l'Observatoire de Paris GEPI
Galaxies Étoiles Physique et Instrumentation

TASK 3

PRESENTATION and FIRST COMPARISONS

TASK3

CASES PROPOSED DURING COROT CW10, NICE, JUNE 2006

GOAL : Test the implementation of diffusion in evolution codes

3x3 fully identified stellar cases (targets)

- in stellar masses, composition, evolutionary stage
- physics specified/ numerics to be investigated

TASK3 CASES

CASE	$M/M_{\odot}$	Y_0	Z_0
3.1	1.0	0.27	0.017
3.2	1.2	0.27	0.017
3.3	1.3	0.27	0.017

PHASE	X_C	$M_{He\ CORE}$
A	0.35	-
B	0.01	-
C	0.00	0.05 M_{star}

TASK3 CASES : PHYSICS

SAME AS IN TASK 1, EXCEPT FOR DIFFUSION PROCESSES

Equation of state: OPAL tables (Rogers et al. 96, 01)

Opacities: Tables : OPAL (Iglesias & Rogers 96) + AF low temperatures (Alexander & Ferguson, 94)

Nuclear reaction rates: NACRE analytical formulae (Angulo et al. 99)

Convection: MLT (Böhm-Vitense 58, Henyey 65) with α_{MLT}=1.6 and No overshoot

Mixture: solar mixture of Grevesse & Noels (93)

Atmosphere: Eddington's grey atmosphere

MICROSCOPIC DIFFUSION of chemicals ⇨ H, He, Z

due to pressure, temperature, concentration gradients

no radiative forces

TASK3 : MODELS

Models from 5 stellar evolution codes have been calculated

ASTEC: J. Christensen-Dalsgaard (Denmark)

CESAM: Y. Lebreton, P. Morel (France)

CLES: J. Montalban, R. Scuflaire, S. Théado, A. Thoul (Belgium)

FRANEC: M. Marconi, S. Degl'Innocenti (Italy)

TGEC: A. Hui Bon Hoa (Toulouse)

TASK3 : MODELS

ASTEC: He diffusion, He-heavy elements diffusion

Michaud & Proffitt's (1993)

CESAM: helium and heavy elements diffusion

Michaud & Proffitt's (1993) or Burgers' formalism (1969)

Paquette et al collision integrals

CLES: helium diffusion or helium and heavy elements diffusion

Thoul et al's (1994)

FRANEC: helium and heavy elements diffusion

Thoul et al's (1994)

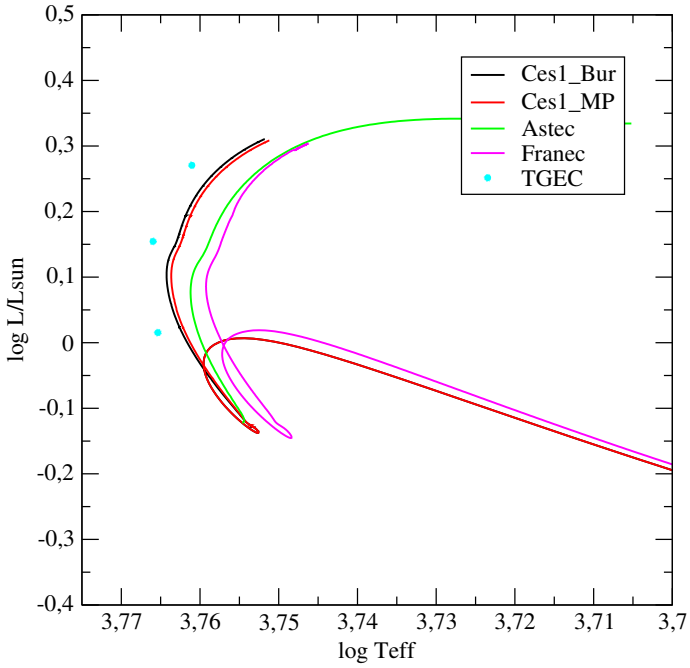
TGEC: helium and heavy elements diffusion

Chapman & Cowling, Paquette et al collision integrals

TASK3 :

CASE 3.1 : MS

1.0 $M_\odot$

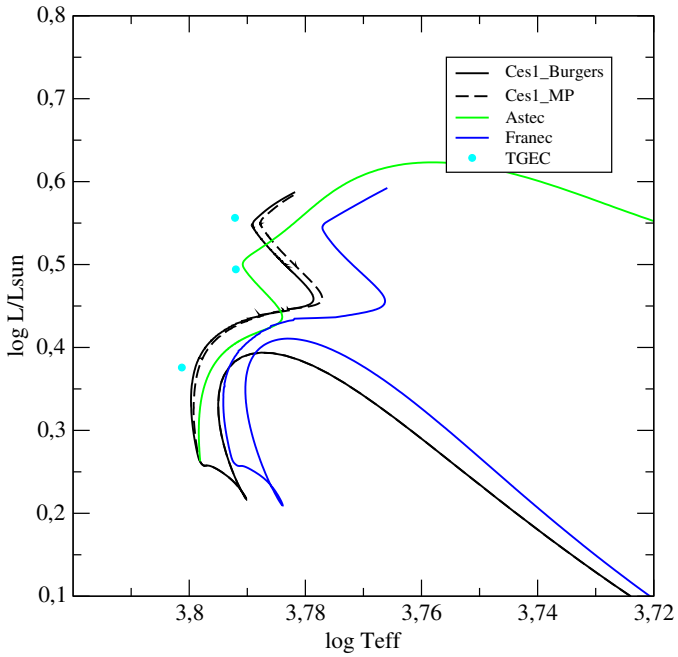


November 2006 Jo

TASK3 : HR DIAGRAM COMPARISON

CASE 3.2 : MS

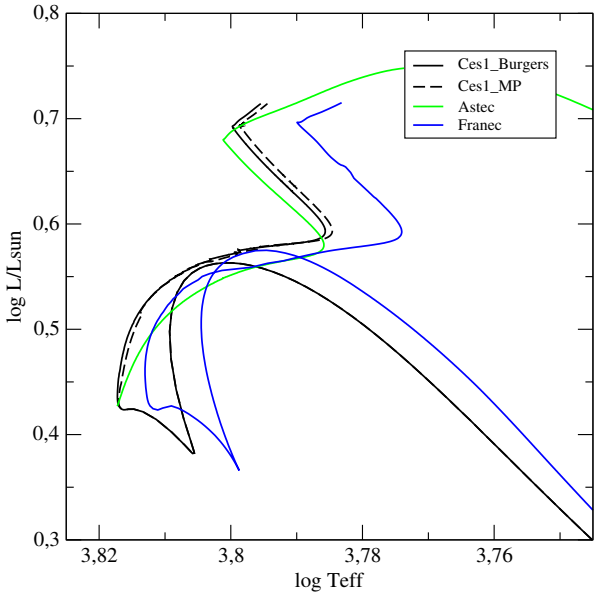
1.2 $M_\odot$



TASK3 : HR DIAGRAM COMPARISON

CASE 3.3 : MS

1.3 $M_\odot$



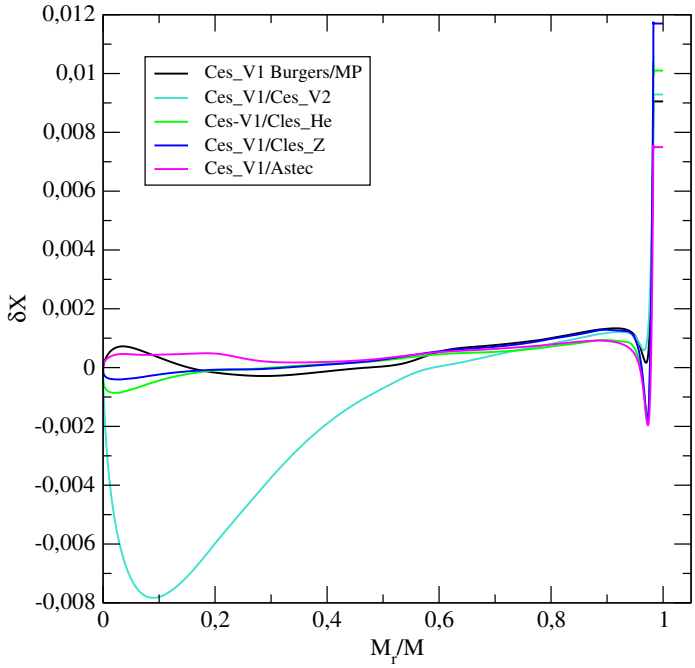
HYDROGEN PROFILE

CASE 3.1 : MS

1.0 $M_\odot$

X_c=0.35 ; Z=0.017

C3.1A



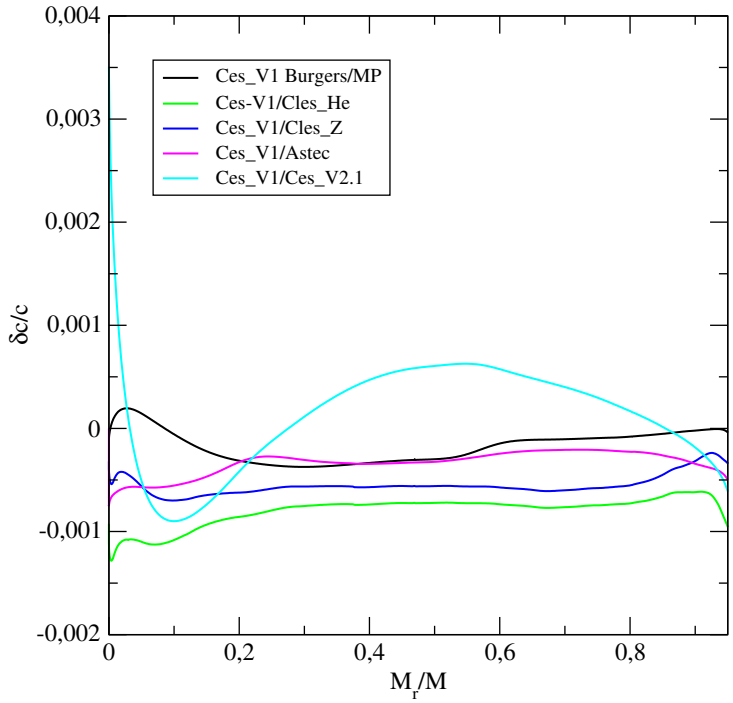
SOUND SPEED PROFILE

C3.1A

CASE 3.1 : MS

1.0 $M_\odot$

X_c=0.35 ; Z=0.017



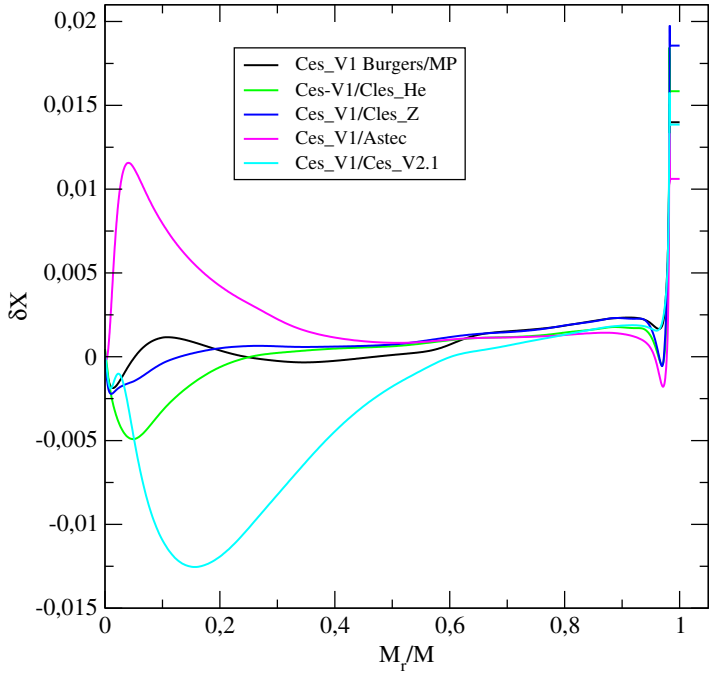
HYDROGEN PROFILE

C3.1B

CASE 3.1 : END MS

1.0 $M_\odot$

X_c=0.01 ; Z=0.017



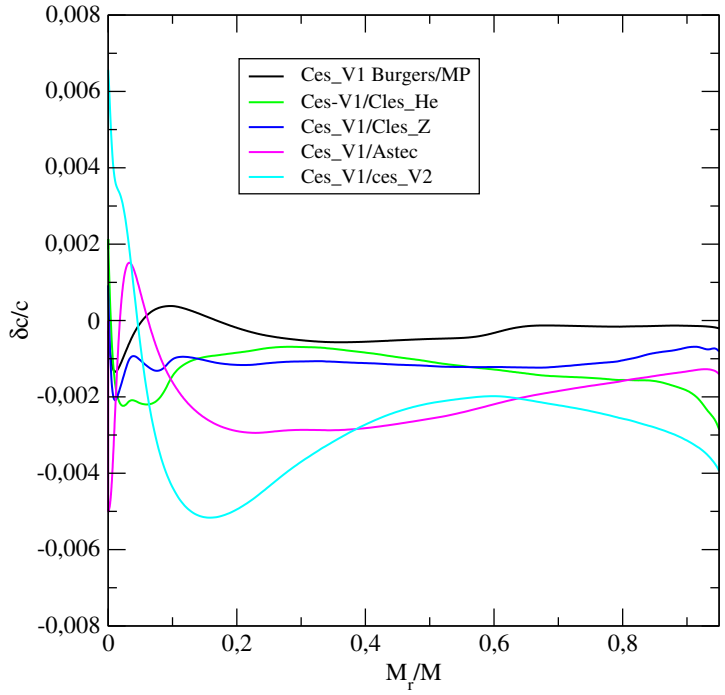
SOUND SPEED PROFILE

CASE 3.1 : END MS

1.0 $M_\odot$

X_c=0.01 ; Z=0.017

C3.1B



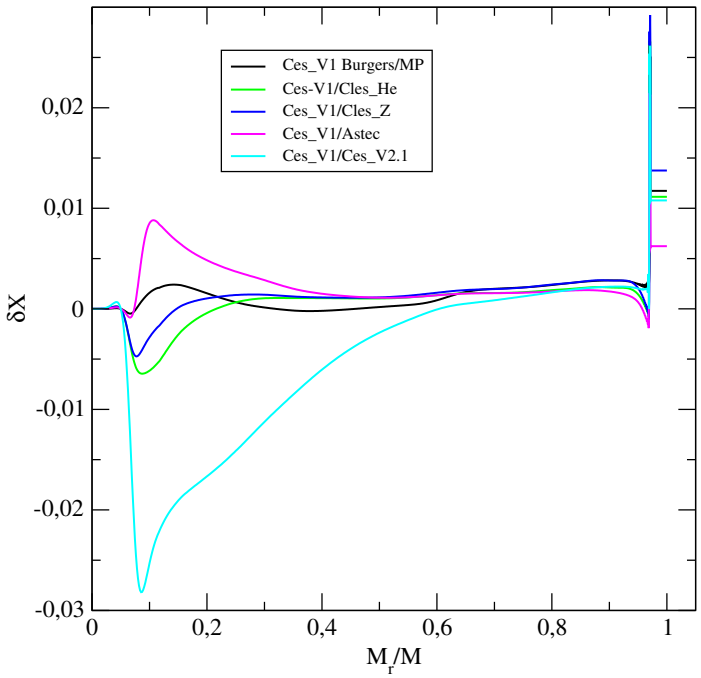
HYDROGEN PROFILE

CASE 3.1 : SUBGIANT

1.0 $M_\odot$

$M_{He\ CORE}$=0.05 M_{star}; Z=0.017

C3.1C



SOUND SPEED PROFILE

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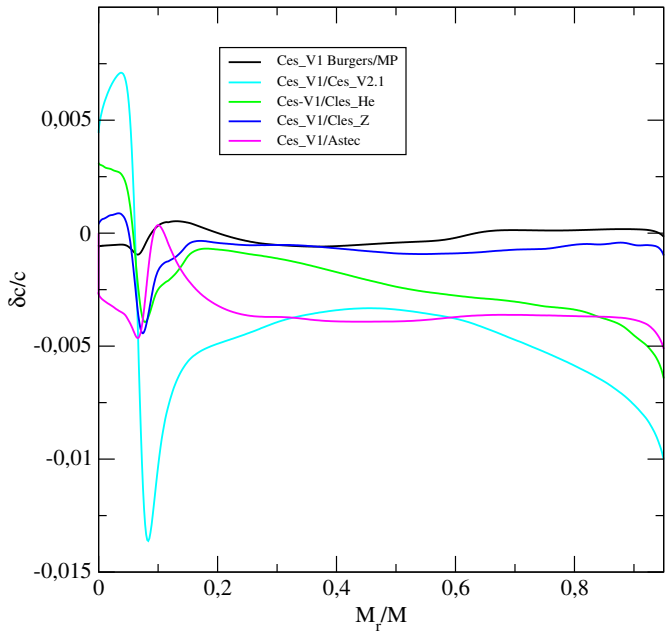
C3.1C



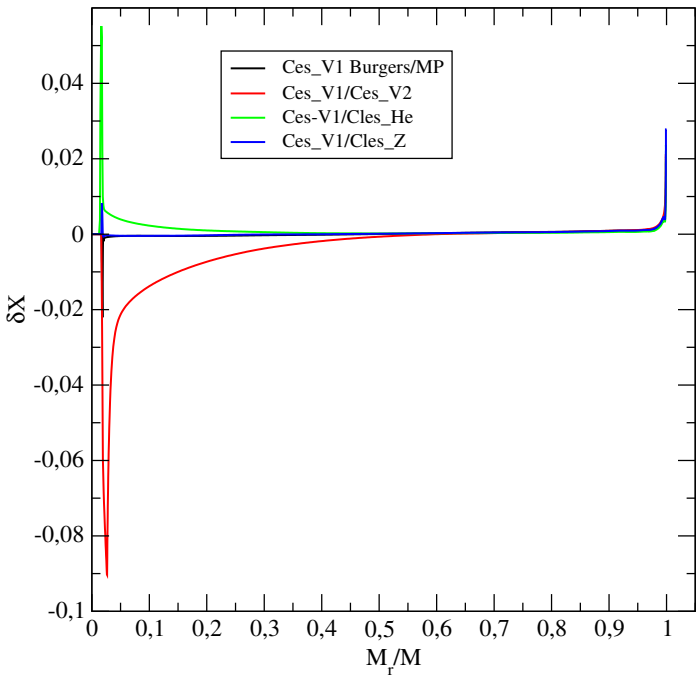
HYDROGEN PROFILE

CASE 3.2 : MS

1.2 $M_\odot$

X_c=0.35 ; Z=0.017

C3.2A



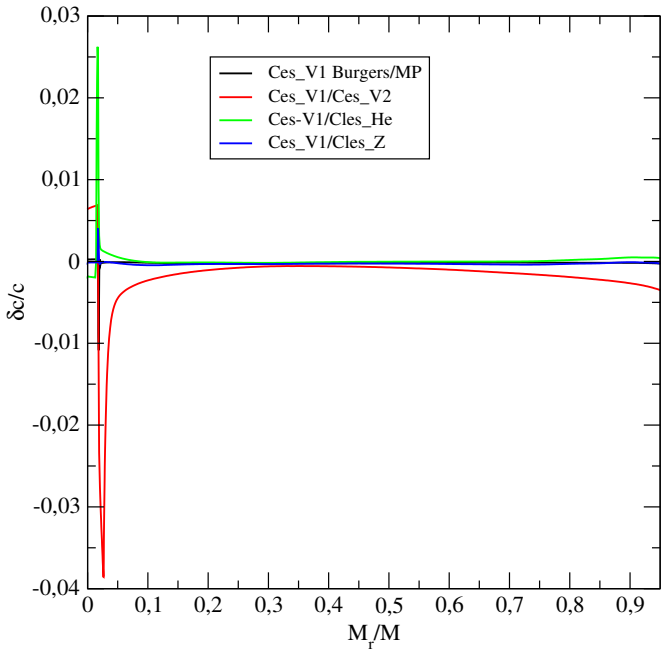
SOUND SPEED PROFILE

CASE 3.2 : MS

1.2 $M_\odot$

X_c=0.35 ; Z=0.017

C3.2A



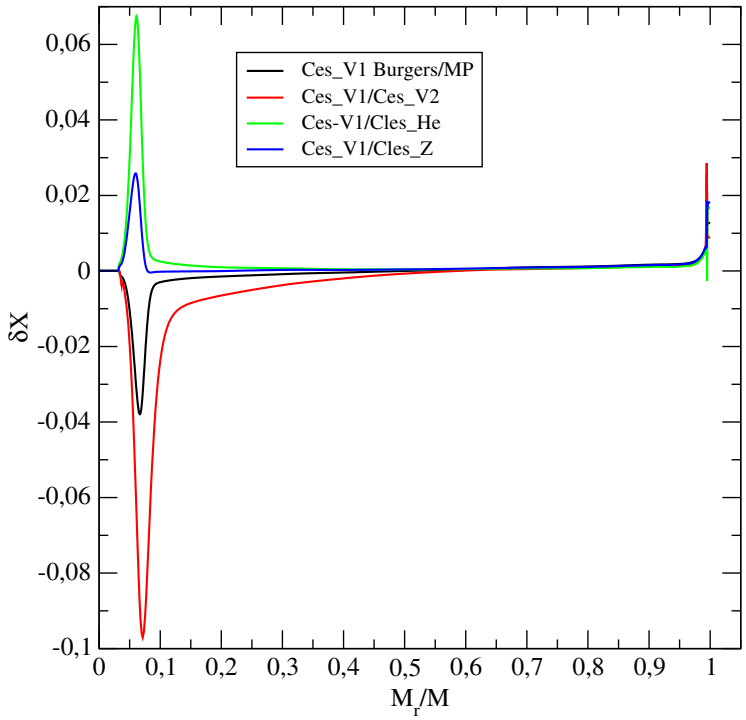
HYDROGEN PROFILE

CASE 3.2 : END MS

1.2 $M_\odot$

X_c=0.01 ; Z=0.017

C3.2B



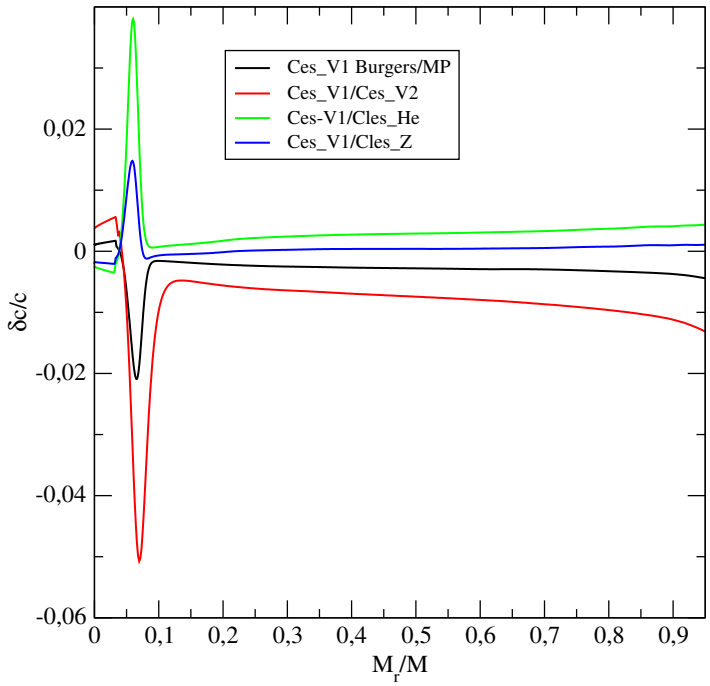
SOUND SPEED PROFILE

CASE 3.2 : END MS

1.2 $M_\odot$

X_c=0.01 ; Z=0.017

C3.2B



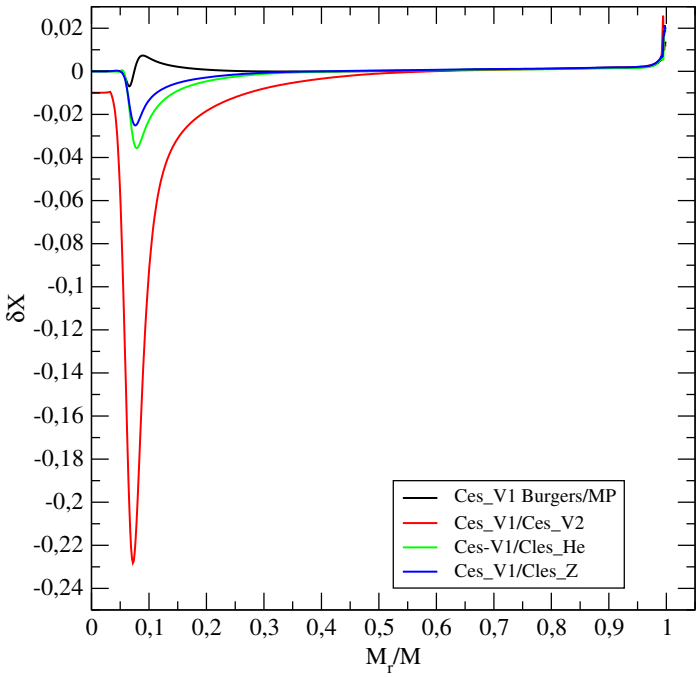
HYDROGEN PROFILE

CASE 3.2 : SUBGIANT

1.2 $M_\odot$

$M_{He\ CORE}$=0.05 M_{star}; Z=0.017

C3.2C



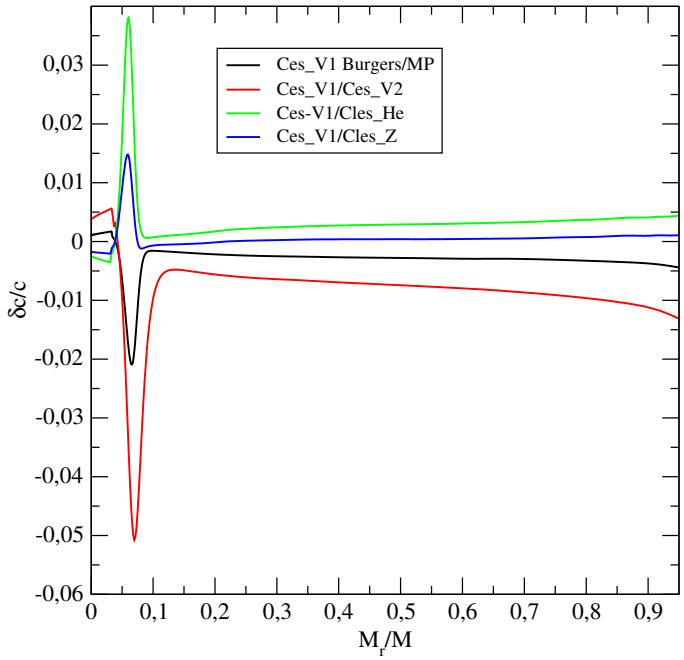
SOUND SPEED PROFILE

CASE 3.2 : SUBGIANT

1.2 $M_\odot$

$M_{He\ CORE}$=0.05 M_{star}; Z=0.01

C3.2C



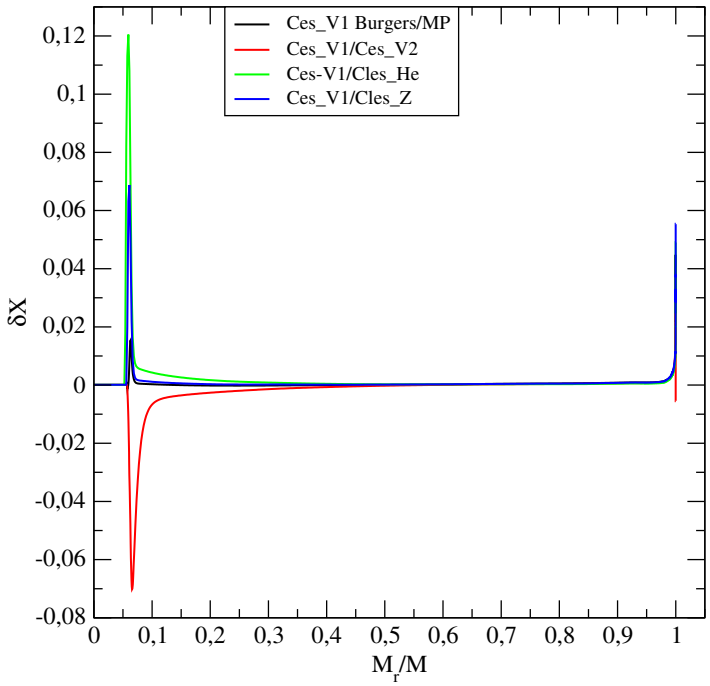
HYDROGEN PROFILE

CASE 3.3 : MS

1.3 $M_\odot$

X_c=0.35 ; Z=0.017

C3.3A



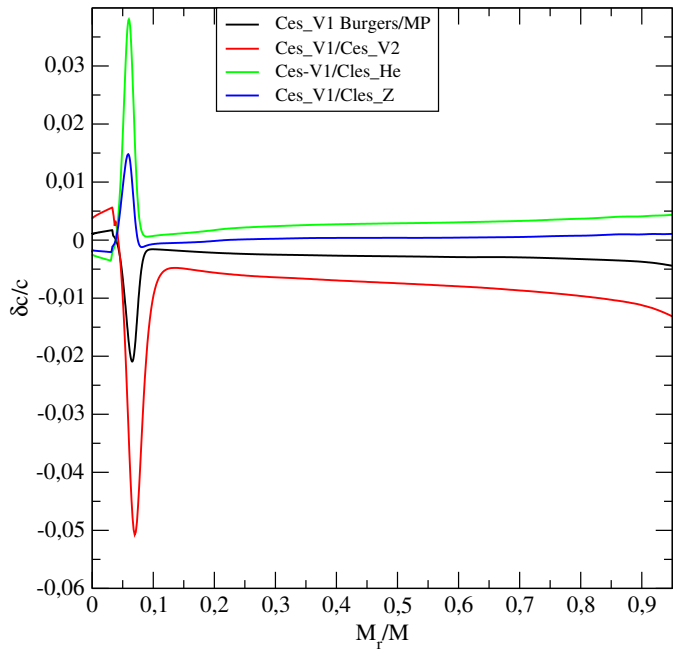
SOUND SPEED PROFILE

CASE 3.3 : MS

1.3 $M_\odot$

X_c=0.35 ; Z=0.017

C3.3A



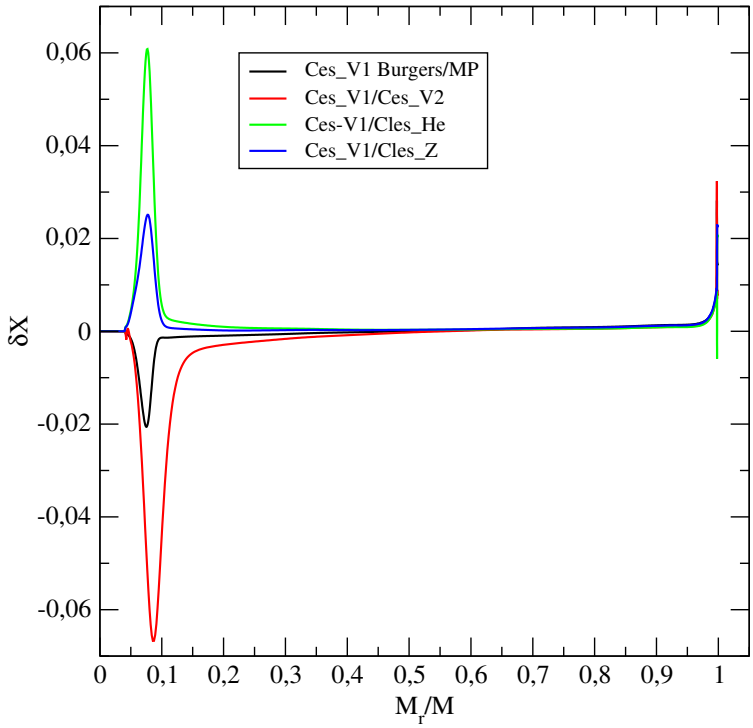
HYDROGEN PROFILE

CASE 3.3 : END MS

1.3 $M_\odot$

X_c=0.01 ; Z=0.017

C3.3B



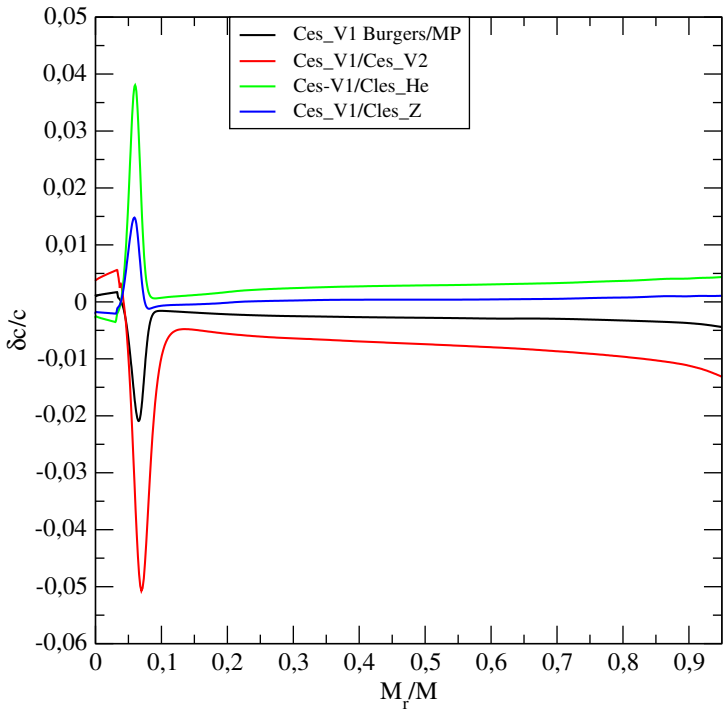
SOUND SPEED PROFILE

CASE 3.3 : END MS

1.3 $M_\odot$

X_c=0.01 ; Z=0.017

C3.3B



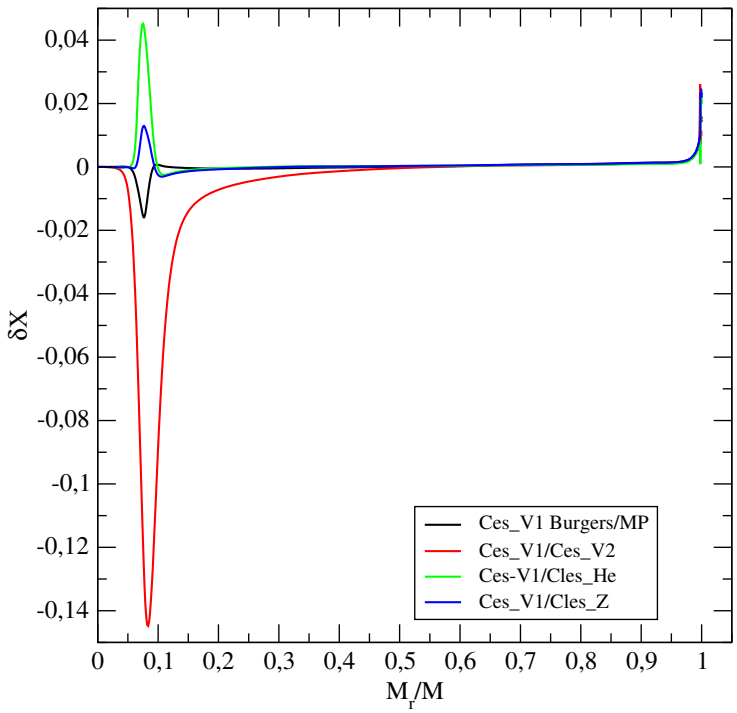
HYDROGEN PROFILE

CASE 3.3 : SUBGIANT

1.3 $M_\odot$

$M_{He\ CORE}$=0.05 M_{star}

C3.3C



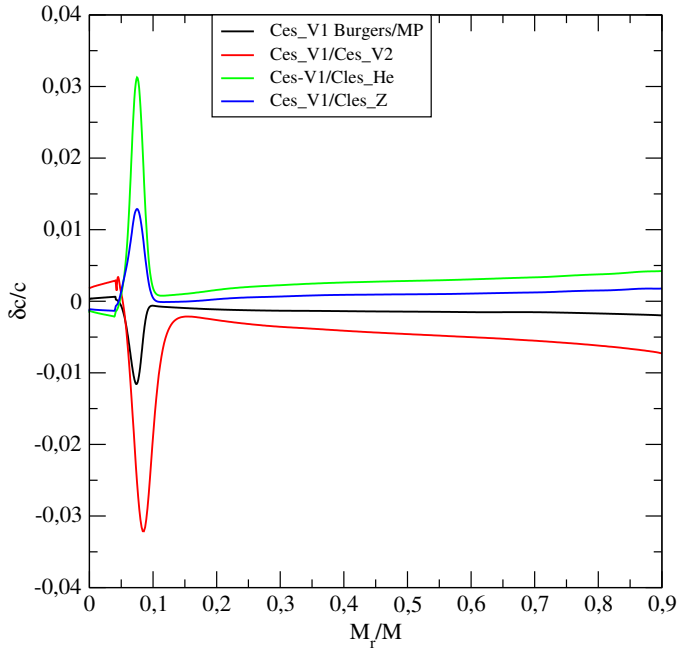
SOUND SPEED PROFILE

C3.3C

CASE 3.3 : SUBGIANT

1.3 $M_{\odot}$

$M_{He\ CORE}$=0.05 M_{star}



TASK3 : WORKING SESSION

POSSIBILITIES :

- **evolution of the helium surface abundance**
- **effects of the time step, mesh**
- **comparisons of the frequencies for the 1 M_{SUN} case**