The Life and Death of Massive Stars in the Starburst Galaxy I Zw 18

Dorottya Szécsi
Norbert Langer

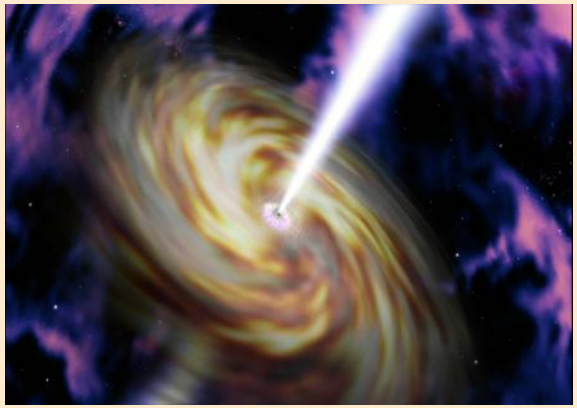
Argelander-Institut für Astronomie

Stellar Explosions in an Ever-Changing Environment (IAU General Assembly FM 10)

11-13. August 2015, Honolulu, Hawaii

Life and Death of Massive Stars

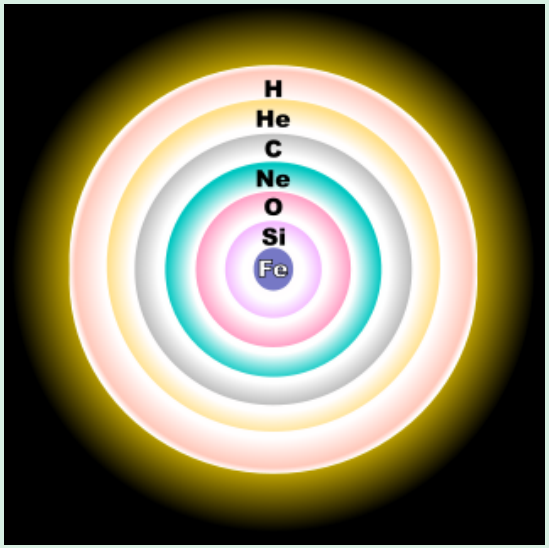
Collapsar → lGRB



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

Life and Death of Massive Stars

Massive stars



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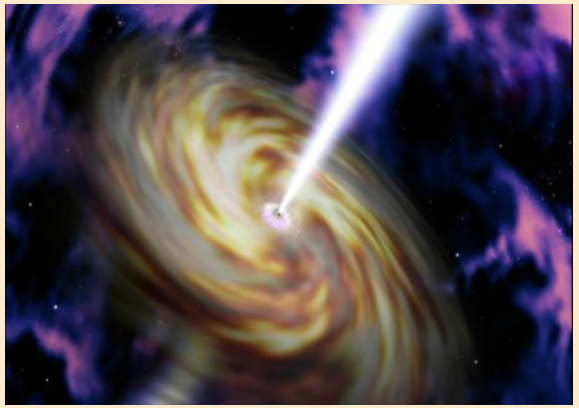

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Meet I Zw 18!

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
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  $Z=1/50\ Z_\odot \approx 0.0002$

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

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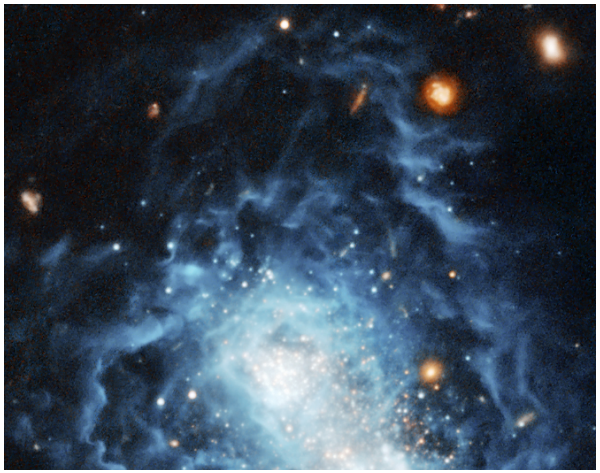

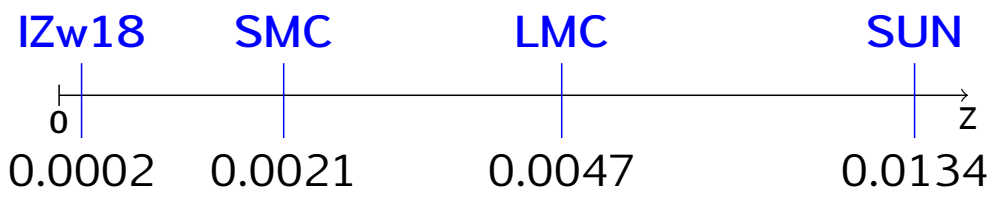

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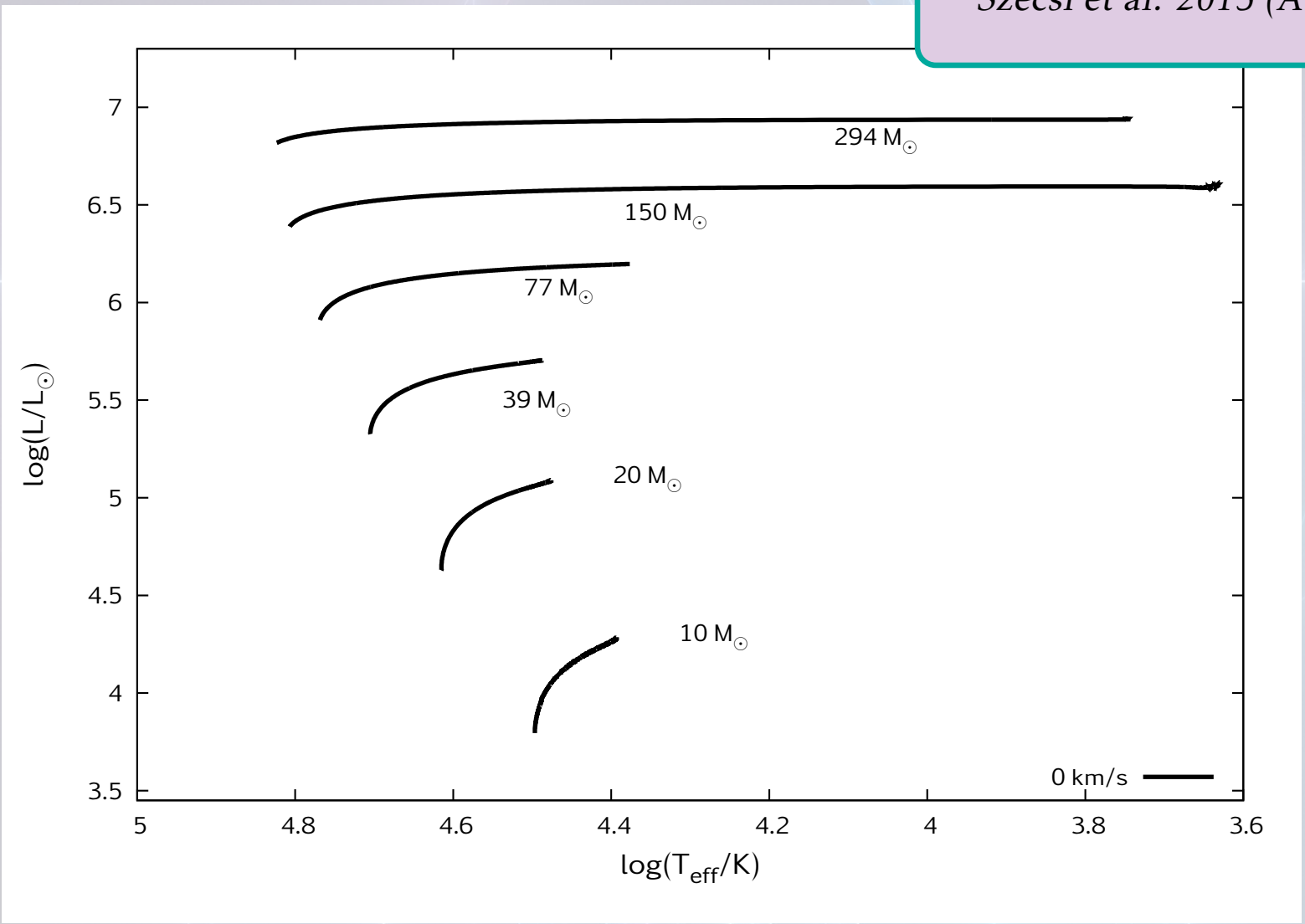
Stellar evolution in I Zw 18

$Z=1/50\ Z_{\odot}$ models from *Szécsi et al. 2015 (A&A)*



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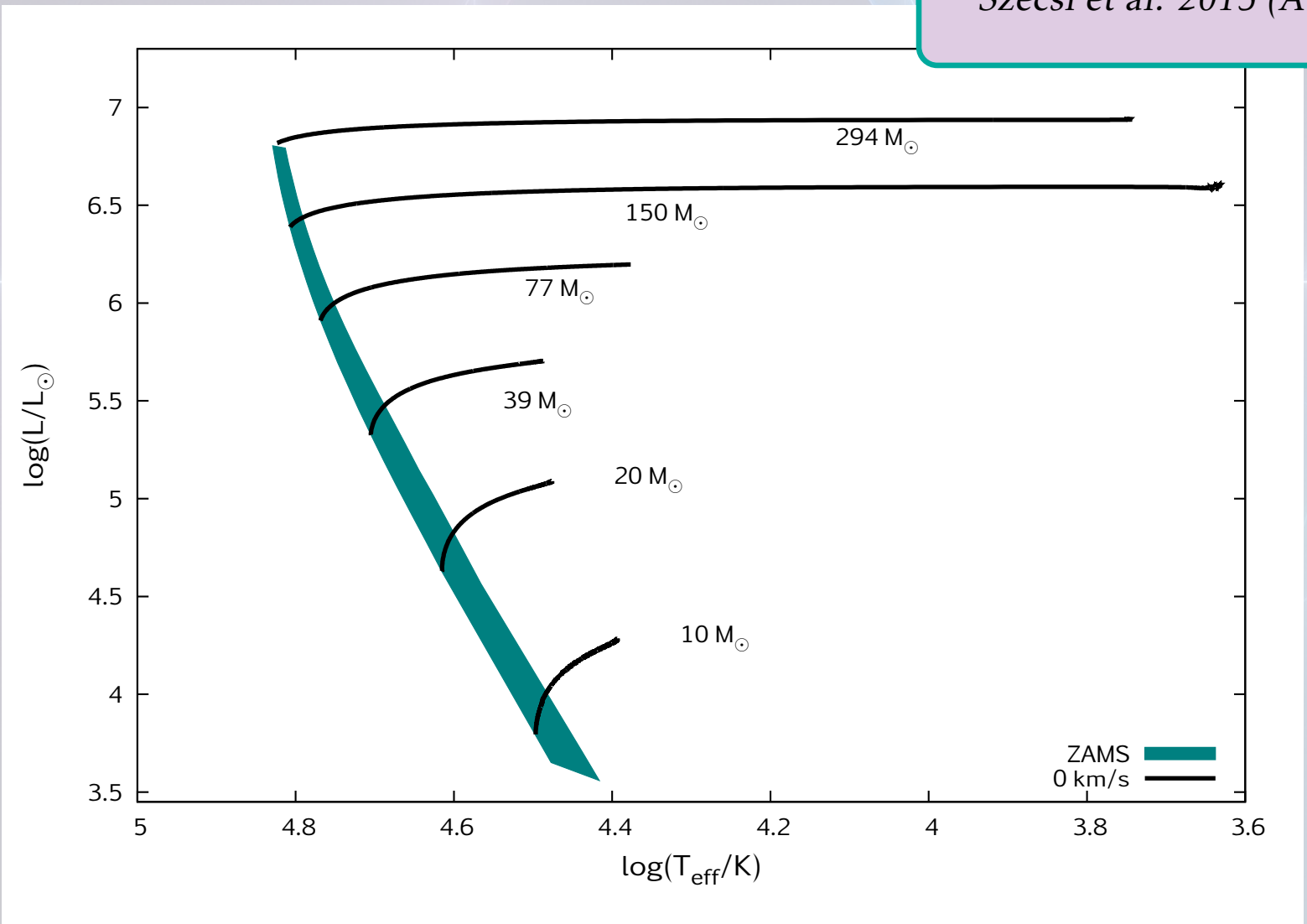

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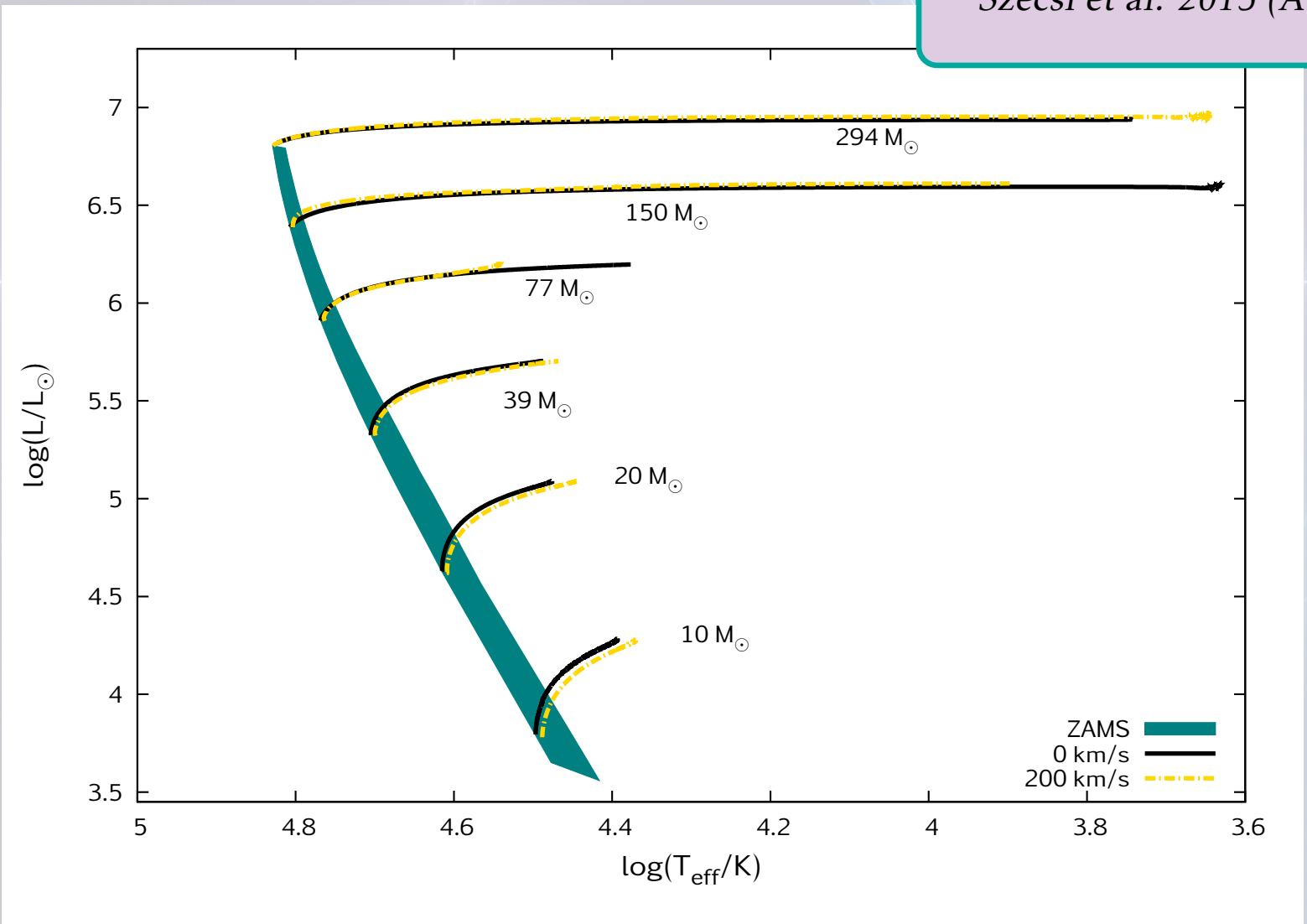

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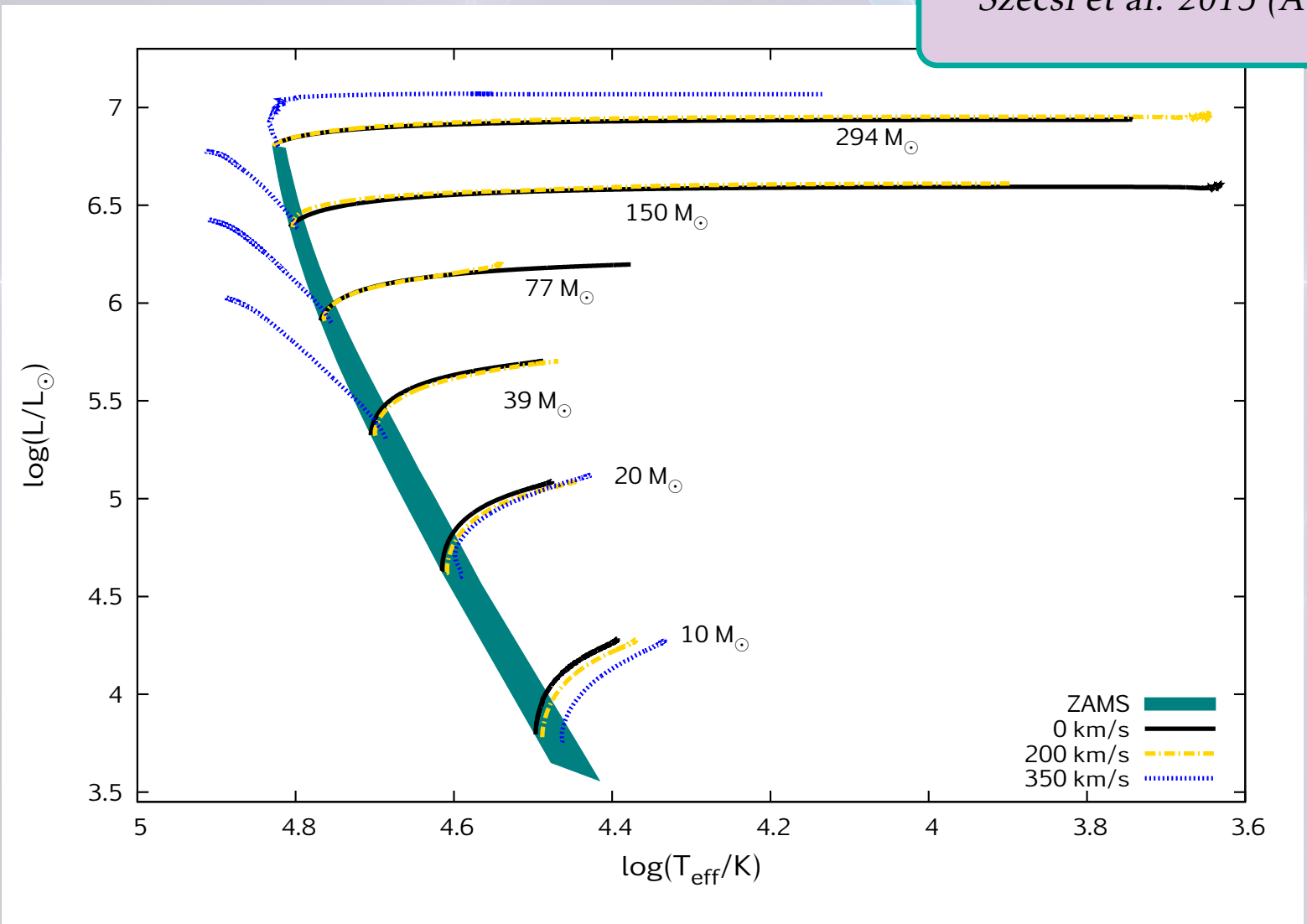

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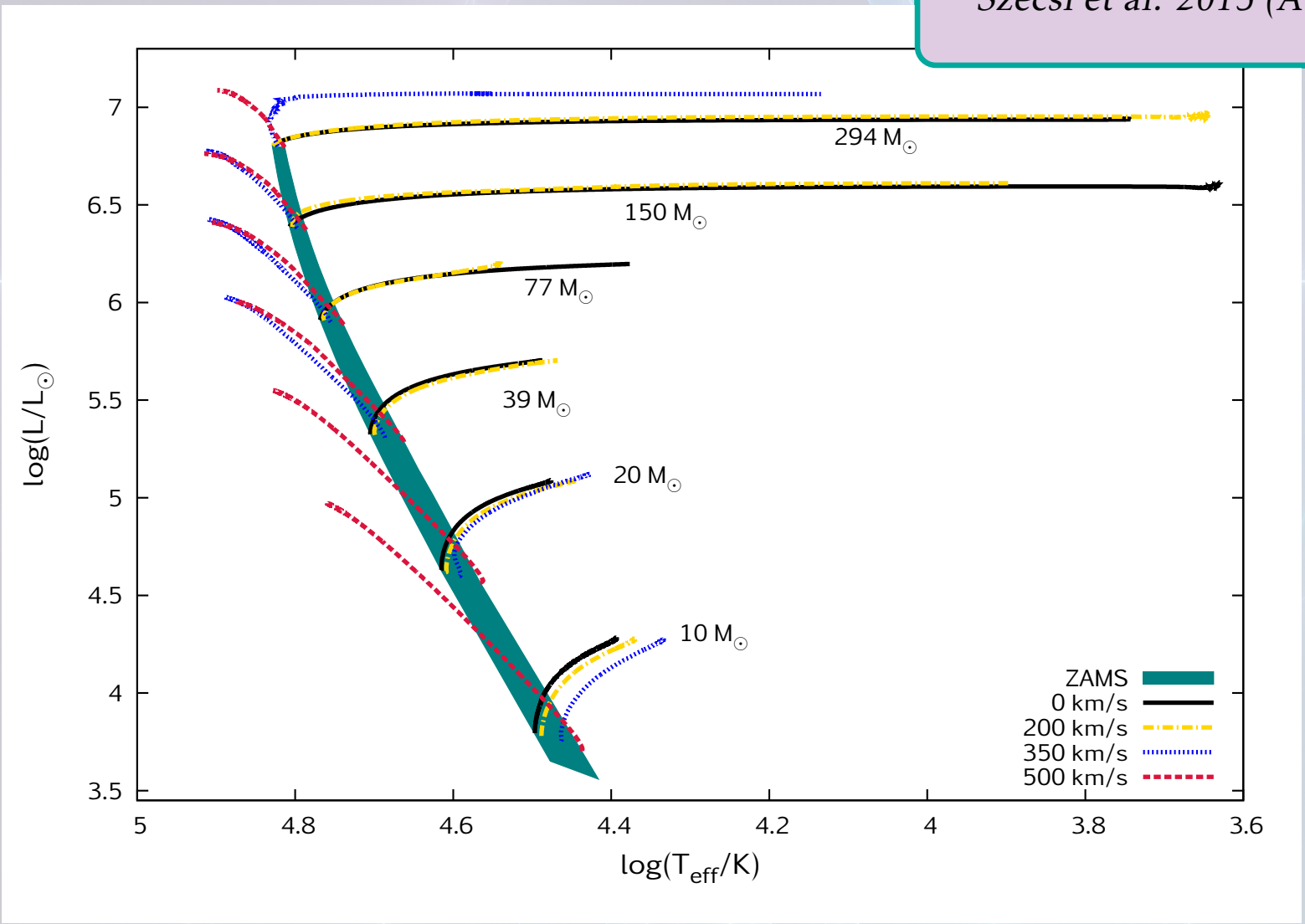

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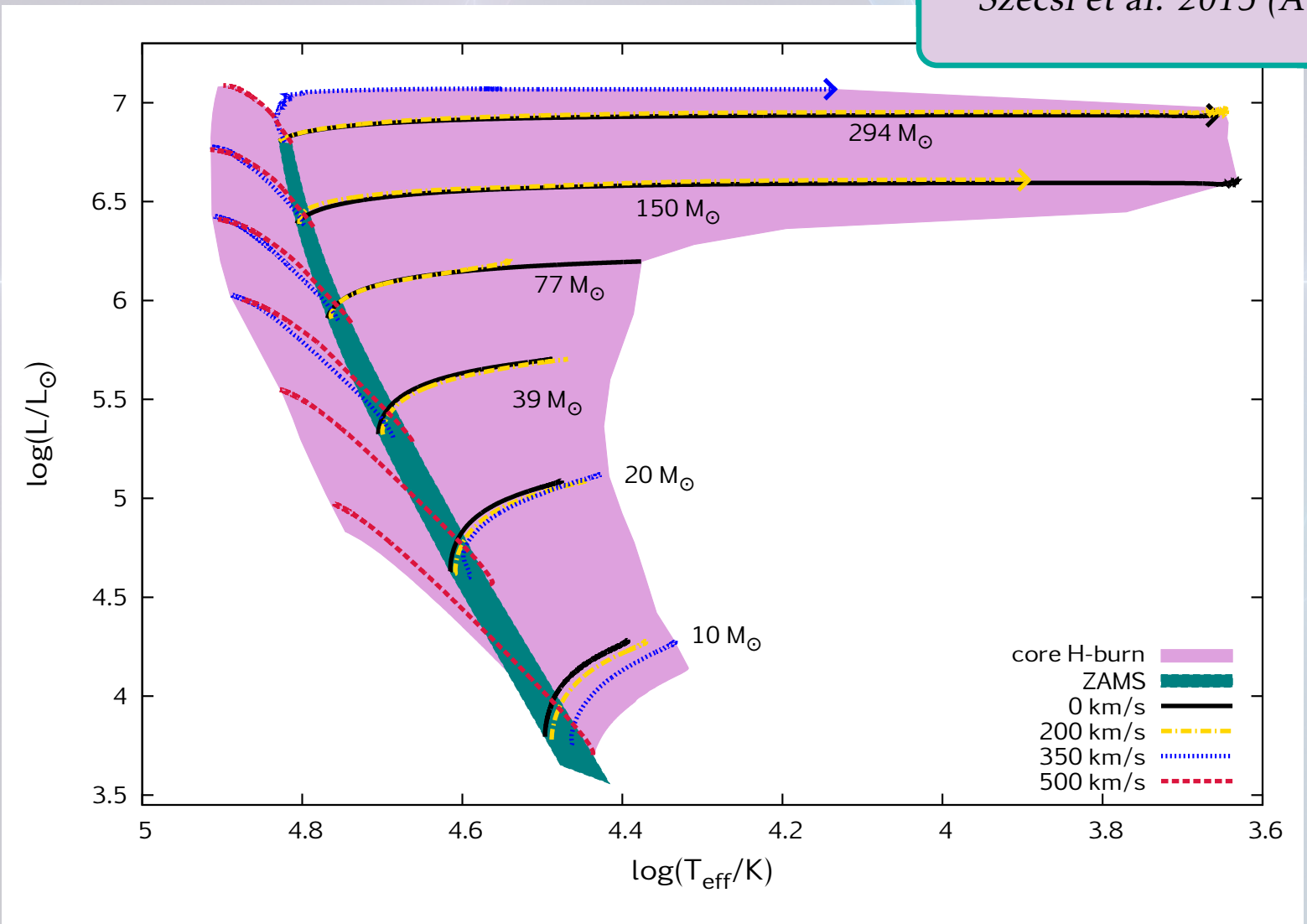

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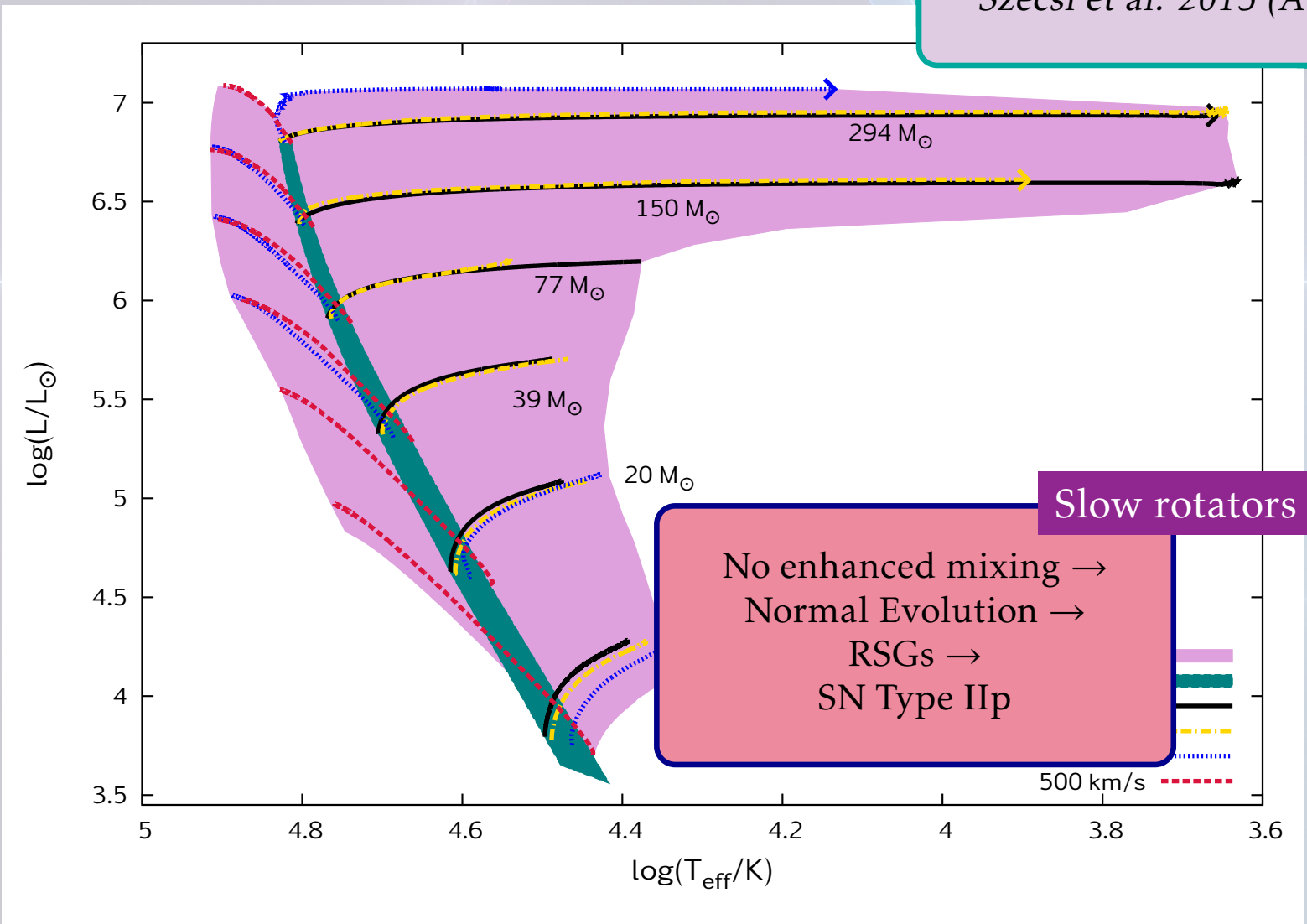

Slow rotators

No enhanced mixing →
Normal Evolution →
RSGs →
SN Type IIp

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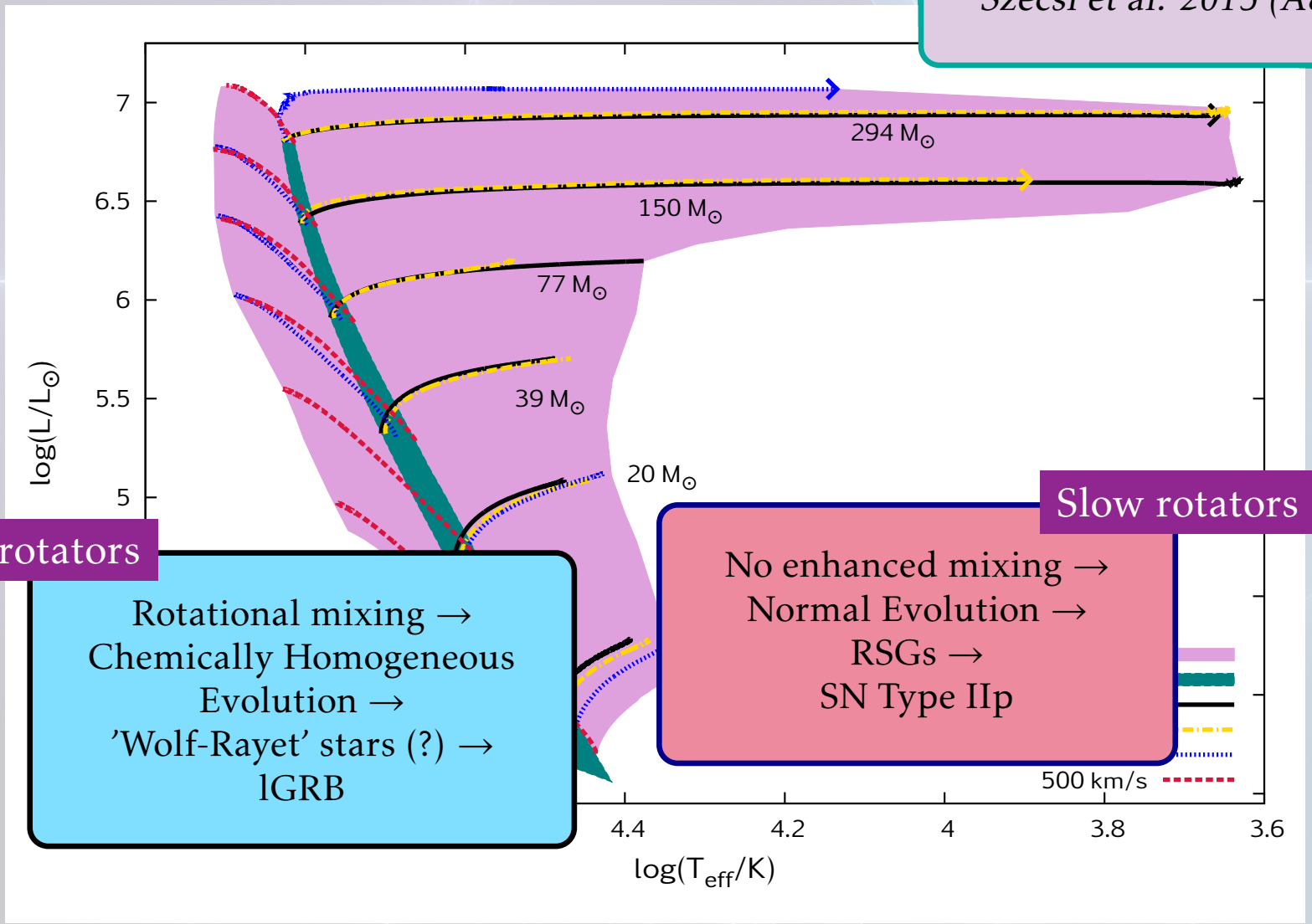

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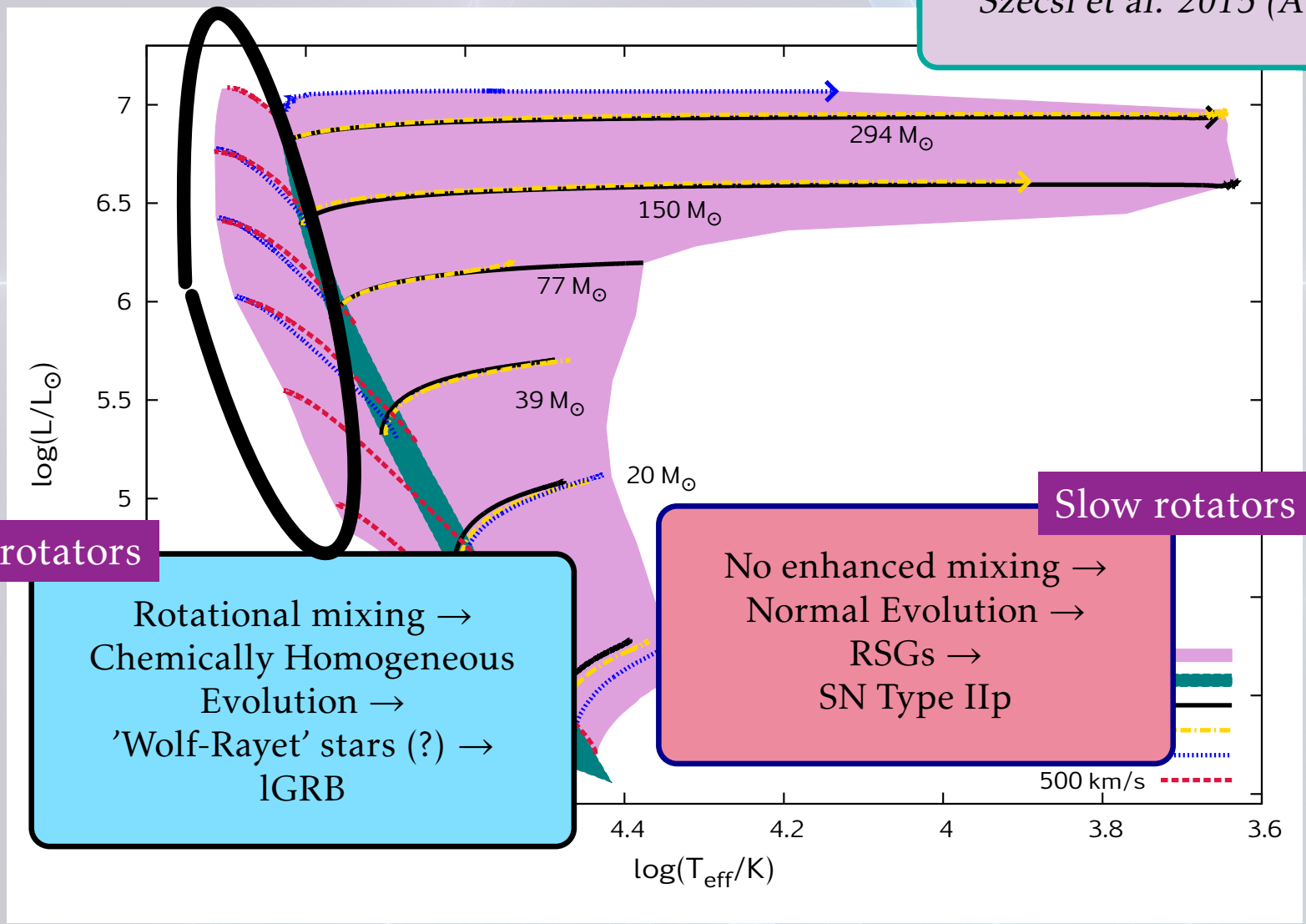

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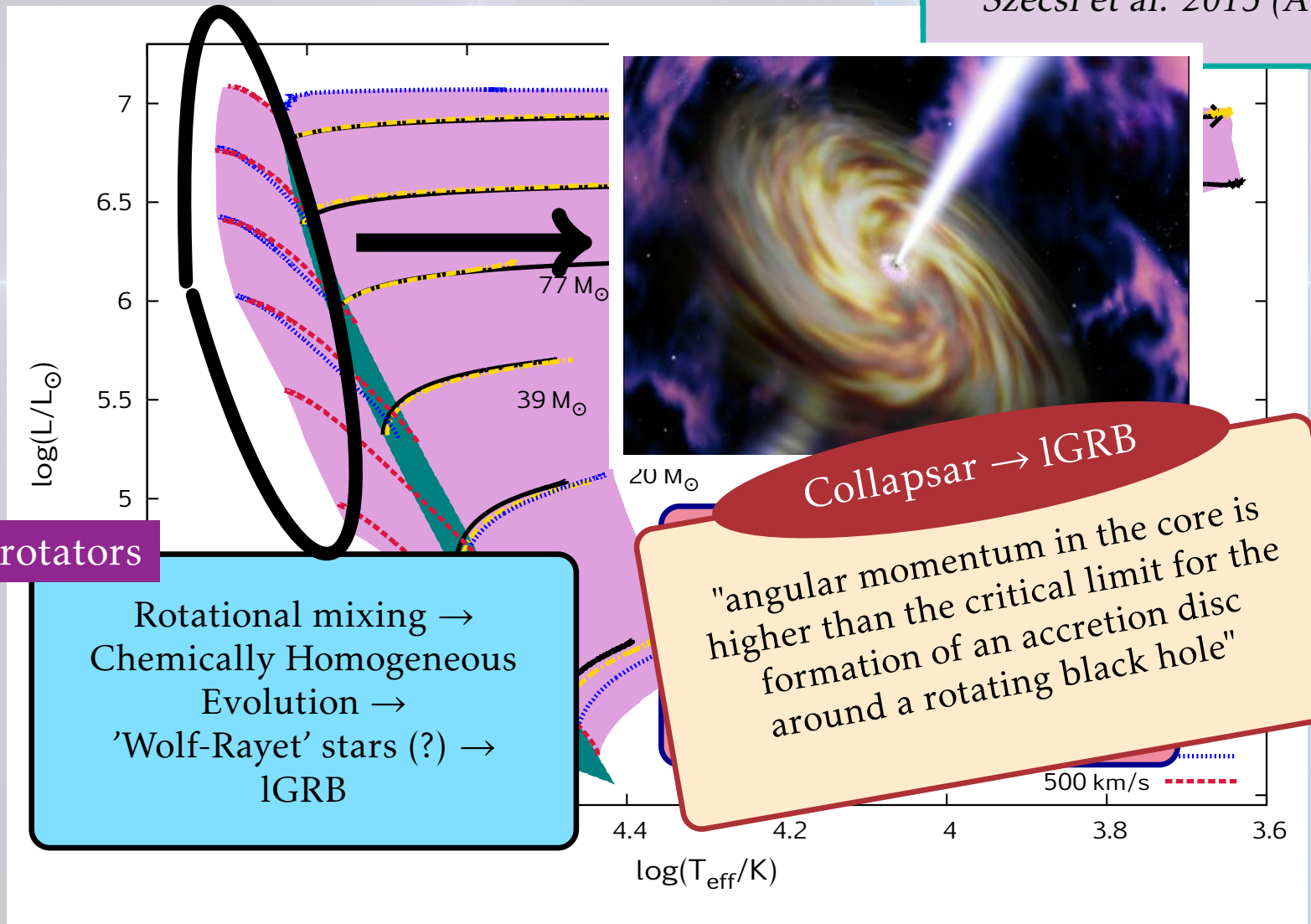

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"angular momentum in the core is higher than the critical limit for the formation of an accretion disc around a rotating black hole"

MS lifetime of the lGRB progenitors

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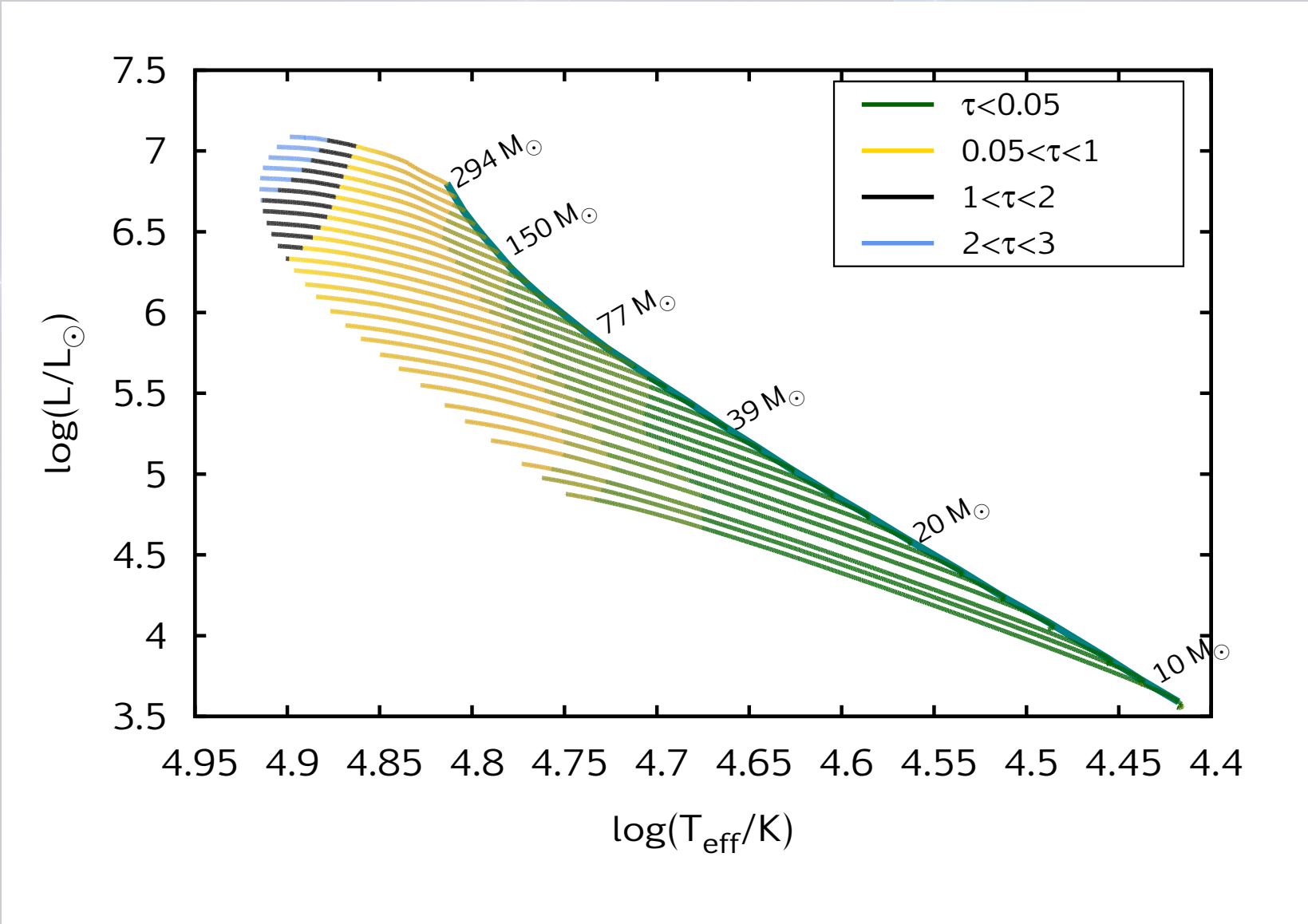
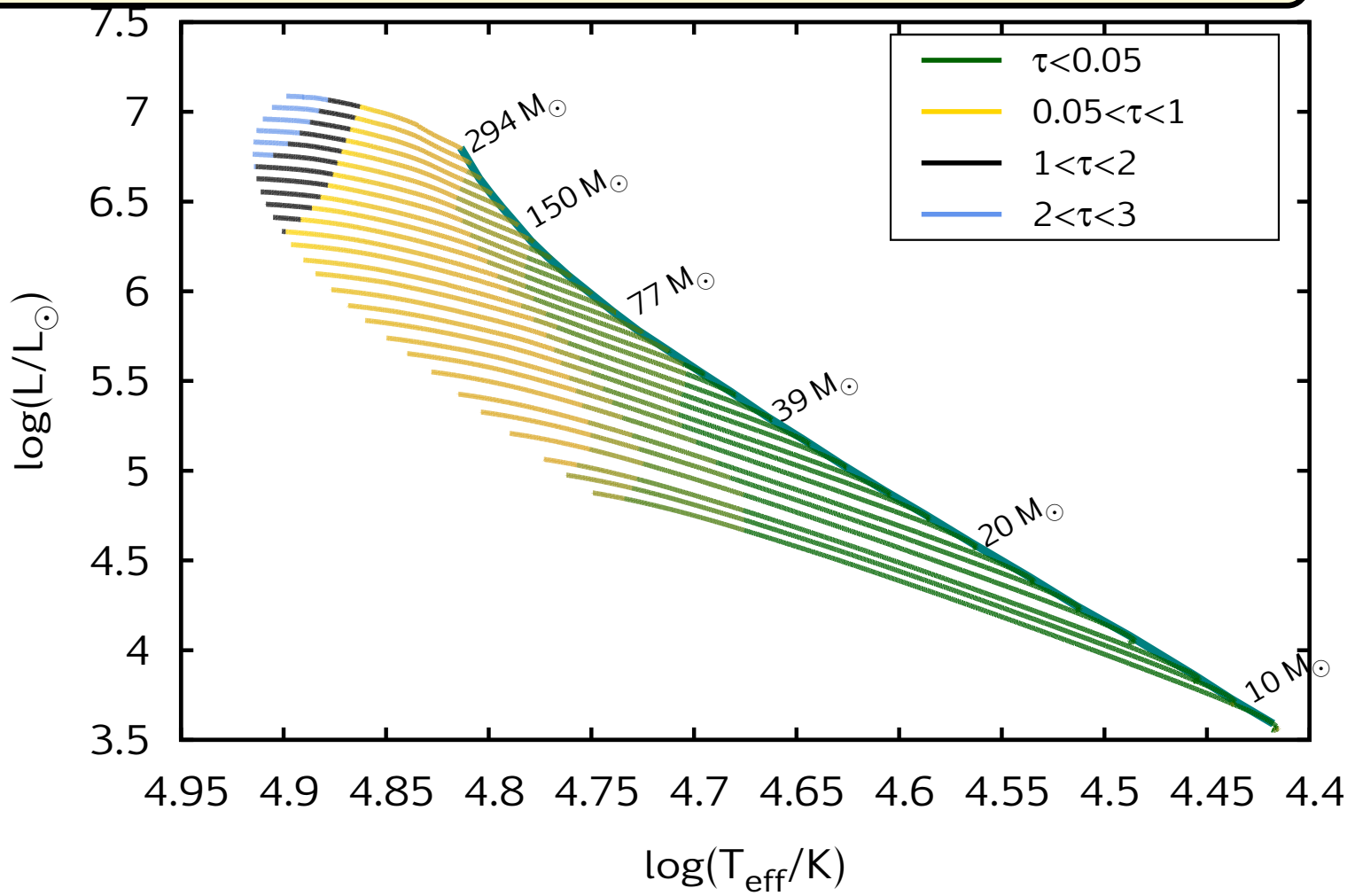


MS lifetime of the lGRB progenitors

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



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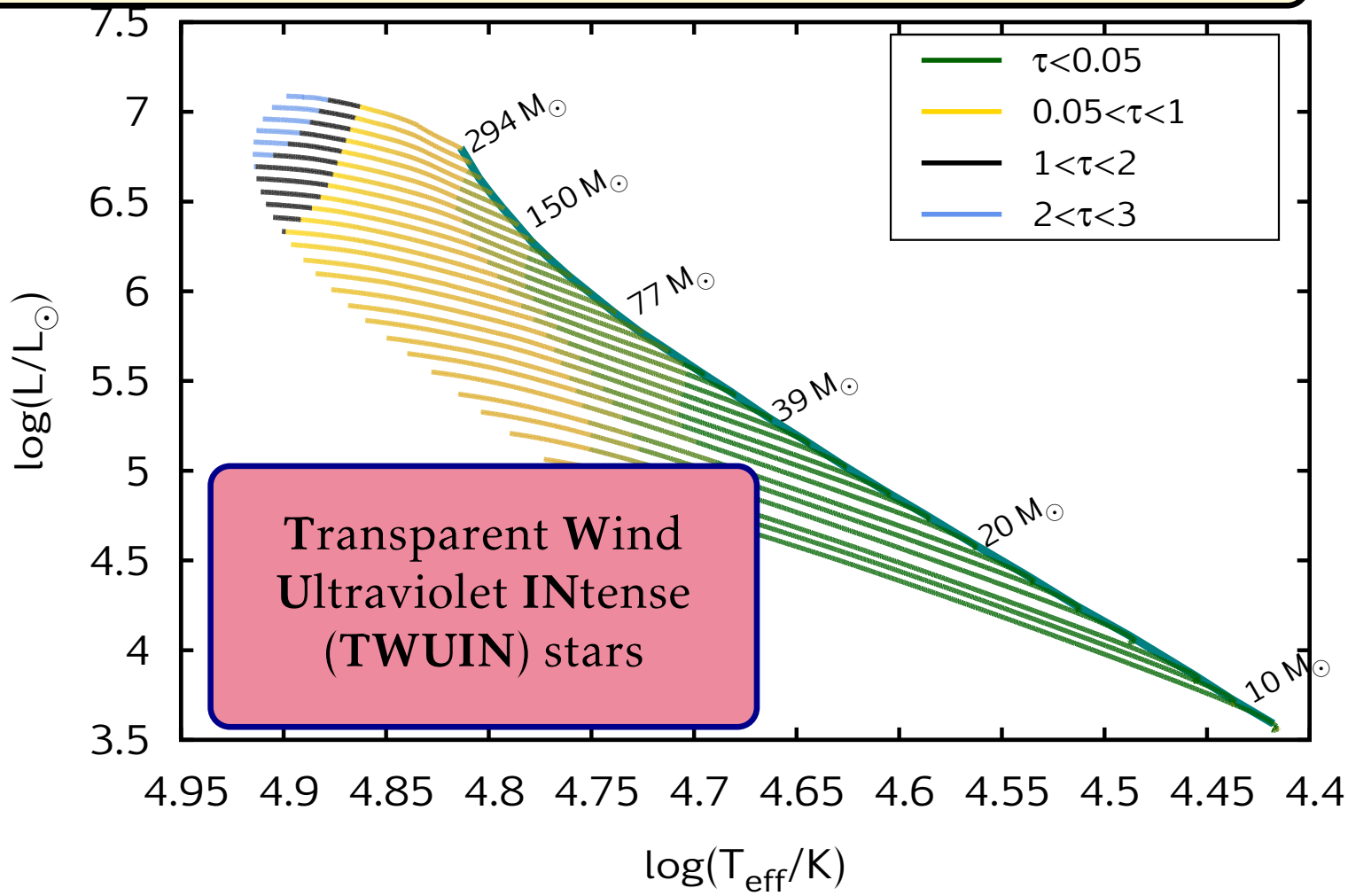

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Photoionization

$$Q(\mathrm{HeII})^{obs} = 1.3 \cdot 10^{50} \text{ photons s}^{-1}$$

+ weak WR features

(*Kehrig+15, Crowther+06*)

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

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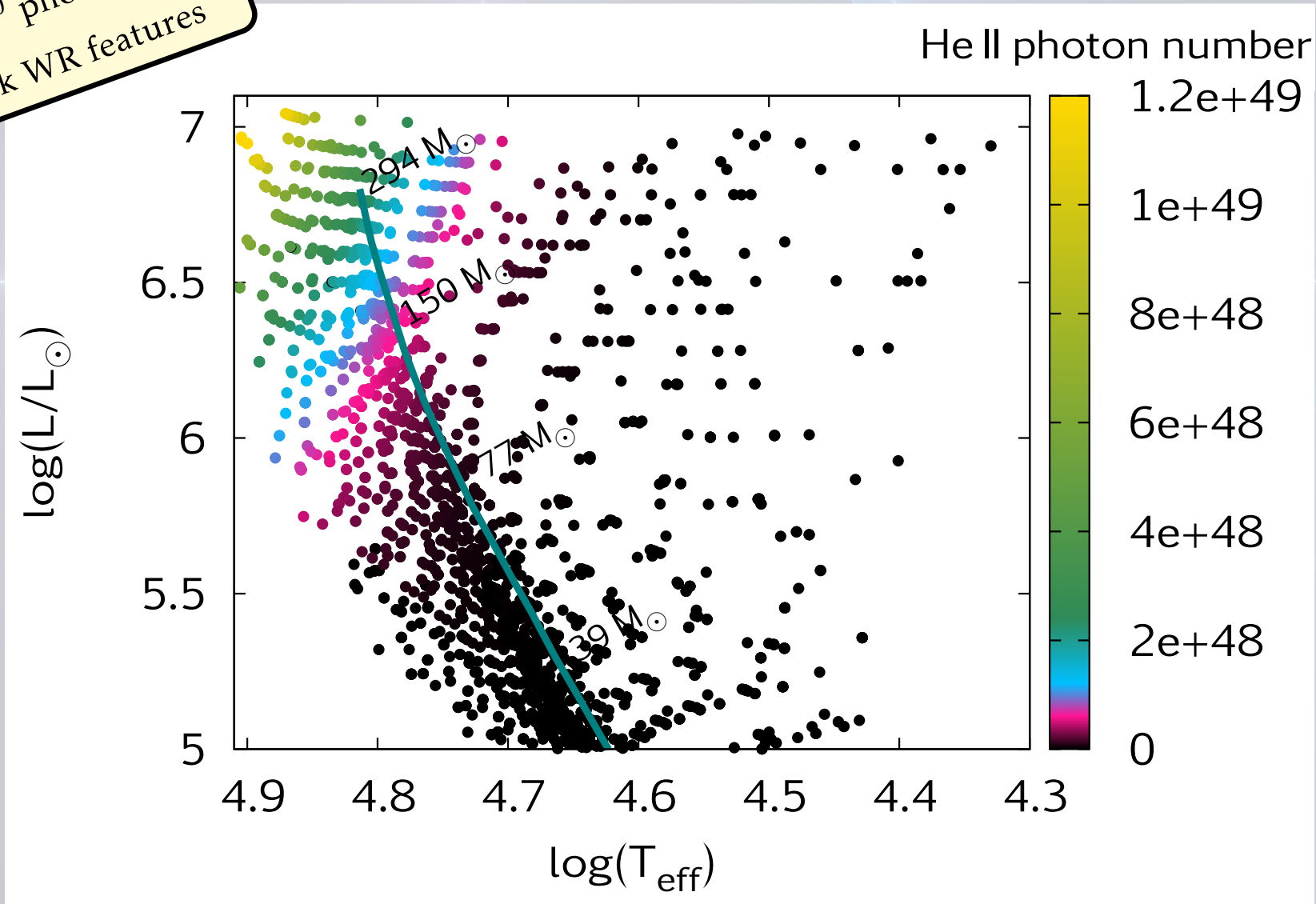

Cowther+06, Shirazi+12, Kehrig+15, Heap+15

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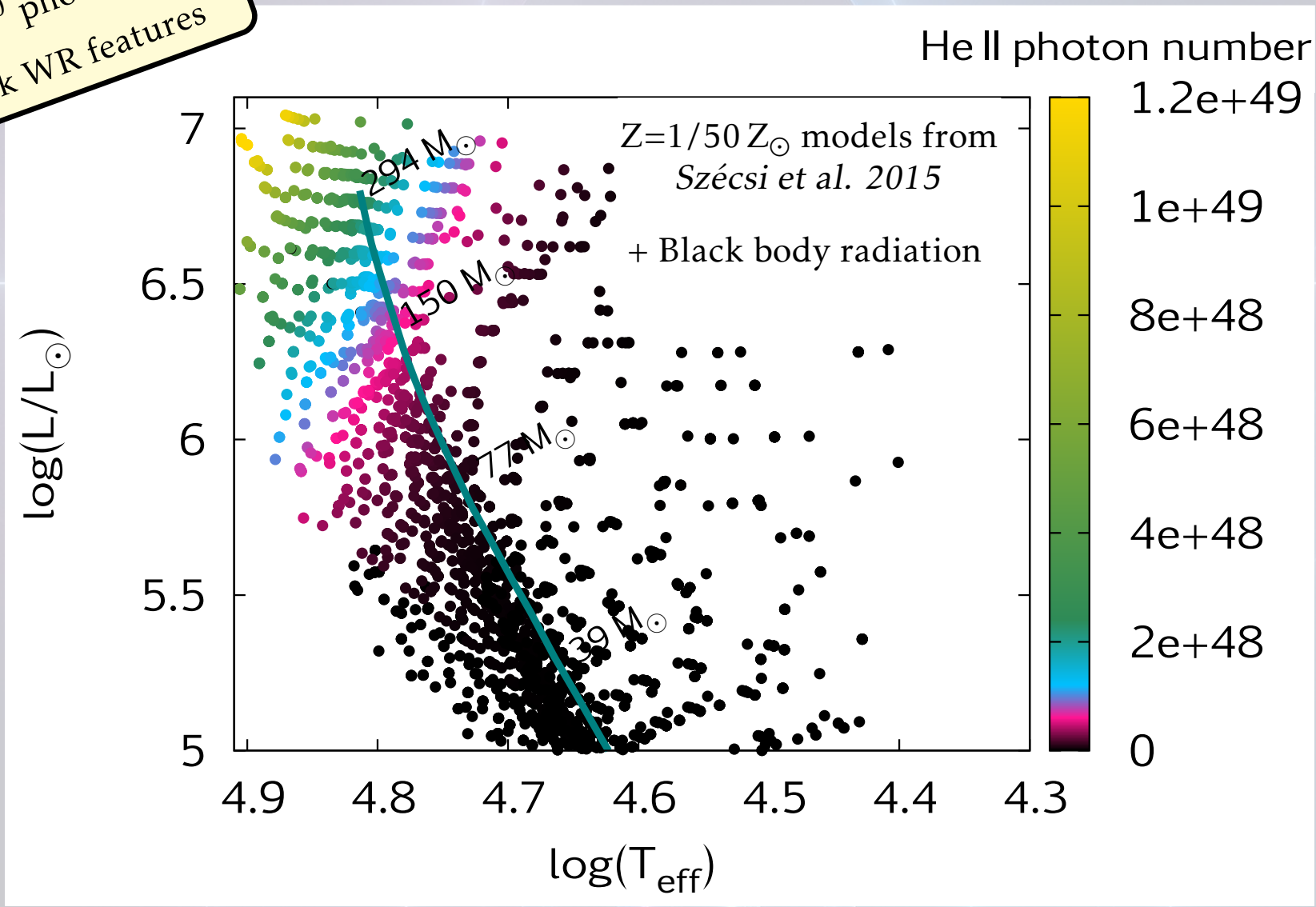

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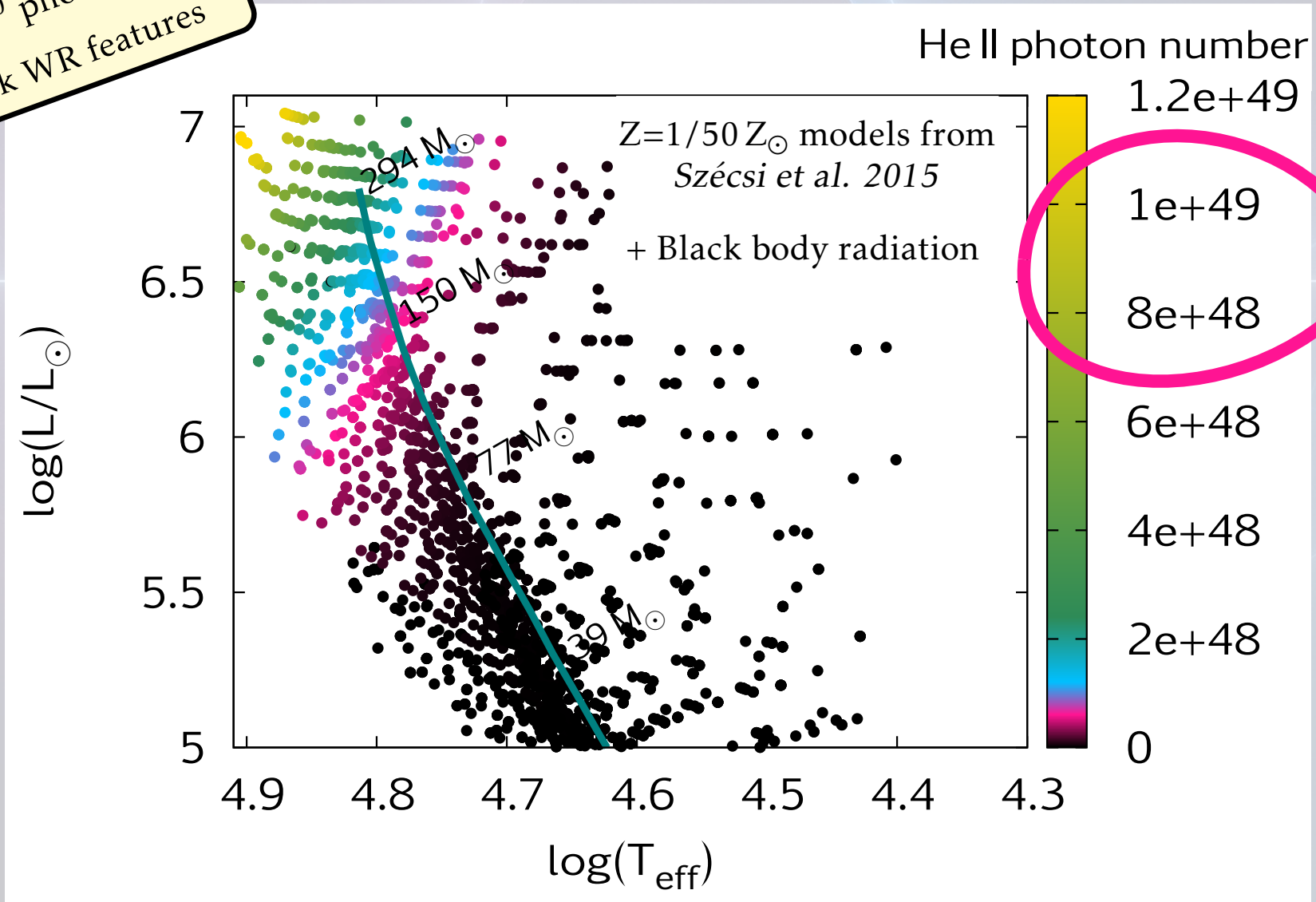

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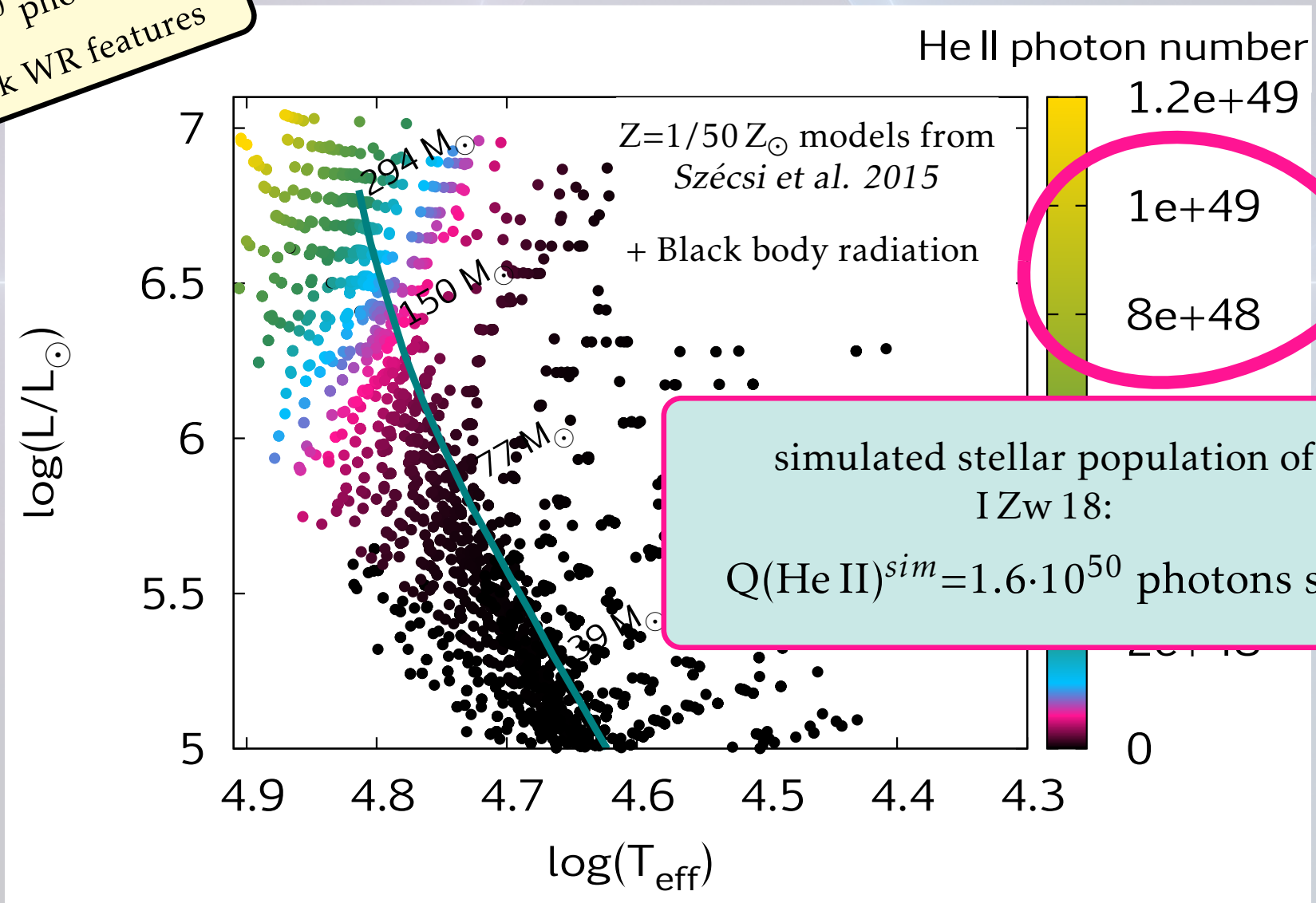

simulated stellar population of I Zw 18:

$Q(\mathrm{He\,II})^{sim} = 1.6 \cdot 10^{50}$ photons s^{-1}

Cowther+06, Shirazi+12, Kehrig+15, Heap+15

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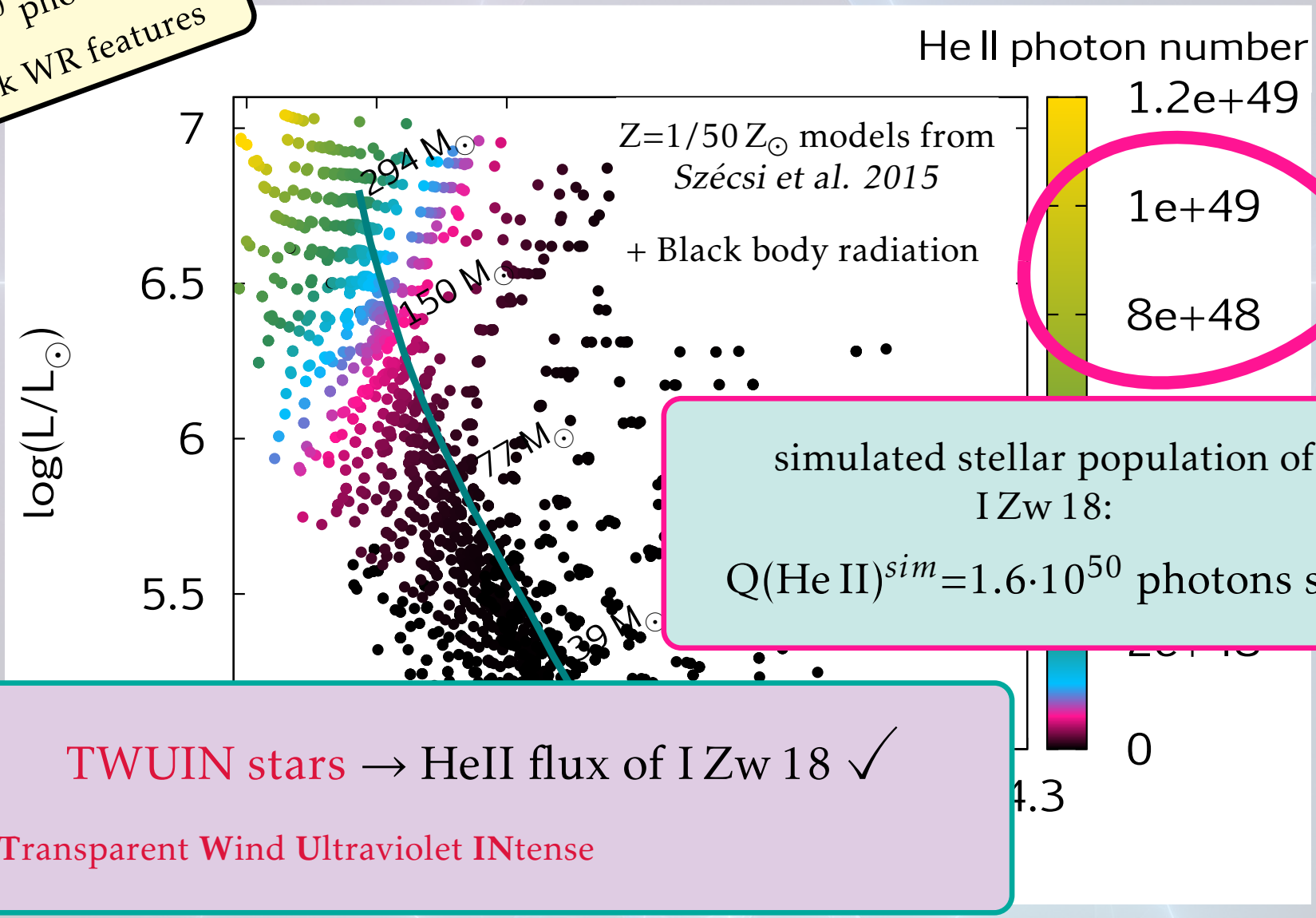

simulated stellar population of I Zw 18:

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TWUIN stars → HeII flux of I Zw 18 ✓

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

Cowther+06, Shirazi+12, Kehrig+15, Heap+15

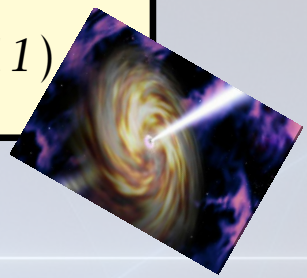
Takeaway message

Takeaway message

Death of Massive Stars

lGRBs

(*Levesque'10, Niino'11*)



Takeaway message

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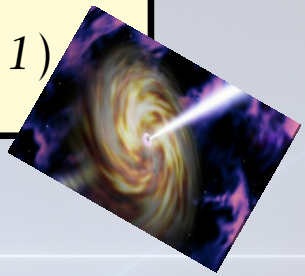

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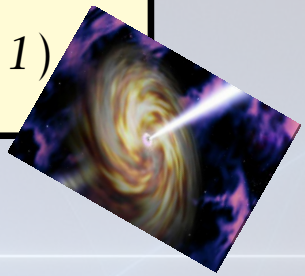

Explanation

Hot stars with weak winds

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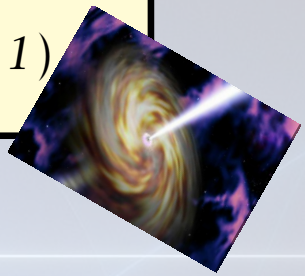

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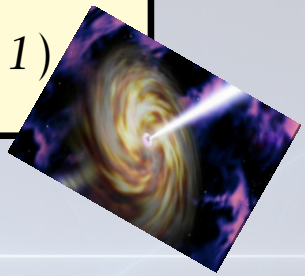

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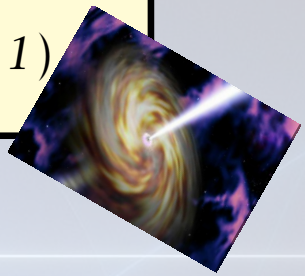

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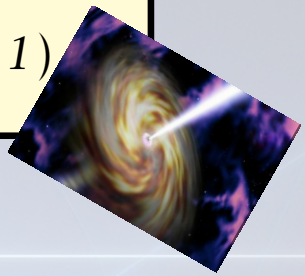

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A&A: Szécsi et al. 2015 [arXiv:1506.09132]

★

Poster: FM 7 p. 64