Introductory Astronomy

Week 4: Stars

Clip 9: Stellar Types

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If We Know the Distance

- Can measure brightness and compute luminosity $L = 4\pi D^2 b \quad \frac{L}{L_\odot} = \frac{b}{b_\odot}\left(\frac{D}{1\,\mathrm{AU}}\right)^2$
- Measure color (spectrum) to find temperature

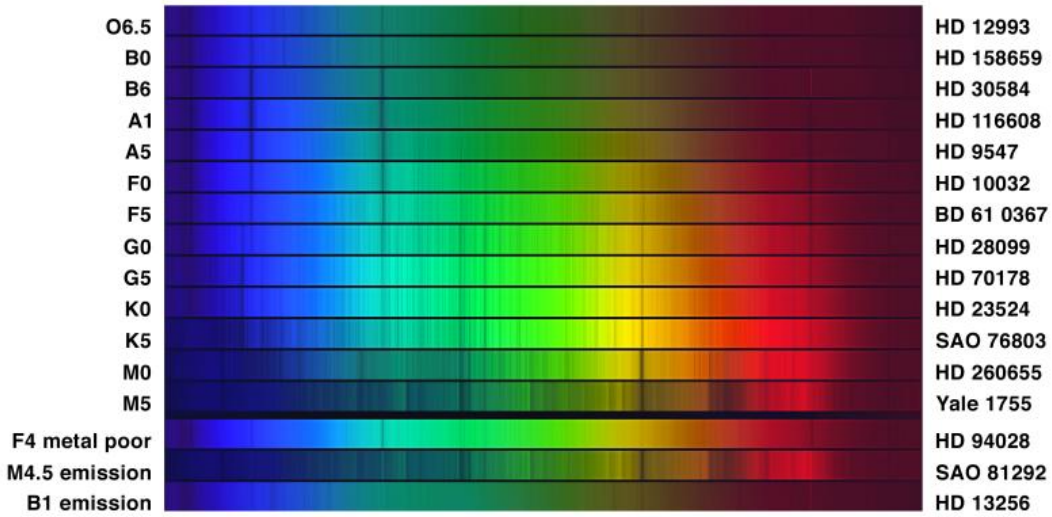
$$T = \frac{0.0029\,\mathrm{m}}{\lambda_{\max}} K$$

- Compare the two to find radius

$$R = \left(\frac{L}{4\pi\sigma T^4}\right)^{1/2} \quad \frac{R}{R_\odot} = \left(\frac{L}{L_\odot}\right)^{1/2}\left(\frac{T}{T_\odot}\right)^{-2}$$

A Better Thermometer

- Blackbody spectrum too broad and subject to distortion by medium
- Stellar line spectra give better data
- Atmosphere composition and ionization state indicate temperature



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Type	Color	Temperature	Lines	Prevalence	Examples
O	Blue	> 33,000	He^0, He^+, weak H	<0.00003%	Orion's Belt
B	Blue-White	10,000-33,000	He^0, strong H	.13%	Spica, Rigel
A	White to Blue-White	7500-10,000	No He, Very strong H, some metal ions	.6%	Sirius, Vega
F	White	6000-7500	strong H, many metal ions	3%	Procyon, Polaris
G	Yellowish White	5200-6000	Weak H, many metals	7.6%	Sun, Capella
K	Orange	3700-5200	Neutral metals	12.1%	Arcturus, Aldebaran
M	Red	2000-3700	Neutral Metals, molecular bands	76.5%	Betelgeuse