APOD
The only difference between these three stars is which energy state the electrons tend to live in.
Electron levels

Star 1

Hydrogen  Iron
Electron levels

Star 1

Hydrogen

Iron

Star 3

Iron
Important conclusion:

’Spectral type’ is another way of talking about the temperature

(Later we will talk about how a star changes spectral type throughout its life, and how, at times, spectral type can be related to stellar mass)
We have seen that luminosity (brightness) and temperature (color) are some of the fundamental parameters of stars (along with radius)
In the course of cataloging stars, astronomers have kept track of luminosity and temperature and have looked for a relationship between them.
HR Diagram
with only a small handful of stars it doesn’t look like much but something interesting happens when a lot of stars get added...
Brightest Stars
Closest stars
- 90% of stars in the solar neighborhood are main sequence stars (most of which are small and red)
- 9% are white dwarfs
- 1% are red giants
the majority of stars are on the main sequence because a star spends most of its life there.
HR diagram explorer
Why so few high mass stars?
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1. Nature makes fewer high mass stars
   (for every 100 sun-like stars, there is one 10 solar mass star)
Why so few high mass stars?

1. Nature makes fewer high mass stars
(for every 100 sun-like stars, there is one 10 solar mass star)

2. High mass stars have shorter lifetimes

\[ \text{stellar lifetime} \propto \frac{1}{(\text{stellar mass})^4} \]
<table>
<thead>
<tr>
<th>Star</th>
<th>Spectral Type</th>
<th>Mass</th>
<th>Luminosity</th>
<th>Lifetime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spica B</td>
<td>B2V</td>
<td>6.8 M☉</td>
<td>800 L☉</td>
<td>90 million years</td>
</tr>
<tr>
<td>Sun</td>
<td>G2V</td>
<td>1.0 M☉</td>
<td>1 L☉</td>
<td>10 billion years</td>
</tr>
<tr>
<td>Proxima Centauri</td>
<td>M5V</td>
<td>0.1 M☉</td>
<td>0.00006 L☉</td>
<td>16,000 billion years</td>
</tr>
</tbody>
</table>
HR diagram lecture tutorial
pg 117-118
In the HR diagram below, which star has a higher temperature?
Which of the following is the most common type of star?

A. blue supergiants  
B. high mass main sequence  
C. red giants  
D. white dwarfs  
E. low mass main sequence
Which point best represents the position on the HR diagram of a low mass main sequence star?
Which point best represents the position on the HR diagram of Antares, a red giant with radius 500 times that of the Sun?
On the main sequence, O-type stars are more massive than M-type stars

A. True
B. False
On the H-R diagram, white dwarfs, with their small radii and high temperatures, lie

A. at the lower left
B. at the lower right
C. close to the Sun, near the center
D. at the top left
E. at the top right