A STUDY OF PRIMORDIAL VERY MASSIVE STAR EVOLUTION

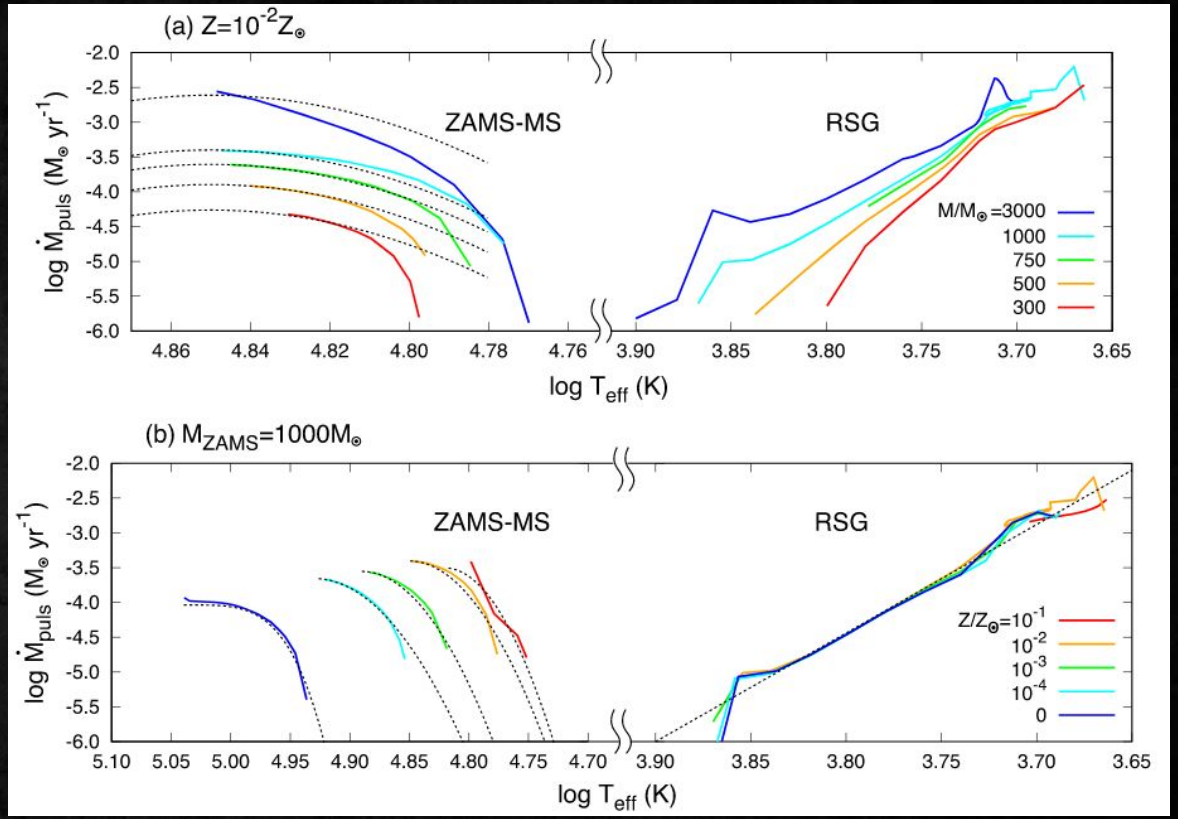
an artist's impression of CR7: a distant galaxy that may contain primordial stars.
credit: ESO/M. Kornmesser

MASS LOSS: A KEY INGREDIENT IN MASSIVE STAR EVOLUTION

- LINE DRIVEN WINDS
- DUST DRIVEN WINDS
- PULSATION DRIVEN WINDS

MASS-LOSS RATE FROM NAKAUCHI ET AL. 2020

TWO DISTINCT REGIMES CORRESPONDING TO ε AND κ MECHANISM

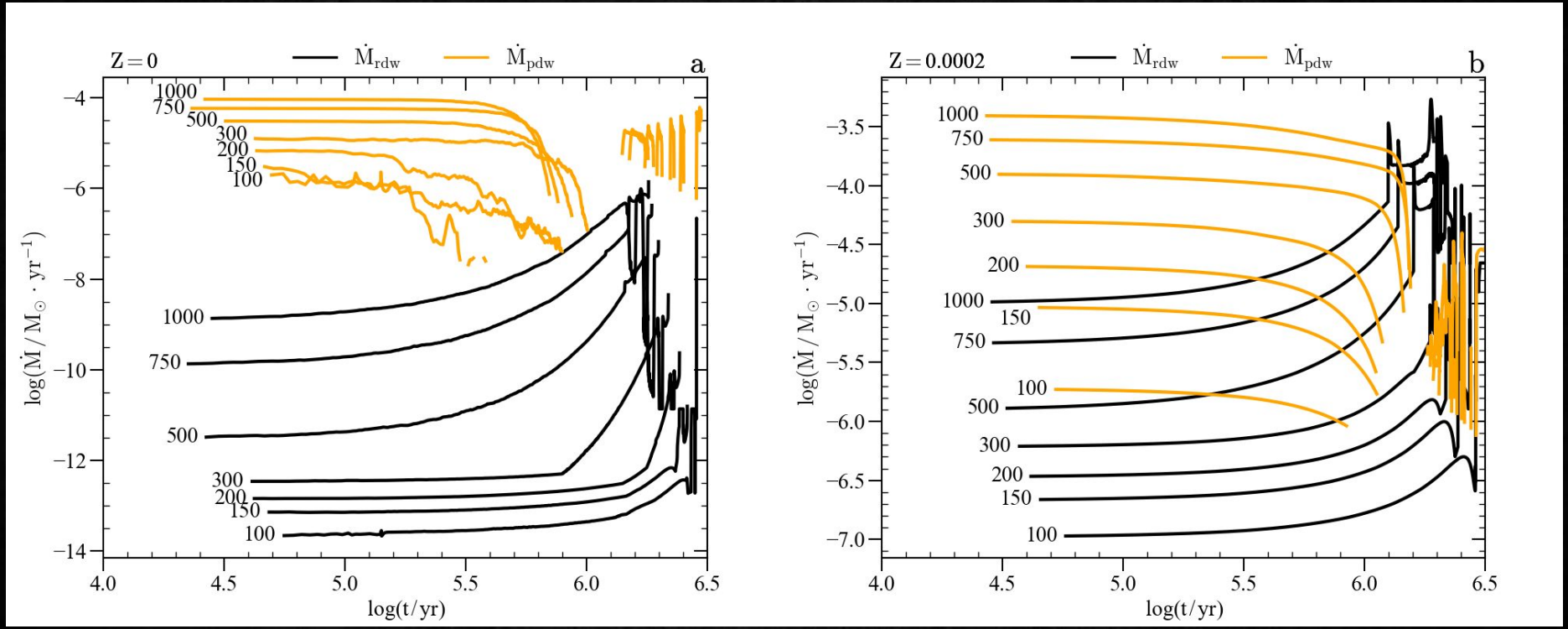


adapted from Fig. 5 of Nakauchi et al. (2020)

STELLAR EVOLUTION MODELS

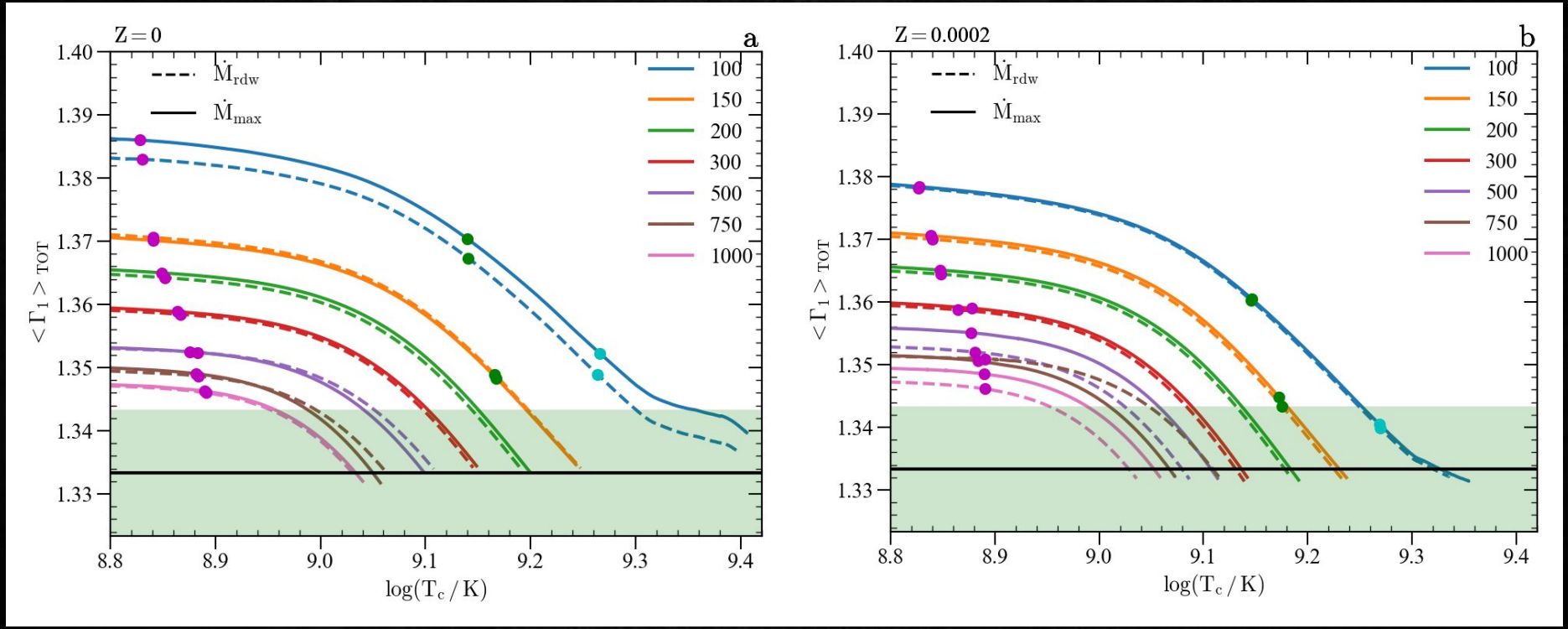
- $Z_i = 10^{-11}$ (0.0); 0.0002
- $M_i/M_\odot$ = 100, 150, 200, 300, 500, 750, 1000
- mass-loss type: radiation-driven (rdw); pulsation-driven (pdw)

RADIATION-DRIVEN VS PULSATION-DRIVEN



Volpato et al. (2023)

END OF STELLAR EVOLUTION CALCULATIONS



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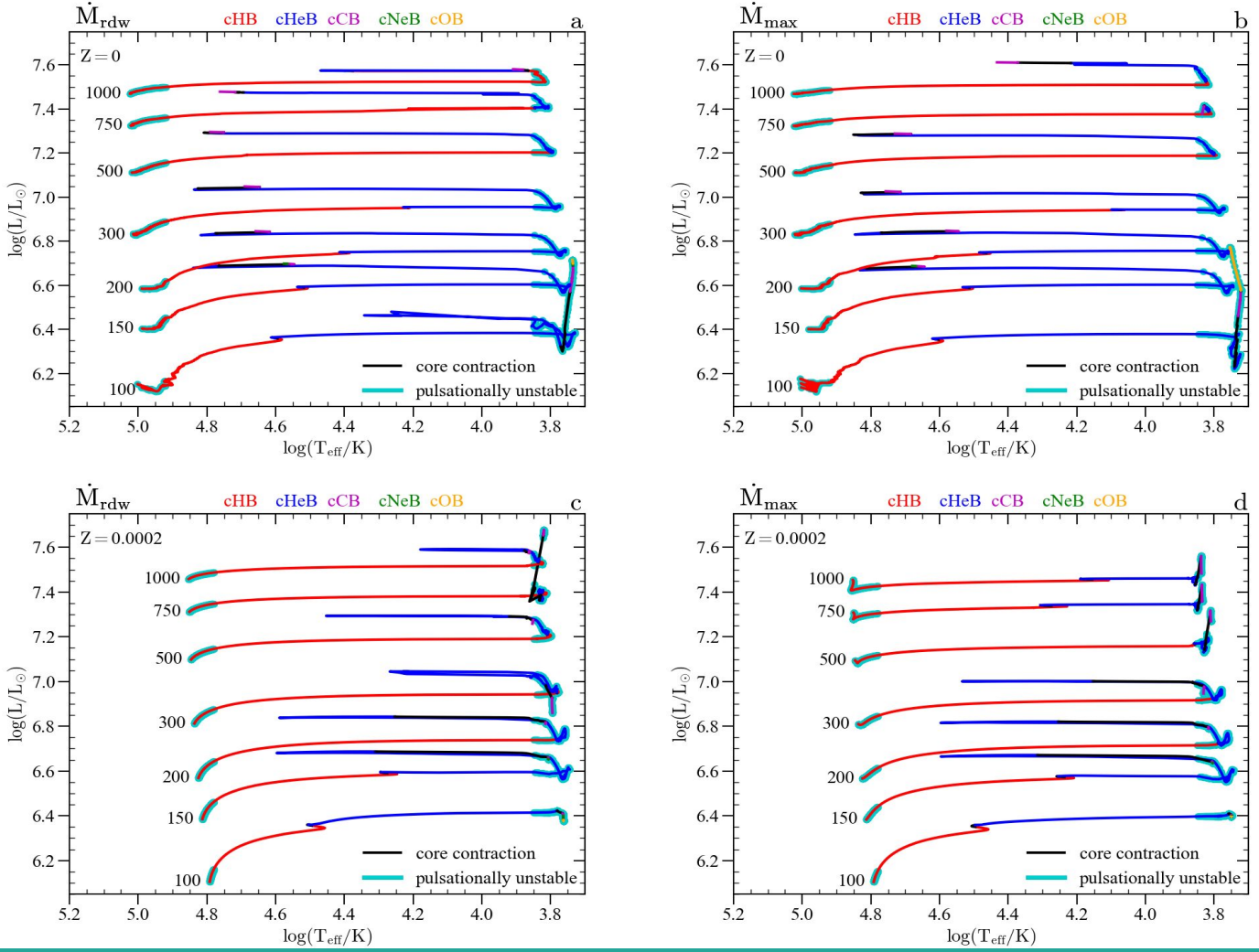
EVOLUTION IN THE HR DIAGRAM



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INTERNAL STRUCTURE OF THE MODELS: THE KIPPENHAHN DIAGRAM

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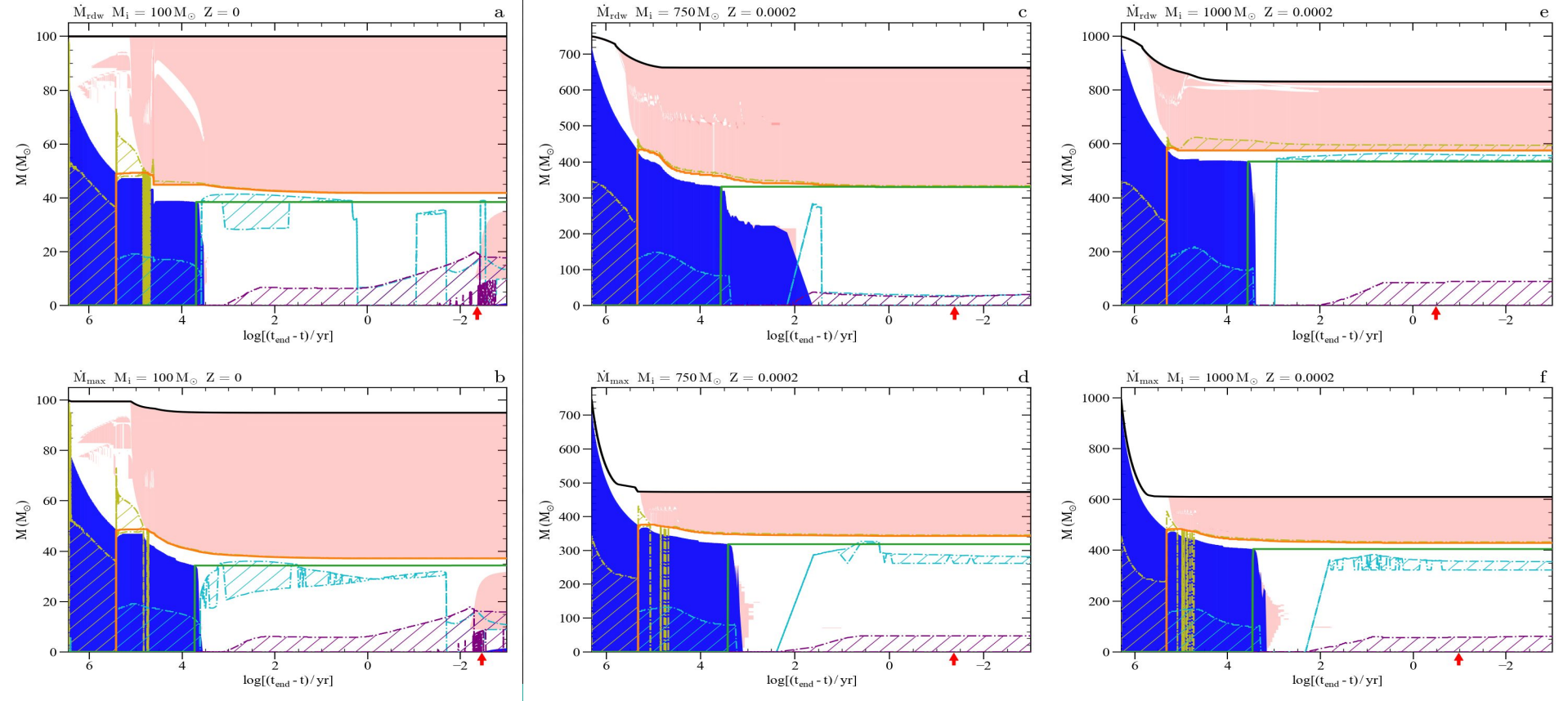

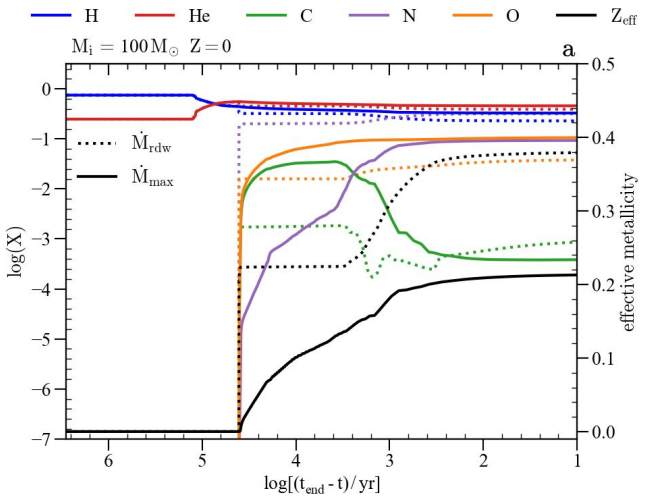

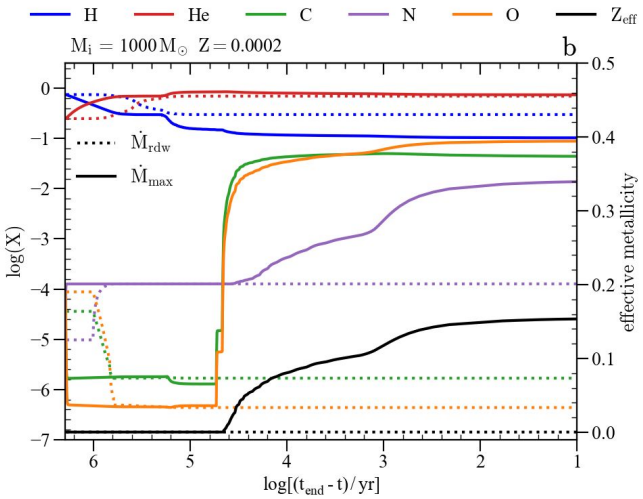

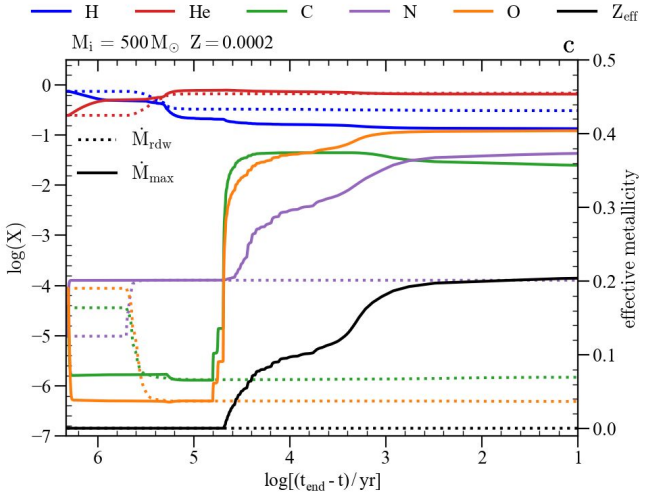

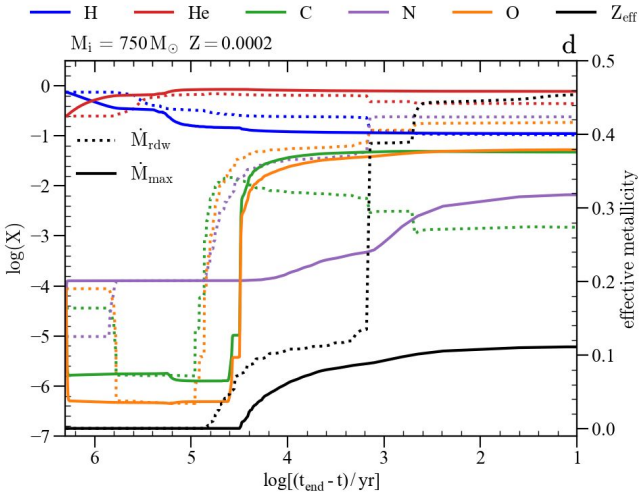

SURFACE ABUNDANCE EVOLUTION

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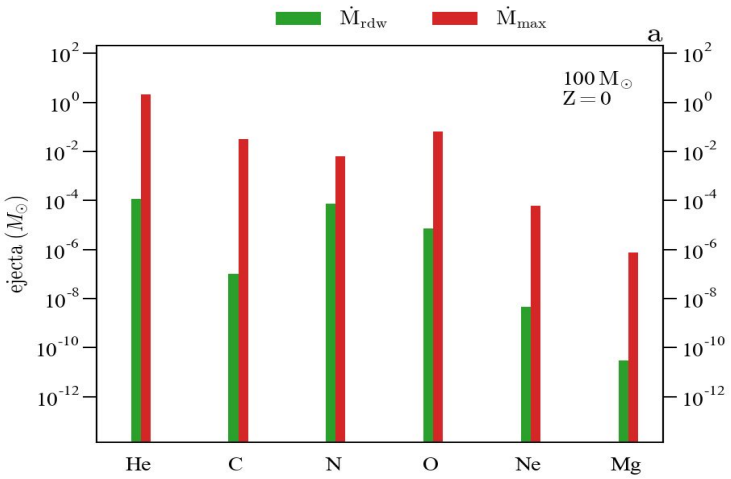
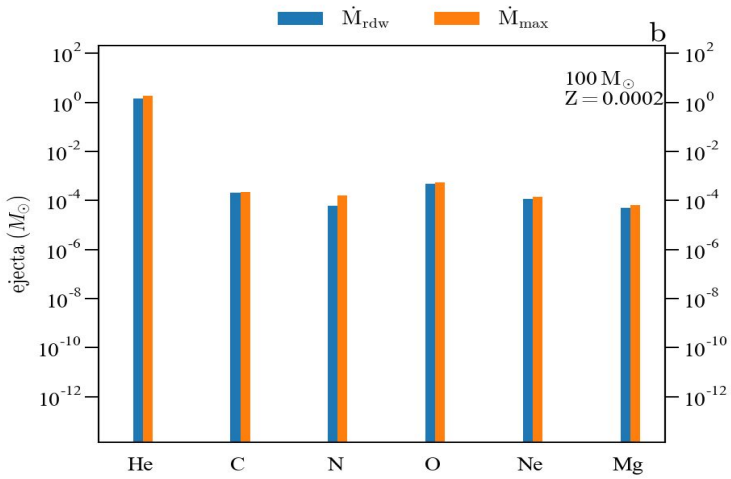
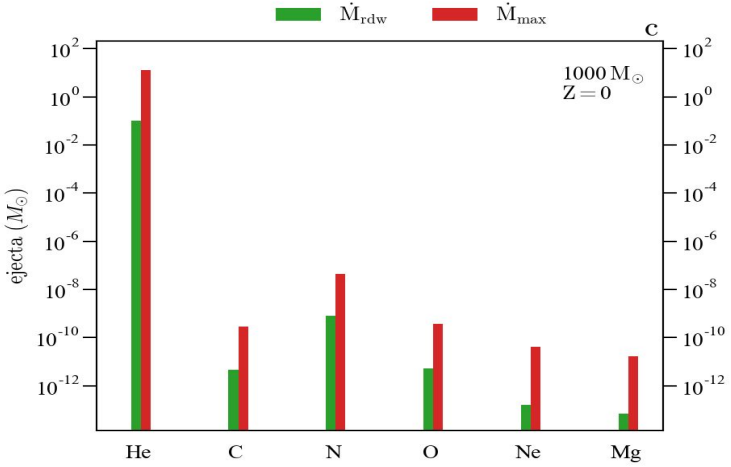
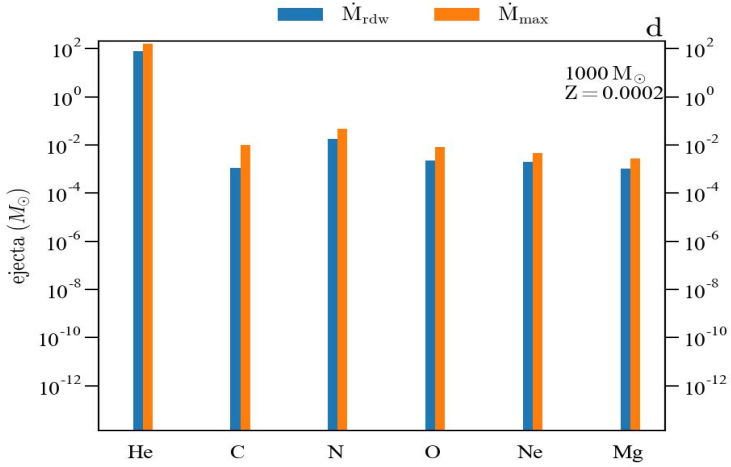
EJECTA MASS









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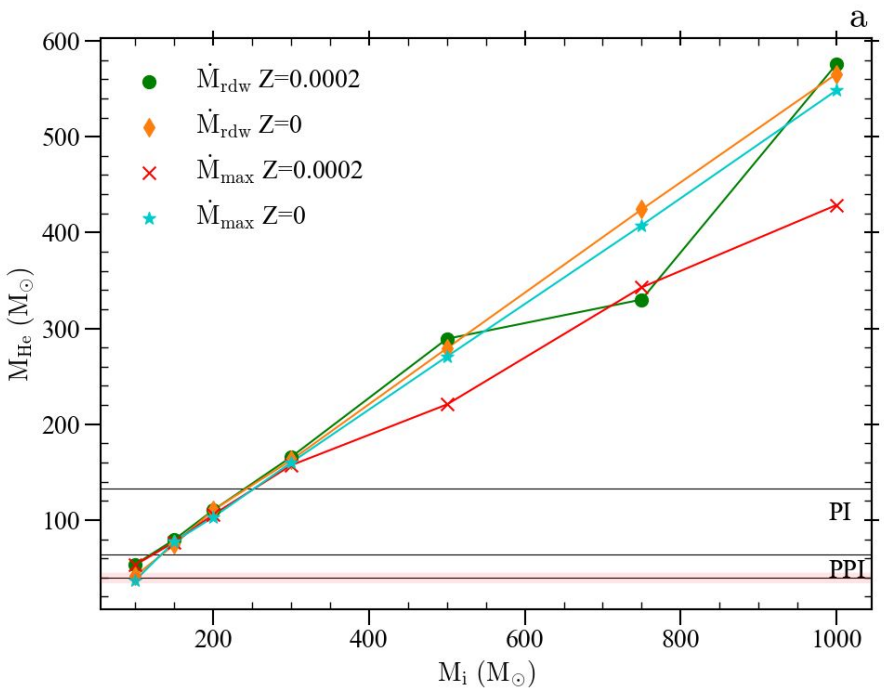
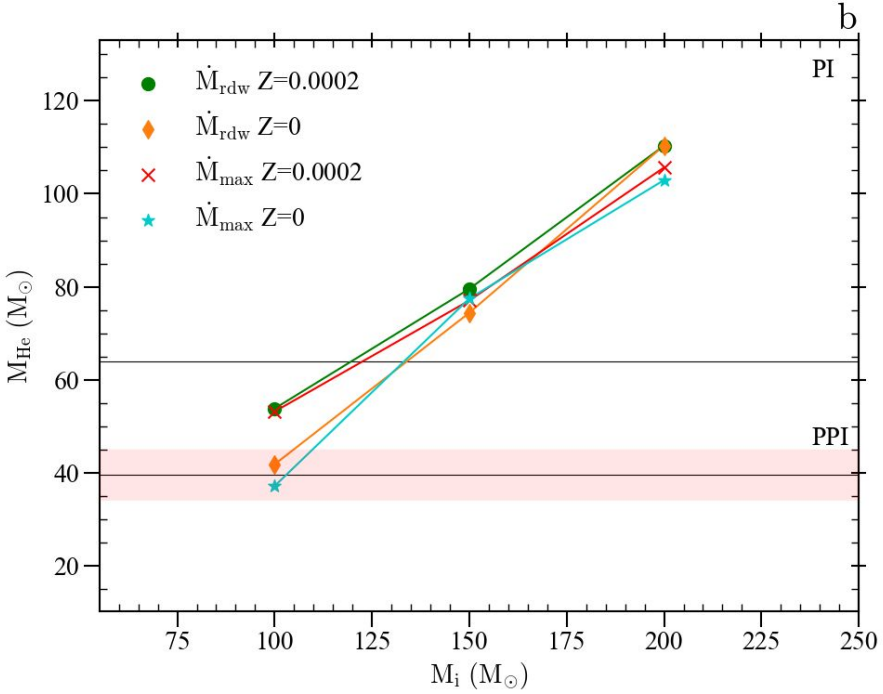
M_{He} AND FINAL FATE OF THE MODELS





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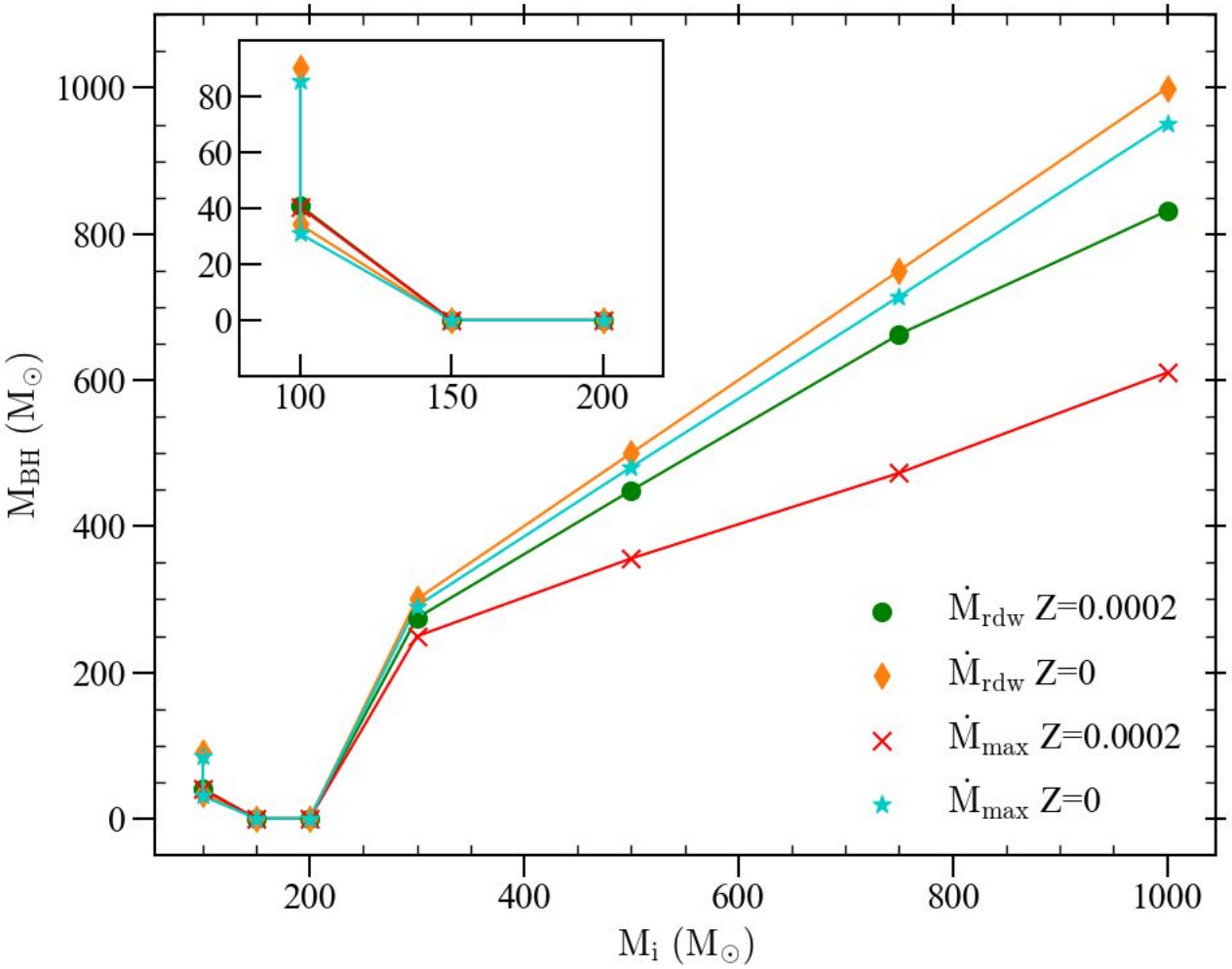
EXPECTED MASS OF THE REMNANTS



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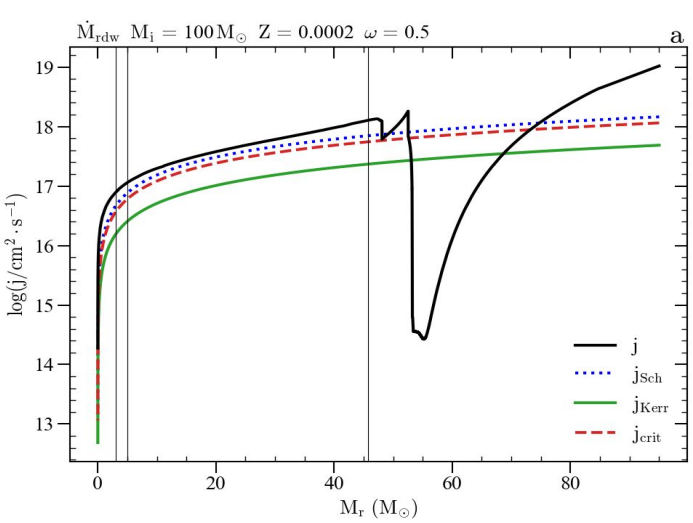
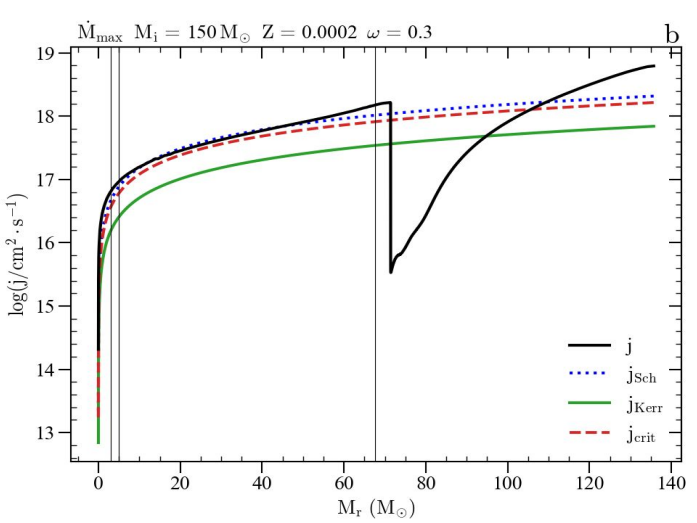
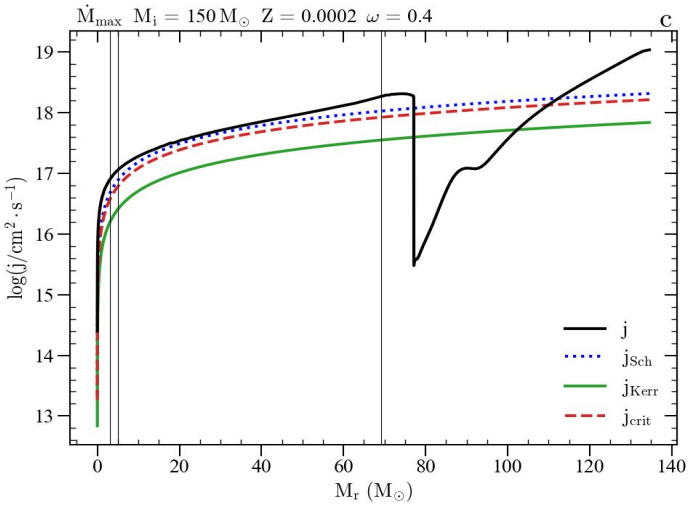
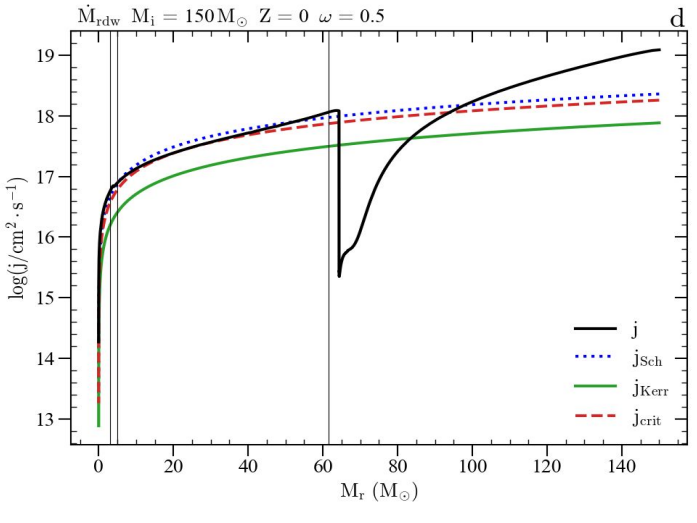
FUTURE WORK: ROTATING PRIMORDIAL VERY MASSIVE STARS









Volpato et al. (to be submitted)

CONCLUSIONS & DISCUSSION LINKS

- NEW MODELS WITH INCLUSION OF PULSTION-DRIVEN WINDS
- PDW → HIGHER MASS EJECTA, ISM CHEMICAL ENRICHMENT
- $M_I / M_\odot \geq 300$ → DUP; 150-200 $M_\odot$ → PISN: PRIMORDIAL BHMG; 100 $M_\odot$ → PPISN/fCCSN: ANOTHER POSSIBLE PATHWAY FOR BH IN MASS RANGE 40/65 - 120 $M_\odot$
- ADDING ROTATION → POSSIBLE PRIMORDIAL GRB PROGENITORS
- JWST → PROBING PROPERTIES OF POP III STARS?
- ET, CE, LISA, DECIGO: GW FROM BH MERGERS WITH ~ 10^2-10^4 $M_\odot$ UP TO Z ~ 20 → CONSTRAINING PROPERTIES OF POP III STARS?