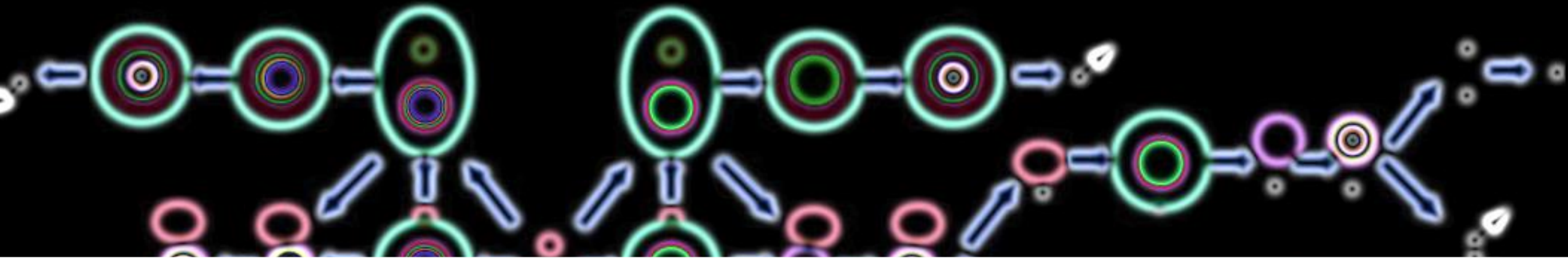


# Binaries, supernovae, blackholes and Stochasticity effects on Lyman radiation escape

Jan J. Eldridge,

Elizabeth Stanway and the BPASS team



MARSDEN FUND

TE PŪTEA RANGAHAU  
A MARSDEN

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THE UNIVERSITY OF  
**AUCKLAND**  
Te Whare Wānanga o Tāmaki Makaurau  
NEW ZEALAND

  
**WARWICK**  
THE UNIVERSITY OF WARWICK

# Who am I?

Prof. **Jan Eldridge**

**She/her/they** pronouns.

**Astrophysicist.**

**UoA Physics HoD.**

“I study **exploding binary stars** while exploding the **myth of a gender binary.**”

Work on **stars, galaxies, supernovae....**

Twitter: **@astro\_jje**



# binary population and spectral synthesis



**JJ Eldridge**



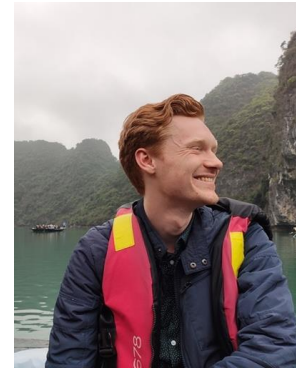
**Elizabeth Stanway**



**Héloïse Stevance**



**Conor Byrne**



**Max Briel**



**Petra Tang**



**Gareth Jones**



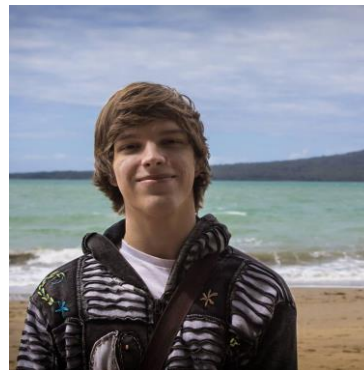
**Sohan Ghodla**



**Wouter van Zeist**



**Sean Richards**



**Gleb Geinke**

**Other Past Students: Adib Mowaz, Ashley Chrimes, Lin Xiao, John Bray, Stephanie Greis, Liam McClelland, Mason Ng, Georgie Taylor, Lillian Guo, Nicole Rodrigues, Lucas Ostrowski, Itwinder Singh.**



# **binary population and spectral synthesis**

Developed by Elizabeth Stanway and JJ Eldridge to study a broad range of astrophysical systems in the Universe: **stars, supernovae, clusters, galaxies, compact remnant mergers**

**“Be the theoretical equivalent of multi-messenger observations, make one model of stars in the Universe and observe in every way possible”.**

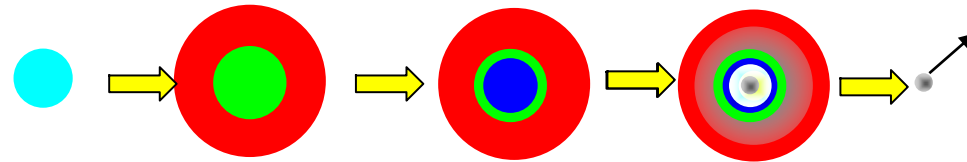
**[BPASS.AUCKLAND.AC.NZ](http://BPASS.AUCKLAND.AC.NZ) and [WARWICK.AC.UK/BPASS](http://WARWICK.AC.UK/BPASS)**

**It is now really easy to use thanks to:**

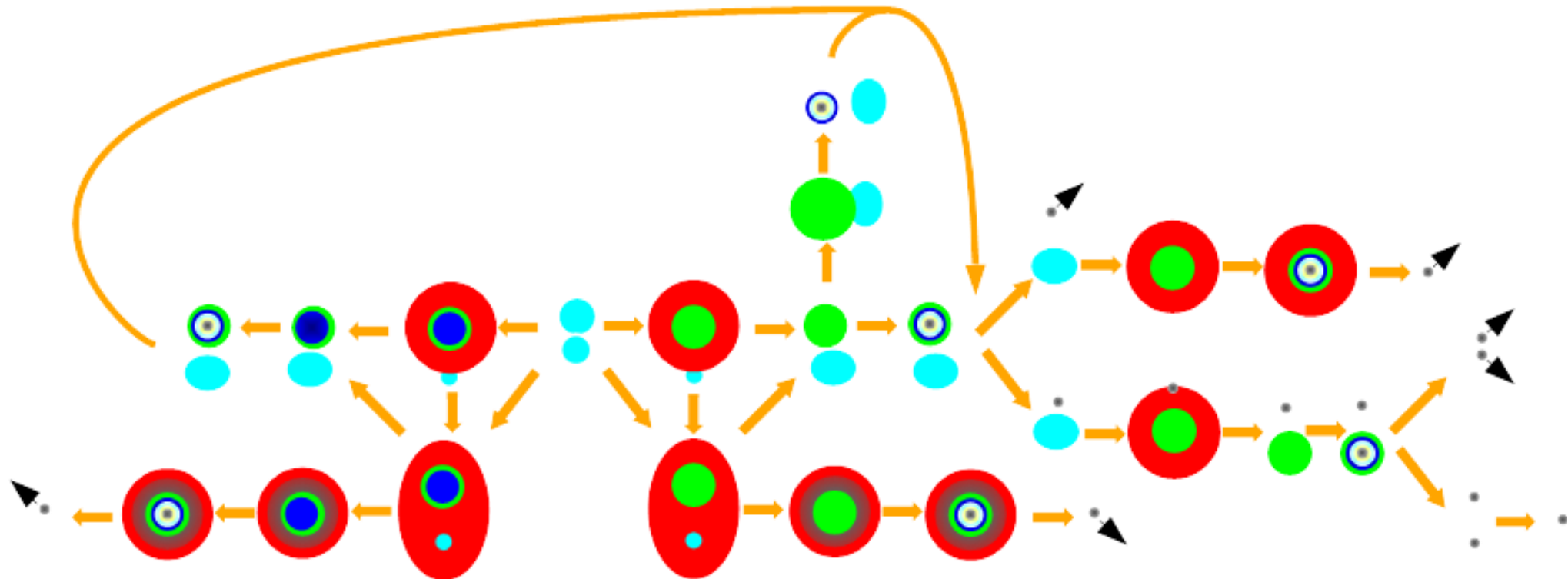
**Python package for easy use: [HOKI](https://github.com/HOKI) details and cookbooks at [HELOISE.GITHUB.IO/HOKI/INTRO](https://HELOISE.GITHUB.IO/HOKI/INTRO).**

**Have a star or star cluster you want to understand, search for it with BPASS! Email us if you have questions.**

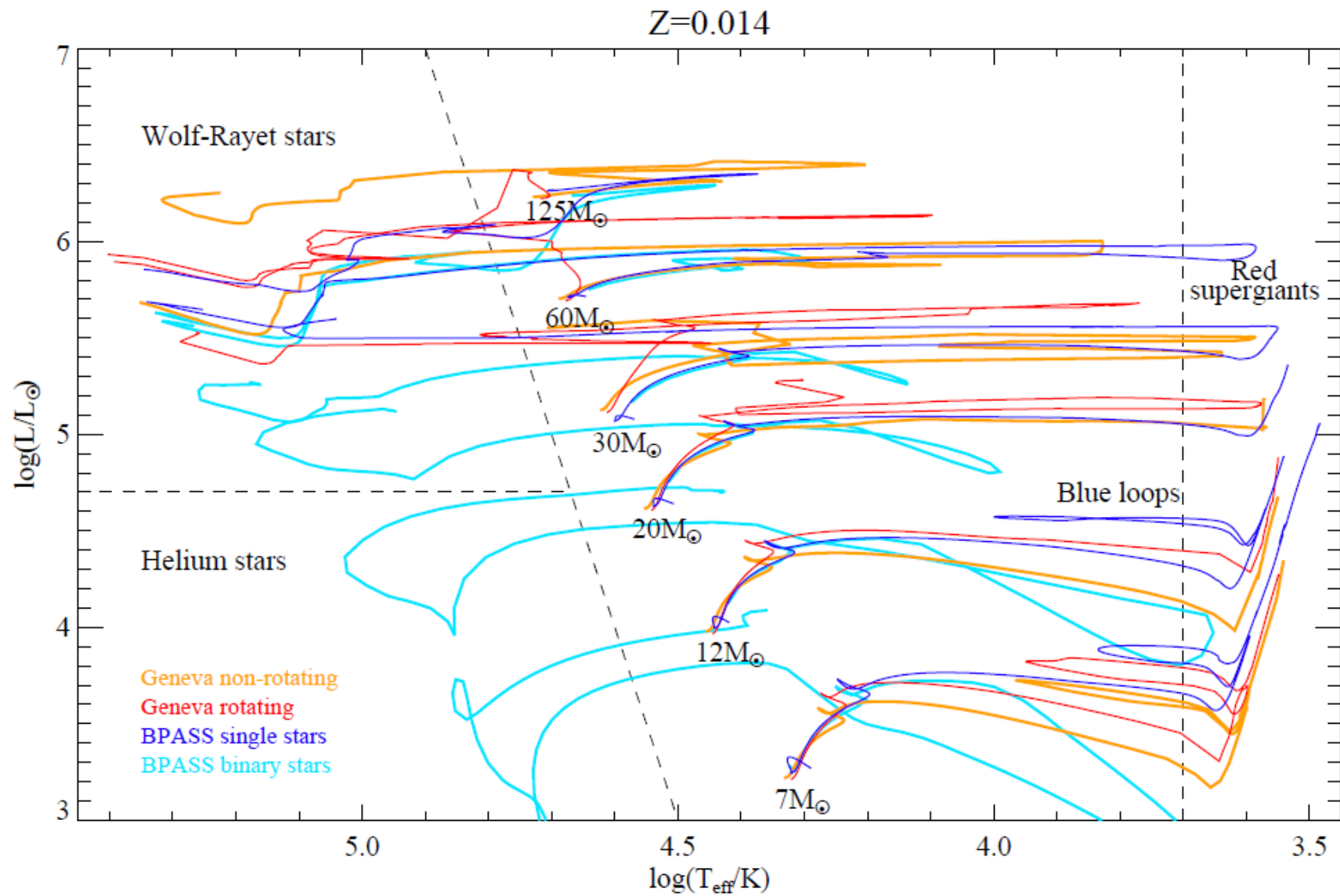
# The evolution of **single stars**....

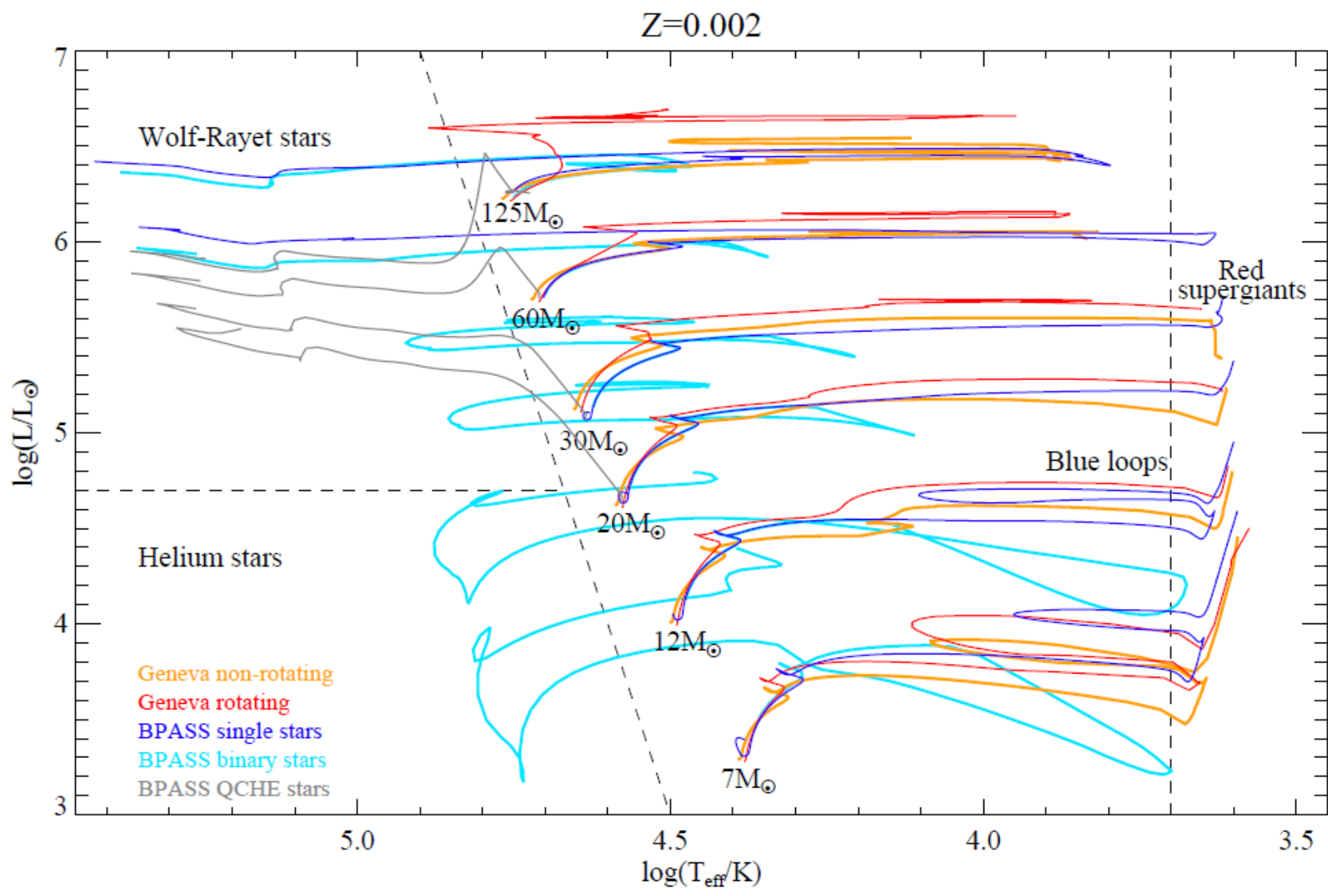


# A few of the **binary** evolutionary pathways that must be included



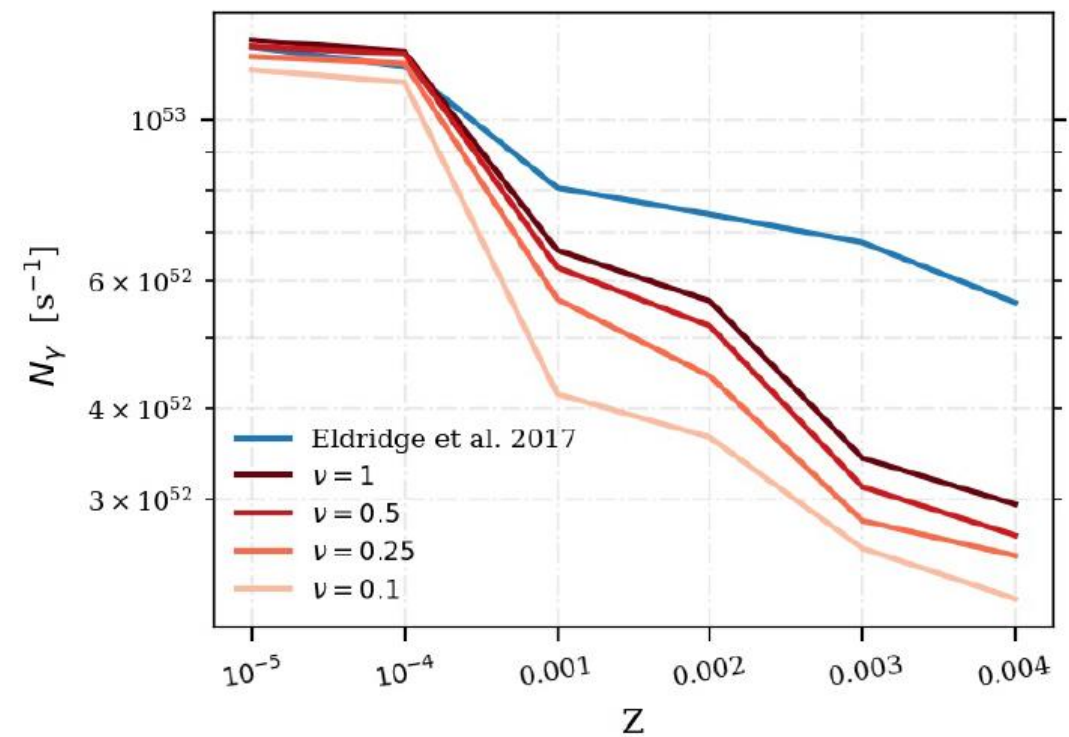
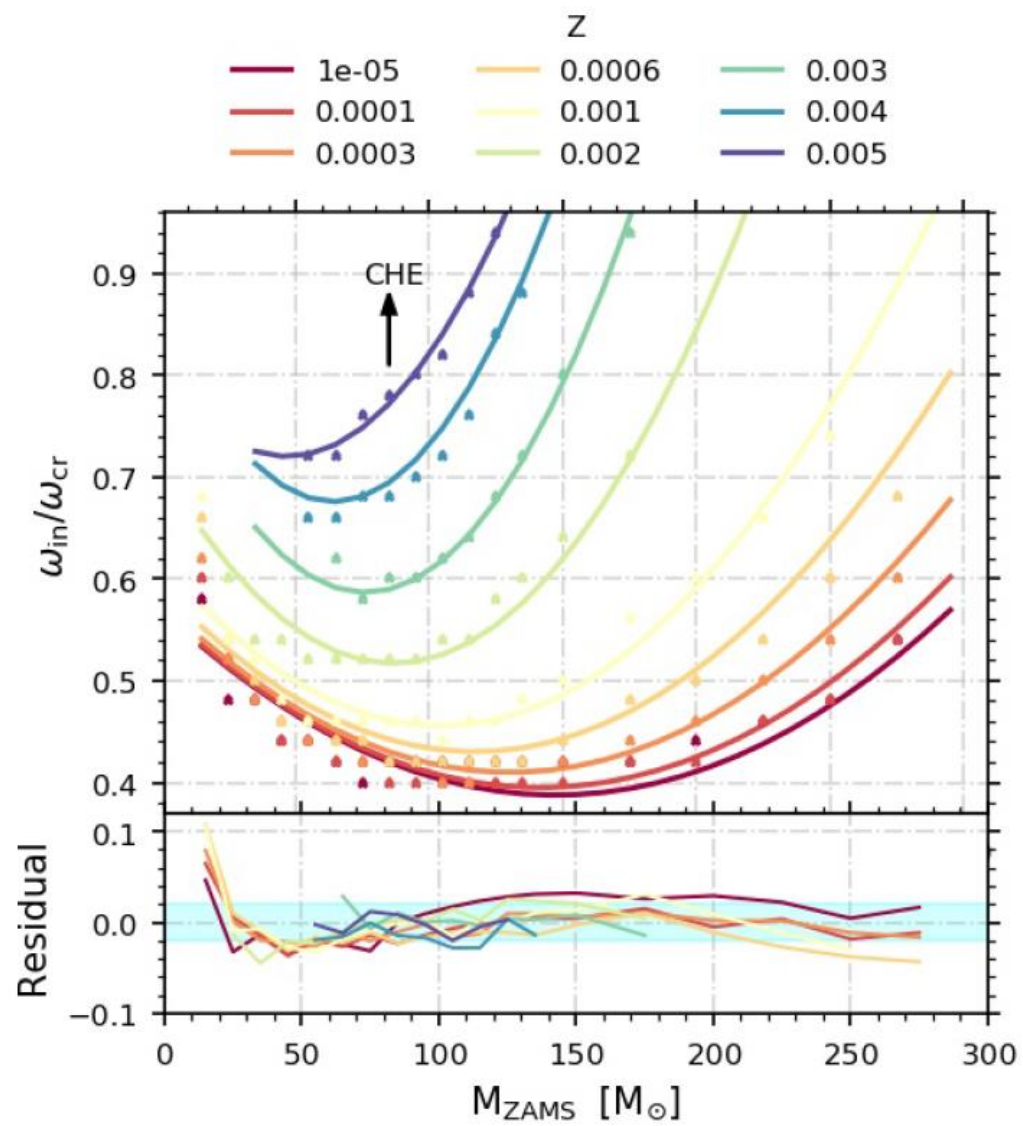
Key point: a **new stellar type** – **helium stars** – occurs, at masses intermediate to Wolf-Rayet and sdB/sdO stars (see also Götberg et al., 2017; 2018).



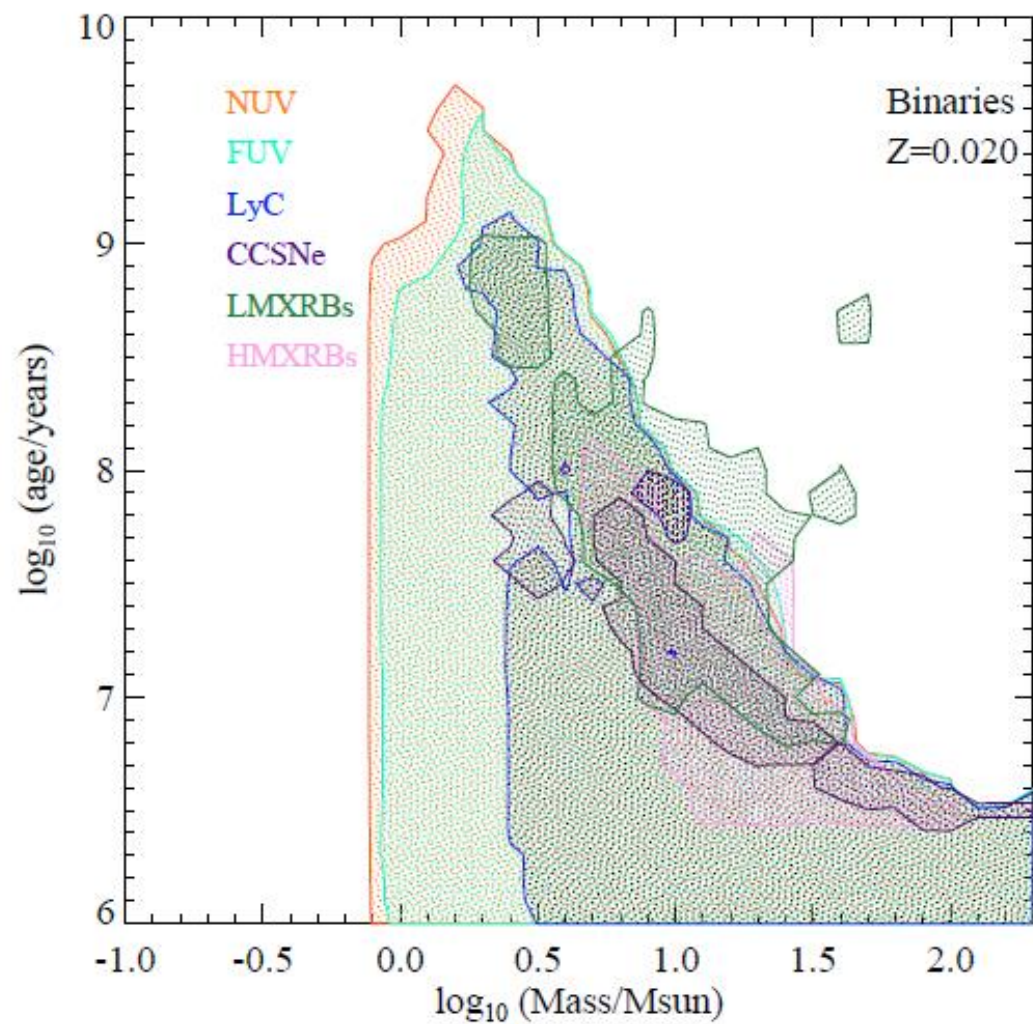
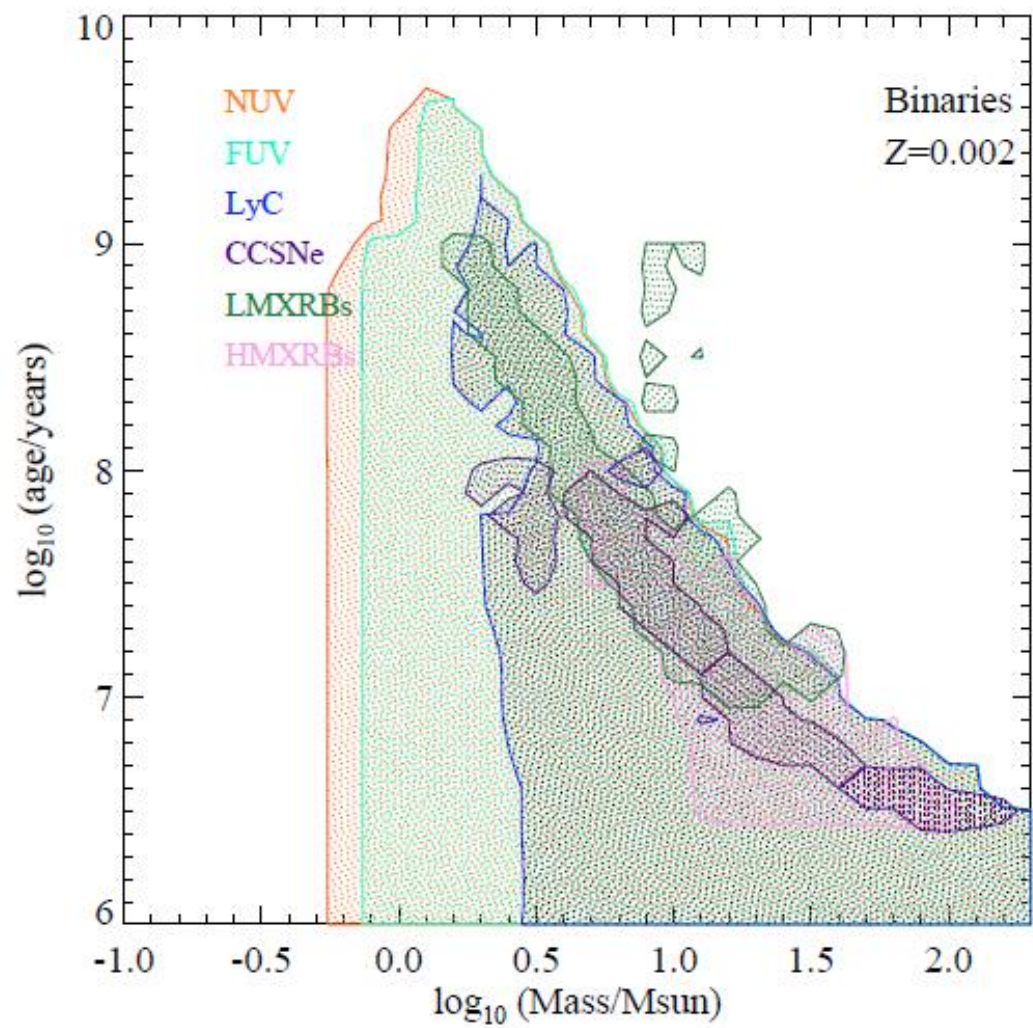




**An update for,  
Quasi-chemically homogeneous  
evolution...**

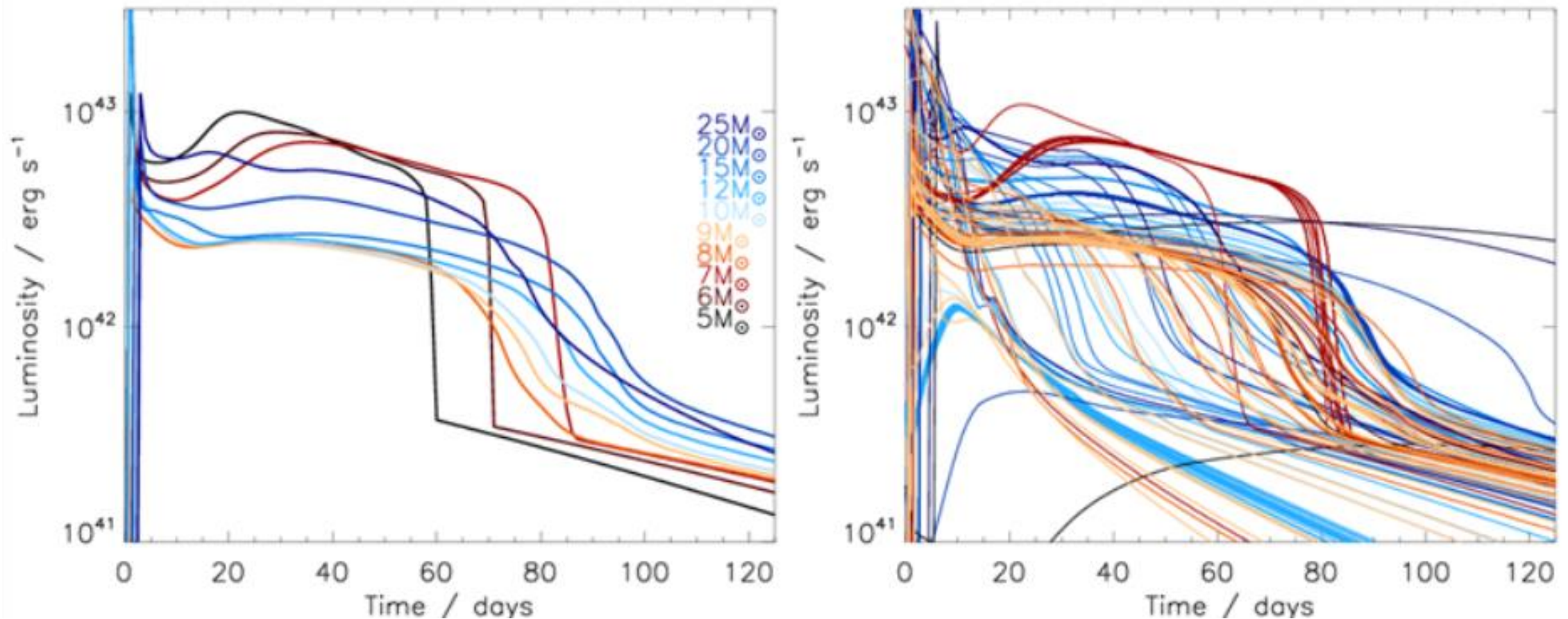


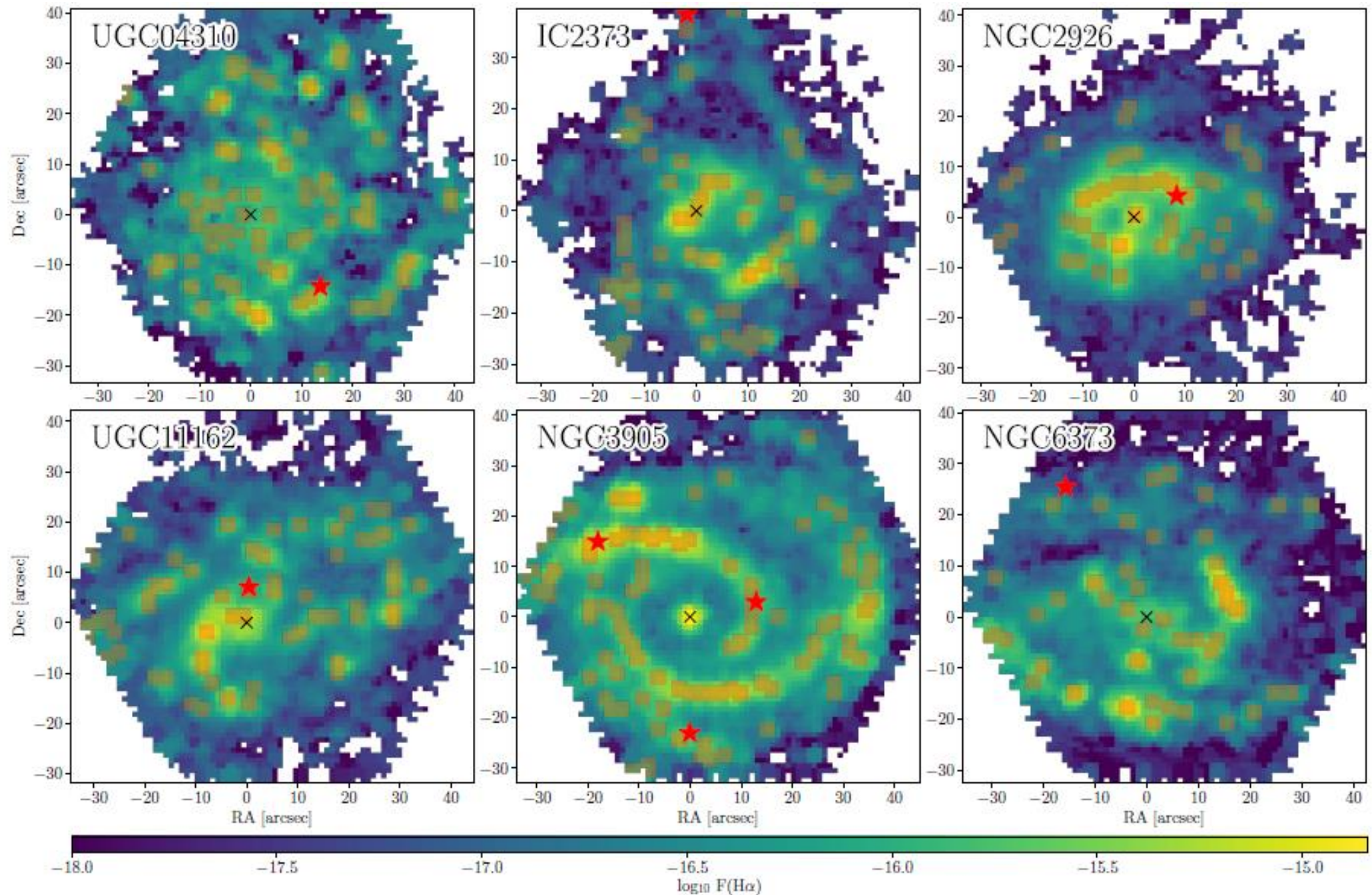
**What are the sources of,  
feedback...?**



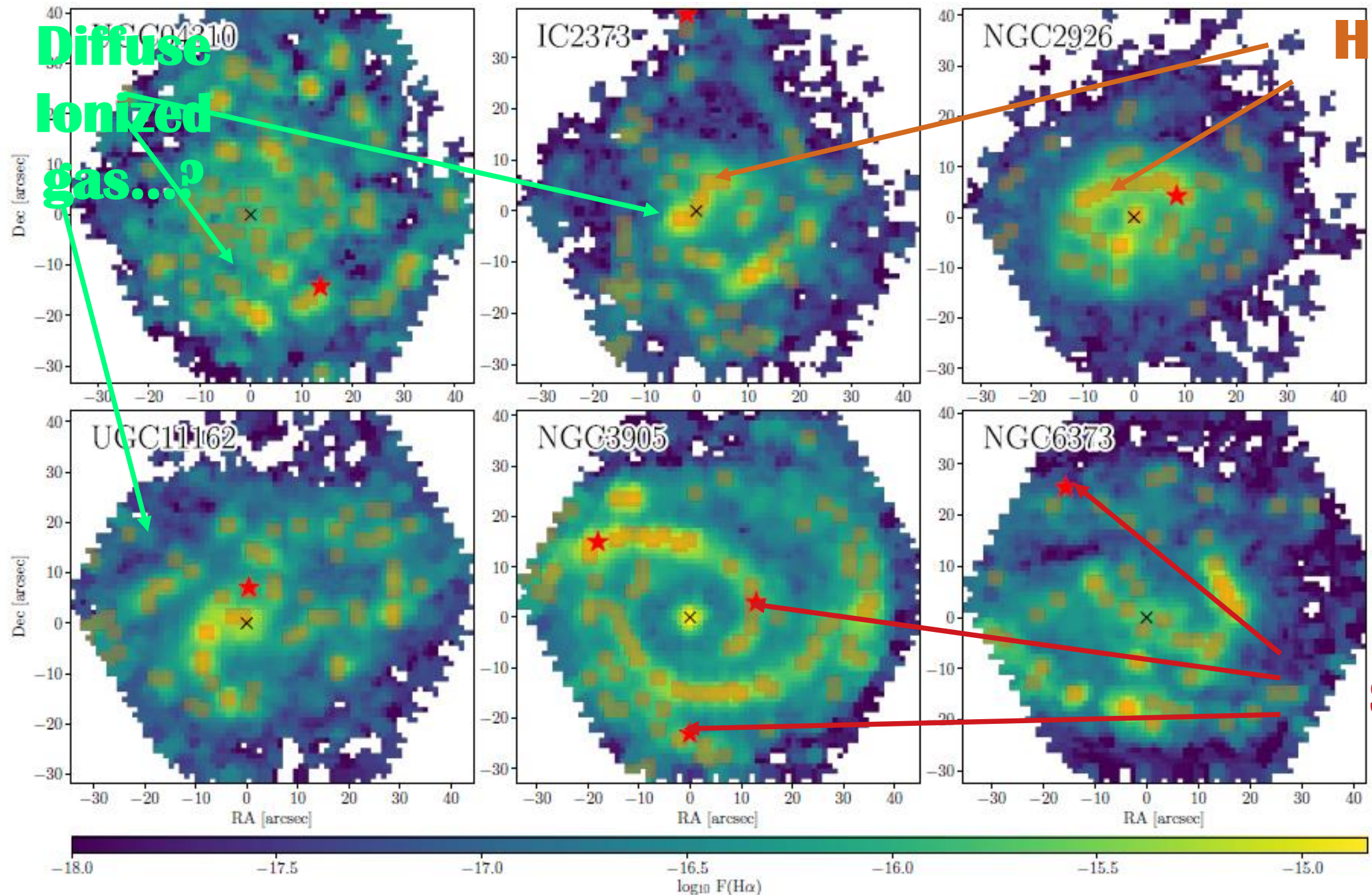
**When is a core-collapse not a  
supernovae...?**

# Type II SN lightcruves from interacting binaries





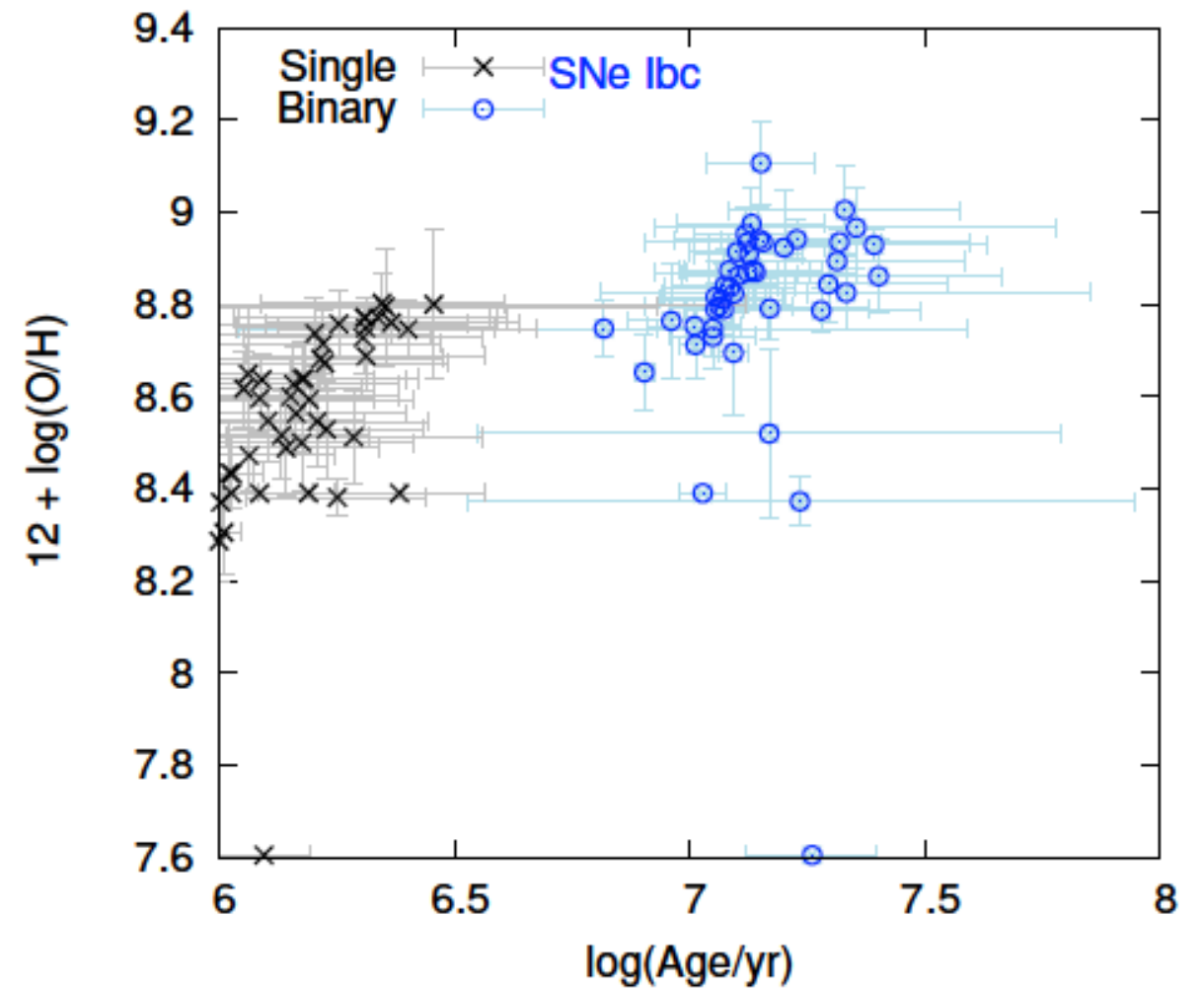
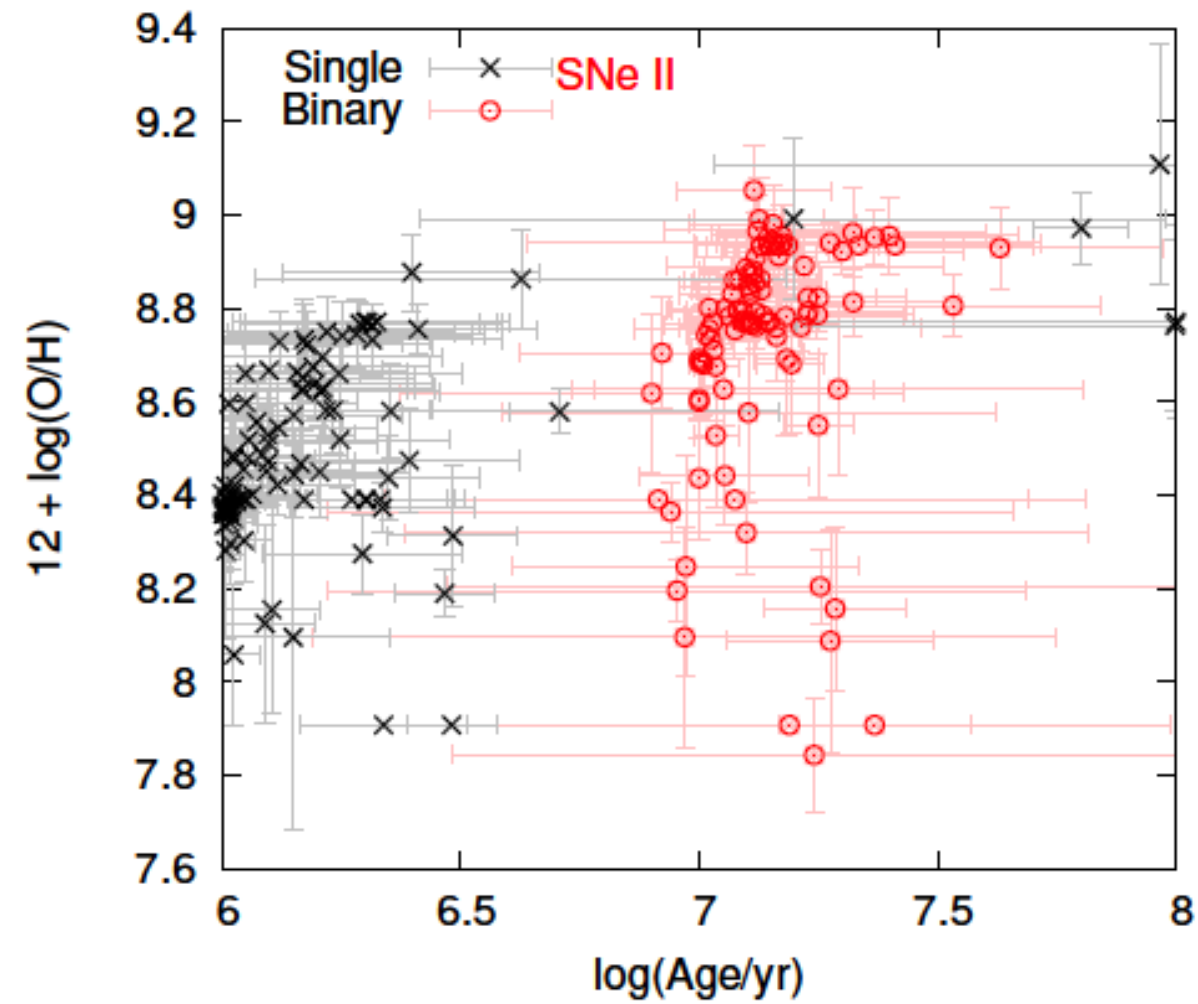
Galbany et al. (2018) - "PISCO: The PMAS/PPak Integral-field Supernova Hosts Compilation".



Galbany et al. (2018) - "PISCO: The PMAS/PPak Integral-field Supernova Hosts Compilation".

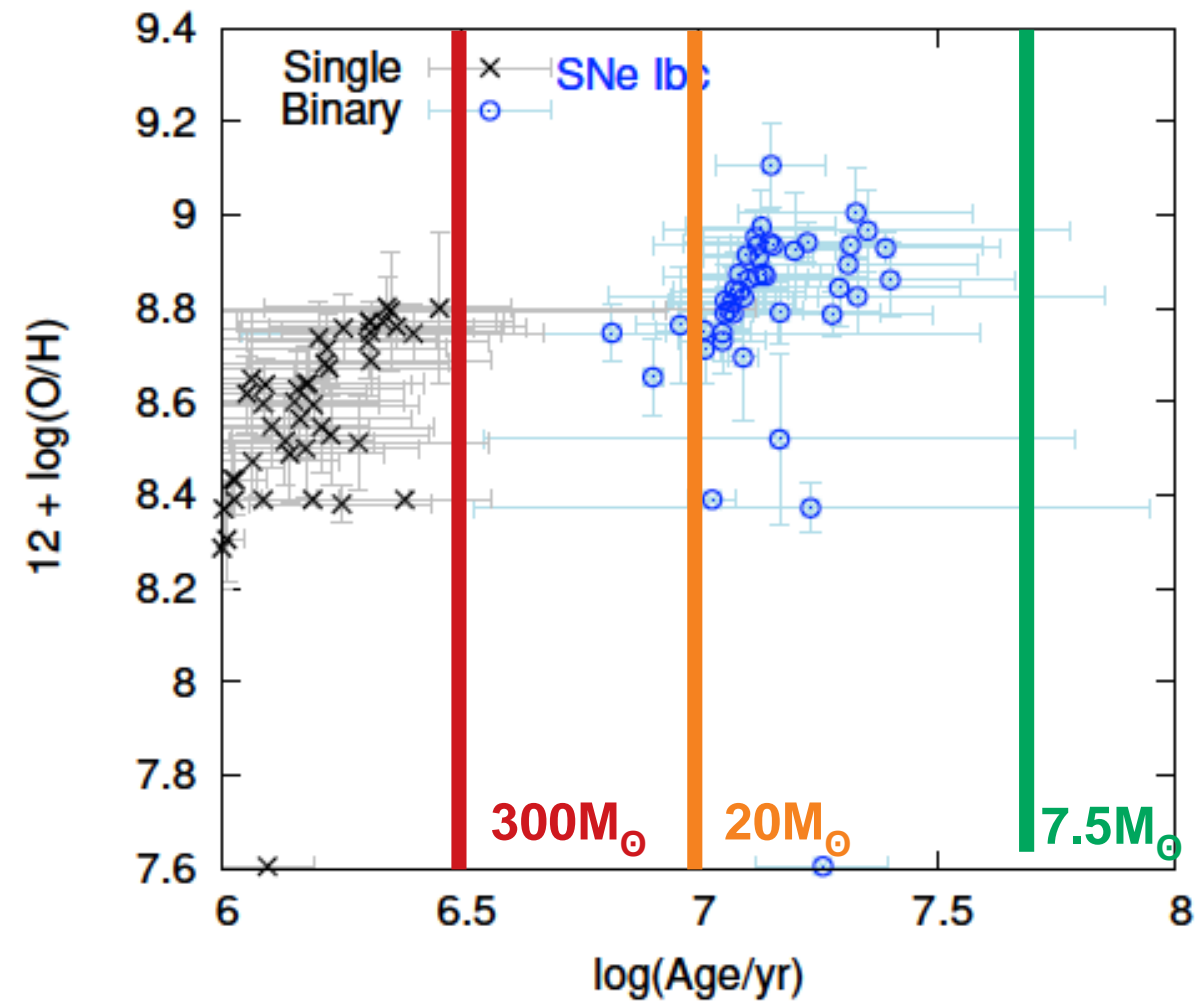
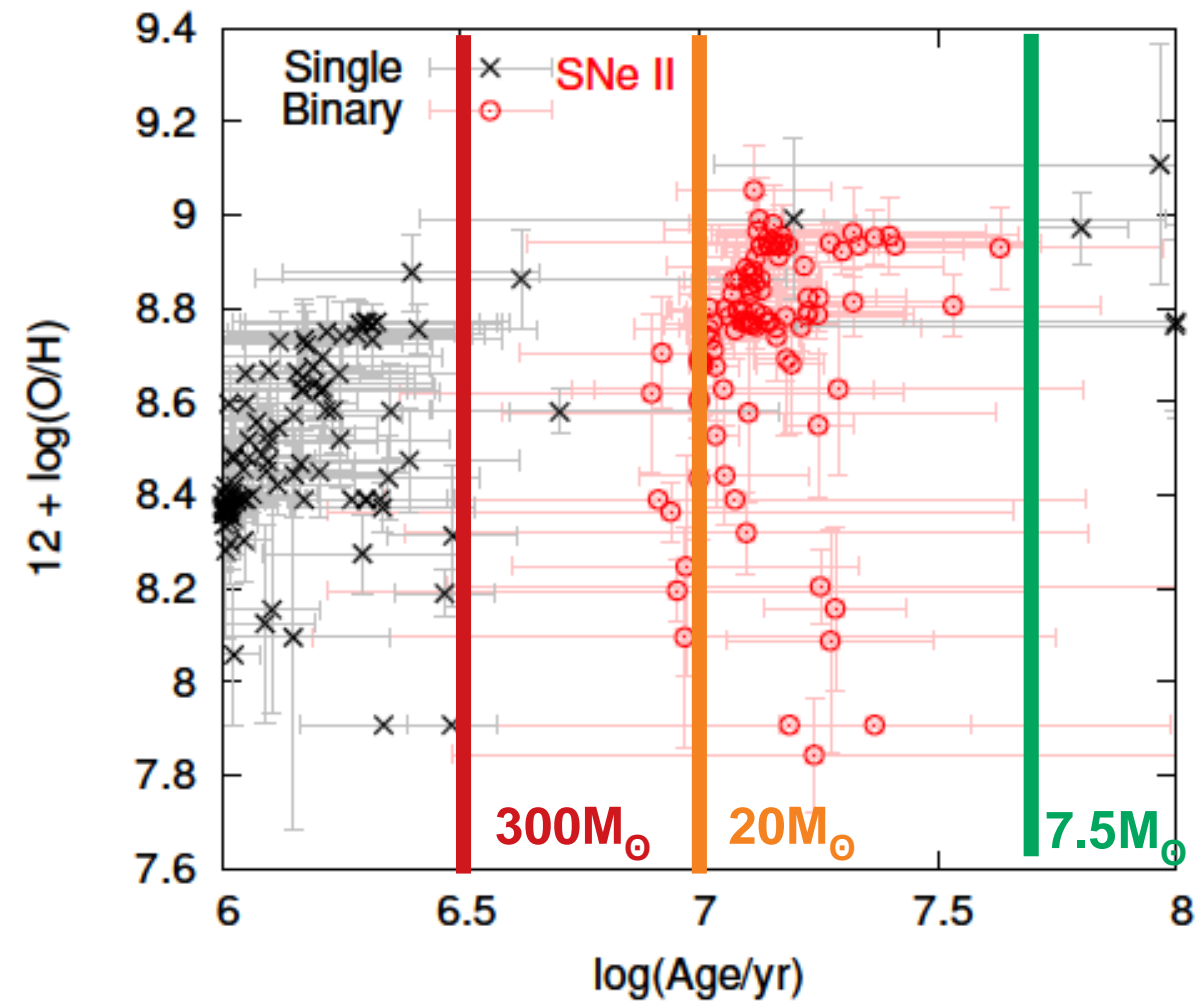


**What happens when we attempt  
to **age** observed stellar  
populations at **supernova sites**  
with **single star** or  
**interacting binary** populations?**



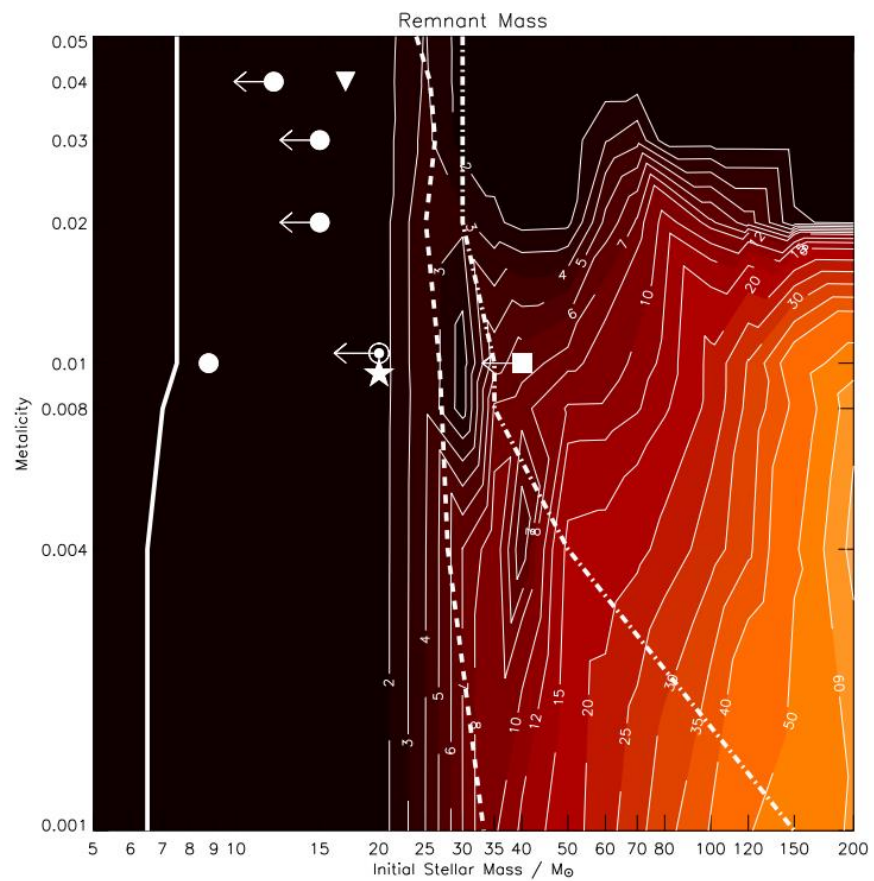
BPASSv2.1

Xiao et al . (2018, 2019) and see works by Götberg et al. and Zapartus et al..

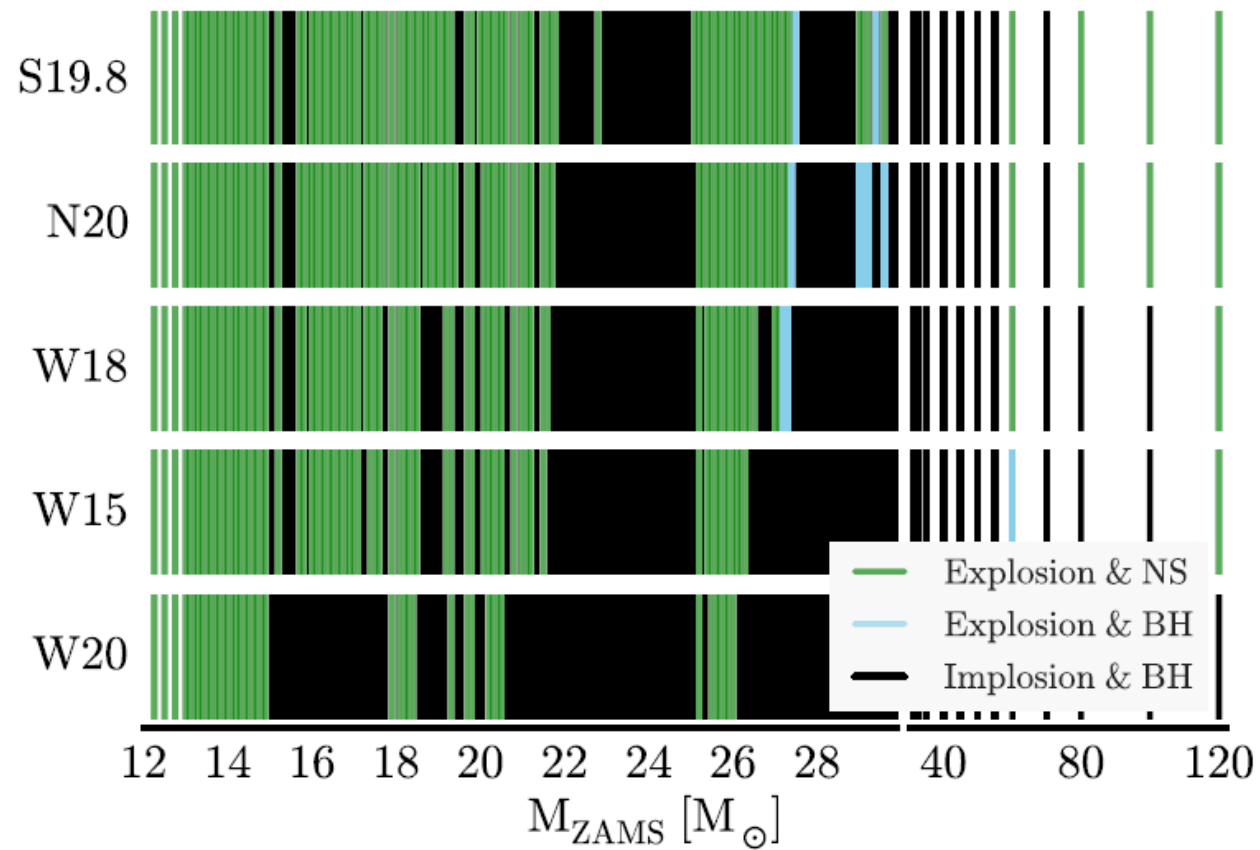


BPASSv2.1

Xiao et al. (2018, 2019) and see works by Götzberg et al. and Zapartus et al..

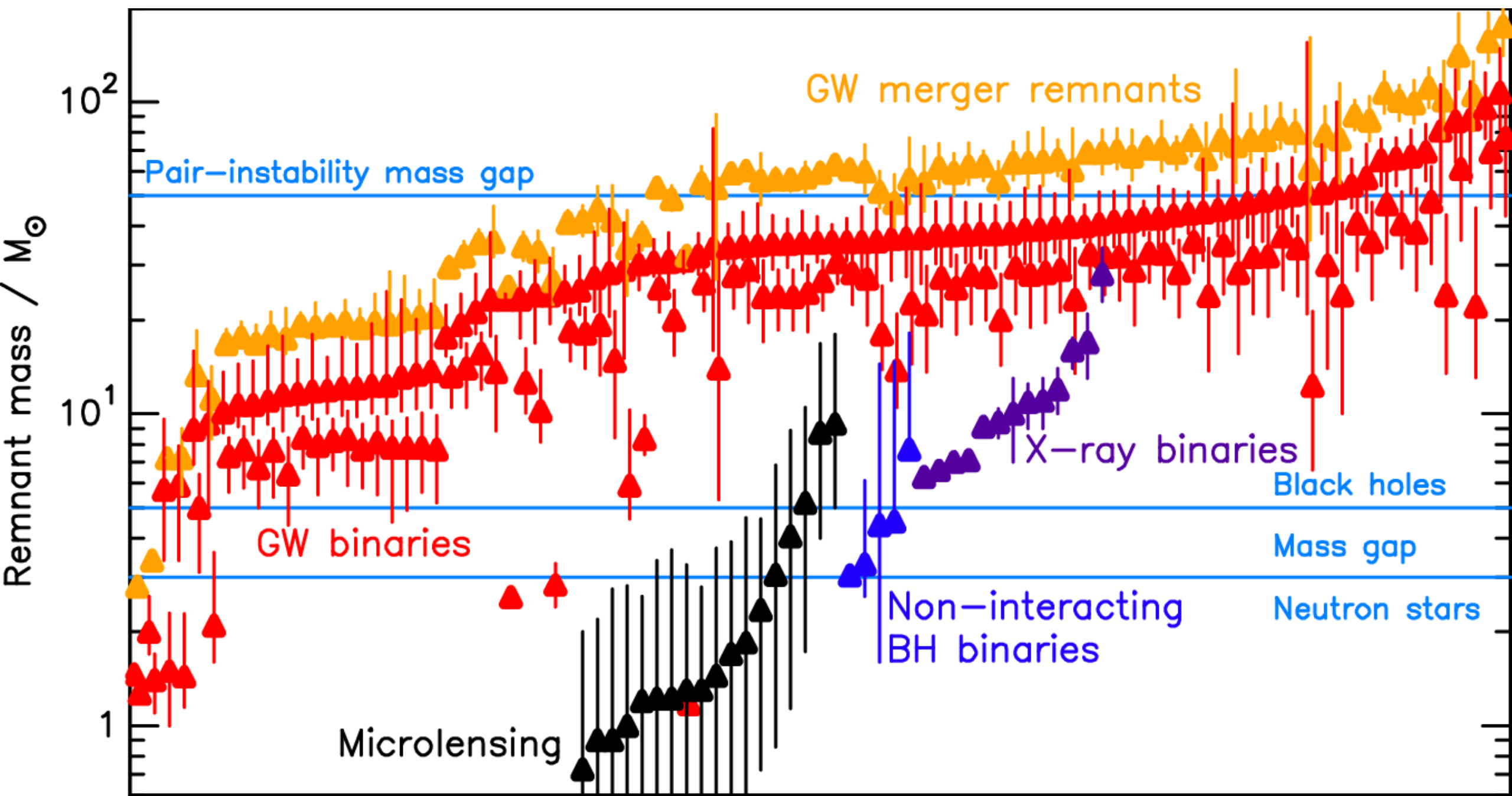


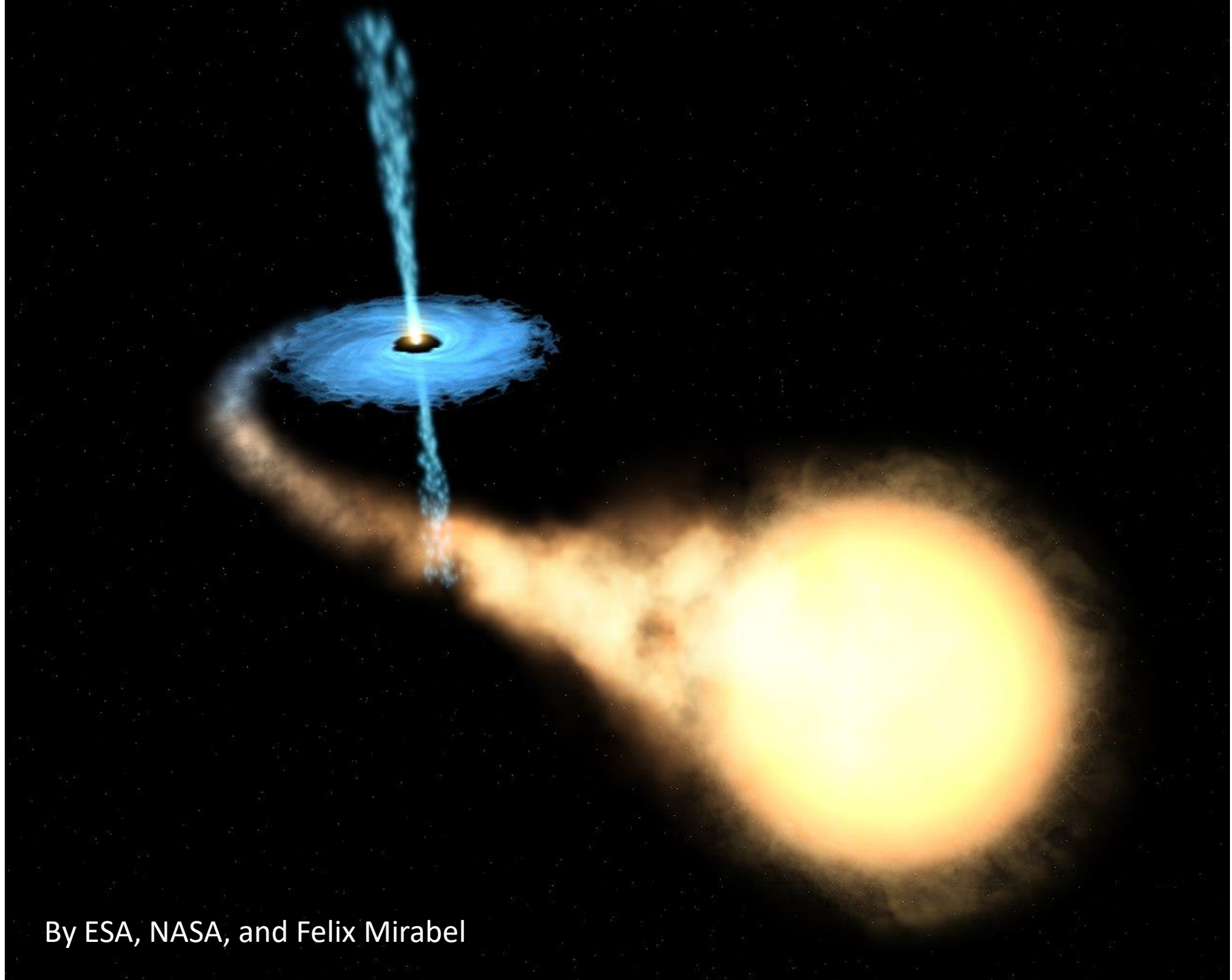
Eldridge (2005)



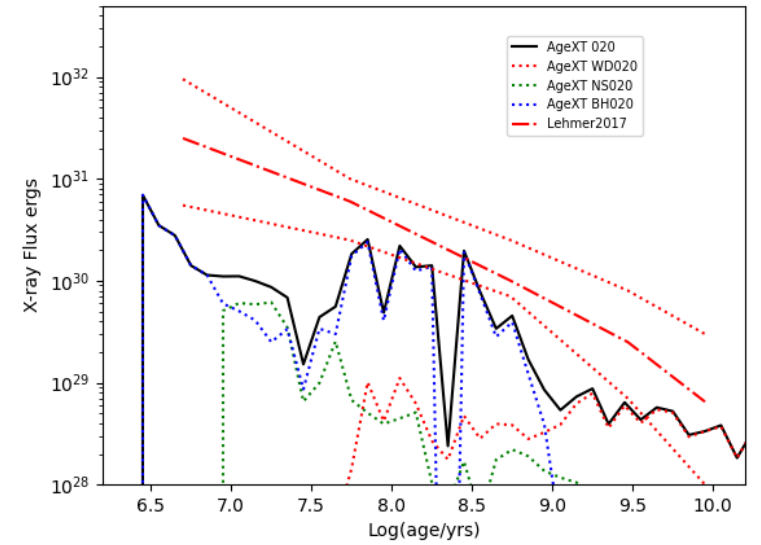
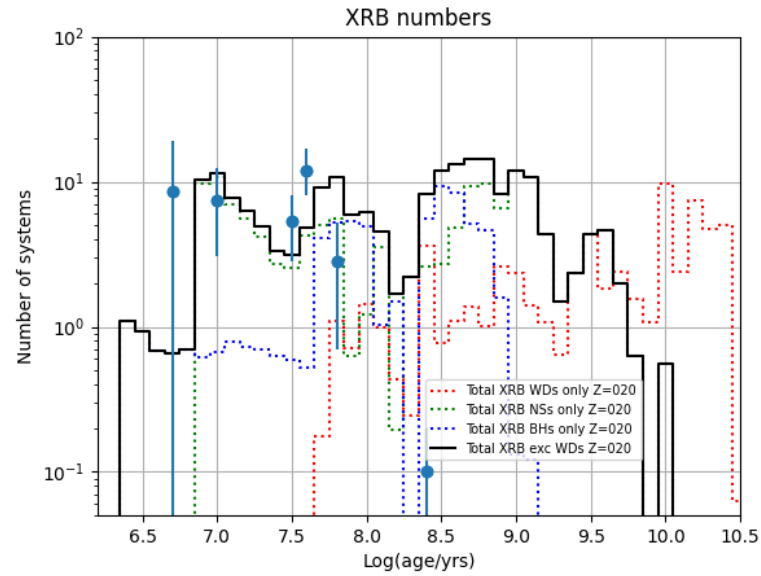
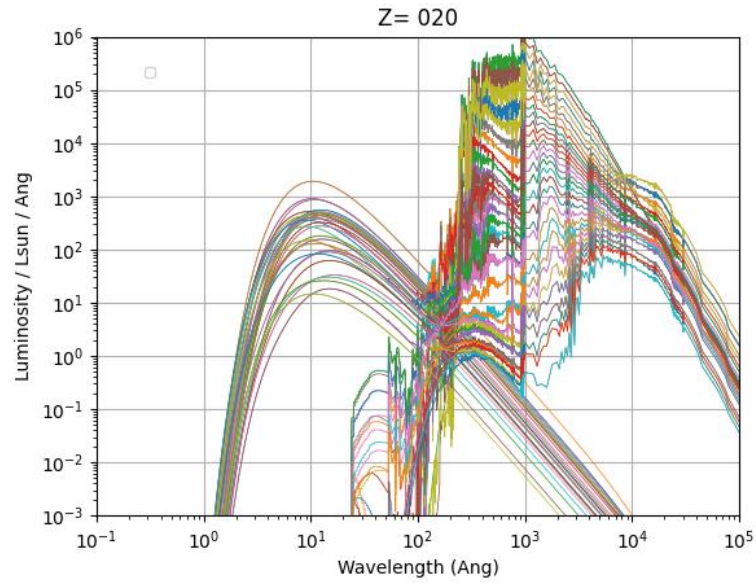
Sukhbold et al. (2016)

**Do we know if these  
black hole masses  
evolve...?**





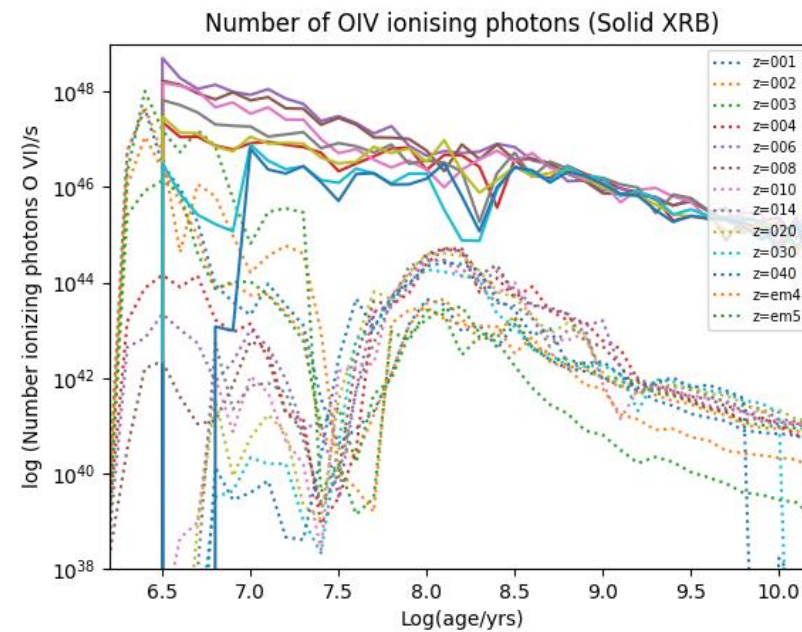
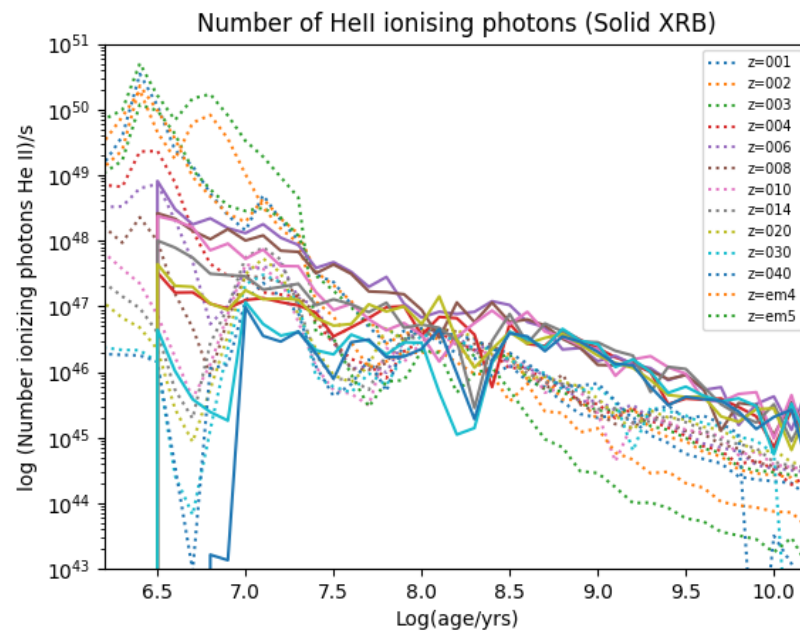
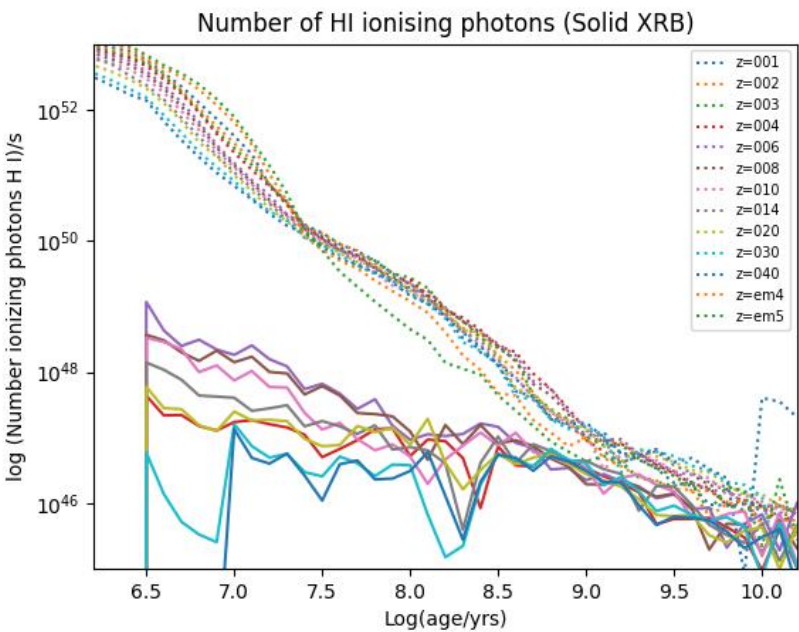
By ESA, NASA, and Felix Mirabel



**BPASS X-ray binary models impact on populations...**

Bray et al. (in prep).

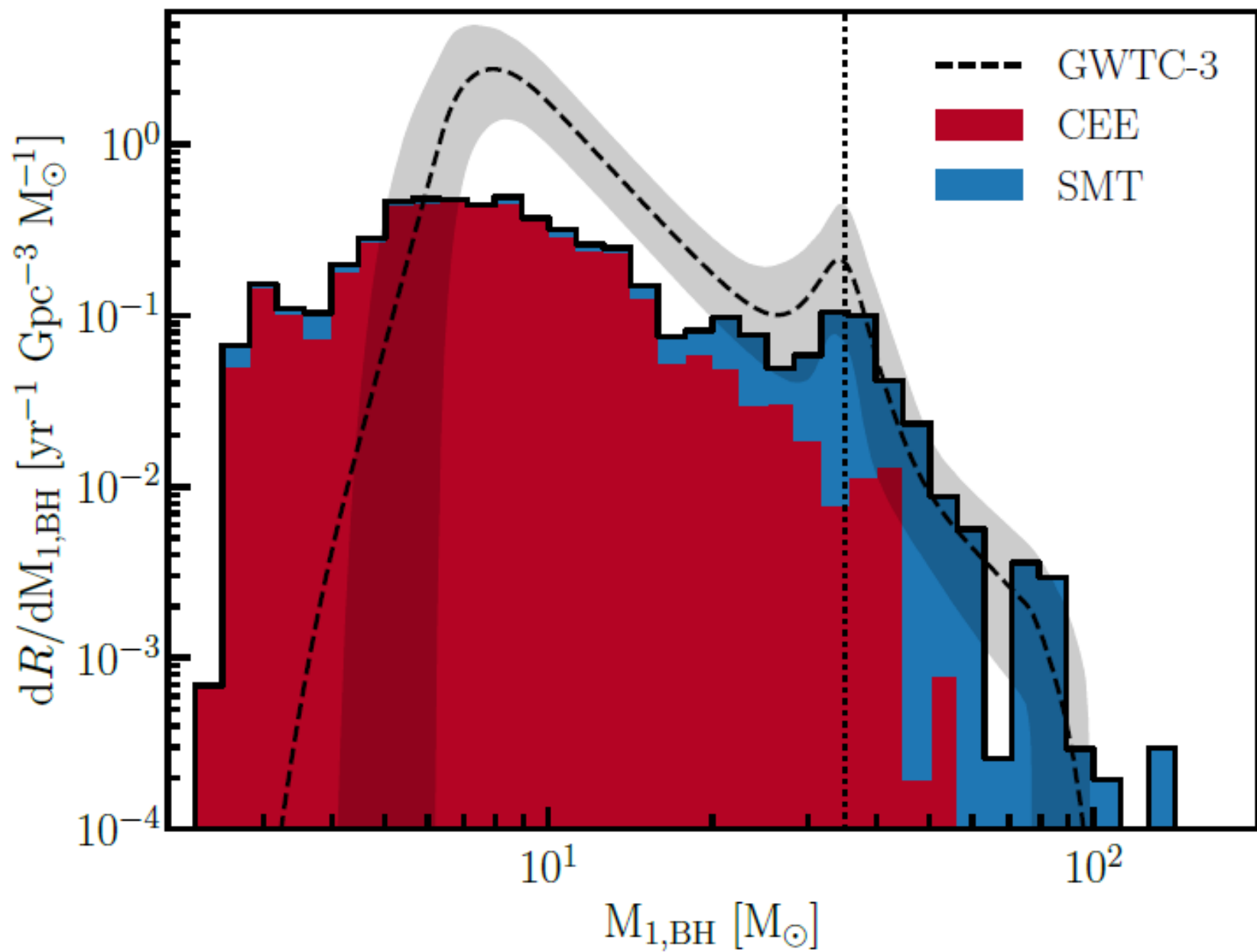




**BPASS X-ray binary models impact on populations...**

Bray et al. (in prep).

**Can this be seen in  
GW transients...?**



**What about,  
stochasticity...?**

