Evolutions of stars just below the critical mass for iron core formation

9-11Moの恒星のコア進化

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Introduction

9-11Mo stars evolution

- complex features
  - Thermal Pulse (SAGB)

- Fe core formation
  → CCSNe
  M_{crit} =??

- ONeMg core ??
  → ECSNe

Introduction

9-11Mo stars evolution

- calculate with large nuclear reaction network

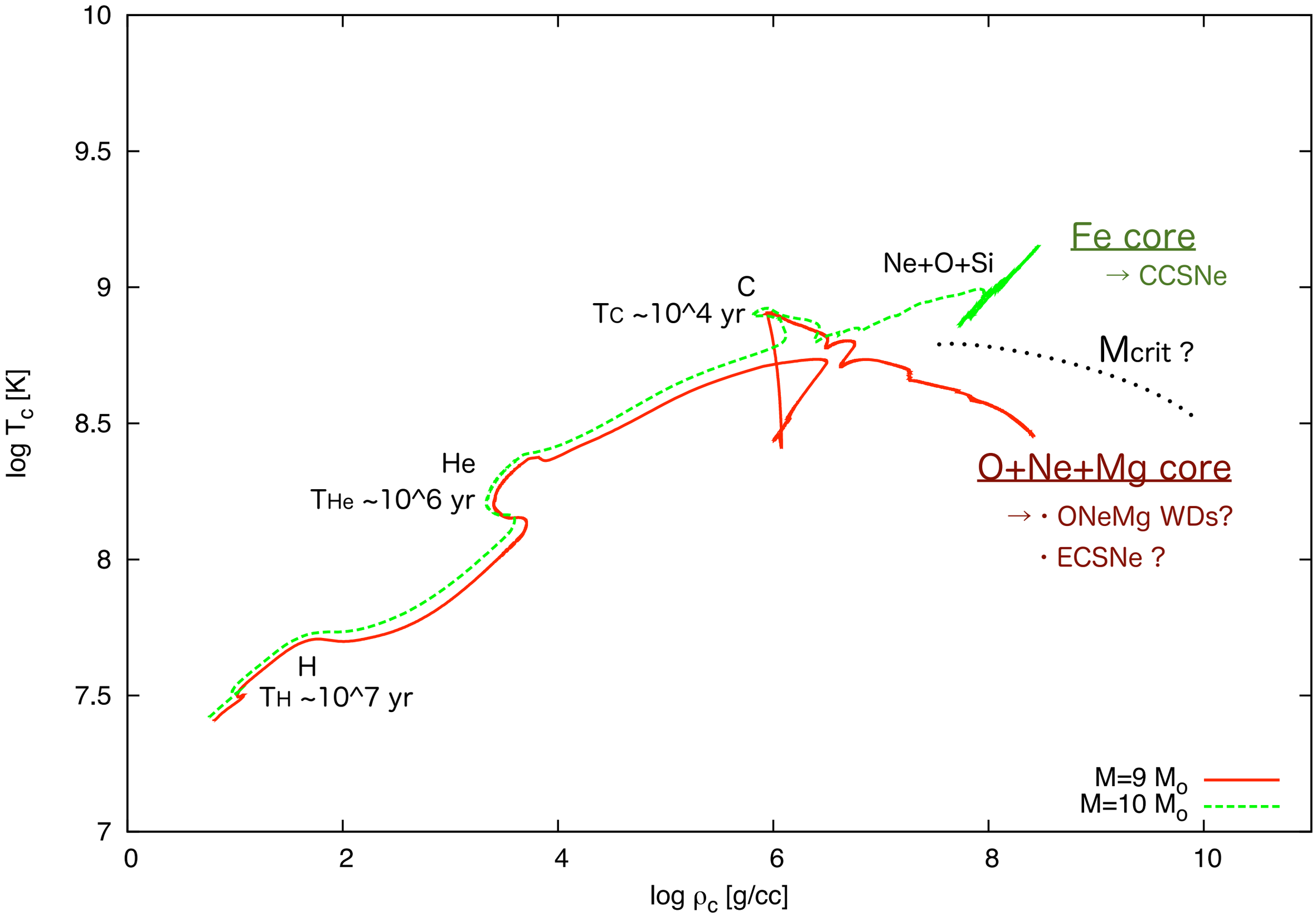
(282 species of nuclei : from ^{1}n,^{1}H to ^{79}Br)

and with fine initial mass grid

(ΔM = 0.01Mo)

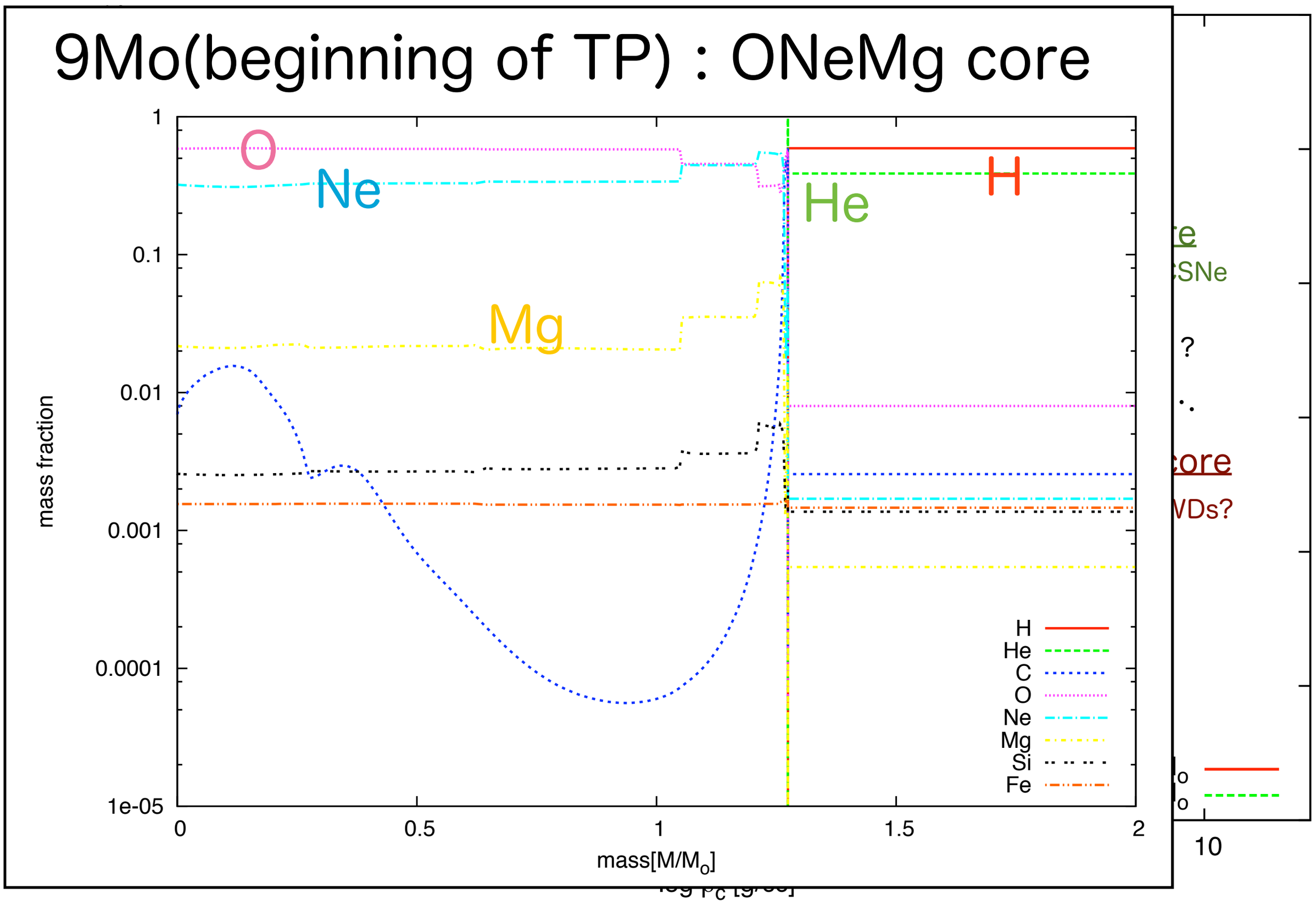
- Poelarends et al. (2008)
- Nomoto & Hashimoto (1988)

center T-rho diagram

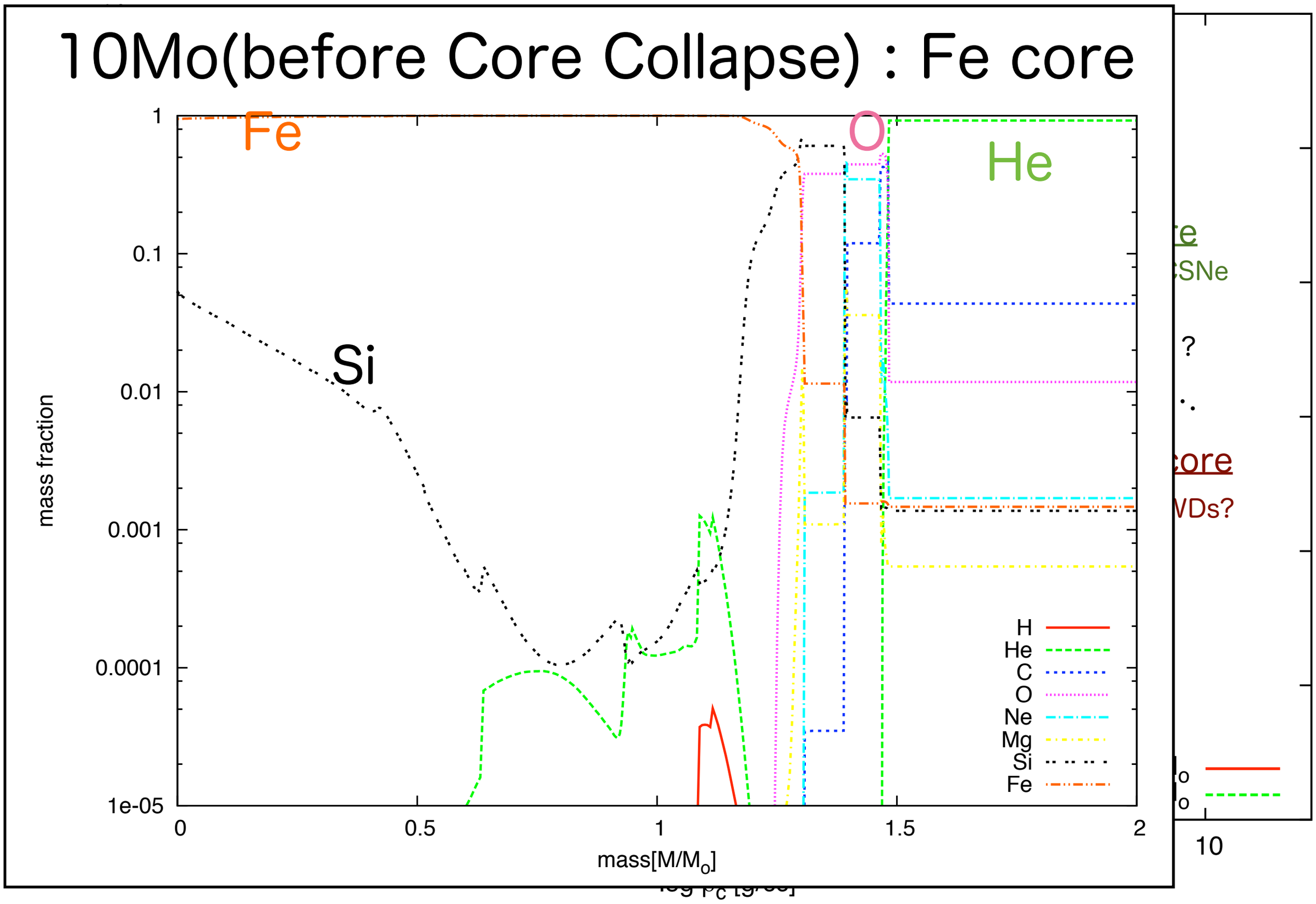


center T-rho diagram

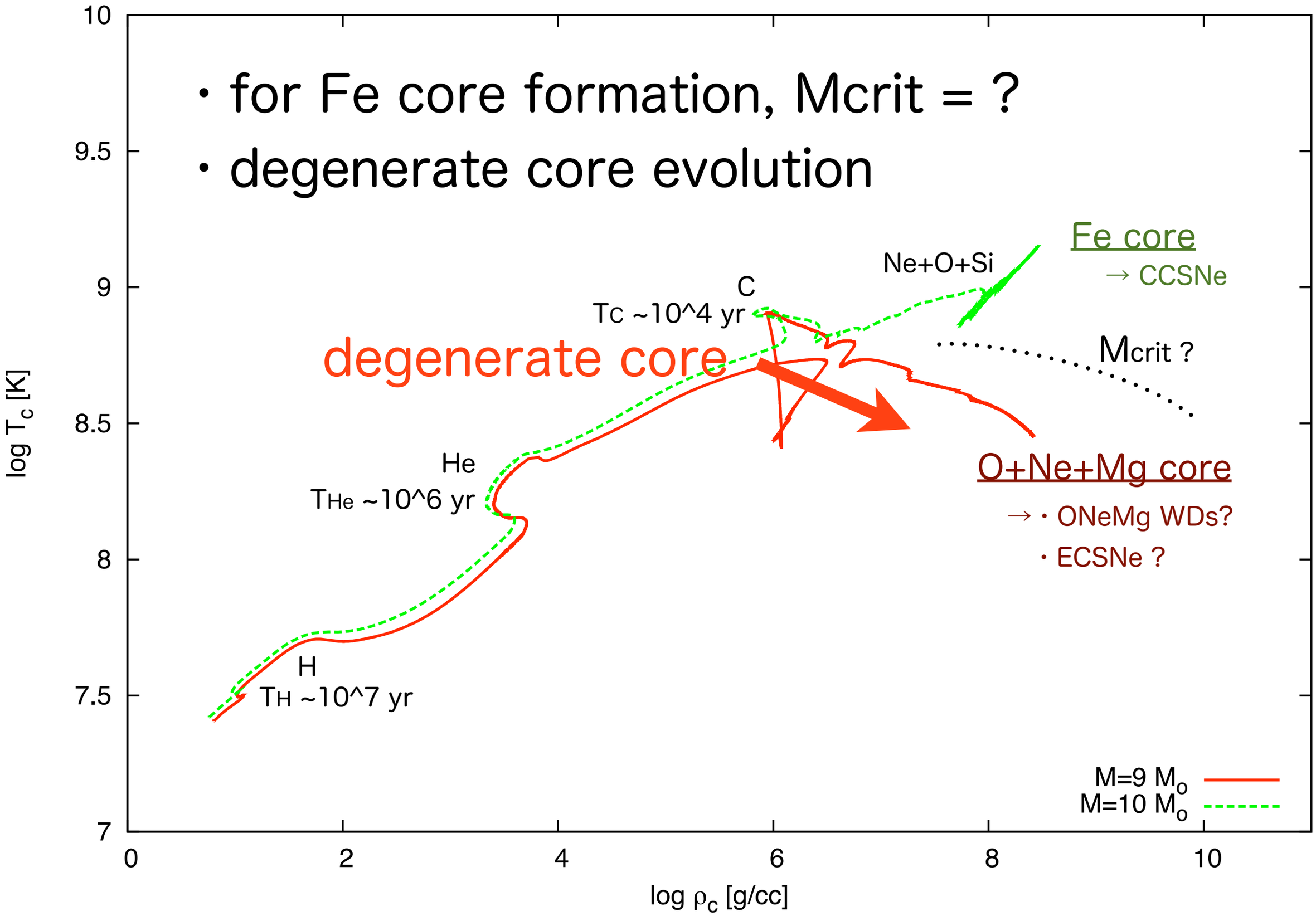
9Mo(beginning of TP) : ONeMg core



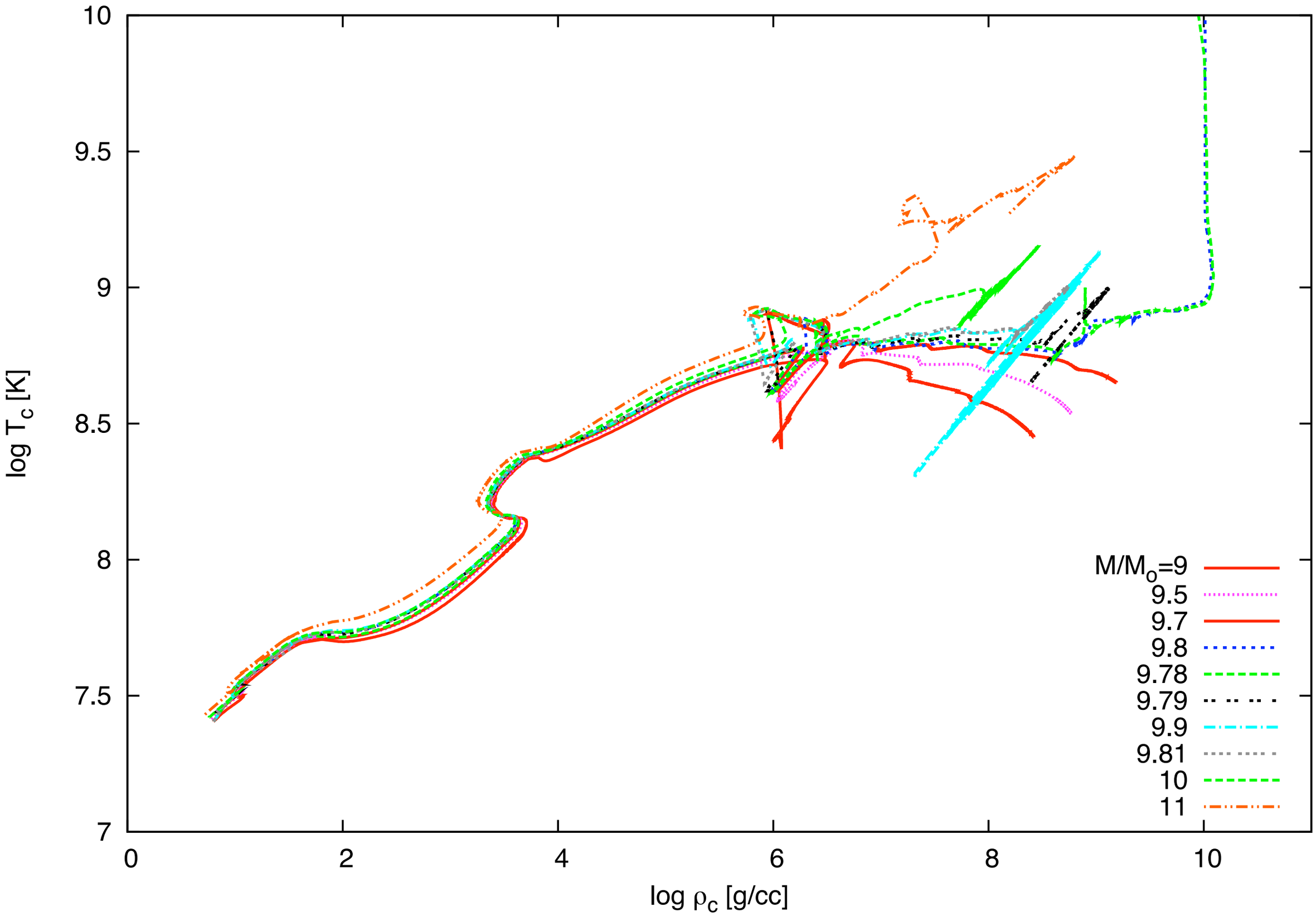
center T-rho diagram



center T-rho diagram



Results


10
9.5
9
8.5
8
7.5
7
0
2
4
6
8
10
log T_c [K]
log ρ_c [g/cc]
M/M_o=9
9.5
9.7
9.8
9.78
9.79
9.9
9.81
10
11

Results

・1.71 etc. : CO core mass [Mo]

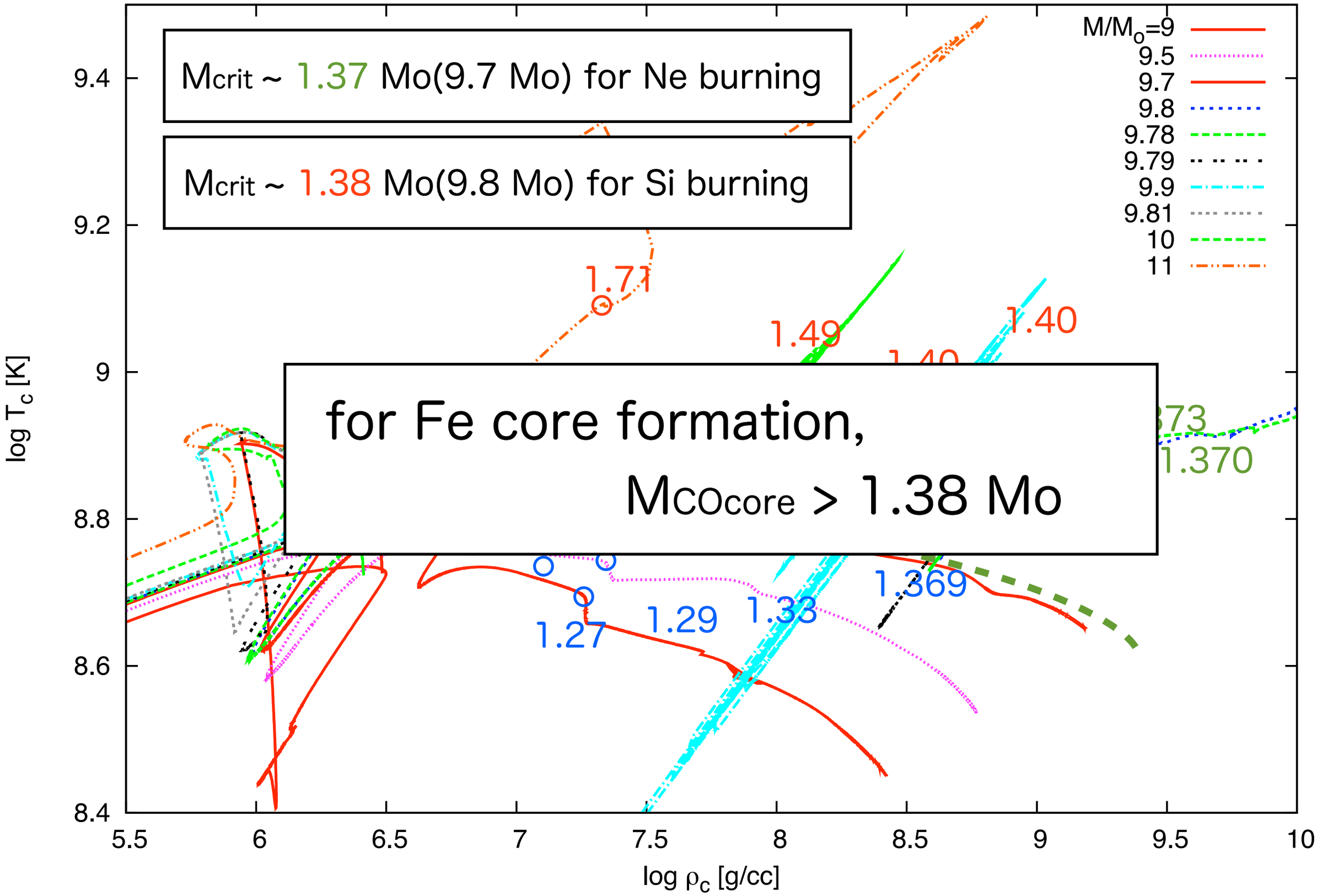
・ ○ : measure point (at the end of C burning)

Mcrit ~ 1.37 Mo(9.7 Mo) for Ne burning

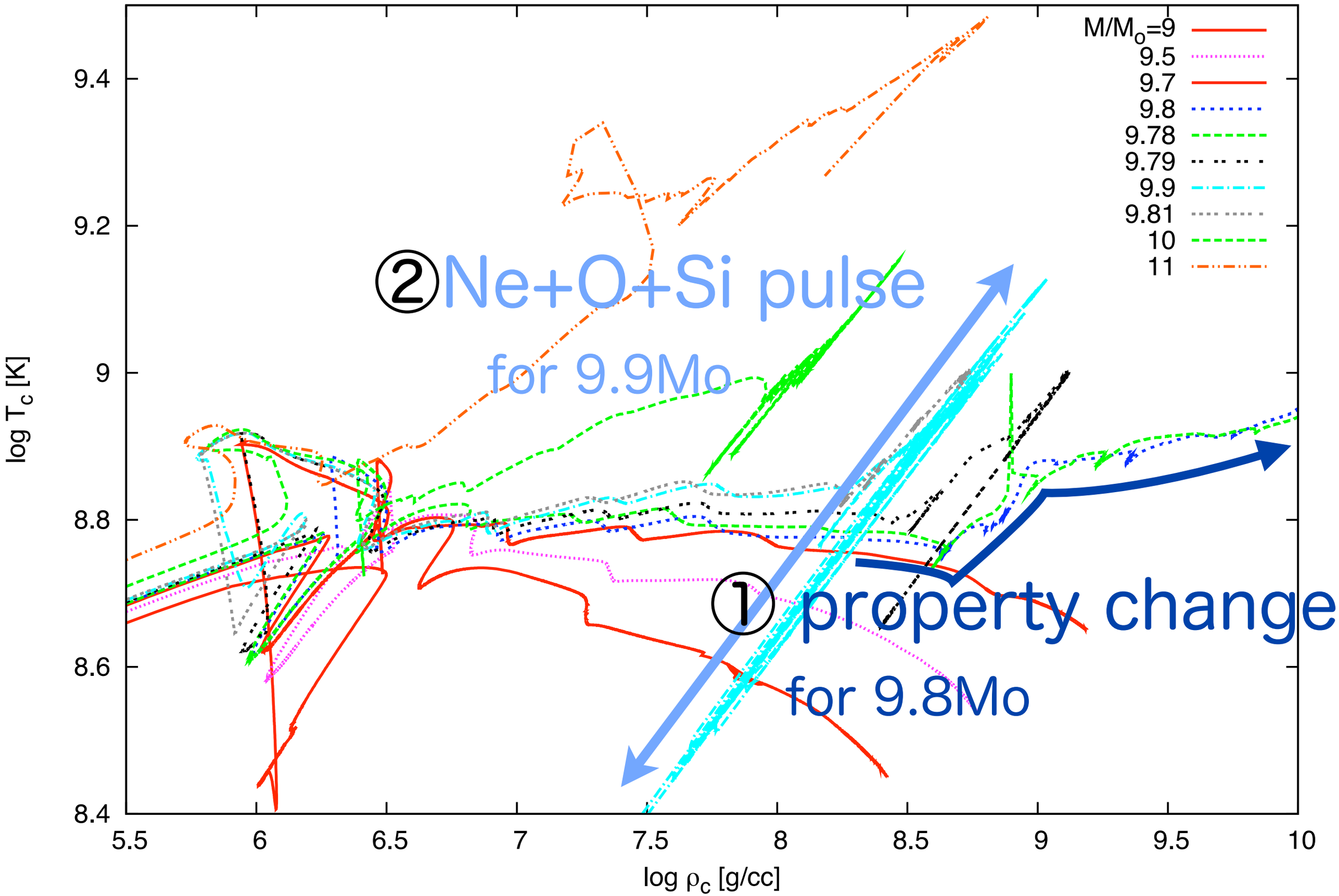
Mcrit ~ 1.38 Mo(9.8 Mo) for Si burning

for Fe core formation,

M_{COcore} > 1.38 Mo

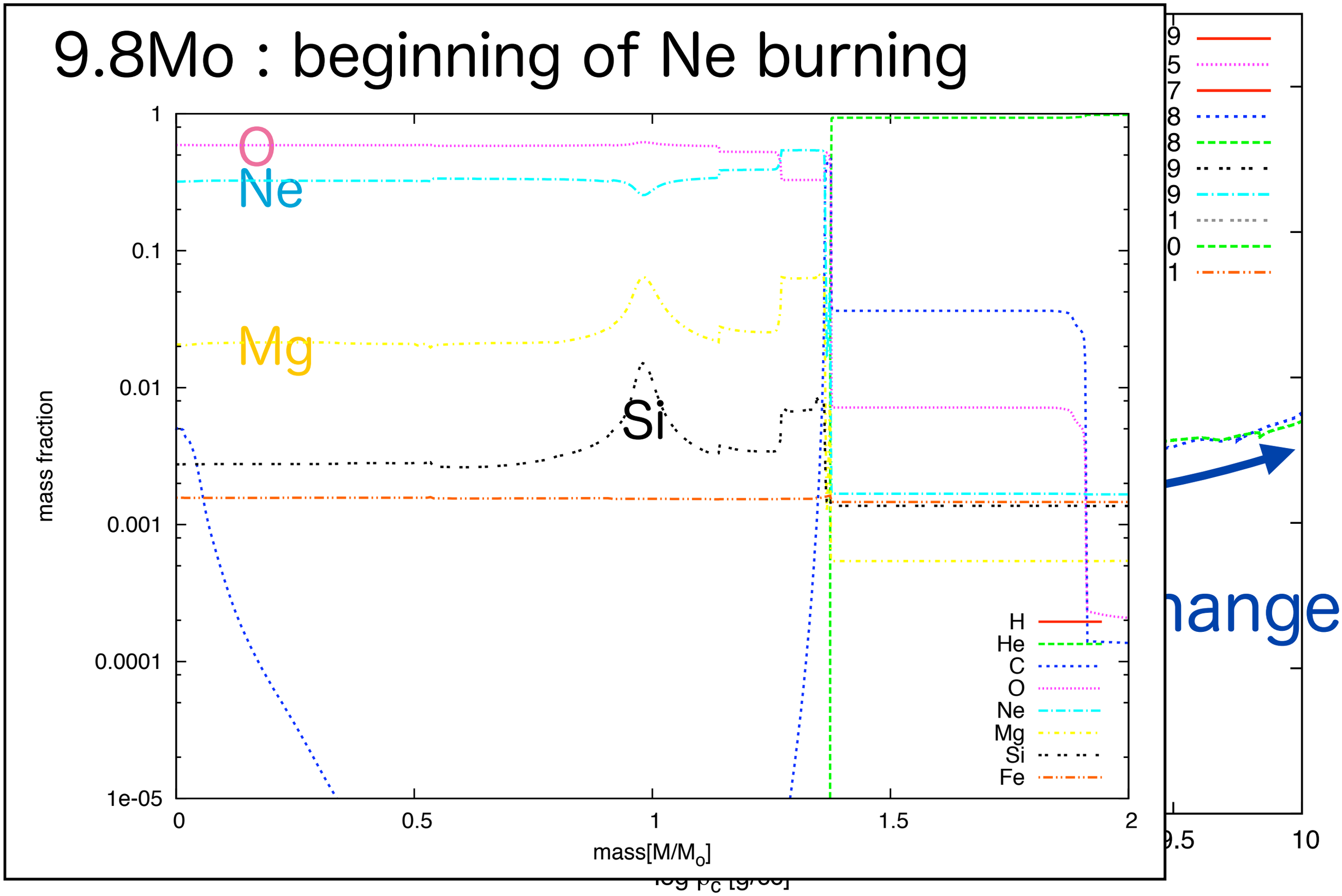


some features

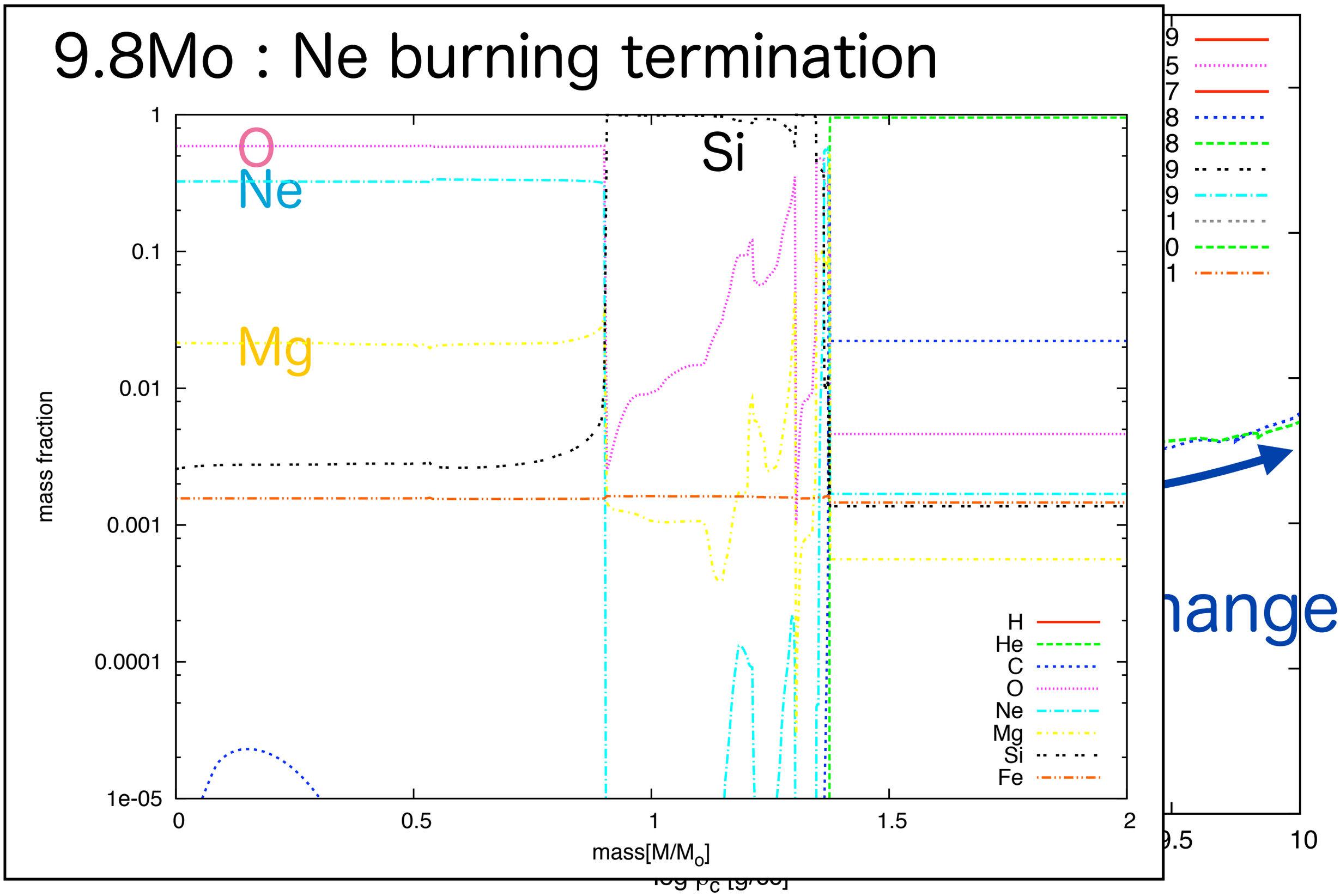


some features

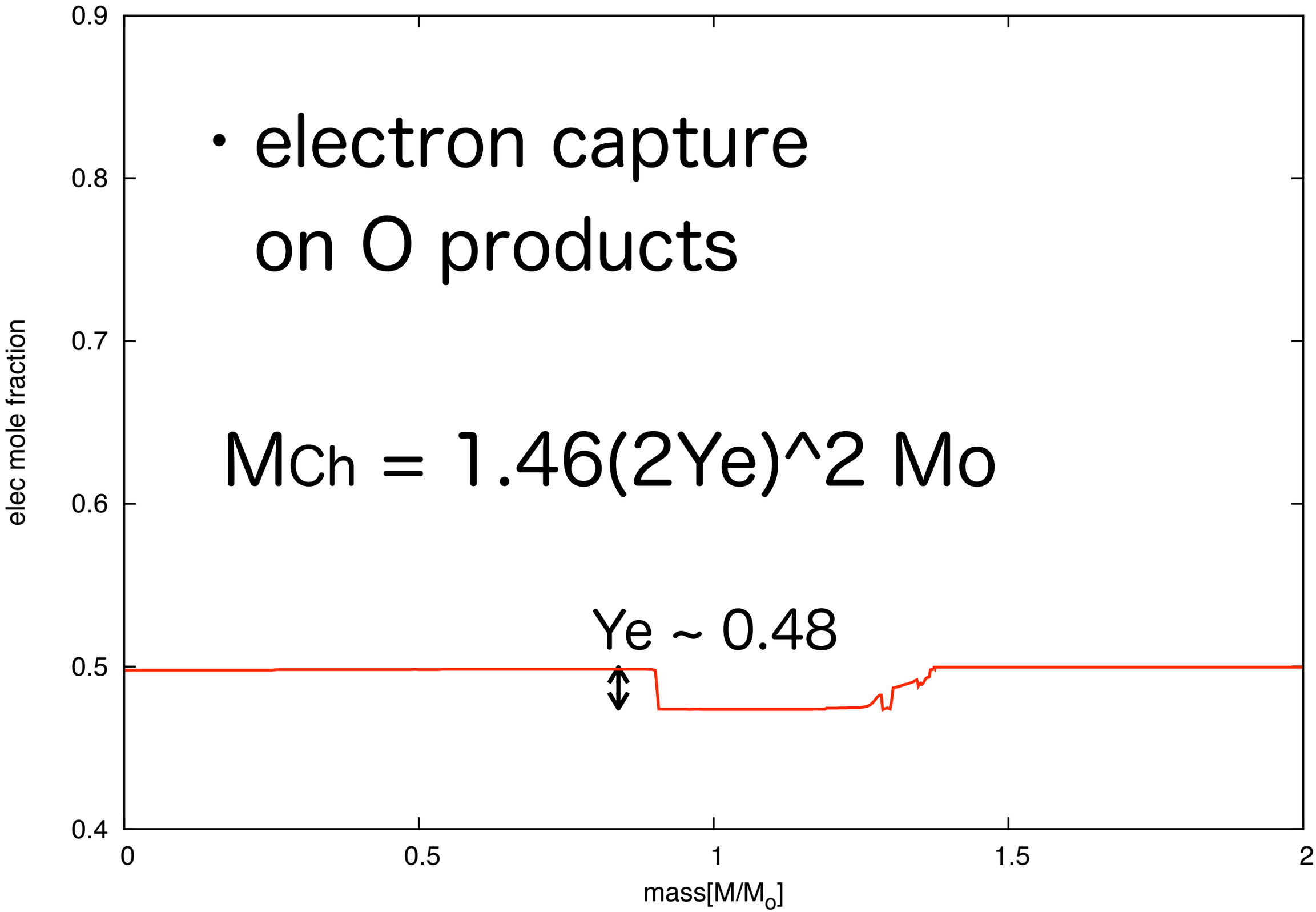
9.8Mo : beginning of Ne burning



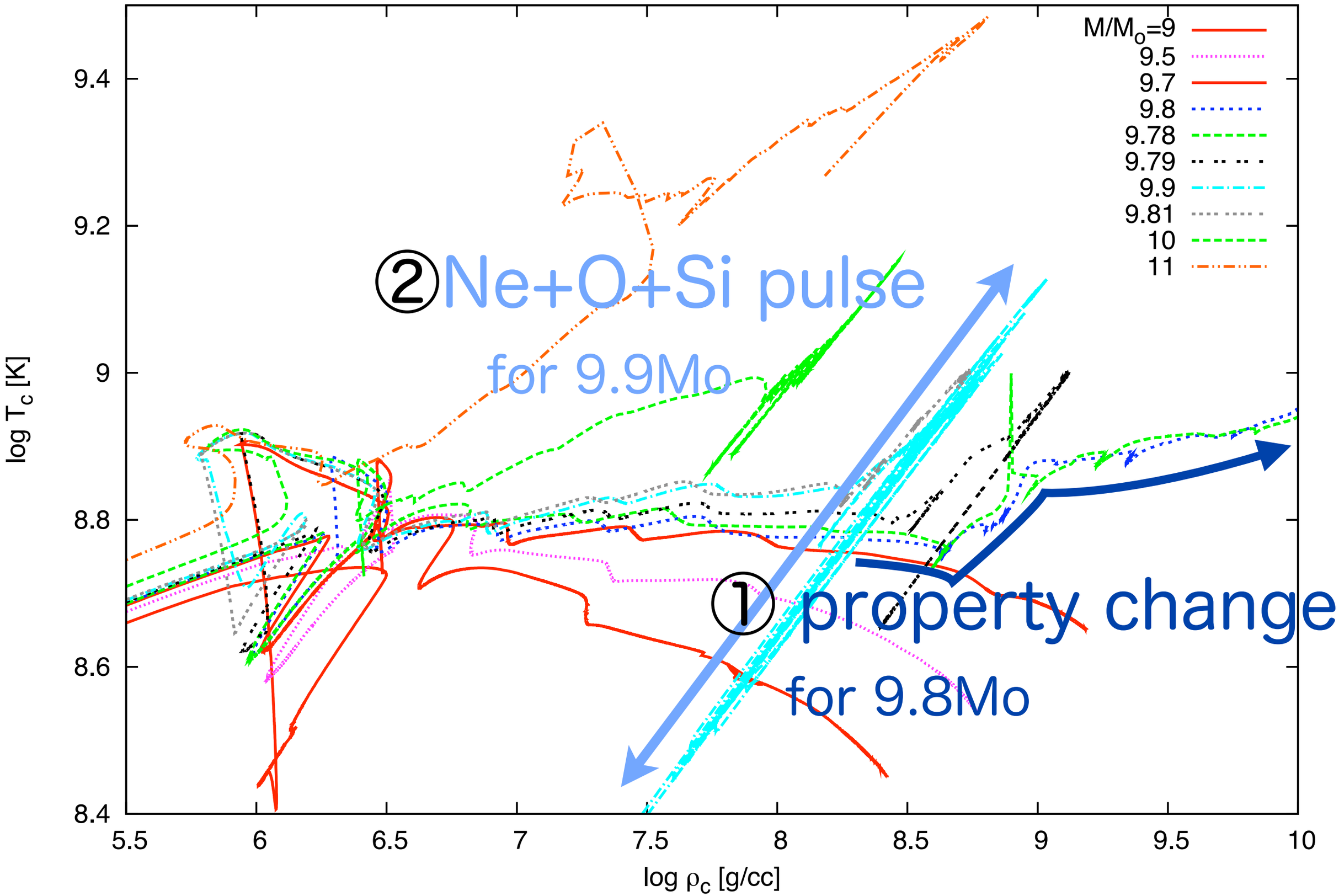
some features



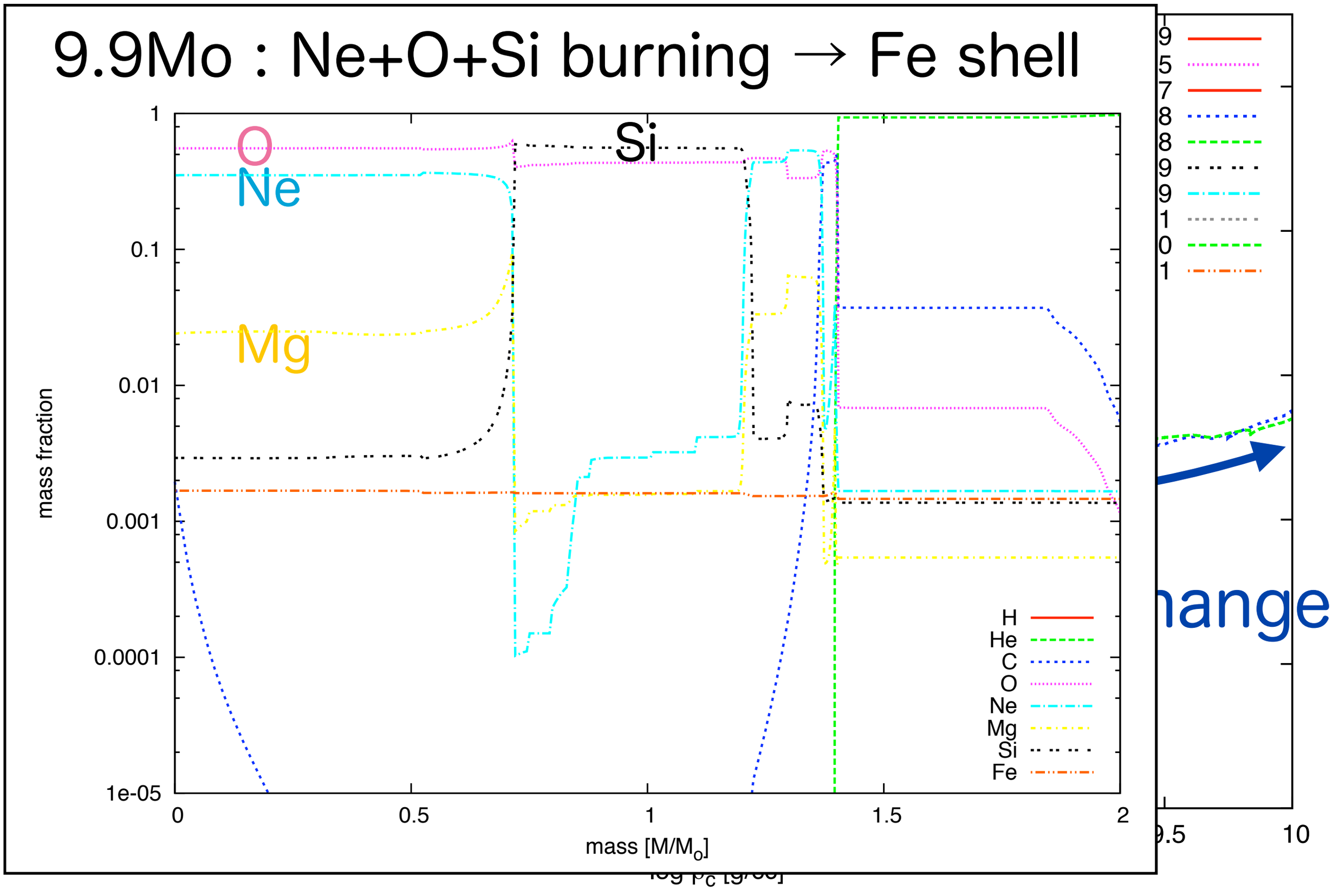
① electron capture for 9.8Mo



some features

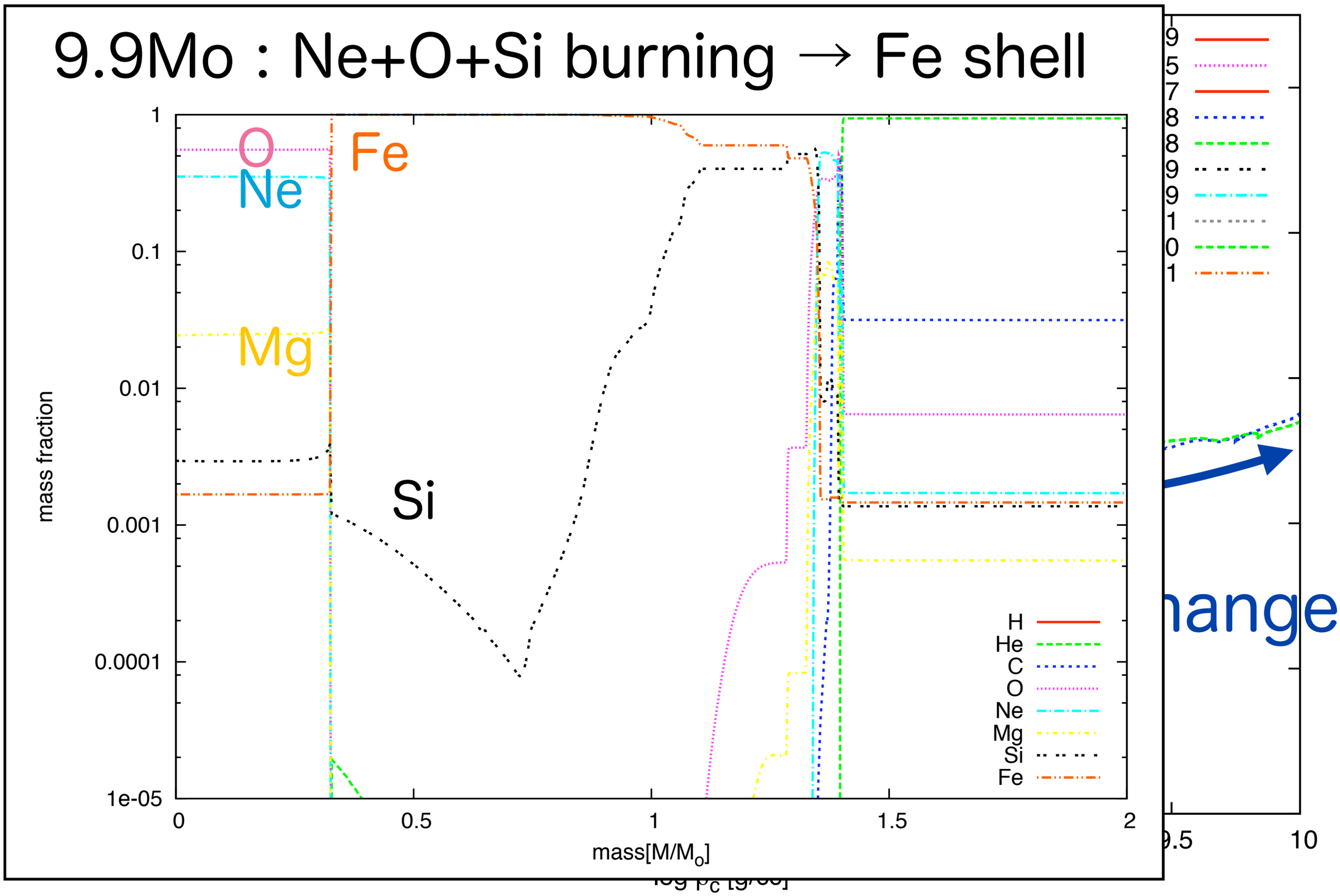


some features

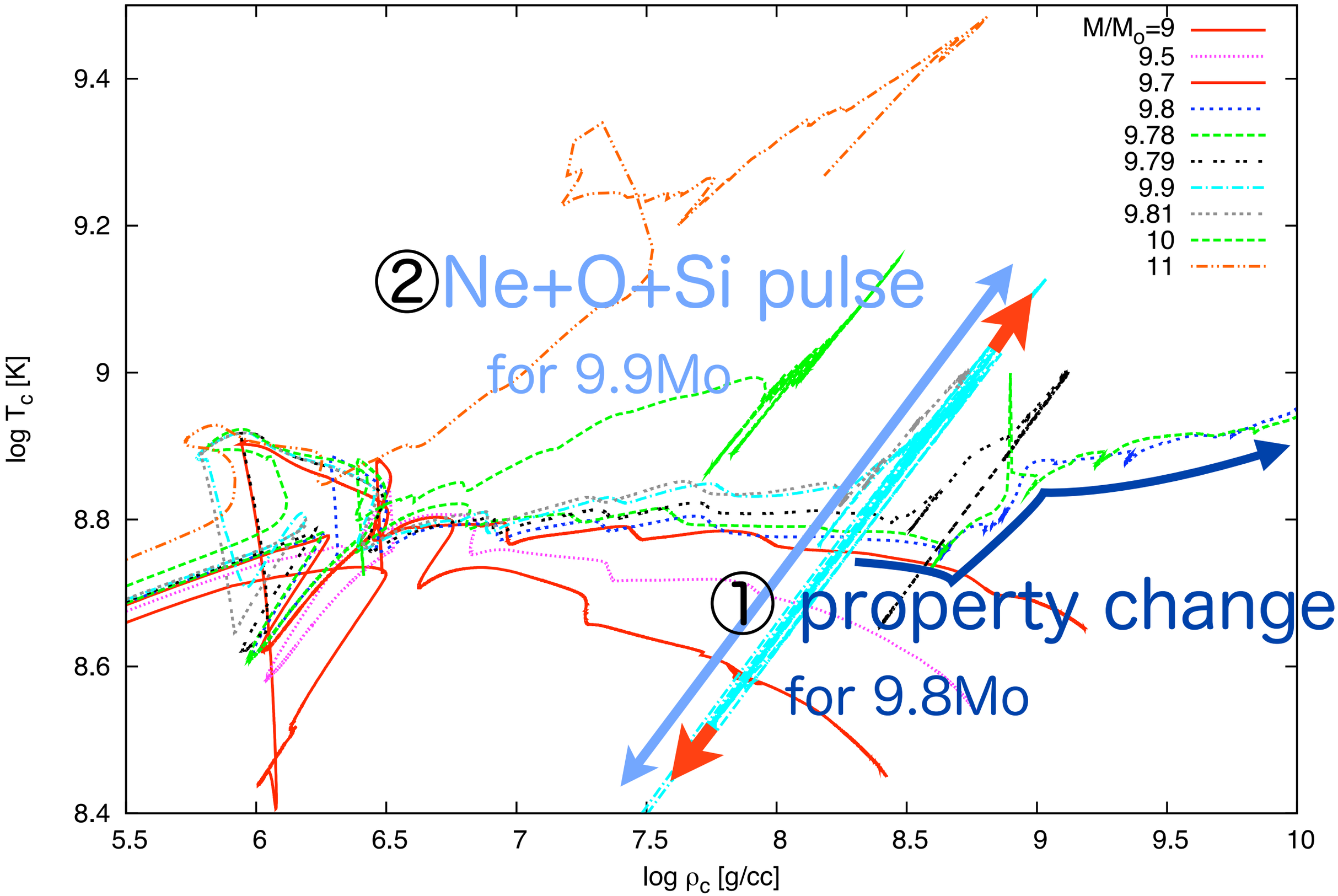


some features

9.9Mo : Ne+O+Si burning → Fe shell



some features



Summary

- We have calculated the evolution for 9-11Mo stars with large nuclear reaction network.

- In an electron degenerate core, effects of neutrino cooling and elec. capture are important.
- The critical mass for Ne ignition is 1.37Mo for CO core, 9.7Mo for ZAMS.
- The critical mass for Si ignition is 1.38Mo for CO core, 9.8Mo for ZAMS.

ご清聴ありがとうございました