The final fate of the hot massive stars in IZw18

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Bonn
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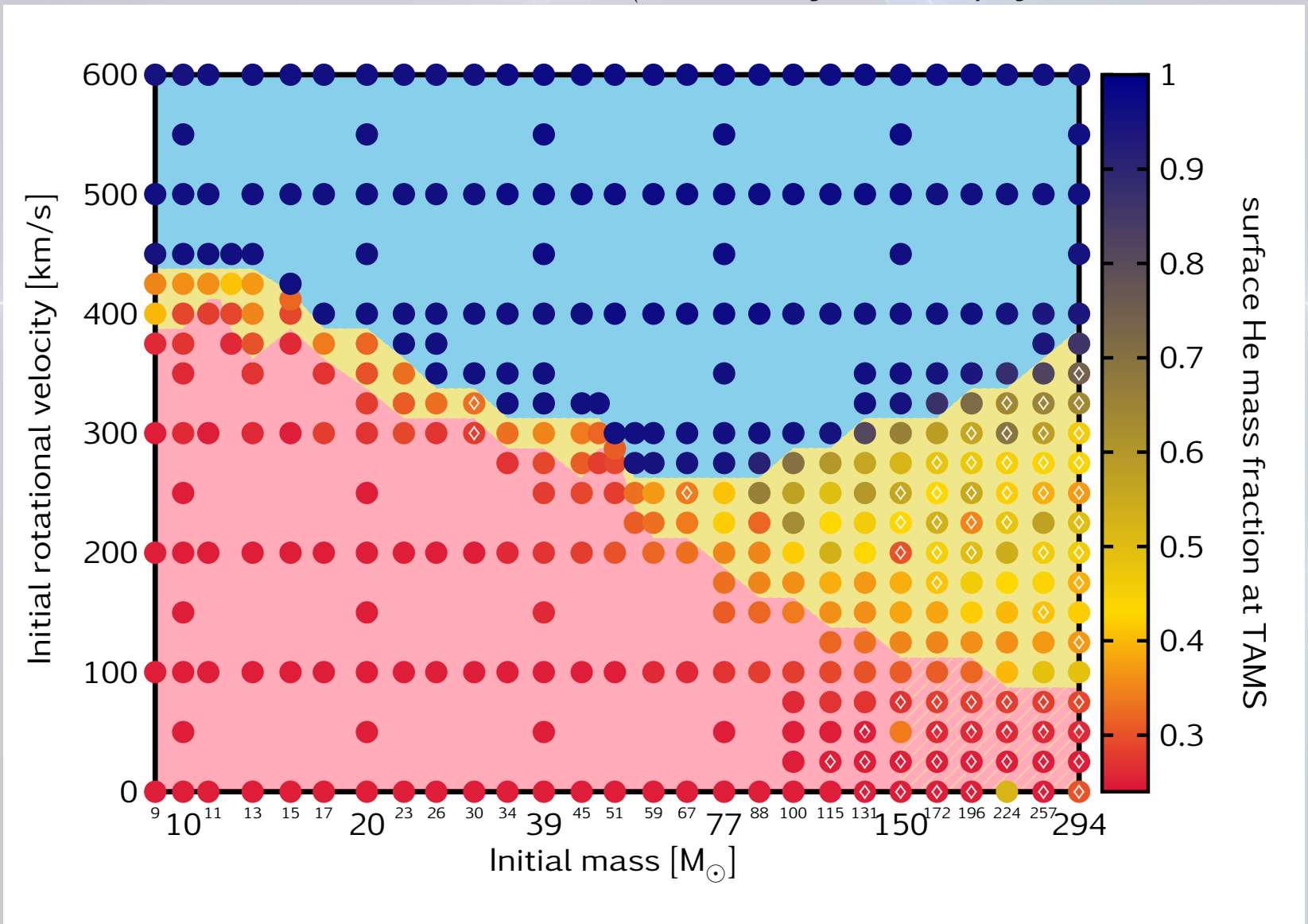
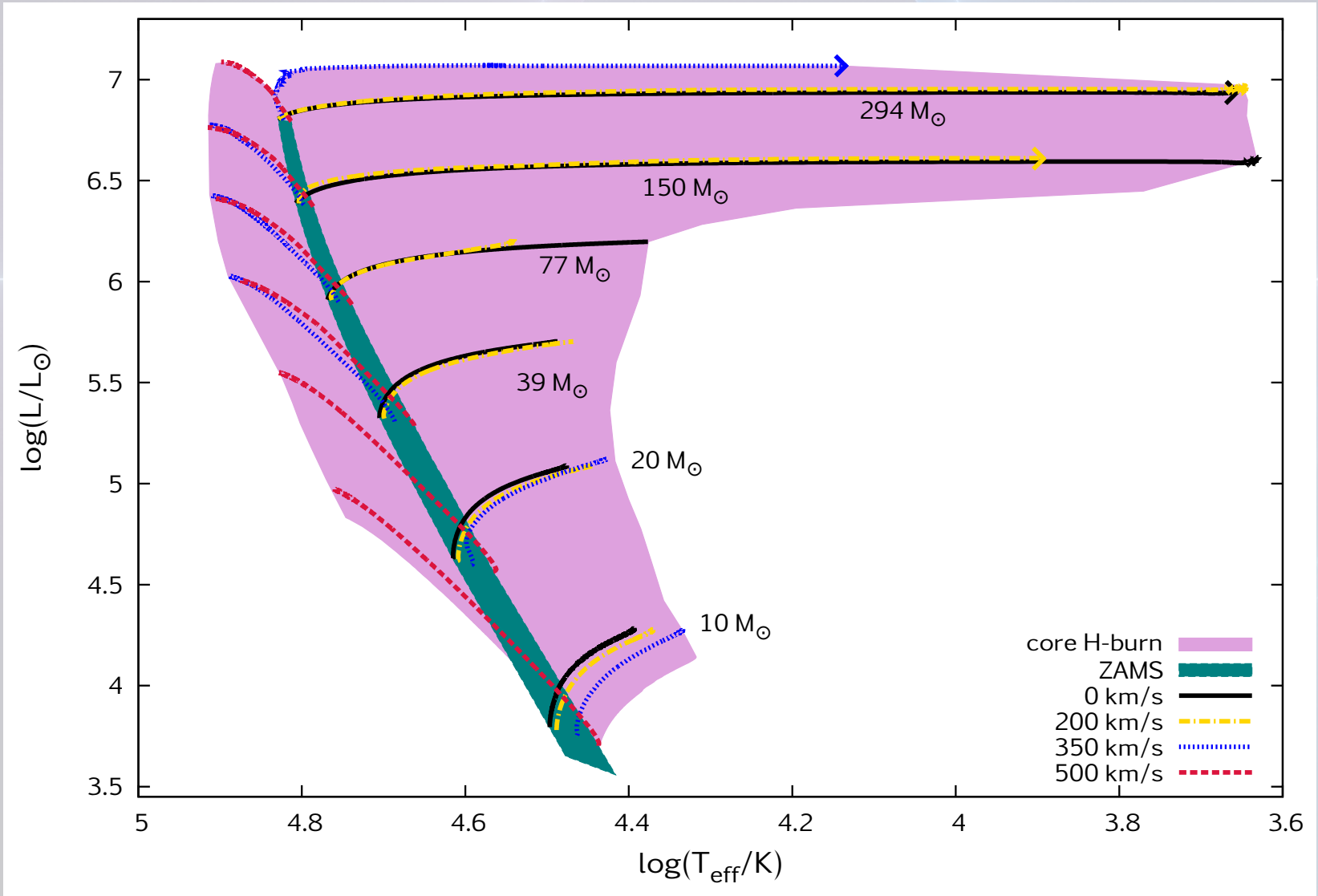
Low Metallicity Massive Stars

Szécsi et al. 2015 (Astronomy & Astrophysics, v.581, A15)



Hertzsprung–Russell diagram

Szécsi et al. 2015 (Astronomy & Astrophysics, v.581, A15)



Hertzsprung–Russell diagram

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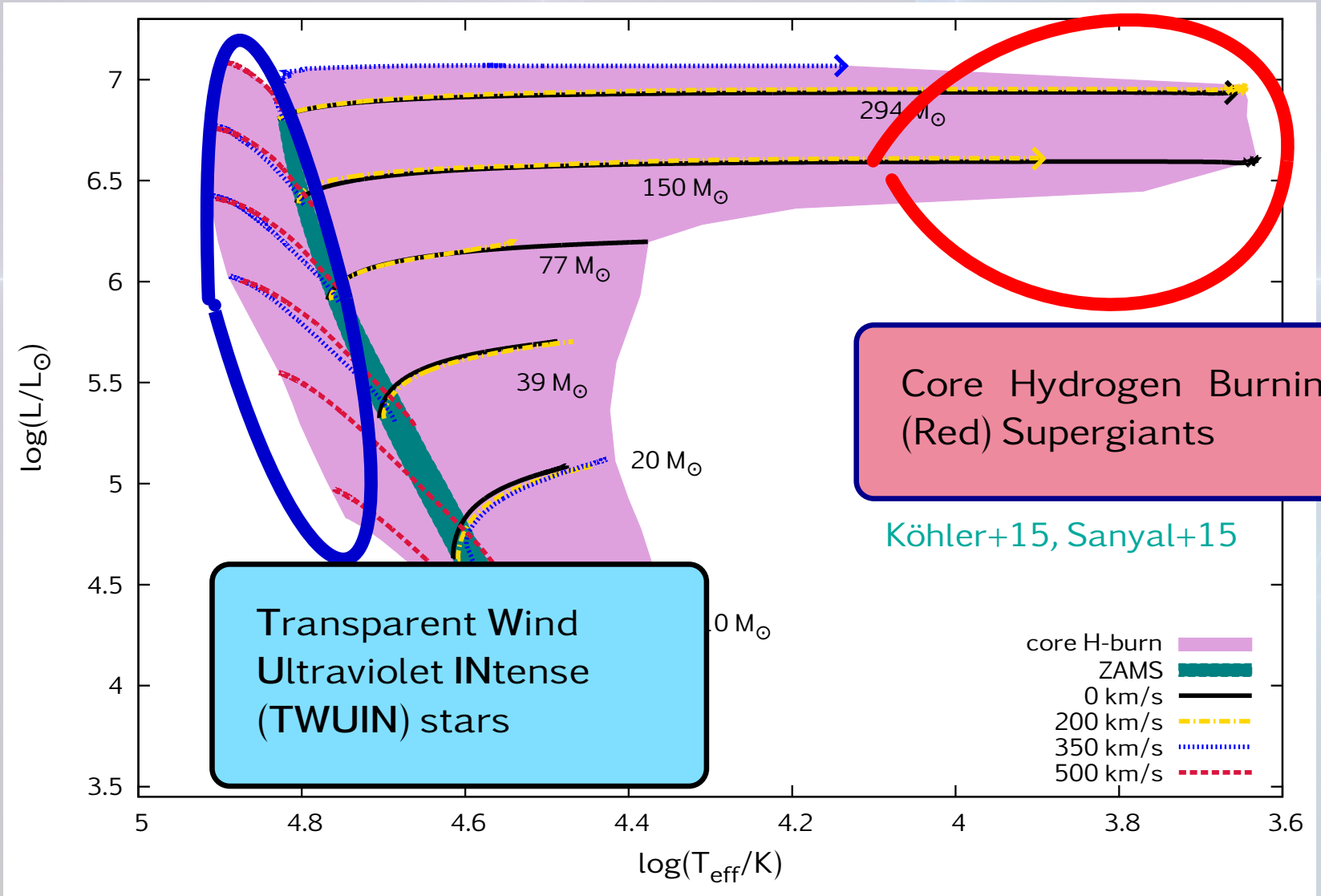
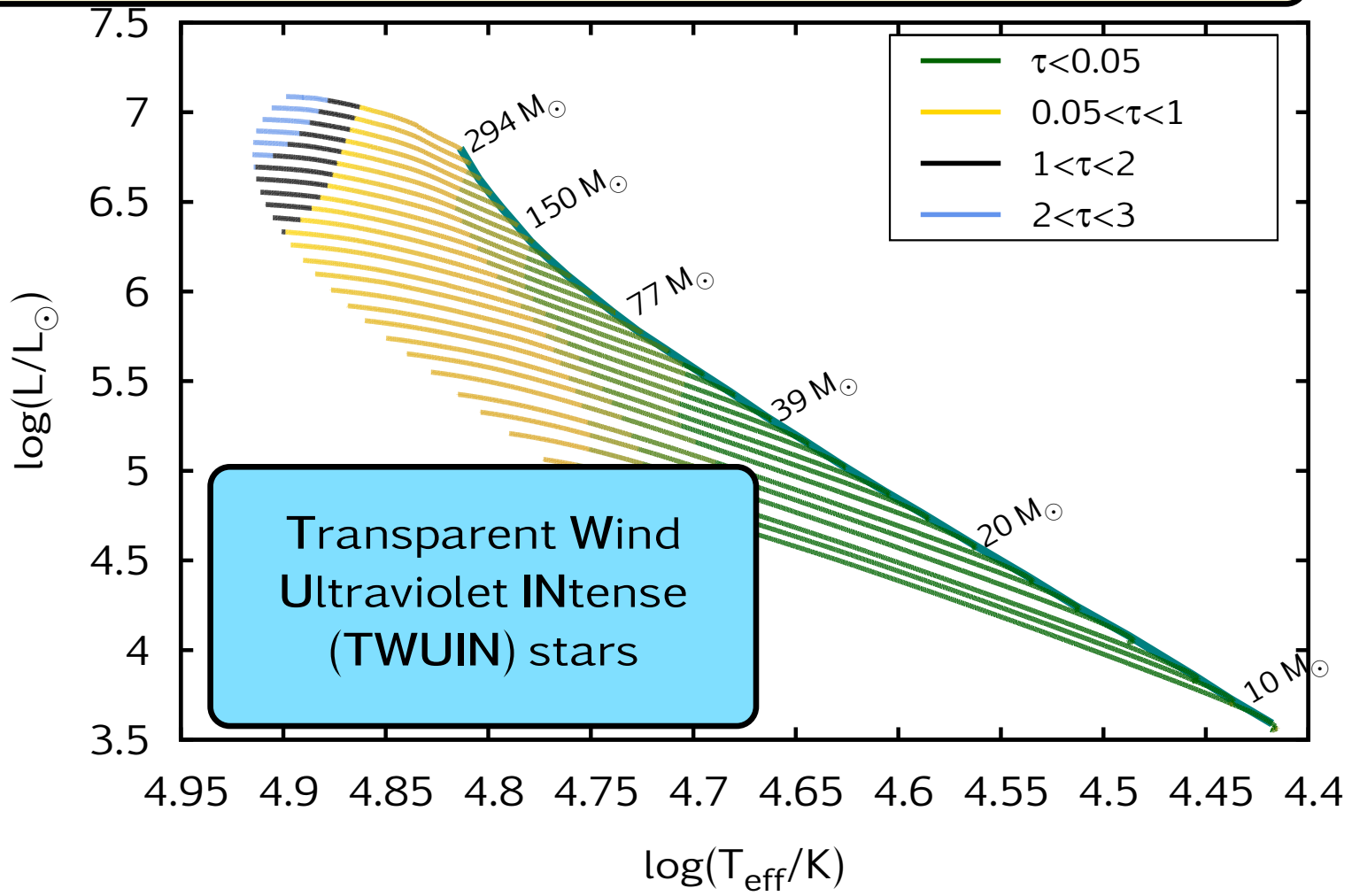
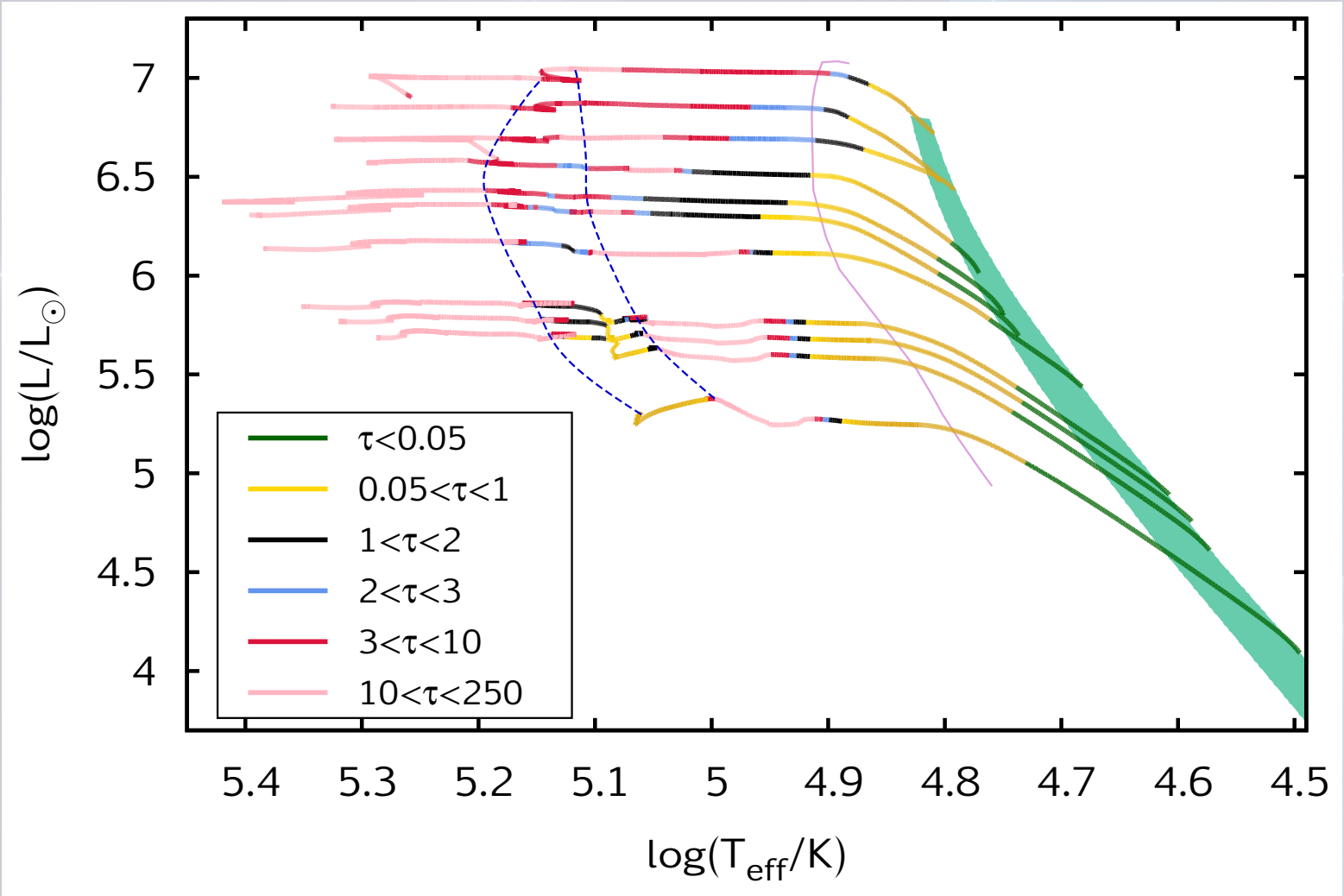


TWUIN stars and their stellar winds

Main sequence lifetime: wind optical depth is $\tau \lesssim 1$



Post-MS evolution



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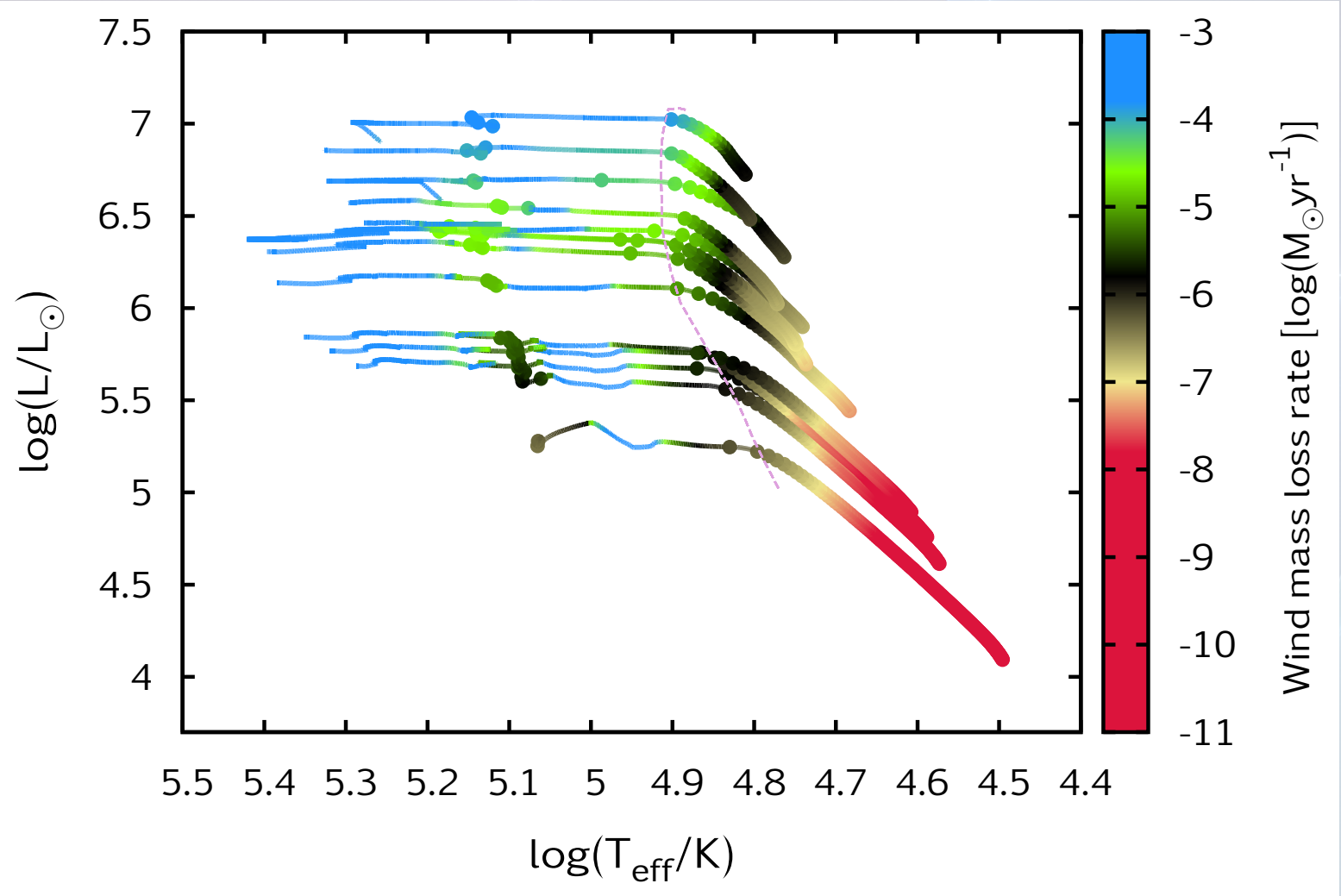

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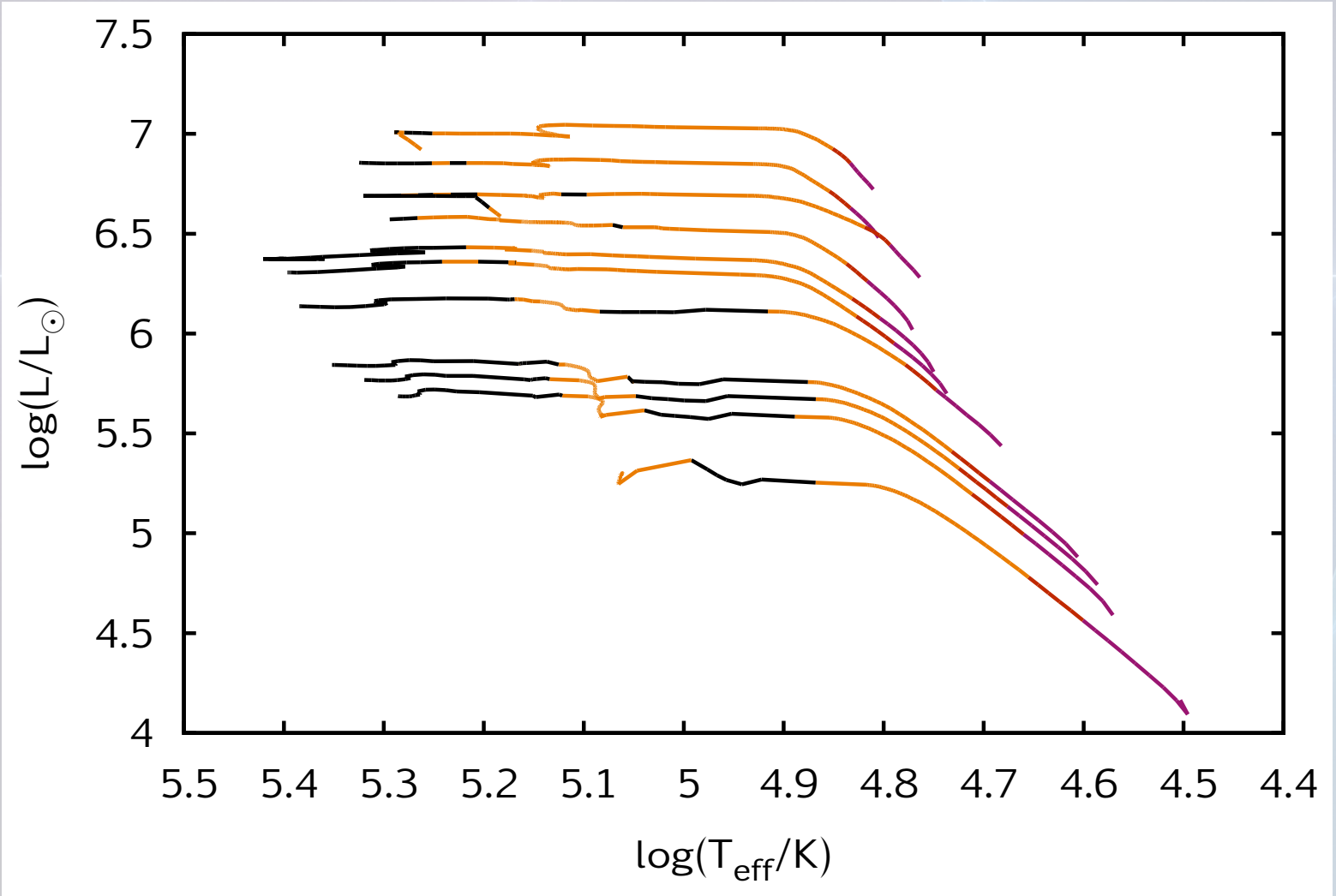

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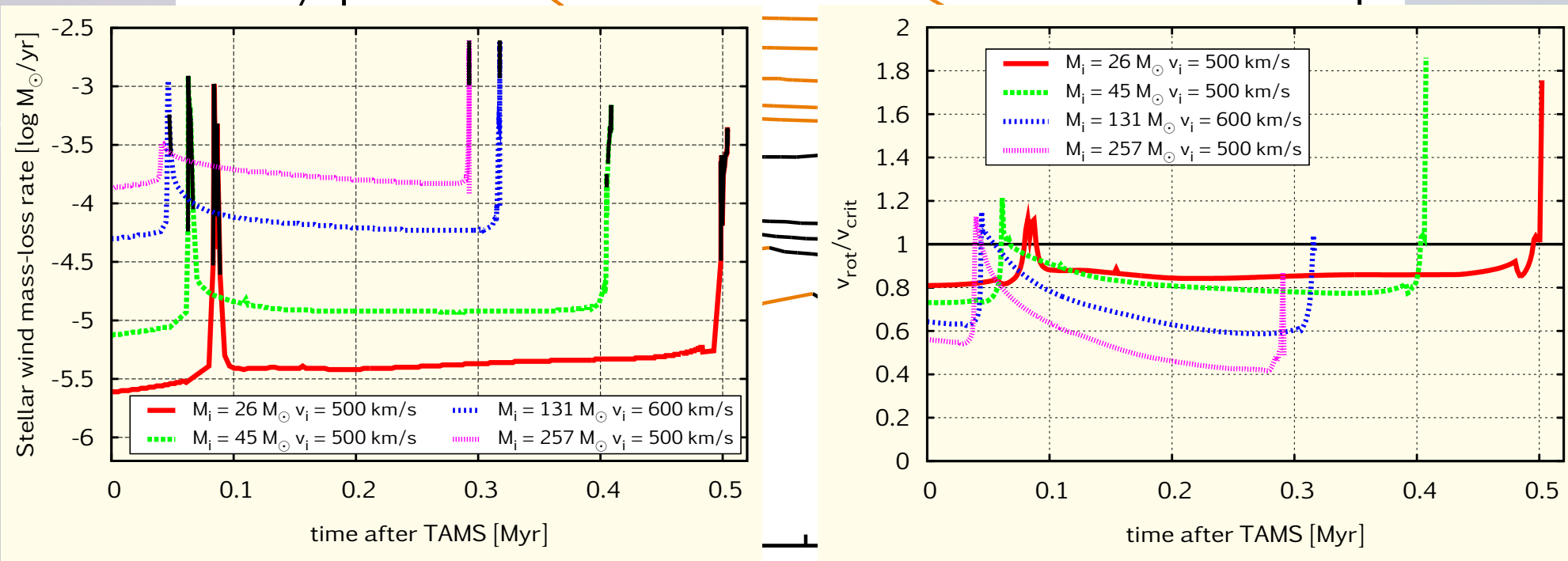
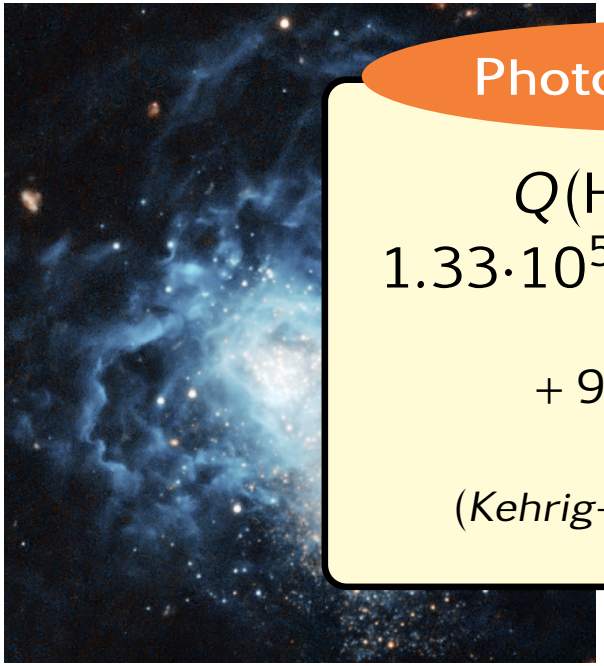


Back to I Zw 18

I Zwicky 18

- Blue Compact Dwarf Galaxy
- 18 Mpc → local
- SFR: 0.1-1 $M_\odot$/yr
- ionized gas
- low metallicity:
  12+log(O/H)=7.17
  ↓
  $Z=1/50\ Z_\odot \approx 0.0002$



Photoionization

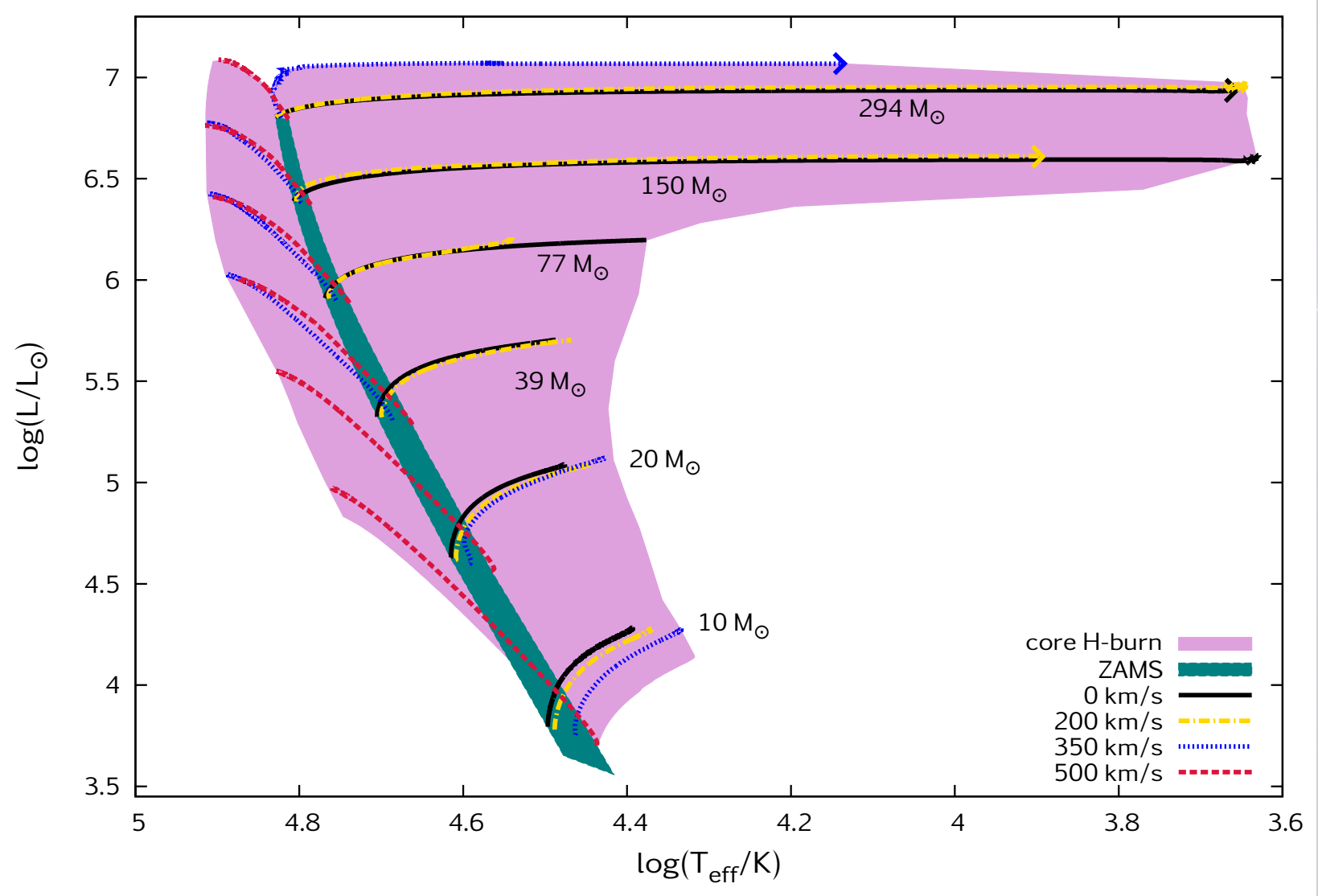
$Q(\mathrm{HeII})^{obs} = 1.33 \cdot 10^{50}$ photons s^{-1}

+ 9 WC stars

(*Kehrig+15, Crowther+06*)

Legrand+07, Aloisi+09, Annibali+13, Kehrig+13, Lebouteiller+13

WC stars? Post-main-sequence!



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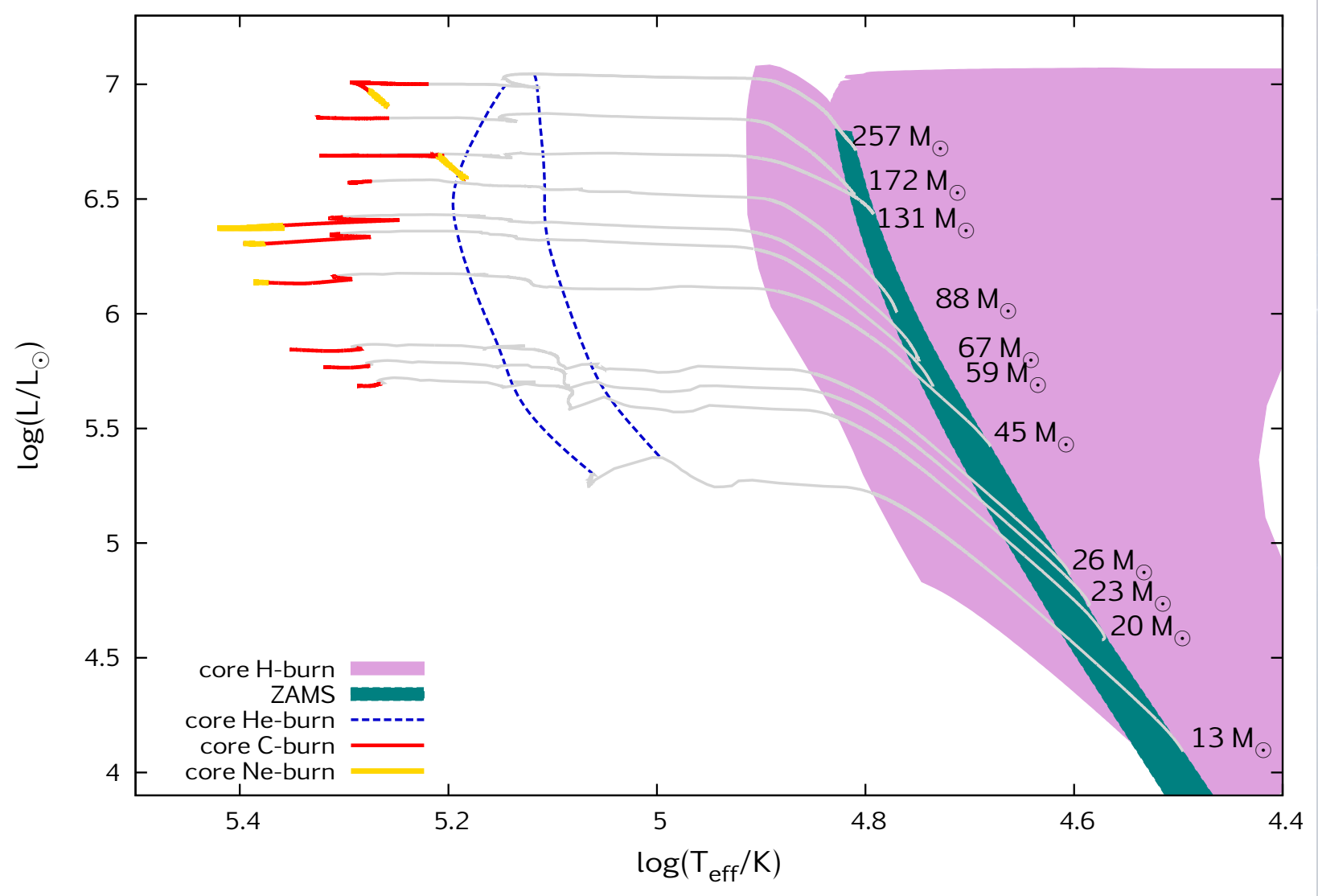

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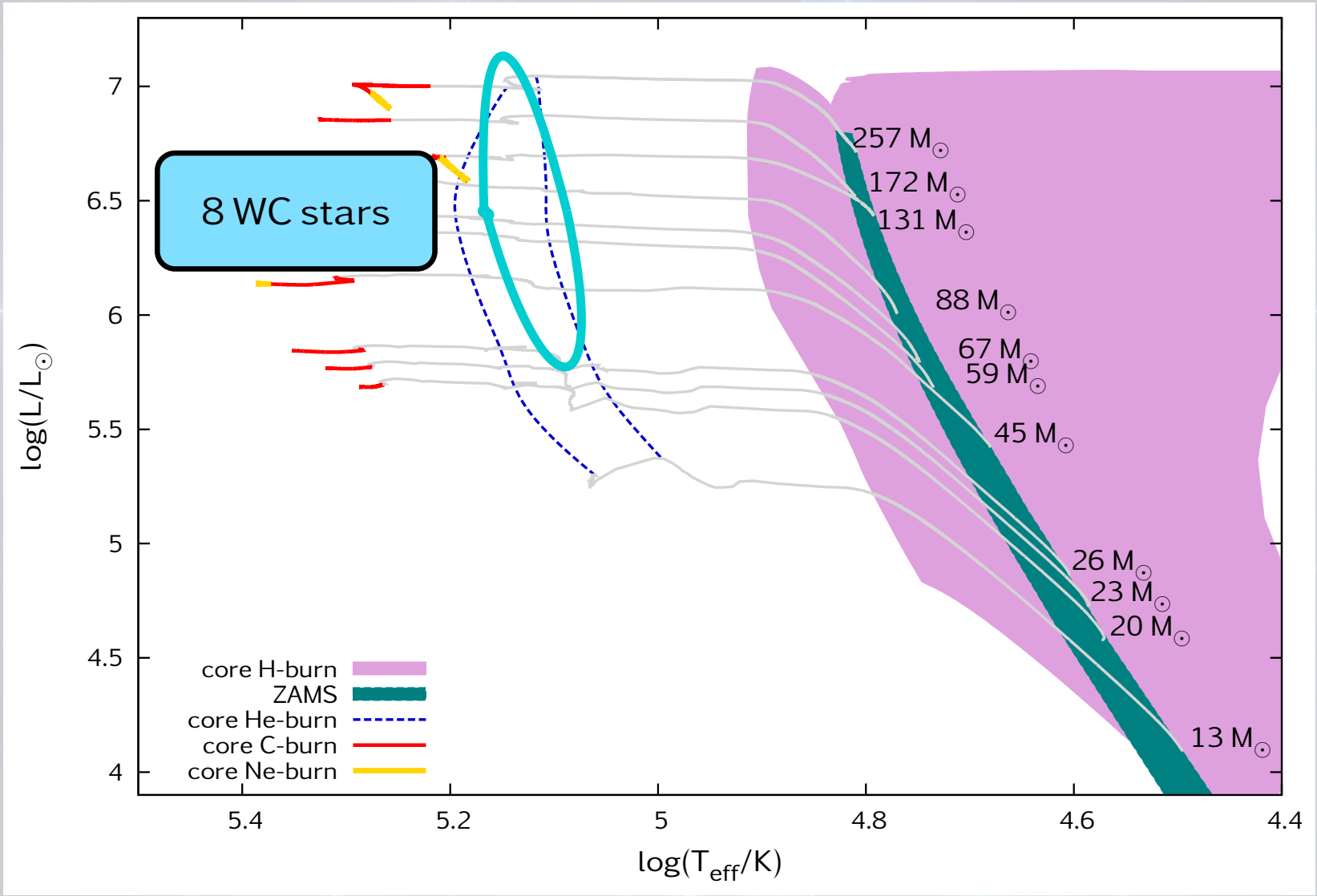

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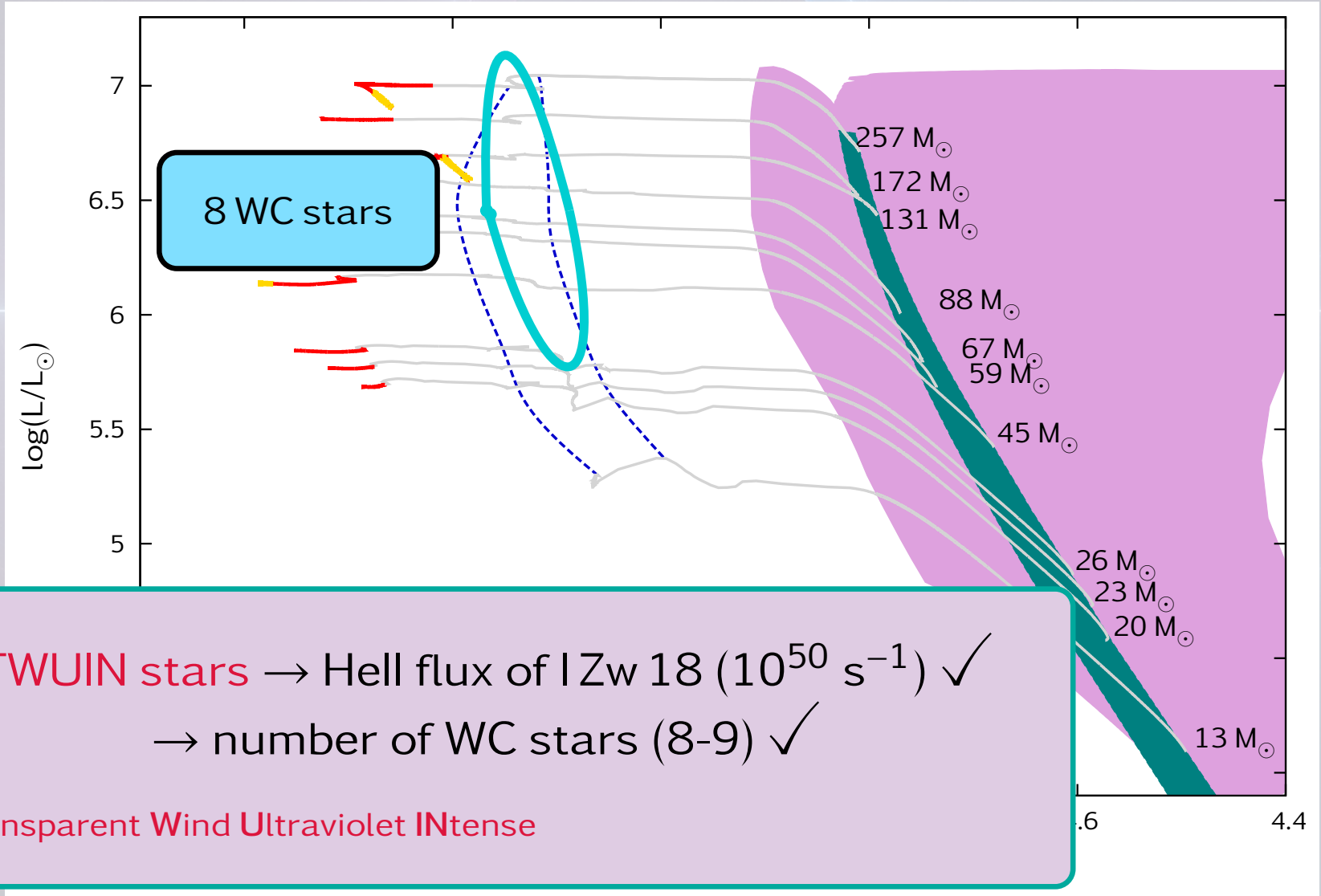
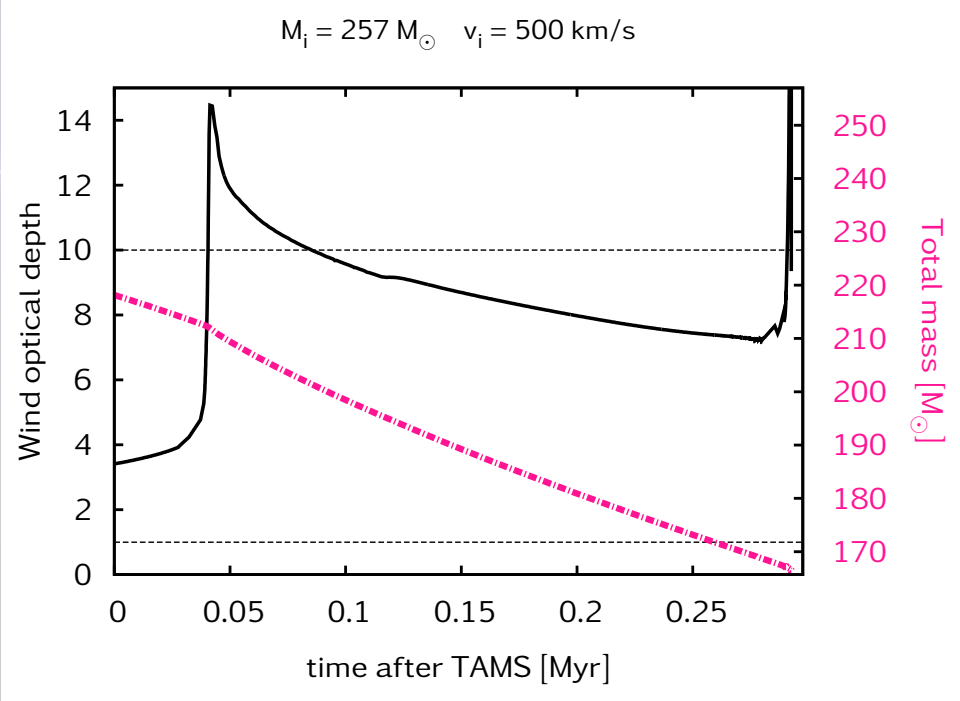


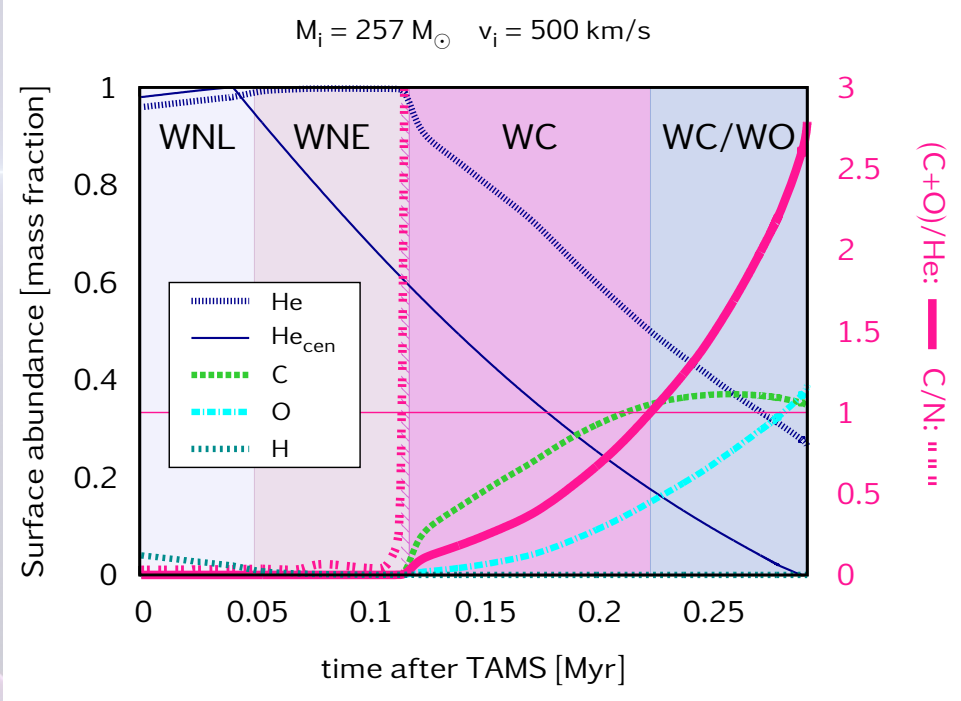
TWUIN stars → Hell flux of I Zw 18 (10^{50} s^{-1}) ✓

→ number of WC stars (8-9) ✓

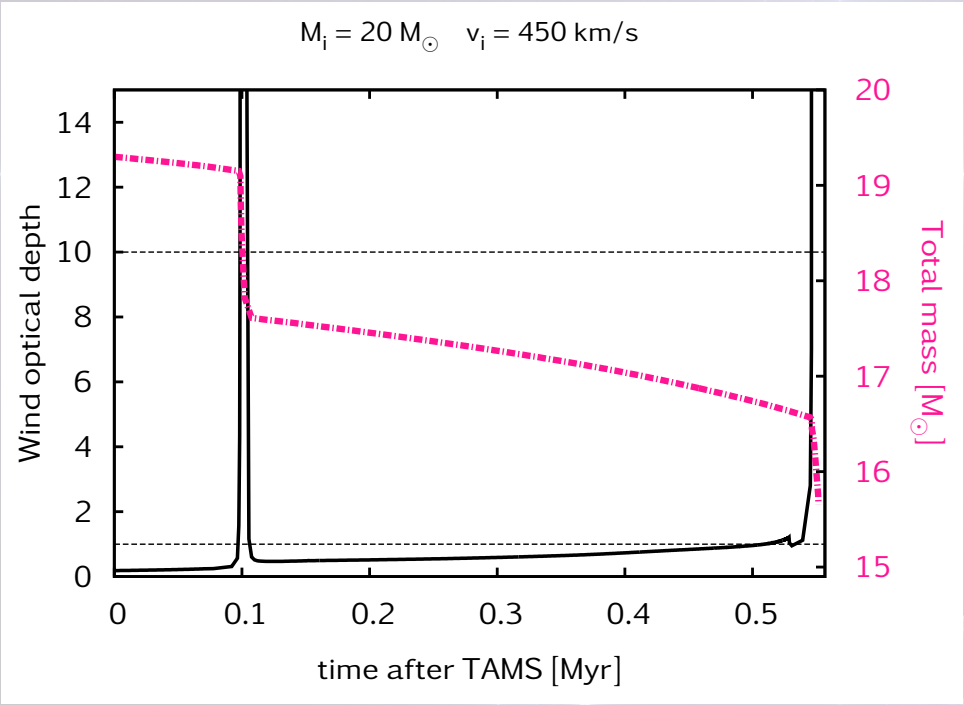
Transparent **W**ind **U**ltraviolet **IN**tense

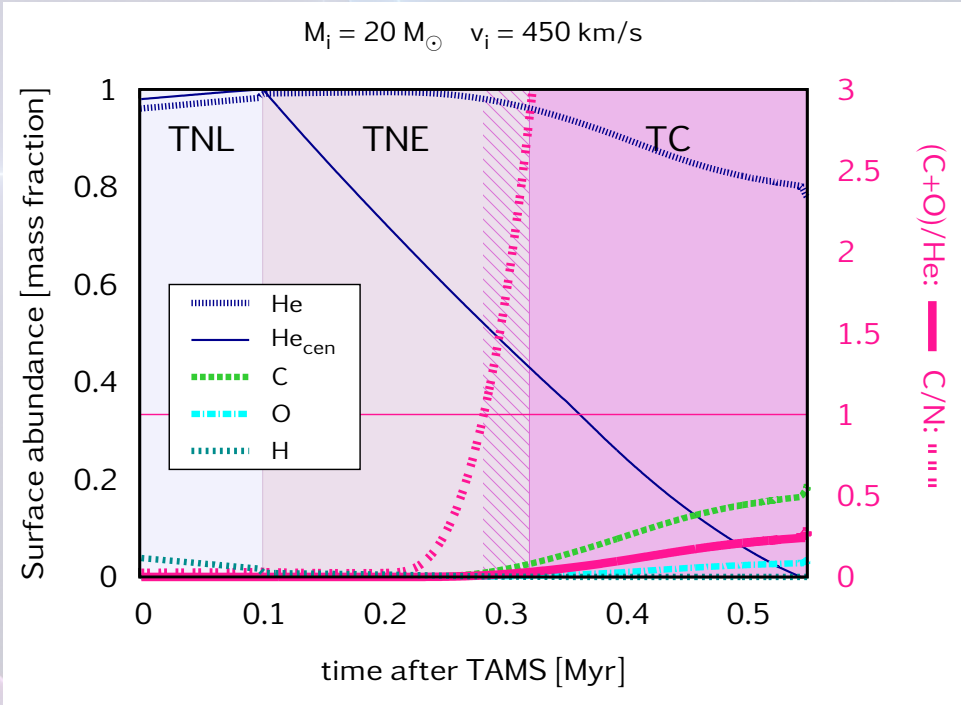
The model with M_{ini}=257 $M_\odot$



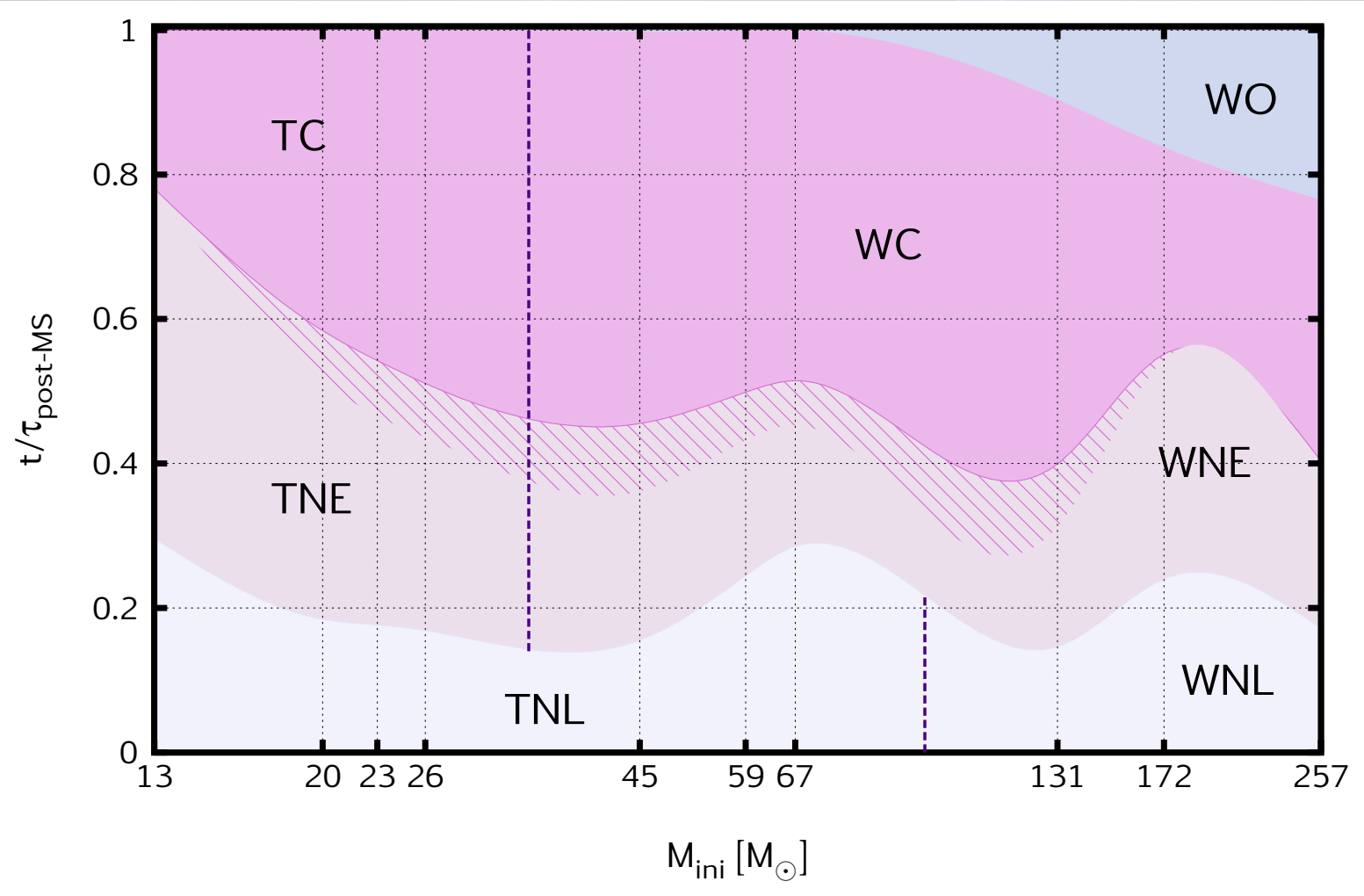


The model with $M_{ini}=20\ M_{\odot}$

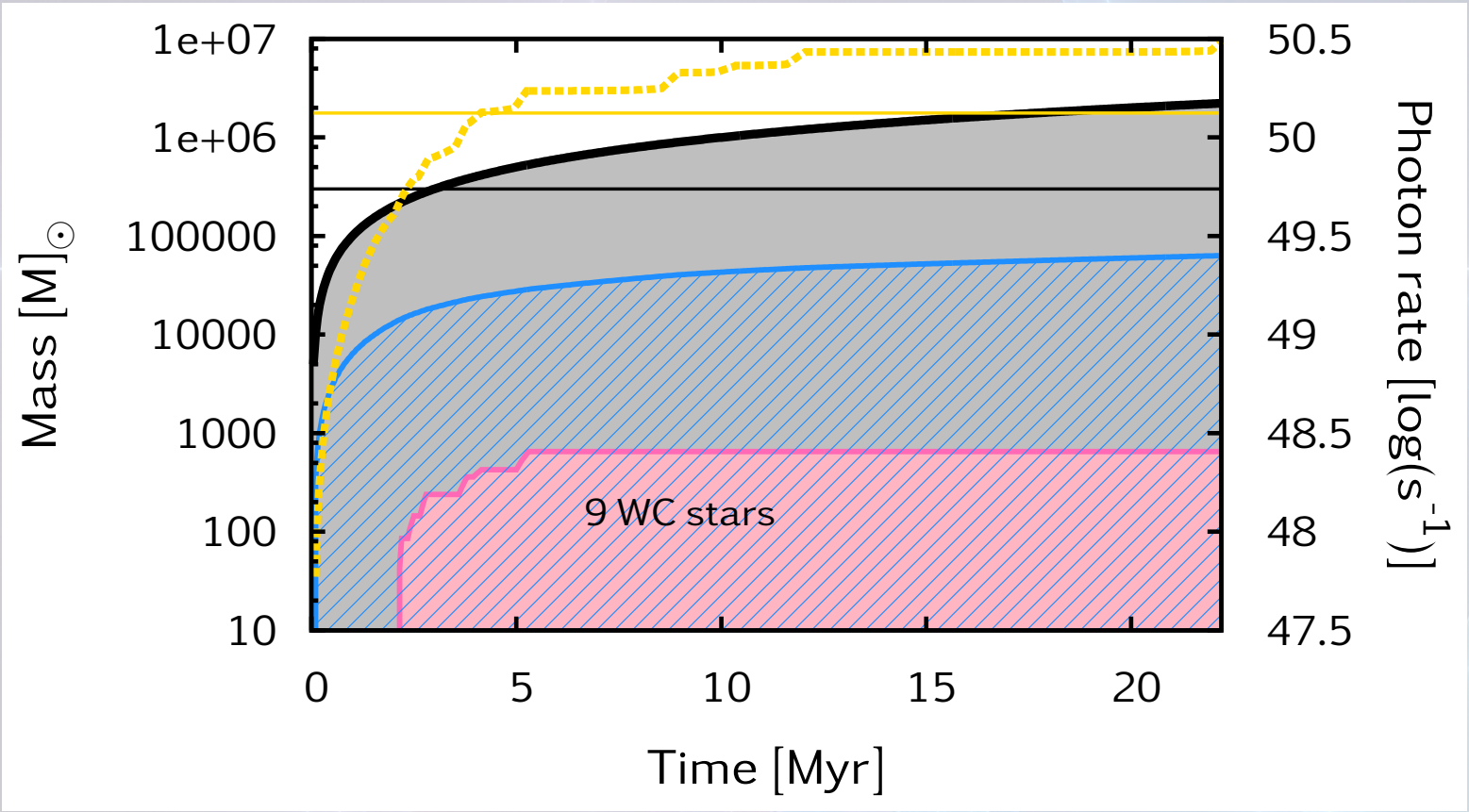




Post-MS phases



Number of WC stars in a synthetic population



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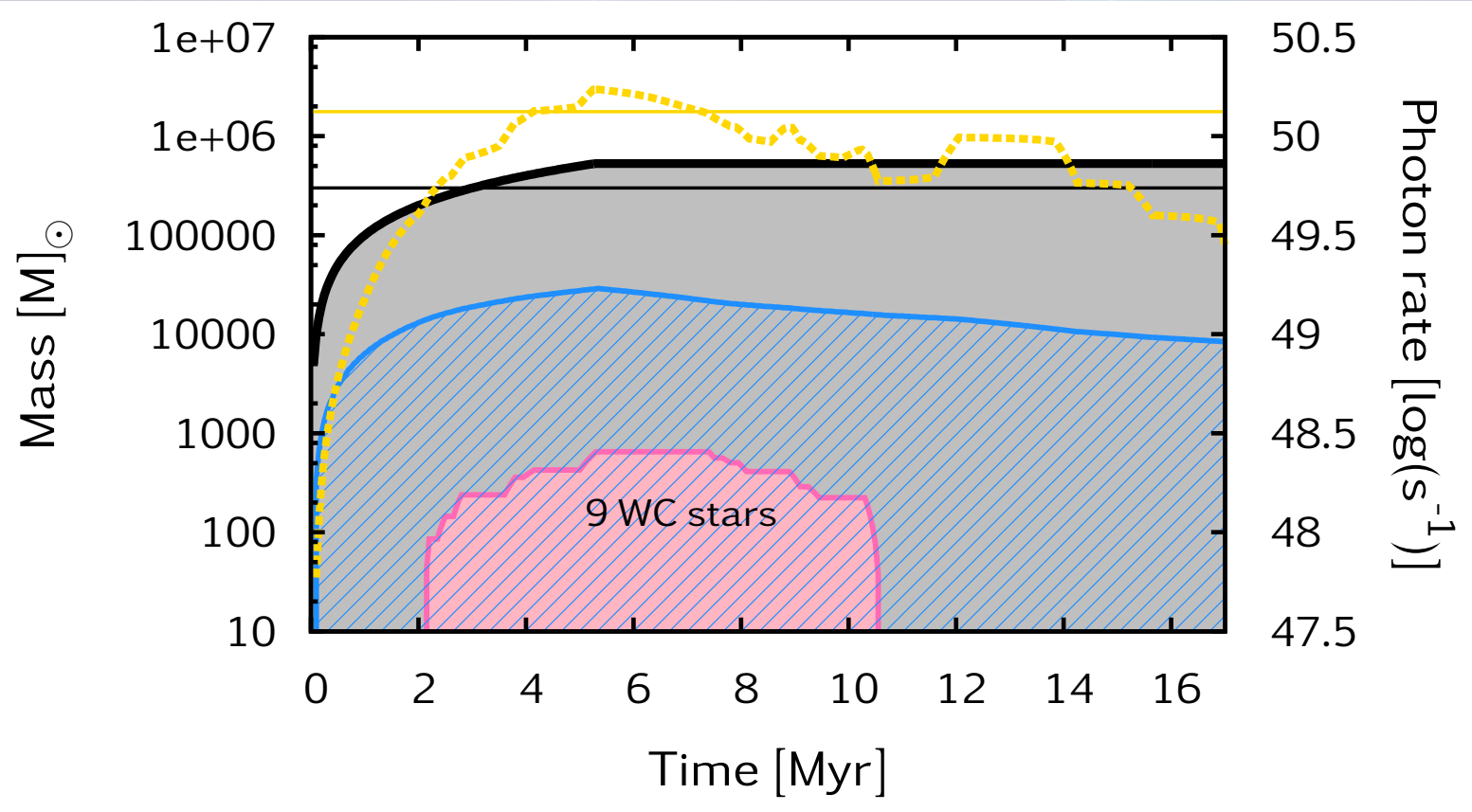

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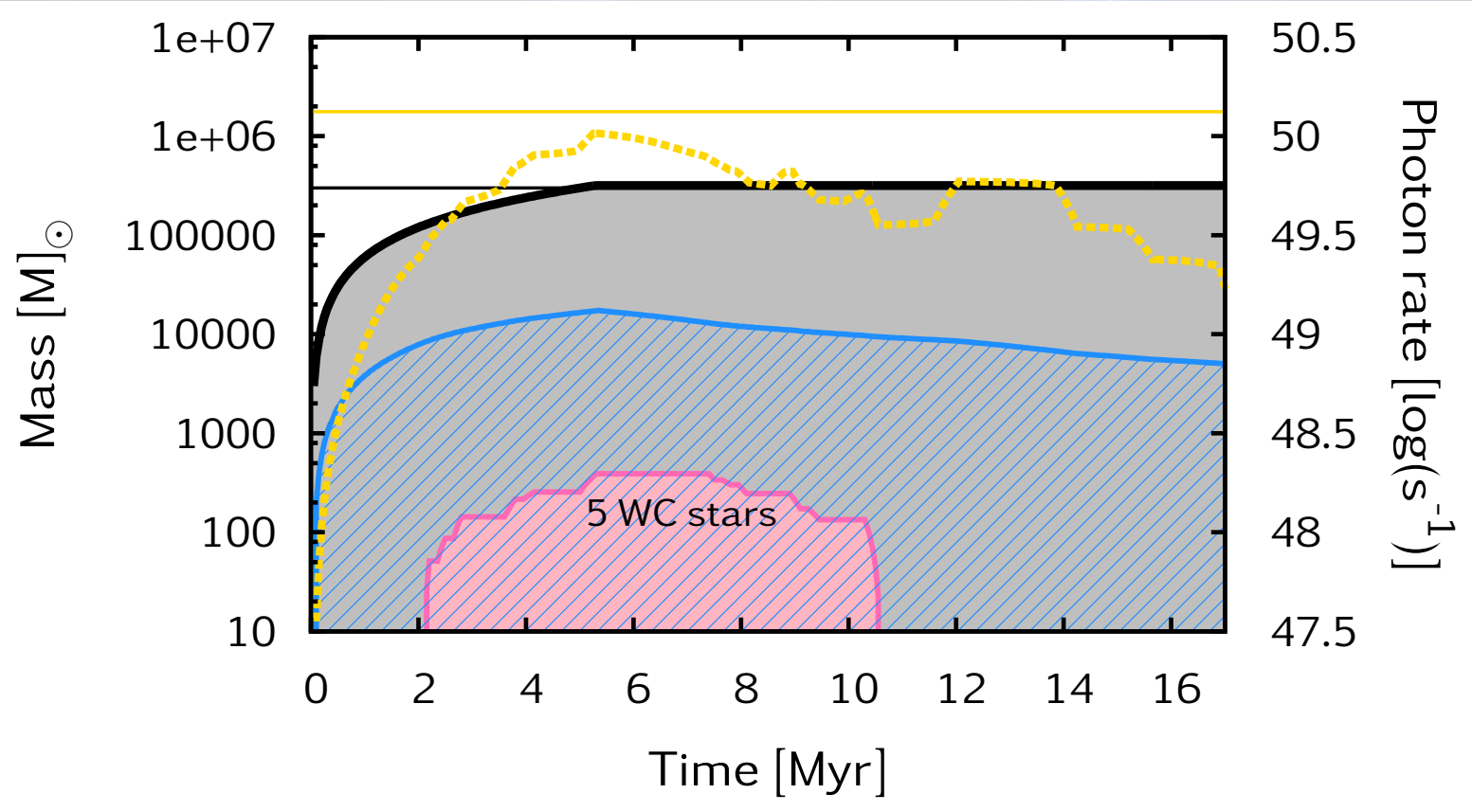
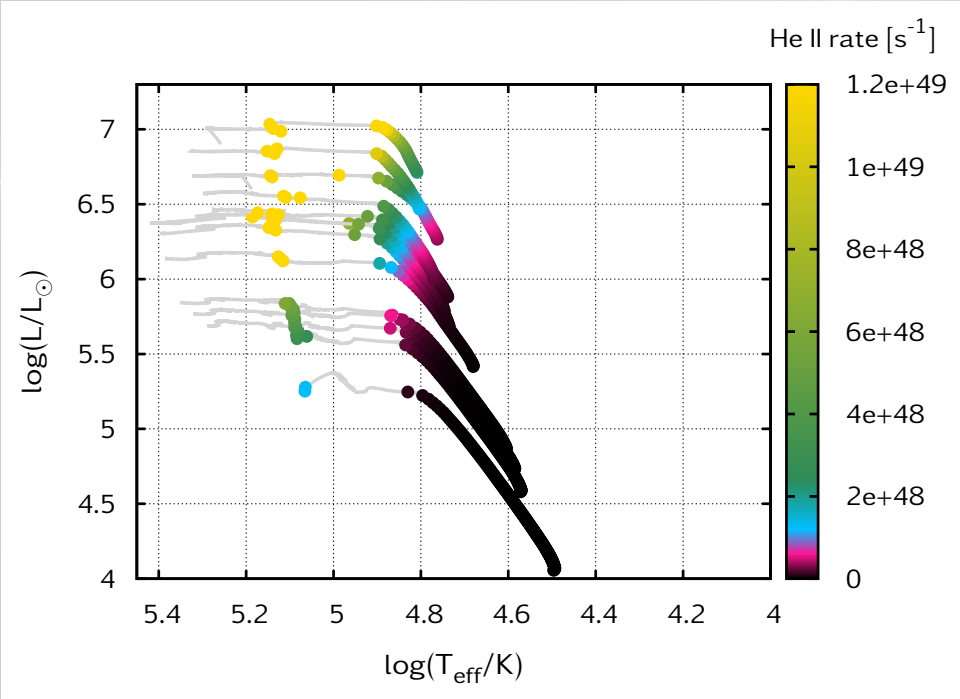
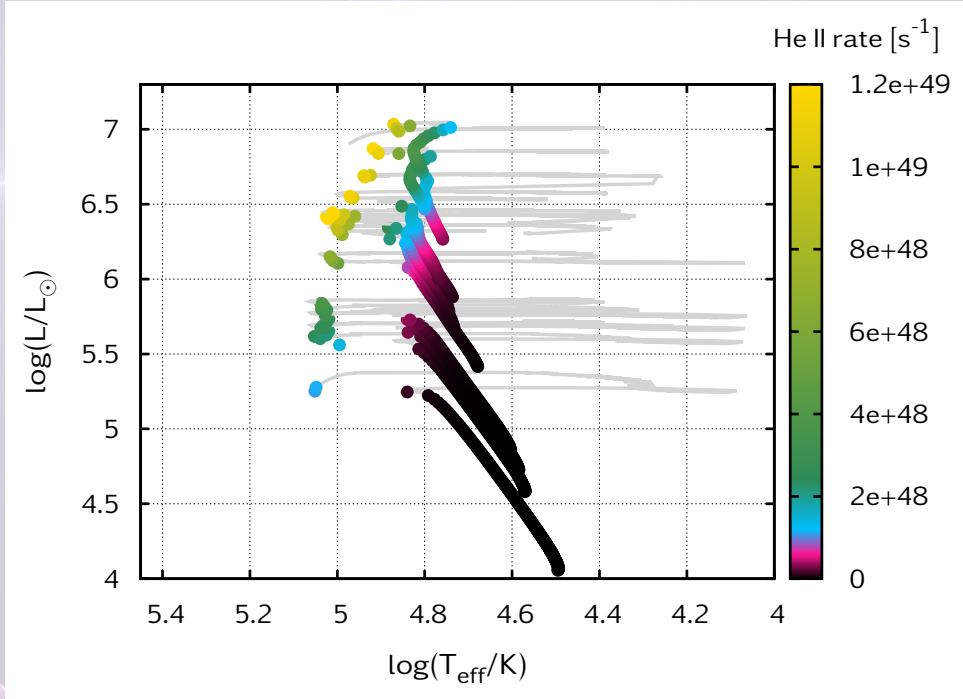


Photo-ionization

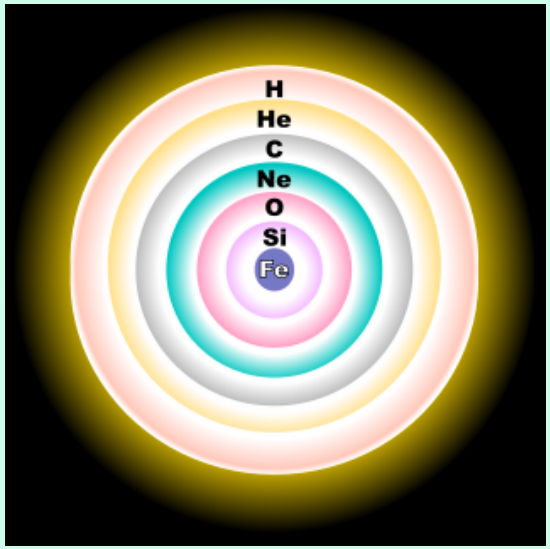




Explosions

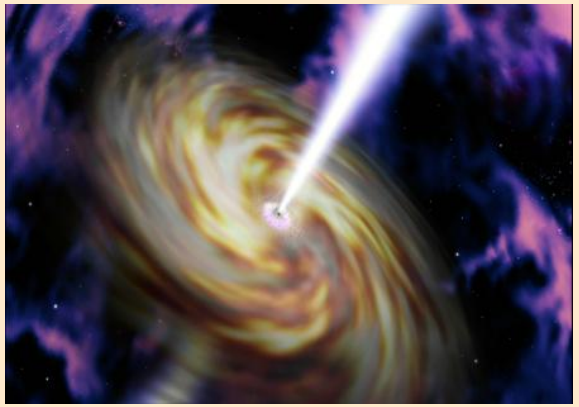
Final Fate of Hot Massive Stars at Low Z

Massive stars



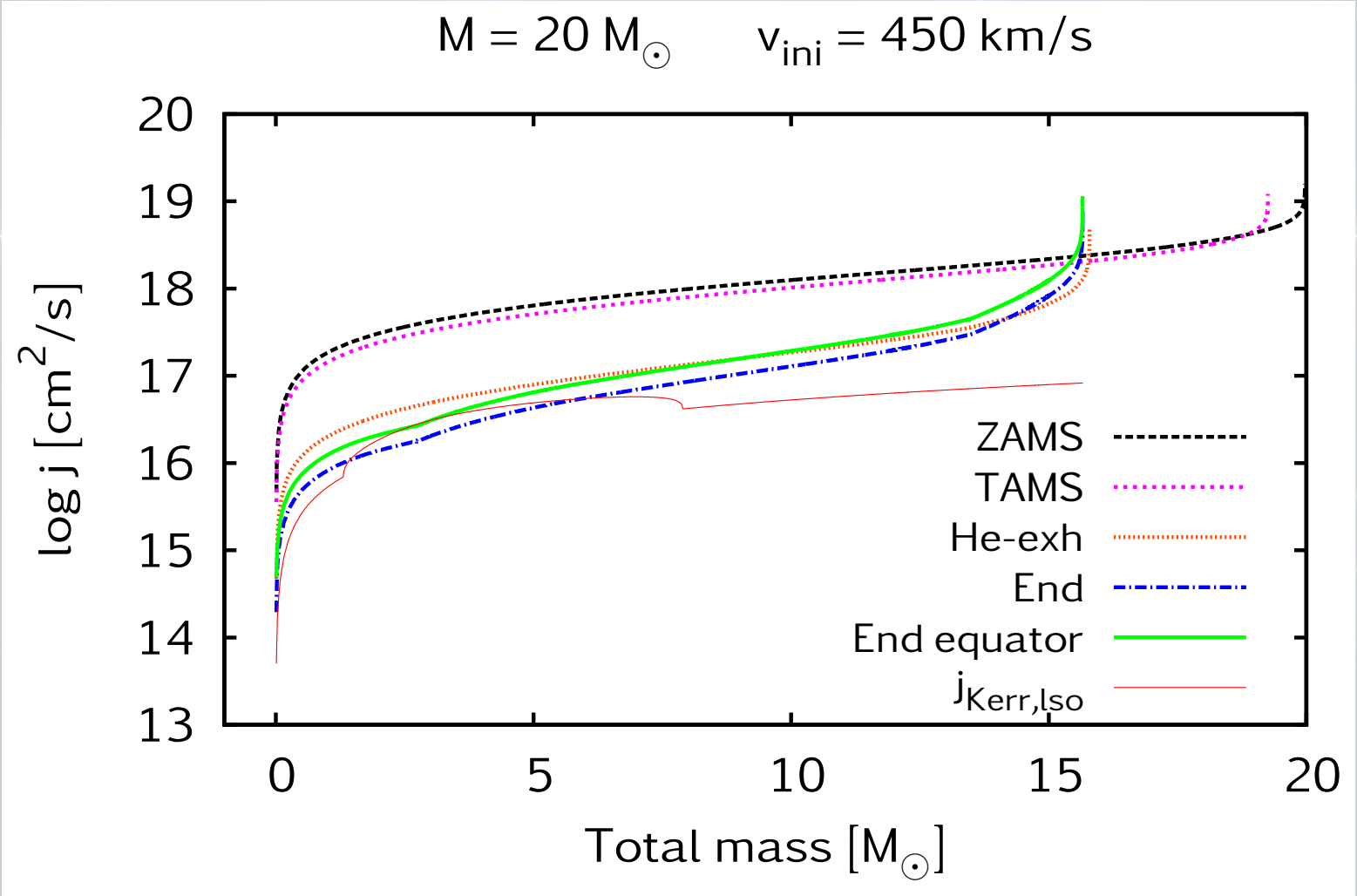
?

Collapsar → lGRB

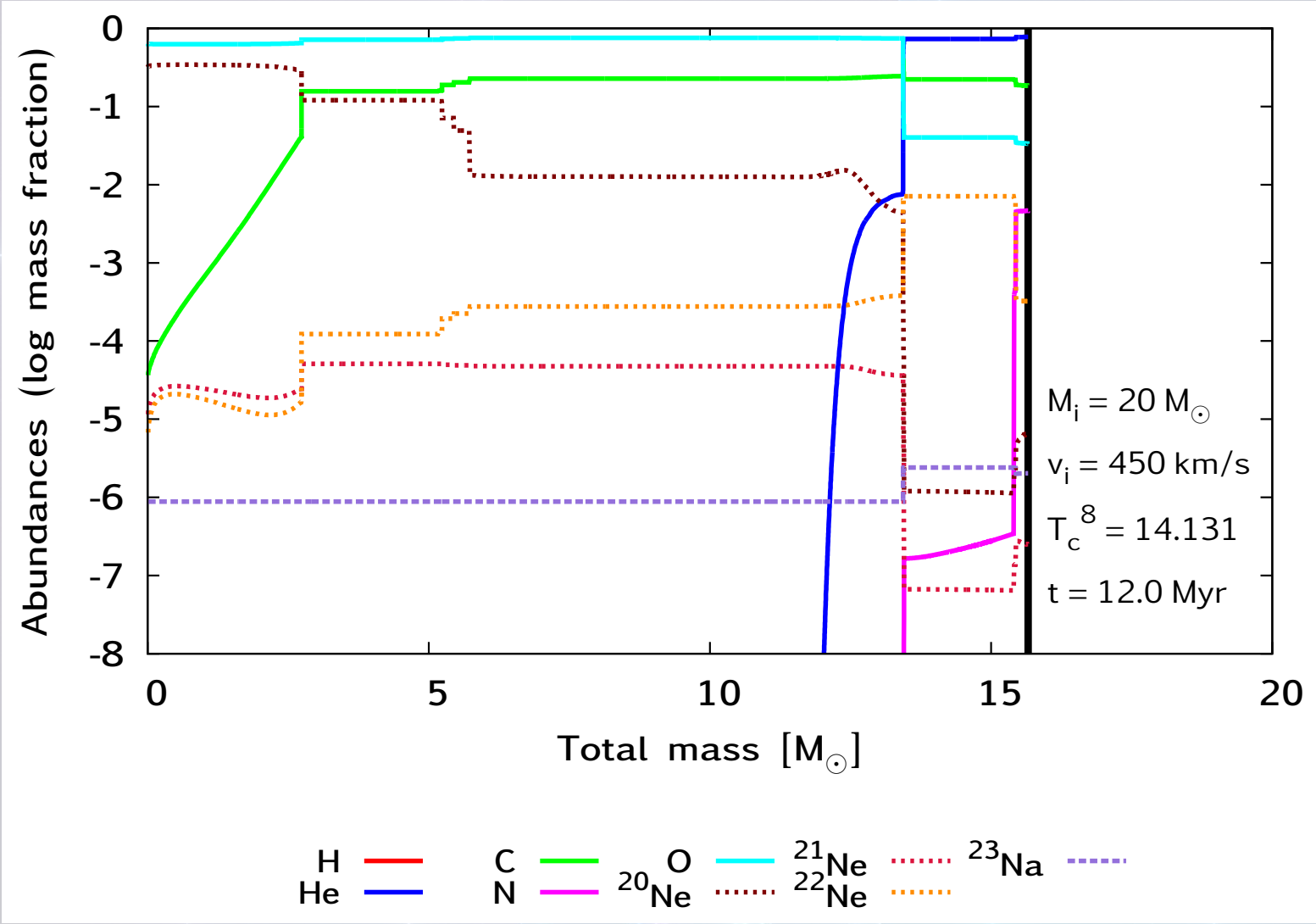


Yoon&Langer'05; Woosley&Heger'06; Yoon+06; Yoon+12

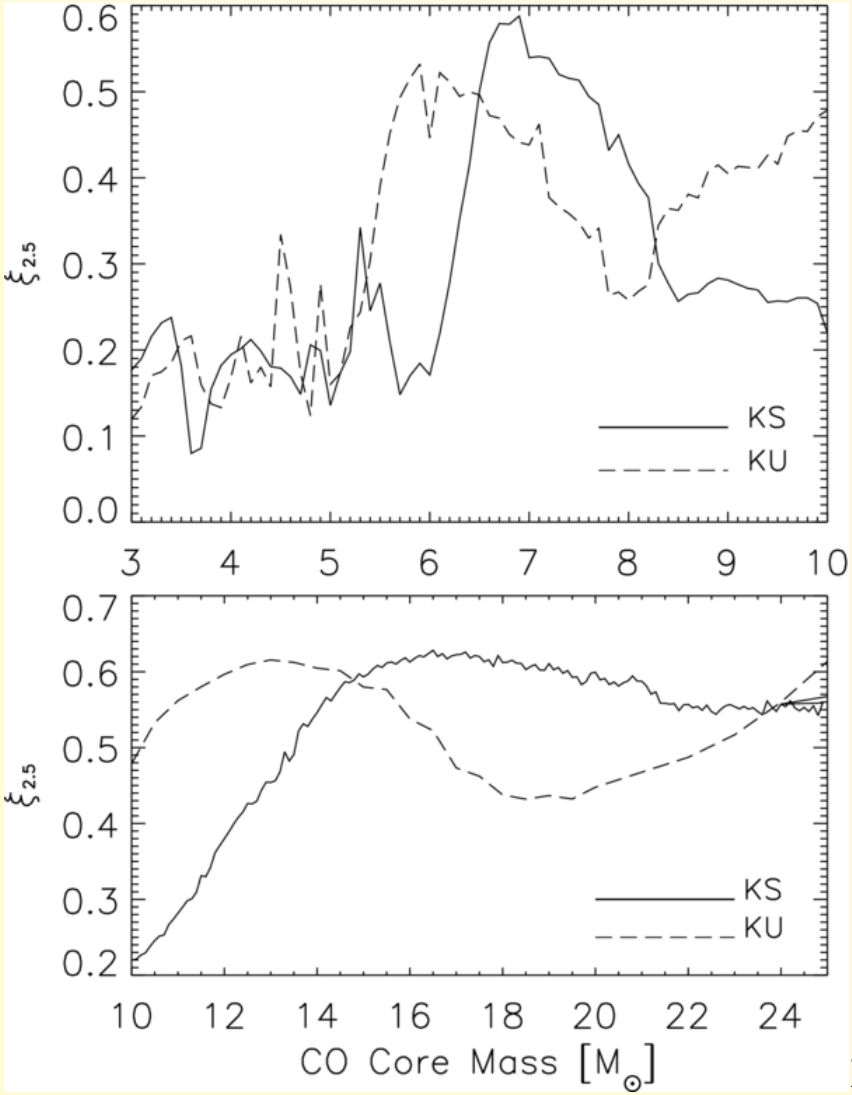
Angular momentum



Angular momentum

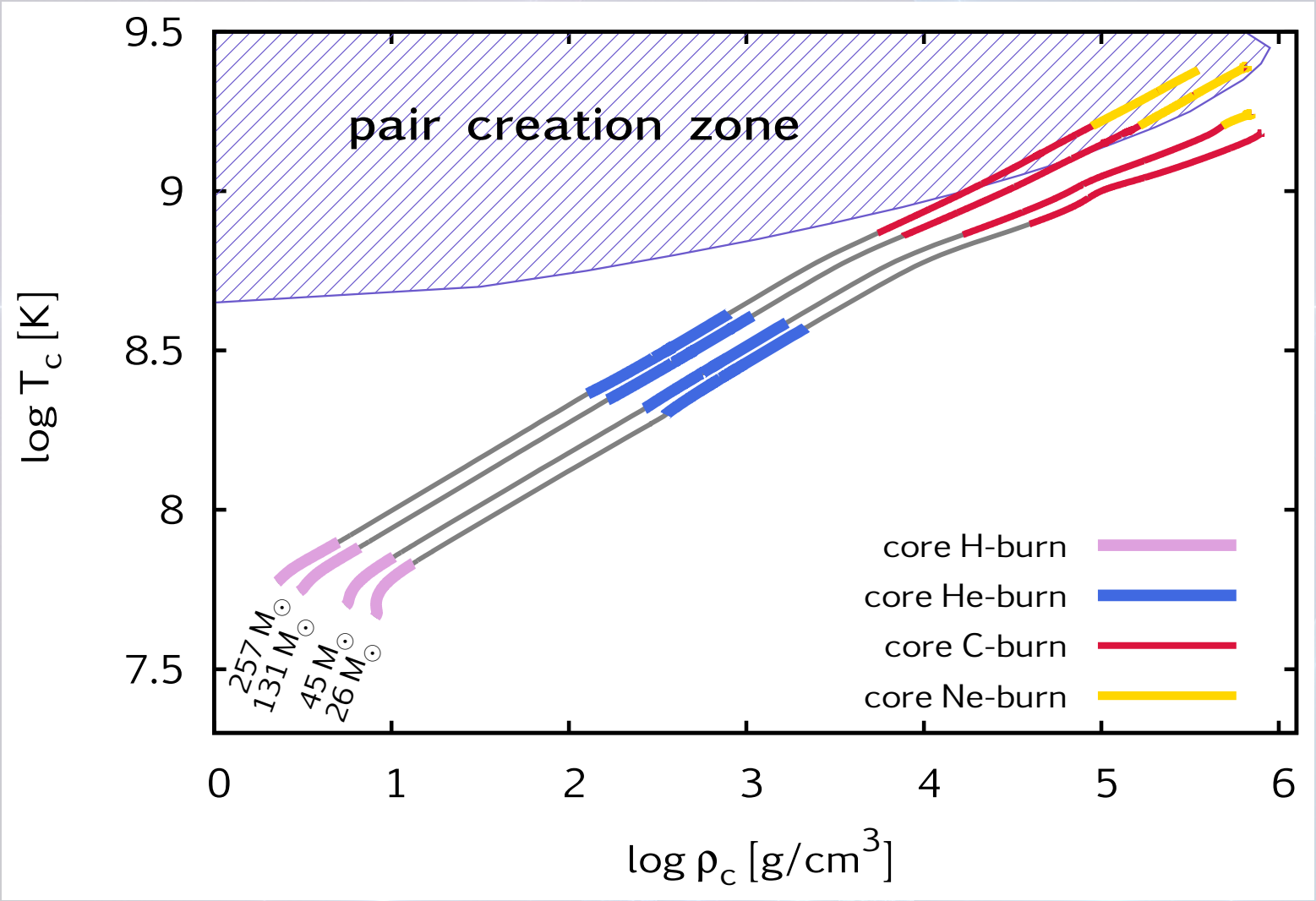


Angular momentum



Sukhbold & Woosley (2014)

Pair instability



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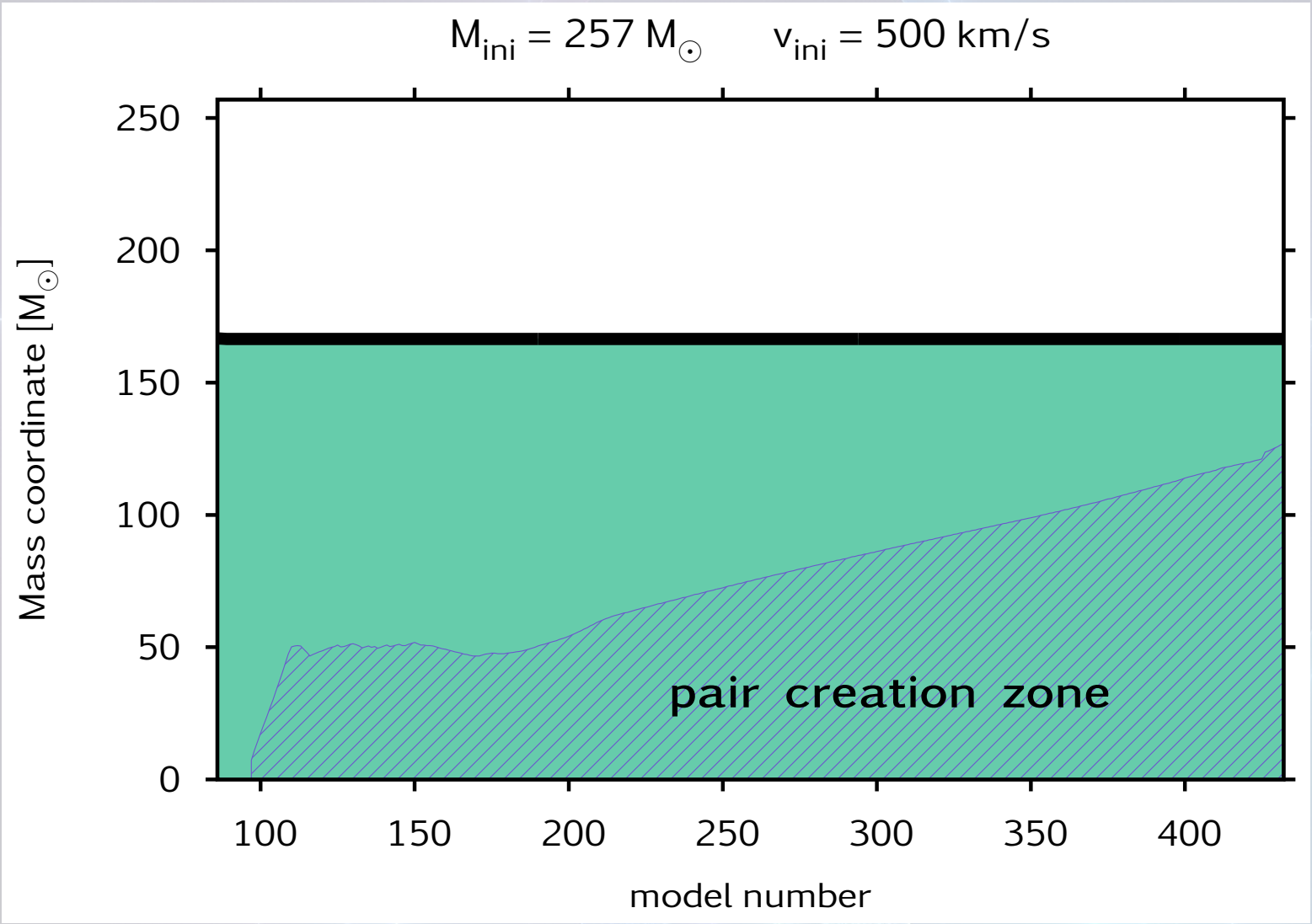

Final fate predictions

M_{ini} [$M_\odot$]	v_{ini} [km s^{-1}]	$M_{He\text{-}exh}^{CO\text{-}core}$ [$M_\odot$]	theoretical scenario (observable event)	remnant
13	450	12.7*	collapsar (lGRB)	black hole
20	450	13.4	collapsar (lGRB)	black hole
23	500	15.4	collapsar (lGRB)	black hole
26	350	25.1*	magnetar (SLSN type I and/or lGRB)	neutron star
26	500	17.6	magnetar (SLSN type I and/or lGRB)	neutron star
45	500	32.5	collapsar (lGRB)	black hole
59	300	44.1	pPISN	black hole
67	275	50.6	pPISN	black hole
67	300	52.7	pPISN	black hole
77	500	56.0	pPISN	black hole
88	275	68.0	PISN	no remnant
131	600	87.4	PISN	no remnant
172	350	122.2	PISN	no remnant
257	500	166.8	direct fall-in	black hole

Beyond the night-sky: Low-Z Massive Stars