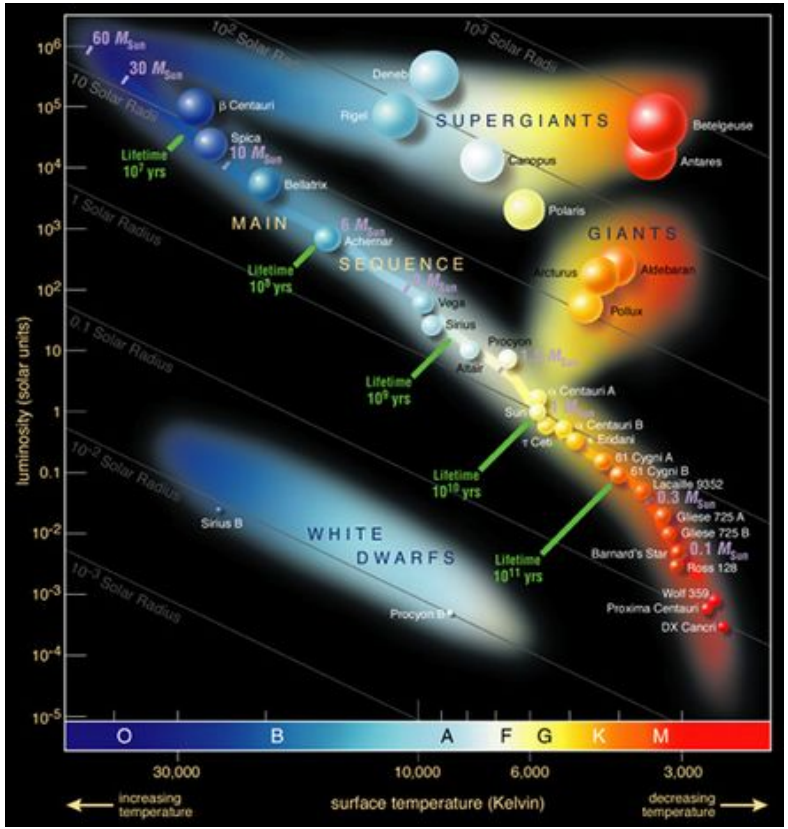
The Hertzsprung–Russell Diagram

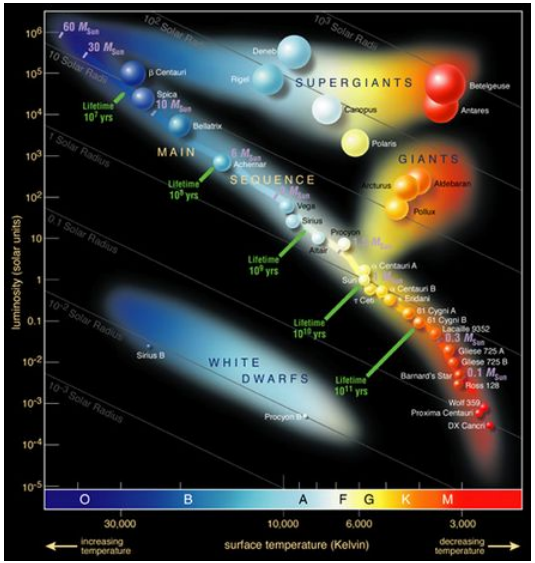
Christian Secular



- Graphs absolute magnitude vs. surface temperature
  - Absolute magnitude is the measure of luminosity of an object at 10 parsecs (32.6 light years
  - Lower absolute magnitude = higher luminosity
- Also used to compare stellar classification, color, luminosity and temperature
- B-V color, or color index may replace temperature
- Turnoff point: point at which stars leave the main sequence

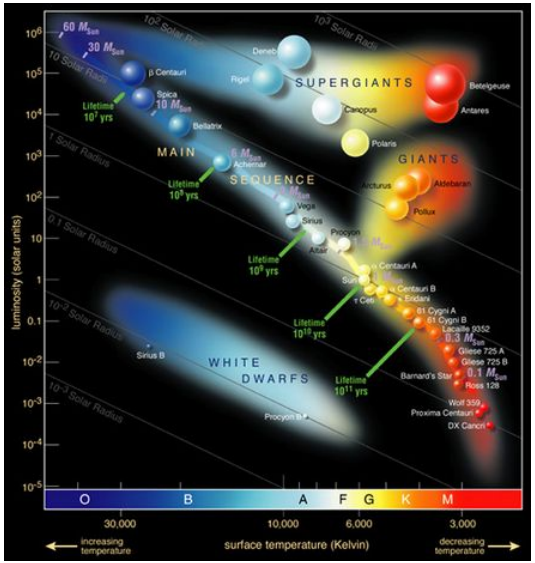
Main Sequence

- Diagonal on the H-R diagram where stars spend most of their lifetime
- White dwarfs appear below while subgiants, giants, and supergiants appear above it
- Stars in this sequence have chemical homogeneity (70% hydrogen, 28% helium and trace amounts of other elements)
- “Zero age” is the time when a star joins the main sequence
- Notable stars:
    - The Sun
    - Proxima Centauri: the nearest star to the sun that is known
    - Sirius: brightest in Earth’s sky
    - Bellatrix: 3rd brightest in Orion



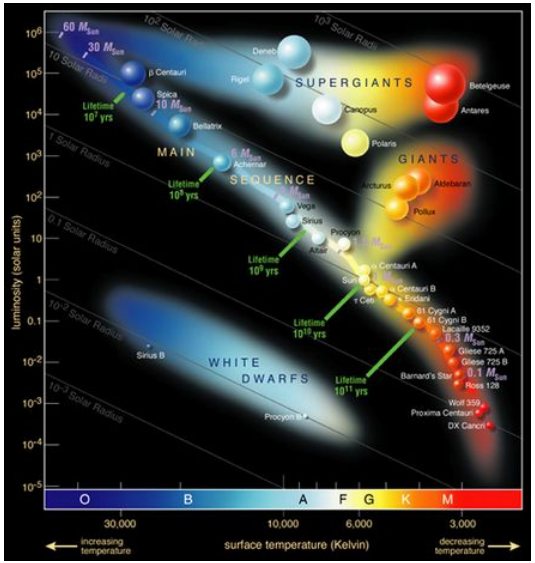
Red Giants

- Large cool stars with low-wavelength found above main sequence
  - Luminosity of class II or III, spectral class of K or M
- Name a namesake branch on the HR diagram that is asymptotic
- Next stage of the sun
- Smaller giants may undergo a helium flash
- Thermal pulsations that shed a planetary nebula
- Notable Red Giants:
  - Aldebaran: Brightest star in Taurus, Arabic for “the follower”
  - Arcturus: Brightest star in Boötes and brightest in northern celestial hemisphere
  - Pollux: Brightest star in Gemini
  - Gamma Crucis: closest red dwarf to the sun



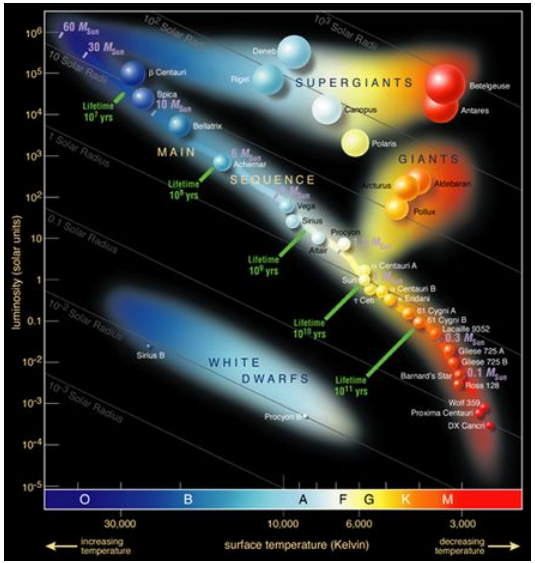
White Dwarf Stars

- Lower left-corner stars that are bright and high-temperature
- Most common evolutionary end-point of stars
- Undergo Debye cooling after crystallization
- Chandrasekhar limit: maximum mass a white dwarf can have and be stable, equal to 1.4 solar masses
- Structure is sustained by pressure of degenerate electrons
- Classified as DZ if they contain metal spectral lines, DA if spectra only contain Balmer lines
- Notable white dwarf stars:
    - Sirius B: Nearest known white dwarf
    - Procyon B: part of Procyon as a binary star system



Brown Dwarf Stars

- “Failed stars” formed when protostars are not massive and dense enough to sustain hydrogen fusion
- Lower right of HR diagram
- Mass ranges for 13 to 85 times the mass of Jupiter, but has similar radius to Jupiter
- WISE, a space telescope, used infrared radiation to detect these
- Notable brown dwarf stars:
  - Teide 1: first brown dwarf to be verified (1995)
  - Gliese 229B
  - Nemesis: theorized to orbit the sun and disrupt the Oort Cloud



Black Holes

- Astronomical objects from which light cannot escape
- Characterized by only mass, charge, and angular momentum
- Membrane paradigm: method used to calculate quantum mechanical effects on the exterior of these entities
- Evaporate due to emission of Hawking radiation
- Schwarzschild radius measures the size of these entities
- Described in string theory as fuzzballs