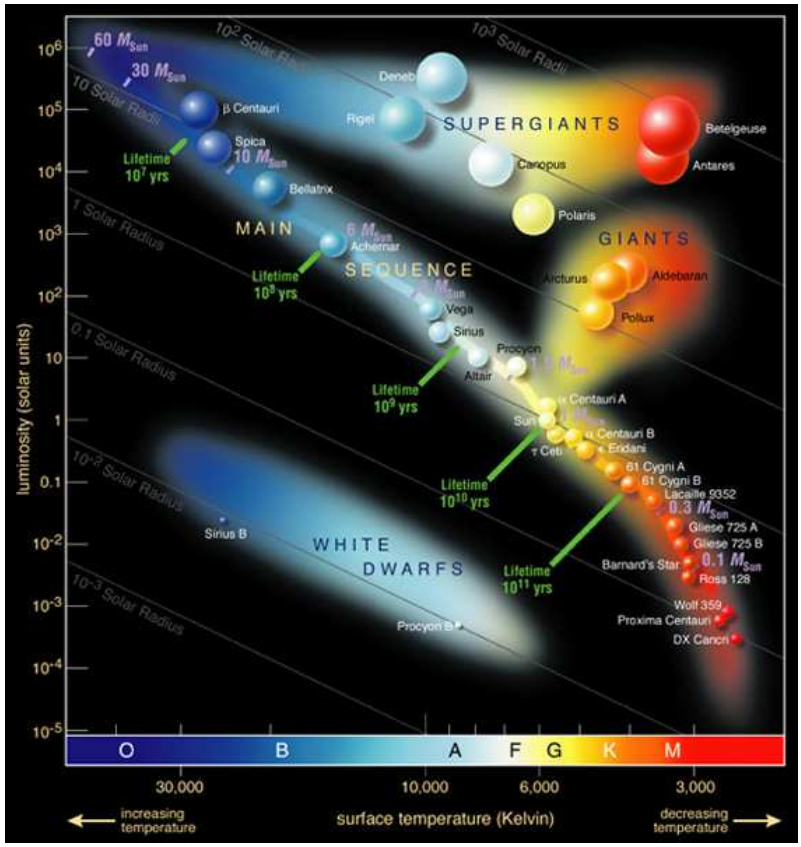

What's the Hertzsprung Gap?

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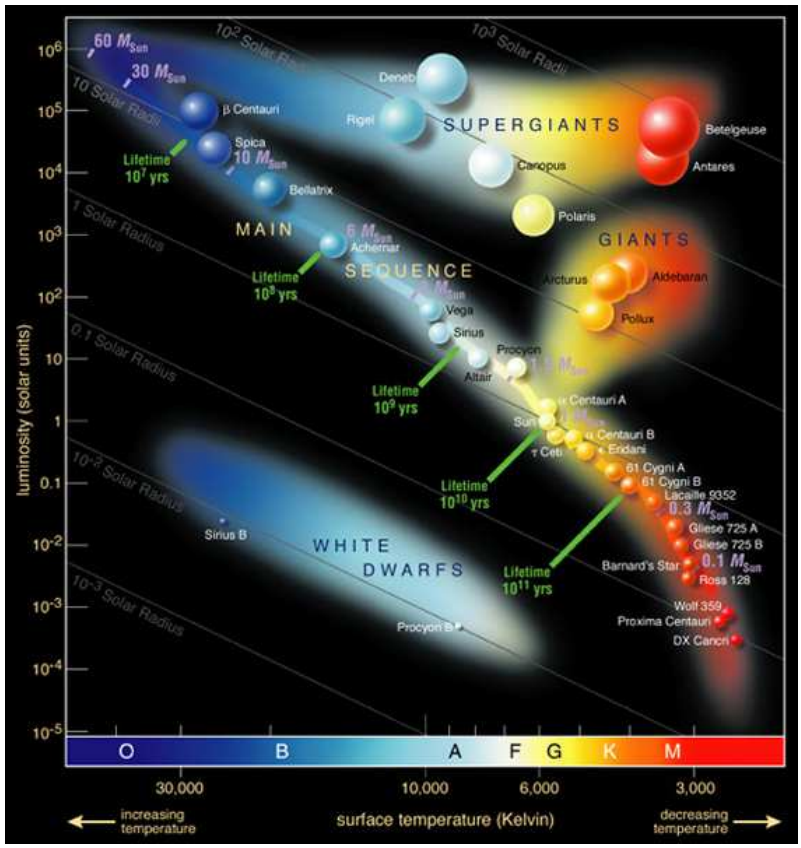

The Hertzsprung Gap is a feature within the Hertzsprung-Russell diagram (usually abbreviated the HR Diagram), both of which have the same name attached to them because the same person who helped to construct the HR diagram, noted the gap within it, and it began to take his name as a descriptor.

I've talked about the HR diagram before, and what it tells us about stars in general, but as a brief summary, the HR diagram is a plot of the brightness of a star versus its colour, and the position of the star within this diagram can tell you about the age of the star, and more specifically, how far along in its lifetime the star has progressed.

The biggest single feature in the HR diagram is called the Main Sequence (we are not good at naming things in astronomy) which goes in a diagonal from the top left to the bottom right. This is where most stars stay for the majority of their lifetimes - any star which is burning hydrogen in its core, as our sun currently is, will sit somewhere along this line, with very large stars at the top left, and very small stars in the bottom right. Our sun sits somewhere in the middle.

The Red Giant Branch, which is the other major feature on the HR diagram we need to be familiar with in order to understand the Hertzsprung Gap, is just to the right of the Main Sequence. This is a narrow collection of stars which are very bright and very red. These are stars which are no longer burning hydrogen in their cores- they've exhausted all the hydrogen that exists in their cores and are now able to burn hydrogen in a shell around a core made primarily of helium, which for a star which is still burning hydrogen, acts like ash to a flame. These are all stars on their way to a death that will be more or less spectacular, depending on their mass.

Now, the Hertzsprung Gap is a region of the HR diagram just between the Main Sequence and the Red Giant Branch, and is notable for having almost no stars - hence the term "gap". In the picture above, it's represented by the narrowing of the background colour just below the "giants" grouping of stars. What causes the gap is linked to what the stars are doing. For most natural objects (stars count), gaps in a distribution usually mean one of two things. Either there's some barrier to the object going in that area, or they move through it very quickly, and it's just unlikely that you'll spot something. In the case of the Hertzsprung Gap, it's the latter. Stars are going through a phase just between finishing their hydrogen burning, and before starting to burn hydrogen in a shell around that core. Once they start up the hydrogen shell burning, they'll lie along the Red Giant Branch, and if they're still burning hydrogen in their core, they'll still be on the Main Sequence.

The reason for the gap is that there's a very short period of time between these two stages of a star's life. The time gap is about 1000 years. A thousand years is basically the length of a blink, in astronomical terms. For comparison, our star will stay on the main

sequence for about 8 billion years. Even high mass stars, which have relatively short lifetimes, stay on the main sequence for about 100 million years. 1000 years is *really* short. Because stars pass through the Hertzsprung Gap so quickly, it's hard to spot them in that region of the diagram, and the stars that would otherwise be in the gap, if they didn't move so quickly through it, are either still on the Main Sequence, or already on the Red Giant Branch.

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