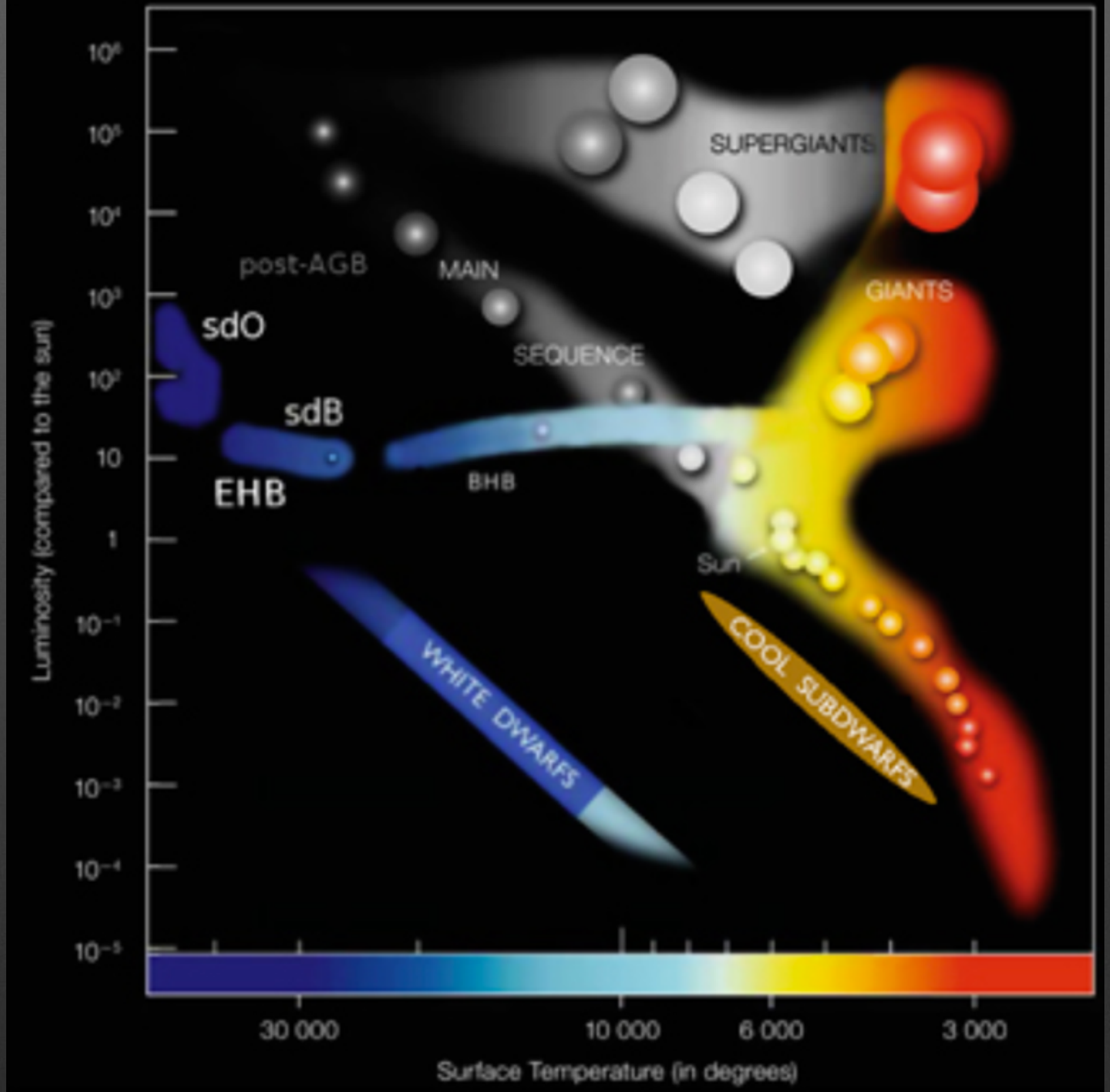
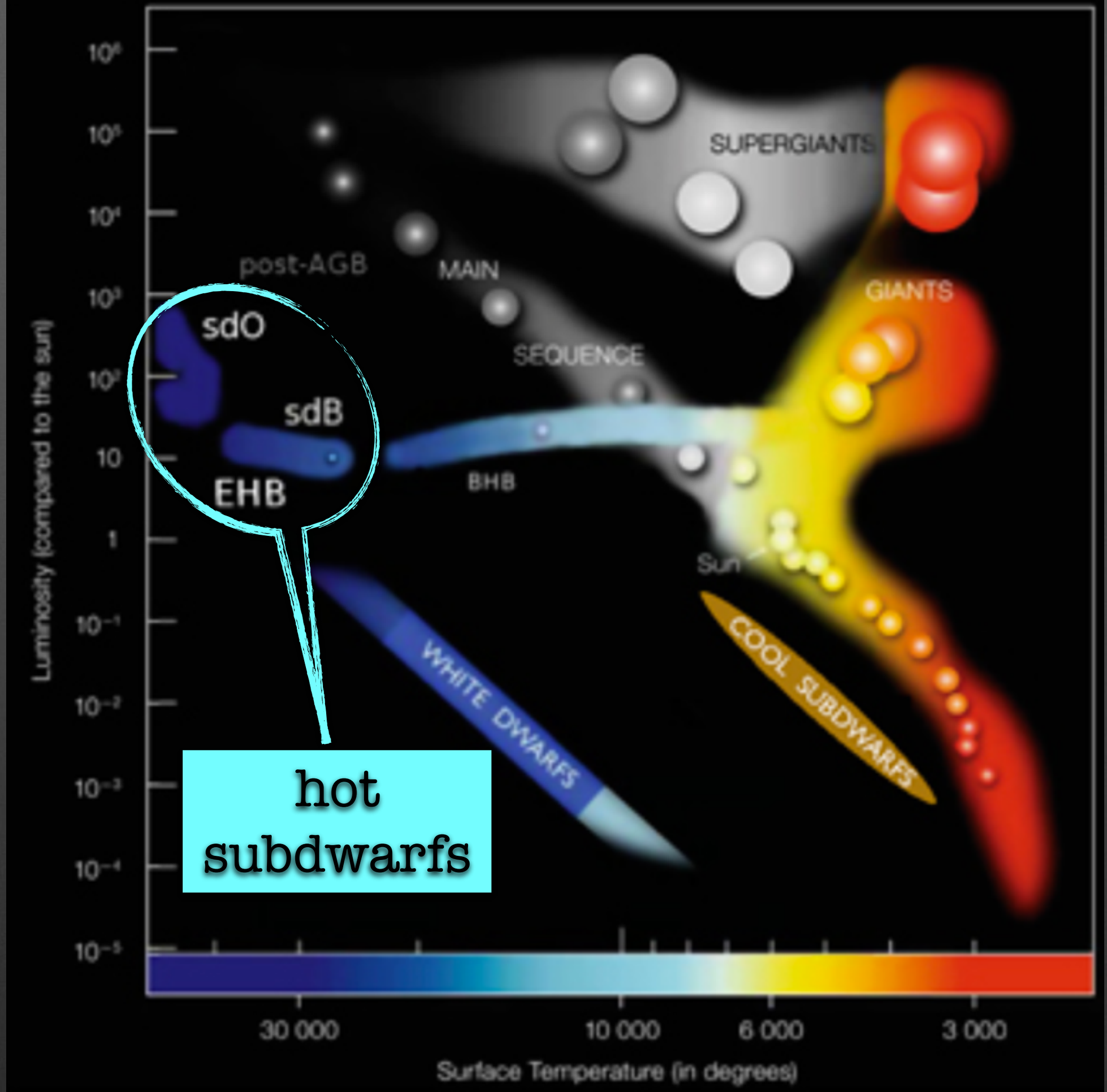
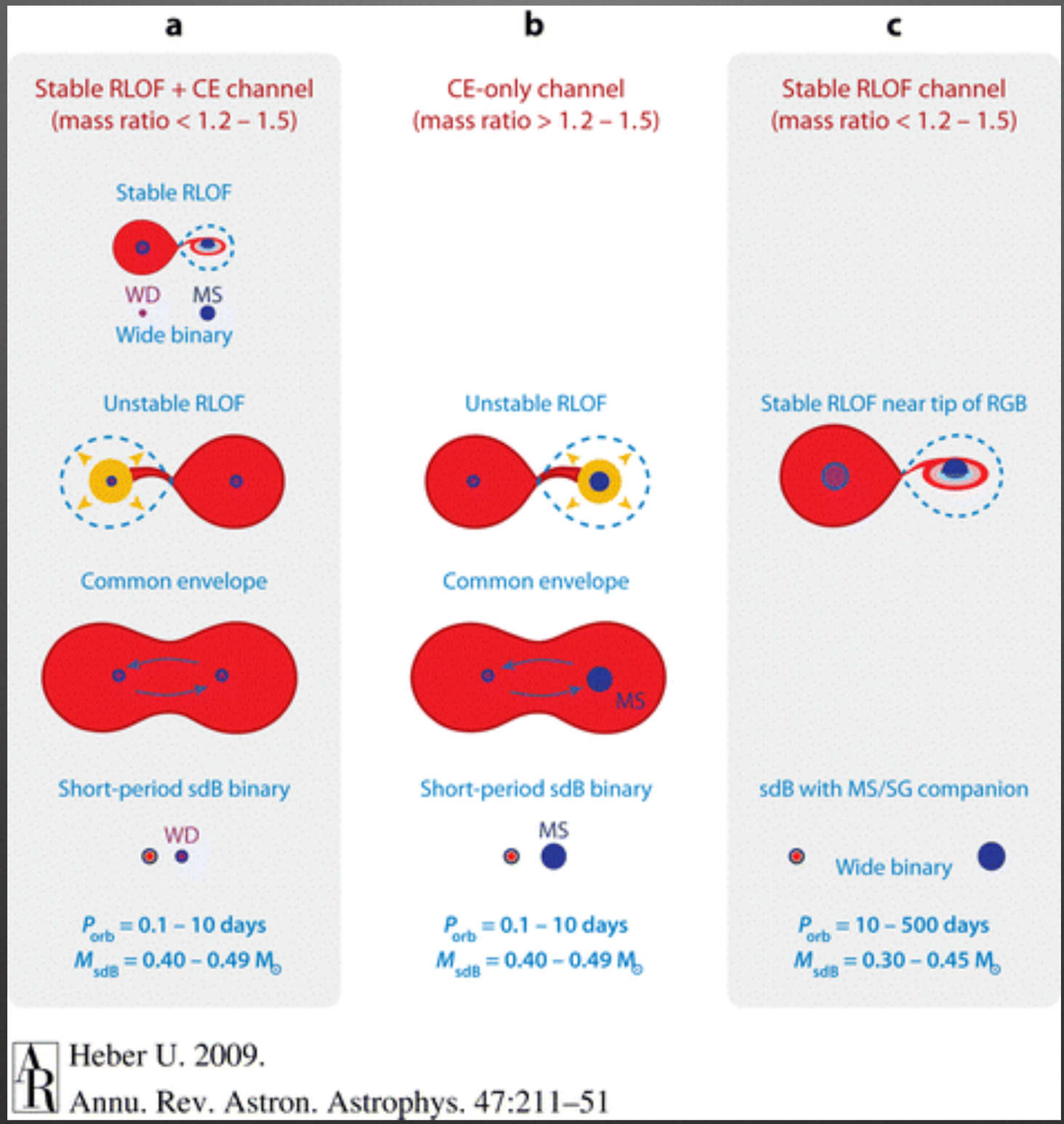
Close binary stars
part III

- Hot subdwarf stars I part
- Hot subdwarf stars II part
- Observables & Observational properties
- Observing techniques
- Time domain / time series
- FT & LS Fitting
- Tools for Frequency Analysis
- Tools for binary modelling
- Binary modelling of your favourite CBS
- MESA binary modul I
- MESA binary modul II
- MESA project


Luminosity (compared to the sun)
10^{6}
10^{5}
10^{4}
10^{3}
10^{2}
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
SUPERGIANTS
post-AGB
MAIN
SEQUENCE
GIANTS
sdO
sdB
EHB
BHB
Sun
WHITE DWARFS
COOL SUBDWARFS
30 000
10 000
6 000
3 000
Surface Temperature (in degrees)

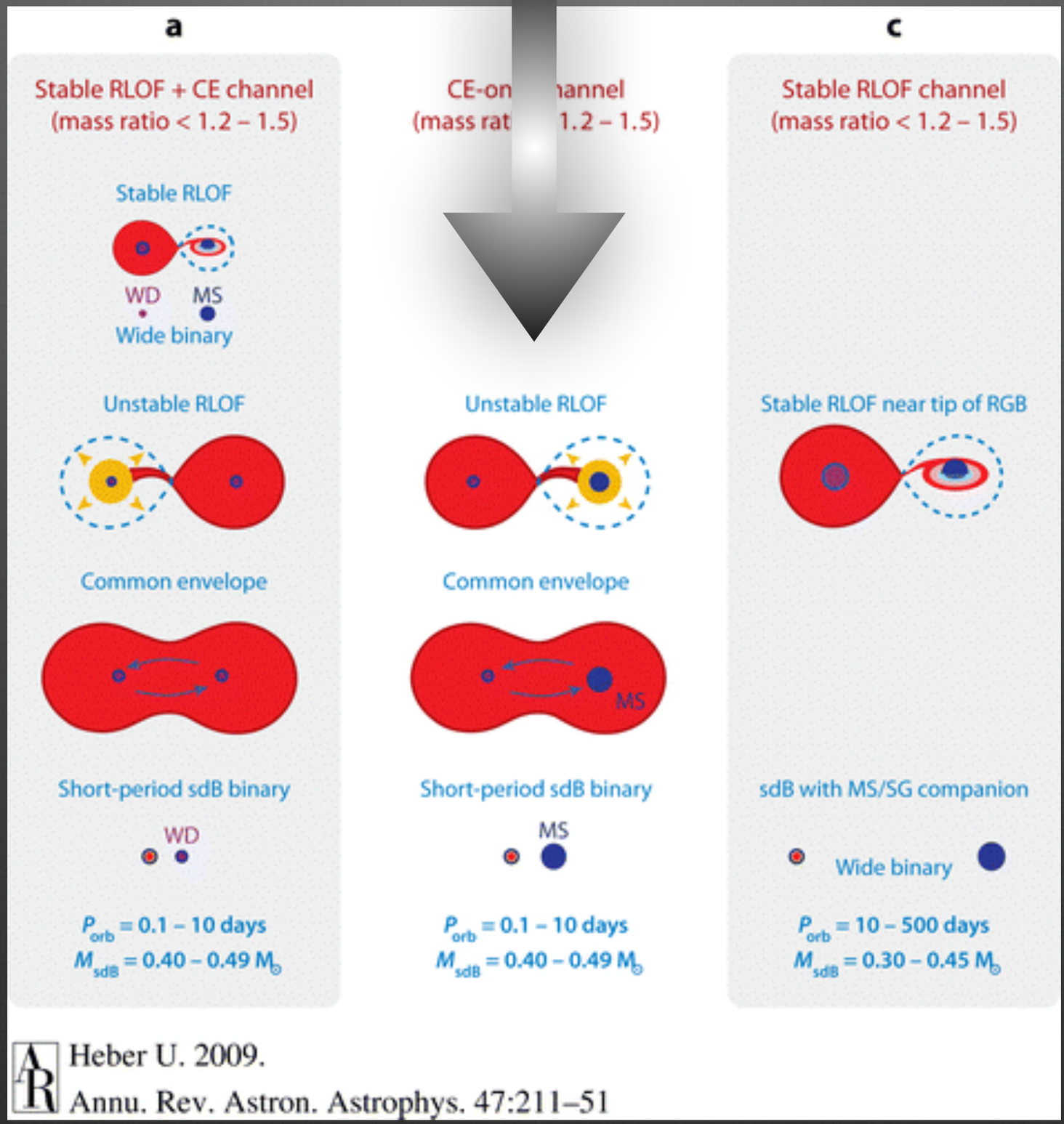

SUPERGIANTS
GIANTS
post-AGB
MAIN
SEQUENCE
sdO
sdB
EHB
BHB
Sun
WHITE DWARFS
COOL SUBDWARFS
hot
subdwarfs
Luminosity (compared to the sun)
Surface Temperature (in degrees)
30 000
10 000
6 000
3 000

Subenanas calientes (sdB)



Heber U. 2009.
Annu. Rev. Astron. Astrophys. 47:211–51

Subenanas calientes (sdB)



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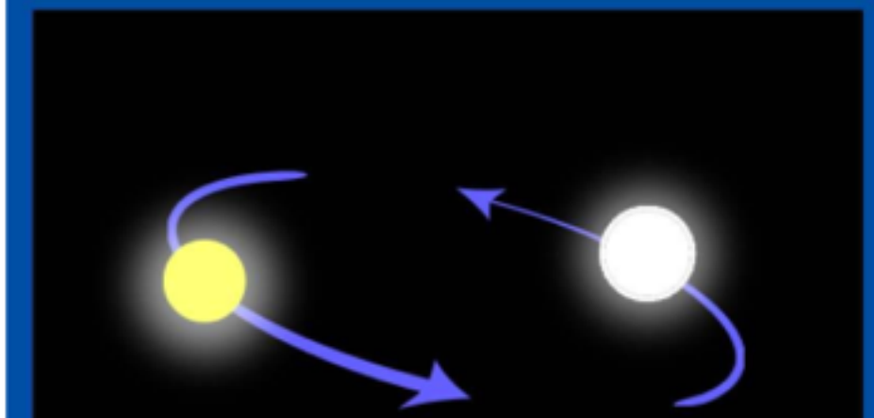
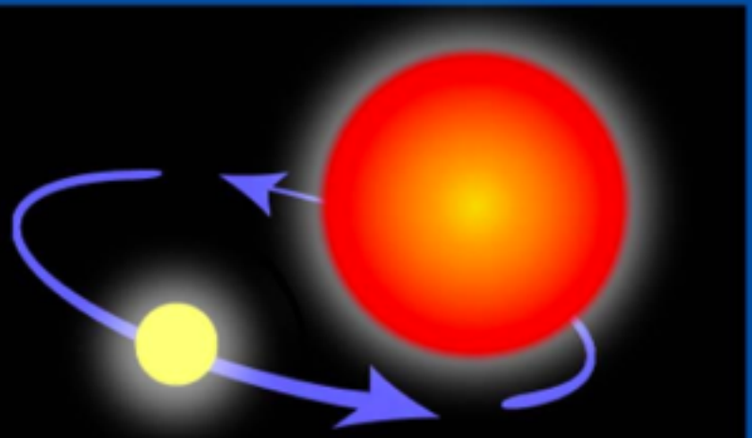
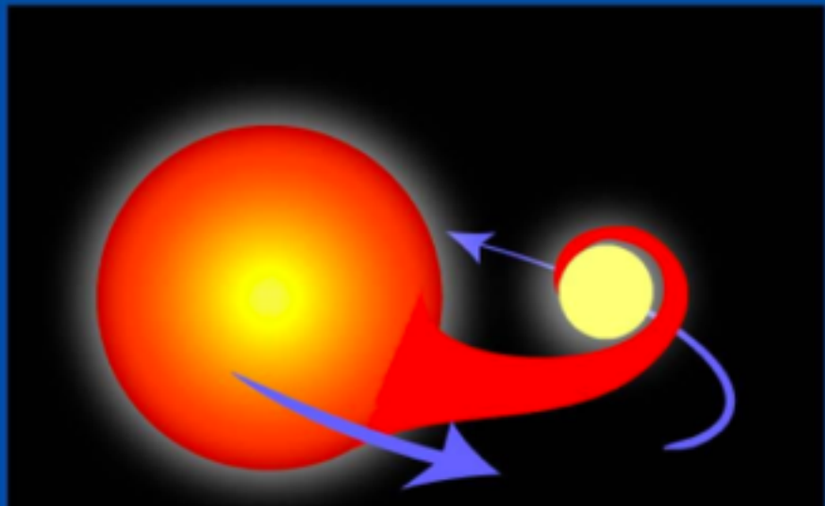


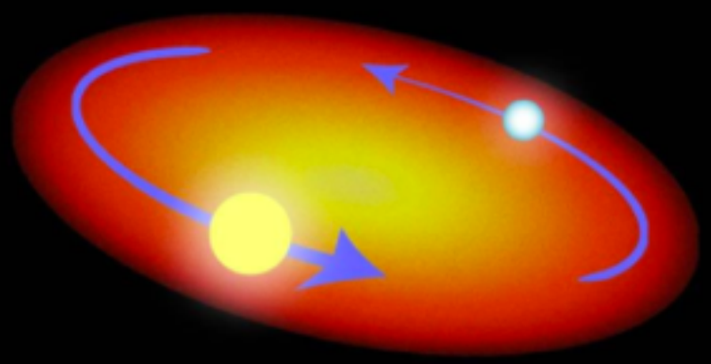
Two normal stars are in a binary pair.



The more massive star becomes a giant...

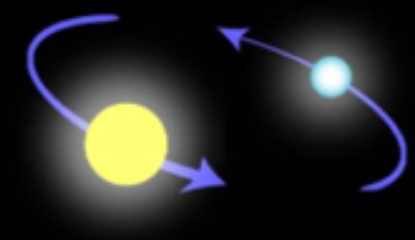


...which spills gas onto the secondary star, causing it to expand and become engulfed.

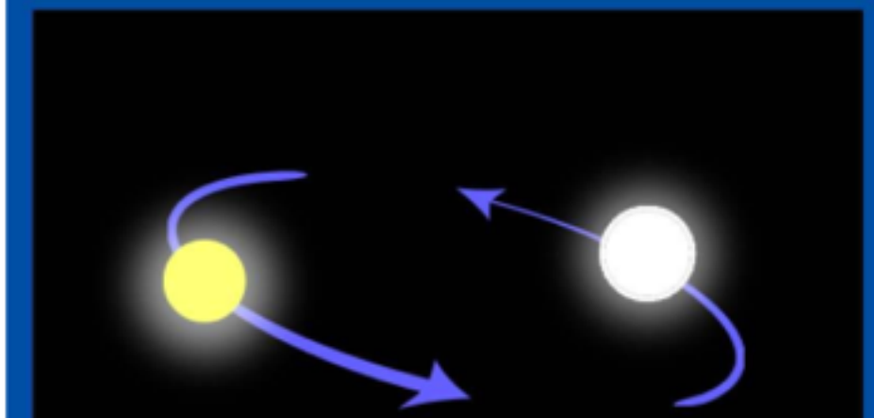


The secondary, lighter star and the core of the giant star spiral inward within a common envelope.

The common envelope is ejected, while the separation between the core and the secondary star decreases.



The remaining core of the giant collapses and becomes a white dwarf.



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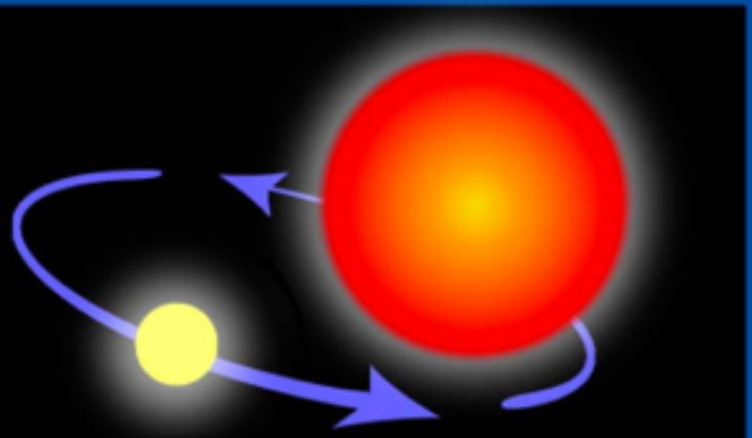

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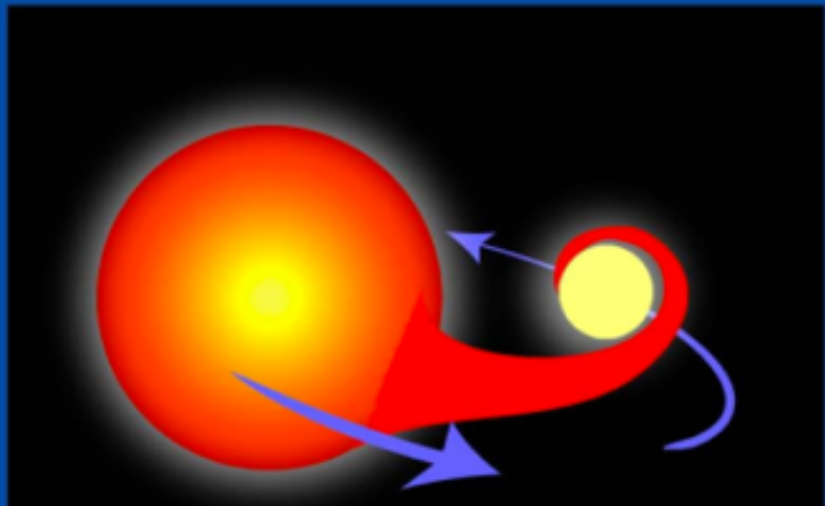

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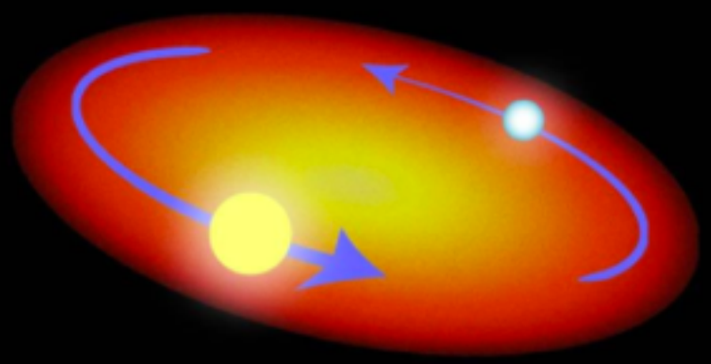

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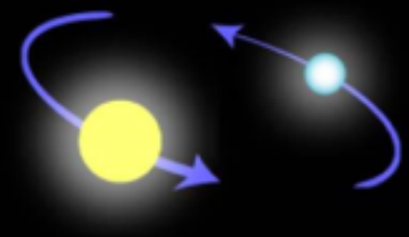
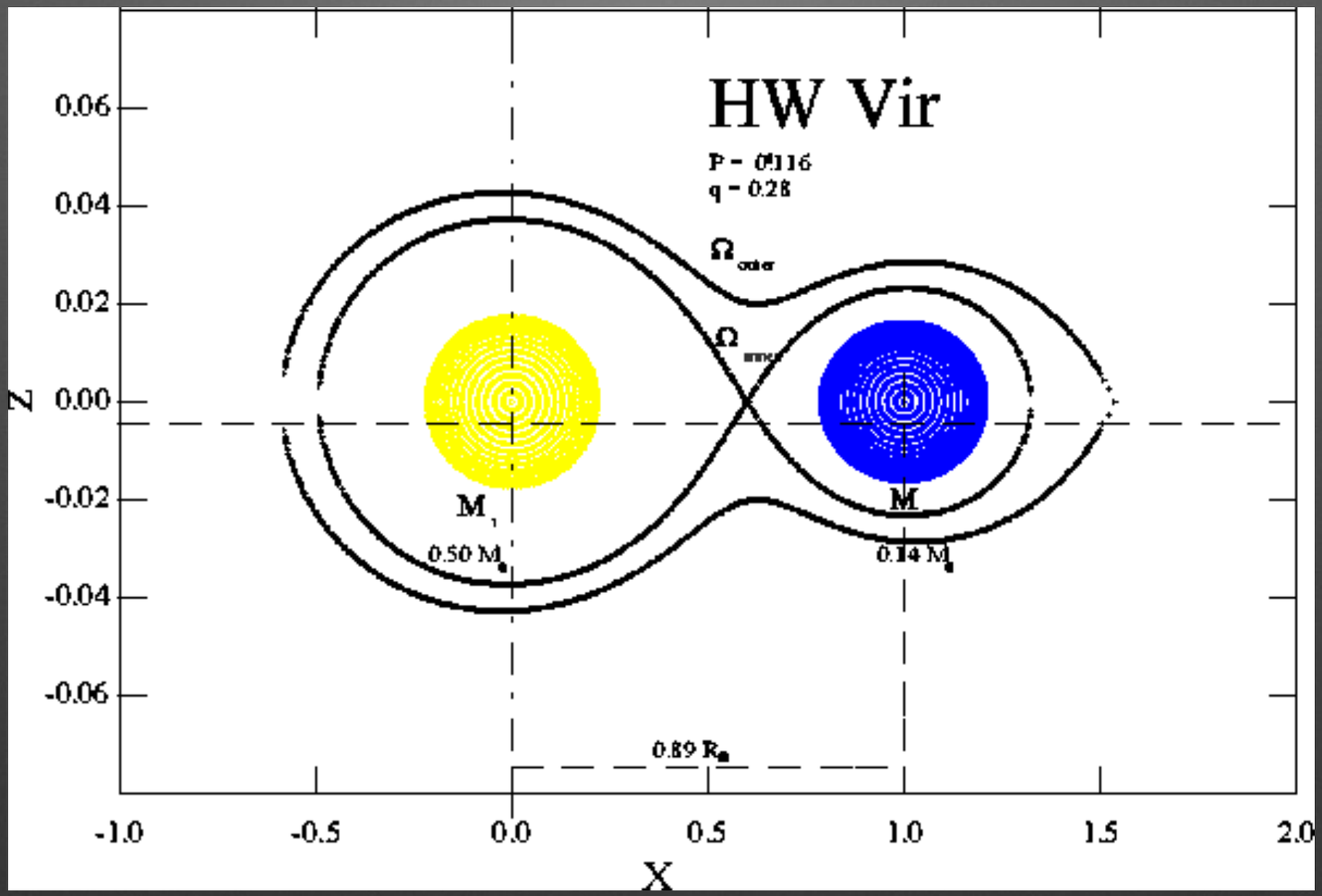
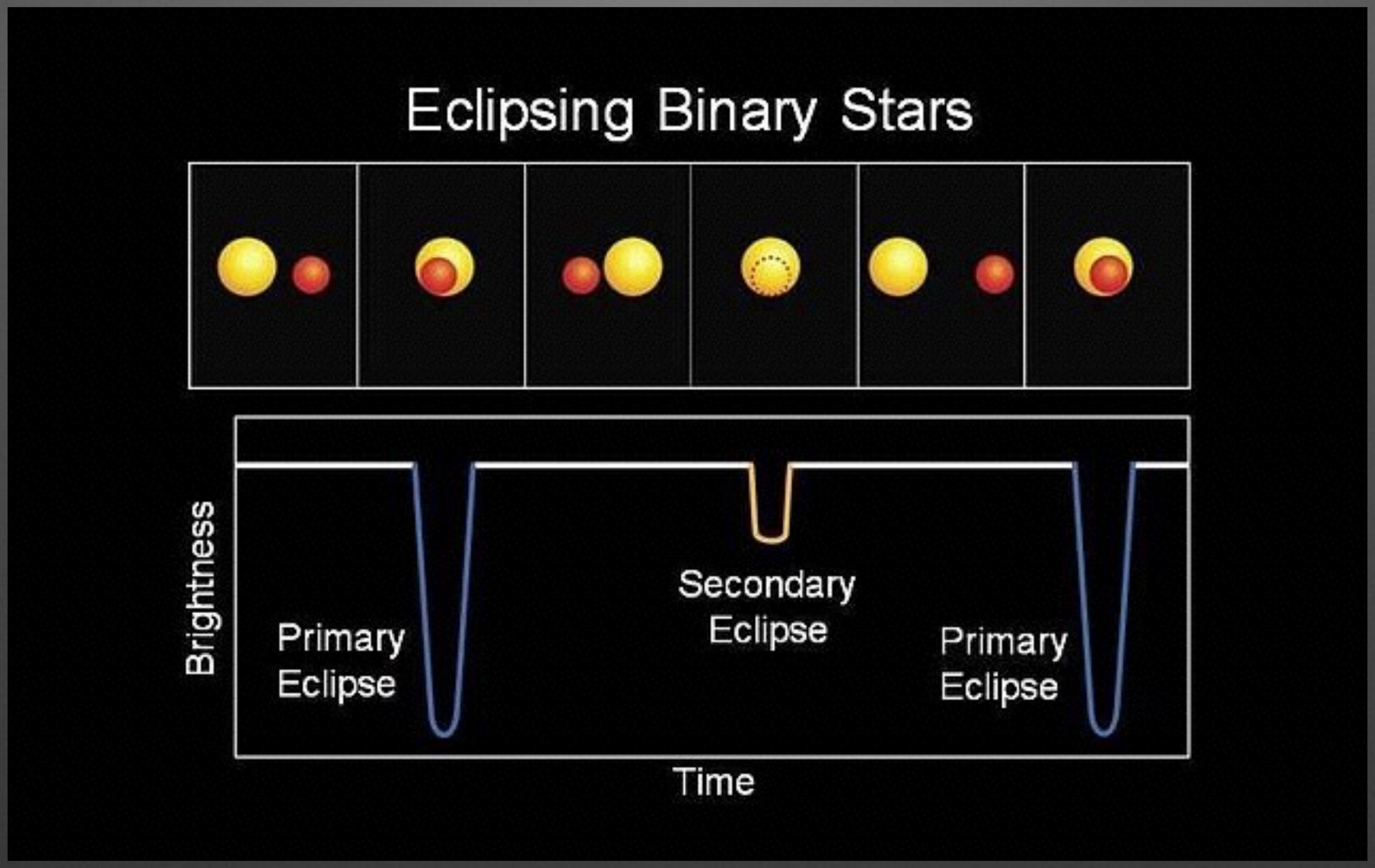


The remaining core of the giant collapses and becomes a white dwarf.

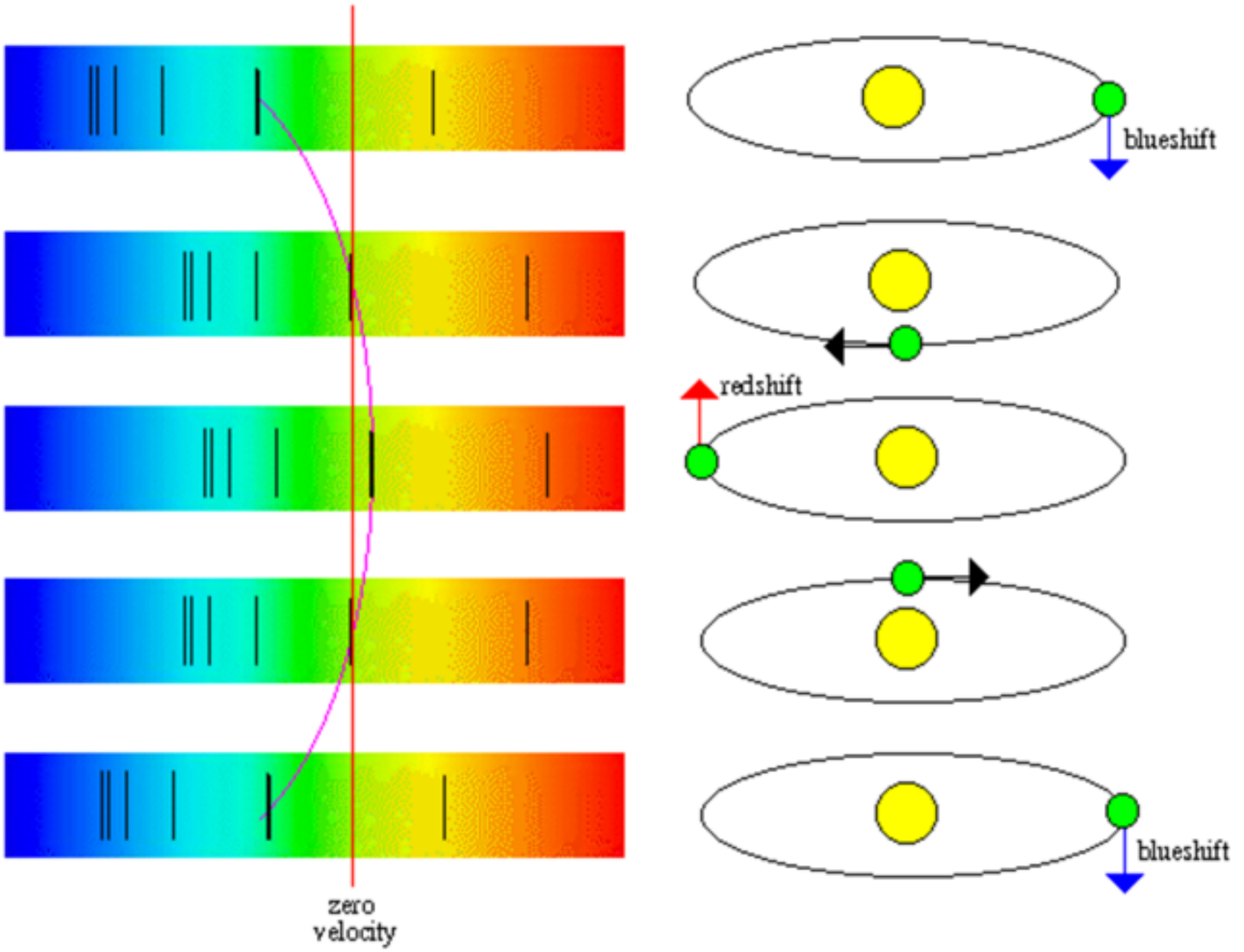
or an sdB!


HW Vir
P = 0.116
q = 0.28
Ω outer
Ω inner
M1
0.50 M⊙
M2
0.14 M⊙
0.89 R⊙
0.06
0.04
0.02
0.00
-0.02
-0.04
-0.06
Z
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
X

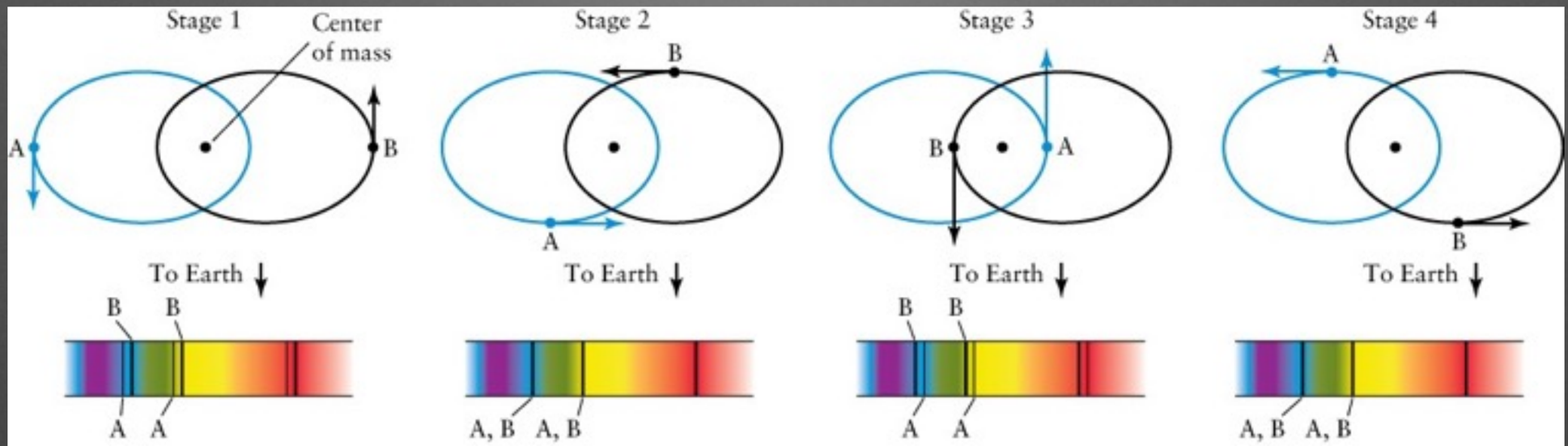
Binarias eclipsantes

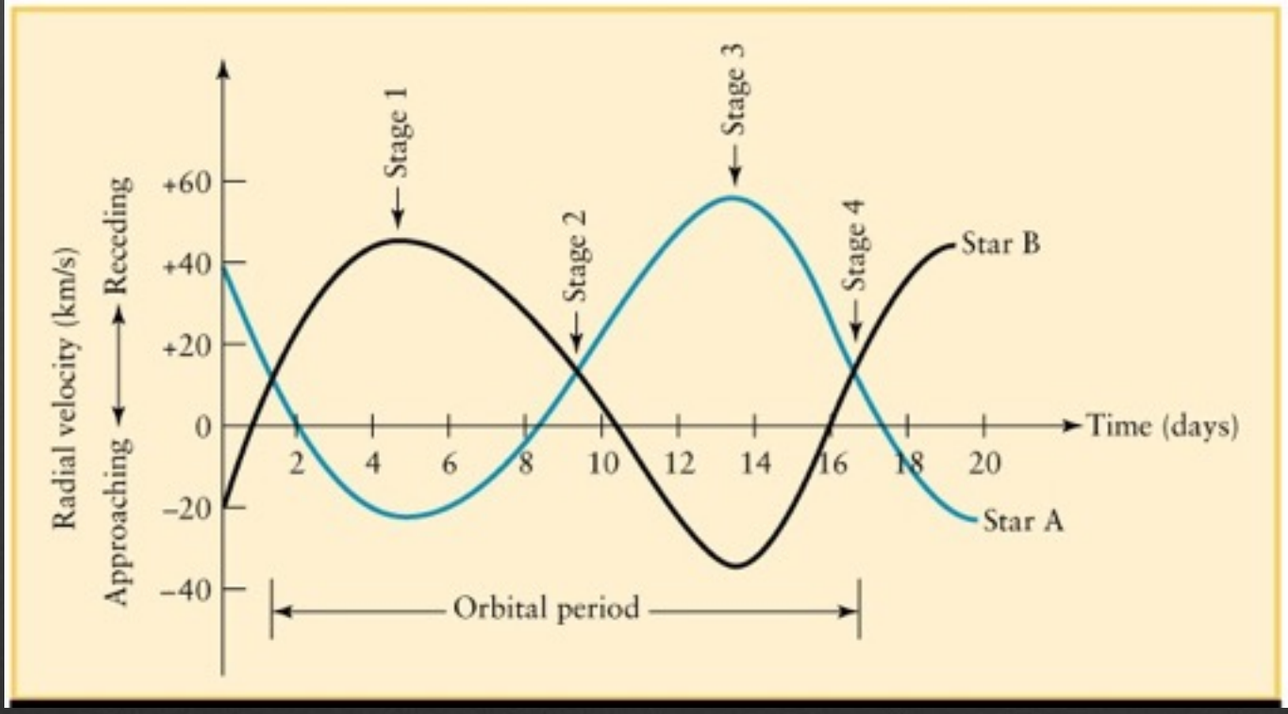


Binarias eclipsantes

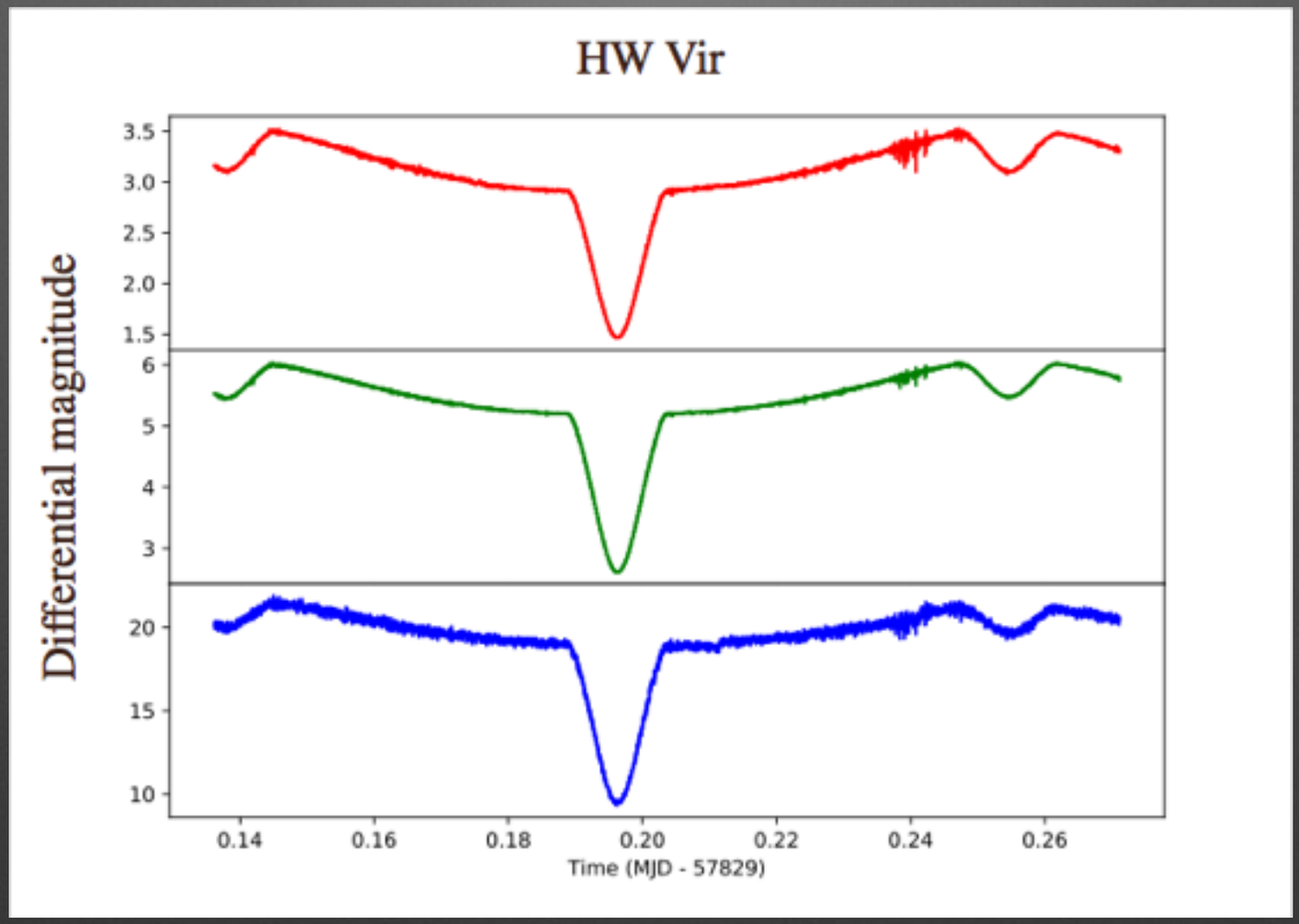


Binarias eclipsantes

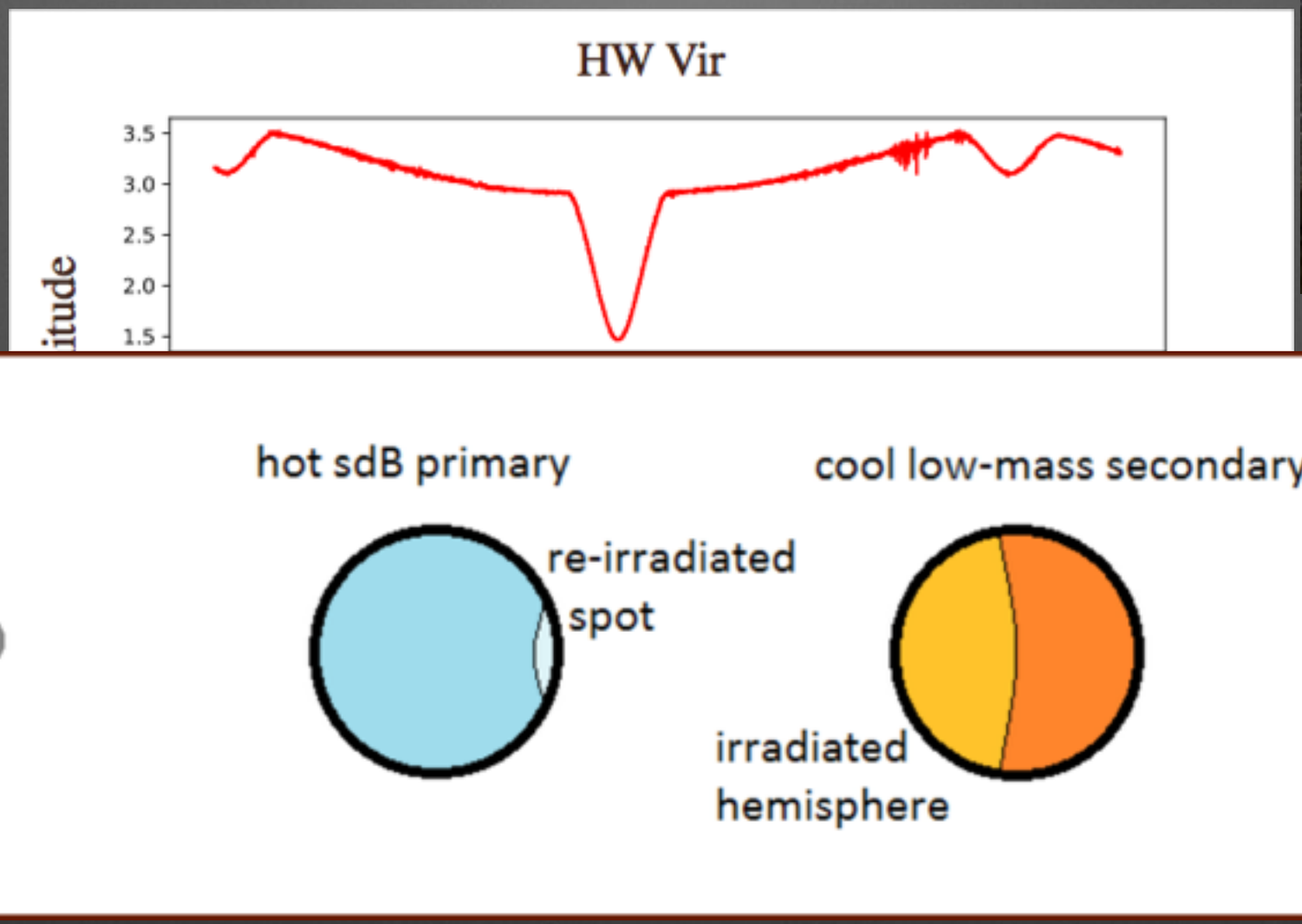




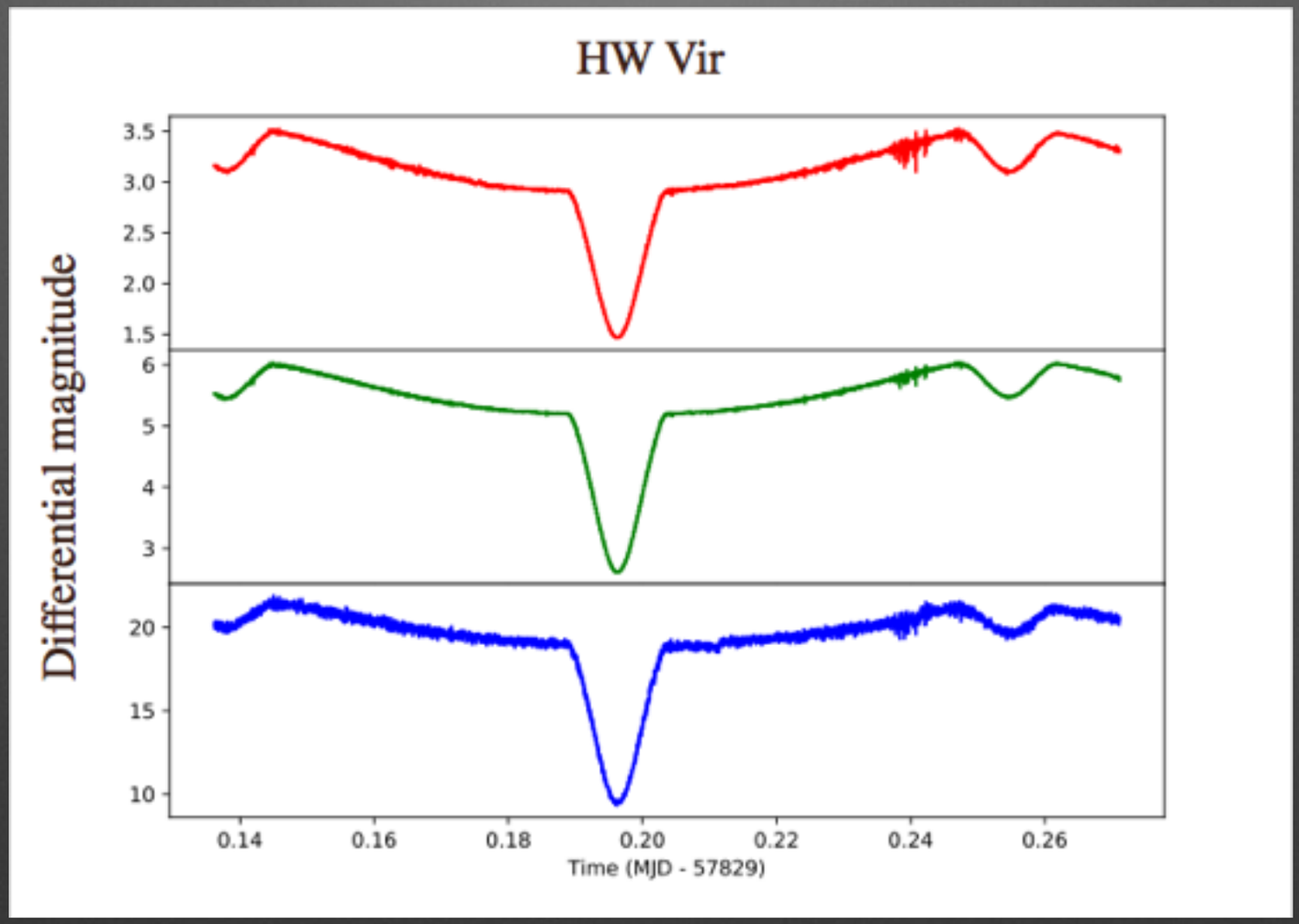
HW Vir


HW Vir
Differential magnitude
3.5
3.0
2.5
2.0
1.5
6
5
4
3
20
15
10
0.14
0.16
0.18
0.20
0.22
0.24
0.26
Time (MJD - 57829)

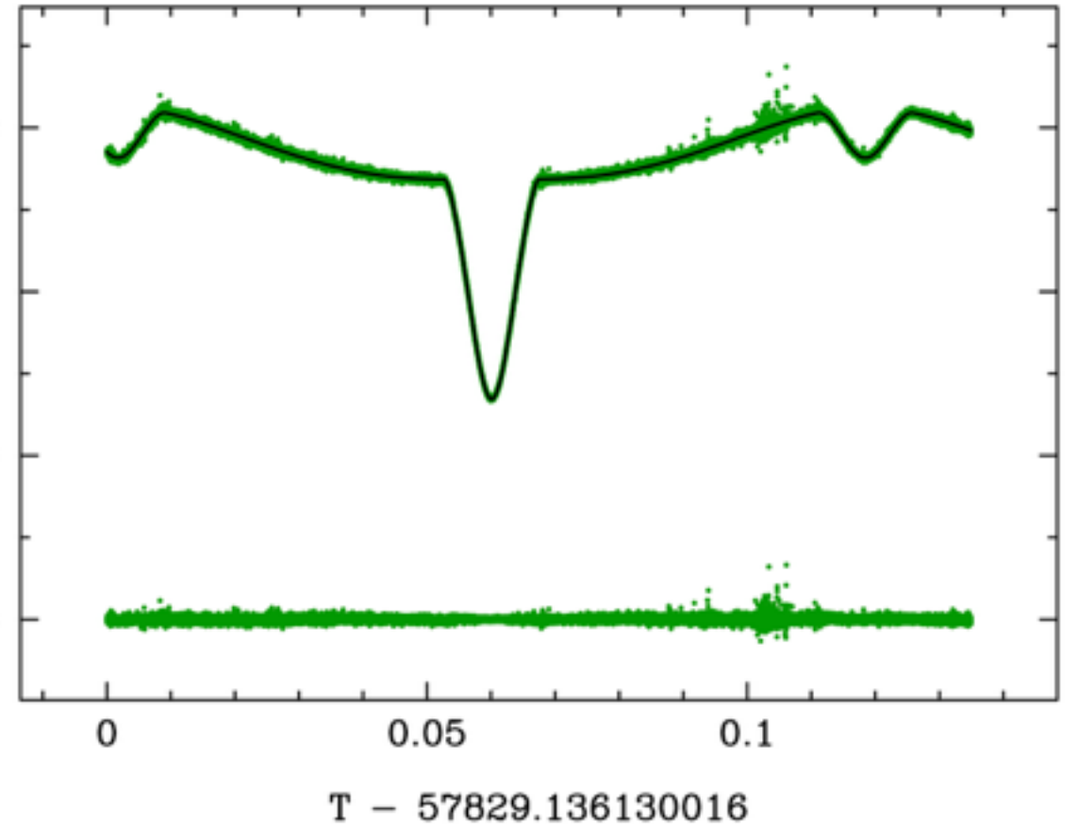
HW Vir


HW Vir
3.5
3.0
2.5
2.0
1.5
hot sdB primary
cool low-mass secondary
re-irradiated
spot
irradiated
hemisphere

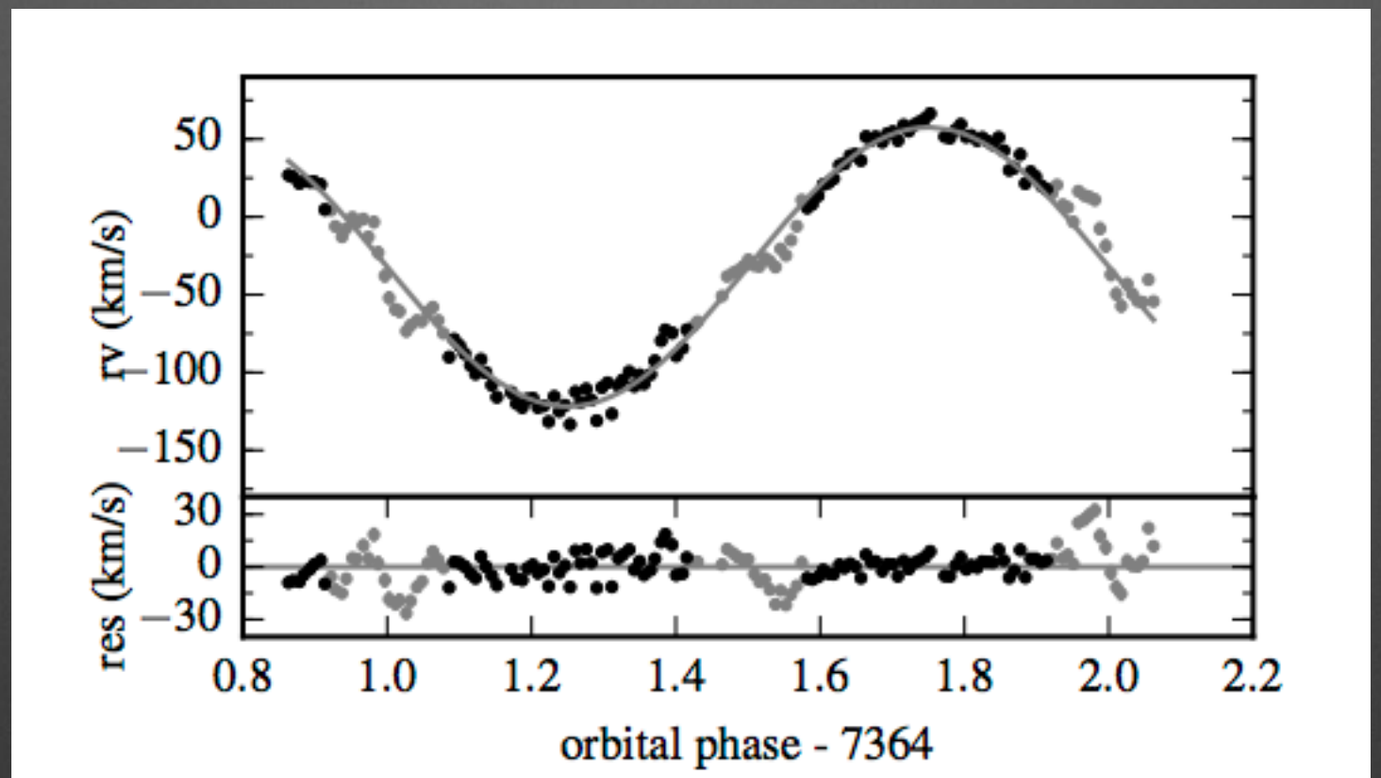
HW Vir


HW Vir
Differential magnitude
3.5
3.0
2.5
2.0
1.5
6
5
4
3
20
15
10
0.14
0.16
0.18
0.20
0.22
0.24
0.26
Time (MJD - 57829)

HW Vir

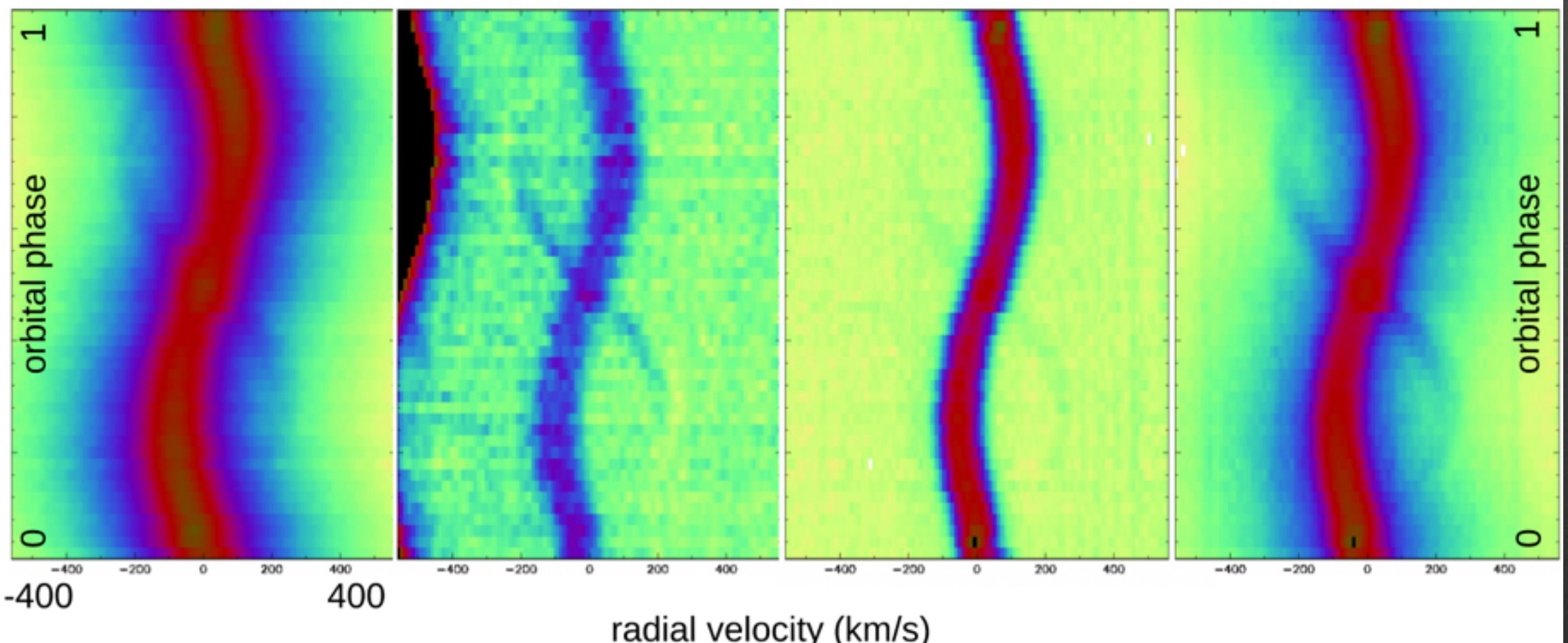


HW Vir


50
0
−50
−100
−150
rv (km/s)
30
0
−30
res (km/s)
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
orbital phase - 7364

HW Vir

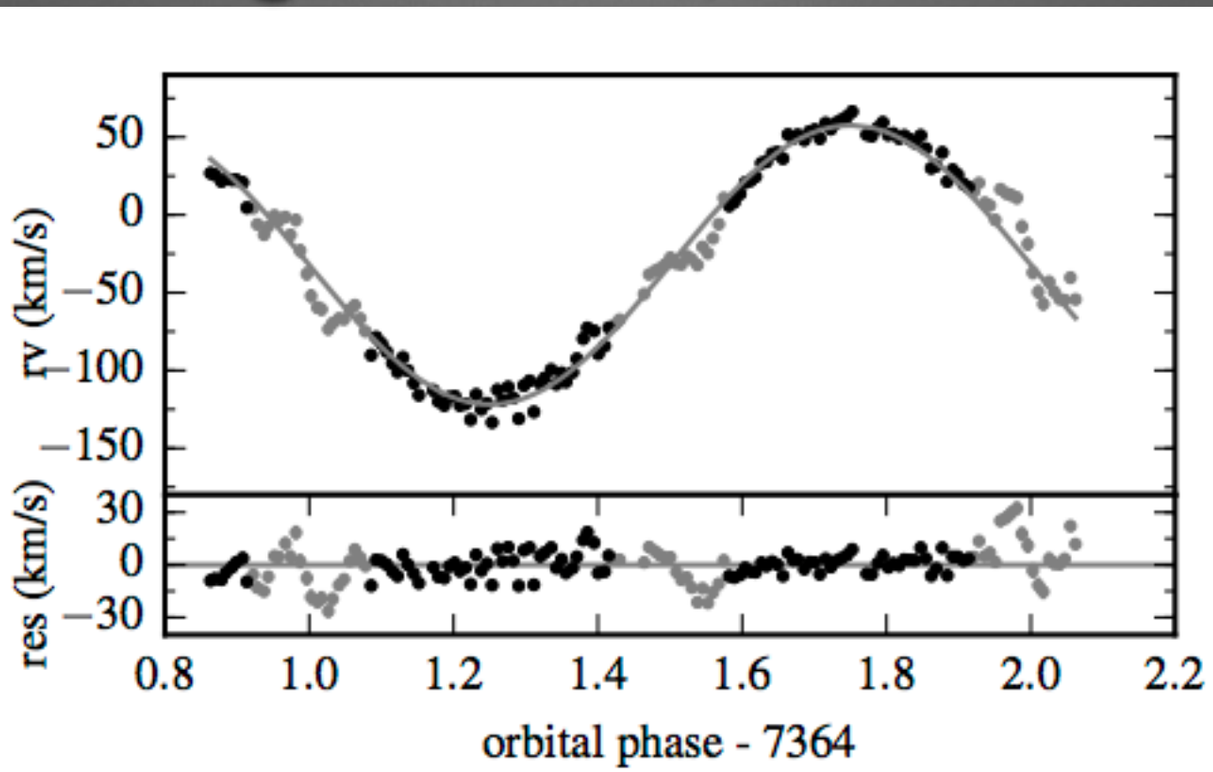
Hβ	Mg II	He I	Hα
4861.3 Å	4481.3 Å	5875.6 Å	6562.7 Å



HW Vir

Rossiter-McLaughlin effect

McLaughlin 1924; Rossiter 1924



HW Vir

Rossiter-McLaughlin effect

McLaughlin 1924; Rossiter 1924