

Report 20111202

Toma Badescu

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Question 1

The Hydrogen in the core of a 1 solar mass star runs out, as it is transformed into heavier elements, like Helium (Figure 1). In the case of the 15 solar mass star, Hydrogen is transformed into Helium which in turn it is fused into heavier elements, like Carbon, as seen in Figure 2.

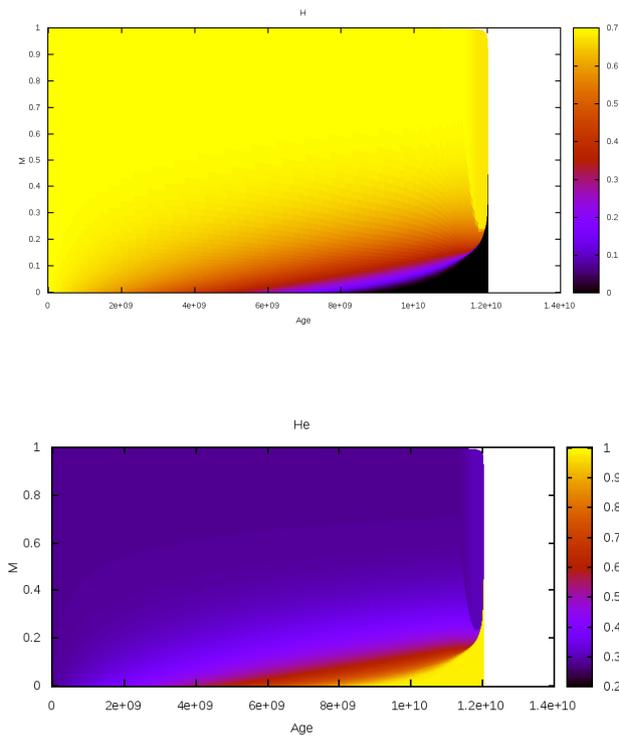


Figure 1: The abundances of Hydrogen (top) and Helium (bottom) inside a 1 solar mass star.

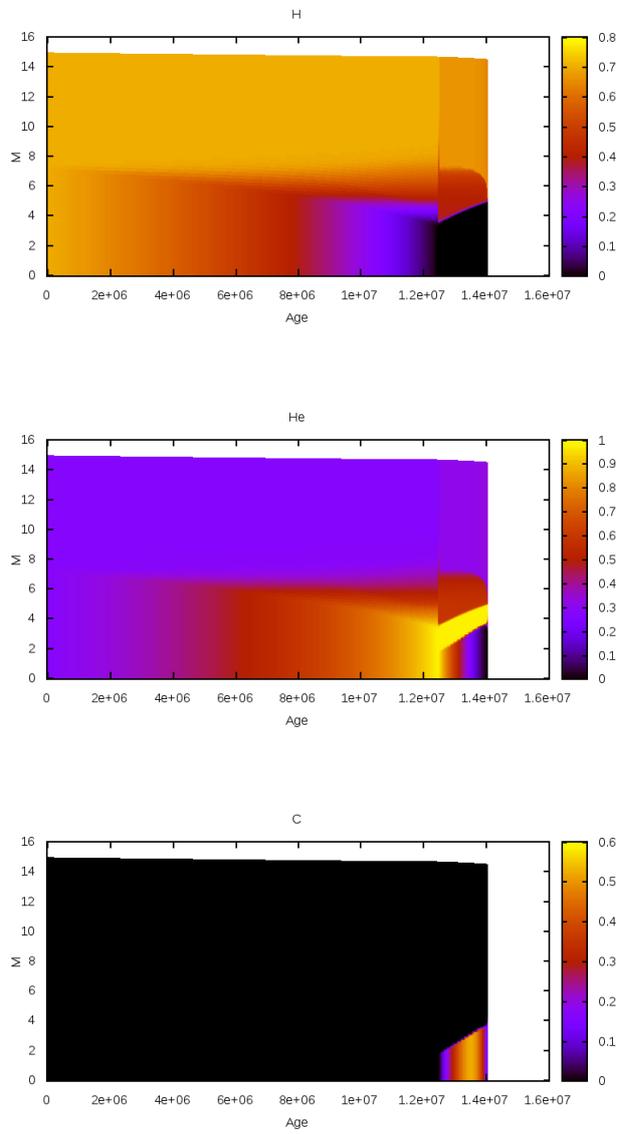


Figure 2: The abundances of Hydrogen (top), Helium (middle) and Carbon bottom inside a 15 solar mass star.

Question 2

In the case of the 1 solar mass star (Figure 3, top) as the core is filled with He the burning stops. The H burning continues in a shell around the core. For the 15 solar mass star (Figure 3, bottom) even as the core is filled with heavier elements, and the burning continues in a shell around it, the fusion in the centre does not stop. There He turns to C and other heavier elements.

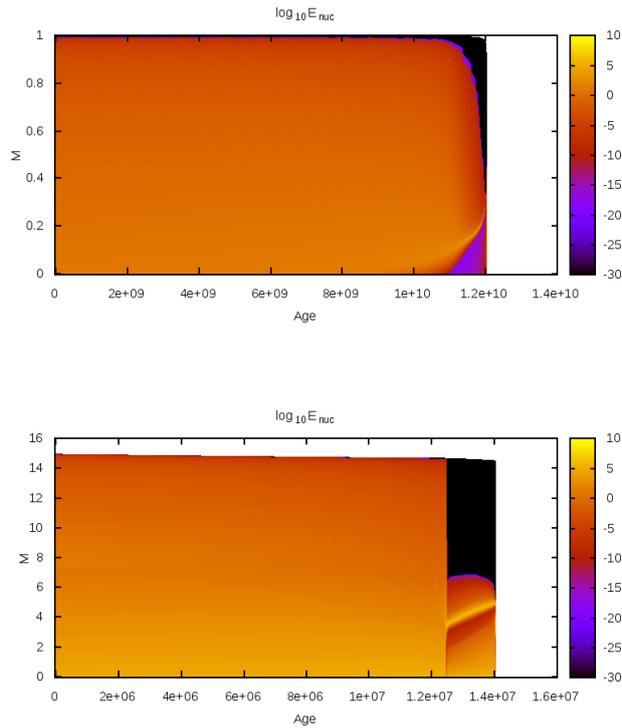


Figure 3: Nuclear energy generation for a 1 solar mass star (top) and a 15 solar mass star (bottom).

The magnitude of the burning increases as the fusing region is squeezed into a thinner shell around the core.

Question 3

The number of steps used at some point depends on the gradient of different values which characterize stellar evolution at that age. This means that for example, for the main sequence when little changes occur, less models are being used than for the end of the stars life, when its structure undergoes changes.

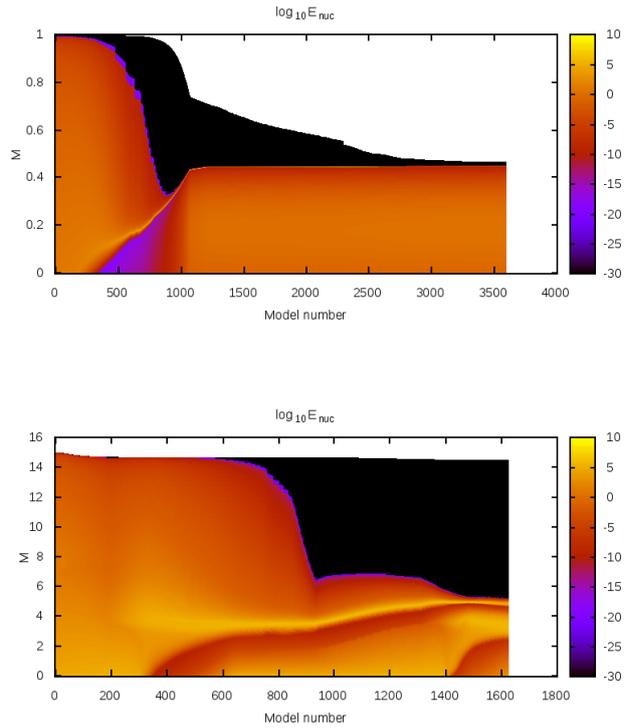


Figure 4: Nuclear energy generation for a 1 solar mass star (top) and a 15 solar mass star (bottom) plotted against the model number instead of the age of the star.

Question 4

Luminosity increases towards the end of the stars life as seen in Figure 5. The star expands, it burns heavier elements, and its energy output is greater. Comparing the maximum luminosities in the plot to those in the HRD diagram, there is a difference in the sense that the HRD diagram shows the total luminosity, while the values obtained in our plot are given for each shell, locally. Integrating with the radius, we would obtain the same values as in the HRD diagram.

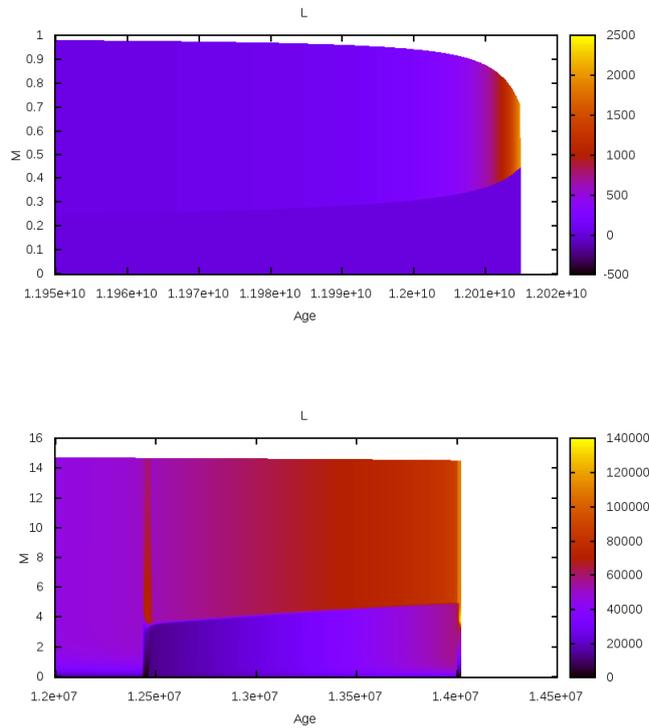


Figure 5: Luminosity evolution of a 1 solar mass star (top) and of a 15 solar mass star (bottom), near the end of the simulation.