

Ugeseddel 9 (week 47)

In the lectures 21 November Günter started the presentation of star formation and early stellar evolution (*Kippenhahn, Weigert & Weiss*, Chapters 26 and 27). This will be continued on 24 November, including also the final stages before the zero-age main sequence (*Kippenhahn, Weigert & Weiss*, Chapter 28). After this we return to the late evolution stages on the so-called asymptotic giant branch, including shell-source instabilities, thermal pulses and slow neutron-capture nucleosynthesis (*Kippenhahn, Weigert & Weiss*, Chapter 34), and the final stages of the evolution of massive stars, leading up to supernova explosions (*Kippenhahn, Weigert & Weiss*, Chapters 35 and 36).

In the exercise class on 30 November we continue experimenting with using MESA. If you have not completed the exercises from 23 November, you should do so. Continuing from this I suggest the following, exploring the properties of stars at the end of central hydrogen burning:

- i) An important aspect is whether or not the star has a convective core which, as you know, should be mainly determined by the importance of the CNO cycle. Assuming a composition of $X = 0.7$, $Z = 0.02$ find the minimum stellar mass where the star develops a significant convective core in the later stages of central hydrogen burning.
- ii) Check how this relates to the appearance of the hook in the evolution track in the HR diagram.
- iii) Explore how internal structure changes during and just after the ‘hook’ phase. An interesting property is the central temperature; try to explain what you find.
- iv) Repeat i) – iii) for stars with a metal-poor composition, with $X = 0.75$, $Z = 0.001$.

In addition, I suggest that you consider

- v) *Lecture Notes on Stellar Structure and Evolution*, Exercise 10.1. We may try to explore this using MESA the following week.