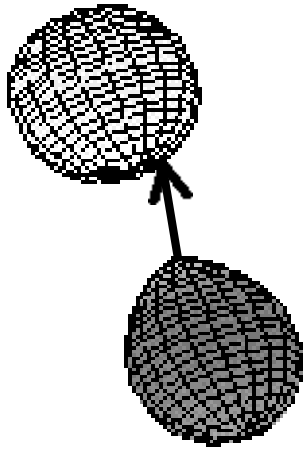
Lightcurves: observations and models

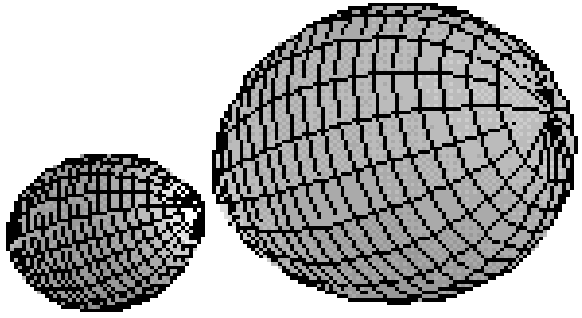
Binaries in Roche-Lobes

detached

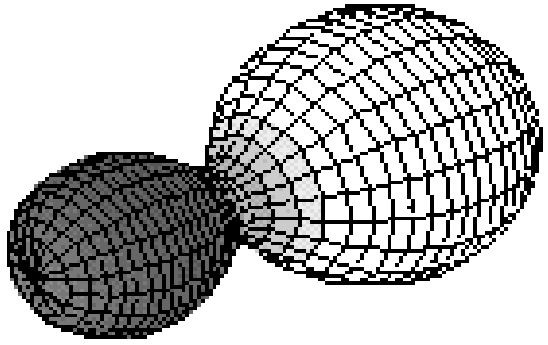
semi-detached (Algol)



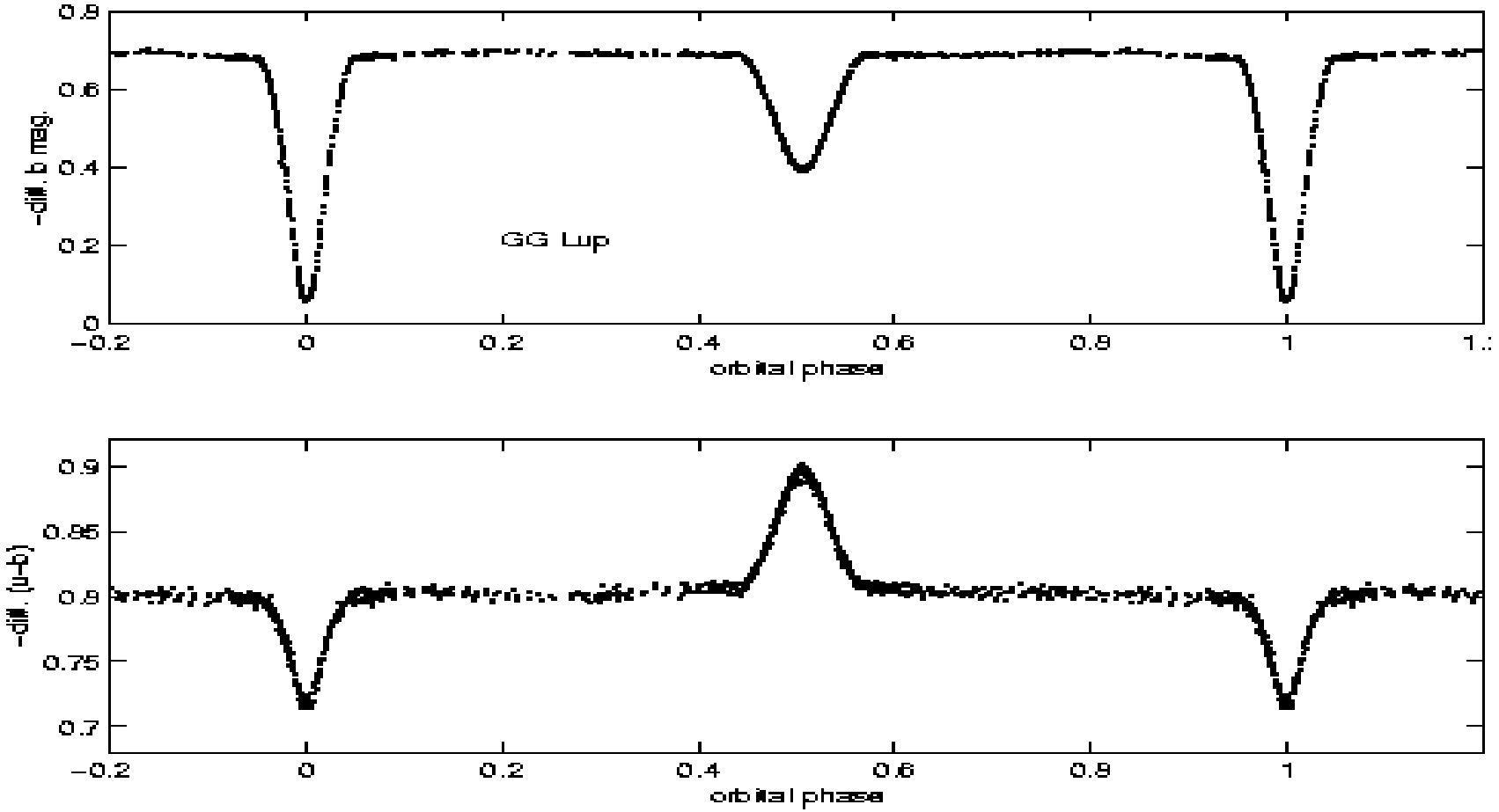
close to contact



contact (W UMa)



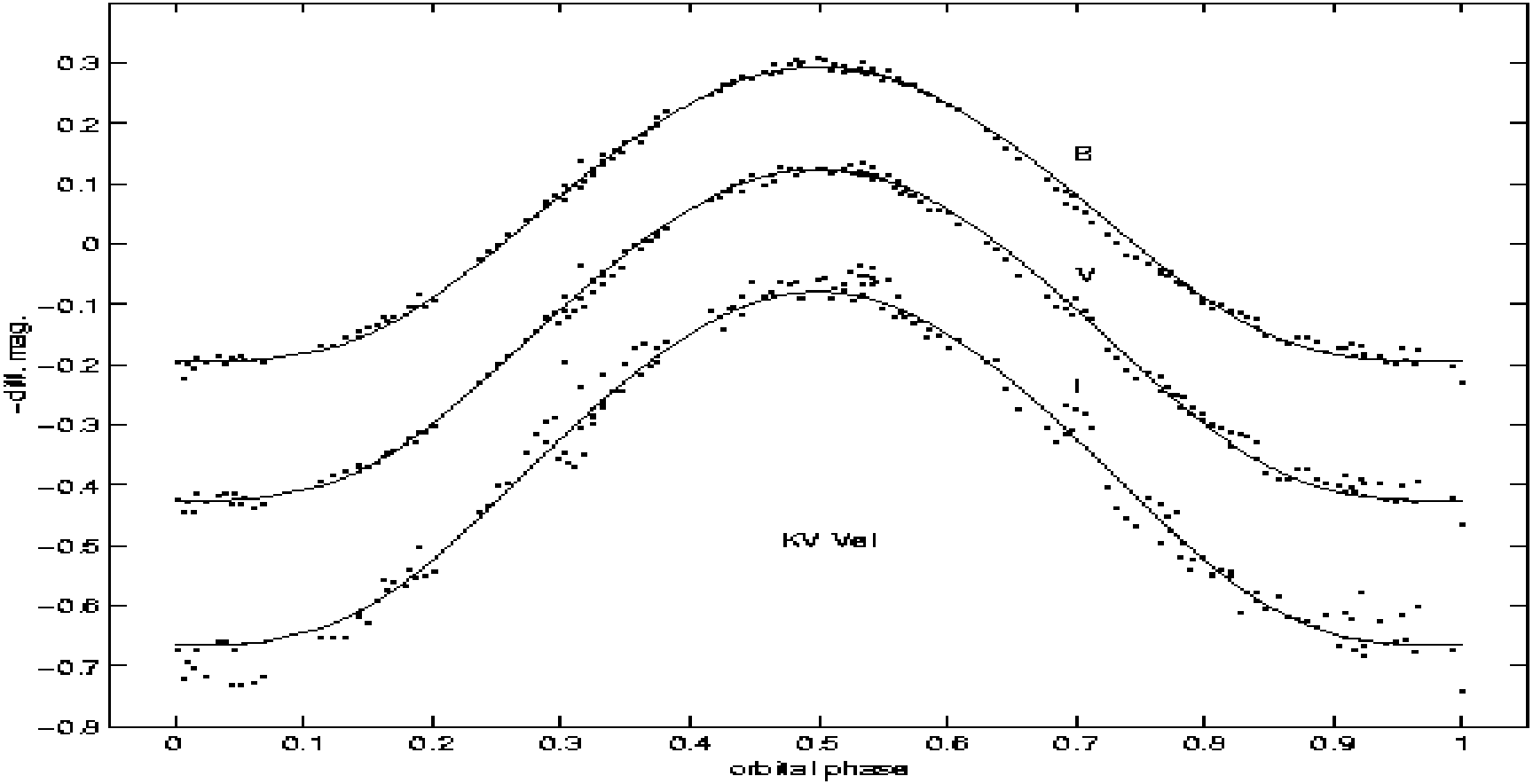
GG Lup -- detached



Colour Changes

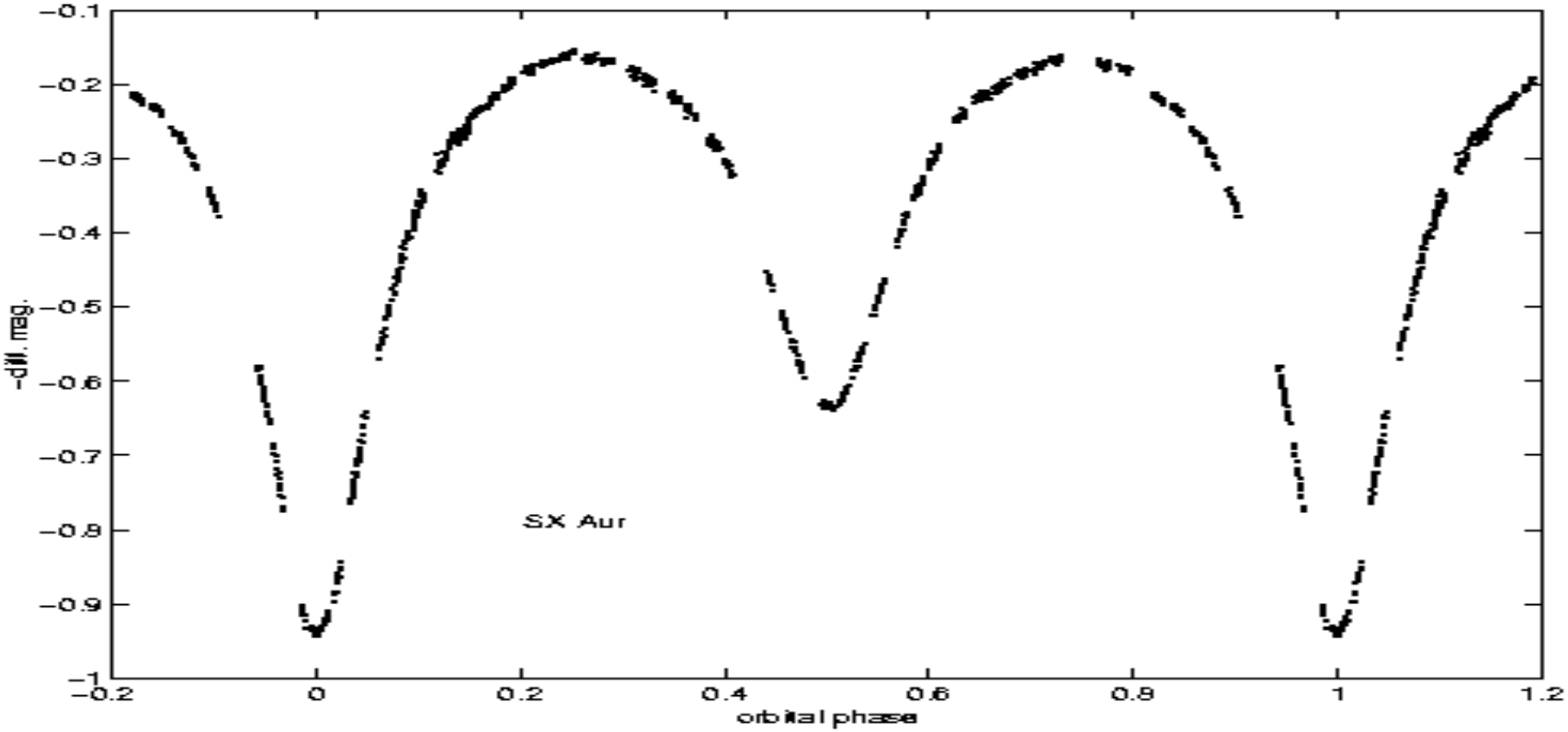
14750 K + 11000 K

KV Vel -- Heating Effects



sdO (75,000 K) + KV (3500 K)

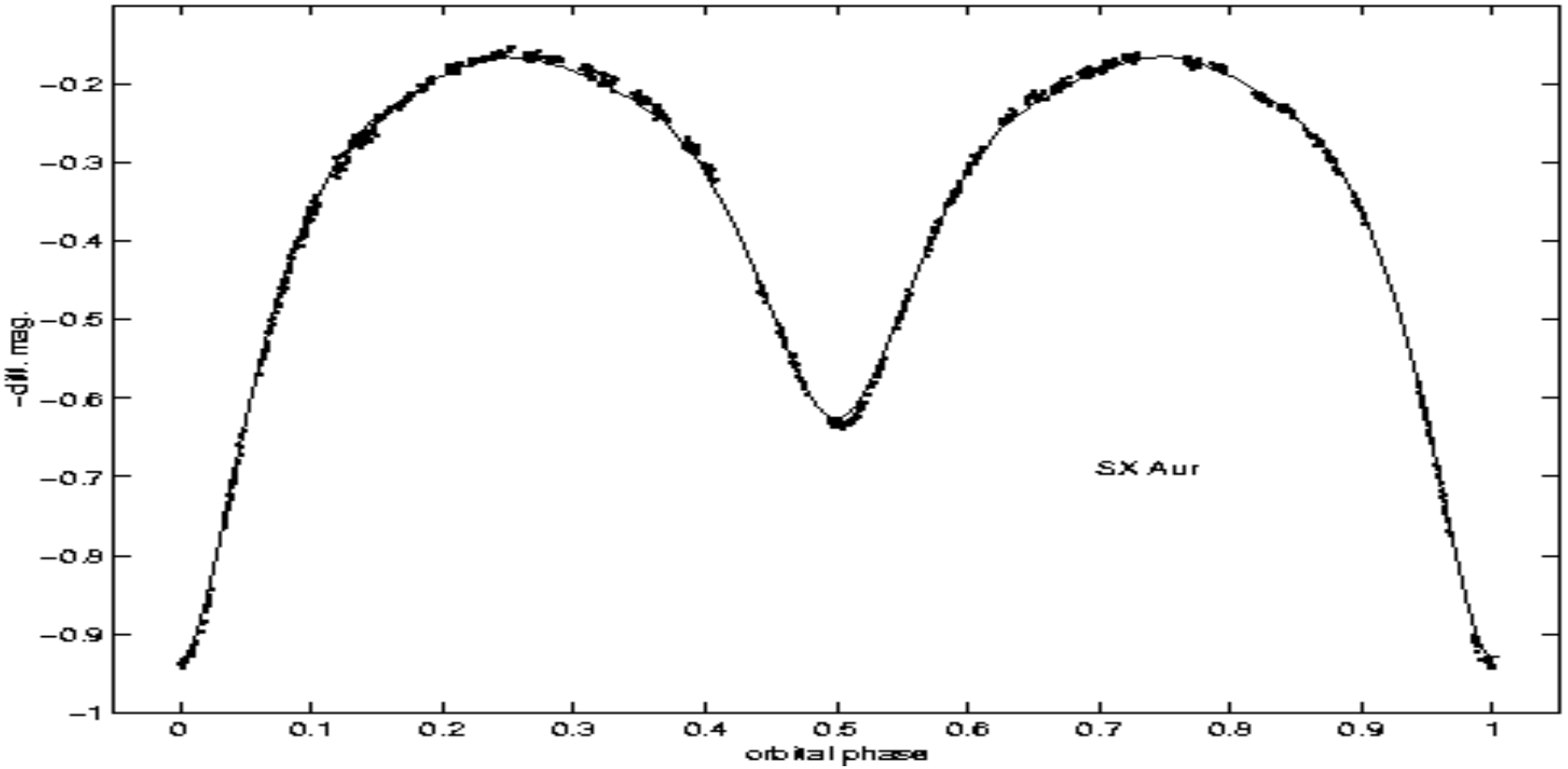
SX Aur -- almost contact



Ellipsoidal variations

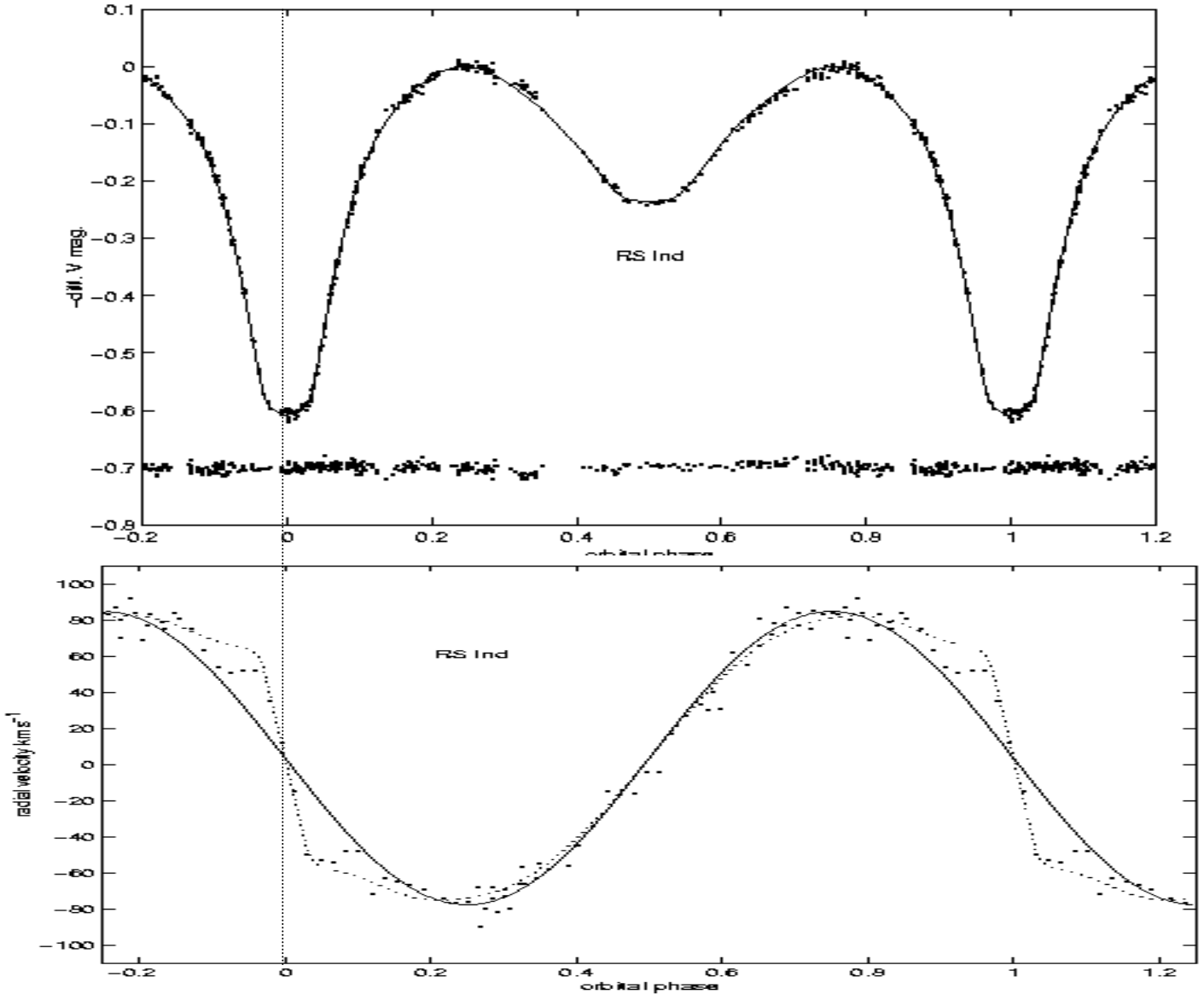
Partial eclipses

SX Aur -- Model Fit

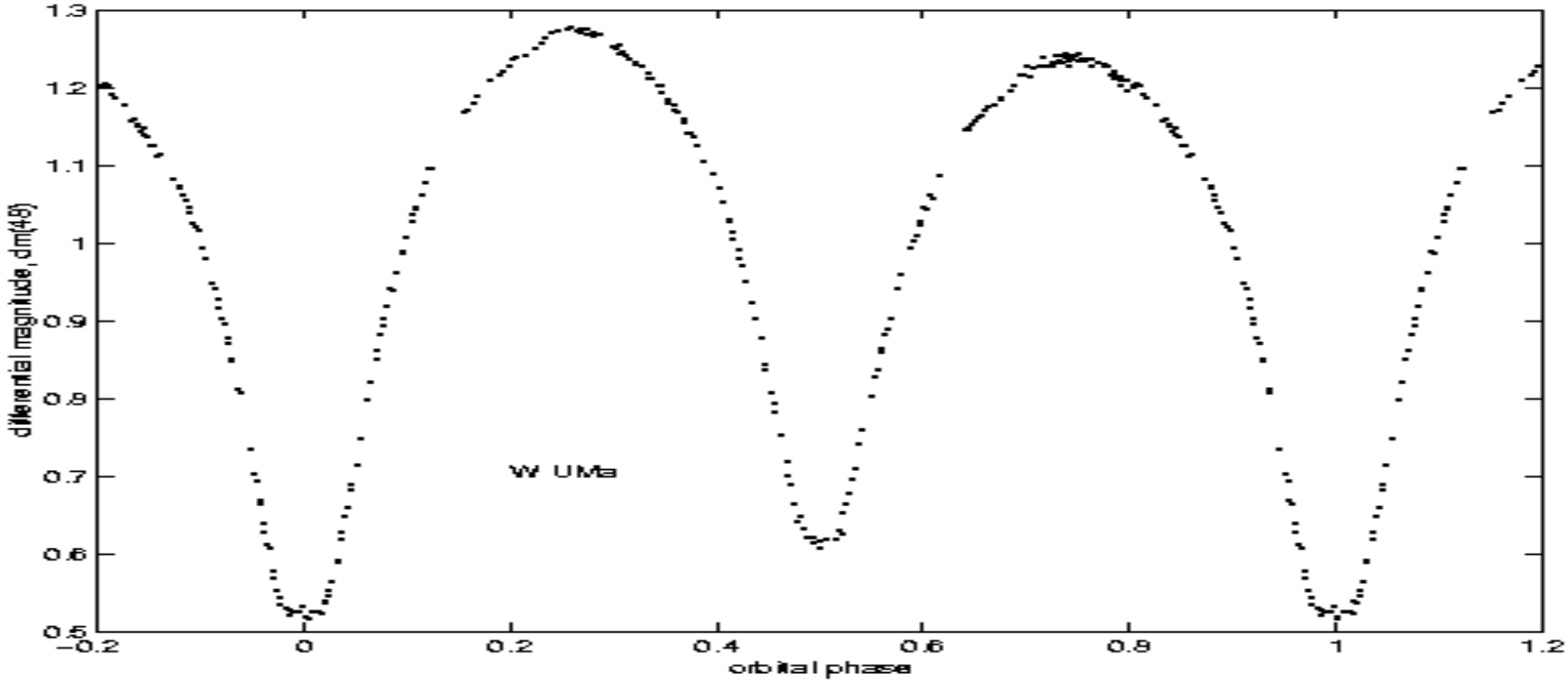


RS Ind -- Rossiter Effect

Eclipse of Rotating star



W UMa -- Contact Binary

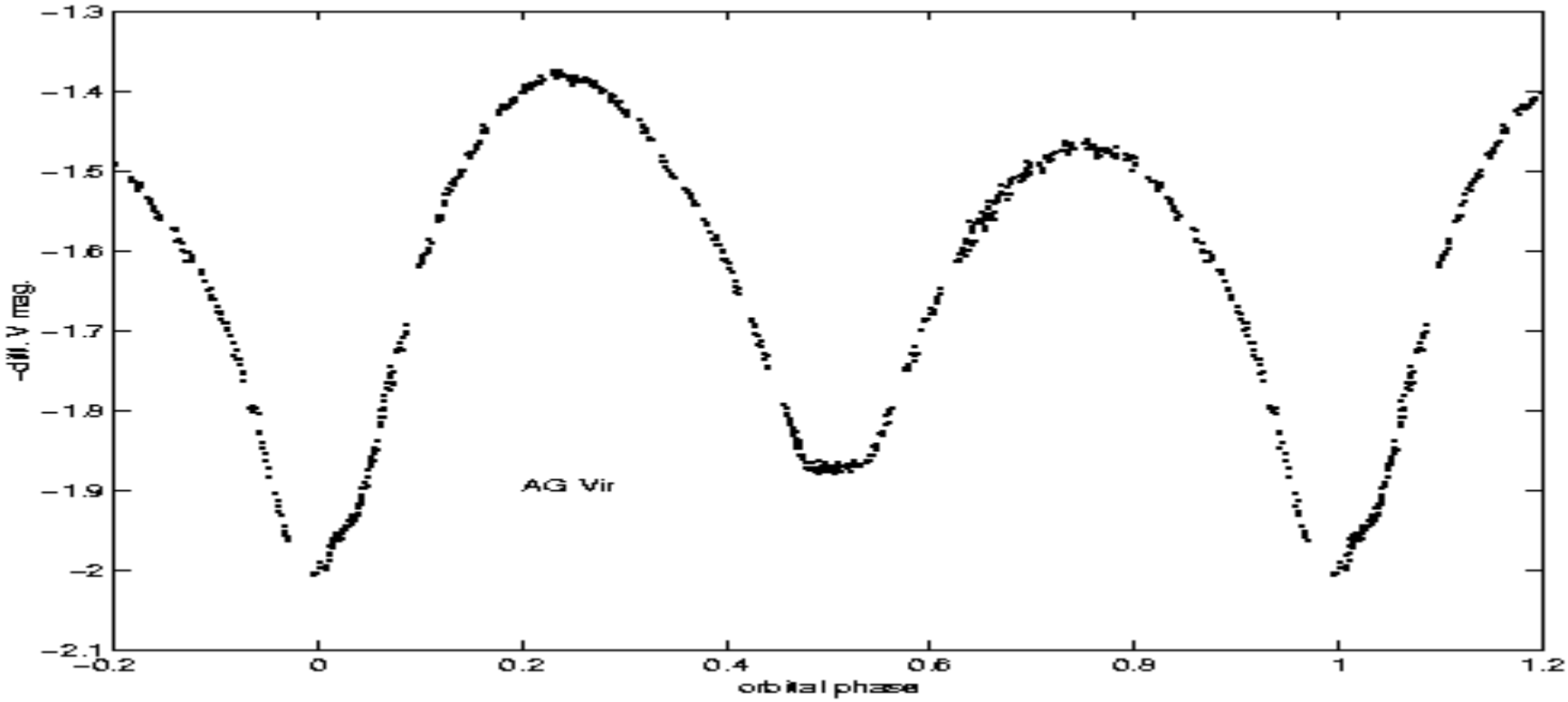


Similar eclipse depths --> similar T

Stars touch --> no clear start / end of eclipses

Asymmetry --> starspots

AG Vir

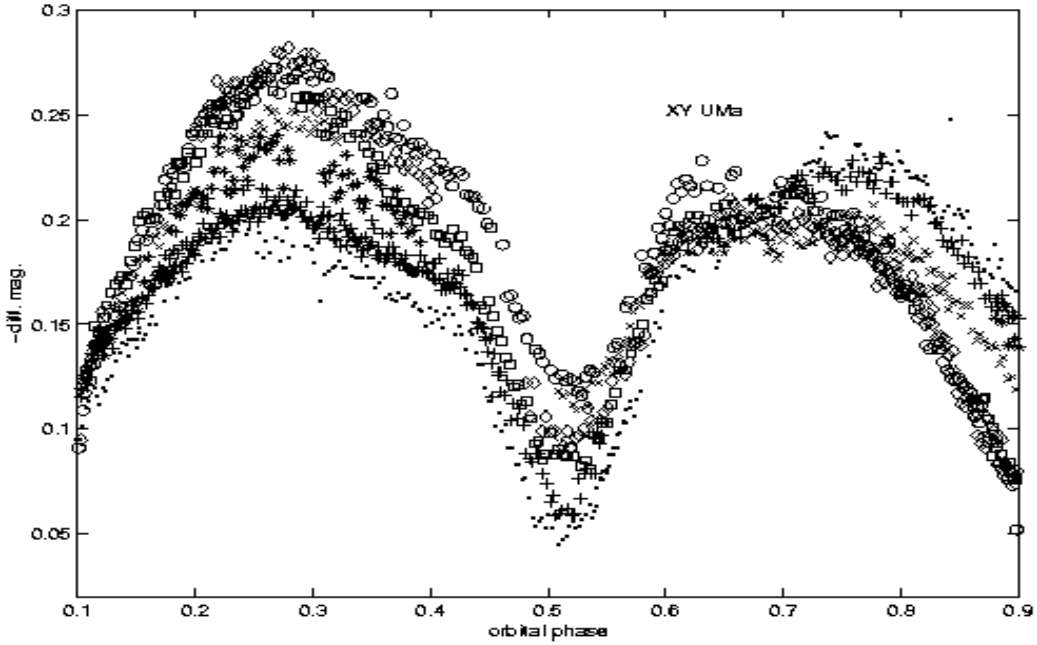


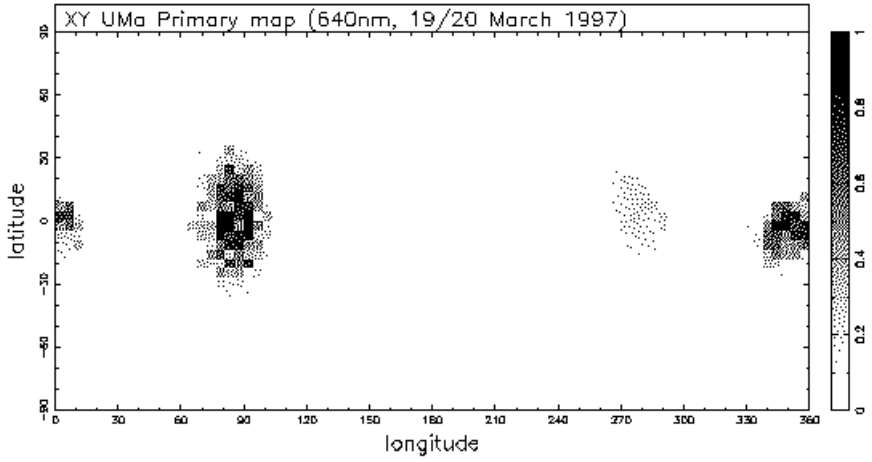
Total or Annular secondary eclipse

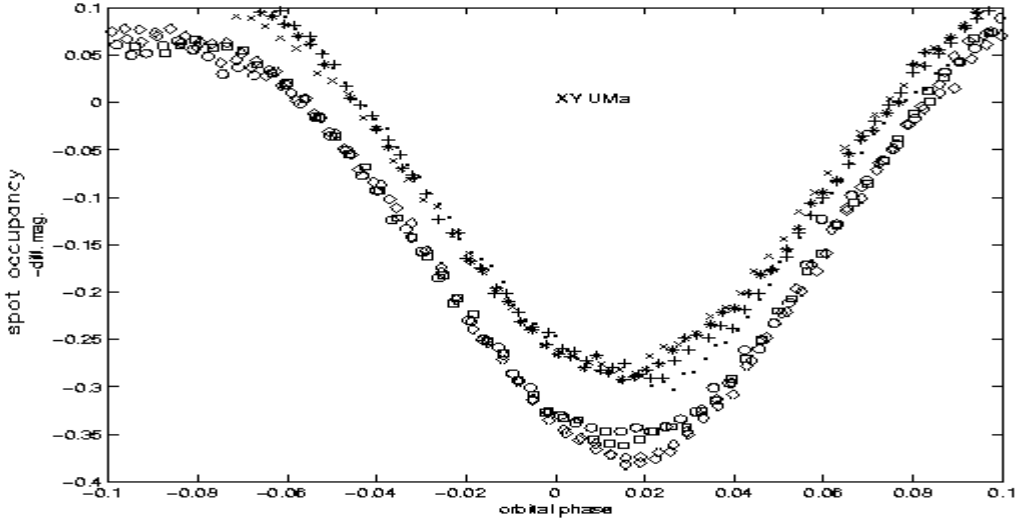
Asymmetric primary eclipse

XY UMa - RS CVn

Variable Starspot Activity



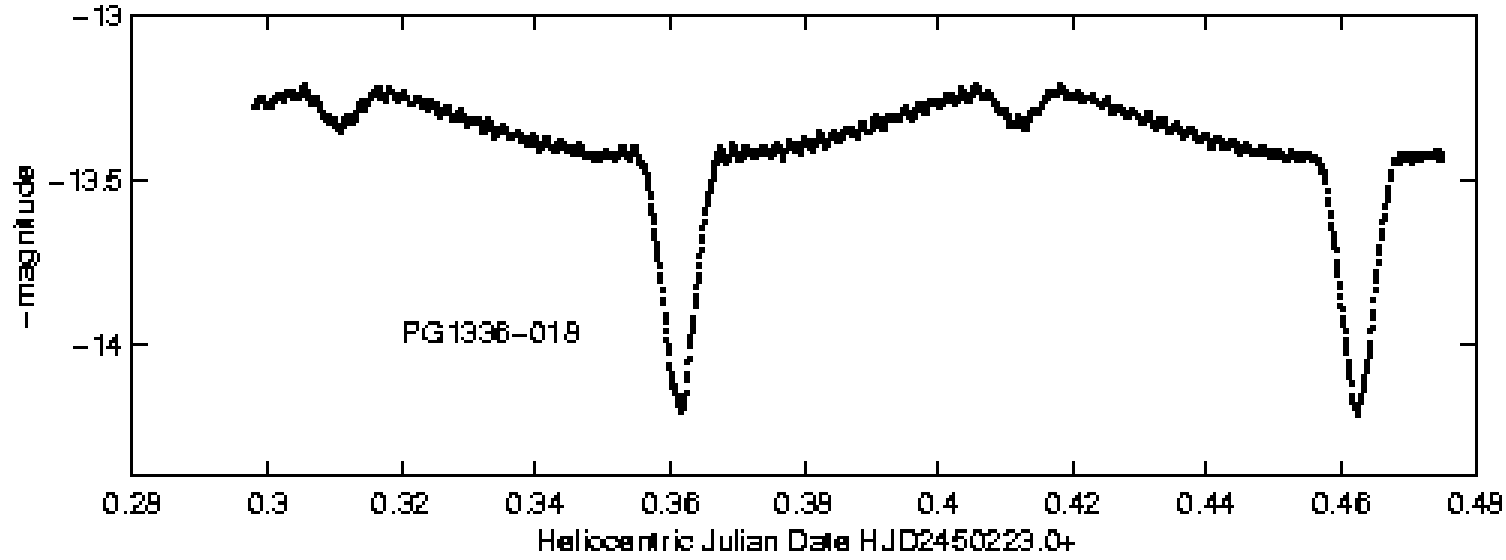


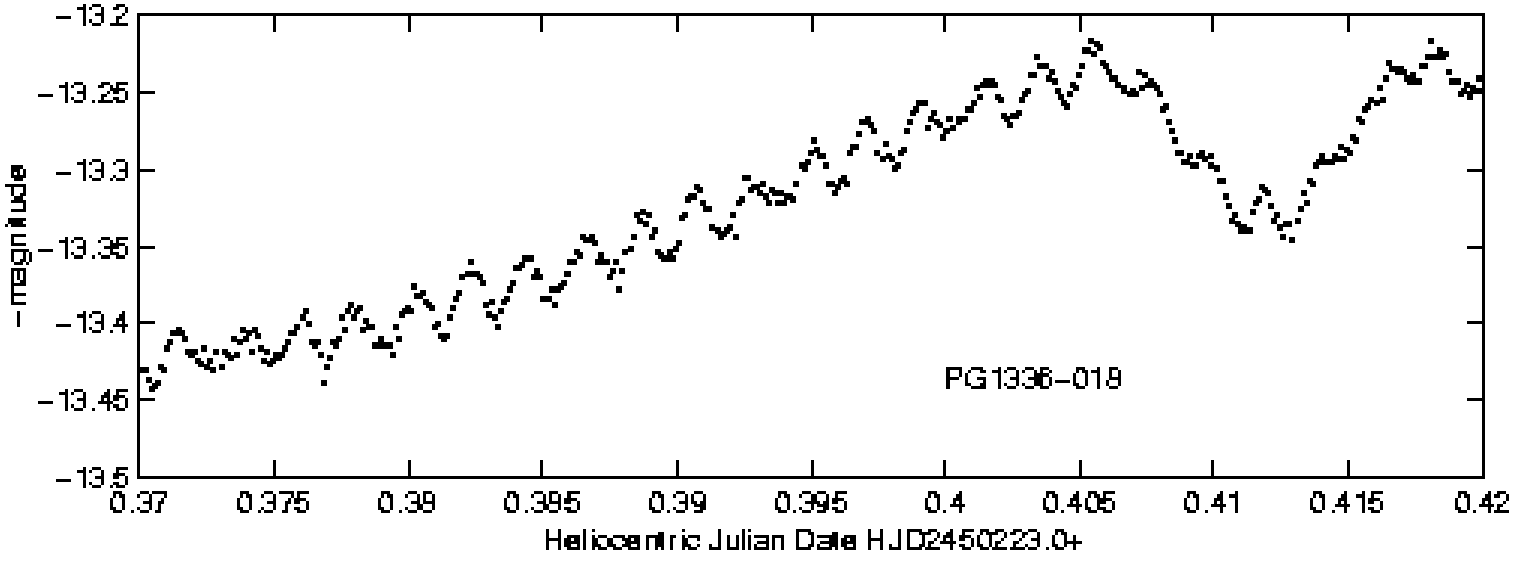


PG1336-018

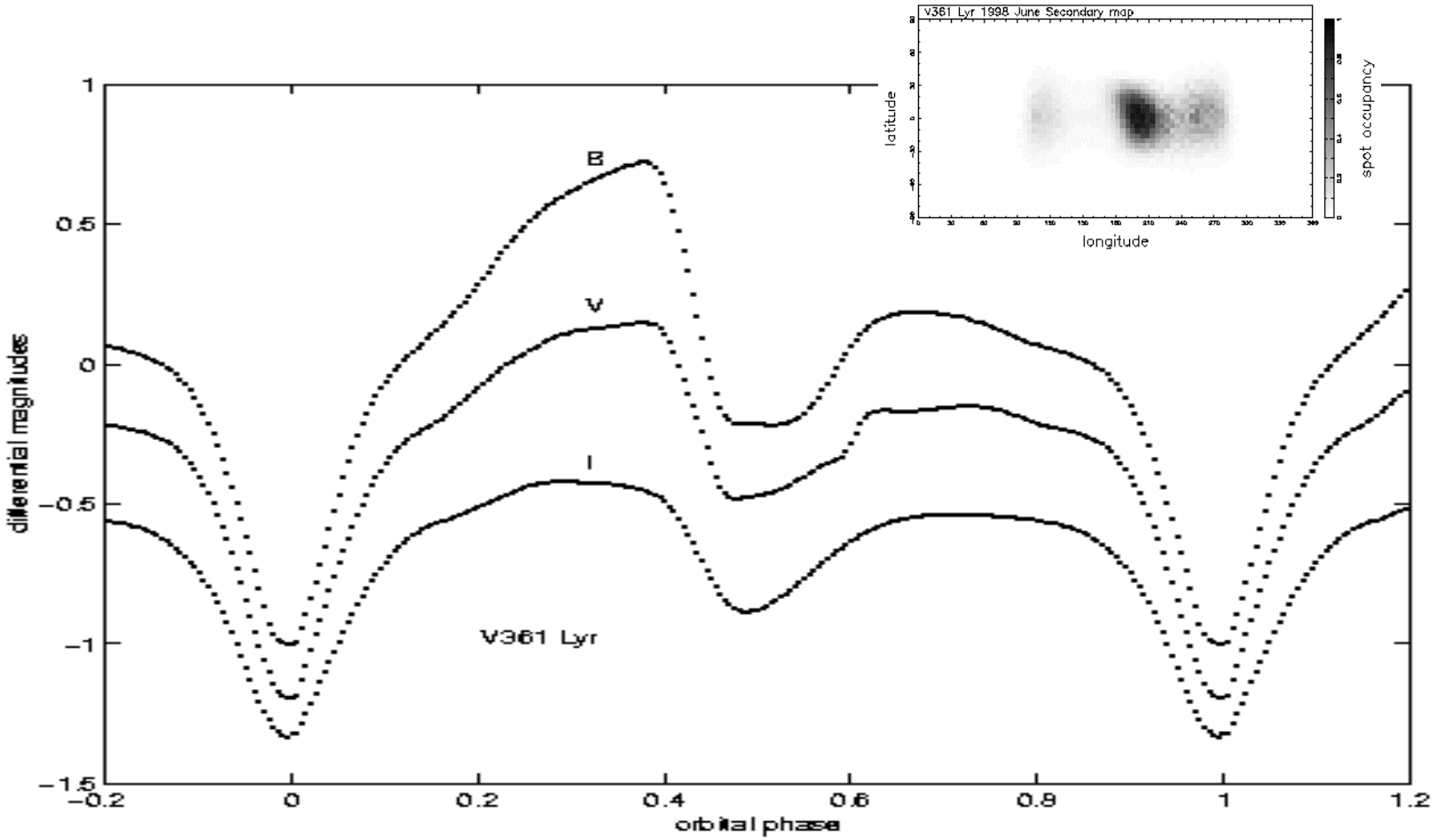
sdB pulsator

184 + 141 s





V361 Lyr - semi-detached



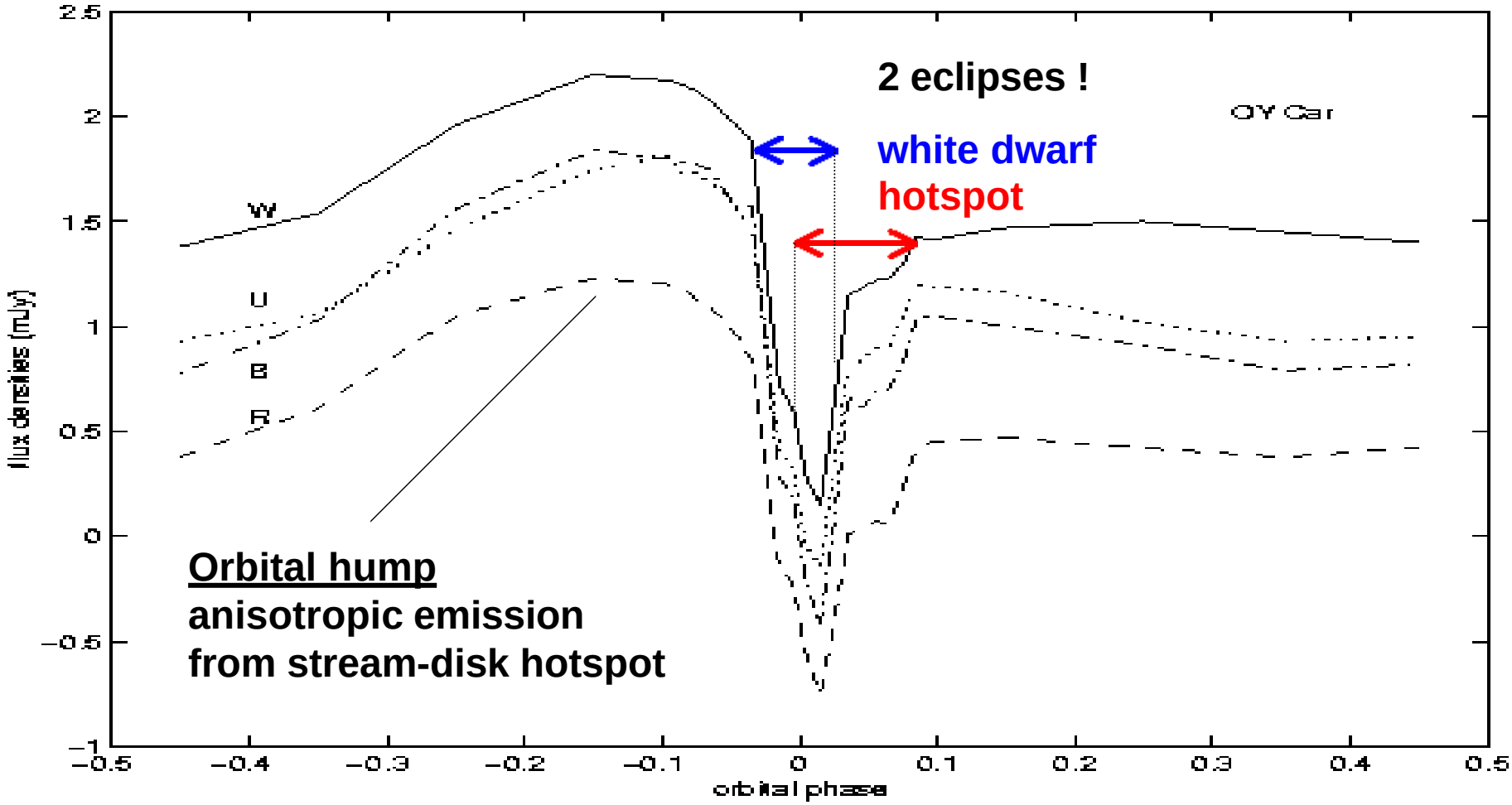
Primary fills Roche lobe

Ellipsoidal variations

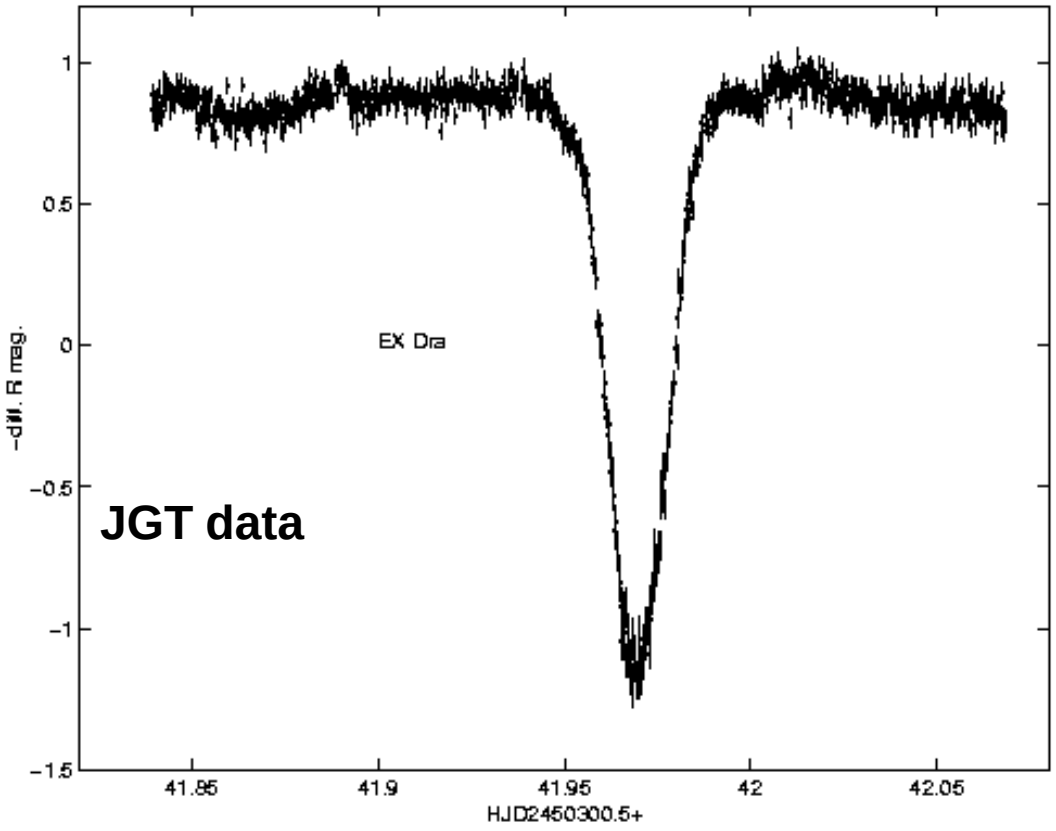
Asymmetric Heating -- stream hits secondary

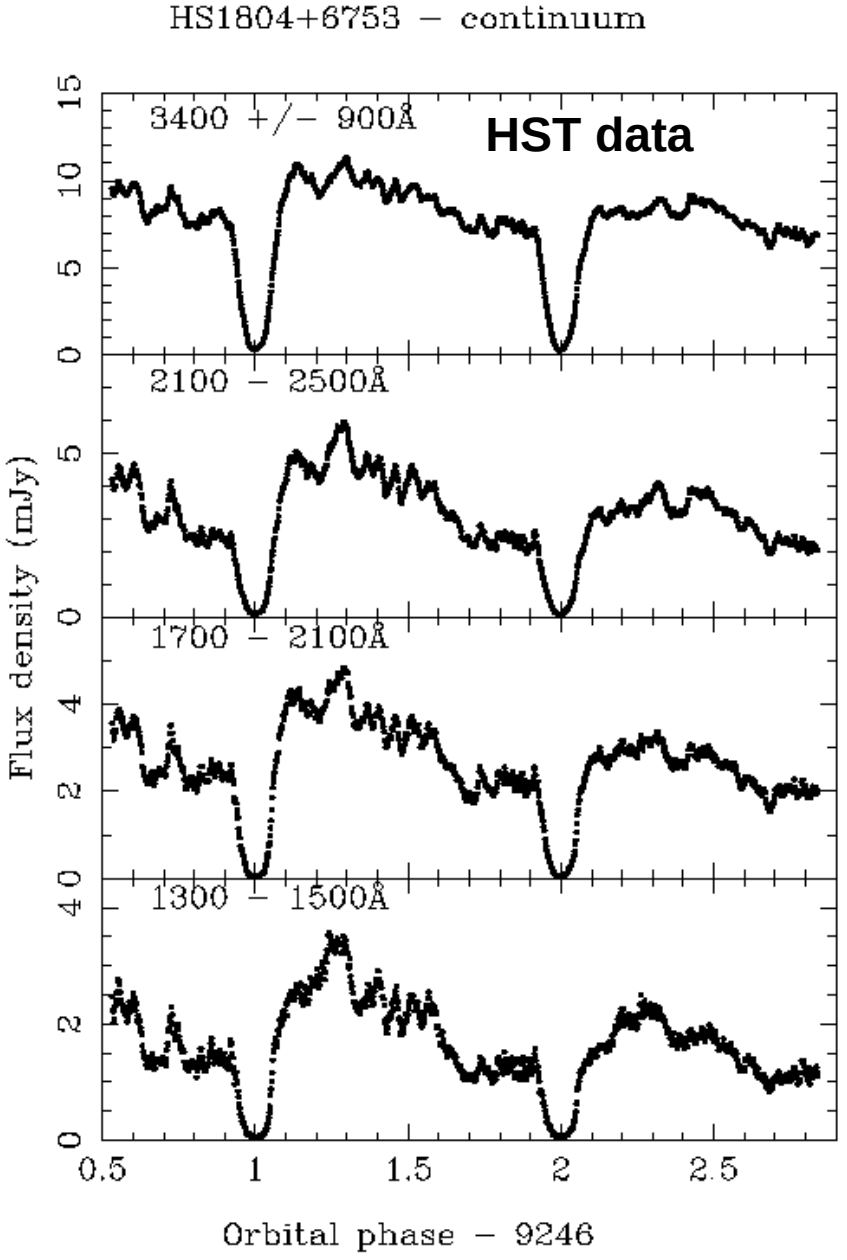
OY Car -- dwarf nova in quiescence

K,M star --> accretion disc --> white dwarf



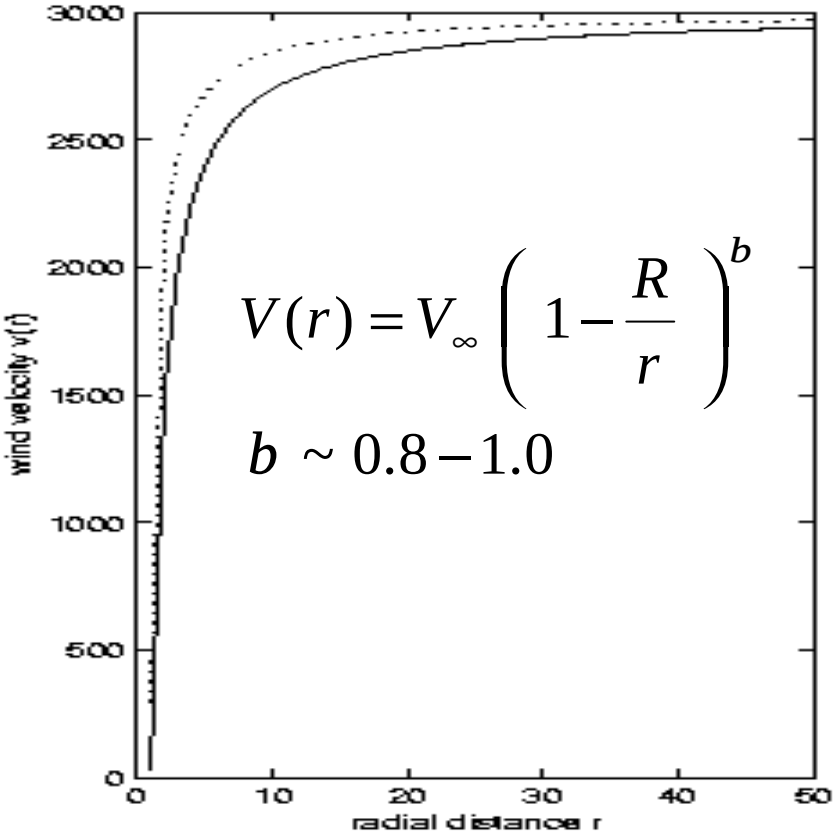
EX Dra -- dwarf nova in outburst





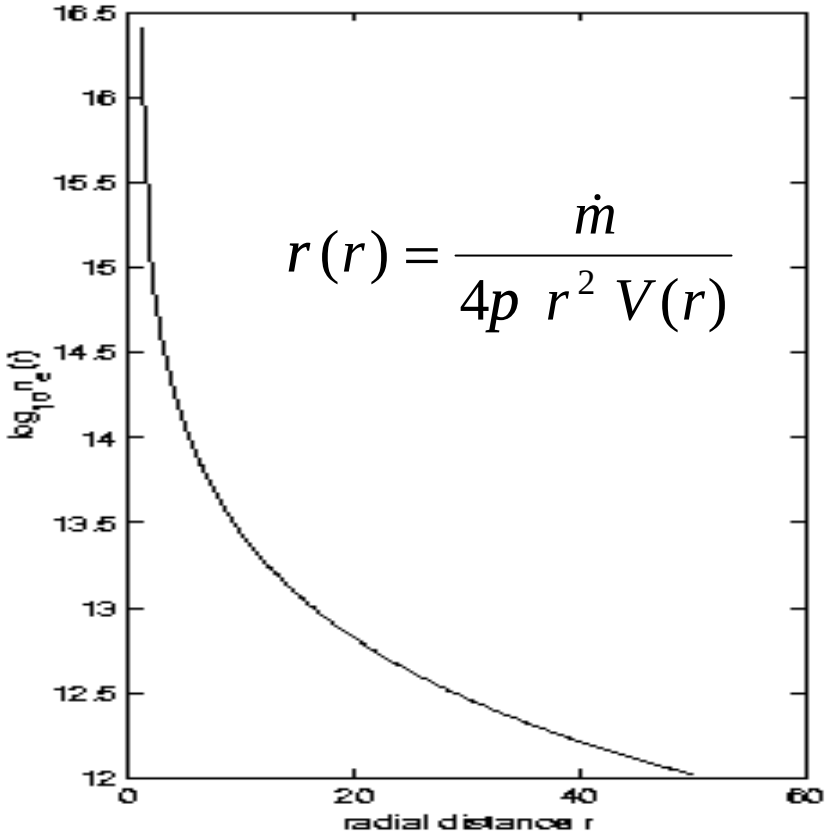
Accretion disc dominates the light

Wolf-Rayet Winds



$$V(r) = V_\infty \left(1 - \frac{R}{r} \right)^b$$

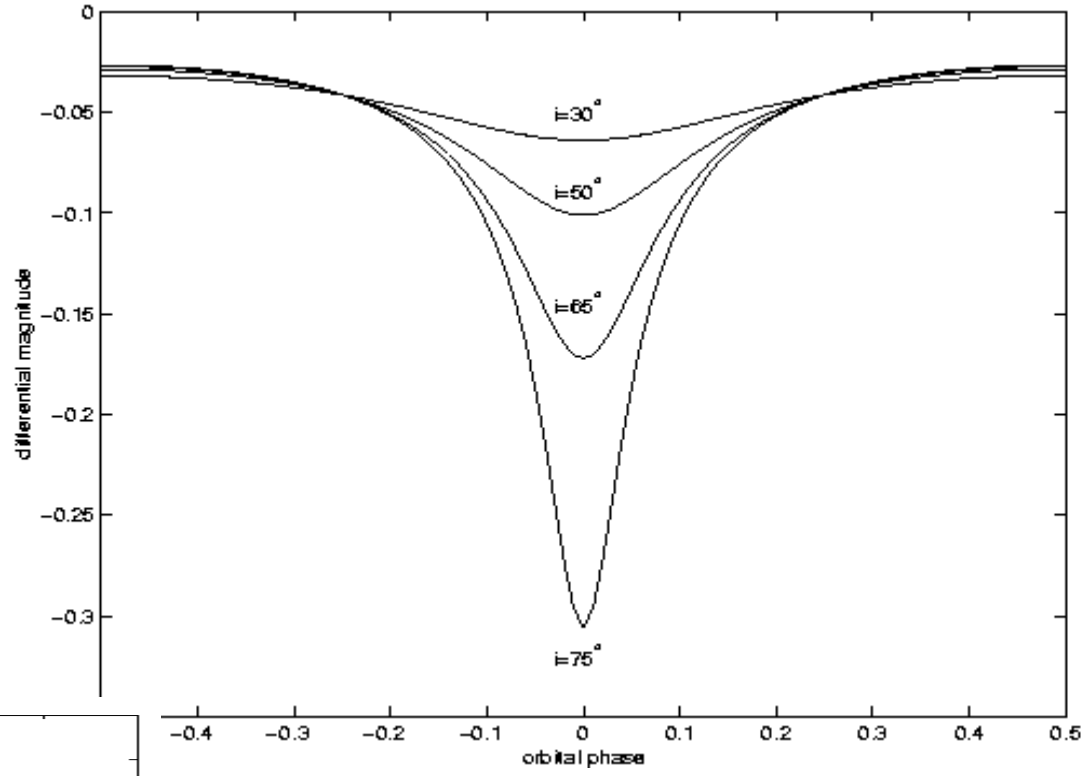
$$b \sim 0.8 - 1.0$$



$$r(r) = \frac{\dot{m}}{4p\ r^2\ V(r)}$$

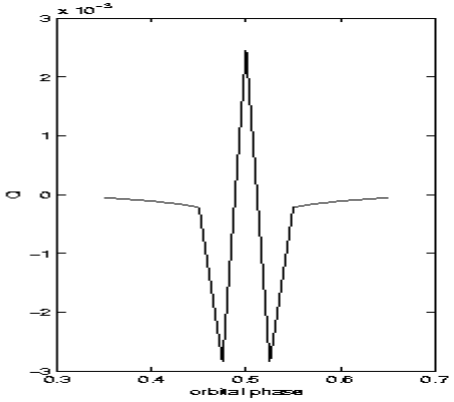
WR+O binary

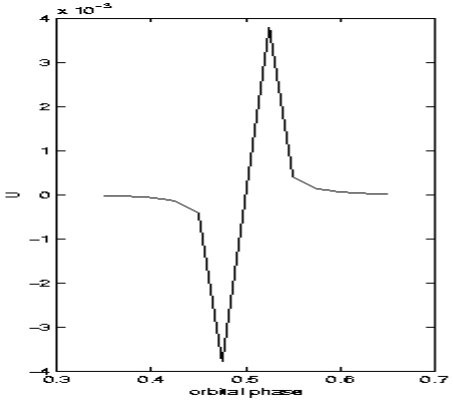
O star viewed thru WR wind



Polarisation effects

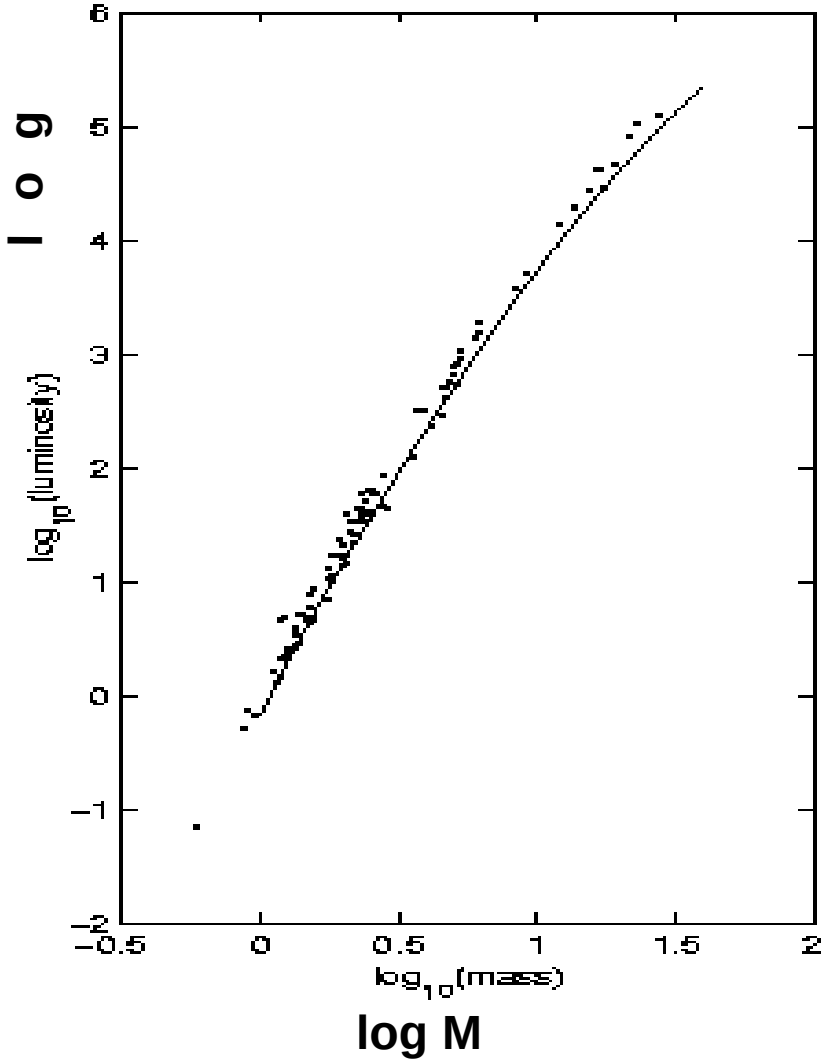
WR wind eclipsed by O star



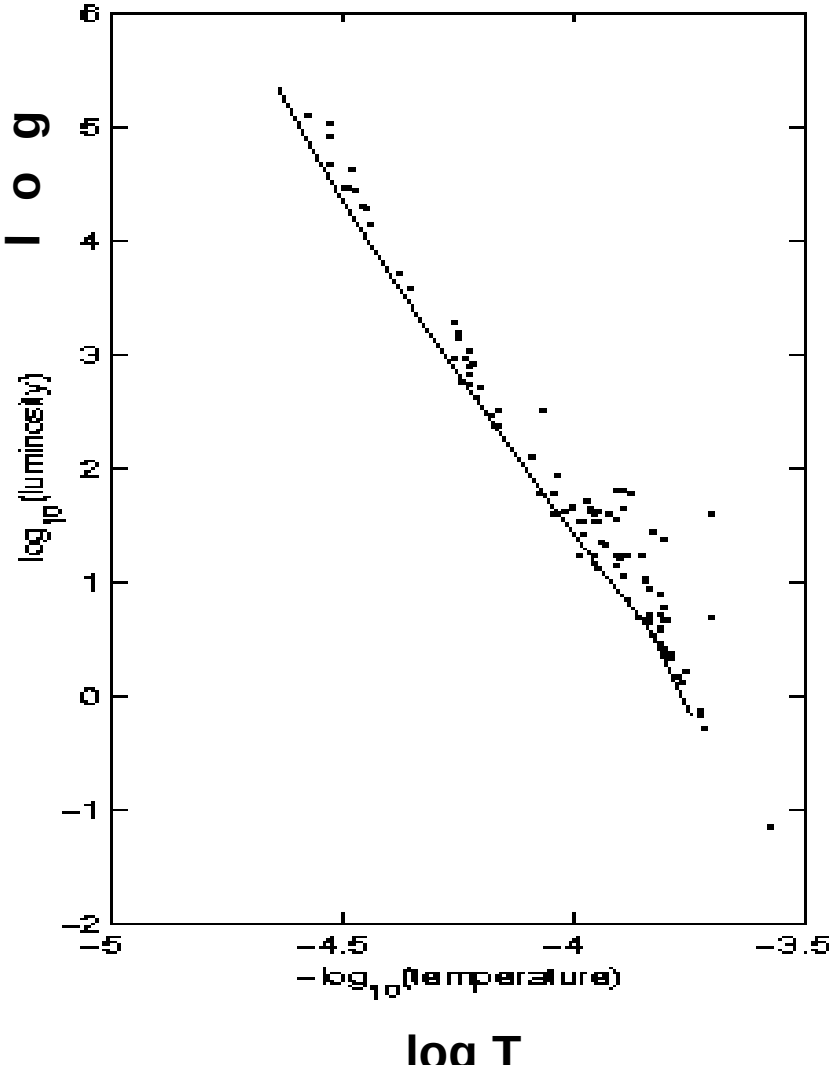


Testing Stellar Evolution Theory

Detached Binaries

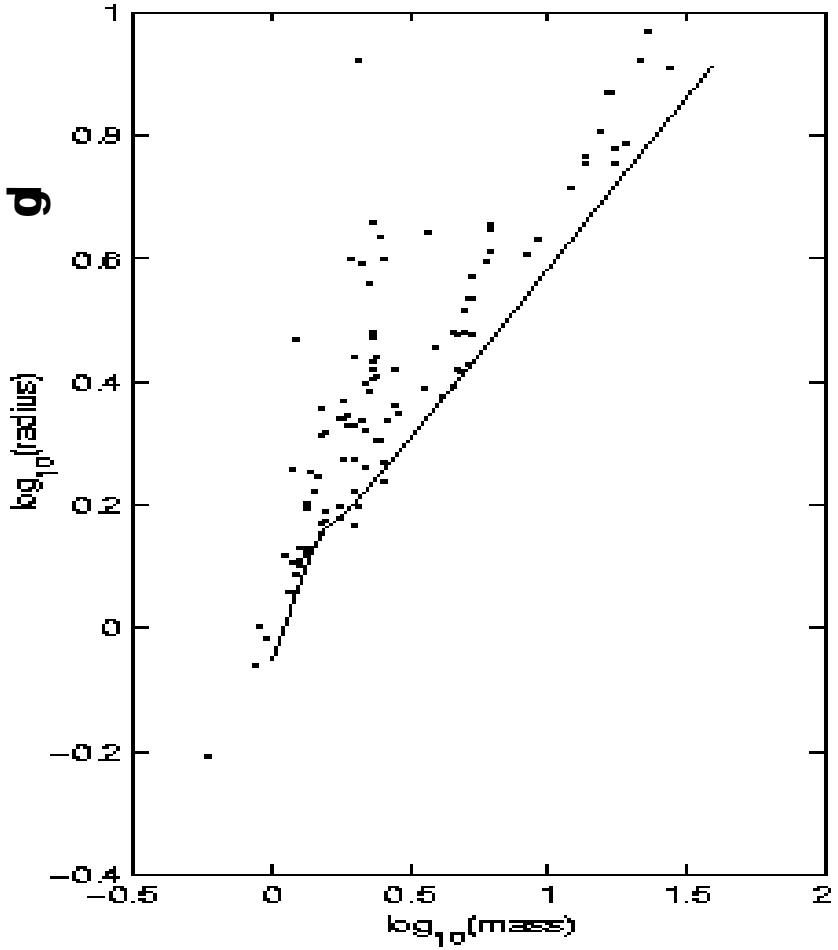


log M

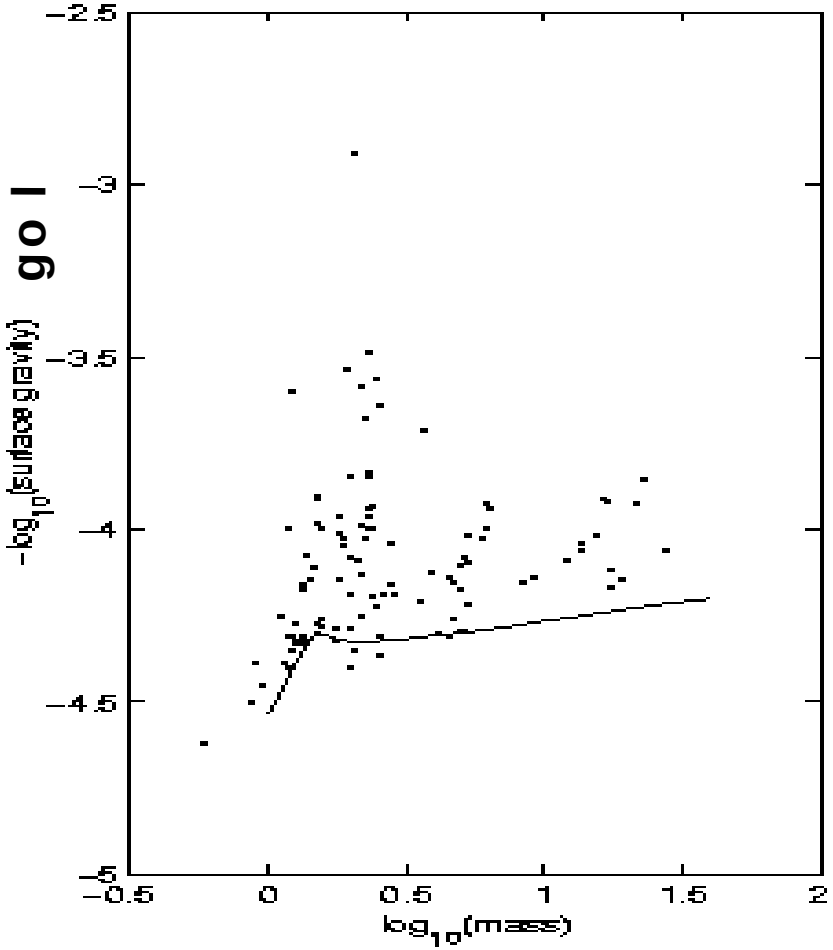


log T

Detached Binaries



log M

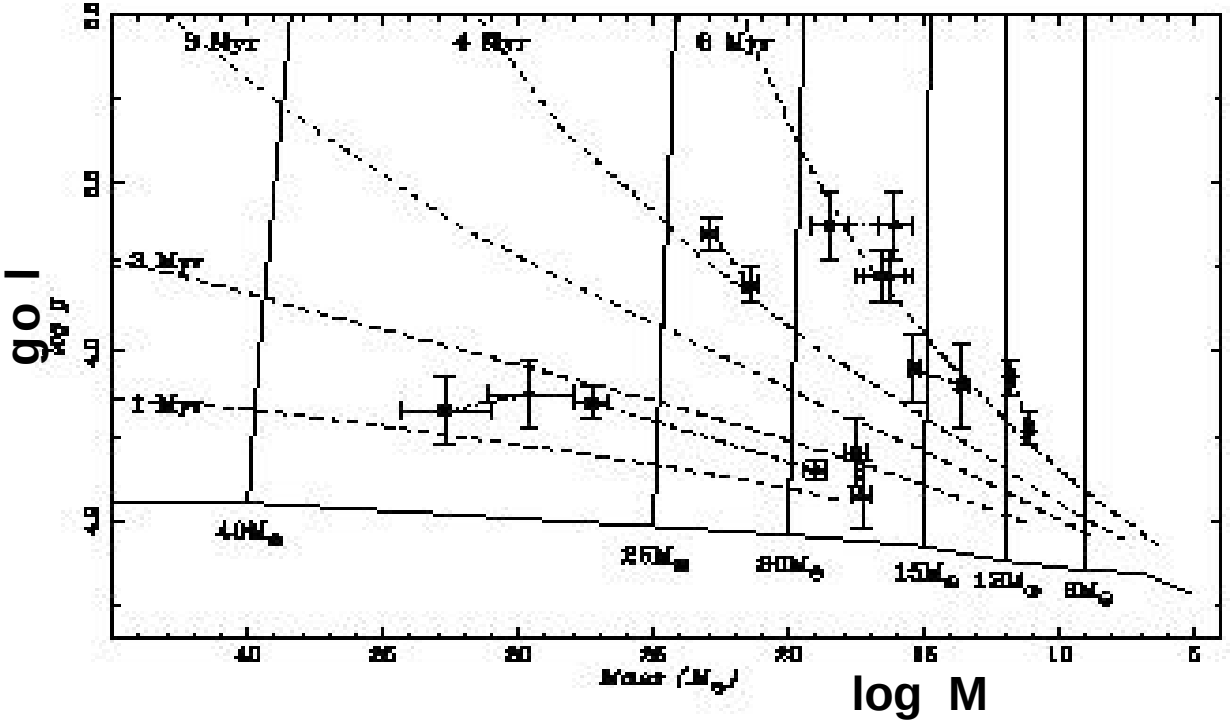


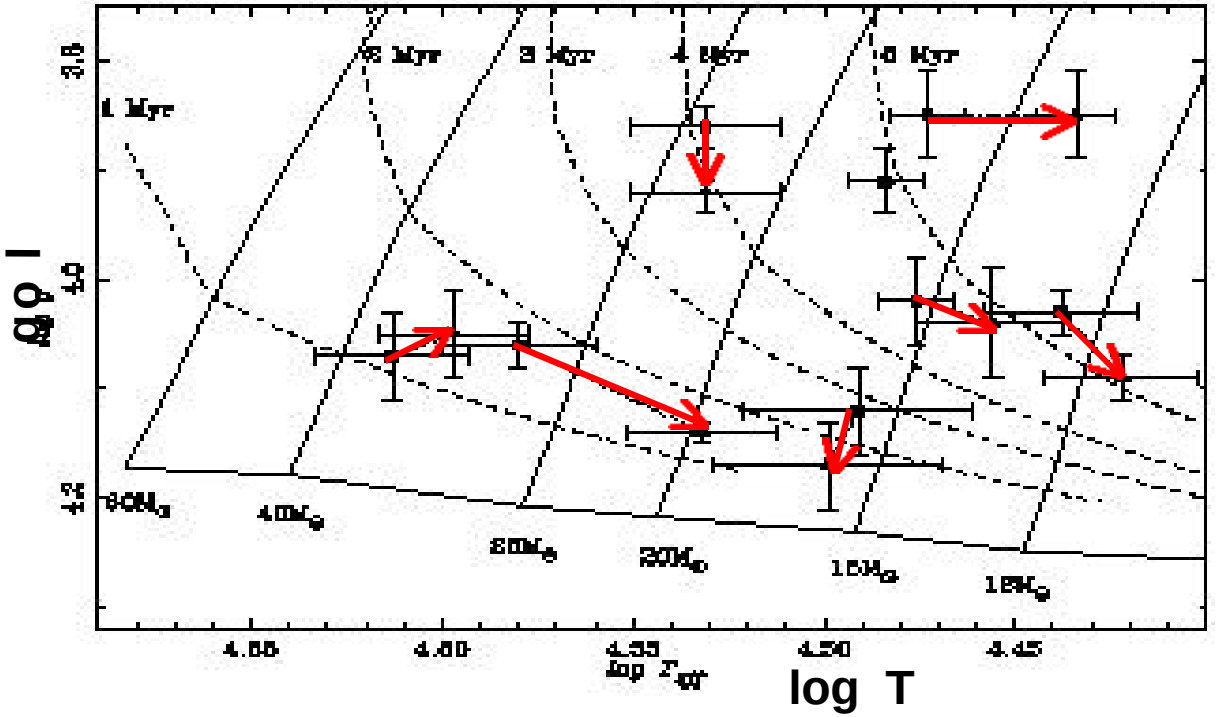
log M

Detached O-star binaries

2 stars have same age

tests stellar evolution theory





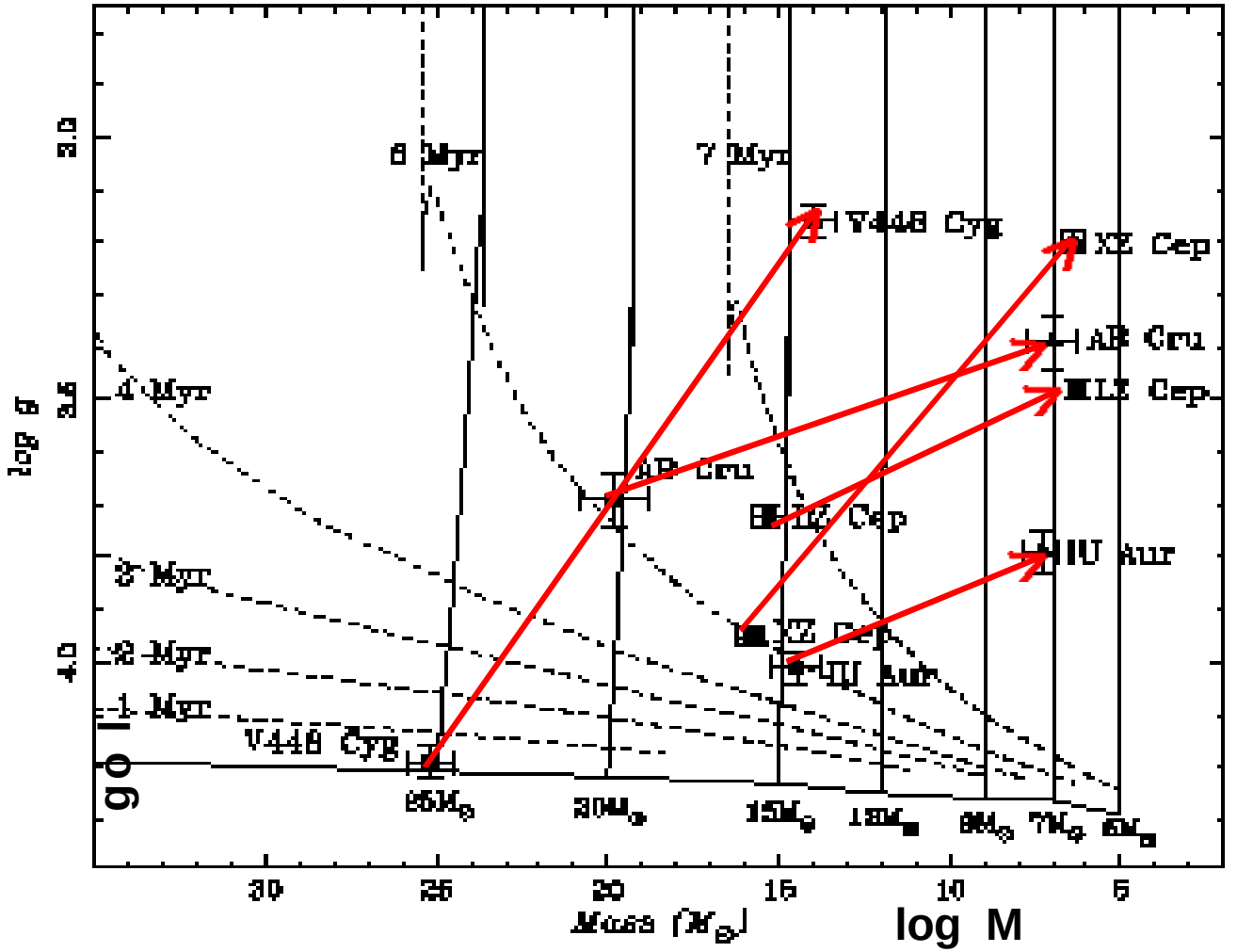
Harries, Hilditch 1997

Semi-Detached O-star binaries

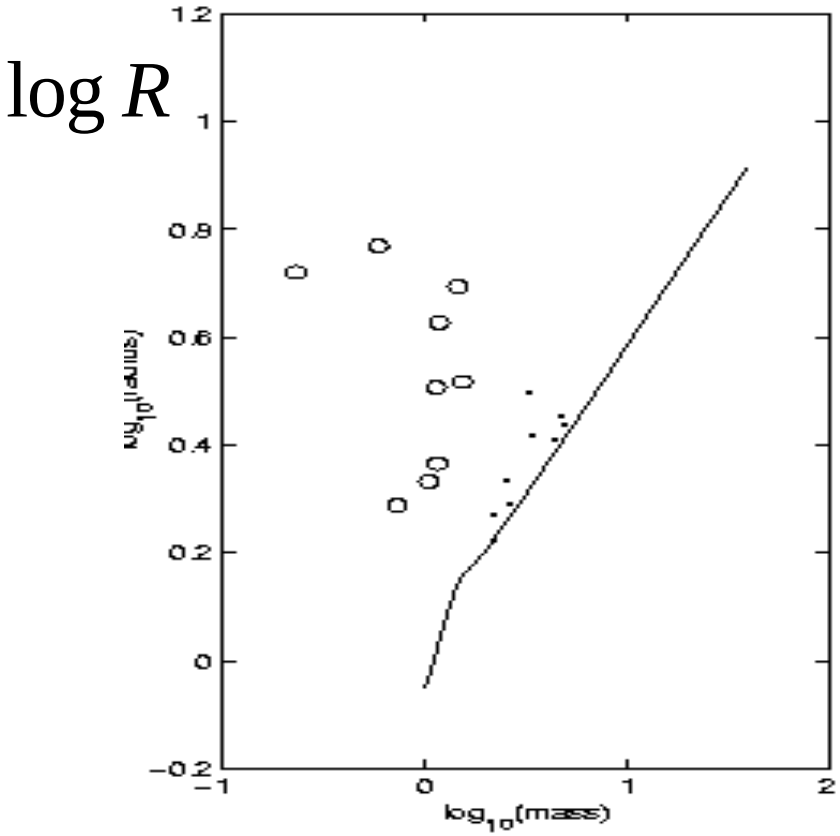
star 2
lower mass
looking older

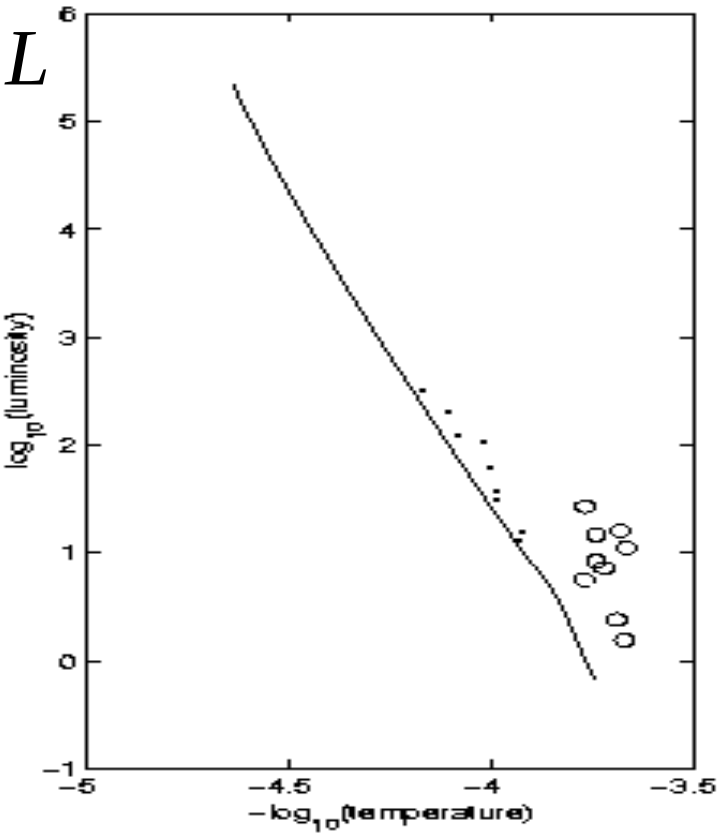
evidence of mass transfer

Harries, Hilditch 1997



Algol Paradox



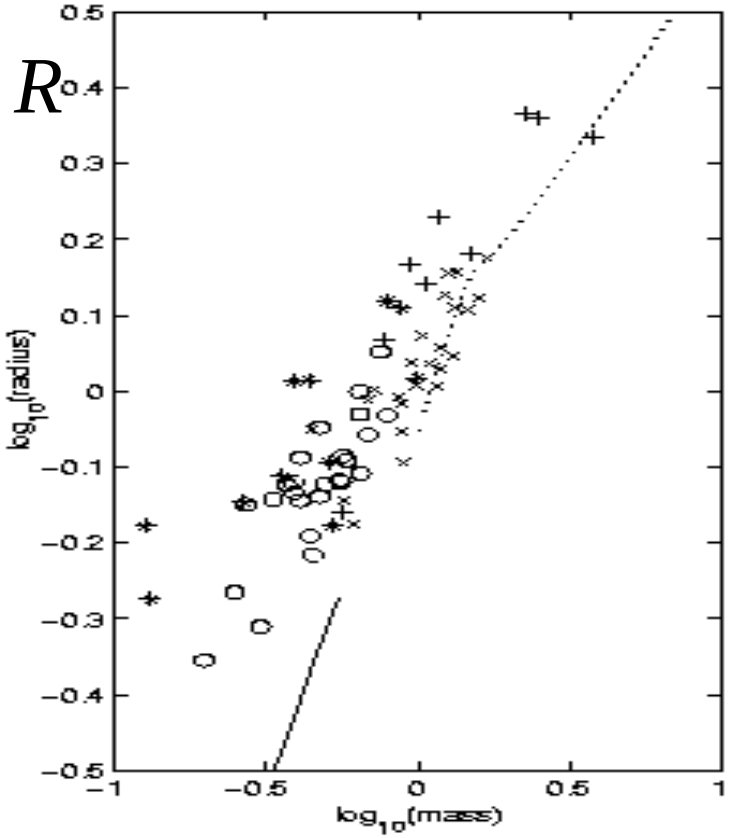


Sub-giant secondary (lower mass) is more evolved than primary

caused by mass transfer

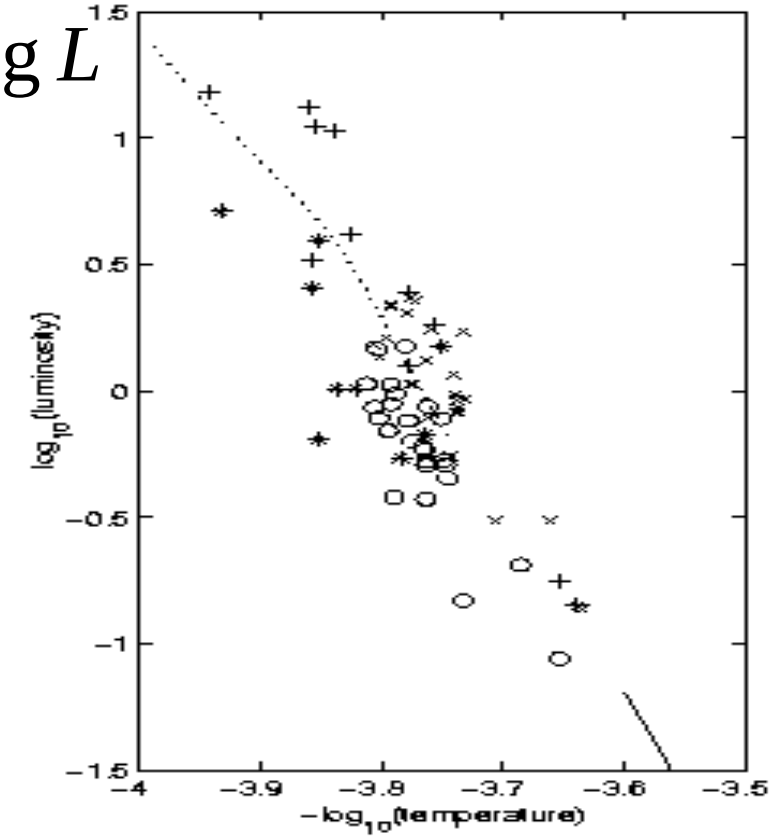
Contact Binaries

$\log R$



$\log m$

$\log L$



$\log T$

Energy exchange thru the neck

Radii and Luminosity higher for given mass than on main sequence.

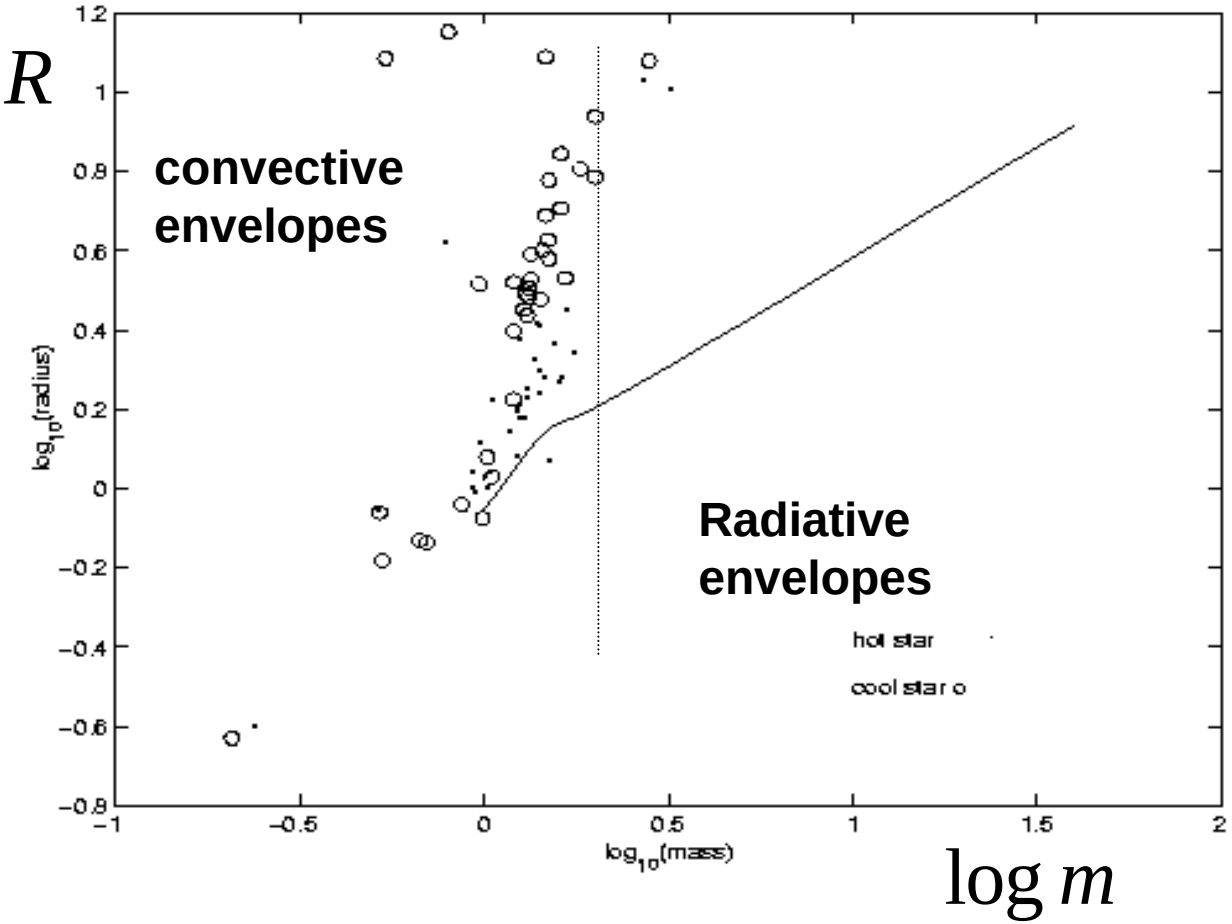
Active Chromosphere binaries

RS CVn

+ BY Dra

stars

rotation + convection = magnetic activity



Cooler (e.g. K subgiant) secondary star

more evolved than hotter (e.g. GV) primary star

Lower Main Sequence