Astro 1: Introductory Astronomy

Class 11: Tuesday, February 25

Spring 2014
spectra of seven different stars: spectral types on the left, temperatures on the right
<table>
<thead>
<tr>
<th>Key Absorption Line Features</th>
<th>Brightest Wavelength (Color)</th>
<th>Typical Spectrum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lines of ionized helium, weak hydrogen lines</td>
<td>$&lt;97$ nm (ultraviolet)*</td>
<td>O</td>
</tr>
<tr>
<td>Lines of neutral helium, moderate hydrogen lines</td>
<td>97–290 nm (ultraviolet)*</td>
<td>B</td>
</tr>
<tr>
<td>Very strong hydrogen lines</td>
<td>290–390 nm (violet)*</td>
<td>A</td>
</tr>
<tr>
<td>Moderate hydrogen lines, moderate lines of ionized calcium</td>
<td>390–480 nm (blue)*</td>
<td>F</td>
</tr>
<tr>
<td>Weak hydrogen lines, strong lines of ionized calcium</td>
<td>480–580 nm (yellow)</td>
<td>G</td>
</tr>
<tr>
<td>Lines of neutral and singly ionized metals, some molecules</td>
<td>580–830 nm (red)</td>
<td>K</td>
</tr>
<tr>
<td>Strong molecular lines</td>
<td>$&gt;830$ nm (infrared)</td>
<td>M</td>
</tr>
</tbody>
</table>

- ionized calcium
- titanium oxide
- sodium
- titanium oxide
the underlying stellar spectrum is thermal, but with absorption lines superimposed.

Stars Glow by **Thermal Emission of Light**

Stars emit light according to the Planck Function (blackbody).

\[ \lambda T = 0.00290 \text{ m-K} \]

Flux at Surface = \( \sigma T^4 \)

- Cool Red & Faint
- Warmer
- Hot
- Hotter White & Bright
Betelgeuse: luminous and red (cool)
FIGURE 15.11 The main sequence from Figure 15.10 is isolated here so that you can more easily see how masses and lifetimes vary along it. Notice that more massive hydrogen-burning stars are brighter and hotter but have shorter lifetimes. (Stellar masses are given in units of solar masses: $1M_{\odot} = 2 \times 10^{30}$ kg.)
star sizes (radii) vary on the main sequence, but only by a factor of 20 or 30
**Figure 15.11** The main sequence from Figure 15.10 is isolated here so that you can more easily see how masses and lifetimes vary along it. Notice that more massive hydrogen-burning stars are brighter and hotter but have shorter lifetimes. (Stellar masses are given in units of solar masses: $1M_{\text{Sun}} = 2 \times 10^{30}$ kg.)
you can find the radii of the indicated stars by comparing their L and T to that of the Sun
Sirius A and B (with an X-ray telescope) - B is a white dwarf
Stellar masses (purple labels) decrease from the upper left to the lower right on the main sequence. Stellar lifetimes (green labels) increase from the upper left to lower right on the main sequence. High-mass stars live shorter lives because their high luminosities mean they burn through their nuclear fuel more quickly.