Impact of the stellar evolution adopting hydrodynamically consistent winds

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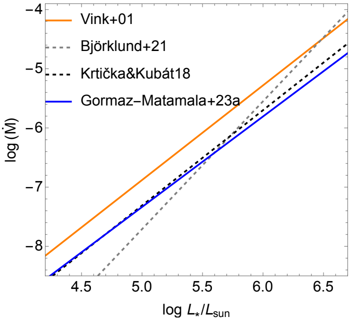
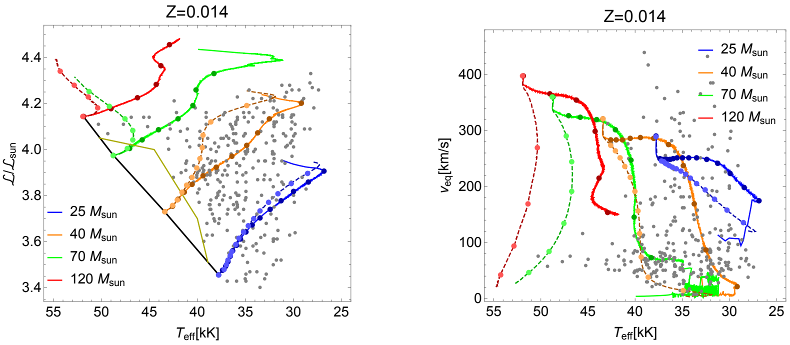
Upgrade of mass-loss rate recipes

- New stellar winds are $\sim 2-3$ lower than standard recipes (Krtička & Kubát 2018; Björklund et al. 2021; Gormaz-Matamala et al. 2019,2022a).
- Stellar evolution models adopting lower values for $\dot{M}$ retain more mass and are brighter compared with former models (Gormaz-Matamala et al. 2022b; Björklund et al. 2023).
- Weaker winds for evolution also affect the rotation and the mixing of the stellar structures (Gormaz-Matamala et al. 2023).

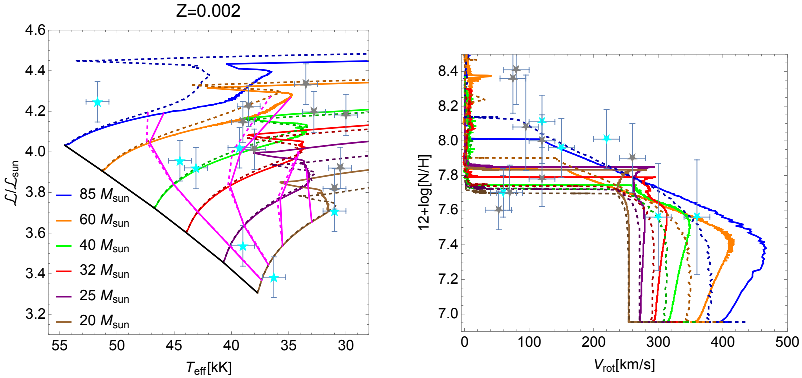


Comparison with rotational surveys from Holgado et al. (2020,2022)



Self-consistent evolution models (solid lines) explain better the lack of fast rotators ($v_{rot} \gtrsim 150$ km s^{-1}) at $T_{eff} \gtrsim 42.5$ kK and the abundance of stars with $v_{rot} \lesssim 150$ km s^{-1} and T_{eff} between ~ 27 and 40 kK.

New winds for SMC stars (Bouret et al. 2013;2021)



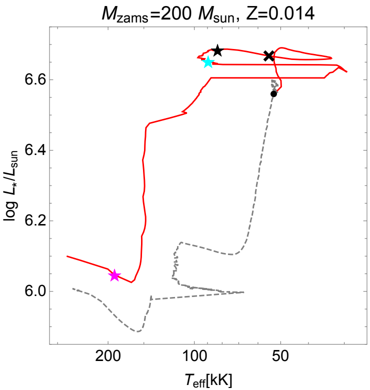
Gormaz-Matamala, Cuadra, Ekström, Meynet, et al. (2024, in prep).

Very Massive Stars

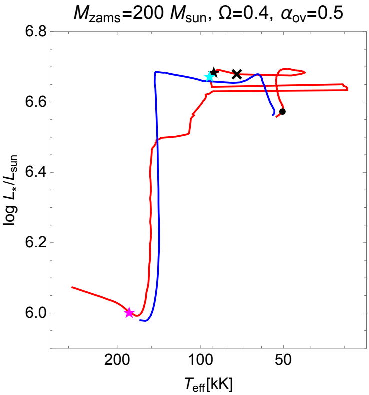
- Stars born with $M_{\rm zams} \gtrsim 100\ M_\odot$, with large convective cores.
- Strong stellar winds make VMS become WR (WNh) stars during their main sequence phase (Crowther et al. 2010).
- In evolution models, transition between optically thin winds (OB-type stars) and thick winds (WNh stars) is done at H-core burning stage once some threshold on $X_{\rm surf}$ is reached: 0.3 for GENEC, 0.4 for Mesa.
- However, there is spectroscopical evidence of WNh with $X_{\rm surf} \gg 0.3$ (Tehrani et al. 2019; Martins & Palacios 2022).
- **We need to find another transition point between thin and thick winds.**

Evolution for $M_{zams} = 200\ M_{\odot}$ and $\Omega = 0.4$

Adopting $\Gamma_{e,trans} = 0.5$:



Grey dashed model from Yusof et al. (2013).



GENEC (red) vs Mesa (blue) models. Gormaz-Matamala et al. (2024, in prep.).

Summary and future work

Based in our new evolution models:

- New weaker winds affects the chemical evolution of massive stars in low metallicity environments (SMC).
- Evaluate the transition between thin (O-type) to thick (WNh) winds for VMS based on the proximity to the Eddington factor ($\Gamma_e = 0.5$).
- New values for remnant masses (BH/NS) at the end of stellar evolution.

¡Muchísimas gracias!

Thanks a lot!

Dziękuję bardzo!

Merci beaucoup!