Model comparison: CESAM – CLES
Effects on oscillation frequencies

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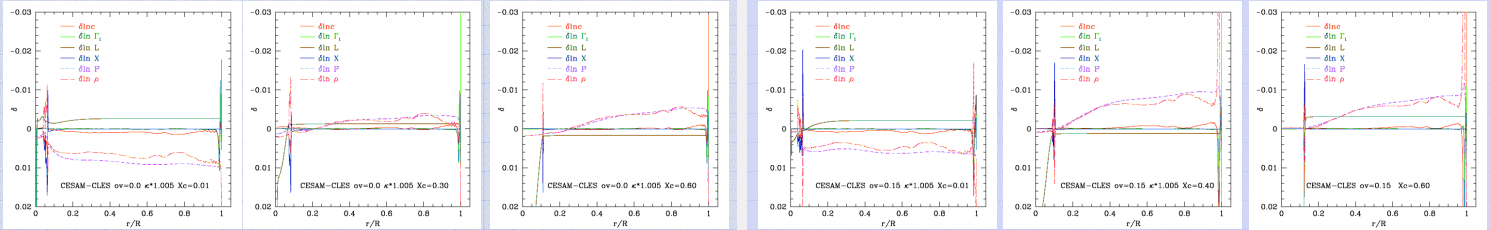[1] Insitut d'Astrophysique et de Géophysique de l'Université de Liège, Belgium

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We present the difference in internal structure between CESAM and CLES task1.5 models for three evolutionary stages (Xc=0.60,0.30, and 0.01). We present the results for two evolutionary tracks: without overshooting (left panels), and with overshooting and adiabatic temperature gradient. Even if the HR location of models is very close (see poster I) the differences on the internal structure are clearly reflected on the difference of frequencies for the p- and g- modes. We also show the effect of the thermodynamic inconsistence in the equation of state (see poster I).
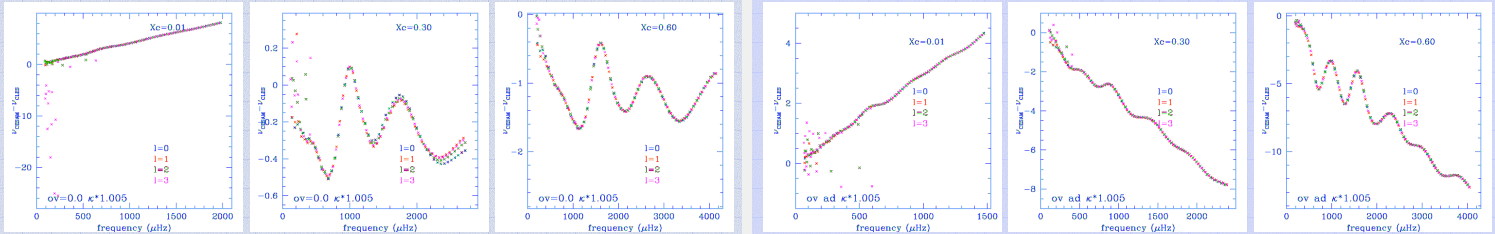
2 $M_\odot$ model without overshooting

2 $M_\odot$ model with overshooting ov=0.15Hp

Differences at fixed mass as a function of radius

CESAM−CLES ov=0.0 κ*1.005 Xc=0.01
CESAM−CLES ov=0.0 κ*1.005 Xc=0.30
CESAM−CLES ov=0.0 κ*1.005 Xc=0.60
CESAM−CLES ov=0.15 κ*1.005 Xc=0.01
CESAM−CLES ov=0.15 κ*1.005 Xc=0.40
CESAM−CLES ov=0.15 κ*1.005 Xc=0.60

Oscillation frequency differences in p-modes domain

Brunt-Väisälä frequency at the stellar centre

Adiabatic overshooting
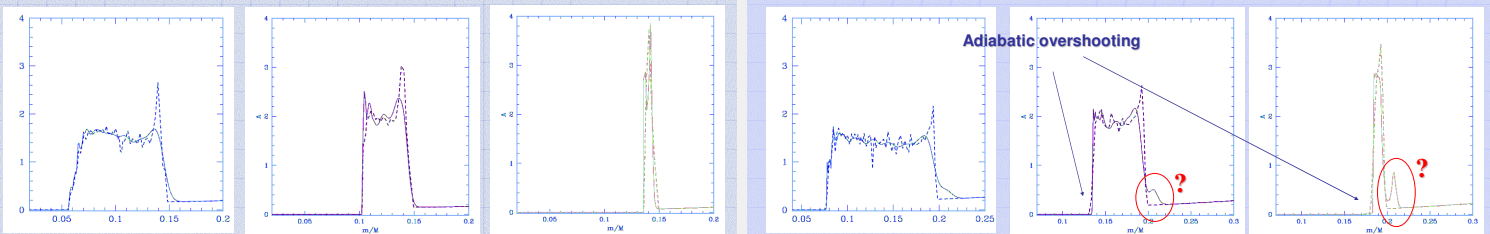
Continuous lines correspond to CESAM models, and dashed lines to CLES models

How the differences in the boundary of the convective core affect the g-mode frequencies
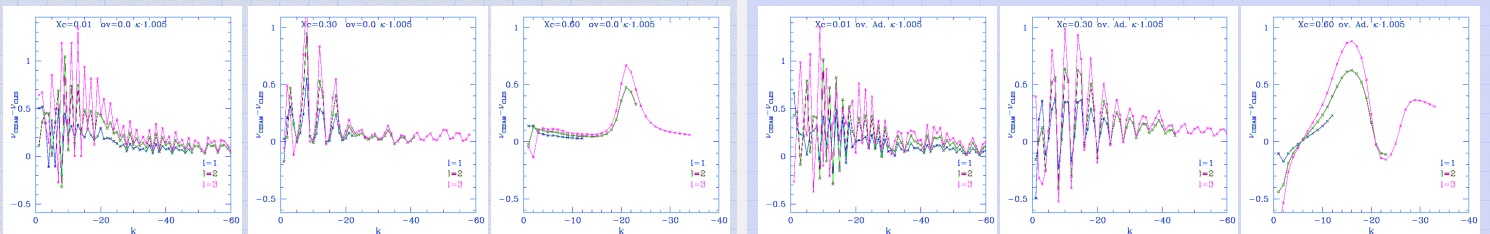
Equation of State

As described in poster I, Cles used OPAL EoS by deriving Γ_1,Cp,Γ_3-1 from Cv, P, χ_ρ and χ_T given by OPAL tables. Here we compare the frequencies from models computed using this Standard EoS in CLES, OPAL_Cv and that obtained by deriving Cv, Cp and Γ_3-1 from Γ_1, P, χ_ρ and χ_T (OPAL-Γ_1)

Comparison between CESAM and CLES-OPAL-Γ_1 models reveals a small decrease of the amplitude of oscillation feature presented in $\Delta\nu$.

OPAL_Γ_1-OPAL_Cv models
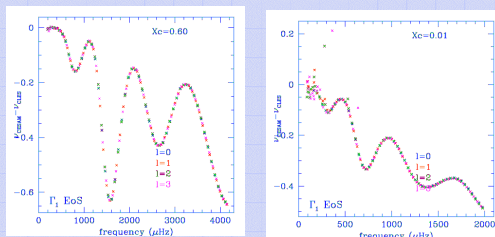
Conclusions

Models computed using the same physics, but different numerical implementations can provide very close global parameters and internal structures. Nevertheless, the small differences in the structure translate in significant frequency difference.

These differences come both, from the external layers of the star (see Poster I. Note that CESAM and CLES models considered in frequency computation stops at τ=2/3) and from the differences of the details of the boundary of the convective core.