BRIEF

HR DIAGRAM
HR Diagram Overview

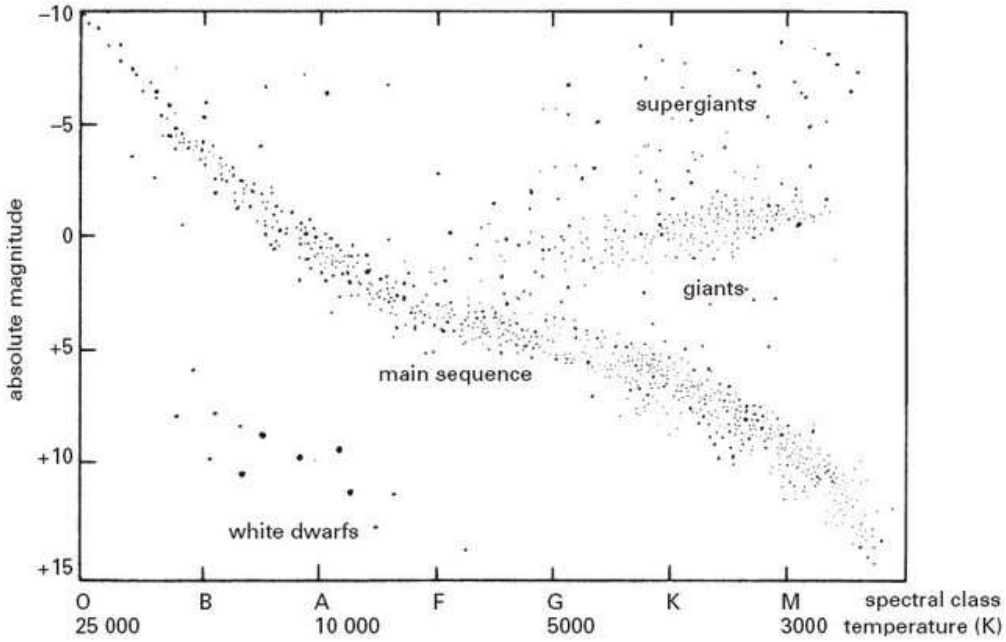
Overview

There are so many stars in the Universe. How do we categorize them? How do we classify them? Do they even classify?

This lesson assumes some familiarity with Wien's Law, Stefan-Boltzmann, and stellar magnitudes.

We'll cover:

- Major categories of stars
- Lifetimes of stars
- Stellar Life Sequence



Hertzsprung–Russell diagram

Hertzsprung-Russell Diagram

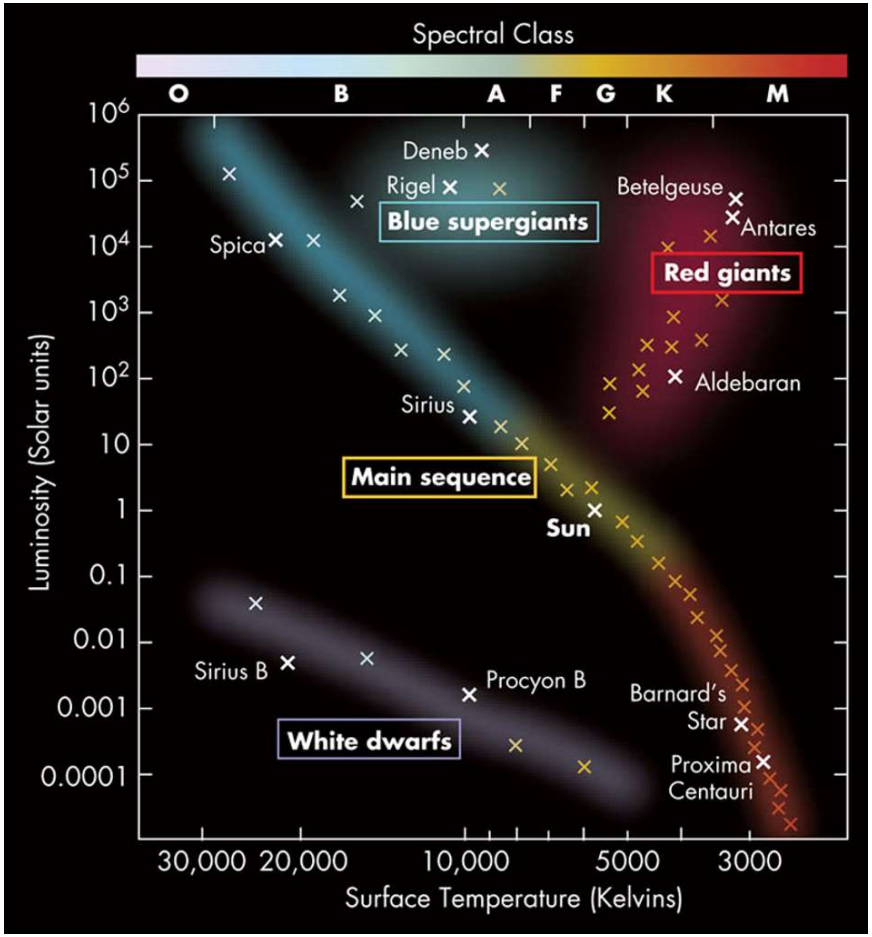
The *H-R diagram* is a plot of stellar temperature vs luminosity. Temperature is classified by Spectral Class

Most of the stars on the H-R diagram lie along a smooth diagonal running from hot, luminous stars (upper left part of diagram) to cool, dim ones (lower right part of diagram): the *Main Sequence*

Generally, 90% of a group of stars will be on the main sequence. This is where a star spends most of its life cycle.

Significant areas of the diagram are:

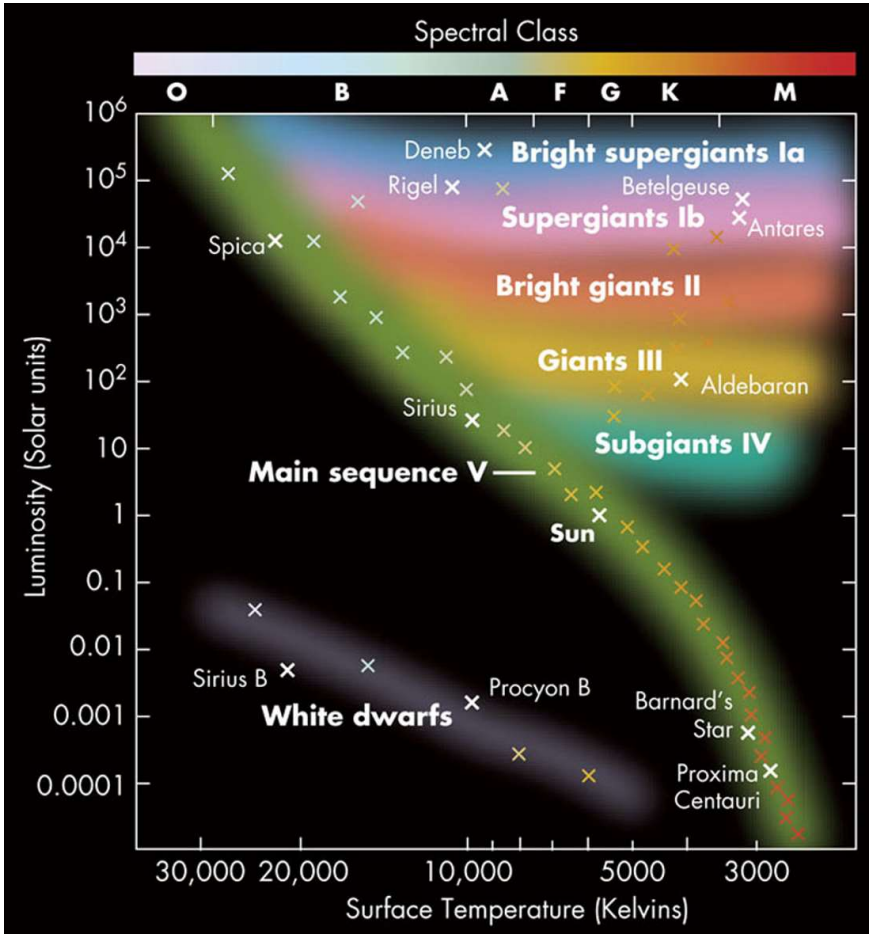
- Main sequence,
- Blue Supergiants
- Red Giants
- White Dwarfs



Hertzsprung-Russell Diagram: Spectral Class and Luminosity Type

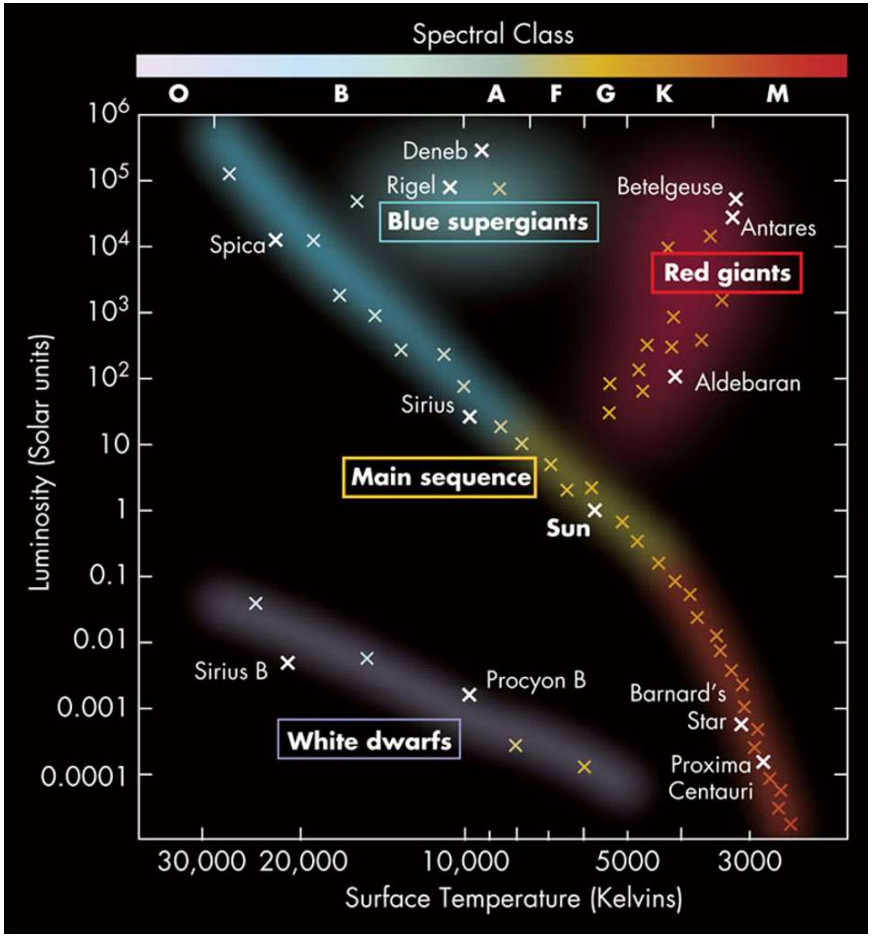
H-R diagram broken into luminosity classes:

- Ia (bright supergiant),
- Ib (supergiants),
- II (bright giants),
- III (giants),
- IV (subgiants),
- V (main sequence)
- White Dwarfs



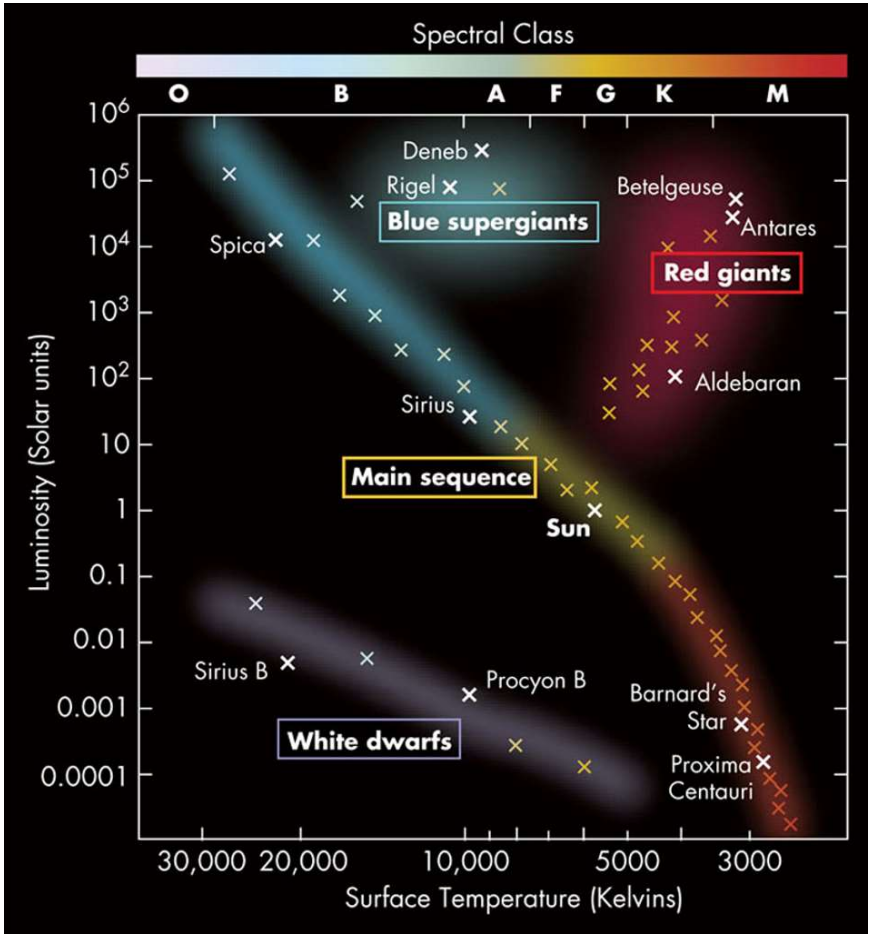
Hertzsprung-Russell Diagram: Major Categories of Stars

1. The *Main Sequence*
   - About 90% of stars occupy this zone from the position of dim stars of very low temperature towards the position of bright stars of high temperature
   - *Healthy stars*, fusing hydrogen in the core.
2. The Blue *Supergiants*
3. The Red *Giants,*
4. The *White Dwarfs*.



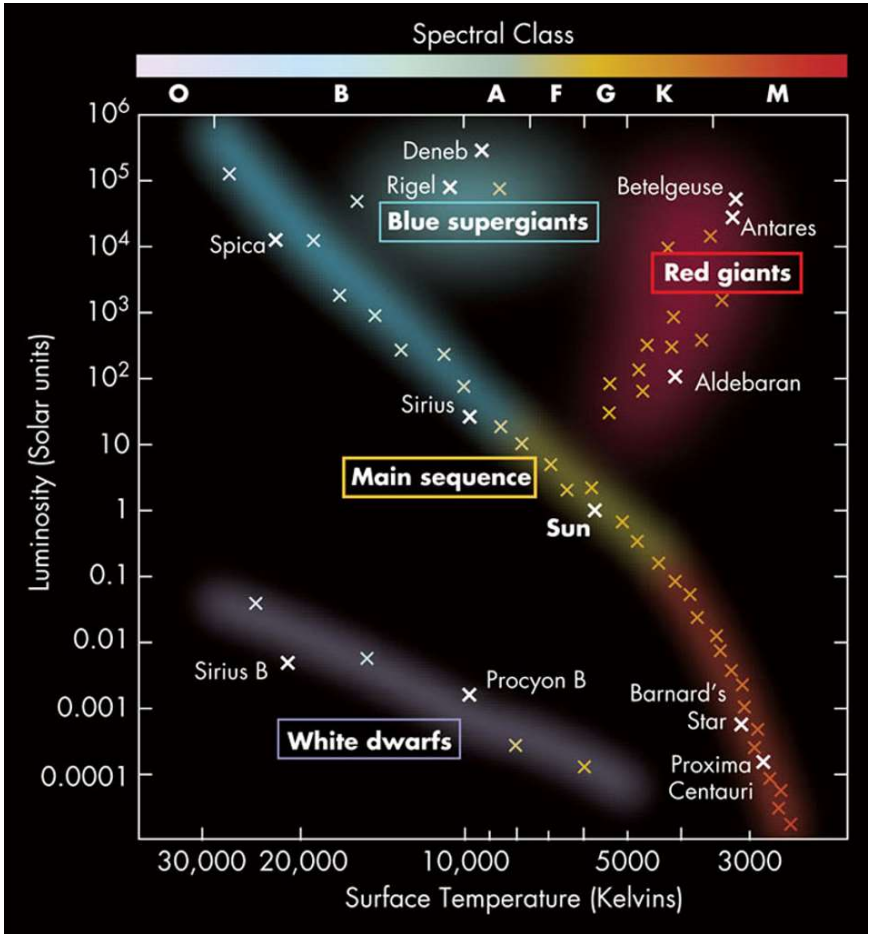
Hertzsprung-Russell Diagram: Major Categories of Stars

1. The *Main Sequence*
2. The Blue *Supergiants*
   - Parallel with and above the Giants are stars of especially large dimensions (more than 100 times bigger than the Sun)
   - Up to 1,000,000 times brighter than the Sun
3. The Red *Giants,*
4. The *White Dwarfs*.



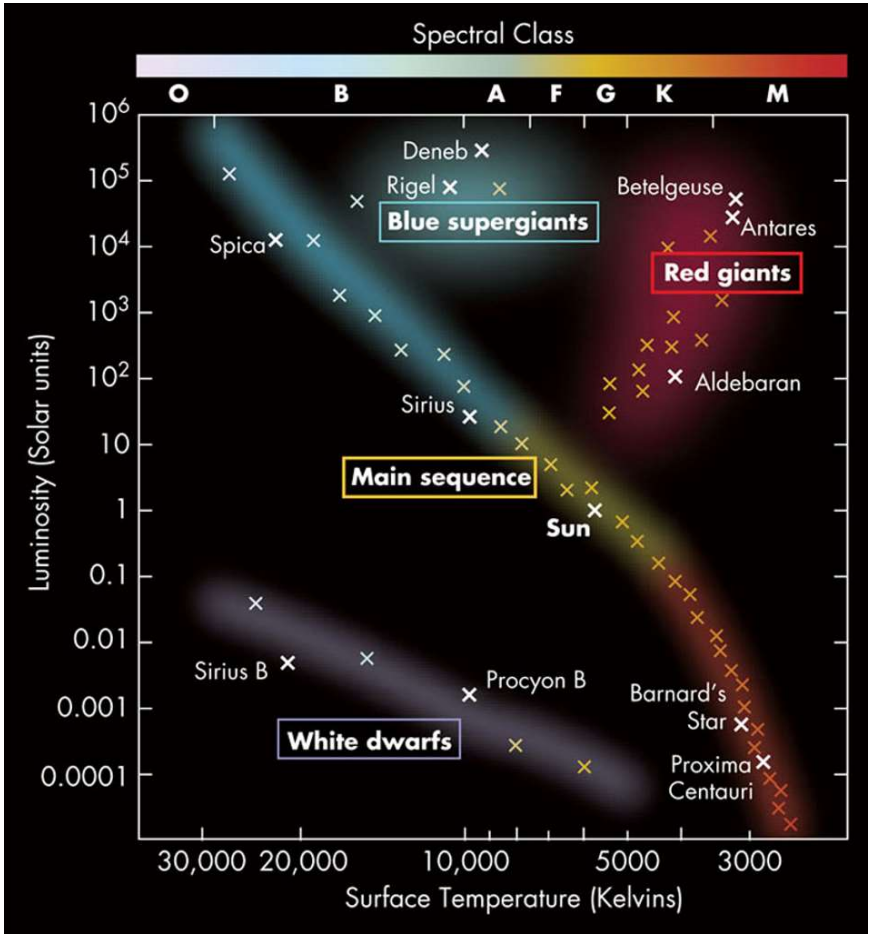
Hertzsprung-Russell Diagram: Major Categories of Stars

1. The *Main Sequence*
2. The Blue *Supergiants*
3. The Red *Giants*
   - At top right, the area of stars of larger dimensions (10 to 100 times bigger than the Sun)
   - Are up to 10.000 times brighter than the Sun
4. The *White Dwarfs*.



Hertzsprung-Russell Diagram: Major Categories of Stars

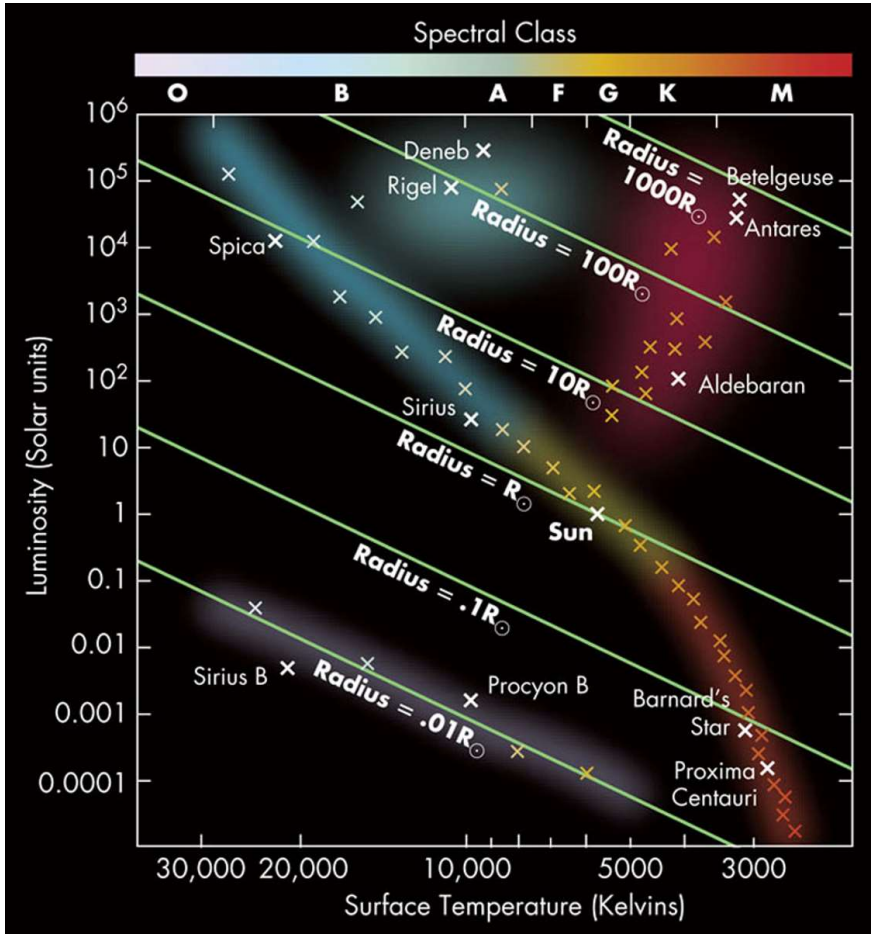
1. The *Main Sequence*
2. The Blue *Supergiants*
3. The Red *Giants*
4. The *White Dwarfs*
   - Bottom left from the Main Sequence stars of high surface temperature but also of very low brightness due to their especially small size (they may be the same size as the Earth)
   - Dead stars, core nuclear fusion have stopped.



Hertzsprung-Russell Diagram

Stefan-Boltzmann law is a key to understanding the H-R diagram

- For stars of a given temperature, the larger the radius, the larger the luminosity
- As one moves up the H-R diagram, a star's radius must become bigger
- On the other hand, for a given luminosity, the larger the radius, the smaller the temperature
- Therefore, as one moves right on the H-R diagram, a star's radius must increase
- The net effect of this is that the smallest stars must be in the lower left corner of the diagram and the largest stars in the upper right

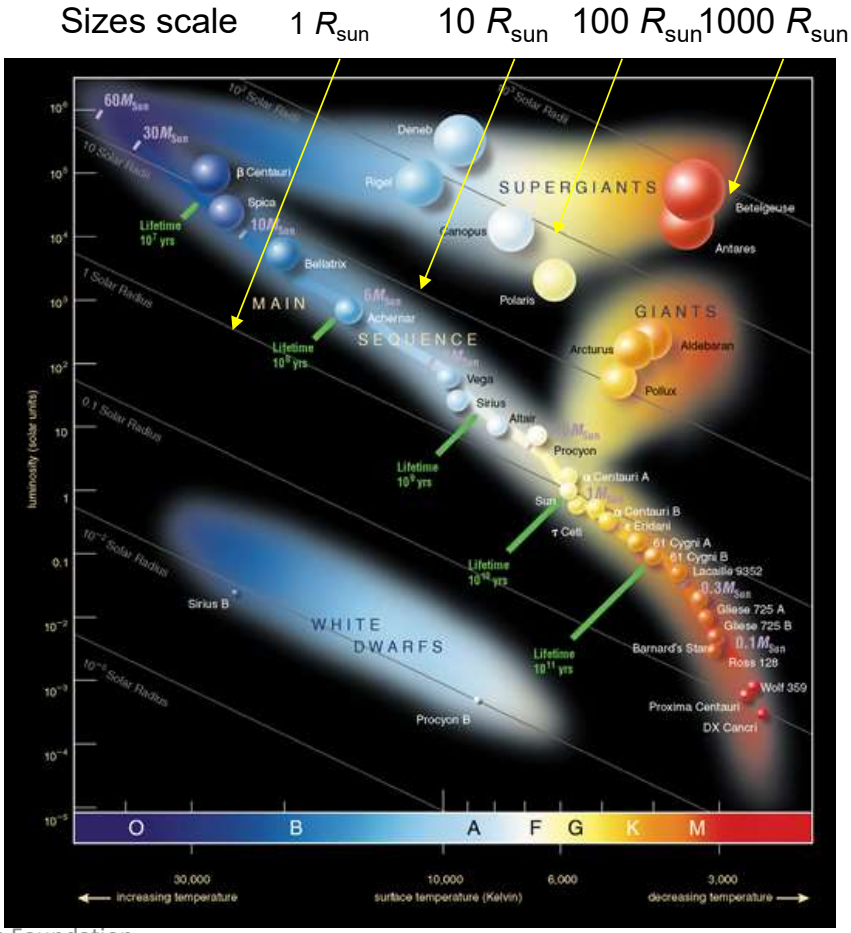


Summary

The HR Diagram is a stellar plot of Luminosity vs. Temperature

Through our understanding of stellar life cycles, placement of a star on the HR Diagram, can lead to an understanding of where in the "life-cycle" the star is.

Other versions of the HR Diagram, such as the one here, show other correlations: Estimated lifetime, Radius



Questions?