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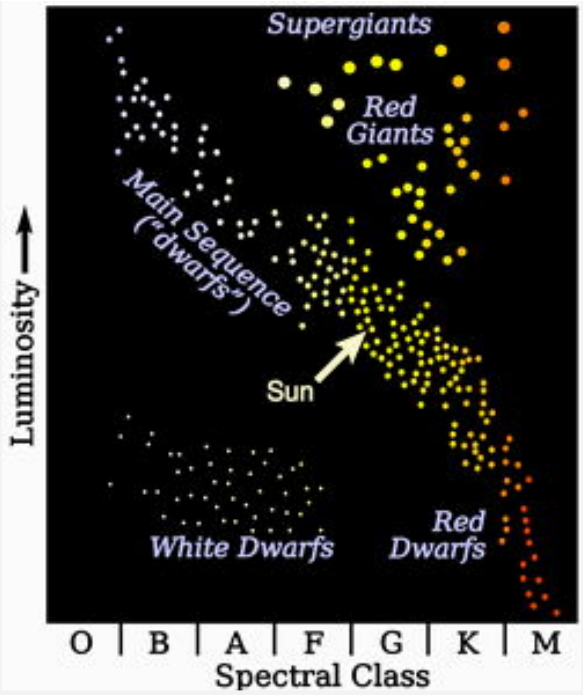
What does the 'family tree' of stars look like?

Week 42



Simplified Hertzsprung-Russell Diagram (HRD)

Not all of the stars in the Universe are the same – differences in brightness and colour can be recognised even with the naked eye. In the 19th century, star spectroscopy developed into an important method of analysis in astronomy: it divides light and other electromagnetic radiation from stars according to its wavelength. For example, visible light is split into the colours of the rainbow. Stellar spectroscopy showed that stars do in fact have different levels of absolute brightness (that is, brightness independent of their distance from the observer) and temperature. The stars were categorised into various spectral classes, according to the appearance of their spectra.

Development phases of stars in a diagram

At the beginning of the 20th century, a fundamental diagram in astronomy was created from the work of the Danish photochemist Ejnar Hertzsprung and the American astronomer Henry Norris Russell: the Hertzsprung-Russell Diagram, or HRD for short. The spectral class (or surface temperature) of stars is plotted on the horizontal axis of the diagram and the absolute brightness (or luminosity) of stars is plotted on its vertical axis. In the middle of the diagram we see many stars in an area that runs diagonally, known as the Main Sequence. Above this we see somewhat fewer stars with greater luminosity and generally a moderate temperature – the giants and supergiants. (See also the astronomy question from week 27: How long will the Sun continue to shine?) Below the Main Sequence sit the 'white dwarfs'.

Even if these names sound as if they come from a fairytale, the HRD describes the actual external condition of stars, which is related to the internal fusion processes at their cores. If we understand

these processes, we can use the HRD to forecast the path of development of certain stars, for example our Sun, or to determine the age of star clusters.

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