

The Masses of Wolf-Rayet Stars in M31 and M33



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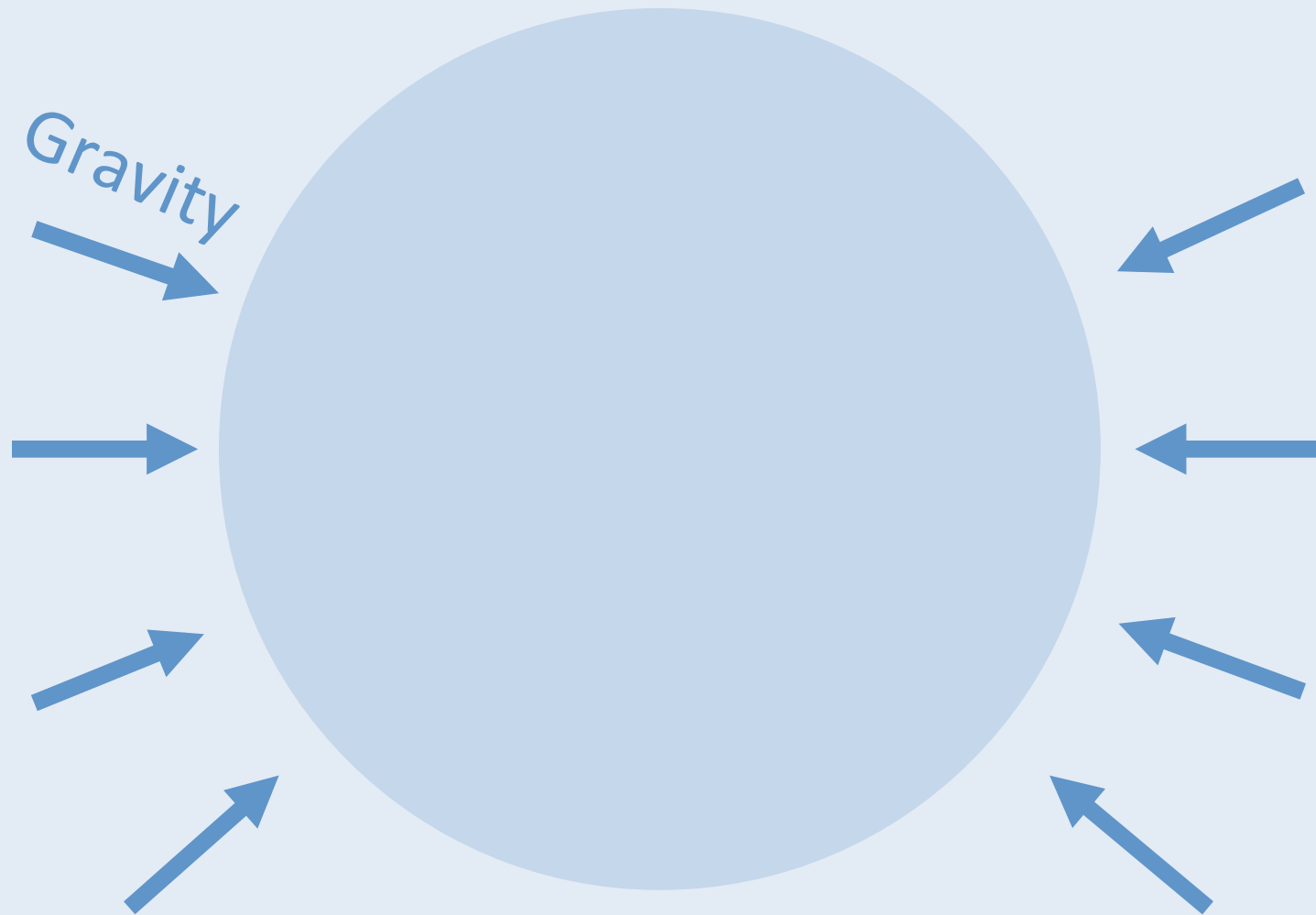
Brian Skiff

Massive Stars are Important!

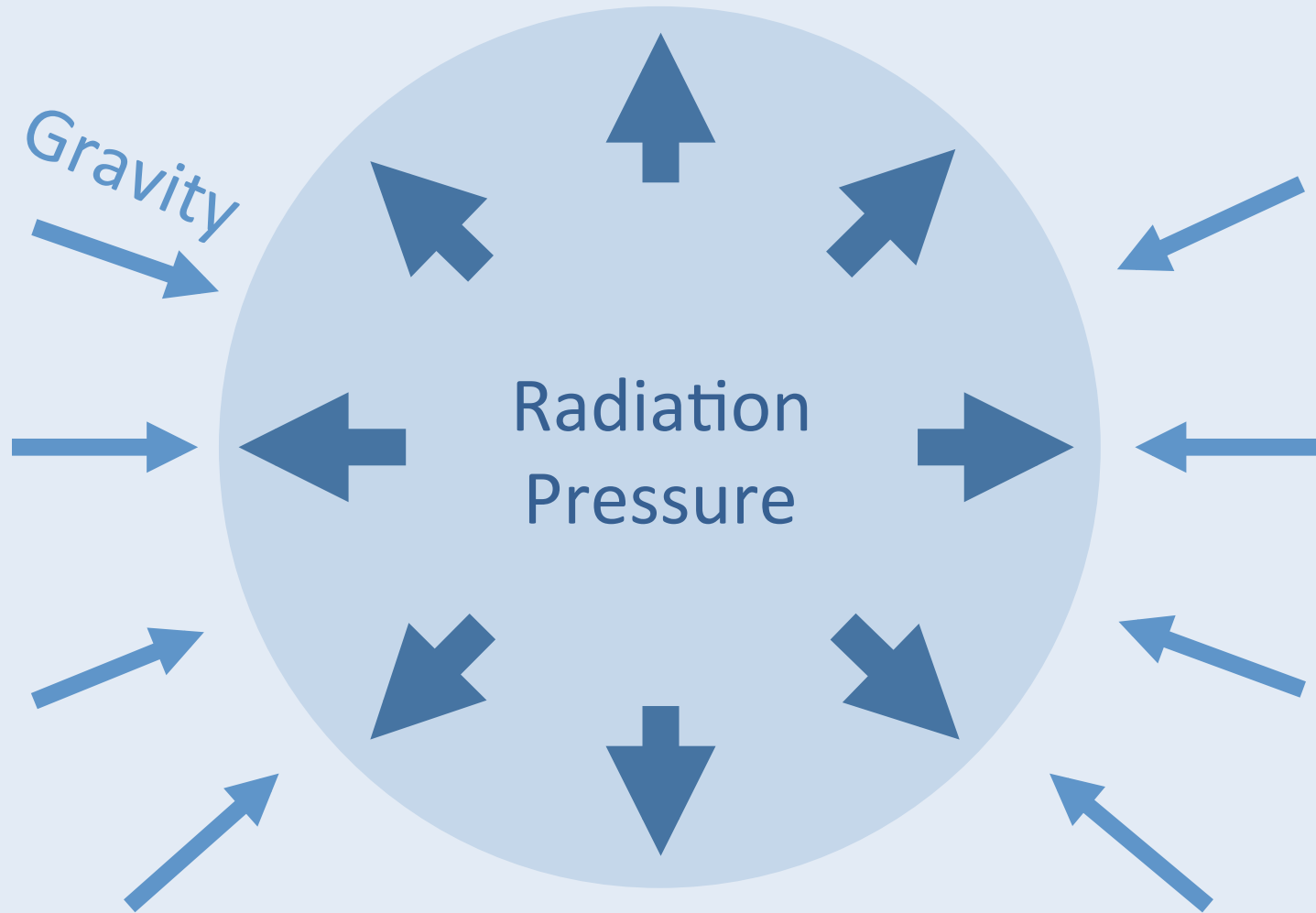
H																		He															
B																		B															
Li	Be																	B	C	N	O	F	Ne										
C	C																	C	S L	S L	S L	L	S L										
Na	Mg																	Al	Si	P	S	Cl	Ar										
L	L																	\$ L	\$ L	L	S L	L	L										
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr																
L	L	L	\$ L	\$ L	L	L	\$ L	\$	\$	L	L	\$	\$	L	\$	\$	\$																
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe																
\$	L	L	L	L	\$ L	L	\$ L	\$	\$ L	\$ L	\$ L	\$ L	\$ L	\$	\$	\$	\$																
Cs	Ba																	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
\$	L																	\$ L	\$ L	\$ L	\$	\$	\$	\$	\$	\$ L	\$ L	\$	\$	\$	\$	\$	\$
Fr	Ra	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu																	
\$	\$	L	L	\$ L	\$ L	\$ L	\$ L	\$	\$	\$	\$	\$	\$	\$	\$ L	\$																	
		Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr																	
		\$	\$	\$	\$	\$	\$	M	M	M	M	M	M	M	M	M																	

B	Big Bang	L	Large stars	\$	Super-novae
c	Cosmic rays	s	Small stars	M	Man-made

Single-Star Evolution



Single-Star Evolution

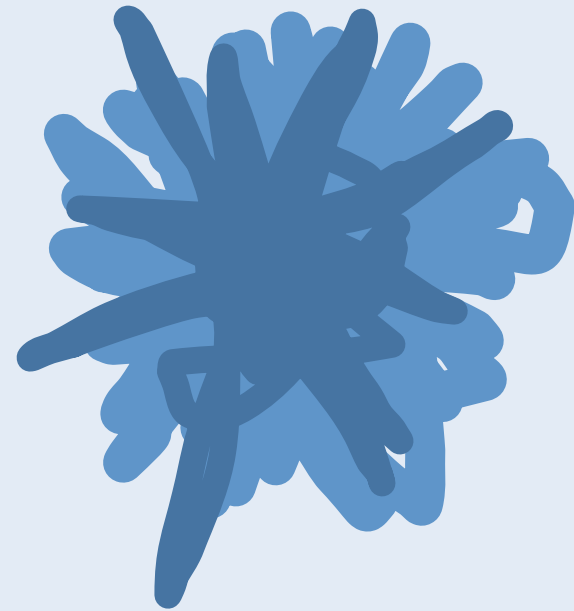


Single-Star Evolution



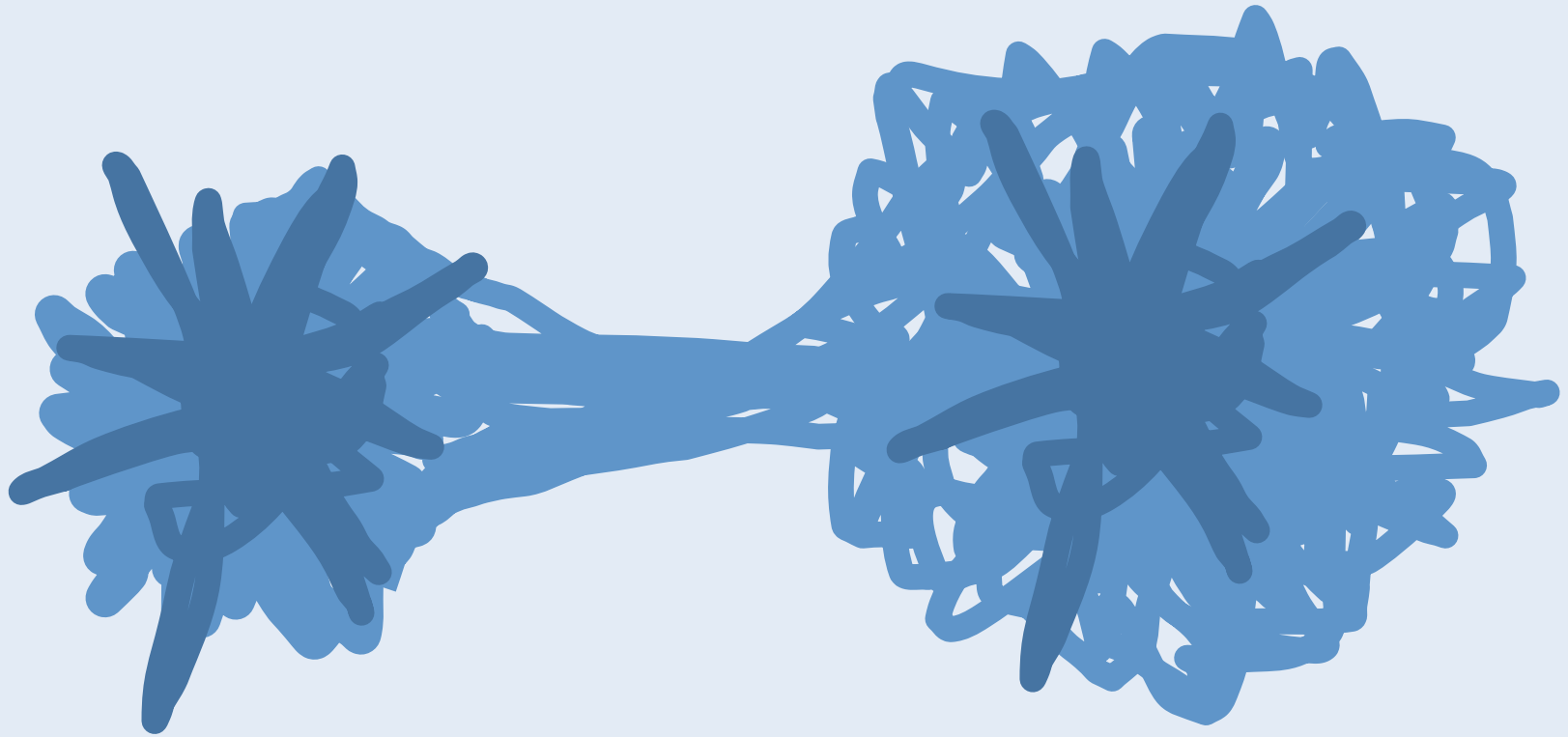
Wolf-Rayet
Star

Binary Evolution



*not to scale

Binary Evolution

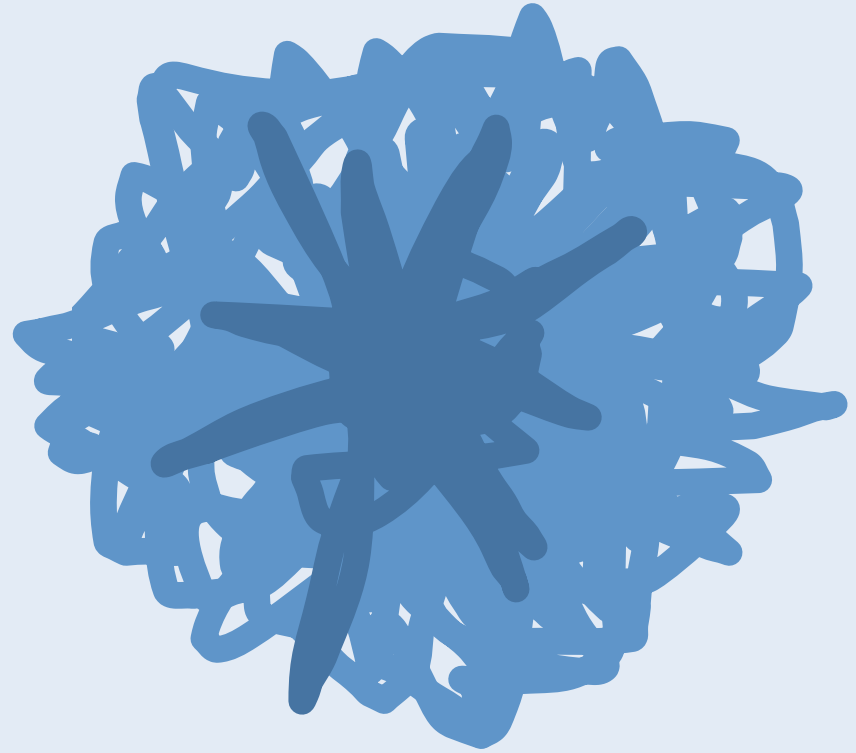


*not to scale

Binary Evolution



Wolf-Rayet Star



O Star

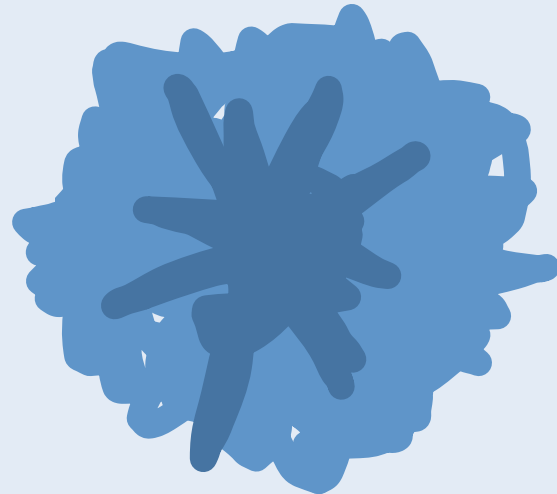
*not to scale

Evolution Mechanisms

Single-Star Evolution
WR + O Star

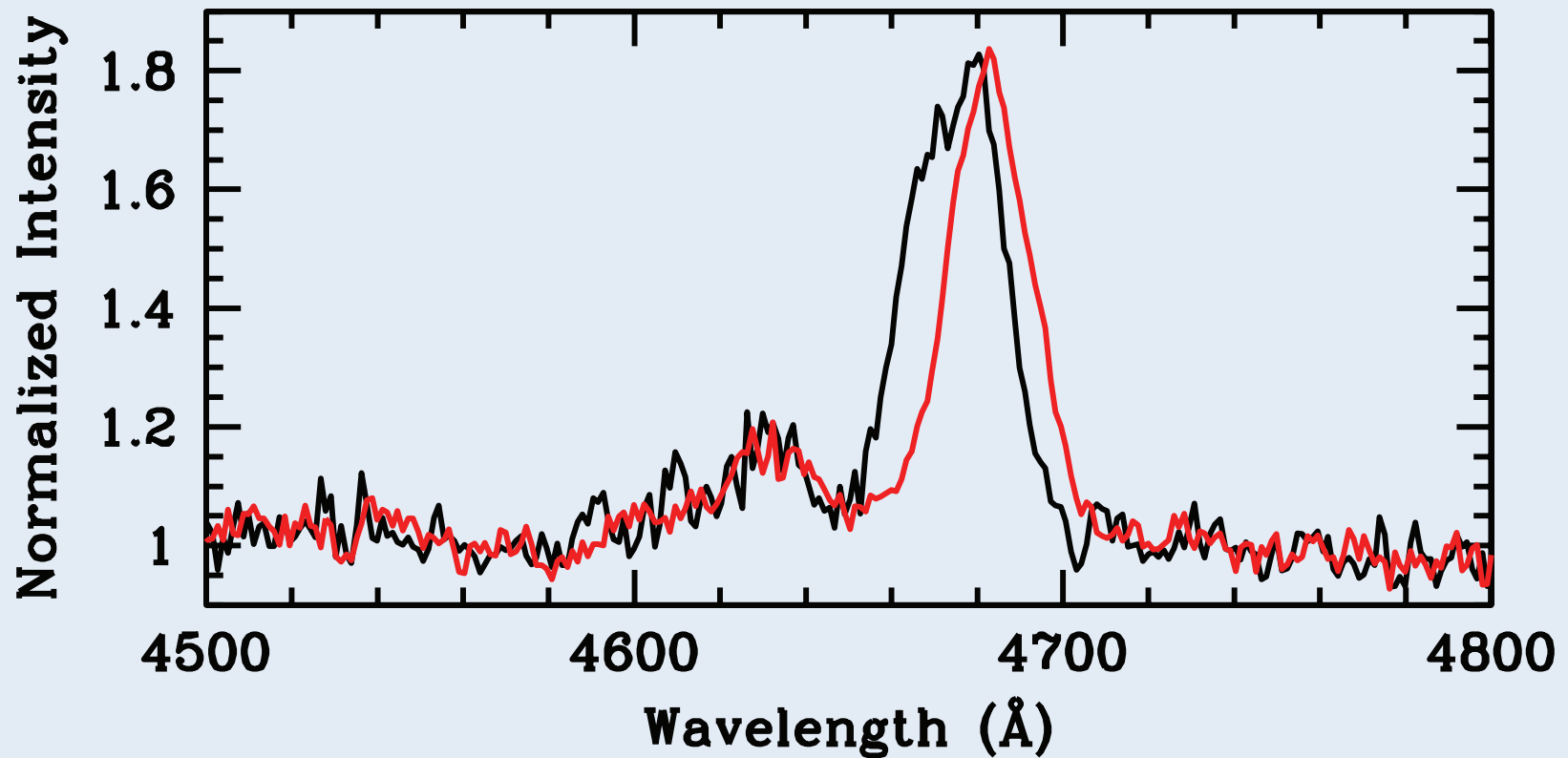


Binary Evolution
WR + Massive O Star

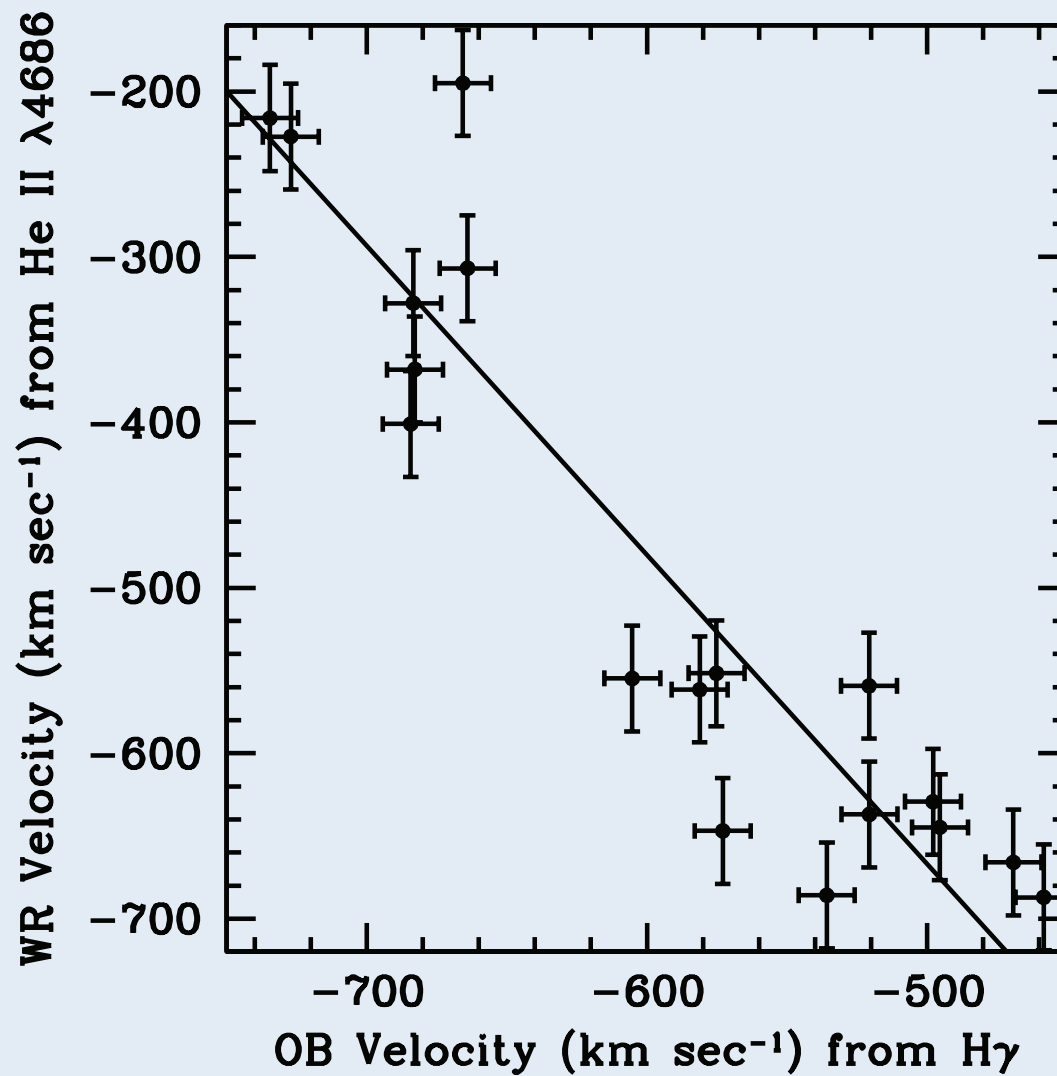


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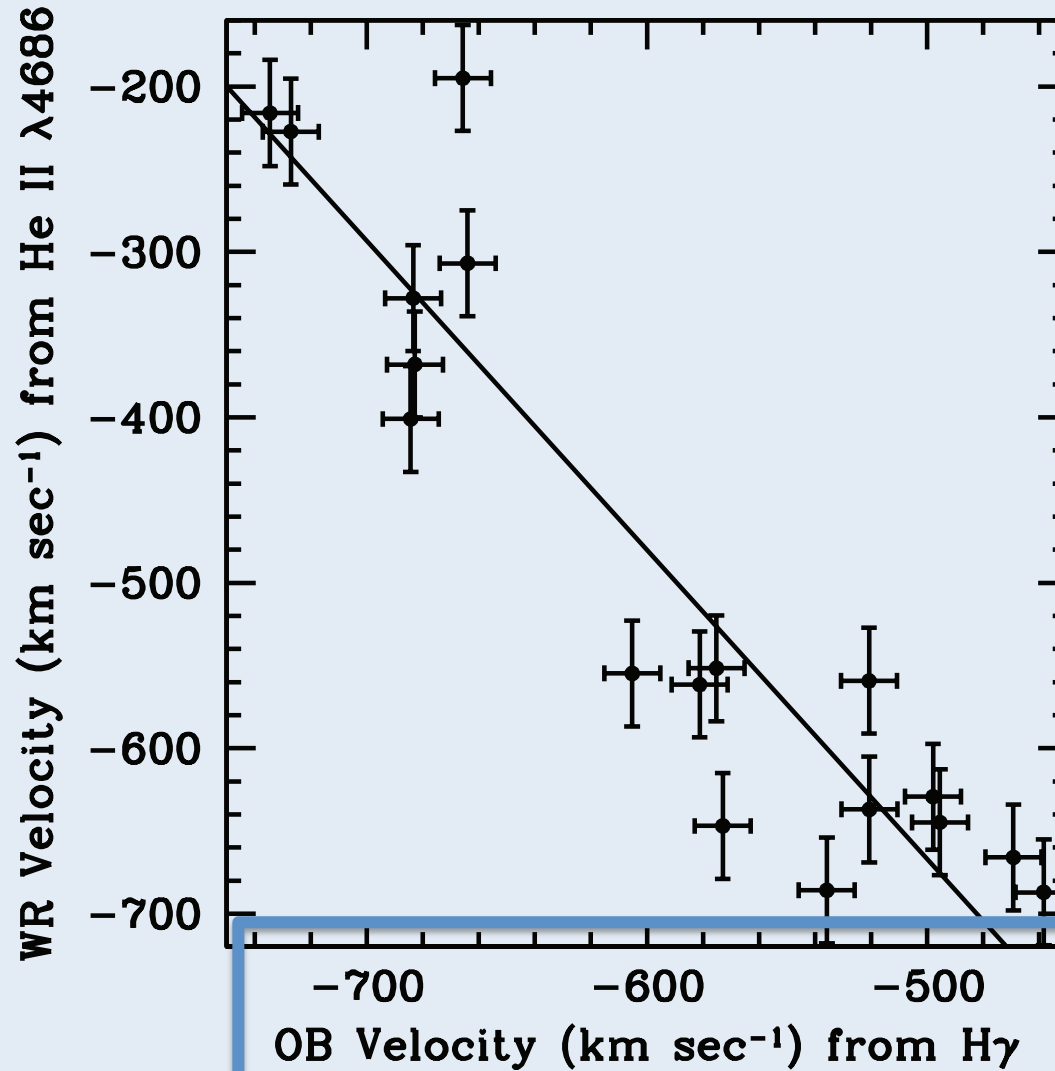
Identified 100+ Binary WRs



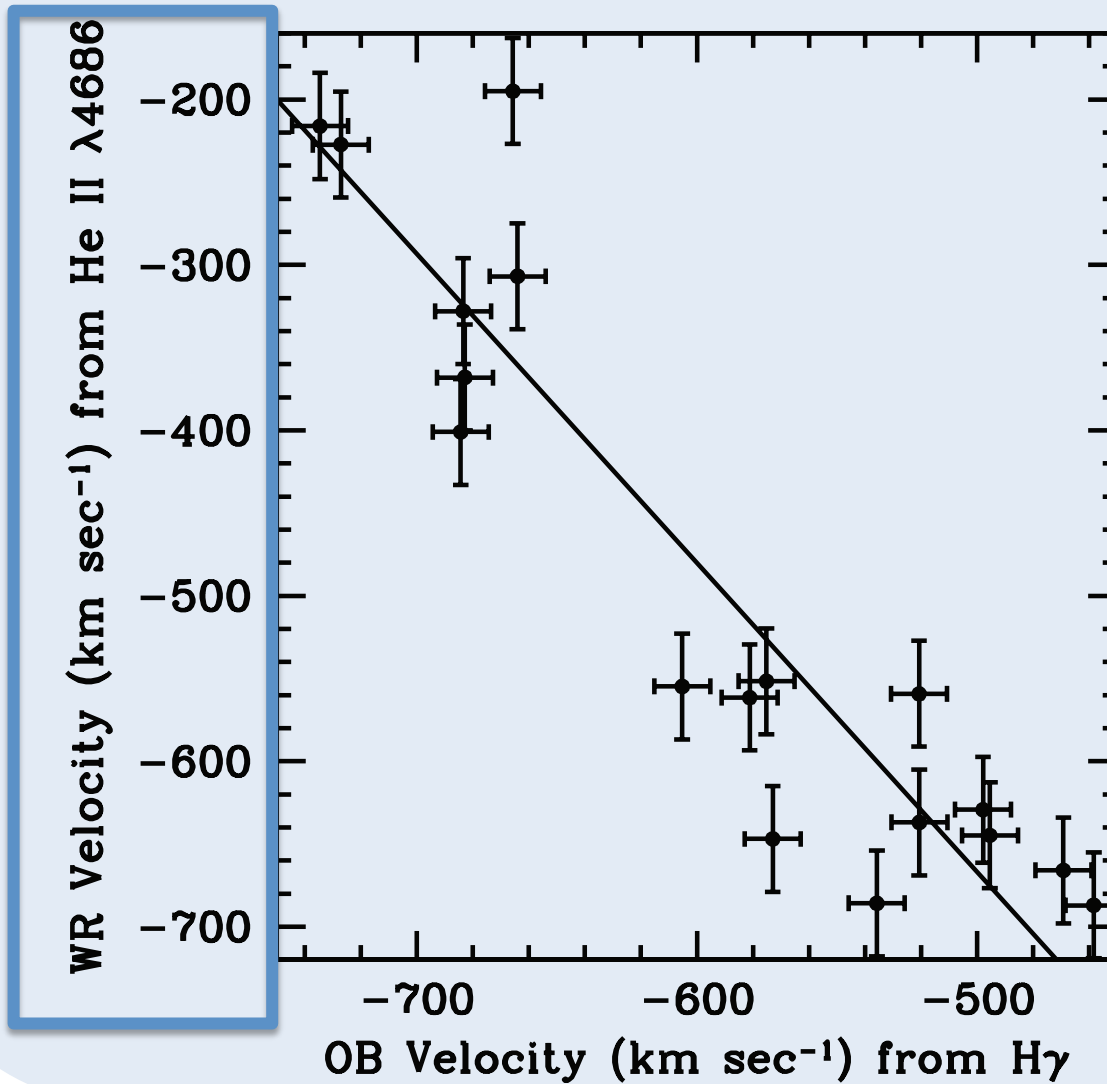
Mass Estimation



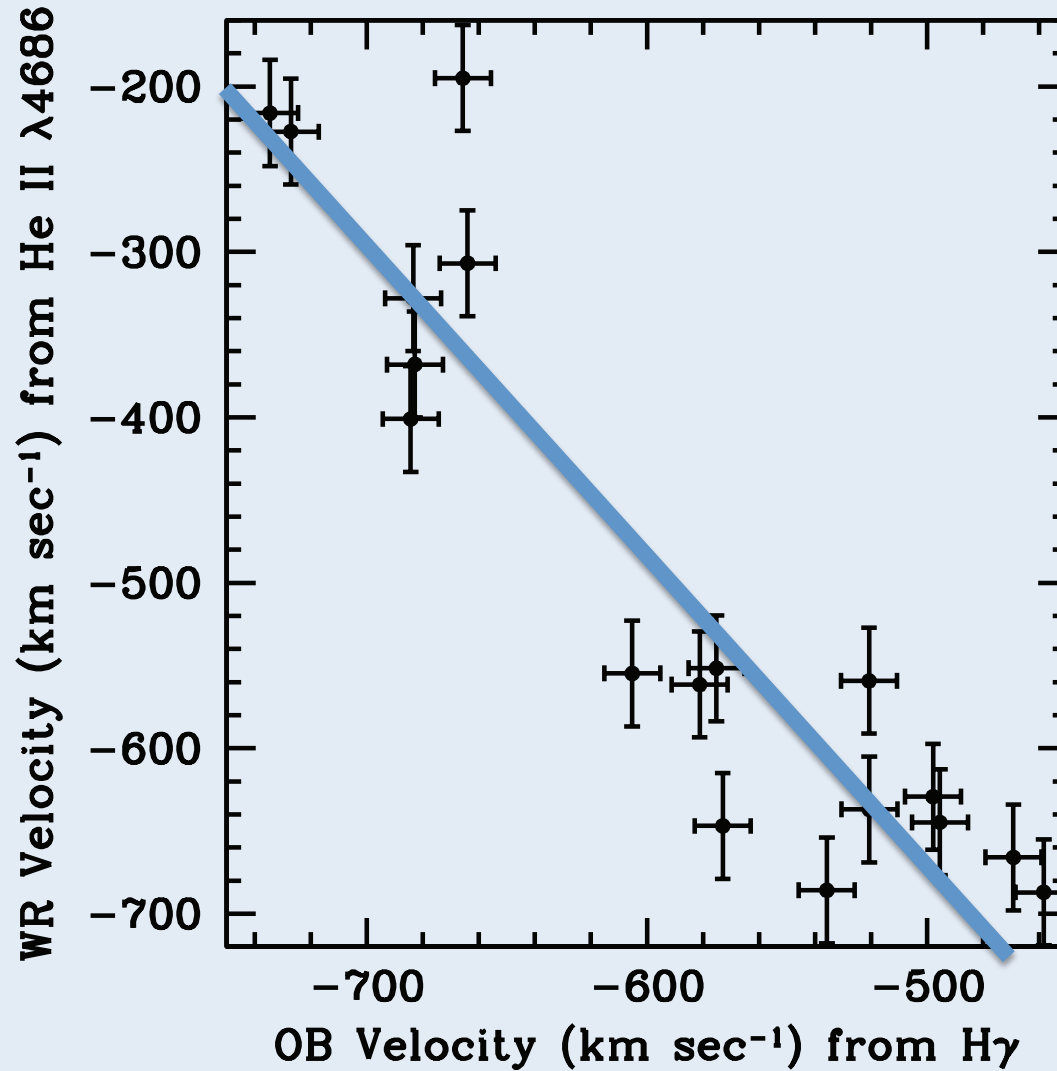
Mass Estimation



Mass Estimation

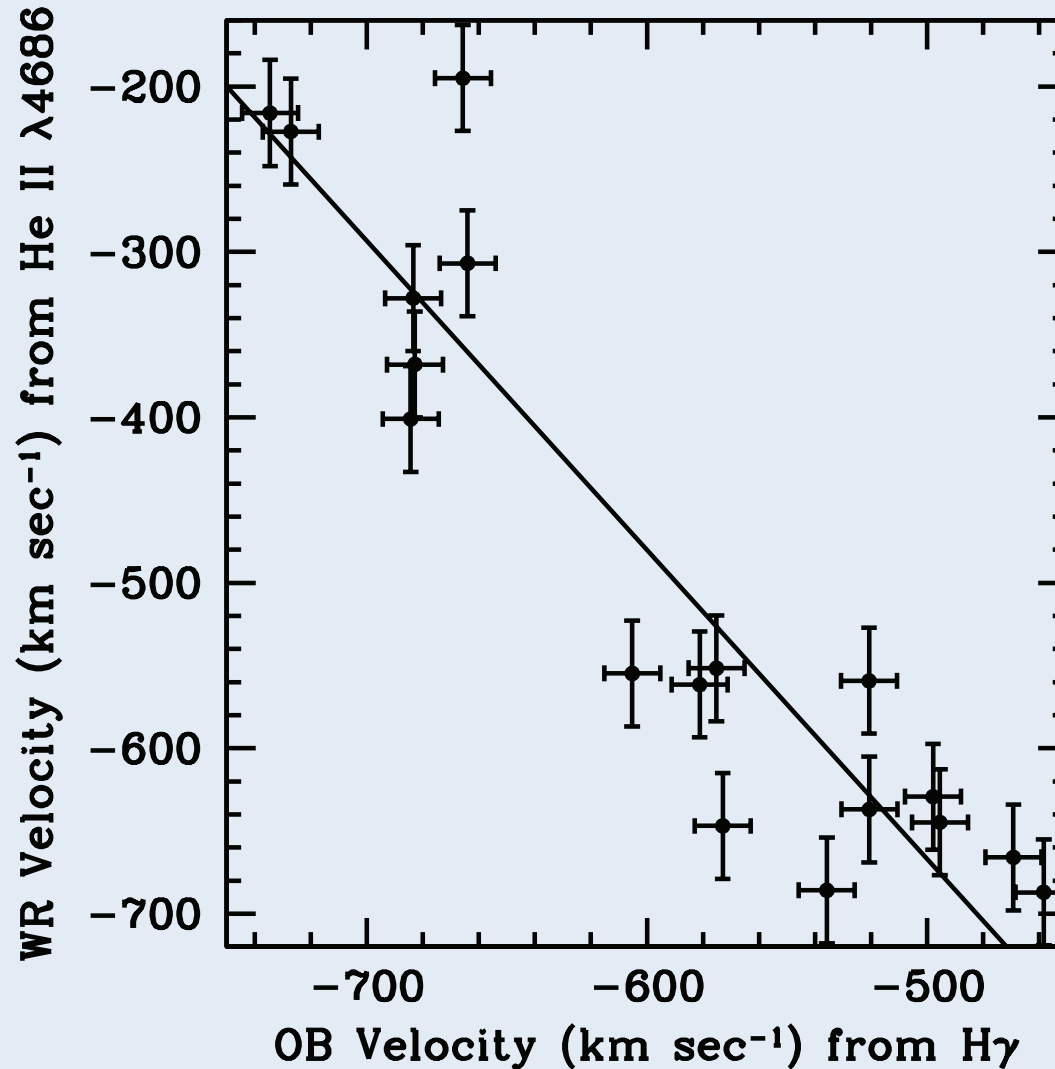


Mass Estimation



Mass (WR/O) =
1/slope

Mass Estimation

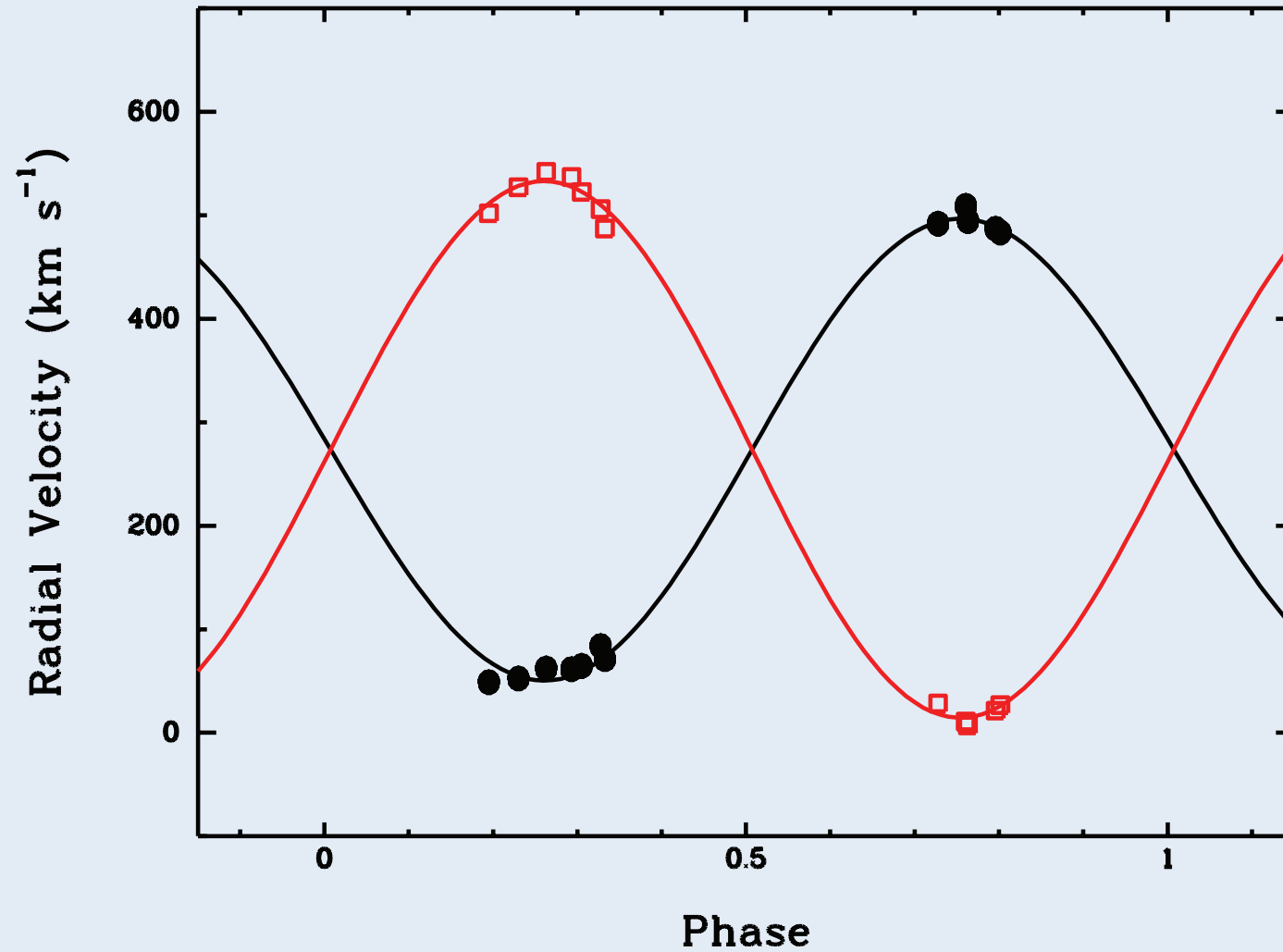


Mass (WR/O) =
1/slope

WR is only
13% more
massive than
the O star.

It has lost
more
than 47%
of its mass!

Orbit Solutions



Binary vs. Single-Star Evolution

