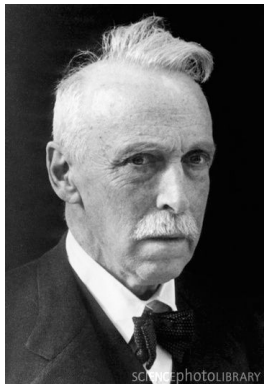


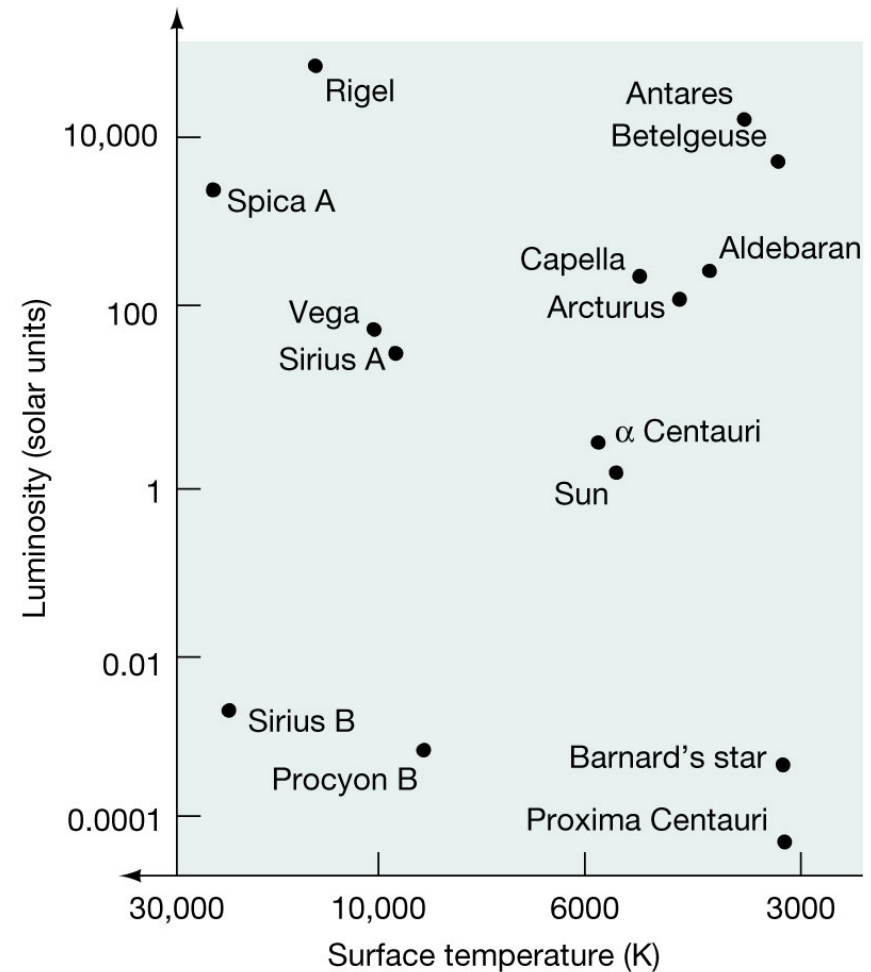
17.5 Hertzsprung–Russell Diagram


Aka “**colour magnitude diagram**”



The H–R diagram plots stellar luminosity against surface temperature.

This is an H–R diagram of a few well-known stars.



or  Spectral classification

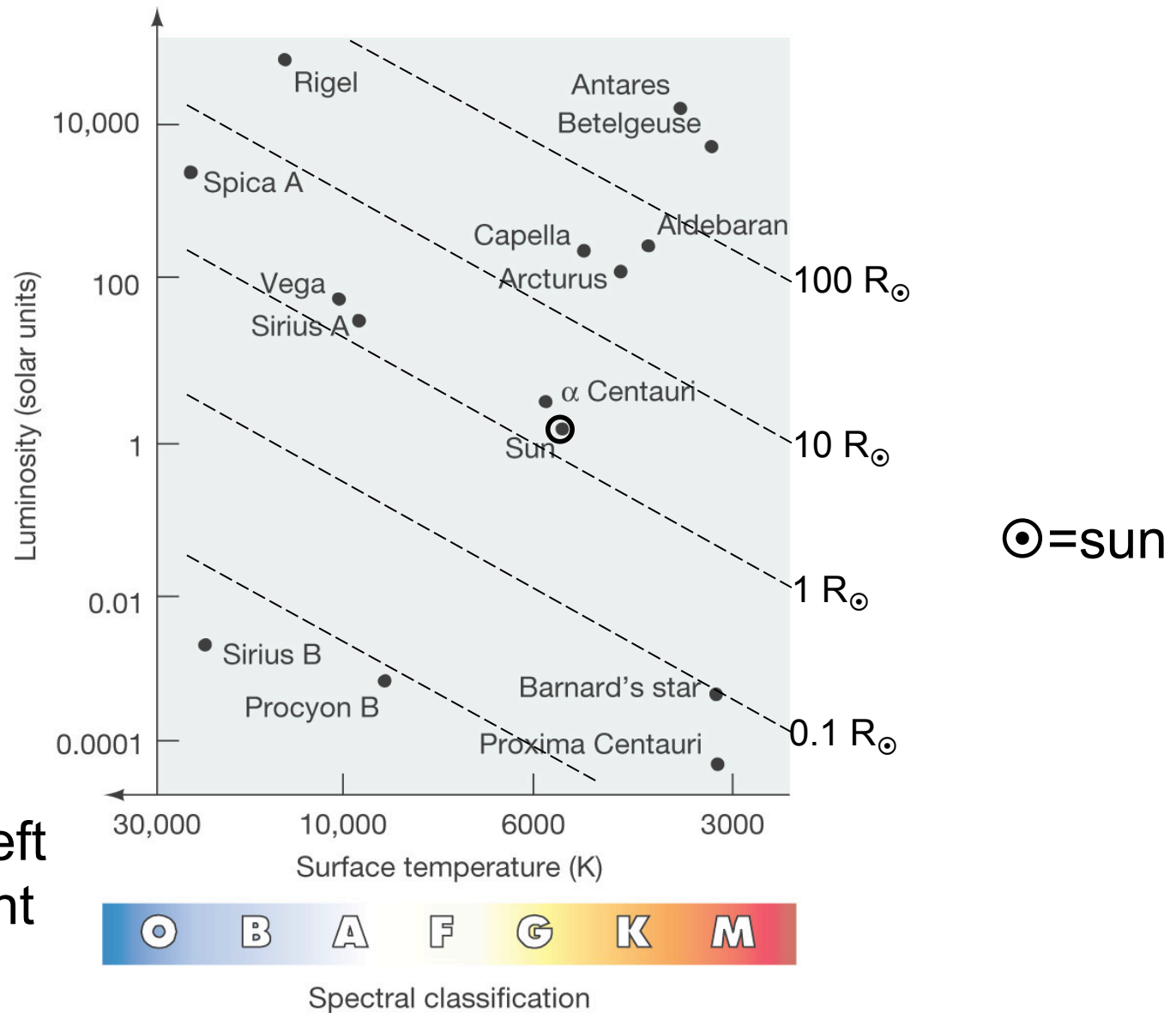
The spectral classification color bar shows a gradient from blue to red, with labels O, B, A, F, G, K, and M. The O and B labels are inside circles, while the others are plain letters.

or colour (Wien)

H-R Diagram in more Detail

Why?

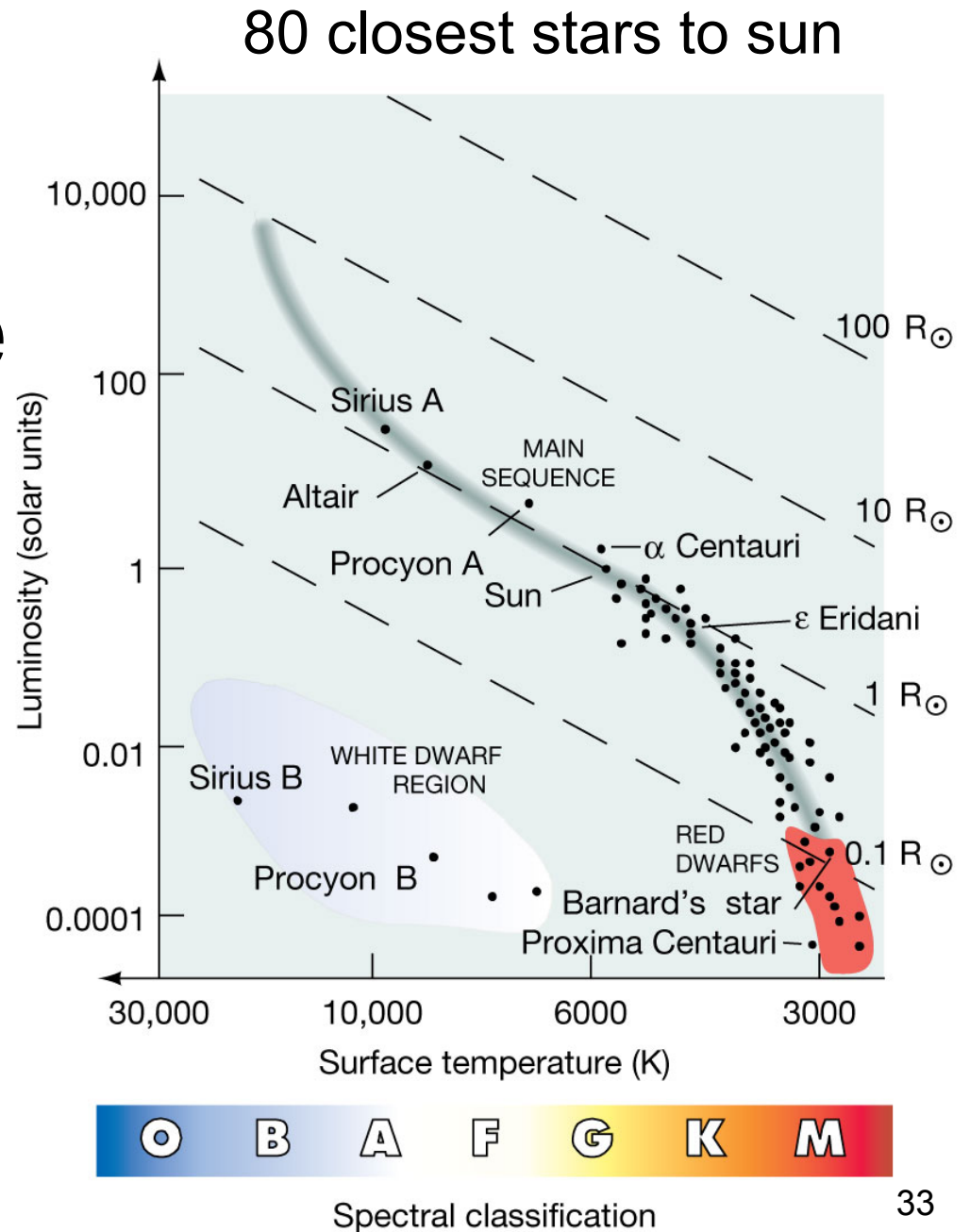
small=lower left
big=upper right



17.5 The H-R Diagram – the Main Sequence

Main sequence - where most stars are.

white dwarf region - these stars are hot but not very luminous, as they are quite small.

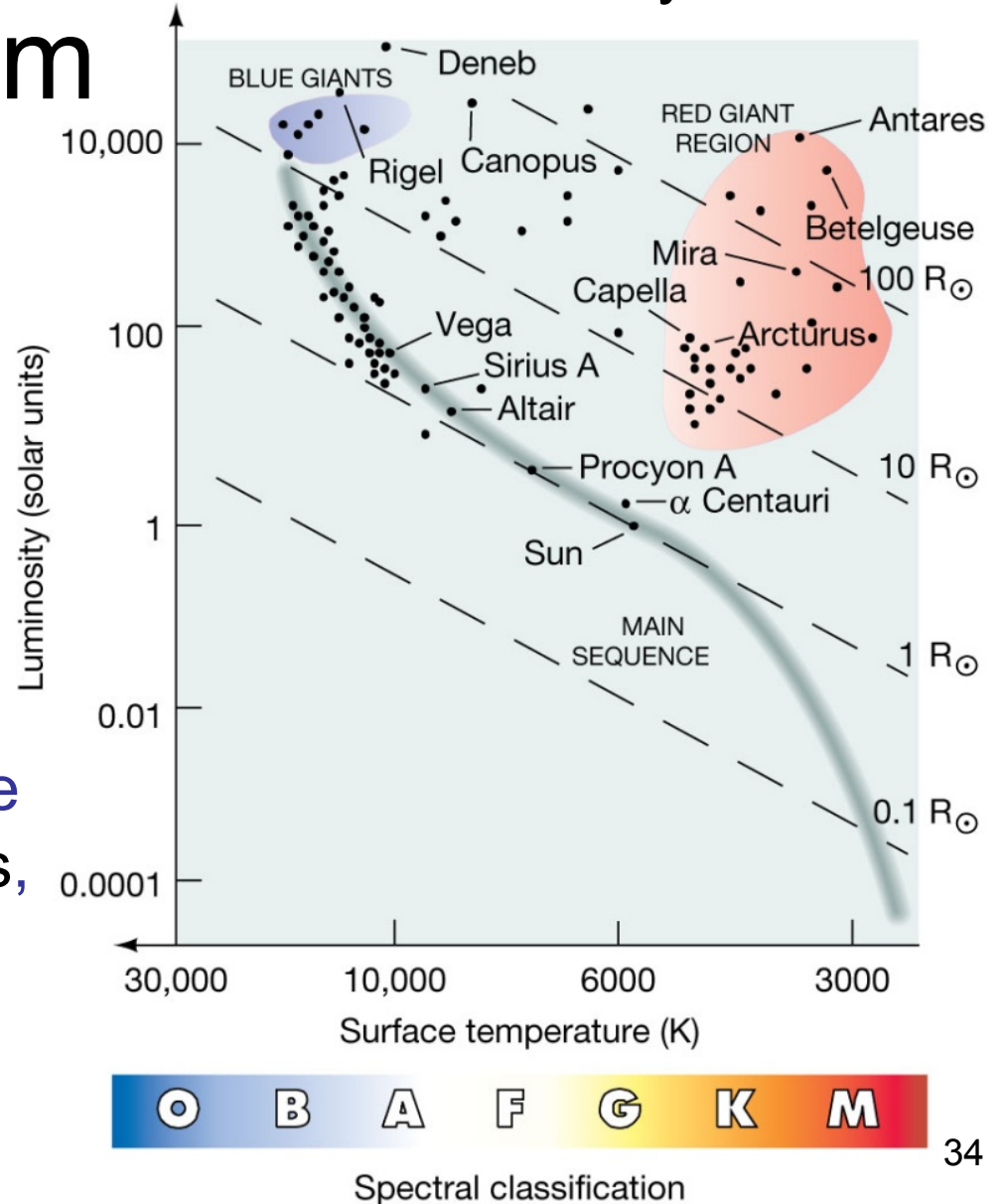


17.5 Hertzsprung–Russell Diagram

These stars are all more luminous than the Sun. Two new categories appear here - the red giants and the blue giants.

Clearly, the brightest stars in the sky appear bright because of their enormous luminosities, not their proximity. They are very rare and mostly distant.

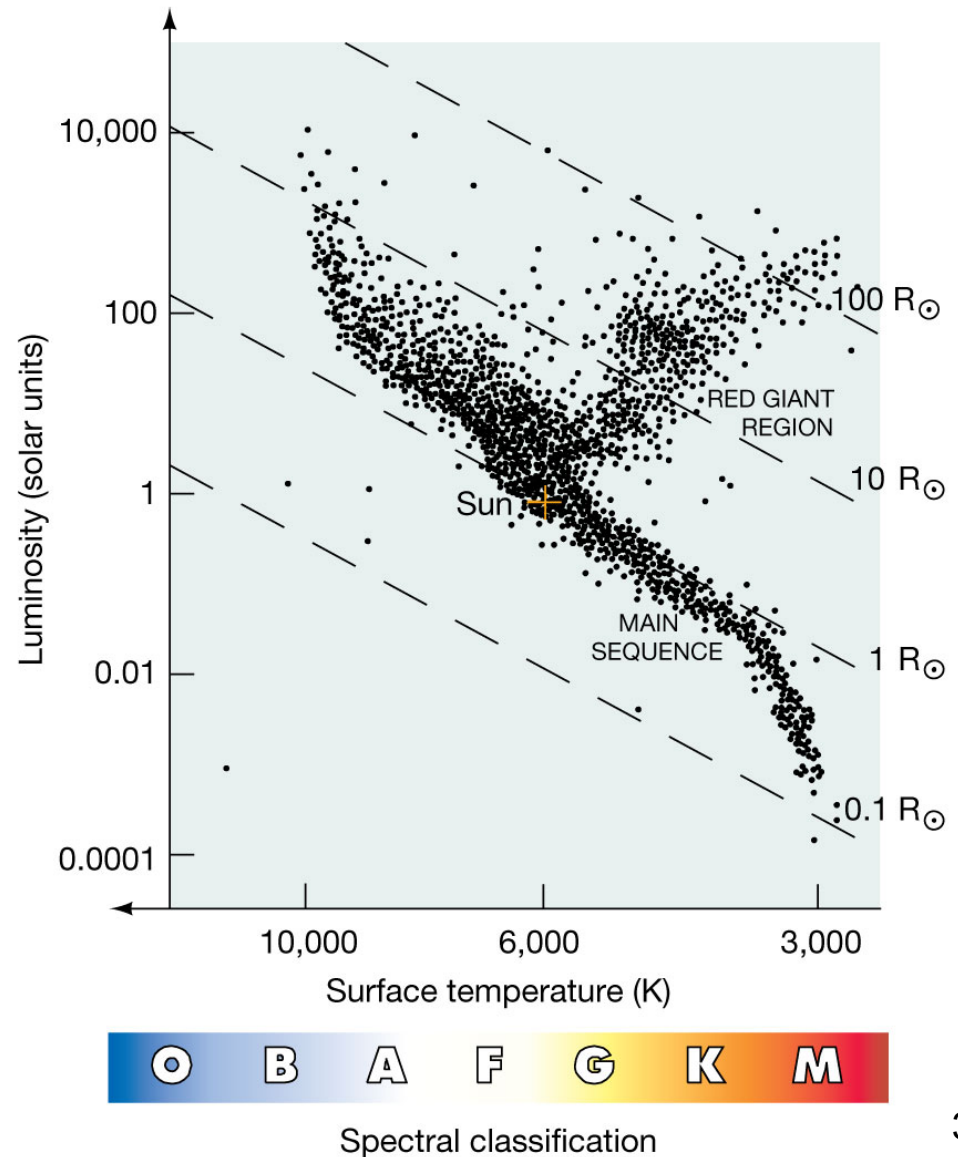
100 brightest stars as seen in the sky



17.5 Hertzsprung–Russell Diagram

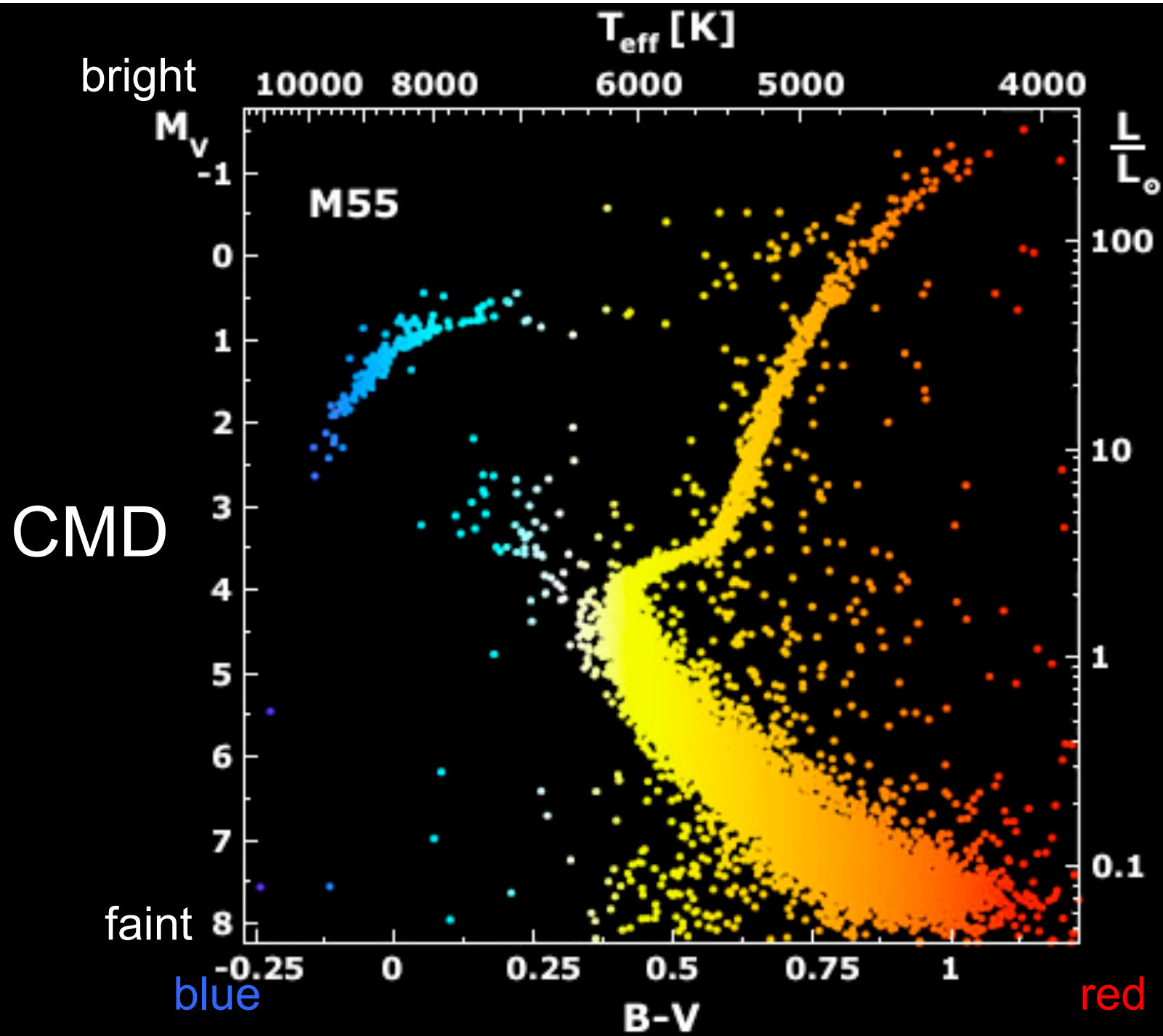
This is an H–R plot of about 20,000 stars (within a few 100 pc of the sun). The main sequence is clear, as is the red giant region.

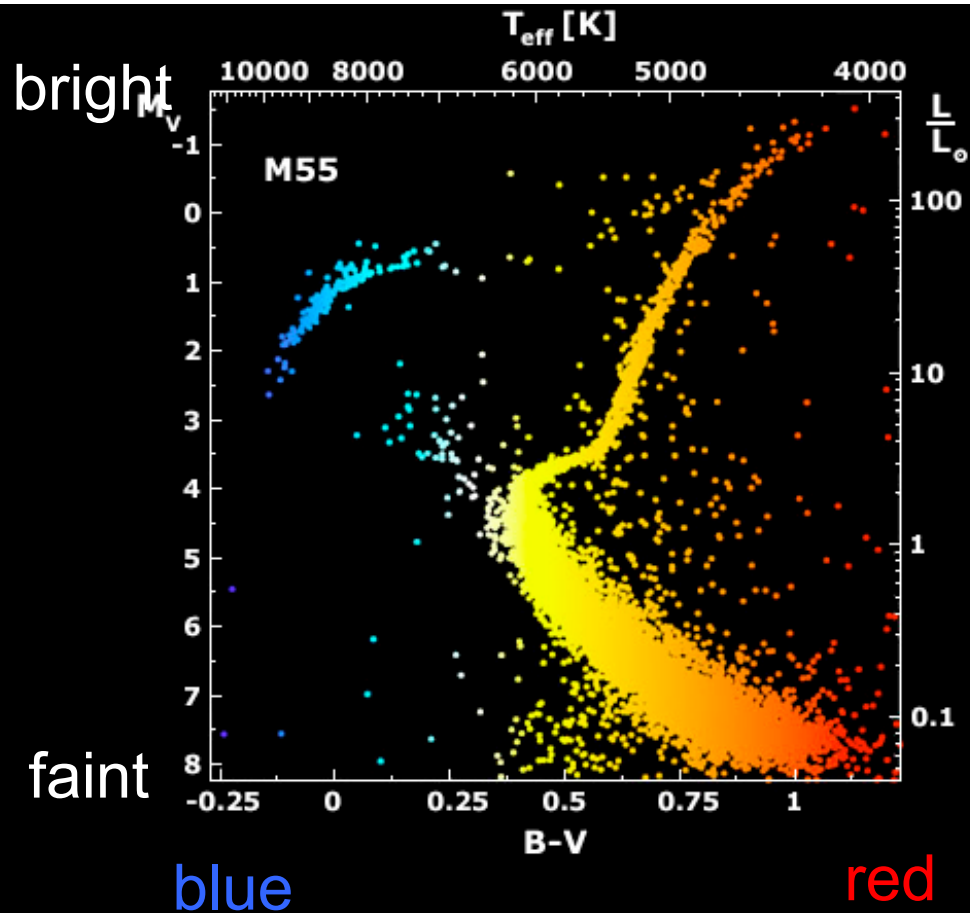
About 90% of these stars lie on the main sequence; 9% are red giants and 1% are white dwarfs.



Question: what is the difference between a “Hertzsprung-Russell Diagram” and a “Colour-Magnitude Diagram”?

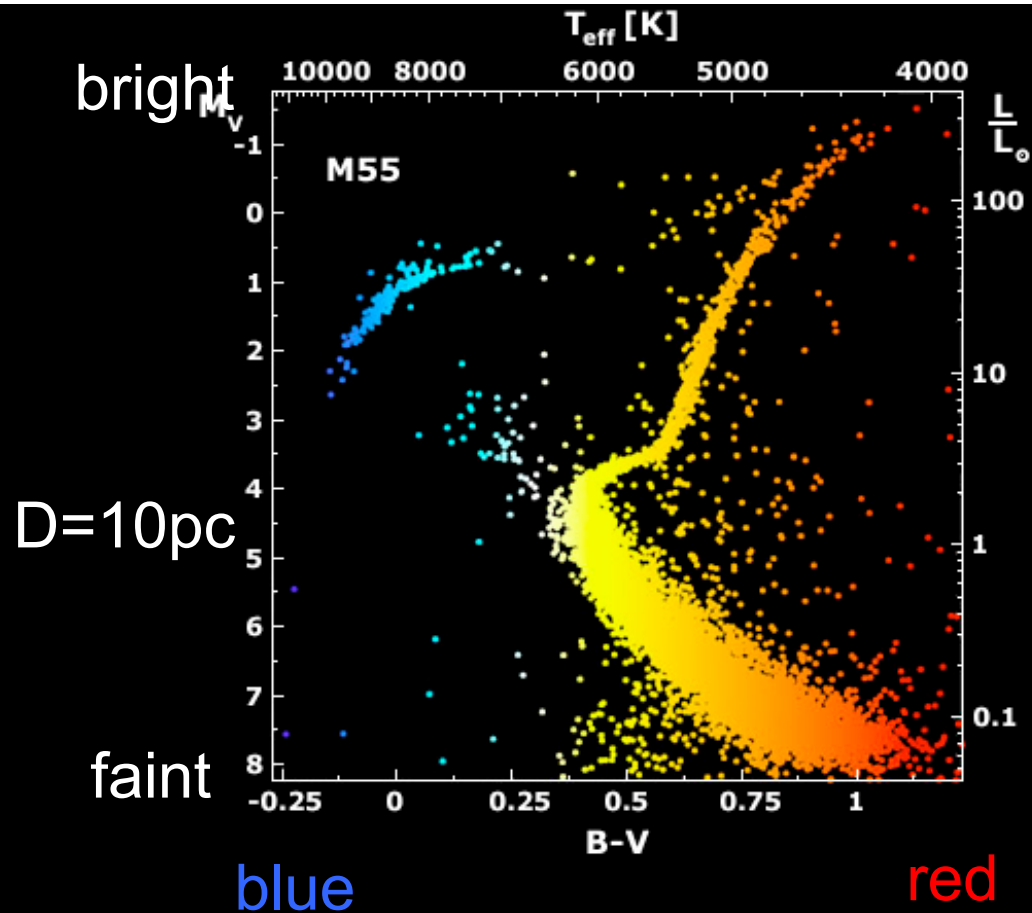
Answer: units!





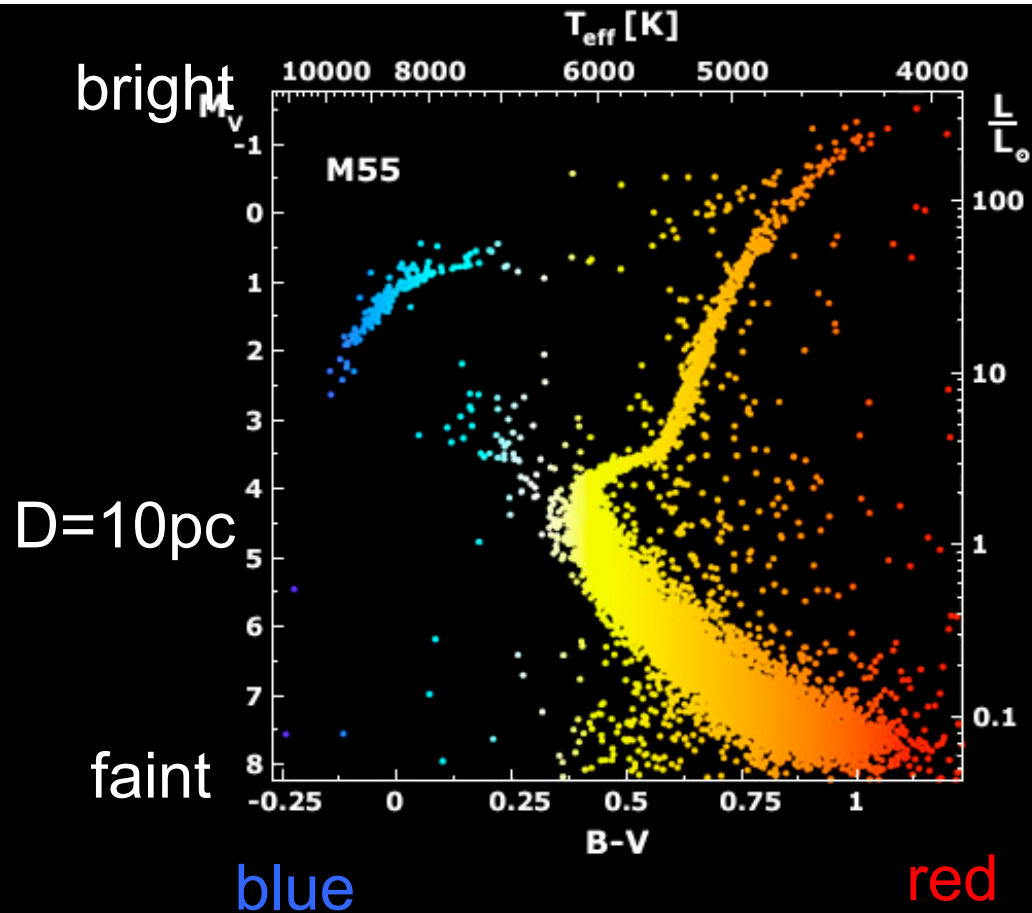
Colour Magnitude Diagram

- Luminosity in magnitudes
- Temperature expressed as “B-V colour”
 - Blue light vs visual light, in magnitudes
- Above is for a “standard” distance of 10 pc



Colour Magnitude Diagram

What is the effect of distance?



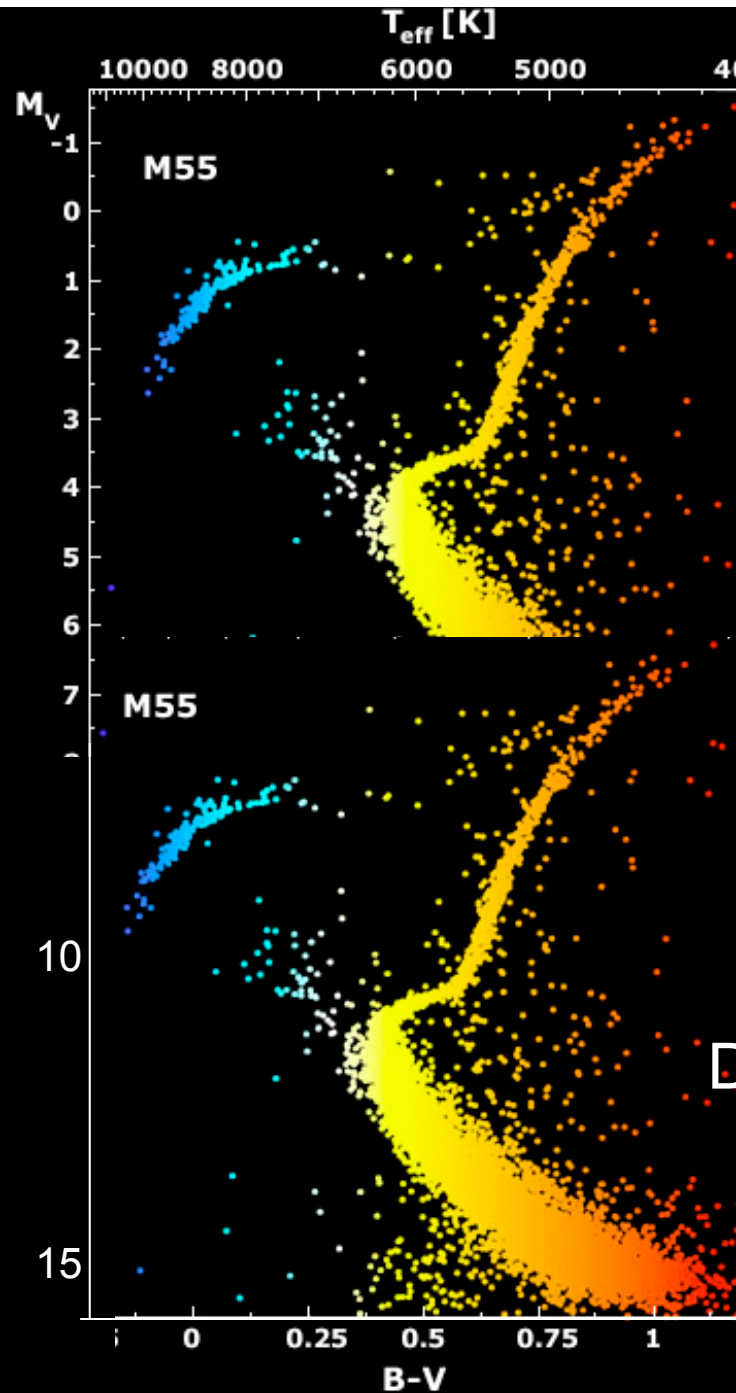
Colour Magnitude Diagram

What is the effect of distance?

bright

$D=10\text{pc}$

faint



CMD

What is the effect of distance?

$D=100\text{pc}$

Q: What is the main
sequence?

Q: What is the main sequence?

Answer: The main sequence is the location in the HR diagram of hydrogen burning stars.

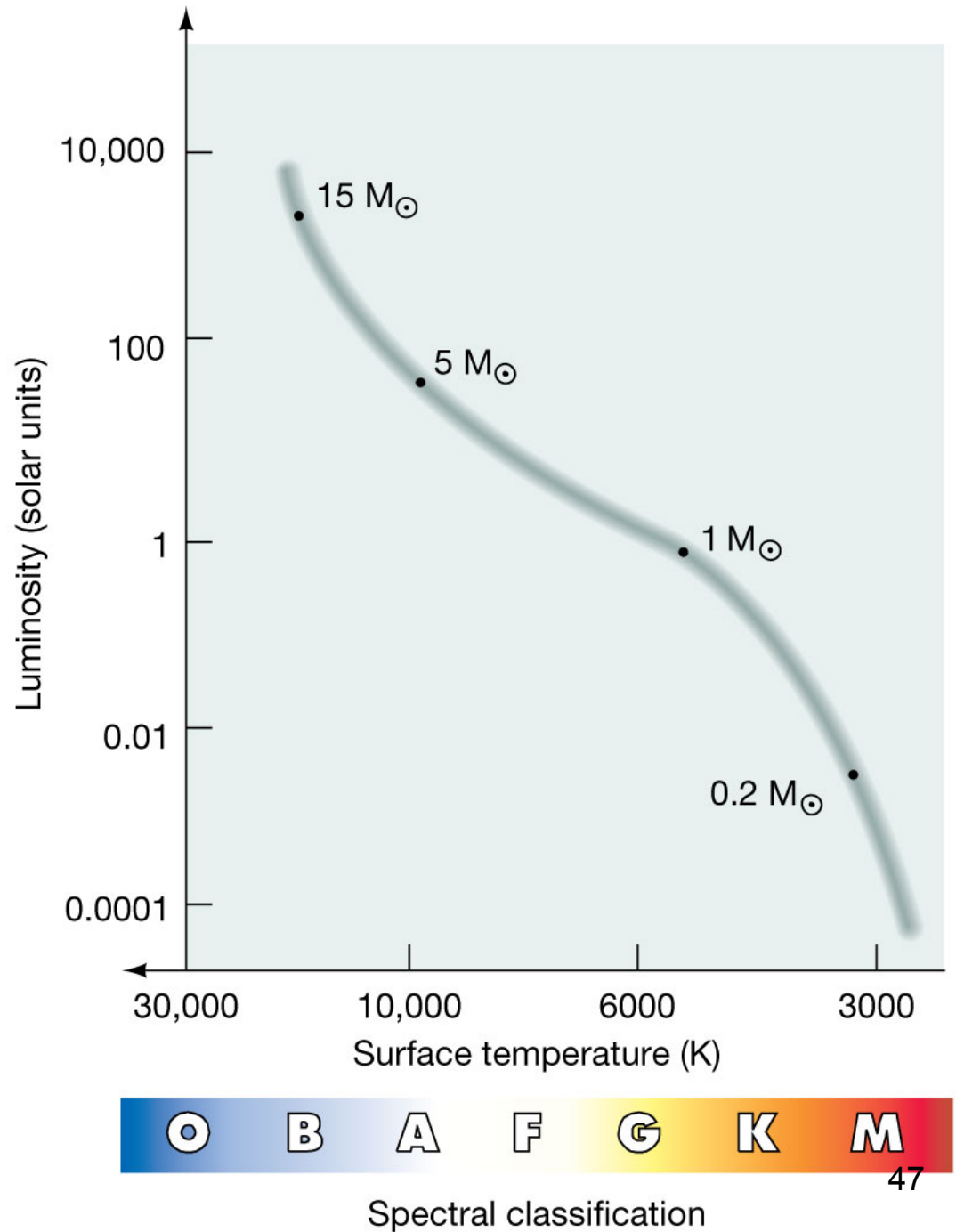
Nuclear reactions: $4\text{H} \rightarrow \text{He}$

Mass lost, $E=mc^2$

17.7 Stellar Masses

Mass is the main determinant of where a star will be on the main sequence .

- *but only for main sequence stars*



What is the main sequence?

- A. The place in the Milky Way where most stars are found.
- B. The place in the HR diagram where the oldest stars are found
- C. The place in the HR diagram where hydrogen burning stars are found
- D. The place in the HR diagram where helium burning stars are found