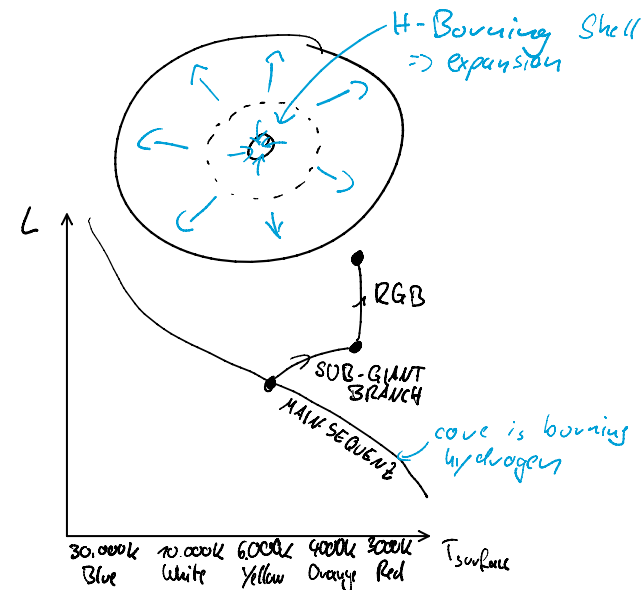


#### 4. What is the red giant branch?

Dienstag, 29. Oktober 2019 14:56

### 4.) What is the red giant branch? (= RGB)

- Stars after their main sequence
- Hydrogen fusion into helium stopped
- Core begins to collapse  $\rightarrow$  additional heat to the shell of the core to enable the hydrogen fusion in those layers
- The additional heat expands the star
- Temperature in the core keeps rising due to the pressure
- BUT: At some point the core collapse stops
- This is due to the electrons in the He, at some point the electron clouds overlap too much and the repulsion of the electrons prevent the core from a complete collapse
- That is called the **electron degeneracy** (core density at that point  $\sim 10^8 \text{ kg/m}^3$ )
- No He fusion in the core
- Growth to about 100 times its initial size
- Takes about 100 million years to go from the main-sequence to the RGB
- Temperature in the core climbs to 100 MK
- $\hookrightarrow$  Next step: He fusion in the core



### 4.1) What is the method: Tip of the RGB?

Hertzsprung-Russell Diagram:

- It's a primary distance indicator
- Here, it uses the luminosity of the brightest RGB stars in a galaxy as a standard candle to get the distance
- When the RG reaches the point where the core starts to burn He, the temperature of the star rises
- For stars with a lower mass than 1.8 times the mass of our sun, this will occur in a process called the **helium flash**
- The evolutionary track in the HR-diagram will curve it towards left (blue)
- The sharp discontinuity is called **tip of the RGB**
- Their I-band (infrared) is insensitive to their composition or their mass
- Works in all populations of stars. Cepheids only in young populations