



Is There a Critical Metallicity of Mass Loss in Massive Star Evolution?



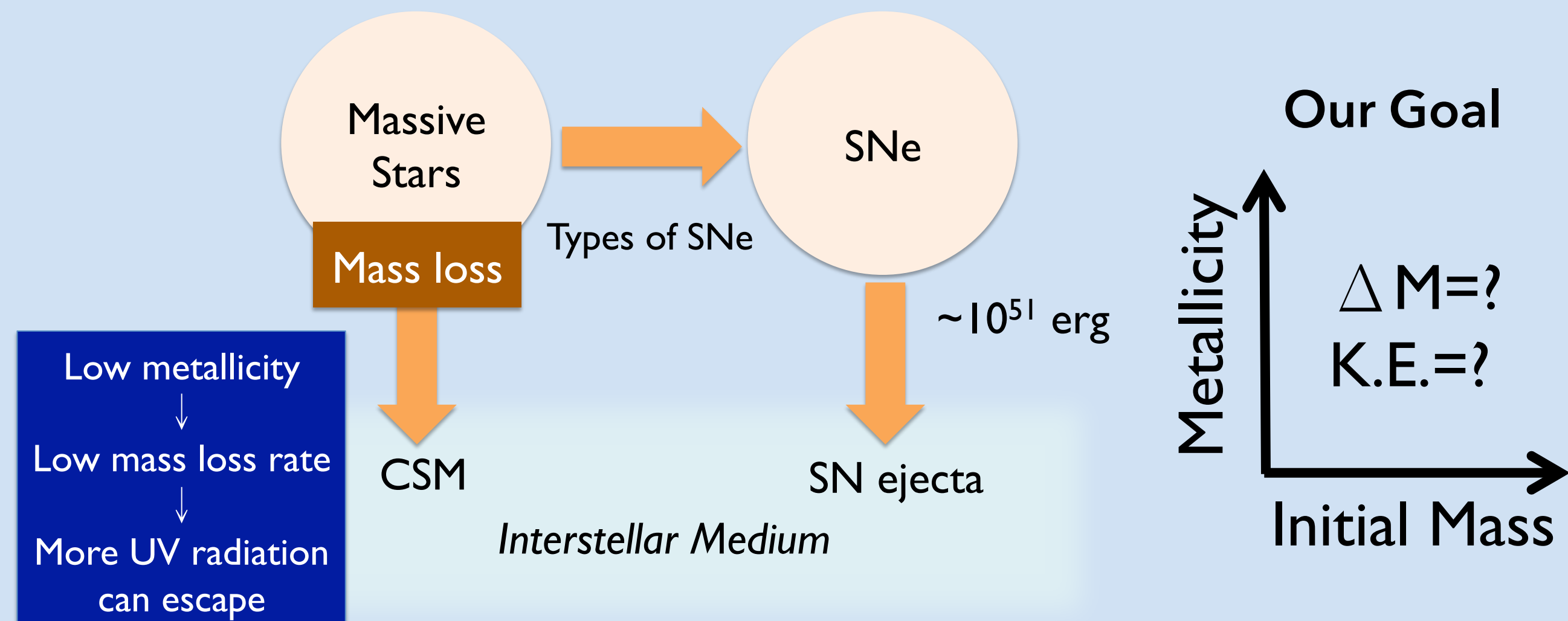
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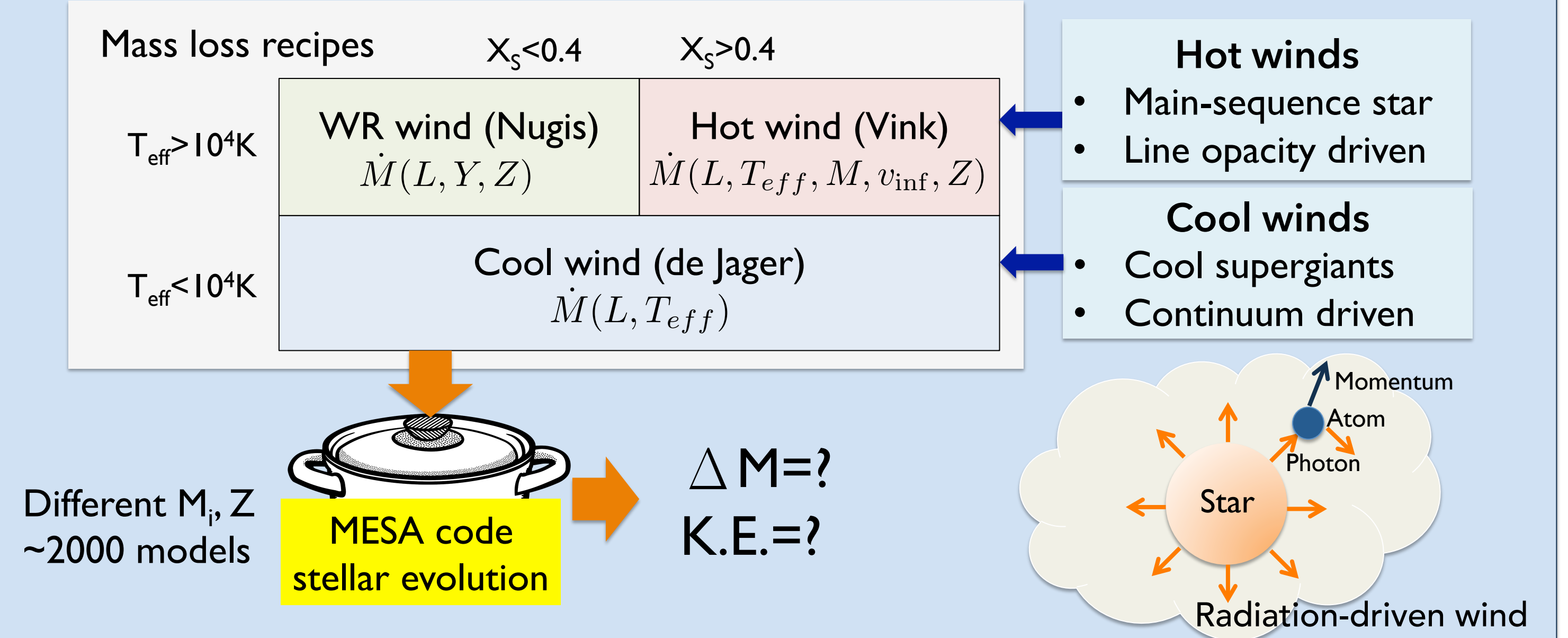
Motivations

- To understand stellar feedback in the early universe, we study mass loss from low-metallicity massive stars.

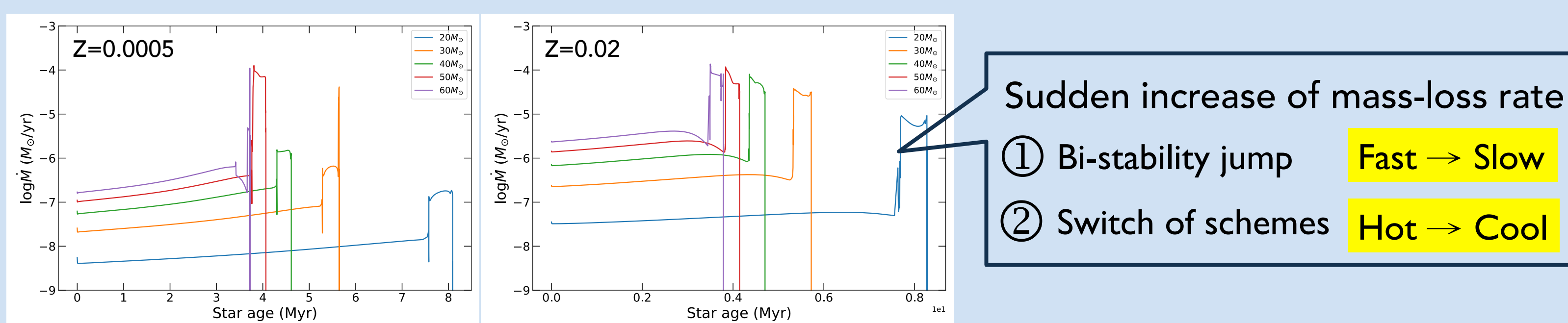


Methods

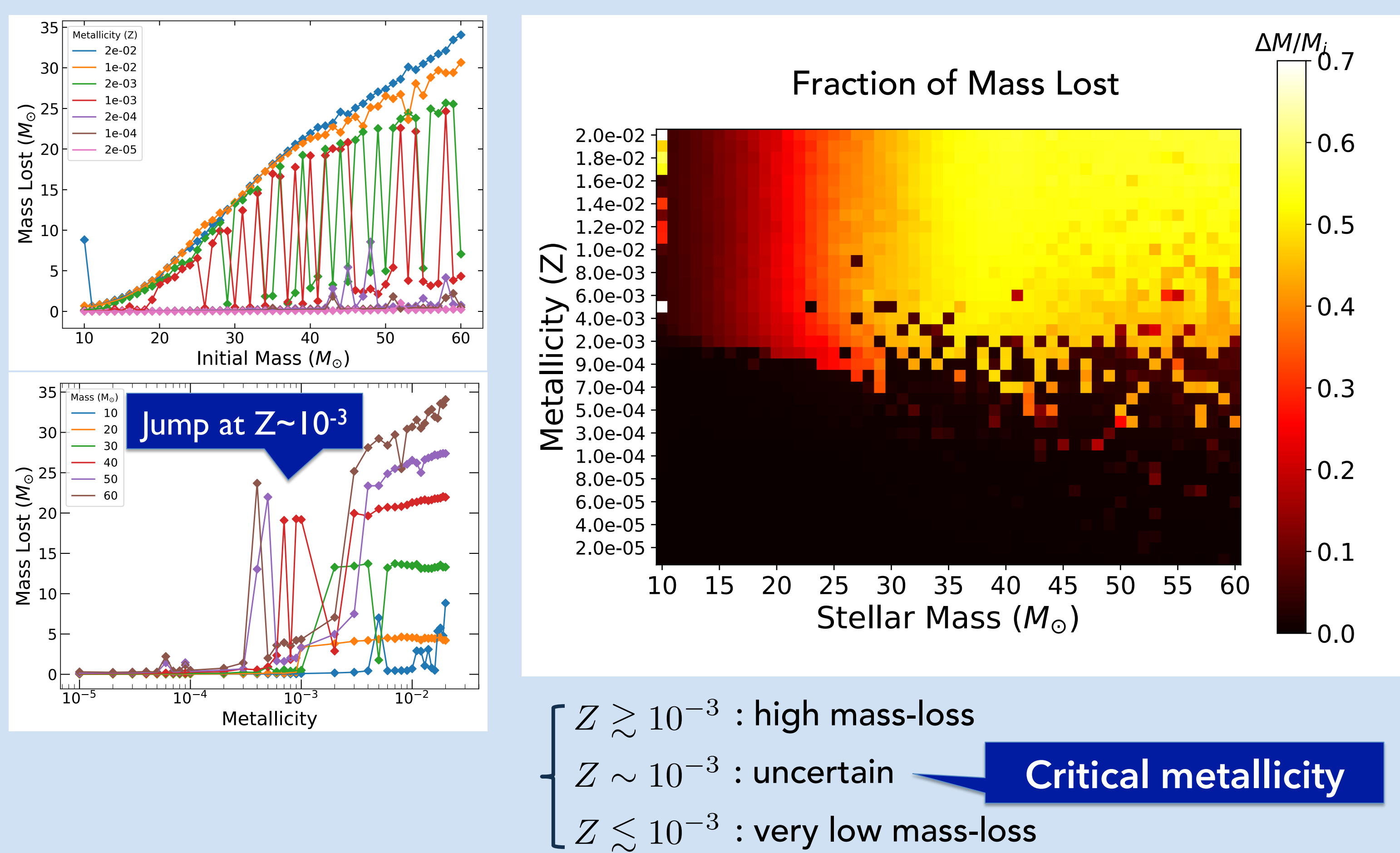
- 1D stellar evolution models with the MESA code



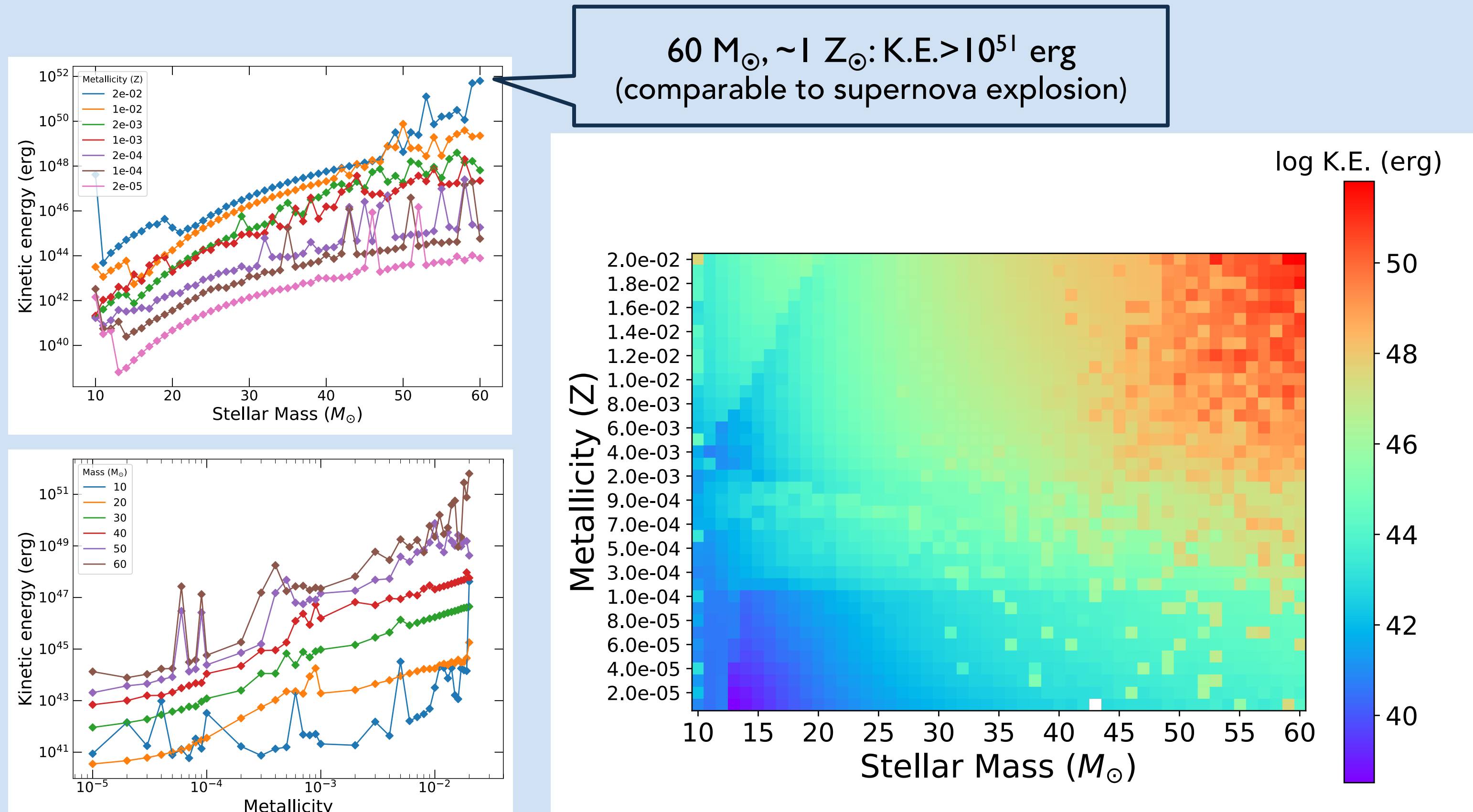
Evolution of Mass Loss Rate $\dot{M}(t)$



Total Mass Lost During the Stellar Lifetime ΔM

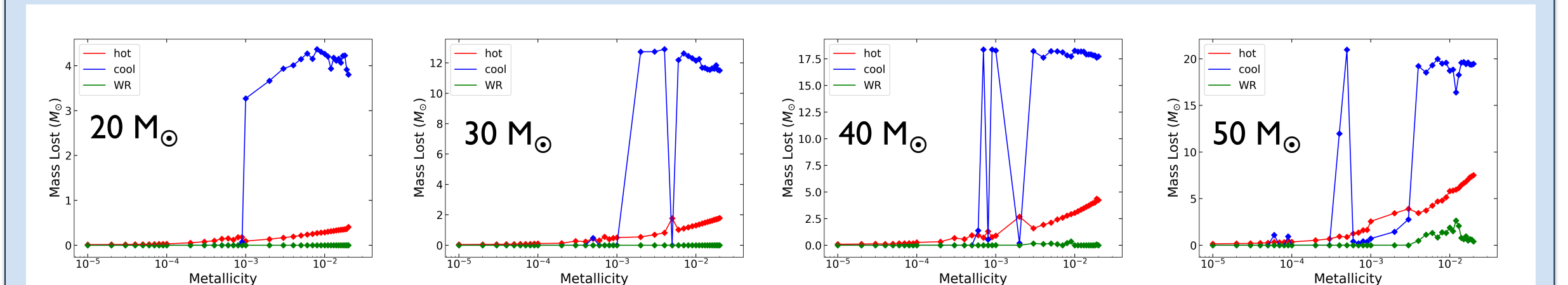


Kinetic Energy Released from Stellar Winds

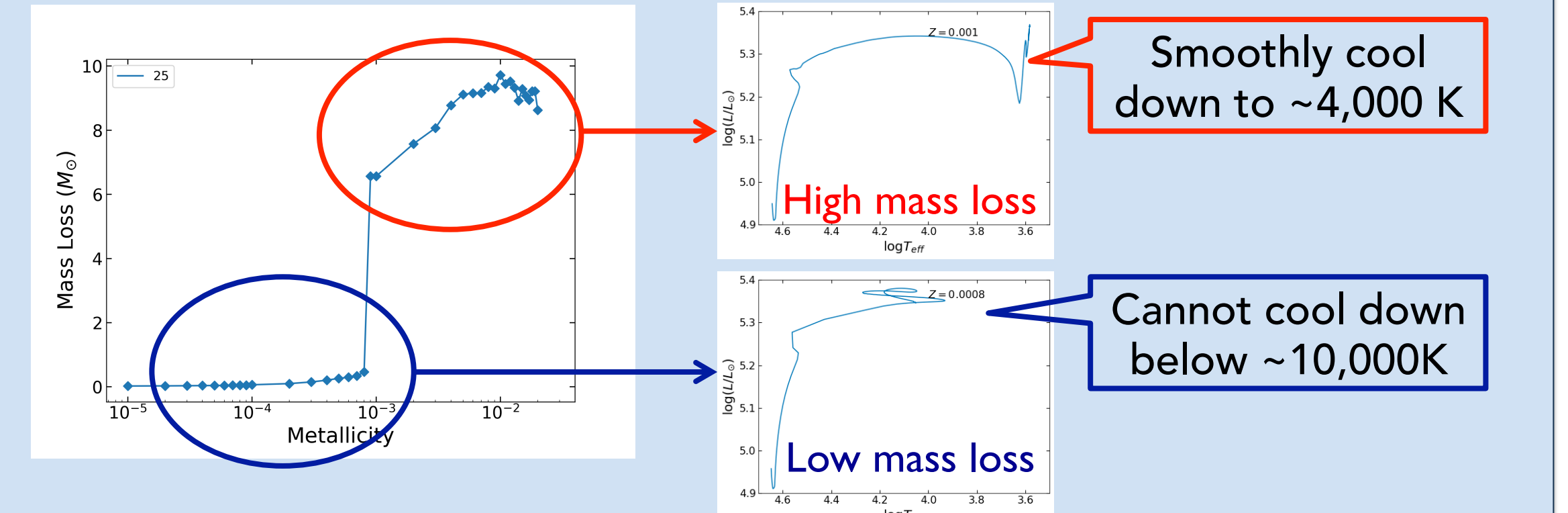


What is the Origin of the Critical Metallicity?

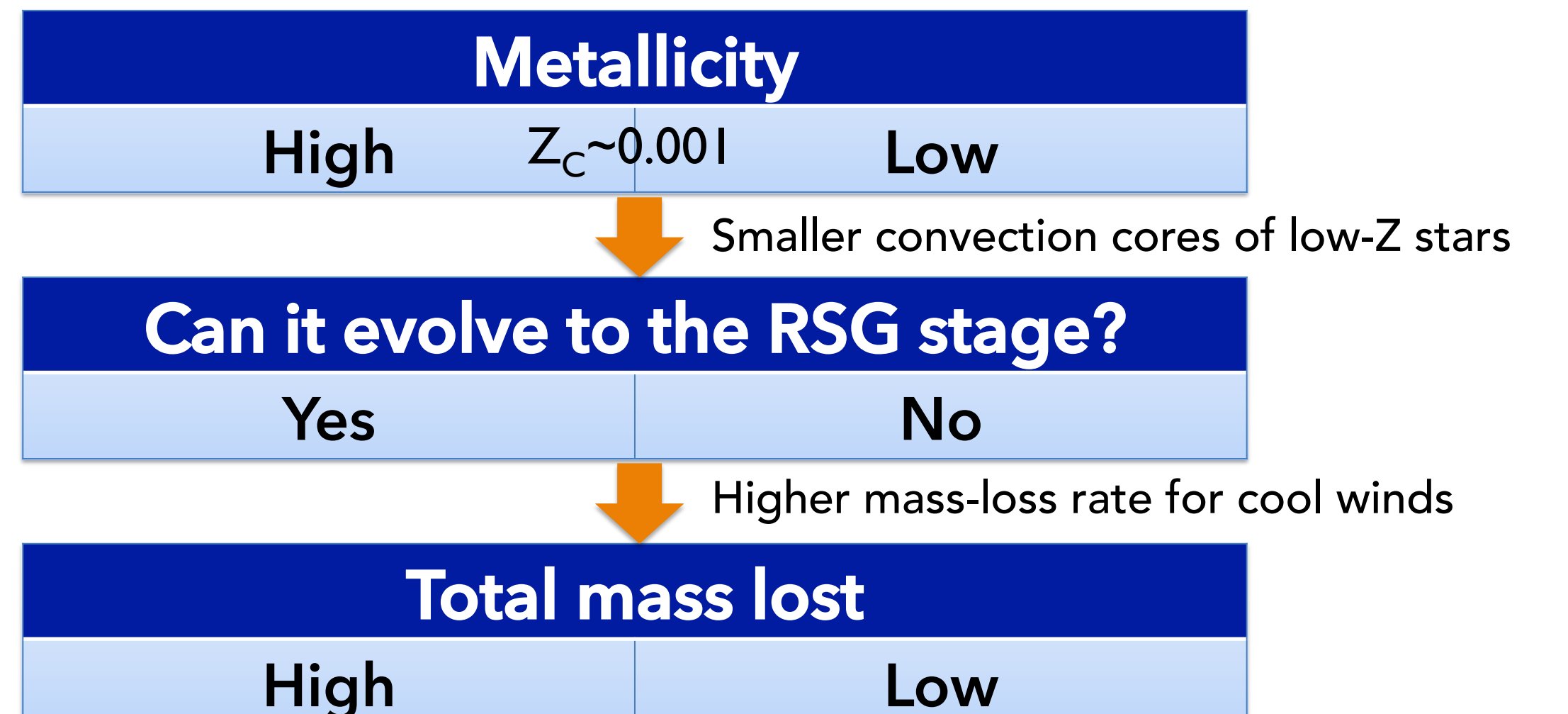
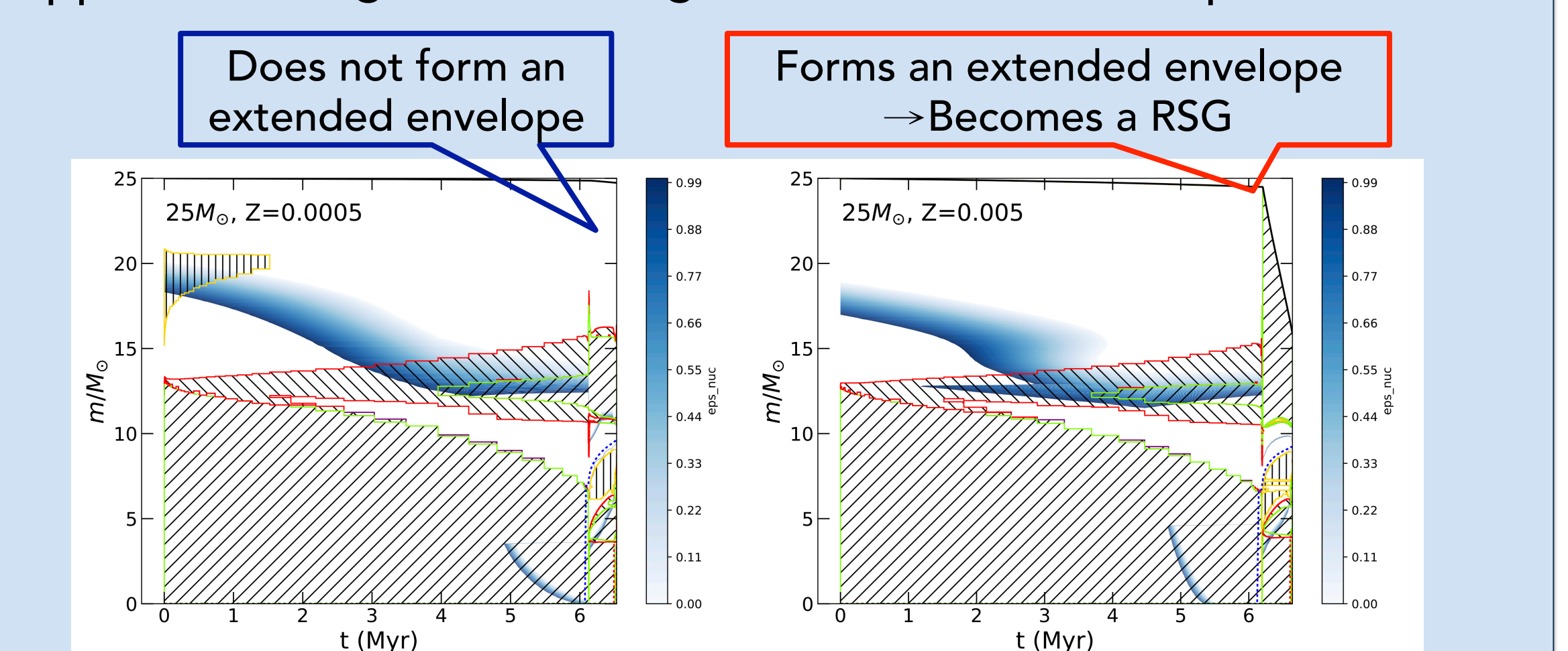
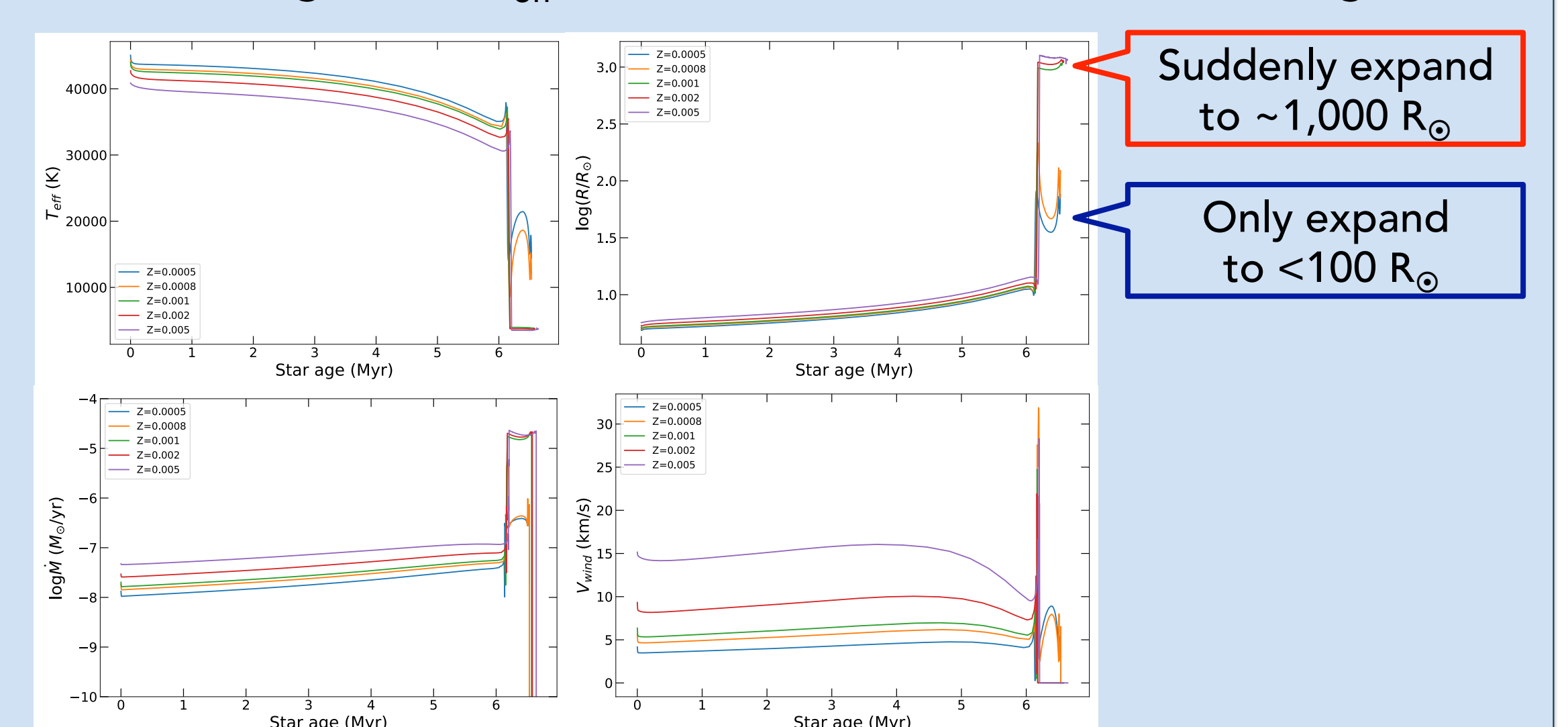
- Critical metallicity is from cool winds



- Different evolutionary tracks of low- and high-mass-loss models



- Sudden change of R , T_{eff} at the onset of helium core burning



Conclusions

- Is there a critical metallicity of mass loss in massive star evolution? Likely yes.
- Mechanism: High-Z stars can evolve to RSG, while low-Z stars never become RSGs.