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THE EVOLUTION OF INTERMEDIATE MASS STARS FROM THE MAIN SEQUENCE TO THE WHITE DWARF STAGE

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Full evolutionary calculations for DA white dwarf stars are presented. Evolution of a 3 $M_\odot$ stellar model is followed from the ZAMS up to the AGB and due to mass loss episodes after 11 thermal pulses a $0.563 M_\odot$ pre-white dwarf model is obtained. In order to have accurate internal chemical profiles for DA models we follow the evolution down to the ZZ Ceti stage self-consistently with element diffusion. This is a key issue to understand the pulsational properties of DAVs (ZZ Ceti stars).

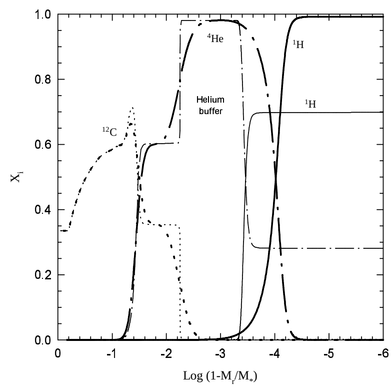

Fig. 1. Internal chemical profiles after the end of mass loss (thin lines) and at the ZZ Ceti stage (thick lines). Step like profiles are smoothened by element diffusion. This will affect the Brunt-Väisälä frequency.

Internal chemical profiles are a key feature in determining the Brunt-Väisälä frequency (BVF), which in turn is fundamental in determining the pulsational properties of stars. We derive a realistic model of DA starting from the ZAMS, through mass loss episodes at the tip of the AGB and finally down to the ZZ Ceti stage in the cooling track. Element diffusion is computed self-consistently with the evolution of our model so as to derive accurate internal chemical profiles. These profiles are shown in Fig. 1, which shows the relevance of element diffusion. In Fig. 2 we present some results for a model with $T_{\rm eff} = 12000$ K in the ZZ Ceti domain.

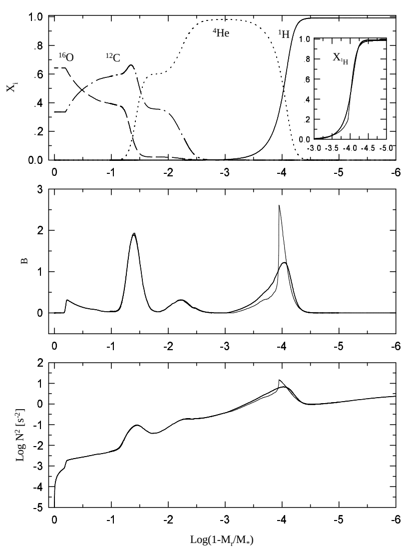

Fig. 2. Upper panel: chemical profiles for a model with $T_{\rm eff} = 12000$. The inset shows the difference between equilibrium diffusion approximation and our full treatment (thick line) for the H-He transition. Middle and lower panel show the Ledoux term and BVF for the same model. Clearly, full treatment of diffusion gives a much smoother BVF, and it will affect trapping properties for these stars.

We conclude that element diffusion must be properly taken into account to derive pulsational properties for DAVs (ZZ Ceti stars).

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