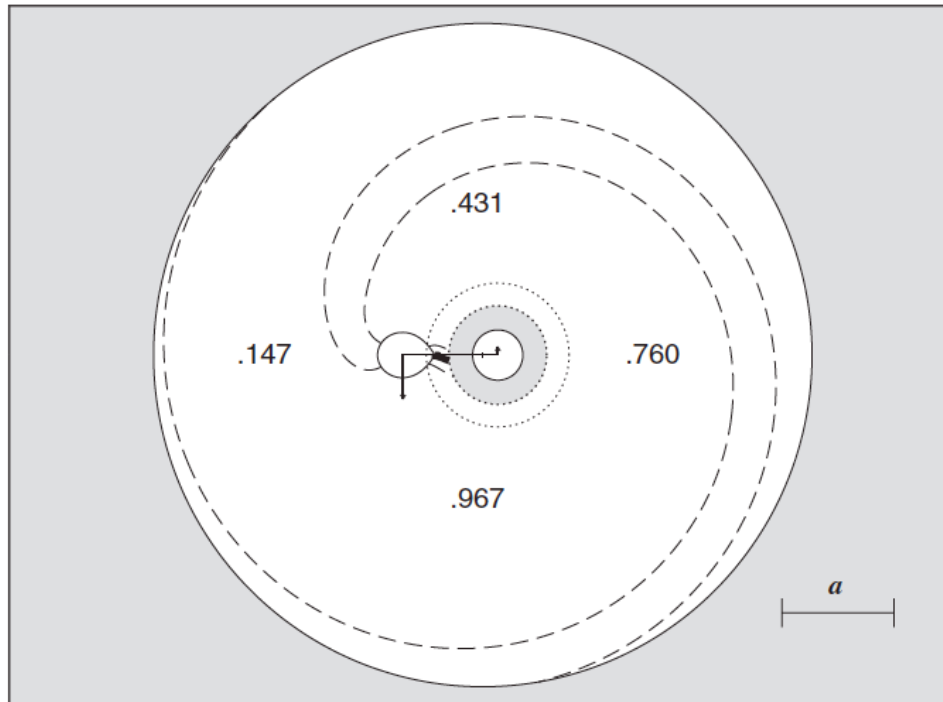


# Example: RY Scuti

Spectra:  
Grundstrom et al. 2007

HST imaging:  
Smith et al. 2011





# HDE 326823

(Richardson et al. 2011)

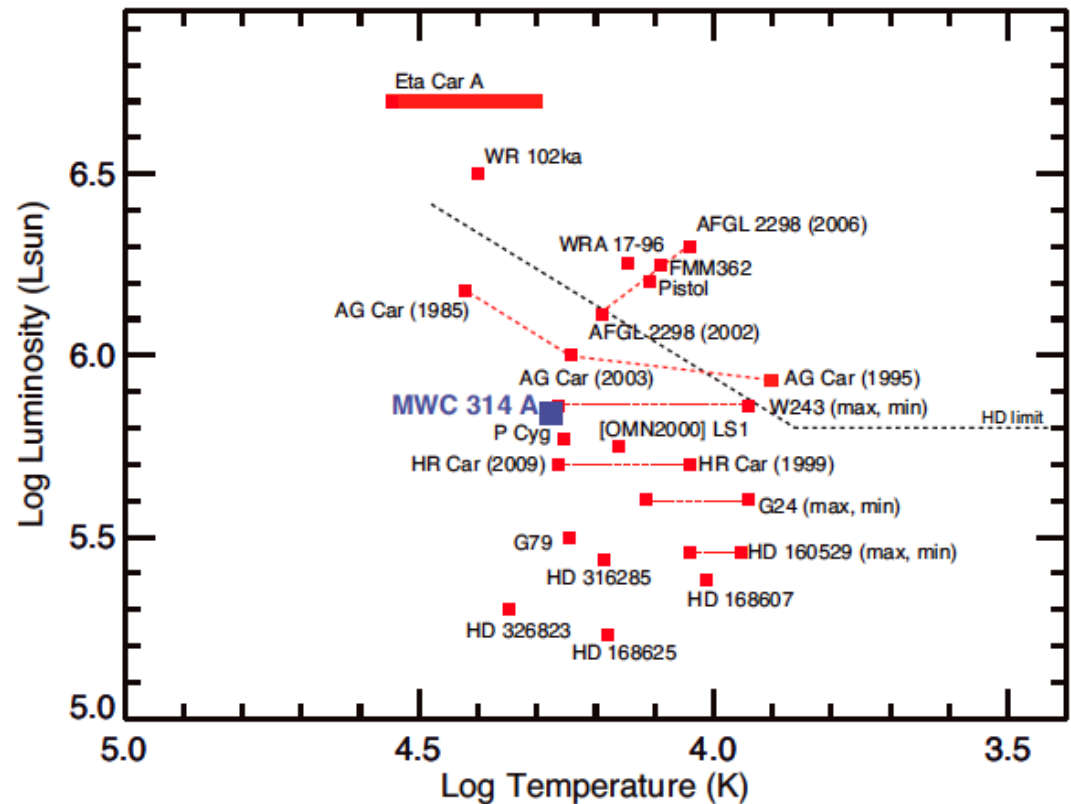
- SB1 plus stationary emission lines from a circumbinary disk
- Rotational broadening suggests mass ratio inversion: 6 + 29 solar masses





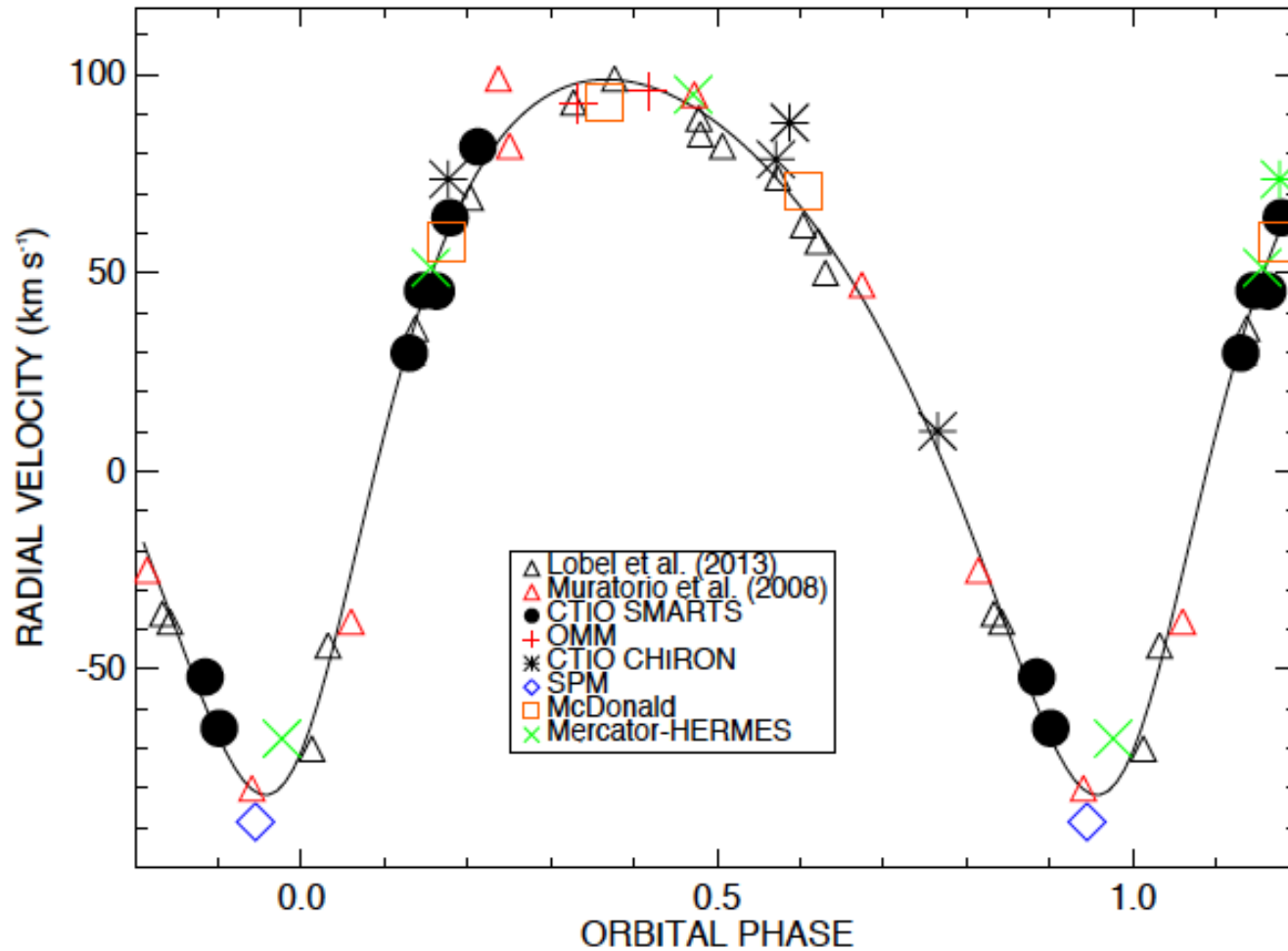
# MWC 314 (Richardson et al.)

- Very similar to HDE 326823 (Lobel et al. 2013)
- $P = 60.8$  d,  $e = 0.29$
- 5 + 15 solar masses
- $d = 2.4$  kpc
- $a = 1$  AU  
or 0.4 mas;  
too small to resolve
- $K = 5.0$   
 $H = 5.5$



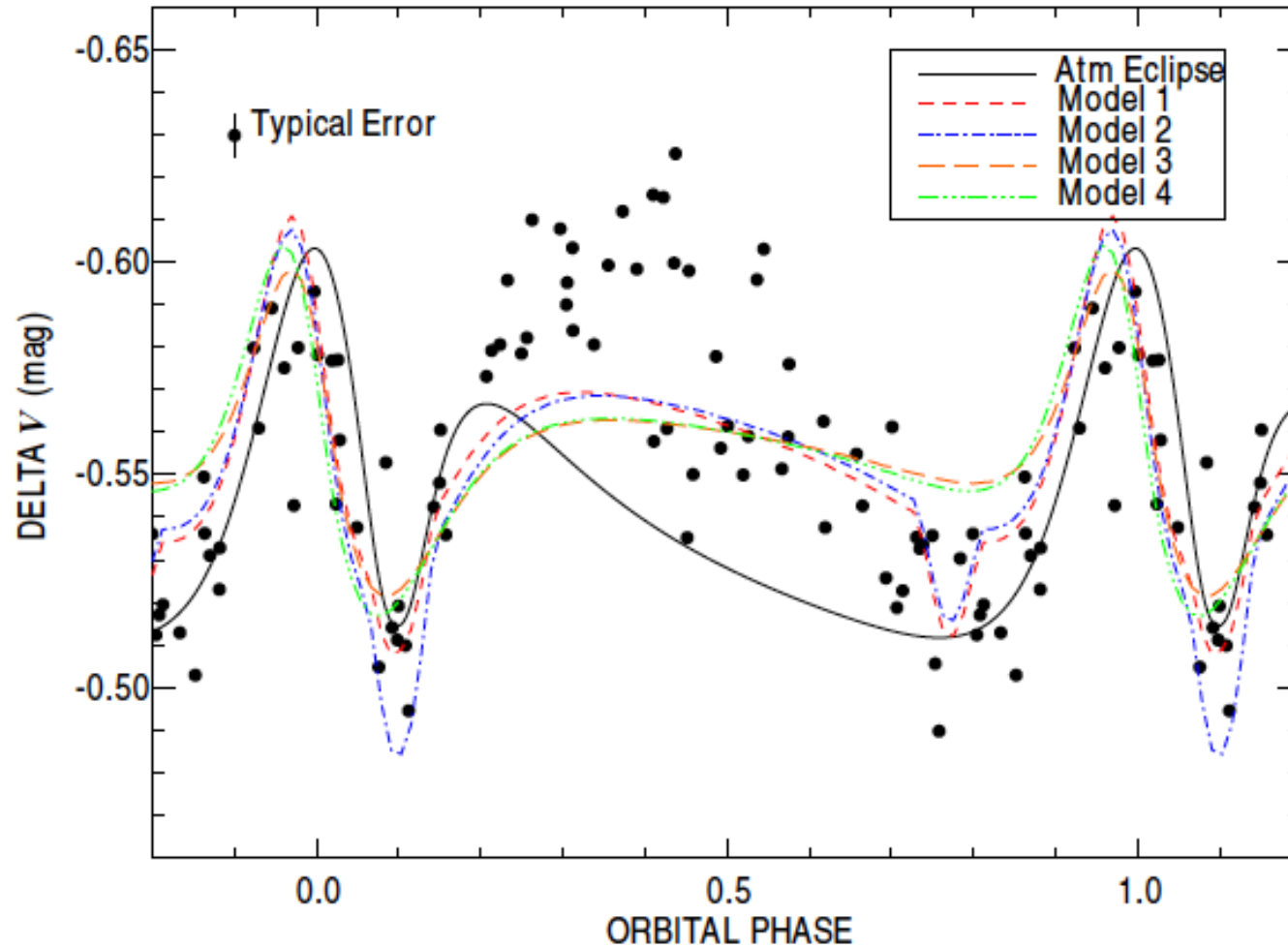


# MWC Radial Velocity Curve





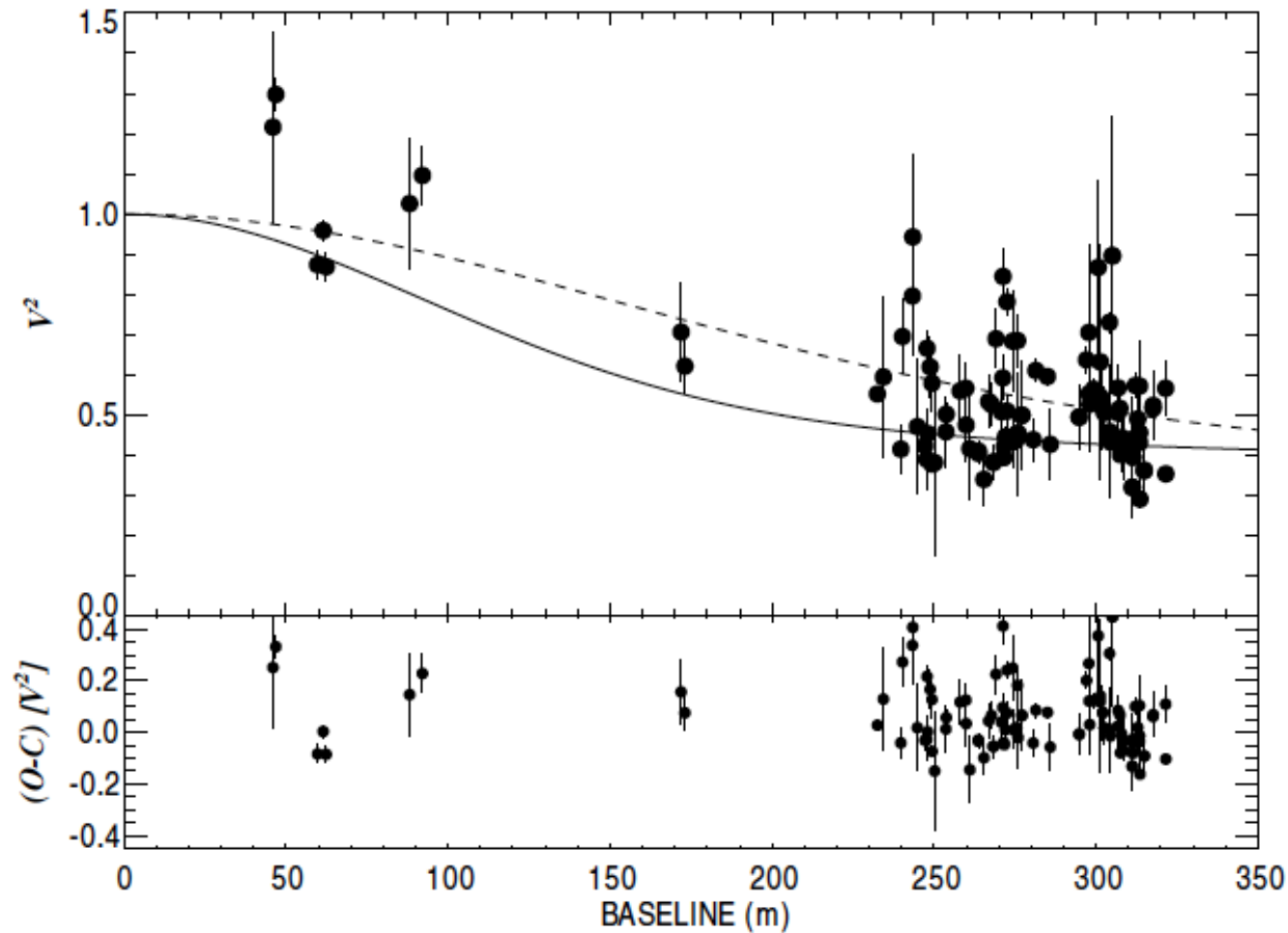
# MWC 314 Light Curve





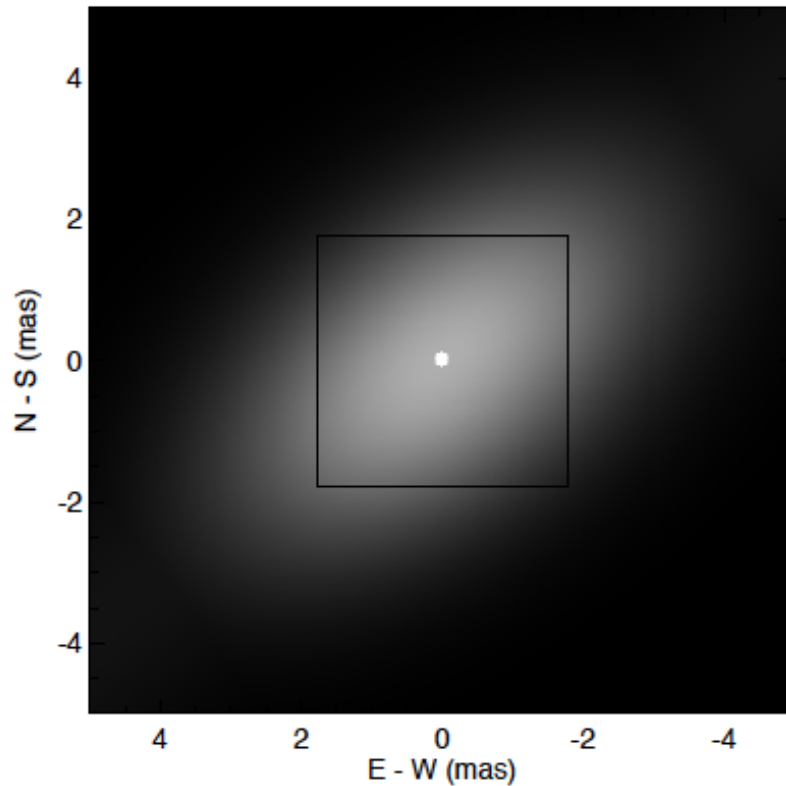
# CHARA Observations

- CLIMB  $K'$ -band, 2010 – 2013

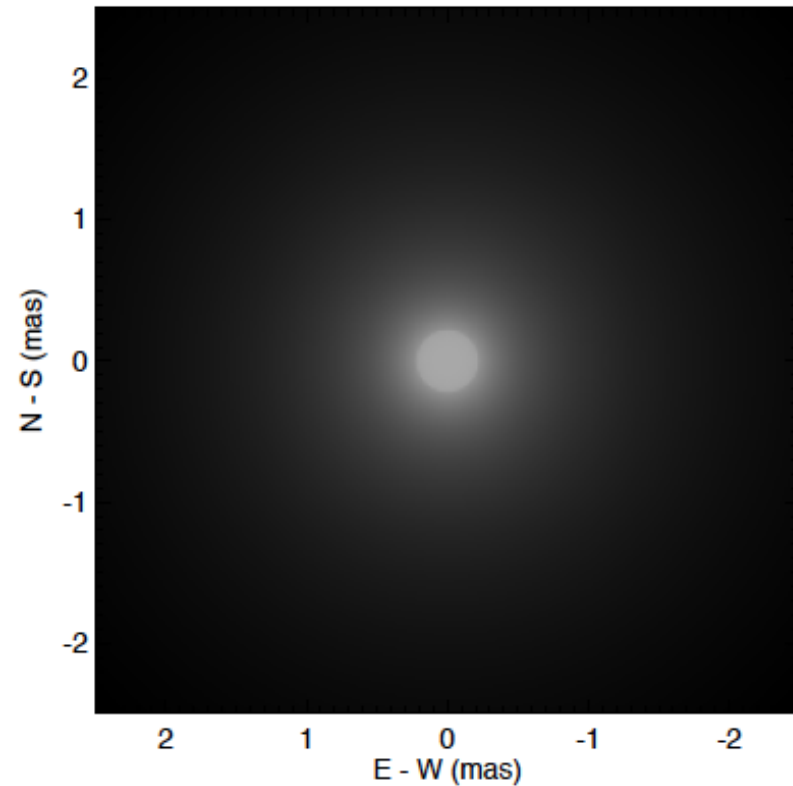




# Model: Circumbinary disk?



MWC 314:  
UD + Gaussian elliptical disk  
Inclination consistent with that  
from photometric light curve



P Cygni:  
CMFGEN model of star + wind





# CHARA/MIRC (Schaefer)

- V729 Cyg
- V367 Cyg
- KX And
- $\mu$  Sgr
- $\nu$  Sgr
- **MWC 314**

*First survey of W Ser binary  
mass loss processes*